# Australian Orthopaedic Association National Joint Replacement Registry

## 2025 ANNUAL REPORT

## Hip, Knee and Shoulder Arthroplasty



AOA
AUSTRALIAN ORTHOPAEDIC ASSOCIATION

Australian Orthopaedic Association National Joint Replacement Registry

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# Australian Orthopaedic Association National Joint Replacement Registry

2025 ANNUAL REPORT

Data Period 1 September 1999 – 31 December 2024

# Hip, Knee and Shoulder Arthroplasty

# Preface

The Registry's strength lies in its ability to turn detailed surgical data into insights that guide practice, improve outcomes, and support excellence in patient care.

The Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR) has now entered its 26th year of reporting. Over this time, the Registry has become one of the most significant sources of arthroplasty data globally. Its scale, depth, and independence ensure that it continues to shape surgical practice and policy, while driving improvements in joint replacement care across Australia.

The 2025 Annual Report reflects both continuity and progress. The Registry's data now encompass more than 2.2 million procedures, providing the basis for robust long-term analyses. This year, for the first time, the Registry presents ten-, fifteen-, and twenty-year outcomes for modern prostheses. These benchmark results demonstrate the sustained performance of devices still in use, offering clear evidence to guide surgeons, health systems, and regulators in evaluating quality and durability.

The Special Chapter of the 2025 report focuses on aseptic revision arthroplasty. Revision procedures are a critical area for both patients and the profession, given their complexity and the resources required to achieve successful outcomes. Building on previous chapters published in 2015 and 2020, this year's analysis expands to include revision shoulder surgery. It offers a comprehensive account of changing revision practices, reasons for reoperation, and the outcomes achieved over time. Such analyses provide valuable insight into the challenges of revision surgery and identify opportunities to reduce its burden.

The structure of reporting has also evolved. Partial hip and knee replacement data, previously published separately, have now been integrated into the main report. This change strengthens the clarity and accessibility of the Registry's reporting. At the same time, expanded coverage of shoulder arthroplasty reflects the increasing number of procedures being performed in Australia. This includes detailed analyses of implant types, prosthesis design features, and revision pathways, helping to build an evidence base that will support practice in this rapidly developing field.

The Registry continues to evaluate the impact of surgeon assistive tools. Analyses of computer navigation, image-derived instrumentation, and robotic assistance in hip and knee arthroplasty provide evidence to inform debate around the benefits and limitations of these tools. As new technologies emerge and are adopted, the Registry remains uniquely positioned to provide objective and independent evaluation of their effect on outcomes.

These achievements are the product of a coordinated effort. I wish to acknowledge the leadership of Clinical Director Paul Smith; Deputy Clinical Directors Peter Lewis, Chris Vertullo and Michael McAuliffe; Assistant Deputy Clinical Directors Chris Wall, David Gill and James Stoney; and the Registry's Executive Manager. I also thank the dedicated AOANJRR and SAHMRI teams whose commitment to accuracy and analysis underpins the quality of the Registry's outputs.

Above all, I recognise the contribution of surgeons across Australia. Their willingness to provide data to the Registry ensures that it remains a trusted national resource. Through their efforts, the Registry continues to deliver knowledge that strengthens practice and, most importantly, supports the care they provide to their patients.

As the AOANJRR enters its second quarter-century, its role as a foundation for clinical excellence and innovation is clear. This year's report demonstrates how comprehensive, high-quality data can be used to inform decision-making at every level of the health system and to shape the future of arthroplasty in Australia.

Sincerely,



**Scott Fletcher**

President, Australian Orthopaedic Association

# AOANJRR Data Snapshot 2024

**2,285,453**
Total number of joint replacement procedures reported by the Registry at the end of 2024

**171**
Data Requests

$$$$
Over a billion dollars of estimated benefit to the national health system accruing from AOANJRR activities

Joint replacement procedures performed in 2024

| 60,414 | 79,331 | 11,306 |
|---|---|---|
| Hips | Knees | Shoulders |

**43**
Hospital Audit Requests

**1,173**
Individual Surgeon Reports

**33**
Conference presentations

**37**
Journal Articles Published

## National PROMs Data Collection

June 2025 Update

Participating Hospitals
**244**

Pre-Op PROMs
**149,121**

Post-Op PROMs
**108,818**

Pre-Op Completion Rate
**74.1%**

Post-Op Completion Rate
**63.0%**



% patient-reported change following hip, knee, or shoulder joint replacement as "much better"
**84.9%**

% patient "very satisfied" or "satisfied" following hip, knee, or shoulder joint replacement
**87.5%**

**841**
Total number of surgeons participating

Total Number of Hospitals Onboard per State /Territory:

- SA: **29**
- ACT: **6**
- NSW: **66**
- VIC: **66**
- NT: **3**
- WA: **22**
- QLD: **45**
- TAS: **7**

**162,434**
Patient participation through AOANJRR patient dashboards

# Executive Summary

This summary provides a brief overview of some of the major findings from the 2025 Annual Report. As with last year's Annual Report, to ensure that the relevance and currency of AOANJRR data are maintained, almost all analyses (unless specifically stated) have been confined to hip, knee and shoulder prostheses that were still being used in 2024. Again, historic data are still available in previous Annual Reports on the AOANJRR website.

In addition to the main report, the Registry continues to publish Supplementary Reports. The Supplementary Reports are listed in the introductory chapter and will be available on the AOANJRR website https://aoanjrr.sahmri.com/ annual-reports-2025 from 1 October 2025. They include a Lay Summary of the main report and 13 additional reports on arthroplasty topics, as well as detailed analyses of all prostheses identified as having a higher than anticipated rate of revision.

## Ten, Fifteen and Twenty Year Outcomes

This section of the report provides 10 and 15 year benchmarks for prostheses used in >350 procedures in primary total conventional hip and primary total knee replacement undertaken for osteoarthritis. Ten year benchmarks for prostheses used in total stemmed anatomic shoulder replacement for osteoarthritis and primary total stemmed reverse shoulder replacement performed for any diagnosis are also included. This chapter reports 20 year outcomes for a small number of prostheses that are still used. All analyses in this chapter are restricted to modern prostheses.

The 10 year benchmark standard is 4.2% for hips and 4.7% for knees. For shoulders, the 10 year benchmark is 7.4% for total stemmed anatomic and 5.4% for total stemmed reverse. The calculated 15 year benchmark standard is 6.0% for hips and 6.3% for knees. The benchmarks reflect proven long- term success.

The AOANJRR uses the benchmark approach recommended by the ISAR International Prosthesis Benchmarking Working Group to identify those devices that have superior and non-inferior performance at 10 years and 15 years. Of those hip, knee and shoulder prosthesis combinations with a sufficient number of procedures and follow-up, 27.1% of hip and 21.1% of knee prosthesis combinations achieved a 10 year superiority benchmark. There was one total stemmed anatomic and one total stemmed reverse shoulder prosthesis combination that achieved a 10 year superiority benchmark. In addition, 2 total stemmed reverse shoulder prosthesis combinations qualified for a 10 year non-inferiority benchmark.

At 15 years, 5 of the hip and 1 of the knee prosthesis combinations still in use achieve a superiority benchmark. There are 11 hip and 7 knee replacement combinations used in >350 procedures for over 20 years. At this time there is no 20 year benchmark standard established.

## Special Chapter: Revision Arthroplasty

This year, the Registry special chapter is providing an updated comprehensive analysis of the outcome of revision hip, knee and shoulder replacement surgery. In 2023, the Registry special chapter focussed on the outcomes of revision for infection. The 2025 Registry special chapter focusses on the outcomes of aseptic revision arthroplasty.

The aim of this chapter is to expand on the previous chapters on revision arthroplasty, from 2015 and 2020, and to add analyses of revision shoulder surgery. It is timely to review this important topic on a regular basis to reflect on changes in revision techniques and evolving reasons for revision. For each joint, information is provided on revisions for specific reasons, and the outcomes of major total, partial and minor revisions. The Registry also examines mortality after the 1st revision.

**REVISION HIP REPLACEMENT**

There are 18,936 1st revision aseptic THR procedures recorded where the primary diagnosis was osteoarthritis. The mean age at the 1st revision is 71.8 years. The median time from the primary procedure to the 1st revision is 3 years, ranging from 1 year for dislocation/instability to 4.2 years for loosening. There are more females undergoing a 1st revision, and this is most pronounced with 1st revision for dislocation/instability . Most patients have an ASA score of 3 and are pre-obese at the time of 1st revision.

Over time there has been an increase in the proportion of 1st revisions for fracture, while there has been a decrease in 1st revisions for dislocation/instability and loosening/lysis. The analysis compares the outcomes of 1st revisions over four successive time periods: 1999-2005, 2006-2012, 2013-2019 and 2020-2024. There has been a reduction in the rate of 2nd revision comparing the most recent period to 1999-2005 and 2006-2012, but no difference is shown in comparison with 2013-2019.

Of the 18,936 1st revision THR procedures, 2,803 have had a 2nd revision. The cumulative percent 2nd revision at 20 years is 26.4%. The most common reasons for 2nd revision are prosthesis dislocation/instability (33.1%), infection (23.3%), loosening (22.5%) and periprosthetic fracture (10.2%).

When the femoral component is revised for loosening, revision procedures using cementless femoral fixation have a lower rate of all-cause 2nd revision (after 6 months) compared to revision procedures using cemented femoral fixation. Similarly, when the femoral component is revised for loosening, there is also a lower rate of 2nd revision for recurrent loosening using cementless femoral fixation compared to when cemented femoral fixation is used.

When the bearing surfaces used for the 1st revision for loosening are compared, there is a higher rate of 2nd revision when metal/non-XLPE is compared to metal or ceramic with XLPE after 3 months.

Where a first revision is performed for dislocation/Instability, the most common reason for 2nd revision is for further dislocation/instability (50.8%). Over time the bearing choice in first revision for dislocation/instability has changed, with an increase in the use of dual mobility bearings. Dual mobility bearings have a lower rate of all-cause 2nd revision compared to other head sizes. Dual mobility prostheses also have a lower rate of 2nd revision for dislocation/instability compared to all femoral head size groups.

When a first revision is performed because of fracture, the most common reason for 2nd revision is infection (28.1%), followed by loosening (24.7%). A revision of the femoral component (35.5%) is the most common type of 2nd revision. When the 1st revision is for fracture, cemented fixation used for revision of the femoral component has a higher rate of 2nd revision compared to cementless femoral fixation after 3 months

For revision hip replacement the posterior approach is the most frequently used surgical approach (69.3%). When the outcomes of the surgical approaches used for the 1st revision are compared, procedures using the anterior approach have a higher rate of 2nd revision.

Mortality following the 1st revision of primary conventional THR and the reason for the 1st revision have been examined. In this analysis 1st revision for infection is included. The overall mortality after a 1st revision procedure is 0.9% at 30 days, 1.9% at 90 days, 4.4% at 1 year and 37.5% at 10 years. Compared to other reasons for revision, 1st revision for loosening has the lowest mortality. 1st Revision for fracture has the highest mortality at all time points.

**REVISION KNEE REPLACEMENT**

This analysis includes 30,460 1st revision TKR procedures undertaken for aseptic reasons. The mean age at 1st revision is 68.7 years. There is some variation in mean age with revision diagnosis, with patients revised for arthrofibrosis being younger (66.1 years) and those revised for fracture being older (74.3 years). 1st revision TKR is more common in females and the highest proportion of patients have an ASA score 2 or 3 and have a BMI in the obese class 1 category.

Of the 30,460 1st revision procedures, 4,825 have had a 2nd revision. The cumulative percent 2nd revision at 20 years is 25.6%.

The most common reasons for 2nd revision are loosening (31.9%), infection (25.8%), instability (12.5%) and pain (6.7%).

Revision of both the tibial and femoral components is the most common 2nd revision procedure.

Patients with an ASA score of 3 have a higher rate of revision compared to patients with an ASA score of 1 in the first 6 months only, but there is no difference between patients with other ASA scores. As ASA score increases, the incidence of 2nd revision for early infection increases. The incidence of 2nd revision for infection also increases with increasing BMI.

The outcomes of 1st revisions of total knee replacement over four successive time periods are compared: 1999-2005, 2006-2012, 2013-2019 and 2020-2024. When all aseptic 1st revisions are included, there is a lower rate of 2nd revision comparing the most recent period to 1999-2005 and 2006-2012, but there is no difference compared to 2013-2019.

Over time there has been a decrease in the proportion of 1st revisions for loosening. There has been an increase in major total revisions and a decrease in major partial knee revisions.

Likewise, over time there has also been an increase in the proportions of fully stabilised and hinge prostheses used for 1st revision, and a decrease in minimally stabilised revision procedures.

When the femoral component and tibial components are revised, over 90% of 1st revision procedures use cemented fixation and this has slightly increased with time.

There has been an increase in 1st revision procedures where the patella component was used in the primary and no patella component was needed in the revision. Correspondingly, there has been a decrease in the proportion of 1st revisions where the patella was initially unresurfaced and left unresurfaced at revision.

Minor revisions are the most common class of 1st revision procedure (52.4%), followed by major total revisions (33.1%) and then major partial revisions (14.4%). Major total revisions have a lower rate of 2nd revision compared to major partial revisions, and also compared to minor revisions, but only until 2.5 years, after which time there is no longer a difference. Minor revisions have a lower rate of 2nd revision compared to major partial revisions.

The risk of 2nd revision varies depending on the reason for the 1st revision, more detailed analyses have been carried out for the 1st revision diagnoses of loosening, patella reasons, instability, pain, arthrofibrosis and fracture. The lowest 15 year cumulative percent 2nd revision is 18.9% when the 1st revision was performed for patella reasons, and the highest is 29.3% for arthrofibrosis.

Loosening is the most common 1st revision diagnosis for total knee replacement with a primary diagnosis of osteoarthritis. Where the 1st revision was for loosening, the most common reasons for the 2nd revision are further loosening (38.8%), infection (28.9%) and instability (10.1%).

When the first revision is for loosening, the use of metaphyseal sleeves, cones and stem extensions have all increased. There is a lower rate of second revision when these technologies are used compared to when they are not used.

Revision for patella reasons is the 2nd most common reason for 1st revision. When the 1st revision is for patella reasons 99.0% of revisions are patella revisions either alone or combined with a tibial insert revision. For knees revised for patella reasons, 97.2% did not have a patella component inserted in the primary procedure.

# Executive Summary

Revision for instability is the 3rd most common reason for 1st aseptic revision. The most common types of 1st revision procedures for instability are insert only and TKR (both femoral and tibial components revised).

When a major revision is performed for instability, fully stabilised and hinged components are the most commonly used. Over time the proportions of minimally stabilised and posterior stabilised components used in 1st revision for instability have declined. There is a lower rate of 2nd revision when fully stabilised prostheses are used in the 1st revision for instability compared to posterior stabilised components. There is no difference in rate of 2nd revision when minimally stabilised or hinged prostheses are compared to fully stabilised designs.

The overall mortality following a first revision knee replacement is 0.4% at 30 days, 0.7% at 90 days, 1.5% at 1 year and 24.8% at 10 years. Compared to 1st revisions for loosening, 1st revisions for infection and fracture have a higher rate of mortality, while those revised for arthrofibrosis have a lower rate of mortality.

**REVISION SHOULDER REPLACEMENT**

There are 4,472 aseptic 1st revisions of primary shoulder replacements and due to small numbers of revisions for some classes, the analysis considered only aseptic 1st revisions of total stemmed anatomic (n= 1,581) and total stemmed reverse shoulder replacements (n= 1,851).

The mean age of 1st revision of primary total stemmed anatomic shoulder replacement was 70.1 years and were predominately performed in females. Most patients are ASA score 2 (44.0%) or 3 (50.9%) and are either pre obese (31.3%) or obese class 1 (29.2%).

The cumulative incidence of aseptic 2nd revision at 10 years is 19.9% from 259 2nd revisions. The most common reason for 2nd revision was instability/dislocation followed by loosening. Revision of both the humeral and glenoid components is the most common 2nd revision procedure (32.8%) followed by humeral component only (32.0%). A total stemmed anatomic shoulder replacement has a lower rate of 2nd revision when revised to a total stemmed reverse replacement compared to a primary total stemmed reverse undergoing a 1st revision to another reverse replacement. Primary total stemmed anatomic shoulder replacement implants may encompass a single design platform prosthesis (SDPP). These platform implant ranges include both anatomic and reverse shoulder replacement. They feature common design, composition metallurgy, coatings, and bearing surfaces. They allow polarity change of humeral or glenoid prostheses by modular exchange. In revision surgery the humeral stem may be retained if in the primary procedure a SDPP implant was used. The 2nd revision rate is not different regardless of whether or not the humeral stem is retained in-1st revision total stemmed anatomic replacements.

Major total is the most common class of 1st revision procedure of a primary total stemmed anatomic total shoulder replacement in 2024, but overall, there are more major partial (53.6%), followed by major (34.7%) and then minor revision (11.7%). Minor revisions have a higher rate of 2nd revision compared to major total and major partial revisions for the entire period. Major total revisions have a higher 2nd revision rate than major partial at all time periods.

The most common type of 1st revision for total stemmed anatomic shoulder replacements is a humeral component followed by humeral/glenoid combination. Isolated head revision has an increased risk of 2nd revision the humeral revision. In addition, glenoid and glenoid/humeral revision has a higher rate of 2nd revision than humeral 1st revision.

There are 710 early 1st revisions (44.9%). 1st revisions performed within 2 years have a higher rate of 2nd revision from 3 months onwards when compared to late 1st revisions, with a lower revision rate prior to this. In addition, there has been an improvement in the rate of 2nd revision comparing the most recent period to pre-2016

The outcome of the 1st revision of primary total stemmed anatomic shoulder replacement varies by age and gender. Females aged <65 years having a higher rate of 2nd revision than females aged ≥65 years. Males aged <65 years have a higher rate of 2nd revision than males aged ≥65 years from 3 months after 1st revision. ASA score and BMI class did not change the rate of 2nd revision.

When comparing to rotator cuff insufficiency, loosening and prosthesis instability/dislocation have a higher rate of 2nd revision. Implant breakage of the glenoid insert also has a higher rate of 2nd revision compared to rotator cuff insufficiency but after 6 months only.

The overall mortality of 1st revision of primary total stemmed anatomic shoulder replacement is 0.1% at 30 days, 0.1% at 90 days, 0.7% at 1 year and 24.0% at 10 years.

The mean age for patients undergoing a 1st revision total stemmed reverse shoulder replacement is 73 years. 1st revision procedures are more common in males (50.1%) and the highest proportion of patients have an ASA score of 2 (26.4%) or 3 (66.1%) and have a BMI in the pre obese category (30.5%).

There are 366 2nd revisions of the 1,851 1st revision procedures and the cumulative percent 2nd revision at 10 years is 25.6%. The most common reasons for 2nd revision are instability/dislocation (45.6%), infection (19.1%), loosening (18%), and fracture (5.2%). Isolated revision of the humeral component is the most common 2nd revision procedure (25.4%) followed by humeral and glenoid revision (17.8%). The 2nd revision rate is not different if the humeral stem is retained or not for 1st revision total stemmed reverse replacements, except in the first two weeks after 1st revision when retaining the humeral stem has a higher revision rate.

Minor revision is the most common class of 1st revision procedure of a primary total stemmed reverse shoulder replacement (51.6%), followed by major partial (39.6%) and then major total revision (8.8%). When the outcomes of the

1st revision by class of 1st revision are compared there is no difference in the rate of 2nd revision.

The most common 1st revision of a total stemmed reverse was a humeral component followed by a cup and or head exchange. A humeral/glenoid 1st revision has a higher rate of 2nd revision than head and or cup revisions in the first 3 months, but no difference after that time.

1st revisions performed within 2 years have a higher rate of 2nd revision in the first 2 weeks when compared to late 1st revisions and do not differ after that time. There is no difference in the rate of 2nd revision of 1st revision total stemmed reverse shoulder replacements on comparing pre 2016 and 2016–2024.

The outcome of the 1st revision of a primary total stemmed reverse shoulder replacement varies by age and gender, with females aged <65 years having a higher rate of 2nd revision than females aged ≥65 years. Males do not differ by age or in comparison to females of the same age. ASA score and BMI class did not change the rate of 2nd revision.

When comparing to fracture, loosening and prosthesis dislocation/instability and rotator cuff insufficiency have a higher rate of 2nd revision.

The overall mortality of 1st revisions of primary total stemmed reverse is 0.2% at 30 days, 0.8% at 90 days, 3.3% at 1 year and 47.0% at 10 years.

## Hip Replacement

There are an additional 62,206 hip replacement procedures compared to the number reported last year. The revision burden in 2024 is 6.7% which is the lowest burden yet reported by the Registry. This equates to 3,747 fewer revision procedures in 2024 than would have been expected if the proportion of revision procedures had remained at the level reported in 2003.

This year, the partial hip data previously found in the partial hip supplementary report has been incorporated back into the main report. The use of bipolar hip replacement continues to increase at the expense of unipolar modular partial hip replacement. Bipolar prostheses continue to be associated with the lowest rate of revision for the management of femoral neck fractures requiring arthroplasty.

Of the two types of primary total hip replacement, total conventional hip has a lower cumulative percent revision than total resurfacing hip replacement. For total conventional hip replacement, the 20 year cumulative percent revision for currently used prostheses undertaken for osteoarthritis is 7.9%. Age has an impact on the risk of revision, particularly in females. Updated information on the effect of ASA score and BMI are provided with the cumulative percent revision increasing with increasing ASA score and increasing BMI category. There is little difference in outcomes based on fixation except for patients aged ≥75 years where the revision rate is lower when either hybrid or cemented fixation is used.

The use of collared cementless stems has increased since 2015. Collarless stems have a higher rate of revision compared to collared stems. Collarless stems have a higher rate of revision for fracture and loosening.

This year there is an analysis of the combination of acetabular and femoral head size used in total conventional hip replacement. In this analysis, all modern bearing surfaces are combined. Acetabular size has been categorised <52mm, 52mm or >52mm according to the outer diameter.

There continues to be an increase in the use of dual mobility prostheses. They have the same risk of revision as standard acetabular prostheses when used in the management of osteoarthritis but have half the risk of being revised for dislocation.

For the first time, the use and outcome of computer navigation, image derived instrumentation (IDI) and robotic assistance, to aid implantation of total hip replacements are shown. Theses have been labelled as 'surgeon assistive tools'. Procedures using traditional instrumentation have decreased to 64.6% of primary hip procedures in 2024. Results for primary total hip replacement for osteoarthritis with the use of these techniques are presented, followed by a comparison of the assistive tools used with XLPE since 2016. Revision outcomes are analysed using each of these methods compared to traditional instrumentation.

When adjusted for age, gender, ASA score, BMI category, femoral fixation, and head size, the anterior approach has a lower rate of revision compared to the lateral and posterior approaches. The posterior approach has a lower rate of major revision. There are also differences in the reasons for revision. The anterior approach has a higher rate of revision for loosening and early fracture compared to the posterior and lateral approach and a lower rate of revision for infection and dislocation.

Data on the outcomes of primary total hip replacement used for the management of femoral neck fracture are also provided and the cumulative percent revision of primary total conventional hip replacement for fractured neck of femur is 10.5% at 20 years.

A summary table indexing statistically significant characteristic comparisons in hip replacements is located at the beginning of the Hip Chapter, while a comprehensive bibliography of hip replacement research utilising AOANJRR data from 2020-2025 is provided at the conclusion of the chapter.

## Knee Replacement

There are an additional 80,402 knee replacement procedures since the last report. The revision burden has remained constant at 6.9%. This equates to 1,552 fewer revision procedures in 2024 than would have been expected if the proportion of revision procedures had remained at the level reported in 2004.

# Executive Summary

There has been a continued decrease in the use of partial knee replacement, and in 2024 it remains a small proportion (5.0%) of all knee replacement procedures. As with hips, this year the information from the partial knees supplementary report has been incorporated into the main report.

Younger age and male gender are associated with higher rates of revision for patella/trochlea knee replacement. Whereas younger age and female gender are associated with higher rates of revision for unicompartmental knee replacement. When adjusted for age, gender, ASA, BMI, and mobility, there is no difference in the rate of revision when robotic assistance is used in patella/trochlea knee replacement or when used in unicompartmental knee replacement. Mobile bearings increase revision risk for unicompartmental knee replacement, but their use is restricted to only two prostheses. There is no difference in revision risk between medial and lateral unicompartmental knee replacement.

Primary total knee replacement increased by 0.4% in 2024. The 20 year cumulative percent revision of knee prostheses still used in 2024 for the management of osteoarthritis is 8.0%. The impact of patient and prosthesis factors on the outcome of knee replacement surgery is similar to previous reports.

There are higher revision rates in younger patients and males, and there is an increased risk of revision for infection associated with increasing ASA score and BMI category. There is a reduced rate of revision when patella resurfacing is used, and when a patella component is used the revision rate is lowest with an all-polyethylene rather than a metal-backed prosthesis.

With respect to bearing surface, the use of XLPE continues to increase. Its impact on the revision rate varies depending on the prosthesis but it is never detrimental and often associated with a reduced revision rate. Femoral components with an alternate bearing surface (that is not cobalt-chrome) have a higher rate of revision, but the rate varies with the material used.

When adjusted for age, gender, fixation, and patella component usage, fixed bearing prostheses have a lower rate of revision compared to mobile bearing prostheses for the majority of the early period, but after 7 years mobile designs have a lower rate of revision.

Posterior stabilised prostheses have higher rates of revision compared to minimally stabilised prostheses. Medial pivot design prostheses have a higher rate of revision compared to minimally stabilised prostheses in the first 1.5 years, no difference between 1.5 and 3 years, and a lower rate after 3 years. Medial pivot designs have a lower rate of revision compared to posterior stabilised prostheses.

The effect of fixation varies depending on prosthesis stability and often with time. For minimally stabilised prostheses, hybrid and cemented fixation have the lowest rates of revision. For posterior stabilised prostheses, cement fixation initially has the lowest revision rate. For medial pivot prostheses, the use of cement for tibial fixation is associated with a lower early rate of revision. There has been renewed interest in cementless fixation over the last few years but, at least for minimally stabilised prostheses, cementless tibial component fixation has a higher rate of revision for all age groups and both genders.

Computer navigation, image derived instrumentation (IDI) and robotic assistance, to aid implantation of knee replacements, have been labelled as 'surgeon assistive tools'. There has been a continued rise in the use of robotic assistance. Analyses of these tools to aid knee replacement insertion have been undertaken with hazard ratios adjusted for age, gender, ASA, BMI, bearing surface, patella component usage and stability. There is no difference in the rate of revision when procedures using computer navigation are compared to procedures with no technology assistance. Similarly, with the same adjustments for potential confounding factors, there is no difference in the rate of revision when procedures using robotic assistance are compared to procedures with no technology assistance.

A summary table indexing statistically significant characteristic comparisons in knee replacements is located at the beginning of the Knee Chapter, while a comprehensive bibliography of knee replacement research utilising AOANJRR data from 2020-2025 is provided at the chapter's conclusion.

## Shoulder Replacement

In 2024, shoulder replacement increased by 6.9% compared to the previous year. The revision burden remained low at 7.5%. There has been an increasing interest in partial shoulder replacements in younger patients (hemi stemmed anatomic), and the outcomes with alternate bearing surfaces. Summary data for partial shoulder anatomic procedures are in the Annual Report and a full analysis in the Partial Shoulder Arthroplasty Supplementary Report.

Of the three classes of primary total shoulder replacement (total stemmed anatomic, total stemless anatomic, and total stemmed reverse) total stemmed reverse shoulder replacement is by far the most common type of total shoulder replacement undertaken in Australia and accounts for 74.4% of all total shoulder procedures. Total stemless anatomic is more frequently utilised than total stemmed anatomic shoulder replacements.

A special clinical assessment compared implant choices in patients under 60 years of age with osteoarthritis. A hemi stemmed anatomic with a pyrocarbon head was not different to traditional total shoulder replacement options in this age group. In a second assessment, total stemmed reverse replacement with custom, augmented or standard glenoid components found custom glenoid prostheses failed earlier than more conventional options.

The most common primary anatomic shoulder replacement, total stemless, had differing outcomes depending upon the age or BMI stratified by gender. Prosthetic factors including

fixation and glenoid component type influenced outcome. By contrast, the outcome of primary total stemmed anatomic shoulders changed depending upon age, gender and gender stratified by ASA score and BMI. There were also many implant, and sizing variations that were associated with the revision rate including glenoid component type, augmentation, and fixation, along with bearing surface, humeral head size and humeral stem length. Surgeon assistive tools did not reduce rates of revision.

Total stemmed reverse shoulder replacement revision rates are higher when used for rotator cuff arthropathy compared to osteoarthritis. Younger age, male gender, ASA score and BMI are associated with an increased risk of revision. In contrast to anatomic shoulder replacements, surgeon assistive tools, prostheses characteristics (bearing surface, glenosphere size and fixation), implant sizing variations (glenoid augmentation, humeral stem length and type), along with rotator cuff repair during the joint replacement surgery influence the outcome depending on the primary diagnosis.

The Registry continues to report on the impact of glenoid morphology on the different types of shoulder replacement. At this point, it appears to have little effect on the early revision rates. This is true for each of the three most common total shoulder designs.

A summary table indexing statistically significant characteristic comparisons in total shoulder replacement is located at the beginning of the Shoulder Chapter, while a comprehensive bibliography of shoulder replacement research utilising AOANJRR data is provided at the chapter's conclusion.

## Prostheses with Higher than Anticipated Rates of Revision

Each year, the AOANJRR identifies prostheses with higher than anticipated rates of revision. This year, 1 total conventional hip prosthesis, 1 total knee prosthesis, and 1 total stemmed reverse shoulder prosthesis have been identified.

# Acknowledgements

The Registry continues to receive support and invaluable assistance from the Australian Government, state and territory health departments and orthopaedic companies.

The Registry acknowledges the cooperation and support provided by those undertaking the surgery and completing the data forms, in particular, all orthopaedic surgeons, registrars and nursing staff.

The Registry acknowledges the ongoing support of all hospitals, both public and private, that undertake arthroplasty surgery nationally. The support provided by each hospital through their nominated coordinator(s) is appreciated. A complete list of participating hospitals and coordinators is presented at the end of the Hip, Knee and Shoulder Arthroplasty Annual Report.

The Registry greatly appreciates the participation of all joint replacement patients throughout Australia. Their contribution allows ongoing improvements in arthroplasty outcomes to be achieved.

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# Introduction

The 2025 Hip, Knee and Shoulder Arthroplasty Report is based on the analysis of 2,285,453 (972,256 hip, 1,205,616 knee and 107,581 shoulder) primary and revision procedures recorded by the Registry, with a procedure date up to and including 31 December 2024. Shoulder arthroplasty has been included in this report with hip and knee arthroplasty since 2017.

In addition, there are 14 supplementary reports that complete the AOANJRR Annual Report for 2025:

1. Lay Summary – Hip, Knee and Shoulder Replacement
2. Patient Reported Outcome Measures (PROMs): Hip, Knee and Shoulder Arthroplasty
3. Demographics of Hip, Knee and Shoulder Arthroplasty
4. Mortality of Hip, Knee and Shoulder Arthroplasty
5. Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report
6. Shoulder Replacement in Australia
7. Cement in Hip and Knee Arthroplasty
8. Metal/Metal Bearing Surface in Total Conventional Hip Arthroplasty
9. Primary Partial Shoulder Arthroplasty
10. Prosthesis Types with No or Minimal Use
11. Demographics and Outcome of Elbow and Wrist Arthroplasty
12. Demographics and Outcome of Ankle Arthroplasty
13. Demographics of Spinal Disc Arthroplasty
14. Comparative Prosthesis Performance

In addition to the 14 supplementary reports, investigations of prostheses with higher than anticipated rates of revision are published on https://aoanjrr.sahmri.com/annual-reports-2025.

All hospitals, public and private, undertaking joint replacement submit their data to the Registry. Currently, there are 319 participating hospitals. However, this may vary from time to time due to hospital closures, new hospitals, or changes to services within hospitals.

## Background

The Australian Orthopaedic Association (AOA) recognised the need to establish a national joint replacement registry in 1993. At that time, the outcome of joint replacement in Australia was unknown. Patient demographics were not available, and the types of prostheses and techniques used to implant them were unknown.

The need to establish a Registry was, in part, based on the documented success of a number of arthroplasty registries in other countries. In particular, the Swedish arthroplasty registries. In Sweden, the ability to identify factors important in achieving successful outcomes has resulted in both improved standards and significant cost savings.

In 1998, the then Commonwealth Department of Health (DoH) funded the AOA to establish the Registry. The Department of Health, Disability and Ageing continues to provide funding to maintain the Registry. In June 2009, Federal Parliament passed legislation to enable the government to cost recover this funding from the orthopaedic industry. This legislation was updated in 2015.

The Registry began hip and knee data collection on 1 September 1999. Implementation was undertaken in a staged manner in each of the Australian states and territories, becoming national during 2002. The first year of full national data collection for shoulder procedures was 2008 (Appendix 6).

The AOA contracts the South Australian Health and Medical Research Institute (SAHMRI) to provide data management and independent data analysis services for the Registry. The SAHMRI team contribute crucial data management and analysis expertise through the Registry Working Group and a variety of project working groups.

The AOA also contracts the University of South Australia to provide specific expertise in the ongoing development of analytical techniques for Registry data.

## Purpose

The purpose of the Registry is to define, improve and maintain the quality of care for individuals receiving joint replacement surgery. This is achieved by collecting a defined minimum data set that enables outcomes to be determined based on patient characteristics, prosthesis type and features, method of prosthesis fixation and surgical technique used.

The principal outcome measure is time to first revision surgery. This is an unambiguous measure of the need for further intervention. Combined with a careful analysis of potential confounding factors, this can be used as an accurate measure of the success, or otherwise, of a procedure. The Registry also monitors mortality of patients, which is critical when determining the rate of revision.

# Introduction

## Aims

1. Establish demographic data related to joint replacement surgery in Australia.
2. Provide accurate information on the use of different types of prostheses.
3. Determine regional variation in the practice of joint surgery.
4. Identify the demographic and diagnostic characteristics of patients that affect outcomes.
5. Analyse the effectiveness of different prostheses and treatment for specific diagnoses.
6. Evaluate the effectiveness of the large variety of prostheses currently on the market by analysing their survival rates.
7. Educate orthopaedic surgeons on the most effective prostheses and techniques to improve patient outcomes.
8. Provide surgeons with an auditing facility.
9. Provide information that can instigate tracking of patients if necessary.
10. Provide information for the comparison of the practice of joint replacement in Australia and other countries.

## Benefits

Since its inception, the Registry has enhanced the outcome of joint replacement surgery in Australia.

There are many factors known to influence the outcome of joint replacement surgery. Some of these include age, gender, diagnosis, ASA score and BMI of patients, as well as the type of prosthesis and surgical technique used.

Another coexisting influence is the rapid rate of change in medical technology. There is continual development and use of new types of prostheses and surgical techniques, for many of which the outcome remains uncertain.

Information obtained by the analysis of Registry data is used to benefit the community. The Registry releases this information through publicly available annual and supplementary reports, journal publications and data reports. These data reports are specific analyses requested by surgeons, hospitals, academic institutions, government, and government agencies as well as orthopaedic companies.

The Registry provides surgeons with access to their individual data and downloadable reports through a secure online portal. Separate online facilities are available for orthopaedic companies to monitor their own prostheses, and for Australian and regulatory bodies in other countries to monitor prostheses used in Australia. The data obtained through the online facilities are updated daily and are over 90% complete within six weeks of the procedure date.

The percentage of revision hip procedures has declined from a peak of 12.9% in 2003 to 6.7% in 2024. The percentage of revision knee procedures has declined from a peak of 8.8% in 2004 to 6.9% in 2024. Revision shoulder arthroplasty peaked at 10.9% in 2012 and has declined to 7.5% in 2024.

A major reason for the reduction in revision following hip, knee and shoulder joint replacement is the increased use of the type and class of prostheses shown to have better outcomes, and an associated decline in use of prostheses when less satisfactory outcomes are identified.

There are many examples of AOANJRR data enhancing the outcome of joint replacement surgery in Australia. These include:

- The identification of high revision rates associated with the use of Austin Moore hemiarthroplasty for the treatment of fractured neck of femur (2003). Its use subsequently reduced, particularly in younger patients with this diagnosis.
- The reduction in the use of unicompartmental knee replacement. This reduction followed the identification of high revision rates (2004) and subsequent reporting, that the results of revision of primary unicompartmental knee replacement, were similar to revising primary total knee replacements.
- The identification of the high revision rate associated with unispacer use (2004).
- The AOANJRR was the first to identify ASR Resurfacing and ASR XL THR as protheses with higher than anticipated rates of revision (2007/2008). These prostheses were subsequently removed from the market in Australia, a year earlier than the global recall.
- The importance of gender, age, and femoral head size to the outcomes of resurfacing prostheses (2007/2008).
- The identification of the entire class of large head metal/metal conventional total hip prostheses (2010).
- The reduction in revision associated with patella resurfacing (2010).
- Detailed analysis of the revision rates relating to bearing surface, including the improved outcomes associated with XLPE for both hips (2011), knees (2013) and shoulders (2017).
- Determining that the rate of revision for total stemmed anatomic shoulder replacement class is confounded by modular metal back glenoids.
- The identification of large numbers of prostheses with higher than anticipated rates of revision. This is almost always associated with a rapid reduction in use. Many of these devices have subsequently been removed from the market.
- The increasing adoption of Registry-identified best practice and use of better performing devices.

## Governance

The AOANJRR is an initiative of the AOA funded by the Commonwealth Government. In 2009, the Commonwealth established the AOANJRR Consultative Committee, which was administered and chaired by the Department of Health. The purpose was to provide advice on the overall strategic direction of the Registry. The Consultative Committee has been under review and is not currently meeting.

The National Board of the AOA established the AOA Registry Committee to review and recommend AOANJRR policies to the Board. The Committee reports to the AOA Board. Members include the Chair, Registry Clinical Director with the three Deputy Registry Clinical Directors and four Assistant Deputy Registry Clinical Directors in attendance. In addition, an orthopaedic surgeon from each state, the ACT, and a representative from each of the AOA specialty arthroplasty groups are included. A complete list of the current AOA Registry Committee is provided in the acknowledgements section of this report.

The Registry Clinical Director, Deputy Registry Clinical Directors and Assistant Deputy Registry Clinical Directors are appointed by the AOA Board and are responsible for providing strategic and clinical guidance. Additionally, the Registry Clinical Directors are responsible for ensuring the cooperation of hospitals, surgeons, and government, maintaining the profile and reputation of the Registry, continued collaboration with other arthroplasty registries internationally, and sustaining the current level of excellence.

The AOANJRR staff include the Registry Services Manager, , Core Data Coordinator, PROMs Coordinator, Data Requests and Publications Manager, Data Requests Coordinator, Data Requests Officer, Publications Coordinator, and Administrative Coordinator. The AOANJRR team are responsible for the day-to-day operations, implementing new strategies, provision of data reports, research, and publications activity, and coordinating the preparation of the Annual Report.

## Data Collection

Hospitals provide joint replacement data on specific Registry forms which are completed in theatre at the time of surgery. The completed forms are submitted to the Registry each month. Examples of these forms are available on the website: https://aoanjrr.sahmri.com/data-collection.

Hard copy forms are sent to the Registry where a small team of expert data entry staff enter the data directly into the database. Onsite Data Managers are available to resolve queries at the time of data entry to reduce any potential data entry errors. The Registry data entry system uses a predictive text function which greatly reduces the possibility of transcription errors and enables the experienced data entry staff to enter the data rapidly and accurately.

The Registry has also established mechanisms to collect data electronically when it becomes feasible for contributing hospitals to do so. To date, there are no hospitals providing data electronically.

## Data Validation

The Registry validates data collected from both public and private hospitals by comparing it to data provided by state and territory health departments. Validation of Registry data is a sequential multi-level matching process against health department unit record data.

## Data Quality

The validation process identifies:

1. Registry procedure records for procedures notified to state/territory health departments by hospitals.
2. State/territory records for procedures not submitted to the Registry by hospitals.
3. 'Exact match' procedures, that is, records held by the Registry and state/territory health departments.
4. Procedures that match on some parameters, but which require additional checking with hospitals to enable verification.

Initial validation is performed using hospital and patient identity numbers with subsequent verification undertaken on relevant procedure codes and appropriate admission periods.

Data errors can occur within Government or Registry data at any of these levels; that is, errors in patient identification, coding, or admission period attribution by either the hospital, state/ territory health department or the Registry. Data mismatches are managed depending on the nature of the error. For example, a health department record for a primary 'knee' may match a Registry-held record for a 'hip' on all parameters except procedure type. The Registry would regard the Registry data to be correct in this instance as the Registry record contains details of the prostheses implanted. Other errors may be resolved by contacting hospitals for clarification. Most commonly, this may include a reassessment of procedure codes or admission period.

The validation process identifies procedures not submitted to the Registry. As in previous years, the majority of these procedures have an ICD10 code for hemiarthroplasty of the femur. Sufficient information is provided in the state unit record data to enable the Registry to request hospitals to provide forms for unreported procedures.

## Outcome Assessment

The Registry describes the time to first revision using the Kaplan-Meier estimates of survivorship. The cumulative percent revision (CPR) at a certain time, for example, 5 years, is the complement in probability) of the Kaplan-Meier survivorship function at that time, multiplied by 100. The cumulative percent revision accounts for right censoring due to death and 'closure' of the database at the time of analysis. Closure of the database occurs in April of the report year for procedures up to 31 December of the preceding year. Due to

delays in receipt of the procedure form, some procedures are not included until the following annual report.

Mortality information is obtained by matching all procedures with the National Death Index (NDI) biannually. The NDI is the national mortality database maintained by the Australian Institute of Health and Welfare (AIHW). The AIHW requires ethics approval for access to the NDI data.

Prior to 2013, the Registry reported the revisions per 100 observed component years. This statistic provides a good estimate of the overall rate of revision. However, it does not allow for changes in the rate of revision over time. A more informative estimate of the rate of revision over time is the cumulative percent revision.

Confidence intervals for the cumulative percent revision are unadjusted point-wise Greenwood estimates and should not be used to infer significant differences in revision between groups. Reported hazard ratios should be used when judging statistical significance.

Hazard ratios (HR) from Cox proportional hazards models, adjusting for age and gender where appropriate, are used to compare rates of revision. For each model, the assumption of proportional hazards is checked analytically. If the interaction between the predictor and the log of time is statistically significant in the standard Cox model, then a time varying model is estimated. Time points are iteratively chosen until the assumption of proportionality is met, then the hazard ratios are calculated for each selected time period. If no time period is specified, then the hazard ratio is over the entire follow-up period. All tests are two-tailed at the 5% level of significance.

The cumulative percent revision is displayed until the number at risk for the group reaches 40, unless the initial number for the group is less than 100, in which case the cumulative percent revision is reported until 10% of the initial number at risk remains. This avoids uninformative, imprecise estimates at the right tail of the distribution where the number at risk is low. Analytical comparisons of revision rates using the proportional hazards model are based on all available data.[1]

In the presence of a competing risk for revision, the Kaplan-Meier method is known to overestimate the true probability of revision. Death of the patient before revision presents such a competing risk. In circumstances where the risk of death is high, e.g., in elderly patients with fractured neck of femur, the bias in the Kaplan-Meier estimates may be substantial and the reported cumulative percent revision should be interpreted with caution.

Cumulative incidence is one method of estimating the probability of revision in the presence of competing risks. Cumulative incidence revision diagnosis graphs deal with the competing risks of reasons for revision, highlighting the differences between groups in the pattern of revision over time. They also provide important insight into different mechanisms of failure. A further approach to address the issue of death is to assess the probability of revision in only those patients that are still alive at the time of assessment. This is referred to as conditional probability.

More detailed information on the statistical methods used in this report is presented in Appendix 2.

An important Registry focus has been the continued development of a standardised algorithm to identify prostheses or combination of prostheses not performing to the level of others in the same class. The Registry refers to this group as 'prostheses with a higher than anticipated rate of revision'. A three-stage approach has been developed and is outlined in detail in the relevant chapter of the report.

## Annual Report Review Prior To Publication

Prior to publication, three workshops were held to review, comment, and provide advice on all sections of the Annual Report. Members of the AOA, Arthroplasty Society, and Shoulder and Elbow Society were invited to attend these surgeon workshops.

The hip, knee and shoulder surgeon workshops were held in Adelaide on the weekend of the 2 and 3 August 2025. In addition to AOANJRR and SAHMRI staff, 33 hip, knee and shoulder arthroplasty specialists from the AOA membership attended the workshops.

Following these meetings, the Annual Report was provided to the AOA Board for consideration and final approval prior to publication.

[1] Pocock SJ, Clayton TC, Altman DG. Survival plots of time to event outcomes in clinical trials: good practice and pitfalls, Lancet 2002; 359: 1686-89.



# Ten, Fifteen and Twenty Year Prosthesis Outcomes

# Ten, Fifteen and Twenty Year Prosthesis Outcomes

## Ten Year Outcomes

The Registry first reported 10 year outcomes in 2011. Since that time, the Registry has reported on an increasing number of hip and knee prostheses that have achieved this length of follow-up. This outcome is widely regarded as an important milestone in assessing the performance of prostheses.

Since the Registry commenced data collection revision rates have declined and many prostheses are no longer used. In order to keep Registry data contemporaneous, only procedures using prostheses that have been available and used in 2024 (described as modern prostheses) are included in the analyses, unless clearly specified. This approach has been applied both to the calculation of the benchmark standard used to identify superior and non-inferior performance and the selection of prostheses combinations reported. In addition, the Registry has excluded prostheses where a single surgeon performed more than 50% of procedures.

Detailed information on prostheses that are no longer used is available in the supplementary report 'Comparative Prosthesis Performance' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2025

### HIP REPLACEMENT

Individual femoral and acetabular prosthesis combinations are reported. A combination is included if >350 procedures have been reported and the follow-up period is ≥10 years.

There are 48 femoral and acetabular combinations with 10 year outcome data. These prosthesis combinations have been used in 83.9% of all primary total conventional hip procedures performed for osteoarthritis.

The 10 year cumulative percent revision for the individual prosthesis combinations ranges from 1.9% to 7.9%. In the past, when assessing superior and non-inferior performance the commonly accepted benchmark standard of 5% cumulative percent revision at 10 years was used. In the 2021 Annual Report, the AOANJRR changed the approach to determining the benchmark so that it is now calculated each year and is based on the aggregate performance of modern prostheses. The 10 year benchmark for this year is 4.2%.

Approaches to benchmarking hip and knee prostheses have been reviewed by the ISAR International Prosthesis Benchmarking Working Group.[2] An important recommendation was to use confidence intervals (CI) for individual prostheses rather than the revision rate, as the CI reflects the precision in estimating the true population revision rate.

The superiority and inferiority approaches suggested by the ISAR International Prosthesis Benchmarking Working Group are utilised in this chapter to identify better performing hip prosthesis combinations.

**Superiority approach:** the upper confidence interval is less than, or equal to, the benchmark standard. Using the benchmark of 4.2% for modern prostheses at 10 years, 13 (27.1%) hip prosthesis combinations qualify for the superiority benchmark. These are highlighted in green in Table BM1.

**Non-inferiority approach:** the permitted upper confidence interval level is 20% above the benchmark standard. For the benchmark standard of 4.2% at 10 years, the accepted upper confidence interval is 5.0% or less. Using this approach, an additional 8 prosthesis combinations can be benchmarked, i.e., 21 (43.8%) prosthesis combinations would receive either a superiority or non-inferiority benchmark. The additional 8 devices with a non-inferiority benchmark are highlighted in blue in Table BM1.

It is important to emphasise that there are many reasons why a prosthesis combination may not achieve a benchmark standard. These include being used in small numbers, higher revision rates due to factors other than the prostheses used, as well as less satisfactory performance. However, it is clear that those prosthesis combinations that have achieved a benchmark standard have done so because they have revision rates that are comparatively lower.

[2] Report by ISAR International Prosthesis Benchmarking Working Group May 2018: https://www.isarhome.org/publications

**Table BM1 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Prosthesis Combinations with 10 Year Data (Primary Diagnosis OA)**

| Femoral Component | Acetabular Component | N Revised | N Total | Type of Revision | | | | 2 Yrs | 5 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | THR | Femoral | Acetabular | Other | | | |
| Accolade II | Trident (Shell) | 474 | 18666 | 45 | 162 | 74 | 193 | 2.2 (2.0, 2.4) | 2.8 (2.6, 3.1) | 3.9 (3.3, 4.6) |
| Anthology | R3 | 285 | 8388 | 27 | 83 | 58 | 117 | 2.4 (2.1, 2.7) | 2.9 (2.5, 3.3) | 3.7 (3.3, 4.2) |
| Avenir | Continuum | 62 | 1332 | 5 | 13 | 13 | 31 | 3.7 (2.8, 4.9) | 4.3 (3.3, 5.5) | 5.3 (4.1, 6.9) |
| C-Stem AMT | Marathon | 10 | 517 | 2 | 2 | 3 | 3 | 0.8 (0.3, 2.1) | 1.5 (0.7, 3.1) | 2.4 (1.3, 4.5) |
| C-Stem AMT | PINNACLE | 159 | 5347 | 15 | 67 | 15 | 62 | 1.6 (1.3, 2.0) | 2.7 (2.3, 3.2) | 4.2 (3.5, 5.0) |
| CORAIL | PINNACLE | 2488 | 63139 | 226 | 955 | 366 | 941 | 2.0 (1.9, 2.1) | 3.0 (2.8, 3.1) | 4.5 (4.3, 4.7) |
| CORAIL | Trident (Shell) | 25 | 640 | 4 | 5 | 3 | 13 | 3.0 (1.9, 4.7) | 4.0 (2.6, 6.1) | 6.2 (3.8, 10.1) |
| CPCS | R3 | 282 | 8054 | 27 | 86 | 56 | 113 | 2.4 (2.1, 2.7) | 3.3 (2.9, 3.8) | 4.6 (4.0, 5.2) |
| CPCS | Reflection (Cup) | 88 | 863 | 28 | 6 | 41 | 13 | 1.6 (0.9, 2.7) | 2.8 (1.9, 4.2) | 7.9 (6.0, 10.4) |
| CPCS | Reflection (Shell) | 115 | 2845 | 17 | 49 | 14 | 35 | 0.9 (0.6, 1.4) | 1.6 (1.2, 2.2) | 3.2 (2.6, 4.0) |
| CPT | Allofit | 62 | 1747 | 8 | 30 | 6 | 18 | 1.4 (0.9, 2.1) | 3.0 (2.3, 4.0) | 4.5 (3.5, 5.9) |
| CPT | Continuum | 143 | 2575 | 9 | 56 | 18 | 60 | 3.3 (2.7, 4.0) | 4.4 (3.7, 5.3) | 6.2 (5.3, 7.3) |
| CPT | Trabecular Metal (Shell) | 121 | 2110 | 11 | 54 | 18 | 38 | 2.7 (2.1, 3.5) | 4.0 (3.2, 5.0) | 6.4 (5.2, 7.7) |
| CPT | Trilogy | 435 | 7895 | 48 | 172 | 46 | 169 | 2.3 (2.0, 2.7) | 3.5 (3.2, 4.0) | 5.5 (5.0, 6.1) |
| CPT | ZCA | 43 | 868 | 16 | 10 | 10 | 7 | 1.2 (0.6, 2.2) | 2.4 (1.6, 3.7) | 4.5 (3.2, 6.3) |
| Evolve | Logical G | 73 | 2806 | 6 | 11 | 10 | 46 | 1.9 (1.5, 2.5) | 2.8 (2.2, 3.5) | 3.5 (2.7, 4.5) |
| Exeter V40 | Exeter | 138 | 1635 | 32 | 17 | 67 | 22 | 1.2 (0.8, 1.9) | 2.9 (2.1, 3.9) | 4.6 (3.6, 5.8) |
| Exeter V40 | Exeter Contemporary | 183 | 2978 | 59 | 37 | 62 | 25 | 1.9 (1.4, 2.4) | 3.0 (2.4, 3.7) | 4.5 (3.8, 5.4) |
| Exeter V40 | Exeter X3 Rimfit | 129 | 4614 | 31 | 37 | 34 | 27 | 1.7 (1.4, 2.2) | 2.5 (2.1, 3.0) | 3.3 (2.7, 3.9) |
| Exeter V40 | Trabecular Metal (Shell) | 21 | 496 | 2 | 3 | 2 | 14 | 2.7 (1.6, 4.5) | 3.7 (2.3, 5.8) | 4.6 (3.0, 7.2) |
| Exeter V40 | Trident (Shell) | 2509 | 82676 | 344 | 824 | 306 | 1035 | 1.5 (1.5, 1.6) | 2.3 (2.2, 2.4) | 3.5 (3.3, 3.6) |
| Exeter V40 | Trident/Tritanium (Shell) | 167 | 5174 | 20 | 44 | 28 | 75 | 1.9 (1.6, 2.3) | 2.9 (2.4, 3.4) | 4.0 (3.3, 4.7) |
| H-Max | Delta-TT | 79 | 1741 | 6 | 37 | 12 | 24 | 2.4 (1.8, 3.3) | 3.7 (2.9, 4.7) | 6.0 (4.7, 7.5) |
| MS 30 | Continuum | 17 | 916 | 1 | 2 | 3 | 11 | 1.7 (1.0, 2.7) | 1.9 (1.2, 3.1) | 1.9 (1.2, 3.1) |
| MS 30 | Fitmore | 19 | 620 | 0 | 2 | 8 | 9 | 1.5 (0.8, 2.9) | 2.6 (1.6, 4.4) | 3.9 (2.4, 6.2) |
| MS 30 | Low Profile Cup | 16 | 412 | 6 | 1 | 7 | 2 | 0.7 (0.2, 2.3) | 1.3 (0.6, 3.2) | 2.8 (1.4, 5.4) |
| Metafix | Trinity | 458 | 21551 | 51 | 126 | 89 | 192 | 1.8 (1.7, 2.0) | 2.4 (2.2, 2.6) | 3.1 (2.7, 3.6) |
| MiniHip | Trinity | 40 | 1307 | 2 | 21 | 10 | 7 | 2.7 (1.9, 3.7) | 3.0 (2.2, 4.1) | 3.3 (2.4, 4.5) |
| Optimys | RM Cup | 66 | 2955 | 9 | 25 | 10 | 22 | 2.0 (1.6, 2.6) | 2.5 (2.0, 3.2) | 2.8 (2.1, 3.7) |
| Origin | Logical G | 152 | 4478 | 7 | 42 | 26 | 77 | 2.9 (2.5, 3.5) | 3.8 (3.2, 4.5) | 6.0 (4.5, 7.9) |
| Polarstem | R3 | 612 | 22165 | 35 | 204 | 89 | 284 | 2.2 (2.0, 2.4) | 2.9 (2.6, 3.1) | 3.8 (3.5, 4.2) |
| Quadra-C | Versafitcup CC | 38 | 2206 | 7 | 8 | 8 | 15 | 1.4 (1.0, 2.0) | 1.8 (1.3, 2.5) | 2.5 (1.7, 3.6) |
| Quadra-H | Mpact | 249 | 6318 | 24 | 126 | 31 | 68 | 2.5 (2.1, 2.9) | 3.9 (3.4, 4.4) | 6.4 (5.1, 8.1) |
| Quadra-H | Versafitcup CC | 422 | 11091 | 49 | 197 | 76 | 100 | 2.1 (1.8, 2.4) | 3.0 (2.7, 3.4) | 4.7 (4.3, 5.3) |
| S-Rom | PINNACLE | 162 | 2668 | 16 | 91 | 16 | 39 | 2.8 (2.3, 3.6) | 4.4 (3.7, 5.3) | 5.7 (4.8, 6.7) |
| SL-Plus | EP-Fit Plus | 48 | 1124 | 3 | 20 | 9 | 16 | 2.0 (1.3, 3.0) | 2.9 (2.1, 4.1) | 4.1 (3.0, 5.5) |
| SL-Plus | R3 | 104 | 1695 | 7 | 28 | 24 | 45 | 3.1 (2.4, 4.0) | 4.2 (3.3, 5.3) | 6.0 (4.9, 7.3) |
| Secur-Fit | Trident (Shell) | 546 | 9895 | 40 | 243 | 99 | 164 | 2.4 (2.1, 2.8) | 3.6 (3.2, 4.0) | 4.8 (4.4, 5.2) |
| Secur-Fit Plus | Trident (Shell) | 92 | 2956 | 9 | 32 | 22 | 29 | 1.6 (1.2, 2.1) | 2.2 (1.7, 2.8) | 3.1 (2.5, 3.9) |
| Spectron EF | R3 | 105 | 2169 | 18 | 22 | 21 | 44 | 2.4 (1.9, 3.2) | 3.8 (3.1, 4.8) | 5.1 (4.2, 6.2) |
| Spectron EF | Reflection (Cup) | 128 | 1406 | 50 | 12 | 57 | 9 | 1.3 (0.8, 2.0) | 2.9 (2.1, 4.0) | 7.2 (5.8, 8.9) |
| Synergy | R3 | 196 | 5403 | 6 | 55 | 48 | 87 | 2.2 (1.8, 2.6) | 2.8 (2.4, 3.3) | 3.5 (3.0, 4.1) |
| Synergy | Trident (Shell) | 22 | 439 | 0 | 4 | 9 | 9 | 1.2 (0.5, 2.7) | 1.9 (0.9, 3.7) | 3.8 (2.3, 6.2) |
| Taper Fit | Trinity | 125 | 5556 | 13 | 38 | 16 | 58 | 1.8 (1.5, 2.3) | 2.7 (2.2, 3.2) | 4.0 (2.8, 5.7) |
| Taperloc | G7 | 158 | 6580 | 11 | 39 | 21 | 87 | 2.2 (1.8, 2.6) | 2.6 (2.2, 3.1) | 3.0 (2.5, 3.5) |

# Ten, Fifteen and Twenty Year Prosthesis Outcomes

| Femoral Component | Acetabular Component | N Revised | N Total | Type of Revision | | | | 2 Yrs | 5 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | THR | Femoral | Acetabular | Other | | | |
| Taperloc Microplasty | G7 | 100 | 6065 | 10 | 43 | 10 | 37 | 1.6 (1.3, 1.9) | 1.9 (1.5, 2.3) | 2.8 (1.6, 4.7) |
| Tri-Fit TS | Trinity | 136 | 5085 | 15 | 58 | 23 | 40 | 1.9 (1.5, 2.3) | 2.5 (2.1, 3.0) | 3.2 (2.6, 3.8) |
| twinSys (cless) | RM Cup | 59 | 1510 | 6 | 16 | 7 | 30 | 2.5 (1.8, 3.4) | 3.3 (2.5, 4.4) | 4.9 (3.6, 6.4) |
| TOTAL | | 12161 | 353676 | 1383 | 4215 | 2001 | 4562 | | | |

Note: Only prostheses with >350 procedures have been listed.
Green: prosthesis combination qualifies for a superiority benchmark.
Blue: prosthesis combination qualifies for non-inferiority benchmark.
Restricted to modern prostheses

**KNEE REPLACEMENT**

The Registry has information on individual femoral and tibial prosthesis combinations. A combination is included if >350 procedures have been reported to the Registry and the follow-up is ≥10 years.

The listed prostheses most often represent a family of devices that have a range of different femoral and tibial components, combined with different tibial inserts, listed under one prosthesis name. Prosthesis types are further characterised according to whether they are minimally stabilised (cruciate retaining) or posteriorly stabilised.

As with hips, to ensure that the data reflects contemporary practice only procedures using modern prostheses are included in the analyses. This approach has been applied both to the calculation of the benchmark standard used to identify superior and non-inferior performance and the selection of prosthesis combinations reported. In addition, the Registry has excluded prostheses where a single surgeon performed more than 50% of procedures.

Detailed information on prostheses that are no longer used is available in the supplementary report 'Comparative Prosthesis Performance' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2025

There are 38 total knee replacement combinations with 10 year outcome data. These prosthesis combinations were used in 98.9% of all primary total knee replacement procedures performed for osteoarthritis.

The 10 year cumulative percent revision ranges from 2.8% to 11.9%. In the past, as with primary total conventional hip replacement, when assessing superior and non-inferior performance the benchmark standard used was a cumulative percent revision at 10 years of 5%. The cumulative percent revision benchmark at 10 years, calculated this year based on the aggregate performance of modern prostheses within the AOANJRR is 4.7%.

The superiority and inferiority approaches suggested by the ISAR International Prosthesis Benchmarking Working Group are utilised in this chapter to identify better performing knee prosthesis combinations.

Applying the recommendations of the ISAR International Prosthesis Benchmarking Working Group, using the new benchmark of 4.7% at 10 years, then 8 (21.1%) knee prosthesis combinations qualify for the superiority benchmark. These are highlighted in green in Table BM2.

To assess non-inferiority, the permitted upper confidence interval level is 20% above the new benchmark standard which is 5.6% or less. An additional 10 knee prosthesis combinations can be benchmarked, i.e., 18 (47.4%) prosthesis combinations would receive either a superiority or a non-inferiority benchmark. The additional 10 devices with a non-inferiority benchmark are highlighted in blue (Table BM2).

It is important to emphasise that there are many reasons why a prosthesis combination may not achieve a benchmark standard. These include being used in small numbers, patella resurfacing rates, higher revision rates due to factors other than the prostheses used, as well as less satisfactory performance. However, those prosthesis combinations that have achieved a benchmark standard have done so because they have revision rates that are comparatively lower.

**Table BM2 Cumulative Percent Revision of Primary Total Knee Replacement Prosthesis Combinations with 10 Year Data (Primary Diagnosis OA)**

| Femoral Component | Tibial Component | N Revised | N Total | Type of Revision | | | | 2 Yrs | 5 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | TKR | Femoral | Tibial | Other | | | |
| ACS | ACS Fixed | 170 | 3850 | 47 | 10 | 21 | 92 | 2.8 (2.3, 3.3) | 4.2 (3.6, 4.9) | 5.4 (4.6, 6.3) |
| ACS | ACS Mobile | 108 | 2246 | 38 | 9 | 4 | 57 | 3.0 (2.3, 3.8) | 4.6 (3.8, 5.6) | 5.8 (4.8, 7.1) |
| Active Knee | Active Knee | 934 | 11106 | 282 | 30 | 43 | 579 | 2.4 (2.1, 2.7) | 4.6 (4.2, 5.0) | 7.8 (7.2, 8.4) |
| Apex Knee CR | Apex Knee | 270 | 14421 | 60 | 24 | 13 | 173 | 1.3 (1.1, 1.5) | 2.2 (1.9, 2.5) | 3.1 (2.6, 3.7) |
| Apex Knee PS | Apex Knee | 220 | 7507 | 87 | 8 | 17 | 108 | 1.7 (1.4, 2.0) | 3.1 (2.7, 3.6) | 4.9 (4.1, 5.7) |
| Attune CR | Attune | 816 | 37247 | 207 | 41 | 54 | 514 | 1.6 (1.4, 1.7) | 2.6 (2.5, 2.8) | 3.5 (3.2, 3.8) |
| Attune PS | Attune | 419 | 17537 | 131 | 24 | 53 | 211 | 1.6 (1.4, 1.8) | 2.7 (2.4, 2.9) | 4.7 (4.1, 5.5) |
| BalanSys | BalanSys | 155 | 5003 | 53 | 8 | 9 | 85 | 1.5 (1.2, 1.9) | 2.5 (2.1, 3.0) | 3.9 (3.3, 4.7) |
| Columbus | Columbus | 276 | 8402 | 72 | 12 | 15 | 177 | 1.9 (1.7, 2.3) | 3.8 (3.3, 4.3) | 6.1 (5.2, 7.2) |
| E.Motion | E.Motion | 77 | 1034 | 23 | 9 | 4 | 41 | 4.3 (3.2, 5.8) | 6.5 (5.2, 8.3) | 8.5 (6.8, 10.6) |
| Evolution | Evolution | 375 | 13525 | 92 | 2 | 15 | 266 | 1.6 (1.4, 1.9) | 2.9 (2.6, 3.2) | 4.2 (3.7, 4.7) |
| GMK Primary | GMK Primary | 149 | 3967 | 43 | 5 | 16 | 85 | 2.5 (2.0, 3.0) | 3.8 (3.2, 4.5) | 5.1 (4.3, 6.0) |
| GMK Sphere Primary | GMK Primary | 653 | 26250 | 150 | 17 | 40 | 446 | 2.1 (1.9, 2.3) | 3.2 (2.9, 3.5) | 4.4 (3.9, 5.0) |
| GMK Sphere Primary | GMK Sphere Primary | 111 | 4011 | 29 | 2 | 9 | 71 | 2.1 (1.7, 2.7) | 3.6 (3.0, 4.4) | 4.9 (3.9, 6.2) |
| Genesis II CR | Genesis II | 1313 | 26672 | 283 | 79 | 57 | 894 | 2.0 (1.8, 2.1) | 3.4 (3.2, 3.7) | 5.0 (4.7, 5.3) |
| Genesis II Oxinium CR (ctd) | Genesis II | 686 | 11473 | 140 | 37 | 28 | 481 | 1.9 (1.7, 2.2) | 3.5 (3.1, 3.9) | 5.9 (5.5, 6.5) |
| Genesis II Oxinium PS (ctd) | Genesis II | 1581 | 22705 | 243 | 37 | 179 | 1122 | 2.7 (2.5, 3.0) | 4.9 (4.6, 5.2) | 7.0 (6.7, 7.4) |
| Genesis II PS | Genesis II | 1013 | 21014 | 185 | 33 | 62 | 733 | 2.0 (1.8, 2.2) | 3.6 (3.3, 3.8) | 4.9 (4.6, 5.3) |
| Journey II Oxinium | Journey | 34 | 3900 | 3 | 2 | 1 | 28 | 1.1 (0.7, 1.6) | 4.5 (2.4, 8.2) | 4.5 (2.4, 8.2) |
| LCS CR | LCS | 638 | 8346 | 262 | 24 | 90 | 262 | 2.5 (2.1, 2.8) | 4.5 (4.0, 4.9) | 6.4 (5.9, 7.0) |
| Legion CR | Genesis II | 370 | 10342 | 72 | 27 | 15 | 256 | 2.1 (1.8, 2.4) | 3.8 (3.4, 4.2) | 5.4 (4.7, 6.1) |
| Legion Oxinium CR | Genesis II | 365 | 12774 | 86 | 28 | 12 | 239 | 1.7 (1.5, 2.0) | 3.1 (2.8, 3.5) | 4.3 (3.8, 4.9) |
| Legion Oxinium FS | Legion | 33 | 360 | 2 | 2 | 0 | 29 | 6.7 (4.5, 10.0) | 8.9 (6.2, 12.8) | 11.9 (8.2, 16.9) |
| Legion Oxinium PS | Genesis II | 822 | 19458 | 126 | 23 | 69 | 604 | 2.1 (1.9, 2.3) | 3.8 (3.5, 4.1) | 5.2 (4.8, 5.5) |
| Legion PS | Genesis II | 234 | 6434 | 60 | 5 | 11 | 158 | 2.0 (1.7, 2.4) | 3.1 (2.7, 3.6) | 4.2 (3.7, 4.8) |
| MRK | MRK | 35 | 855 | 9 | 1 | 0 | 25 | 1.9 (1.2, 3.1) | 3.1 (2.1, 4.5) | 4.6 (3.2, 6.6) |
| Nexgen LCCK | Nexgen | 57 | 983 | 10 | 3 | 1 | 43 | 3.0 (2.1, 4.3) | 4.6 (3.4, 6.1) | 5.9 (4.4, 7.8) |
| Nexgen LPS Flex | Nexgen | 1536 | 31636 | 441 | 65 | 216 | 814 | 1.9 (1.7, 2.0) | 3.2 (3.0, 3.4) | 4.9 (4.7, 5.2) |
| Nexgen RH | Nexgen | 44 | 832 | 4 | 5 | 4 | 31 | 2.9 (1.9, 4.4) | 5.2 (3.7, 7.3) | 8.8 (6.4, 12.1) |
| Persona CR | Persona | 1195 | 76213 | 227 | 56 | 111 | 801 | 1.5 (1.4, 1.6) | 2.4 (2.3, 2.6) | 2.8 (2.5, 3.1) |
| Persona PS | Persona | 154 | 6546 | 30 | 10 | 4 | 110 | 1.8 (1.5, 2.2) | 2.8 (2.4, 3.3) | 3.4 (2.8, 4.0) |
| SAIPH | SAIPH | 120 | 6711 | 30 | 4 | 0 | 86 | 1.1 (0.9, 1.4) | 2.1 (1.7, 2.5) | 2.8 (2.1, 3.6) |
| Score | Score | 454 | 6400 | 188 | 23 | 12 | 231 | 3.0 (2.6, 3.5) | 5.6 (5.1, 6.3) | 9.0 (8.1, 9.9) |
| Trekking | Trekking | 75 | 1287 | 34 | 7 | 3 | 31 | 3.1 (2.3, 4.3) | 4.8 (3.7, 6.1) | 6.1 (4.9, 7.7) |
| Triathlon CR | Triathlon | 4360 | 187428 | 819 | 173 | 214 | 3154 | 1.4 (1.4, 1.5) | 2.3 (2.3, 2.4) | 3.5 (3.4, 3.6) |
| Triathlon FS | Triathlon | 27 | 494 | 7 | 2 | 1 | 17 | 4.2 (2.7, 6.6) | 6.4 (4.4, 9.3) | 6.4 (4.4, 9.3) |
| Triathlon PS | Triathlon | 704 | 15654 | 138 | 38 | 86 | 442 | 2.2 (2.0, 2.5) | 3.7 (3.4, 4.0) | 5.2 (4.8, 5.6) |
| Vanguard CR | Vanguard | 1224 | 27180 | 311 | 45 | 72 | 796 | 1.7 (1.5, 1.9) | 2.9 (2.7, 3.1) | 4.6 (4.4, 4.9) |
| TOTAL | | 21807 | 661803 | 5024 | 930 | 1561 | 14292 | | | |

Note: Only prostheses with >350 procedures have been listed.
CR 'cruciate retaining' refers to minimally stabilised.
Green: prosthesis combination qualifies for a superiority benchmark.
Blue: prosthesis combination qualifies for non-inferiority benchmark.
Restricted to modern prostheses.

# Ten, Fifteen and Twenty Year Prosthesis Outcomes

## SHOULDER REPLACEMENT

The Registry is reporting 10 year outcomes for primary total shoulder replacements. Individual humeral and glenoid prosthesis combinations are reported. A combination is included if >50 procedures have been reported to the Registry and the follow-up is ≥10 years.

As with hips and knees, to ensure that the data reflects contemporary practice only procedures using modern prostheses are included in the analyses. This approach has been applied both to the calculation of the benchmark standard used to identify superior and non-inferior performance and the selection of prosthesis combinations reported. In addition, the Registry has excluded prostheses where a single surgeon performed more than 50% of procedures.

Detailed information on prostheses that are no longer used is available in the supplementary report 'Comparative Prosthesis Performance' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2025

### Total Stemmed Anatomic Shoulder Replacement

There are 5 total stemmed anatomic shoulder replacement combinations with a primary diagnosis of osteoarthritis with 10 year outcomes. These prosthesis combinations were used in 73.7% of all primary total stemmed anatomic shoulder replacement procedures performed for osteoarthritis.

The 10 year cumulative percent revision ranges from 4.9% to 24.2%. The cumulative percent revision benchmark at 10 years, calculated this year is based on the aggregate performance of modern prostheses where cemented polyethylene glenoid components are used for a primary diagnosis of osteoarthritis, which is 7.4%.

Using the benchmark of 7.4% at 10 years, then one total stemmed anatomic shoulder prosthesis combination qualifies for the superiority benchmark.

To assess non-inferiority, the permitted upper confidence interval level is 20% above the new benchmark standard which is 8.9% or less. No additional total stemmed anatomic shoulder prosthesis combination qualify for a non-inferiority benchmark (Table BM3).

### Primary Total Stemmed Reverse Shoulder Replacement

There are 6 total stemmed reverse shoulder replacement combinations undertaken for all diagnoses with 10 year outcomes.

These prosthesis combinations were used in 67.7% of primary total stemmed reverse shoulder replacement procedures performed for any diagnosis reported to the Registry.

The 10 year cumulative percent revision ranges from 3.4% to 6.7%. The cumulative percent revision benchmark at 10 years, calculated this year based on the aggregate performance of modern prostheses with cementless fixation is 5.4%.

Applying a benchmark of 5.4% at 10 years then one total stemmed reverse shoulder prosthesis combination qualifies for the superiority benchmark.

To assess non-inferiority, the permitted upper confidence interval level is 20% above the new benchmark standard which is 6.5% or less. Using this approach, an additional 2 total stemmed reverse shoulder replacement combinations can be benchmarked, i.e. 3 (50%) prosthesis combinations would receive either a superiority or a non-inferiority benchmark. The additional 2 devices with a non-inferiority benchmark are highlighted in blue (Table BM4).

It is important to emphasise that there are many reasons why a prosthesis combination may not achieve a benchmark standard. These include being used in small numbers, higher revision rates due to factors other than the prostheses used, as well as less satisfactory performance. However, it is clear that those prosthesis combinations that have achieved a benchmark standard have done so because they have revision rates that are comparatively lower.

**Table BM3 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement Combinations with 10 Year Data (Primary Diagnosis OA)**

| Humeral Component | Glenoid Component | N Revised | N Total | Type of Revision | | | | 2 Yrs | 5 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | TSR | Humeral | Glenoid | Other | | | |
| Affinis | Affinis | 21 | 198 | 7 | 1 | 7 | 6 | 1.1 (0.3, 4.3) | 5.0 (2.7, 9.5) | 8.9 (5.4, 14.3) |
| Ascend Flex | Perform | 40 | 1385 | 37 | 1 | 0 | 2 | 1.6 (1.0, 2.4) | 2.7 (1.9, 3.9) | 4.9 (3.3, 7.0) |
| Comprehensive | Comprehensive | 55 | 930 | 41 | 3 | 1 | 10 | 4.7 (3.5, 6.3) | 5.7 (4.3, 7.5) | 7.5 (5.6, 10.0) |
| Equinoxe | Equinoxe | 80 | 726 | 55 | 6 | 4 | 15 | 5.1 (3.7, 7.0) | 9.6 (7.4, 12.3) | 24.2 (18.1, 32.0) |
| SMR | SMR | 36 | 533 | 29 | 1 | 1 | 5 | 4.5 (3.0, 6.7) | 5.6 (3.9, 8.0) | 7.0 (5.0, 9.7) |
| TOTAL | | 232 | 3772 | 169 | 12 | 13 | 38 | | | |

Note: Only prostheses with >50 procedures have been listed.
Green: prosthesis combination qualifies for a superiority benchmark.
Blue: prosthesis combination qualifies for non-inferiority benchmark.
Restricted to modern prostheses.

**Table BM4 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement Combinations with 10 Year Data (All Diagnoses)**

| Humeral Component | Glenoid Component | N Revised | N Total | Type of Revision | | | | 2 Yrs | 5 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | TSR | Humeral | Glenoid | Other | | | |
| Aequalis | Aequalis | 219 | 4555 | 13 | 38 | 17 | 151 | 2.9 (2.4, 3.4) | 4.4 (3.8, 5.1) | 6.7 (5.8, 7.7) |
| Ascend Flex | Aequalis | 157 | 4084 | 33 | 94 | 2 | 28 | 3.4 (2.9, 4.1) | 4.9 (4.2, 5.8) | 5.7 (4.6, 7.2) |
| Comprehensive | Comprehensive Reverse | 159 | 8747 | 62 | 66 | 4 | 27 | 1.8 (1.5, 2.1) | 2.5 (2.1, 3.0) | 3.4 (2.2, 5.2) |
| Delta Xtend | Delta Xtend | 490 | 12331 | 28 | 72 | 29 | 361 | 2.8 (2.5, 3.1) | 3.7 (3.4, 4.1) | 5.0 (4.5, 5.5) |
| SMR | SMR L1 | 504 | 11869 | 36 | 110 | 40 | 318 | 3.6 (3.3, 4.0) | 4.3 (3.9, 4.7) | 5.3 (4.8, 5.8) |
| Trabecular Metal | Trabecular Metal | 105 | 1988 | 2 | 8 | 35 | 60 | 3.5 (2.8, 4.5) | 5.1 (4.2, 6.3) | 6.4 (5.2, 7.9) |
| **TOTAL** | | **1634** | **43574** | **174** | **388** | **127** | **945** | | | |

Note: Only prostheses with >50 procedures have been listed.
Green: prosthesis combination qualifies for a superiority benchmark.
Blue: prosthesis combination qualifies for non-inferiority benchmark.
Restricted to modern prostheses.

## Fifteen Year Outcomes

This year, the Registry is reporting 15 year outcomes for 27 hip and 19 knee prosthesis combinations. A combination is included if >350 procedures have been reported to the Registry, and the follow-up period is 15 or more years.

Detailed information on prostheses that are no longer used is available in the supplementary report 'Comparative Prosthesis Performance' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2025

### HIP REPLACEMENT

The 27 listed prosthesis combinations were used in 59.6% of all primary total conventional hip replacement procedures performed for osteoarthritis.

The 15 year cumulative percent revision ranges from 4.1% to 17.3%. The benchmark used to assess superiority and non-inferiority performance at 15 years was calculated based on modern prostheses. This year, the 15 year benchmark is 6.0%. There are 5 (18.5%) hip prosthesis combinations that qualify for a superiority benchmark and these are highlighted in green (Table BM5).

An additional 4 prosthesis combinations qualify for a non-inferiority benchmark, i.e., 9 (33.3%) qualify for either a superiority or non-inferiority benchmark. Those prosthesis combinations that qualify for a non-inferiority benchmark are highlighted in blue (Table BM5).

### KNEE REPLACEMENT

The listed 19 prosthesis combinations were used in 64.8% of all primary total knee replacement procedures performed for osteoarthritis.

The 15 year cumulative percent revision ranges from 4.7% to 11.1%. This year, the benchmark used to assess superiority and non-inferiority at 15 years is 6.3%. There is 1 (5.3%) knee prosthesis combination that qualifies for a superiority benchmark and this is highlighted in green (Table BM6).

There are an additional 7 prosthesis combinations that qualify for a non-inferiority benchmark, i.e., 8 (42.1%) qualify for either a superiority or non-inferiority benchmark. Those prostheses that qualify for a non-inferiority benchmark are highlighted in blue (Table BM6).

# Ten, Fifteen and Twenty Year Prosthesis Outcomes

**Table BM5 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Prosthesis Combinations with 15 Year Data (Primary Diagnosis OA)**

| Femoral Component | Acetabular Component | N Revised | N Total | Type of Revision | | | | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | THR | Femoral | Acetabular | Other | | | |
| Anthology | R3 | 285 | 8388 | 27 | 83 | 58 | 117 | 2.9 (2.5, 3.3) | 3.7 (3.3, 4.2) | 4.3 (3.8, 5.0) |
| C-Stem AMT | PINNACLE | 159 | 5347 | 15 | 67 | 15 | 62 | 2.7 (2.3, 3.2) | 4.2 (3.5, 5.0) | 6.7 (4.5, 9.9) |
| CORAIL | PINNACLE | 2488 | 63139 | 226 | 955 | 366 | 941 | 3.0 (2.8, 3.1) | 4.5 (4.3, 4.7) | 7.0 (6.6, 7.4) |
| CPCS | R3 | 282 | 8054 | 27 | 86 | 56 | 113 | 3.3 (2.9, 3.8) | 4.6 (4.0, 5.2) | 5.3 (4.5, 6.2) |
| CPCS | Reflection (Cup) | 88 | 863 | 28 | 6 | 41 | 13 | 2.8 (1.9, 4.2) | 7.9 (6.0, 10.4) | 17.3 (13.8, 21.6) |
| CPCS | Reflection (Shell) | 115 | 2845 | 17 | 49 | 14 | 35 | 1.6 (1.2, 2.2) | 3.2 (2.6, 4.0) | 5.3 (4.3, 6.5) |
| CPT | Allofit | 62 | 1747 | 8 | 30 | 6 | 18 | 3.0 (2.3, 4.0) | 4.5 (3.5, 5.9) | 5.7 (4.1, 7.9) |
| CPT | Trabecular Metal (Shell) | 121 | 2110 | 11 | 54 | 18 | 38 | 4.0 (3.2, 5.0) | 6.4 (5.2, 7.7) | 8.9 (7.2, 11.0) |
| CPT | Trilogy | 435 | 7895 | 48 | 172 | 46 | 169 | 3.5 (3.2, 4.0) | 5.5 (5.0, 6.1) | 7.0 (6.3, 7.7) |
| CPT | ZCA | 43 | 868 | 16 | 10 | 10 | 7 | 2.4 (1.6, 3.7) | 4.5 (3.2, 6.3) | 6.1 (4.3, 8.5) |
| Exeter V40 | Exeter | 138 | 1635 | 32 | 17 | 67 | 22 | 2.9 (2.1, 3.9) | 4.6 (3.6, 5.8) | 9.7 (8.0, 11.6) |
| Exeter V40 | Exeter Contemporary | 183 | 2978 | 59 | 37 | 62 | 25 | 3.0 (2.4, 3.7) | 4.5 (3.8, 5.4) | 7.7 (6.6, 9.1) |
| Exeter V40 | Trabecular Metal (Shell) | 21 | 496 | 2 | 3 | 2 | 14 | 3.7 (2.3, 5.8) | 4.6 (3.0, 7.2) | 5.1 (3.3, 7.8) |
| Exeter V40 | Trident (Shell) | 2509 | 82676 | 344 | 824 | 306 | 1035 | 2.3 (2.2, 2.4) | 3.5 (3.3, 3.6) | 4.9 (4.7, 5.2) |
| MS 30 | Fitmore | 19 | 620 | 0 | 2 | 8 | 9 | 2.6 (1.6, 4.4) | 3.9 (2.4, 6.2) | 4.9 (2.8, 8.4) |
| MS 30 | Low Profile Cup | 16 | 412 | 6 | 1 | 7 | 2 | 1.3 (0.6, 3.2) | 2.8 (1.4, 5.4) | 5.9 (3.2, 10.8) |
| Polarstem | R3 | 612 | 22165 | 35 | 204 | 89 | 284 | 2.9 (2.6, 3.1) | 3.8 (3.5, 4.2) | 4.6 (3.9, 5.5) |
| Quadra-H | Versafitcup CC | 422 | 11091 | 49 | 197 | 76 | 100 | 3.0 (2.7, 3.4) | 4.7 (4.3, 5.3) | 7.7 (6.3, 9.3) |
| S-Rom | PINNACLE | 162 | 2668 | 16 | 91 | 16 | 39 | 4.4 (3.7, 5.3) | 5.7 (4.8, 6.7) | 6.8 (5.8, 8.0) |
| SL-Plus | EP-Fit Plus | 48 | 1124 | 3 | 20 | 9 | 16 | 2.9 (2.1, 4.1) | 4.1 (3.0, 5.5) | 4.6 (3.5, 6.1) |
| SL-Plus | R3 | 104 | 1695 | 7 | 28 | 24 | 45 | 4.2 (3.3, 5.3) | 6.0 (4.9, 7.3) | 7.6 (6.2, 9.3) |
| Secur-Fit | Trident (Shell) | 546 | 9895 | 40 | 243 | 99 | 164 | 3.6 (3.2, 4.0) | 4.8 (4.4, 5.2) | 6.4 (5.9, 7.0) |
| Secur-Fit Plus | Trident (Shell) | 92 | 2956 | 9 | 32 | 22 | 29 | 2.2 (1.7, 2.8) | 3.1 (2.5, 3.9) | 4.1 (3.3, 5.1) |
| Spectron EF | R3 | 105 | 2169 | 18 | 22 | 21 | 44 | 3.8 (3.1, 4.8) | 5.1 (4.2, 6.2) | 6.9 (5.5, 8.7) |
| Spectron EF | Reflection (Cup) | 128 | 1406 | 50 | 12 | 57 | 9 | 2.9 (2.1, 4.0) | 7.2 (5.8, 8.9) | 12.9 (10.8, 15.5) |
| Synergy | R3 | 196 | 5403 | 6 | 55 | 48 | 87 | 2.8 (2.4, 3.3) | 3.5 (3.0, 4.1) | 5.0 (4.2, 5.8) |
| Synergy | Trident (Shell) | 22 | 439 | 0 | 4 | 9 | 9 | 1.9 (0.9, 3.7) | 3.8 (2.3, 6.2) | 6.1 (4.0, 9.5) |
| **TOTAL** | | **9401** | **251084** | **1099** | **3304** | **1552** | **3446** | | | |

Note: Only prostheses with >350 procedures have been listed.

Green: prosthesis combination qualifies for a superiority benchmark.

Blue: prosthesis combination qualifies for non-inferiority benchmark.

Restricted to modern prostheses

**Table BM6 Cumulative Percent Revision of Primary Total Knee Replacement Prosthesis Combinations with 15 Year Data (Primary Diagnosis OA)**

| Femoral Component | Tibial Component | N Revised | N Total | Type of Revision | | | | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | TKR | Femoral | Tibial | Other | | | |
| Active Knee | Active Knee | 934 | 11106 | 282 | 30 | 43 | 579 | 4.6 (4.2, 5.0) | 7.8 (7.2, 8.4) | 11.1 (10.4, 11.9) |
| BalanSys | BalanSys | 155 | 5003 | 53 | 8 | 9 | 85 | 2.5 (2.1, 3.0) | 3.9 (3.3, 4.7) | 5.2 (4.0, 6.8) |
| Columbus | Columbus | 276 | 8402 | 72 | 12 | 15 | 177 | 3.8 (3.3, 4.3) | 6.1 (5.2, 7.2) | 8.6 (6.9, 10.6) |
| Genesis II CR | Genesis II | 1313 | 26672 | 283 | 79 | 57 | 894 | 3.4 (3.2, 3.7) | 5.0 (4.7, 5.3) | 6.1 (5.8, 6.5) |
| Genesis II Oxinium CR (ctd) | Genesis II | 686 | 11473 | 140 | 37 | 28 | 481 | 3.5 (3.1, 3.9) | 5.9 (5.5, 6.5) | 8.4 (7.7, 9.1) |
| Genesis II Oxinium PS (ctd) | Genesis II | 1581 | 22705 | 243 | 37 | 179 | 1122 | 4.9 (4.6, 5.2) | 7.0 (6.7, 7.4) | 9.3 (8.8, 9.9) |
| Genesis II PS | Genesis II | 1013 | 21014 | 185 | 33 | 62 | 733 | 3.6 (3.3, 3.8) | 4.9 (4.6, 5.3) | 6.2 (5.8, 6.7) |
| LCS CR | LCS | 638 | 8346 | 262 | 24 | 90 | 262 | 4.5 (4.0, 4.9) | 6.4 (5.9, 7.0) | 8.1 (7.5, 8.8) |
| Legion CR | Genesis II | 370 | 10342 | 72 | 27 | 15 | 256 | 3.8 (3.4, 4.2) | 5.4 (4.7, 6.1) | 7.2 (5.9, 8.7) |
| Legion Oxinium CR | Genesis II | 365 | 12774 | 86 | 28 | 12 | 239 | 3.1 (2.8, 3.5) | 4.3 (3.8, 4.9) | 5.7 (4.8, 6.8) |
| Legion Oxinium PS | Genesis II | 822 | 19458 | 126 | 23 | 69 | 604 | 3.8 (3.5, 4.1) | 5.2 (4.8, 5.5) | 7.9 (6.9, 9.1) |
| Legion PS | Genesis II | 234 | 6434 | 60 | 5 | 11 | 158 | 3.1 (2.7, 3.6) | 4.2 (3.7, 4.8) | 6.3 (4.5, 8.7) |
| MRK | MRK | 35 | 855 | 9 | 1 | 0 | 25 | 3.1 (2.1, 4.5) | 4.6 (3.2, 6.6) | 6.6 (4.4, 9.6) |
| Nexgen LCCK | Nexgen | 57 | 983 | 10 | 3 | 1 | 43 | 4.6 (3.4, 6.1) | 5.9 (4.4, 7.8) | 9.2 (6.5, 13.1) |
| Nexgen LPS Flex | Nexgen | 1536 | 31636 | 441 | 65 | 216 | 814 | 3.2 (3.0, 3.4) | 4.9 (4.7, 5.2) | 6.5 (6.1, 6.8) |
| Score | Score | 454 | 6400 | 188 | 23 | 12 | 231 | 5.6 (5.1, 6.3) | 9.0 (8.1, 9.9) | 10.7 (9.6, 11.9) |
| Triathlon CR | Triathlon | 4360 | 187428 | 819 | 173 | 214 | 3154 | 2.3 (2.3, 2.4) | 3.5 (3.4, 3.6) | 4.7 (4.5, 4.9) |
| Triathlon PS | Triathlon | 704 | 15654 | 138 | 38 | 86 | 442 | 3.7 (3.4, 4.0) | 5.2 (4.8, 5.6) | 6.5 (5.9, 7.1) |
| Vanguard CR | Vanguard | 1224 | 27180 | 311 | 45 | 72 | 796 | 2.9 (2.7, 3.1) | 4.6 (4.4, 4.9) | 6.9 (6.4, 7.5) |
| TOTAL | | 16757 | 433865 | 3780 | 691 | 1191 | 11095 | | | |

Note: Only prostheses with >350 procedures have been listed.

Green: prosthesis combination qualifies for a superiority benchmark.

Blue: prosthesis combination qualifies for non-inferiority benchmark.

Restricted to modern prostheses

# Ten, Fifteen and Twenty Year Prosthesis Outcomes

## Twenty Year Outcomes

The Registry is able to report 20 year outcomes for 11 hip and 7 knee prosthesis combinations. A combination is included if >350 procedures have been reported to the Registry, the follow-up period is ≥20 years, and the prosthesis is still used, with the exception of those eligible prostheses where a single surgeon performed more than 50% of procedures.

Detailed information on prostheses that are no longer used is available in the supplementary report 'Comparative Prosthesis Performance' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2025

### HIP REPLACEMENT

The 11 listed prosthesis combinations have been used in 41.9% of all primary total conventional hip replacement procedures performed for osteoarthritis. The 20 year cumulative percent revision ranges from 6.3% to 26.3% (Table BM7).

### KNEE REPLACEMENT

The 7 listed prosthesis combinations were used in 19.9% of all primary total knee replacement procedures performed for osteoarthritis. The 20 year cumulative percent revision ranges from 7.2% to 13.9% (Table BM8).

**Table BM7 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Prosthesis Combinations with 20 Year Data (Primary Diagnosis OA)**

| Femoral Component | Acetabular Component | N Revised | N Total | Type of Revision | | | | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | THR | Femoral | Acetabular | Other | | | |
| CORAIL | PINNACLE | 2488 | 63139 | 226 | 955 | 366 | 941 | 4.5 (4.3, 4.7) | 7.0 (6.6, 7.4) | 8.7 (7.5, 10.1) |
| CPCS | Reflection (Cup) | 88 | 863 | 28 | 6 | 41 | 13 | 7.9 (6.0, 10.4) | 17.3 (13.8, 21.6) | 26.3 (20.5, 33.2) |
| CPCS | Reflection (Shell) | 115 | 2845 | 17 | 49 | 14 | 35 | 3.2 (2.6, 4.0) | 5.3 (4.3, 6.5) | 8.2 (6.4, 10.5) |
| CPT | Trilogy | 435 | 7895 | 48 | 172 | 46 | 169 | 5.5 (5.0, 6.1) | 7.0 (6.3, 7.7) | 8.2 (7.2, 9.4) |
| CPT | ZCA | 43 | 868 | 16 | 10 | 10 | 7 | 4.5 (3.2, 6.3) | 6.1 (4.3, 8.5) | 8.8 (6.0, 12.7) |
| Exeter V40 | Exeter | 138 | 1635 | 32 | 17 | 67 | 22 | 4.6 (3.6, 5.8) | 9.7 (8.0, 11.6) | 15.1 (12.6, 18.0) |
| Exeter V40 | Exeter Contemporary | 183 | 2978 | 59 | 37 | 62 | 25 | 4.5 (3.8, 5.4) | 7.7 (6.6, 9.1) | 11.5 (9.3, 14.1) |
| Exeter V40 | Trident (Shell) | 2509 | 82676 | 344 | 824 | 306 | 1035 | 3.5 (3.3, 3.6) | 4.9 (4.7, 5.2) | 6.3 (5.9, 6.7) |
| S-Rom | PINNACLE | 162 | 2668 | 16 | 91 | 16 | 39 | 5.7 (4.8, 6.7) | 6.8 (5.8, 8.0) | 9.2 (6.8, 12.4) |
| Secur-Fit | Trident (Shell) | 546 | 9895 | 40 | 243 | 99 | 164 | 4.8 (4.4, 5.2) | 6.4 (5.9, 7.0) | 8.1 (7.2, 9.0) |
| Spectron EF | Reflection (Cup) | 128 | 1406 | 50 | 12 | 57 | 9 | 7.2 (5.8, 8.9) | 12.9 (10.8, 15.5) | 15.8 (13.0, 19.2) |
| **TOTAL** | | **6835** | **176868** | **876** | **2416** | **1084** | **2459** | | | |

Note: Restricted to modern prostheses

**Table BM8 Cumulative Percent Revision of Primary Total Knee Replacement Combinations with 20 Year Data (Primary Diagnosis OA)**

| Femoral Component | Tibial Component | N Revised | N Total | Type of Revision | | | | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | TKR | Femoral | Tibial | Other | | | |
| Active Knee | Active Knee | 934 | 11106 | 282 | 30 | 43 | 579 | 7.8 (7.2, 8.4) | 11.1 (10.4, 11.9) | 13.9 (12.9, 15.0) |
| Genesis II CR | Genesis II | 1313 | 26672 | 283 | 79 | 57 | 894 | 5.0 (4.7, 5.3) | 6.1 (5.8, 6.5) | 7.4 (6.9, 7.9) |
| Genesis II Oxinium CR (ctd) | Genesis II | 686 | 11473 | 140 | 37 | 28 | 481 | 5.9 (5.5, 6.5) | 8.4 (7.7, 9.1) | 10.6 (9.7, 11.6) |
| Genesis II Oxinium PS (ctd) | Genesis II | 1581 | 22705 | 243 | 37 | 179 | 1122 | 7.0 (6.7, 7.4) | 9.3 (8.8, 9.9) | 11.9 (10.8, 13.1) |
| Genesis II PS | Genesis II | 1013 | 21014 | 185 | 33 | 62 | 733 | 4.9 (4.6, 5.3) | 6.2 (5.8, 6.7) | 7.2 (6.7, 7.9) |
| LCS CR | LCS | 638 | 8346 | 262 | 24 | 90 | 262 | 6.4 (5.9, 7.0) | 8.1 (7.5, 8.8) | 9.3 (8.6, 10.0) |
| Nexgen LPS Flex | Nexgen | 1536 | 31636 | 441 | 65 | 216 | 814 | 4.9 (4.7, 5.2) | 6.5 (6.1, 6.8) | 8.3 (7.4, 9.3) |
| **TOTAL** | | **7701** | **132952** | **1836** | **305** | **675** | **4885** | | | |

Note: Restricted to modern prostheses. CR 'cruciate retaining' refers to minimally stabilised



# Revision Arthroplasty

# Revision Arthroplasty

## Introduction

This year, the Registry is providing an updated comprehensive analysis of the outcome of revision hip, knee and shoulder replacement surgery. The aim of this chapter is to expand on the previous chapters on revision arthroplasty, from 2015 and 2020, and to add analyses of revision shoulder surgery. For each joint, information is provided on revisions for specific reasons, and the outcomes of major total, partial and minor revisions. The Registry also examines mortality after the 1st revision.

A revision is defined as a re-operation of a previous joint replacement where one or more of the prosthetic components are replaced, removed, or one or more components are added. To fully understand the outcome of an initial revision procedure, it is necessary to know the details of the primary procedure. Without this information, it is not apparent if the revision is the 1st revision or a subsequent revision. The Registry has a linking process, which is run monthly and automatically links a primary procedure to any subsequent revisions on the same side. The key to determining the order of revisions is knowledge of the primary procedure.

### TERMINOLOGY

Reporting the outcome of revision procedures has the potential to be confusing. This is in part related to a lack of agreed terminology.

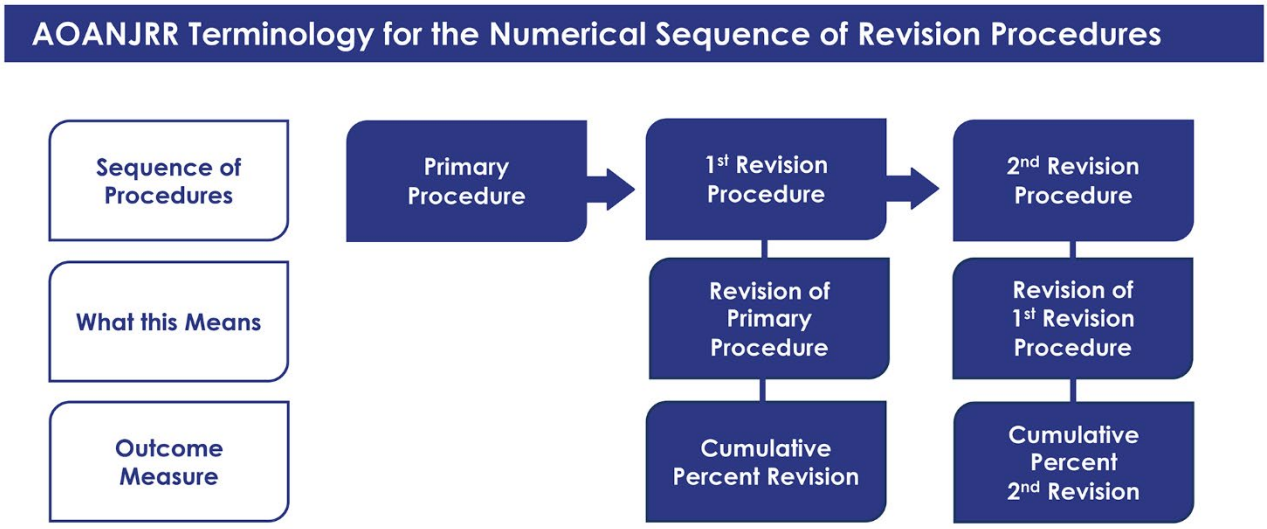
Using definitions from the 2020 Annual Report, the Registry has endeavoured to standardise the sequence of revisions and uses a numerical approach to describe revision procedures.

The 1st revision is the revision of a primary procedure. The 2nd revision is the revision of the 1st revision, and so on. Non-specific terminology such as 're-revision' has been avoided. This numerical sequence becomes increasingly important as registries have longer follow-up of known primary procedures that have multiple revisions.

When reporting the cumulative percent revision, the specific numerical terminology is used to correctly report the revision sequence. We have defined the term cumulative percent 2nd revision as the percent of 1st revision procedures revised up until time allowing for right censoring due to death and 'closure' of the database at the time of the analysis.

### APPROACH TO ANALYSIS

The analyses for hip and knee replacement revisions are only performed for procedures with a primary diagnosis of osteoarthritis, whereas all primary diagnoses are included for the analyses for shoulder replacement revisions. Due to the complexities involved in the analysis of revisions for sepsis, 1st revision procedures undertaken for infection have been excluded from all analyses. However, 2nd revisions for infection are reported. The 2023 Annual Report provided a more comprehensive analysis of the outcomes of revision for infection.



## Revision Total Conventional Hip Replacement

For the analysis of the 1st revision of primary total conventional hip replacement (THR), primary procedures involving metal/metal bearing surfaces and exchangeable necks have been excluded. Metal/metal bearing surfaces may have major issues associated with revisions, such as extensive soft tissue destruction, which are not seen with conventional bearings, making comparative analysis of the 1st revision more complicated. Metal/metal bearing surfaces also have not been used since 2017. Exchangeable necks are also seldom used in recent years, have an additional revision option (isolated head/neck exchange), and the reasons for revision vary from conventional THR.

There are 24,012 1st revision THR procedures recorded where the primary diagnosis was osteoarthritis. There are 4,998 1st revision procedures for infection that are excluded from this analysis. There are also a further 78 1st revision procedures excluded from the analysis where the diagnosis was not infection. These include 37 prostheses that were removed and not re-inserted, 1 cement only, 32 cement spacers, 7 total femur replacements and one saddle prosthesis. The following analysis is based on 18,936 aseptic 1st revision procedures.

### DEMOGRAPHICS OF 1ST REVISION

The mean age at the 1st revision is 71.8 years. There is some variation depending on the reason for revision. For example, patients revised for fracture are on average slightly older (mean 76.5 years).

The median time from the primary procedure to the 1st revision is 3 years, ranging from 1 year for dislocation/instability to 4.2 years for loosening. There are more females (54.8%) undergoing a 1st revision, and this is most pronounced with 1st revision for dislocation/instability (females 62.2%). Most patients have an ASA score of 3 (51.1%) and are pre-obese (36.3%) at the time of 1st revision.

When an acetabular cup or femoral stem is revised at the 1st revision, cementless fixation is more likely to be used. The most common head size used in the 1st revision is >32mm (37.9%), and the most common bearing surface is metal/XLPE (46.6%), followed by ceramic/ XLPE (23.2%). Although primary conventional THR with metal/metal bearing surfaces were excluded from the analysis, it is to be noted that there were 76 procedures where metal/metal bearings were used in the 1st revision.

Table N1 provides demographic details of 1st revision procedures.

**Table N1 Summary of 1st Revisions of Known Primary Total Conventional Hip Replacement (Primary Diagnosis OA, Excluding 1st Revisions for Infection)**

| Variable | Loosening (n=5,312) | Prosthesis Dislocation/ Instability (n=4,903) | Fracture (n=5,408) | Other (n=3,313) | TOTAL (n=18,936) |
|---|---|---|---|---|---|
| **Follow-up Years (Primary to 1st Revision)** | | | | | |
| Mean ± SD | 5.7 ± 5.2 | 3.1 ± 4.4 | 5.3 ± 5.6 | 6.1 ± 5.7 | 5 ± 5.3 |
| Median (IQR) | 4.2 (1.2, 9.1) | 1 (0.1, 4.4) | 3.6 (0.1, 9.1) | 4.3 (1.2, 10) | 3 (0.4, 8.3) |
| Minimum | 0 | 0 | 0 | 0 | 0 |
| Maximum | 24.3 | 24.2 | 24 | 23.5 | 24.3 |
| **Age at 1st Revision** | | | | | |
| Mean ± SD | 70.4 ± 10.7 | 71.3 ± 10.9 | 76.5 ± 10.5 | 67 ± 11.3 | 71.8 ± 11.3 |
| Median (IQR) | 71 (64, 78) | 73 (65, 79) | 78 (70, 84) | 68 (60, 75) | 73 (65, 80) |
| **Age at 1st Revision in groups** | | | | | |
| <55 | 433 (8.2%) | 368 (7.5%) | 172 (3.2%) | 438 (13.2%) | 1,411 (7.5%) |
| 55-64 | 1,019 (19.2%) | 812 (16.6%) | 539 (10%) | 816 (24.6%) | 3,186 (16.8%) |
| 65-74 | 1,834 (34.5%) | 1,601 (32.7%) | 1,349 (24.9%) | 1,132 (34.2%) | 5,916 (31.2%) |
| ≥75 | 2,026 (38.1%) | 2,122 (43.3%) | 3,348 (61.9%) | 927 (28%) | 8,423 (44.5%) |
| **Gender** | | | | | |
| Male | 2,630 (49.5%) | 1,854 (37.8%) | 2,527 (46.7%) | 1,542 (46.5%) | 8,553 (45.2%) |
| Female | 2,682 (50.5%) | 3,049 (62.2%) | 2,881 (53.3%) | 1,771 (53.5%) | 10,383 (54.8%) |
| **ASA at 1st Revision[1]** | | | | | |
| ASA 1 | 213 (5.9%) | 128 (3.9%) | 90 (2.1%) | 188 (7.5%) | 619 (4.5%) |
| ASA 2 | 1,589 (43.9%) | 1,283 (38.8%) | 1,045 (24.5%) | 1,170 (46.6%) | 5,087 (37.1%) |
| ASA 3 | 1,675 (46.3%) | 1,773 (53.6%) | 2,479 (58.1%) | 1,082 (43.1%) | 7,009 (51.1%) |
| ASA 4 | 139 (3.8%) | 125 (3.8%) | 649 (15.2%) | 71 (2.8%) | 984 (7.2%) |
| ASA 5 | 1 (0%) | 1 (0%) | 7 (0.2%) | | 9 (0.1%) |
| **BMI at 1st Revision[2]** | | | | | |
| Underweight | 18 (0.6%) | 29 (1.1%) | 52 (1.8%) | 18 (0.9%) | 117 (1.1%) |
| Normal | 559 (19%) | 600 (22.5%) | 847 (29.3%) | 376 (17.9%) | 2,382 (22.5%) |
| Pre Obese | 1,063 (36.2%) | 964 (36.1%) | 1,030 (35.6%) | 788 (37.5%) | 3,845 (36.3%) |
| Obese Class 1 | 792 (27%) | 668 (25%) | 571 (19.7%) | 549 (26.2%) | 2,580 (24.3%) |
| Obese Class 2 | 333 (11.3%) | 270 (10.1%) | 238 (8.2%) | 252 (12%) | 1,093 (10.3%) |
| Obese Class 3 | 170 (5.8%) | 137 (5.1%) | 156 (5.4%) | 116 (5.5%) | 579 (5.5%) |
| **Fixation of Primary Procedure** | | | | | |
| Cemented | 787 (14.8%) | 307 (6.3%) | 260 (4.8%) | 100 (3%) | 1,454 (7.7%) |
| Cementless | 3,297 (62.1%) | 2,867 (58.5%) | 3,611 (66.8%) | 2,459 (74.2%) | 12,234 (64.6%) |
| Hybrid | 1,228 (23.1%) | 1,729 (35.3%) | 1,537 (28.4%) | 754 (22.8%) | 5,248 (27.7%) |
| **Femoral Fixation in 1st Revision** | | | | | |
| Femoral Cemented | 1,329 (25%) | 388 (7.9%) | 1,211 (22.4%) | 474 (14.3%) | 3,402 (18%) |
| Femoral Cementless | 1,966 (37%) | 275 (5.6%) | 3,469 (64.1%) | 637 (19.2%) | 6,347 (33.5%) |
| Femoral Component Not Revised | 2,017 (38%) | 4,240 (86.5%) | 728 (13.5%) | 2,202 (66.5%) | 9,187 (48.5%) |
| **Acetabular Fixation in 1st Revision** | | | | | |
| Acetabular Cemented | 476 (9%) | 281 (5.7%) | 180 (3.3%) | 166 (5%) | 1,103 (5.8%) |
| Acetabular Cementless | 2,030 (38.2%) | 1,682 (34.3%) | 438 (8.1%) | 1,240 (37.4%) | 5,390 (28.5%) |
| Acetabular Component Not Revised | 2,806 (52.8%) | 2,940 (60%) | 4,790 (88.6%) | 1,907 (57.6%) | 12,443 (65.7%) |
| **Type of Acetabular Prosthesis in 1st Revision[3]** | | | | | |
| Constrained Prosthesis | 192 (3.7%) | 1,297 (27.1%) | 159 (3.2%) | 85 (2.6%) | 1,733 (9.5%) |
| Dual Mobility Prosthesis | 648 (12.5%) | 1,123 (23.4%) | 561 (11.3%) | 474 (14.6%) | 2,806 (15.4%) |

| Variable | Loosening (n=5,312) | Prosthesis Dislocation/ Instability (n=4,903) | Fracture (n=5,408) | Other (n=3,313) | TOTAL (n=18,936) |
|---|---|---|---|---|---|
| Acetabular Insert Internal Diameter >32mm | 2,268 (43.8%) | 1,213 (25.3%) | 1,993 (40%) | 1,425 (43.9%) | 6,899 (37.9%) |
| Acetabular Insert Internal Diameter 32mm | 1,484 (28.7%) | 811 (16.9%) | 1,533 (30.8%) | 965 (29.7%) | 4,793 (26.3%) |
| Acetabular Insert Internal Diameter <32mm | 581 (11.2%) | 348 (7.3%) | 733 (14.7%) | 297 (9.1%) | 1,959 (10.8%) |
| **Bearing Surface of Primary[4]** | | | | | |
| Ceramic/Ceramic | 1,104 (20.8%) | 667 (13.6%) | 1,272 (23.5%) | 1,094 (33.1%) | 4,137 (21.9%) |
| Ceramic/Non XLPE | 223 (4.2%) | 118 (2.4%) | 153 (2.8%) | 155 (4.7%) | 649 (3.4%) |
| Ceramic/XLPE | 952 (17.9%) | 1,137 (23.2%) | 1,132 (21%) | 594 (18%) | 3,815 (20.2%) |
| Ceramic/Metal | 7 (0.1%) | 5 (0.1%) | 7 (0.1%) | 8 (0.2%) | 27 (0.1%) |
| Metal/Non XLPE | 1,262 (23.8%) | 615 (12.5%) | 468 (8.7%) | 496 (15%) | 2,841 (15%) |
| Metal/XLPE | 1,550 (29.2%) | 2,009 (41%) | 2,073 (38.4%) | 789 (23.8%) | 6,421 (33.9%) |
| Ceramicised Metal/Non XLPE | 22 (0.4%) | 9 (0.2%) | 3 (0.1%) | 22 (0.7%) | 56 (0.3%) |
| Ceramicised Metal/XLPE | 190 (3.6%) | 341 (7%) | 294 (5.4%) | 151 (4.6%) | 976 (5.2%) |
| **Bearing Surface of 1st Revision[5]** | | | | | |
| Ceramic/Ceramic | 184 (5.2%) | 77 (1.8%) | 52 (3.2%) | 296 (11.8%) | 609 (5.1%) |
| Ceramic/Non XLPE | 79 (2.2%) | 158 (3.7%) | 51 (3.1%) | 64 (2.6%) | 352 (2.9%) |
| Ceramic/XLPE | 810 (22.9%) | 790 (18.5%) | 328 (19.9%) | 847 (33.8%) | 2,775 (23.2%) |
| Ceramic/Metal | 5 (0.1%) | 6 (0.1%) | | 8 (0.3%) | 19 (0.2%) |
| Metal/Metal | 24 (0.7%) | 28 (0.7%) | 9 (0.5%) | 15 (0.6%) | 76 (0.6%) |
| Metal/Non XLPE | 380 (10.7%) | 1,027 (24%) | 214 (13%) | 130 (5.2%) | 1,751 (14.6%) |
| Metal/XLPE | 1,834 (51.9%) | 1,864 (43.6%) | 920 (55.8%) | 964 (38.4%) | 5,582 (46.6%) |
| Ceramicised Metal/Metal | 2 (0.1%) | | | | 2 (0%) |
| Ceramicised Metal/Non XLPE | 8 (0.2%) | 62 (1.5%) | 7 (0.4%) | 9 (0.4%) | 86 (0.7%) |
| Ceramicised Metal/XLPE | 210 (5.9%) | 262 (6.1%) | 67 (4.1%) | 176 (7%) | 715 (6%) |
| **Surgical Approach at 1st Revision[6]** | | | | | |
| Anterior | 291 (9.4%) | 288 (9.9%) | 179 (4.7%) | 292 (13.3%) | 1,050 (8.8%) |
| Lateral | 594 (19.2%) | 545 (18.8%) | 1,019 (27%) | 460 (21%) | 2,618 (21.9%) |
| Posterior | 2,213 (71.4%) | 2,062 (71.2%) | 2,573 (68.2%) | 1,442 (65.7%) | 8,290 (69.3%) |

Abbreviations: SD - standard deviation, IQR - interquartile range, ASA - American Society of Anesthesiologists, BMI - Body Mass Index (kg/m2).

1. Excludes 5,228 procedures with unknown ASA at 1st revision.
2. Excludes 8,340 procedures with unknown BMI at 1st revision.
3. Excludes 746 procedures with unknown type of acetabular prosthesis in 1st revision.
4. Excludes 14 procedures with unknown bearing surface of primary.
5. Excludes 6,969 procedures with unknown bearing surface of 1st revision.
6. Excludes 6,978 procedures with unknown surgical approach at 1st revision.

# Revision Arthroplasty

## OUTCOME OF 1ST REVISION

Of the 18,936 1st revision procedures, 2,803 have had a 2nd revision. The cumulative percent 2nd revision at 20 years is 26.4% (Table N2 and Figure N1).

The most common reasons for 2nd revision are prosthesis dislocation/instability (33.1%), infection (23.3%), loosening (22.5%) and periprosthetic fracture (10.2%) (Table N3 and Figure N2).

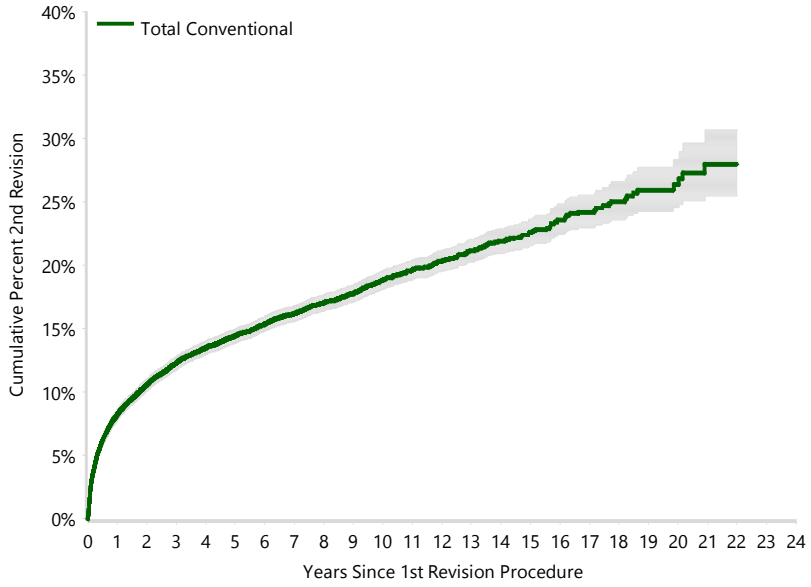
Revision of the head/insert is the most common type of 2nd revision (25.5%), followed by acetabular component (24.0%), femoral component (22.8%), THR (femoral/acetabular) (14.2%), and cement spacer (5.9%). All types of 2nd revisions are listed in Table N4.

**Table N2 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| Revision of Primary | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Total Conventional | 2803 | 18936 | 8.3 (7.9, 8.7) | 12.3 (11.8, 12.8) | 14.4 (13.9, 15.0) | 18.8 (18.1, 19.5) | 22.6 (21.5, 23.6) | 26.4 (24.5, 28.3) |
| TOTAL | 2803 | 18936 | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Figure N1 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Total Conventional | 18936 | 15452 | 11802 | 8930 | 3396 | 943 | 164 |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Table N3** **Revision Diagnosis of 2nd Revision of Known Primary Total Conventional Hip Replacement (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| 2nd Revision Diagnosis | Number | Percent |
|---|---|---|
| Prosthesis Dislocation/Instability | 929 | 33.1 |
| Infection | 653 | 23.3 |
| Loosening | 631 | 22.5 |
| Fracture | 287 | 10.2 |
| Pain | 50 | 1.8 |
| Implant Breakage Stem | 46 | 1.6 |
| Metal Related Pathology | 29 | 1.0 |
| Lysis | 27 | 1.0 |
| Implant Breakage Acetabular Insert | 25 | 0.9 |
| Implant Breakage Acetabular | 25 | 0.9 |
| Malposition | 25 | 0.9 |
| Leg Length Discrepancy | 20 | 0.7 |
| Incorrect Sizing | 8 | 0.3 |
| Wear Acetabular Insert | 4 | 0.1 |
| Heterotopic Bone | 4 | 0.1 |
| Tumour | 3 | 0.1 |
| Implant Breakage Head | 2 | 0.1 |
| Synovitis | 1 | 0.0 |
| Wear Acetabulum | 1 | 0.0 |
| Wear Head | 1 | 0.0 |
| Chondrolysis/Acetab. Erosion | 1 | 0.0 |
| Other | 31 | 1.1 |
| TOTAL | 2803 | 100.0 |

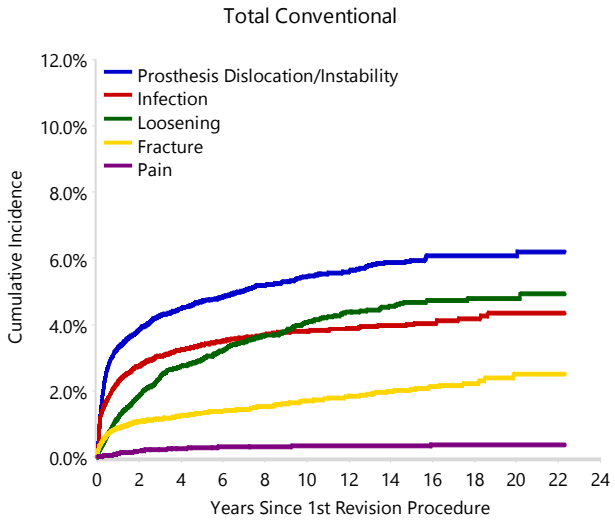
Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Table N4** **Type of Revision of 2nd Revision of Known Primary Total Conventional Hip Replacement (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| Type of 2nd Revision | Number | Percent |
|---|---|---|
| Head/Insert | 716 | 25.5 |
| Acetabular Component | 672 | 24.0 |
| Femoral Component | 638 | 22.8 |
| THR (Femoral/Acetabular) | 399 | 14.2 |
| Cement Spacer | 164 | 5.9 |
| Head Only | 105 | 3.7 |
| Minor Components | 50 | 1.8 |
| Insert Only | 28 | 1.0 |
| Removal of Prostheses | 25 | 0.9 |
| Bipolar Only | 2 | 0.1 |
| Total Femoral | 2 | 0.1 |
| Reinsertion of Components | 1 | 0.0 |
| Bipolar Head and Femoral | 1 | 0.0 |
| TOTAL | 2803 | 100.0 |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Figure N2** **Cumulative Incidence 2nd Revision Diagnosis of Known Primary Total Conventional Hip Replacement (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

## OUTCOME OF 1ST REVISION BY PATIENT CHARACTERISTICS

The outcome of the 1st revision varies by age and gender, with females aged <65 years having a higher rate of 2nd revision than females aged ≥65 years after 6 months.

Males aged <65 years have a higher rate of 2nd revision than males aged ≥65 years.

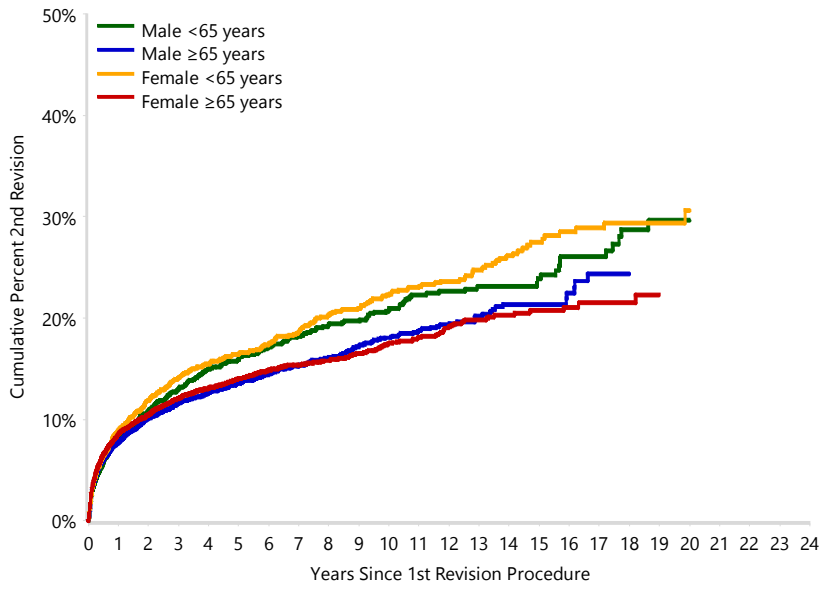
Males aged ≥65 years have a higher rate of revision compared to females of the same age group after 2 years, with no difference prior to this time (Table N5 and Figure N3).

**Table N5 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Gender and Age at 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| Gender | Age at 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Male | <65 years | 401 | 2245 | 8.0 (6.9, 9.2) | 13.0 (11.6, 14.5) | 15.9 (14.4, 17.6) | 20.7 (18.8, 22.8) | 23.9 (21.5, 26.5) | 29.6 (25.6, 34.1) |
| | ≥65 years | 834 | 6308 | 7.7 (7.1, 8.4) | 11.6 (10.8, 12.5) | 13.6 (12.6, 14.5) | 18.1 (16.8, 19.4) | 21.4 (19.5, 23.4) | |
| Female | <65 years | 457 | 2352 | 8.9 (7.8, 10.2) | 14.1 (12.7, 15.6) | 16.4 (14.9, 18.1) | 22.3 (20.3, 24.3) | 27.5 (24.9, 30.3) | 30.6 (26.9, 34.7) |
| | ≥65 years | 1111 | 8031 | 8.5 (7.9, 9.2) | 12.1 (11.3, 12.8) | 14.0 (13.2, 14.9) | 17.5 (16.4, 18.6) | 20.7 (19.2, 22.4) | |
| TOTAL | | 2803 | 18936 | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Figure N3 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Gender and Age at 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




Male <65 years vs Male ≥65 years
Entire Period: HR=1.16 (95% CI 1.03, 1.31), p=0.013

Male <65 years vs Female <65 years
Entire Period: HR=0.94 (95% CI 0.82, 1.07), p=0.340

Male ≥65 years vs Female ≥65 years
0 - 2Yr: HR=0.93 (95% CI 0.84, 1.03), p=0.145
2Yr+: HR=1.17 (95% CI 1.01, 1.35), p=0.034

Female <65 years vs Female ≥65 years
0 - 1Mth: HR=1.00 (95% CI 0.81, 1.23), p=0.996
1Mth - 3Mth: HR=1.06 (95% CI 0.86, 1.31), p=0.578
3Mth - 6Mth: HR=1.07 (95% CI 0.84, 1.35), p=0.591
6Mth+: HR=1.41 (95% CI 1.24, 1.60), p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Male | <65 years | 2245 | 1925 | 1548 | 1242 | 551 | 203 | 55 |
| | ≥65 years | 6308 | 4994 | 3668 | 2654 | 906 | 202 | 18 |
| Female | <65 years | 2352 | 2009 | 1629 | 1322 | 650 | 233 | 52 |
| | ≥65 years | 8031 | 6524 | 4957 | 3712 | 1289 | 305 | 39 |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**ASA SCORE AND BMI CATEGORY**

ASA scores are available for 13,708 1st revision procedures. There are 9 patients with an ASA score of 5, and these were excluded from the comparative analysis.

Patients with ASA scores of 2 and 3 have a higher cumulative percent 2nd revision compared to patients with an ASA score of 1. Patients with an ASA score of 4 also have a higher rate of 2nd revision compared to patients with an ASA score of 1, but only for the first 3 months, with no difference after this time (Table N6 and Figure N4).

Considering ASA scores, patients with ASA 1 have the lowest rate of 2nd revision.

Prosthesis dislocation/instability is the most common reason for 2nd revision for patients with an ASA score of 2, 3 and 4 (Figure N5).

BMI is available for 10,596 1st revision procedures. There is no difference in cumulative percent 2nd revision comparing patients who are pre-obese or in obese class 1 to the normal BMI group. Patients in obese classes 2 and 3 have a higher cumulative percent 2nd revision compared to patients with a normal BMI (Table N7 and Figure N6).

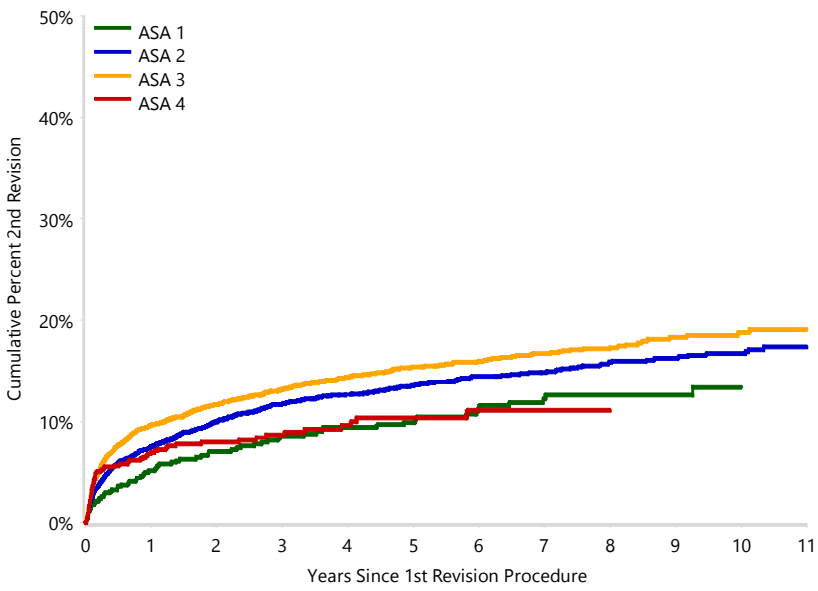
The most common reason for 2nd revision for patients in normal, pre-obese and obese class 1 groups is dislocation/instability, and for patients in obese classes 2 and 3, the most common reason for 2nd revision is infection (Figure N7).

**Table N6 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by ASA (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| ASA Grade | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| ASA 1 | 67 | 619 | 5.1 (3.6, 7.2) | 8.6 (6.6, 11.1) | 9.9 (7.7, 12.7) | 12.2 (9.6, 15.5) | 13.4 (10.4, 17.2) |
| ASA 2 | 663 | 5087 | 7.5 (6.8, 8.3) | 11.7 (10.8, 12.7) | 13.6 (12.6, 14.6) | 14.8 (13.7, 15.9) | 16.6 (15.4, 18.0) |
| ASA 3 | 940 | 7009 | 9.6 (8.9, 10.4) | 13.2 (12.3, 14.0) | 15.3 (14.4, 16.3) | 16.7 (15.7, 17.8) | 18.8 (17.3, 20.3) |
| ASA 4 | 76 | 984 | 6.9 (5.4, 8.9) | 8.6 (6.8, 10.9) | 10.3 (8.1, 13.1) | 11.1 (8.5, 14.3) | |
| ASA 5 | 1 | 9 | 11.1 (1.6, 56.7) | 11.1 (1.6, 56.7) | | | |
| TOTAL | 1747 | 13708 | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted. Excludes 5,228 procedures with no ASA recorded.

**Figure N4 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by ASA (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




HR - adjusted for age and gender

ASA 2 vs ASA 1

Entire Period: HR=1.52 (95% CI 1.18, 1.96), p=0.001

ASA 3 vs ASA 1

Entire Period: HR=1.95 (95% CI 1.51, 2.52), p<0.001

ASA 4 vs ASA 1

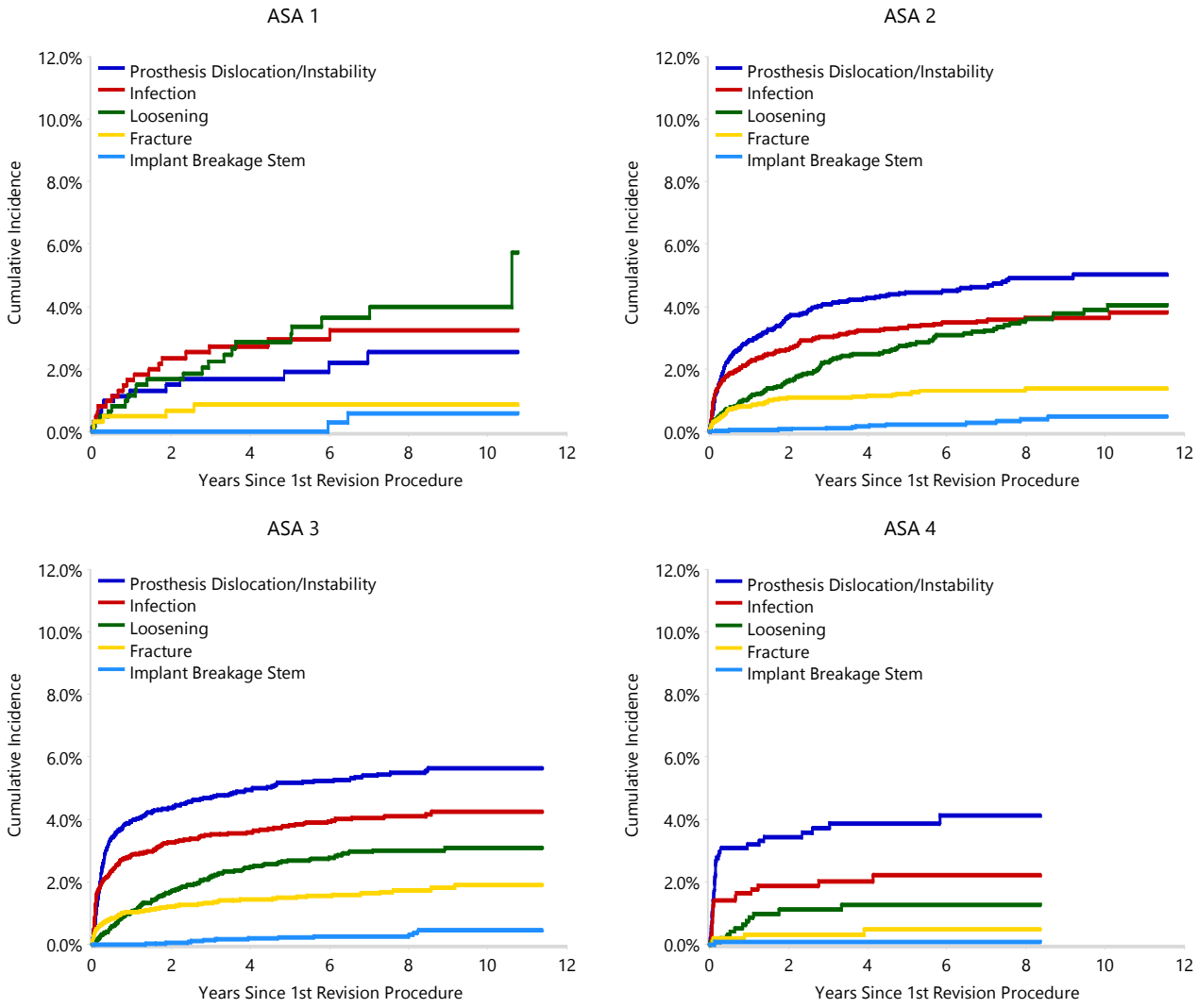
0 - 3Mth: HR=2.18 (95% CI 1.48, 3.22), p<0.001

3Mth+: HR=1.00 (95% CI 0.63, 1.56), p=0.987

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|
| ASA 1 | 619 | 561 | 461 | 358 | 252 | 69 |
| ASA 2 | 5087 | 4262 | 3271 | 2410 | 1476 | 419 |
| ASA 3 | 7009 | 5346 | 3568 | 2291 | 1219 | 272 |
| ASA 4 | 984 | 611 | 340 | 172 | 75 | 16 |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted. Excludes 5,228 procedures with no ASA recorded.

**Figure N5 Cumulative Incidence 2nd Revision Diagnosis of Known Primary Total Conventional Hip Replacement by ASA Grade (Primary Diagnosis OA, Excluding 1st Revision for Infection)**



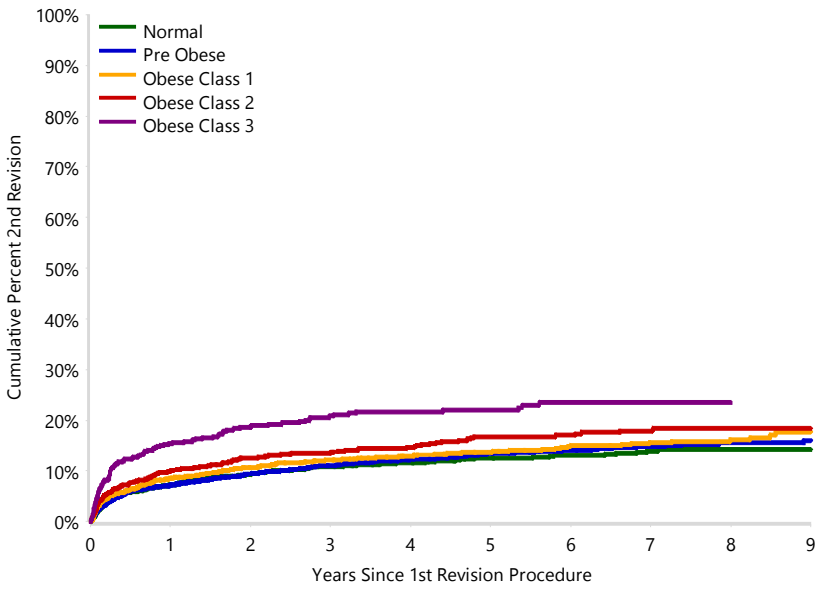

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.
Excludes 5,228 procedures with no ASA recorded.

**Table N7 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by BMI (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| BMI Category | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|
| Underweight | 7 | 117 | 6.3 (3.1, 12.8) | 6.3 (3.1, 12.8) | | |
| Normal | 251 | 2382 | 7.3 (6.3, 8.5) | 10.8 (9.6, 12.3) | 12.5 (11.0, 14.1) | 13.9 (12.2, 15.8) |
| Pre Obese | 440 | 3845 | 7.2 (6.4, 8.0) | 11.1 (10.0, 12.2) | 13.4 (12.2, 14.7) | 14.8 (13.5, 16.3) |
| Obese Class 1 | 324 | 2580 | 8.5 (7.5, 9.7) | 12.1 (10.8, 13.5) | 13.7 (12.3, 15.2) | 15.6 (14.0, 17.4) |
| Obese Class 2 | 158 | 1093 | 10.1 (8.4, 12.1) | 13.6 (11.6, 16.0) | 16.8 (14.4, 19.5) | 17.9 (15.4, 20.9) |
| Obese Class 3 | 120 | 579 | 15.3 (12.6, 18.6) | 20.8 (17.5, 24.6) | 22.0 (18.6, 26.0) | 23.4 (19.8, 27.7) |
| TOTAL | 1300 | 10596 | | | | |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted
Excludes 8,340 procedures with no BMI recorded.
BMI has not been presented for patients aged ≤19 years.

**Figure N6 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by BMI (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




HR - adjusted for age and gender

Pre Obese vs Normal
Entire Period: HR=1.04 (95% CI 0.89, 1.21), p=0.659

Obese Class 1 vs Normal
Entire Period: HR=1.11 (95% CI 0.94, 1.31), p=0.216

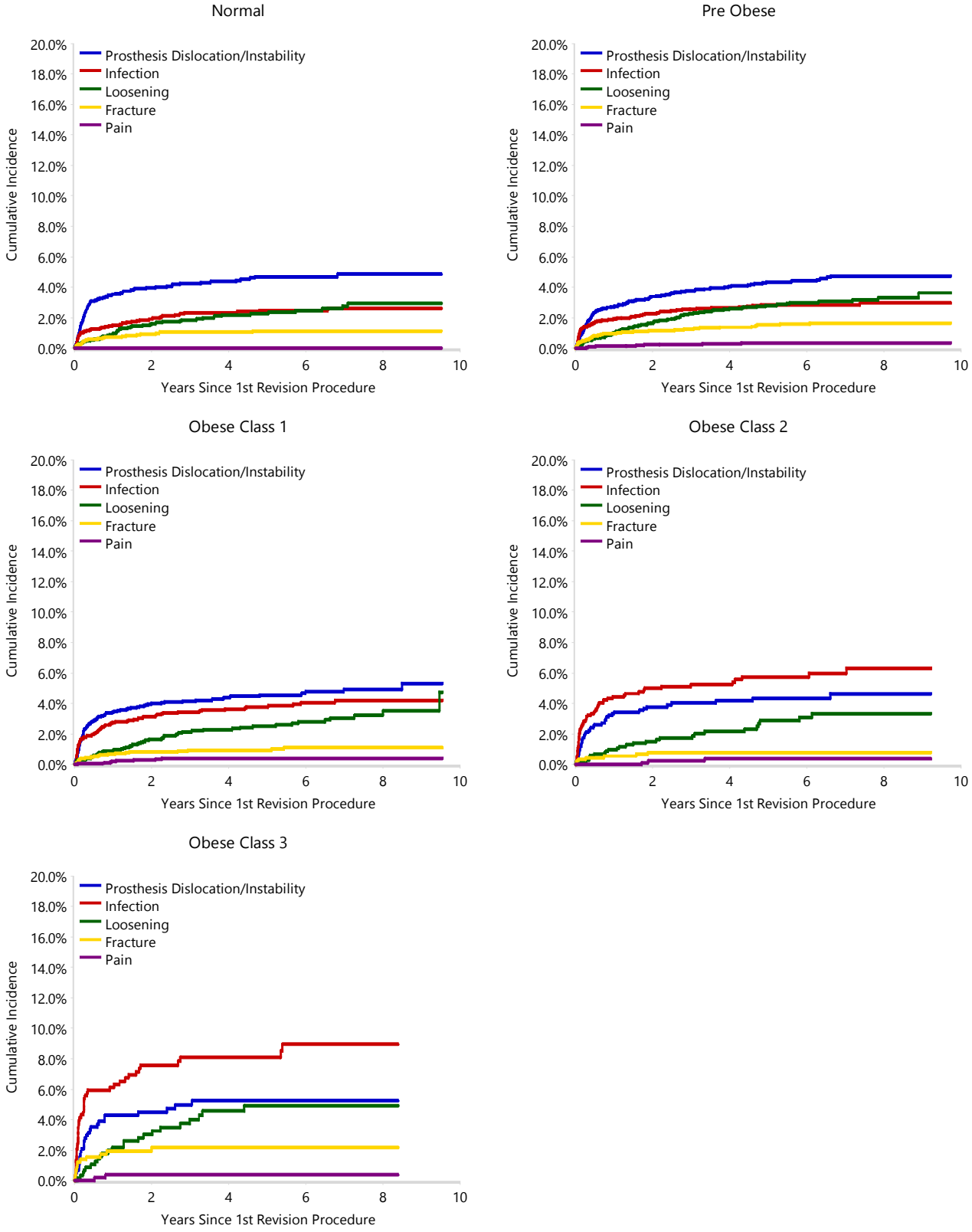
Obese Class 2 vs Normal
Entire Period: HR=1.26 (95% CI 1.03, 1.54), p=0.025

Obese Class 3 vs Normal
Entire Period: HR=1.83 (95% CI 1.46, 2.28), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|
| Normal | 2382 | 1842 | 1211 | 738 | 347 |
| Pre Obese | 3845 | 3046 | 2090 | 1355 | 672 |
| Obese Class 1 | 2580 | 2042 | 1432 | 937 | 438 |
| Obese Class 2 | 1093 | 847 | 608 | 399 | 209 |
| Obese Class 3 | 579 | 424 | 290 | 184 | 85 |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted
Excludes 8,340 procedures with no BMI recorded.
BMI has not been presented for patients aged ≤19 years.

**Figure N7 Cumulative Incidence 2nd Revision Diagnosis of Known Primary Total Conventional Hip Replacement by BMI Category (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.
Excludes 8,340 procedures with no BMI recorded.
BMI has not been presented for patients aged ≤19 years.

# Revision Arthroplasty

## CHANGES IN REVISION HIP REPLACEMENT OVER TIME

Since 2003, the annual number of 1st revision hip replacement procedures has increased more than 5 times. In 2003, there were 246 aseptic 1st revision procedures, while in 2024, there were 1341 recorded (Figure N8).

The yearly proportion of the 3 classes of 1st revision (minor, major partial and major total) is shown in Figure N9. There has been a small decrease in the proportion of minor 1st revisions.

There has been an increase in the proportion of 1st revisions for fracture over time, while there has been a decrease in 1st revisions for dislocation/instability (Figure N10).

The proportion of ceramic/XLPE bearings in the 1st revision procedure has increased, while there are fewer 1st revisions in which metal/non XLPE bearings are used. Changes in other bearing types have been less noticeable (Figure N11).

In 2024, acetabular inserts with an internal diameter >32mm are the most commonly used type of articulation in 1st revision procedures (36.3%). Since its introduction in 2007, the use of dual mobility acetabular components has increased to now be the 2nd most common (35.1%). In 2003, acetabular inserts used with head size <32mm were the most common type of articulation for 1st revision procedures, but their use has declined, and now these are rarely used (3.1%). There has also been a decline in the use of constrained inserts for 1st revision procedures from 18.6% in 2003 to 9.7% in 2024 (Figure N12).

When the femoral component is revised, the fixation used for the 1st revision procedure is shown in Figure N13. In 2024, 65.6% of procedures use cementless femoral fixation.

**Figure N8** **1st Revision of Known Primary Total Conventional Hip Replacement (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

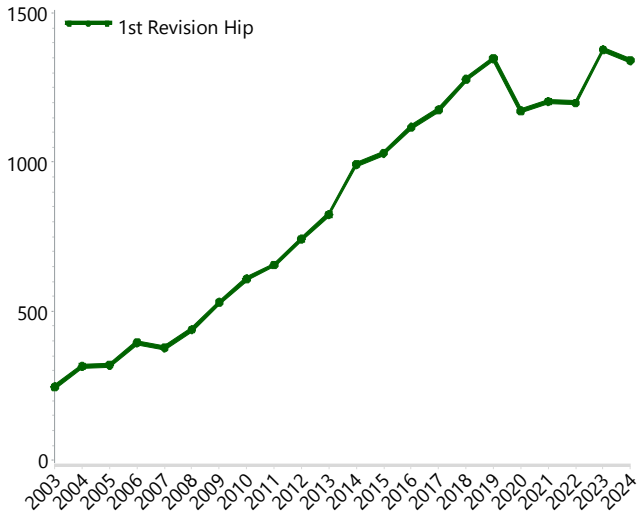



**Figure N9** **Trends in 1st Revision Hip Replacement by Class Over Time (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

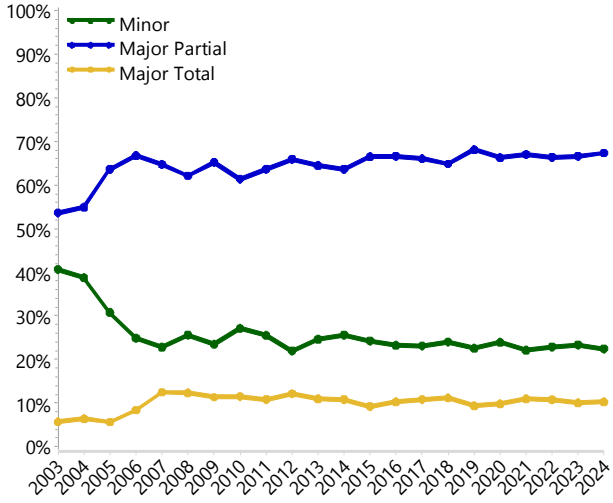


**Figure N10** **Trends in 1st Revision Diagnosis of Known Primary Total Conventional Hip Replacement Over Time (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

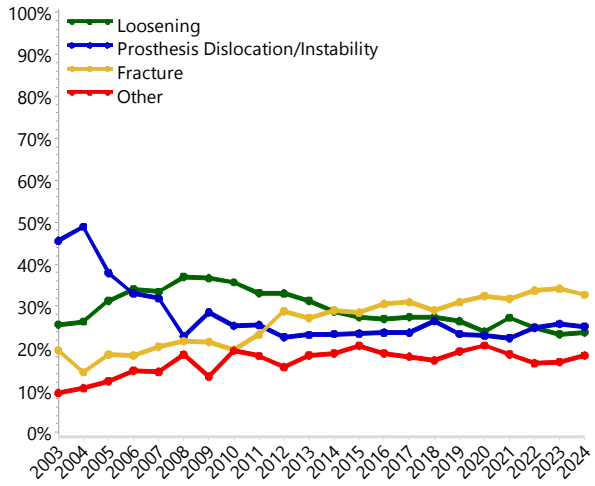



**Figure N11** **Trends in Bearing Surface Used in 1st Revision of Known Primary Total Conventional Hip Replacement Over Time (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

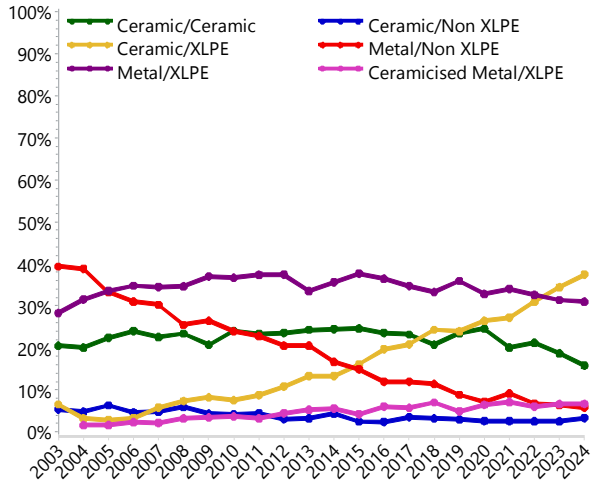



**Figure N12** **Trends in Acetabular Components Used in 1st Revision of Known Primary Total Conventional Hip Replacement Over Time (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

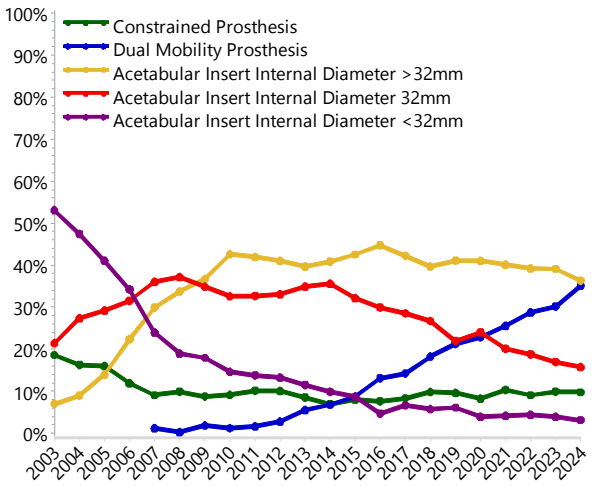
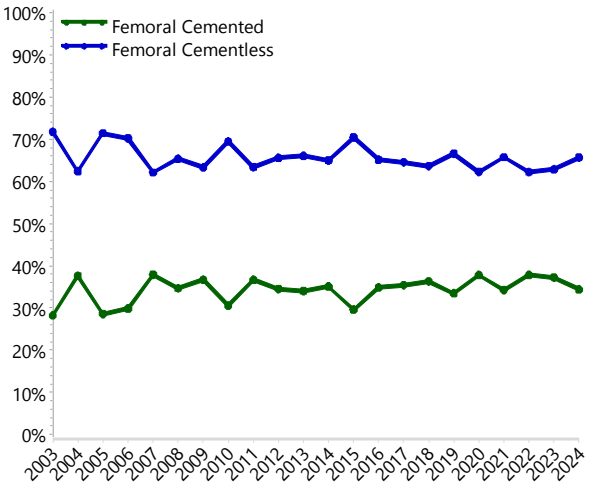



**Figure N13** **Trends in Femoral Fixation Used in 1st Revision of Known Primary Total Conventional Hip Replacement Over Time (Primary Diagnosis OA, Excluding 1st Revision for Infection)**



## OUTCOMES OF 1ST REVISION BY CLASS OF 1ST REVISION

Major partial revision is the most common class of 1st revision procedure (65.4%), followed by minor revision (24.4%) and major total revision (10.2%). The outcomes of the 1st revision by class of 1st revision are compared.

Minor revisions have a higher rate of 2nd revision compared to major total revisions for the entire period, and when compared to major partial revisions from 1 month onwards.

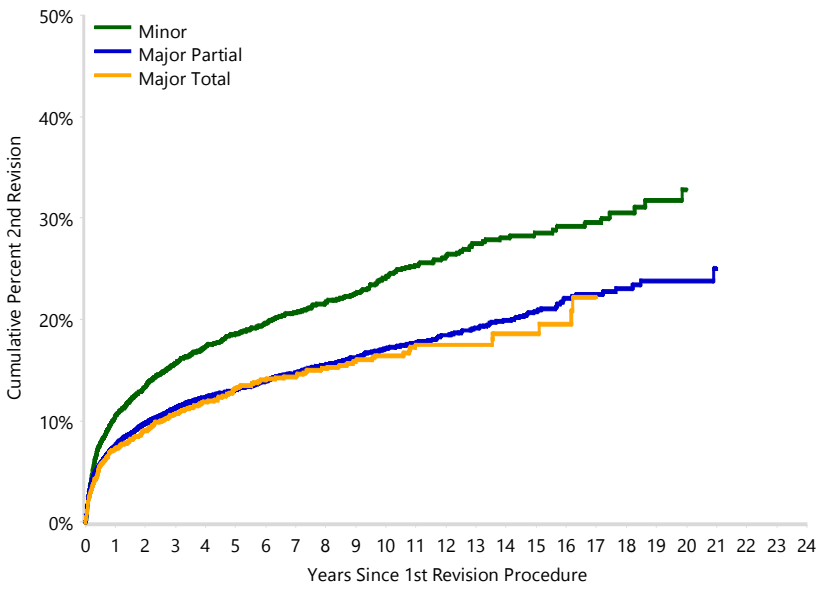
There is no difference in 2nd revision rate between major total and major partial 1st revisions (Table N8 and Figure N14).

**Table N8 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Class of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| Class of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Minor | 901 | 4618 | 10.5 (9.6, 11.4) | 15.7 (14.6, 16.8) | 18.6 (17.4, 19.8) | 24.0 (22.5, 25.6) | 28.5 (26.5, 30.7) | 32.8 (29.2, 36.7) |
| Major Partial | 1649 | 12382 | 7.6 (7.1, 8.1) | 11.3 (10.7, 11.9) | 13.0 (12.4, 13.7) | 17.1 (16.3, 18.0) | 20.8 (19.5, 22.1) | 23.8 (21.8, 26.0) |
| Major Total | 253 | 1936 | 7.2 (6.1, 8.4) | 10.7 (9.3, 12.2) | 13.2 (11.6, 15.0) | 16.4 (14.5, 18.6) | 18.6 (16.0, 21.5) | |
| TOTAL | 2803 | 18936 | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Figure N14 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Class of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




HR - adjusted for age and gender

Minor vs Major Partial

0 - 1Mth: HR=0.92 (95% CI 0.73, 1.16), p=0.498

1Mth - 3Mth: HR=1.49 (95% CI 1.21, 1.82), p<0.001

3Mth+: HR=1.54 (95% CI 1.40, 1.69), p<0.001

Minor vs Major Total

Entire Period: HR=1.49 (95% CI 1.29, 1.71), p<0.001

Major Partial vs Major Total

Entire Period: HR=1.04 (95% CI 0.91, 1.19), p=0.530

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Minor | 4618 | 3765 | 2885 | 2212 | 889 | 264 | 60 |
| Major Partial | 12382 | 10076 | 7681 | 5791 | 2133 | 592 | 97 |
| Major Total | 1936 | 1611 | 1236 | 927 | 374 | 87 | 7 |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

## OUTCOMES OF THE 1ST REVISION BY REASON FOR 1ST REVISION

Further analyses on the outcomes of the most common reasons for 1st revision have been performed. These include periprosthetic fracture, loosening, and prosthesis dislocation/instability.

When comparing the outcomes by reason for the 1st revision, prosthesis dislocation/instability has the highest rate of 2nd revision compared to other reasons for 1st revision. When the 1st revision is for loosening, there is a lower rate of 2nd revision for the first 3 months when compared to 1st revision for fracture. After 3 months this reverses, with revision for loosening then having a higher rate of 2nd revision (Table N9 and Figure N15).

When the reason for the 1st revision is loosening, the most common diagnosis for 2nd revision is also loosening (32.9%).

When the reason for the 1st revision is dislocation/instability, the most common diagnosis for 2nd revision is also dislocation/ instability (50.8%). When the reason for the 1st revision is fracture, the most common diagnosis for 2nd revision is infection (28.1%) (Table N10).

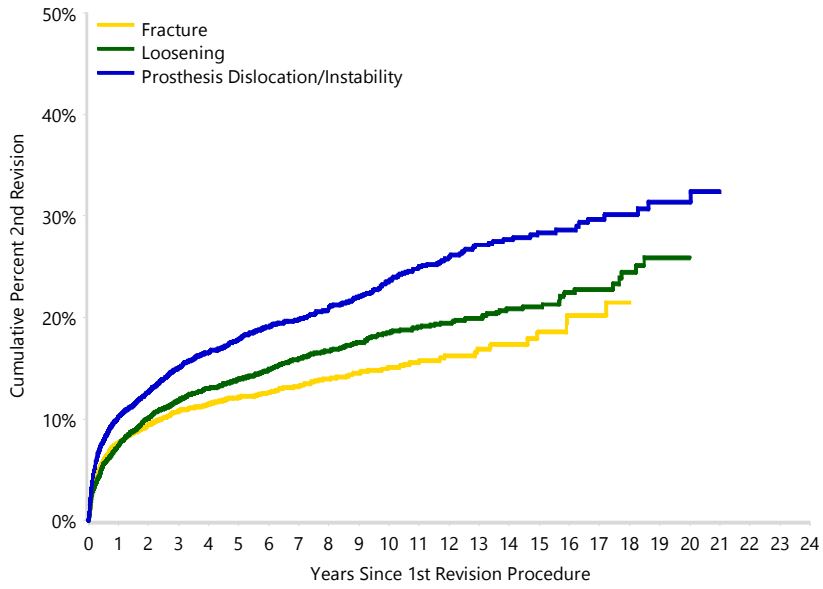
When the diagnosis for the 1st revision is loosening, the most common type of revision procedure is a femoral component only revision (25.8%). When the diagnosis for the 1st revision is dislocation/instability, the most common type of revision procedure is a head/insert revision (35.5%). When the revision diagnosis for the 1st revision is fracture, the most common type of revision procedure is a femoral component only revision (35.5%) (Table N11).

**Table N9 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Reason for 1st Revision (Primary Diagnosis OA)**

| Reason for 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Fracture | 598 | 5408 | 7.7 (7.0, 8.5) | 10.8 (10.0, 11.8) | 12.1 (11.2, 13.2) | 15.1 (13.8, 16.5) | 18.5 (16.1, 21.3) | |
| Loosening | 800 | 5312 | 7.4 (6.7, 8.1) | 11.8 (10.9, 12.7) | 13.9 (13.0, 15.0) | 18.5 (17.2, 19.8) | 21.0 (19.4, 22.7) | 25.9 (22.7, 29.5) |
| Prosthesis Dislocation/ Instability | 923 | 4903 | 10.2 (9.4, 11.1) | 15.0 (14.0, 16.1) | 17.9 (16.7, 19.1) | 23.5 (22.0, 25.1) | 28.3 (26.3, 30.5) | 31.4 (28.4, 34.5) |
| TOTAL | 2321 | 15623 | | | | | | |

Note: Excluding revisions where no minor or major femoral/acetabular components have been inserted.

**Figure N15 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Reason for 1st Revision (Primary Diagnosis OA)**




HR - adjusted for age and gender

Loosening vs Fracture

0 - 3Mth: HR=0.80 (95% CI 0.66, 0.97), p=0.024

3Mth+: HR=1.21 (95% CI 1.06, 1.38), p=0.003

Prosthesis Dislocation/Instability vs Fracture

0 - 3Mth: HR=1.29 (95% CI 1.08, 1.54), p=0.004

3Mth - 3Yr: HR=1.37 (95% CI 1.19, 1.59), p<0.001

3Yr+: HR=1.76 (95% CI 1.46, 2.13), p<0.001

Prosthesis Dislocation/Instability vs Loosening

Entire Period: HR=1.33 (95% CI 1.21, 1.47), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Fracture | 5408 | 4117 | 2883 | 2030 | 597 | 125 | 26 |
| Loosening | 5312 | 4536 | 3609 | 2825 | 1169 | 342 | 43 |
| Prosthesis Dislocation/ Instability | 4903 | 3987 | 3049 | 2320 | 908 | 288 | 67 |

Note: Excluding revisions where no minor or major femoral/acetabular components have been inserted.

**Table N10 Revision Diagnosis of 2nd Revision of Known Primary Total Conventional Hip Replacement by Reason for 1st Revision (Primary Diagnosis OA)**

| 2nd Revision Diagnosis | Loosening | | Prosthesis Dislocation/Instability | | Fracture | | TOTAL | |
|---|---|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% | N | Col% |
| Prosthesis Dislocation/Instability | 184 | 23.0 | 469 | 50.8 | 137 | 22.9 | 790 | 34.0 |
| Infection | 202 | 25.3 | 181 | 19.6 | 168 | 28.1 | 551 | 23.7 |
| Loosening | 263 | 32.9 | 121 | 13.1 | 148 | 24.7 | 532 | 22.9 |
| Fracture | 70 | 8.8 | 67 | 7.3 | 102 | 17.1 | 239 | 10.3 |
| Implant Breakage Stem | 17 | 2.1 | 7 | 0.8 | 10 | 1.7 | 34 | 1.5 |
| Pain | 14 | 1.8 | 9 | 1.0 | 10 | 1.7 | 33 | 1.4 |
| Implant Breakage Acetabular | 5 | 0.6 | 14 | 1.5 | 2 | 0.3 | 21 | 0.9 |
| Implant Breakage Acetabular Insert | 3 | 0.4 | 16 | 1.7 | 1 | 0.2 | 20 | 0.9 |
| Lysis | 8 | 1.0 | 7 | 0.8 | 4 | 0.7 | 19 | 0.8 |
| Metal Related Pathology | 5 | 0.6 | 9 | 1.0 | 3 | 0.5 | 17 | 0.7 |
| Malposition | 6 | 0.8 | 7 | 0.8 | 1 | 0.2 | 14 | 0.6 |
| Leg Length Discrepancy | 7 | 0.9 | . | . | 7 | 1.2 | 14 | 0.6 |
| Incorrect Sizing | 2 | 0.3 | 2 | 0.2 | 2 | 0.3 | 6 | 0.3 |
| Wear Acetabular Insert | 1 | 0.1 | 2 | 0.2 | . | . | 3 | 0.1 |
| Heterotopic Bone | 1 | 0.1 | 1 | 0.1 | . | . | 2 | 0.1 |
| Synovitis | 1 | 0.1 | . | . | . | . | 1 | 0.0 |
| Implant Breakage Head | 1 | 0.1 | . | . | . | . | 1 | 0.0 |
| Wear Acetabulum | . | . | 1 | 0.1 | . | . | 1 | 0.0 |
| Chondrolysis/Acetab. Erosion | . | . | 1 | 0.1 | . | . | 1 | 0.0 |
| Other | 10 | 1.3 | 9 | 1.0 | 3 | 0.5 | 22 | 0.9 |
| **TOTAL** | **800** | **100.0** | **923** | **100.0** | **598** | **100.0** | **2321** | **100.0** |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N11 Type of 2nd Revision of Known Primary Total Conventional Hip Replacement by Type of 1st Revision (Primary Diagnosis OA)**

| Type of 2nd Revision | Loosening | | Prosthesis Dislocation/Instability | | Fracture | | TOTAL | |
|---|---|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% | N | Col% |
| Head/Insert | 170 | 21.3 | 328 | 35.5 | 112 | 18.7 | 610 | 26.3 |
| Femoral Component | 206 | 25.8 | 116 | 12.6 | 212 | 35.5 | 534 | 23.0 |
| Acetabular Component | 159 | 19.9 | 269 | 29.1 | 105 | 17.6 | 533 | 23.0 |
| THR (Femoral/Acetabular) | 132 | 16.5 | 112 | 12.1 | 84 | 14.0 | 328 | 14.1 |
| Cement Spacer | 67 | 8.4 | 39 | 4.2 | 31 | 5.2 | 137 | 5.9 |
| Head Only | 30 | 3.8 | 22 | 2.4 | 31 | 5.2 | 83 | 3.6 |
| Minor Components | 20 | 2.5 | 9 | 1.0 | 13 | 2.2 | 42 | 1.8 |
| Insert Only | 5 | 0.6 | 15 | 1.6 | 6 | 1.0 | 26 | 1.1 |
| Removal of Prostheses | 9 | 1.1 | 10 | 1.1 | 4 | 0.7 | 23 | 1.0 |
| Bipolar Only | . | . | 2 | 0.2 | . | . | 2 | 0.1 |
| Reinsertion of Components | . | . | 1 | 0.1 | . | . | 1 | 0.0 |
| Bipolar Head and Femoral | 1 | 0.1 | . | . | . | . | 1 | 0.0 |
| Total Femoral | 1 | 0.1 | . | . | . | . | 1 | 0.0 |
| **TOTAL** | **800** | **100.0** | **923** | **100.0** | **598** | **100.0** | **2321** | **100.0** |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

## LOOSENING

There are 5,312 1st revision procedures for loosening, and 800 of these have had a 2nd revision. The median time from primary procedure to 1st revision for loosening is 4.2 years, the mean patient age is 70.4 years, with a slight female predominance (50.5%).

Of the 1st revisions performed for loosening, the majority of the primary procedures are cementless (n=3,297, 62.1%), followed by hybrid (n=1,228, 23.1%) and cemented (n=787, 14.8%). The most common primary bearing surface of those revised for loosening is metal/XLPE (29.2%), metal/non XLPE (23.8%), ceramic/ceramic (20.8%), and ceramic/XLPE (17.9%) (Table N1).

The cumulative percent 2nd revision at 15 years is 21% (Table N9 and Figure N15). The most common reasons for 2nd revision are further loosening (32.9%), followed by infection (25.3%), prosthesis dislocation/instability (23.0%), and fracture (8.8%) (Table N10).

After a 1st revision for loosening, the more common 2nd revision procedures are femoral component only revisions (25.8%), minor revisions that involve both head/insert exchange (21.3%), and acetabular only revisions (19.9%) (Table N11).

It is unclear why a minor revision is performed for loosening, but it could reflect surgeons revising with a longer femoral neck for leg shortening as a result of stem subsidence.

When the 1st revision is for loosening, a minor revision has the highest cumulative percent revision 2nd revision. Conversely, when the 1st revision is for loosening a THR (femoral/acetabular) revision has a lower rate of 2nd revision compared to other 1st revision procedures (Table N12 and Figure N17).

When the femoral component is revised for loosening, revision procedures using cementless femoral fixation have a lower rate of all-cause 2nd revision (after 6 months) compared to revision procedures using cemented femoral fixation (Table N13 and Figure N18).

When the femoral component is revised for loosening, there is also a lower rate of 2nd revision for recurrent loosening using cementless femoral fixation compared to when cemented femoral fixation is used (Table N14 and Figure N19).

When a femoral component is revised for loosening, cementless femoral fixation has a lower 2nd revision rate than cement fixation.

When the bearing surfaces used for the 1st revision for loosening are compared, there is no difference in rate of 2nd revision between procedures using metal/XLPE and ceramic/XLPE, but there is a higher rate of 2nd revision when metal/non XLPE is compared to both alternatives with XLPE after 3 months (Table N15 and Figure N20).

**Figure N16 Trends in Femoral Fixation in 1st Revision Total Hip Replacement Over Time (Primary Diagnosis OA, 1st Revision for Loosening)**

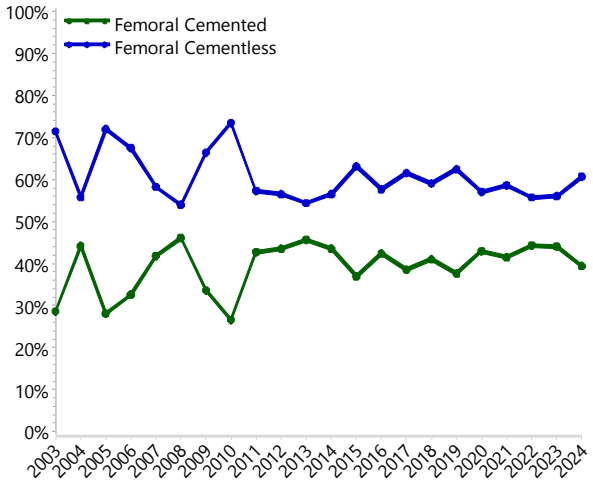
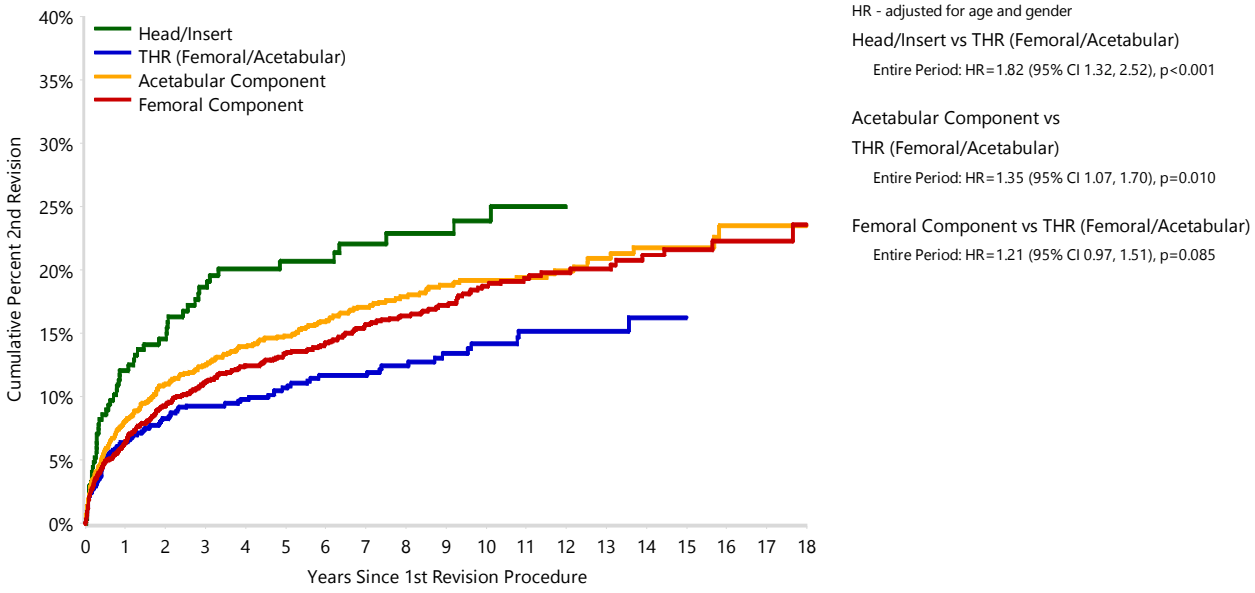


**Table N12 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Type of 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**

| Type of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|
| Head/Insert | 57 | 273 | 12.1 (8.7, 16.7) | 18.6 (14.3, 24.0) | 20.7 (16.1, 26.3) | 23.9 (18.6, 30.3) | |
| THR (Femoral/Acetabular) | 104 | 895 | 6.4 (4.9, 8.2) | 9.3 (7.5, 11.5) | 10.7 (8.7, 13.1) | 14.2 (11.6, 17.3) | 16.2 (12.9, 20.4) |
| Acetabular Component | 265 | 1611 | 8.1 (6.8, 9.5) | 12.5 (10.9, 14.3) | 14.8 (13.1, 16.8) | 19.2 (17.0, 21.5) | 21.8 (19.1, 24.8) |
| Femoral Component | 345 | 2400 | 6.4 (5.5, 7.5) | 11.1 (9.9, 12.5) | 13.4 (12.0, 15.0) | 18.8 (16.8, 20.9) | 21.6 (19.1, 24.5) |
| TOTAL | 771 | 5179 | | | | | |

Note: Excludes 133 1st revisions for loosening with other minor types of revisions.

**Figure N17 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Type of 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|
| Head/Insert | 273 | 220 | 174 | 129 | 70 | 18 |
| THR (Femoral/Acetabular) | 895 | 755 | 604 | 483 | 208 | 48 |
| Acetabular Component | 1611 | 1395 | 1137 | 903 | 398 | 117 |
| Femoral Component | 2400 | 2060 | 1606 | 1241 | 464 | 149 |

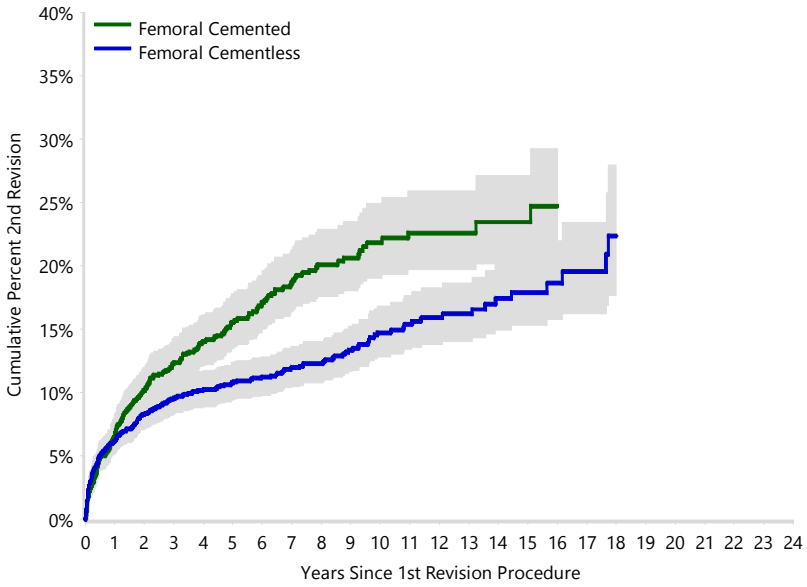
Note: Excludes 133 1st revisions for loosening with other minor types of revisions.

**Table N13 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Femoral Fixation of 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**

| Femoral Fixation in 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|
| Femoral Cemented | 213 | 1329 | 6.8 (5.5, 8.3) | 12.3 (10.5, 14.3) | 15.5 (13.5, 17.8) | 21.8 (19.1, 24.9) | 23.5 (20.2, 27.2) |
| Femoral Cementless | 236 | 1966 | 6.2 (5.2, 7.3) | 9.5 (8.3, 11.0) | 10.8 (9.4, 12.3) | 14.7 (12.9, 16.9) | 17.9 (15.3, 20.9) |
| TOTAL | 449 | 3295 | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Figure N18 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Femoral Fixation of 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**




HR - adjusted for age and gender

Femoral Cemented vs Femoral Cementless

0 - 3Mth: HR=0.82 (95% CI 0.55, 1.21), p=0.309

3Mth - 6Mth: HR=1.55 (95% CI 0.90, 2.67), p=0.113

6Mth+: HR=1.86 (95% CI 1.47, 2.35), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|
| Femoral Cemented | 1329 | 1131 | 854 | 635 | 230 | 61 |
| Femoral Cementless | 1966 | 1684 | 1356 | 1089 | 442 | 136 |

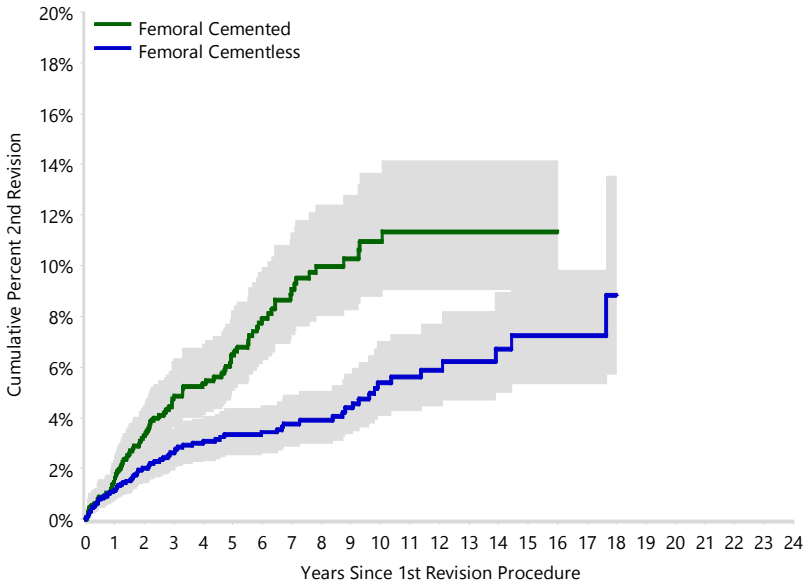
Note: Excluding 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Table N14 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Femoral Fixation of 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening, 2nd Revision for Loosening)**

| Femoral Fixation in 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|
| Femoral Cemented | 88 | 1329 | 1.6 (1.1, 2.5) | 4.8 (3.6, 6.2) | 6.5 (5.1, 8.2) | 11.0 (8.8, 13.6) | 11.3 (9.1, 14.1) |
| Femoral Cementless | 72 | 1966 | 1.1 (0.7, 1.8) | 2.6 (2.0, 3.5) | 3.3 (2.5, 4.4) | 5.4 (4.1, 7.0) | 7.2 (5.3, 9.8) |
| TOTAL | 160 | 3295 | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.
Excludes 1st revision with no femoral component inserted.

**Figure N19 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Femoral Fixation of 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening, 2nd Revision for Loosening)**




HR - adjusted for age and gender
Femoral Cemented vs Femoral Cementless
Entire Period: HR=2.11 (95% CI 1.54, 2.89), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|
| Femoral Cemented | 1329 | 1131 | 854 | 635 | 230 | 61 |
| Femoral Cementless | 1966 | 1684 | 1356 | 1089 | 442 | 136 |

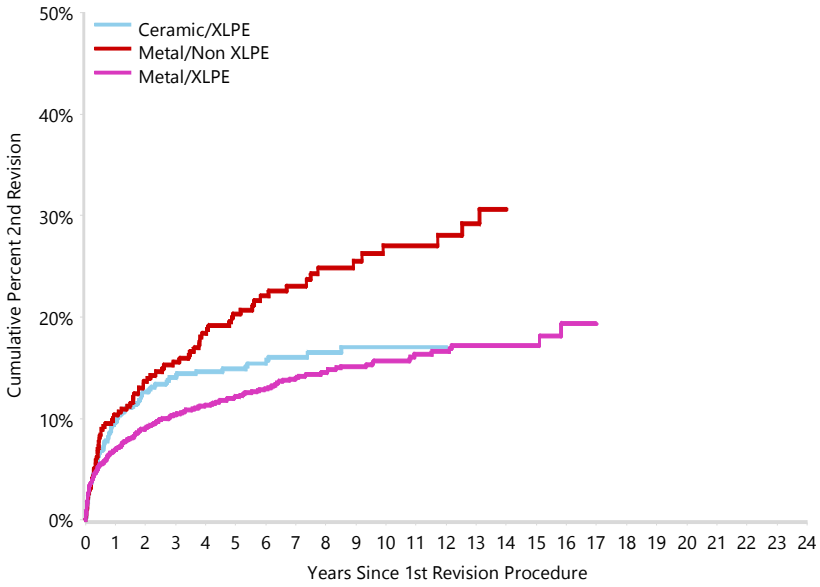
Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.
Excludes 1st revision with no femoral component inserted.

**Table N15 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Bearing Surface of 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**

| Bearing Surface of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|
| Ceramic/XLPE | 115 | 810 | 9.7 (7.8, 12.0) | 14.1 (11.7, 16.8) | 14.9 (12.4, 17.7) | 17.0 (14.1, 20.4) | |
| Metal/Non XLPE | 85 | 380 | 10.3 (7.6, 13.9) | 15.5 (12.2, 19.8) | 20.3 (16.3, 25.1) | 27.0 (22.0, 33.0) | |
| Metal/XLPE | 242 | 1834 | 6.9 (5.8, 8.2) | 10.3 (9.0, 11.9) | 12.1 (10.6, 13.8) | 15.6 (13.8, 17.7) | 17.2 (15.0, 19.6) |
| TOTAL | 442 | 3024 | | | | | |

Note: XLPE includes XLPE and XLPE+antioxidant.

**Figure N20 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Bearing Surface of 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**




HR - adjusted for age and gender

Ceramic/XLPE vs Metal/XLPE

Entire Period: HR=1.12 (95% CI 0.89, 1.41), p=0.328

Metal/Non XLPE vs Ceramic/XLPE

0 - 3Mth: HR=0.99 (95% CI 0.57, 1.71), p=0.957

3Mth - 6Mth: HR=2.35 (95% CI 1.28, 4.31), p=0.006

6Mth+: HR=1.72 (95% CI 1.21, 2.43), p=0.002

Metal/Non XLPE vs Metal/XLPE

0 - 3Mth: HR=1.10 (95% CI 0.65, 1.88), p=0.714

3Mth - 6Mth: HR=2.63 (95% CI 1.46, 4.75), p=0.001

6Mth+: HR=1.93 (95% CI 1.41, 2.62), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|
| Ceramic/XLPE | 810 | 653 | 473 | 348 | 94 | 17 |
| Metal/Non XLPE | 380 | 308 | 255 | 197 | 90 | 38 |
| Metal/XLPE | 1834 | 1590 | 1291 | 1029 | 452 | 96 |

Note: XLPE includes XLPE and XLPE+antioxidant.

# Revision Arthroplasty

## DISLOCATION/INSTABILITY

There are 4,903 1st revision procedures for dislocation/instability, and 923 of these have had a 2nd revision. The median time from primary procedure to revision for dislocation is 1 year, and the mean age of patients is 71.3 years, with more females undergoing revision (62.2%) (Table N1).

The cumulative percent 2nd revision at 15 years is 28.3% (Table N9 and Figure N15). The most common reason for 2nd revision is for further dislocation/instability (50.8%) followed by infection (19.6%), loosening (13.1%), and fracture (7.3%) (Table N10).

The most common 1st revision procedure for dislocation/instability is a minor revision that involves both head and insert exchange (35.5%), followed by acetabular component only revision (29.1%), femoral component only revision (12.6%) and THR (femoral/acetabular) revision (12.1%) (Table N11).

The outcomes of 1st revision procedures performed for dislocation/instability are compared. Revision of the acetabular component only has a lower rate of 2nd revision compared to THR and femoral only revision for the entire period, and when compared to a minor revision involving head/insert exchange after 1 month (Table N16 and Figure N22).

The use of insert types in the 1st revision procedures for dislocation/instability over time is shown in Figure N21.

There has been a decline in the use of head sizes <32mm and 32mm with time and an increase in the use of dual mobility bearings.

Femoral head size and use of constrained or dual mobility prostheses for the 1st revision procedures for dislocation/instability are also assessed. Acetabular inserts used with femoral heads <32mm are used in 348 (7.3%) procedures, head size 32mm in 811 procedures (16.9%), and head size >32mm in 1,213 procedures (25.3%), while constrained liners are used in 1,297 procedures (27.1%), and dual mobility constructs in 1,123 procedures (23.4%).

> Dual mobility prostheses have a lower all-cause 2nd revision rate compared to acetabular inserts used with head sizes <32mm, 32mm and >32mm, and constrained prostheses after 3 months.

There is no difference in the rate of overall 2nd revision between head sizes. Dual mobility prostheses have a lower rate of all-cause 2nd revision compared to acetabular inserts used with head sizes <32mm, 32mm and >32mm, and when compared to constrained prostheses after 3 months (Table N17 and Figure N23).

The effectiveness of these acetabular insert types for preventing a 2nd revision for dislocation/instability is also assessed. Dual mobility prostheses have a lower rate of 2nd revision for dislocation/instability compared to all femoral head size groups (<32mm, 32mm and >32mm) and also when compared to constrained prostheses after 6 months (Table N18 and Figure N24).

**Figure N21 Trends in Acetabular Prosthesis Use in 1st Revision Total Hip Replacement Over Time (Primary Diagnosis OA, 1st Revision for Prosthesis Dislocation/Instability)**

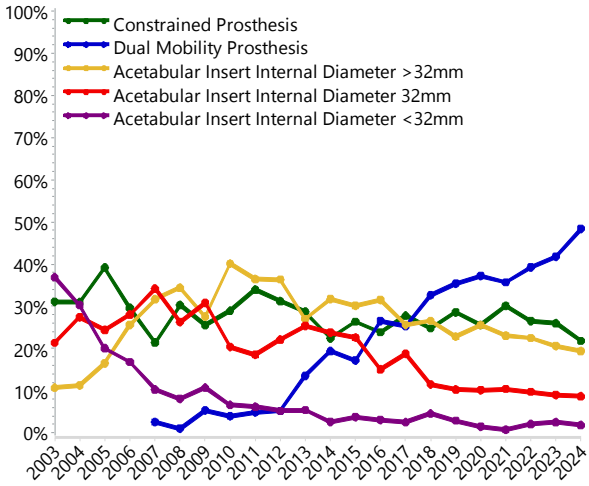
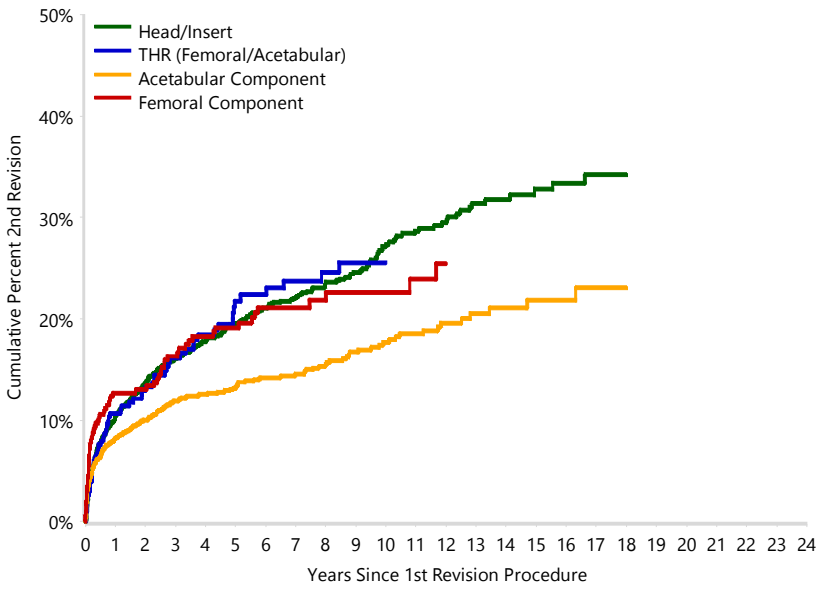


**Table N16 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Type of 1st Revision (Primary Diagnosis OA, 1st Revision for Prosthesis Dislocation/Instability)**

| Type of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|
| Head/Insert | 451 | 2180 | 10.4 (9.1, 11.7) | 16.1 (14.5, 17.8) | 19.5 (17.8, 21.4) | 27.1 (24.7, 29.8) | 32.7 (29.4, 36.4) |
| THR (Femoral/Acetabular) | 64 | 307 | 10.6 (7.6, 14.7) | 16.1 (12.3, 21.0) | 21.7 (17.1, 27.4) | 25.5 (20.2, 32.0) | |
| Acetabular Component | 234 | 1656 | 8.2 (6.9, 9.6) | 11.9 (10.3, 13.6) | 13.2 (11.5, 15.0) | 17.6 (15.4, 20.2) | 21.8 (18.5, 25.6) |
| Femoral Component | 70 | 356 | 12.6 (9.6, 16.6) | 16.3 (12.7, 20.7) | 19.1 (15.1, 23.9) | 22.6 (18.0, 28.1) | |
| TOTAL | 819 | 4499 | | | | | |

Note: Excludes 404 1st revision for prosthesis dislocation/Instability procedures with other minor type of revisions.

**Figure N22 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Type of 1st Revision (Primary Diagnosis OA, 1st Revision for Prosthesis Dislocation/Instability)**




HR - adjusted for age and gender

Head/Insert vs Acetabular Component

0 - 1Mth: HR=0.79 (95% CI 0.54, 1.14), p=0.208

1Mth - 3Mth: HR=1.45 (95% CI 1.02, 2.07), p=0.038

3Mth+: HR=1.82 (95% CI 1.51, 2.19), p<0.001

THR (Femoral/Acetabular) vs Acetabular Component

Entire Period: HR=1.50 (95% CI 1.13, 1.97), p=0.004

Femoral Component vs Acetabular Component

Entire Period: HR=1.40 (95% CI 1.07, 1.83), p=0.013

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|
| Head/Insert | 2180 | 1765 | 1305 | 980 | 372 | 122 |
| THR (Femoral/Acetabular) | 307 | 255 | 195 | 133 | 51 | 17 |
| Acetabular Component | 1656 | 1368 | 1073 | 831 | 313 | 91 |
| Femoral Component | 356 | 280 | 220 | 171 | 70 | 21 |

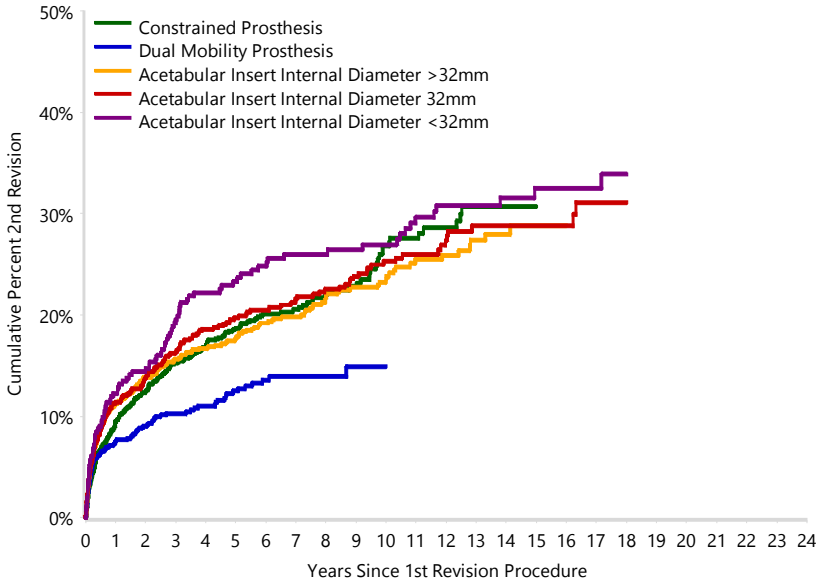
Note: Excludes 404 1st revision for prosthesis dislocation/Instability procedures with other minor type of revisions.

**Table N17 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Prosthesis Used in 1st Revision (Primary Diagnosis OA, 1st Revision for Prosthesis Dislocation/Instability)**

| Prosthesis Used in 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|
| Constrained Prosthesis | 247 | 1297 | 9.5 (8.0, 11.2) | 15.3 (13.3, 17.5) | 18.7 (16.5, 21.2) | 26.8 (23.4, 30.5) | 30.7 (26.5, 35.4) |
| Dual Mobility Prosthesis | 120 | 1123 | 7.5 (6.1, 9.2) | 10.3 (8.5, 12.4) | 12.5 (10.4, 14.9) | 14.9 (12.0, 18.4) | |
| Acetabular Insert Internal Diameter >32mm | 243 | 1213 | 11.2 (9.5, 13.1) | 15.6 (13.7, 17.9) | 17.7 (15.6, 20.1) | 23.2 (20.5, 26.2) | 28.8 (25.0, 33.1) |
| Acetabular Insert Internal Diameter 32mm | 184 | 811 | 11.4 (9.4, 13.8) | 16.4 (13.9, 19.2) | 19.7 (17.0, 22.8) | 25.3 (22.0, 28.9) | 28.8 (24.9, 33.1) |
| Acetabular Insert Internal Diameter <32mm | 97 | 348 | 12.3 (9.2, 16.2) | 19.5 (15.7, 24.2) | 23.3 (19.0, 28.3) | 26.9 (22.3, 32.3) | 32.5 (27.0, 38.7) |
| TOTAL | 891 | 4792 | | | | | |

Note: Excluding 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Figure N23 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Prosthesis Used in 1st Revision (Primary Diagnosis OA, 1st Revision for Prosthesis Dislocation/Instability)**




HR - adjusted for age and gender

Constrained Prosthesis vs Dual Mobility Prosthesis

0 - 3Mth: HR=1.10 (95% CI 0.79, 1.53), p=0.572

3Mth+: HR=1.94 (95% CI 1.53, 2.46), p<0.001

Acetabular Insert Internal Diameter >32mm vs Dual Mobility Prosthesis

Entire Period: HR=1.48 (95% CI 1.19, 1.85), p<0.001

Acetabular Insert Internal Diameter 32mm vs Dual Mobility Prosthesis

Entire Period: HR=1.57 (95% CI 1.24, 1.98), p<0.001

Acetabular Insert Internal Diameter <32mm vs Dual Mobility Prosthesis

Entire Period: HR=1.83 (95% CI 1.40, 2.40), p<0.001

Acetabular Insert Internal Diameter >32mm vs Acetabular Insert Internal Diameter 32mm

Entire Period: HR=0.94 (95% CI 0.78, 1.14), p=0.546

Acetabular Insert Internal Diameter <32mm vs Acetabular Insert Internal Diameter 32mm

Entire Period: HR=1.17 (95% CI 0.91, 1.49), p=0.217

Acetabular Insert Internal Diameter <32mm vs Acetabular Insert Internal Diameter >32mm

Entire Period: HR=1.24 (95% CI 0.98, 1.57), p=0.079

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|
| Constrained Prosthesis | 1297 | 1053 | 780 | 574 | 186 | 47 |
| Dual Mobility Prosthesis | 1123 | 868 | 570 | 362 | 41 | 2 |
| Acetabular Insert Internal Diameter >32mm | 1213 | 1010 | 806 | 642 | 265 | 63 |
| Acetabular Insert Internal Diameter 32mm | 811 | 684 | 577 | 476 | 241 | 89 |
| Acetabular Insert Internal Diameter <32mm | 348 | 290 | 245 | 208 | 141 | 72 |

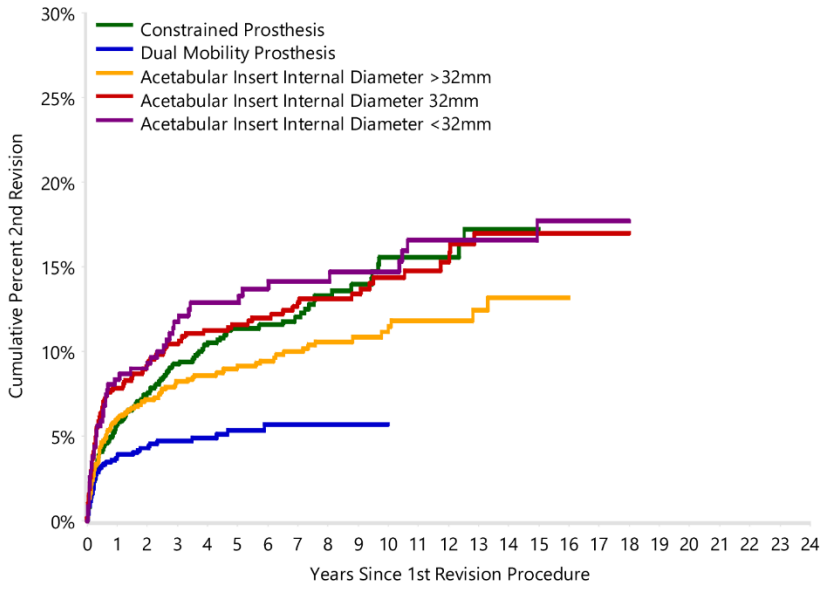
Note: Excluding 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Table N18 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Prosthesis Used in 1st Revision (Primary Diagnosis OA, 1st Revision for Prosthesis Dislocation/Instability, 2nd Revision for Prosthesis Dislocation/Instability)**

| Prosthesis Used in 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|
| Constrained Prosthesis | 137 | 1297 | 5.7 (4.6, 7.2) | 9.3 (7.7, 11.1) | 11.4 (9.6, 13.5) | 15.6 (12.9, 18.7) | 17.2 (13.9, 21.2) |
| Dual Mobility Prosthesis | 51 | 1123 | 3.8 (2.8, 5.2) | 4.7 (3.6, 6.3) | 5.4 (4.0, 7.1) | 5.7 (4.3, 7.6) | |
| Acetabular Insert Internal Diameter >32mm | 112 | 1213 | 6.0 (4.8, 7.5) | 8.3 (6.8, 10.1) | 9.2 (7.6, 11.1) | 11.2 (9.2, 13.5) | 13.2 (10.5, 16.4) |
| Acetabular Insert Internal Diameter 32mm | 104 | 811 | 7.9 (6.2, 10.0) | 10.5 (8.5, 12.9) | 11.6 (9.5, 14.2) | 14.4 (11.8, 17.4) | 17.0 (13.8, 20.9) |
| Acetabular Insert Internal Diameter <32mm | 49 | 348 | 8.4 (5.9, 11.9) | 11.8 (8.7, 15.8) | 12.9 (9.6, 17.1) | 14.7 (11.1, 19.3) | 17.7 (13.4, 23.3) |
| TOTAL | 453 | 4792 | | | | | |

Note: Excluding 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Figure N24 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Prosthesis Used in 1st Revision (Primary Diagnosis OA, 1st Revision for Prosthesis Dislocation/Instability, 2nd Revision for Prosthesis Dislocation/Instability)**




HR - adjusted for age and gender

Constrained Prosthesis vs Dual Mobility Prosthesis
0 - 6Mth: HR=1.49 (95% CI 1.00, 2.22), p=0.052
6Mth+: HR=2.93 (95% CI 2.02, 4.25), p<0.001

Acetabular Insert Internal Diameter >32mm vs Dual Mobility Prosthesis
Entire Period: HR=1.76 (95% CI 1.26, 2.46), p<0.001

Acetabular Insert Internal Diameter 32mm vs Dual Mobility Prosthesis
Entire Period: HR=2.24 (95% CI 1.60, 3.14), p<0.001

Acetabular Insert Internal Diameter <32mm vs Dual Mobility Prosthesis
Entire Period: HR=2.40 (95% CI 1.62, 3.57), p<0.001

Acetabular Insert Internal Diameter >32mm vs Acetabular Insert Internal Diameter <32mm
Entire Period: HR=0.73 (95% CI 0.52, 1.02), p=0.068

Acetabular Insert Internal Diameter 32mm vs Acetabular Insert Internal Diameter <32mm
Entire Period: HR=0.93 (95% CI 0.66, 1.31), p=0.676

Acetabular Insert Internal Diameter >32mm vs Acetabular Insert Internal Diameter 32mm
Entire Period: HR=0.79 (95% CI 0.60, 1.03), p=0.078

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Constrained Prosthesis | 1297 | 1053 | 780 | 574 | 186 | 47 | 11 |
| Dual Mobility Prosthesis | 1123 | 868 | 570 | 362 | 41 | 2 | 0 |
| Acetabular Insert Internal Diameter >32mm | 1213 | 1010 | 806 | 642 | 265 | 63 | 4 |
| Acetabular Insert Internal Diameter 32mm | 811 | 684 | 577 | 476 | 241 | 89 | 18 |
| Acetabular Insert Internal Diameter <32mm | 348 | 290 | 245 | 208 | 141 | 72 | 30 |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**PERIPROSTHETIC FRACTURE**

There are 5,408 1st revision procedures for fracture, and 598 of these procedures have had a 2nd revision. The median time from primary procedure to revision for fracture is 3.6 years, and the mean age of patients is slightly older than for other reasons for revision at 76.5 years, with more females undergoing revision for fracture (53.3%) (Table N1).

Of those who had a 1st revision for fracture, the fixation used for the primary total hip replacement is cementless (66.8%), hybrid (28.4%) and cemented (4.8%) (Table N1).

The cumulative percent 2nd revision at 15 years is 18.5% (Table N9 and Figure N15). The most common reason for 2nd revision is infection (28.1%), followed by loosening (24.7%), prosthesis dislocation/instability (22.9%), and further fracture (17.1%) (Table N10).

After 1st revision for fracture, the most common reason for 2nd revision is infection.

A revision of the femoral component (35.5%) is the most common type of 2nd revision, followed by minor revisions that involve both head/insert exchange (18.7%) and acetabular only revisions (17.6%) (Table N11). Minor 1st revisions for fracture are likely to be combined with fracture fixation procedures.

The outcomes of the type of 1st revision procedure for fractures are compared. Revision of the acetabular component only has a higher rate of 2nd revision compared to THR (femoral/acetabular). There are no other differences between procedure types (Table N19 and Figure N25).

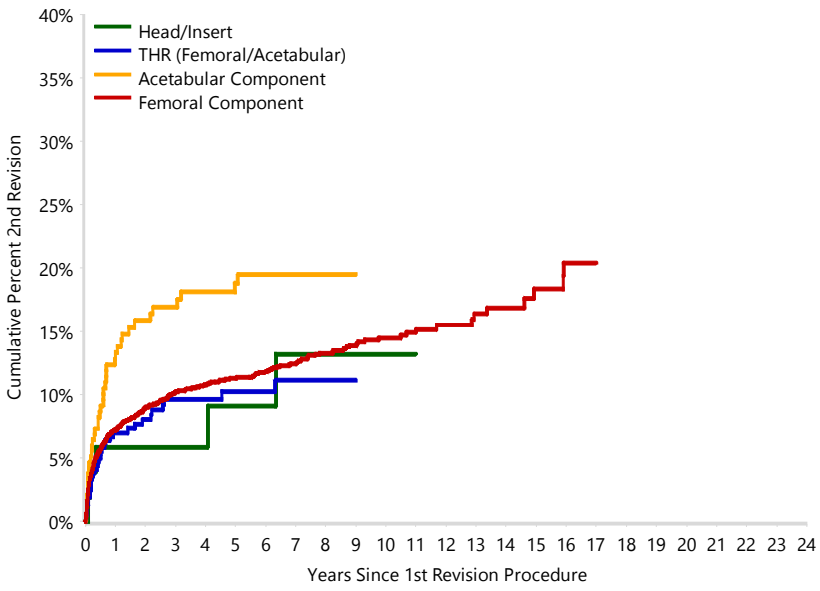
When the 1st revision is for fracture, cemented fixation used for revision of the femoral component has a higher rate of 2nd revision compared to cementless femoral fixation after 3 months (Table N20 and Figure N26).

**Table N19 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Type of 1st Revision (Primary Diagnosis OA, 1st Revision for Fracture)**

| Type of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|
| Head/Insert | 5 | 53 | 5.8 (1.9, 17.0) | 5.8 (1.9, 17.0) | 9.1 (3.4, 23.1) | 13.2 (5.4, 30.4) | |
| THR (Femoral/Acetabular) | 34 | 380 | 7.0 (4.8, 10.2) | 9.6 (6.9, 13.4) | 10.3 (7.3, 14.3) | | |
| Acetabular Component | 43 | 238 | 13.3 (9.5, 18.5) | 16.9 (12.5, 22.6) | 18.8 (14.1, 24.8) | | |
| Femoral Component | 450 | 4300 | 7.2 (6.5, 8.1) | 10.2 (9.3, 11.3) | 11.3 (10.3, 12.4) | 14.5 (13.1, 16.1) | 18.3 (15.5, 21.6) |
| TOTAL | 532 | 4971 | | | | | |

Note: Excludes 437 1st revision procedures for fracture procedures with other minor types of revision.

**Figure N25 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Type of 1st Revision (Primary Diagnosis OA, 1st Revision for Fracture)**




HR - adjusted for age and gender

Head/Insert vs THR (Femoral/Acetabular)

Entire Period: HR=0.88 (95% CI 0.34, 2.24), p=0.782

Acetabular Component vs THR (Femoral/Acetabular)

Entire Period: HR=1.85 (95% CI 1.17, 2.90), p=0.007

Femoral Component vs THR (Femoral/Acetabular)

Entire Period: HR=1.21 (95% CI 0.86, 1.72), p=0.275

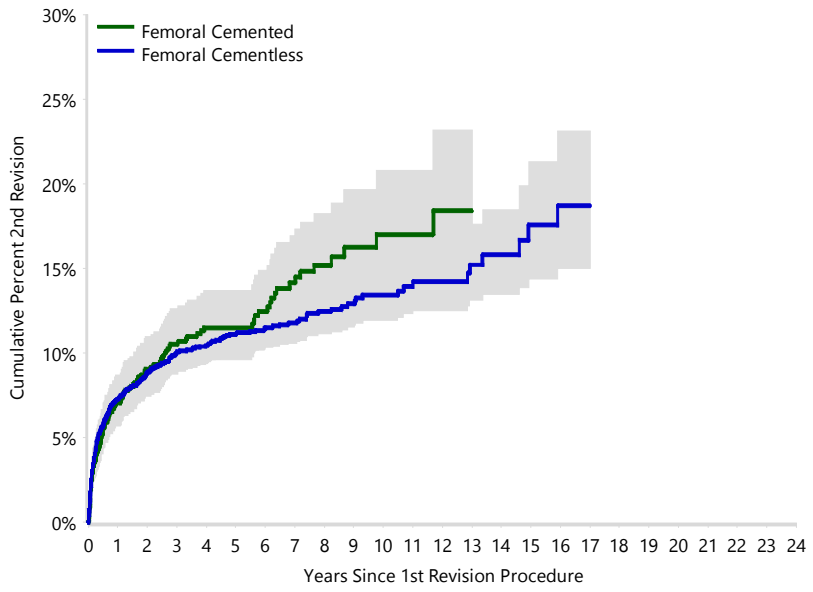
| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Head/Insert | 53 | 43 | 35 | 24 | 8 | 0 | 0 |
| THR (Femoral/Acetabular) | 380 | 298 | 202 | 133 | 36 | 7 | 2 |
| Acetabular Component | 238 | 182 | 142 | 117 | 39 | 3 | 0 |
| Femoral Component | 4300 | 3255 | 2277 | 1584 | 461 | 104 | 18 |

Note: Excludes 437 1st revision procedures for fracture procedures with other minor types of revision.

**Table N20 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Femoral Fixation in 1st Revision (Primary Diagnosis OA, 1st Revision for Fracture, when the Femoral Component is Revised)**

| Femoral Fixation in 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|---|
| Femoral Cemented | 131 | 1211 | 7.0 (5.7, 8.7) | 10.5 (8.8, 12.6) | 11.5 (9.6, 13.7) | 14.2 (11.8, 16.9) | 17.0 (13.9, 20.8) | |
| Femoral Cementless | 353 | 3469 | 7.3 (6.5, 8.2) | 10.1 (9.0, 11.2) | 11.1 (10.0, 12.3) | 11.8 (10.6, 13.1) | 13.4 (11.9, 15.0) | 17.6 (14.4, 21.3) |
| TOTAL | 484 | 4680 | | | | | | |

**Figure N26 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Femoral Fixation in 1st Revision (Primary Diagnosis OA, 1st Revision for Fracture, when the Femoral Component is Revised)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|
| Femoral Cemented | 1211 | 902 | 606 | 413 | 265 | 100 | 21 |
| Femoral Cementless | 3469 | 2651 | 1873 | 1304 | 848 | 397 | 90 |

# Revision Arthroplasty

## TIMING OF 1ST REVISION

The timing of the 1st revision was classified as early if it occurred within 2 years of the primary procedure (<2 years) or late if it occurred 2 years or more (≥2 years) after the primary procedure. There are 8,216 early 1st revisions (43.4%). When performed within 2 years, 1st revisions have a higher rate of 2nd revision in the first month and again from 3 months onwards when compared to late 1st revisions (Table N21 and Figure N27).

The reasons for 1st revision vary with time from the primary procedure. The three most common early 1st revision diagnoses are dislocation/instability, fracture and loosening, but while remaining the most common, the order of these reverses for late 1st revision. Most revisions for leg length discrepancy and incorrect sizing occur early, while lysis and wear or breakage-related revisions mostly occur late (Table N22 and Figure N28).

The most common reasons for a 2nd revision after an early 1st revision are dislocation/instability, infection and loosening, while after a late 1st revision, these are dislocation/instability, loosening and infection.

Of the 1st revisions for loosening, 34.5% (n=1,832) occur early. Early loosening most likely represents a failure of initial fixation. 1st revisions for loosening performed within 2 years have a higher rate of 2nd revision compared to late revisions for loosening (Table N23 and Figure N29).

Most of the 1st revisions for dislocation/instability occur early (60.7%, n=2975). Early 1st revisions for dislocation/instability have a higher rate of 2nd revision than late 1st revisions for dislocation/instability for the first 2 weeks only, and after this time, there is no difference (Table N24 and Figure N30).

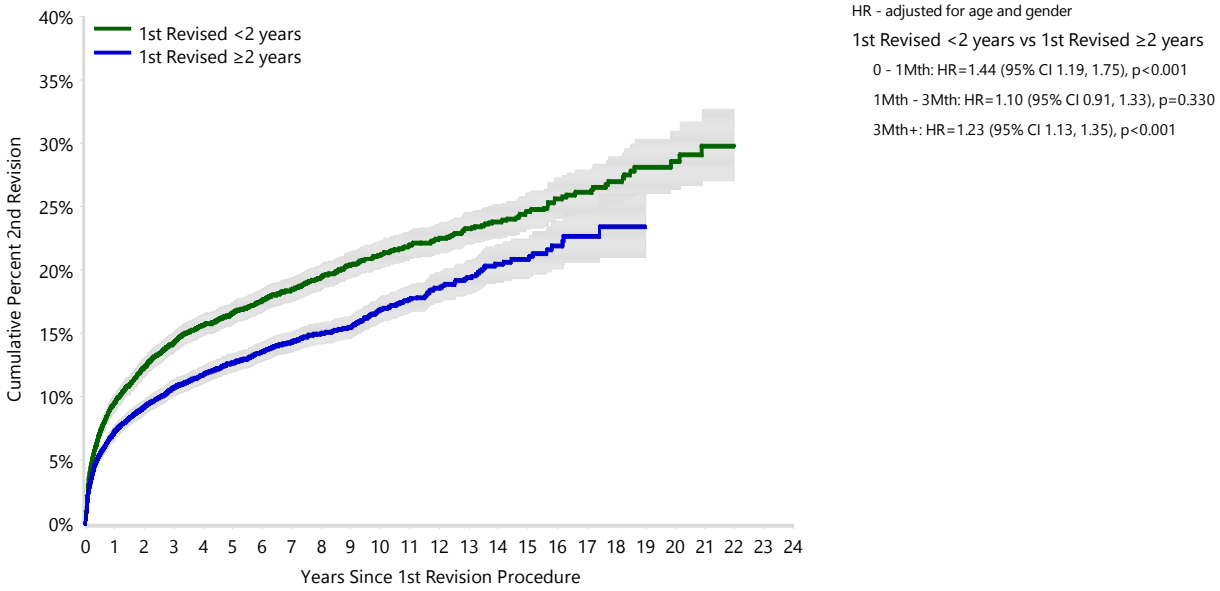
There are 42.8% of 1st revisions for fracture that occur within 2 years of the primary procedure (n=2,314). Early 1st revisions for fracture have a higher rate of 2nd revision than 1st revisions for fracture occurring late (Table N25 and Figure N31).

**Table N21 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Timing of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| Timing of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|
| 1st Revised <2 years | 1472 | 8216 | 9.5 (8.9, 10.2) | 14.3 (13.5, 15.1) | 16.6 (15.7, 17.5) | 21.1 (20.1, 22.2) | 24.6 (23.2, 26.1) |
| 1st Revised ≥2 years | 1331 | 10720 | 7.3 (6.8, 7.8) | 10.7 (10.1, 11.4) | 12.7 (12.0, 13.4) | 16.8 (15.9, 17.8) | 20.8 (19.3, 22.4) |
| **TOTAL** | **2803** | **18936** | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Figure N27 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Timing of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|
| 1st Revised <2 years | 8216 | 6860 | 5477 | 4332 | 1827 | 602 |
| 1st Revised ≥2 years | 10720 | 8592 | 6325 | 4598 | 1569 | 341 |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Table N22 Reasons for 1st Revision Total Conventional Hip Replacement by Timing of 1st Revision**

| 1st Revision Diagnosis | 1st Revised <2 years | | | 1st Revised ≥2 years | | | TOTAL | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | Row% | Col% | N | Row% | Col% | N | Row% | Col% |
| Fracture | 2314 | 42.8 | 28.2 | 3094 | 57.2 | 28.9 | 5408 | 100.0 | 28.6 |
| Heterotopic Bone | 13 | 36.1 | 0.2 | 23 | 63.9 | 0.2 | 36 | 100.0 | 0.2 |
| Implant Breakage Acetabular | 32 | 25.2 | 0.4 | 95 | 74.8 | 0.9 | 127 | 100.0 | 0.7 |
| Implant Breakage Acetabular Insert | 67 | 34.7 | 0.8 | 126 | 65.3 | 1.2 | 193 | 100.0 | 1.0 |
| Implant Breakage Head | 13 | 25.5 | 0.2 | 38 | 74.5 | 0.4 | 51 | 100.0 | 0.3 |
| Implant Breakage Stem | 37 | 12.8 | 0.5 | 253 | 87.2 | 2.4 | 290 | 100.0 | 1.5 |
| Incorrect Sizing | 107 | 82.9 | 1.3 | 22 | 17.1 | 0.2 | 129 | 100.0 | 0.7 |
| Leg Length Discrepancy | 270 | 75.4 | 3.3 | 88 | 24.6 | 0.8 | 358 | 100.0 | 1.9 |
| Loosening | 1832 | 34.5 | 22.3 | 3480 | 65.5 | 32.5 | 5312 | 100.0 | 28.1 |
| Lysis | 34 | 7.0 | 0.4 | 452 | 93.0 | 4.2 | 486 | 100.0 | 2.6 |
| Malposition | 184 | 51.5 | 2.2 | 173 | 48.5 | 1.6 | 357 | 100.0 | 1.9 |
| Metal Related Pathology | 7 | 5.2 | 0.1 | 128 | 94.8 | 1.2 | 135 | 100.0 | 0.7 |
| Pain | 164 | 38.5 | 2.0 | 262 | 61.5 | 2.4 | 426 | 100.0 | 2.2 |
| Prosthesis Dislocation/Instability | 2975 | 60.7 | 36.2 | 1928 | 39.3 | 18.0 | 4903 | 100.0 | 25.9 |
| Synovitis | 1 | 50.0 | 0.0 | 1 | 50.0 | 0.0 | 2 | 100.0 | 0.0 |
| Tumour | 8 | 23.5 | 0.1 | 26 | 76.5 | 0.2 | 34 | 100.0 | 0.2 |
| Wear Acetabular Insert | 7 | 3.1 | 0.1 | 218 | 96.9 | 2.0 | 225 | 100.0 | 1.2 |
| Wear Acetabulum | . | . | . | 20 | 100.0 | 0.2 | 20 | 100.0 | 0.1 |
| Wear Head | 10 | 11.1 | 0.1 | 80 | 88.9 | 0.7 | 90 | 100.0 | 0.5 |
| Other | 141 | 39.8 | 1.7 | 213 | 60.2 | 2.0 | 354 | 100.0 | 1.9 |
| TOTAL | 8216 | 43.4 | 100.0 | 10720 | 56.6 | 100.0 | 18936 | 100.0 | 100.0 |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Figure N28 Cumulative Incidence 2nd Revision Diagnosis of Total Conventional Hip Replacement by Timing of 1st Revision**

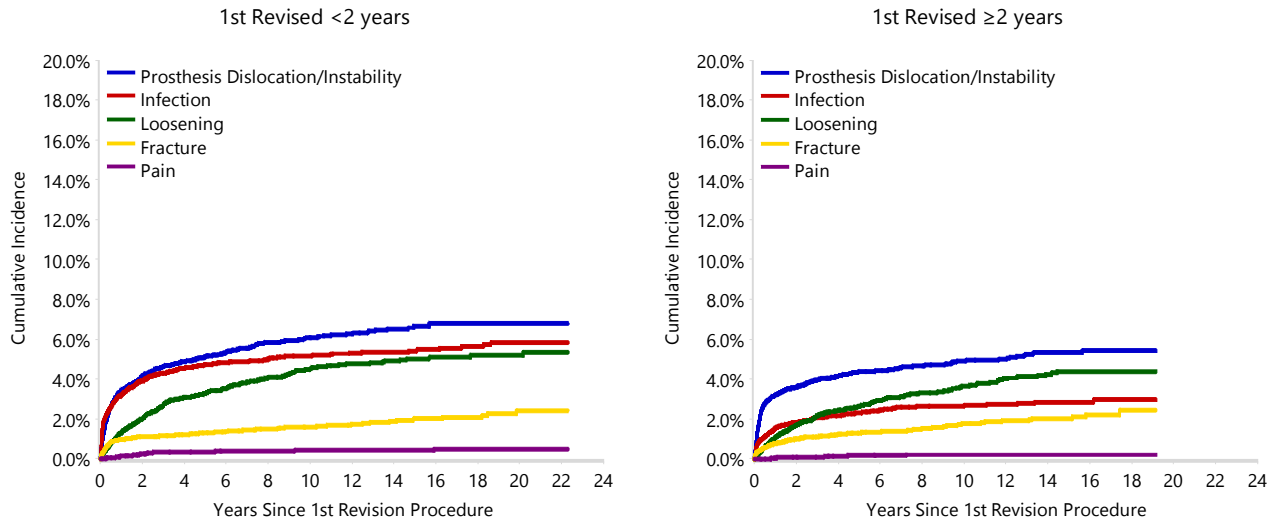
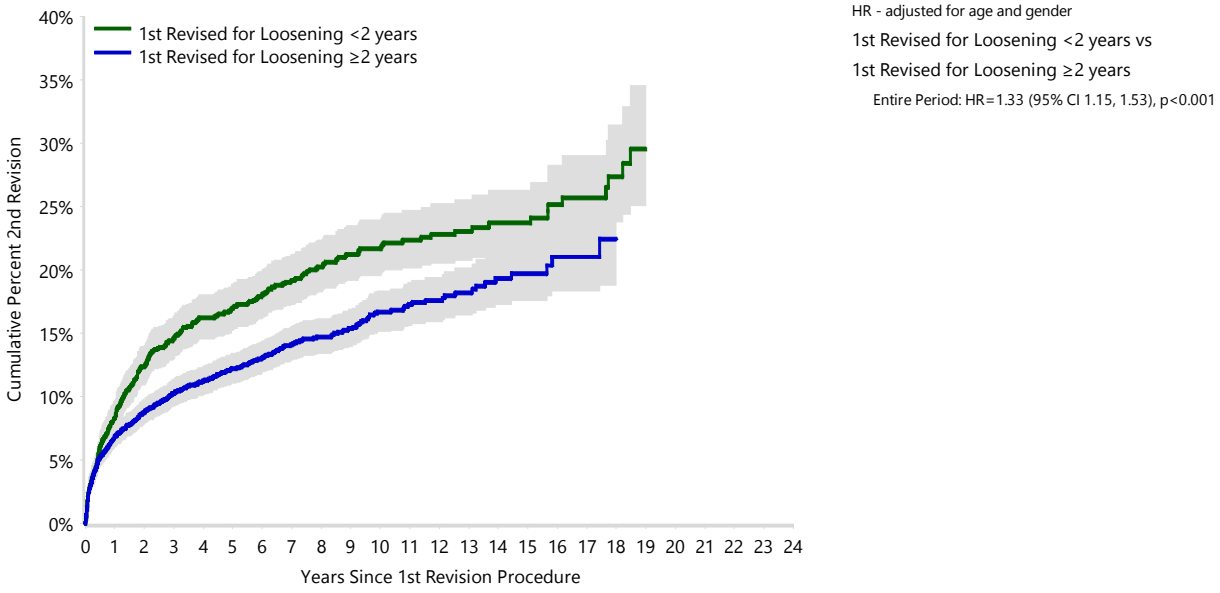


**Table N23 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Timing of 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**

| Type of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|
| 1st Revised for Loosening <2 years | 348 | 1832 | 8.3 (7.1, 9.7) | 14.6 (13.0, 16.3) | 17.0 (15.3, 18.9) | 21.7 (19.6, 23.9) | 23.7 (21.3, 26.3) |
| 1st Revised for Loosening ≥2 years | 452 | 3480 | 6.9 (6.1, 7.8) | 10.3 (9.3, 11.4) | 12.2 (11.1, 13.5) | 16.7 (15.2, 18.4) | 19.7 (17.6, 22.1) |
| TOTAL | 800 | 5312 | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Figure N29 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Timing of 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|
| 1st Revised for Loosening <2 years | 1832 | 1579 | 1290 | 1041 | 485 | 177 |
| 1st Revised for Loosening ≥2 years | 3480 | 2957 | 2319 | 1784 | 684 | 165 |

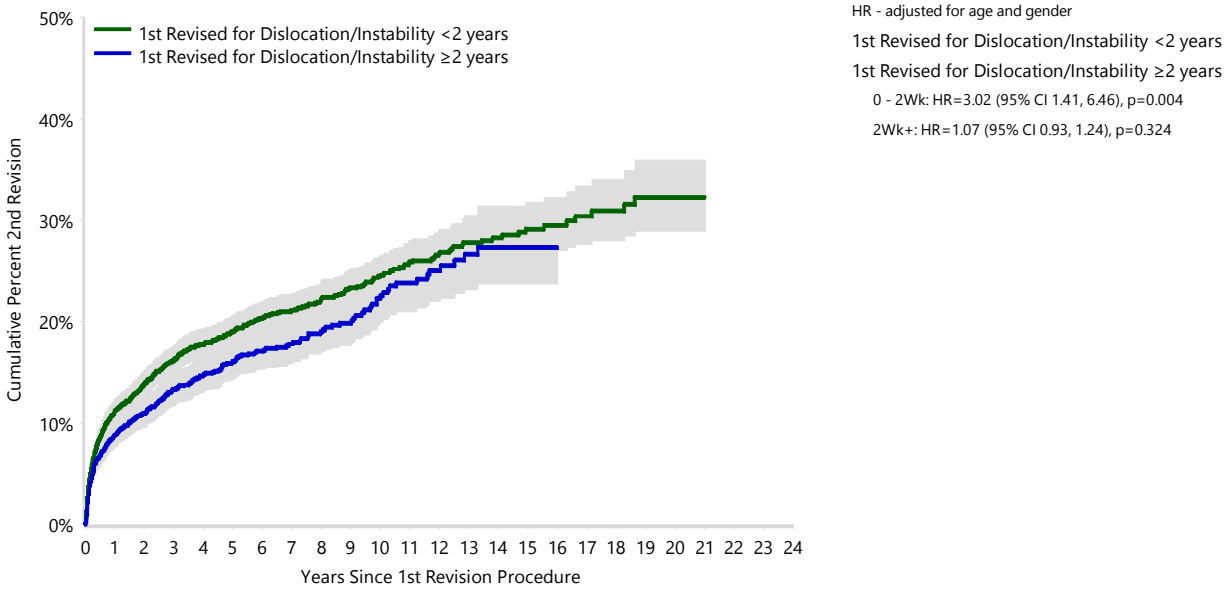
Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Table N24 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Timing of 1st Revision (Primary Diagnosis OA, 1st Revision for Prosthesis Dislocation/Instability)**

| Timing of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|
| 1st Revised for Dislocation/Instability <2 years | 613 | 2975 | 11.1 (10.0, 12.3) | 16.2 (14.9, 17.6) | 19.0 (17.5, 20.5) | 24.4 (22.6, 26.4) | 29.1 (26.7, 31.7) |
| 1st Revised for Dislocation/Instability ≥2 years | 310 | 1928 | 8.8 (7.6, 10.1) | 13.2 (11.7, 14.9) | 16.1 (14.3, 18.0) | 22.2 (19.7, 25.1) | 27.3 (23.6, 31.3) |
| TOTAL | 923 | 4903 | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Figure N30 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement Timing of 1st Revision (Primary Diagnosis OA, 1st Revision for Prosthesis Dislocation/Instability)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|
| 1st Revised for Dislocation/Instability <2 years | 2975 | 2434 | 1921 | 1517 | 644 | 222 |
| 1st Revised for Dislocation/Instability ≥2 years | 1928 | 1553 | 1128 | 803 | 264 | 66 |

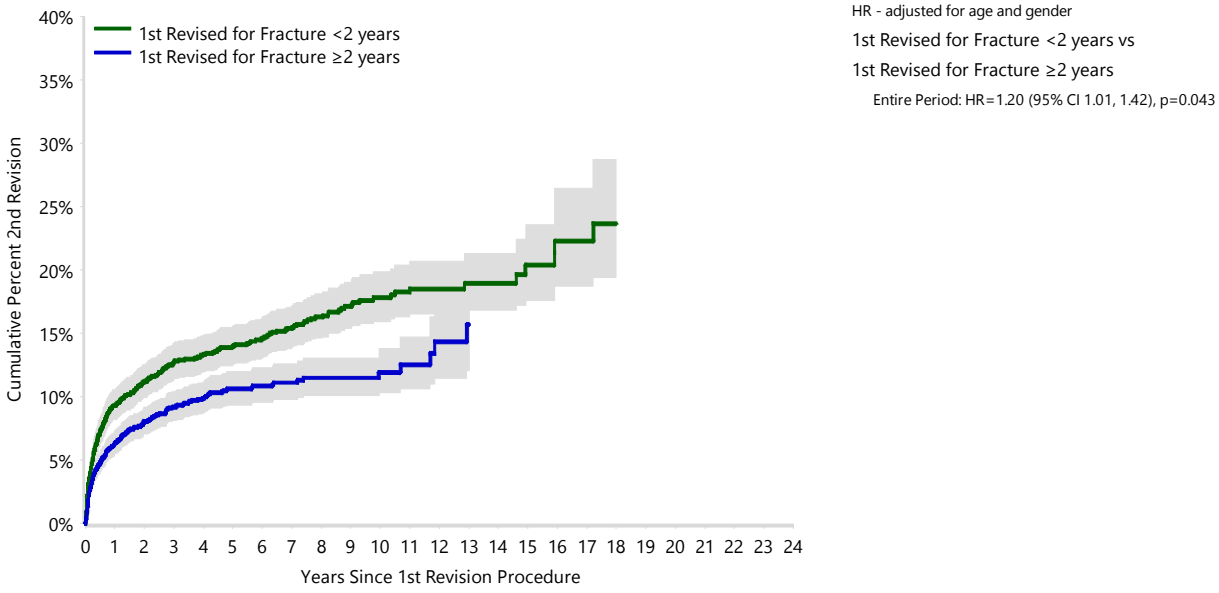
Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Table N25 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Timing of 1st Revision (Primary Diagnosis OA, 1st Revision for Fracture)**

| Timing of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|
| 1st Revised for Fracture <2 years | 336 | 2314 | 9.3 (8.2, 10.6) | 12.8 (11.4, 14.3) | 14.0 (12.5, 15.6) | 17.8 (16.0, 19.8) | 20.4 (17.6, 23.6) |
| 1st Revised for Fracture ≥2 years | 262 | 3094 | 6.4 (5.5, 7.4) | 9.2 (8.1, 10.4) | 10.6 (9.4, 12.0) | 11.9 (10.3, 13.8) | |
| TOTAL | 598 | 5408 | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Figure N31 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Timing of 1st Revision (Primary Diagnosis OA, 1st Revision for Fracture)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|
| 1st Revised for Fracture <2 years | 2314 | 1908 | 1488 | 1154 | 401 | 104 |
| 1st Revised for Fracture ≥2 years | 3094 | 2209 | 1395 | 876 | 196 | 21 |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

# Revision Arthroplasty

## SURGICAL APPROACH USED IN 1ST REVISION

Surgical approach data has been collected since 2015 and has been recorded for 11,958 1st revision hip replacement procedures. For revision hip replacement, the posterior approach is the most frequently used surgical approach (69.3%), while the lateral approach is used in 21.9% of procedures and the anterior approach in 8.8%. This contrasts with primary procedures for osteoarthritis, where the posterior approach is also the most common (used in 56.5%), the anterior approach second most common (30.5%), while the lateral approach is used for 13.0% of procedures (Table N26).

The posterior approach is used for 69.3%, lateral approach for 21.9% and anterior approach for 8.8% of 1st revision hip procedures.

Surgical approach use varies with class of 1st revision. For minor revisions, the posterior approach is used for 65.3% of procedures, the lateral approach for 22.1% and the anterior approach for 12.6%. For major partial revisions, the posterior approach is used for 69.7%, the lateral for 22.2% and the anterior for 8.2% of procedures. When a major total revision is performed, the posterior approach is used for 76.3% of these procedures, the lateral approach for 19.5% and the anterior approach for 4.2% (Table N26).

Surgical approach also varies with the reason for 1st revision. When the 1st revision is for loosening, the posterior approach is used for 71.4% of procedures, while the lateral approach is used for 19.2% and the anterior approach for 9.4%. Similarly, when the 1st revision is for dislocation/instability, the posterior approach is used for 71.2%, the lateral for 18.8% and the anterior for 9.9% (Table N27). Only a small percentage of revisions for fracture use the anterior approach (4.7%), where proportionately more use either the lateral (27.0%) or posterior approaches (68.2%).

When the outcomes of the surgical approaches used for the 1st revision are compared, procedures using the anterior approach have a higher rate of 2nd revision compared to those using the posterior approach, and also for the first 9 months when compared to the lateral approach. The lateral approach has a higher rate of 2nd revision compared to the posterior approach (after 9 months) (Table N28 and Figure N32).

When the surgical approaches used for the 1st revision are compared for the class of revision, there are no differences in the rate of 2nd revision for minor revisions or major total revision procedures (Table N29, Figure N33, Table N30 and Figure N34). Major partial revisions have a higher rate of 2nd revision when the anterior approach is used compared to the other two approaches, with no difference between the lateral and posterior approaches (Table N31 and Figure N35).

After using the anterior approach for the 1st revision, the most common reasons for 2nd revision are infection (31.8%), loosening (26.7%), dislocation/instability (22.2%) and fracture (8.5%). For 1st revisions using the lateral and posterior approaches, the most common reasons for 2nd revision are dislocation/instability (33.5% and 38.0% for lateral and posterior approaches, respectively), followed by infection (23.5% and 26.8%), loosening (22.9% and 16.0%) and fracture (10.1% and 10.0%) (Table N32).

**Table N26 Revision Hip Replacement by 1st Revision Class and Surgical Approach (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| Revision Class | Anterior | | | Lateral | | | Posterior | | | TOTAL | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | Row% | Col% | N | Row% | Col% | N | Row% | Col% | N | Row% | Col% |
| Minor | 348 | 12.6 | 33.1 | 612 | 22.1 | 23.4 | 1806 | 65.3 | 21.8 | 2766 | 100.0 | 23.1 |
| Major Partial | 650 | 8.2 | 61.9 | 1767 | 22.2 | 67.5 | 5549 | 69.7 | 66.9 | 7966 | 100.0 | 66.6 |
| Major Total | 52 | 4.2 | 5.0 | 239 | 19.5 | 9.1 | 935 | 76.3 | 11.3 | 1226 | 100.0 | 10.3 |
| **TOTAL** | **1050** | **8.8** | **100.0** | **2618** | **21.9** | **100.0** | **8290** | **69.3** | **100.0** | **11958** | **100.0** | **100.0** |

Note: Excludes 6,978 procedures with unknown approach. Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Table N27 Revision Hip Replacement by Surgical Approach and Reason for 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| Reason for 1st Revision | Anterior | | | Lateral | | | Posterior | | | TOTAL | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | Row% | Col% | N | Row% | Col% | N | Row% | Col% | N | Row% | Col% |
| Fracture | 179 | 4.7 | 17.0 | 1019 | 27.0 | 38.9 | 2573 | 68.2 | 31.0 | 3771 | 100.0 | 31.5 |
| Heterotopic Bone | 1 | 4.3 | 0.1 | 3 | 13.0 | 0.1 | 19 | 82.6 | 0.2 | 23 | 100.0 | 0.2 |
| Implant Breakage Acetabular | 11 | 14.9 | 1.0 | 20 | 27.0 | 0.8 | 43 | 58.1 | 0.5 | 74 | 100.0 | 0.6 |
| Implant Breakage Acetabular Insert | 20 | 16.4 | 1.9 | 21 | 17.2 | 0.8 | 81 | 66.4 | 1.0 | 122 | 100.0 | 1.0 |
| Implant Breakage Head | 2 | 9.5 | 0.2 | 7 | 33.3 | 0.3 | 12 | 57.1 | 0.1 | 21 | 100.0 | 0.2 |
| Implant Breakage Stem | 5 | 2.3 | 0.5 | 51 | 23.4 | 1.9 | 162 | 74.3 | 2.0 | 218 | 100.0 | 1.8 |
| Incorrect Sizing | 18 | 25.7 | 1.7 | 18 | 25.7 | 0.7 | 34 | 48.6 | 0.4 | 70 | 100.0 | 0.6 |
| Leg Length Discrepancy | 68 | 31.2 | 6.5 | 27 | 12.4 | 1.0 | 123 | 56.4 | 1.5 | 218 | 100.0 | 1.8 |
| Loosening | 291 | 9.4 | 27.7 | 594 | 19.2 | 22.7 | 2213 | 71.4 | 26.7 | 3098 | 100.0 | 25.9 |
| Lysis | 12 | 3.9 | 1.1 | 67 | 21.8 | 2.6 | 229 | 74.4 | 2.8 | 308 | 100.0 | 2.6 |
| Malposition | 43 | 17.2 | 4.1 | 48 | 19.2 | 1.8 | 159 | 63.6 | 1.9 | 250 | 100.0 | 2.1 |
| Metal Related Pathology | 5 | 4.3 | 0.5 | 23 | 19.8 | 0.9 | 88 | 75.9 | 1.1 | 116 | 100.0 | 1.0 |
| Pain | 43 | 15.8 | 4.1 | 47 | 17.2 | 1.8 | 183 | 67.0 | 2.2 | 273 | 100.0 | 2.3 |
| Prosthesis Dislocation/Instability | 288 | 9.9 | 27.4 | 545 | 18.8 | 20.8 | 2062 | 71.2 | 24.9 | 2895 | 100.0 | 24.2 |
| Synovitis | . | . | . | 1 | 100.0 | 0.0 | . | . | . | 1 | 100.0 | 0.0 |
| Tumour | . | . | . | 13 | 56.5 | 0.5 | 10 | 43.5 | 0.1 | 23 | 100.0 | 0.2 |
| Wear Acetabular Insert | 10 | 6.8 | 1.0 | 39 | 26.5 | 1.5 | 98 | 66.7 | 1.2 | 147 | 100.0 | 1.2 |
| Wear Acetabulum | 2 | 22.2 | 0.2 | 4 | 44.4 | 0.2 | 3 | 33.3 | 0.0 | 9 | 100.0 | 0.1 |
| Wear Head | 8 | 11.9 | 0.8 | 16 | 23.9 | 0.6 | 43 | 64.2 | 0.5 | 67 | 100.0 | 0.6 |
| Other | 44 | 17.3 | 4.2 | 55 | 21.7 | 2.1 | 155 | 61.0 | 1.9 | 254 | 100.0 | 2.1 |
| **TOTAL** | **1050** | **8.8** | **100.0** | **2618** | **21.9** | **100.0** | **8290** | **69.3** | **100.0** | **11958** | **100.0** | **100.0** |

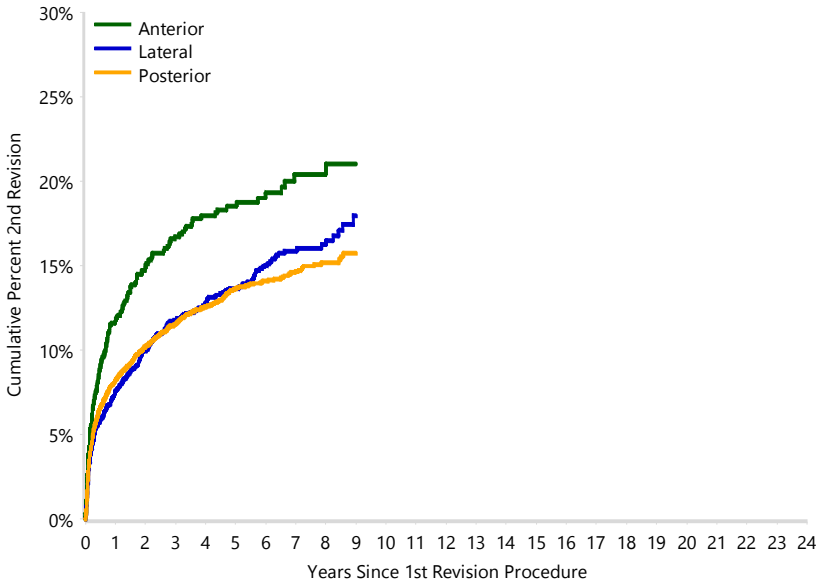
Note: Excludes 6,978 procedures with unknown approach. Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Table N28 Cumulative Percent 2nd Revision of Known Primary 1st Revision Hip Replacement by Surgical Approach used for 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| Surgical Approach | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|
| Anterior | 176 | 1050 | 11.8 (10.0, 14.0) | 16.7 (14.5, 19.3) | 18.5 (16.1, 21.3) | 20.4 (17.6, 23.5) | 21.0 (18.1, 24.4) |
| Lateral | 328 | 2618 | 7.6 (6.6, 8.7) | 11.8 (10.5, 13.2) | 13.7 (12.3, 15.2) | 15.9 (14.2, 17.7) | 17.9 (15.7, 20.4) |
| Posterior | 958 | 8290 | 8.2 (7.6, 8.9) | 11.6 (10.8, 12.3) | 13.6 (12.8, 14.5) | 14.7 (13.7, 15.7) | 15.7 (14.6, 17.0) |
| TOTAL | 1462 | 11958 | | | | | |

Note: Excludes 6,978 procedures with unknown approach. Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Figure N32 Cumulative Percent 2nd Revision of Known Primary 1st Revision Hip Replacement by Surgical Approach used for 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




HR - adjusted for age and gender

Anterior vs Lateral

0 - 3Mth: HR=1.36 (95% CI 1.02, 1.82), p=0.035

3Mth - 6Mth: HR=1.65 (95% CI 1.05, 2.61), p=0.031

6Mth - 9Mth: HR=2.28 (95% CI 1.34, 3.87), p=0.002

9Mth+: HR=1.02 (95% CI 0.77, 1.36), p=0.884

Anterior vs Posterior

Entire Period: HR=1.34 (95% CI 1.14, 1.58), p<0.001

Lateral vs Posterior

0 - 1Mth: HR=0.90 (95% CI 0.67, 1.21), p=0.481

1Mth - 9Mth: HR=0.90 (95% CI 0.73, 1.11), p=0.325

9Mth+: HR=1.27 (95% CI 1.06, 1.53), p=0.010

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|
| Anterior | 1050 | 797 | 584 | 378 | 201 | 50 |
| Lateral | 2618 | 2088 | 1451 | 1017 | 543 | 152 |
| Posterior | 8290 | 6371 | 4263 | 2629 | 1220 | 277 |

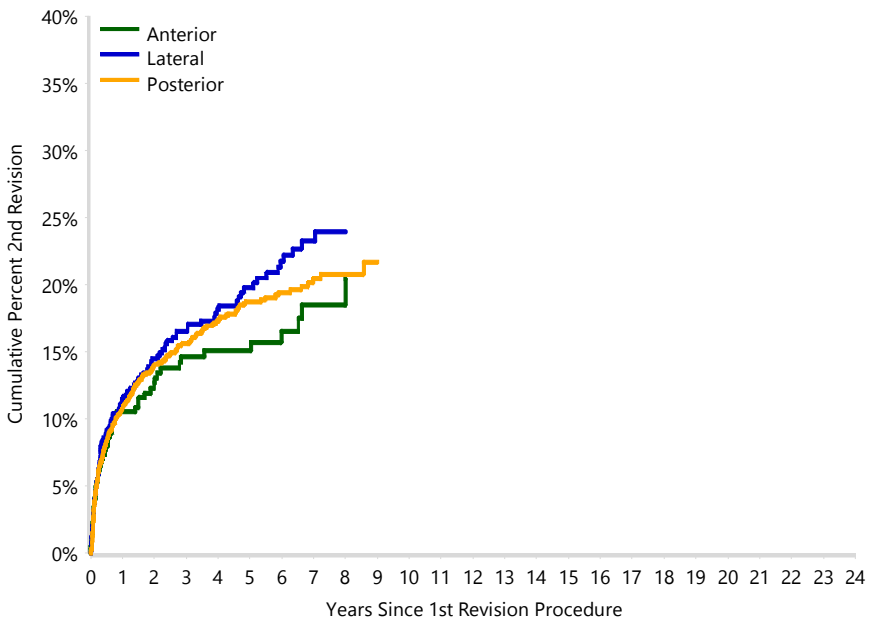
Note: Excluding 6,978 procedures with unknown approach. Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Table N29 Cumulative Percent 2nd Revision of Known Primary 1st Revision Hip Replacement by Surgical Approach used for 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection, 1st Minor Revisions Only)**

| Surgical Approach | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|
| Anterior | 52 | 348 | 10.5 (7.7, 14.3) | 14.6 (11.1, 19.1) | 15.1 (11.5, 19.7) | 18.5 (14.0, 24.2) | |
| Lateral | 113 | 612 | 11.5 (9.2, 14.4) | 16.5 (13.6, 19.9) | 19.8 (16.5, 23.6) | 23.2 (19.4, 27.7) | |
| Posterior | 290 | 1806 | 10.9 (9.5, 12.4) | 15.6 (13.9, 17.5) | 18.7 (16.8, 20.9) | 20.5 (18.2, 22.9) | 21.7 (18.9, 24.9) |
| TOTAL | 455 | 2766 | | | | | |

Excludes 6,978 procedures with unknown approach. Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Figure N33 Cumulative Percent 2nd Revision of Known Primary 1st Revision Hip Replacement by Surgical Approach used for 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection, 1st Minor Revisions Only)**




HR - adjusted for age and gender

Lateral vs Anterior

Entire Period: HR=1.31 (95% CI 0.94, 1.83), p=0.107

Lateral vs Posterior

Entire Period: HR=1.13 (95% CI 0.91, 1.40), p=0.286

Posterior vs Anterior

Entire Period: HR=1.17 (95% CI 0.87, 1.57), p=0.311

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|
| Anterior | 348 | 270 | 203 | 137 | 74 | 14 |
| Lateral | 612 | 473 | 329 | 224 | 112 | 26 |
| Posterior | 1806 | 1391 | 918 | 580 | 267 | 49 |

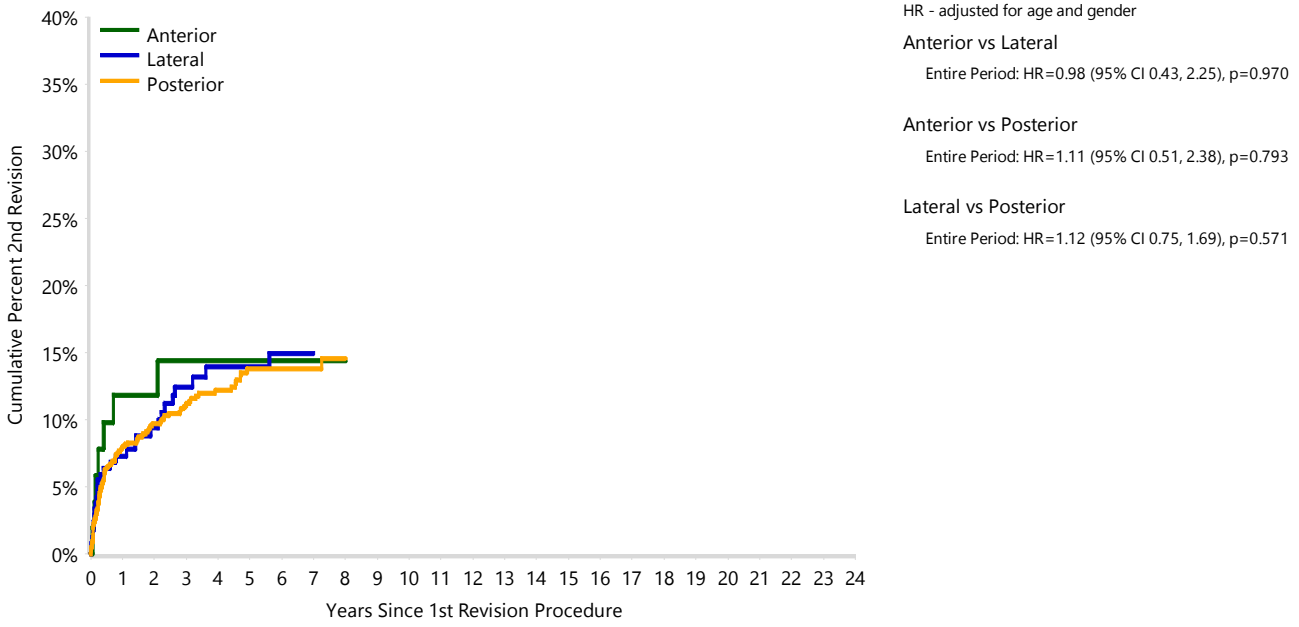
Note: Excluding 6978 procedures with unknown approach. Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Table N30 Cumulative Percent 2nd Revision of Known Primary 1st Revision Hip Replacement by Surgical Approach used for 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection, 1st Major Total Revisions Only)**

| Surgical Approach | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|
| Anterior | 7 | 52 | 11.9 (5.5, 24.5) | 14.4 (7.1, 28.0) | 14.4 (7.1, 28.0) | 14.4 (7.1, 28.0) |
| Lateral | 30 | 239 | 7.3 (4.6, 11.5) | 12.5 (8.6, 17.9) | 13.9 (9.7, 19.7) | 15.0 (10.5, 21.1) |
| Posterior | 104 | 935 | 7.9 (6.3, 9.9) | 11.2 (9.2, 13.6) | 13.8 (11.4, 16.7) | 13.8 (11.4, 16.7) |
| TOTAL | 141 | 1226 | | | | |

Excludes 6,978 procedures with unknown approach. Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Figure N34 Cumulative Percent 2nd Revision of Known Primary 1st Revision Hip Replacement by Surgical Approach used for 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection, 1st Major Total Revisions Only)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|
| Anterior | 52 | 40 | 30 | 19 | 11 | 3 |
| Lateral | 239 | 194 | 130 | 88 | 57 | 17 |
| Posterior | 935 | 731 | 489 | 291 | 131 | 31 |

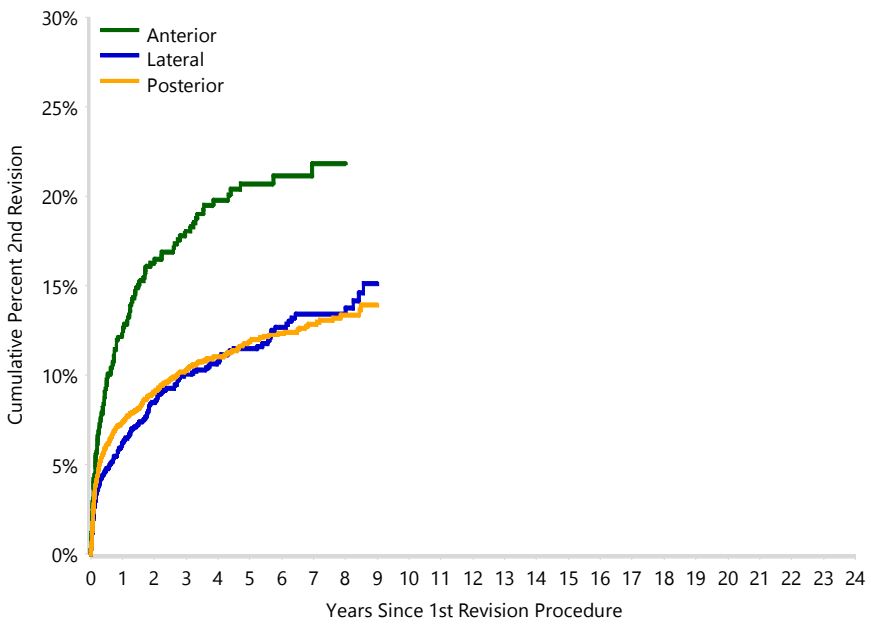
Excludes 6,978 procedures with unknown approach. Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Table N31 Cumulative Percent 2nd Revision of Known Primary 1st Revision Hip Replacement by Surgical Approach used for 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection, 1st Major Partial Revisions Only)**

| Surgical Approach | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|
| Anterior | 117 | 650 | 12.5 (10.1, 15.4) | 18.0 (15.1, 21.5) | 20.7 (17.5, 24.4) | 21.8 (18.3, 25.9) | |
| Lateral | 185 | 1767 | 6.2 (5.2, 7.5) | 10.0 (8.6, 11.7) | 11.5 (9.9, 13.3) | 13.4 (11.6, 15.5) | 15.1 (12.7, 17.9) |
| Posterior | 564 | 5549 | 7.4 (6.7, 8.2) | 10.3 (9.4, 11.2) | 11.9 (10.9, 12.9) | 12.8 (11.8, 14.0) | 13.9 (12.6, 15.4) |
| TOTAL | 866 | 7966 | | | | | |

Excludes 6,978 procedures with unknown approach. Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Figure N35 Cumulative Percent 2nd Revision of Known Primary 1st Revision by Surgical Approach used for 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection, 1st Major Partial Revisions Only)**




HR - adjusted for age and gender

Anterior vs Lateral

Entire Period: HR=1.68 (95% CI 1.33, 2.13), p<0.001

Anterior vs Posterior

Entire Period: HR=1.66 (95% CI 1.36, 2.03), p<0.001

Posterior vs Lateral

0 - 9Mth: HR=1.18 (95% CI 0.96, 1.45), p=0.117

9Mth+: HR=0.81 (95% CI 0.64, 1.03), p=0.080

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|
| Anterior | 650 | 487 | 351 | 222 | 116 | 33 |
| Lateral | 1767 | 1421 | 992 | 705 | 374 | 109 |
| Posterior | 5549 | 4249 | 2856 | 1758 | 822 | 197 |

Note: Excludes 6,978 procedures with unknown approach. Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Table N32 Revision Diagnosis of 2nd Revision of Total Conventional Hip Replacement by Surgical Approach Used for 1st Revision (Primary Diagnosis OA)**

| 2nd Revision Diagnosis | Anterior | | Lateral | | Posterior | | TOTAL | |
|---|---|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% | N | Col% |
| Prosthesis Dislocation/Instability | 39 | 22.2 | 110 | 33.5 | 364 | 38.0 | 513 | 35.1 |
| Infection | 56 | 31.8 | 77 | 23.5 | 257 | 26.8 | 390 | 26.7 |
| Loosening | 47 | 26.7 | 75 | 22.9 | 153 | 16.0 | 275 | 18.8 |
| Fracture | 15 | 8.5 | 33 | 10.1 | 96 | 10.0 | 144 | 9.8 |
| Implant Breakage Stem | 1 | 0.6 | 8 | 2.4 | 18 | 1.9 | 27 | 1.8 |
| Pain | 7 | 4.0 | 4 | 1.2 | 14 | 1.5 | 25 | 1.7 |
| Malposition | 1 | 0.6 | 3 | 0.9 | 10 | 1.0 | 14 | 1.0 |
| Leg Length Discrepancy | 3 | 1.7 | 1 | 0.3 | 9 | 0.9 | 13 | 0.9 |
| Metal Related Pathology | 1 | 0.6 | 6 | 1.8 | 5 | 0.5 | 12 | 0.8 |
| Implant Breakage Acetabular Insert | . | . | 5 | 1.5 | 6 | 0.6 | 11 | 0.8 |
| Incorrect Sizing | 2 | 1.1 | 1 | 0.3 | 4 | 0.4 | 7 | 0.5 |
| Implant Breakage Acetabular | . | . | 1 | 0.3 | 4 | 0.4 | 5 | 0.3 |
| Lysis | 1 | 0.6 | 1 | 0.3 | 3 | 0.3 | 5 | 0.3 |
| Chondrolysis/Acetab. Erosion | . | . | 1 | 0.3 | . | . | 1 | 0.1 |
| Other | 3 | 1.7 | 2 | 0.6 | 15 | 1.6 | 20 | 1.4 |
| **TOTAL** | **176** | **100.0** | **328** | **100.0** | **958** | **100.0** | **1462** | **100.0** |

Note: Excludes 6,978 procedures with unknown approach. Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

## OUTCOMES OF 1ST REVISION OVER TIME

This analysis compares the outcomes of 1st revisions over four successive time periods: 1999-2005, 2006-2012, 2013-2019 and 2020-2024. There has been a reduction in the rate of 2nd revision comparing the most recent period to 1999-2005 and 2006-2012, but no difference is shown with 2013-2019 (Table N33 and Figure N36).

In all four time periods, dislocation/instability is the most common reason for a 2nd revision procedure (Table N34 and Figure N37).

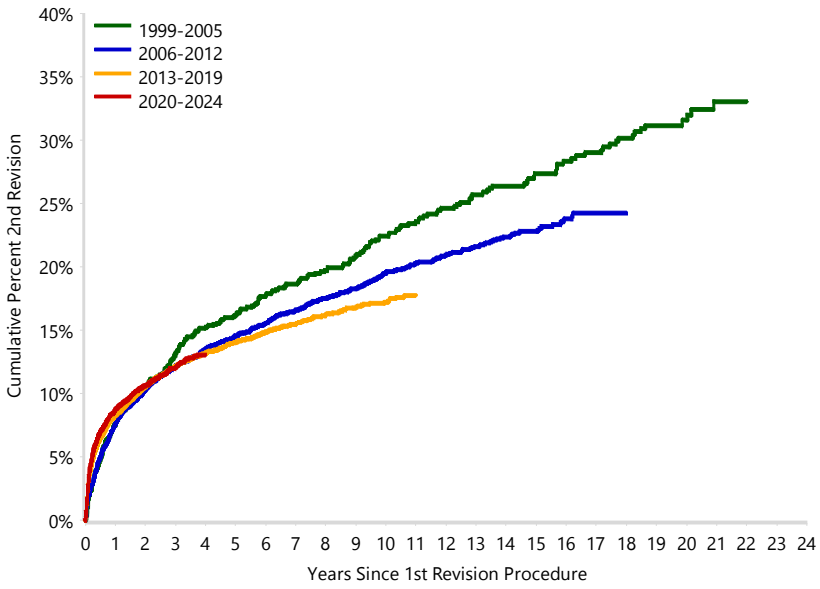
When the individual reasons for 1st revision are analysed over time, there is a decrease in the rate of 2nd revision when the 1st revision is for dislocation/instability (after 6 months) (Table N35 and Figure N38), for loosening (after 3 months) (Table N36 and Figure N39), or for fracture (after 1 year) (Table N37 and Figure N40) when the most recent period (2020-2024) is compared to 1999-2005, but there is no or minimal change compared to the other periods.

**Table N33 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Time Period of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| Year of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| 1999-2005 | 281 | 1141 | 7.6 (6.2, 9.3) | 13.2 (11.4, 15.4) | 16.2 (14.1, 18.5) | 22.4 (19.9, 25.2) | 27.3 (24.5, 30.4) | 31.6 (28.3, 35.1) |
| 2006-2012 | 719 | 3743 | 7.6 (6.8, 8.5) | 12.2 (11.1, 13.3) | 14.6 (13.4, 15.8) | 19.5 (18.1, 20.9) | 22.8 (21.2, 24.4) | |
| 2013-2019 | 1162 | 7762 | 8.3 (7.7, 8.9) | 12.2 (11.4, 12.9) | 14.1 (13.3, 14.9) | 17.2 (16.3, 18.2) | | |
| 2020-2024 | 641 | 6290 | 8.8 (8.1, 9.5) | 12.1 (11.2, 13.0) | | | | |
| TOTAL | 2803 | 18936 | | | | | | |

Note: Excludes revisions where no minor or major femoral/acetabular components have been inserted.

**Figure N36 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Time Period of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




HR - adjusted for age and gender

1999-2005 vs 2020-2024

0 - 3Mth: HR=0.55 (95% CI 0.39, 0.79), p<0.001

3Mth - 6Mth: HR=1.06 (95% CI 0.68, 1.66), p=0.792

6Mth+: HR=1.60 (95% CI 1.35, 1.90), p<0.001

2006-2012 vs 2020-2024

0 - 3Mth: HR=0.57 (95% CI 0.46, 0.70), p<0.001

3Mth+: HR=1.26 (95% CI 1.11, 1.42), p<0.001

2013-2019 vs 2020-2024

Entire Period: HR=0.97 (95% CI 0.88, 1.07), p=0.519

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| 1999-2005 | 1141 | 1022 | 907 | 803 | 570 | 382 | 164 |
| 2006-2012 | 3743 | 3346 | 2987 | 2662 | 1893 | 561 | 0 |
| 2013-2019 | 7762 | 6823 | 6108 | 5465 | 933 | 0 | 0 |
| 2020-2024 | 6290 | 4261 | 1800 | 0 | 0 | 0 | 0 |

Note: Excludes revisions where no minor or major femoral/acetabular components have been inserted.

**Table N34 2nd Revision Diagnosis of Known Primary Total Conventional Hip Replacement by Year of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| 2nd Revision Diagnosis | 1999-2005 | | | 2006-2012 | | |
|---|---|---|---|---|---|---|
| | Number | % 1st Revisions Revised | % 2nd Revisions | Number | % 1st Revisions Revised | % 2nd Revisions |
| Prosthesis Dislocation/Instability | 96 | 8.4 | 34.2 | 208 | 5.6 | 28.9 |
| Infection | 50 | 4.4 | 17.8 | 137 | 3.7 | 19.1 |
| Loosening | 80 | 7.0 | 28.5 | 196 | 5.2 | 27.3 |
| Fracture | 20 | 1.8 | 7.1 | 86 | 2.3 | 12.0 |
| Implant Breakage Stem | 3 | 0.3 | 1.1 | 10 | 0.3 | 1.4 |
| Pain | 8 | 0.7 | 2.8 | 9 | 0.2 | 1.3 |
| Metal Related Pathology | 1 | 0.1 | 0.4 | 13 | 0.3 | 1.8 |
| Implant Breakage Acetabular | 5 | 0.4 | 1.8 | 11 | 0.3 | 1.5 |
| Leg Length Discrepancy | | | | 4 | 0.1 | 0.6 |
| Lysis | 10 | 0.9 | 3.6 | 11 | 0.3 | 1.5 |
| Malposition | 1 | 0.1 | 0.4 | 7 | 0.2 | 1.0 |
| Implant Breakage Acetabular Insert | 2 | 0.2 | 0.7 | 10 | 0.3 | 1.4 |
| Incorrect Sizing | | | | | | |
| Heterotopic Bone | 1 | 0.1 | 0.4 | 3 | 0.1 | 0.4 |
| Tumour | | | | 1 | 0.0 | 0.1 |
| Wear Acetabular Insert | 1 | 0.1 | 0.4 | 2 | 0.1 | 0.3 |
| Chondrolysis/Acetab. Erosion | | | | | | |
| Implant Breakage Head | 1 | 0.1 | 0.4 | 1 | 0.0 | 0.1 |
| Synovitis | | | | 1 | 0.0 | 0.1 |
| Wear Acetabulum | 1 | 0.1 | 0.4 | | | |
| Wear Head | | | | 1 | 0.0 | 0.1 |
| Other | 1 | 0.1 | 0.4 | 8 | 0.2 | 1.1 |
| **N 2nd Revision** | **281** | **24.6** | **100.0** | **719** | **19.2** | **100.0** |
| **N 1st Revision** | **1141** | | | **3743** | | |

| 2nd Revision Diagnosis | 2013-2019 | | | 2020-2024 | | |
|---|---|---|---|---|---|---|
| | Number | % 1st Revisions Revised | % 2nd Revisions | Number | % 1st Revisions Revised | % 2nd Revisions |
| Prosthesis Dislocation/Instability | 376 | 4.8 | 32.4 | 249 | 4.0 | 38.8 |
| Infection | 284 | 3.7 | 24.4 | 182 | 2.9 | 28.4 |
| Loosening | 272 | 3.5 | 23.4 | 83 | 1.3 | 12.9 |
| Fracture | 104 | 1.3 | 9.0 | 77 | 1.2 | 12.0 |
| Implant Breakage Stem | 28 | 0.4 | 2.4 | 5 | 0.1 | 0.8 |
| Pain | 21 | 0.3 | 1.8 | 12 | 0.2 | 1.9 |
| Metal Related Pathology | 12 | 0.2 | 1.0 | 3 | 0.0 | 0.5 |
| Implant Breakage Acetabular | 8 | 0.1 | 0.7 | 1 | 0.0 | 0.2 |
| Leg Length Discrepancy | 11 | 0.1 | 0.9 | 5 | 0.1 | 0.8 |
| Lysis | 3 | 0.0 | 0.3 | 3 | 0.0 | 0.5 |
| Malposition | 11 | 0.1 | 0.9 | 6 | 0.1 | 0.9 |
| Implant Breakage Acetabular Insert | 9 | 0.1 | 0.8 | 4 | 0.1 | 0.6 |

## Revision Arthroplasty

| 2nd Revision Diagnosis | 2013-2019 Number | 2013-2019 % 1st Revisions Revised | 2013-2019 % 2nd Revisions | 2020-2024 Number | 2020-2024 % 1st Revisions Revised | 2020-2024 % 2nd Revisions |
|---|---|---|---|---|---|---|
| Incorrect Sizing | 5 | 0.1 | 0.4 | 3 | 0.0 | 0.5 |
| Heterotopic Bone | | | | | | |
| Tumour | 2 | 0.0 | 0.2 | | | |
| Wear Acetabular Insert | 1 | 0.0 | 0.1 | | | |
| Chondrolysis/Acetab. Erosion | 1 | 0.0 | 0.1 | | | |
| Implant Breakage Head | | | | | | |
| Synovitis | | | | | | |
| Wear Acetabulum | | | | | | |
| Wear Head | | | | | | |
| Other | 14 | 0.2 | 1.2 | 8 | 0.1 | 1.2 |
| **N 2nd Revision** | **1162** | **15.0** | **100.0** | **641** | **10.2** | **100.0** |
| **N 1st Revision** | **7762** | | | **6290** | | |

**Figure N37 Cumulative Incidence 2nd Revision Diagnosis of Known Primary Total Conventional Hip Replacement by Time Period of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

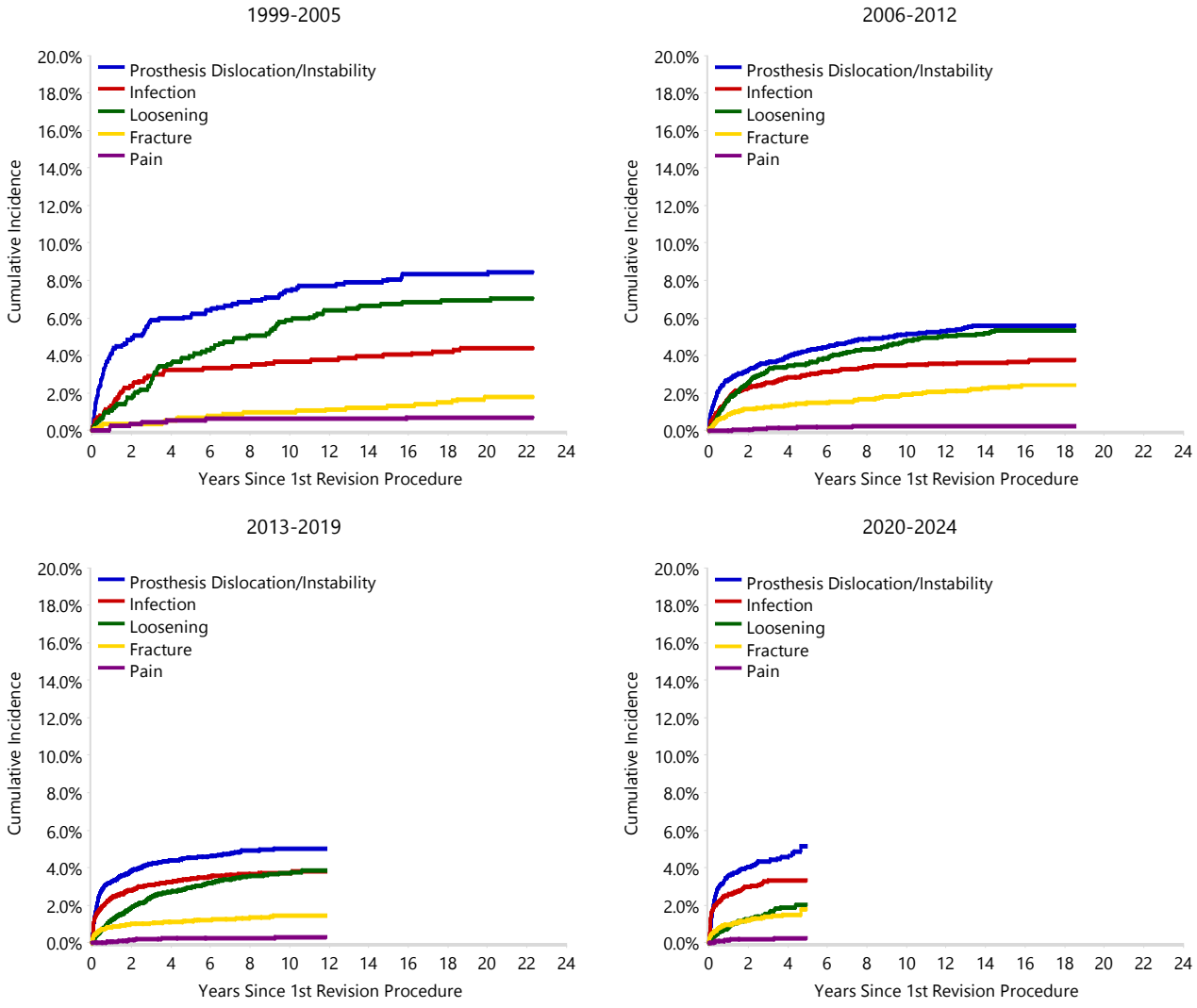
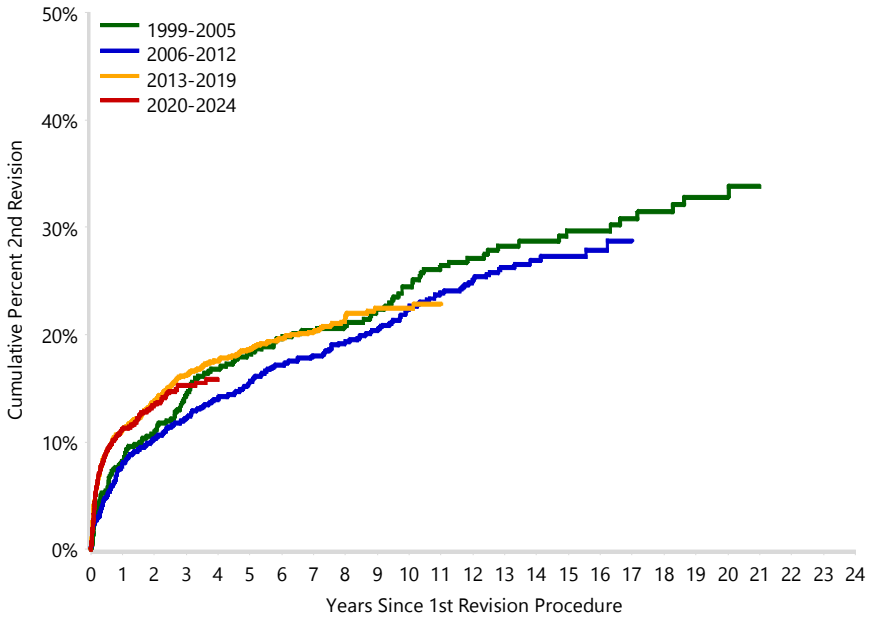


**Table N35 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Year of 1st Revision (Primary Diagnosis OA, 1st Revision for Prosthesis Dislocation/Instability)**

| Year of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| 1999-2005 | 133 | 522 | 8.2 (6.1, 10.9) | 14.5 (11.7, 17.8) | 18.2 (15.0, 21.9) | 24.4 (20.7, 28.7) | 29.6 (25.3, 34.5) | 32.8 (27.9, 38.3) |
| 2006-2012 | 221 | 990 | 8.0 (6.5, 9.9) | 12.3 (10.4, 14.5) | 15.6 (13.5, 18.1) | 22.3 (19.7, 25.3) | 27.3 (24.1, 30.7) | |
| 2013-2019 | 372 | 1861 | 11.1 (9.8, 12.7) | 16.2 (14.6, 18.0) | 18.6 (16.9, 20.5) | 22.4 (20.3, 24.7) | | |
| 2020-2024 | 197 | 1530 | 11.2 (9.6, 12.9) | 15.3 (13.3, 17.5) | | | | |
| TOTAL | 923 | 4903 | | | | | | |

Note: Excludes revisions where no minor or major femoral/acetabular components have been inserted.

**Figure N38 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Year of 1st Revision (Primary Diagnosis OA, 1st Revision for Prosthesis Dislocation/Instability)**




HR - adjusted for age and gender

1999-2005 vs 2020-2024

0 - 6Mth: HR=0.61 (95% CI 0.41, 0.92), p=0.016

6Mth+: HR=1.36 (95% CI 1.04, 1.79), p=0.024

2006-2012 vs 2020-2024

0 - 1Mth: HR=0.72 (95% CI 0.45, 1.16), p=0.177

1Mth - 3Mth: HR=0.21 (95% CI 0.10, 0.44), p<0.001

3Mth+: HR=1.17 (95% CI 0.93, 1.47), p=0.173

2013-2019 vs 2020-2024

Entire Period: HR=1.03 (95% CI 0.86, 1.23), p=0.724

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| 1999-2005 | 522 | 464 | 406 | 353 | 239 | 145 | 67 |
| 2006-2012 | 990 | 894 | 796 | 692 | 468 | 143 | 0 |
| 2013-2019 | 1861 | 1612 | 1440 | 1275 | 201 | 0 | 0 |
| 2020-2024 | 1530 | 1017 | 407 | 0 | 0 | 0 | 0 |

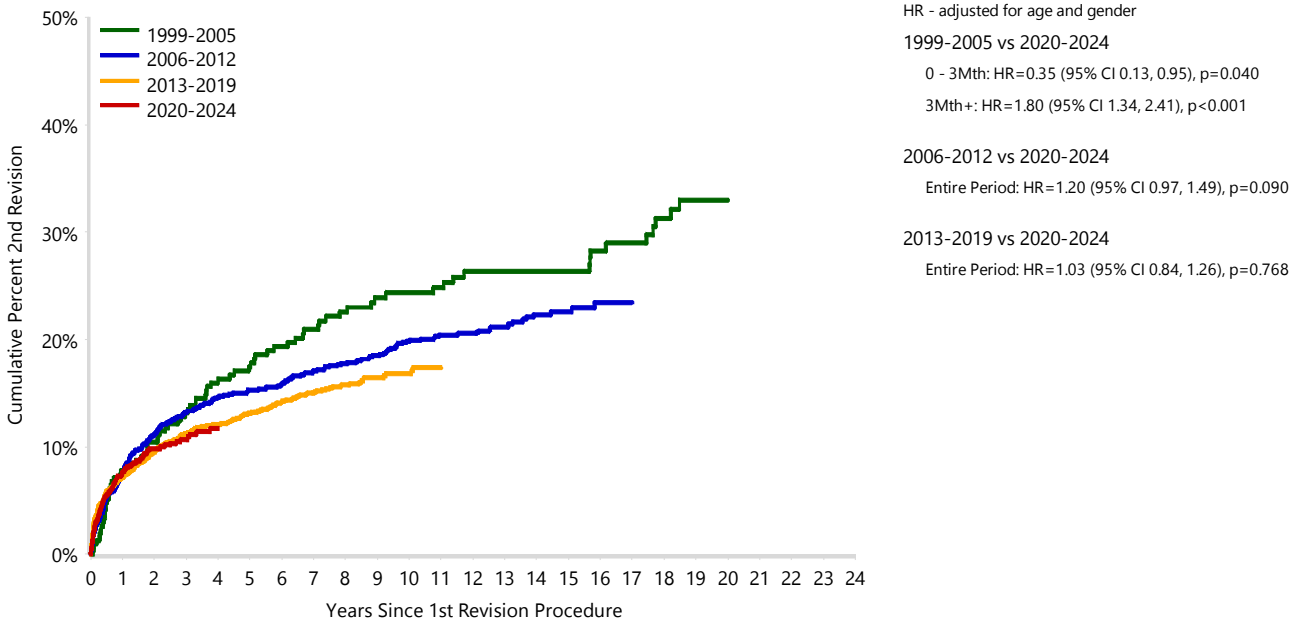
Note: Excludes revisions where no minor or major femoral/acetabular components have been inserted.

**Table N36 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Year of 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**

| Year of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| 1999-2005 | 82 | 314 | 7.8 (5.3, 11.4) | 13.1 (9.8, 17.5) | 17.4 (13.6, 22.3) | 24.3 (19.7, 29.8) | 26.3 (21.4, 32.0) | 32.9 (27.0, 39.8) |
| 2006-2012 | 256 | 1295 | 7.5 (6.2, 9.0) | 13.2 (11.4, 15.1) | 15.3 (13.4, 17.4) | 19.8 (17.6, 22.2) | 22.6 (20.1, 25.3) | |
| 2013-2019 | 320 | 2156 | 7.1 (6.1, 8.3) | 11.2 (10.0, 12.6) | 13.1 (11.7, 14.6) | 16.8 (15.0, 18.6) | | |
| 2020-2024 | 142 | 1547 | 7.6 (6.3, 9.1) | 10.6 (9.0, 12.4) | | | | |
| TOTAL | 800 | 5312 | | | | | | |

Note: Excludes revisions where no minor or major femoral/acetabular components have been inserted.

**Figure N39 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Year of 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| 1999-2005 | 314 | 280 | 252 | 220 | 161 | 116 | 43 |
| 2006-2012 | 1295 | 1178 | 1049 | 959 | 701 | 226 | 0 |
| 2013-2019 | 2156 | 1963 | 1801 | 1646 | 307 | 0 | 0 |
| 2020-2024 | 1547 | 1115 | 507 | 0 | 0 | 0 | 0 |

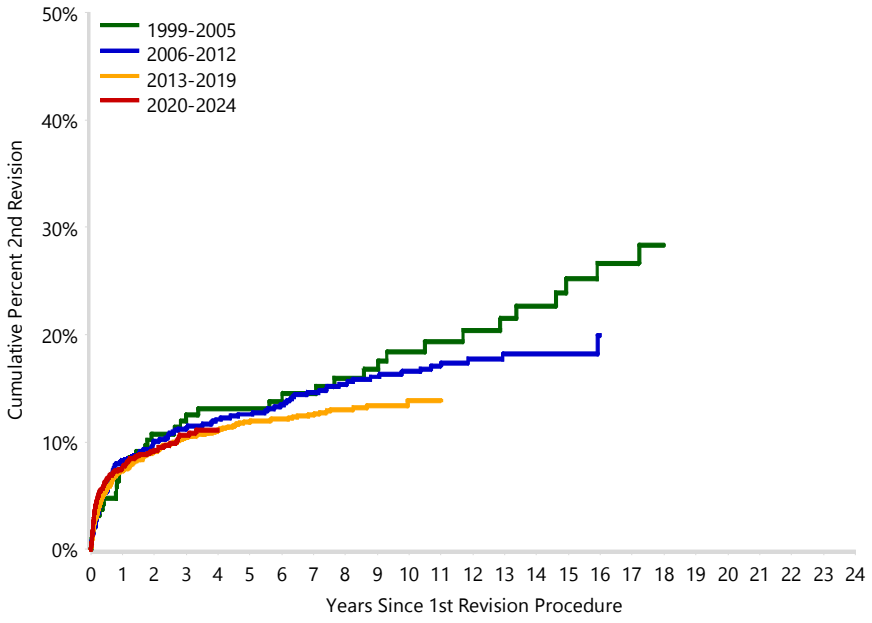
Note: Excludes revisions where no minor or major femoral/acetabular components have been inserted.

**Table N37 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Year of 1st Revision (Primary Diagnosis OA, 1st Revision for Fracture)**

| Year of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| 1999-2005 | 39 | 192 | 7.4 (4.5, 12.3) | 12.5 (8.5, 18.2) | 13.1 (9.0, 18.9) | 18.4 (13.2, 25.3) | 25.2 (18.5, 33.7) | |
| 2006-2012 | 123 | 843 | 8.2 (6.5, 10.3) | 11.3 (9.3, 13.8) | 12.6 (10.4, 15.1) | 16.6 (13.9, 19.6) | 18.2 (15.3, 21.6) | |
| 2013-2019 | 260 | 2298 | 7.4 (6.3, 8.5) | 10.5 (9.2, 11.8) | 11.9 (10.6, 13.4) | 13.8 (12.1, 15.8) | | |
| 2020-2024 | 176 | 2075 | 7.7 (6.6, 9.1) | 10.7 (9.1, 12.4) | | | | |
| TOTAL | 598 | 5408 | | | | | | |

Note: Excludes revisions where no minor or major femoral/acetabular components have been inserted.

**Figure N40 Cumulative Percent 2nd Revision of Known Primary Total Conventional Hip Replacement by Year of 1st Revision (Primary Diagnosis OA, 1st Revision for Fracture)**




HR - adjusted for age and gender

1999-2005 vs 2020-2024

0 - 3Mth: HR=0.63 (95% CI 0.28, 1.42), p=0.264

3Mth - 1Yr: HR=1.09 (95% CI 0.53, 2.24), p=0.817

1Yr+: HR=1.70 (95% CI 1.06, 2.73), p=0.028

2006-2012 vs 2020-2024

0 - 6Mth: HR=0.85 (95% CI 0.60, 1.19), p=0.334

6Mth+: HR=1.27 (95% CI 0.93, 1.72), p=0.126

2013-2019 vs 2020-2024

Entire Period: HR=0.94 (95% CI 0.77, 1.14), p=0.503

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| 1999-2005 | 192 | 171 | 151 | 133 | 90 | 58 | 26 |
| 2006-2012 | 843 | 709 | 618 | 529 | 319 | 67 | 0 |
| 2013-2019 | 2298 | 1920 | 1625 | 1368 | 188 | 0 | 0 |
| 2020-2024 | 2075 | 1317 | 489 | 0 | 0 | 0 | 0 |

Note: Excludes revisions where no minor or major femoral/acetabular components have been inserted.

# Revision Arthroplasty

## MORTALITY FOLLOWING THE 1ST REVISION

Mortality following the 1st revision of primary conventional THR has been assessed. The overall mortality of a 1st revision procedure is 0.9% at 30 days, 1.9% at 90 days, 4.4% at 1 year and 37.5% at 10 years (Table N38 and Figure N41).

The 10-year survival of 1st revision hip replacements is 62.3%, while the 10-year survival of unrevised primary hip replacements is 81.1% (Table N39 and Figure N42).

Major partial 1st revisions have a higher mortality compared to minor revisions for the first 4 years, and when compared to major total revisions until 2.5 years, with no difference after these times (Table N40 and Figure N43).

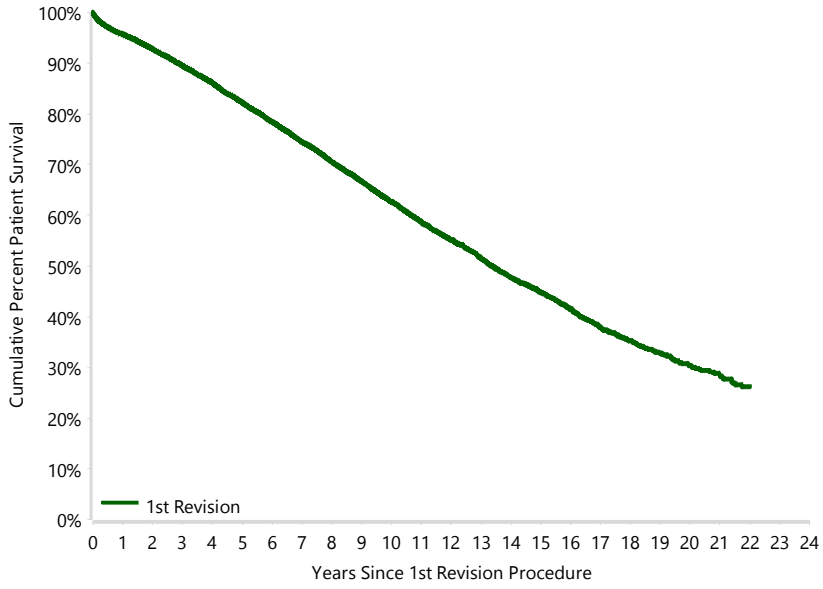
Mortality after 1st revision has also been assessed by common revision diagnoses. In this analysis, 1st revision for infection is included. Compared to other reasons for revision, 1st revision for loosening has the lowest mortality, both early at 30 days, 90 days and 1 year, and later at 10 years. By 10 years, 69.3% of patients have survived if revised for loosening. 1st revision for fracture has the highest mortality at all time points (Table N41 and Figure N44).

Compared to other diagnoses, revision for fracture has the highest mortality.

**Table N38 Cumulative Percent Survival of Patients with Known Primary Total Conventional Hip Replacement since 1st Revised (Excluding 1st Revision for Infection)**

| Class | N Deceased | N Total | 30 Days | 90 Days | 1 Yr | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| 1st Revision | 5715 | 18482 | 99.1 (98.9, 99.2) | 98.1 (97.9, 98.3) | 95.6 (95.3, 95.9) | 82.1 (81.5, 82.7) | 62.5 (61.6, 63.4) | 44.7 (43.4, 45.9) | 30.1 (28.3, 31.9) |
| **TOTAL** | **5715** | **18482** | | | | | | | |

**Figure N41 Cumulative Percent Survival of Patients with Known Primary Total Conventional Hip Replacement since 1st Revised (Excluding 1st Revision for Infection)**



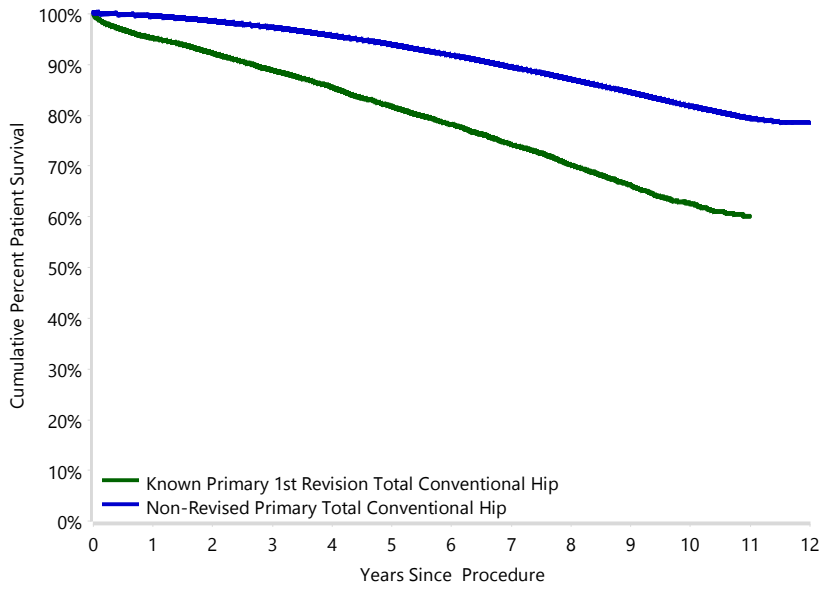

| Number at Risk | 0 Yr | 30 Days | 90 Days | 1 Yr | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| 1st Revision | 18482 | 18228 | 17815 | 16434 | 10223 | 4159 | 1257 | 241 |

**Table N39 Cumulative Percent Survival of Patients with Non-Revised Primary Total Conventional Hip Replacement and Known Primary 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| Procedure Type | N Deceased | N Total | 1 Yr | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|
| Known Primary 1st Revision Total Conventional Hip | 2737 | 13315 | 95.2 (94.8, 95.6) | 81.6 (80.8, 82.3) | 62.3 (60.9, 63.7) | |
| Non-Revised Primary Total Conventional Hip | 32783 | 389697 | 99.3 (99.3, 99.3) | 93.5 (93.4, 93.6) | 81.1 (80.9, 81.3) | |
| TOTAL | 35520 | 403012 | | | | |

Note: Restricted to the first of the revision or primary procedures for bilateral patients in each procedure type with known age, sex and ASA score
Time to survival is time from the primary procedure to death for the non-revised primary cohort and from the 1st revision procedure to death for the known primary 1st revision cohort

**Figure N42 Cumulative Percent Survival of Patients with Non-Revised Primary Total Conventional Hip Replacement and Known Primary 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




HR - adjusted for age, gender and ASA score at procedure

Known Primary 1st Revision Total Conventional Hip VS Non-Revised Primary Total Conventional Hip

0Mth - 9Mth: HR=4.82 (95% CI: 4.37, 5.30), p<0.0001

9Mth - 2Yrs: HR=2.04 (95% CI: 1.85, 2.26), p<0.0001

2Yrs - 4.5Yr: HR=1.69 (95% CI: 1.58, 1.82), p<0.0001

4.5Yrs+: HR=1.43 (95% CI: 1.34, 1.52), p<0.0001

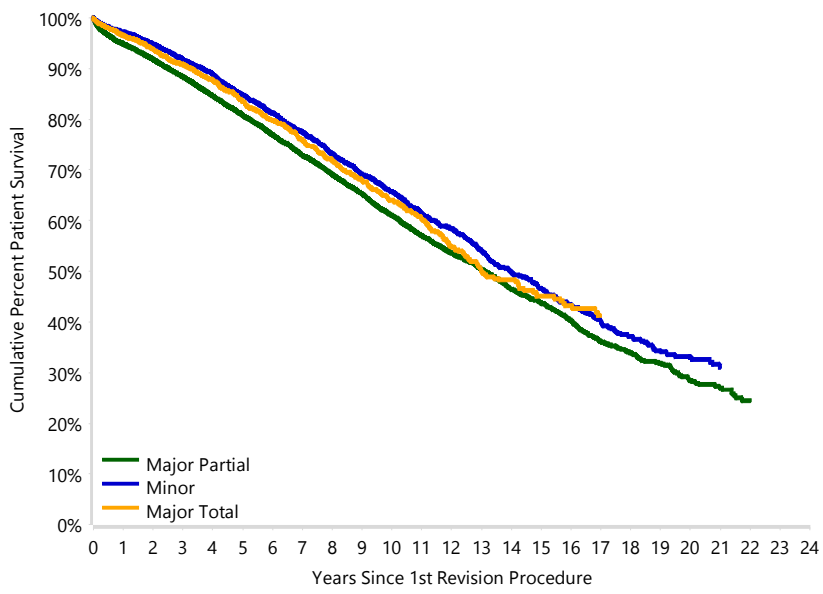
| Number at Risk | 0 Yr | 1 Yr | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|
| Known Primary 1st Revision Total Conventional Hip | 13315 | 11439 | 5933 | 915 | 0 |
| Non-Revised Primary Total Conventional Hip | 389697 | 345216 | 187544 | 34799 | 0 |

Note: Restricted to the first of the revision or primary procedures for bilateral patients in each procedure type with known age, sex and ASA score
Time to survival is time from the primary procedure to death for the non-revised primary cohort and from the 1st revision procedure to death for the known primary 1st revision cohort

**Table N40 Cumulative Percent Survival of Patients with Known Primary Total Conventional Hip Procedures since 1st Revised by Class of 1st Revision (Excluding 1st Revision for Infection)**

| Type of 1st Revision | N Deceased | N Total | 30 Days | 90 Days | 1 Yr | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Major Partial | 3826 | 12092 | 98.8 (98.6, 99.0) | 97.7 (97.4, 97.9) | 94.9 (94.5, 95.3) | 80.9 (80.1, 81.6) | 61.0 (59.9, 62.2) | 43.9 (42.3, 45.4) | 28.5 (26.2, 30.8) |
| Minor | 1346 | 4523 | 99.5 (99.2, 99.6) | 98.9 (98.6, 99.2) | 97.3 (96.7, 97.7) | 84.8 (83.6, 86.0) | 65.7 (63.9, 67.5) | 46.7 (44.1, 49.2) | 32.9 (29.7, 36.2) |
| Major Total | 543 | 1867 | 99.4 (98.9, 99.6) | 98.8 (98.2, 99.2) | 96.5 (95.6, 97.3) | 83.5 (81.5, 85.3) | 64.0 (61.0, 66.8) | 45.0 (40.9, 49.1) | |
| **TOTAL** | **5715** | **18482** | | | | | | | |

**Figure N43 Cumulative Percent Survival of Patients with Known Primary Total Conventional Hip Procedures since 1st Revised by Class of 1st Revision (Excluding 1st Revision for Infection)**




HR - adjusted for age and gender

Major Partial vs Minor

0 - 3Mth: HR=1.88 (95% CI 1.45, 2.45), p<0.001

3Mth - 4Yr: HR=1.20 (95% CI 1.08, 1.33), p<0.001

4Yr+: HR=1.02 (95% CI 0.94, 1.10), p=0.652

Major Partial vs Major Total

0 - 3Mth: HR=1.86 (95% CI 1.42, 2.43), p<0.001

3Mth - 2.5Yr: HR=1.17 (95% CI 1.02, 1.36), p=0.028

2.5Yr+: HR=1.03 (95% CI 0.94, 1.14), p=0.516

Major Total vs Minor

Entire Period: HR=1.02 (95% CI 0.92, 1.12), p=0.769

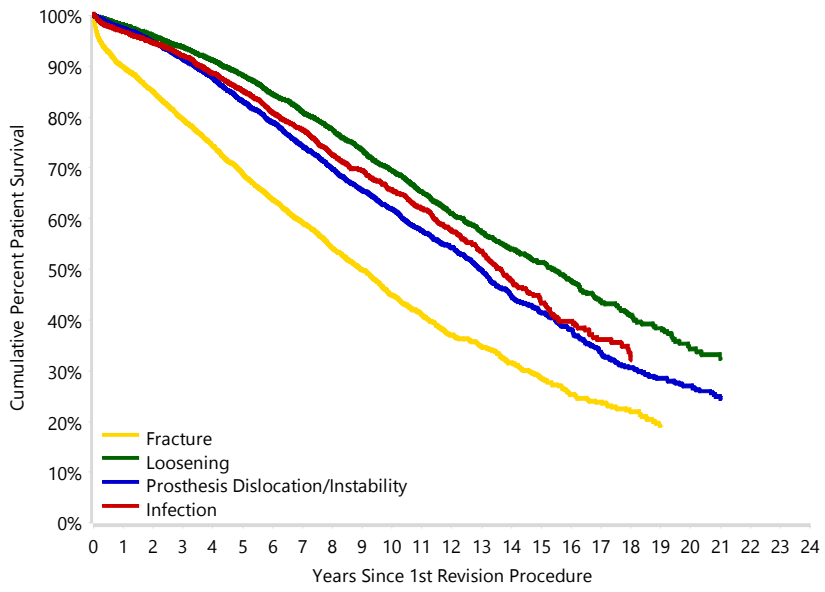
| Number at Risk | 0 Yr | 30 Days | 90 Days | 1 Yr | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Major Partial | 12092 | 11902 | 11606 | 10644 | 6533 | 2582 | 785 | 137 |
| Minor | 4523 | 4479 | 4396 | 4115 | 2651 | 1142 | 367 | 94 |
| Major Total | 1867 | 1847 | 1813 | 1675 | 1039 | 435 | 105 | 10 |

**Table N41 Cumulative Percent Survival of Patients with Known Primary Total Conventional Hip Replacement since 1st Revised by Reason for 1st Revision**

| Reason for 1st Revision | N Deceased | N Total | 30 Days | 90 Days | 1 Yr | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Fracture | 2170 | 5303 | 97.4 (96.9, 97.8) | 94.8 (94.2, 95.4) | 89.9 (89.0, 90.7) | 68.8 (67.4, 70.2) | 44.8 (42.9, 46.7) | 28.4 (26.0, 30.9) | |
| Loosening | 1413 | 5177 | 99.7 (99.6, 99.9) | 99.4 (99.1, 99.6) | 98.0 (97.6, 98.4) | 88.1 (87.1, 89.0) | 69.3 (67.6, 70.9) | 51.1 (48.8, 53.3) | 34.2 (30.5, 37.9) |
| Prosthesis Dislocation/ Instability | 1625 | 4795 | 99.7 (99.5, 99.8) | 99.3 (99.0, 99.5) | 97.2 (96.7, 97.7) | 82.9 (81.7, 84.1) | 61.6 (59.8, 63.4) | 41.2 (38.9, 43.6) | 26.8 (24.1, 29.6) |
| Infection | 947 | 4108 | 99.4 (99.1, 99.6) | 98.4 (97.9, 98.7) | 96.6 (95.9, 97.1) | 84.9 (83.5, 86.1) | 65.3 (63.0, 67.5) | 43.0 (39.4, 46.6) | |
| TOTAL | 6155 | 19383 | | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

**Figure N44 Cumulative Percent Survival of Patients with Known Primary Total Conventional Hip Replacement since 1st Revised by Reason for 1st Revision**




HR - adjusted for age and gender

Fracture vs Loosening

0 - 3Mth: HR=5.54 (95% CI 4.22, 7.27), p<0.001

3Mth - 3Yr: HR=1.90 (95% CI 1.70, 2.13), p<0.001

3Yr+: HR=1.41 (95% CI 1.30, 1.52), p<0.001

Prosthesis Dislocation/Instability vs Loosening

Entire Period: HR=1.32 (95% CI 1.23, 1.41), p<0.001

Infection vs Loosening

0 - 3Mth: HR=3.20 (95% CI 2.27, 4.51), p<0.001

3Mth - 7Yr: HR=1.28 (95% CI 1.16, 1.42), p<0.001

7Yr+: HR=1.37 (95% CI 1.21, 1.55), p<0.001

| Number at Risk | 0 Yr | 30 Days | 90 Days | 1 Yr | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Fracture | 5303 | 5142 | 4932 | 4374 | 2289 | 716 | 169 | 32 |
| Loosening | 5177 | 5141 | 5063 | 4771 | 3230 | 1447 | 453 | 68 |
| Prosthesis Dislocation/Instability | 4795 | 4762 | 4684 | 4348 | 2752 | 1159 | 399 | 101 |
| Infection | 4108 | 4059 | 3938 | 3545 | 1911 | 665 | 140 | 18 |

Note: Excludes 1st revisions where no minor or major femoral/acetabular components have been inserted.

# Revision Arthroplasty

## Revision Total Knee Replacement

The Registry has collected data for 41,026 1st revision total knee replacement (TKR) procedures where the primary diagnosis was osteoarthritis. In the following analysis, there are 10,283 procedures excluded where the 1st revision was undertaken for infection.

There are also 283 procedures excluded where minor or major TKR prostheses were not inserted, and the diagnosis was not infection. This group includes procedures where the prosthesis is removed and not replaced for indications such as patella fracture, patella component breakage or loosening (n=143), procedures where a cement spacer is inserted and the diagnosis is not recorded as infection (n=106), procedures that are cement only (n=10), or procedures where a total femoral replacement is used (n=24). This analysis includes 30,460 1st revision TKR procedures.

### DEMOGRAPHICS OF 1ST REVISION

The mean age at 1st revision is 68.7 years. There is some variation in mean age with revision diagnosis, with patients revised for arthrofibrosis being younger (66.1 years) and those revised for fracture being older (74.3 years). 1st revision TKR is more common in females (56.9%) and the highest proportion of patients have an ASA score 2 (45.1%) or 3 (48.9%) and have a BMI in the obese class 1 category (31.5%). Demographic details for 1st revision TKR procedures are shown in Table N42.

**Table N42 Summary of 1st Revisions of Known Primary Total Knee Replacement (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| Variable | Loosening (n=9,590) | Patella Reasons (n=5,924) | Instability (n=3,755) | Pain (n=2,992) | Arthrofibrosis (n=1,502) | Fracture (n=1,510) | Other (n=5,187) | TOTAL (n=30,460) |
|---|---|---|---|---|---|---|---|---|
| **Follow-up Years (Primary to 1st Revision)** | | | | | | | | |
| Mean ± SD | 5.1 ± 4.6 | 4.6 ± 4.2 | 4 ± 3.9 | 4 ± 3.6 | 2.5 ± 2.5 | 5.9 ± 5.5 | 6.1 ± 5.3 | 4.8 ± 4.5 |
| Median (IQR) | 3.4 (1.5, 7.5) | 2.9 (1.4, 6.8) | 2.4 (1.2, 5.6) | 2.5 (1.4, 5.3) | 1.6 (0.9, 3.1) | 4.3 (0.8, 9.8) | 4.5 (1.4, 10) | 3 (1.3, 7.2) |
| Minimum | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Maximum | 24.2 | 22 | 23.2 | 20.8 | 19 | 21.8 | 24.1 | 24.2 |
| **Age at 1st Revision** | | | | | | | | |
| Mean ± SD | 68.3 ± 9.1 | 69.3 ± 9.3 | 67.4 ± 9.5 | 68.5 ± 9 | 66.1 ± 8.8 | 74.3 ± 10.2 | 69 ± 9.2 | 68.7 ± 9.3 |
| Median (IQR) | 69 (62, 75) | 70 (63, 76) | 68 (61, 74) | 69 (62, 75) | 67 (60, 72) | 75 (68, 82) | 69 (63, 76) | 69 (62, 75) |
| **Age at 1st Revision in groups** | | | | | | | | |
| <55 | 654 (6.8%) | 377 (6.4%) | 354 (9.4%) | 197 (6.6%) | 147 (9.8%) | 48 (3.2%) | 317 (6.1%) | 2,094 (6.9%) |
| 55-64 | 2,580 (26.9%) | 1,372 (23.2%) | 1,074 (28.6%) | 770 (25.7%) | 472 (31.4%) | 214 (14.2%) | 1,269 (24.5%) | 7,751 (25.4%) |
| 65-74 | 3,840 (40%) | 2,369 (40%) | 1,427 (38%) | 1,212 (40.5%) | 627 (41.7%) | 480 (31.8%) | 2,080 (40.1%) | 12,035 (39.5%) |
| ≥75 | 2,516 (26.2%) | 1,806 (30.5%) | 900 (24%) | 813 (27.2%) | 256 (17%) | 768 (50.9%) | 1,521 (29.3%) | 8,580 (28.2%) |
| **Gender** | | | | | | | | |
| Male | 4,154 (43.3%) | 2,593 (43.8%) | 1,502 (40%) | 1,343 (44.9%) | 811 (54%) | 351 (23.2%) | 2,363 (45.6%) | 13,117 (43.1%) |
| Female | 5,436 (56.7%) | 3,331 (56.2%) | 2,253 (60%) | 1,649 (55.1%) | 691 (46%) | 1,159 (76.8%) | 2,824 (54.4%) | 17,343 (56.9%) |
| **ASA at 1st Revision[1]** | | | | | | | | |
| ASA 1 | 197 (3.2%) | 165 (4.2%) | 105 (3.5%) | 68 (3.7%) | 63 (6%) | 12 (1%) | 127 (3.5%) | 737 (3.5%) |
| ASA 2 | 2,771 (44.5%) | 1,917 (48.7%) | 1,350 (44.8%) | 935 (50.4%) | 545 (52.1%) | 329 (27.4%) | 1,567 (43.5%) | 9,414 (45.1%) |
| ASA 3 | 3,156 (50.7%) | 1,810 (46%) | 1,486 (49.4%) | 827 (44.6%) | 428 (40.9%) | 707 (58.8%) | 1,803 (50.1%) | 10,217 (48.9%) |
| ASA 4 | 106 (1.7%) | 46 (1.2%) | 70 (2.3%) | 24 (1.3%) | 10 (1%) | 153 (12.7%) | 101 (2.8%) | 510 (2.4%) |

| Variable | Loosening (n=9,590) | Patella Reasons (n=5,924) | Instability (n=3,755) | Pain (n=2,992) | Arthrofibrosis (n=1,502) | Fracture (n=1,510) | Other (n=5,187) | TOTAL (n=30,460) |
|---|---|---|---|---|---|---|---|---|
| ASA 5 | | | | | | 1 (0.1%) | 1 (0%) | 2 (0%) |
| **BMI at 1st Revision[2]** | | | | | | | | |
| Underweight (<18.5) | 12 (0.2%) | 4 (0.1%) | 6 (0.2%) | 1 (0.1%) | 5 (0.5%) | 6 (0.7%) | 8 (0.3%) | 42 (0.2%) |
| Normal (18.5-24.9) | 432 (8.3%) | 286 (9%) | 265 (10%) | 141 (9.1%) | 121 (13.2%) | 163 (17.7%) | 299 (10%) | 1,707 (9.8%) |
| Pre Obese (25.0-29.9) | 1,461 (27.9%) | 946 (29.8%) | 751 (28.2%) | 439 (28.5%) | 297 (32.5%) | 247 (26.9%) | 914 (30.4%) | 5,055 (29%) |
| Obese Class 1 (30.0-34.9) | 1,640 (31.4%) | 1,014 (31.9%) | 856 (32.2%) | 540 (35%) | 285 (31.2%) | 255 (27.7%) | 913 (30.4%) | 5,503 (31.5%) |
| Obese Class 2 (35.0-39.9) | 986 (18.8%) | 577 (18.2%) | 515 (19.4%) | 281 (18.2%) | 142 (15.5%) | 114 (12.4%) | 516 (17.2%) | 3,131 (17.9%) |
| Obese Class 3 (≥40.0) | 700 (13.4%) | 352 (11.1%) | 266 (10%) | 140 (9.1%) | 64 (7%) | 134 (14.6%) | 354 (11.8%) | 2,010 (11.5%) |
| **Fixation at Primary** | | | | | | | | |
| Cemented | 5,225 (54.5%) | 2,858 (48.2%) | 2,103 (56%) | 1,622 (54.2%) | 873 (58.1%) | 812 (53.8%) | 2,524 (48.7%) | 16,017 (52.6%) |
| Cementless | 2,249 (23.5%) | 1,656 (28%) | 775 (20.6%) | 663 (22.2%) | 352 (23.4%) | 351 (23.2%) | 1,575 (30.4%) | 7,621 (25%) |
| Hybrid (Tibial Cemented) | 1,935 (20.2%) | 1,313 (22.2%) | 841 (22.4%) | 662 (22.1%) | 263 (17.5%) | 324 (21.5%) | 1,042 (20.1%) | 6,380 (20.9%) |
| Hybrid (Tibial Cementless) | 181 (1.9%) | 97 (1.6%) | 36 (1%) | 45 (1.5%) | 14 (0.9%) | 23 (1.5%) | 46 (0.9%) | 442 (1.5%) |
| **Femoral Fixation in 1st Revision** | | | | | | | | |
| Femoral Cemented | 5,363 (55.9%) | 37 (0.6%) | 1,616 (43%) | 561 (18.8%) | 612 (40.7%) | 962 (63.7%) | 2,193 (42.3%) | 11,344 (37.2%) |
| Femoral Cementless | 117 (1.2%) | | 21 (0.6%) | 10 (0.3%) | 10 (0.7%) | 65 (4.3%) | 72 (1.4%) | 295 (1%) |
| Femoral Component Not Revised | 4,110 (42.9%) | 5,887 (99.4%) | 2,118 (56.4%) | 2,421 (80.9%) | 880 (58.6%) | 483 (32%) | 2,922 (56.3%) | 18,821 (61.8%) |
| **Tibial Fixation in 1st Revision** | | | | | | | | |
| Tibia Cemented | 6,679 (69.6%) | 28 (0.5%) | 1,429 (38.1%) | 593 (19.8%) | 551 (36.7%) | 1,083 (71.7%) | 2,235 (43.1%) | 12,598 (41.4%) |
| Tibia Cementless | 169 (1.8%) | | 31 (0.8%) | 14 (0.5%) | 13 (0.9%) | 35 (2.3%) | 64 (1.2%) | 326 (1.1%) |
| Tibial Component Not Revised | 2,742 (28.6%) | 5,896 (99.5%) | 2,295 (61.1%) | 2,385 (79.7%) | 938 (62.5%) | 392 (26%) | 2,888 (55.7%) | 17,536 (57.6%) |
| **Patella Usage in Primary and 1st Revision** | | | | | | | | |
| Patella in Primary / Patella in 1st Revision | 1,650 (17.2%) | 145 (2.4%) | 225 (6%) | 428 (14.3%) | 184 (12.3%) | 119 (7.9%) | 969 (18.7%) | 3,720 (12.2%) |
| Patella in Primary / No Patella in 1st Revision | 3,854 (40.2%) | 15 (0.3%) | 2,028 (54%) | 517 (17.3%) | 717 (47.7%) | 764 (50.6%) | 2,057 (39.7%) | 9,952 (32.7%) |
| No Patella in Primary / Patella in 1st Revision | 2,513 (26.2%) | 5,756 (97.2%) | 960 (25.6%) | 1,945 (65%) | 461 (30.7%) | 296 (19.6%) | 1,321 (25.5%) | 13,252 (43.5%) |
| No Patella in Primary / No Patella in 1st Revision | 1,573 (16.4%) | 8 (0.1%) | 542 (14.4%) | 102 (3.4%) | 140 (9.3%) | 331 (21.9%) | 840 (16.2%) | 3,536 (11.6%) |
| **Stability of Primary Procedure** | | | | | | | | |
| Minimally Stabilised | 6,225 (64.9%) | 4,346 (73.4%) | 2,581 (68.7%) | 2,064 (69%) | 1,019 (67.8%) | 980 (64.9%) | 3,624 (69.9%) | 20,839 (68.4%) |
| Posterior Stabilised | 3,033 (31.6%) | 1,377 (23.2%) | 910 (24.2%) | 801 (26.8%) | 407 (27.1%) | 454 (30.1%) | 1,378 (26.6%) | 8,360 (27.4%) |
| Medial Pivot Design | 264 (2.8%) | 185 (3.1%) | 234 (6.2%) | 114 (3.8%) | 73 (4.9%) | 40 (2.6%) | 135 (2.6%) | 1,045 (3.4%) |
| Fully Stabilised | 40 (0.4%) | 7 (0.1%) | 24 (0.6%) | 5 (0.2%) | 1 (0.1%) | 13 (0.9%) | 25 (0.5%) | 115 (0.4%) |
| Hinged | 25 (0.3%) | 8 (0.1%) | 4 (0.1%) | 7 (0.2%) | 1 (0.1%) | 23 (1.5%) | 21 (0.4%) | 89 (0.3%) |

# Revision Arthroplasty

| Variable | Loosening (n=9,590) | Patella Reasons (n=5,924) | Instability (n=3,755) | Pain (n=2,992) | Arthrofibrosis (n=1,502) | Fracture (n=1,510) | Other (n=5,187) | TOTAL (n=30,460) |
|---|---|---|---|---|---|---|---|---|
| Unknown | 3 (0%) | 1 (0%) | 2 (0.1%) | 1 (0%) | 1 (0.1%) | | 4 (0.1%) | 12 (0%) |
| **Stability of 1st Revision[3]** | | | | | | | | |
| Minimally Stabilised | 1,901 (25.9%) | 16 (34.8%) | 106 (6.3%) | 161 (24%) | 125 (17.7%) | 214 (17.7%) | 556 (21.9%) | 3,079 (21.7%) |
| Posterior Stabilised | 2,644 (36%) | 20 (43.5%) | 394 (23.4%) | 273 (40.6%) | 303 (43%) | 157 (13%) | 891 (35.1%) | 4,682 (33%) |
| Medial Pivot | 86 (1.2%) | 3 (6.5%) | 22 (1.3%) | 8 (1.2%) | 11 (1.6%) | 14 (1.2%) | 25 (1%) | 169 (1.2%) |
| Fully Stabilised | 2,078 (28.3%) | 7 (15.2%) | 606 (36%) | 192 (28.6%) | 191 (27.1%) | 106 (8.8%) | 761 (30%) | 3,941 (27.7%) |
| Hinged | 640 (8.7%) | | 556 (33%) | 38 (5.7%) | 75 (10.6%) | 720 (59.5%) | 305 (12%) | 2,334 (16.4%) |
| **Metaphyseal Fixation in 1st Revision4** | | | | | | | | |
| No Metaphyseal Fixation | 5,806 (77.4%) | 44 (95.7%) | 1,213 (71.2%) | 567 (83%) | 568 (79.7%) | 829 (66.7%) | 1,953 (75.4%) | 10,980 (75.8%) |
| Metaphyseal Fixation | 1,699 (22.6%) | 2 (4.3%) | 490 (28.8%) | 116 (17%) | 145 (20.3%) | 414 (33.3%) | 638 (24.6%) | 3,504 (24.2%) |
| **Augments in 1st Revision[6]** | | | | | | | | |
| Femoral and Tibial | 160 (9.3%) | 1 (10%) | 22 (5.2%) | 4 (3%) | 6 (5.7%) | 6 (4.5%) | 60 (8.8%) | 259 (8.1%) |
| Femoral Only | 1,231 (71.9%) | 8 (80%) | 328 (76.8%) | 109 (82.6%) | 81 (76.4%) | 50 (37.9%) | 531 (78%) | 2,338 (73.1%) |
| Tibial Only | 321 (18.8%) | 1 (10%) | 77 (18%) | 19 (14.4%) | 19 (17.9%) | 76 (57.6%) | 90 (13.2%) | 603 (18.8%) |
| No Augments | 5,793 (77.2%) | 36 (78.3%) | 1,276 (74.9%) | 551 (80.7%) | 607 (85.1%) | 1,111 (89.4%) | 1,910 (73.7%) | 11,284 (77.9%) |
| **Stem Extensions in 1st Revision[7]** | | | | | | | | |
| Femoral and Tibial | 3,422 (45.6%) | 12 (26.1%) | 1,070 (62.8%) | 318 (46.6%) | 335 (47%) | 593 (47.7%) | 1,411 (54.5%) | 7,161 (49.4%) |
| Femoral Only | 478 (6.4%) | 8 (17.4%) | 244 (14.3%) | 49 (7.2%) | 87 (12.2%) | 296 (23.8%) | 247 (9.5%) | 1,409 (9.7%) |
| Tibial Only | 2,062 (27.5%) | 10 (21.7%) | 132 (7.8%) | 132 (19.3%) | 89 (12.5%) | 276 (22.2%) | 403 (15.6%) | 3,104 (21.4%) |
| Location Not Specified | 58 (0.8%) | | 1 (0.1%) | 2 (0.3%) | 3 (0.4%) | 10 (0.8%) | 6 (0.2%) | 80 (0.6%) |
| No Stem Extension Used | 1,485 (19.8%) | 16 (34.8%) | 256 (15%) | 182 (26.6%) | 199 (27.9%) | 68 (5.5%) | 524 (20.2%) | 2,730 (18.8%) |

Note: Excluding 1st revisions where no minor or major femoral/tibial components have been inserted.

Abbreviations: SD - standard deviation, IQR - interquartile range, ASA - American Society of Anesthesiologists, BMI - Body Mass Index (kg/m$^2$).

1. Excludes 9,580 procedures with unknown ASA at 1st Revision
2. Excludes 13,012 procedures with unknown BMI at 1st Revision
3. Stability of 1st revision only presented for major partial (incl. reinsertion of components) and major total 1st revision procedures.
4. Excludes 16,255 procedures with unknown Stability of 1st Revision
5. Metaphyseal fixation in 1st revision only presented for major partial (incl. reinsertion of components) and major total 1st revision procedures. (A metaphyseal fixation is defined as an attachment to a major component (and often the stem) that is designed to substitute for a central metaphyseal bone defect and aid fixation of the major component).
6. Excludes 15,976 procedures with unknown Metaphyseal Fixation in 1st Revision
7. Augments in 1st revision only presented when augments have been used in major partial (incl. reinsertion of components) and major total 1st revision procedures. (An augment is defined as an attachment to the non-articular surface of a major component that is used to substitute for bone deficiency at the articular surface level).
8. Excludes 15,976 procedures with unknown Augments in 1st Revision
9. Stem extension in 1st revision only presented for major partial (incl. reinsertion of components) and major total 1st revision procedures. (A stem extension is defined as an attachment to the major component used to aid fixation that is at least 15mm in length)
10. Excludes 15,976 procedures with unknown Stem Extension in 1st Revision

## OUTCOME OF 1ST REVISION

Of the 30,460 1st revision procedures, 4,825 have had a 2nd revision. The cumulative percent 2nd revision at 20 years is 25.6% (Table N43 and Figure N45).

The most common reasons for 2nd revision are loosening (31.9%), infection (25.8%), instability (12.5%) and pain (6.7%) (Table N44 and Figure N46).

Loosening is the most common reason for 1st and 2nd revision.

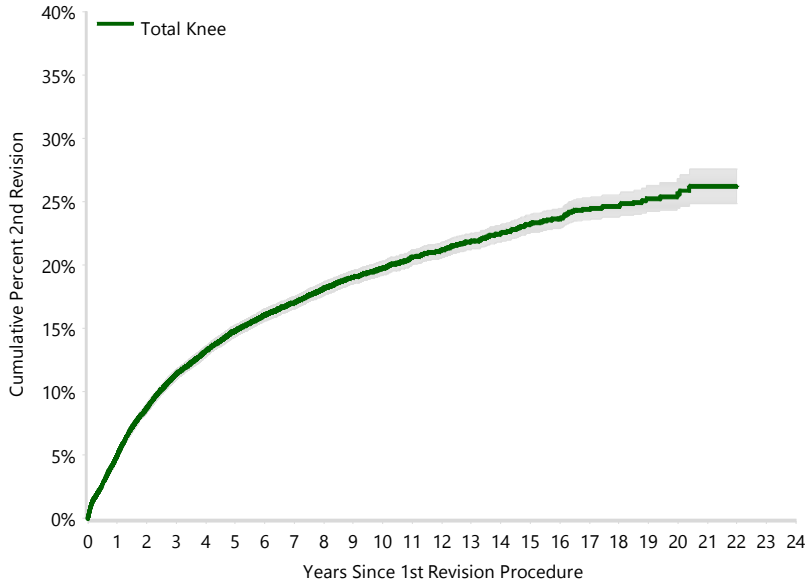
Revision of both the tibial and femoral components is the most common 2nd revision procedure (44.4%), followed by insert only (22.4%), femoral component only (8.2%), patella only (7.2%), cement spacer (6.5%), and tibial component only (6.3%) (Table N45).

**Table N43 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| Revision of Primary | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Total Knee | 4825 | 30460 | 5.0 (4.8, 5.3) | 11.4 (11.0, 11.8) | 14.8 (14.4, 15.2) | 19.8 (19.2, 20.3) | 23.3 (22.5, 24.0) | 25.6 (24.5, 26.8) |
| TOTAL | 4825 | 30460 | | | | | | |

Note: Excluding 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N45 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Total Knee | 30460 | 26737 | 21021 | 16420 | 7323 | 2146 | 316 |

Note: Excluding 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N44** **2nd Revision Diagnosis of Known Primary Total Knee Replacement (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| 2nd Revision Diagnosis | Number | Percent |
|---|---|---|
| Loosening | 1537 | 31.9 |
| Infection | 1243 | 25.8 |
| Instability | 604 | 12.5 |
| Pain | 321 | 6.7 |
| Arthrofibrosis | 213 | 4.4 |
| Malalignment | 153 | 3.2 |
| Fracture | 114 | 2.4 |
| Lysis | 88 | 1.8 |
| Wear Tibial Insert | 69 | 1.4 |
| Patellofemoral Pain | 58 | 1.2 |
| Metal Related Pathology | 51 | 1.1 |
| Patella Maltracking | 42 | 0.9 |
| Patella Erosion | 42 | 0.9 |
| Prosthesis Dislocation | 38 | 0.8 |
| Incorrect Sizing | 38 | 0.8 |
| Bearing Dislocation | 38 | 0.8 |
| Other | 176 | 3.6 |
| TOTAL | 4825 | 100.0 |

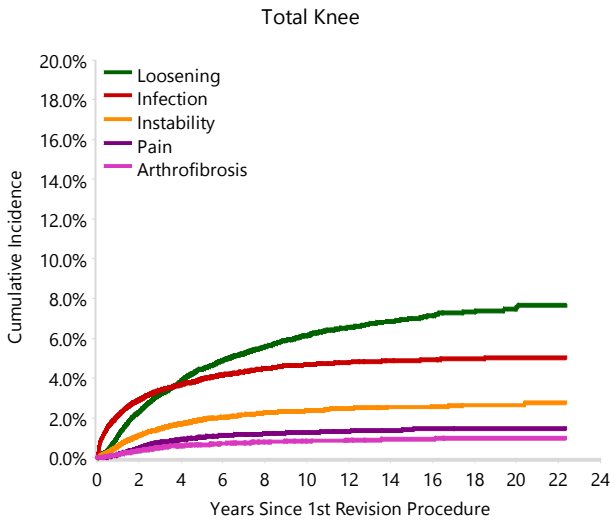
Note: Excluding 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N45** **Type of 2nd Revision of Known Primary Total Knee Replacement (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| Type of 2nd Revision | Number | Percent |
|---|---|---|
| TKR (Tibial/Femoral) | 2144 | 44.4 |
| Insert Only | 1082 | 22.4 |
| Femoral Component | 394 | 8.2 |
| Patella Only | 346 | 7.2 |
| Cement Spacer | 316 | 6.5 |
| Tibial Component | 306 | 6.3 |
| Insert/Patella | 157 | 3.3 |
| Removal of Prostheses | 44 | 0.9 |
| Minor Components | 22 | 0.5 |
| Total Femoral | 9 | 0.2 |
| Cement Only | 4 | 0.1 |
| Reinsertion of Components | 1 | 0.0 |
| TOTAL | 4825 | 100.0 |

Note: Excluding 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N46** **Cumulative Incidence 2nd Revision Diagnosis of Known Primary Total Knee Replacement (Primary Diagnosis OA, Excluding 1st Revision for Infection)**



## OUTCOME OF 1ST REVISION BY PATIENT CHARACTERISTICS

The outcome of the 1st revision varies by age and gender. Males aged <65 years have a higher rate of 2nd revision than females aged <65 years, at all time points, and males aged ≥65 years, except for the periods <3 months and from 6 to 7 years.

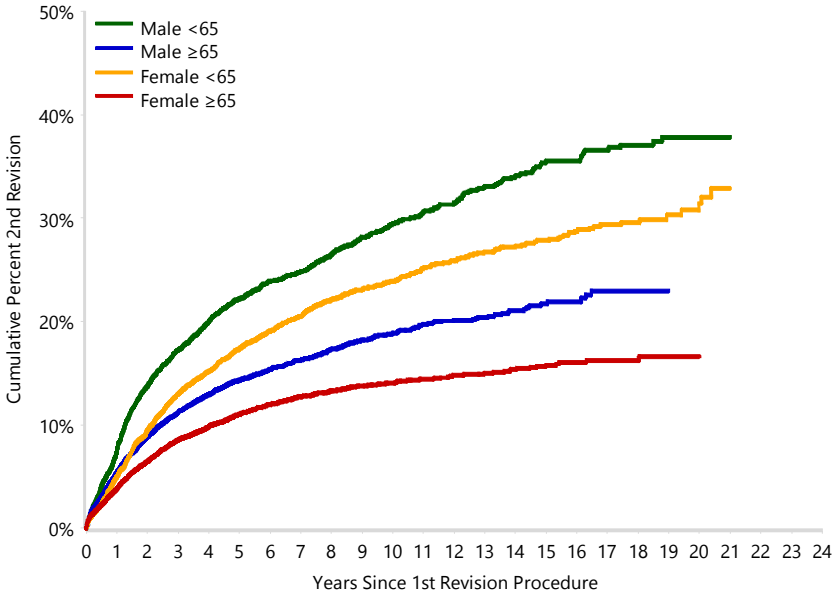
Females aged <65 years have a lower rate of revision than females aged ≥65 years for the first 2 weeks only, and after 1 month, there is a higher rate of revision. Males aged ≥65 years have a higher rate of revision than females aged ≥65 years (Table N46 and Figure N47).

**Table N46 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Gender and Age (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| Gender | Age at 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Male | <65 | 1112 | 4332 | 7.5 (6.8, 8.4) | 17.2 (16.1, 18.4) | 22.2 (20.9, 23.6) | 29.5 (27.9, 31.1) | 35.5 (33.5, 37.6) | 37.8 (35.4, 40.3) |
| | ≥65 | 1258 | 8785 | 5.4 (4.9, 5.9) | 11.2 (10.5, 11.9) | 14.3 (13.5, 15.1) | 18.8 (17.8, 19.9) | 21.7 (20.3, 23.2) | |
| Female | <65 | 1150 | 5513 | 4.9 (4.4, 5.5) | 13.0 (12.1, 13.9) | 17.4 (16.3, 18.5) | 23.9 (22.6, 25.2) | 27.8 (26.3, 29.4) | 31.4 (28.9, 34.0) |
| | ≥65 | 1305 | 11830 | 3.8 (3.5, 4.2) | 8.5 (8.0, 9.1) | 11.0 (10.4, 11.6) | 14.0 (13.3, 14.8) | 15.7 (14.8, 16.8) | 16.6 (15.3, 18.0) |
| TOTAL | | 4825 | 30460 | | | | | | |

Note: Excluding 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N47 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Gender and Age (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




Male <65 vs Male ≥65
- 0 - 3Mth: HR=1.12 (95% CI 0.89, 1.41), p=0.331
- 3Mth - 1.5Yr: HR=1.80 (95% CI 1.59, 2.05), p<0.001
- 1.5Yr - 2Yr: HR=1.50 (95% CI 1.17, 1.92), p=0.001
- 2Yr - 2.5Yr: HR=1.55 (95% CI 1.20, 2.00), p<0.001
- 2.5Yr - 3.5Yr: HR=1.50 (95% CI 1.19, 1.88), p<0.001
- 3.5Yr - 4Yr: HR=2.05 (95% CI 1.49, 2.82), p<0.001
- 4Yr - 6Yr: HR=1.63 (95% CI 1.32, 2.01), p<0.001
- 6Yr - 7Yr: HR=1.04 (95% CI 0.67, 1.62), p=0.850
- 7Yr - 7.5Yr: HR=1.96 (95% CI 1.20, 3.20), p=0.007
- 7.5Yr+: HR=2.42 (95% CI 1.98, 2.96), p<0.001

Male <65 vs Female <65
- 0 - 1.5Yr: HR=1.55 (95% CI 1.36, 1.76), p<0.001
- 1.5Yr+: HR=1.17 (95% CI 1.05, 1.30), p=0.003

Male ≥65 vs Female ≥65
- Entire Period: HR=1.37 (95% CI 1.26, 1.48), p<0.001

Female <65 vs Female ≥65
- 0 - 2Wk: HR=0.49 (95% CI 0.32, 0.74), p<0.001
- 2Wk - 1Mth: HR=0.80 (95% CI 0.56, 1.15), p=0.230
- 1Mth - 6Mth: HR=1.45 (95% CI 1.18, 1.77), p<0.001
- 6Mth - 1Yr: HR=1.50 (95% CI 1.24, 1.83), p<0.001
- 1Yr - 2Yr: HR=1.85 (95% CI 1.59, 2.15), p<0.001
- 2Yr - 2.5Yr: HR=1.61 (95% CI 1.28, 2.02), p<0.001
- 2.5Yr - 4Yr: HR=1.86 (95% CI 1.56, 2.21), p<0.001
- 4Yr - 4.5Yr: HR=2.43 (95% CI 1.69, 3.51), p<0.001
- 4.5Yr - 7Yr: HR=1.66 (95% CI 1.37, 2.01), p<0.001
- 7Yr+: HR=3.12 (95% CI 2.48, 3.92), p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Male | <65 | 4332 | 3768 | 2975 | 2405 | 1202 | 445 | 94 |
| | ≥65 | 8785 | 7600 | 5773 | 4318 | 1653 | 371 | 34 |
| Female | <65 | 5513 | 4967 | 4024 | 3289 | 1793 | 634 | 106 |
| | ≥65 | 11830 | 10402 | 8249 | 6408 | 2675 | 696 | 82 |

Note: Excluding 1st revisions where no minor or major femoral/tibial components have been inserted.

## ASA SCORE AND BMI CATEGORY

ASA score is available for 20,878 1st revision TKR procedures. Patients with an ASA score of 3 have a higher rate of revision compared to patients with an ASA score of 1 in the first 6 months only, but there is no difference between patients with other ASA scores (Table N47and Figure N48).

The number of patients with an ASA score of 1 is small (n=737), as is the number with an ASA score of 4 (n=510). The incidence of 2nd revision for loosening is higher for patients with an ASA score of 1. As ASA score increases, the incidence of 2nd revision for early infection increases (Figure N49).

BMI is recorded for 17,448 1st revision procedures. Patients in obese class 3 have a higher rate of 2nd revision compared to patients with a normal BMI, in the first 6 months only (Table N48 and Figure N50).

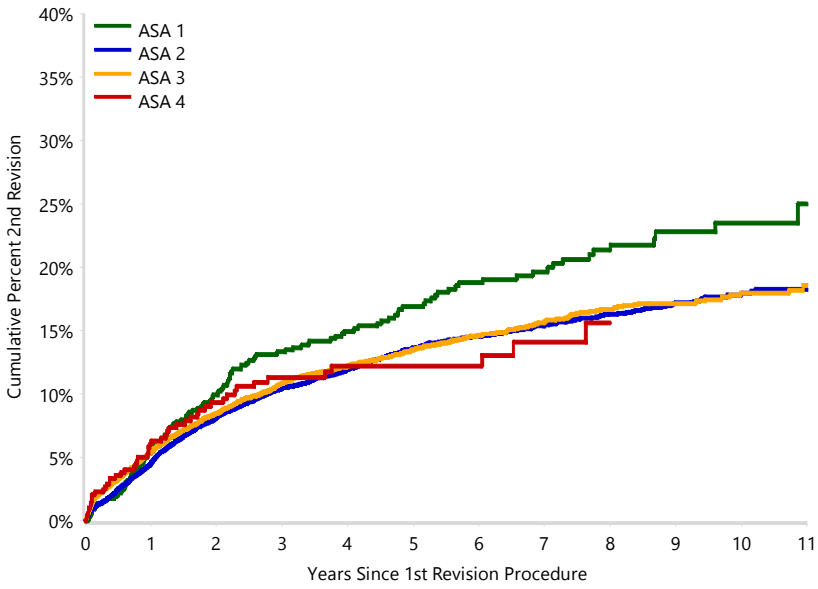
The incidence of 2nd revision for infection increases with increasing BMI (Figure N51).

**Table N47 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by ASA Score (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| ASA Score at 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|
| ASA 1 | 129 | 737 | 5.3 (3.9, 7.3) | 13.3 (11.0, 16.1) | 16.9 (14.2, 20.1) | 23.5 (19.7, 27.8) | 25.0 (20.5, 30.3) |
| ASA 2 | 1210 | 9414 | 4.6 (4.1, 5.0) | 10.4 (9.8, 11.1) | 13.6 (12.9, 14.4) | 17.8 (16.8, 18.9) | 18.2 (17.1, 19.4) |
| ASA 3 | 1222 | 10217 | 5.4 (5.0, 5.9) | 10.8 (10.2, 11.5) | 13.5 (12.7, 14.3) | 17.9 (16.8, 19.1) | 18.6 (17.2, 20.1) |
| ASA 4 | 50 | 510 | 6.0 (4.2, 8.7) | 11.3 (8.5, 14.9) | 12.2 (9.2, 16.0) | | |
| TOTAL | 2611 | 20878 | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.
Excludes 9,580 procedures with no ASA score, and 2 procedures with an ASA score of 5 at 1st revision.

**Figure N48 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by ASA Score (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




HR - adjusted for age and gender

ASA 2 vs ASA 1

Entire Period: HR=0.92 (95% CI 0.77, 1.11), p=0.398

ASA 3 vs ASA 1

0 - 6Mth: HR=1.39 (95% CI 1.10, 1.75), p=0.006

6Mth - 2.5Yr: HR=0.95 (95% CI 0.77, 1.16), p=0.593

2.5Yr+: HR=0.97 (95% CI 0.78, 1.20), p=0.770

ASA 4 vs ASA 1

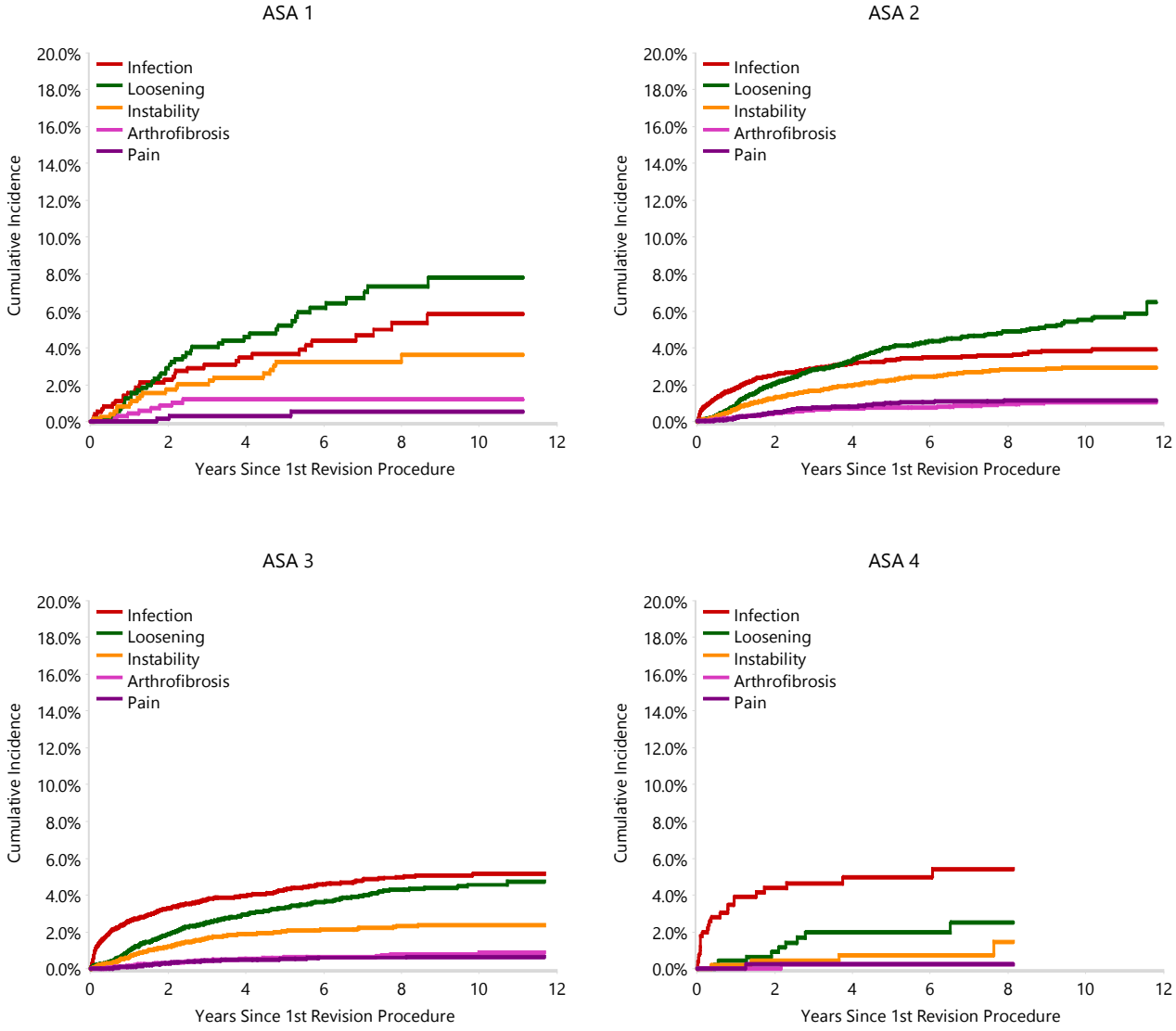
0 - 2.5Yr: HR=1.38 (95% CI 0.97, 1.96), p=0.071

2.5Yr+: HR=0.61 (95% CI 0.28, 1.30), p=0.199

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|
| ASA 1 | 737 | 662 | 496 | 367 | 89 | 48 |
| ASA 2 | 9414 | 8183 | 6229 | 4541 | 891 | 356 |
| ASA 3 | 10217 | 8494 | 5960 | 3981 | 597 | 196 |
| ASA 4 | 510 | 374 | 229 | 142 | 13 | 4 |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.
Excludes 9,580 procedures with no ASA score, and 2 procedures with an ASA score of 5 at 1st revision.

**Figure N49 Cumulative Incidence 2nd Revision Diagnosis of Known Primary Total Knee Replacement by ASA Score at 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**



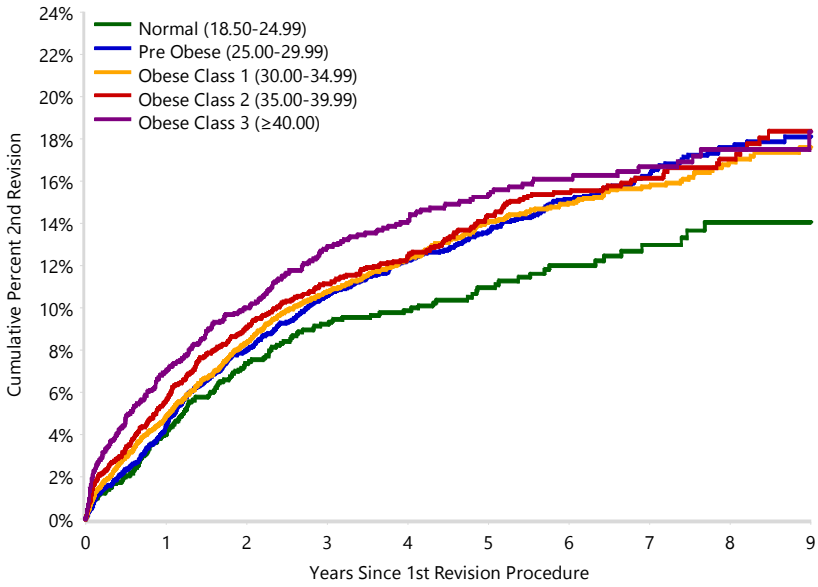

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.
Excludes 9,580 procedures with no ASA score, and 2 procedures with an ASA score of 5 at 1st revision.

**Table N48 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by BMI Category at 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| BMI Category at 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|
| Underweight | 3 | 42 | 8.4 (2.8, 23.9) | 8.4 (2.8, 23.9) | 8.4 (2.8, 23.9) | | |
| Normal | 159 | 1707 | 4.0 (3.2, 5.1) | 9.2 (7.8, 10.9) | 11.0 (9.3, 12.8) | | |
| Pre Obese | 600 | 5055 | 4.4 (3.9, 5.0) | 10.6 (9.7, 11.5) | 13.6 (12.5, 14.8) | | |
| Obese Class 1 | 651 | 5503 | 4.9 (4.3, 5.5) | 10.8 (9.9, 11.7) | 14.1 (13.0, 15.2) | | |
| Obese Class 2 | 387 | 3131 | 5.6 (4.8, 6.5) | 11.1 (10.0, 12.4) | 14.4 (13.0, 15.9) | | |
| Obese Class 3 | 265 | 2010 | 7.0 (6.0, 8.3) | 12.9 (11.4, 14.6) | 15.4 (13.7, 17.3) | | |
| TOTAL | 2065 | 17448 | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.
Excludes 13,012 procedures with no BMI data at 1st revision.
BMI has not been presented for patients aged ≤19 years.

**Figure N50 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by BMI Category at 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




HR - adjusted for age and gender

Pre Obese (25.00-29.99) vs Normal (18.50-24.99)
Entire Period: HR=1.14 (95% CI 0.96, 1.36), p=0.145

Obese Class 1 (30.00-34.99) vs Normal (18.50-24.99)
Entire Period: HR=1.10 (95% CI 0.93, 1.31), p=0.272

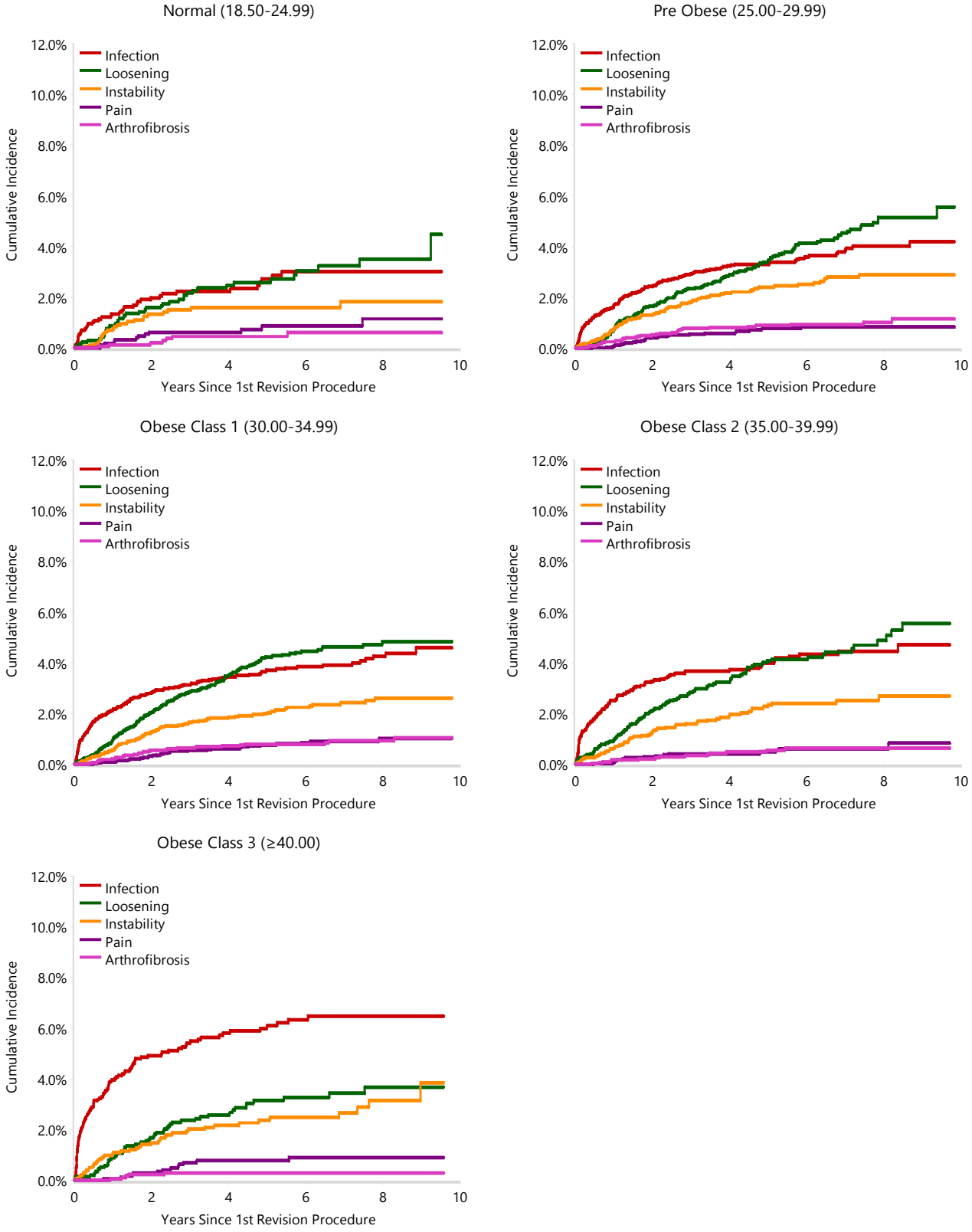
Obese Class 2 (35.00-39.99) vs Normal (18.50-24.99)
Entire Period: HR=1.14 (95% CI 0.94, 1.37), p=0.180

Obese Class 3 (≥40.00) vs Normal (18.50-24.99)
0 - 6Mth: HR=1.88 (95% CI 1.43, 2.46), p<0.001
6Mth+: HR=1.02 (95% CI 0.82, 1.27), p=0.847

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs | 9 Yrs | 10 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Normal | 1707 | 1416 | 1143 | 930 | 760 | 576 | 434 | 307 | 182 | 94 | 1 | 0 |
| Pre Obese | 5055 | 4274 | 3539 | 2955 | 2404 | 1903 | 1405 | 999 | 611 | 265 | 6 | 1 |
| Obese Class 1 | 5503 | 4590 | 3845 | 3232 | 2612 | 2073 | 1523 | 1035 | 610 | 292 | 2 | 0 |
| Obese Class 2 | 3131 | 2606 | 2169 | 1806 | 1492 | 1194 | 882 | 602 | 367 | 170 | 0 | 0 |
| Obese Class 3 | 2010 | 1637 | 1370 | 1153 | 924 | 747 | 555 | 378 | 231 | 96 | 1 | 0 |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.
Excludes 13,012 procedures with no BMI data at 1st revision.
BMI has not been presented for patients aged ≤19 years.

**Figure N51 Cumulative Incidence 2nd Revision Diagnosis of Known Primary Total Knee Replacement by BMI Category at 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.
Excludes 13,012 procedures with no BMI data at 1st revision.
BMI has not been presented for patients aged ≤19 years.

### CHANGES IN REVISION KNEE SURGERY OVER TIME

Since 2003, the annual number of 1st revision knee replacement procedures has increased more than 6 times. In 2003, there were 334 aseptic 1st revision procedures, while in 2024, there were 2,034 recorded (Figure N52).

The yearly proportion of the 3 classes of 1st revision (minor, major partial and major total) is shown in Figure N53. There has been an increase in major total revisions and a decrease in major partial revisions.

With regard to the reason for 1st revision, there has been a decrease in proportion of 1st revisions for loosening (Figure N54).

Over time, there has been an increase in the proportions of fully stabilised and hinge prostheses used for 1st revision, and a decrease in minimally stabilised with time (Figure N55).

When the femoral component is revised, the fixation used for the 1st revision procedure is shown in Figure N56. Over 90% of 1st revision procedures use cemented femoral fixation, and this has slightly increased with time.

The proportion of tibial components using cemented fixation when revised remains comparable, with a slight increase (Figure N57).

Over time, there has been a decrease in use of non XLPE for the 1st revision and an increase in use of XLPE and, more recently, XLPE with antioxidant (Figure N58).

Reflecting the increased use of patella components in primary procedures over time, there have been an increase in 1st revision procedures where the patella component was used in the primary and no patella component was needed in the revision. Correspondingly, there has been a decrease in proportion of 1st revisions where the patella was initially unresurfaced and left further unresurfaced at revision (Figure N59).

While the use of stem extensions in the 1st revision is more common for tibial than for femoral components, the use of these for both components is the most common practice and has increased with time (Figure N60).

**Figure N52 Known Primary Total Knee Replacement by 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

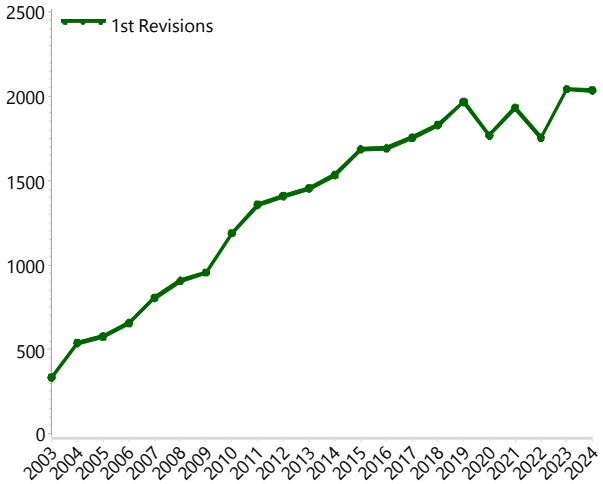



**Figure N53 Known Primary Total Knee Replacement by 1st Revision Class (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

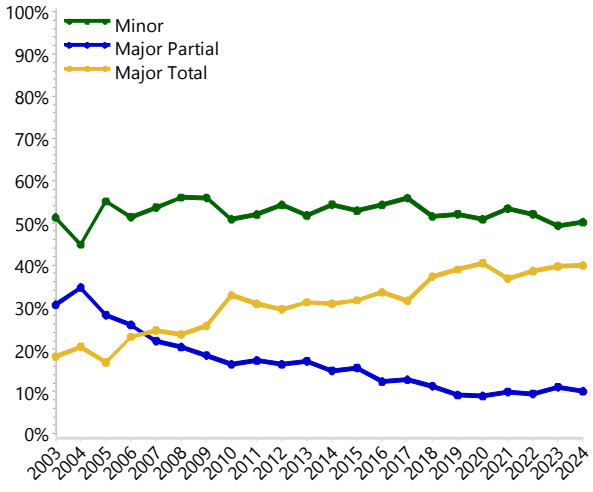


**Figure N54** **Known Primary Total Knee Replacement by 1st Revision Diagnoses (Primary Diagnosis OA, Excluding 1st Revision for Infection, Restricted to Top Six 1st Revision Diagnoses)**

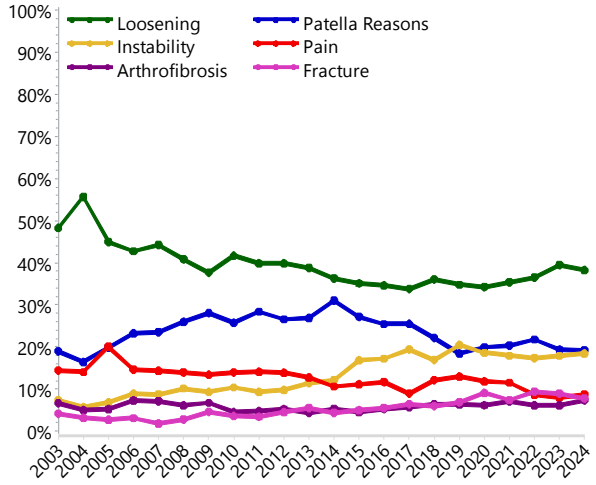



**Figure N55** **Known Primary Total Knee Replacement by Stability of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

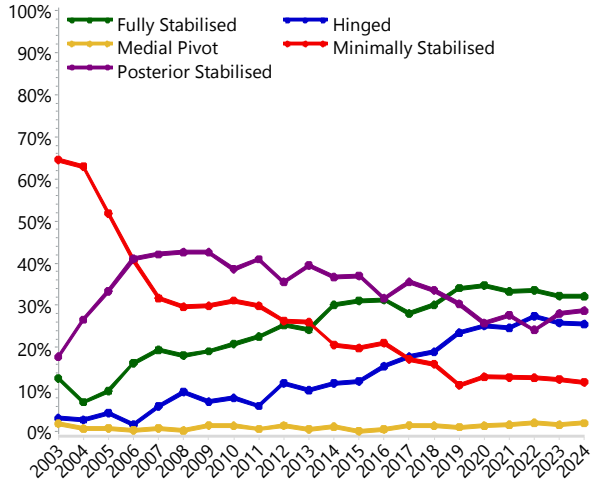



**Figure N56** **Known Primary Total Knee Replacement by Femoral Fixation of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

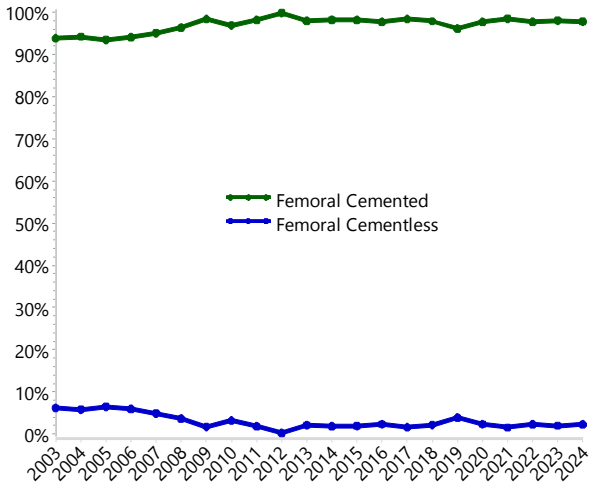



**Figure N57** **Known Primary 1st Revision Total Knee Replacement by Tibial Fixation of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

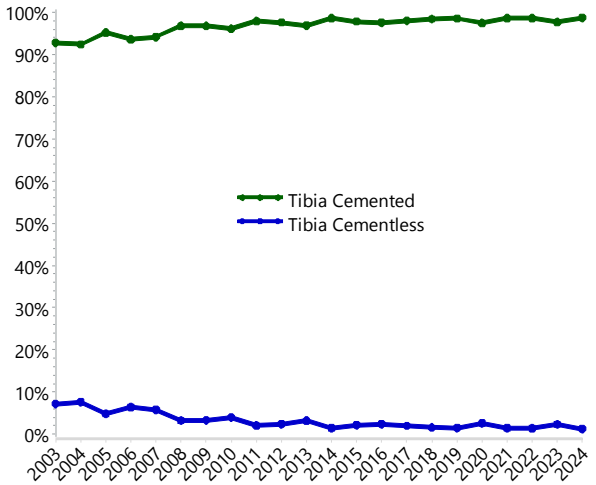


**Figure N58** **Known Primary Total Knee Replacement by Polyethylene Type in 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

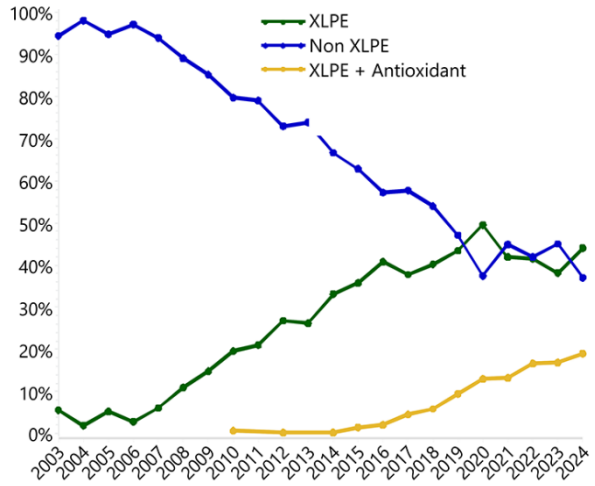



**Figure N59** **Known Primary Total Knee Replacement by Patella Usage in Primary/1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

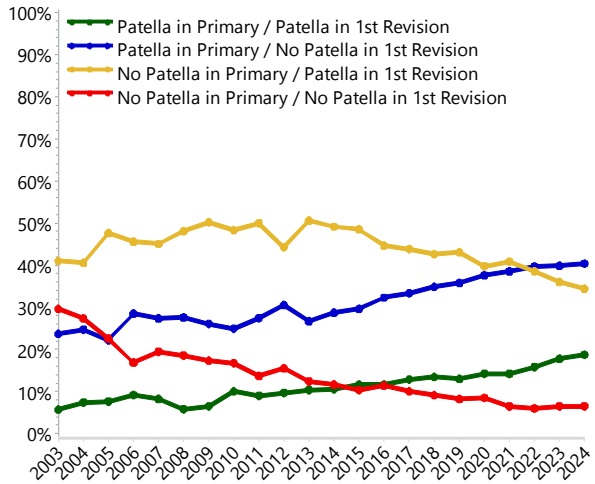
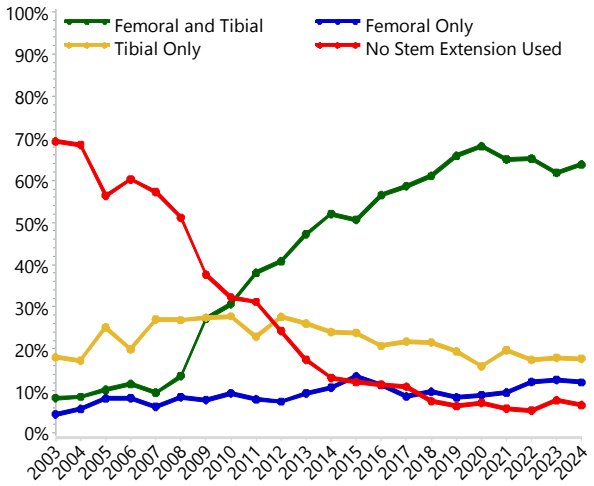



**Figure N60** **Known Primary Total Knee Replacement by Stem Extension in 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**



## OUTCOME OF 1ST REVISION BY CLASS OF REVISION

Minor revisions are the most common class of 1st revision procedure (52.4%), with major total revisions second most common (33.1%) and then major partial revisions (14.4%). The outcome by class of the 1st revision is listed in Table N49.

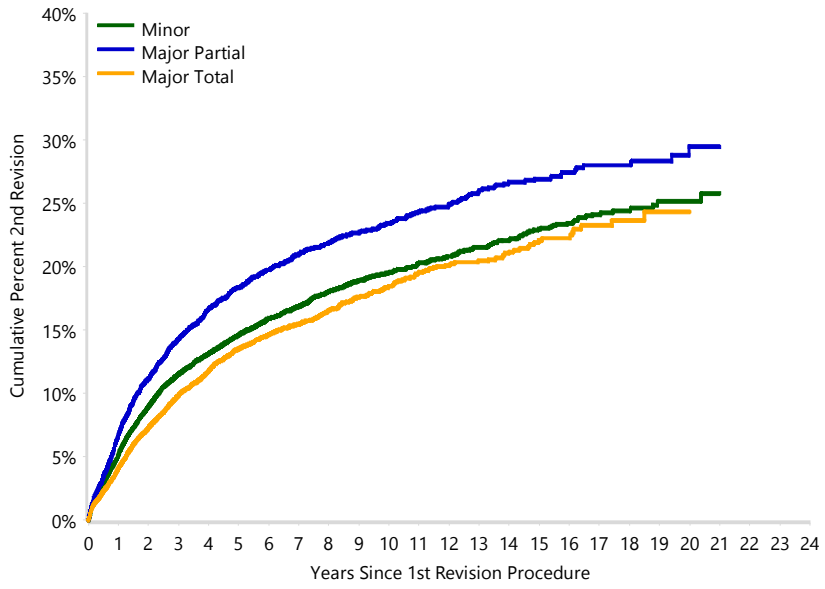
Major total revisions have a lower rate of 2nd revision compared to major partial revisions, and also compared to minor revisions, but only until 2.5 years, after which time there is no longer a difference. Minor revisions have a lower rate of 2nd revision compared to major partial revisions (Table N49 and Figure N61).

**Table N49 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Class of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| Class of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Minor | 2543 | 15976 | 5.1 (4.8, 5.5) | 11.5 (11.0, 12.0) | 14.6 (14.0, 15.2) | 19.5 (18.8, 20.3) | 23.0 (22.0, 24.0) | 25.2 (23.7, 26.7) |
| Major Partial | 916 | 4399 | 6.7 (6.0, 7.5) | 14.3 (13.3, 15.4) | 18.4 (17.2, 19.6) | 23.4 (22.0, 24.8) | 26.9 (25.3, 28.7) | 29.5 (27.0, 32.0) |
| Major Total | 1366 | 10085 | 4.1 (3.7, 4.5) | 9.8 (9.2, 10.5) | 13.5 (12.8, 14.3) | 18.5 (17.5, 19.5) | 22.1 (20.7, 23.6) | 24.3 (22.1, 26.8) |
| TOTAL | 4825 | 30460 | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N61 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Class of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




HR - adjusted for age and gender

Minor vs Major Total

0 - 2.5Yr: HR=1.19 (95% CI 1.10, 1.30), p<0.001

2.5Yr+: HR=0.91 (95% CI 0.83, 1.01), p=0.076

Major Partial vs Minor

Entire Period: HR=1.21 (95% CI 1.12, 1.30), p<0.001

Major Partial vs Major Total

0 - 1Yr: HR=1.54 (95% CI 1.34, 1.77), p<0.001

1Yr - 1.5Yr: HR=1.42 (95% CI 1.15, 1.76), p=0.001

1.5Yr+: HR=1.14 (95% CI 1.03, 1.28), p=0.014

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Minor | 15976 | 14113 | 11196 | 8803 | 3942 | 1175 | 151 |
| Major Partial | 4399 | 3881 | 3155 | 2634 | 1437 | 508 | 110 |
| Major Total | 10085 | 8743 | 6670 | 4983 | 1944 | 463 | 55 |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

### OUTCOME OF 1ST REVISION BY REASON FOR 1ST REVISION

As the risk of 2nd revision varies depending on the reason for the 1st revision, more detailed analyses have been carried out for the 1st revision diagnoses of loosening, patella reasons, instability, pain, arthrofibrosis and fracture. 'Patella reasons' include patella erosion, patellofemoral pain and patella maltracking.

The lowest 15 year cumulative percent 2nd revision is 18.9% when the 1st revision was performed for patella reasons, and the highest is 29.3% for arthrofibrosis (Table N50 and Figure N62).

Loosening, infection, and a recurrence of the 1st revision diagnosis are the most common reasons for 2nd revision (apart from patella reasons).

When compared to the 1st revision for loosening, 1st revision for patella reasons, and 1st revision for pain have a lower rate of 2nd revision, as does the 1st revision for instability, but only after 1.5 years. 1st revision for instability and for fracture both have an initial higher rate of revision compared to 1st revision for loosening, but only for the first 1.5 years and 6 months, respectively. For each reason (apart from patella reasons) for 1st revision, loosening, infection, and a recurrence of the original revision diagnosis are the most common reasons for 2nd revision (Table N51).

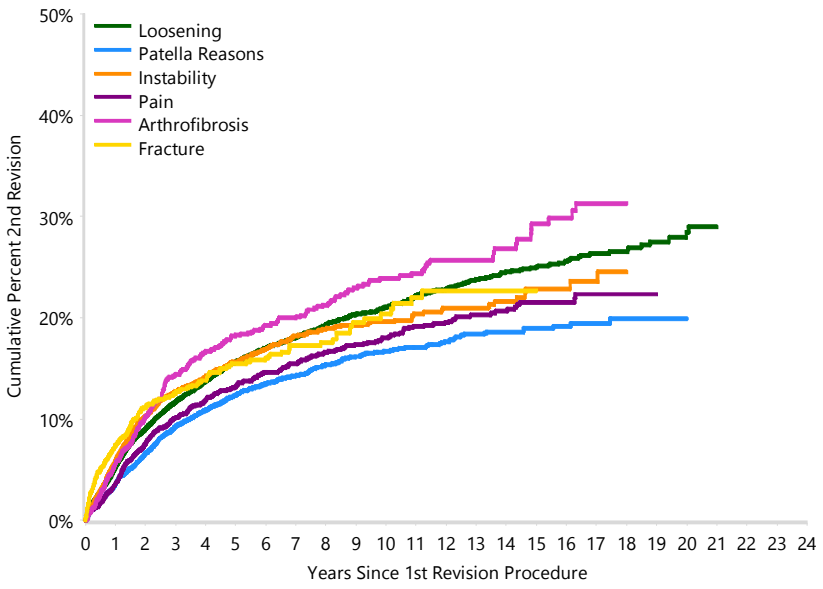
The most common type of 2nd revision procedure is revision of both tibial and femoral components (44.4%), insert only (22.4%), femoral component only (8.2%), patella only (7.2%), and cement spacer (6.5%) (Table N52).

**Table N50 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Reason for 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| Reason for 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Loosening | 1653 | 9590 | 5.2 (4.7, 5.6) | 11.7 (11.0, 12.4) | 15.6 (14.9, 16.4) | 21.1 (20.1, 22.1) | 25.0 (23.8, 26.3) | 28.4 (26.3, 30.7) |
| Patella Reasons | 809 | 5924 | 3.5 (3.1, 4.0) | 9.2 (8.5, 10.0) | 12.3 (11.5, 13.3) | 16.7 (15.6, 17.9) | 18.9 (17.6, 20.4) | 19.9 (18.2, 21.8) |
| Instability | 579 | 3755 | 5.9 (5.2, 6.7) | 12.7 (11.6, 13.8) | 15.6 (14.4, 17.0) | 19.6 (18.1, 21.2) | 22.9 (20.6, 25.4) | |
| Pain | 457 | 2992 | 3.6 (3.0, 4.3) | 10.1 (9.1, 11.3) | 13.2 (11.9, 14.5) | 18.0 (16.5, 19.7) | 21.5 (19.5, 23.7) | |
| Arthrofibrosis | 289 | 1502 | 5.6 (4.6, 7.0) | 14.4 (12.6, 16.4) | 18.3 (16.2, 20.5) | 23.9 (21.4, 26.7) | 29.3 (25.8, 33.2) | |
| Fracture | 209 | 1510 | 7.4 (6.2, 8.9) | 12.5 (10.8, 14.4) | 15.5 (13.5, 17.7) | 20.4 (17.5, 23.6) | 22.7 (19.2, 26.6) | |
| TOTAL | 3996 | 25273 | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N62 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Reason for 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




HR - adjusted for age and gender

Patella Reasons vs Loosening

Entire Period: HR=0.78 (95% CI 0.72, 0.85), p<0.001

Instability vs Loosening

0 - 1.5Yr: HR=1.14 (95% CI 1.00, 1.30), p=0.043

1.5Yr+: HR=0.81 (95% CI 0.71, 0.93), p=0.001

Pain vs Loosening

Entire Period: HR=0.84 (95% CI 0.76, 0.93), p<0.001

Arthrofibrosis vs Loosening

Entire Period: HR=1.05 (95% CI 0.93, 1.19), p=0.419

Fracture vs Loosening

0 - 6Mth: HR=2.55 (95% CI 1.99, 3.27), p<0.001

6Mth - 1.5Yr: HR=1.18 (95% CI 0.90, 1.56), p=0.233

1.5Yr+: HR=0.92 (95% CI 0.74, 1.15), p=0.464

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Loosening | 9590 | 8443 | 6664 | 5272 | 2497 | 807 | 138 |
| Patella Reasons | 5924 | 5390 | 4401 | 3554 | 1638 | 433 | 47 |
| Instability | 3755 | 3228 | 2460 | 1825 | 601 | 158 | 20 |
| Pain | 2992 | 2726 | 2270 | 1808 | 866 | 284 | 35 |
| Arthrofibrosis | 1502 | 1297 | 999 | 772 | 365 | 138 | 18 |
| Fracture | 1510 | 1190 | 795 | 531 | 168 | 41 | 7 |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N51 2nd Revision Diagnosis of Known Primary Total Knee Replacement by Reason for 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| 2nd Revision Diagnosis | Loosening | | Patella Reasons | | Instability | | Pain | | Arthrofibrosis | | Fracture | | Other | | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% | N | Col% | N | Col% | N | Col% | N | Col% | N | Col% |
| Loosening | 641 | 38.8 | 247 | 30.5 | 140 | 24.2 | 142 | 31.1 | 64 | 22.1 | 51 | 24.4 | 252 | 30.4 | 1537 | 31.9 |
| Infection | 478 | 28.9 | 184 | 22.7 | 132 | 22.8 | 97 | 21.2 | 61 | 21.1 | 76 | 36.4 | 215 | 25.9 | 1243 | 25.8 |
| Instability | 167 | 10.1 | 97 | 12.0 | 163 | 28.2 | 58 | 12.7 | 13 | 4.5 | 14 | 6.7 | 92 | 11.1 | 604 | 12.5 |
| Pain | 78 | 4.7 | 91 | 11.2 | 27 | 4.7 | 70 | 15.3 | 17 | 5.9 | 2 | 1.0 | 36 | 4.3 | 321 | 6.7 |
| Arthrofibrosis | 40 | 2.4 | 34 | 4.2 | 10 | 1.7 | 13 | 2.8 | 87 | 30.1 | . | . | 29 | 3.5 | 213 | 4.4 |
| Malalignment | 33 | 2.0 | 41 | 5.1 | 21 | 3.6 | 17 | 3.7 | 15 | 5.2 | 2 | 1.0 | 24 | 2.9 | 153 | 3.2 |
| Fracture | 27 | 1.6 | 13 | 1.6 | 16 | 2.8 | 8 | 1.8 | 5 | 1.7 | 30 | 14.4 | 15 | 1.8 | 114 | 2.4 |
| Lysis | 25 | 1.5 | 17 | 2.1 | 5 | 0.9 | 6 | 1.3 | 6 | 2.1 | 1 | 0.5 | 28 | 3.4 | 88 | 1.8 |
| Wear Tibial Insert | 15 | 0.9 | 23 | 2.8 | 3 | 0.5 | 6 | 1.3 | 3 | 1.0 | 1 | 0.5 | 18 | 2.2 | 69 | 1.4 |
| Patellofemoral Pain | 27 | 1.6 | . | . | 9 | 1.6 | 6 | 1.3 | 2 | 0.7 | 1 | 0.5 | 13 | 1.6 | 58 | 1.2 |
| Metal Related Pathology | 13 | 0.8 | 12 | 1.5 | 4 | 0.7 | 3 | 0.7 | 3 | 1.0 | 2 | 1.0 | 14 | 1.7 | 51 | 1.1 |
| Patella Maltracking | 8 | 0.5 | 7 | 0.9 | 8 | 1.4 | 8 | 1.8 | 1 | 0.3 | 2 | 1.0 | 8 | 1.0 | 42 | 0.9 |
| Patella Erosion | 22 | 1.3 | . | . | 7 | 1.2 | . | . | 3 | 1.0 | 5 | 2.4 | 5 | 0.6 | 42 | 0.9 |
| Prosthesis Dislocation | 9 | 0.5 | 3 | 0.4 | 8 | 1.4 | . | . | . | . | . | . | 18 | 2.2 | 38 | 0.8 |
| Incorrect Sizing | 9 | 0.5 | 11 | 1.4 | . | . | 4 | 0.9 | 1 | 0.3 | 2 | 1.0 | 11 | 1.3 | 38 | 0.8 |
| Bearing Dislocation | 18 | 1.1 | . | . | 1 | 0.2 | 1 | 0.2 | 1 | 0.3 | 5 | 2.4 | 12 | 1.4 | 38 | 0.8 |
| Other | 43 | 2.6 | 29 | 3.6 | 25 | 4.3 | 18 | 3.9 | 7 | 2.4 | 15 | 7.2 | 39 | 4.7 | 176 | 3.6 |
| TOTAL | 1653 | 100.0 | 809 | 100.0 | 579 | 100.0 | 457 | 100.0 | 289 | 100.0 | 209 | 100.0 | 829 | 100.0 | 4825 | 100.0 |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N52 Type of 2nd Revision of Known Primary Total Knee Replacement by Reason for 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| Type of 2nd Revision | Loosening | | Patella Reasons | | Instability | | Pain | | Arthrofibrosis | | Fracture | | Other | | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% | N | Col% | N | Col% | N | Col% | N | Col% | N | Col% |
| TKR (Tibial/Femoral) | 679 | 41.1 | 385 | 47.6 | 280 | 48.4 | 227 | 49.7 | 144 | 49.8 | 45 | 21.5 | 384 | 46.3 | 2144 | 44.4 |
| Insert Only | 359 | 21.7 | 191 | 23.6 | 124 | 21.4 | 86 | 18.8 | 54 | 18.7 | 60 | 28.7 | 208 | 25.1 | 1082 | 22.4 |
| Femoral Component | 142 | 8.6 | 54 | 6.7 | 42 | 7.3 | 33 | 7.2 | 22 | 7.6 | 47 | 22.5 | 54 | 6.5 | 394 | 8.2 |
| Patella Only | 123 | 7.4 | 64 | 7.9 | 47 | 8.1 | 41 | 9.0 | 7 | 2.4 | 17 | 8.1 | 47 | 5.7 | 346 | 7.2 |
| Cement Spacer | 130 | 7.9 | 38 | 4.7 | 31 | 5.4 | 30 | 6.6 | 23 | 8.0 | 12 | 5.7 | 52 | 6.3 | 316 | 6.5 |
| Tibial Component | 140 | 8.5 | 42 | 5.2 | 22 | 3.8 | 23 | 5.0 | 21 | 7.3 | 11 | 5.3 | 47 | 5.7 | 306 | 6.3 |
| Insert/Patella | 50 | 3.0 | 30 | 3.7 | 25 | 4.3 | 14 | 3.1 | 11 | 3.8 | 4 | 1.9 | 23 | 2.8 | 157 | 3.3 |
| Removal of Prostheses | 18 | 1.1 | 4 | 0.5 | 5 | 0.9 | 3 | 0.7 | 5 | 1.7 | 2 | 1.0 | 7 | 0.8 | 44 | 0.9 |
| Minor Components | 7 | 0.4 | . | . | 3 | 0.5 | . | . | 1 | 0.3 | 5 | 2.4 | 6 | 0.7 | 22 | 0.5 |
| Total Femoral | 2 | 0.1 | . | . | . | . | . | . | . | . | 6 | 2.9 | 1 | 0.1 | 9 | 0.2 |
| Cement Only | 2 | 0.1 | 1 | 0.1 | . | . | . | . | 1 | 0.3 | . | . | . | . | 4 | 0.1 |
| Reinsertion of Components | 1 | 0.1 | . | . | . | . | . | . | . | . | . | . | . | . | 1 | 0.0 |
| TOTAL | 1653 | 100.0 | 809 | 100.0 | 579 | 100.0 | 457 | 100.0 | 289 | 100.0 | 209 | 100.0 | 829 | 100.0 | 4825 | 100.0 |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

## LOOSENING

Loosening is the most common 1st revision diagnosis for total knee replacement, with a primary diagnosis of osteoarthritis (31.5% of aseptic revisions). There are 9,590 1st revision total knee procedures for loosening. There are more females revised for loosening (56.7%). The mean age at the time of 1st revision is 68.3 years, and the median time to 1st revision is 3.4 years (Table N42).

> For loosening, revising both femoral and tibial components results in a lower rate of 2nd revision.

The most common type of 1st revision procedures for loosening are TKR (both tibial and femoral components revised) (50.3%), tibial only (21.1%), and femoral only (6.8%). Patella components are used in 13.0% of 1st revisions for loosening, either alone or with the addition of a polyethylene insert. Insert only revision is performed in 8.6% of 1st revisions for loosening. It is unclear why a minor revision is performed for loosening, but perhaps these are revisions for wear without actual component loosening, or misclassified revisions for instability.

Of the 9,590 primary total knee replacements revised for loosening, 1,653 have had a 2nd revision. The 15 year cumulative percent 2nd revision, where the 1st revision is for loosening, is 25.0% (Table N50 and Figure N62).

Where major components are revised in a 1st revision for loosening, cement fixation is used for 97.9% of the femoral components and 97.5% of the tibial components. Stem extensions are used in 80.2% of major revisions. Stems are added to both femoral and tibial components in 46.0% of procedures, 27.7% have only a tibial stem, 6.4% have only a femoral stem, and in 0.8% the location of the stem is unknown. The use of stem extensions for both femoral and tibial components has increased to 65.1% of 1st revisions for loosening, while revisions without stem extensions account for only 6.0% of procedures in 2024 (Figure N63).

Augment use is recorded for major component 1st revisions for loosening. Where these are used, 71.9% are added to the femoral component only, 18.8% to the tibial component only, and 9.3% have both femoral and tibial augments.

Metaphyseal fixation can be achieved by using sleeves or cones (Table N53). Metaphyseal sleeves or cones are used in 26.6% of major revisions for loosening (Table N42 and Figure N64 ).

The use of metaphyseal fixation in 1st revision for loosening has increased to 43.3% of major revisions for loosening in 2024 (Figure N63).

Where the 1st revision was for loosening, the most common reasons for the 2nd revision are further loosening (38.8%), infection (28.9%) and instability (10.1%) (Table N51). When a major revision is performed for loosening, revising both femoral and tibial components results in a lower rate of 2nd revision compared to revising only the femoral component, or compared to revising only the tibial component for the majority of the first 3.5 years. Tibial component only 1st revisions for loosening have a lower rate of 2nd revision compared to those where the femoral component only is revised (Table N54 and Figure N65).

There is a lower rate of 2nd revision when a stem extension is used in the 1st revision for loosening, compared to when a stem extension is not used (Table N55 and Figure N66). Use of stem extensions for both femoral and tibial components when revising for loosening has a lower rate of 2nd revision when compared to stem extensions on either femoral or tibial components alone or where no stem extension is used (Table N56 and Figure N67).

The use of metaphyseal fixation in the 1st revision for loosening has a lower rate of 2nd revision compared to when no metaphyseal fixation is used (Table N57 and Figure N68).

**Figure N63 Trends in Stem Extension Use in Revision Total Knee Replacement Over Time (Primary Diagnosis OA, 1st Revision for Loosening)**

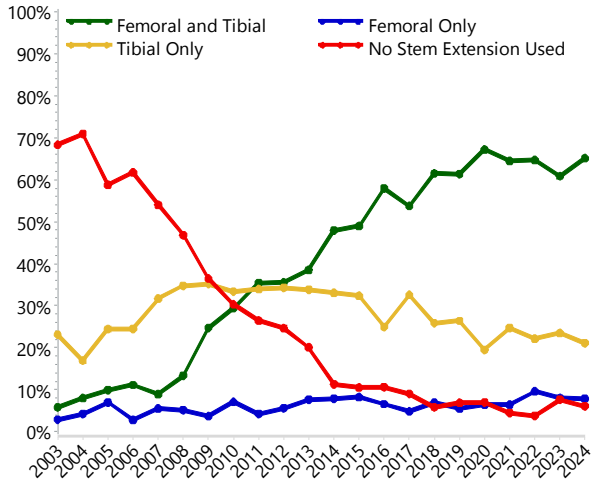
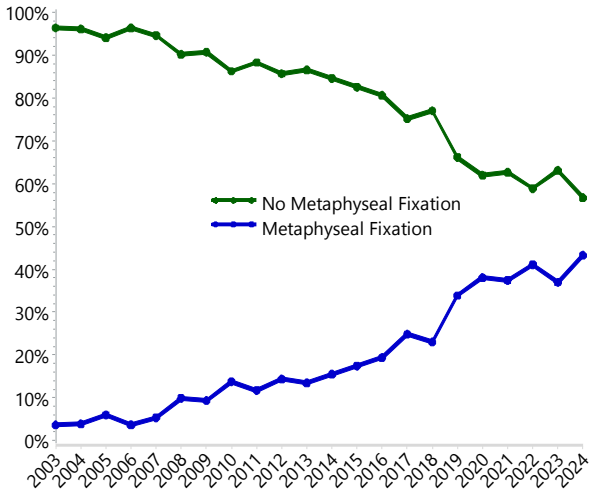


**Table N53** **Known Primary 1st Revision Total Knee Replacement by Use of Metaphyseal fixation in 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**

| Procedure Year | No Metaphyseal Fixation | | Metaphyseal Fixation | | TOTAL | |
|---|---|---|---|---|---|---|
| | N | Row% | N | Row% | N | Row% |
| ≤2002 | 69 | 92.0 | 6 | 8.0 | 75 | 100.0 |
| 2003 | 106 | 96.4 | 4 | 3.6 | 110 | 100.0 |
| 2004 | 221 | 96.1 | 9 | 3.9 | 230 | 100.0 |
| 2005 | 173 | 94.0 | 11 | 6.0 | 184 | 100.0 |
| 2006 | 184 | 96.3 | 7 | 3.7 | 191 | 100.0 |
| 2007 | 229 | 94.6 | 13 | 5.4 | 242 | 100.0 |
| 2008 | 210 | 90.1 | 23 | 9.9 | 233 | 100.0 |
| 2009 | 224 | 90.7 | 23 | 9.3 | 247 | 100.0 |
| 2010 | 282 | 86.2 | 45 | 13.8 | 327 | 100.0 |
| 2011 | 294 | 88.3 | 39 | 11.7 | 333 | 100.0 |
| 2012 | 293 | 85.7 | 49 | 14.3 | 342 | 100.0 |
| 2013 | 296 | 86.5 | 46 | 13.5 | 342 | 100.0 |
| 2014 | 323 | 84.6 | 59 | 15.4 | 382 | 100.0 |
| 2015 | 322 | 82.6 | 68 | 17.4 | 390 | 100.0 |
| 2016 | 320 | 80.6 | 77 | 19.4 | 397 | 100.0 |
| 2017 | 284 | 75.1 | 94 | 24.9 | 378 | 100.0 |
| 2018 | 335 | 77.0 | 100 | 23.0 | 435 | 100.0 |
| 2019 | 291 | 66.1 | 149 | 33.9 | 440 | 100.0 |
| 2020 | 251 | 62.0 | 154 | 38.0 | 405 | 100.0 |
| 2021 | 266 | 62.6 | 159 | 37.4 | 425 | 100.0 |
| 2022 | 235 | 58.9 | 164 | 41.1 | 399 | 100.0 |
| 2023 | 314 | 63.1 | 184 | 36.9 | 498 | 100.0 |
| 2024 | 283 | 56.7 | 216 | 43.3 | 499 | 100.0 |
| **TOTAL** | **5805** | **77.4** | **1699** | **22.6** | **7504** | **100.0** |

Note: Restricted to TKR (femoral/tibial), femoral only and tibial only 1st revisions

**Figure N64** **Known Primary 1st Revision Total Knee Replacement by Use of Metaphyseal fixation in 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**



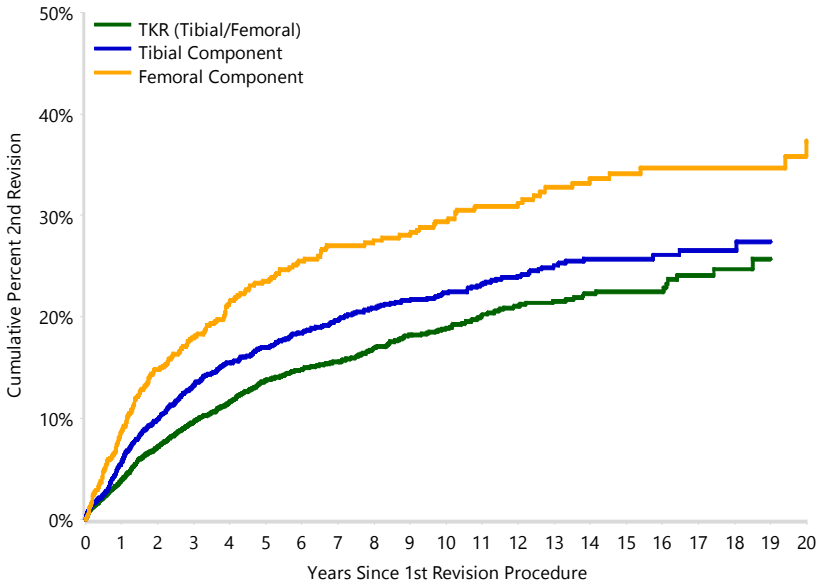

Note: Restricted to TKR (femoral/tibial), femoral only and tibial only 1st revisions

**Table N54 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Type of 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**

| Type of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| TKR (Tibial/Femoral) | 681 | 4824 | 3.9 (3.4, 4.5) | 9.6 (8.7, 10.5) | 13.7 (12.7, 14.9) | 18.9 (17.5, 20.3) | 22.5 (20.7, 24.5) | |
| Tibial Component | 407 | 2024 | 5.6 (4.7, 6.8) | 13.2 (11.7, 14.8) | 16.9 (15.3, 18.7) | 22.3 (20.4, 24.4) | 25.7 (23.4, 28.2) | |
| Femoral Component | 183 | 656 | 8.7 (6.8, 11.2) | 17.9 (15.1, 21.2) | 23.5 (20.3, 27.1) | 29.4 (25.7, 33.4) | 34.1 (29.9, 38.7) | 37.3 (32.0, 43.2) |
| TOTAL | 1271 | 7504 | | | | | | |

Note: Restricted to TKR (femoral/tibial), femoral only and tibial only 1st revisions.

**Figure N65 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Type of 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**




HR - adjusted for age and gender

Tibial Component vs TKR (Tibial/Femoral)

- 0 - 2Wk: HR=3.49 (95% CI 1.50, 8.09), p=0.003
- 2Wk - 6Mth: HR=0.84 (95% CI 0.57, 1.22), p=0.348
- 6Mth - 1Yr: HR=1.78 (95% CI 1.29, 2.44), p<0.001
- 1Yr - 1.5Yr: HR=1.26 (95% CI 0.90, 1.76), p=0.186
- 1.3.5Yr - 3.5Yr: HR=1.31 (95% CI 1.04, 1.66), p=0.022
- 3.5Yr - 5Yr: HR=0.80 (95% CI 0.56, 1.14), p=0.217
- 5Yr+: HR=1.06 (95% CI 0.82, 1.37), p=0.637

Femoral Component vs TKR (Tibial/Femoral)

- 0 - 1.5Yr: HR=1.97 (95% CI 1.54, 2.54), p<0.001
- 1.5Yr+: HR=1.34 (95% CI 1.08, 1.67), p=0.007

Femoral Component vs Tibial Component

- Entire Period: HR=1.33 (95% CI 1.12, 1.59), p=0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| TKR (Tibial/Femoral) | 4824 | 4223 | 3260 | 2452 | 990 | 279 | 38 |
| Tibial Component | 2024 | 1827 | 1510 | 1281 | 708 | 240 | 39 |
| Femoral Component | 656 | 576 | 463 | 387 | 249 | 123 | 42 |

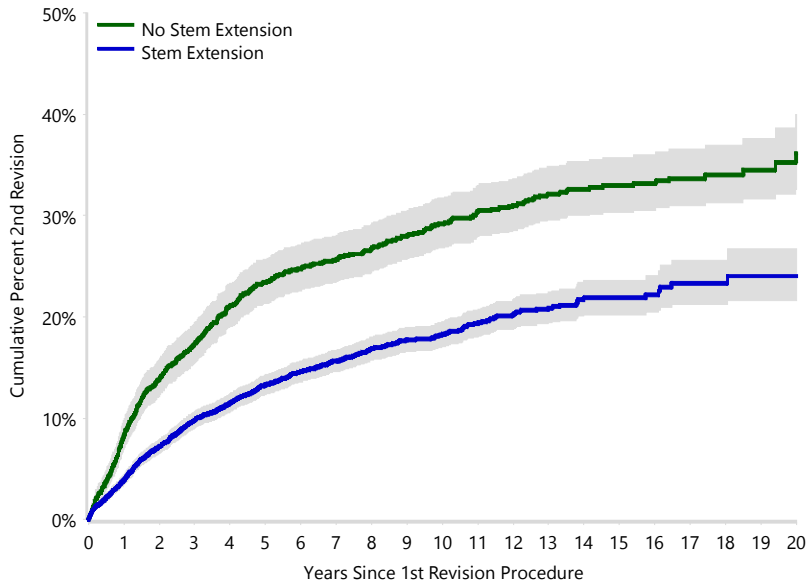
Note: Restricted to TKR (femoral/tibial), femoral only and tibial only 1st revisions.

**Table N55 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Stem Extension Used in 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**

| Stem Extension Used in 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| No Stem Extension | 433 | 1484 | 8.3 (7.0, 9.8) | 17.3 (15.5, 19.4) | 23.4 (21.3, 25.7) | 29.2 (26.8, 31.7) | 32.9 (30.3, 35.7) | 36.1 (32.6, 39.9) |
| Stem Extension | 838 | 6020 | 3.9 (3.4, 4.4) | 9.8 (9.0, 10.6) | 13.3 (12.4, 14.3) | 18.2 (17.0, 19.5) | 21.9 (20.2, 23.6) | 24.0 (21.6, 26.7) |
| TOTAL | 1271 | 7504 | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N66 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Stem Extension Used in 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**




HR - adjusted for age and gender

No Stem Extension vs Stem Extension

0 - 1Yr: HR=1.99 (95% CI 1.59, 2.48), p<0.001

1Yr+: HR=1.48 (95% CI 1.28, 1.69), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| No Stem Extension | 1484 | 1334 | 1131 | 980 | 667 | 331 | 71 |
| Stem Extension | 6020 | 5292 | 4102 | 3140 | 1280 | 311 | 48 |

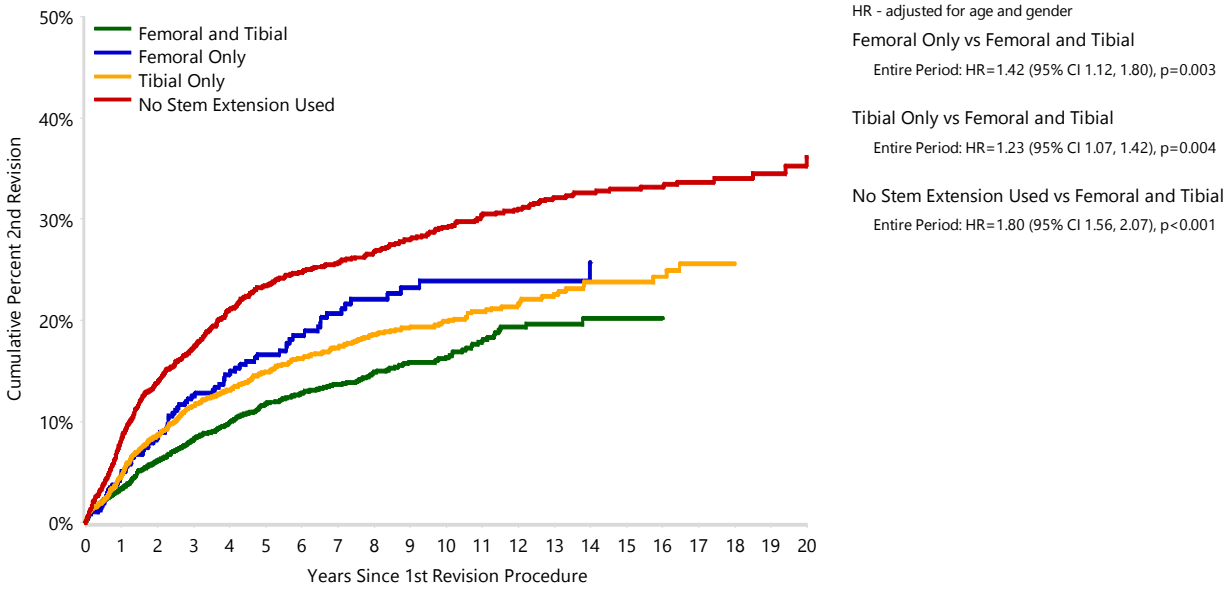
Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N56 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Stem Extension Used in 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**

| Stem Extension Used in 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Femoral and Tibial | 390 | 3422 | 3.4 (2.8, 4.0) | 8.2 (7.2, 9.2) | 11.7 (10.6, 13.0) | 16.3 (14.7, 18.1) | 20.2 (17.7, 22.9) | |
| Femoral Only | 83 | 478 | 5.1 (3.4, 7.5) | 12.5 (9.6, 16.1) | 16.6 (13.2, 20.8) | 23.9 (19.4, 29.2) | | |
| Tibial Only | 354 | 2062 | 4.6 (3.8, 5.6) | 11.5 (10.2, 13.0) | 14.9 (13.3, 16.6) | 19.9 (18.0, 22.0) | 23.7 (21.3, 26.4) | |
| No Stem Extension Used | 433 | 1484 | 8.3 (7.0, 9.8) | 17.3 (15.5, 19.4) | 23.4 (21.3, 25.7) | 29.2 (26.8, 31.7) | 32.9 (30.3, 35.7) | 36.1 (32.6, 39.9) |
| TOTAL | 1260 | 7446 | | | | | | |

Note: Restricted to TKR (femoral/tibial), femoral only and tibial only 1st revisions. Of these, excludes 58 procedures with a non-specified stem location.

**Figure N67 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Stem Extension Used in 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs | 21 Yrs |
|---|---|---|---|---|---|---|---|---|
| Femoral and Tibial | 3422 | 2965 | 2245 | 1615 | 509 | 79 | 7 | 3 |
| Femoral Only | 478 | 414 | 308 | 236 | 108 | 28 | 3 | 2 |
| Tibial Only | 2062 | 1855 | 1500 | 1242 | 628 | 179 | 26 | 9 |
| No Stem Extension Used | 1484 | 1334 | 1131 | 980 | 667 | 331 | 71 | 19 |

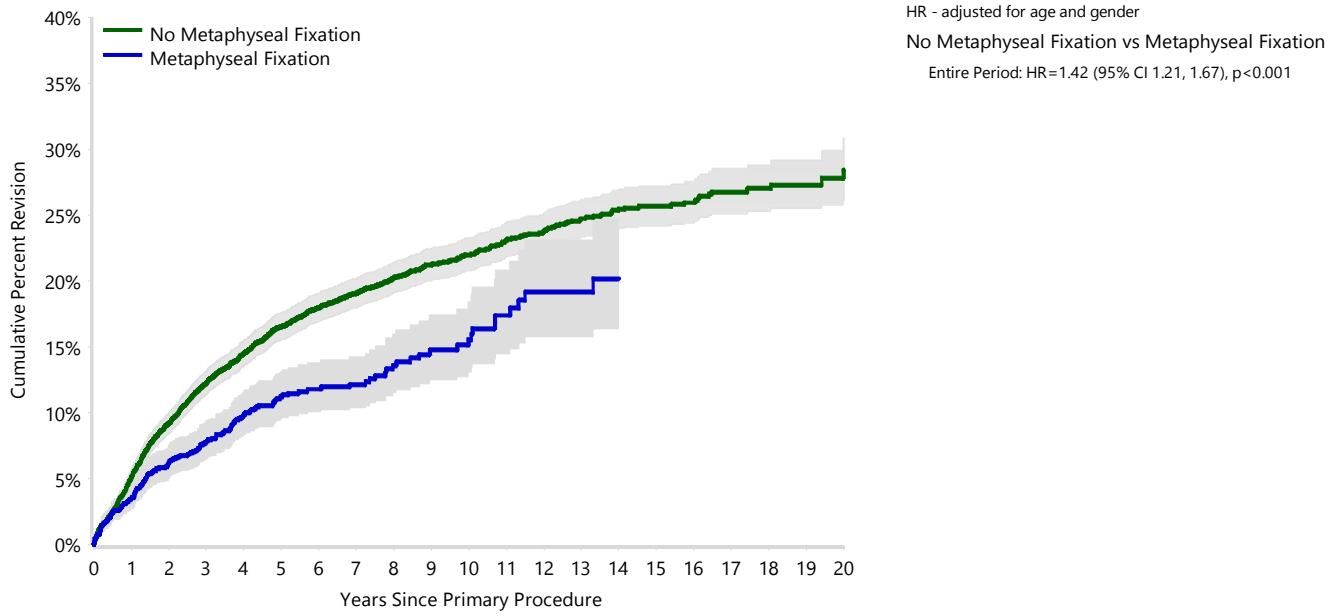
Note: Restricted to TKR (femoral/tibial), femoral only and tibial only 1st revisions. Of these, excludes 58 procedures with a non-specified stem location.

**Table N57 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Metaphyseal Fixation Used in 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**

| Use of Metaphyseal fixation in 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| No Metaphyseal Fixation | 1100 | 5805 | 5.1 (4.6, 5.8) | 12.3 (11.4, 13.2) | 16.6 (15.6, 17.6) | 22.0 (20.8, 23.3) | 25.7 (24.2, 27.2) | 28.4 (26.1, 30.9) |
| Metaphyseal Fixation | 171 | 1699 | 3.5 (2.7, 4.6) | 7.8 (6.5, 9.3) | 11.2 (9.6, 13.1) | 15.6 (13.1, 18.4) | | |
| **TOTAL** | **1271** | **7504** | | | | | | |

Note: Restricted to TKR (femoral/tibial), femoral only and tibial only 1st revisions

**Figure N68 Cumulative Percent Revision of Known Primary 1st Revision Total Knee Replacement by Metaphyseal Fixation for 1st Revision Since the Primary Procedure (Primary Diagnosis OA, 1st Revision for Loosening)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| No Metaphyseal Fixation | 5805 | 5208 | 4223 | 3448 | 1743 | 603 | 115 |
| Metaphyseal Fixation | 1699 | 1418 | 1010 | 672 | 204 | 39 | 4 |

Note: Restricted to TKR (femoral/tibial), femoral only and tibial only 1st revisions.

## PATELLA REASONS

After loosening, revision for patella reasons is the 2nd most common reason for 1st revision (19.4% of aseptic revisions). There are 5,924 primary TKRs that have been revised for patella reasons. Within this revision diagnosis category, there are 2,886 procedures for patella pain (48.7%), 2,762 for patella erosion (46.6%) and 276 for patella maltracking (4.7%). There are more females revised for patella reasons (56.2%). The mean age at revision is 69.3 years, and the median time to revision is 2.9 years (Table N42).

When the 1st revision is for patella reasons, 99.0% of revisions are patella revisions either alone (77.6%) or combined with a tibial insert revision (21.4%). There are very small numbers of TKR or femoral only revisions for these reasons. For knees revised for patella reasons, 97.2% did not have a patella component inserted in the primary procedure (Figure N69). Where the 1st revision is for patella reasons, the majority of procedures involve insertion of a patella component in a previously unresurfaced patella. There are 145 revisions for patella reasons where the initial procedure included a patella component, and that patella component was revised.

There are only 23 minor revision procedures for patella reasons that did not use a patella component in the revision procedure, and 15 of these had a prior patella prosthesis (Table N42).

Of the 5,924 1st revisions for patella reasons, 809 have had a 2nd revision. The 15 year cumulative percent 2nd revision is 18.9%. When a 1st revision for patella reasons is performed, the rate of 2nd revision is lower when an unresurfaced patella has a patella component inserted compared to when the patella component is revised (Table N58 and Figure N70).

Where the 1st revision was for patella reasons, the most common reasons for the 2nd revision are loosening (30.5%), infection (22.7%), instability (12.0%), and pain (11.2%). Further revision for any patella cause is uncommon (Table N51).

The most common types of 2nd revision are revision of both tibial and femoral components (47.6%), insert only (23.6%), patella only (7.9%), and femoral component only (6.7%) (Table N52).

**Figure N69 Trends in Patella Usage in Primary and Revision Total Knee Replacement Over Time (Primary Diagnosis OA, 1st Revision for Patella Reasons)**

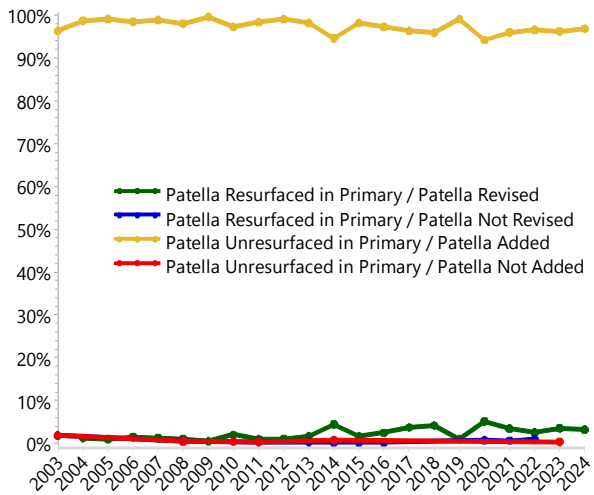
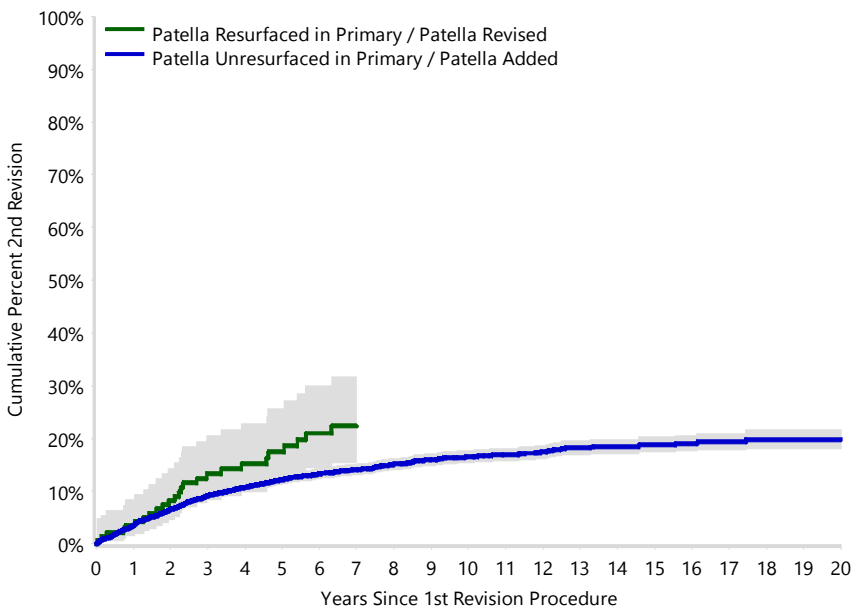


**Table N58 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Patella Usage at Primary and 1st Revision (Primary Diagnosis OA, 1st Revision for Patella Reasons)**

| Patella Usage in Primary and 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Patella Resurfaced in Primary / Patella Revised | 27 | 145 | 3.5 (1.5, 8.3) | 13.2 (8.4, 20.5) | 17.4 (11.6, 25.6) | | | |
| Patella Resurfaced in Primary / Patella Not Revised | 4 | 15 | 6.7 (1.0, 38.7) | 20.0 (6.9, 50.0) | 20.0 (6.9, 50.0) | 33.3 (12.9, 69.7) | | |
| Patella Unresurfaced in Primary / Patella Added | 777 | 5756 | 3.5 (3.1, 4.0) | 9.1 (8.4, 9.9) | 12.2 (11.3, 13.1) | 16.5 (15.4, 17.7) | 18.8 (17.4, 20.2) | 19.8 (18.0, 21.7) |
| Patella Unresurfaced in Primary / Patella Not Added | 1 | 8 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 16.7 (2.5, 72.7) | 16.7 (2.5, 72.7) | | |
| TOTAL | 809 | 5924 | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N70 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Patella Usage at Primary and 1st Revision (Primary Diagnosis OA, 1st Revision for Patella Reasons)**




HR - adjusted for age and gender
Patella Resurfaced in Primary / Patella Revised vs
Patella Unresurfaced in Primary / Patella Added
Entire Period: HR=1.53 (95% CI 1.04, 2.25), p=0.029

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Patella Resurfaced in Primary / Patella Revised | 145 | 130 | 98 | 69 | 26 | 4 | 1 |
| Patella Unresurfaced in Primary / Patella Added | 5756 | 5238 | 4288 | 3474 | 1603 | 428 | 46 |

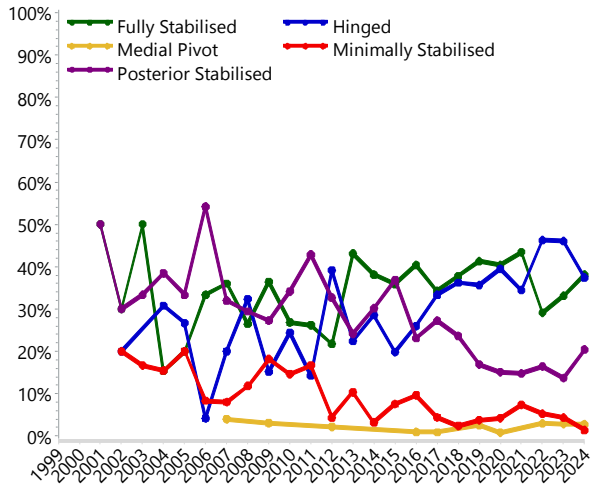
Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

## INSTABILITY

There are 3,755 primary TKRs that have been revised for instability, which is the 3rd most common reason for 1st aseptic revision (12.3%). More females are revised for instability (60.0%). The mean age at the time of revision for instability is 67.4 years, and the median time to revision is 2.4 years (Table N42).

The most common types of 1st revision procedures for instability are insert only (38.4%), TKR (both femoral and tibial components revised) (37.1%), insert/patella (14.5%), and femoral component only (6.5%). When a major revision is performed for instability, fully stabilised prostheses are used in 36.0%, hinged components in 33.0%, posterior stabilised in 23.4% and minimally stabilised prostheses in 6.3% of revision procedures (Table N42). Over time, the proportions of minimally stabilised and posterior stabilised components used in 1st revision for instability have declined (Figure N71).

**Figure N71 Trends in Implant Stability Use in Revision Total Knee Replacement Over Time (Primary Diagnosis OA, 1st Revision for Instability)**




Of the 3,755 primary TKR revised for instability, 579 have had a 2nd revision. The 15 year cumulative percent 2nd revision is 22.9% (Table N50 and Figure N62).

Where the 1st revision was for instability, the most common reasons for the 2nd revision are further instability (28.2%), loosening (24.2%), infection (22.8%), and pain (4.7%) (Table N51).

The most common types of 2nd revision are revision of both tibial and femoral components (48.4%), insert only (21.4%), patella only (8.1%), and femoral component only (7.3%) (Table N52).

When comparing major 1st revision procedures for instability, there is no difference in the rate of 2nd revision when one or both femoral and tibial components are revised (Table N59 and Figure N72).

There is a lower rate of 2nd revision when fully stabilised prostheses are used in the 1st revision for instability compared to posterior stabilised components. There is no difference in rate of 2nd revision when minimally stabilised or hinged prostheses are compared to fully stabilised designs (Table N60 and Figure N73).

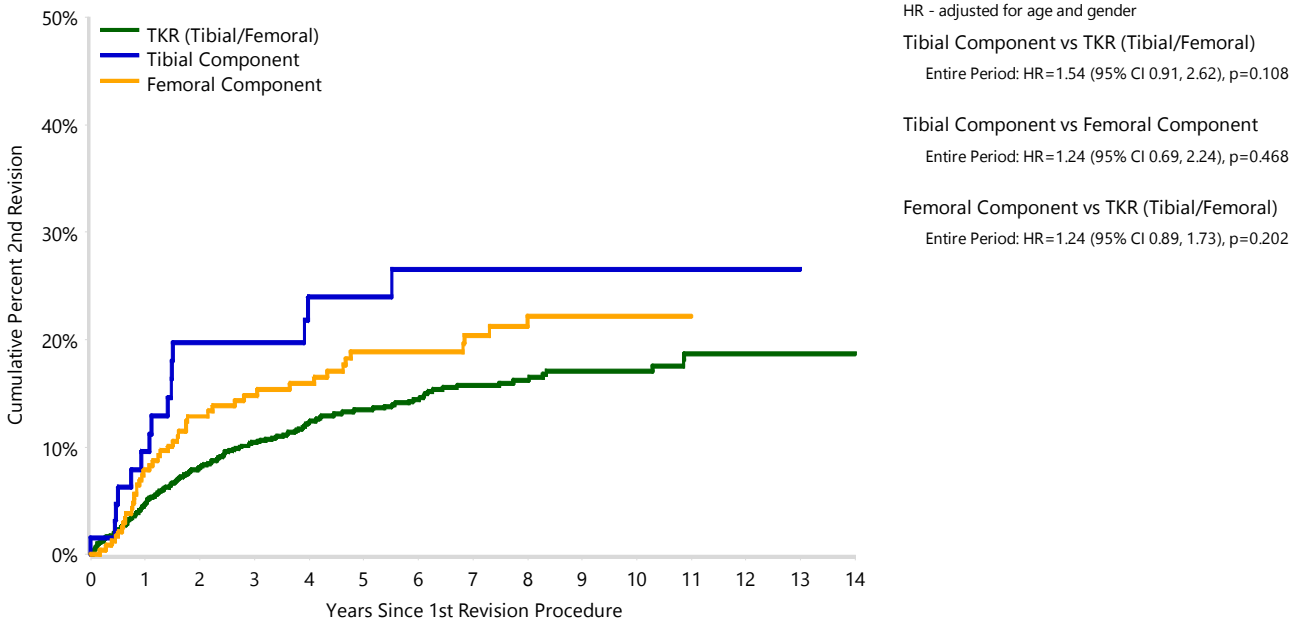
There is a lower rate of 2nd revision when a fully stabilised prosthesis is used for revision for instability, compared to PS components.

**Table N59 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Type of 1st Revision (Primary Diagnosis OA, 1st Revision for Instability)**

| Type of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| TKR (Tibial/Femoral) | 176 | 1394 | 4.7 (3.7, 6.0) | 10.4 (8.8, 12.3) | 13.5 (11.6, 15.7) | 17.0 (14.7, 19.8) | | |
| Tibial Component | 15 | 66 | 9.5 (4.4, 20.0) | 19.7 (11.7, 32.2) | 24.0 (14.9, 37.4) | 26.5 (16.7, 40.5) | | |
| Femoral Component | 44 | 243 | 7.8 (5.0, 12.2) | 14.8 (10.8, 20.2) | 18.8 (14.1, 24.9) | 22.2 (16.8, 28.9) | | |
| TOTAL | 235 | 1703 | | | | | | |

Note: Restricted to TKR (femoral/tibial), femoral only and tibial only 1st revisions.

**Figure N72 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Type of 1st Revision (Primary Diagnosis OA, 1st Revision for Instability)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| TKR (Tibial/Femoral) | 1394 | 1192 | 887 | 633 | 169 | 39 | 5 |
| Tibial Component | 66 | 55 | 44 | 32 | 21 | 5 | 1 |
| Femoral Component | 243 | 206 | 165 | 133 | 52 | 15 | 3 |

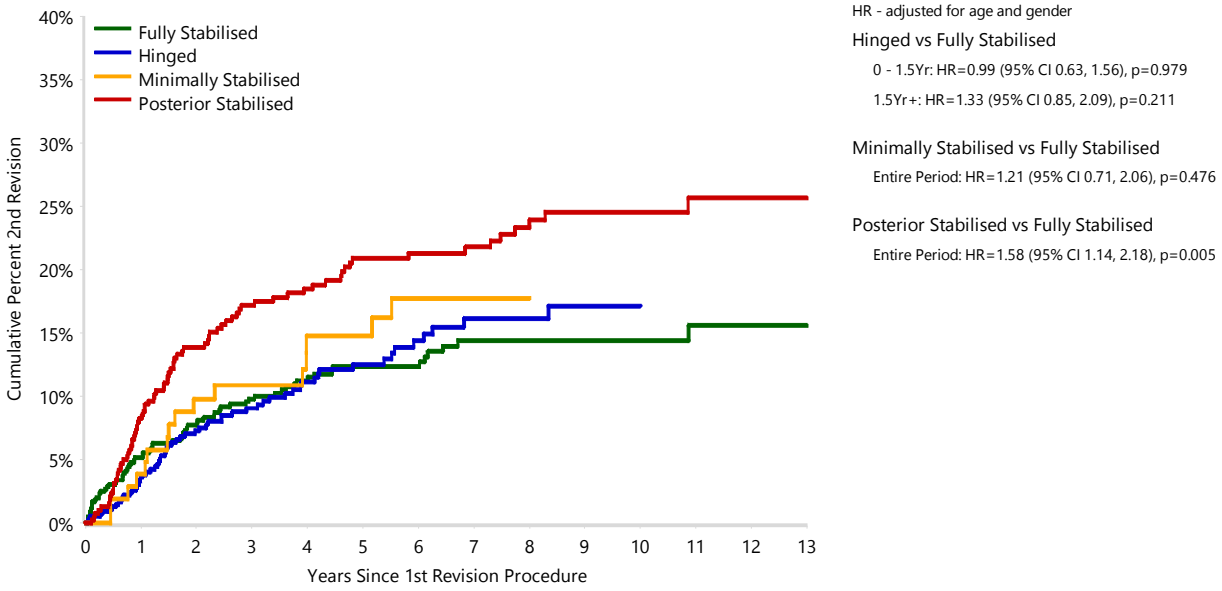
Note: Restricted to TKR (femoral/tibial), femoral only and tibial only 1st revisions.

**Table N60 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Stability of 1st Revision (Primary Diagnosis OA, 1st Revision for Instability)**

| Stability of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Minimally Stabilised | 17 | 106 | 3.9 (1.5, 9.9) | 10.9 (6.2, 18.8) | 14.8 (9.0, 23.8) | | | |
| Posterior Stabilised | 82 | 394 | 8.3 (5.9, 11.6) | 17.2 (13.7, 21.5) | 20.9 (17.0, 25.6) | 24.5 (20.0, 29.8) | | |
| Medial Pivot | 2 | 22 | 5.6 (0.8, 33.4) | 11.1 (2.9, 37.6) | 11.1 (2.9, 37.6) | | | |
| Fully Stabilised | 69 | 606 | 5.2 (3.7, 7.3) | 9.8 (7.6, 12.7) | 12.4 (9.7, 15.6) | 14.4 (11.4, 18.1) | | |
| Hinged | 63 | 556 | 3.6 (2.3, 5.6) | 9.1 (6.8, 12.1) | 12.5 (9.7, 16.2) | 17.1 (13.2, 22.1) | | |
| TOTAL | 233 | 1684 | | | | | | |

Note: Restricted to TKR (femoral/tibial), femoral only and tibial only 1st revisions. Of these, excludes 19 procedures with unknown stability in 1st revision.

**Figure N73 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Stability of 1st Revision (Primary Diagnosis OA, 1st Revision for Instability)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Fully Stabilised | 606 | 512 | 402 | 286 | 82 | 26 | 5 |
| Hinged | 556 | 477 | 329 | 222 | 49 | 6 | 0 |
| Minimally Stabilised | 106 | 99 | 78 | 59 | 28 | 7 | 0 |
| Posterior Stabilised | 394 | 333 | 267 | 217 | 81 | 20 | 4 |

Note: Restricted to TKR (femoral/tibial), femoral only and tibial only 1st revisions. Of these, excludes 19 procedures with unknown stability in 1st revision.

## Revision Arthroplasty

### PAIN

There are 2,992 primary TKR procedures revised with a 1st revision diagnosis of pain (9.8% of aseptic 1st revisions). Females are more commonly revised for pain (55.1%). The mean age at time of revision for pain is 68.5 years, and the median time to revision is 2.5 years (Table N42).

The most common types of 1st revision for pain are patella only (45.2%), insert/patella (23.1%), both femoral and tibial components (16.6%), and insert only (8.9%). Of those revised for pain, 68.4% did not have a patella component in the primary procedure and a patella component was inserted in 95.0% of these. Where major components were revised, 98.2% of femoral components and 97.7% of the tibial components used cement fixation in the 2nd revision (Table N42)

Of the 2,992 primary total knee replacements revised for pain, 457 have had a 2nd revision. The 15 year cumulative percent 2nd revision for pain is 21.5% (Table N50 and Figure N62).

Where the 1st revision was for pain, the most common reasons for the 2nd revision are loosening (31.1%), infection (21.2%), further pain (15.3%), and instability (12.7%) (Table N51).

The most common types of 2nd revision procedures are revision of both tibial and femoral components (49.2%), insert only (18.8%), patella only (9.0%), and femoral component only (7.2%) (Table N52).

When a major 1st revision is performed for pain, there is no difference in rate of 2nd revision with the class of 1st revision (Table N61 and Figure N74).

There is no difference in 2nd revision rate with 1st revision procedures for pain.

There is no difference in rate of 2nd revision when a major 1st revision for pain involves revision of the femoral or tibial component, or both (Table N62 and Figure N75).

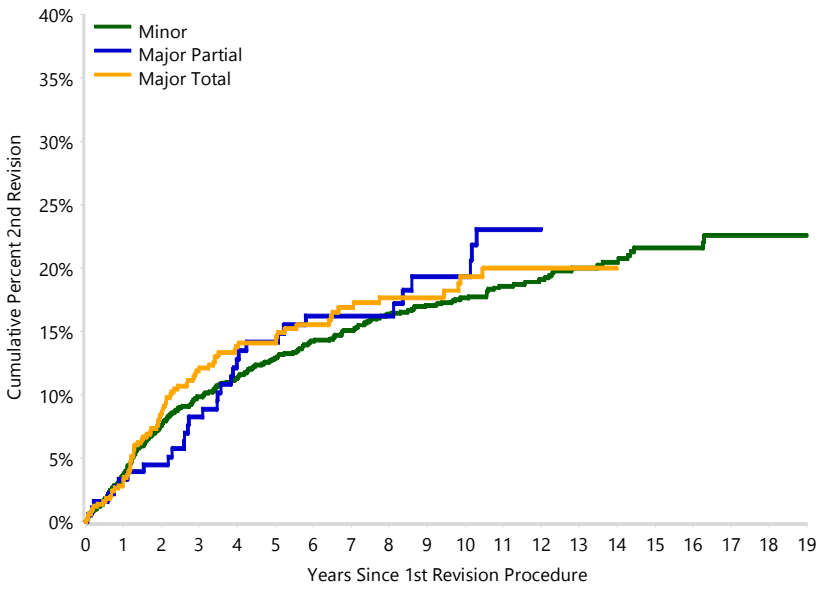
There is no difference in the 2nd revision rate when using a patella component in revision for pain compared to when no patella component is used (Table N63 and Figure N76).

**Table N61 Cumulative Percent 2nd Revision of Known Primary 1st Revision Total Knee Replacement by Class of 1st Revision (Primary Diagnosis OA, 1st Revision for Pain)**

| Class of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Minor | 346 | 2309 | 3.7 (3.0, 4.6) | 9.8 (8.7, 11.2) | 12.9 (11.5, 14.4) | 17.6 (15.9, 19.6) | 21.6 (19.3, 24.2) | |
| Major Partial | 32 | 185 | 3.3 (1.5, 7.3) | 8.3 (5.0, 13.6) | 14.1 (9.6, 20.6) | 19.3 (13.7, 26.9) | | |
| Major Total | 79 | 498 | 3.3 (2.0, 5.3) | 12.1 (9.4, 15.5) | 14.1 (11.2, 17.6) | 19.4 (15.6, 23.8) | | |
| TOTAL | 457 | 2992 | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N74 Cumulative Percent 2nd Revision of Known Primary 1st Revision Total Knee Replacement by Class of 1st Revision (Primary Diagnosis OA, 1st Revision for Pain)**




HR - adjusted for age and gender

Minor vs Major Partial

Entire Period: HR=0.93 (95% CI 0.65, 1.34), p=0.697

Major Total vs Minor

Entire Period: HR=0.99 (95% CI 0.78, 1.27), p=0.954

Major Total vs Major Partial

Entire Period: HR=0.92 (95% CI 0.61, 1.39), p=0.706

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Minor | 2309 | 2095 | 1750 | 1378 | 662 | 229 | 28 |
| Major Partial | 185 | 168 | 145 | 124 | 65 | 21 | 3 |
| Major Total | 498 | 463 | 375 | 306 | 139 | 34 | 4 |

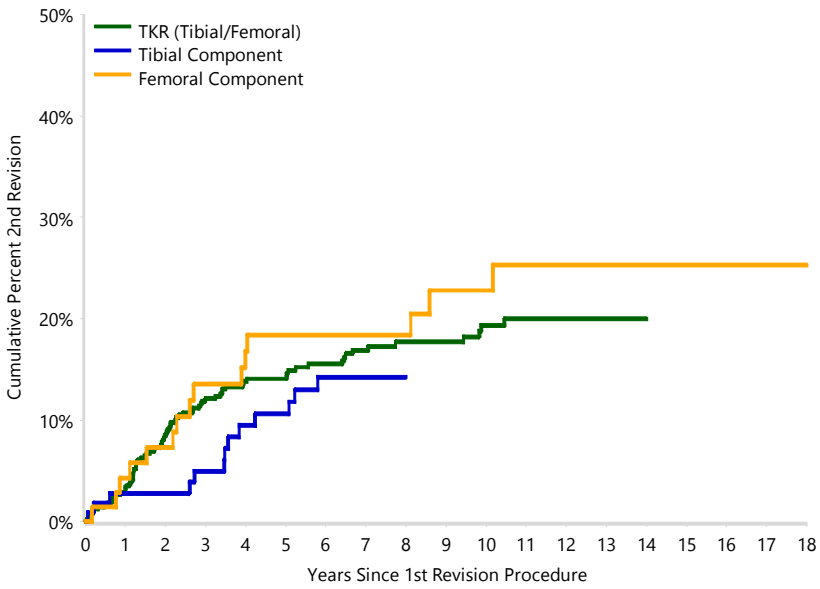
Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N62 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Type of 1st Revision (Primary Diagnosis OA, 1st Revision for Pain)**

| Type of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| TKR (Tibial/Femoral) | 79 | 498 | 3.3 (2.0, 5.3) | 12.1 (9.4, 15.5) | 14.1 (11.2, 17.6) | 19.4 (15.6, 23.8) | | |
| Tibial Component | 16 | 109 | 2.8 (0.9, 8.4) | 5.0 (2.1, 11.6) | 10.6 (5.8, 18.9) | | | |
| Femoral Component | 15 | 73 | 4.3 (1.4, 12.8) | 13.5 (7.3, 24.4) | 18.4 (10.9, 30.2) | 22.8 (14.0, 35.8) | 25.3 (15.8, 38.9) | |
| TOTAL | 110 | 680 | | | | | | |

Note: Restricted to TKR (femoral/tibial), femoral only and tibial only 1st revisions.

**Figure N75 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Type of 1st Revision (Primary Diagnosis OA, 1st Revision for Pain)**




HR - adjusted for age and gender

TKR (Tibial/Femoral) vs Tibial Component

Entire Period: HR=1.09 (95% CI 0.64, 1.88), p=0.742

Femoral Component vs TKR (Tibial/Femoral)

Entire Period: HR=1.28 (95% CI 0.73, 2.22), p=0.385

Femoral Component vs Tibial Component

Entire Period: HR=1.40 (95% CI 0.69, 2.83), p=0.350

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| TKR (Tibial/Femoral) | 498 | 463 | 375 | 306 | 139 | 34 | 4 |
| Tibial Component | 109 | 99 | 88 | 75 | 34 | 11 | 2 |
| Femoral Component | 73 | 66 | 54 | 49 | 31 | 10 | 1 |

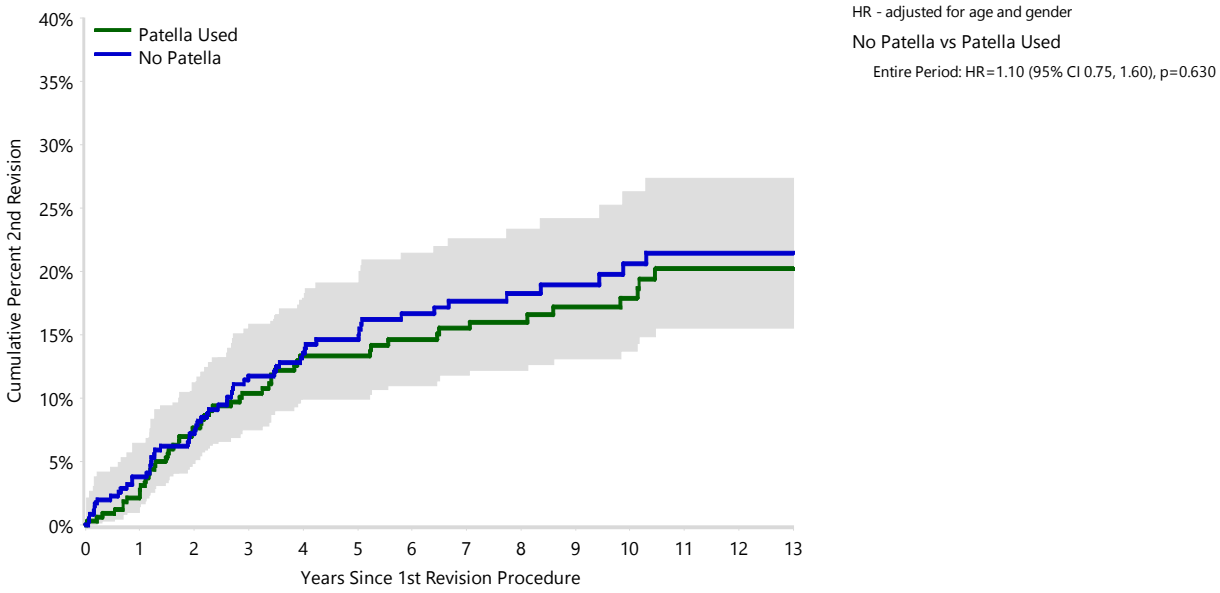
Note: Restricted to TKR (femoral/tibial), femoral only and tibial only 1st revisions.

**Table N63 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Patella Usage in 1st Revision (Primary Diagnosis OA, 1st Revision for Pain)**

| Patella Usage in 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Patella Used | 52 | 330 | 2.8 (1.5, 5.3) | 10.4 (7.5, 14.4) | 13.4 (10.0, 17.8) | 17.9 (13.7, 23.2) | | |
| No Patella | 58 | 350 | 3.8 (2.2, 6.5) | 11.8 (8.7, 15.8) | 14.6 (11.2, 19.1) | 20.6 (16.0, 26.3) | | |
| TOTAL | 110 | 680 | | | | | | |

Note: Restricted to TKR (femoral/tibial), femoral only and tibial only 1st revisions.

**Figure N76 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Patella Usage in 1st Revision (Primary Diagnosis OA, 1st Revision for Pain)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Patella Used | 330 | 309 | 256 | 216 | 110 | 30 | 4 |
| No Patella | 350 | 319 | 261 | 214 | 94 | 25 | 3 |

Note: Restricted to TKR (femoral/tibial), femoral only and tibial only 1st revisions.

# Revision Arthroplasty

## ARTHROFIBROSIS

Arthrofibrosis is the reason for 4.9% of aseptic 1st revisions of primary TKR procedures for osteoarthritis. There are 1,502 primary TKR procedures revised for arthrofibrosis. There are more males than females revised for arthrofibrosis (54.0%). The mean age at the time of revision for arthrofibrosis is 66.1 years, and the median time to revision is 1.6 years (Table N42).

The most common types of 1st revision for arthrofibrosis are both femoral and tibial components (31.5%), insert only (31.2%), insert/patella (13.9%), femoral component only (9.9%), and patella only (7.4%).

Of the 1,502 primary TKR procedures revised for arthrofibrosis, 289 have had a 2nd revision. The 15 year cumulative percent 2nd revision for this reason is 29.3% (Table N50 and Figure N62).

Where the 1st revision was for arthrofibrosis, the most common reasons for the 2nd revision are further arthrofibrosis (30.1%), loosening (22.1%), infection (21.1%), and pain (5.9%).

When the reason for 1st revision is arthrofibrosis, the most common types of 2nd revision are revision of both tibial and femoral components (49.8%), insert only (18.7%), cement spacer (8.0%), femoral component only (7.6%), and tibial component only (7.3%) (Table N52).

When comparing the more common types of 1st revision procedures, insert only has a higher rate of 2nd revision compared to revision of both femoral and tibial components (Table N64 and Figure N77).

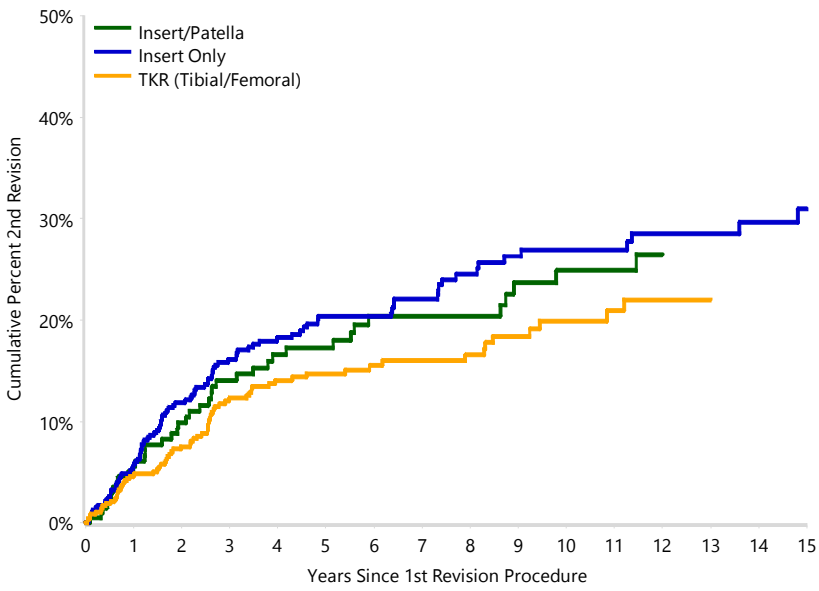
> Insert only 1st revisions for arthrofibrosis have a higher rate of 2nd revision than revision of femoral and tibial components.

When the stability of the prostheses used for 1st revisions for arthrofibrosis is compared, minimally stabilised components have a higher rate of 2nd revision compared to fully stabilised, but there is no difference when the other groups are compared (Table N65 and Figure N78).

**Table N64 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Type of 1st Revision (Primary Diagnosis OA, 1st Revision for Arthrofibrosis)**

| Type of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Insert/Patella | 41 | 209 | 5.6 (3.1, 9.8) | 14.0 (9.8, 20.0) | 17.3 (12.4, 23.7) | 24.9 (18.5, 33.0) | | |
| Insert Only | 98 | 469 | 5.8 (4.0, 8.4) | 16.2 (12.9, 20.1) | 20.4 (16.6, 24.8) | 26.9 (22.2, 32.4) | 30.9 (25.2, 37.6) | |
| TKR (Tibial/Femoral) | 73 | 473 | 4.6 (3.0, 7.0) | 12.3 (9.5, 15.9) | 14.7 (11.6, 18.6) | 19.9 (15.7, 25.1) | | |
| TOTAL | 212 | 1151 | | | | | | |

**Figure N77 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Type of 1st Revision (Primary Diagnosis OA, 1st Revision for Arthrofibrosis)**




HR - adjusted for age and gender

Insert/Patella vs TKR (Tibial/Femoral)

Entire Period: HR=1.22 (95% CI 0.83, 1.79), p=0.308

Insert Only vs Insert/Patella

Entire Period: HR=1.12 (95% CI 0.77, 1.61), p=0.558

Insert Only vs TKR (Tibial/Femoral)

Entire Period: HR=1.36 (95% CI 1.00, 1.85), p=0.047

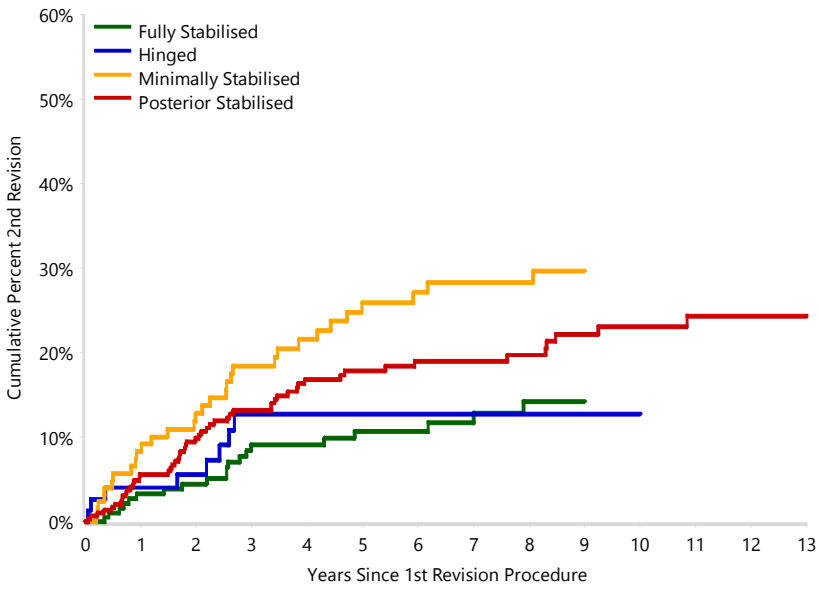
| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Insert/Patella | 209 | 180 | 140 | 115 | 59 | 18 | 4 |
| Insert Only | 469 | 400 | 294 | 218 | 105 | 53 | 9 |
| TKR (Tibial/Femoral) | 473 | 419 | 322 | 241 | 90 | 26 | 0 |

**Table N65 Cumulative Percent 2nd Revision of Known Primary 1st Revision Total Knee Replacement by Stability of 1st Revision (Primary Diagnosis OA, 1st Revision for Arthrofibrosis)**

| Stability of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Fully Stabilised | 23 | 191 | 3.3 (1.5, 7.1) | 9.1 (5.6, 14.7) | 10.7 (6.7, 16.7) | | | |
| Hinged | 9 | 75 | 4.1 (1.3, 12.1) | 12.7 (6.5, 24.1) | 12.7 (6.5, 24.1) | 12.7 (6.5, 24.1) | | |
| Medial Pivot | 1 | 11 | 9.1 (1.3, 49.2) | 9.1 (1.3, 49.2) | 9.1 (1.3, 49.2) | | | |
| Minimally Stabilised | 36 | 125 | 8.3 (4.6, 14.9) | 18.5 (12.4, 27.0) | 25.9 (18.6, 35.4) | | | |
| Posterior Stabilised | 54 | 303 | 5.6 (3.5, 9.0) | 13.2 (9.6, 17.9) | 17.9 (13.6, 23.2) | 23.1 (17.8, 29.7) | | |
| **TOTAL** | **123** | **705** | | | | | | |

Note: Restricted to major total and major partial revisions. Of these, excludes 8 procedures with unknown stability.

**Figure N78 Cumulative Percent 2nd Revision of Known Primary 1st Revision Total Knee Replacement by Stability of 1st Revision (Primary Diagnosis OA, 1st Revision for Arthrofibrosis)**




HR - adjusted for age and gender

Hinged vs Fully Stabilised

Entire Period: HR=1.14 (95% CI 0.53, 2.46), p=0.745

Minimally Stabilised vs Fully Stabilised

Entire Period: HR=2.34 (95% CI 1.39, 3.96), p=0.001

Posterior Stabilised vs Fully Stabilised

Entire Period: HR=1.45 (95% CI 0.89, 2.37), p=0.135

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Fully Stabilised | 191 | 171 | 136 | 107 | 39 | 8 | 0 |
| Hinged | 75 | 67 | 44 | 29 | 9 | 2 | 0 |
| Minimally Stabilised | 125 | 105 | 84 | 66 | 38 | 14 | 2 |
| Posterior Stabilised | 303 | 259 | 205 | 156 | 71 | 27 | 1 |

Note: Restricted to major total and major partial revisions. Of these, excludes 8 procedures with unknown stability.

**FRACTURE**

Fracture is the reason for 5.0% of aseptic 1st revisions of primary TKR procedures for osteoarthritis. There are 1,510 primary TKR procedures revised for fracture. There are more females than males revised for fracture (76.8%). The mean age at the time of revision for fracture is 74.3 years, and the median time to revision is 4.3 years (Table N42).

The most common types of 1st revision for fracture are both femoral and tibial components (59.7%), tibial component only (14.3%), patella only (9.9%), femoral component only (8.3%) and insert only (4.0%). Minor revisions for fracture are most likely accompanying fracture fixation procedures.

There is no difference in 2nd revision rate with constraint of the revision procedure, including distal femoral replacement and hinged procedures.

Of the 1,510 primary TKR procedures revised for fracture, 209 have had a 2nd revision. The 10 year cumulative percent 2nd revision for this reason is 20.4% (Table N50 and Figure N62).

Where the 1st revision was for fracture, the most common reasons for the 2nd revision are infection (36.4%), loosening (24.4%), further fracture (14.4%) and instability (6.7%) (Table N51).

The most common types of 2nd revision are insert only (28.7%), femoral component only (22.5%), both femoral and tibial components (21.5%) and patella only (8.1%) (Table N52).

When comparing the more common types of 1st revision procedures, there is no difference in the rate of 2nd revision except for tibial component only revision, which has a higher rate of 2nd revision compared to a revision of both femoral and tibial components in the first month only (Table N66 and Figure N79).

Where the 1st revision is for fracture, there is a lower rate of 2nd revision where cement fixation is used for the revised femoral component (Table N67 and Figure N80). Similarly, when the 1st revision is for fracture, there is a lower rate of 2nd revision where cement is used for fixation of the revised tibial component (Table N68 and Figure N81).

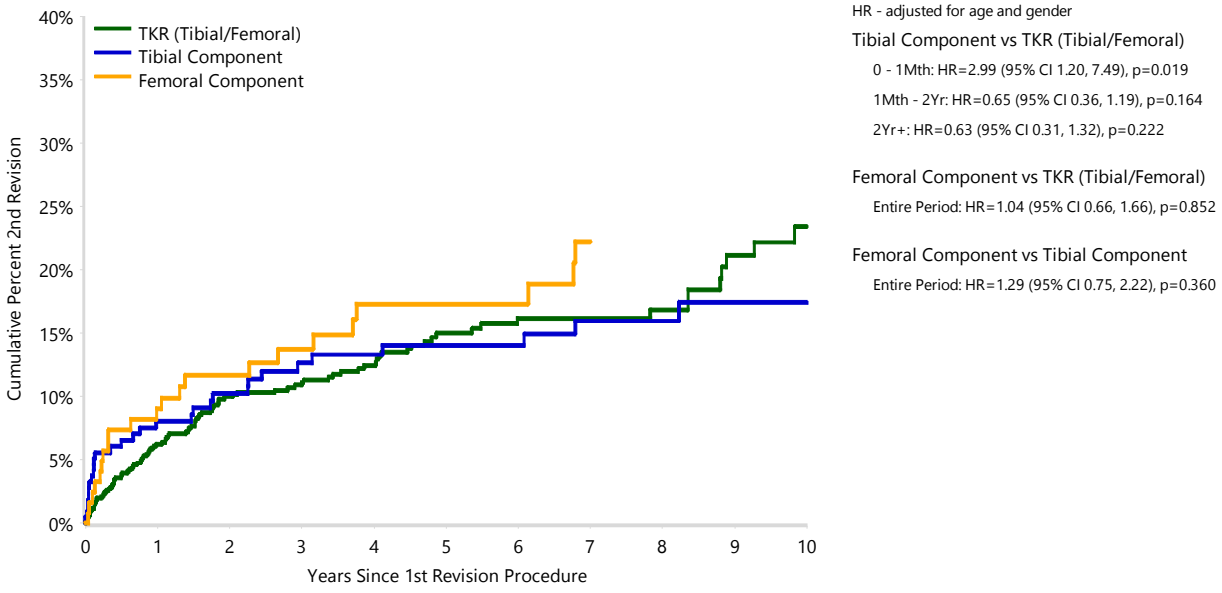
Where the 1st revision is for fracture, there is no difference in the rate of 2nd revision when comparing the use of articulations of varying levels of constraint (Table N69 and Figure N82).

**Table N66 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Type of 1st Revision (Primary Diagnosis OA, 1st Revision for Fracture)**

| Type of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| TKR (Tibial/Femoral) | 108 | 902 | 6.2 (4.8, 8.1) | 10.9 (8.8, 13.4) | 15.0 (12.3, 18.2) | 23.4 (18.3, 29.7) | | |
| Tibial Component | 30 | 216 | 8.0 (5.1, 12.6) | 12.6 (8.7, 18.2) | 14.0 (9.8, 19.9) | 17.4 (12.2, 24.6) | | |
| Femoral Component | 23 | 125 | 9.0 (5.1, 15.7) | 13.8 (8.6, 21.5) | 17.3 (11.3, 26.0) | | | |
| TOTAL | 161 | 1243 | | | | | | |

Note: Restricted to TKR (femoral/tibial), femoral only and tibial only 1st revisions.

**Figure N79 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Type of 1st Revision (Primary Diagnosis OA, 1st Revision for Fracture)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| TKR (Tibial/Femoral) | 902 | 682 | 434 | 256 | 58 | 12 | 0 |
| Tibial Component | 216 | 181 | 134 | 107 | 44 | 8 | 1 |
| Femoral Component | 125 | 108 | 78 | 60 | 24 | 10 | 2 |

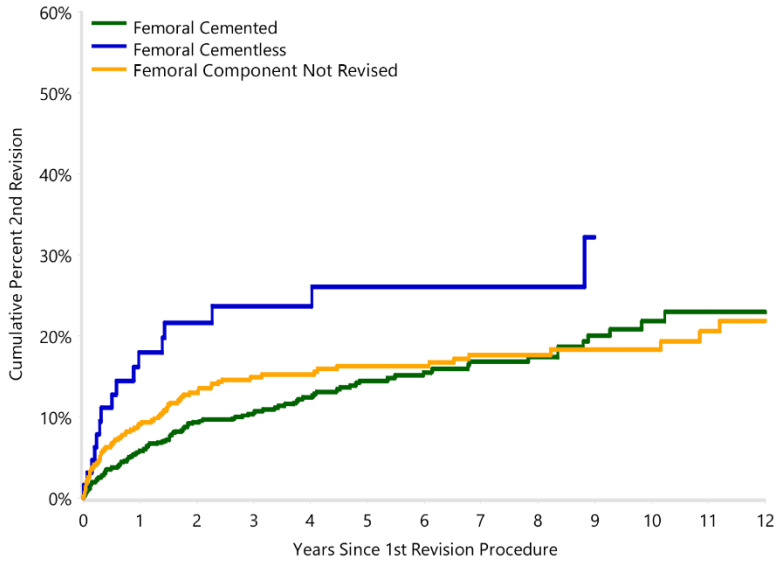
Note: Restricted to TKR (femoral/tibial), femoral only and tibial only 1st revisions.

**Table N67 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Femoral Fixation of 1st Revision (Primary Diagnosis OA, 1st Revision for Fracture)**

| Femoral Fixation of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Femoral Cemented | 115 | 962 | 5.8 (4.4, 7.6) | 10.4 (8.4, 12.8) | 14.5 (11.9, 17.5) | 21.8 (17.5, 27.1) | | |
| Femoral Cementless | 16 | 65 | 17.9 (10.3, 30.1) | 23.7 (14.7, 36.9) | 26.0 (16.4, 39.7) | | | |
| Femoral Component Not Revised | 78 | 483 | 9.2 (6.9, 12.1) | 14.9 (11.9, 18.6) | 16.3 (13.0, 20.2) | 18.3 (14.7, 22.8) | | |
| TOTAL | 209 | 1510 | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N80 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Femoral Fixation of 1st Revision (Primary Diagnosis OA, 1st Revision for Fracture)**




HR - adjusted for age and gender

Femoral Cementless vs Femoral Cemented

Entire Period: HR=2.02 (95% CI 1.20, 3.42), p=0.008

Femoral Cementless vs Femoral Component Not Revised

Entire Period: HR=2.01 (95% CI 1.17, 3.47), p=0.011

Femoral Component Not Revised vs Femoral Cemented

0 – 2Yr: HR=1.20 (95% CI 0.85, 1.68), p=0.304

2Yr+: HR=0.65 (95% CI 0.38, 1.13), p=0.129

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Femoral Cemented | 962 | 743 | 478 | 289 | 75 | 21 | 2 |
| Femoral Cementless | 65 | 47 | 34 | 27 | 7 | 1 | 0 |
| Femoral Component Not Revised | 483 | 400 | 283 | 215 | 86 | 19 | 5 |

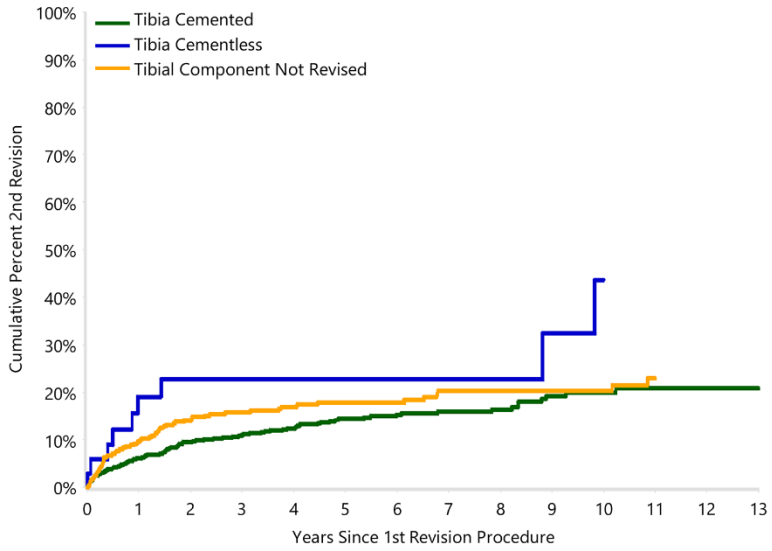
Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N68 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Tibial Fixation of 1st Revision (Primary Diagnosis OA, 1st Revision for Fracture)**

| Tibial Fixation of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Tibia Cemented | 129 | 1083 | 6.2 (4.8, 7.9) | 10.9 (9.0, 13.1) | 14.4 (12.0, 17.1) | 19.9 (16.2, 24.2) | | |
| Tibia Cementless | 9 | 35 | 19.1 (9.0, 37.7) | 22.7 (11.5, 42.1) | 22.7 (11.5, 42.1) | 43.7 (21.9, 73.6) | | |
| Tibial Component Not Revised | 71 | 392 | 9.7 (7.1, 13.2) | 15.8 (12.4, 20.0) | 17.8 (14.1, 22.4) | 20.2 (16.0, 25.3) | | |
| TOTAL | 209 | 1510 | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N81 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Tibial Fixation of 1st Revision (Primary Diagnosis OA, 1st Revision for Fracture)**




HR – adjusted for age and gender

Tibia Cementless vs Tibia Cemented
Entire period: HR=2.13 (95% CI 1.08, 4.19), p=0.028

Tibia Cementless vs Tibial Component Not Revised
Entire period: HR=1.84 (95% CI 0.92, 3.71), p=0.086

Tibial Component Not Revised vs Tibia Cemented
Entire period: HR=1.15 (95% CI 0.86, 1.56), p=0.343

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs | 21 Yrs |
|---|---|---|---|---|---|---|---|---|
| Tibia Cemented | 1083 | 840 | 552 | 349 | 97 | 17 | 1 | 0 |
| Tibia Cementless | 35 | 23 | 16 | 14 | 5 | 3 | 0 | 0 |
| Tibial Component Not Revised | 392 | 327 | 227 | 168 | 66 | 21 | 6 | 5 |

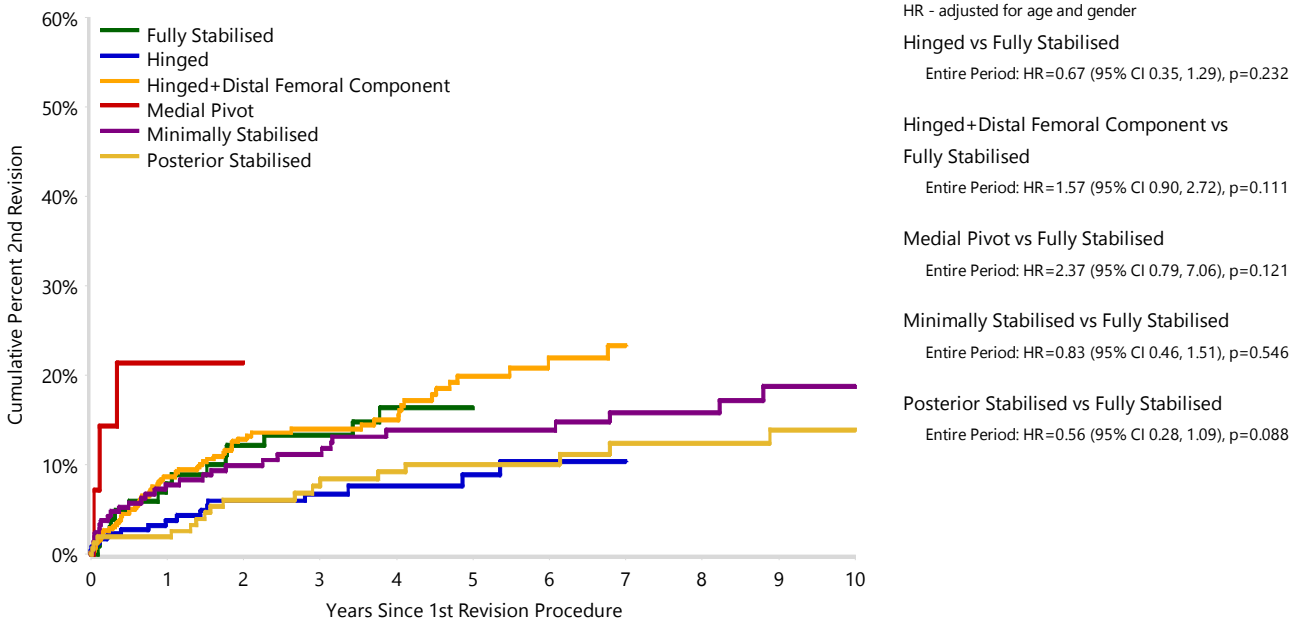
Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N69 Cumulative Percent Revision of Known Primary 1st Revision Total Knee Replacement by Stability and Distal Femoral Replacement of 1st Revision (Primary Diagnosis OA, 1st Revision for Fracture)**

| Stability and Distal Femoral Component of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|
| Fully Stabilised | 17 | 106 | 7.9 (4.0, 15.2) | 13.4 (8.0, 21.9) | 16.4 (10.1, 25.9) | | |
| Hinged | 19 | 232 | 3.8 (1.9, 7.4) | 6.7 (3.9, 11.4) | 8.9 (5.3, 14.8) | | |
| Hinged + Distal Femoral Component | 68 | 488 | 8.6 (6.3, 11.8) | 14.0 (10.8, 18.0) | 19.9 (15.5, 25.4) | | |
| Medial Pivot | 4 | 14 | 21.4 (7.5, 52.8) | | | | |
| Minimally Stabilised | 30 | 214 | 7.8 (4.8, 12.4) | 11.1 (7.5, 16.5) | 13.9 (9.6, 19.8) | 18.7 (13.0, 26.5) | |
| Posterior Stabilised | 17 | 157 | 1.9 (0.6, 5.8) | 7.6 (4.3, 13.3) | 10.1 (6.1, 16.5) | 13.9 (8.7, 21.9) | |
| TOTAL | 155 | 1211 | | | | | |

Note: Restricted to major total and major partial revisions. Of these, excludes 32 procedures with missing stability.

**Figure N82 Cumulative Percent Revision of Known Primary 1st Revision Total Knee Replacement by Stability and Distal Femoral Replacement of 1st Revision (Primary Diagnosis OA, 1st Revision for Fracture)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Fully Stabilised | 106 | 91 | 60 | 43 | 10 | 1 | 0 |
| Hinged | 232 | 183 | 118 | 68 | 17 | 3 | 0 |
| Hinged+ Distal Femoral Component | 488 | 339 | 197 | 103 | 10 | 0 | 0 |
| Medial Pivot | 14 | 9 | 2 | 2 | 0 | 0 | 0 |
| Minimally Stabilised | 214 | 177 | 135 | 106 | 41 | 13 | 3 |
| Posterior Stabilised | 157 | 148 | 118 | 92 | 42 | 10 | 0 |

Note: Restricted to major total and major partial revisions. Of these, excludes 32 procedures with missing stability.

# Revision Arthroplasty

## TIMING OF 1ST REVISION

The timing of the 1st revision was classified as early if it occurred within 2 years of the primary procedure (<2 years) or late if it occurred 2 years or more (≥2 years) after the primary procedure. There are 11,249 early 1st revisions (36.9%). 1st revisions performed within 2 years have a higher rate of 2nd revision when compared to late 1st revisions after 3months and until 4.5 years, with no difference outside of this period (Table N70 and Figure N83).

The most common reasons for early revision are loosening, instability and patellofemoral pain, while the most common reasons for late revision are loosening, instability and patella erosion. Revisions for implant breakage or wear more often occur late (Table N71).

Loosening, infection and instability are the most common reasons for 2nd revision for both early and late 1st revisions (Figure N84).

There are 32.9% (n=3,156) of 1st revisions for loosening that occur early; 37.4% (n=2,215) of 1st revisions for patella reasons that occur early, 39.2% (n=1,173) of 1st revisions for pain that occur early; and 58.4% (n=873) of 1st revisions for arthrofibrosis that occur early (Table N71 and Figure N84). For all of these reasons for revision, early 1st revisions have a higher rate of revision compared to late 1st revisions (Table N72 to Table N75 and Figure N85 to Figure N88).

There are 1,621 early 1st revisions for instability (43.2% of 1st revisions for instability). 1st revisions performed within 2 years have a higher rate of 2nd revision for the first 1.5 years compared to late 1st revisions for instability (Table N76 and Figure N89).

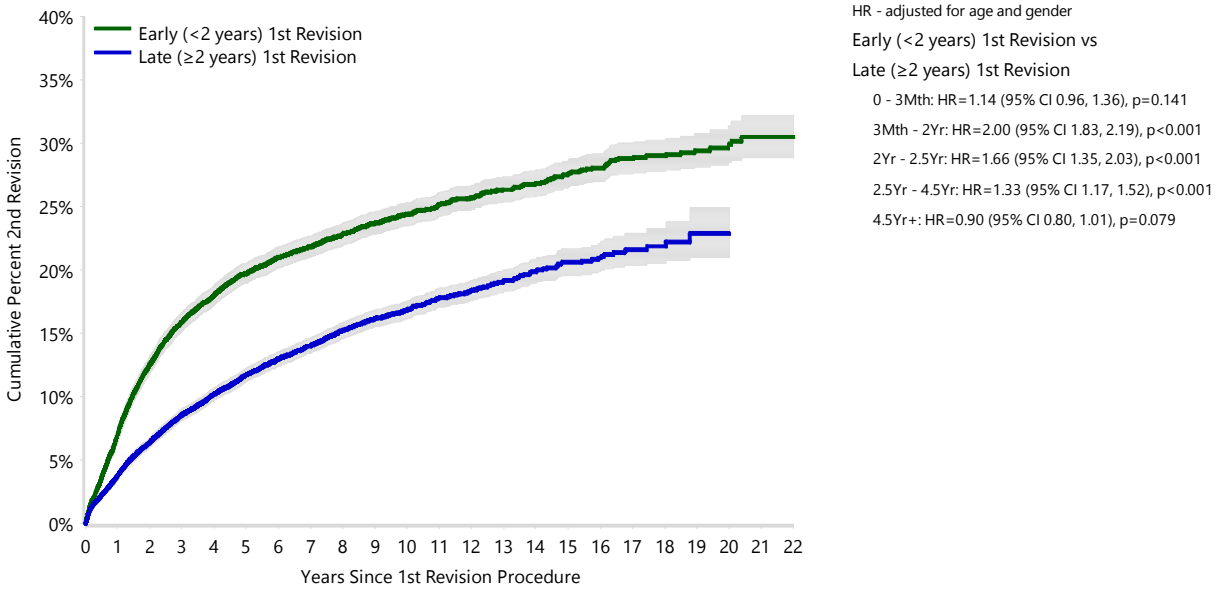
There are 547 early 1st revisions for fracture (36.4% of 1st revisions for fracture). There is no difference in rate of 2nd revision comparing early and late 1st revisions for fracture (Table N77 and Figure N90).

**Table N70 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Timing of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| Timing of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Early (<2 years) 1st Revision | 2446 | 11249 | 7.0 (6.6, 7.5) | 15.9 (15.2, 16.6) | 19.7 (19.0, 20.5) | 24.4 (23.5, 25.3) | 27.6 (26.6, 28.7) | 29.9 (28.5, 31.4) |
| Late (≥2 years) 1st Revision | 2379 | 19211 | 3.8 (3.5, 4.1) | 8.6 (8.2, 9.0) | 11.7 (11.2, 12.2) | 16.9 (16.2, 17.6) | 20.6 (19.6, 21.6) | 22.9 (21.0, 24.9) |
| TOTAL | 4825 | 30460 | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N83 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Timing of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Early (<2 years) 1st Revision | 11249 | 9915 | 7990 | 6540 | 3470 | 1306 | 270 |
| Late (≥2 years) 1st Revision | 19211 | 16822 | 13031 | 9880 | 3853 | 840 | 46 |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N71 Reasons for 1st Revision Total Knee Replacement by Timing of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| 1st Revision Diagnosis | Early (<2 years) 1st Revision | | | Late (≥2 years) 1st Revision | | | TOTAL | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | Row% | Col% | N | Row% | Col% | N | Row% | Col% |
| Arthrofibrosis | 877 | 58.4 | 7.8 | 625 | 41.6 | 3.3 | 1502 | 100.0 | 4.9 |
| Bearing Dislocation | 159 | 71.9 | 1.4 | 62 | 28.1 | 0.3 | 221 | 100.0 | 0.7 |
| Fracture | 547 | 36.2 | 4.9 | 963 | 63.8 | 5.0 | 1510 | 100.0 | 5.0 |
| Heterotopic Bone | 7 | 36.8 | 0.1 | 12 | 63.2 | 0.1 | 19 | 100.0 | 0.1 |
| Implant Breakage Femoral | 12 | 22.6 | 0.1 | 41 | 77.4 | 0.2 | 53 | 100.0 | 0.2 |
| Implant Breakage Patella | 39 | 21.2 | 0.3 | 145 | 78.8 | 0.8 | 184 | 100.0 | 0.6 |
| Implant Breakage Tibial | 19 | 20.0 | 0.2 | 76 | 80.0 | 0.4 | 95 | 100.0 | 0.3 |
| Implant Breakage Tibial Insert | 55 | 13.1 | 0.5 | 364 | 86.9 | 1.9 | 419 | 100.0 | 1.4 |
| Incorrect Side | 2 | 100.0 | 0.0 | . | . | . | 2 | 100.0 | 0.0 |
| Incorrect Sizing | 250 | 69.4 | 2.2 | 110 | 30.6 | 0.6 | 360 | 100.0 | 1.2 |
| Instability | 1621 | 43.2 | 14.4 | 2134 | 56.8 | 11.1 | 3755 | 100.0 | 12.3 |
| Loosening | 3156 | 32.9 | 28.1 | 6434 | 67.1 | 33.5 | 9590 | 100.0 | 31.5 |
| Lysis | 105 | 12.0 | 0.9 | 770 | 88.0 | 4.0 | 875 | 100.0 | 2.9 |
| Malalignment | 397 | 49.4 | 3.5 | 406 | 50.6 | 2.1 | 803 | 100.0 | 2.6 |
| Metal Related Pathology | 84 | 19.7 | 0.7 | 342 | 80.3 | 1.8 | 426 | 100.0 | 1.4 |
| Osteonecrosis | 23 | 39.7 | 0.2 | 35 | 60.3 | 0.2 | 58 | 100.0 | 0.2 |
| Pain | 1173 | 39.2 | 10.4 | 1819 | 60.8 | 9.5 | 2992 | 100.0 | 9.8 |
| Patella Dislocation | 1 | 50.0 | 0.0 | 1 | 50.0 | 0.0 | 2 | 100.0 | 0.0 |
| Patella Erosion | 768 | 27.8 | 6.8 | 1994 | 72.2 | 10.4 | 2762 | 100.0 | 9.1 |
| Patella Maltracking | 166 | 60.1 | 1.5 | 110 | 39.9 | 0.6 | 276 | 100.0 | 0.9 |
| Patellofemoral Pain | 1281 | 44.4 | 11.4 | 1605 | 55.6 | 8.4 | 2886 | 100.0 | 9.5 |
| Progression Of Disease | 1 | 8.3 | 0.0 | 11 | 91.7 | 0.1 | 12 | 100.0 | 0.0 |
| Prosthesis Dislocation | 74 | 59.2 | 0.7 | 51 | 40.8 | 0.3 | 125 | 100.0 | 0.4 |
| Synovitis | 53 | 44.9 | 0.5 | 65 | 55.1 | 0.3 | 118 | 100.0 | 0.4 |
| Tumour | 9 | 27.3 | 0.1 | 24 | 72.7 | 0.1 | 33 | 100.0 | 0.1 |
| Wear Femoral | . | . | . | 3 | 100.0 | 0.0 | 3 | 100.0 | 0.0 |
| Wear Patella | 6 | 8.1 | 0.1 | 68 | 91.9 | 0.4 | 74 | 100.0 | 0.2 |
| Wear Tibial | 3 | 18.8 | 0.0 | 13 | 81.3 | 0.1 | 16 | 100.0 | 0.1 |
| Wear Tibial Insert | 75 | 8.4 | 0.7 | 819 | 91.6 | 4.3 | 894 | 100.0 | 2.9 |
| Other | 286 | 72.4 | 2.5 | 109 | 27.6 | 0.6 | 395 | 100.0 | 1.3 |
| **TOTAL** | **11249** | **36.9** | **100.0** | **19211** | **63.1** | **100.0** | **30460** | **100.0** | **100.0** |

Note: Excluding 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N84 Cumulative Incidence 2nd Revision Diagnosis of Known Primary 1st Revision Total Knee Replacement by Timing of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

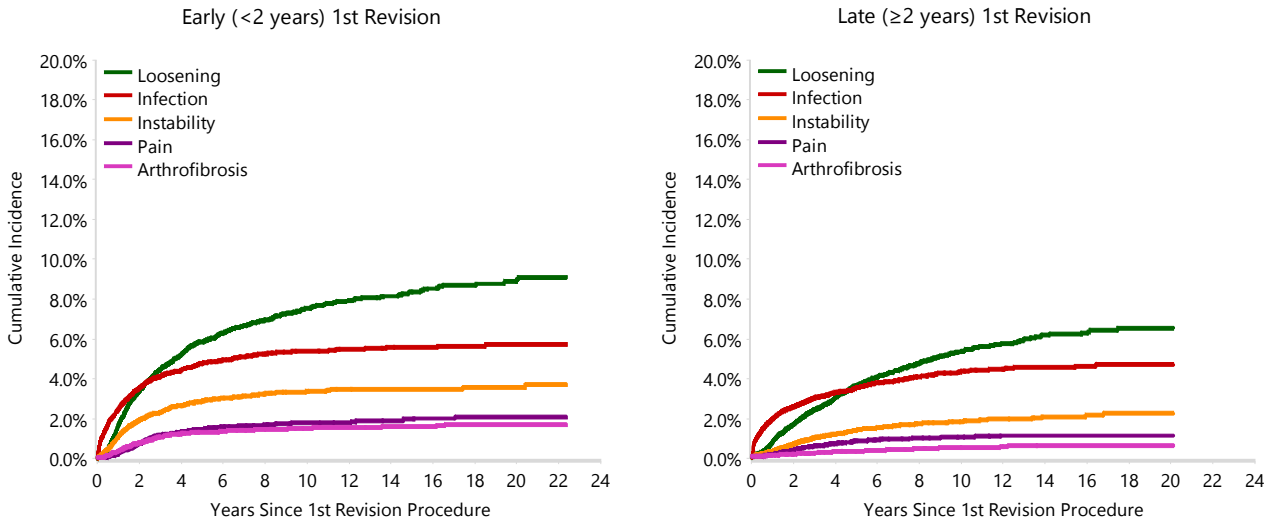
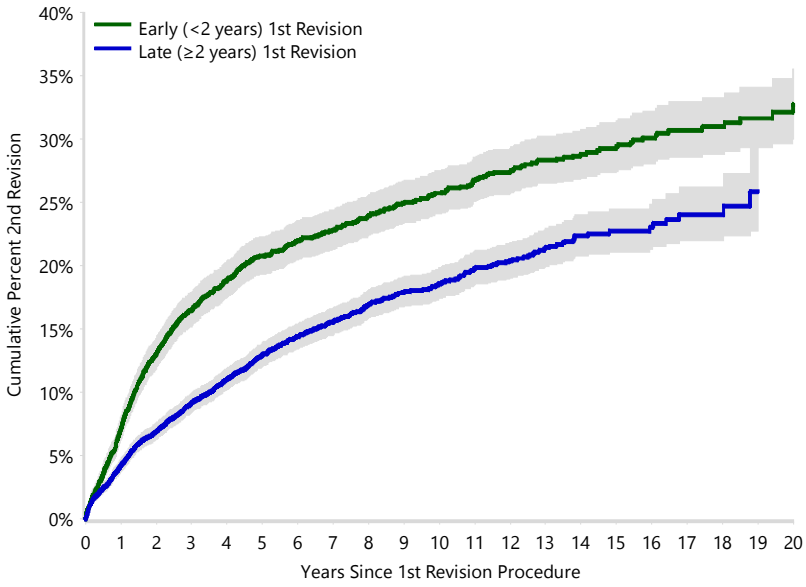


**Table N72 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Timing of 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**

| Timing of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Early (<2 years) 1st Revision | 751 | 3156 | 7.1 (6.2, 8.0) | 16.5 (15.2, 17.9) | 20.7 (19.3, 22.3) | 25.7 (24.1, 27.5) | 29.4 (27.5, 31.4) | 32.7 (30.0, 35.6) |
| Late (≥2 years) 1st Revision | 902 | 6434 | 4.2 (3.7, 4.7) | 9.2 (8.4, 9.9) | 12.9 (12.1, 13.9) | 18.6 (17.4, 19.9) | 22.7 (21.1, 24.5) | |
| TOTAL | 1653 | 9590 | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N85 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Timing of 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**




HR - adjusted for age and gender

Early (<2 years) 1st Revision vs

Late (≥2 years) 1st Revision

0 - 1.5Yr: HR=1.65 (95% CI 1.42, 1.91), p<0.001

1.5Yr - 2.5Yr: HR=2.06 (95% CI 1.59, 2.66), p<0.001

2.5Yr+: HR=1.01 (95% CI 0.87, 1.17), p=0.934

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Early (<2 years) 1st Revision | 3156 | 2814 | 2283 | 1901 | 1075 | 436 | 116 |
| Late (≥2 years) 1st Revision | 6434 | 5629 | 4381 | 3371 | 1422 | 371 | 22 |

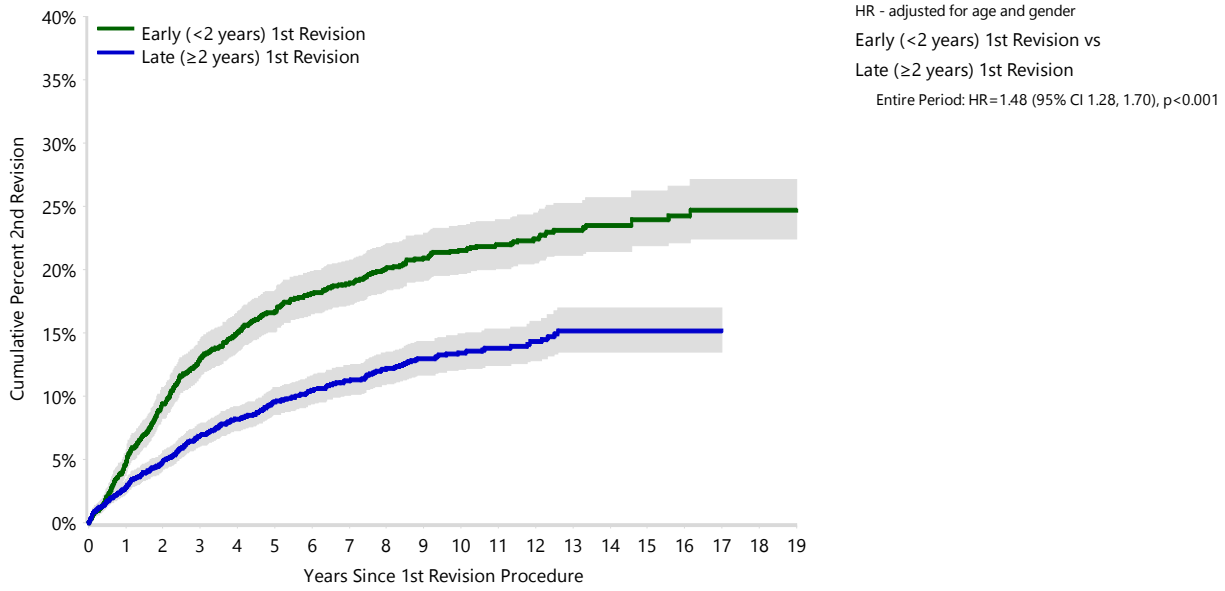
Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N73 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Timing of 1st Revision (Primary Diagnosis OA, 1st Revision for Patella Reasons)**

| Timing of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Early (<2 years) 1st Revision | 434 | 2215 | 4.6 (3.8, 5.6) | 12.9 (11.6, 14.5) | 16.7 (15.1, 18.4) | 21.5 (19.7, 23.5) | 24.0 (21.9, 26.2) | |
| Late (≥2 years) 1st Revision | 375 | 3709 | 2.8 (2.3, 3.4) | 6.9 (6.1, 7.8) | 9.6 (8.6, 10.7) | 13.4 (12.1, 14.9) | 15.2 (13.5, 17.0) | |
| TOTAL | 809 | 5924 | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N86 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Timing of 1st Revision (Primary Diagnosis OA, 1st Revision for Patella Reasons)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs | 21 Yrs |
|---|---|---|---|---|---|---|---|---|
| Early (<2 years) 1st Revision | 2215 | 2048 | 1699 | 1451 | 828 | 286 | 38 | 19 |
| Late (≥2 years) 1st Revision | 3709 | 3342 | 2702 | 2103 | 810 | 147 | 9 | 2 |

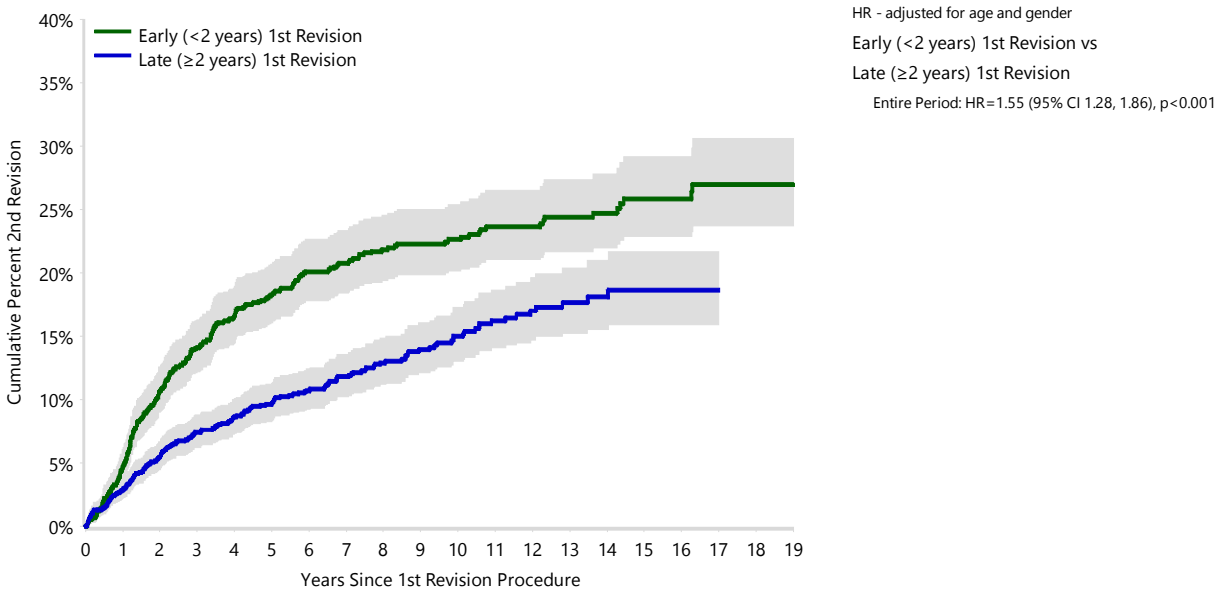
Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N74 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Timing of 1st Revision (Primary Diagnosis OA, 1st Revision for Pain)**

| Timing of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Early (<2 years) 1st Revision | 246 | 1173 | 4.7 (3.6, 6.1) | 14.1 (12.2, 16.3) | 18.3 (16.1, 20.7) | 22.6 (20.1, 25.4) | 25.9 (22.9, 29.1) | |
| Late (≥2 years) 1st Revision | 211 | 1819 | 2.9 (2.2, 3.8) | 7.4 (6.3, 8.8) | 9.7 (8.3, 11.2) | 15.0 (13.1, 17.3) | 18.6 (15.9, 21.7) | |
| TOTAL | 457 | 2992 | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N87 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Timing of 1st Revision (Primary Diagnosis OA, 1st Revision for Pain)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Early (<2 years) 1st Revision | 1173 | 1072 | 892 | 746 | 416 | 173 | 30 |
| Late (≥2 years) 1st Revision | 1819 | 1654 | 1378 | 1062 | 450 | 111 | 5 |

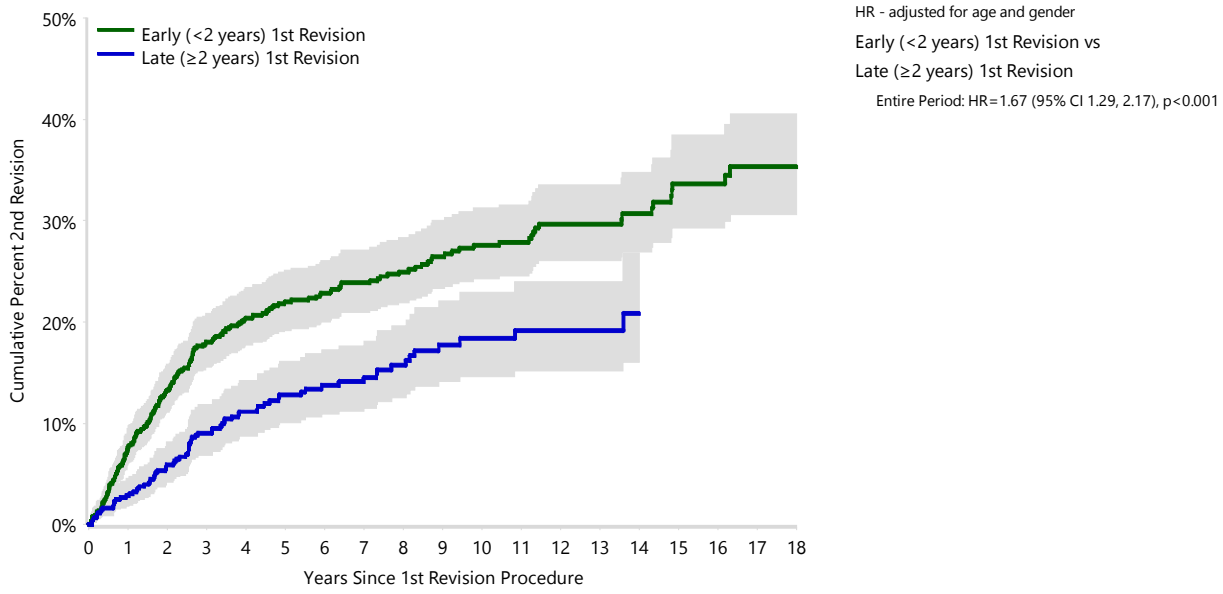
Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N75 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Timing of 1st Revision (Primary Diagnosis OA, 1st Revision for Arthrofibrosis)**

| Timing of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Early (<2 years) 1st Revision | 210 | 877 | 7.6 (6.0, 9.6) | 18.0 (15.5, 20.9) | 22.0 (19.2, 25.1) | 27.6 (24.3, 31.2) | 33.6 (29.3, 38.4) | |
| Late (≥2 years) 1st Revision | 79 | 625 | 2.8 (1.8, 4.5) | 9.0 (6.9, 11.8) | 12.8 (10.1, 16.1) | 18.3 (14.6, 22.9) | | |
| TOTAL | 289 | 1502 | | | | | | |

Note: Excluding 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N88 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Timing of 1st Revision (Primary Diagnosis OA, 1st Revision for Arthrofibrosis)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs | 21 Yrs |
|---|---|---|---|---|---|---|---|---|
| Early (<2 years) 1st Revision | 877 | 754 | 583 | 464 | 246 | 106 | 17 | 11 |
| Late (≥2 years) 1st Revision | 625 | 543 | 416 | 308 | 119 | 32 | 1 | 0 |

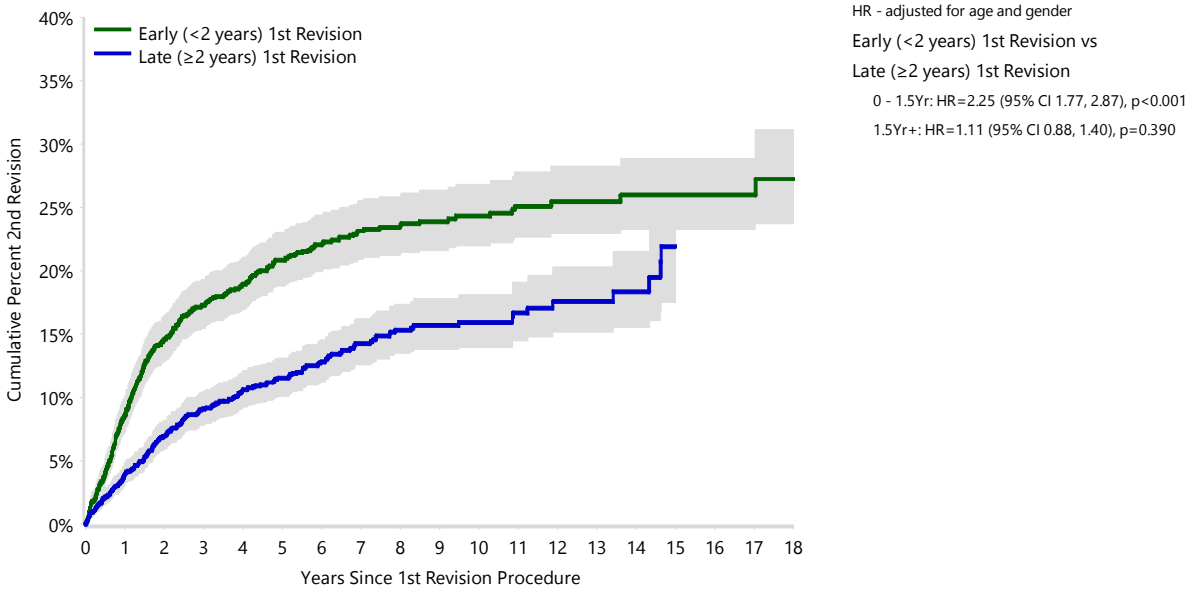
Note: Excluding 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N76 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Timing of 1st Revision (Primary Diagnosis OA, 1st Revision for Instability)**

| Timing of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Early (<2 years) 1st Revision | 332 | 1621 | 8.5 (7.2, 10.0) | 17.3 (15.5, 19.3) | 20.8 (18.8, 23.1) | 24.3 (22.0, 26.8) | 26.0 (23.3, 28.9) | |
| Late (≥2 years) 1st Revision | 247 | 2134 | 3.9 (3.2, 4.9) | 9.1 (7.9, 10.5) | 11.5 (10.1, 13.1) | 15.9 (14.0, 18.1) | 21.9 (17.5, 27.3) | |
| TOTAL | 579 | 3755 | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N89 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Timing of 1st Revision (Primary Diagnosis OA, 1st Revision for Instability)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Early (<2 years) 1st Revision | 1621 | 1367 | 1059 | 826 | 321 | 102 | 16 |
| Late (≥2 years) 1st Revision | 2134 | 1861 | 1401 | 999 | 280 | 56 | 4 |

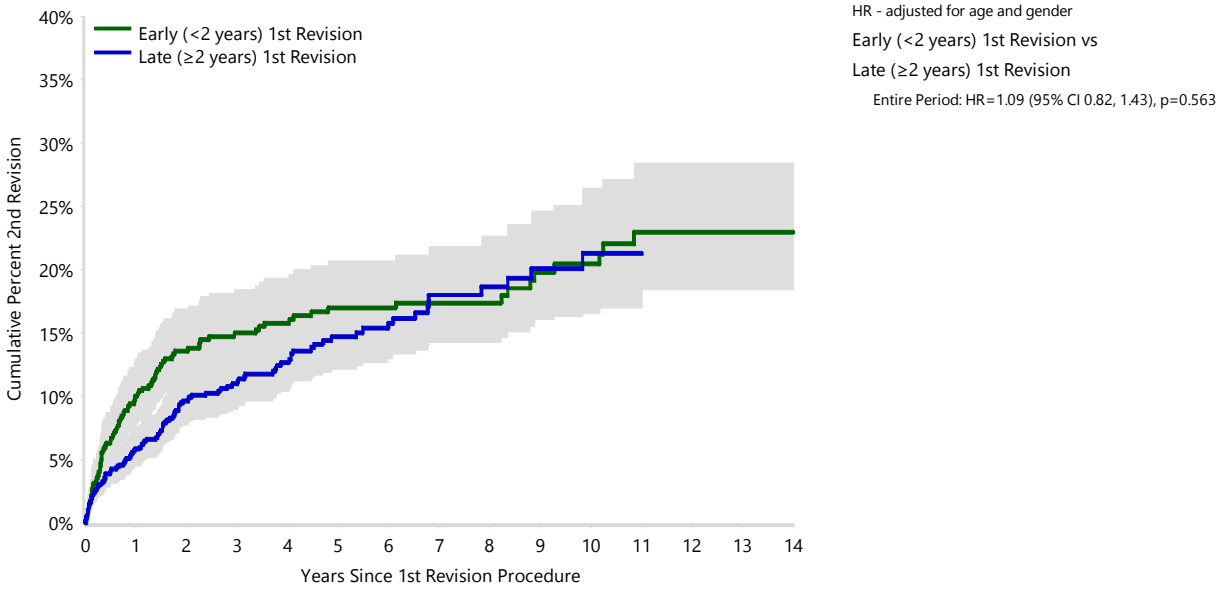
Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N77 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Timing of 1st Revision (Primary Diagnosis OA, 1st Revision for Fracture)**

| Timing of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Early (<2 years) 1st Revision | 94 | 547 | 10.0 (7.8, 12.9) | 15.0 (12.1, 18.4) | 17.0 (13.9, 20.7) | 20.4 (16.6, 25.1) | | |
| Late (≥2 years) 1st Revision | 115 | 963 | 5.8 (4.5, 7.6) | 11.0 (8.9, 13.4) | 14.7 (12.1, 17.7) | 21.3 (17.0, 26.4) | | |
| TOTAL | 209 | 1510 | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N90 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Timing of 1st Revision (Primary Diagnosis OA, 1st Revision for Fracture)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Early (<2 years) 1st Revision | 547 | 449 | 338 | 248 | 106 | 33 | 6 |
| Late (≥2 years) 1st Revision | 963 | 741 | 457 | 283 | 62 | 8 | 1 |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

### OUTCOMES OF 1ST REVISION OVER TIME

This analysis compares the outcomes of 1st revisions of total knee replacement over four successive time periods: 1999-2005, 2006-2012, 2013-2019 and 2020-2024. When all aseptic 1st revisions are included, there is a lower rate of 2nd revision comparing the most recent period to 1999-2005 and 2006-2012, but there is no difference compared to 2013-2019 (Table N78 and Figure N91).

There has been little change in 2nd revision rate for any reason since 2006-2012.

The numbers and proportions of the 2nd revision diagnoses for each time period are shown in (Table N79).
The proportion of 2nd revision for loosening has decreased over time, while revisions for infection and instability have increased.

Where the 1st revision is for loosening the rate of the 2nd revision , is lower for the period 2020-2024 compared to 1999-2005 after 9 months, but there is little difference when compared to the other time periods (Table N80 and Figure N93).

There is a lower rate of 2nd revision where the 1st revision is for instability comparing time periods 2020-2024 to 1999-2005, but there is no difference when compared to the other time periods (Table N81 and Figure N94).

Where the 1st revision is for patella reasons the rate of 2nd revision is again lower when comparing 2020-2025 to 1999-2005 after 1.5 years, but there is no difference when compared to other time periods (Table N83 and Figure N95).

Where the 1st revision is for pain the rate of 2nd revision is also lower when comparing 2020-2025 to 1999- 2005 after 1.5 years, but there is no difference when compared to other time periods (Table N86 and Figure N98).

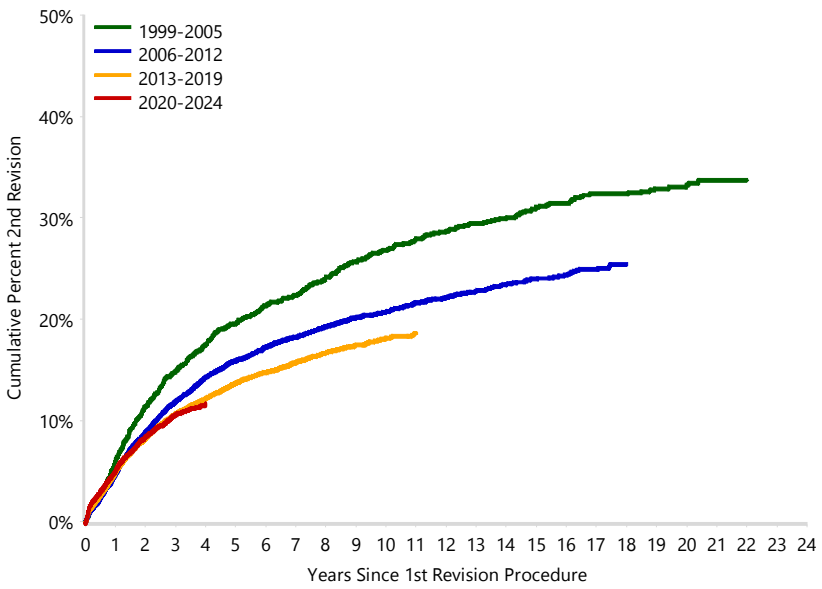
There has been no change in the rate of 2nd revision over time where the 1st revision is for arthrofibrosis or fracture. (Table N84, Figure N96, Table N85, Figure N97).

**Table N78 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Year of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| Year of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| 1999-2005 | 510 | 1743 | 6.0 (5.0, 7.2) | 14.8 (13.2, 16.6) | 19.6 (17.7, 21.5) | 26.8 (24.7, 29.0) | 31.1 (28.8, 33.5) | 33.3 (30.8, 35.8) |
| 2006-2012 | 1599 | 7275 | 4.7 (4.2, 5.2) | 11.9 (11.2, 12.7) | 15.9 (15.1, 16.8) | 20.8 (19.9, 21.8) | 24.1 (23.0, 25.2) | |
| 2013-2019 | 1916 | 11913 | 4.9 (4.6, 5.4) | 10.8 (10.2, 11.4) | 13.8 (13.2, 14.5) | 18.3 (17.5, 19.1) | | |
| 2020-2024 | 800 | 9529 | 5.2 (4.7, 5.6) | 10.7 (10.0, 11.5) | | | | |
| TOTAL | 4825 | 30460 | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N91 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Year of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




HR - adjusted for age and gender

1999-2005 vs 2020-2024

0 - 3Mth: HR=0.56 (95% CI 0.36, 0.85), p=0.006

3Mth+: HR=1.58 (95% CI 1.39, 1.79), p<0.001

2006-2012 vs 2020-2024

0 - 3Mth: HR=0.55 (95% CI 0.43, 0.70), p<0.001

3Mth - 1.5Yr: HR=1.14 (95% CI 1.00, 1.30), p=0.042

1.5Yr+: HR=1.25 (95% CI 1.12, 1.40), p<0.001

2013-2019 vs 2020-2024

0 - 3Mth: HR=0.71 (95% CI 0.58, 0.86), p<0.001

3Mth+: HR=1.05 (95% CI 0.95, 1.16), p=0.324

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| 1999-2005 | 1743 | 1617 | 1426 | 1280 | 980 | 696 | 316 |
| 2006-2012 | 7275 | 6882 | 6221 | 5700 | 4464 | 1450 | 0 |
| 2013-2019 | 11913 | 11214 | 10219 | 9440 | 1879 | 0 | 0 |
| 2020-2024 | 9529 | 7024 | 3155 | 0 | 0 | 0 | 0 |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N79 2nd Revision Diagnosis of Known Primary Total Knee Replacement by Year of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| 2nd Revision Diagnosis | 1999-2005 | | | 2006-2012 | | |
|---|---|---|---|---|---|---|
| | Number | % 1st Revisions Revised | % 2nd Revisions | Number | % 1st Revisions Revised | % 2nd Revisions |
| Loosening | 211 | 12.1 | 41.4 | 570 | 7.8 | 35.6 |
| Infection | 106 | 6.1 | 20.8 | 349 | 4.8 | 21.8 |
| Instability | 30 | 1.7 | 5.9 | 156 | 2.1 | 9.8 |
| Pain | 38 | 2.2 | 7.5 | 149 | 2.0 | 9.3 |
| Arthrofibrosis | 23 | 1.3 | 4.5 | 53 | 0.7 | 3.3 |
| Malalignment | 12 | 0.7 | 2.4 | 52 | 0.7 | 3.3 |
| Fracture | 6 | 0.3 | 1.2 | 26 | 0.4 | 1.6 |
| Lysis | 10 | 0.6 | 2.0 | 44 | 0.6 | 2.8 |
| Wear Tibial Insert | 13 | 0.7 | 2.5 | 29 | 0.4 | 1.8 |
| Metal Related Pathology | 4 | 0.2 | 0.8 | 26 | 0.4 | 1.6 |
| Patellofemoral Pain | 14 | 0.8 | 2.7 | 25 | 0.3 | 1.6 |
| Bearing Dislocation | 2 | 0.1 | 0.4 | 8 | 0.1 | 0.5 |
| Patella Erosion | 2 | 0.1 | 0.4 | 13 | 0.2 | 0.8 |
| Prosthesis Dislocation | 6 | 0.3 | 1.2 | 15 | 0.2 | 0.9 |
| Implant Breakage Tibial Insert | 4 | 0.2 | 0.8 | 10 | 0.1 | 0.6 |
| Incorrect Sizing | 7 | 0.4 | 1.4 | 14 | 0.2 | 0.9 |
| Patella Maltracking | 6 | 0.3 | 1.2 | 14 | 0.2 | 0.9 |
| Implant Breakage Patella | 3 | 0.2 | 0.6 | 6 | 0.1 | 0.4 |
| Implant Breakage Femoral | 2 | 0.1 | 0.4 | 5 | 0.1 | 0.3 |
| Implant Breakage Tibial | 1 | 0.1 | 0.2 | 8 | 0.1 | 0.5 |
| Wear Patella | 3 | 0.2 | 0.6 | 6 | 0.1 | 0.4 |
| Synovitis | 2 | 0.1 | 0.4 | 5 | 0.1 | 0.3 |
| Heterotopic Bone | 1 | 0.1 | 0.2 | 3 | 0.0 | 0.2 |
| Osteonecrosis | | | | 1 | 0.0 | 0.1 |
| Implant Breakage Stem | | | | | | |
| Progression Of Disease | | | | 1 | 0.0 | 0.1 |
| Tumour | 1 | 0.1 | 0.2 | | | |
| Wear Femoral | | | | 1 | 0.0 | 0.1 |
| Wear Tibial | 1 | 0.1 | 0.2 | 1 | 0.0 | 0.1 |
| Other | 2 | 0.1 | 0.4 | 9 | 0.1 | 0.6 |
| **N 2nd Revision** | **510** | **29.3** | **100.0** | **1599** | **22.0** | **100.0** |
| **N 1st Revision** | **1743** | | | **7275** | | |

**Table N80** ***Continued***

| 2nd Revision Diagnosis | 2013-2019 | | | 2020-2024 | | |
|---|---|---|---|---|---|---|
| | Number | % 1st Revisions Revised | % 2nd Revisions | Number | % 1st Revisions Revised | % 2nd Revisions |
| Loosening | 573 | 4.8 | 29.9 | 183 | 1.9 | 22.9 |
| Infection | 495 | 4.2 | 25.8 | 293 | 3.1 | 36.6 |
| Instability | 302 | 2.5 | 15.8 | 116 | 1.2 | 14.5 |
| Pain | 105 | 0.9 | 5.5 | 29 | 0.3 | 3.6 |
| Arthrofibrosis | 90 | 0.8 | 4.7 | 47 | 0.5 | 5.9 |
| Malalignment | 70 | 0.6 | 3.7 | 19 | 0.2 | 2.4 |
| Fracture | 54 | 0.5 | 2.8 | 28 | 0.3 | 3.5 |
| Lysis | 22 | 0.2 | 1.1 | 12 | 0.1 | 1.5 |
| Wear Tibial Insert | 22 | 0.2 | 1.1 | 5 | 0.1 | 0.6 |
| Metal Related Pathology | 15 | 0.1 | 0.8 | 6 | 0.1 | 0.8 |
| Patellofemoral Pain | 18 | 0.2 | 0.9 | 1 | 0.0 | 0.1 |
| Bearing Dislocation | 20 | 0.2 | 1.0 | 8 | 0.1 | 1.0 |
| Patella Erosion | 19 | 0.2 | 1.0 | 8 | 0.1 | 1.0 |
| Prosthesis Dislocation | 11 | 0.1 | 0.6 | 6 | 0.1 | 0.8 |
| Implant Breakage Tibial Insert | 14 | 0.1 | 0.7 | 7 | 0.1 | 0.9 |
| Incorrect Sizing | 14 | 0.1 | 0.7 | 3 | 0.0 | 0.4 |
| Patella Maltracking | 14 | 0.1 | 0.7 | 8 | 0.1 | 1.0 |
| Implant Breakage Patella | 11 | 0.1 | 0.6 | 3 | 0.0 | 0.4 |
| Implant Breakage Femoral | 8 | 0.1 | 0.4 | | | |
| Implant Breakage Tibial | 7 | 0.1 | 0.4 | 2 | 0.0 | 0.3 |
| Wear Patella | 6 | 0.1 | 0.3 | 3 | 0.0 | 0.4 |
| Synovitis | 5 | 0.0 | 0.3 | 2 | 0.0 | 0.3 |
| Heterotopic Bone | 2 | 0.0 | 0.1 | 2 | 0.0 | 0.3 |
| Osteonecrosis | 2 | 0.0 | 0.1 | 1 | 0.0 | 0.1 |
| Implant Breakage Stem | 1 | 0.0 | 0.1 | | | |
| Progression Of Disease | | | | | | |
| Tumour | 1 | 0.0 | 0.1 | 1 | 0.0 | 0.1 |
| Wear Femoral | | | | | | |
| Wear Tibial | | | | | | |
| Other | 15 | 0.1 | 0.8 | 7 | 0.1 | 0.9 |
| **N 2nd Revision** | **1916** | **16.1** | **100.0** | **800** | **8.4** | **100.0** |
| **N 1st Revision** | **11913** | | | **9529** | | |

**Figure N92 Cumulative Incidence 2nd Revision Diagnosis of Known Primary Total Knee Replacement by Time Period of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

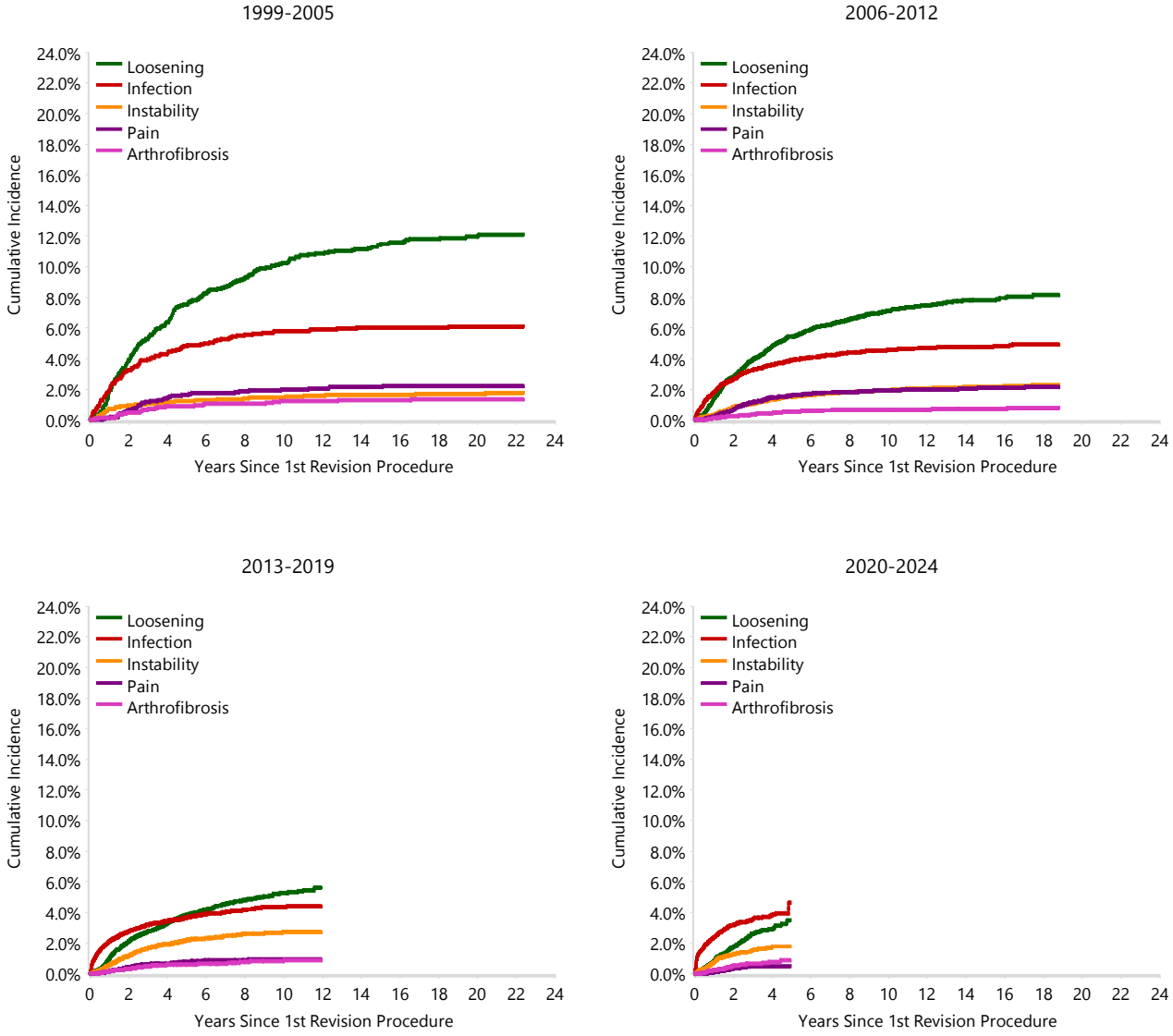
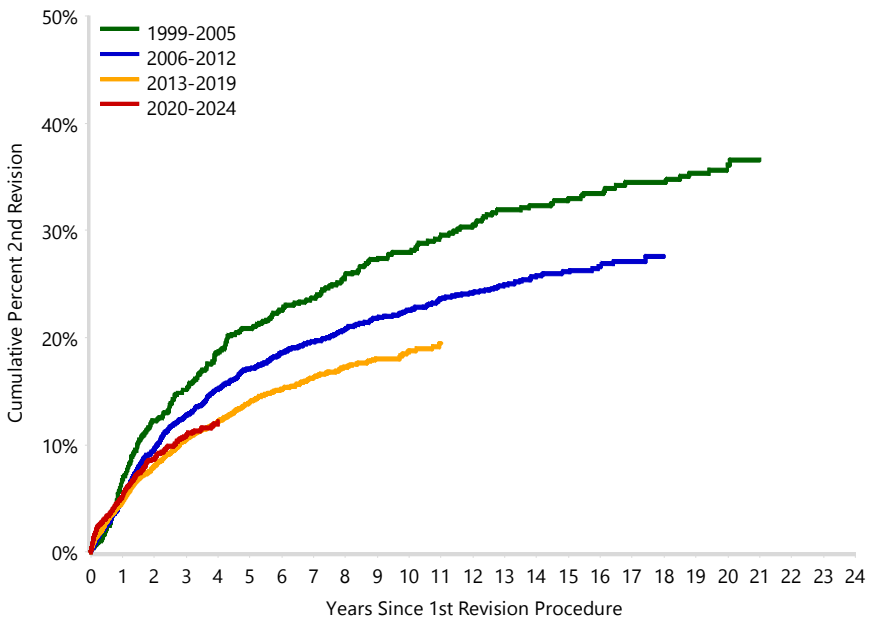


**Table N81 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Year of 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**

| Year of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs | 21 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| 1999-2005 | 230 | 723 | 6.8 (5.2, 8.9) | 15.1 (12.7, 18.0) | 20.9 (18.1, 24.1) | 27.9 (24.7, 31.5) | 33.0 (29.5, 36.8) | 36.1 (32.3, 40.2) | 36.6 (32.7, 40.8) |
| 2006-2012 | 592 | 2464 | 5.2 (4.4, 6.1) | 12.8 (11.5, 14.1) | 17.1 (15.6, 18.7) | 22.6 (20.9, 24.3) | 26.1 (24.3, 28.1) | | |
| 2013-2019 | 586 | 3545 | 4.7 (4.1, 5.5) | 10.5 (9.5, 11.6) | 14.0 (12.9, 15.2) | 18.8 (17.3, 20.4) | | | |
| 2020-2024 | 245 | 2858 | 5.2 (4.5, 6.2) | 10.8 (9.5, 12.3) | | | | | |
| TOTAL | 1653 | 9590 | | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N93 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Year of 1st Revision (Primary Diagnosis OA, 1st Revision for Loosening)**




HR - adjusted for age and gender

1999-2005 vs 2020-2024

0 - 3Mth: HR=0.42 (95% CI 0.19, 0.90), p=0.025

3Mth - 9Mth: HR=1.46 (95% CI 0.92, 2.31), p=0.104

9Mth - 1Yr: HR=2.32 (95% CI 1.42, 3.81), p<0.001

1Yr+: HR=1.40 (95% CI 1.13, 1.75), p=0.002

2006-2012 vs 2020-2024

0 - 3Mth: HR=0.62 (95% CI 0.42, 0.91), p=0.015

3Mth - 2.5Yr: HR=1.22 (95% CI 1.01, 1.47), p=0.035

2.5Yr - 4Yr: HR=1.10 (95% CI 0.82, 1.47), p=0.538

4Yr+: HR=1.04 (95% CI 0.81, 1.32), p=0.761

2013-2019 vs 2020-2024

Entire Period: HR=0.92 (95% CI 0.79, 1.08), p=0.308

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs | 21 Yrs |
|---|---|---|---|---|---|---|---|---|
| 1999-2005 | 723 | 667 | 595 | 528 | 408 | 295 | 138 | 46 |
| 2006-2012 | 2464 | 2321 | 2088 | 1915 | 1501 | 512 | 0 | 0 |
| 2013-2019 | 3545 | 3354 | 3070 | 2829 | 588 | 0 | 0 | 0 |
| 2020-2024 | 2858 | 2101 | 911 | 0 | 0 | 0 | 0 | 0 |

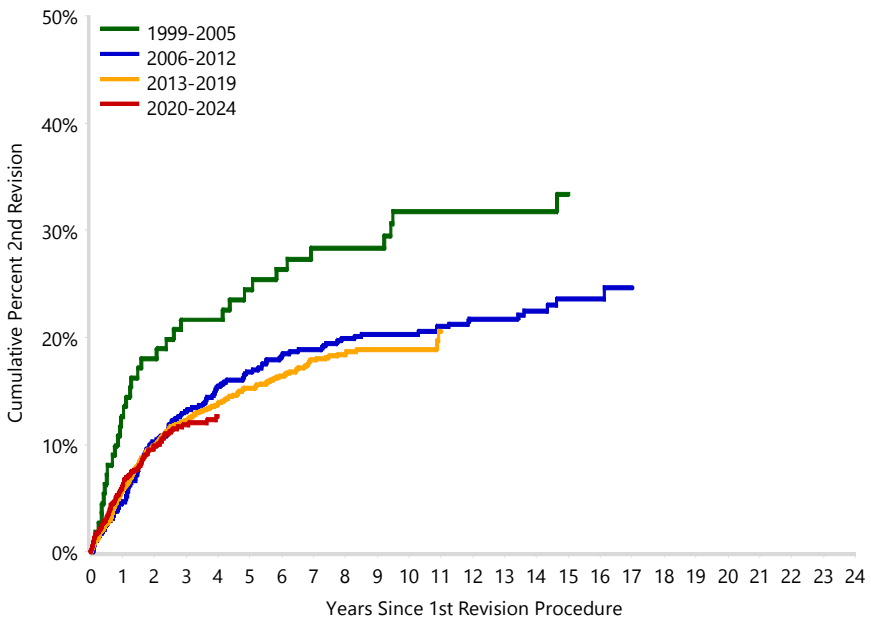
Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N82 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Year of 1st Revision (Primary Diagnosis OA, 1st Revision for Instability)**

| Year of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| 1999-2005 | 35 | 111 | 12.6 (7.7, 20.4) | 21.7 (15.1, 30.5) | 24.4 (17.5, 33.6) | 31.8 (23.8, 41.6) | 33.4 (25.1, 43.5) | |
| 2006-2012 | 125 | 580 | 4.5 (3.1, 6.6) | 13.1 (10.6, 16.2) | 16.8 (13.9, 20.1) | 20.3 (17.2, 23.9) | 23.5 (20.0, 27.7) | |
| 2013-2019 | 289 | 1662 | 5.7 (4.7, 7.0) | 12.3 (10.8, 14.0) | 15.2 (13.6, 17.1) | 18.9 (16.9, 21.0) | | |
| 2020-2024 | 130 | 1402 | 6.2 (5.0, 7.7) | 11.8 (10.0, 14.0) | | | | |
| TOTAL | 579 | 3755 | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N94 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Year of 1st Revision (Primary Diagnosis OA, 1st Revision for Instability)**




HR - adjusted for age and gender

1999-2005 vs 2020-2024

Entire Period: HR=1.73 (95% CI 1.17, 2.57), p=0.006

2006-2012 vs 2020-2024

0 - 1.5Yr: HR=0.90 (95% CI 0.64, 1.28), p=0.564

1.5Yr+: HR=1.45 (95% CI 0.98, 2.15), p=0.065

2013-2019 vs 2020-2024

0 - 1.5Yr: HR=0.95 (95% CI 0.74, 1.23), p=0.703

1.5Yr+: HR=1.26 (95% CI 0.88, 1.81), p=0.201

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| 1999-2005 | 111 | 97 | 86 | 79 | 58 | 41 | 20 |
| 2006-2012 | 580 | 549 | 486 | 446 | 350 | 117 | 0 |
| 2013-2019 | 1662 | 1558 | 1413 | 1300 | 193 | 0 | 0 |
| 2020-2024 | 1402 | 1024 | 475 | 0 | 0 | 0 | 0 |

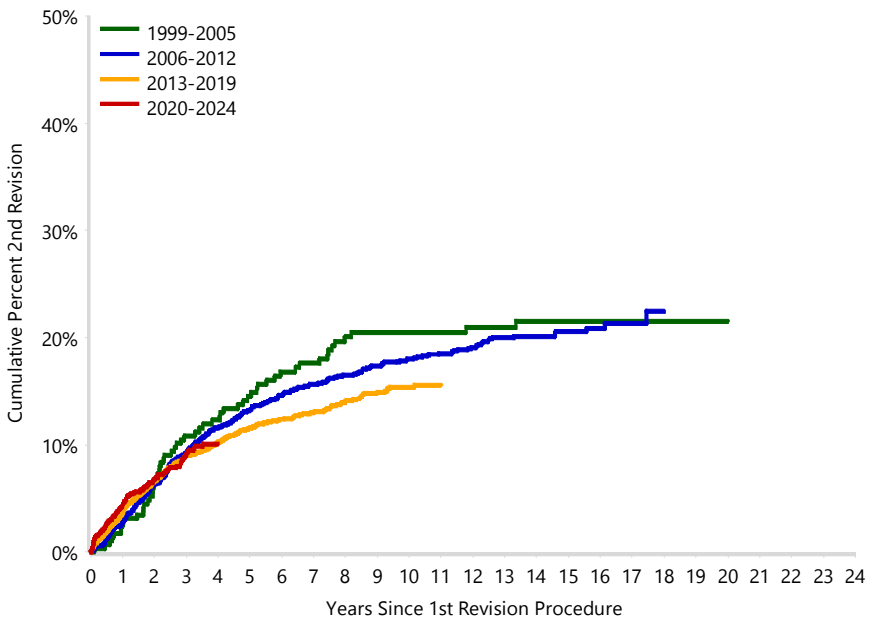
Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N83 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Year of 1st Revision (Primary Diagnosis OA, 1st Revision for Patella Reasons)**

| Year of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| 1999-2005 | 60 | 291 | 2.4 (1.2, 5.0) | 10.8 (7.7, 15.0) | 14.5 (10.9, 19.2) | 20.5 (16.1, 25.8) | 21.5 (17.0, 27.0) | 21.5 (17.0, 27.0) |
| 2006-2012 | 298 | 1585 | 2.7 (2.0, 3.7) | 9.2 (7.9, 10.7) | 13.3 (11.7, 15.1) | 18.0 (16.2, 20.1) | 20.5 (18.5, 22.8) | |
| 2013-2019 | 339 | 2487 | 3.6 (3.0, 4.4) | 9.0 (7.9, 10.2) | 11.5 (10.3, 12.9) | 15.4 (13.9, 17.1) | | |
| 2020-2024 | 112 | 1561 | 4.3 (3.4, 5.5) | 9.1 (7.5, 11.1) | | | | |
| TOTAL | 809 | 5924 | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N95 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Year of 1st Revision (Primary Diagnosis OA, 1st Revision for Patella Reasons)**




HR - adjusted for age and gender

1999-2005 vs 2020-2024

0 - 1.5Yr: HR=0.54 (95% CI 0.28, 1.04), p=0.066

1.5Yr+: HR=1.46 (95% CI 1.01, 2.11), p=0.047

2006-2012 vs 2020-2024

0 - 6Mth: HR=0.54 (95% CI 0.33, 0.90), p=0.017

6Mth - 9Mth: HR=1.09 (95% CI 0.59, 2.00), p=0.790

9Mth - 1Yr: HR=0.43 (95% CI 0.19, 0.97), p=0.043

1Yr - 2.5Yr: HR=1.19 (95% CI 0.87, 1.62), p=0.278

2.5Yr - 3.5Yr: HR=1.48 (95% CI 0.94, 2.34), p=0.088

3.5Yr+: HR=1.33 (95% CI 0.95, 1.85), p=0.092

2013-2019 vs 2020-2024

Entire Period: HR=0.94 (95% CI 0.75, 1.18), p=0.591

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| 1999-2005 | 291 | 282 | 250 | 228 | 179 | 127 | 47 |
| 2006-2012 | 1585 | 1531 | 1403 | 1284 | 994 | 306 | 0 |
| 2013-2019 | 2487 | 2384 | 2202 | 2042 | 465 | 0 | 0 |
| 2020-2024 | 1561 | 1193 | 546 | 0 | 0 | 0 | 0 |

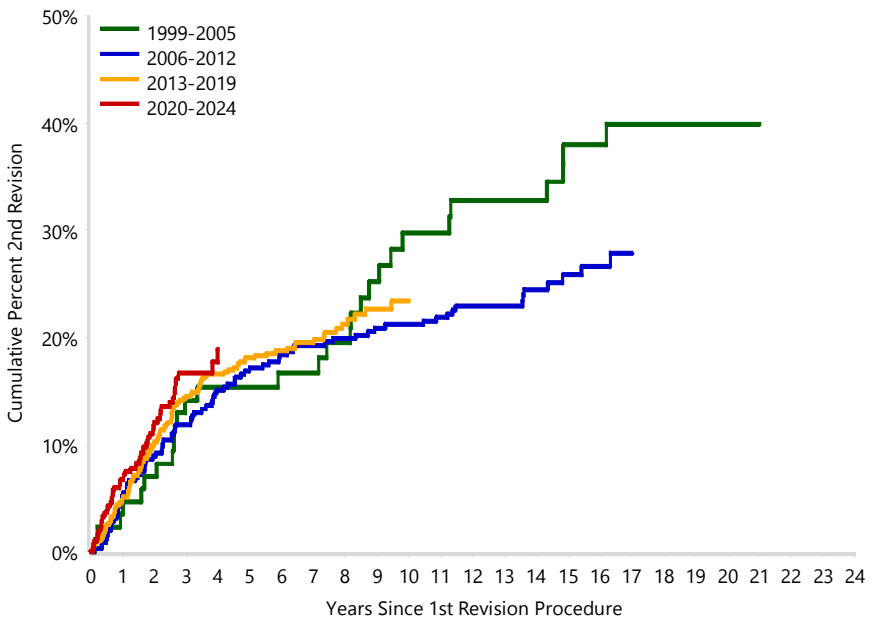
Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N84 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Year of 1st Revision (Primary Diagnosis OA, 1st Revision for Arthrofibrosis)**

| Year of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| 1999-2005 | 29 | 86 | 3.5 (1.1, 10.5) | 14.1 (8.3, 23.6) | 15.3 (9.2, 25.0) | 29.7 (20.8, 41.5) | 38.0 (27.8, 50.4) | 39.9 (29.4, 52.5) |
| 2006-2012 | 84 | 350 | 5.5 (3.5, 8.4) | 11.9 (8.9, 15.8) | 17.2 (13.6, 21.6) | 21.2 (17.2, 25.9) | 25.8 (21.2, 31.3) | |
| 2013-2019 | 113 | 551 | 5.1 (3.5, 7.3) | 14.5 (11.8, 17.7) | 18.1 (15.1, 21.6) | 23.4 (19.6, 27.9) | | |
| 2020-2024 | 63 | 515 | 6.7 (4.8, 9.4) | 16.6 (13.0, 21.2) | | | | |
| TOTAL | 289 | 1502 | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N96 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Year of 1st Revision (Primary Diagnosis OA, 1st Revision for Arthrofibrosis)**




HR - adjusted for age and gender

1999-2005 vs 2020-2024

0 - 2.5Yr: HR=0.57 (95% CI 0.26, 1.25), p=0.163

2.5Yr+: HR=1.48 (95% CI 0.85, 2.56), p=0.163

2006-2012 vs 2020-2024

Entire Period: HR=0.78 (95% CI 0.55, 1.11), p=0.160

2013-2019 vs 2020-2024

Entire Period: HR=0.84 (95% CI 0.61, 1.16), p=0.291

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| 1999-2005 | 86 | 82 | 72 | 68 | 46 | 35 | 18 |
| 2006-2012 | 350 | 328 | 302 | 278 | 239 | 103 | 0 |
| 2013-2019 | 551 | 519 | 460 | 426 | 80 | 0 | 0 |
| 2020-2024 | 515 | 368 | 165 | 0 | 0 | 0 | 0 |

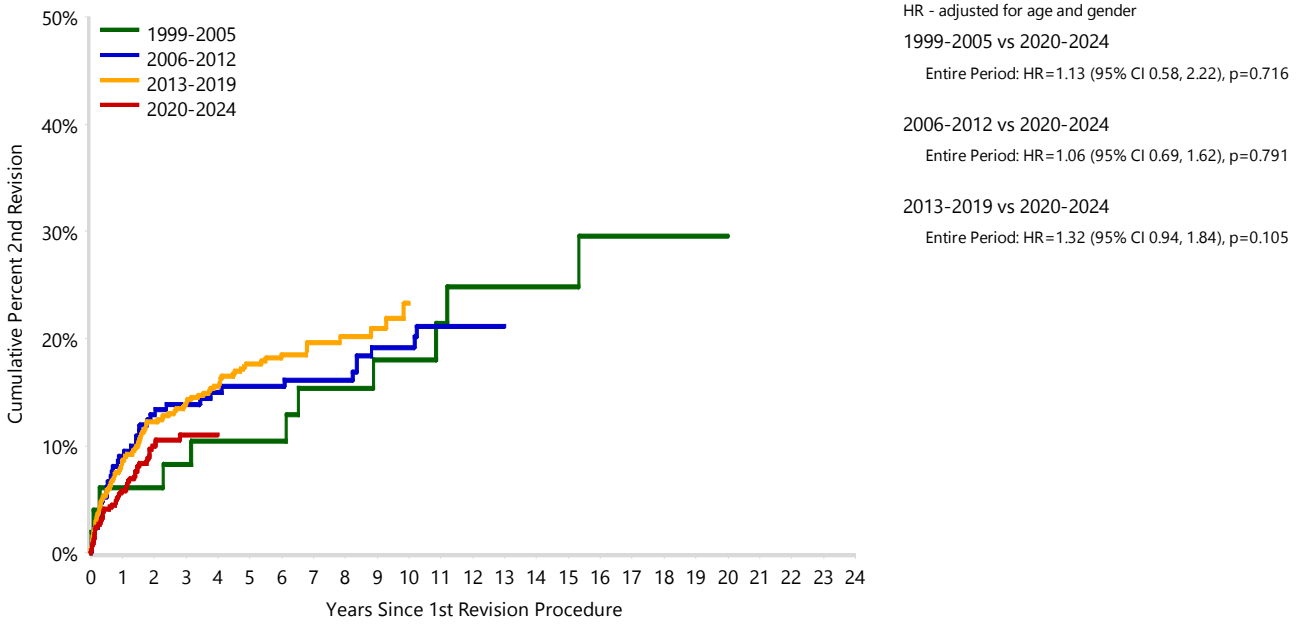
Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N85 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Year of 1st Revision (Primary Diagnosis OA, 1st Revision for Fracture)**

| Year of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| 1999-2005 | 11 | 52 | 6.1 (2.0, 17.7) | 8.2 (3.2, 20.5) | 10.4 (4.5, 23.3) | 18.0 (9.4, 33.0) | 24.9 (13.9, 42.0) | 29.6 (16.9, 48.5) |
| 2006-2012 | 40 | 216 | 9.0 (5.8, 13.8) | 13.9 (9.9, 19.4) | 15.5 (11.2, 21.3) | 19.2 (14.2, 25.6) | | |
| 2013-2019 | 102 | 579 | 8.6 (6.6, 11.3) | 13.8 (11.2, 17.1) | 17.6 (14.6, 21.2) | 23.3 (18.7, 28.8) | | |
| 2020-2024 | 56 | 663 | 5.8 (4.2, 8.1) | 11.0 (8.5, 14.3) | | | | |
| TOTAL | 209 | 1510 | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N97 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Year of 1st Revision (Primary Diagnosis OA, 1st Revision for Fracture)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| 1999-2005 | 52 | 45 | 43 | 39 | 30 | 16 | 7 |
| 2006-2012 | 216 | 190 | 168 | 145 | 87 | 25 | 0 |
| 2013-2019 | 579 | 496 | 409 | 347 | 51 | 0 | 0 |
| 2020-2024 | 663 | 459 | 175 | 0 | 0 | 0 | 0 |

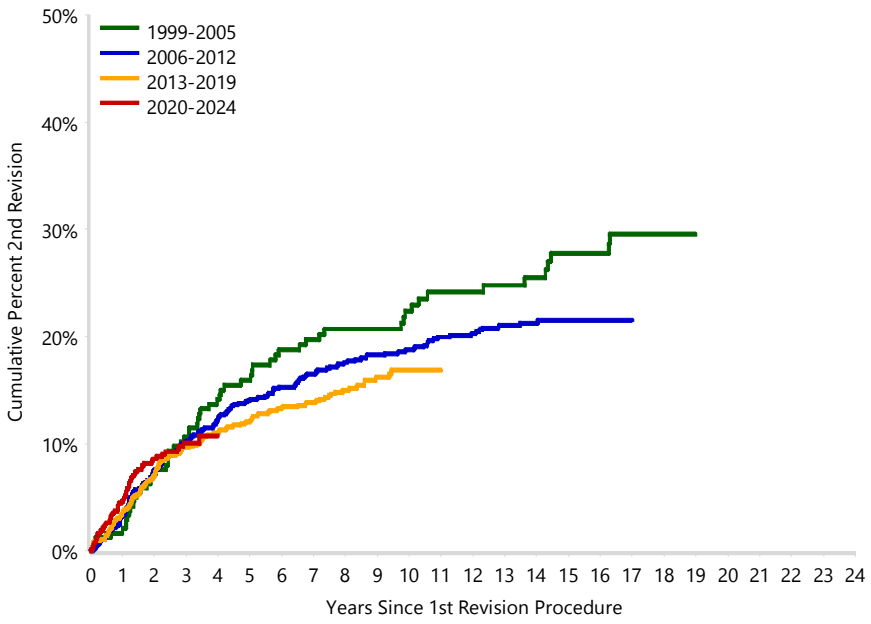
Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N86 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Year of 1st Revision (Primary Diagnosis OA, 1st Revision for Pain)**

| Year of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| 1999-2005 | 60 | 241 | 2.1 (0.9, 4.9) | 10.6 (7.3, 15.3) | 15.9 (11.8, 21.3) | 22.4 (17.4, 28.5) | 27.7 (22.0, 34.6) | |
| 2006-2012 | 168 | 848 | 3.2 (2.2, 4.6) | 10.2 (8.4, 12.5) | 14.0 (11.8, 16.6) | 18.7 (16.2, 21.6) | 21.5 (18.8, 24.7) | |
| 2013-2019 | 167 | 1147 | 3.6 (2.7, 4.8) | 9.7 (8.1, 11.6) | 12.1 (10.3, 14.1) | 16.8 (14.5, 19.6) | | |
| 2020-2024 | 62 | 756 | 4.7 (3.3, 6.5) | 10.0 (7.8, 12.8) | | | | |
| TOTAL | 457 | 2992 | | | | | | |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N98 Cumulative Percent 2nd Revision of Known Primary Total Knee Replacement by Year of 1st Revision (Primary Diagnosis OA, 1st Revision for Pain)**




HR - adjusted for age and gender

1999-2005 vs 2020-2024

0 - 1.5Yr: HR=0.83 (95% CI 0.45, 1.52), p=0.540

1.5Yr+: HR=1.68 (95% CI 1.10, 2.57), p=0.017

2006-2012 vs 2020-2024

0 - 1.5Yr: HR=0.89 (95% CI 0.60, 1.32), p=0.571

1.5Yr+: HR=1.22 (95% CI 0.85, 1.75), p=0.283

2013-2019 vs 2020-2024

Entire Period: HR=0.95 (95% CI 0.70, 1.28), p=0.735

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| 1999-2005 | 241 | 234 | 205 | 180 | 137 | 93 | 35 |
| 2006-2012 | 848 | 816 | 746 | 684 | 543 | 191 | 0 |
| 2013-2019 | 1147 | 1096 | 1001 | 944 | 186 | 0 | 0 |
| 2020-2024 | 756 | 580 | 318 | 0 | 0 | 0 | 0 |

Note: Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

## MORTALITY FOLLOWING 1ST REVISION TOTAL KNEE REPLACEMENT

Mortality following revision total knee replacement has been calculated for all 1st revision procedures. The overall mortality is 0.2% at 30 days, 0.4% at 90 days, 1.0% at 1 year and 22.1% at 10 years (Table N87 and Figure N99).

The 10-year survival of 1st revision knee replacements is 78.4% while the 10-years survival of unrevised primary knee replacements is 82.9% (Table N88 and Figure N100).

Major total 1st revisions have a higher rate of mortality compared to minor revisions for the majority of the first 10 years, and when compared to major partial revisions until 3 months, with little difference after these times. Compared to minor 1st revisions, major partial revisions also have a higher early mortality (between 2 weeks and 3 months) (Table N89 and Figure N101).

Mortality following 1st revision has also been assessed by the revision diagnosis, and in this analysis, 1st revision for infection is included.

Compared to 1st revisions for loosening, 1st revisions for infection and fracture have a higher rate of mortality, while those revised for arthrofibrosis have a lower rate of mortality. 1st revisions for patella reasons, pain, instability and lysis have a similar mortality to 1st revisions for loosening (Table N90 and Figure N102).

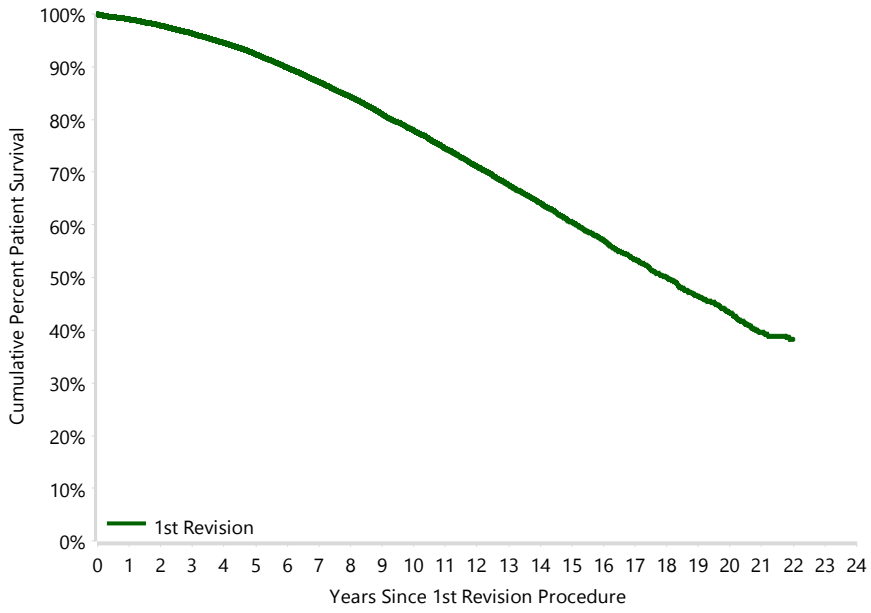
Revisions for fracture and infection have higher rates of mortality.

**Table N87 Cumulative Percent Survival of Patients with Known Primary Total Knee Replacement Since 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| Class | N Deceased | N Total | 30 Day | 90 Day | 1 Yr | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| 1st Revisions | 5953 | 28811 | 99.8 (99.8, 99.9) | 99.6 (99.5, 99.7) | 99.0 (98.9, 99.1) | 92.4 (92.0, 92.7) | 77.9 (77.2, 78.5) | 60.5 (59.6, 61.5) | 43.3 (41.7, 44.9) |
| TOTAL | 5953 | 28811 | | | | | | | |

Note: Restricted to the first of the revision procedures for bilateral patients
Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N99 Cumulative Percent Survival of Patients with Known Primary Total Knee Replacement Since 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| 1st Revisions | 28811 | 26643 | 22526 | 18425 | 8989 | 2927 | 503 |

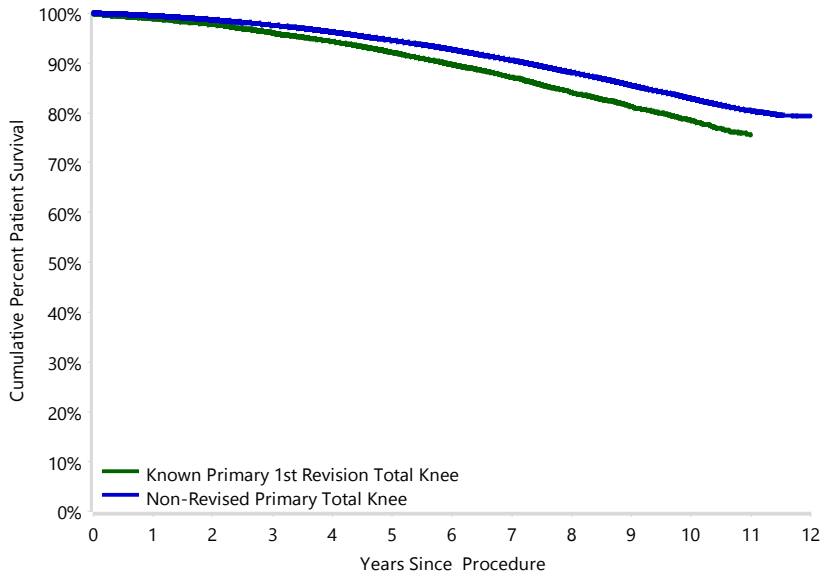
Note: Restricted to the first of the revision procedures for bilateral patients.
Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N88 Cumulative Percent Survival of Patients with Non-Revised Primary Total Knee Replacement and Known Primary 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| Procedure Type | N Deceased | N Total | 1 Yr | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|
| Known Primary 1st Revision Total Knee | 2047 | 19557 | 98.9 (98.8, 99.1) | 92.2 (91.7, 92.6) | 78.4 (77.4, 79.4) | |
| Non-Revised Primary Total Knee | 47003 | 629400 | 99.5 (99.5, 99.5) | 94.6 (94.5, 94.6) | 82.9 (82.7, 83.0) | |
| **TOTAL** | **49050** | **648957** | | | | |

Note: Restricted to the first of the revision procedures for bilateral patients in each procedure type with known age, sex and ASA score.
Time to survival is time from the primary procedure to death for the non-revised primary cohort and from the 1st revision procedure to death for the known primary 1st revision cohort.

**Figure N100 Cumulative Percent Survival of Patients with Non-Revised Primary Total Knee Replacement and Known Primary 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




HR - adjusted for age, gender and ASA score at procedure

Known Primary 1st Revision Total Conventional Hip VS Non-Revised Primary Total Conventional Hip

0Mth - 3Mth: HR=2.67 (95% CI: 2.12, 3.35), p<0.0001

3Mth – 1.5Yrs: HR=1.51 (95% CI: 1.32, 1.72), p<0.0001

1.5Yrs - 2.5Yr: HR=1.36 (95% CI: 1.19, 1.56), p<0.0001

2.5Yrs+: HR=1.20 (95% CI: 1.14, 1.26), p<0.0001

| Number at Risk | 0 Yr | 1 Yr | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|
| Known Primary 1st Revision Total Knee | 19557 | 17479 | 9867 | 1849 | 0 |
| Non-Revised Primary Total Knee | 629400 | 557917 | 309997 | 59077 | 0 |

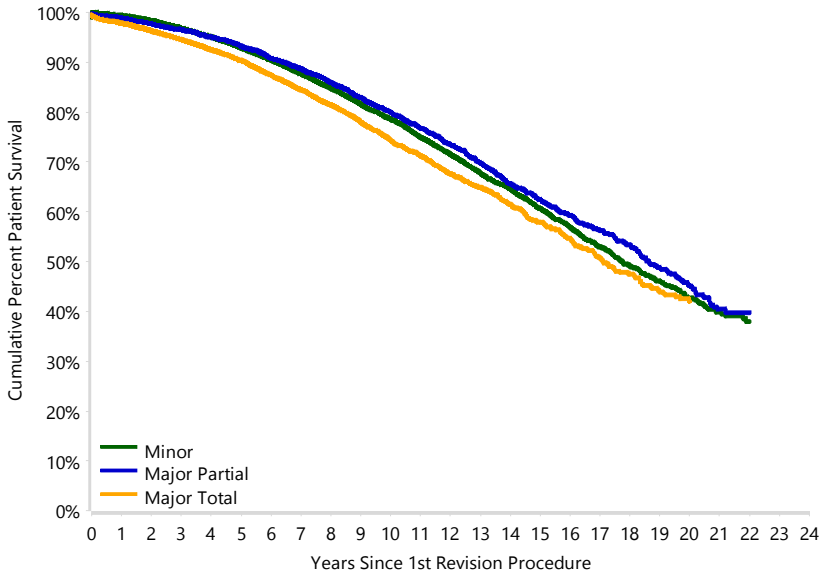
Note: Restricted to the first of the revision or primary procedures for bilateral patients in each procedure type with known age, sex and ASA score.
Time to survival is time from the primary procedure to death for the non-revised primary cohort and from the 1st revision procedure to death for the known primary 1st revision cohort.

**Table N89 Cumulative Percent Survival of Patients with Known Primary 1st Revision Total Knee Replacement Since 1st Revision by Class of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**

| Type of 1st Revision | N Deceased | N Total | 30 Days | 90 Days | 1 Yr | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Minor | 3048 | 15037 | 99.9 (99.9, 100.0) | 99.9 (99.8, 99.9) | 99.4 (99.3, 99.5) | 93.0 (92.5, 93.4) | 78.8 (77.9, 79.6) | 60.9 (59.5, 62.3) | 43.0 (40.6, 45.2) |
| Major Partial | 1055 | 4262 | 99.9 (99.7, 100.0) | 99.7 (99.5, 99.8) | 99.2 (98.8, 99.4) | 93.6 (92.8, 94.3) | 80.3 (78.8, 81.7) | 62.9 (60.7, 65.0) | 45.7 (42.5, 48.8) |
| Major Total | 1850 | 9512 | 99.6 (99.4, 99.7) | 99.2 (99.0, 99.3) | 98.2 (98.0, 98.5) | 90.9 (90.2, 91.5) | 74.8 (73.6, 76.0) | 58.5 (56.6, 60.4) | 42.7 (39.3, 46.0) |
| TOTAL | 5953 | 28811 | | | | | | | |

Note: Restricted to the first of the revision procedures for bilateral patients.
Excluding 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N101 Cumulative Percent Survival of Patients with Known Primary 1st Revision Total Knee Replacement Since 1st Revision by Class of 1st Revision (Primary Diagnosis OA, Excluding 1st Revision for Infection)**




HR - adjusted for age and gender

Major Partial vs Minor

0 - 2Wk: HR=1.19 (95% CI 0.25, 5.72), p=0.830
2Wk - 1Mth: HR=8.65 (95% CI 2.05, 36.52), p=0.003
1Mth - 3Mth: HR=3.40 (95% CI 1.29, 8.98), p=0.013
3Mth - 6Mth: HR=2.22 (95% CI 0.89, 5.57), p=0.088
6Mth - 9Mth: HR=0.71 (95% CI 0.28, 1.79), p=0.469
9Mth - 2.5Yr: HR=1.23 (95% CI 0.97, 1.57), p=0.093
2.5Yr - 3.5Yr: HR=0.80 (95% CI 0.58, 1.11), p=0.178
3.5Yr - 4Yr: HR=1.11 (95% CI 0.75, 1.64), p=0.611
4Yr - 5Yr: HR=0.99 (95% CI 0.75, 1.30), p=0.925
5Yr - 5.5Yr: HR=0.79 (95% CI 0.53, 1.17), p=0.243
5.5Yr - 6Yr: HR=1.50 (95% CI 1.10, 2.04), p=0.009
6Yr+: HR=1.02 (95% CI 0.94, 1.11), p=0.580

Major Total vs Minor

0 - 2Wk: HR=6.89 (95% CI 3.06, 15.55), p<0.001
2Wk - 3Mth: HR=6.50 (95% CI 3.27, 12.89), p<0.001
3Mth - 6Mth: HR=3.62 (95% CI 1.90, 6.89), p<0.001
6Mth - 2Yr: HR=1.35 (95% CI 1.10, 1.65), p=0.003
2Yr - 5Yr: HR=1.09 (95% CI 0.96, 1.23), p=0.174
5Yr - 10Yr: HR=1.20 (95% CI 1.10, 1.32), p<0.001
10Yr+: HR=1.02 (95% CI 0.91, 1.14), p=0.719

Major Total vs Major Partial

0 - 2Wk: HR=3.17 (95% CI 1.43, 6.99), p=0.004
2Wk - 3Mth: HR=1.92 (95% CI 1.05, 3.51), p=0.034
3Mth - 1.5Yr: HR=1.22 (95% CI 0.92, 1.61), p=0.173
1.5Yr - 2.5Yr: HR=1.01 (95% CI 0.76, 1.35), p=0.922
2.5Yr - 5Yr: HR=1.16 (95% CI 0.95, 1.42), p=0.145
5Yr - 5.5Yr: HR=1.56 (95% CI 1.02, 2.39), p=0.040
5.5Yr - 6Yr: HR=0.79 (95% CI 0.56, 1.12), p=0.187
6Yr+: HR=1.08 (95% CI 0.98, 1.19), p=0.116

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Minor | 15037 | 14013 | 11940 | 9781 | 4778 | 1564 | 232 |
| Major Partial | 4262 | 4032 | 3575 | 3136 | 1842 | 737 | 177 |
| Major Total | 9512 | 8598 | 7011 | 5508 | 2369 | 626 | 94 |

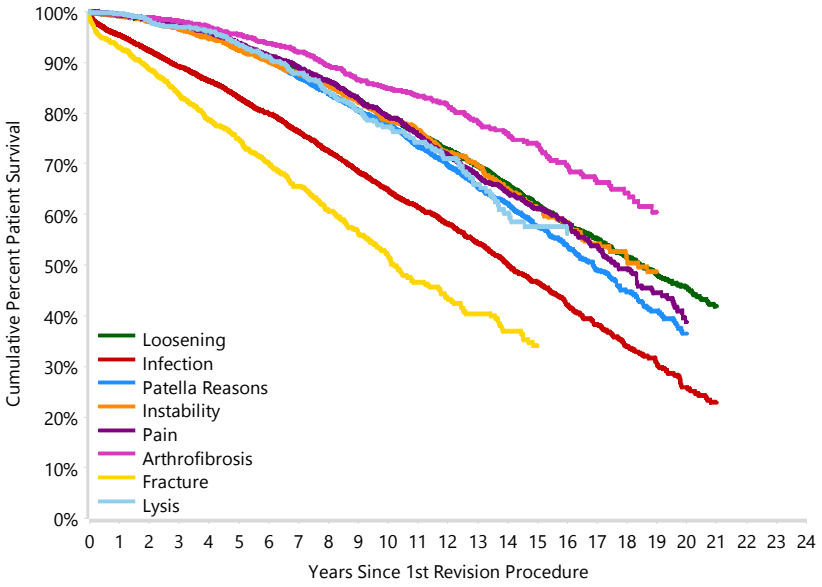
Note: Restricted to the first of the revision procedures for bilateral patients.
Excluding 1st revisions where no minor or major femoral/tibial components have been inserted.

**Table N90 Cumulative Percent Survival of Patients with Known Primary Total Knee Replacement Since 1st Revision by Reason for 1st Revision (Primary Diagnosis OA)**

| Reason for 1st Revision | N Deceased | N Total | 30 Day | 90 Day | 1 Yr | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|---|
| Loosening | 1902 | 9114 | 99.9 (99.8, 100.0) | 99.8 (99.7, 99.9) | 99.3 (99.1, 99.4) | 93.4 (92.8, 93.9) | 79.3 (78.2, 80.3) | 61.9 (60.3, 63.6) |
| Infection | 2235 | 8128 | 99.0 (98.7, 99.2) | 97.7 (97.3, 98.0) | 95.4 (94.9, 95.9) | 83.0 (82.0, 83.9) | 64.8 (63.4, 66.3) | 46.5 (44.5, 48.6) |
| Patella Reasons | 1263 | 5517 | 100.0 (99.9, 100.0) | 100.0 (99.9, 100.0) | 99.5 (99.3, 99.7) | 93.2 (92.5, 93.9) | 77.8 (76.4, 79.2) | 57.7 (55.4, 59.9) |
| Instability | 547 | 3559 | 99.9 (99.7, 100.0) | 99.8 (99.6, 99.9) | 99.3 (99.0, 99.5) | 92.4 (91.4, 93.4) | 78.7 (76.6, 80.6) | 61.3 (57.6, 64.7) |
| Pain | 645 | 2841 | 100.0 (99.8, 100.0) | 99.9 (99.7, 100.0) | 99.3 (99.0, 99.6) | 93.8 (92.7, 94.7) | 79.3 (77.3, 81.1) | 61.2 (58.3, 64.0) |
| Arthrofibrosis | 201 | 1470 | 99.9 (99.5, 100.0) | 99.8 (99.4, 99.9) | 99.5 (99.0, 99.8) | 95.5 (94.1, 96.6) | 84.9 (82.2, 87.2) | 73.7 (69.6, 77.3) |
| Fracture | 497 | 1458 | 97.7 (96.7, 98.3) | 95.9 (94.7, 96.8) | 93.0 (91.6, 94.2) | 74.8 (72.1, 77.2) | 51.6 (47.7, 55.3) | 34.1 (29.1, 39.1) |
| Lysis | 140 | 804 | 99.9 (99.1, 100.0) | 99.8 (99.0, 99.9) | 99.6 (98.8, 99.9) | 93.5 (91.2, 95.2) | 77.3 (73.0, 81.1) | 57.5 (50.5, 63.9) |
| **TOTAL** | **7430** | **32891** | | | | | | |

Note: Restricted to the first of the revision procedures for bilateral patients
Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

**Figure N102 Cumulative Percent Survival of Patients with Known Primary Total Knee Replacement Since 1st Revision by Reason for 1st Revision (Primary Diagnosis OA)**




HR - adjusted for age and gender

Infection vs Loosening
- 0 - 3Mth: HR=11.93 (95% CI 8.20, 17.36), p<0.001
- 3Mth - 6Mth: HR=4.29 (95% CI 2.93, 6.27), p<0.001
- 6Mth - 2Yr: HR=2.63 (95% CI 2.23, 3.10), p<0.001
- 2Yr - 3Yr: HR=2.21 (95% CI 1.83, 2.68), p<0.001
- 3Yr - 5.5Yr: HR=1.56 (95% CI 1.38, 1.76), p<0.001
- 5.5Yr+: HR=1.30 (95% CI 1.20, 1.41), p<0.001

Patella Reasons vs Loosening
- 0 - 2Yr: HR=0.67 (95% CI 0.51, 0.87), p=0.002
- 2Yr - 2.5Yr: HR=1.20 (95% CI 0.85, 1.70), p=0.293
- 2.5Yr - 6Yr: HR=0.99 (95% CI 0.87, 1.13), p=0.890
- 6Yr+: HR=1.08 (95% CI 0.99, 1.17), p=0.087

Instability vs Loosening
- Entire Period: HR=1.09 (95% CI 0.99, 1.20), p=0.081

Pain vs Loosening
- Entire Period: HR=0.98 (95% CI 0.89, 1.07), p=0.620

Arthrofibrosis vs Loosening
- Entire Period: HR=0.77 (95% CI 0.66, 0.89), p<0.001

Fracture vs Loosening
- 0 - 2Wk: HR=26.24 (95% CI 15.09, 45.62), p<0.001
- 2Wk - 3Mth: HR=10.94 (95% CI 6.66, 17.97), p<0.001
- 3Mth - 3Yr: HR=2.78 (95% CI 2.31, 3.36), p<0.001
- 3Yr+: HR=1.71 (95% CI 1.51, 1.94), p<0.001

Lysis vs Loosening
- Entire Period: HR=0.94 (95% CI 0.79, 1.12), p=0.482

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| **Loosening** | 9114 | 8473 | 7209 | 6008 | 3147 | 1125 | 235 |
| **Infection** | 8128 | 7051 | 5475 | 4166 | 1667 | 500 | 71 |
| **Patella Reasons** | 5517 | 5203 | 4525 | 3816 | 1906 | 548 | 63 |
| **Instability** | 3559 | 3255 | 2691 | 2079 | 736 | 211 | 28 |
| **Pain** | 2841 | 2695 | 2408 | 2006 | 1041 | 368 | 47 |
| **Arthrofibrosis** | 1470 | 1346 | 1144 | 924 | 468 | 202 | 33 |
| **Fracture** | 1458 | 1238 | 881 | 614 | 209 | 53 | 7 |
| **Lysis** | 804 | 720 | 586 | 474 | 218 | 54 | 7 |

Note: Restricted to the first of the revision procedures for bilateral patients
Excludes 1st revisions where no minor or major femoral/tibial components have been inserted.

# Revision Arthroplasty

## Revision Shoulder Replacement

The Registry has information on 5,347 1st revision shoulder replacement procedures for all primary diagnoses. There were 848 procedures excluded where the 1st revision was undertaken for infection.

There are also 27 1st revision procedures excluded where minor or major prostheses were not inserted, and the diagnosis was not infection.

All shoulder replacement classes other than partial resurfacing anatomic were revised predominately to total stemmed reverse at the 1st revision.

A hemi stemmed anatomic is amongst the most widely undertaken primary shoulder replacements, and this procedure is revised to a total stemmed reverse at the 1st revision in 94.8% of cases. Similarly, a total stemless anatomic is revised to a total stemmed reverse in 89.7% of cases, a total stemmed anatomic in 89.4% and a total stemmed reverse in 87.2% of cases, respectively. The primary diagnosis of 1st revision shoulder replacement classes is summarised in Table N91. Due to the number of 1st revisions available, the following analyses are limited to 1st revisions of primary total stemmed anatomic and total stemmed reverse shoulder replacements.

**Table N91 1st Revision of Primary Shoulder Replacement by Primary Diagnosis and Type of Primary**

| Primary Diagnosis | Partial Resurfacing Anatomic | | | Hemi Resurfacing Anatomic | | | Hemi Stemmed Anatomic | | | Hemi Stemless Anatomic | | | Humeral Ball | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | Row% | Col% | N | Row% | Col% | N | Row% | Col% | N | Row% | Col% | N | Row% | Col% |
| Fracture | . | . | . | 2 | 0.3 | 0.7 | 325 | 48.6 | 60.3 | 1 | 0.1 | 6.3 | . | . | . |
| Instability | 2 | 3.3 | 11.1 | 2 | 3.3 | 0.7 | 5 | 8.3 | 0.9 | . | . | . | . | . | . |
| Osteoarthritis | 15 | 0.5 | 83.3 | 231 | 8.4 | 85.2 | 139 | 5.1 | 25.8 | 10 | 0.4 | 62.5 | 2 | 0.1 | 100.0 |
| Osteonecrosis | . | . | . | 5 | 6.0 | 1.8 | 19 | 22.6 | 3.5 | 3 | 3.6 | 18.8 | . | . | . |
| Other Inflammatory Arthritis | . | . | . | 1 | 3.8 | 0.4 | 5 | 19.2 | 0.9 | . | . | . | . | . | . |
| Rheumatoid Arthritis | . | . | . | 4 | 5.1 | 1.5 | 7 | 9.0 | 1.3 | . | . | . | . | . | . |
| Rotator Cuff Arthropathy | 1 | 0.1 | 5.6 | 26 | 3.4 | 9.6 | 20 | 2.6 | 3.7 | 2 | 0.3 | 12.5 | . | . | . |
| Tumour | . | . | . | . | . | . | 19 | 38.8 | 3.5 | . | . | . | . | . | . |
| Other | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **TOTAL** | **18** | **0.4** | **100.0** | **271** | **6.1** | **100.0** | **539** | **12.1** | **100.0** | **16** | **0.4** | **100.0** | **2** | **0.0** | **100.0** |

| Primary Diagnosis | Total Resurfacing Anatomic | | | Total Stemmed Anatomic | | | Total Stemless Anatomic | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | Row% | Col% | N | Row% | Col% | N | Row% | Col% |
| Fracture | 1 | 0.1 | 4.0 | 19 | 2.8 | 1.2 | 1 | 0.1 | 0.6 |
| Instability | . | . | . | 13 | 21.7 | 0.8 | 1 | 1.7 | 0.6 |
| Osteoarthritis | 23 | 0.8 | 92.0 | 1469 | 53.7 | 92.9 | 158 | 5.8 | 94.6 |
| Osteonecrosis | . | . | . | 33 | 39.3 | 2.1 | 5 | 6.0 | 3.0 |
| Other Inflammatory Arthritis | 1 | 3.8 | 4.0 | 11 | 42.3 | 0.7 | 1 | 3.8 | 0.6 |
| Rheumatoid Arthritis | . | . | . | 22 | 28.2 | 1.4 | . | . | . |
| Rotator Cuff Arthropathy | . | . | . | 13 | 1.7 | 0.8 | 1 | 0.1 | 0.6 |
| Tumour | . | . | . | . | . | . | . | . | . |
| Other | . | . | . | 1 | 50.0 | 0.1 | . | . | . |
| **TOTAL** | **25** | **0.6** | **100.0** | **1581** | **35.4** | **100.0** | **167** | **3.7** | **100.0** |

| Primary Diagnosis | Total Stemmed Reverse | | | Total Stemless Reverse | | | TOTAL | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | Row% | Col% | N | Row% | Col% | N | Row% | Col% |
| Fracture | 320 | 47.8 | 17.3 | . | . | . | 669 | 100.0 | 15.0 |
| Instability | 37 | 61.7 | 2.0 | . | . | . | 60 | 100.0 | 1.3 |
| Osteoarthritis | 689 | 25.2 | 37.2 | 2 | 0.1 | 100.0 | 2738 | 100.0 | 61.2 |
| Osteonecrosis | 19 | 22.6 | 1.0 | . | . | . | 84 | 100.0 | 1.9 |
| Other Inflammatory Arthritis | 7 | 26.9 | 0.4 | . | . | . | 26 | 100.0 | 0.6 |
| Rheumatoid Arthritis | 45 | 57.7 | 2.4 | . | . | . | 78 | 100.0 | 1.7 |
| Rotator Cuff Arthropathy | 703 | 91.8 | 38.0 | . | . | . | 766 | 100.0 | 17.1 |
| Tumour | 30 | 61.2 | 1.6 | . | . | . | 49 | 100.0 | 1.1 |
| Other | 1 | 50.0 | 0.1 | . | . | . | 2 | 100.0 | 0.0 |
| **TOTAL** | **1851** | **41.4** | **100.0** | **2** | **0.0** | **100.0** | **4472** | **100.0** | **100.0** |

## Revision of Total Stemmed Anatomic Shoulder Replacement

The Registry has information on 1,705 1st revisions of total stemmed anatomic shoulder replacement procedures for all primary diagnoses. There are 119 procedures excluded where the 1st revision was undertaken for infection.

There are also 5 procedures excluded where minor or major prostheses were not inserted, and the diagnosis was not infection. Therefore, this analysis includes 1581 1st revisions of total stemmed anatomic replacements.

### DEMOGRAPHICS OF 1ST REVISION

The mean age at 1st revision is 70.1 years. 1st revision of total stemmed anatomic is more common in females (58.4%) except for implant breakage of the glenoid insert (45.1%). The highest proportion of patients have an ASA score of 3 (50.9%) or 2 (44.0%) and are pre obese (31.3%) or have a BMI in the obese class 1 category (29.2%). Demographic details for revision of total stemmed anatomic shoulder replacement procedures are shown in Table N92.

**Table N92 Summary of 1st Revision of Known Primary Total Stemmed Anatomic Replacement (All Diagnoses, Excluding 1st Revisions for Infection)**

| Variable | Rotator Cuff Insufficiency (n=426) | Instability/ Dislocation (n=367) | Loosening (n=365) | Implant Breakage Glenoid Insert (n=102) | Other (n=321) | TOTAL (n=1,581) |
|---|---|---|---|---|---|---|
| **Follow-up Years (Primary to 1st Revision)** | | | | | | |
| Mean (SD) | 3.5 ± 3.5 | 2.4 ± 3.1 | 5.8 ± 4.2 | 4.4 ± 3.4 | 4.2 ± 3.8 | 4 ± 3.8 |
| Median (IQR) | 2 (0.9, 5.8) | 1 (0.4, 3.1) | 5.4 (2, 8.7) | 3.7 (1.8, 6.3) | 2.8 (1, 6.6) | 2.4 (0.9, 6.5) |
| Minimum | 0 | 0 | 0 | 0.2 | 0 | 0 |
| Maximum | 16 | 15.6 | 16.9 | 15.1 | 17.7 | 17.7 |
| **Age at 1st Revision** | | | | | | |
| Mean (SD) | 70.8 ± 8.8 | 69 ± 9.9 | 70.9 ± 8.2 | 71 ± 8.7 | 69.1 ± 9.5 | 70.1 ± 9.1 |
| Median (IQR) | 71 (66, 77) | 70 (64, 76) | 72 (66, 77) | 71.5 (66, 77) | 70 (64, 76) | 71 (65, 76) |
| **Age at 1st Revision in groups** | | | | | | |
| <55 | 18 (4.2%) | 28 (7.6%) | 12 (3.3%) | 4 (3.9%) | 21 (6.5%) | 83 (5.2%) |
| 55-64 | 72 (16.9%) | 73 (19.9%) | 65 (17.8%) | 16 (15.7%) | 67 (20.9%) | 293 (18.5%) |
| 65-74 | 188 (44.1%) | 151 (41.1%) | 160 (43.8%) | 48 (47.1%) | 136 (42.4%) | 683 (43.2%) |
| ≥75 | 148 (34.7%) | 115 (31.3%) | 128 (35.1%) | 34 (33.3%) | 97 (30.2%) | 522 (33%) |
| **Gender** | | | | | | |
| Male | 151 (35.4%) | 119 (32.4%) | 167 (45.8%) | 56 (54.9%) | 164 (51.1%) | 657 (41.6%) |
| Female | 275 (64.6%) | 248 (67.6%) | 198 (54.2%) | 46 (45.1%) | 157 (48.9%) | 924 (58.4%) |
| **ASA at 1st Revision[1]** | | | | | | |
| ASA 1 | 6 (1.8%) | 9 (3.5%) | 9 (3%) | | 13 (5.3%) | 37 (3.1%) |
| ASA 2 | 144 (43%) | 103 (40.6%) | 134 (44.2%) | 33 (52.4%) | 113 (46.3%) | 527 (44%) |
| ASA 3 | 175 (52.2%) | 139 (54.7%) | 157 (51.8%) | 29 (46%) | 110 (45.1%) | 610 (50.9%) |
| ASA 4 | 10 (3%) | 3 (1.2%) | 3 (1%) | 1 (1.6%) | 8 (3.3%) | 25 (2.1%) |
| **BMI at 1st Revision[2]** | | | | | | |
| Underweight | 3 (1.1%) | | 2 (0.8%) | | 1 (0.5%) | 6 (0.6%) |
| Normal | 35 (12.4%) | 41 (20.6%) | 50 (19.4%) | 7 (16.3%) | 24 (13%) | 157 (16.2%) |
| Pre Obese | 93 (32.9%) | 59 (29.6%) | 74 (28.7%) | 17 (39.5%) | 60 (32.4%) | 303 (31.3%) |
| Obese Class 1 | 76 (26.9%) | 54 (27.1%) | 83 (32.2%) | 9 (20.9%) | 61 (33%) | 283 (29.2%) |
| Obese Class 2 | 50 (17.7%) | 27 (13.6%) | 34 (13.2%) | 7 (16.3%) | 23 (12.4%) | 141 (14.6%) |
| Obese Class 3 | 26 (9.2%) | 18 (9%) | 15 (5.8%) | 3 (7%) | 16 (8.6%) | 78 (8.1%) |
| **Fixation of Primary Procedure** | | | | | | |
| Cemented | 11 (2.6%) | 24 (6.5%) | 39 (10.7%) | 1 (1%) | 8 (2.5%) | 83 (5.2%) |
| Cementless | 276 (64.8%) | 220 (59.9%) | 69 (18.9%) | 98 (96.1%) | 196 (61.1%) | 859 (54.3%) |
| Hybrid | 139 (32.6%) | 123 (33.5%) | 257 (70.4%) | 3 (2.9%) | 117 (36.4%) | 639 (40.4%) |

| Variable | Rotator Cuff Insufficiency (n=426) | Instability/ Dislocation (n=367) | Loosening (n=365) | Implant Breakage Glenoid Insert (n=102) | Other (n=321) | TOTAL (n=1,581) |
|---|---|---|---|---|---|---|
| **Glenoid Fixation in 1st Revision** | | | | | | |
| **Glenoid Cemented** | 3 (0.7%) | 11 (3%) | 47 (12.9%) | 2 (2%) | 14 (4.4%) | 77 (4.9%) |
| **Glenoid Cementless** | 142 (33.3%) | 120 (32.7%) | 214 (58.6%) | 7 (6.9%) | 65 (20.2%) | 548 (34.7%) |
| **No Glenoid inserted in 1st Revision** | 281 (66%) | 236 (64.3%) | 104 (28.5%) | 93 (91.2%) | 242 (75.4%) | 956 (60.5%) |
| **Humeral Fixation in 1st Revision** | | | | | | |
| **Humeral Cemented** | 38 (8.9%) | 35 (9.5%) | 91 (24.9%) | | 33 (10.3%) | 197 (12.5%) |
| **Humeral Cementless** | 376 (88.3%) | 282 (76.8%) | 171 (46.8%) | 83 (81.4%) | 209 (65.1%) | 1,121 (70.9%) |
| **No Humeral component inserted in 1st Revision** | 12 (2.8%) | 50 (13.6%) | 103 (28.2%) | 19 (18.6%) | 79 (24.6%) | 263 (16.6%) |

Abbreviations: SD - standard deviation, IQR - interquartile range, ASA - American Society of Anesthesiologists, BMI - Body Mass Index (kg/m$^2$).

[1]Excludes 382 procedures with unknown ASA at 1st Revision.

[2]Excludes 613 procedures with unknown BMI at 1st Revision

BMI are not provided for patients aged ≤19 years.

## Revision Arthroplasty

### OUTCOME OF 1ST REVISION

There are 259 revisions of the 1,581 1st revision procedures. The cumulative percent 2nd revision at 10 years is 19.9% and at 14 years is 20.5% (Table N93 and Figure N103).

The most common reasons for 2nd revision are instability/ dislocation (31.7%), loosening (24.7%), infection (13.1%) and rotator cuff insufficiency (7.7%) (Table N94 and Figure N104).

At 10 years, the cumulative percent 2nd revision for known primary total stemmed anatomic replacement is 19.9%.

Revision of both the humeral and glenoid components is the most common 2nd revision procedure (32.8%) followed by humeral component only (32.0%), glenoid component only (8.5%), head only (8.1%), cement spacer (6.6%), and cup only (4.2%) (Table N95).

A total stemmed anatomic shoulder replacement has a lower rate of 2nd revision when revised to a total stemmed reverse replacement compared to a primary total stemmed reverse undergoing a 1st revision to another reverse replacement. (Table N96 and Figure N105).

A total stemmed anatomic shoulder replacement revised to a total stemmed reverse has a lower rate of 2nd revision than a primary total stemmed reverse revised to another reverse.

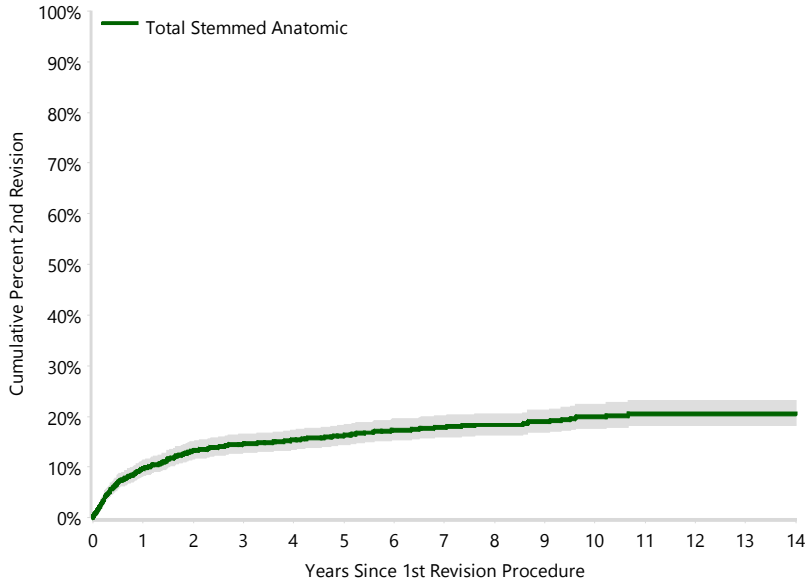
Primary total stemmed anatomic shoulder replacement implants may encompass a single design platform prosthesis (SDPP). These platform implant ranges include both anatomic and reverse shoulder replacement. They feature common design, composition metallurgy, coatings, and bearing surfaces. They allow polarity change of humeral or glenoid prostheses by modular exchange. In revision surgery the humeral stem may be retained if in the primary procedure a SDPP implant was used. The 2nd revision rate is not different regardless of whether or not the humeral stem is retained in 1st revision total stemmed anatomic replacements (Table N97 and Figure N106).

**Table N93 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement (All Diagnoses, Excluding 1st Revision for Infection)**

| Revision of Primary | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Total Stemmed Anatomic | 259 | 1581 | 9.8 (8.4, 11.4) | 14.6 (12.9, 16.5) | 16.2 (14.3, 18.2) | 17.9 (15.9, 20.1) | 19.9 (17.6, 22.4) | 20.5 (18.1, 23.2) |
| TOTAL | 259 | 1581 | | | | | | |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted.

**Figure N103 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Class of 1st Revision (All Diagnoses, Excluding 1st revision for Infection)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Total Stemmed Anatomic | 1581 | 1302 | 1026 | 821 | 586 | 289 | 46 |

**Table N94 2nd Revision Diagnosis of Known Primary Total Stemmed Anatomic Replacement (All Diagnoses, Excluding 1st Revision for Infection)**

| 2nd Revision Diagnosis | Number | Percent |
|---|---|---|
| Instability/Dislocation | 82 | 31.7 |
| Loosening | 64 | 24.7 |
| Infection | 34 | 13.1 |
| Rotator Cuff Insufficiency | 20 | 7.7 |
| Dissociation | 11 | 4.2 |
| Pain | 8 | 3.1 |
| Fracture | 8 | 3.1 |
| Implant Breakage Glenoid Insert | 8 | 3.1 |
| Metal Related Pathology | 5 | 1.9 |
| Implant Breakage Glenoid | 4 | 1.5 |
| Malposition | 3 | 1.2 |
| Wear Glenoid Insert | 3 | 1.2 |
| Wear Glenoid | 2 | 0.8 |
| Osteonecrosis | 1 | 0.4 |
| Implant Breakage Humeral | 1 | 0.4 |
| Lysis | 1 | 0.4 |
| Wear Humeral Cup | 1 | 0.4 |
| Heterotopic Bone | 1 | 0.4 |
| Glenoid Erosion | 1 | 0.4 |
| Other | 1 | 0.4 |
| TOTAL | 259 | 100.0 |

Note: Excluding 1st revisions where no minor or major humeral/glenoid components have been inserted.

**Table N95 Type of 2nd Revision of Known Primary Total Stemmed Anatomic Replacement (All Diagnoses, Excluding 1st Revision for Infection)**

| Type of 2nd Revision | Number | Percent |
|---|---|---|
| Humeral/Glenoid | 85 | 32.8 |
| Humeral Component | 83 | 32.0 |
| Glenoid Component | 22 | 8.5 |
| Head Only | 21 | 8.1 |
| Cement Spacer | 17 | 6.6 |
| Cup Only | 11 | 4.2 |
| Cup/Head | 8 | 3.1 |
| Removal of Prostheses | 6 | 2.3 |
| Head/Insert | 3 | 1.2 |
| Cement Only | 2 | 0.8 |
| Reinsertion of Components | 1 | 0.4 |
| TOTAL | 259 | 100.0 |

Note: Excluding 1st revisions where no minor or major humeral/glenoid components have been inserted.

**Figure N104 Cumulative Incidence 2nd Revision Diagnosis of Known Primary Total Stemmed Anatomic Replacement (All Diagnoses, Excluding 1st Revision for Infection)**

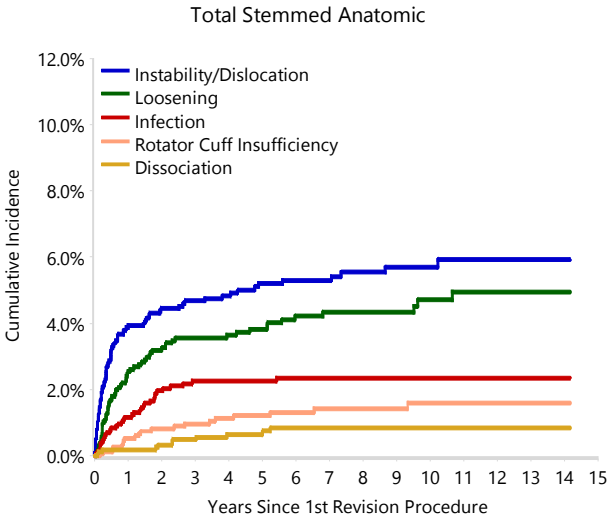
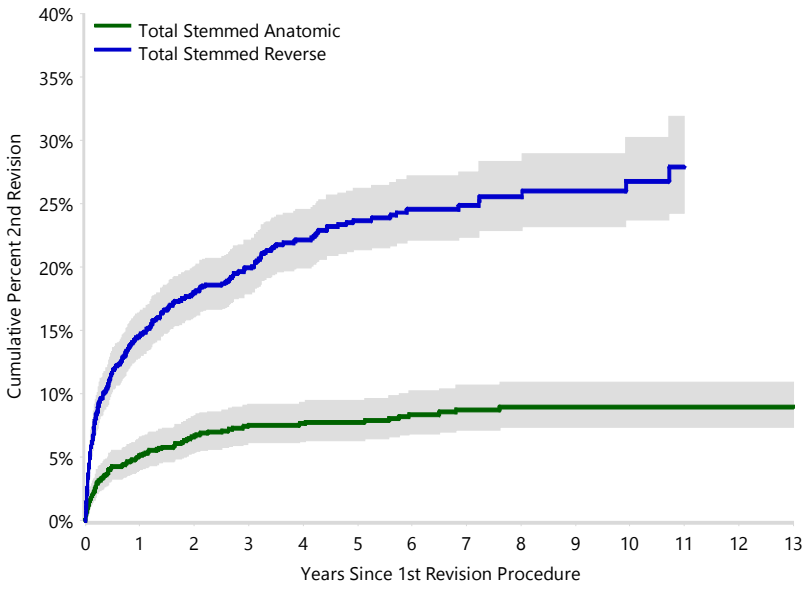


**Table N96 Cumulative Percent 2nd Revision of 1st Revision of Known Primary Total Shoulder Replacement by Primary Shoulder Class (1st Revision to Total Stemmed Reverse Shoulder, Excluding 1st Revision for Infection)**

| Type of Primary | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|
| Total Stemmed Anatomic | 95 | 1234 | 5.2 (4.0, 6.6) | 7.5 (6.1, 9.2) | 7.8 (6.3, 9.5) | 8.7 (7.2, 10.7) |
| Total Stemmed Reverse | 326 | 1603 | 14.6 (12.9, 16.4) | 19.9 (17.9, 22.1) | 23.7 (21.4, 26.2) | 24.8 (22.3, 27.5) |
| TOTAL | 421 | 2837 | | | | |

**Figure N105 Cumulative Percent 2nd Revision of 1st Revision of Known Primary Total Shoulder Replacement by Primary Shoulder Class (1st Revision to Total Stemmed Reverse Shoulder, Excluding 1st Revision for Infection)**




HR - adjusted for age and gender

Total Stemmed Anatomic vs Total Stemmed Reverse

Entire Period: HR=0.30 (95% CI 0.24, 0.38), p<0.001

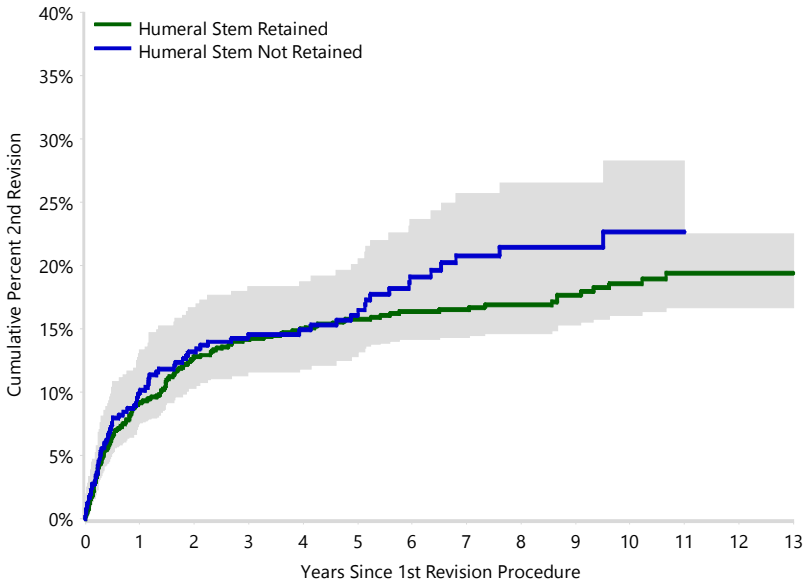
| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|
| Total Stemmed Anatomic | 1234 | 1053 | 837 | 662 | 455 |
| Total Stemmed Reverse | 1603 | 1141 | 733 | 432 | 237 |

**Table N97 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Humeral Retention (All Diagnoses, Excluding 1st Revision for Infection and Removal of Prosthesis Only Revision)**

| Type of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Humeral Stem Retained | 173 | 1092 | 9.2 (7.6, 11.1) | 14.1 (12.1, 16.4) | 15.8 (13.6, 18.2) | 16.5 (14.3, 19.0) | 18.6 (16.0, 21.4) |
| Humeral Stem Not Retained | 79 | 472 | 10.1 (7.7, 13.3) | 14.6 (11.6, 18.3) | 16.1 (12.8, 20.1) | 20.8 (16.7, 25.7) | 22.6 (18.0, 28.2) |
| TOTAL | 252 | 1564 | | | | | |

Note: Excludes 17 removal of prostheses only procedures.

**Figure N106 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Humeral Retention (All Diagnoses, Excluding 1st Revision for Infection and Removal of Prosthesis Only Revision)**




HR - adjusted for age and gender

Humeral Stem Not Retained vs Humeral Stem Retained

Entire Period: HR=1.14 (95% CI 0.87, 1.49), p=0.335

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|
| Humeral Stem Retained | 1092 | 920 | 744 | 611 | 457 | 228 |
| Humeral Stem Not Retained | 472 | 372 | 276 | 207 | 127 | 59 |

Note: Excludes 17 removal of prostheses only procedures.

## OUTCOME OF 1ST REVISION BY CLASS OF REVISION

In 2024, major total revision is the most common class of 1st revision procedure of a primary total stemmed anatomic total shoulder replacement. The yearly proportion of the 3 classes of 1st revision has changed over the past 20 years and is shown in Figure N107. There has been an ongoing increase in the proportion of major total 1st revisions.

The most common 2nd revision was to a minor class 1st revision, followed by 2nd revision to major partial class 1st revisions (Table N98).

The outcomes of the 1st revision by class of 1st revision are compared. Minor revisions have a higher rate of 2nd revision compared to major total and major partial revisions for the entire period. Major total revisions have a higher 2nd revision rate than major partial at all time periods (Table N98 and Figure N108). Both minor and major partial revisions undergo 2nd revision predominately for instability/dislocation, while major total revisions are more commonly revised for loosening (Figure N109).

**Figure N107 Revision Shoulder Replacement by Class of 1st Revision (Primary Total Stemmed Anatomic Shoulder Replacement)**

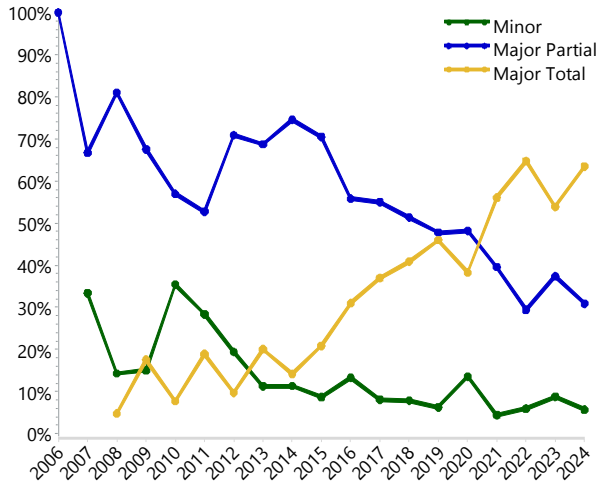
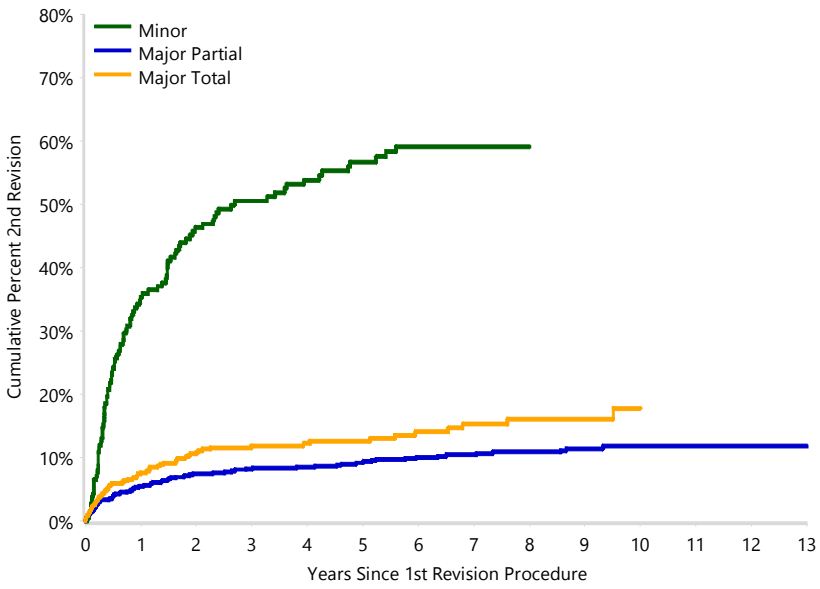


**Table N98 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Class of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**

| Class of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Minor | 107 | 185 | 35.3 (28.9, 42.8) | 50.5 (43.4, 58.1) | 56.7 (49.4, 64.3) | 59.1 (51.7, 66.7) | |
| Major Partial | 85 | 848 | 5.5 (4.2, 7.3) | 8.3 (6.6, 10.4) | 9.2 (7.4, 11.4) | 10.4 (8.4, 12.9) | 11.8 (9.5, 14.5) |
| Major Total | 67 | 548 | 7.6 (5.7, 10.3) | 11.9 (9.3, 15.2) | 12.6 (9.9, 16.0) | 15.3 (11.9, 19.5) | 17.8 (13.3, 23.6) |
| TOTAL | 259 | 1581 | | | | | |

Note: Excluding 1st revisions where no minor or major humeral/glenoid components have been inserted.

**Figure N108 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Class of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**




HR - adjusted for age and gender

Minor vs Major Partial

Entire Period: HR=7.63 (95% CI 5.72, 10.19), p<0.001

Minor vs Major Total

Entire Period: HR=5.05 (95% CI 3.71, 6.87), p<0.001

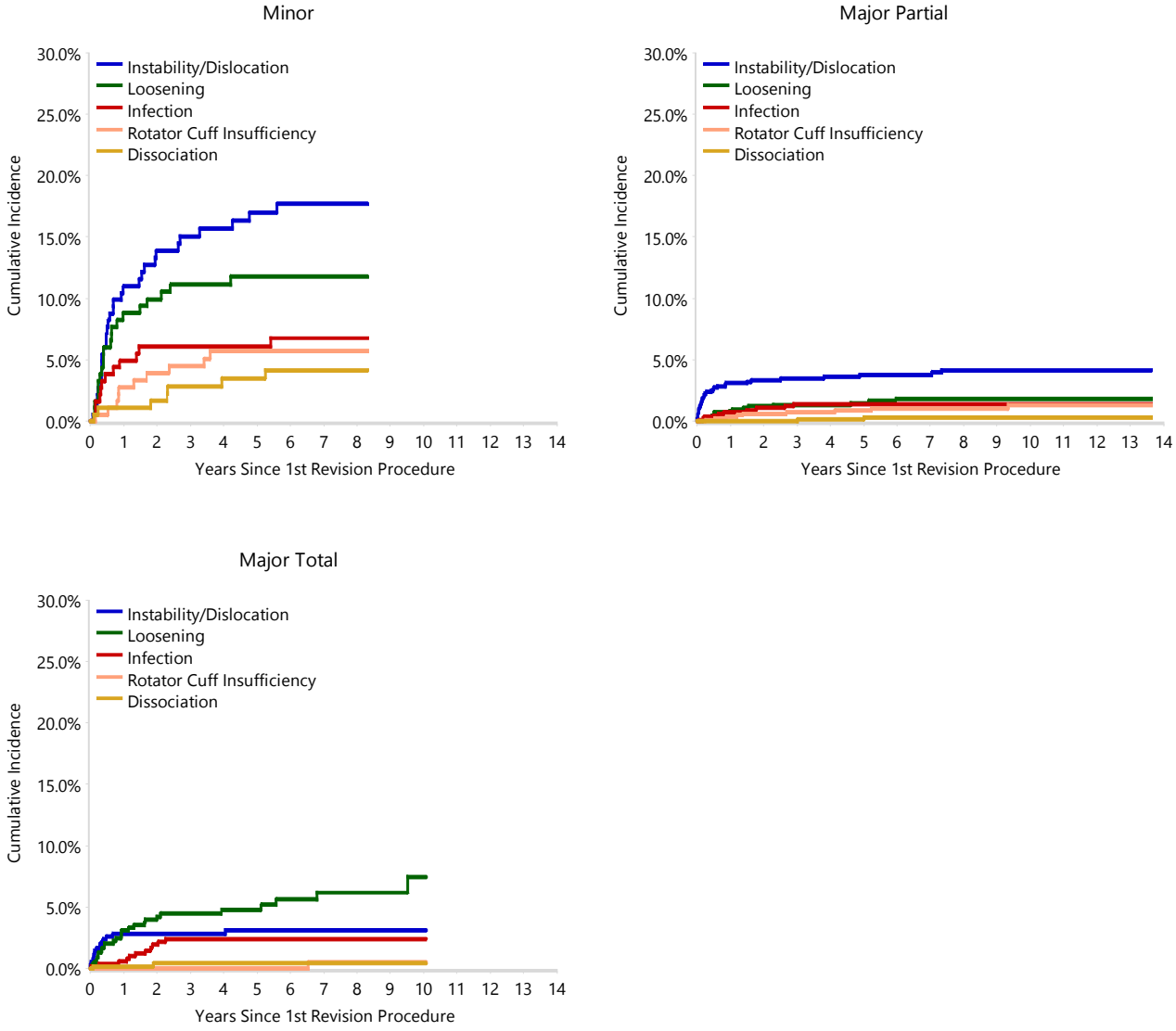
Major Total vs Major Partial

Entire Period: HR=1.51 (95% CI 1.09, 2.08), p=0.012

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|
| Minor | 185 | 113 | 76 | 57 | 46 | 26 |
| Major Partial | 848 | 758 | 653 | 552 | 421 | 221 |
| Major Total | 548 | 431 | 297 | 212 | 119 | 42 |

Note: Excluding 1st revisions where no minor or major humeral/glenoid components have been inserted.

**Figure N109 Cumulative Incidence 2nd Revision Diagnosis of Known Primary Total Stemmed Anatomic Replacement by Class of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**



## Revision Arthroplasty

### OUTCOME OF 1ST REVISION BY TYPE OF REVISION

The most common type of 1st revision for total stemmed anatomic shoulder replacements is a humeral component, followed by humeral/glenoid combination.

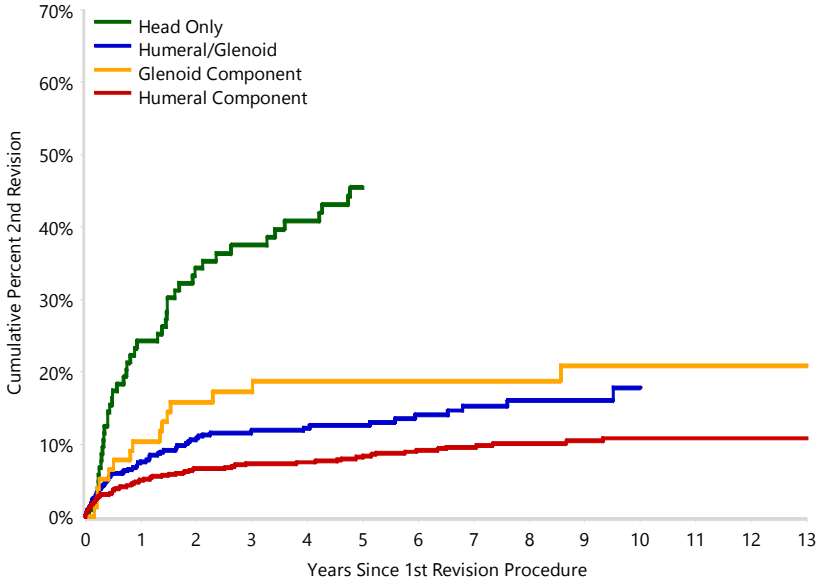
Isolated head revision, glenoid revision and glenoid/humeral revision have an increased risk of 2nd revision when compared to humeral revision.

Isolated head revision has an increased risk of 2nd revision when compared to the humeral revision. In addition, glenoid and glenoid/humeral revision have a higher rate of 2nd revision than humeral 1st revision (Table N99 and Figure N110).

**Table N99 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Type of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**

| Type of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Head Only | 52 | 104 | 24.2 (17.1, 33.7) | 37.5 (28.8, 47.7) | 45.4 (36.1, 55.9) | | |
| Humeral/Glenoid | 67 | 548 | 7.6 (5.7, 10.3) | 11.9 (9.3, 15.2) | 12.6 (9.9, 16.0) | 15.3 (11.9, 19.5) | 17.8 (13.3, 23.6) |
| Glenoid Component | 15 | 77 | 10.4 (5.4, 19.8) | 17.2 (10.4, 27.9) | 18.8 (11.6, 29.7) | 18.8 (11.6, 29.7) | 20.9 (13.0, 32.4) |
| Humeral Component | 70 | 770 | 5.0 (3.7, 6.8) | 7.4 (5.7, 9.5) | 8.2 (6.4, 10.5) | 9.6 (7.6, 12.1) | 10.8 (8.6, 13.6) |
| TOTAL | 204 | 1499 | | | | | |

**Figure N110 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Type of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**




HR - adjusted for age and gender

Head Only vs Humeral Component

0 - 3Mth: HR=2.51 (95% CI 1.11, 5.68), p=0.027

3Mth+: HR=7.84 (95% CI 5.31, 11.58), p<0.001

Humeral/Glenoid vs Humeral Component

Entire Period: HR=1.64 (95% CI 1.17, 2.30), p=0.004

Glenoid Component vs Humeral Component

Entire Period: HR=1.94 (95% CI 1.11, 3.40), p=0.019

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|
| Head Only | 104 | 76 | 56 | 45 | 35 | 19 |
| Humeral/Glenoid | 548 | 431 | 297 | 212 | 119 | 42 |
| Glenoid Component | 77 | 68 | 54 | 51 | 44 | 28 |
| Humeral Component | 770 | 689 | 598 | 500 | 376 | 193 |

### HUMERAL FIXATION OUTCOME

At the time of the 1st revision, the most common fixation for an implanted humeral component is cementless, followed by no exchange of a humeral prosthesis, while the percentage of 2nd revision for no humeral exchanged 1st revision is higher than 1st revisions with cementless fixation. The method of humeral fixation at 1st revision does not change the rate of 2nd revision (Table N100).

**Table N100 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Humeral Fixation of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**

| Humeral Fixation in 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|
| **Humeral Cemented** | 24 | 197 | 5.7 (3.2, 10.1) | 10.0 (6.4, 15.5) | 11.7 (7.6, 17.6) | 15.0 (10.0, 22.3) |
| **Humeral Cementless** | 113 | 1121 | 6.2 (4.9, 7.8) | 9.0 (7.4, 10.9) | 9.7 (8.0, 11.7) | 11.2 (9.3, 13.4) |
| **No Humeral component inserted in 1st Revision** | 122 | 263 | 27.8 (22.8, 33.7) | 40.5 (34.7, 46.8) | 45.2 (39.2, 51.6) | 46.7 (40.6, 53.2) |
| **TOTAL** | **259** | **1581** | | | | |

Note: Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

## TIMING OF 1ST REVISION

The timing of the 1st revision was classified as early if it occurred within 2 years of the primary procedure (<2 years) or late if it occurred 2 years or more (≥2 years) after the primary procedure.

The reason for the 1st revision and the timing (early or late) are shown in Table N101.

There are 710 early 1st revisions (44.9%). In the first 3 months, the revision rate is lower for early 1st revisions compared to procedures performed later. However, from 3 months onwards, this reverses, and early 1st revisions have a higher rate of 2nd revision compared to procedures performed later (Table N102 and Figure N111).

There are 91 early 1st revisions for loosening (24.9%). There is no difference in the 2nd revision rate between early 1st revisions for loosening and those undertaken later (Table N103).

There are 248 early 1st revisions for instability/dislocation (67.6%). There is no difference in the 2nd revision rate between early 1st revisions for dislocation/instability and those performed later (Table N104).

There are 215 early 1st revisions for rotator cuff insufficiency (50.5%). Late 1st revisions have a higher rate of 2nd revision compared to early 1st revisions for rotator cuff insufficiency (Table N105 and Figure N112).

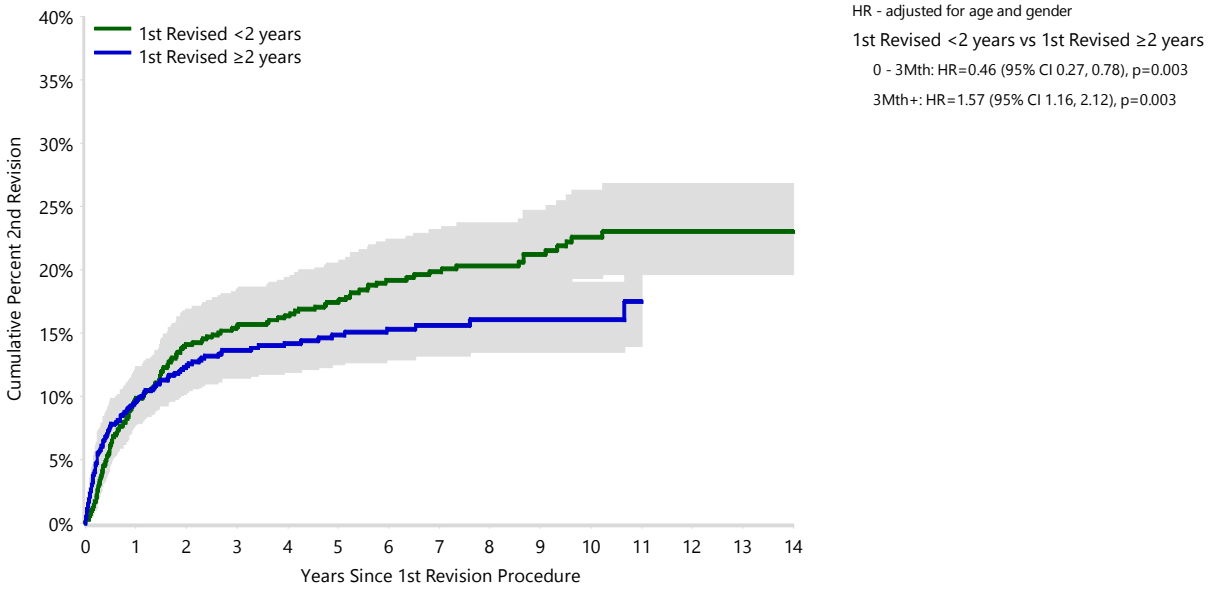
**Table N101 Known Primary Total Stemmed Anatomic Shoulder by Timing and Reason of 1st Revision (Excluding 1st Revision for Infection)**

| Revision for 1st Revision | 1st Revised <2 years | | | 1st Revised ≥2 years | | | TOTAL | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | Row% | Col% | N | Row% | Col% | N | Row% | Col% |
| Arthrofibrosis | 15 | 71.4 | 2.1 | 6 | 28.6 | 0.7 | 21 | 100.0 | 1.3 |
| Dissociation | 17 | 28.3 | 2.4 | 43 | 71.7 | 4.9 | 60 | 100.0 | 3.8 |
| Fracture | 22 | 48.9 | 3.1 | 23 | 51.1 | 2.6 | 45 | 100.0 | 2.8 |
| Glenoid Erosion | 2 | 66.7 | 0.3 | 1 | 33.3 | 0.1 | 3 | 100.0 | 0.2 |
| Implant Breakage Glenoid | 6 | 16.2 | 0.8 | 31 | 83.8 | 3.6 | 37 | 100.0 | 2.3 |
| Implant Breakage Glenoid Insert | 32 | 31.4 | 4.5 | 70 | 68.6 | 8.0 | 102 | 100.0 | 6.5 |
| Implant Breakage Head | 1 | 50.0 | 0.1 | 1 | 50.0 | 0.1 | 2 | 100.0 | 0.1 |
| Implant Breakage Humeral | . | . | . | 2 | 100.0 | 0.2 | 2 | 100.0 | 0.1 |
| Incorrect Sizing | 17 | 89.5 | 2.4 | 2 | 10.5 | 0.2 | 19 | 100.0 | 1.2 |
| Instability/Dislocation | 248 | 67.6 | 34.9 | 119 | 32.4 | 13.7 | 367 | 100.0 | 23.2 |
| Loosening | 91 | 24.9 | 12.8 | 274 | 75.1 | 31.5 | 365 | 100.0 | 23.1 |
| Lysis | 2 | 7.7 | 0.3 | 24 | 92.3 | 2.8 | 26 | 100.0 | 1.6 |
| Malposition | 11 | 84.6 | 1.5 | 2 | 15.4 | 0.2 | 13 | 100.0 | 0.8 |
| Metal Related Pathology | 4 | 16.7 | 0.6 | 20 | 83.3 | 2.3 | 24 | 100.0 | 1.5 |
| Pain | 21 | 56.8 | 3.0 | 16 | 43.2 | 1.8 | 37 | 100.0 | 2.3 |
| Progression Of Disease | . | . | . | 3 | 100.0 | 0.3 | 3 | 100.0 | 0.2 |
| Rotator Cuff Insufficiency | 215 | 50.5 | 30.3 | 211 | 49.5 | 24.2 | 426 | 100.0 | 26.9 |
| Wear Glenoid | . | . | . | 1 | 100.0 | 0.1 | 1 | 100.0 | 0.1 |
| Wear Glenoid Insert | 2 | 10.0 | 0.3 | 18 | 90.0 | 2.1 | 20 | 100.0 | 1.3 |
| Other | 4 | 50.0 | 0.6 | 4 | 50.0 | 0.5 | 8 | 100.0 | 0.5 |
| **TOTAL** | **710** | **44.9** | **100.0** | **871** | **55.1** | **100.0** | **1581** | **100.0** | **100.0** |

**Table N102 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Type of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**

| Type of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| 1st Revised <2 years | 139 | 710 | 9.9 (7.9, 12.3) | 15.5 (13.0, 18.5) | 17.5 (14.8, 20.6) | 19.8 (16.9, 23.2) | 22.6 (19.3, 26.3) |
| 1st Revised ≥2 years | 120 | 871 | 9.6 (7.8, 11.9) | 13.7 (11.4, 16.3) | 14.8 (12.5, 17.6) | 15.6 (13.2, 18.6) | 16.0 (13.5, 19.1) |
| TOTAL | 259 | 1581 | | | | | |

**Figure N111 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Type of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|
| 1st Revised <2 years | 710 | 615 | 515 | 447 | 344 | 200 |
| 1st Revised ≥2 years | 871 | 687 | 511 | 374 | 242 | 89 |

**Table N103 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Time of 1st Revision (All Diagnoses, 1st Revision for Loosening)**

| Time of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| 1st Revised for Loosening <2 years | 20 | 91 | 15.6 (9.6, 24.9) | 21.5 (14.3, 31.7) | 21.5 (14.3, 31.7) | 21.5 (14.3, 31.7) | 24.2 (16.0, 35.7) |
| 1st Revised for Loosening ≥2 years | 44 | 274 | 11.2 (7.9, 15.8) | 17.0 (12.8, 22.5) | 18.6 (14.0, 24.4) | 18.6 (14.0, 24.4) | |
| TOTAL | 64 | 365 | | | | | |

Note: Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Table N104 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Time of 1st Revision (All Diagnoses, 1st Revision for Instability/Dislocation)**

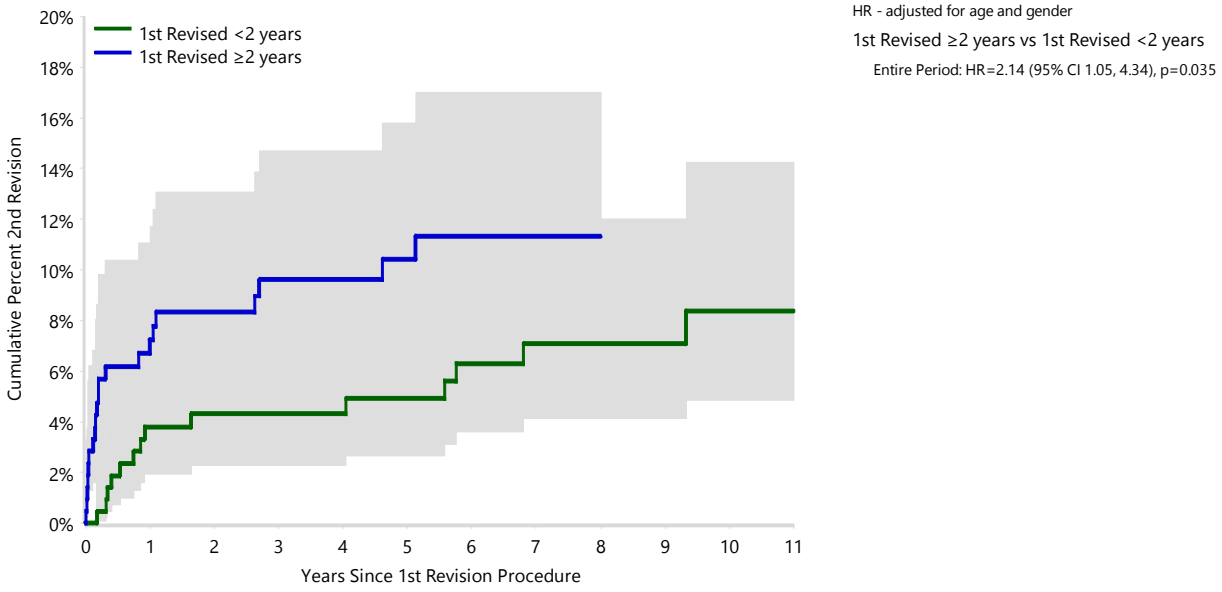
| Time of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| 1st Revised for Dislocation/ Instability <2 years | 43 | 248 | 9.9 (6.7, 14.3) | 13.3 (9.6, 18.4) | 15.4 (11.3, 20.8) | 17.8 (13.3, 23.6) | 20.5 (15.4, 27.0) |
| 1st Revised for Dislocation/ Instability ≥2 years | 16 | 119 | 9.5 (5.4, 16.6) | 13.7 (8.4, 21.7) | 15.4 (9.6, 24.2) | | |
| TOTAL | 59 | 367 | | | | | |

Note: Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Table N105 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Time of 1st Revision (All Diagnoses, 1st Revision for Rotator Cuff Insufficiency)**

| Type of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| 1st Revised <2 years | 14 | 215 | 3.8 (1.9, 7.5) | 4.3 (2.3, 8.1) | 4.9 (2.7, 9.0) | 7.1 (4.1, 12.0) | 8.4 (4.9, 14.2) |
| 1st Revised ≥2 years | 22 | 211 | 7.2 (4.4, 11.7) | 9.6 (6.2, 14.7) | 10.4 (6.8, 15.8) | 11.3 (7.4, 17.0) | |
| TOTAL | 36 | 426 | | | | | |

**Figure N112 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Time of 1st Revision (All Diagnoses, 1st Revision for Rotator Cuff Insufficiency)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|
| 1st Revised <2 years | 215 | 197 | 170 | 149 | 111 | 61 |
| 1st Revised ≥2 years | 211 | 172 | 137 | 101 | 59 | 11 |

## OUTCOME OF 1ST REVISION BY PATIENT CHARACTERISTICS

The outcome of the 1st revision of primary total stemmed anatomic shoulder replacement varies by age and gender. Females aged <65 years have a higher rate of 2nd revision than females aged ≥65 years (Table N106 and Figure N113).

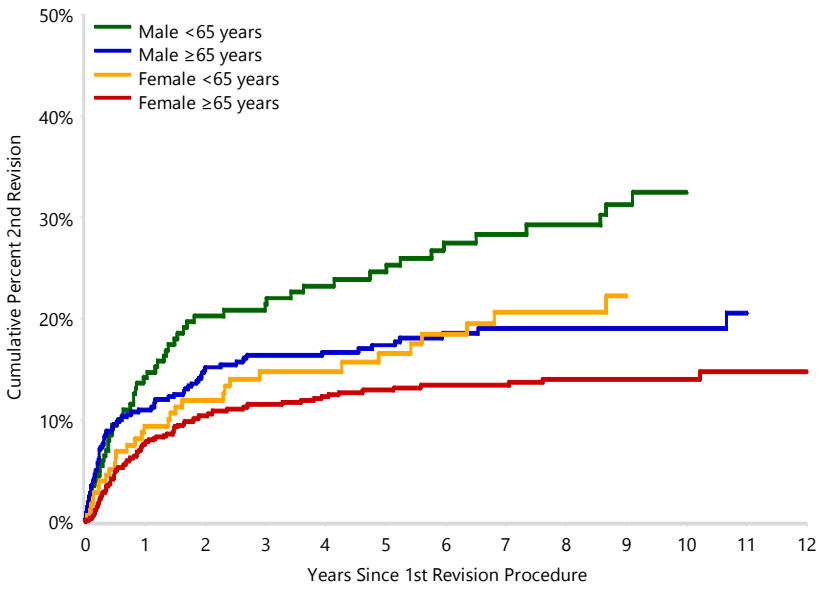
Males aged <65 years have a higher rate of 2nd revision than males aged ≥65 years from 3 months after the 1st revision. Males aged ≥65 years have a higher rate of revision compared to females of the same age group in the first 3 months, with no difference after this time.

**Table N106 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Gender and Age (All Diagnoses, Excluding 1st Revision for Infection)**

| Gender | Age at 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Male | <65 years | 55 | 201 | 14.2 (10.0, 19.9) | 21.4 (16.2, 28.0) | 24.6 (19.0, 31.5) | 28.3 (22.2, 35.7) | 32.5 (25.6, 40.6) |
| | ≥65 years | 77 | 456 | 11.0 (8.5, 14.3) | 16.4 (13.1, 20.3) | 17.4 (14.0, 21.5) | 19.0 (15.4, 23.4) | 19.0 (15.4, 23.4) |
| Female | <65 years | 34 | 175 | 9.4 (5.9, 14.9) | 14.8 (10.2, 21.4) | 16.6 (11.5, 23.5) | 20.6 (14.7, 28.5) | |
| | ≥65 years | 93 | 749 | 7.9 (6.1, 10.1) | 11.6 (9.4, 14.2) | 13.0 (10.6, 15.7) | 13.4 (11.0, 16.3) | 14.1 (11.5, 17.1) |
| TOTAL | | 259 | 1581 | | | | | |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted.

**Figure N113 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Gender and Age (All Diagnoses, Excluding 1st Revision for Infection)**




Male <65 years vs Male ≥65 years
0 - 3Mth: HR=0.80 (95% CI 0.41, 1.57), p=0.518
3Mth+: HR=2.03 (95% CI 1.36, 3.05), p<0.001

Male <65 years vs Female <65 years
Entire Period: HR=1.43 (95% CI 0.93, 2.20), p=0.098

Male ≥65 years vs Female ≥65 years
0 - 3Mth: HR=3.06 (95% CI 1.72, 5.47), p<0.001
3Mth+: HR=1.09 (95% CI 0.76, 1.55), p=0.641

Female <65 years vs Female ≥65 years
Entire Period: HR=1.57 (95% CI 1.06, 2.32), p=0.024

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Male | <65 years | 201 | 162 | 132 | 110 | 81 | 48 |
| | ≥65 years | 456 | 358 | 279 | 224 | 153 | 74 |
| Female | <65 years | 175 | 145 | 110 | 93 | 68 | 39 |
| | ≥65 years | 749 | 637 | 505 | 394 | 284 | 128 |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted.

### ASA SCORE AND BMI CATEGORY

ASA score is available for 1,199 1st revision of primary total stemmed anatomic shoulder replacements. There is no difference in the rate of 2nd revision between patients with ASA scores of 1-4 (Table N107). BMI is recorded for 968 1st revision procedures. The rate of 2nd revision did not differ between BMI classes (Table N108).

**Table N107 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by ASA (All Diagnoses, Excluding 1st Revision for Infection)**

| ASA Grade | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| ASA 1 | 5 | 37 | 8.3 (2.8, 23.7) | 14.6 (6.3, 31.6) | 14.6 (6.3, 31.6) | 14.6 (6.3, 31.6) | 14.6 (6.3, 31.6) |
| ASA 2 | 68 | 527 | 7.5 (5.5, 10.2) | 12.3 (9.6, 15.6) | 13.6 (10.8, 17.1) | 14.4 (11.5, 18.1) | 16.2 (12.6, 20.7) |
| ASA 3 | 78 | 610 | 9.5 (7.4, 12.2) | 12.0 (9.5, 15.0) | 13.2 (10.6, 16.4) | 15.9 (12.7, 19.8) | |
| ASA 4 | 4 | 25 | 16.0 (6.3, 37.2) | 16.0 (6.3, 37.2) | 16.0 (6.3, 37.2) | 16.0 (6.3, 37.2) | |
| TOTAL | 155 | 1199 | | | | | |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted.
Excludes 382 procedures with no ASA score recorded.
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Table N108 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by BMI (All Diagnoses, Excluding 1st Revision for Infection)**

| BMI Category | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|
| Underweight | 0 | 6 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | |
| Normal | 18 | 157 | 7.9 (4.6, 13.5) | 10.2 (6.3, 16.4) | 13.0 (8.3, 19.9) | 13.0 (8.3, 19.9) | |
| Pre Obese | 39 | 303 | 7.5 (5.0, 11.2) | 10.9 (7.7, 15.2) | 12.2 (8.8, 16.8) | 15.2 (11.2, 20.4) | 16.3 (11.9, 22.2) |
| Obese Class 1 | 29 | 283 | 8.3 (5.5, 12.3) | 10.4 (7.3, 14.8) | 10.9 (7.7, 15.5) | 11.6 (8.2, 16.4) | 11.6 (8.2, 16.4) |
| Obese Class 2 | 16 | 141 | 9.0 (5.2, 15.3) | 9.0 (5.2, 15.3) | 10.0 (5.9, 16.7) | 11.4 (6.8, 18.7) | |
| Obese Class 3 | 11 | 78 | 11.8 (6.3, 21.5) | 13.3 (7.4, 23.3) | 13.3 (7.4, 23.3) | 13.3 (7.4, 23.3) | 13.3 (7.4, 23.3) |
| TOTAL | 113 | 968 | | | | | |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted
Excludes 613 procedures with no BMI recorded.
BMI has not been presented for patients aged ≤19 years.
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

## CHANGES IN REVISION SHOULDER SURGERY OVER TIME

The most common reason for 1st revision has changed over time. In 2008, the majority of 1st revision procedures were performed for loosening or instability/dislocation, but since 2022, loosening has been more common (Figure N114).

Up to 2020, the most common 1st revision of primary total stemmed anatomic shoulder arthroplasty was a partial major revision.

After that time, major total revision has predominated (Figure N107). In 2024, 63.4% of 1st revisions are major total, 30.9% major partial and 5.7% are minor.

The type of fixation of the humeral component at the 1st revision remains predominately cementless when the humeral component is exchanged (Figure N115).

The results of the 1st revision are stratified by the reason for the 1st revision in the following section.

**Figure N114 Revision Shoulder Replacement by Class (Primary Total Stemmed Anatomic Shoulder Replacement) by Reason for 1st Revision**

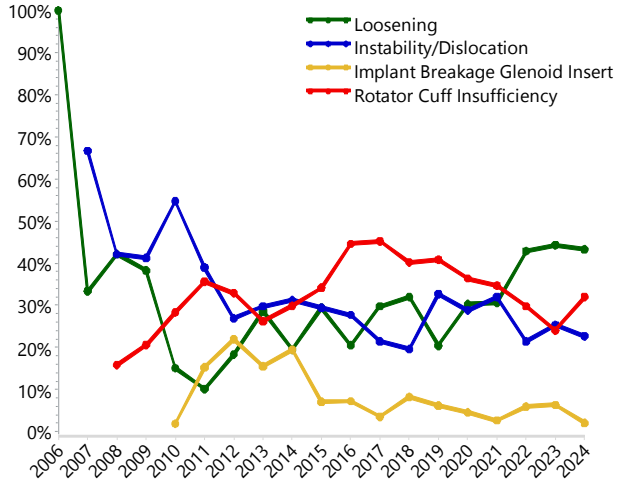
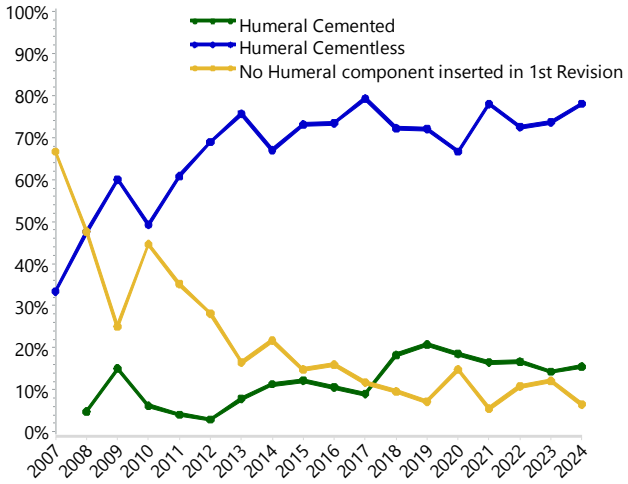



**Figure N115 Primary Known 1st Revision Shoulder Replacement by Humeral Fixation (All Diagnoses, Primary class Total Stemmed Anatomic, Excluding 1st Revision for Infection) by Humeral Fixation in 1st Revision**



### OUTCOMES OF THE 1ST REVISION BY REASON FOR 1ST REVISION

Further analyses on the outcomes of the most common reasons for 1st revision have been performed. These include loosening, prosthesis instability/dislocation, implant breakage of the glenoid insert, and rotator cuff insufficiency.

When compared to rotator cuff insufficiency, loosening and prosthesis instability/dislocation have a higher rate of 2nd revision. Implant breakage of the glenoid insert also has a higher rate of 2nd revision compared to rotator cuff insufficiency, but only after 6 months (Table N109 and Figure N116).

Instability/dislocation, loosening and implant breakage at 1st revision were predominately revised for the same reasons at the 2nd revision. 1st revisions for rotator cuff insufficiency most commonly underwent 2nd revision for instability/dislocation (Table N110).

Loosening and prosthesis instability/dislocation have a higher rate of 2nd revision compared to rotator cuff insufficiency.

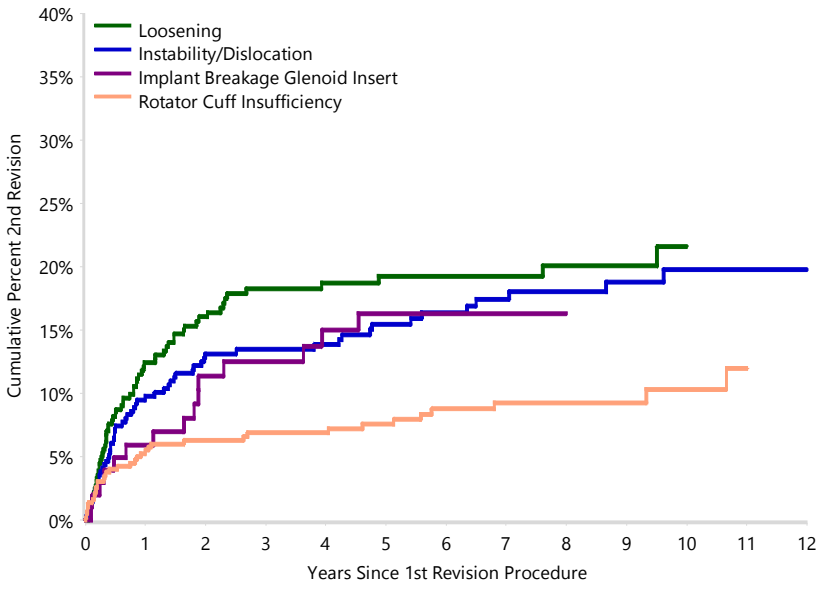
When the 1st revision is for loosening or instability/dislocation, the most common 2nd revision involves both humeral and glenoid components. In contrast, 1st revisions for implant breakage and rotator cuff insufficiency most commonly undergo 2nd revision of the humeral component only (Table N111).

**Table N109 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Reason for 1st Revision (All Diagnoses)**

| Reason for 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Loosening | 64 | 365 | 12.4 (9.4, 16.4) | 18.3 (14.5, 22.9) | 19.3 (15.3, 24.1) | 19.3 (15.3, 24.1) | 21.6 (16.8, 27.6) |
| Instability/Dislocation | 59 | 367 | 9.8 (7.1, 13.3) | 13.5 (10.3, 17.5) | 15.5 (12.0, 19.9) | 17.4 (13.6, 22.2) | 19.8 (15.4, 25.3) |
| Implant Breakage Glenoid Insert | 18 | 102 | 5.9 (2.7, 12.7) | 12.5 (7.3, 21.0) | 16.3 (10.1, 25.7) | 16.3 (10.1, 25.7) | |
| Rotator Cuff Insufficiency | 36 | 426 | 5.5 (3.7, 8.2) | 6.9 (4.8, 9.8) | 7.6 (5.3, 10.7) | 9.3 (6.6, 12.9) | 10.3 (7.2, 14.7) |
| TOTAL | 177 | 1260 | | | | | |

Note: Excluding 1st revisions where no minor or major humeral/glenoid components have been inserted.

**Figure N116 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Reason for 1st Revision (All Diagnoses)**




HR - adjusted for age and gender

Loosening vs Rotator Cuff Insufficiency

Entire Period: HR=2.29 (95% CI 1.52, 3.45), p<0.001

Instability/Dislocation vs Rotator Cuff Insufficiency

Entire Period: HR=1.80 (95% CI 1.19, 2.73), p=0.005

Implant Breakage Glenoid Insert vs Rotator Cuff Insufficiency

0 - 3Mth: HR=1.25 (95% CI 0.37, 4.17), p=0.721

3Mth - 6Mth: HR=1.20 (95% CI 0.28, 5.20), p=0.802

6Mth+: HR=2.39 (95% CI 1.24, 4.60), p=0.009

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|
| Loosening | 365 | 279 | 194 | 149 | 103 | 48 |
| Instability/Dislocation | 367 | 310 | 252 | 200 | 142 | 78 |
| Implant Breakage Glenoid Insert | 102 | 93 | 73 | 62 | 48 | 27 |
| Rotator Cuff Insufficiency | 426 | 369 | 307 | 250 | 170 | 72 |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted.

**Table N110 Revision Diagnosis of 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Reason for 1st Revision (All Diagnoses)**

| 2nd Revision Diagnosis | Loosening | | Instability/ Dislocation | | Implant Breakage Glenoid Insert | | Rotator Cuff Insufficiency | | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% | N | Col% | N | Col% |
| Instability/Dislocation | 9 | 14.1 | 31 | 52.5 | 2 | 11.1 | 12 | 33.3 | 54 | 30.5 |
| Loosening | 30 | 46.9 | 10 | 16.9 | 1 | 5.6 | 10 | 27.8 | 51 | 28.8 |
| Infection | 14 | 21.9 | 5 | 8.5 | . | . | 5 | 13.9 | 24 | 13.6 |
| Rotator Cuff Insufficiency | 3 | 4.7 | 5 | 8.5 | . | . | 3 | 8.3 | 11 | 6.2 |
| Pain | 3 | 4.7 | 2 | 3.4 | . | . | 2 | 5.6 | 7 | 4.0 |
| Dissociation | 2 | 3.1 | 1 | 1.7 | 4 | 22.2 | . | . | 7 | 4.0 |
| Implant Breakage Glenoid Insert | . | . | . | . | 5 | 27.8 | . | . | 5 | 2.8 |
| Wear Glenoid Insert | 1 | 1.6 | 1 | 1.7 | 1 | 5.6 | . | . | 3 | 1.7 |
| Implant Breakage Glenoid | . | . | . | . | 3 | 16.7 | . | . | 3 | 1.7 |
| Fracture | 1 | 1.6 | 1 | 1.7 | . | . | 1 | 2.8 | 3 | 1.7 |
| Malposition | . | . | 1 | 1.7 | . | . | 1 | 2.8 | 2 | 1.1 |
| Metal Related Pathology | . | . | 1 | 1.7 | 1 | 5.6 | . | . | 2 | 1.1 |
| Osteonecrosis | 1 | 1.6 | . | . | . | . | . | . | 1 | 0.6 |
| Implant Breakage Humeral | . | . | . | . | 1 | 5.6 | . | . | 1 | 0.6 |
| Lysis | . | . | . | . | . | . | 1 | 2.8 | 1 | 0.6 |
| Glenoid Erosion | . | . | 1 | 1.7 | . | . | . | . | 1 | 0.6 |
| Other | . | . | . | . | . | . | 1 | 2.8 | 1 | 0.6 |
| TOTAL | 64 | 100.0 | 59 | 100.0 | 18 | 100.0 | 36 | 100.0 | 177 | 100.0 |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted.

**Table N111 Type of 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Type of 1st Revision (All Diagnoses)**

| Type of 2nd Revision | Loosening | | Instability/ Dislocation | | Implant Breakage Glenoid Insert | | Rotator Cuff Insufficiency | | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% | N | Col% | N | Col% |
| Humeral Component | 10 | 15.6 | 20 | 33.9 | 13 | 72.2 | 14 | 38.9 | 57 | 32.2 |
| Humeral/Glenoid | 24 | 37.5 | 21 | 35.6 | 2 | 11.1 | 7 | 19.4 | 54 | 30.5 |
| Head Only | 9 | 14.1 | 6 | 10.2 | 1 | 5.6 | 3 | 8.3 | 19 | 10.7 |
| Glenoid Component | 7 | 10.9 | 3 | 5.1 | 1 | 5.6 | 3 | 8.3 | 14 | 7.9 |
| Cement Spacer | 8 | 12.5 | 4 | 6.8 | . | . | 2 | 5.6 | 14 | 7.9 |
| Cup Only | 1 | 1.6 | 2 | 3.4 | . | . | 4 | 11.1 | 7 | 4.0 |
| Cup/Head | . | . | 2 | 3.4 | . | . | 2 | 5.6 | 4 | 2.3 |
| Removal of Prostheses | 2 | 3.1 | . | . | . | . | 1 | 2.8 | 3 | 1.7 |
| Head/Insert | . | . | 1 | 1.7 | 1 | 5.6 | . | . | 2 | 1.1 |
| Cement Only | 2 | 3.1 | . | . | . | . | . | . | 2 | 1.1 |
| Reinsertion of Components | 1 | 1.6 | . | . | . | . | . | . | 1 | 0.6 |
| TOTAL | 64 | 100.0 | 59 | 100.0 | 18 | 100.0 | 36 | 100.0 | 177 | 100.0 |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted.

## LOOSENING

There are 365 1st revision total stemmed anatomic shoulder replacements for loosening, and 46 of these have had a 2nd revision (Table N112).

The most common 1st revision for loosening is humeral/glenoid revision, followed by isolated humeral and glenoid revisions. There is no difference in the cumulative percent 2nd revision comparing types of 1st revision (Table N112).

Where the humeral component is revised in a 1st revision for loosening, the fixation chosen is most commonly cementless. There is no difference in the rate of 2nd revision comparing the fixation of a revised humeral component (Table N113).

**Table N112 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Type of 1st Revision (All Diagnoses, 1st Revision for Loosening)**

| Type of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Head Only | 5 | 24 | 12.9 (4.3, 34.8) | 22.6 (10.0, 46.3) | 22.6 (10.0, 46.3) | 22.6 (10.0, 46.3) | 22.6 (10.0, 46.3) |
| Humeral/Glenoid | 23 | 213 | 5.5 (3.1, 9.7) | 11.2 (7.3, 16.8) | 12.1 (8.0, 18.2) | 12.1 (8.0, 18.2) | |
| Glenoid Component | 9 | 48 | 12.6 (5.9, 25.9) | 19.2 (10.5, 33.6) | 19.2 (10.5, 33.6) | 19.2 (10.5, 33.6) | 19.2 (10.5, 33.6) |
| Humeral Component | 9 | 49 | 12.3 (5.7, 25.3) | 16.8 (8.8, 30.9) | 19.5 (10.6, 34.3) | 19.5 (10.6, 34.3) | 19.5 (10.6, 34.3) |
| TOTAL | 46 | 334 | | | | | |

Note: Excludes 31 1st revisions with other minor revision types.
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Table N113 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Humeral Fixation of 1st Revision (All Diagnoses, 1st Revision for Loosening)**

| Humeral Fixation in 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|
| Humeral Cemented | 8 | 91 | 3.4 (1.1, 10.2) | 9.1 (4.4, 18.4) | 9.1 (4.4, 18.4) | 9.1 (4.4, 18.4) |
| Humeral Cementless | 24 | 171 | 8.7 (5.2, 14.2) | 14.0 (9.3, 20.7) | 16.4 (11.1, 24.0) | 16.4 (11.1, 24.0) |
| No Humeral component inserted in 1st Revision | 32 | 103 | 26.1 (18.6, 35.9) | 32.6 (24.3, 42.9) | 32.6 (24.3, 42.9) | |
| TOTAL | 64 | 365 | | | | |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted.
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

### INSTABILITY/DISLOCATION

Instability/dislocation is the second most common 1st revision diagnosis for total stemmed anatomic shoulder replacement. There are 349 1st revision total stemmed anatomic shoulder replacements for instability/dislocation, and 52 of these have had a 2nd revision.

The most common 1st revision for instability/dislocation is isolated humeral revision, followed by revision of the humeral and glenoid components. There is no difference in the rate of 2nd revision when these two types of revision are compared.

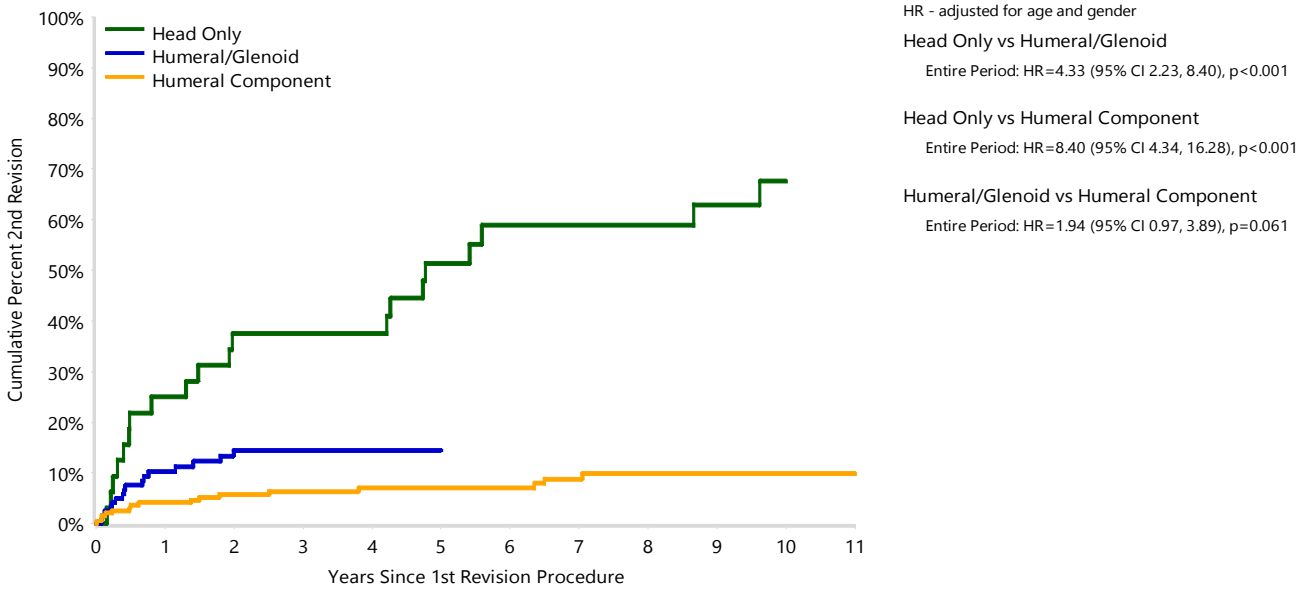
Head only 1st revisions for instability/dislocation are the least common form of revision procedure. When performed for instability/dislocation, they are associated with a higher rate of 2nd revision compared to isolated humeral and humeral glenoid combinations (Table N114 and Figure N117).

**Table N114 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Type of 1st Revision (All Diagnoses, 1st Revision for Instability/Dislocation)**

| Type of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Head Only | 20 | 32 | 25.0 (13.4, 43.8) | 37.5 (23.3, 56.5) | 51.4 (35.3, 69.8) | 58.9 (42.1, 76.4) | 67.6 (50.1, 84.0) |
| Humeral/Glenoid | 16 | 122 | 10.3 (6.0, 17.4) | 14.4 (9.1, 22.6) | 14.4 (9.1, 22.6) | | |
| Humeral Component | 16 | 195 | 4.1 (2.1, 8.1) | 6.4 (3.7, 10.9) | 7.0 (4.1, 11.8) | 8.8 (5.3, 14.4) | 9.8 (6.0, 15.8) |
| TOTAL | 52 | 349 | | | | | |

Note: Excludes 18 1st revisions with other minor revision types.

**Figure N117 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Type of 1st Revision (All Diagnoses, 1st Revision for Instability/Dislocation)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|
| Head Only | 32 | 24 | 18 | 14 | 10 | 6 |
| Humeral/Glenoid | 122 | 94 | 70 | 52 | 32 | 15 |
| Humeral Component | 195 | 182 | 156 | 126 | 92 | 51 |

## ROTATOR CUFF INSUFFICIENCY

There are 415 primary total stemmed anatomic shoulder replacements that have been revised for rotator cuff insufficiency, and 30 of these have had a 2nd revision.

The most common type of 1st revision for rotator cuff insufficiency is isolated humeral component revision, followed by combined humeral/glenoid revision. There is no difference in the rate of 2nd revision when these two types of revision are compared (Table N115).

**Table N115 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Type of 1st Revision (All Diagnoses, 1st Revision for Rotator Cuff Insufficiency)**

| Type of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| **Humeral/Glenoid** | 13 | 144 | 5.0 (2.4, 10.2) | 6.6 (3.5, 12.3) | 7.9 (4.2, 14.3) | | |
| **Glenoid Component** | 0 | 1 | | | | | |
| **Humeral Component** | 17 | 270 | 4.2 (2.3, 7.4) | 5.4 (3.3, 9.0) | 5.9 (3.6, 9.7) | 6.5 (4.0, 10.4) | 7.8 (4.7, 12.8) |
| **TOTAL** | **30** | **415** | | | | | |

Note: Excludes 11 1st revisions with other minor revision types.

Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

### OUTCOMES OF 1ST REVISION OVER TIME

This analysis compares the outcomes of 1st revisions of total stemmed anatomic replacement over two successive time periods: pre 2016 and 2016–2024. There has been an improvement in the rate of 2nd revision comparing the most recent period to pre 2016 (Table N116 and Figure N118).

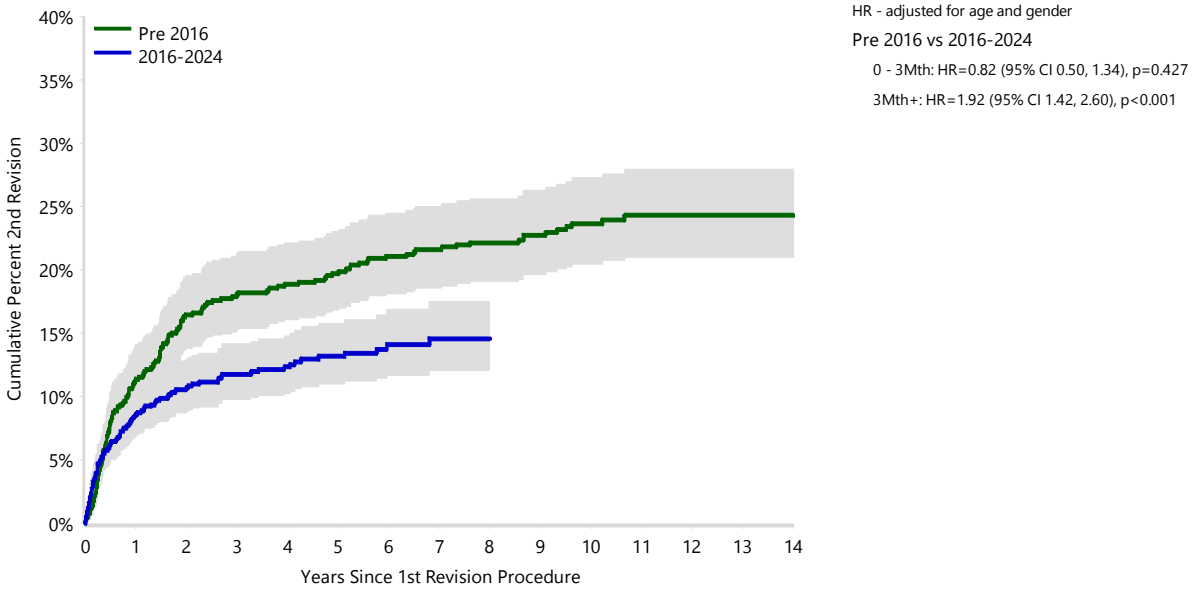
There has been a reduction in the cumulative percent revision for instability/dislocation between the two time periods (Figure N119, Table N117 and Figure N120). There is no difference in the rate of 2nd revision for infection or loosening for time periods pre 2016 and 2016-2024 (Table N118 and Table N118).

**Table N116 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Year of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**

| Year of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Pre 2016 | 148 | 643 | 11.4 (9.1, 14.1) | 18.1 (15.3, 21.3) | 19.7 (16.8, 23.0) | 21.6 (18.6, 25.0) | 23.7 (20.5, 27.3) |
| 2016-2024 | 111 | 938 | 8.6 (6.9, 10.6) | 11.8 (9.8, 14.2) | 13.2 (11.0, 15.8) | 14.6 (12.1, 17.5) | |
| TOTAL | 259 | 1581 | | | | | |

Note: Excludes revisions where no minor or major humeral/glenoid components have been inserted.

**Figure N118 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Year of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|
| Pre 2016 | 643 | 566 | 503 | 474 | 431 | 289 |
| 2016-2024 | 938 | 736 | 523 | 347 | 155 | 0 |

Note: Excludes revisions where no minor or major humeral/glenoid components have been inserted.

**Figure N119 Cumulative Incidence 2nd Revision Diagnosis of Known Primary Total Stemmed Anatomic Replacement by Year of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**

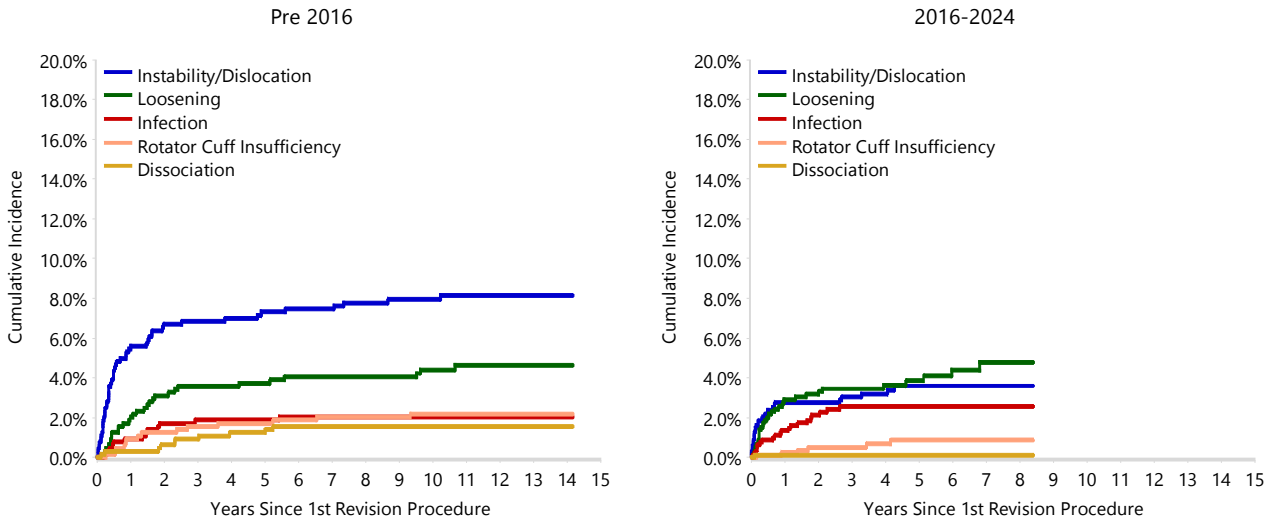
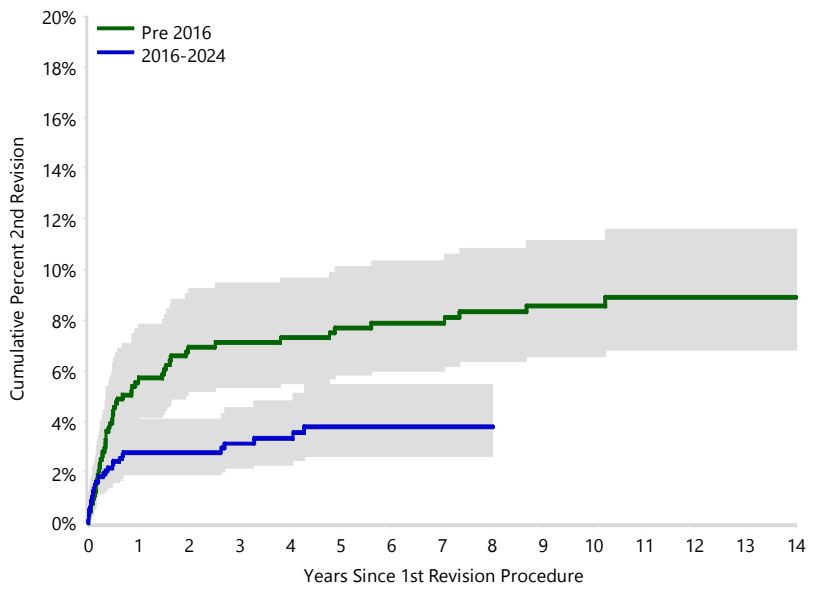


**Table N117 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Year of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection, 2nd Revision for Dislocation/Instability)**

| Year of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Pre 2016 | 52 | 643 | 5.7 (4.2, 7.8) | 7.1 (5.3, 9.5) | 7.7 (5.8, 10.1) | 7.9 (6.0, 10.4) | 8.6 (6.6, 11.1) | 8.9 (6.8, 11.6) |
| 2016-2024 | 30 | 938 | 2.8 (1.9, 4.1) | 3.1 (2.1, 4.6) | 3.8 (2.6, 5.5) | 3.8 (2.6, 5.5) | | |
| TOTAL | 82 | 1581 | | | | | | |

Note: Excludes revisions where no minor or major humeral/glenoid components have been inserted.

**Figure N120 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Year of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection, 2nd Revision for Dislocation/Instability)**




HR - adjusted for age and gender

Pre 2016 vs 2016-2024

Entire Period: HR=2.12 (95% CI 1.35, 3.35), p=0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Pre 2016 | 643 | 566 | 503 | 474 | 431 | 289 | 46 |
| 2016-2024 | 938 | 736 | 523 | 347 | 155 | 0 | 0 |

Note: Excludes revisions where no minor or major humeral/glenoid components have been inserted.

**Table N118 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Year of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection, 2nd Revision for Infection)**

| Year of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Pre 2016 | 13 | 643 | 1.0 (0.4, 2.2) | 2.1 (1.2, 3.7) | 2.1 (1.2, 3.7) | 2.3 (1.3, 3.9) | 2.3 (1.3, 3.9) | 2.3 (1.3, 3.9) |
| 2016-2024 | 21 | 938 | 1.4 (0.8, 2.5) | 2.8 (1.8, 4.2) | 2.8 (1.8, 4.2) | 2.8 (1.8, 4.2) | | |
| TOTAL | 34 | 1581 | | | | | | |

Note: Excludes revisions where no minor or major humeral/glenoid components have been inserted.
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Table N119 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Anatomic Replacement by Year of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection, 2nd Revision for Loosening)**

| Year of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Pre 2016 | 29 | 643 | 2.1 (1.3, 3.7) | 3.9 (2.6, 5.9) | 4.1 (2.8, 6.1) | 4.6 (3.1, 6.6) | 5.1 (3.6, 7.4) | 5.6 (3.8, 8.0) |
| 2016-2024 | 35 | 938 | 3.0 (2.1, 4.4) | 3.6 (2.5, 5.1) | 4.1 (2.9, 5.8) | 5.3 (3.6, 7.7) | | |
| TOTAL | 64 | 1581 | | | | | | |

Note: Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

### MORTALITY FOLLOWING THE 1ST REVISION

Mortality following a 1st revision of total stemmed anatomic shoulder replacement has been calculated for all 1st revision procedures and according to the more common 1st revision diagnoses.

The overall mortality is 0.1% at 30 days, 0.1% at 90 days, 0.7% at 1 year and 24.0% at 10 years (Table N120 and Figure N121).

Overall, the mortality after 1st revision of total stemmed anatomic shoulder replacement does not change depending on the reason for 1st revision or the class of the 1st revision (Table N122 and Table N123).

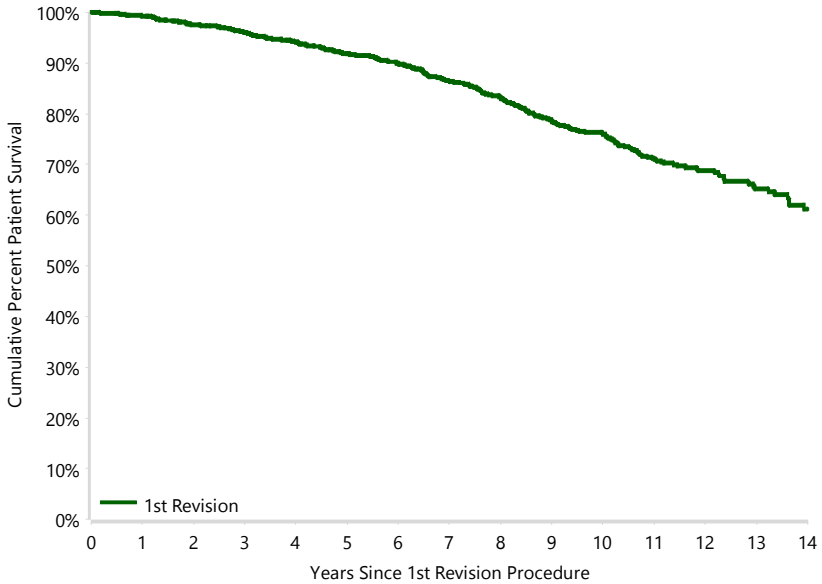
The cumulative percentage survival of the 1st revision total stemmed anatomic shoulder replacement is lower than an unrevised primary total stemmed anatomic (Table N121 and Figure N122).

The overall mortality is 0.1% at 30 days, 0.1% at 90 days, 0.7% at 1 year and 24.0% at 10 years.

**Table N120 Cumulative Percent Survival of Patients with Known Primary Total Stemmed Anatomic Replacement since 1st Revised (Excluding 1st Revision for Infection)**

| 1st Revision | N Deceased | N Total | 30 Days | 90 Days | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| 1st Revision | 278 | 1536 | 99.9 (99.5, 100.0) | 99.9 (99.5, 100.0) | 99.3 (98.7, 99.6) | 96.1 (94.9, 97.0) | 91.8 (90.1, 93.2) | 86.4 (84.3, 88.3) | 76.0 (73.0, 78.7) |
| TOTAL | 278 | 1536 | | | | | | | |

**Figure N121 Cumulative Percent Survival of Patients with Known Primary Total Stemmed Anatomic Replacement since 1st Revised (Excluding 1st Revision for Infection)**



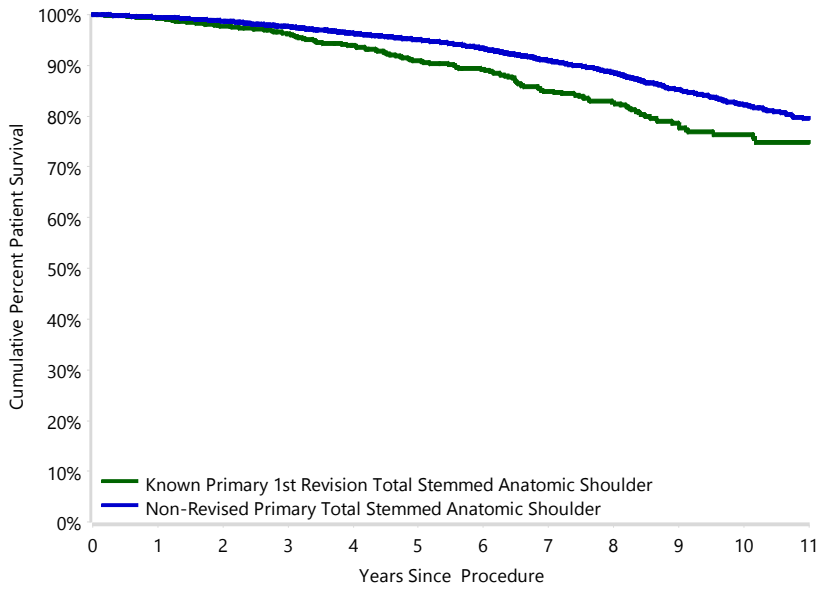

| Number at Risk | 0 Yr | 30 Days | 90 Days | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| 1st Revision | 1536 | 1531 | 1513 | 1410 | 1185 | 981 | 736 | 402 |

**Table N121 Cumulative Percent Survival of Patients with Non-Revised Primary Total Stemmed Anatomic Shoulder and Known Primary 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**

| Procedure Type | N Deceased | N Total | 1 Yr | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|
| Known Primary 1st Revision Total Stemmed Anatomic Shoulder | 142 | 1156 | 99.3 (98.5, 99.6) | 90.9 (88.7, 92.6) | 76.4 (72.1, 80.1) | |
| Non-Revised Primary Total Stemmed Anatomic Shoulder | 933 | 9053 | 99.5 (99.3, 99.6) | 95.0 (94.5, 95.5) | 82.3 (81.0, 83.4) | |
| TOTAL | 1075 | 10209 | | | | |

Note: Restricted to the first of the revision or primary procedures for bilateral patients in each procedure type with known age, sex and ASA score.
Time to survival is time from the primary procedure to death for the non-revised primary cohort and from the 1st revision procedure to death for the known primary 1st revision cohort

**Figure N122 Cumulative Percent Survival of Patients with Non-Revised Primary Total Stemmed Anatomic Shoulder and Known Primary 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**




HR - adjusted for age, gender and ASA score at procedure

Known Primary 1st Revision Total Stemmed Anatomic Shoulder VS Non-Revised Primary Total Stemmed Anatomic Shoulder

Entire period: HR=1.31 (95% CI: 1.10, 1.57), P=0.0029

| Number at Risk | 0 Yr | 1 Yr | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|
| Known Primary 1st Revision Total Stemmed Anatomic Shoulder | 1156 | 1032 | 625 | 116 | 0 |
| Non-Revised Primary Total Stemmed Anatomic Shoulder | 9053 | 8665 | 6191 | 1381 | 1 |

Note: Restricted to the first of the revision or primary procedures for bilateral patients in each procedure type with known age, sex and ASA score.
Time to survival is time from the primary procedure to death for the non-revised primary cohort and from the 1st revision procedure to death for the known primary 1st revision cohort

**Table N122 Cumulative Percent Survival of Patients with Known Primary Total Stemmed Anatomic Replacement since 1st Revised by Reason for 1st Revision**

| Reason for 1st Revision | N Deceased | N Total | 30 Days | 90 Days | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Rotator Cuff Insufficiency | 76 | 414 | 100.0 (100.0, 100.0) | 99.8 (98.3, 100.0) | 99.0 (97.4, 99.6) | 95.2 (92.5, 97.0) | 91.4 (87.9, 93.9) | 71.0 (64.1, 76.9) |
| Instability/ Dislocation | 73 | 357 | 100.0 (100.0, 100.0) | 100.0 (100.0, 100.0) | 99.7 (97.9, 100.0) | 96.2 (93.4, 97.8) | 92.9 (89.4, 95.3) | 76.9 (70.6, 82.1) |
| Loosening | 53 | 355 | 100.0 (100.0, 100.0) | 100.0 (100.0, 100.0) | 99.4 (97.5, 99.8) | 96.4 (93.4, 98.0) | 91.5 (87.2, 94.4) | 79.6 (72.7, 84.9) |
| Infection | 21 | 116 | 100.0 (100.0, 100.0) | 100.0 (100.0, 100.0) | 98.2 (93.2, 99.6) | 94.4 (87.9, 97.5) | 92.2 (85.0, 96.0) | |
| TOTAL | 223 | 1242 | | | | | | |

Note: Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Table N123 Cumulative Percent Survival of Patients with Known Primary Total Stemmed Anatomic Shoulder Procedures since 1st Revised by Reason for 1st Revision (Excluding 1st Revision for Infection)**

| Type of 1st Revision | N Deceased | N Total | 30 Days | 90 Days | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Major Partial | 175 | 820 | 99.9 (99.1, 100.0) | 99.8 (99.0, 99.9) | 99.0 (98.0, 99.5) | 95.9 (94.3, 97.1) | 91.9 (89.7, 93.7) | 75.4 (71.5, 78.8) |
| Major Total | 64 | 533 | 100.0 (100.0, 100.0) | 100.0 (100.0, 100.0) | 99.8 (98.6, 100.0) | 96.5 (94.2, 97.9) | 91.5 (88.1, 94.1) | 77.2 (70.4, 82.6) |
| Minor | 39 | 183 | 100.0 (100.0, 100.0) | 100.0 (100.0, 100.0) | 99.4 (96.1, 99.9) | 95.8 (91.4, 98.0) | 91.9 (86.5, 95.2) | 78.0 (70.0, 84.1) |
| TOTAL | 278 | 1536 | | | | | | |

Note: Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

## Revision of Total Stemmed Reverse Shoulder Replacement

The Registry has recorded 2,490 1st revision procedures of total stemmed reverse shoulder replacement for all diagnoses. There are 628 procedures excluded where the 1st revision was undertaken for infection. There are also 11 procedures excluded where minor or major shoulder prostheses were not inserted, and the diagnosis was not infection. Therefore, this analysis includes 1851 1st revision procedures of total stemmed reverse shoulder replacements.

### DEMOGRAPHICS OF 1ST REVISION

The mean age for patients undergoing a 1st revision total stemmed reverse shoulder replacement is 73 years. 1st revision procedures are more common in males (50.1%), and the highest proportion of patients have an ASA score of 2 (26.4%) or 3 (66.1%) and have a BMI in the pre obese category (30.5%). Demographic details for the 1st revision of total stemmed reverse shoulder replacement procedures are shown in Table N124.

**Table N124 Summary of 1st Revision of Known Primary Total Stemmed Reverse Replacement (All Diagnoses, Excluding 1st Revisions for Infection)**

| Variable | Instability/ Dislocation (n=782) | Loosening (n= 406) | Fracture (n=273) | Rotator Cuff Insufficiency (n=9) | Other (n=381) | TOTAL (n=1,851) |
|---|---|---|---|---|---|---|
| **Follow-up Years (Primary to 1st Revision)** | | | | | | |
| Mean (SD) | 0.9 ± 1.7 | 2 ± 2.5 | 1.9 ± 2.6 | 1.9 ± 2.3 | 2.1 ± 2.4 | 1.5 ± 2.3 |
| Median (IQR) | 0.2 (0.1, 0.7) | 1.1 (0.3, 2.8) | 0.7 (0.2, 2.1) | 1.2 (0.4, 2.5) | 1.3 (0.5, 2.8) | 0.5 (0.1, 1.9) |
| Minimum | 0 | 0 | 0 | 0 | 0 | 0 |
| Maximum | 11.2 | 16.7 | 12.2 | 6.9 | 14.8 | 16.7 |
| **Age at 1st Revision** | | | | | | |
| Mean (SD) | 71.7 ± 9.7 | 74.2 ± 8.4 | 75.9 ± 7.9 | 74.8 ± 9.4 | 72.5 ± 8.7 | 73 ± 9.1 |
| Median (IQR) | 72 (65, 78) | 75 (69, 80) | 76 (71, 82) | 75 (68, 83) | 73 (67, 78) | 74 (67, 79) |
| **Age at 1st Revision in groups** | | | | | | |
| <55 | 29 (3.7%) | 6 (1.5%) | 2 (0.7%) | | 12 (3.1%) | 49 (2.6%) |
| 55-64 | 144 (18.4%) | 48 (11.8%) | 22 (8.1%) | 1 (11.1%) | 51 (13.4%) | 266 (14.4%) |
| 65-74 | 289 (37%) | 136 (33.5%) | 89 (32.6%) | 3 (33.3%) | 152 (39.9%) | 669 (36.1%) |
| ≥75 | 320 (40.9%) | 216 (53.2%) | 160 (58.6%) | 5 (55.6%) | 166 (43.6%) | 867 (46.8%) |
| **Gender** | | | | | | |
| Male | 471 (60.2%) | 153 (37.7%) | 98 (35.9%) | 5 (55.6%) | 201 (52.8%) | 928 (50.1%) |
| Female | 311 (39.8%) | 253 (62.3%) | 175 (64.1%) | 4 (44.4%) | 180 (47.2%) | 923 (49.9%) |
| **ASA at 1st Revision[1]** | | | | | | |
| ASA 1 | 11 (1.6%) | 6 (1.7%) | 5 (2.1%) | 1 (14.3%) | 5 (1.4%) | 28 (1.7%) |
| ASA 2 | 163 (24%) | 105 (29.2%) | 61 (25.3%) | 2 (28.6%) | 99 (28.7%) | 430 (26.4%) |
| ASA 3 | 467 (68.9%) | 231 (64.3%) | 147 (61%) | 4 (57.1%) | 228 (66.1%) | 1,077 (66.1%) |
| ASA 4 | 37 (5.5%) | 17 (4.7%) | 28 (11.6%) | | 13 (3.8%) | 95 (5.8%) |
| **BMI at 1st Revision[2]** | | | | | | |
| Underweight | 8 (1.4%) | 4 (1.3%) | 3 (1.5%) | | 4 (1.3%) | 19 (1.3%) |
| Normal | 93 (16.1%) | 62 (19.6%) | 42 (21.2%) | 2 (28.6%) | 67 (21.1%) | 266 (18.8%) |
| Pre Obese | 159 (27.5%) | 104 (32.8%) | 62 (31.3%) | 1 (14.3%) | 106 (33.3%) | 432 (30.5%) |
| Obese Class 1 | 170 (29.4%) | 93 (29.3%) | 56 (28.3%) | 2 (28.6%) | 82 (25.8%) | 403 (28.4%) |
| Obese Class 2 | 86 (14.9%) | 31 (9.8%) | 22 (11.1%) | 2 (28.6%) | 35 (11%) | 176 (12.4%) |
| Obese Class 3 | 62 (10.7%) | 23 (7.3%) | 13 (6.6%) | | 24 (7.5%) | 122 (8.6%) |
| **Fixation of Primary Procedure** | | | | | | |
| Cemented | 8 (1%) | 4 (1%) | 1 (0.4%) | | 2 (0.5%) | 15 (0.8%) |
| Cementless | 557 (71.2%) | 322 (79.3%) | 214 (78.4%) | 7 (77.8%) | 303 (79.5%) | 1,403 (75.8%) |

## Revision Arthroplasty

| Variable | Instability/ Dislocation (n=782) | Loosening (n= 406) | Fracture (n=273) | Rotator Cuff Insufficiency (n=9) | Other (n=381) | TOTAL (n=1,851) |
|---|---|---|---|---|---|---|
| Hybrid | 217 (27.7%) | 80 (19.7%) | 58 (21.2%) | 2 (22.2%) | 76 (19.9%) | 433 (23.4%) |
| **Glenoid Fixation in 1st Revision** | | | | | | |
| Glenoid Cemented | 16 (3.9%) | | 1 (0.4%) | | 1 (0.3%) | 18 (1%) |
| Glenoid Cementless | 41 (5.2%) | 133 (32.8%) | 43 (15.8%) | 6 (66.7%) | 95 (24.9%) | 318 (17.2%) |
| No Glenoid inserted in 1st Revision | 741 (94.8%) | 257 (63.3%) | 229 (83.9%) | 3 (33.3%) | 285 (74.8%) | 1,515 (81.8%) |
| **Humeral Fixation in 1st Revision** | | | | | | |
| Humeral Cemented | 58 (7.4%) | 80 (19.7%) | 99 (36.3%) | 1 (11.1%) | 33 (8.7%) | 271 (14.6%) |
| Humeral Cementless | 194 (24.8%) | 72 (17.7%) | 70 (25.6%) | 6 (66.7%) | 105 (27.6%) | 447 (24.1%) |
| No Humeral component inserted in 1st Revision | 530 (67.8%) | 254 (62.6%) | 104 (38.1%) | 2 (22.2%) | 243 (63.8%) | 1,133 (61.2%) |

Abbreviations: SD - standard deviation, IQR - interquartile range, ASA - American Society of Anesthesiologists, BMI - Body Mass Index (kg/m$^2$)

[1]Excludes 221 procedures with unknown ASA at the1st Revision

[2]Excludes 433 procedures with unknown BMI at the 1st Revision

## OUTCOME OF 1ST REVISION

There are 366 2nd revisions of the 1,851 1st revision procedures, and the cumulative percent 2nd revision at 10 years is 25.6% (Table N125 and Figure N123).

The most common reasons for 2nd revision are instability/dislocation (45.6%), infection (19.1%), loosening (18%), and fracture (5.2%) (Table N126 and Figure N124).

Isolated revision of the humeral component is the most common 2nd revision procedure (25.4%), followed by humeral and glenoid revision (17.8%), cup and head (16.1%), glenoid only (10.7%), and head only (10.1%) (Table N127).

Primary total stemmed reverse shoulder replacement implants may encompass a single design platform prosthesis (SDPP). These platform implants range include both anatomic and reverse shoulder replacement. They feature common design, composition metallurgy, coatings, and bearing surfaces. They allow polarity change of humeral or glenoid prostheses by modular exchange. In revision surgery, the humeral stem may be retained if a SDPP was used in the primary procedure. In the first two weeks following the 1st revision, procedures that retain the humeral stem have a higher rate of 2nd revision compared to procedures that do not retain the humeral stem. After this time, there is no difference (Table N128 and Figure N125).

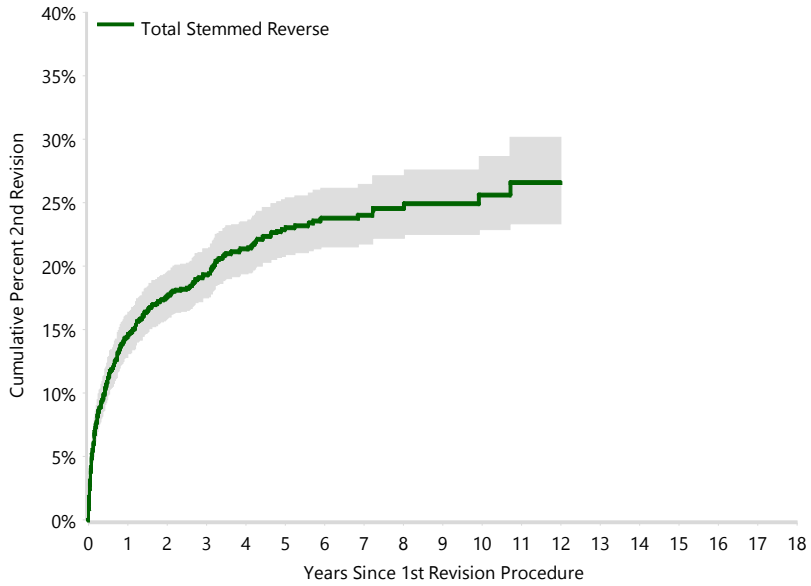
At 10 years, the cumulative percent 2nd revision for known primary total stemmed reverse replacement is 25.6%.

**Table N125 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement (All Diagnoses, Excluding 1st Revision for Infection)**

| Revision of Primary | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Total Stemmed Reverse | 366 | 1851 | 14.5 (12.9, 16.2) | 19.3 (17.5, 21.4) | 22.9 (20.8, 25.2) | 24.0 (21.8, 26.5) | 25.6 (22.9, 28.6) |
| TOTAL | 366 | 1851 | | | | | |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted.

**Figure N123 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement (All Diagnoses, Excluding 1st Revision for Infection)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|
| Total Stemmed Reverse | 1851 | 1327 | 860 | 519 | 292 | 105 |

**Table N126 Revision Diagnosis of 2nd Revision of Known Primary Total Stemmed Reverse Replacement (All Diagnoses, Excluding 1st Revision for Infection)**

| 2nd Revision Diagnosis | Number | Percent |
|---|---|---|
| Instability/Dislocation | 167 | 45.6 |
| Infection | 70 | 19.1 |
| Loosening | 66 | 18.0 |
| Fracture | 19 | 5.2 |
| Dissociation | 14 | 3.8 |
| Pain | 7 | 1.9 |
| Implant Breakage Humeral | 3 | 0.8 |
| Glenoid Erosion | 3 | 0.8 |
| Metal Related Pathology | 3 | 0.8 |
| Malposition | 2 | 0.5 |
| Rotator Cuff Insufficiency | 2 | 0.5 |
| Lysis | 2 | 0.5 |
| Wear Humeral Cup | 1 | 0.3 |
| Implant Breakage Glenoid Insert | 1 | 0.3 |
| Arthrofibrosis | 1 | 0.3 |
| Implant Breakage Head | 1 | 0.3 |
| Incorrect Sizing | 1 | 0.3 |
| Other | 3 | 0.8 |
| TOTAL | 366 | 100.0 |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted.

**Table N127 Type of Revision of 2nd Revision of Known Primary Total Stemmed Reverse Replacement (All Diagnoses, Excluding 1st Revision for Infection)**

| Type of 2nd Revision | Number | Percent |
|---|---|---|
| Humeral Component | 93 | 25.4 |
| Humeral/Glenoid | 65 | 17.8 |
| Cup/Head | 59 | 16.1 |
| Glenoid Component | 39 | 10.7 |
| Head Only | 37 | 10.1 |
| Cup Only | 30 | 8.2 |
| Cement Spacer | 25 | 6.8 |
| Removal of Prostheses | 9 | 2.5 |
| Head/Insert | 3 | 0.8 |
| Minor Components | 3 | 0.8 |
| Cement Only | 2 | 0.5 |
| Reoperation | 1 | 0.3 |
| TOTAL | 366 | 100.0 |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted

**Figure N124 Cumulative Incidence 2nd Revision Diagnosis of Known Primary Total Stemmed Reverse Replacement (All Diagnoses, Excluding 1st Revision for Infection)**

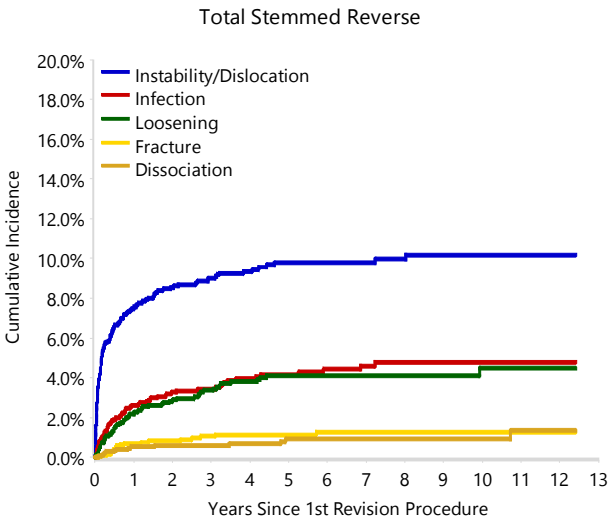
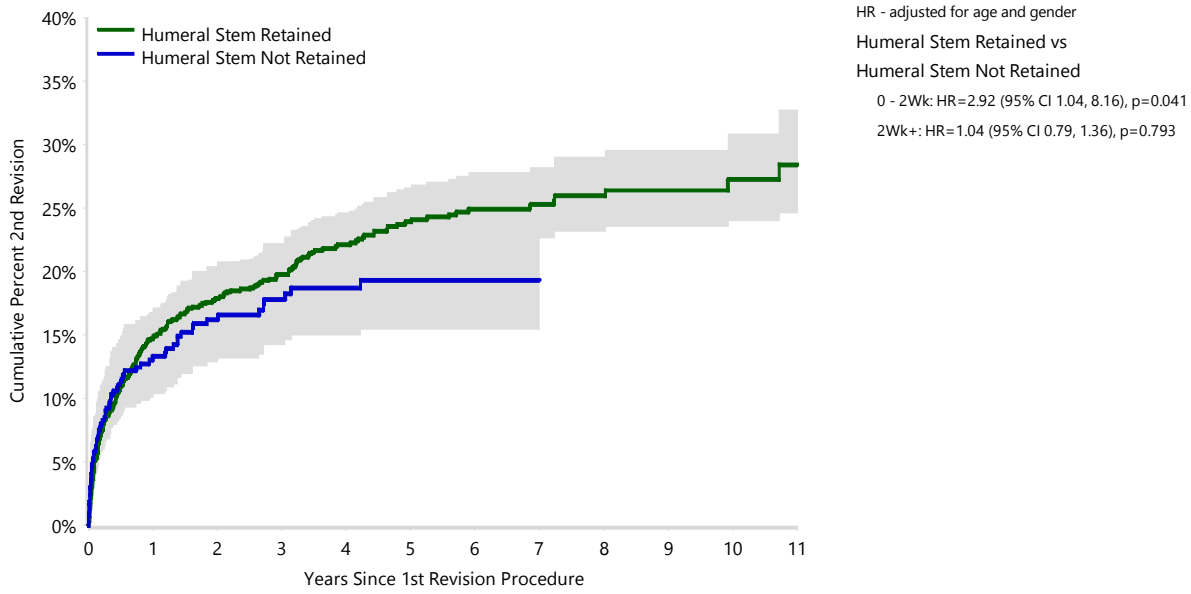


**Table N128 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Humeral Retention (All Diagnoses, Excluding 1st Revision for Infection and Removal of Prosthesis Only Revision)**

| Type of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Humeral Stem Retained | 292 | 1416 | 14.7 (12.9, 16.7) | 19.8 (17.6, 22.1) | 23.9 (21.4, 26.6) | 25.3 (22.6, 28.2) | 27.3 (24.0, 30.8) |
| Humeral Stem Not Retained | 70 | 414 | 13.3 (10.4, 17.1) | 17.8 (14.2, 22.2) | 19.4 (15.5, 24.1) | 19.4 (15.5, 24.1) | |
| TOTAL | 362 | 1830 | | | | | |

**Figure N125 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Humeral Retention (All Diagnoses, Excluding 1st Revision for Infection and Removal of Prosthesis Only Revision)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|
| Humeral Stem Retained | 1416 | 1021 | 661 | 409 | 230 | 85 |
| Humeral Stem Not Retained | 414 | 293 | 188 | 100 | 58 | 20 |

### OUTCOME OF 1ST REVISION BY CLASS OF REVISION

Minor revision is the most common class of 1st revision procedure of a primary total stemmed reverse shoulder replacement (51.6%), followed by major partial (39.6%) and then major total revision (8.8%). Since 2006, there has been an ongoing increase in the proportion of major partial 1st revisions with a corresponding reduction in the proportion of minor 1st revisions (Figure N126).

When the outcomes of the 1st revision by class of 1st revision are compared, there is no difference in the rate of 2nd revision (Table N129 and Figure N127).

All classes of 1st revision undergo 2nd revision predominately for instability/dislocation (Figure N128).

When comparing 1st revision outcomes by class, the rate of 2nd revision does not vary.

**Figure N126 Revision Shoulder Replacement by Class of 1st Revision (Primary Total Stemmed Reverse Shoulder Replacement)**

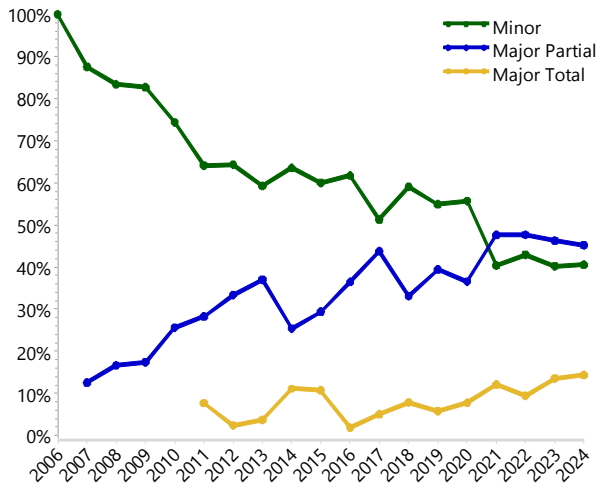
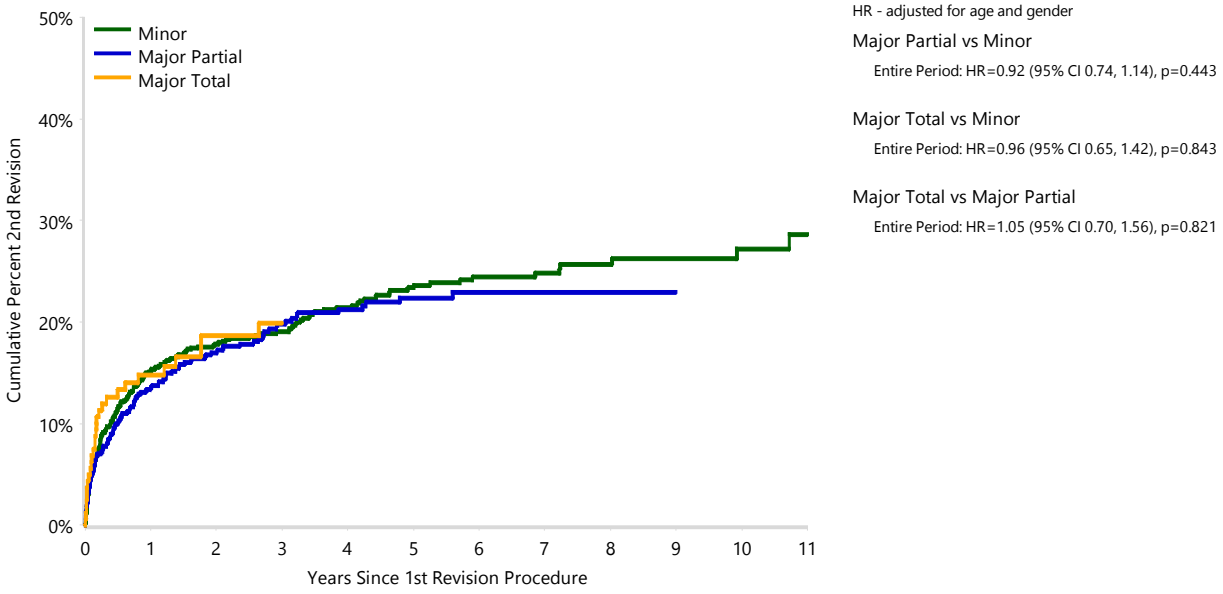


**Table N129 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Class of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**

| Class of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Minor | 202 | 956 | 15.1 (12.9, 17.6) | 19.0 (16.6, 21.8) | 23.4 (20.5, 26.6) | 24.8 (21.8, 28.2) | 27.2 (23.4, 31.5) |
| Major Partial | 135 | 733 | 13.6 (11.2, 16.4) | 19.8 (16.8, 23.2) | 22.4 (19.0, 26.2) | 23.0 (19.5, 26.9) | |
| Major Total | 29 | 162 | 14.8 (10.1, 21.5) | 19.9 (14.0, 27.8) | | | |
| TOTAL | 366 | 1851 | | | | | |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted.

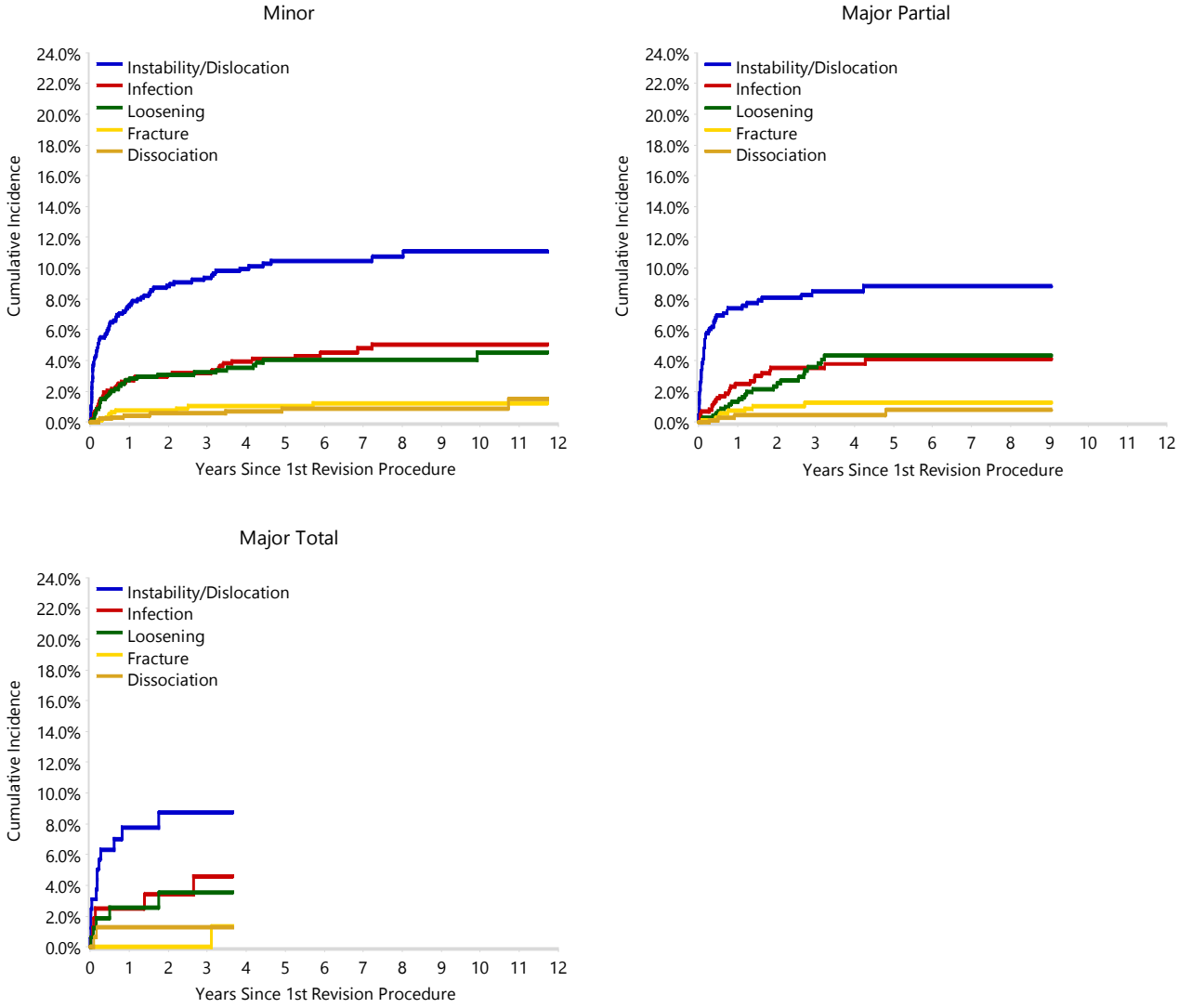
**Figure N127 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Class of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|
| Minor | 956 | 703 | 496 | 320 | 186 | 70 |
| Major Partial | 733 | 519 | 305 | 171 | 89 | 29 |
| Major Total | 162 | 105 | 59 | 28 | 17 | 6 |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted.

**Figure N128 Cumulative Incidence 2nd Revision Diagnosis of Known Primary Total Stemmed Reverse Replacement by Class of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**



### Outcome of 1ST Revision by Type of Revision

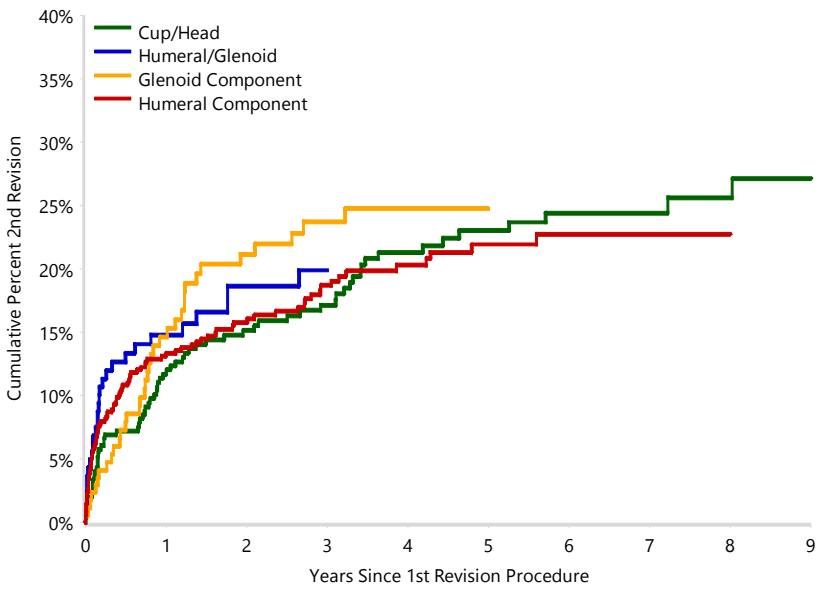
The most common type of 1st revision of a total stemmed reverse is of the humeral component followed by a cup and head exchange.

A humeral/glenoid 1st revision has a higher rate of 2nd revision than head and cup revisions in the first 3 months, but no difference after that time. There is no difference in the rate of 2nd revision between other 1st revision combinations (Table N130 and Figure N129).

**Table N130 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Type of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**

| Type of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|
| Cup/Head | 71 | 350 | 11.7 (8.7, 15.7) | 17.2 (13.4, 21.9) | 23.0 (18.4, 28.6) | 24.4 (19.6, 30.3) |
| Humeral/Glenoid | 29 | 162 | 14.8 (10.1, 21.5) | 19.9 (14.0, 27.8) | | |
| Glenoid Component | 36 | 172 | 14.6 (10.0, 21.2) | 23.7 (17.6, 31.6) | 24.7 (18.4, 32.8) | |
| Humeral Component | 99 | 557 | 13.3 (10.7, 16.5) | 18.7 (15.4, 22.6) | 21.9 (18.1, 26.5) | 22.8 (18.7, 27.6) |
| TOTAL | 235 | 1241 | | | | |

**Figure N129 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Type of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**




HR - adjusted for age and gender

Humeral/Glenoid vs Cup/Head

0 - 3Mth: HR=2.02 (95% CI 1.11, 3.68), p=0.020

3Mth+: HR=0.62 (95% CI 0.33, 1.19), p=0.154

Glenoid Component vs Cup/Head

Entire Period: HR=1.15 (95% CI 0.77, 1.72), p=0.499

Humeral Component vs Cup/Head

0 - 3Mth: HR=1.45 (95% CI 0.90, 2.35), p=0.126

3Mth+: HR=0.80 (95% CI 0.55, 1.17), p=0.250

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|
| Cup/Head | 350 | 270 | 188 | 119 | 67 | 34 |
| Humeral/Glenoid | 162 | 105 | 59 | 28 | 17 | 6 |
| Glenoid Component | 172 | 123 | 79 | 49 | 22 | 6 |
| Humeral Component | 557 | 393 | 223 | 119 | 65 | 23 |

### Humeral Fixation Outcome

Total stemmed reverse shoulder replacements are the most commonly revised without exchange of the humeral component in the 1st revision.

There is no difference in the rate of 2nd revision of total stemmed reverse shoulder replacements when cemented or cementless humeral components are revised in the 1st revision compared to procedures with no exchange of the humeral component (Table N131).

**Table N131 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Humeral Fixation of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**

| Humeral Fixation in 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|
| **Humeral Cemented** | 51 | 271 | 13.8 (10.1, 18.6) | 19.9 (15.2, 25.8) | 22.4 (17.2, 29.0) | |
| **Humeral Cementless** | 77 | 447 | 13.6 (10.7, 17.3) | 18.5 (14.8, 22.9) | 21.6 (17.3, 26.8) | 22.5 (17.9, 28.0) |
| **No Humeral Component Inserted in 1st Revision** | 238 | 1133 | 14.9 (12.9, 17.2) | 19.6 (17.3, 22.2) | 23.5 (20.8, 26.4) | 24.7 (21.9, 27.8) |
| **TOTAL** | **366** | **1851** | | | | |

Note: Excluding 1st revisions where no minor or major humeral/glenoid components have been inserted.
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

## TIMING OF 1ST REVISION

The timing of the 1st revision was classified as early if it occurred within 2 years of the primary procedure (<2 years) or late if it occurred 2 years or more (≥2 years) after the primary procedure.

There are 1,412 early 1st revisions (76.3%). Diagnoses and timing of 1st revisions of primary total stemmed reverse shoulder replacements are shown in Table N133.

1st revisions performed within 2 years have a higher rate of 2nd revision in the first 2 weeks when compared to late 1st revisions and do not differ after that time (Table N132 and Figure N130).

There are 276 early 1st revisions for loosening (68%). These early revisions have a higher rate of 2nd revision compared to those performed later (Table N134 and Figure N131).

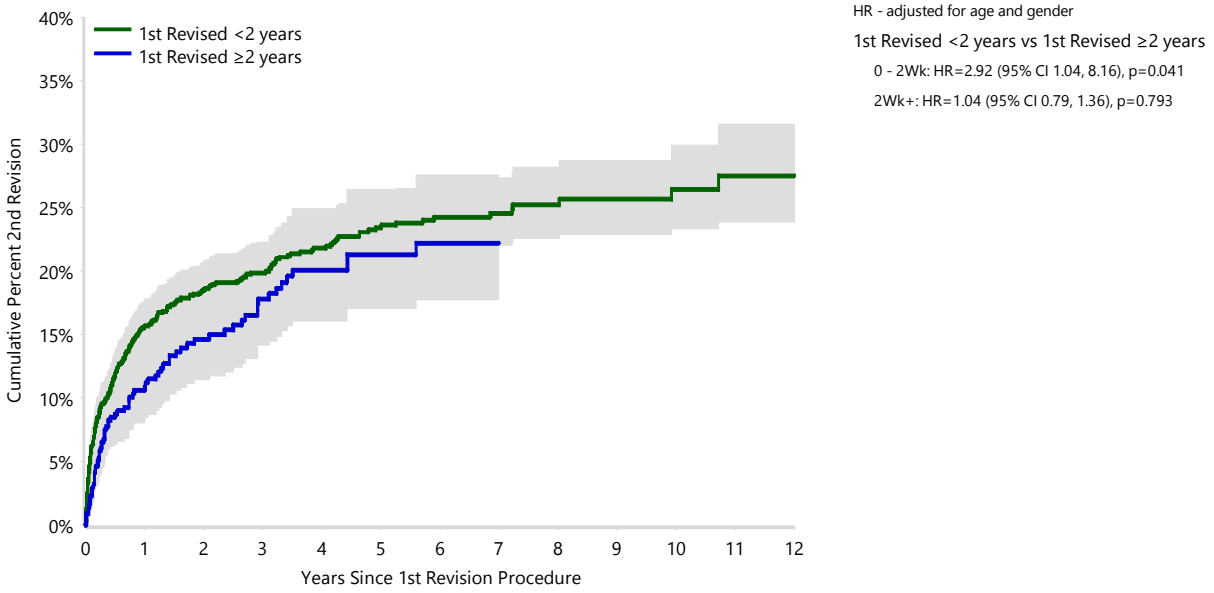
There are 681 early 1st revisions for dislocation/instability (87.1%). There is no difference in the rate of 2nd revision comparing early or late 1st revisions performed for dislocation/ instability (Table N135).

There are 198 early 1st revisions for fracture (72.5%). There is no difference in 2nd revision rates comparing early and late 1st revisions performed for fracture (Table N136).

**Table N132 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Timing of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**

| Timing of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| 1st Revised <2 years | 293 | 1412 | 15.6 (13.8, 17.7) | 19.9 (17.8, 22.2) | 23.4 (21.0, 26.1) | 24.6 (22.0, 27.4) | 26.5 (23.4, 29.9) |
| 1st Revised ≥2 years | 73 | 439 | 10.6 (8.0, 14.0) | 17.8 (14.1, 22.3) | 21.3 (17.1, 26.4) | 22.2 (17.7, 27.6) | |
| **TOTAL** | **366** | **1851** | | | | | |

**Figure N130 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Timing of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|
| 1st Revised <2 years | 1412 | 1017 | 666 | 412 | 238 | 92 |
| 1st Revised ≥2 years | 439 | 310 | 194 | 107 | 54 | 13 |

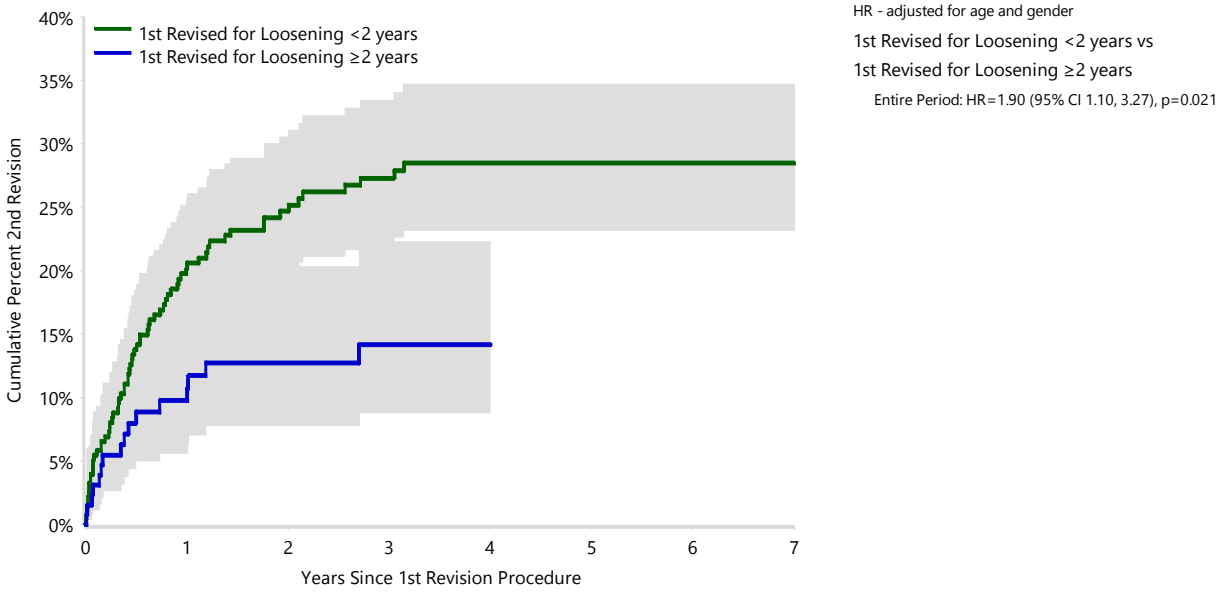
**Table N133 Known Primary Total Stemmed Reverse Shoulder by Timing and Reason of 1st Revision (Excluding 1st Revision for Infection)**

| Revision of 1st Revision | 1st Revised <2 years | | | 1st Revised ≥2 years | | | TOTAL | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | Row% | Col% | N | Row% | Col% | N | Row% | Col% |
| Arthrofibrosis | 20 | 71.4 | 1.4 | 8 | 28.6 | 1.8 | 28 | 100.0 | 1.5 |
| Dissociation | 71 | 79.8 | 5.0 | 18 | 20.2 | 4.1 | 89 | 100.0 | 4.8 |
| Fracture | 198 | 72.5 | 14.0 | 75 | 27.5 | 17.1 | 273 | 100.0 | 14.7 |
| Glenoid Erosion | 2 | 100.0 | 0.1 | . | . | . | 2 | 100.0 | 0.1 |
| Heterotopic Bone | 7 | 58.3 | 0.5 | 5 | 41.7 | 1.1 | 12 | 100.0 | 0.6 |
| Implant Breakage Glenoid | 13 | 68.4 | 0.9 | 6 | 31.6 | 1.4 | 19 | 100.0 | 1.0 |
| Implant Breakage Glenoid Insert | 1 | 25.0 | 0.1 | 3 | 75.0 | 0.7 | 4 | 100.0 | 0.2 |
| Implant Breakage Humeral | 3 | 50.0 | 0.2 | 3 | 50.0 | 0.7 | 6 | 100.0 | 0.3 |
| Incorrect Sizing | 14 | 82.4 | 1.0 | 3 | 17.6 | 0.7 | 17 | 100.0 | 0.9 |
| Instability/Dislocation | 681 | 87.1 | 48.2 | 101 | 12.9 | 23.0 | 782 | 100.0 | 42.2 |
| Loosening | 276 | 68.0 | 19.5 | 130 | 32.0 | 29.6 | 406 | 100.0 | 21.9 |
| Lysis | 11 | 36.7 | 0.8 | 19 | 63.3 | 4.3 | 30 | 100.0 | 1.6 |
| Malposition | 24 | 92.3 | 1.7 | 2 | 7.7 | 0.5 | 26 | 100.0 | 1.4 |
| Metal Related Pathology | 6 | 46.2 | 0.4 | 7 | 53.8 | 1.6 | 13 | 100.0 | 0.7 |
| Pain | 31 | 63.3 | 2.2 | 18 | 36.7 | 4.1 | 49 | 100.0 | 2.6 |
| Rotator Cuff Insufficiency | 6 | 66.7 | 0.4 | 3 | 33.3 | 0.7 | 9 | 100.0 | 0.5 |
| Synovitis | . | . | . | 1 | 100.0 | 0.2 | 1 | 100.0 | 0.1 |
| Tumour | 3 | 60.0 | 0.2 | 2 | 40.0 | 0.5 | 5 | 100.0 | 0.3 |
| Wear Glenoid Insert | . | . | . | 2 | 100.0 | 0.5 | 2 | 100.0 | 0.1 |
| Wear Humeral Cup | . | . | . | 9 | 100.0 | 2.1 | 9 | 100.0 | 0.5 |
| Other | 45 | 65.2 | 3.2 | 24 | 34.8 | 5.5 | 69 | 100.0 | 3.7 |
| **TOTAL** | **1412** | **76.3** | **100.0** | **439** | **23.7** | **100.0** | **1851** | **100.0** | **100.0** |

**Table N134 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Timing of 1st Revision (All Diagnoses, 1st Revision for Loosening)**

| Timing of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|
| 1st Revised for Loosening <2 years | 70 | 276 | 20.2 (15.8, 25.6) | 27.3 (22.1, 33.4) | 28.5 (23.2, 34.7) | 28.5 (23.2, 34.7) |
| 1st Revised for Loosening ≥2 years | 16 | 130 | 9.8 (5.7, 16.6) | 14.2 (8.8, 22.3) | | |
| TOTAL | **86** | **406** | | | | |

**Figure N131 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Timing of 1st Revision (All Diagnoses, 1st Revision for Loosening)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|
| 1st Revised for Loosening <2 years | 276 | 193 | 128 | 76 | 52 |
| 1st Revised for Loosening ≥2 years | 130 | 92 | 55 | 32 | 18 |

**Table N135 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Timing of 1st Revision (All Diagnoses, 1st Revision for Instability/Dislocation)**

| Timing of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| 1st Revised for Dislocation/Instability <2 years | 164 | 681 | 17.6 (14.9, 20.8) | 21.9 (18.9, 25.4) | 26.3 (22.7, 30.3) | 28.5 (24.6, 32.9) | 32.0 (27.0, 37.6) |
| 1st Revised for Dislocation/Instability ≥2 years | 22 | 101 | 15.1 (9.2, 24.3) | 22.8 (15.0, 33.8) | | | |
| TOTAL | 186 | 782 | | | | | |

Note: Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report

**Table N136 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Timing of 1st Revision (All Diagnoses, 1st Revision for Fracture)**

| Timing of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|
| 1st Revised for Fracture <2 years | 25 | 198 | 10.0 (6.5, 15.3) | 12.1 (8.1, 17.8) | 14.4 (9.7, 21.2) | |
| 1st Revised for Fracture ≥2 years | 9 | 75 | 11.2 (5.8, 21.2) | 13.0 (6.9, 23.6) | 13.0 (6.9, 23.6) | 13.0 (6.9, 23.6) |
| TOTAL | 34 | 273 | | | | |

Note: Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report

## OUTCOME OF 1ST REVISION BY PATIENT CHARACTERISTICS

The outcome of the 1st revision of a primary total stemmed reverse shoulder replacement varies by age and gender, with females aged <65 years having a higher rate of 2nd revision than females aged ≥65 years.

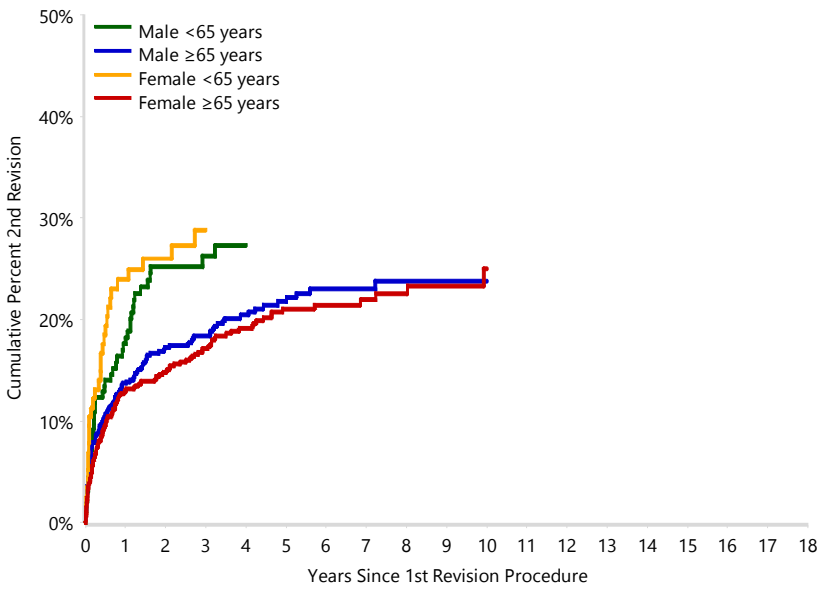
In males, the 2nd revision rate does not differ by age or when compared to females in the same age group (Table N137 and Figure N132).

**Table N137 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Gender and Age (All Diagnoses, Excluding 1st Revision for Infection)**

| Gender | Age at 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Male | <65 years | 48 | 199 | 17.6 (12.8, 23.9) | 26.2 (20.2, 33.6) | | | |
| | ≥65 years | 138 | 729 | 13.7 (11.4, 16.5) | 18.4 (15.6, 21.6) | 21.8 (18.5, 25.5) | 23.0 (19.6, 26.9) | 23.8 (20.1, 28.0) |
| Female | <65 years | 34 | 116 | 23.9 (17.1, 33.0) | 28.8 (21.1, 38.6) | | | |
| | ≥65 years | 146 | 807 | 13.0 (10.8, 15.6) | 17.1 (14.5, 20.1) | 21.1 (18.0, 24.6) | 22.0 (18.7, 25.7) | 25.0 (20.4, 30.4) |
| TOTAL | | 366 | 1851 | | | | | |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted.

**Figure N132 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Gender and Age (All Diagnoses, Excluding 1st Revision for Infection)**




Male <65 years vs Male ≥65 years
Entire Period: HR=1.36 (95% CI 0.98, 1.88), p=0.069

Male <65 years vs Female <65 years
Entire Period: HR=0.83 (95% CI 0.54, 1.29), p=0.408

Male ≥65 years vs Female ≥65 years
Entire Period: HR=1.09 (95% CI 0.86, 1.37), p=0.472

Female <65 years vs Female ≥65 years
Entire Period: HR=1.78 (95% CI 1.22, 2.58), p=0.002

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Male | <65 years | 199 | 134 | 71 | 37 | 24 | 9 |
| | ≥65 years | 729 | 522 | 337 | 202 | 105 | 43 |
| Female | <65 years | 116 | 78 | 43 | 29 | 18 | 8 |
| | ≥65 years | 807 | 593 | 409 | 251 | 145 | 45 |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted.

### ASA SCORE AND BMI CATEGORY

ASA score is available for 1,630 1st revision total stemmed reverse shoulder replacements. There is no difference in the rate of 2nd revision between patients of ASA scores 1-4 (Table N138).

BMI is recorded for 1,418 1st revision procedures. The rate of 2nd revision does not differ between BMI classes (Table N139).

**Table N138 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by ASA (All Diagnoses, Excluding 1st Revision for Infection)**

| ASA Grade | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|
| ASA 1 | 7 | 28 | 15.6 (6.1, 36.3) | 26.4 (12.5, 50.5) | 26.4 (12.5, 50.5) | |
| ASA 2 | 110 | 430 | 18.1 (14.7, 22.2) | 26.6 (22.3, 31.5) | 29.7 (25.1, 34.9) | 30.4 (25.6, 35.7) |
| ASA 3 | 197 | 1077 | 14.6 (12.6, 16.9) | 18.4 (16.1, 21.0) | 21.7 (18.9, 24.7) | 23.1 (20.0, 26.6) |
| ASA 4 | 6 | 95 | 5.7 (2.4, 13.2) | 7.2 (3.3, 15.4) | 7.2 (3.3, 15.4) | |
| TOTAL | 320 | 1630 | | | | |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted.
Excludes 221 procedures with no ASA recorded.
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Table N139 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by BMI (All Diagnoses, Excluding 1st Revision for Infection)**

| BMI Category | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|---|
| Underweight | 2 | 19 | 5.3 (0.8, 31.9) | 5.3 (0.8, 31.9) | 21.1 (4.8, 68.2) | | | |
| Normal | 48 | 266 | 14.4 (10.6, 19.4) | 16.5 (12.3, 21.8) | 19.6 (14.9, 25.5) | 21.0 (16.1, 27.2) | 21.0 (16.1, 27.2) | |
| Pre Obese | 84 | 432 | 15.5 (12.3, 19.5) | 19.5 (15.9, 23.9) | 20.3 (16.6, 24.8) | 22.5 (18.3, 27.3) | 23.2 (18.9, 28.3) | 24.4 (19.7, 30.0) |
| Obese Class 1 | 85 | 403 | 16.0 (12.7, 20.1) | 20.3 (16.5, 24.9) | 22.4 (18.3, 27.2) | 24.0 (19.7, 29.1) | 25.4 (20.8, 30.9) | 27.0 (21.7, 33.2) |
| Obese Class 2 | 36 | 176 | 17.5 (12.5, 24.3) | 20.5 (15.0, 27.7) | 21.5 (15.8, 28.9) | 21.5 (15.8, 28.9) | 24.8 (18.0, 33.4) | |
| Obese Class 3 | 22 | 122 | 13.6 (8.4, 21.6) | 19.8 (13.1, 29.2) | 21.4 (14.3, 31.3) | | | |
| TOTAL | 277 | 1418 | | | | | | |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted.
Excludes 433 procedures are excluded as BMI has not been recorded.
BMI has not been presented for patients aged ≤19 years.
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

## CHANGES IN REVISION SHOULDER SURGERY OVER TIME

The most common reason for 1st revision of total stemmed reverse shoulder replacements has changed over time. In 2008, loosening was more common than instability/dislocation, but after 2008, instability/dislocation predominated (Figure N133).

Up to 2020, the most common 1st revision of primary total stemmed reverse shoulder arthroplasty was a minor revision, but after that time, it was major partial revision.

In 2024, 45.1% of 1st revisions were major partial, 40.5% minor and 14.3% major total (Figure N126).

The type of fixation of the humeral component at 1st revision has remained predominately cementless when the humeral component was exchanged (Figure N134). The results of cemented or uncemented 1st revision humeral components are stratified by reason of 1st revision in the following section.

**Figure N133 Revision Shoulder Replacement by Reason for 1st Revision (Primary Total Stemmed Reverse Shoulder Replacement)**

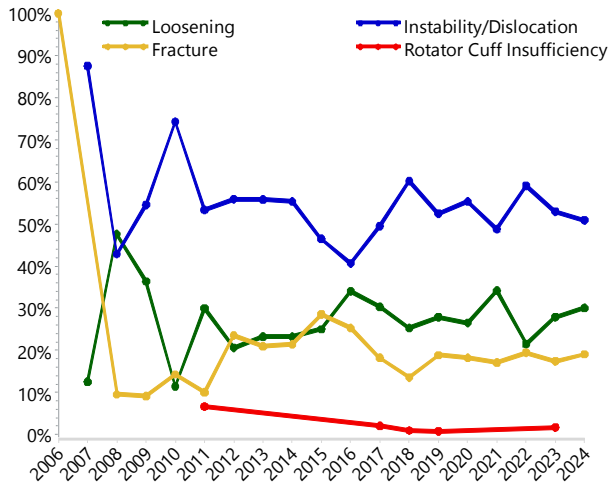
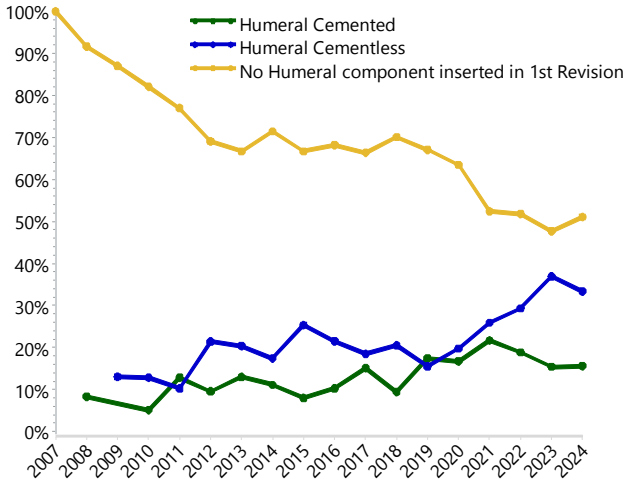



**Figure N134 Primary Known 1st Revision Shoulder Replacement by Humeral Fixation (All Diagnoses, Primary Class Total Stemmed Reverse, Excluding 1st Revision for Infection)**



### OUTCOMES OF THE 1ST REVISION BY REASON FOR 1ST REVISION

Further analyses on the outcomes of the most common reasons for 1st revision have been performed. These include loosening, prosthesis dislocation/instability, fracture, and rotator cuff insufficiency.

When compared to fracture, loosening and prosthesis dislocation/instability and rotator cuff insufficiency have a higher rate of 2nd revision (Table N140 and Figure N135).

1st revision procedures for instability/ dislocation and loosening were predominately revised for the same reasons at 2nd revision. 1st revision procedures for rotator cuff insufficiency mainly underwent 2nd revision for loosening. 1st revision for fracture was most commonly revised for instability/dislocation (Table N141).

When there is a 1st revision for instability/dislocation or fracture, the most common 2nd revision was an isolated humeral revision. There was no predominate 2nd revision type for rotator cuff insufficiency (Table N142).

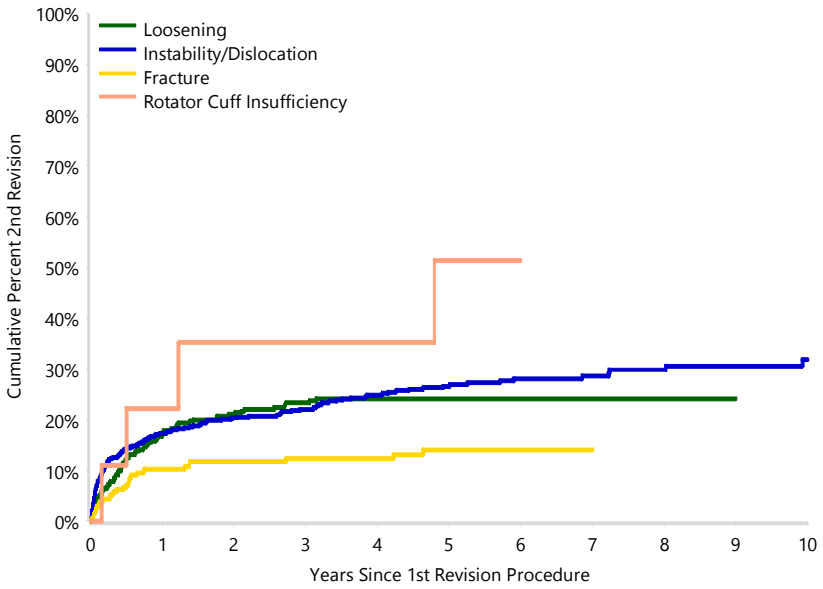
When compared to fracture, loosening and prosthesis dislocation/instability and rotator cuff insufficiency have a higher rate of 2nd revision.

**Table N140 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Reason for 1st Revision (All Diagnoses)**

| Reason for 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Loosening | 86 | 406 | 17.0 (13.6, 21.1) | 23.3 (19.2, 28.1) | 24.1 (19.9, 29.0) | 24.1 (19.9, 29.0) | |
| Instability/Dislocation | 186 | 782 | 17.3 (14.8, 20.2) | 22.0 (19.1, 25.3) | 26.6 (23.2, 30.4) | 28.7 (25.0, 32.8) | 31.9 (27.2, 37.1) |
| Fracture | 34 | 273 | 10.4 (7.2, 14.8) | 12.3 (8.8, 17.1) | 14.1 (10.1, 19.6) | 14.1 (10.1, 19.6) | |
| Rotator Cuff Insufficiency | 4 | 9 | 22.2 (6.1, 63.5) | 35.2 (12.8, 74.7) | 51.4 (22.4, 87.2) | | |
| TOTAL | 310 | 1470 | | | | | |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted.

**Figure N135 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Reason for 1st Revision (All Diagnoses)**




HR - adjusted for age and gender

Loosening vs Fracture

Entire Period: HR=1.72 (95% CI 1.15, 2.56), p=0.007

Instability/Dislocation vs Fracture

Entire Period: HR=1.77 (95% CI 1.22, 2.57), p=0.002

Rotator Cuff Insufficiency vs Fracture

Entire Period: HR=3.42 (95% CI 1.21, 9.65), p=0.020

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|
| Loosening | 406 | 285 | 183 | 108 | 70 | 26 |
| Instability/Dislocation | 782 | 545 | 352 | 221 | 124 | 53 |
| Fracture | 273 | 209 | 139 | 82 | 49 | 8 |
| Rotator Cuff Insufficiency | 9 | 7 | 4 | 3 | 1 | 0 |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted.

**Table N141 Revision Diagnosis of 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Reason for 1st Revision (All Diagnoses)**

| 2nd Revision Diagnosis | Loosening | | Instability/ Dislocation | | Fracture | | Rotator Cuff Insufficiency | | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% | N | Col% | N | Col% |
| Instability/Dislocation | 18 | 20.9 | 125 | 67.2 | 11 | 32.4 | . | . | 154 | 49.7 |
| Loosening | 35 | 40.7 | 15 | 8.1 | 5 | 14.7 | 2 | 50.0 | 57 | 18.4 |
| Infection | 24 | 27.9 | 27 | 14.5 | 5 | 14.7 | . | . | 56 | 18.1 |
| Fracture | 3 | 3.5 | 5 | 2.7 | 10 | 29.4 | . | . | 18 | 5.8 |
| Dissociation | 1 | 1.2 | 7 | 3.8 | . | . | 1 | 25.0 | 9 | 2.9 |
| Pain | 2 | 2.3 | . | . | 1 | 2.9 | . | . | 3 | 1.0 |
| Malposition | . | . | 1 | 0.5 | . | . | 1 | 25.0 | 2 | 0.6 |
| Glenoid Erosion | . | . | 1 | 0.5 | 1 | 2.9 | . | . | 2 | 0.6 |
| Lysis | 2 | 2.3 | . | . | . | . | . | . | 2 | 0.6 |
| Metal Related Pathology | . | . | 2 | 1.1 | . | . | . | . | 2 | 0.6 |
| Implant Breakage Glenoid Insert | . | . | 1 | 0.5 | . | . | . | . | 1 | 0.3 |
| Arthrofibrosis | . | . | 1 | 0.5 | . | . | . | . | 1 | 0.3 |
| Implant Breakage Humeral | . | . | 1 | 0.5 | . | . | . | . | 1 | 0.3 |
| Other | 1 | 1.2 | . | . | 1 | 2.9 | . | . | 2 | 0.6 |
| TOTAL | 86 | 100.0 | 186 | 100.0 | 34 | 100.0 | 4 | 100.0 | 310 | 100.0 |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted.

**Table N142 Type of 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Type of 1st Revision (Primary Diagnosis OA)**

| Type of 2nd Revision | Loosening | | Instability/ Dislocation | | Fracture | | Rotator Cuff Insufficiency | | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% | N | Col% | N | Col% |
| Humeral Component | 15 | 17.4 | 56 | 30.1 | 7 | 20.6 | 1 | 25.0 | 79 | 25.5 |
| Cup/Head | 9 | 10.5 | 39 | 21.0 | 4 | 11.8 | 1 | 25.0 | 53 | 17.1 |
| Humeral/Glenoid | 25 | 29.1 | 19 | 10.2 | 5 | 14.7 | 1 | 25.0 | 50 | 16.1 |
| Head Only | 8 | 9.3 | 20 | 10.8 | 5 | 14.7 | . | . | 33 | 10.6 |
| Glenoid Component | 12 | 14.0 | 10 | 5.4 | 6 | 17.6 | 1 | 25.0 | 29 | 9.4 |
| Cup Only | 3 | 3.5 | 20 | 10.8 | 3 | 8.8 | . | . | 26 | 8.4 |
| Cement Spacer | 12 | 14.0 | 10 | 5.4 | . | . | . | . | 22 | 7.1 |
| Removal of Prostheses | 1 | 1.2 | 6 | 3.2 | 2 | 5.9 | . | . | 9 | 2.9 |
| Head/Insert | . | . | 2 | 1.1 | 1 | 2.9 | . | . | 3 | 1.0 |
| Minor Components | . | . | 2 | 1.1 | 1 | 2.9 | . | . | 3 | 1.0 |
| Cement Only | . | . | 2 | 1.1 | . | . | . | . | 2 | 0.6 |
| Reoperation | 1 | 1.2 | . | . | . | . | . | . | 1 | 0.3 |
| TOTAL | 86 | 100.0 | 186 | 100.0 | 34 | 100.0 | 4 | 100.0 | 310 | 100.0 |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted.

## LOOSENING

Loosening is the most common 1st revision diagnosis for total stemmed reverse shoulder replacement. There are 260 1st revision total stemmed reverse shoulder replacement procedures for loosening, and 52 of these have had a 2nd revision.

The most common 1st revision for loosening is an isolated humeral revision, followed by isolated glenoid and humeral/glenoid revision.

Isolated glenoid 1st revisions have the highest number of 2nd revisions. Isolated glenoid 1st revisions have a higher rate of 2nd revision than humeral 1st revisions (Table N143 and Figure N136).

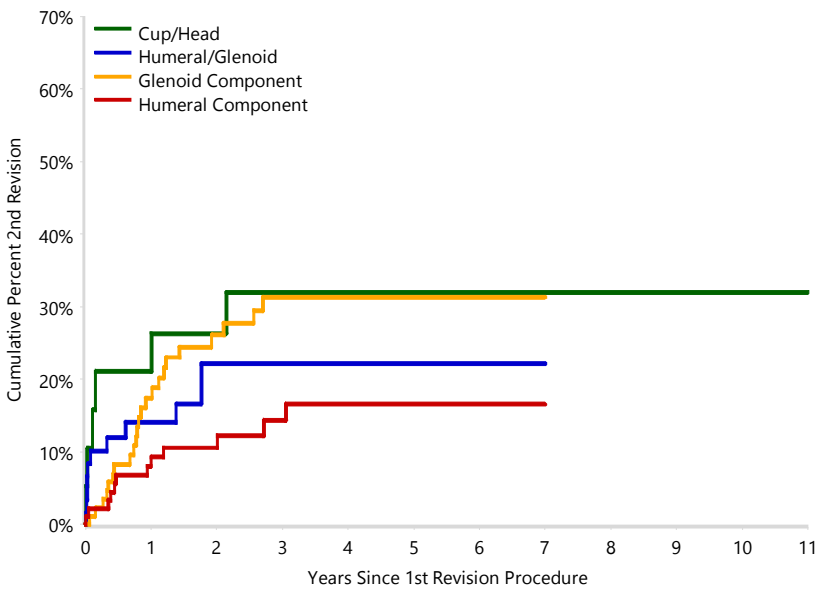
Where a 1st revision is performed for loosening and the humeral component is exchanged, the majority are cemented. There is a higher rate of 2nd revision where the exchanged humeral component in the 1st revision is cementless (Table N144 and Figure N137).

**Table N143 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Type of 1st Revision (All Diagnoses, 1st Revision for Loosening)**

| Type of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Cup/Head | 6 | 19 | 21.1 (8.5, 46.8) | 32.0 (15.8, 57.9) | 32.0 (15.8, 57.9) | 32.0 (15.8, 57.9) | 32.0 (15.8, 57.9) |
| Humeral/Glenoid | 11 | 60 | 14.1 (7.3, 26.3) | 22.2 (12.7, 37.1) | 22.2 (12.7, 37.1) | 22.2 (12.7, 37.1) | |
| Glenoid Component | 23 | 89 | 17.4 (10.7, 27.7) | 31.3 (21.9, 43.6) | 31.3 (21.9, 43.6) | 31.3 (21.9, 43.6) | |
| Humeral Component | 12 | 92 | 9.3 (4.7, 17.7) | 14.3 (8.0, 24.7) | 16.5 (9.5, 28.0) | 16.5 (9.5, 28.0) | |
| TOTAL | 52 | 260 | | | | | |

Note: Excludes 146 1st revisions with other revision types.

**Figure N136 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Type of 1st Revision (All Diagnoses, 1st Revision for Loosening)**




HR - adjusted for age and gender

Cup/Head vs Humeral Component

Entire Period: HR=2.18 (95% CI 0.81, 5.87), p=0.124

Humeral/Glenoid vs Humeral Component

Entire Period: HR=1.91 (95% CI 0.83, 4.39), p=0.129

Glenoid Component vs Humeral Component

Entire Period: HR=2.30 (95% CI 1.13, 4.71), p=0.022

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|
| Cup/Head | 19 | 15 | 10 | 7 | 7 | 4 |
| Humeral/Glenoid | 60 | 38 | 22 | 10 | 7 | 2 |
| Glenoid Component | 89 | 61 | 37 | 22 | 12 | 4 |
| Humeral Component | 92 | 73 | 39 | 18 | 12 | 4 |

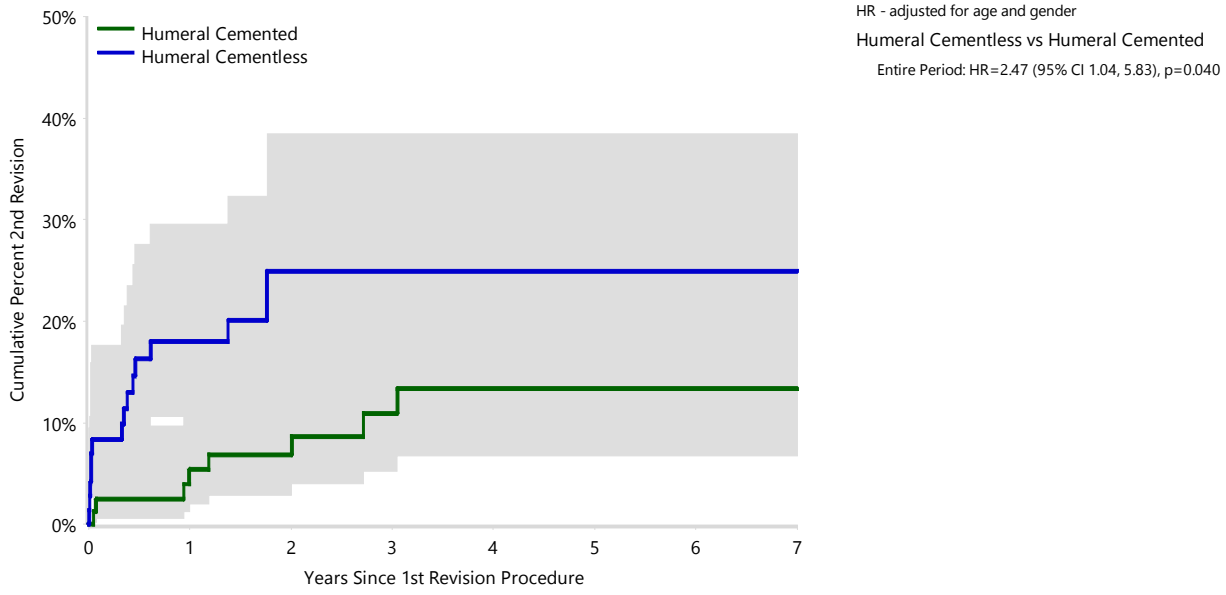
Note: Excludes 146 1st revisions with other revision types.

**Table N144 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Humeral Fixation of 1st Revision (All Diagnoses, 1st Revision for Loosening)**

| Humeral Fixation in 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|
| Humeral Cemented | 8 | 80 | 5.4 (2.0, 13.7) | 10.9 (5.3, 22.0) | 13.3 (6.7, 25.5) | 13.3 (6.7, 25.5) |
| Humeral Cementless | 15 | 72 | 18.0 (10.6, 29.6) | 24.9 (15.6, 38.5) | 24.9 (15.6, 38.5) | 24.9 (15.6, 38.5) |
| No Humeral component inserted in 1st Revision | 63 | 254 | 20.3 (15.7, 25.9) | 26.7 (21.4, 33.0) | 27.3 (22.0, 33.7) | 27.3 (22.0, 33.7) |
| TOTAL | 86 | 406 | | | | |

Note: Excludes 1st revisions where no minor or major humeral/glenoid components have been inserted.

**Figure N137 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Humeral Fixation of 1st Revision (All Diagnoses, 1st Revision for Loosening)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|
| Humeral Cemented | 80 | 66 | 37 | 15 | 9 |
| Humeral Cementless | 72 | 45 | 24 | 13 | 10 |

### DISLOCATION/INSTABILITY

Instability/dislocation is the second most common 1st revision diagnosis for total stemmed reverse shoulder replacement. There are 692 1st revision total stemmed reverse shoulder replacements for dislocation/instability, and 165 of these have had a 2nd revision.

The most common 1st revision for instability/dislocation is isolated humeral cup revision, followed by humeral revision.1st revision of humeral cup only has the highest number of 2nd revisions. There is no difference in the rate of 2nd revision between these types of 1st revision (Table N145).

**Table N145 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Type of 1st Revision (All Diagnoses, 1st Revision for Instability/Dislocation)**

| Type of 1st Revision | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|
| Cup/Head | 46 | 204 | 14.4 (10.1, 20.1) | 17.3 (12.6, 23.5) | 18.8 (13.8, 25.4) | 24.1 (18.1, 31.7) | |
| Cup Only | 65 | 264 | 16.4 (12.4, 21.6) | 19.6 (15.2, 25.2) | 21.2 (16.5, 26.9) | 26.8 (21.2, 33.5) | 29.3 (23.1, 36.7) |
| Humeral Component | 54 | 224 | 20.4 (15.6, 26.4) | 24.2 (18.9, 30.8) | 26.0 (20.3, 32.9) | 28.2 (22.0, 35.6) | |
| TOTAL | 165 | 692 | | | | | |

Note: Excludes 90 1st revisions with other revision types.
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

## FRACTURE

There are 244 primary total stemmed reverse shoulder replacements that have been revised for fracture, and 32 of these have had a 2nd revision.

The most common type of 1st revision for fracture is isolated humeral component revision, followed by head only revision. Humeral component only 1st revision has the highest number of 2nd revisions.

There is an increased rate of 2nd revision for isolated glenoid 1st revisions compared to humeral 1st revisions (Table N146 and Figure N138).

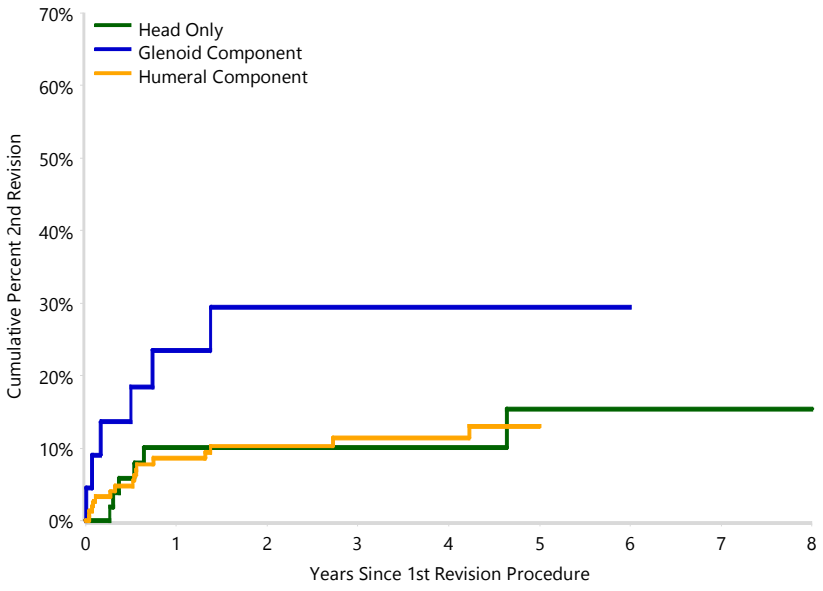
When 1st revision procedures are performed for fracture and the humeral component revised, cemented fixation predominates. There is no difference in the rate of 2nd revision comparing cemented versus cementless fixation of the humeral component used in the 1st revision (Table N147).

**Table N146 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Type of 1st Revision (All Diagnoses, 1st Revision for Fracture)**

| Type of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|
| Head Only | 6 | 52 | 10.1 (4.3, 22.6) | 10.1 (4.3, 22.6) | 15.4 (6.5, 33.8) | 15.4 (6.5, 33.8) |
| Humeral/Glenoid | 3 | 21 | 14.3 (4.8, 38.0) | 14.3 (4.8, 38.0) | 14.3 (4.8, 38.0) | 14.3 (4.8, 38.0) |
| Glenoid Component | 6 | 22 | 23.5 (10.5, 47.7) | 29.4 (14.3, 54.5) | 29.4 (14.3, 54.5) | |
| Humeral Component | 17 | 149 | 8.6 (5.0, 14.7) | 11.4 (7.0, 18.4) | 13.0 (8.0, 20.9) | |
| TOTAL | 32 | 244 | | | | |

Note: Excludes 29 1st revisions with other revision types.

**Figure N138 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Type of 1st Revision (All Diagnoses, 1st Revision for Fracture)**




HR - adjusted for age and gender

Glenoid Component vs Head Only

Entire Period: HR=2.24 (95% CI 0.69, 7.29), p=0.182

Glenoid Component vs Humeral Component

Entire Period: HR=2.59 (95% CI 1.00, 6.70), p=0.049

Humeral Component vs Head Only

Entire Period: HR=0.86 (95% CI 0.33, 2.26), p=0.764

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|
| Head Only | 52 | 42 | 27 | 16 | 13 |
| Glenoid Component | 22 | 14 | 9 | 7 | 3 |
| Humeral Component | 149 | 112 | 74 | 41 | 22 |

**Table N147 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Humeral Fixation in 1st Revision (All Diagnoses, 1st Revision for Fracture)**

| Humeral Fixation in 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|
| **Humeral Cemented** | 15 | 99 | 11.4 (6.5, 19.7) | 14.4 (8.5, 23.8) | 17.0 (10.0, 28.0) | |
| **Humeral Cementless** | 5 | 70 | 6.3 (2.4, 16.0) | 8.2 (3.5, 18.7) | 8.2 (3.5, 18.7) | 8.2 (3.5, 18.7) |
| **No Humeral component inserted in 1st Revision** | 14 | 104 | 11.9 (6.9, 20.0) | 13.1 (7.8, 21.5) | | |
| **TOTAL** | **34** | **273** | | | | |

Note: Excludes 1 humeral component revision with unknown fixation.
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

## OUTCOMES OF 1ST REVISION OVER TIME

This analysis compares the outcomes of 1st revisions of total stemmed reverse replacement over-two successive time periods: pre 2016 and 2016–2024. There is no difference in the rate of 2nd revision of revised primary total stemmed reverse shoulder replacements when the two time periods are compared (Table N148).

There is no change in the rate of 2nd revision between pre-2016 and 2016-2024 for 2nd revision diagnoses of instability/dislocation, infection, loosening or fracture (Table N149 to Table N152).

**Table N148 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Year of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**

| Year of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Pre 2016 | 75 | 368 | 10.7 (7.9, 14.3) | 14.2 (11.0, 18.2) | 19.0 (15.2, 23.6) | 19.7 (15.9, 24.4) | 21.8 (17.6, 26.9) |
| 2016-2024 | 291 | 1483 | 15.5 (13.7, 17.5) | 20.8 (18.6, 23.1) | 23.6 (21.2, 26.3) | 25.3 (22.4, 28.5) | |
| TOTAL | 366 | 1851 | | | | | |

Note: Excludes revisions where no minor or major humeral/glenoid components have been inserted.
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Table N149 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Year of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection, 2nd Revision for Dislocation/Instability)**

| Year of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Pre 2016 | 35 | 368 | 6.3 (4.2, 9.4) | 8.2 (5.7, 11.6) | 9.6 (6.9, 13.3) | 9.6 (6.9, 13.3) | 10.6 (7.7, 14.6) |
| 2016-2024 | 132 | 1483 | 8.1 (6.7, 9.6) | 9.7 (8.2, 11.5) | 10.5 (8.9, 12.5) | 10.5 (8.9, 12.5) | |
| TOTAL | 167 | 1851 | | | | | |

Note: Excludes revisions where no minor or major humeral/glenoid components have been inserted.
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Table N150 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Year of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection, 2nd Revision for Infection)**

| Year of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Pre 2016 | 13 | 368 | 2.0 (1.0, 4.2) | 2.3 (1.2, 4.6) | 3.4 (1.9, 6.1) | 3.9 (2.2, 6.7) | 4.4 (2.5, 7.5) |
| 2016-2024 | 57 | 1483 | 3.0 (2.2, 4.1) | 4.3 (3.3, 5.7) | 5.3 (4.0, 7.0) | 6.6 (4.6, 9.5) | |
| TOTAL | 70 | 1851 | | | | | |

Note: Excludes revisions where no minor or major humeral/glenoid components have been inserted.
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Table N151 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Year of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection, 2nd Revision for Loosening)**

| Year of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Pre 2016 | 15 | 368 | 1.5 (0.6, 3.6) | 2.5 (1.3, 5.0) | 4.0 (2.3, 6.9) | 4.0 (2.3, 6.9) | 4.9 (2.7, 8.6) |
| 2016-2024 | 51 | 1483 | 2.6 (1.9, 3.6) | 4.2 (3.2, 5.6) | 5.0 (3.8, 6.7) | 5.0 (3.8, 6.7) | |
| TOTAL | 66 | 1851 | | | | | |

Note: Excludes revisions where no minor or major humeral/glenoid components have been inserted.
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Table N152 Cumulative Percent 2nd Revision of Known Primary Total Stemmed Reverse Replacement by Year of 1st Revision (All Diagnoses, Excluding 1st Revision for Infection, 2nd Revision for Fracture)**

| Year of 1st Revision | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Pre 2016 | 2 | 368 | 0.3 (0.0, 2.1) | 0.3 (0.0, 2.1) | 0.3 (0.0, 2.1) | 0.7 (0.2, 3.1) | 0.7 (0.2, 3.1) |
| 2016-2024 | 17 | 1483 | 0.9 (0.5, 1.7) | 1.6 (0.9, 2.6) | 1.7 (1.1, 2.8) | 1.7 (1.1, 2.8) | |
| TOTAL | 19 | 1851 | | | | | |

Note: Excludes revisions where no minor or major humeral/glenoid components have been inserted.
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

## MORTALITY FOLLOWING THE 1ST REVISION

Mortality following a 1st revision of a primary total stemmed reverse shoulder replacement has been calculated for all 1st revision procedures and according to the more common 1st revision diagnoses.

The overall mortality is 0.2% at 30 days, 0.8% at 90 days, 3.3% at 1 year and 47.0% at 10 years (Table N153 and Figure N139).

There is no difference in mortality of 1st revision for total stemmed reverse shoulder replacements with respect to the 1st revision diagnosis or class of revision (Table N155 and Table N156).

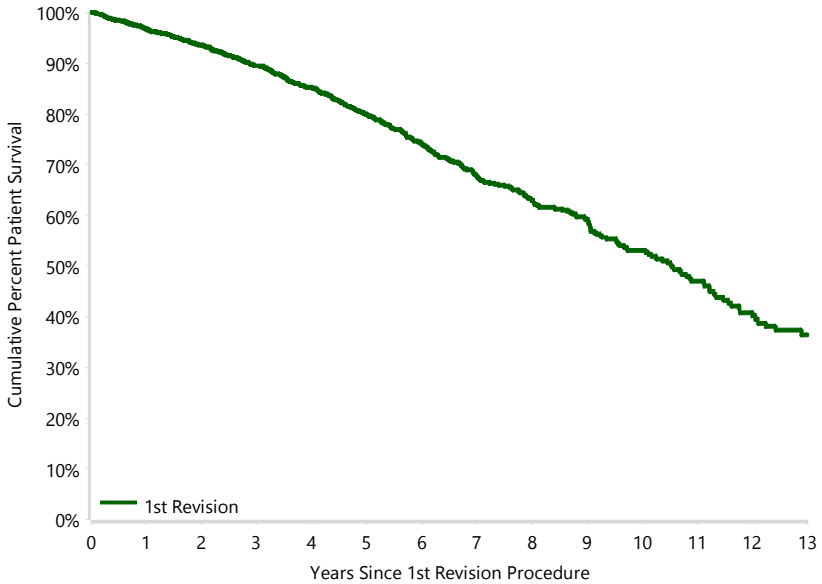
However, 1st revision total stemmed reverse shoulder replacements have a higher risk of mortality compared to unrevised primary total stemmed reverse patients (Table N154 and Figure N140).

The overall mortality is 0.2% at 30 days, 0.8% at 90 days, 3.3% at 1 year and 47.0% at 10 years.

**Table N153 Cumulative Percent Survival of Patients with Known Primary Total Stemmed Reverse Replacement since 1st Revised (Excluding 1st Revision for Infection)**

| 1st Revision | N Deceased | N Total | 30 Days | 90 Days | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| 1st Revision | 430 | 1806 | 99.8 (99.5, 99.9) | 99.2 (98.7, 99.5) | 96.7 (95.8, 97.5) | 89.5 (87.8, 91.0) | 79.8 (77.4, 82.1) | 53.0 (48.7, 57.1) |
| TOTAL | 430 | 1806 | | | | | | |

**Figure N139 Cumulative Percent Survival of Patients with Known Primary Total Stemmed Reverse Replacement since 1st Revised (Excluding 1st Revision for Infection)**



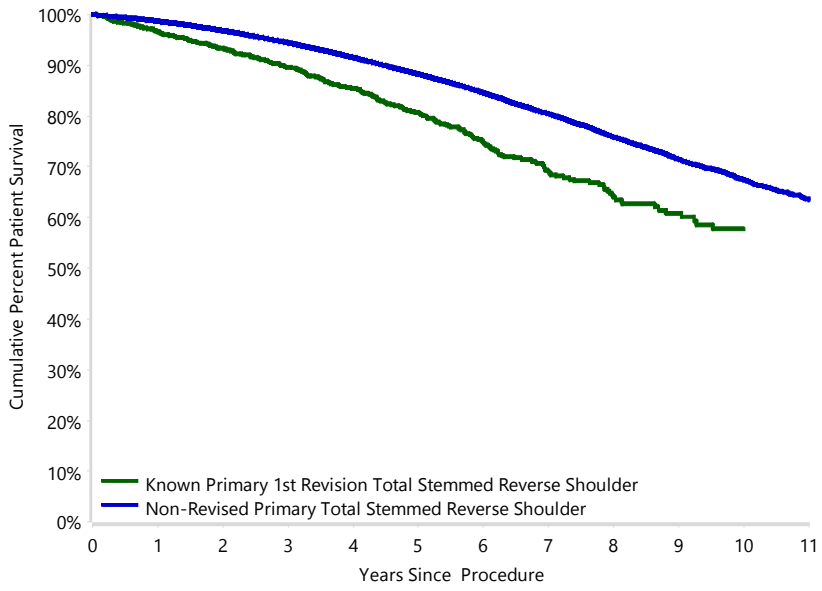

| Number at Risk | 0 Yr | 30 Days | 90 Days | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| 1st Revision | 1806 | 1781 | 1736 | 1526 | 1047 | 671 | 382 | 142 |

**Table N154 Cumulative Percent Survival of Patients with Non-Revised Primary Total Stemmed Reverse Shoulder Replacement and Known Primary 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**

| Procedure Type | N Deceased | N Total | 1 Yr | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|
| Known Primary 1st Revision Total Stemmed Reverse Shoulder | 281 | 1587 | 96.6 (95.5, 97.4) | 80.7 (78.0, 83.1) | 57.7 (52.2, 62.9) | |
| Non-Revised Primary Total Stemmed Reverse Shoulder | 6393 | 57513 | 98.7 (98.6, 98.8) | 88.2 (87.9, 88.6) | 67.4 (66.5, 68.4) | |
| TOTAL | 6674 | 59100 | | | | |

Note: Restricted to the first of the revision or primary procedures for bilateral patients in each procedure type with known age, sex and ASA score.
Time to survival is time from the primary procedure to death for the non-revised primary cohort and from the 1st revision procedure to death for the known primary 1st revision cohort

**Figure N140 Cumulative Percent Survival of Patients with Non-Revised Primary Total Stemmed Reverse Shoulder Replacement and Known Primary 1st Revision (All Diagnoses, Excluding 1st Revision for Infection)**




HR - adjusted for age, gender and ASA score at procedure

Known Primary 1st Revision Total Stemmed Reverse Shoulder VS Non-Revised Primary Total Stemmed Reverse Shoulder

Entire period: HR=1.52 (95% CI: 1.34, 1.71), P<0.0001

| Number at Risk | 0 Yr | 1 Yr | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|
| Known Primary 1st Revision Total Stemmed Reverse Shoulder | 1587 | 1314 | 503 | 41 | 0 |
| Non-Revised Primary Total Stemmed Reverse Shoulder | 57513 | 48057 | 19542 | 1831 | 0 |

Note: Restricted to the first of the revision or primary procedures for bilateral patients in each procedure type with known age, sex and ASA score.
Time to survival is time from the primary procedure to death for the non-revised primary cohort and from the 1st revision procedure to death for the known primary 1st revision cohort

**Table N155 Cumulative Percent Survival of Patients with Known Primary Total Stemmed Reverse Replacement since 1st Revised by Reason for 1st Revision**

| Reason for 1st Revision | N Deceased | N Total | 30 Days | 90 Days | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Instability/Dislocation | 182 | 765 | 99.9 (99.1, 100.0) | 98.9 (97.9, 99.5) | 96.0 (94.2, 97.2) | 89.0 (86.3, 91.2) | 81.6 (77.9, 84.7) | 55.7 (49.3, 61.6) |
| Infection | 107 | 617 | 99.7 (98.7, 99.9) | 99.2 (98.0, 99.7) | 97.2 (95.5, 98.3) | 91.7 (88.8, 93.8) | 83.6 (79.4, 87.1) | |
| Loosening | 107 | 395 | 99.5 (98.0, 99.9) | 99.2 (97.6, 99.8) | 97.3 (95.0, 98.5) | 87.7 (83.5, 90.9) | 77.0 (71.4, 81.6) | |
| Fracture | 70 | 267 | 100.0 (100.0, 100.0) | 99.2 (97.0, 99.8) | 97.3 (94.3, 98.7) | 89.9 (85.0, 93.3) | 76.2 (68.9, 82.0) | |
| TOTAL | 466 | 2044 | | | | | | |

Note: Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Table N156 Cumulative Percent Survival of Patients with Known Primary Total Stemmed Reverse Shoulder Procedures since 1st Revised by Type of 1st Revision (Excluding 1st Revision for Infection)**

| Type of 1st Revision | N Deceased | N Total | 30 Days | 90 Days | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Minor | 269 | 933 | 99.9 (99.2, 100.0) | 99.2 (98.4, 99.6) | 96.8 (95.4, 97.8) | 89.4 (87.0, 91.3) | 78.9 (75.6, 81.8) | 51.6 (46.3, 56.7) |
| Major Partial | 140 | 716 | 99.9 (99.0, 100.0) | 99.1 (98.1, 99.6) | 96.4 (94.6, 97.6) | 89.3 (86.4, 91.6) | 80.9 (76.7, 84.4) | |
| Major Total | 21 | 157 | 99.4 (95.5, 99.9) | 99.4 (95.5, 99.9) | 97.9 (93.5, 99.3) | 91.6 (84.2, 95.6) | | |
| TOTAL | 430 | 1806 | | | | | | |

Note: Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05); it is available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.





# Hip Replacement

# Hip Replacement

As with previous year's Annual Reports, to ensure that the relevance and currency of AOANJRR data are maintained, almost all analyses (unless specifically stated) have been confined to hip, knee and shoulder prostheses that were still being used in 2024. Again, historic data are still available in previous Annual Reports on the AOANJRR website.

In addition to the main report, the Registry continues to publish Supplementary Reports. The Supplementary Reports are listed in the introductory chapter and will be available on the AOANJRR website https://aoanjrr.sahmri.com/annual-reports-2025 from 1 October 2025. They include a Lay Summary of the main report and 13 additional reports on arthroplasty topics, as well as detailed analyses of all prostheses identified as having a higher than anticipated rate of revision.

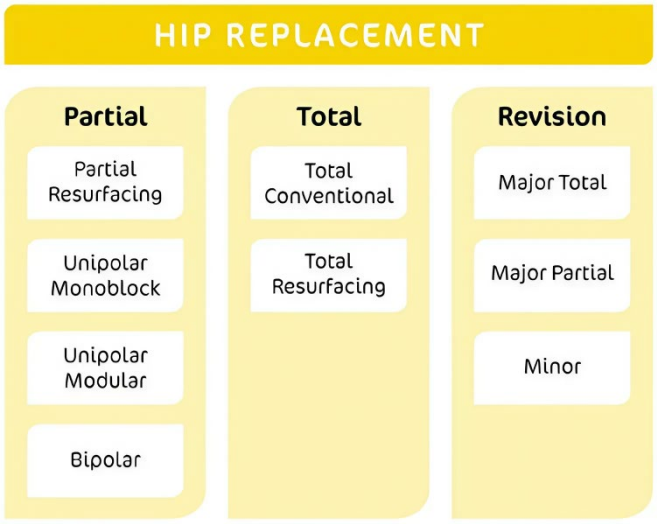
## Categories of Hip Replacement

Hip replacement is grouped into three broad categories: primary partial, primary total and revision hip replacement.

A primary replacement is an initial replacement procedure undertaken on a joint and involves replacing either part (partial) or all (total) of the articular surface.

Primary partial and primary total hip replacement are further subcategorised into classes depending on the type of prostheses used. Partial hip classes include partial resurfacing, unipolar monoblock, unipolar modular, and bipolar. Total hip classes include total conventional and total resurfacing. Definitions for each of these classes are detailed in the subsequent sections.

Revision hip replacements are re-operations of previous hip replacements where one or more of the prosthetic components are replaced, removed, or one or more components are added. Revisions include re-operations of primary partial, primary total, or previous revision procedures. Hip revisions are subcategorised into three classes: major total, major partial, or minor revisions.




Detailed information on demographics of each category of hip replacement is available in the supplementary report 'Demographics of Hip, Knee and Shoulder Arthroplasty' on the AOANJRR website: https://www.aoanjrr.sahmri.com/annual-reports-2025

## Executive Summary Reference Tables

An index of the analyses presented in this chapter is provided in Table H1, Table H2 and Table H3. Variables are listed, and where there is a significant finding for a comparison, a red diamond is shown in the table. Hyperlinks to the relevant tables and figures are included.

**Table H1 Indexing Significant Characteristic Comparisons: Partial Hip Replacements**

| Characteristic | Variable | Partial Hip Fractured NoF | | Unipolar Monoblock Fractured NoF | | Unipolar Modular Fractured NoF | | Bipolar Fractured NoF | |
|---|---|---|---|---|---|---|---|---|---|
| | | Significant HR | Figure | Significant HR | Figure | Significant HR | Figure | Significant HR | Figure |
| | Mortality* | ♦ | Figure HP3 | NT | | NT | | NT | |
| | Class | ♦ | Figure HP4 | NT | | NT | | NT | |
| | Class and Age | ♦ | Figure HP5 | NT | | NT | | NT | |
| Patient | | | | | | | | | |
| | Age | NT | | ♦ | Figure HP9 | ♦ | Figure HP14 | ♦ | Figure HP21 |
| | Gender | NT | | | Figure HP10 | ♦ | Figure HP15 | | Figure HP22 |
| Prosthesis | | | | | | | | | |
| | Fixation | NT | | NT | | ♦ | Figure HP16 | ♦ | Figure HP23 |

♦ Significant Hazard Ratio difference between categories where $p<0.05$
N T Not tested: Insufficient numbers to make statistical comparisons
*New analysis for this year's Annual Report

**Table H2 Indexing Significant Characteristic Comparisons: Total Hip Replacements**

| Characteristic | Variable | Total Conventional Hip Osteoarthritis | | Total Conventional Hip All Diagnoses | | Total Conventional Hip Fractured NoF | | Hip Fractured NoF | |
|---|---|---|---|---|---|---|---|---|---|
| | | Significant HR | Table/ Figure | Significant HR | Table/ Figure | Significant HR | Table/ Figure | Significant HR | Table/ Figure |
| | Primary Diagnosis | NT | | ♦ | Figure HT4 | NT | | NT | |
| | Class | NT | | NT | | ♦ | | ♦ | Figure HT112 |
| | Class and Age <70 | NT | | NT | | NT | | ♦ | Figure HT113 |
| | Class and Age ≥70 | NT | | NT | | NT | | ♦ | Figure HT114 |
| | Class and Gender | NT | | NT | | NT | | NT | |
| Patient | | | | | | | | | |
| | Age | ♦ | Figure HT7 | NT | | ♦ | Figure HT93 | NT | |
| | Gender | ♦ | Figure HT8 | NT | | ♦ | Figure HT94 | NT | |
| | Gender by Age | ♦ | Figure HT9<br>Figure HT10 | NT | | ♦ | Figure HT95<br>Figure HT96 | NT | |
| | ASA Score | ♦ | Figure HT14 | NT | | ♦ | Figure HT100 | NT | |
| | ASA and Gender* | ♦ | Figure HT16 | | | NT | | NT | |
| | ASA and Age* | ♦ | Figure HT17 | | | NT | | NT | |
| | BMI | ♦ | Figure HT19 | NT | | ♦ | Figure HT103 | NT | |
| | BMI and Gender* | | Figure HT21 | | | NT | | NT | |
| | BMI and Age* | | Figure HT22 | | | NT | | NT | |
| Prosthesis | | | | | | | | | |
| | Fixation | ♦ | Figure HT25 | NT | | ♦ | Figure HT105 | NT | |

## Hip Replacement

| Characteristic | Variable | Total Conventional Hip Osteoarthritis Significant HR | Total Conventional Hip Osteoarthritis Table/ Figure | Total Conventional Hip All Diagnoses Significant HR | Total Conventional Hip All Diagnoses Table/ Figure | Total Conventional Hip Fractured NoF Significant HR | Total Conventional Hip Fractured NoF Table/ Figure | Hip Fractured NoF Significant HR | Hip Fractured NoF Table/ Figure |
|---|---|---|---|---|---|---|---|---|---|
| | Fixation and age <55 | | Figure HT26 | NT | | NT | | NT | |
| | Fixation and age 55-64 | ♦ | Figure HT27 | NT | | NT | | NT | |
| | Fixation and age 65-74 | ♦ | Figure HT28 | NT | | NT | | NT | |
| | Fixation and age ≥75 | ♦ | Figure HT29 | NT | | NT | | NT | |
| | Fixation and age <70 | NT | | NT | | ♦ | Figure HT106 | NT | |
| | Fixation and age ≥70 | NT | | NT | | ♦ | Figure HT107 | NT | |
| | Stem Collar | ♦ | Figure HT30 | NT | | NT | | NT | |
| | Surgical Approach and Stem Collar Use | ♦ | Figure HT32<br>Figure HT33<br>Figure HT34 | NT | | NT | | NT | |
| | Prosthesis Combinations and Stem Collar Use* | ♦ | Table HT33 | NT | | NT | | NT | |
| | Mini Stems | ♦ | Figure HT35 | NT | | NT | | NT | |
| | Mini Stems and Age | ♦ | Figure HT36 | | | NT | | NT | |
| | Mini Stems and BMI | ♦ | Figure HT37 | | | NT | | NT | |
| | Mini Stems Revision for Loosening | ♦ | Figure HT39 | NT | | NT | | NT | |
| | Mini Stems Revision for Fracture | ♦ | Figure HT40 | NT | | NT | | NT | |
| | Bearing Surface | ♦ | Figure HT45 | NT | | NT | | NT | |
| | Polyethylene Type | ♦ | Figure HT47<br>Figure HT53 | NT | | NT | | NT | |
| | Head Size | NT | | NT | | ♦ | Figure HT108 | NT | |
| | Head Size and Revision for Prosthesis Dislocation/Instability | NT | | NT | | ♦ | Figure HT109 | NT | |
| | Non XLPE Polyethylene and Head Size | | Figure HT49 | NT | | NT | | NT | |
| | XLPE Polyethylene Type and Head Size | ♦ | Figure HT50 | NT | | NT | | NT | |
| | Mixed Ceramic Bearings by Head Size | | Figure HT56 | NT | | NT | | NT | |
| | Acetabular Size <52cm* | ♦ | Figure HT58 | | | NT | | NT | |
| | Acetabular Size 52cm* | ♦ | Figure HT59 | | | NT | | NT | |
| | Acetabular Size >52cm* | ♦ | Figure HT60 | | | NT | | NT | |
| | Acetabular Type | NT | | ♦ | Figure HT61 | | Figure HT110 | NT | |
| | Constrained Acetabular Components | ♦ | Table HT53 | NT | | NT | | NT | |
| | Dual Mobility | | | ♦ | Figure HT63 | ♦ | Figure HT111 | NT | |
| | Dual Mobility and Age | | Table HT62 | NT | | NT | | NT | |
| | Dual Mobility and Gender | ♦ | Table HT62 | NT | | NT | | NT | |
| | Dual Mobility and Fixation | | Table HT62 | NT | | NT | | NT | |

| Characteristic | Variable | Total Conventional Hip Osteoarthritis Significant HR | Total Conventional Hip Osteoarthritis Table/ Figure | Total Conventional Hip All Diagnoses Significant HR | Total Conventional Hip All Diagnoses Table/ Figure | Total Conventional Hip Fractured NoF Significant HR | Total Conventional Hip Fractured NoF Table/ Figure | Hip Fractured NoF Significant HR | Hip Fractured NoF Table/ Figure |
|---|---|---|---|---|---|---|---|---|---|
| | Dual Mobility and Reason for Revision | ♦ | Table HT62 | NT | | NT | | NT | |
| | Dual Mobility and* Surgical Approach | | Figure HT66<br>Figure HT67<br>Figure HT68<br>Figure HT67 | NT | | NT | | NT | |
| Surgeon Assistive Tools (SAT)* | | | | | | | | | |
| | Computer Navigation* | | Figure HT70 | NT | | NT | | NT | |
| | Computer Navigation and Age* | | Figure HT72 | NT | | NT | | NT | |
| | IDI* | ♦ | Figure HT74 | NT | | NT | | NT | |
| | IDI and Age* | ♦ | Figure HT75 | NT | | NT | | NT | |
| | Robotic Assistance* | ♦ | Figure HT76 | NT | | NT | | NT | |
| | Robotic Assistance and Age* | | Figure HT78 | NT | | NT | | NT | |
| | XLPE by SAT* | ♦ | Figure HT79 | NT | | NT | | NT | |
| | Accolade II/Trident (Shell)Combination with XLPE by SAT* | | Figure HT80 | NT | | NT | | NT | |
| | Exeter V40/Trident (Shell) Combination with XLPE by SAT* | | Figure HT81 | NT | | NT | | NT | |
| Surgical Approach | | | | | | | | | |
| | Surgical Approach for osteoarthritis | ♦ | Figure HT83 | NT | | NT | | NT | |
| | Surgical Approach Major Revision | ♦ | Figure HT84 | NT | | NT | | NT | |
| | Surgical Approach Revision for Loosening | ♦ | Figure HT86 | NT | | NT | | NT | |
| | Surgical Approach Revision for Fracture | ♦ | Figure HT87 | NT | | NT | | NT | |
| | Surgical Approach Revision for Infection | ♦ | Figure HT88 | NT | | NT | | NT | |
| | Surgical Approach Revision for Dislocation/Instability | ♦ | Figure HT89 | NT | | NT | | NT | |

♦ Significant Hazard Ratio difference between categories where $p<0.05$

N T Not tested: Insufficient numbers to make statistical comparisons.

*New analysis for this year's Annual Report

# Hip Replacement

**Table H3 Indexing Significant Characteristic Comparisons: Total Hip Replacements**

| Characteristic | Variable | Total Resurfacing Hip All Diagnoses | | Total Resurfacing Hip Osteoarthritis | | Primary Total Hip Osteoarthritis | |
|---|---|---|---|---|---|---|---|
| | | Significant HR | Figure | Significant HR | Figure | Significant HR | Figure |
| | Primary Diagnosis | ♦ | Figure HT117 | NT | | NT | |
| | Class | NT | | NT | | ♦ | Figure HT127 |
| | Class and Gender | NT | | NT | | ♦ | Figure HT128 |
| **Patient** | | | | | | | |
| | Age | NT | | ♦ | Figure HT120 | NT | |
| | Gender | NT | | ♦ | Figure HT121 | NT | |
| | Male Gender by Age | NT | | ♦ | Figure HT122 | NT | |
| | Female Gender by Age | NT | | | Figure HT123 | NT | |
| **Prosthesis** | | | | | | | |
| | Head Size | NT | | ♦ | Figure HT124 | NT | |
| | Head Size and Gender | NT | | ♦ | Figure HT125 | NT | |

♦ Note Significant Hazard Ratio difference between categories where p<0.05 Not tested: Insufficient numbers to make statistical comparisons

## Use of Hip Replacement

There are 972,256 hip replacements with a procedure date up to and including 31 December 2024. This represents an additional 62,206 hip procedures compared to the number reported last year. The relative frequency of each type of hip procedure is provided in Table H4.

For further information on the **closure of the database** please see the Glossary of this report.

**Table H4 Number of Hip Replacements**

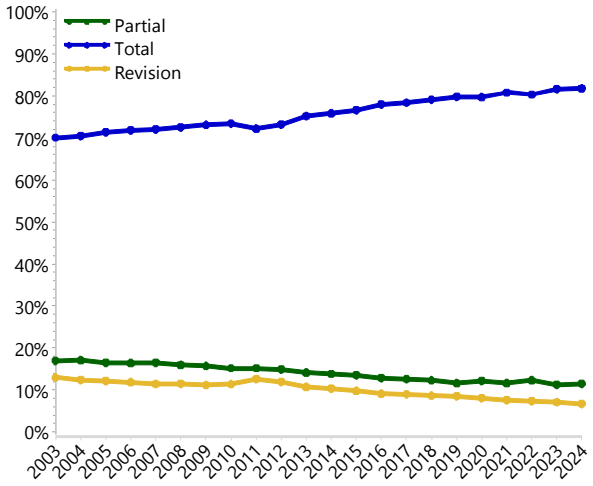
| Hip Category | Number | Percent |
|---|---|---|
| Partial | 134340 | 13.8 |
| Total | 742248 | 76.3 |
| Revision | 95668 | 9.8 |
| **TOTAL** | **972256** | **100.0** |

The number of hip replacement procedures undertaken in 2024 is a 127.1% increase since 2003. The corresponding increase in primary total hip replacement is 165.1%, for primary partial it is 53.3% and for revision hip replacement it is 18.3%.

There have been 632 more hip replacement procedures undertaken in 2024 compared to the previous year. During this time, the use of primary total hip replacement increased by 1.3%, accounting for 81.8% of all hip replacement procedures in 2024. Primary partial hip replacement increased by 3.0%, accounting for 11.5% of hip procedures in 2024.

The proportion of revision hip procedures has declined from a peak of 12.9% in 2003 to 6.7% in 2024. This equates to 3,747 fewer revision procedures in 2024 than would have been expected if the proportion of revision procedures had remained at the level reported in 2003 (Figure H1).

**Figure H1 Proportion of Hip Replacement**



## ASA Score and BMI in Hip Replacement

Data are reported on hip replacement procedures for both the American Society of Anesthesiologists – Physical Status Classification (ASA score) and Body Mass Index (BMI). ASA score and BMI are both known to impact the outcome of hip replacement surgery. The Registry commenced collection of ASA score in 2012 and BMI data in 2015.

There are ASA score data on 583,980 hip replacement procedures and BMI data on 461,747 hip replacement procedures. Since its initial collection, ASA score has been recorded for 97.2% of procedures. BMI has been recorded for 89.2% of procedures since collection commenced.

### ASA Score

There are five ASA score classifications:[3]

1. A normal healthy patient
2. A patient with mild systemic disease
3. A patient with severe systemic disease
4. A patient with severe systemic disease that is a constant threat to life
5. A moribund patient who is not expected to survive without the operation

There is a difference in ASA score depending on the class of hip replacement. Partial hip replacement procedures have a higher proportion of patients with ASA scores 3 and 4 compared to patients undergoing primary total or revision hip replacement. Total hip replacement procedures have more patients with ASA scores 1 and 2 (Table H5).

### BMI Category

BMI for adults is classified into six main categories:[4]

| | |
|---|---|
| Underweight | <18.5 |
| Normal | 18.5 – 24.9 |
| Pre-obese | 25.0 – 29.9 |
| Obese Class 1 | 30.0 – 34.9 |
| Obese Class 2 | 35.0 – 39.9 |
| Obese Class 3 | ≥40.0 |

The majority of hip replacement procedures are undertaken in patients who have a normal BMI or are pre-obese (Table H6).

**Table H5 ASA Score for Hip Replacement**

| ASA Score | Partial | | Total | | Revision | | TOTAL | |
|---|---|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% | N | Col% |
| ASA 1 | 189 | 0.3 | 38502 | 8.3 | 1706 | 3.5 | 40397 | 6.9 |
| ASA 2 | 6814 | 9.5 | 240187 | 51.8 | 15876 | 32.4 | 262877 | 45.0 |
| ASA 3 | 43397 | 60.6 | 175465 | 37.9 | 27013 | 55.2 | 245875 | 42.1 |
| ASA 4 | 20930 | 29.2 | 9221 | 2.0 | 4317 | 8.8 | 34468 | 5.9 |
| ASA 5 | 292 | 0.4 | 41 | 0.0 | 30 | 0.1 | 363 | 0.1 |
| **TOTAL** | **71622** | **100.0** | **463416** | **100.0** | **48942** | **100.0** | **583980** | **100.0** |

**Table H6 BMI Category for Hip Replacement**

| BMI Category | Partial | | Total | | Revision | | TOTAL | |
|---|---|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% | N | Col% |
| Underweight | 3479 | 9.7 | 4186 | 1.1 | 623 | 1.8 | 8288 | 1.8 |
| Normal | 17700 | 49.4 | 86454 | 22.1 | 8462 | 23.9 | 112616 | 24.4 |
| Pre Obese | 10228 | 28.6 | 142319 | 36.4 | 12145 | 34.2 | 164692 | 35.7 |
| Obese Class 1 | 3180 | 8.9 | 96918 | 24.8 | 8324 | 23.5 | 108422 | 23.5 |
| Obese Class 2 | 872 | 2.4 | 40879 | 10.5 | 3696 | 10.4 | 45447 | 9.8 |
| Obese Class 3 | 343 | 1.0 | 19716 | 5.0 | 2223 | 6.3 | 22282 | 4.8 |
| **TOTAL** | **35802** | **100.0** | **390472** | **100.0** | **35473** | **100.0** | **461747** | **100.0** |

Note: BMI has not been presented for patients aged ≤19 years

[3] https://www.asahq.org/standards-and-practice-parameters/statement-on-asa-physical-status-classification-system

[4] https://www.aihw.gov.au/reports/overweight-obesity/overweight-and-obesity/contents/measuring-overweight-and-obesity

# Primary Partial Hip Replacement

## Classes of Partial Hip Replacement

There are four classes of primary partial hip replacement. These are defined by the type of prostheses used.

**Partial resurfacing** involves the use of one or more button prostheses to replace part of the natural articulating surface on one or both sides of the hip joint. These prostheses are no longer used.

**Unipolar monoblock** involves the use of a femoral stem prosthesis with a fixed large head that replaces the natural femoral head.

**Unipolar modular** involves the use of a femoral stem and exchangeable large head prosthesis that replaces the natural femoral head.

**Bipolar** involves the use of a femoral stem and standard head prosthesis that articulates with a non-fixed component replacing the natural femoral head.

## Use of Partial Hip Replacement

The most common class of primary partial hip replacement is unipolar modular followed by bipolar and unipolar monoblock (Table HP1).

**Table HP1 Primary Partial Hip Replacement by Class**

| Hip Class | Number | Percent |
|---|---|---|
| Unipolar Monoblock | 29417 | 21.9 |
| Unipolar Modular | 60161 | 44.8 |
| Bipolar | 44747 | 33.3 |
| TOTAL | 134325 | 100.0 |

Note: Excludes 15 partial resurfacing hip procedures.
Partial resurfacing hip procedures have not been performed since 2014

Continuing the trend from 2020, in 2024, bipolar hip replacement was more commonly used than unipolar modular. The use of unipolar monoblock has declined since 2004 and now accounts for only 1.1% of primary partial hip replacements (Figure HP1).

Cement fixation remains the most common fixation method for partial hip replacement (Figure HP2).

The 10 most used femoral prostheses for partial hip replacement are listed in Table HP2. The Exeter V40, CPCS and CPT were the most frequently used femoral prostheses.

Detailed demographic information on primary partial hip replacement is available in the supplementary report 'Demographics of Hip, Knee and Shoulder Arthroplasty' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2025

**Figure HP1 Primary Partial Hip Replacement by Class**

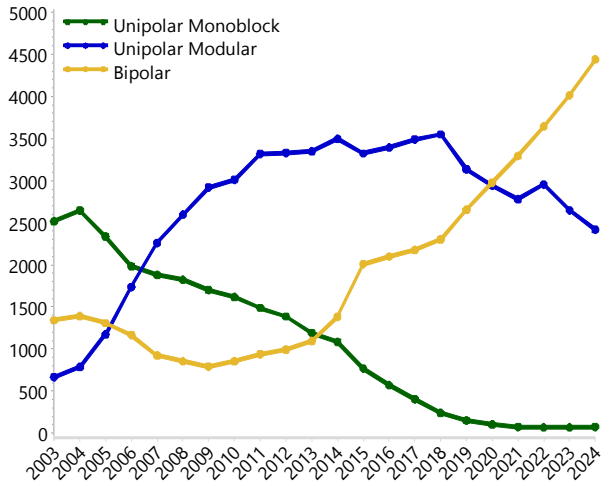
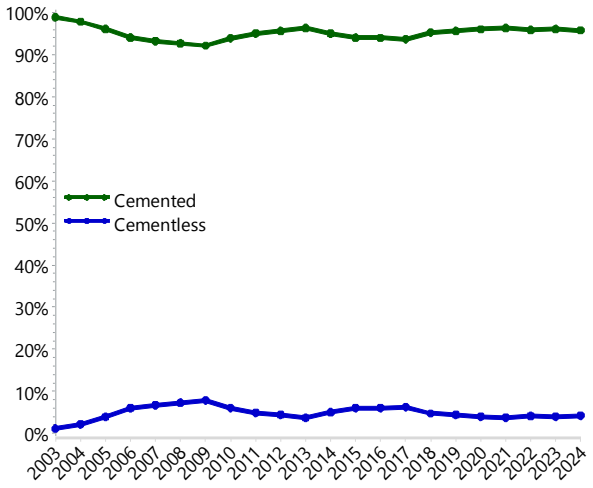



**Figure HP2 Primary Partial Hip Replacement by Fixation (All Diagnoses)**




Detailed information on partial resurfacing hip replacement is available in the supplementary report 'Prosthesis Types with No or Minimal Use' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2025

**Table HP2 10 Most Used Femoral Prostheses in Primary Partial Hip Replacement**

| 2003 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 1988 | Austin-Moore Type | 3115 | Exeter V40 | 3491 | Exeter V40 | 3345 | Exeter V40 | 3469 | Exeter V40 |
| 810 | Exeter V40 | 875 | CPT | 874 | CPT | 914 | CPT | 723 | CPCS |
| 526 | Thompson Type | 724 | CPCS | 732 | CPCS | 772 | CPCS | 623 | CPT |
| 186 | Alloclassic | 500 | C-Stem AMT | 496 | C-Stem AMT | 488 | C-Stem AMT | 525 | C-Stem AMT |
| 127 | Elite Plus | 132 | CORAIL | 205 | Short Exeter V40 | 216 | Taper Fit | 284 | Taper Fit |
| 105 | CPT | 130 | Short Exeter V40 | 185 | CORAIL | 165 | CORAIL | 221 | MS 30 |
| 95 | Spectron EF | 93 | Absolut | 102 | Quadra-C | 148 | Short Exeter V40 | 217 | Short Exeter V40 |
| 74 | C-Stem | 74 | Taper Fit | 82 | Taper Fit | 110 | Quadra-C | 176 | CORAIL |
| 65 | CPCS | 73 | ETS | 70 | ETS | 93 | MS 30 | 135 | Quadra-C |
| 63 | Omnifit | 72 | Quadra-C | 60 | Polarstem | 73 | Polarstem | 116 | Polarstem |
| **10 Most Used** | | | | | | | | | |
| 4039 | (10) 89.3% | 5788 | (10) 94.2% | 6297 | (10) 94.5% | 6324 | (10) 93.9% | 6489 | (10) 93.6% |
| **Remainder** | | | | | | | | | |
| 482 | (52) 10.7% | 356 | (38) 5.8% | 370 | (39) 5.5% | 409 | (35) 6.1% | 443 | (33) 6.4% |
| **TOTAL** | | | | | | | | | |
| 4521 | (62) 100.0% | 6144 | (48) 100.0% | 6667 | (49) 100.0% | 6733 | (45) 100.0% | 6932 | (43) 100.0% |

Note: Excludes partial resurfacing

# Primary Partial Hip Replacement

## Outcome for Fractured Neck of Femur

In order to keep Registry data contemporaneous, only procedures using prostheses that have been available and used in 2024 (described as modern prostheses) are included in the analyses, unless clearly specified. Due to the restriction to modern prostheses 41,329 (30.8%) partial hip replacement procedures have been excluded from this analysis in 2025.

Fractured neck of femur is the principal diagnosis for the three main classes of primary partial hip replacement: unipolar monoblock (98.1%), unipolar modular (96.5%) and bipolar (94.8%). A comparative analysis of partial hip replacement and total conventional hip replacement has been undertaken for fractured neck of femur and is presented after the primary total conventional hip replacement for osteoarthritis section of this report.

The outcome of primary partial hip replacement varies depending on the class. Outcomes are restricted to 10 years because of the high mortality in this group.

The prosthesis class variation in mortality is almost certainly due to patient selection (Table HT3).

When used for fractured neck of femur, bipolar has a lower cumulative percent revision compared to unipolar modular after 2.5 years. While unipolar monoblock has the lowest cumulative percent revision, this most likely is related to recent low rate of use, patient selection, restriction of analyses to modern prostheses and the high competing risk of mortality (Table HP4 and Figure HP4). The difference in outcome between bipolar and unipolar modular classes is more apparent in patients aged <75 years (Table HP5 and Figure HP5).

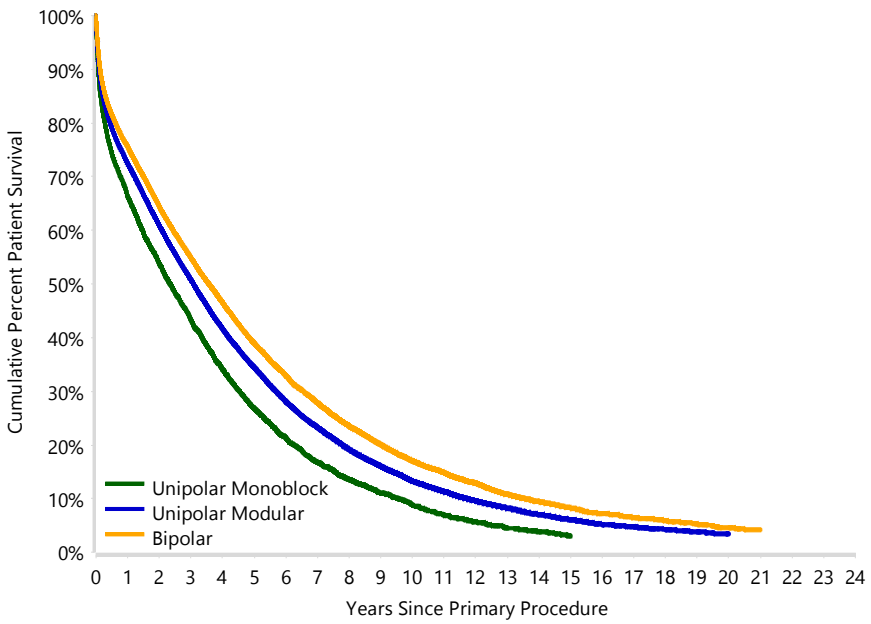
The rate of revision for fractured neck of femur in primary total conventional hip replacement compared to primary partial hip replacement can be found later in this chapter in the following section: **Outcome of Total Conventional Compared to Partial Hip Replacement**.

**Table HP3 Cumulative Percent Survival of Patients with Mortality of Primary Partial Hip Replacement by Class (Primary Diagnosis Fractured NOF)**

| Hip Class | N Deceased | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Unipolar Monoblock | 3343 | 3779 | 66.2 (64.6, 67.7) | 53.8 (52.2, 55.4) | 43.2 (41.6, 44.9) | 26.8 (25.4, 28.3) | 16.8 (15.6, 18.1) | 8.8 (7.8, 9.8) |
| Unipolar Modular | 35196 | 47442 | 72.3 (71.9, 72.7) | 60.9 (60.5, 61.4) | 50.7 (50.3, 51.2) | 34.4 (33.9, 34.9) | 23.2 (22.8, 23.7) | 13.3 (12.9, 13.7) |
| Bipolar | 20558 | 35146 | 75.5 (75.0, 76.0) | 64.5 (63.9, 65.0) | 54.8 (54.2, 55.4) | 38.9 (38.3, 39.5) | 27.8 (27.2, 28.5) | 17.1 (16.5, 17.7) |
| TOTAL | 59097 | 86367 | | | | | | |

Note: Restricted to modern prostheses
Restricted to first procedure performed per patient

**Figure HP3 Cumulative Percent Survival of Patients with Mortality of Primary Partial Hip Replacement by Class (Primary Diagnosis Fractured NOF)**




HR - adjusted for age and gender

Unipolar Monoblock vs Unipolar Modular

Entire Period: HR=1.19 (95% CI 1.15, 1.23), p<0.001

Unipolar Monoblock vs Bipolar

0 - 2Wk: HR=1.49 (95% CI 1.30, 1.70), p<0.001

2Wk - 3Mth: HR=1.30 (95% CI 1.18, 1.43), p<0.001

3Mth+: HR=1.30 (95% CI 1.25, 1.36), p<0.001

Unipolar Modular vs Bipolar

0 - 3Mth: HR=1.14 (95% CI 1.10, 1.18), p<0.001

3Mth+: HR=1.10 (95% CI 1.08, 1.12), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Unipolar Monoblock | 3779 | 2418 | 1924 | 1509 | 905 | 537 | 229 |
| Unipolar Modular | 47442 | 31897 | 25283 | 19648 | 11696 | 6801 | 2876 |
| Bipolar | 35146 | 22559 | 16756 | 12508 | 6859 | 3828 | 1507 |

Note: Restricted to modern prostheses
Restricted to first procedure performed per patient

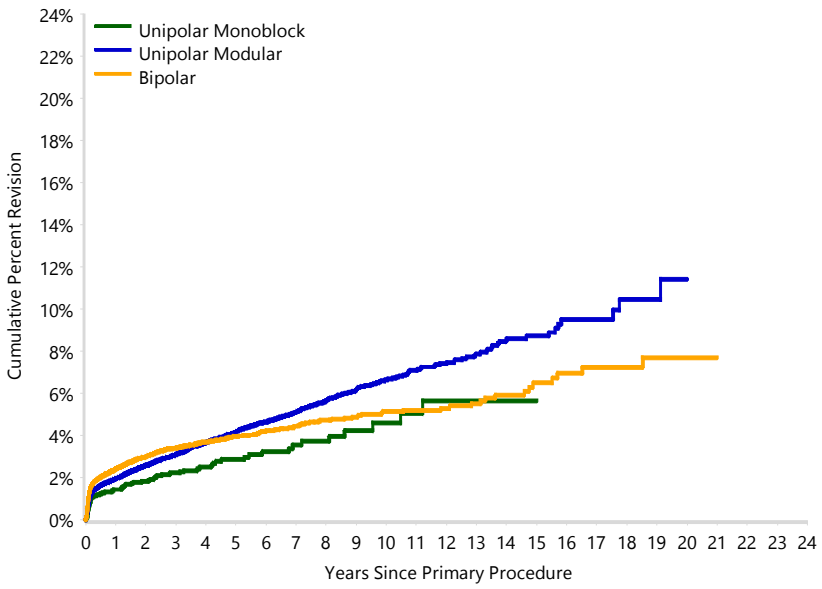
# Primary Partial Hip Replacement

**Table HP4 Cumulative Percent Revision of Primary Partial Hip Replacement by Class (Primary Diagnosis Fractured NOF)**

| Hip Class | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Unipolar Monoblock | 82 | 3866 | 1.4 (1.1, 1.9) | 1.8 (1.4, 2.4) | 2.2 (1.7, 2.8) | 2.9 (2.2, 3.7) | 3.6 (2.7, 4.6) | 4.6 (3.4, 6.2) |
| Unipolar Modular | 1531 | 49089 | 2.0 (1.8, 2.1) | 2.6 (2.4, 2.7) | 3.1 (2.9, 3.3) | 4.2 (3.9, 4.4) | 5.1 (4.8, 5.4) | 6.6 (6.2, 7.1) |
| Bipolar | 1061 | 36182 | 2.4 (2.2, 2.6) | 3.0 (2.8, 3.2) | 3.4 (3.2, 3.6) | 3.9 (3.7, 4.2) | 4.4 (4.1, 4.8) | 5.1 (4.7, 5.6) |
| TOTAL | 2674 | 89137 | | | | | | |

Note: Restricted to modern prostheses

**Figure HP4 Cumulative Percent Revision of Primary Partial Hip Replacement by Class (Primary Diagnosis Fractured NOF)**




HR - adjusted for age and gender

Unipolar Monoblock vs Unipolar Modular

Entire Period: HR=0.73 (95% CI 0.59, 0.91), p=0.005

Bipolar vs Unipolar Monoblock

0 - 3Mth: HR=1.64 (95% CI 1.29, 2.09), p<0.001

3Mth - 6Mth: HR=1.52 (95% CI 1.06, 2.18), p=0.023

6Mth - 1.5Yr: HR=1.41 (95% CI 1.06, 1.88), p=0.019

1.5Yr - 2Yr: HR=1.22 (95% CI 0.81, 1.84), p=0.334

2Yr - 2.5Yr: HR=1.22 (95% CI 0.80, 1.87), p=0.356

2.5Yr+: HR=0.67 (95% CI 0.50, 0.89), p=0.005

Bipolar vs Unipolar Modular

0 - 1Mth: HR=1.32 (95% CI 1.13, 1.54), p<0.001

1Mth - 3Mth: HR=1.09 (95% CI 0.93, 1.28), p=0.296

3Mth - 2.5Yr: HR=1.01 (95% CI 0.88, 1.15), p=0.938

2.5Yr+: HR=0.49 (95% CI 0.40, 0.59), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Unipolar Monoblock | 3866 | 2468 | 1963 | 1540 | 919 | 546 | 233 |
| Unipolar Modular | 49089 | 32943 | 26055 | 20216 | 12002 | 6952 | 2934 |
| Bipolar | 36182 | 23182 | 17191 | 12809 | 7002 | 3882 | 1528 |

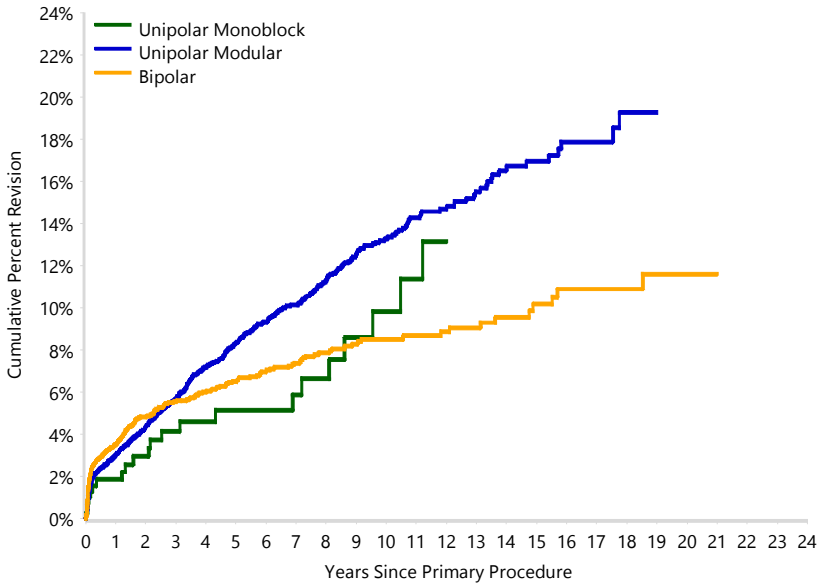
Note: Restricted to modern prostheses

**Table HP5 Cumulative Percent Revision of Primary Partial Hip Replacement in Patients Aged <75 Years by Class (Primary Diagnosis Fractured NOF)**

| Hip Class | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Unipolar Monoblock | 22 | 415 | 1.9 (0.9, 3.9) | 2.9 (1.6, 5.5) | 4.2 (2.4, 7.1) | 5.2 (3.1, 8.5) | 5.9 (3.5, 9.7) | 9.8 (6.0, 15.9) |
| Unipolar Modular | 526 | 6776 | 3.0 (2.6, 3.5) | 4.3 (3.8, 4.9) | 5.7 (5.1, 6.4) | 8.3 (7.5, 9.2) | 10.1 (9.2, 11.1) | 13.3 (12.1, 14.6) |
| Bipolar | 334 | 6186 | 3.5 (3.1, 4.0) | 4.8 (4.3, 5.5) | 5.5 (4.9, 6.2) | 6.5 (5.8, 7.3) | 7.4 (6.6, 8.3) | 8.5 (7.5, 9.7) |
| TOTAL | 882 | 13377 | | | | | | |

Note: Restricted to modern prostheses

**Figure HP5 Cumulative Percent Revision of Primary Partial Hip Replacement in Patients Aged <75 Years by Class (Primary Diagnosis Fractured NOF)**




HR - adjusted for age and gender

Unipolar Monoblock vs Bipolar

0 - 1Mth: HR=0.61 (95% CI 0.19, 1.92), p=0.397

1Mth - 2Yr: HR=0.64 (95% CI 0.30, 1.36), p=0.244

2Yr+: HR=1.59 (95% CI 0.87, 2.89), p=0.128

Unipolar Modular vs Unipolar Monoblock

Entire Period: HR=1.42 (95% CI 0.93, 2.18), p=0.107

Unipolar Modular vs Bipolar

0 - 3Mth: HR=0.79 (95% CI 0.62, 1.00), p=0.050

3Mth - 3Yr: HR=1.18 (95% CI 0.94, 1.48), p=0.148

3Yr - 3.5Yr: HR=4.66 (95% CI 1.95, 11.15), p<0.001

3.5Yr+: HR=2.42 (95% CI 1.79, 3.25), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Unipolar Monoblock | 415 | 291 | 248 | 218 | 164 | 127 | 65 |
| Unipolar Modular | 6776 | 5090 | 4283 | 3624 | 2584 | 1856 | 1049 |
| Bipolar | 6186 | 4298 | 3396 | 2742 | 1813 | 1234 | 633 |

Note: Restricted to modern prostheses

# Primary Partial Hip Replacement

## Unipolar Monoblock

### DEMOGRAPHICS

There are 29,417 unipolar monoblock procedures recorded. This is an additional 84 procedures compared to the previous report.

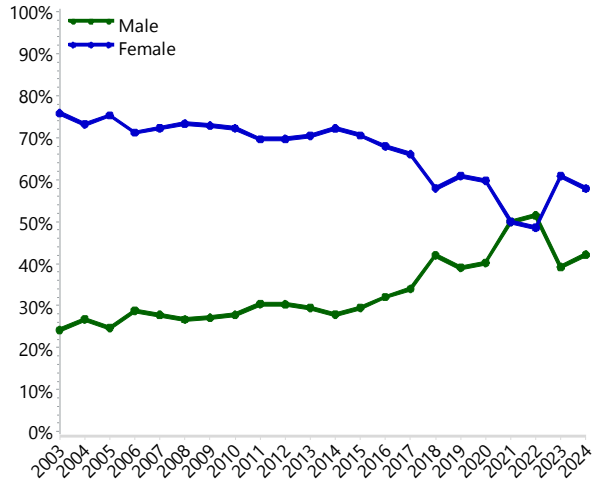
For further information on the **closure of the database** please see the Glossary of this report.

The yearly use of unipolar monoblock hip replacement in Australia in 2024 has decreased by 97.0% compared to 2003. While the number of procedures reported in 2024 remains small, this has increased by 10.1% compared to 2023.

Fractured neck of femur is the principal diagnosis for primary unipolar monoblock hip replacement (97.7%).

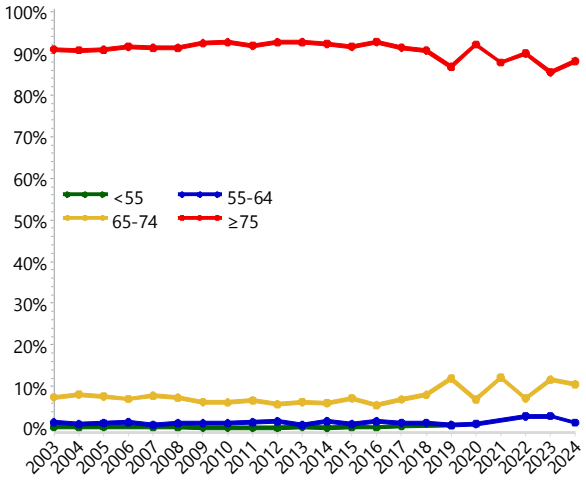
The majority of patients are female (57.9%) and aged ≥75 years (91.2%).

**Figure HP6 Primary Unipolar Monoblock Hip Replacement by Gender**




The proportion of patients aged ≥85 years has change little from 51.0% in 2003 to 50.0% in 2024. The mean age of patients is 84.5 years (Table HP6, Figure HP6, and Figure HP7).

**Figure HP7 Primary Unipolar Monoblock Hip Replacement by Age**




The Exeter Trauma Stem (ETS) is the only unipolar monoblock prosthesis used in 2024 (Table HP7).

**Table HP6 Age and Gender of Primary Unipolar Monoblock Hip Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 8065 | 27.4% | 32 | 107 | 84 | 83.5 | 7.8 |
| Female | 21352 | 72.6% | 16 | 108 | 86 | 85.0 | 7.2 |
| **TOTAL** | **29417** | **100.0%** | **16** | **108** | **85** | **84.5** | **7.4** |

**Table HP7 Most Used Prostheses in Primary Unipolar Monoblock Hip Replacement**

| 2003 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 1988 | Austin-Moore Type | 73 | ETS | 70 | ETS | 68 | ETS | 76 | ETS |
| 526 | Thompson Type | 1 | Austin-Moore Type | | | 1 | Austin-Moore Type | | |
| **Most Used** | | | | | | | | | |
| 2514 | (2) 100.0% | 74 | (2) 100.0% | 70 | (1) 100.0% | 69 | (2) 100.0% | 76 | (1) 100.0% |

### Outcome for Fractured Neck of Femur

The cumulative percent revision at 10 years for unipolar monoblock replacement undertaken for fractured neck of femur is 4.6% (Table HP8 and Figure HP8).

The main reason for revision is dislocation/instability (26.8%), followed by infection (24.4%), fracture (14.6%) and chondrolysis/acetabular erosion (13.4%) (Table HP9). Of the revisions of unipolar monoblock hip replacements, the majority are revised to a total hip replacement (61.0%). Revision to another unipolar hip replacement (femoral component only) has occurred in 12.2% of revisions with the same proportion revised to cement spacers (Table HP10).

Age <75 years is a risk factor for revision. The rate of revision for this age group is higher than for those 75-84 years and also ≥85 years (Table HP11 and Figure HP9).

There is no difference in the rate of revision between males and females (Table HP12 and Figure HP10).

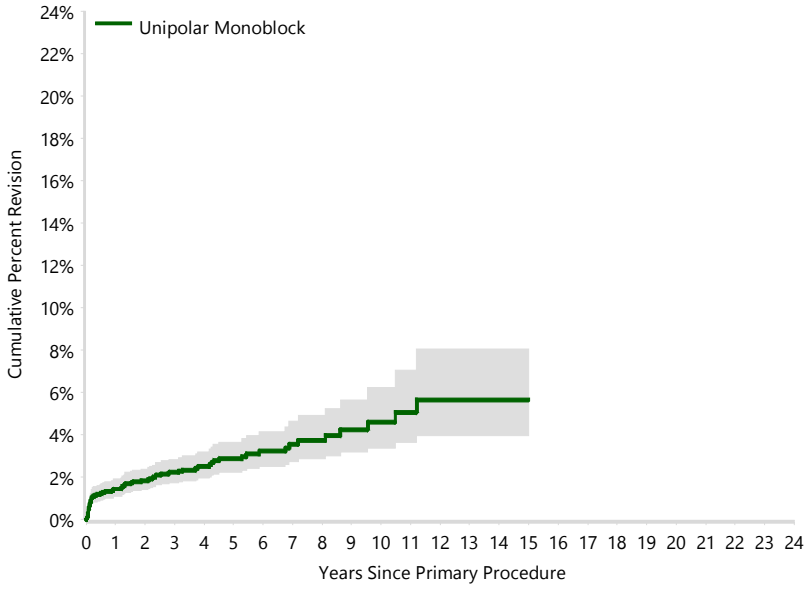
All unipolar monoblock hip replacements in 2024 used cemented fixation.

**Table HP8 Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement (Primary Diagnosis Fractured NOF)**

| Hip Type | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Unipolar Monoblock | 82 | 3866 | 1.4 (1.1, 1.9) | 1.8 (1.4, 2.4) | 2.2 (1.7, 2.8) | 2.9 (2.2, 3.7) | 3.6 (2.7, 4.6) | 4.6 (3.4, 6.2) |
| TOTAL | 82 | 3866 | | | | | | |

Note: Restricted to modern prostheses

**Figure HP8 Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement (Primary Diagnosis Fractured NOF)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Unipolar Monoblock | 3866 | 2468 | 1963 | 1540 | 919 | 546 | 233 |

Note: Restricted to modern prostheses

# Primary Partial Hip Replacement

**Table HP9 Primary Unipolar Monoblock Hip Replacement by Reason for Revision (Primary Diagnosis Fractured NOF)**

| Reason for Revision | Number | Percent |
|---|---|---|
| Prosthesis Dislocation/Instability | 22 | 26.8 |
| Infection | 20 | 24.4 |
| Fracture | 12 | 14.6 |
| Chondrolysis/Acetabular Erosion | 11 | 13.4 |
| Pain | 9 | 11.0 |
| Loosening | 5 | 6.1 |
| Malposition | 1 | 1.2 |
| Other | 2 | 2.4 |
| TOTAL | 82 | 100.0 |

Note: Restricted to modern prostheses

**Table HP10 Primary Unipolar Monoblock Hip Replacement by Type of Revision (Primary Diagnosis Fractured NOF)**

| Type of Revision | Number | Percent |
|---|---|---|
| THR (Femoral/Acetabular) | 50 | 61.0 |
| Cement Spacer | 10 | 12.2 |
| Femoral Component | 10 | 12.2 |
| Removal of Prostheses | 7 | 8.5 |
| Minor Components | 3 | 3.7 |
| Bipolar Head and Femoral | 2 | 2.4 |
| TOTAL | 82 | 100.0 |

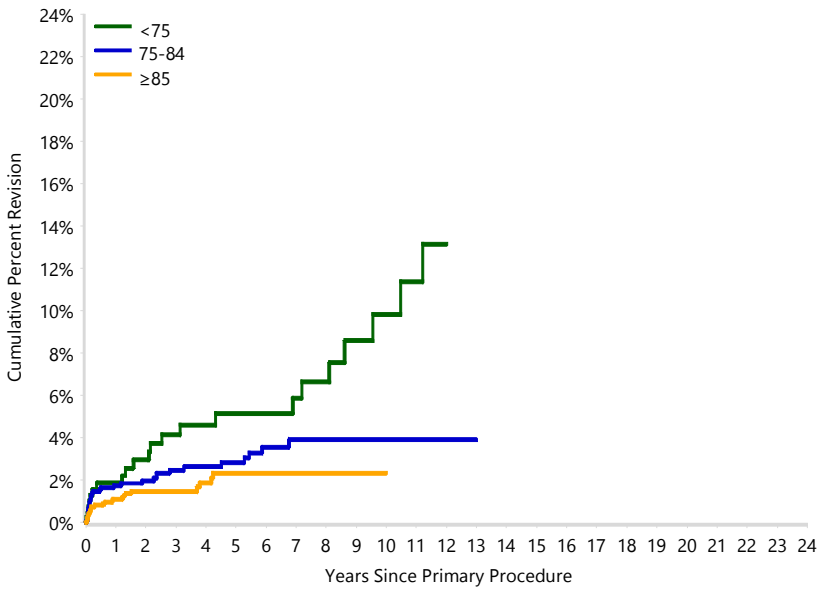
Note: Restricted to modern prostheses.

**Table HP11 Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement by Age (Primary Diagnosis Fractured NOF)**

| Age | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| <75 | 22 | 415 | 1.9 (0.9, 3.9) | 2.9 (1.6, 5.5) | 4.2 (2.4, 7.1) | 5.2 (3.1, 8.5) | 5.9 (3.5, 9.7) | 9.8 (6.0, 15.9) |
| 75-84 | 34 | 1433 | 1.7 (1.2, 2.6) | 2.0 (1.3, 2.9) | 2.5 (1.7, 3.6) | 2.8 (2.0, 4.1) | 3.9 (2.7, 5.7) | 3.9 (2.7, 5.7) |
| ≥85 | 26 | 2018 | 1.1 (0.7, 1.8) | 1.5 (1.0, 2.3) | 1.5 (1.0, 2.3) | 2.3 (1.5, 3.7) | 2.3 (1.5, 3.7) | 2.3 (1.5, 3.7) |
| TOTAL | 82 | 3866 | | | | | | |

Note: Restricted to modern prostheses

**Figure HP9 Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement by Age (Primary Diagnosis Fractured NOF)**




HR - adjusted for gender

<75 vs 75-84

Entire Period: HR=1.90 (95% CI 1.11, 3.27), p=0.020

<75 vs ≥85

Entire Period: HR=2.74 (95% CI 1.53, 4.90), p<0.001

75-84 vs ≥85

Entire Period: HR=1.44 (95% CI 0.86, 2.40), p=0.166

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| <75 | 415 | 291 | 248 | 218 | 164 | 127 | 65 |
| 75-84 | 1433 | 987 | 829 | 683 | 442 | 278 | 124 |
| ≥85 | 2018 | 1190 | 886 | 639 | 313 | 141 | 44 |

Note: Restricted to modern prostheses

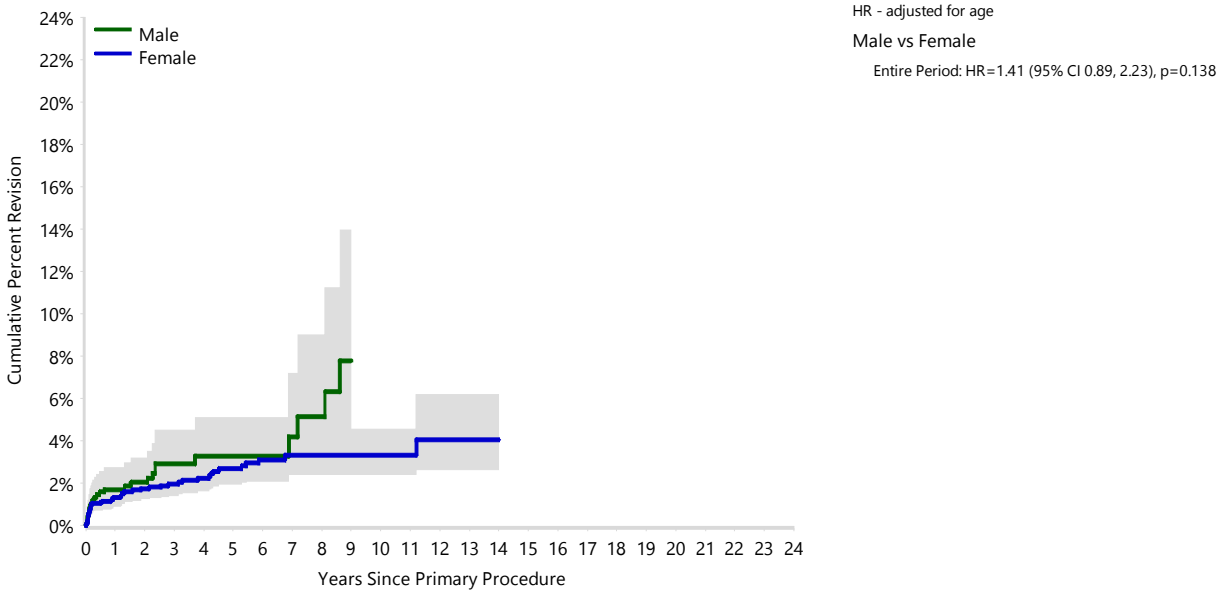
# Primary Partial Hip Replacement

**Table HP12 Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement by Gender (Primary Diagnosis Fractured NOF)**

| Gender | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Male | 30 | 1257 | 1.7 (1.1, 2.7) | 2.0 (1.3, 3.2) | 2.9 (1.9, 4.5) | 3.3 (2.1, 5.1) | 4.2 (2.4, 7.2) | |
| Female | 52 | 2609 | 1.3 (0.9, 1.9) | 1.7 (1.3, 2.4) | 2.0 (1.4, 2.7) | 2.7 (2.0, 3.6) | 3.3 (2.4, 4.5) | 3.3 (2.4, 4.5) |
| TOTAL | 82 | 3866 | | | | | | |

Note: Restricted to modern prostheses

**Figure HP10 Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement by Gender (Primary Diagnosis Fractured NOF)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Male | 1257 | 686 | 485 | 332 | 180 | 105 | 39 |
| Female | 2609 | 1782 | 1478 | 1208 | 739 | 441 | 194 |

Note: Restricted to modern prostheses

## Unipolar Modular

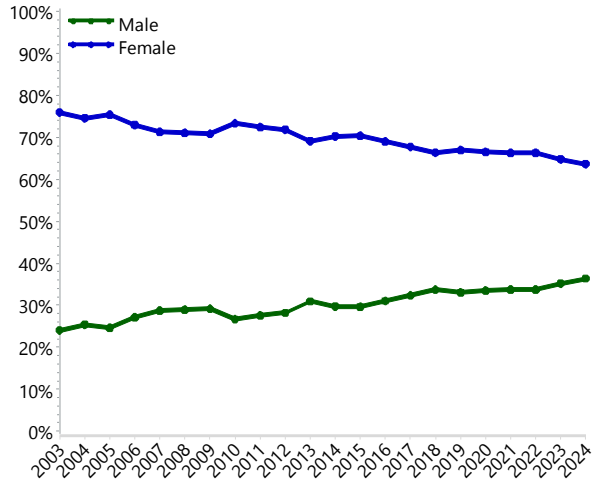
### Demographics

There are 60,161 unipolar modular procedures recorded. This is an additional 2,464 procedures compared to the previous report.

In 2024, the number of unipolar modular procedures decreased by 232 procedures (8.8%) compared to 2023 but has increased by 262.9% since 2003.

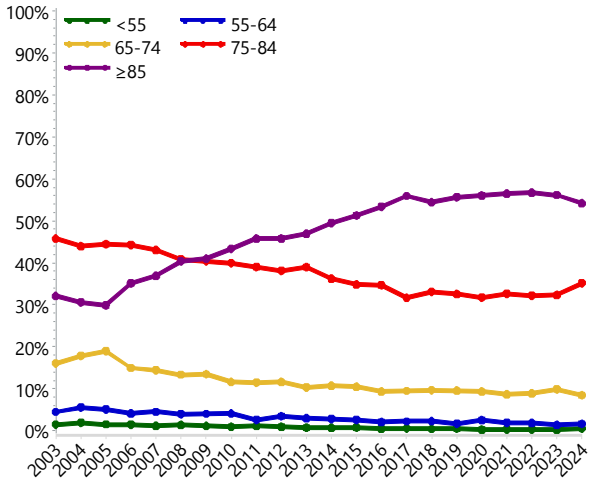
Fractured neck of femur is the principal diagnosis for primary unipolar modular hip replacement (96.2%).

**Figure HP11 Primary Unipolar Modular Hip Replacement by Gender**




The majority of patients are female (69.3%) and aged ≥75 years (85.2%). The proportion of patients aged ≥85 years has increased from 32.1% in 2003 to 54.2% in 2024. The mean age of patients is 83.0 years (Table HP13, Figure HP11 and Figure HP12).

**Figure HP12 Primary Unipolar Modular Hip Replacement by Age**




Overall, there have been 254 unipolar modular head and stem combinations recorded by the Registry. The 10 most frequently used unipolar modular head prostheses and femoral stems are listed in Table HP14 and Table HP15.

In 2024, 13 different unipolar modular head prostheses were used. The Unitrax head is the most frequently used (74.4%). The 10 most used unipolar modular head prostheses account for 99.8% of all primary unipolar modular hip procedures (Table HP14).

There were 17 different stem prostheses used in 2024. The most frequently used stem is the Exeter V40 (70%). The 10 most used femoral stems account for 99.3% of all primary unipolar modular hip procedures (Table HP15).

The cumulative percent revision of unipolar modular head/stem prosthesis combinations with more than 100 procedures is detailed in Table HP16.

**Table HP13 Age and Gender of Primary Unipolar Modular Hip Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 18461 | 30.7% | 5 | 106 | 84 | 82.1 | 9.3 |
| Female | 41700 | 69.3% | 18 | 108 | 85 | 83.4 | 8.4 |
| **TOTAL** | **60161** | **100.0%** | **5** | **108** | **84** | **83.0** | **8.7** |

# Primary Partial Hip Replacement

**Table HP14 10 Most Used Unipolar Head Prostheses in Primary Unipolar Modular Hip Replacement**

| 2003 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 193 | Unitrax | 1848 | Unitrax | 2074 | Unitrax | 1822 | Unitrax | 1799 | Unitrax |
| 142 | Unipolar Head (Zimmer) | 438 | Unipolar Head (S&N) | 411 | Unipolar Head (S&N) | 401 | Unipolar Head (S&N) | 317 | Unipolar Head (S&N) |
| 127 | Unipolar Head (S&N) | 322 | Cathcart | 317 | Cathcart | 300 | Cathcart | 221 | Cathcart |
| 75 | VerSys | 101 | VerSys | 97 | VerSys | 66 | VerSys | 26 | Unipolar Head (Signature) |
| 64 | Unipolar Head (Mathys) | 37 | Unipolar Head (Mathys) | 25 | Unipolar Head (Mathys) | 18 | Unipolar Head (Mathys) | 25 | VerSys |
| 46 | Elite | 16 | Unipolar Head (Signature) | 16 | Unipolar Head (Signature) | 17 | Unipolar Head (Signature) | 8 | Unipolar Head (Mathys) |
| 16 | Ultima | 6 | Femoral Head (Stryker) | 6 | Femoral Head (Stryker) | 8 | Femoral Head (Stryker) | 6 | Femoral Head (S&N) |
| 1 | Metasul | 4 | Articul/Eze | 3 | Articul/Eze | 4 | Femoral Head (S&N) | 6 | Trinity |
| 1 | Optimom | 2 | Femoral Head (S&N) | 2 | Femoral Head (S&N) | 3 | Femoral Head (Zimmer) | 3 | Femoral Head (Stryker) |
| 1 | Unipolar Head (Sulzer) | 1 | Generic Unipolar Head | 1 | Articul/Eze Zir | 2 | Articul/Eze | 2 | Articul/Eze |
| **10 Most Used** | | | | | | | | | |
| 666 | (10) 100.0% | 2775 | (10) 99.9% | 2952 | (10) 99.9% | 2641 | (10) 99.7% | 2413 | (10) 99.8% |
| **Remainder** | | | | | | | | | |
| 0 | (0) 0% | 2 | (2) 0.1% | 4 | (4) 0.1% | 8 | (6) 0.3% | 4 | (3) 0.2% |
| **TOTAL** | | | | | | | | | |
| 666 | (10) 100.0% | 2777 | (12) 100.0% | 2956 | (14) 100.0% | 2649 | (16) 100.0% | 2417 | (13) 100.0% |

**Table HP15 10 Most Used Femoral Stem Prostheses in Primary Unipolar Modular Hip Replacement**

| 2003 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 180 | Exeter V40 | 1762 | Exeter V40 | 1961 | Exeter V40 | 1743 | Exeter V40 | 1692 | Exeter V40 |
| 111 | Alloclassic | 371 | CPCS | 360 | CPCS | 348 | CPCS | 264 | CPCS |
| 91 | CPT | 297 | C-Stem AMT | 278 | C-Stem AMT | 273 | C-Stem AMT | 195 | C-Stem AMT |
| 70 | Spectron EF | 98 | CPT | 109 | Short Exeter V40 | 78 | Short Exeter V40 | 103 | Short Exeter V40 |
| 49 | Fullfix | 80 | Short Exeter V40 | 93 | CPT | 60 | CPT | 56 | Polarstem |
| 38 | SL-Plus | 37 | twinSys (ctd) | 43 | CORAIL | 43 | Polarstem | 30 | CORAIL |
| 33 | Elite Plus | 36 | Spectron EF | 30 | Polarstem | 31 | CORAIL | 26 | Evolve |
| 18 | Basis | 26 | CORAIL | 23 | twinSys (ctd) | 18 | twinSys (ctd) | 20 | CPT |
| 15 | CCA | 24 | Polarstem | 13 | Evolve | 17 | Evolve | 7 | Taper Fit |
| 15 | Thompson Modular Stem | 14 | Evolve | 13 | Spectron EF | 9 | Accolade II | 7 | twinSys (ctd) |
| **10 Most Used** | | | | | | | | | |
| 620 | (10) 93.1% | 2745 | (10) 98.8% | 2923 | (10) 98.9% | 2620 | (10) 98.9% | 2400 | (10) 99.3% |
| **Remainder** | | | | | | | | | |
| 46 | (13) 6.9% | 32 | (12) 1.2% | 33 | (15) 1.1% | 29 | (11) 1.1% | 17 | (7) 0.7% |
| **TOTAL** | | | | | | | | | |
| 666 | (23) 100.0% | 2777 | (22) 100.0% | 2956 | (25) 100.0% | 2649 | (21) 100.0% | 2417 | (17) 100.0% |

**Table HP16 Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement by Prosthesis Combination**

| Unipolar Head | Femoral Component | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Cathcart | C-Stem AMT | 61 | 2783 | 1.8 (1.3, 2.4) | 2.1 (1.6, 2.8) | 2.4 (1.8, 3.2) | 3.7 (2.7, 5.1) | 4.0 (2.9, 5.6) | |
| | CORAIL | 100 | 1673 | 3.1 (2.3, 4.1) | 4.3 (3.3, 5.5) | 5.5 (4.3, 6.9) | 6.7 (5.3, 8.4) | 9.2 (7.3, 11.4) | 11.5 (9.1, 14.6) |
| Unipolar Head (Mathys) | twinSys (ctd) | 7 | 265 | 3.1 (1.5, 6.4) | 3.1 (1.5, 6.4) | 3.1 (1.5, 6.4) | | | |
| Unipolar Head (S&N) | CPCS | 206 | 7678 | 1.9 (1.6, 2.3) | 2.3 (2.0, 2.7) | 2.7 (2.3, 3.2) | 3.7 (3.1, 4.3) | 4.3 (3.7, 5.1) | 5.5 (4.5, 6.7) |
| | Polarstem | 8 | 272 | 1.5 (0.5, 4.5) | 2.2 (0.8, 5.9) | 4.9 (2.0, 11.6) | | | |
| | Spectron EF | 126 | 3149 | 1.6 (1.2, 2.2) | 2.5 (2.0, 3.2) | 3.0 (2.4, 3.7) | 4.0 (3.3, 5.0) | 5.4 (4.4, 6.6) | 7.5 (6.1, 9.3) |
| Unipolar Head (Signature) | Evolve | 7 | 221 | 2.1 (0.8, 5.6) | 4.0 (1.8, 9.2) | 5.2 (2.4, 11.2) | | | |
| Unitrax | Exeter V40 | 878 | 28767 | 2.0 (1.8, 2.2) | 2.6 (2.4, 2.8) | 3.1 (2.9, 3.3) | 4.2 (3.9, 4.5) | 5.1 (4.7, 5.6) | 6.7 (6.1, 7.3) |
| | Short Exeter V40 | 12 | 655 | 1.7 (0.9, 3.2) | 1.7 (0.9, 3.2) | 2.1 (1.1, 3.9) | 2.8 (1.4, 5.3) | | |
| VerSys | CPT | 192 | 5001 | 2.0 (1.7, 2.5) | 2.9 (2.4, 3.5) | 3.4 (2.9, 4.1) | 4.6 (3.9, 5.4) | 5.7 (4.9, 6.7) | 6.9 (5.8, 8.1) |
| Other (31) | | 24 | 416 | 4.4 (2.7, 7.1) | 5.7 (3.7, 8.9) | 6.3 (4.0, 9.7) | 7.8 (5.0, 12.0) | 7.8 (5.0, 12.0) | |
| TOTAL | | 1621 | 50880 | | | | | | |

Note: Restricted to modern prostheses. Only combinations with >100 procedures have been listed

# Primary Partial Hip Replacement

**Outcome for Fractured Neck of Femur**

The cumulative percent revision at 10 years for unipolar modular hip replacement, when undertaken for fractured neck of femur, is 6.6% (Table HP17 and Figure HP13).

The Registry has recorded 1,531 revisions of primary unipolar modular hip replacement with a primary diagnosis of fractured neck of femur.

The main reasons for revision are infection (25.8%), prosthesis dislocation/instability (21.3%), chondrolysis/acetabular erosion (16.3%), fracture (15.7%), pain (9.7%) and loosening (7.9%) (Table HP18).

Most revisions are acetabular only (39.8%), followed by head only (17.6%) and THR (16.3%) (Table HP19).

Age, gender, and femoral stem fixation are risk factors for revision. The rate of revision decreases with increasing age (Table HP20 and Figure HP14). Males have a higher rate of revision than females (Table HP21 and Figure HP15).

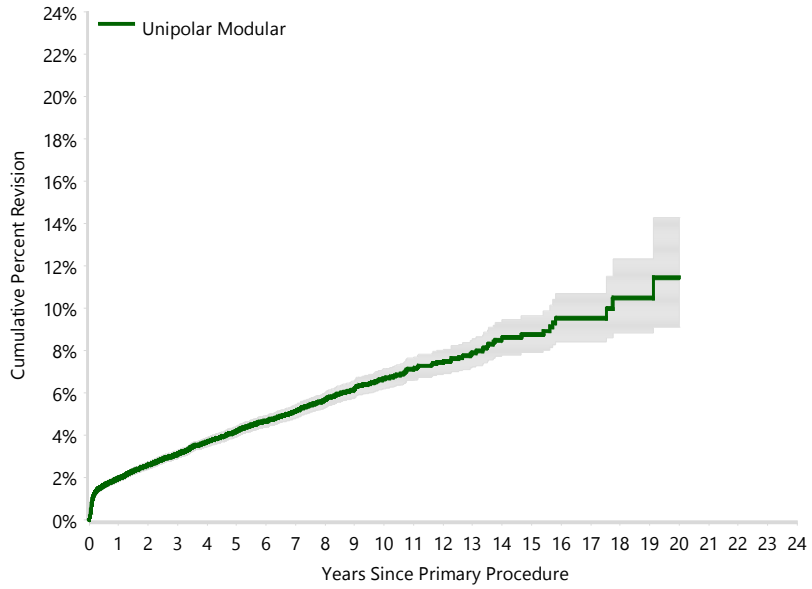
Cementless fixation has a higher rate of revision compared to cemented fixation (Table HP22 and Figure HP16). The cumulative incidence of revision for pain, fracture and chondrolysis/acetabular erosion is higher for cementless compared to cemented fixation (Figure HP17).

**Table HP17 Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement (Primary Diagnosis Fractured NOF)**

| Hip Type | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Unipolar Modular | 1531 | 49089 | 2.0 (1.8, 2.1) | 2.6 (2.4, 2.7) | 3.1 (2.9, 3.3) | 4.2 (3.9, 4.4) | 5.1 (4.8, 5.4) | 6.6 (6.2, 7.1) |
| TOTAL | 1531 | 49089 | | | | | | |

Note: Restricted to modern prostheses

**Figure HP13 Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement (Primary Diagnosis Fractured NOF)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Unipolar Modular | 49089 | 32943 | 26055 | 20216 | 12002 | 6952 | 2934 |

Note: Restricted to modern prostheses

**Table HP18 Primary Unipolar Modular Hip Replacement by Reason for Revision (Primary Diagnosis Fractured NOF)**

| Reason for Revision | Number | Percent |
|---|---|---|
| Infection | 395 | 25.8 |
| Prosthesis Dislocation/Instability | 326 | 21.3 |
| Chondrolysis/Acetabular Erosion | 250 | 16.3 |
| Fracture | 241 | 15.7 |
| Pain | 149 | 9.7 |
| Loosening | 121 | 7.9 |
| Lysis | 18 | 1.2 |
| Malposition | 3 | 0.2 |
| Other | 28 | 1.8 |
| TOTAL | 1531 | 100.0 |

Note: Restricted to modern prostheses

**Table HP19 Primary Unipolar Modular Hip Replacement by Type of Revision (Primary Diagnosis Fractured NOF)**

| Type of Revision | Number | Percent |
|---|---|---|
| Acetabular Component | 609 | 39.8 |
| Head Only | 269 | 17.6 |
| THR (Femoral/Acetabular) | 250 | 16.3 |
| Femoral Component | 158 | 10.3 |
| Bipolar Head and Femoral | 75 | 4.9 |
| Cement Spacer | 53 | 3.5 |
| Removal of Prostheses | 48 | 3.1 |
| Minor Components | 39 | 2.5 |
| Bipolar Only | 22 | 1.4 |
| Reinsertion of Components | 6 | 0.4 |
| Head/Insert | 2 | 0.1 |
| TOTAL | 1531 | 100.0 |

Note: Restricted to modern prostheses

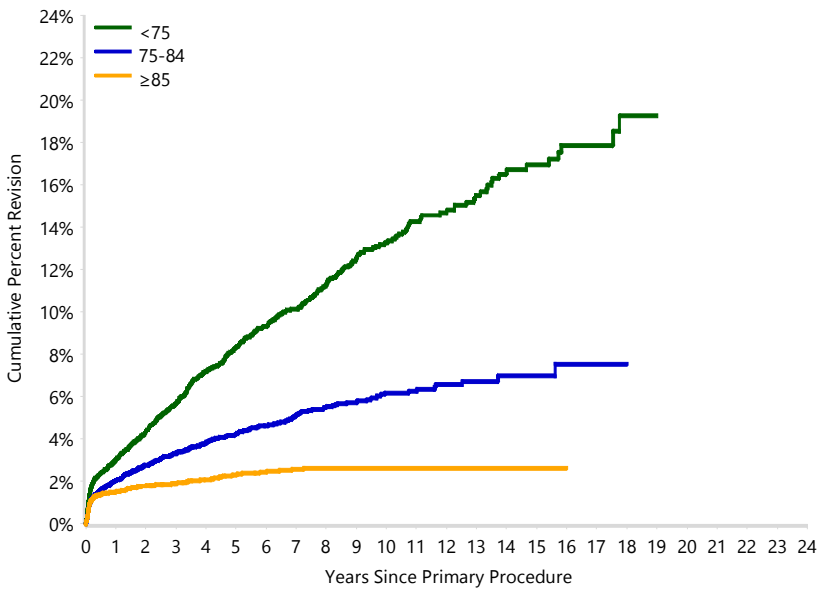
# Primary Partial Hip Replacement

**Table HP20 Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement by Age (Primary Diagnosis Fractured NOF)**

| Age | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| <75 | 526 | 6776 | 3.0 (2.6, 3.5) | 4.3 (3.8, 4.9) | 5.7 (5.1, 6.4) | 8.3 (7.5, 9.2) | 10.1 (9.2, 11.1) | 13.3 (12.1, 14.6) |
| 75-84 | 601 | 17754 | 2.1 (1.9, 2.3) | 2.8 (2.5, 3.1) | 3.3 (3.0, 3.6) | 4.3 (3.9, 4.7) | 5.1 (4.7, 5.6) | 6.2 (5.6, 6.9) |
| ≥85 | 404 | 24559 | 1.5 (1.4, 1.7) | 1.8 (1.6, 2.0) | 1.9 (1.7, 2.2) | 2.3 (2.1, 2.6) | 2.6 (2.3, 2.9) | 2.7 (2.3, 3.0) |
| TOTAL | 1531 | 49089 | | | | | | |

Note: Restricted to modern prostheses

**Figure HP14 Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement by Age (Primary Diagnosis Fractured NOF)**




HR - adjusted for gender

<75 vs 75-84

0 - 3Mth: HR=1.51 (95% CI 1.22, 1.89), p<0.001

3Mth - 2Yr: HR=1.51 (95% CI 1.21, 1.88), p<0.001

2Yr - 4.5Yr: HR=2.55 (95% CI 1.99, 3.26), p<0.001

4.5Yr+: HR=3.16 (95% CI 2.43, 4.10), p<0.001

<75 vs ≥85

0 - 3Mth: HR=1.53 (95% CI 1.24, 1.89), p<0.001

3Mth - 1.5Yr: HR=4.11 (95% CI 3.10, 5.43), p<0.001

1.5Yr - 2Yr: HR=5.67 (95% CI 3.53, 9.11), p<0.001

2Yr+: HR=8.21 (95% CI 6.47, 10.41), p<0.001

75-84 vs ≥85

0 - 3Mth: HR=1.01 (95% CI 0.85, 1.21), p=0.899

3Mth+: HR=2.91 (95% CI 2.38, 3.56), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| <75 | 6776 | 5090 | 4283 | 3624 | 2584 | 1856 | 1049 |
| 75-84 | 17754 | 12787 | 10515 | 8476 | 5454 | 3282 | 1408 |
| ≥85 | 24559 | 15066 | 11257 | 8116 | 3964 | 1814 | 477 |

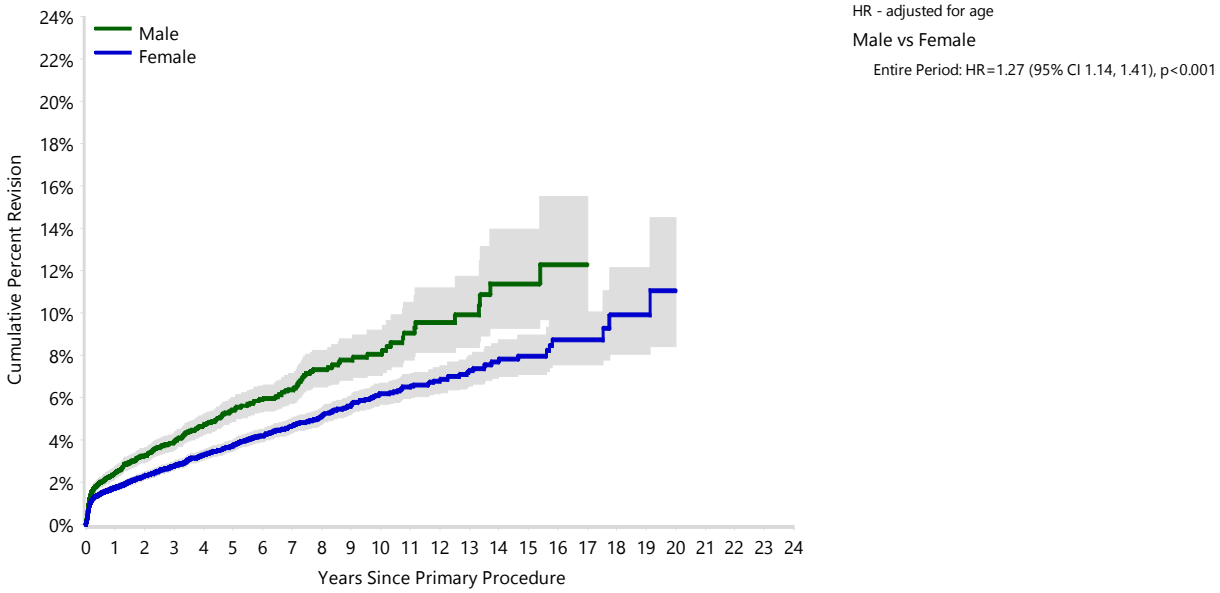
Note: Restricted to modern prostheses

**Table HP21 Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement by Gender (Primary Diagnosis Fractured NOF)**

| Gender | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Male | 509 | 15218 | 2.5 (2.2, 2.8) | 3.3 (2.9, 3.6) | 3.9 (3.6, 4.3) | 5.4 (4.9, 6.0) | 6.4 (5.7, 7.1) | 8.1 (7.1, 9.2) |
| Female | 1022 | 33871 | 1.8 (1.6, 1.9) | 2.3 (2.1, 2.5) | 2.8 (2.6, 3.0) | 3.7 (3.5, 4.0) | 4.7 (4.3, 5.0) | 6.2 (5.7, 6.7) |
| TOTAL | 1531 | 49089 | | | | | | |

Note: Restricted to modern prostheses

**Figure HP15 Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement by Gender (Primary Diagnosis Fractured NOF)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Male | 15218 | 8780 | 6398 | 4644 | 2458 | 1328 | 520 |
| Female | 33871 | 24163 | 19657 | 15572 | 9544 | 5624 | 2414 |

Note: Restricted to modern prostheses

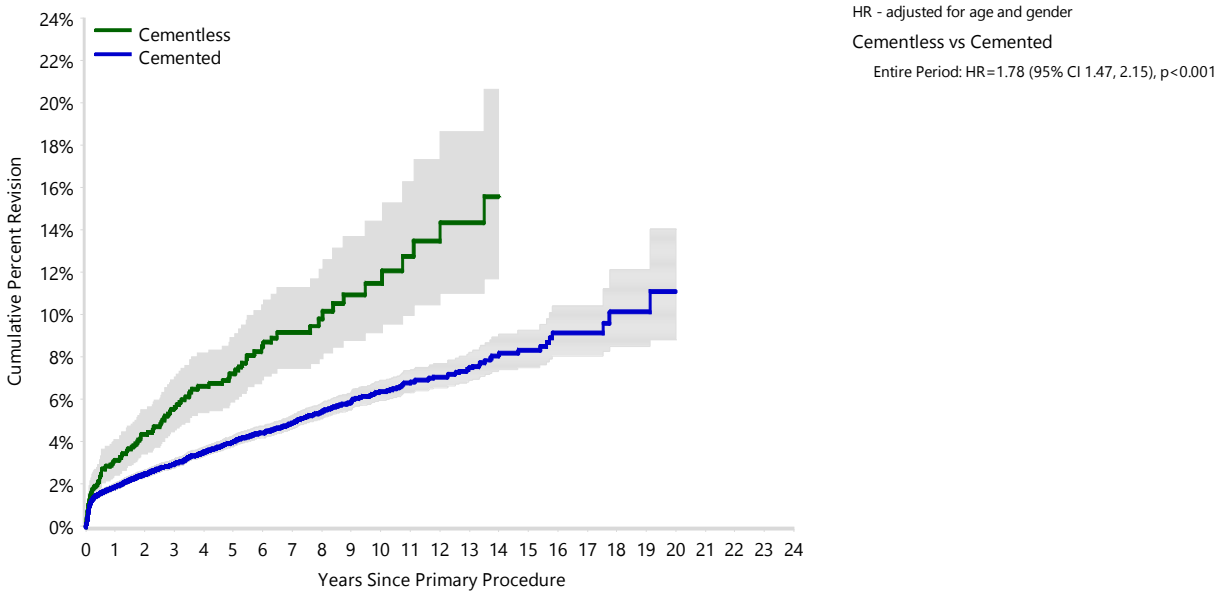
# Primary Partial Hip Replacement

**Table HP22 Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement by Femoral Fixation (Primary Diagnosis Fractured NOF)**

| Femoral Fixation | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cementless | 113 | 1903 | 3.1 (2.4, 4.1) | 4.4 (3.4, 5.5) | 5.7 (4.5, 7.0) | 7.2 (5.9, 8.9) | 9.2 (7.4, 11.3) | 11.5 (9.1, 14.4) |
| Cemented | 1418 | 47186 | 1.9 (1.8, 2.0) | 2.5 (2.3, 2.7) | 3.0 (2.8, 3.2) | 4.0 (3.8, 4.3) | 4.9 (4.6, 5.2) | 6.4 (6.0, 6.9) |
| TOTAL | 1531 | 49089 | | | | | | |

Note: Restricted to modern prostheses

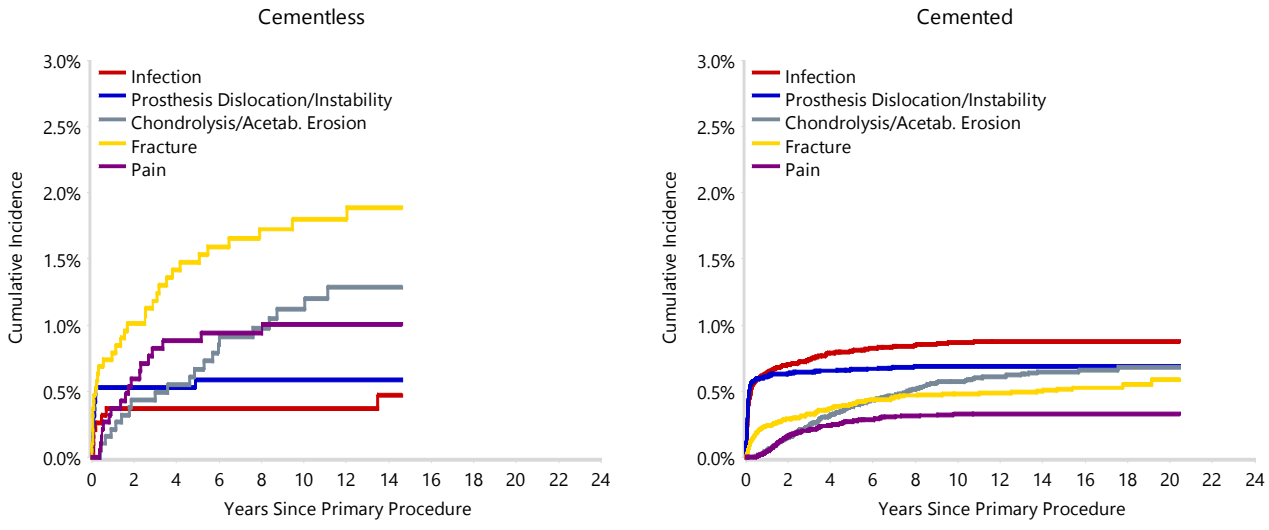
**Figure HP16 Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement by Femoral Fixation (Primary Diagnosis Fractured NOF)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Cementless | 1903 | 1329 | 1071 | 858 | 565 | 335 | 148 |
| Cemented | 47186 | 31614 | 24984 | 19358 | 11437 | 6617 | 2786 |

Note: Restricted to modern prostheses

**Figure HP17 Cumulative Incidence Revision Diagnosis of Primary Unipolar Modular Hip Replacement by Femoral Fixation (Primary Diagnosis Fractured NOF)**




Note: Restricted to modern prostheses

## Bipolar

### DEMOGRAPHICS

There are 44,747 bipolar hip replacement procedures recorded. This is an additional 4,574 procedures compared to the previous report.

Since 2010, there has been an increase in the number of bipolar procedures undertaken each year, with 10.6% more procedures in 2024 compared to 2023. The total number of bipolar procedures has increased by 231% since 2003.

Fractured neck of femur is the principal diagnosis for bipolar hip replacement (93.9%).

The majority of patients are female (67.7%) and aged ≥75 years (80.7%). The proportion of patients aged ≥85 years has increased from 26.0% in 2003 to 44.9% in 2024 (Figure HP18, and Figure HP19).

The mean age of patients is 81.6 years (Table HP23, Figure HP18 and Figure HP19).

**Figure HP18 Primary Bipolar Hip Replacement by Gender**

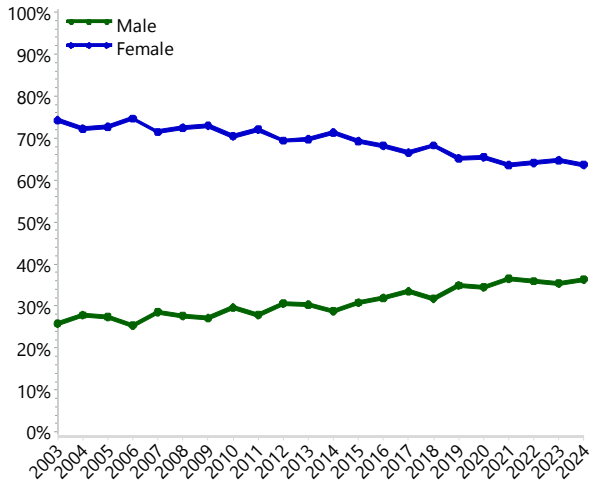
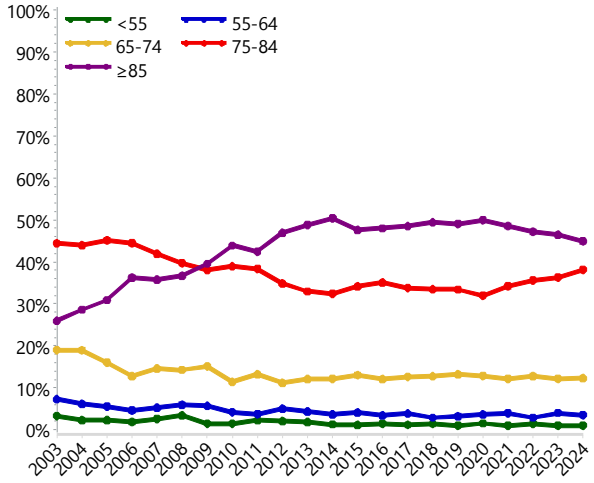



**Figure HP19 Primary Bipolar Hip Replacement by Age**




Overall, there have been 338 bipolar head and stem combinations recorded by the Registry. In 2024, there were 10 different bipolar heads, and 41 different femoral stem prostheses used.

In 2024, the UHR remains the most frequently used bipolar head (42.9%) (Table HP24). The Exeter V40 is the most frequently used femoral stem (40.0%). The 10 most used femoral stems account for 92.8% of all bipolar hip procedures (Table HP25).

The cumulative percent revision of bipolar head/stem prosthesis combinations with >100 procedures is detailed in Table HP26.

**Table HP23 Age and Gender of Primary Bipolar Hip Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 14444 | 32.3% | 9 | 105 | 83 | 80.7 | 10.5 |
| Female | 30303 | 67.7% | 9 | 107 | 83 | 82.1 | 9.5 |
| **TOTAL** | **44747** | **100.0%** | **9** | **107** | **83** | **81.6** | **9.8** |

# Primary Partial Hip Replacement

**Table HP24 10 Most Used Bipolar Head Prostheses in Primary Bipolar Hip Replacement**

| 2003 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 760 | UHR | 1443 | UHR | 1667 | UHR | 1716 | UHR | 1905 | UHR |
| 140 | Hastings | 843 | Multipolar Bipolar | 857 | Multipolar Bipolar | 978 | Multipolar Bipolar | 868 | Multipolar Bipolar |
| 115 | Convene | 383 | Tandem | 409 | Tandem | 455 | Tandem | 530 | Tandem |
| 91 | Bipolar Head (Zimmer) | 317 | Self-Centering | 375 | Self-Centering | 358 | Self-Centering | 482 | Self-Centering |
| 87 | Self-Centering | 180 | BioBall | 143 | BioBall | 264 | BioBall | 351 | BioBall |
| 59 | Multipolar Bipolar | 90 | Bipolar Head (Medacta) | 137 | Bipolar Head (Medacta) | 198 | Bipolar Head (Medacta) | 277 | Bipolar Head (Medacta) |
| 39 | Bipolar Head (Mathys) | 22 | Bipolar Head (Mathys) | 25 | Bipolar Head (Mathys) | 15 | Bipolar Head (Lima) | 16 | Vario-Cup (Bipolar Head) |
| 19 | Bipolar Head (Lima) | 8 | Bipolar Head (Lima) | 20 | Bipolar Head (Lima) | 12 | Bipolar Head (Mathys) | 8 | Bipolar Head (Implantcast) |
| 19 | Ringloc | 7 | Bipolar Head (Implantcast) | 8 | Bipolar Head (Implantcast) | 11 | Bipolar Head (Implantcast) | 1 | Bipolar Head (Lima) |
| 5 | UHL | | | | | 8 | Vario-Cup (Bipolar Head) | 1 | Bipolar Head (Mathys) |
| **10 Most Used** | | | | | | | | | |
| 1334 | (10) 99.5% | 3293 | (9) 100.0% | 3641 | (9) 100.0% | 4015 | (10) 100.0% | 4439 | (10) 100.0% |
| **Remainder** | | | | | | | | | |
| 7 | (2) 0.5% | 0 | (0) 0% | 0 | (0) 0% | 0 | (0) 0% | 0 | (0) 0% |
| **TOTAL** | | | | | | | | | |
| 1341 | (12) 100.0% | 3293 | (9) 100.0% | 3641 | (9) 100.0% | 4015 | (10) 100.0% | 4439 | (10) 100.0% |

**Table HP25 10 Most Used Femoral Stem Prostheses in Primary Bipolar Hip Replacement**

| 2003 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 630 | Exeter V40 | 1353 | Exeter V40 | 1530 | Exeter V40 | 1602 | Exeter V40 | 1777 | Exeter V40 |
| 94 | Elite Plus | 777 | CPT | 781 | CPT | 854 | CPT | 603 | CPT |
| 75 | Alloclassic | 353 | CPCS | 372 | CPCS | 424 | CPCS | 459 | CPCS |
| 65 | CPCS | 203 | C-Stem AMT | 218 | C-Stem AMT | 215 | C-Stem AMT | 330 | C-Stem AMT |
| 61 | C-Stem | 106 | CORAIL | 142 | CORAIL | 213 | Taper Fit | 277 | Taper Fit |
| 59 | Omnifit | 91 | Absolut | 102 | Quadra-C | 134 | CORAIL | 217 | MS 30 |
| 33 | VerSys | 73 | Taper Fit | 96 | Short Exeter V40 | 110 | Quadra-C | 146 | CORAIL |
| 26 | ABGII | 72 | Quadra-C | 82 | Taper Fit | 90 | MS 30 | 135 | Quadra-C |
| 25 | CCA | 50 | Short Exeter V40 | 49 | Absolut | 70 | Short Exeter V40 | 114 | Short Exeter V40 |
| 25 | Spectron EF | 29 | MS 30 | 37 | MS 30 | 41 | Evolve | 62 | X-Acta |
| **10 Most Used** | | | | | | | | | |
| 1093 | (10) 81.5% | 3107 | (10) 94.4% | 3409 | (10) 93.6% | 3753 | (10) 93.5% | 4120 | (10) 92.8% |
| **Remainder** | | | | | | | | | |
| 248 | (46) 18.5% | 186 | (32) 5.6% | 232 | (33) 6.4% | 262 | (31) 6.5% | 319 | (31) 7.2% |
| **TOTAL** | | | | | | | | | |
| 1341 | (56) 100.0% | 3293 | (42) 100.0% | 3641 | (43) 100.0% | 4015 | (41) 100.0% | 4439 | (41) 100.0% |

**Table HP26 Cumulative Percent Revision of Primary Bipolar Hip Replacement by Prosthesis Combination**

| Bipolar Head | Femoral Component | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| BioBall | Taper Fit | 17 | 718 | 3.0 (1.8, 4.8) | 3.0 (1.8, 4.8) | 3.0 (1.8, 4.8) | | | |
| Bipolar Head (Lima) | H-Max | 8 | 194 | 2.8 (1.2, 6.6) | 4.2 (2.0, 8.7) | 4.2 (2.0, 8.7) | 5.5 (2.7, 11.1) | | |
| Bipolar Head (Medacta) | Quadra-C | 16 | 887 | 1.9 (1.1, 3.2) | 2.1 (1.3, 3.5) | 2.1 (1.3, 3.5) | 2.1 (1.3, 3.5) | 3.5 (1.5, 7.8) | |
| | X-Acta | 3 | 260 | 1.4 (0.5, 4.5) | 1.4 (0.5, 4.5) | 1.4 (0.5, 4.5) | | | |
| Multipolar Bipolar | Avenir | 6 | 118 | 5.0 (2.1, 11.8) | 5.0 (2.1, 11.8) | 5.0 (2.1, 11.8) | | | |
| | CPT | 249 | 7438 | 3.0 (2.6, 3.4) | 3.7 (3.2, 4.2) | 3.9 (3.5, 4.5) | 4.6 (4.0, 5.3) | 4.8 (4.2, 5.6) | 5.7 (4.6, 7.1) |
| | MS 30 | 7 | 492 | 1.4 (0.6, 3.1) | 1.4 (0.6, 3.1) | 1.4 (0.6, 3.1) | 2.5 (1.0, 6.6) | | |
| | VerSys | 7 | 306 | 1.3 (0.4, 4.0) | 3.1 (1.4, 7.0) | 3.1 (1.4, 7.0) | 3.1 (1.4, 7.0) | 3.1 (1.4, 7.0) | |
| Self-Centering | C-Stem AMT | 40 | 1576 | 1.9 (1.3, 2.8) | 3.1 (2.2, 4.3) | 3.4 (2.5, 4.8) | 4.1 (2.9, 5.8) | | |
| | CORAIL | 58 | 1536 | 3.6 (2.7, 4.7) | 4.3 (3.3, 5.5) | 4.5 (3.5, 5.9) | 4.5 (3.5, 5.9) | 5.0 (3.7, 6.6) | 5.0 (3.7, 6.6) |
| Tandem | CPCS | 115 | 4152 | 2.3 (1.8, 2.8) | 2.8 (2.3, 3.4) | 3.2 (2.6, 3.9) | 3.8 (3.1, 4.7) | 4.7 (3.7, 5.9) | 4.9 (3.9, 6.3) |
| | Polarstem | 3 | 199 | 1.1 (0.3, 4.2) | 1.1 (0.3, 4.2) | | | | |
| | Spectron EF | 8 | 212 | 2.1 (0.8, 5.5) | 3.4 (1.5, 7.5) | 4.1 (2.0, 8.5) | 5.0 (2.5, 9.9) | 5.0 (2.5, 9.9) | |
| UHR | Accolade II | 1 | 199 | 0.6 (0.1, 3.9) | 0.6 (0.1, 3.9) | 0.6 (0.1, 3.9) | | | |
| | Exeter V40 | 536 | 18178 | 2.2 (2.0, 2.5) | 2.8 (2.5, 3.1) | 3.3 (3.0, 3.6) | 3.8 (3.5, 4.2) | 4.3 (3.9, 4.7) | 5.1 (4.5, 5.7) |
| | GMRS | 18 | 228 | 1.9 (0.7, 5.1) | 4.8 (2.4, 9.6) | 6.6 (3.5, 12.1) | 10.1 (5.8, 17.2) | | |
| | Short Exeter V40 | 12 | 454 | 2.2 (1.2, 4.3) | 2.7 (1.4, 5.0) | 2.7 (1.4, 5.0) | | | |
| Other (86) | | 38 | 1029 | 2.6 (1.7, 4.0) | 3.3 (2.2, 5.0) | 4.2 (2.8, 6.1) | 5.8 (3.9, 8.5) | 6.5 (4.3, 9.8) | |
| TOTAL | | 1142 | 38176 | | | | | | |

Note: Restricted to modern prostheses
Only prostheses with >100 procedures have been listed.

# Primary Partial Hip Replacement

## OUTCOME FOR FRACTURED NECK OF FEMUR

The cumulative percent revision at 10 years for primary bipolar hip replacement undertaken for fractured neck of femur is 5.1% (Table HP27 and Figure HP20).

The Registry has recorded 1,061 revisions of primary bipolar hip replacement procedures with a primary diagnosis of fractured neck of femur.

The main reasons for revision are infection (31.5%), prosthesis dislocation/instability (26.7%), fracture (17.8%), chondrolysis/acetabular erosion (8.0%) and loosening (7.4%) (Table HP28).

The most frequent type of revision is acetabular component only (31.3%), followed by bipolar only (22.7%), total hip replacement (femoral/acetabular) (17.2%), and bipolar head and femoral stem replacement (13.6%) (Table HP29).

Age is a risk factor for revision. The rate of revision decreases with increasing age (Table HP30 and Figure HP21).

Males have a similar rate of revision to females (Table HP31 and Figure HP22).

The rate of revision decreases with increasing age.

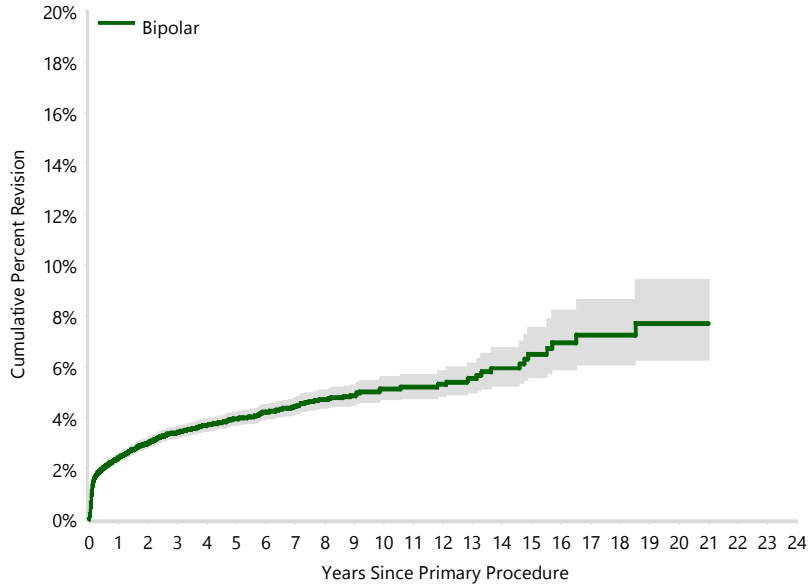
Cementless fixation has a higher rate of revision compared to cemented fixation for the first 3 months only (Table HP32 and Figure HP23). The cumulative incidence of revision for fracture and prosthesis dislocation/instability with cementless fixation is higher than for cemented fixation (Figure HP24).

**Table HP27 Cumulative Percent Revision of Primary Bipolar Hip Replacement (Primary Diagnosis Fractured NOF)**

| Hip Type | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Bipolar | 1061 | 36182 | 2.4 (2.2, 2.6) | 3.0 (2.8, 3.2) | 3.4 (3.2, 3.6) | 3.9 (3.7, 4.2) | 4.4 (4.1, 4.8) | 5.1 (4.7, 5.6) |
| TOTAL | 1061 | 36182 | | | | | | |

Note: Restricted to modern prostheses

**Figure HP20 Cumulative Percent Revision of Primary Bipolar Hip Replacement (Primary Diagnosis Fractured NOF)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Bipolar | 36182 | 23182 | 17191 | 12809 | 7002 | 3882 | 1528 |

Note: Restricted to modern prostheses

**Table HP28 Bipolar Hip Replacement by Reason for Revision (Primary Diagnosis Fractured NOF)**

| Reason for Revision | Number | Percent |
|---|---|---|
| Infection | 334 | 31.5 |
| Prosthesis Dislocation/Instability | 283 | 26.7 |
| Fracture | 189 | 17.8 |
| Chondrolysis/Acetabular Erosion | 85 | 8.0 |
| Loosening | 79 | 7.4 |
| Pain | 65 | 6.1 |
| Lysis | 4 | 0.4 |
| Malposition | 3 | 0.3 |
| Other | 19 | 1.8 |
| TOTAL | 1061 | 100.0 |

Note: Restricted to modern prostheses

**Table HP29 Primary Bipolar Hip Replacement by Type of Revision (Primary Diagnosis Fractured NOF)**

| Type of Revision | Number | Percent |
|---|---|---|
| Acetabular Component | 332 | 31.3 |
| Bipolar Only | 241 | 22.7 |
| THR (Femoral/Acetabular) | 182 | 17.2 |
| Bipolar Head and Femoral | 144 | 13.6 |
| Cement Spacer | 39 | 3.7 |
| Head Only | 38 | 3.6 |
| Femoral Component | 36 | 3.4 |
| Removal of Prostheses | 27 | 2.5 |
| Minor Components | 21 | 2.0 |
| Head/Insert | 1 | 0.1 |
| TOTAL | 1061 | 100.0 |

Note: Restricted to modern prostheses

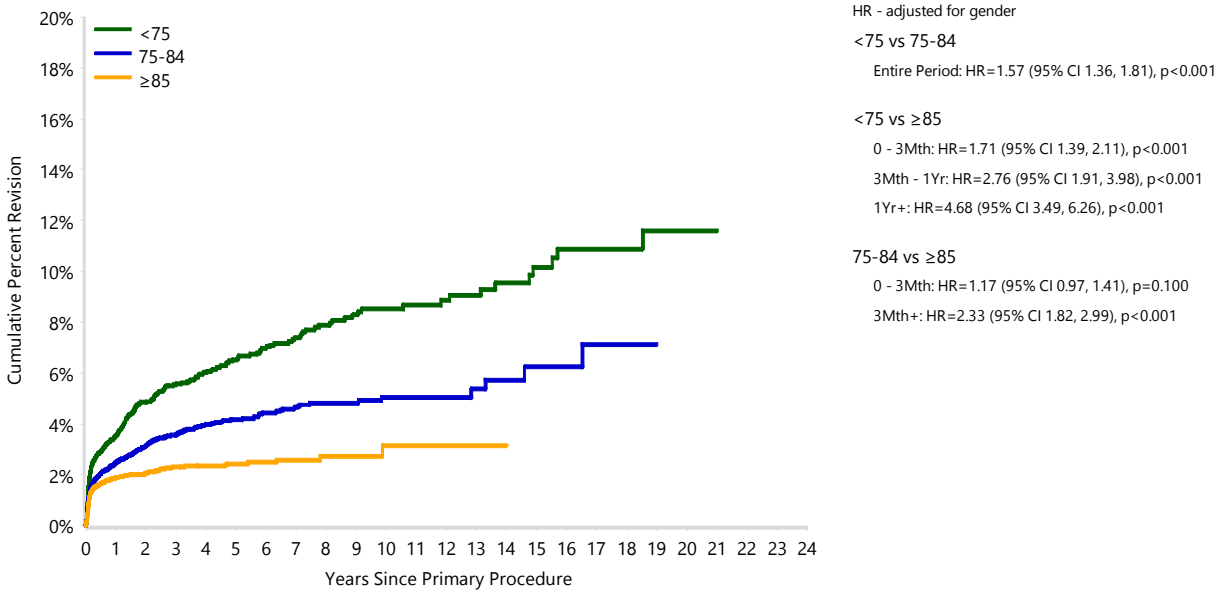
# Primary Partial Hip Replacement

**Table HP30 Cumulative Percent Revision of Primary Bipolar Hip Replacement by Age (Primary Diagnosis Fractured NOF)**

| Age | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| <75 | 334 | 6186 | 3.5 (3.1, 4.0) | 4.8 (4.3, 5.5) | 5.5 (4.9, 6.2) | 6.5 (5.8, 7.3) | 7.4 (6.6, 8.3) | 8.5 (7.5, 9.7) |
| 75-84 | 417 | 13175 | 2.5 (2.2, 2.8) | 3.2 (2.8, 3.5) | 3.6 (3.2, 4.0) | 4.2 (3.8, 4.6) | 4.6 (4.2, 5.2) | 5.1 (4.5, 5.7) |
| ≥85 | 310 | 16821 | 1.9 (1.7, 2.1) | 2.1 (1.8, 2.3) | 2.3 (2.0, 2.6) | 2.4 (2.2, 2.8) | 2.6 (2.3, 3.0) | 3.2 (2.3, 4.3) |
| TOTAL | 1061 | 36182 | | | | | | |

Note: Restricted to modern prostheses

**Figure HP21 Cumulative Percent Revision of Primary Bipolar Hip Replacement by Age (Primary Diagnosis Fractured NOF)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| <75 | 6186 | 4298 | 3396 | 2742 | 1813 | 1234 | 633 |
| 75-84 | 13175 | 8891 | 6745 | 5184 | 3029 | 1754 | 680 |
| ≥85 | 16821 | 9993 | 7050 | 4883 | 2160 | 894 | 215 |

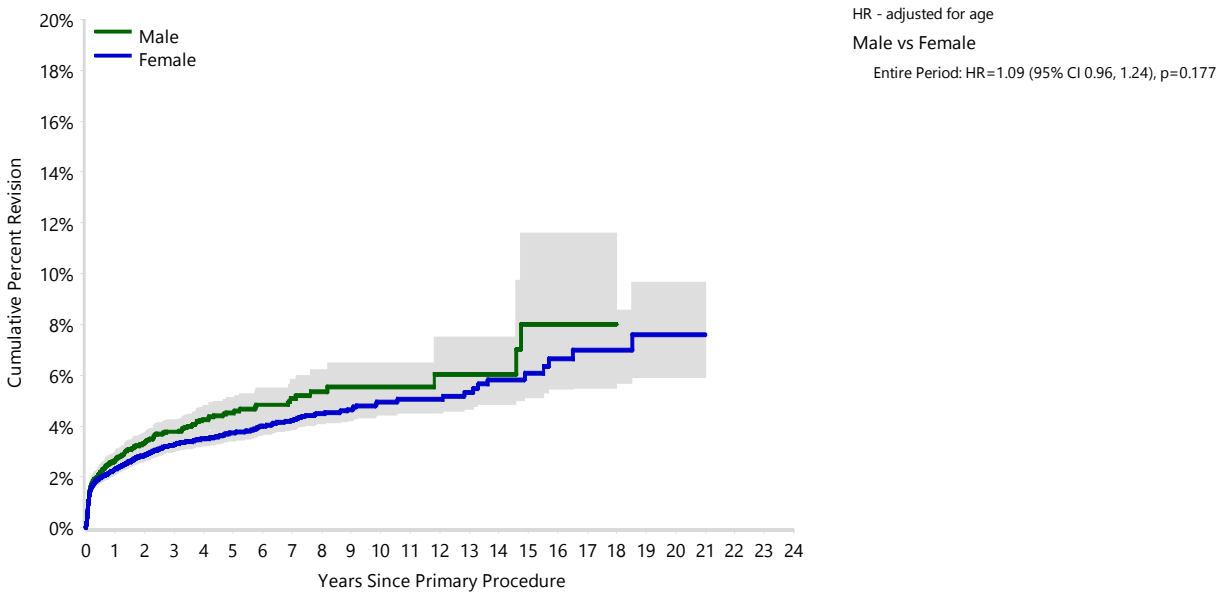
Note: Restricted to modern prostheses

**Table HP31 Cumulative Percent Revision of Primary Bipolar Hip Replacement by Gender (Primary Diagnosis Fractured NOF)**

| Gender | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Male | 347 | 11849 | 2.7 (2.4, 3.0) | 3.4 (3.0, 3.8) | 3.8 (3.4, 4.2) | 4.5 (4.0, 5.1) | 5.1 (4.4, 5.8) | 5.5 (4.7, 6.5) |
| Female | 714 | 24333 | 2.3 (2.1, 2.5) | 2.8 (2.6, 3.1) | 3.2 (3.0, 3.5) | 3.7 (3.4, 4.0) | 4.2 (3.9, 4.6) | 4.9 (4.4, 5.5) |
| TOTAL | 1061 | 36182 | | | | | | |

Note: Restricted to modern prostheses

**Figure HP22 Cumulative Percent Revision of Primary Bipolar Hip Replacement by Gender (Primary Diagnosis Fractured NOF)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Male | 11849 | 6586 | 4512 | 3112 | 1481 | 776 | 277 |
| Female | 24333 | 16596 | 12679 | 9697 | 5521 | 3106 | 1251 |

Note: Restricted to modern prostheses

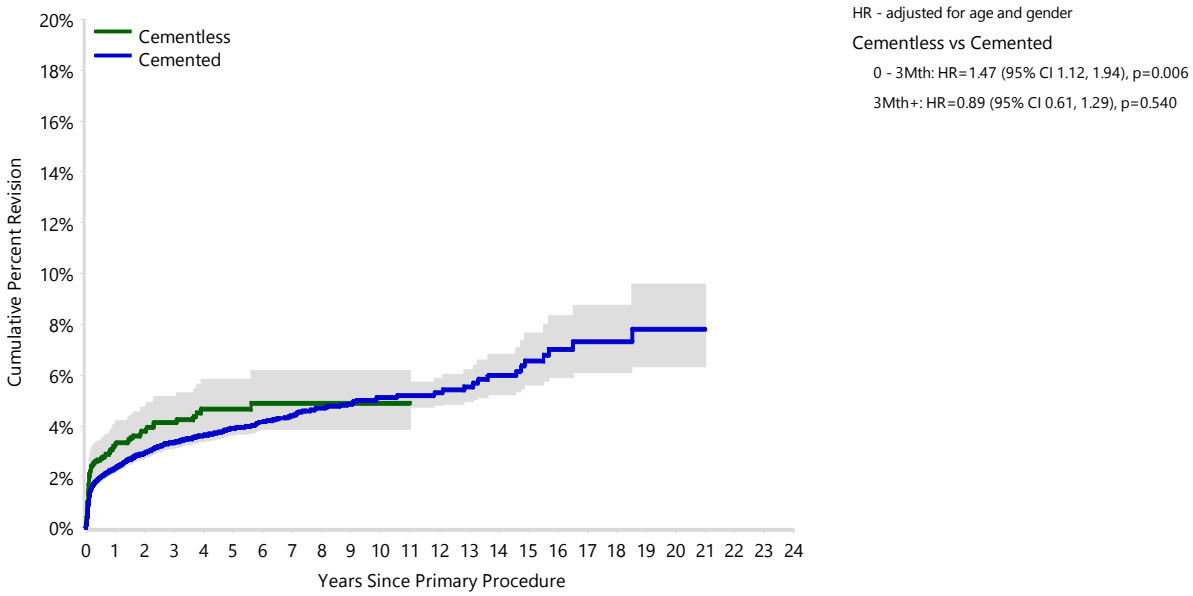
# Primary Partial Hip Replacement

**Table HP32 Cumulative Percent Revision of Primary Bipolar Hip Replacement by Femoral Fixation (Primary Diagnosis Fractured NOF)**

| Femoral Fixation | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cementless | 85 | 2395 | 3.3 (2.6, 4.1) | 3.8 (3.0, 4.7) | 4.1 (3.3, 5.2) | 4.7 (3.7, 5.8) | 4.9 (3.9, 6.2) | 4.9 (3.9, 6.2) |
| Cemented | 976 | 33787 | 2.4 (2.2, 2.5) | 2.9 (2.7, 3.2) | 3.4 (3.1, 3.6) | 3.9 (3.6, 4.2) | 4.4 (4.1, 4.8) | 5.1 (4.7, 5.6) |
| TOTAL | 1061 | 36182 | | | | | | |

Note: Restricted to modern prostheses

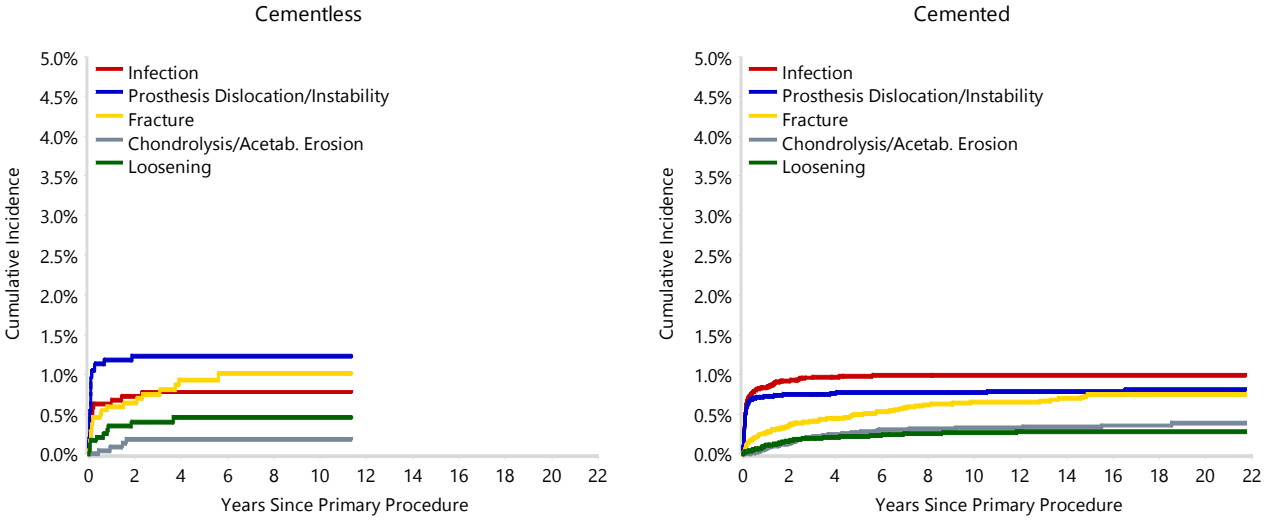
**Figure HP23 Cumulative Percent Revision of Primary Bipolar Hip Replacement by Femoral Fixation (Primary Diagnosis Fractured NOF)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Cementless | 2395 | 1511 | 1146 | 874 | 493 | 259 | 66 |
| Cemented | 33787 | 21671 | 16045 | 11935 | 6509 | 3623 | 1462 |

Note: Restricted to modern prostheses

**Figure HP24 Cumulative Incidence Revision Diagnosis of Primary Bipolar Hip Replacement by Femoral Fixation (Primary Diagnosis Fractured NOF)**




Note: Restricted to modern prostheses

# Primary Total Hip Replacement

## Classes of Total Hip Replacement

A total hip replacement procedure replaces both the femoral and acetabular articular surfaces. Primary total hip replacement is subcategorised into two classes. These are defined by the type of femoral prosthesis used.

**Total conventional** involves acetabular replacement combined with resection of the femoral head and replacement with a stemmed femoral prosthesis and femoral head prosthesis.

**Total resurfacing** involves acetabular replacement and the use of a femoral prosthesis that replaces the femoral articular surface without resecting the head.

Detailed demographic information on primary total hip replacement is available in the supplementary report 'Demographics of Hip, Knee & Shoulder Arthroplasty' on the AOANJRR website:
https://aoanjrr.sahmri.com/annual-reports-2025

## Use of Total Hip Replacement

There are 741,990 primary total hip replacement procedures. Of these, total conventional is the most common class, followed by total resurfacing (Table HT1).

**Table HT1 Primary Total Hip Replacement by Class**

| Total Hip Class | Number | Percent |
|---|---|---|
| Total Conventional | 720817 | 97.1 |
| Total Resurfacing | 21173 | 2.9 |
| TOTAL | 741990 | 100.0 |

Note: Excludes 258 thrust plate procedures

Osteoarthritis is the principal diagnosis for primary total hip replacement (88.1%).

Total conventional hip replacement (all bearing surfaces included) has a lower cumulative percent revision compared to total resurfacing at 20 years (Table HT2).

**Table HT2 Cumulative Percent Revision of Primary Total Hip Replacement by Class**

| Total Hip Class | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Total Resurfacing | 2272 | 21173 | 1.6 (1.5, 1.8) | 3.0 (2.8, 3.3) | 4.6 (4.3, 4.9) | 8.7 (8.3, 9.1) | 11.7 (11.3, 12.2) | 14.2 (13.7, 14.8) |
| Total Conventional | 34654 | 720817 | 1.8 (1.7, 1.8) | 2.7 (2.6, 2.7) | 3.5 (3.4, 3.5) | 5.5 (5.4, 5.6) | 8.0 (7.9, 8.2) | 10.8 (10.7, 11.0) |
| TOTAL | 36926 | 741990 | | | | | | |

Note: The data extends for 24 years but only data for the first 20 years follow-up is presented.

## Primary Total Conventional Hip Replacement

### DEMOGRAPHICS

There are 720,817 primary total conventional hip replacement procedures. This is an additional 49,933 procedures compared to the previous report.

For further information on the **closure of the database** please see the Glossary of this report.

The proportion of males and females has been stable for many years with a female predominance. This is primarily due to larger numbers of females compared to males in older age groups (Table HT1).

**Figure HT1 Primary Total Conventional Hip Replacement by Gender**



The mean age of patients is 67.9 years. There has been minimal change in the proportion of patients aged 55–64 years (21.9% in 2003 to 22.0% in 2024) and for patients aged <55 years (11.7% in 2003 to 11.2% in 2024) (Table HT3 and Figure HT2).

Primary total conventional hip replacement increased by 1.2% in 2024 compared to the previous year and by 185.6% since 2003.

The use of cementless fixation has increased from 51.3% in 2003 to 62.9% in 2024. Hybrid fixation has increased from 34.8% to 35.7% and cemented fixation has declined from 13.9% to 1.4% (Figure HT3).

**Figure HT2 Primary Total Conventional Hip Replacement by Age**

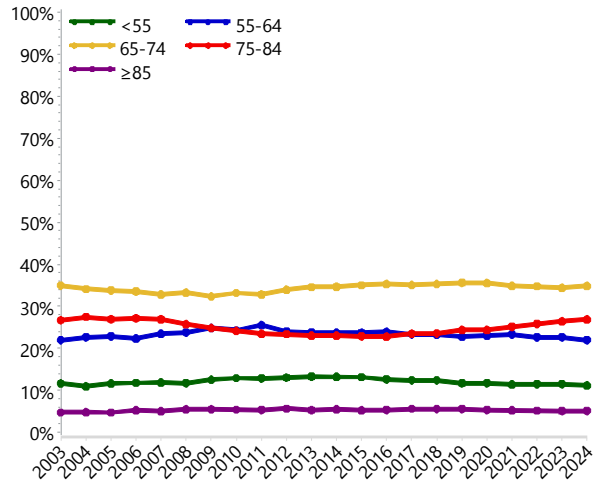



**Figure HT3 Primary Total Conventional Hip Replacement by Fixation**

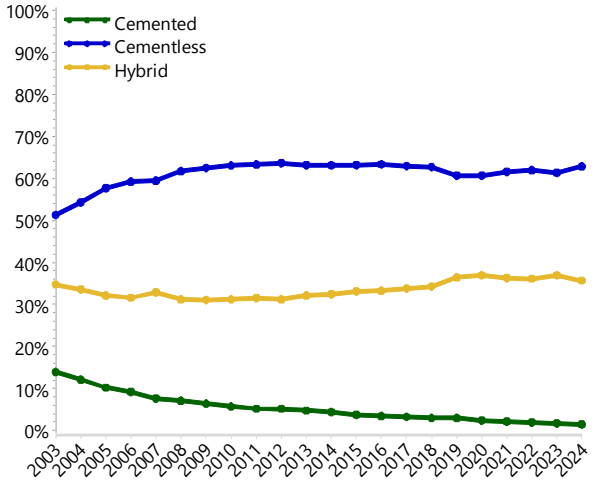



**Table HT3 Age and Gender of Primary Total Conventional Hip Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 324188 | 45.0% | 11 | 108 | 67 | 66.5 | 11.5 |
| Female | 396629 | 55.0% | 11 | 103 | 70 | 69.0 | 11.3 |
| **TOTAL** | **720817** | **100.0%** | **11** | **108** | **69** | **67.9** | **11.4** |

## Primary Total Hip Replacement

The Exeter V40, Accolade II, and CORAIL are the most used femoral stems for primary total conventional hip replacement (Table HT4). In 2024, 65.3% of primary total conventional hip replacements used stems in the 10 most used femoral component list. Seven of these stems are cementless. The 10 most used cemented and cementless stems are listed in Table HT5 and Table HT6, respectively. The 10 most used cemented stems account for 90.0% of cemented stem procedures. The 10 most used cementless stems account for 76.3% of cementless stem procedures.

The Trident (Shell), Trinity and G7 are the most frequently used acetabular prostheses for primary total conventional hip replacement. In 2024, 89.7% of primary total conventional hip procedures used acetabular components from the 10 most used list (Table HT7). All of the acetabular components in this list are cementless prostheses. The 10 most used cemented and cementless acetabular prostheses are listed separately in Table HT8 and Table HT9, respectively.

**Table HT4 10 Most Used Femoral Components in Primary Total Conventional Hip Replacement**

| 2003 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 3901 | Exeter V40 | 7612 | Exeter V40 | 7840 | Exeter V40 | 8409 | Exeter V40 | 8342 | Exeter V40 |
| 1029 | ABGII | 4450 | CORAIL | 3915 | CORAIL | 4682 | Accolade II | 5079 | Accolade II |
| 1000 | Synergy | 3621 | Accolade II | 3787 | Accolade II | 4349 | CORAIL | 4059 | CORAIL |
| 819 | Alloclassic | 2796 | Polarstem | 3313 | Metafix | 3452 | Metafix | 3475 | Metafix |
| 809 | VerSys | 2689 | Metafix | 2835 | Polarstem | 2953 | Polarstem | 3398 | Polarstem |
| 780 | Spectron EF | 1821 | Quadra-H | 1565 | Quadra-H | 2007 | Paragon | 2136 | Paragon |
| 713 | Secur-Fit Plus HA | 1455 | Paragon | 1520 | Paragon | 1758 | Quadra-C | 1495 | Taperloc Microplasty |
| 618 | Omnifit | 1446 | Quadra-C | 1509 | Quadra-C | 1566 | CPT | 1334 | Quadra-C |
| 565 | C-Stem | 1409 | CPT | 1449 | AMIStem H | 1506 | AMIStem H | 1302 | Short Exeter V40 |
| 485 | S-Rom | 1276 | AMIStem H | 1333 | CPT | 1436 | Quadra-H | 1239 | Taperloc |
| **10 Most Used** | | | | | | | | | |
| 10719 | (10) 62.8% | 28575 | (10) 67.6% | 29066 | (10) 67.7% | 32118 | (10) 66.7% | 31859 | (10) 65.3% |
| **Remainder** | | | | | | | | | |
| 6353 | (73) 37.2% | 13674 | (82) 32.4% | 13883 | (77) 32.3% | 16056 | (75) 33.3% | 16896 | (76) 34.7% |
| **TOTAL** | | | | | | | | | |
| 17072 | (83) 100.0% | 42249 | (92) 100.0% | 42949 | (87) 100.0% | 48174 | (85) 100.0% | 48755 | (86) 100.0% |

**Table HT5 10 Most Used Cemented Femoral Components in Primary Total Conventional Hip Replacement**

| 2003 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 3901 | Exeter V40 | 7612 | Exeter V40 | 7840 | Exeter V40 | 8409 | Exeter V40 | 8342 | Exeter V40 |
| 780 | Spectron EF | 1446 | Quadra-C | 1509 | Quadra-C | 1758 | Quadra-C | 1334 | Quadra-C |
| 565 | C-Stem | 1409 | CPT | 1333 | CPT | 1566 | CPT | 1302 | Short Exeter V40 |
| 477 | CPT | 976 | CPCS | 922 | Short Exeter V40 | 1204 | Taper Fit | 1024 | CPT |
| 445 | Elite Plus | 900 | Short Exeter V40 | 901 | CPCS | 1160 | Short Exeter V40 | 933 | Taper Fit |
| 358 | MS 30 | 798 | Taper Fit | 853 | Taper Fit | 943 | CPCS | 786 | CPCS |
| 338 | Omnifit | 705 | C-Stem AMT | 592 | Evolve | 686 | Evolve | 746 | X-Acta |
| 321 | Charnley | 636 | Evolve | 555 | C-Stem AMT | 684 | X-Acta | 637 | MS 30 |
| 245 | CPCS | 368 | MS 30 | 370 | MS 30 | 602 | C-Stem AMT | 579 | Evolve |
| 122 | Exeter | 322 | X-Acta | 360 | X-Acta | 426 | MS 30 | 551 | C-Stem AMT |
| **10 Most Used** | | | | | | | | | |
| 7552 | (10) 91.7% | 15172 | (10) 93.7% | 15235 | (10) 93.5% | 17438 | (10) 93.9% | 16234 | (10) 90.0% |
| **Remainder** | | | | | | | | | |
| 680 | (26) 8.3% | 1012 | (19) 6.3% | 1056 | (20) 6.5% | 1132 | (21) 6.1% | 1802 | (23) 10.0% |
| **TOTAL** | | | | | | | | | |
| 8232 | (36) 100.0% | 16184 | (29) 100.0% | 16291 | (30) 100.0% | 18570 | (31) 100.0% | 18036 | (33) 100.0% |

**Table HT6 10 Most Used Cementless Femoral Components in Primary Total Conventional Hip Replacement**

| 2003 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 1029 | ABGII | 4450 | CORAIL | 3874 | CORAIL | 4682 | Accolade II | 5079 | Accolade II |
| 980 | Synergy | 3621 | Accolade II | 3787 | Accolade II | 4268 | CORAIL | 3966 | CORAIL |
| 819 | Alloclassic | 2689 | Metafix | 3313 | Metafix | 3452 | Metafix | 3475 | Metafix |
| 739 | VerSys | 2576 | Polarstem | 2595 | Polarstem | 2572 | Polarstem | 2880 | Polarstem |
| 713 | Secur-Fit Plus HA | 1821 | Quadra-H | 1565 | Quadra-H | 2007 | Paragon | 2136 | Paragon |
| 485 | S-Rom | 1455 | Paragon | 1520 | Paragon | 1506 | AMIStem H | 1495 | Taperloc Microplasty |
| 482 | Secur-Fit | 1276 | AMIStem H | 1449 | AMIStem H | 1436 | Quadra-H | 1239 | Taperloc |
| 376 | CORAIL | 978 | Taperloc Microplasty | 1050 | Taperloc Microplasty | 1251 | Taperloc Microplasty | 1154 | ACTIS |
| 334 | Accolade I | 918 | Taperloc | 1000 | Taperloc | 1209 | Taperloc | 1050 | AMIStem-P |
| 334 | Mallory-Head | 589 | Origin | 850 | Origin | 988 | ACTIS | 968 | Quadra-P |
| **10 Most Used** | | | | | | | | | |
| 6291 | (10) 71.2% | 20373 | (10) 78.2% | 21003 | (10) 78.8% | 23371 | (10) 78.9% | 23442 | (10) 76.3% |
| **Remainder** | | | | | | | | | |
| 2549 | (47) 28.8% | 5692 | (58) 21.8% | 5655 | (53) 21.2% | 6233 | (54) 21.1% | 7277 | (53) 23.7% |
| **TOTAL** | | | | | | | | | |
| 8840 | (57) 100.0% | 26065 | (68) 100.0% | 26658 | (63) 100.0% | 29604 | (64) 100.0% | 30719 | (63) 100.0% |

# Primary Total Hip Replacement

**Table HT7 10 Most Used Acetabular Components in Primary Total Conventional Hip Replacement**

| 2003 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 3986 | Trident (Shell) | 9843 | Trident (Shell) | 9481 | Trident (Shell) | 9517 | Trident (Shell) | 8779 | Trident (Shell) |
| 1748 | Reflection (Shell) | 5409 | Trinity | 6213 | Trinity | 7022 | Trinity | 6930 | Trinity |
| 1524 | Trilogy | 5157 | PINNACLE | 4641 | PINNACLE | 5229 | PINNACLE | 5365 | G7 |
| 955 | Vitalock | 4201 | R3 | 4099 | G7 | 5096 | G7 | 4779 | PINNACLE |
| 907 | Duraloc | 3641 | G7 | 3973 | R3 | 4195 | Mpact | 4756 | Trident II/Tritanium (Shell) |
| 827 | ABGII | 3383 | Mpact | 3547 | Mpact | 4040 | R3 | 4690 | Mpact |
| 793 | Allofit | 1735 | Versafitcup CC | 1645 | Versafitcup CC | 3043 | Trident II/Tritanium (Shell) | 4419 | R3 |
| 729 | Mallory-Head | 1553 | Trident/Tritanium (Shell) | 1397 | Logical G | 1846 | Versafitcup CC | 1780 | Versafitcup CC |
| 539 | Contemporary | 1327 | Logical G | 1396 | Trident/Tritanium (Shell) | 1505 | Logical G | 1642 | Logical G |
| 537 | PINNACLE | 804 | RM Cup | 786 | Trident II/Tritanium (Shell) | 858 | Trident/Tritanium (Shell) | 598 | RM Cup |
| **10 Most Used** | | | | | | | | | |
| 12545 | (10) 73.5% | 37053 | (10) 87.7% | 37178 | (10) 86.6% | 42351 | (10) 87.9% | 43738 | (10) 89.7% |
| **Remainder** | | | | | | | | | |
| 4527 | (69) 26.5% | 5196 | (62) 12.3% | 5771 | (63) 13.4% | 5823 | (63) 12.1% | 5017 | (63) 10.3% |
| **TOTAL** | | | | | | | | | |
| 17072 | (79) 100.0% | 42249 | (72) 100.0% | 42949 | (73) 100.0% | 48174 | (73) 100.0% | 48755 | (73) 100.0% |

**Table HT8 10 Most Used Cemented Acetabular Components in Primary Total Conventional Hip Replacement**

| 2003 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 539 | Contemporary | 489 | Exeter X3 Rimfit | 427 | Exeter X3 Rimfit | 378 | Exeter X3 Rimfit | 161 | Exeter |
| 256 | Exeter | 57 | Avantage | 76 | Avantage | 122 | Avantage | 158 | Exeter X3 Rimfit |
| 251 | Reflection (Cup) | 50 | Marathon | 41 | Reflection (Cup) | 39 | Reflection (Cup) | 93 | Avantage |
| 227 | Exeter Contemporary | 40 | Reflection (Cup) | 40 | Marathon | 37 | Marathon | 46 | Reflection (Cup) |
| 199 | Charnley Ogee | 27 | Apricot | 30 | Muller | 27 | Apricot | 35 | Marathon |
| 149 | Elite Plus LPW | 26 | Contemporary | 25 | Apricot | 23 | BI-MENTUM | 30 | Apricot |
| 130 | Low Profile Cup | 25 | Novae E | 17 | Exeter Contemporary | 23 | Exeter Contemporary | 30 | Polarcup |
| 109 | Elite Plus Ogee | 23 | Muller | 16 | Trident (Cup) | 21 | Dual Mobility Cup | 18 | BI-MENTUM |
| 102 | Charnley | 19 | Exeter Contemporary | 15 | Novae E | 21 | Exeter | 13 | Versacem |
| 90 | ZCA | 19 | ZCA | 15 | ZCA | 20 | Polarcup | 11 | Dual Mobility Cup |
| **10 Most Used** | | | | | | | | | |
| 2052 | (10) 85.4% | 775 | (10) 87.5% | 702 | (10) 87.1% | 711 | (10) 88.3% | 595 | (10) 87.1% |
| **Remainder** | | | | | | | | | |
| 351 | (16) 14.6% | 111 | (17) 12.5% | 104 | (18) 12.9% | 94 | (18) 11.7% | 88 | (20) 12.9% |
| **TOTAL** | | | | | | | | | |
| 2403 | (26) 100.0% | 886 | (27) 100.0% | 806 | (28) 100.0% | 805 | (28) 100.0% | 683 | (30) 100.0% |

**Table HT9 10 Most Used Cementless Acetabular Components in Primary Total Conventional Hip Replacement**

| 2003 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 3986 | Trident (Shell) | 9842 | Trident (Shell) | 9480 | Trident (Shell) | 9517 | Trident (Shell) | 8779 | Trident (Shell) |
| 1748 | Reflection (Shell) | 5409 | Trinity | 6213 | Trinity | 7022 | Trinity | 6929 | Trinity |
| 1524 | Trilogy | 5156 | PINNACLE | 4641 | PINNACLE | 5229 | PINNACLE | 5365 | G7 |
| 955 | Vitalock | 4201 | R3 | 4099 | G7 | 5096 | G7 | 4779 | PINNACLE |
| 907 | Duraloc | 3641 | G7 | 3973 | R3 | 4195 | Mpact | 4756 | Trident II/Tritanium (Shell) |
| 827 | ABGII | 3383 | Mpact | 3547 | Mpact | 4040 | R3 | 4690 | Mpact |
| 793 | Allofit | 1735 | Versafitcup CC | 1645 | Versafitcup CC | 3043 | Trident II/Tritanium (Shell) | 4418 | R3 |
| 729 | Mallory-Head | 1553 | Trident/Tritanium (Shell) | 1397 | Logical G | 1846 | Versafitcup CC | 1780 | Versafitcup CC |
| 537 | PINNACLE | 1327 | Logical G | 1396 | Trident/Tritanium (Shell) | 1505 | Logical G | 1642 | Logical G |
| 521 | Fitmore | 804 | RM Cup | 786 | Trident II/Tritanium (Shell) | 858 | Trident/Tritanium (Shell) | 598 | RM Cup |
| **10 Most Used** | | | | | | | | | |
| 12527 | (10) 85.4% | 37051 | (10) 89.6% | 37177 | (10) 88.2% | 42351 | (10) 89.4% | 43736 | (10) 91.0% |
| **Remainder** | | | | | | | | | |
| 2142 | (43) 14.6% | 4306 | (42) 10.4% | 4953 | (41) 11.8% | 5000 | (42) 10.6% | 4320 | (42) 9.0% |
| **TOTAL** | | | | | | | | | |
| 14669 | (53) 100.0% | 41357 | (52) 100.0% | 42130 | (51) 100.0% | 47351 | (52) 100.0% | 48056 | (52) 100.0% |

Note: In 2024, 2 shells in the cementless group were inserted with cement

## OUTCOME FOR ALL DIAGNOSES

Hip replacement prosthesis use and availability change with time. In order to keep data contemporaneous, only procedures using prostheses that have been available and used in 2024 (described as modern prostheses) are included in the analyses, unless clearly specified. This has resulted in 146,695 (21%) hip procedures being excluded from the analysis for the 2025 Annual Report.

Detailed information on prostheses that are no longer used is available in the supplementary report 'Comparative Prosthesis Performance' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2025

Osteoarthritis is the principal diagnosis for primary total conventional hip replacement, followed by fractured neck of femur, osteonecrosis, developmental dysplasia, rheumatoid arthritis, and tumour (Table HT10). Osteoarthritis has a lower rate of revision compared to fractured neck of femur, rheumatoid arthritis and osteonecrosis. Osteoarthritis also has a lower rate of revision compared to developmental dysplasia. However, this difference is only evident in the first 4 weeks and between 3 months to 2.5 years (Figure HT4).

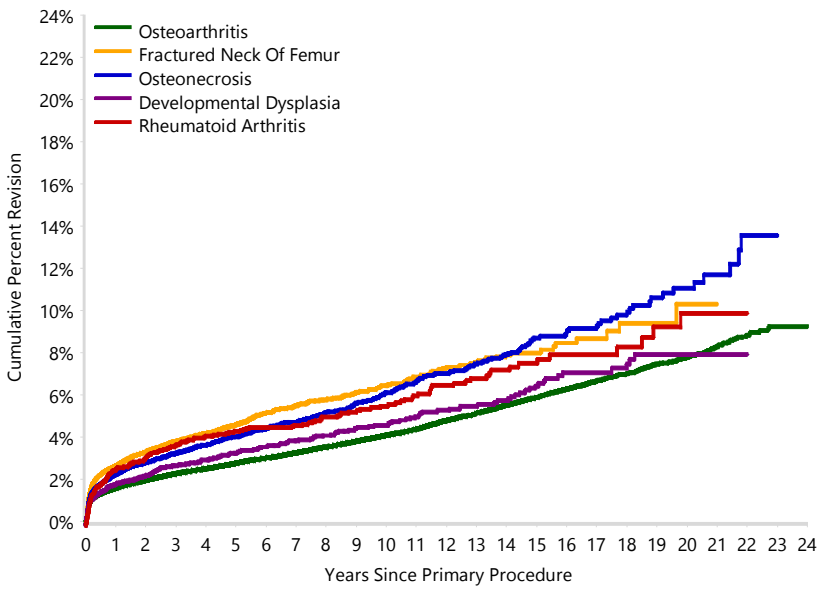
# Primary Total Hip Replacement

**Table HT10 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Primary Diagnosis**

| Primary Diagnosis | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | 16159 | 483080 | 1.6 (1.6, 1.6) | 2.3 (2.3, 2.3) | 2.8 (2.8, 2.9) | 4.2 (4.1, 4.3) | 6.0 (5.9, 6.1) | 7.9 (7.7, 8.2) |
| Fractured Neck of Femur | 1435 | 31470 | 2.8 (2.6, 3.0) | 3.9 (3.7, 4.2) | 4.8 (4.5, 5.0) | 6.6 (6.2, 7.0) | 8.2 (7.5, 8.9) | 10.5 (8.5, 12.9) |
| Osteonecrosis | 856 | 17731 | 2.4 (2.2, 2.6) | 3.4 (3.1, 3.7) | 4.2 (3.9, 4.5) | 6.3 (5.8, 6.8) | 8.9 (8.1, 9.7) | 11.2 (9.9, 12.7) |
| Developmental Dysplasia | 305 | 7635 | 1.9 (1.6, 2.3) | 2.8 (2.5, 3.3) | 3.4 (3.0, 3.9) | 4.7 (4.2, 5.4) | 6.6 (5.7, 7.6) | 8.1 (6.8, 9.6) |
| Rheumatoid Arthritis | 210 | 3997 | 2.6 (2.2, 3.2) | 3.8 (3.2, 4.4) | 4.4 (3.8, 5.2) | 5.7 (4.9, 6.6) | 7.7 (6.5, 9.0) | 10.1 (7.9, 12.7) |
| Tumour | 148 | 2811 | 4.2 (3.5, 5.1) | 6.5 (5.4, 7.8) | 8.0 (6.6, 9.6) | 13.3 (10.3, 17.0) | 14.0 (10.8, 18.1) | |
| Other Inflammatory Arthritis | 112 | 2143 | 2.3 (1.8, 3.1) | 3.5 (2.8, 4.4) | 4.2 (3.3, 5.2) | 5.9 (4.8, 7.3) | 8.5 (6.7, 10.7) | 14.5 (10.0, 20.8) |
| Failed Internal Fixation | 157 | 2128 | 4.8 (4.0, 5.9) | 6.9 (5.8, 8.1) | 8.0 (6.8, 9.4) | 9.4 (7.9, 11.2) | 11.5 (9.1, 14.4) | |
| Other (3) | 86 | 1020 | 5.9 (4.5, 7.6) | 7.8 (6.2, 9.8) | 8.7 (6.9, 10.8) | 11.3 (8.9, 14.2) | 12.2 (9.4, 15.7) | |
| TOTAL | 19468 | 552015 | | | | | | |

Note: Restricted to modern prostheses. All procedures using metal/metal prostheses have been excluded. Only primary diagnoses with >2,000 procedures have been listed.

**Figure HT4 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Primary Diagnosis**




HR - adjusted for age and gender

Fractured Neck Of Femur vs Osteoarthritis

Entire Period: HR=1.71 (95% CI 1.62, 1.81), p<0.001

Osteonecrosis vs Osteoarthritis

Entire Period: HR=1.44 (95% CI 1.34, 1.54), p<0.001

Developmental Dysplasia vs Osteoarthritis

0 - 1Mth: HR=1.35 (95% CI 1.06, 1.71), p=0.014

1Mth - 3Mth: HR=0.74 (95% CI 0.51, 1.09), p=0.126

3Mth - 2.5Yr: HR=1.33 (95% CI 1.09, 1.63), p=0.005

2.5Yr+: HR=0.98 (95% CI 0.81, 1.18), p=0.809

Rheumatoid Arthritis vs Osteoarthritis

Entire Period: HR=1.41 (95% CI 1.23, 1.62), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Osteoarthritis | 483080 | 429889 | 341258 | 264792 | 110429 | 34148 | 6519 |
| Fractured Neck of Femur | 31470 | 25985 | 18538 | 12519 | 3560 | 705 | 86 |
| Osteonecrosis | 17731 | 15394 | 11950 | 8925 | 3727 | 1269 | 328 |
| Developmental Dysplasia | 7635 | 6723 | 5272 | 4165 | 1956 | 830 | 248 |
| Rheumatoid Arthritis | 3997 | 3607 | 2976 | 2411 | 1242 | 498 | 128 |

Note: Restricted to modern prostheses. All procedures using metal/metal prostheses have been excluded. Only primary diagnoses with >3,000 procedures have been listed.

## Prosthesis Types

There are 1,544 different stem and acetabular combinations for primary total conventional hip replacement. This is an increase of 80 prosthesis combinations since the previous report.

The cumulative percent revision of the 107 prosthesis combinations with ≥500 procedures are listed in Table HT11 to Table HT13. Although the listed combinations are a small proportion of the possible combinations, they represent 93.1% of all primary total conventional hip replacement procedures. A large number of prosthesis combinations have been used in small numbers. The 'Other' group consists of all prosthesis combinations with <500 procedures. This group accounts for 6.9% of all primary total conventional hip replacement procedures.

There are 9 cemented primary total conventional stem and acetabular combinations with ≥500 procedures. The CPT/ZCA has the lowest 15 year cumulative percent revision of 7.1% (n=1,071) (Table HT11).

There are 62 cementless primary total conventional stem and acetabular combinations with ≥500 procedures listed. The Secur-Fit Plus/Trident (Shell) has the lowest 15 year cumulative percent revision of 4.0% (n=3,163) (Table HT12).

There are 36 combinations of primary total hip replacement with hybrid fixation with ≥500 procedures listed. The Exeter V40 /Trilogy has the lowest cumulative percent revision at 15 years of 3.8% (n=606) followed by the Exeter V40 /PINNACLE with a cumulative percent revision of 4.3% (n=2,924) (Table HT13).

**Table HT11 Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Cemented Fixation by Prosthesis Combination**

| Femoral Component | Acetabular Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| C-Stem AMT | Marathon | 20 | 686 | 1.8 (1.0, 3.2) | 2.4 (1.4, 3.9) | 2.8 (1.7, 4.4) | 3.6 (2.3, 5.6) | | |
| CPCS | Reflection (Cup) | 111 | 1186 | 2.1 (1.4, 3.1) | 3.1 (2.2, 4.3) | 3.9 (2.9, 5.3) | 8.3 (6.5, 10.5) | 17.1 (13.9, 21.0) | 26.2 (20.9, 32.6) |
| CPT | ZCA | 58 | 1071 | 1.1 (0.6, 2.0) | 2.5 (1.7, 3.6) | 3.0 (2.1, 4.3) | 4.9 (3.6, 6.6) | 7.1 (5.2, 9.7) | 11.0 (7.8, 15.4) |
| Exeter V40 | Exeter | 162 | 1868 | 0.8 (0.5, 1.4) | 1.9 (1.3, 2.7) | 3.1 (2.4, 4.1) | 5.0 (4.0, 6.3) | 10.1 (8.5, 12.0) | 16.0 (13.6, 18.9) |
| | Exeter Contemporary | 220 | 3488 | 1.4 (1.1, 1.9) | 2.3 (1.9, 2.9) | 3.1 (2.6, 3.8) | 4.7 (4.0, 5.5) | 8.1 (7.0, 9.3) | 11.6 (9.7, 13.9) |
| | Exeter X3 Rimfit | 188 | 6055 | 1.6 (1.3, 2.0) | 2.4 (2.1, 2.9) | 2.9 (2.5, 3.4) | 3.8 (3.2, 4.4) | | |
| MS 30 | Low Profile Cup | 23 | 500 | 1.0 (0.4, 2.4) | 1.0 (0.4, 2.4) | 1.5 (0.7, 3.2) | 3.1 (1.8, 5.6) | 8.4 (5.1, 13.5) | |
| Short Exeter V40 | Exeter X3 Rimfit | 17 | 583 | 1.6 (0.8, 3.0) | 2.6 (1.5, 4.3) | 3.1 (1.9, 5.0) | | | |
| Spectron EF | Reflection (Cup) | 142 | 1672 | 1.1 (0.7, 1.7) | 1.8 (1.3, 2.6) | 2.9 (2.1, 3.8) | 7.2 (5.9, 8.8) | 12.7 (10.7, 15.1) | 16.1 (13.3, 19.4) |
| Other (279) | | 279 | 4865 | 3.6 (3.1, 4.2) | 5.0 (4.3, 5.7) | 5.9 (5.2, 6.7) | 8.4 (7.3, 9.6) | 10.9 (9.1, 13.0) | |
| TOTAL | | 1220 | 21974 | | | | | | |

Note: Restricted to modern prostheses
Some cementless components have been cemented
Procedures using metal/metal prostheses have been included
Only prostheses with ≥500 procedures have been listed

**Table HT12 Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Cementless Fixation by Prosthesis Combination**

| Femoral Component | Acetabular Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| ACTIS | PINNACLE | 40 | 2314 | 1.7 (1.2, 2.3) | 2.1 (1.5, 2.8) | | | | |
| AMIStem H | Mpact | 118 | 4895 | 1.5 (1.2, 1.9) | 2.3 (1.9, 2.8) | 3.0 (2.5, 3.7) | | | |
| | Versafitcup CC | 116 | 4264 | 1.3 (1.0, 1.7) | 1.8 (1.5, 2.3) | 2.7 (2.2, 3.2) | | | |
| AMIStem-P | Mpact | 8 | 875 | 1.1 (0.5, 2.1) | | | | | |
| Accolade II | Trident (Shell) | 523 | 19963 | 1.8 (1.7, 2.0) | 2.5 (2.3, 2.8) | 2.9 (2.7, 3.2) | 4.1 (3.5, 4.8) | | |
| | Trident II/Tritanium (Shell) | 72 | 4166 | 1.8 (1.4, 2.3) | | | | | |
| | Trident/Tritanium (Shell) | 163 | 4359 | 2.3 (1.9, 2.8) | 3.4 (2.9, 4.0) | 3.9 (3.3, 4.6) | | | |
| Anthology | R3 | 320 | 9090 | 2.1 (1.8, 2.4) | 2.7 (2.4, 3.0) | 3.0 (2.7, 3.4) | 3.8 (3.4, 4.2) | 4.5 (4.0, 5.1) | |
| | Reflection (Shell)* | 32 | 907 | 1.9 (1.2, 3.0) | 2.2 (1.4, 3.4) | 2.6 (1.7, 3.8) | 3.4 (2.3, 4.8) | 3.7 (2.6, 5.3) | |
| Avenir | Continuum | 66 | 1461 | 3.1 (2.3, 4.1) | 3.5 (2.7, 4.6) | 4.1 (3.2, 5.3) | 5.2 (4.0, 6.7) | | |
| | G7 | 27 | 1113 | 2.1 (1.4, 3.2) | 2.6 (1.7, 4.0) | 3.3 (2.2, 5.2) | | | |
| | Trilogy* | 16 | 626 | 1.0 (0.4, 2.1) | 1.1 (0.5, 2.3) | 1.3 (0.6, 2.6) | 2.7 (1.6, 4.5) | | |
| C2 | Delta-TT | 35 | 1378 | 1.3 (0.8, 2.0) | 1.9 (1.3, 2.9) | 2.3 (1.6, 3.3) | 3.0 (2.1, 4.3) | | |
| CLS | Allofit* | 34 | 501 | 1.8 (0.9, 3.4) | 3.4 (2.1, 5.5) | 4.0 (2.6, 6.2) | 5.4 (3.7, 7.8) | 7.9 (5.6, 11.1) | 7.9 (5.6, 11.1) |
| | Fitmore | 26 | 724 | 1.2 (0.6, 2.4) | 2.6 (1.6, 4.1) | 3.0 (1.9, 4.6) | 4.2 (2.8, 6.4) | 4.2 (2.8, 6.4) | |
| CORAIL | BI-MENTUM | 10 | 602 | 1.2 (0.6, 2.5) | 2.1 (1.1, 3.9) | | | | |
| | Fitmore* | 16 | 514 | 2.1 (1.2, 3.8) | 2.3 (1.3, 4.1) | 2.3 (1.3, 4.1) | 3.3 (2.0, 5.5) | | |
| | G7 | 13 | 791 | 1.0 (0.5, 2.1) | 1.6 (0.9, 2.9) | 2.5 (1.2, 5.3) | | | |
| | PINNACLE | 2811 | 69169 | 1.7 (1.6, 1.8) | 2.5 (2.4, 2.7) | 3.1 (3.0, 3.2) | 4.7 (4.5, 4.9) | 7.1 (6.8, 7.5) | 8.7 (7.6, 10.0) |
| | PINNACLE*[MoM] | 156 | 966 | 2.2 (1.4, 3.3) | 3.7 (2.6, 5.1) | 5.9 (4.6, 7.6) | 12.3 (10.3, 14.7) | 18.0 (15.5, 20.8) | |
| | Trident (Shell) | 29 | 734 | 2.5 (1.6, 3.9) | 3.5 (2.4, 5.2) | 4.1 (2.8, 6.0) | 6.1 (3.9, 9.6) | | |
| | Trinity | 24 | 1628 | 1.3 (0.9, 2.1) | 1.5 (1.0, 2.2) | 1.5 (1.0, 2.2) | | | |
| EVOK | Austral | 22 | 668 | 2.6 (1.7, 4.2) | 5.2 (3.2, 8.6) | 5.2 (3.2, 8.6) | | | |
| | Logical G | 38 | 952 | 2.8 (1.9, 4.1) | 4.2 (3.0, 5.8) | 4.7 (3.4, 6.5) | | | |
| H-Max | Delta-TT | 91 | 1843 | 1.9 (1.4, 2.6) | 3.3 (2.6, 4.3) | 4.0 (3.2, 5.0) | 6.3 (5.1, 7.9) | | |
| HACTIV | Logical G | 79 | 1382 | 3.8 (2.9, 4.9) | 4.9 (3.9, 6.2) | 5.3 (4.3, 6.7) | | | |
| | Saturne | 25 | 1151 | 1.4 (0.8, 2.2) | 2.1 (1.4, 3.3) | 2.3 (1.5, 3.5) | | | |
| M/L Taper | Allofit* | 27 | 752 | 1.6 (0.9, 2.8) | 1.9 (1.1, 3.2) | 2.2 (1.3, 3.5) | 3.3 (2.2, 5.1) | 5.9 (3.7, 9.2) | |
| | Continuum* | 60 | 1423 | 2.3 (1.6, 3.2) | 3.3 (2.5, 4.3) | 3.7 (2.8, 4.8) | 4.5 (3.5, 5.8) | | |
| | Trilogy | 38 | 924 | 1.3 (0.7, 2.3) | 1.6 (1.0, 2.7) | 2.7 (1.8, 4.0) | 3.7 (2.6, 5.2) | 4.7 (3.3, 6.6) | |
| MasterLoc | Mpact | 22 | 1572 | 1.3 (0.8, 2.0) | 1.4 (0.9, 2.1) | 1.6 (1.0, 2.4) | | | |
| | Versafitcup CC | 19 | 1161 | 1.2 (0.7, 2.1) | 1.9 (1.2, 3.0) | 1.9 (1.2, 3.0) | | | |
| Metafix | Trinity | 503 | 23275 | 1.5 (1.3, 1.6) | 2.2 (2.0, 2.4) | 2.4 (2.2, 2.7) | 3.2 (2.8, 3.7) | | |
| MiniHip | Trinity | 44 | 1345 | 2.5 (1.8, 3.5) | 3.1 (2.3, 4.1) | 3.2 (2.4, 4.4) | 3.5 (2.6, 4.7) | | |
| Nanos | R3 | 13 | 674 | 1.2 (0.6, 2.4) | 1.5 (0.8, 2.8) | 1.5 (0.8, 2.8) | 1.8 (1.0, 3.2) | | |
| Optimys | RM Cup | 73 | 3160 | 1.7 (1.3, 2.3) | 2.3 (1.8, 2.9) | 2.6 (2.1, 3.3) | 2.8 (2.2, 3.7) | | |
| Origin | Logical G | 163 | 4742 | 2.3 (1.9, 2.8) | 3.2 (2.7, 3.8) | 3.8 (3.2, 4.5) | 5.9 (4.6, 7.7) | | |
| Paragon | Acetabular Shell (Global) | 17 | 693 | 1.9 (1.1, 3.2) | 2.3 (1.4, 3.7) | 2.6 (1.6, 4.2) | | | |

**Table HT12** ***Continued***

| Femoral Component | Acetabular Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| | Trinity | 99 | 6010 | 1.5 (1.3, 1.9) | 1.9 (1.5, 2.3) | | | | |
| Polarstem | EP-Fit Plus | 14 | 2804 | 0.2 (0.1, 0.4) | 0.4 (0.2, 0.7) | 0.5 (0.3, 0.8) | 0.7 (0.4, 1.2) | | |
| | Polarcup | 12 | 631 | 1.1 (0.5, 2.4) | 1.5 (0.8, 2.9) | 2.1 (1.1, 3.9) | | | |
| | R3 | 661 | 22548 | 2.0 (1.8, 2.2) | 2.6 (2.4, 2.8) | 3.0 (2.7, 3.2) | 4.0 (3.7, 4.4) | 4.8 (4.1, 5.5) | |
| Profemur L | Procotyl L | 25 | 1812 | 1.0 (0.6, 1.6) | 1.2 (0.8, 1.9) | 1.9 (1.2, 3.2) | | | |
| Quadra-H | Mpact | 275 | 6798 | 2.0 (1.7, 2.4) | 3.0 (2.6, 3.4) | 4.0 (3.5, 4.6) | 6.5 (5.2, 8.2) | | |
| | Trident (Shell)* | 27 | 712 | 1.5 (0.9, 2.8) | 2.7 (1.7, 4.2) | 3.1 (2.1, 4.7) | | | |
| | Versafitcup CC | 450 | 11728 | 1.8 (1.6, 2.0) | 2.5 (2.2, 2.8) | 3.0 (2.7, 3.4) | 4.9 (4.4, 5.4) | 7.7 (6.4, 9.3) | |
| | Versafitcup DM | 53 | 1286 | 2.7 (1.9, 3.7) | 4.0 (3.0, 5.2) | 4.4 (3.3, 5.8) | | | |
| Quadra-P | Mpact | 21 | 1300 | 1.6 (1.0, 2.6) | 2.0 (1.3, 3.2) | | | | |
| S-Rom | PINNACLE | 253 | 3867 | 2.5 (2.0, 3.0) | 4.0 (3.5, 4.7) | 4.8 (4.2, 5.5) | 6.2 (5.5, 7.1) | 7.4 (6.5, 8.4) | 9.3 (7.6, 11.4) |
| SL-Plus | EP-Fit Plus | 50 | 1229 | 1.5 (1.0, 2.4) | 2.1 (1.4, 3.0) | 2.7 (1.9, 3.7) | 3.7 (2.8, 5.0) | 4.3 (3.3, 5.7) | |
| | R3 | 121 | 1850 | 2.5 (1.9, 3.3) | 3.9 (3.1, 4.9) | 4.3 (3.5, 5.3) | 6.3 (5.2, 7.6) | 8.1 (6.7, 9.8) | |
| Secur-Fit | Trident (Shell) | 602 | 10687 | 1.9 (1.7, 2.2) | 3.0 (2.6, 3.3) | 3.7 (3.3, 4.1) | 4.9 (4.5, 5.3) | 6.5 (6.0, 7.1) | 8.2 (7.4, 9.1) |
| Secur-Fit Plus | Trident (Shell) | 98 | 3163 | 1.3 (0.9, 1.7) | 1.8 (1.4, 2.3) | 2.3 (1.8, 2.9) | 3.1 (2.5, 3.8) | 4.0 (3.2, 4.9) | |
| Synergy | R3 | 226 | 5881 | 1.9 (1.6, 2.3) | 2.5 (2.1, 2.9) | 2.9 (2.5, 3.4) | 3.8 (3.3, 4.4) | 5.2 (4.5, 6.0) | |
| | Reflection (Shell)* | 463 | 7910 | 1.5 (1.3, 1.8) | 2.3 (2.0, 2.7) | 2.7 (2.4, 3.1) | 3.9 (3.5, 4.4) | 5.6 (5.1, 6.2) | 7.7 (7.0, 8.5) |
| Taperloc | Continuum | 17 | 711 | 1.5 (0.9, 2.8) | 2.3 (1.4, 3.7) | 2.4 (1.5, 3.9) | | | |
| | G7 | 184 | 7241 | 2.1 (1.8, 2.4) | 2.6 (2.2, 3.0) | 2.8 (2.4, 3.3) | 3.1 (2.7, 3.7) | | |
| Taperloc Microplasty | Continuum* | 21 | 633 | 2.7 (1.7, 4.3) | 3.0 (1.9, 4.7) | 3.2 (2.1, 5.0) | | | |
| | G7 | 105 | 6598 | 1.3 (1.1, 1.6) | 1.7 (1.4, 2.1) | 1.8 (1.5, 2.2) | 2.6 (1.6, 4.2) | | |
| Tri-Fit TS | Trinity | 146 | 5295 | 1.4 (1.1, 1.7) | 2.2 (1.9, 2.7) | 2.6 (2.2, 3.1) | 3.3 (2.7, 3.9) | | |
| VerSys | Trilogy* | 286 | 4497 | 2.6 (2.2, 3.1) | 3.4 (2.9, 4.0) | 4.0 (3.5, 4.7) | 5.4 (4.7, 6.1) | 6.4 (5.7, 7.2) | 7.5 (6.7, 8.5) |
| twinSys (class) | RM Cup | 67 | 1613 | 2.4 (1.7, 3.2) | 3.1 (2.3, 4.0) | 3.5 (2.7, 4.5) | 5.1 (3.9, 6.7) | | |
| Other (602) | | 850 | 21214 | 2.4 (2.2, 2.6) | 3.4 (3.1, 3.6) | 3.8 (3.6, 4.1) | 5.3 (4.9, 5.7) | 6.9 (6.3, 7.6) | 8.4 (7.3, 9.7) |
| **TOTAL** | | **11015** | **314775** | | | | | | |

Note: Restricted to modern prostheses. Procedures using metal/metal prostheses have been included.

MoM denotes metal/metal prostheses with head size >32mm.

* Indicates a prosthesis combination with no reported use in primary total conventional hip procedures in 2024, while at least one component continues to be used.

Only prostheses with ≥500 procedures have been listed.

**Table HT13 Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Hybrid Fixation by Prosthesis Combination**

| Femoral Component | Acetabular Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| AMIStem C | Mpact | 7 | 696 | 1.1 (0.5, 2.8) | | | | | |
| C-Stem AMT | PINNACLE | 242 | 7175 | 1.6 (1.3, 1.9) | 2.5 (2.1, 2.9) | 3.3 (2.9, 3.8) | 4.8 (4.1, 5.6) | 7.0 (5.0, 9.7) | |
| CPCS | R3 | 399 | 10220 | 2.3 (2.0, 2.6) | 3.0 (2.7, 3.4) | 3.7 (3.3, 4.1) | 5.2 (4.7, 5.8) | 6.0 (5.2, 6.8) | |
| | Reflection (Shell) | 138 | 3219 | 0.9 (0.6, 1.3) | 1.3 (0.9, 1.7) | 1.7 (1.3, 2.2) | 3.5 (2.8, 4.3) | 5.7 (4.7, 6.9) | 8.8 (7.0, 11.1) |
| CPT | Allofit | 77 | 1930 | 1.5 (1.0, 2.1) | 2.1 (1.6, 2.9) | 3.4 (2.6, 4.4) | 5.0 (3.9, 6.3) | 6.2 (4.6, 8.4) | |
| | Continuum | 185 | 3135 | 3.1 (2.5, 3.7) | 4.1 (3.5, 4.9) | 4.9 (4.2, 5.7) | 6.6 (5.7, 7.6) | | |
| | G7 | 170 | 5283 | 2.4 (2.0, 2.9) | 3.5 (3.0, 4.1) | 4.2 (3.5, 4.9) | | | |
| | Trabecular Metal (Shell) | 151 | 2580 | 2.4 (1.9, 3.1) | 3.5 (2.8, 4.3) | 4.4 (3.6, 5.3) | 6.6 (5.6, 7.8) | 8.7 (7.2, 10.6) | |
| | Trilogy | 513 | 8996 | 1.9 (1.7, 2.3) | 2.9 (2.5, 3.2) | 3.7 (3.4, 4.2) | 5.7 (5.2, 6.3) | 7.3 (6.7, 8.1) | 8.5 (7.5, 9.5) |
| Evolve | Agilis | 5 | 591 | 0.6 (0.2, 1.7) | 1.2 (0.5, 3.0) | | | | |
| | Logical G | 86 | 3092 | 1.9 (1.5, 2.4) | 2.5 (2.0, 3.1) | 3.0 (2.4, 3.7) | 3.6 (2.9, 4.6) | | |
| Exeter V40 | Fixa | 44 | 931 | 2.9 (2.0, 4.2) | 3.5 (2.5, 4.9) | 3.8 (2.7, 5.3) | 5.1 (3.8, 7.0) | | |
| | G7 | 22 | 523 | 2.9 (1.8, 4.8) | 4.0 (2.6, 6.3) | 5.9 (3.6, 9.7) | | | |
| | PINNACLE | 85 | 2924 | 1.4 (1.0, 1.9) | 2.0 (1.5, 2.6) | 2.3 (1.8, 3.0) | 3.7 (2.9, 4.7) | 4.3 (3.3, 5.5) | |
| | R3 | 119 | 2904 | 2.1 (1.6, 2.7) | 2.9 (2.4, 3.6) | 3.7 (3.1, 4.5) | 4.4 (3.6, 5.3) | 5.7 (4.5, 7.2) | |
| | Trabecular Metal (Shell) | 32 | 635 | 2.7 (1.7, 4.3) | 3.2 (2.1, 5.0) | 4.1 (2.7, 6.0) | 5.6 (3.9, 8.0) | 6.4 (4.5, 9.2) | |
| | Trident (Shell) | 3174 | 97795 | 1.3 (1.3, 1.4) | 2.0 (1.9, 2.1) | 2.5 (2.4, 2.6) | 3.8 (3.7, 4.0) | 5.3 (5.1, 5.6) | 6.7 (6.3, 7.1) |
| | Trident II (Shell) | 15 | 1259 | 1.3 (0.7, 2.1) | 1.5 (0.9, 2.6) | | | | |
| | Trident II/Tritanium (Shell) | 59 | 3366 | 2.0 (1.5, 2.6) | | | | | |
| | Trident/Tritanium (Shell) | 272 | 7024 | 1.9 (1.6, 2.3) | 2.9 (2.5, 3.3) | 3.6 (3.2, 4.1) | 4.9 (4.3, 5.6) | | |
| | Trilogy* | 20 | 606 | 1.7 (0.9, 3.1) | 2.4 (1.4, 4.0) | 2.6 (1.5, 4.2) | 3.5 (2.2, 5.4) | 3.8 (2.4, 5.9) | 3.8 (2.4, 5.9) |
| MS 30 | Allofit* | 54 | 1337 | 1.1 (0.6, 1.8) | 1.6 (1.0, 2.4) | 2.2 (1.5, 3.1) | 3.6 (2.7, 4.9) | 5.5 (4.1, 7.4) | 5.9 (4.4, 7.9) |
| | Continuum | 21 | 980 | 1.6 (1.0, 2.7) | 2.0 (1.3, 3.1) | 2.1 (1.4, 3.3) | 2.3 (1.5, 3.5) | | |
| | Fitmore | 27 | 724 | 1.4 (0.8, 2.6) | 2.2 (1.3, 3.5) | 3.1 (2.0, 4.9) | 4.4 (3.0, 6.6) | 5.9 (3.7, 9.3) | |
| | G7 | 40 | 1979 | 1.5 (1.0, 2.2) | 2.2 (1.5, 3.1) | 2.7 (1.9, 3.8) | | | |
| Polarstem | R3 | 23 | 1295 | 1.5 (1.0, 2.4) | 2.5 (1.6, 3.9) | | | | |
| Quadra-C | Mpact | 123 | 7005 | 1.2 (0.9, 1.5) | 1.8 (1.5, 2.1) | 2.0 (1.7, 2.4) | | | |
| | Versafitcup CC | 45 | 2461 | 1.3 (0.9, 1.9) | 1.6 (1.2, 2.2) | 1.9 (1.4, 2.7) | 2.6 (1.8, 3.7) | | |
| Short Exeter V40 | Trident (Shell) | 124 | 5590 | 1.4 (1.1, 1.7) | 2.0 (1.7, 2.5) | 2.6 (2.2, 3.2) | | | |
| | Trident II/Tritanium (Shell) | 12 | 716 | 2.1 (1.2, 3.8) | | | | | |
| Spectron EF | R3 | 118 | 2449 | 1.8 (1.3, 2.4) | 2.9 (2.3, 3.7) | 3.7 (3.0, 4.6) | 5.3 (4.4, 6.5) | 7.0 (5.7, 8.6) | |
| | Reflection (Shell)* | 380 | 5205 | 1.1 (0.9, 1.5) | 2.0 (1.6, 2.4) | 2.8 (2.4, 3.3) | 5.5 (4.8, 6.2) | 9.1 (8.2, 10.1) | 12.2 (10.8, 13.6) |
| Taper Fit | Trinity | 153 | 6442 | 1.6 (1.4, 2.0) | 2.3 (2.0, 2.8) | 2.8 (2.4, 3.4) | 4.1 (3.0, 5.7) | | |
| X-Acta | Mpact | 27 | 1873 | 1.2 (0.8, 1.8) | 1.8 (1.2, 2.7) | 1.9 (1.3, 2.9) | | | |
| | Versafitcup CC | 16 | 961 | 1.2 (0.7, 2.1) | 1.3 (0.8, 2.3) | 1.7 (1.0, 2.9) | | | |
| twinSys (ctd) | RM Cup | 24 | 801 | 2.2 (1.3, 3.4) | 2.9 (1.9, 4.3) | 3.5 (2.3, 5.3) | | | |
| Other (556) | | 448 | 12011 | 2.2 (1.9, 2.4) | 3.1 (2.8, 3.5) | 3.8 (3.4, 4.2) | 5.5 (4.9, 6.2) | 7.9 (6.7, 9.2) | 11.8 (9.1, 15.1) |
| TOTAL | | 7450 | 216713 | | | | | | |

Note: Restricted to modern prostheses. Procedures using metal/metal prostheses have been included. MoM denotes metal/metal prostheses with head size >32mm
* Indicates a prosthesis combination with no reported use in primary total conventional hip procedures in 2024, while at least one component continues to be used. Only prostheses with ≥500 procedures have been listed.

## OUTCOME FOR OSTEOARTHRITIS – PATIENT CHARACTERISTICS

The 20-year cumulative percent revision of primary total conventional hip replacement undertaken for osteoarthritis is 7.9% (Table HT14 and Figure HT5).

### Reason for Revision

Dislocation and instability are combined together for the analyses as they both reflect a similar reason for revision. Periprosthetic joint infection is the most common reason for revision of primary total conventional hip replacement followed by fracture, dislocation/instability, and loosening (Table HT15).

The most common reasons for revision vary with time. In the first 11 years, infection and dislocation/instability are the most frequent reasons for revision. After 11 years, loosening and fracture are the predominant reasons for revision (Figure HT6).

The aetiology of loosening changes with time. Loosening reported in the first few years most likely reflects failure to gain fixation. Loosening reported in later years is often due to loss of fixation secondary to lysis and bone resorption.

Loosening and lysis are reported separately. The diagnosis of loosening is used when loosening is reported either alone or in combination with lysis. The diagnosis of lysis is used for procedures that report only this diagnosis.

### Type of Revision

The five most common types of revision are femoral component, head and insert, acetabular component, total hip replacement (femoral/acetabular), and head only (Table HT16).

### Age and Gender

There is a difference in the rate of revision with respect to age and this varies with time. Compared to all other age groups patients aged ≥75 years have a brief early period of a higher rate of revision, however this reverses and after 3 months they have a lower rate of revision when compared to patients aged <55 years, and also after 9 months when compared to patients 55-64 years. There is also a lower rate of revision compared to patients 65-74 years but only between 9 months and 1.5 years and then from 7.5 years onwards (Table HT17 and Figure HT7).

Compared to males, females have a higher rate of revision in the first 2 weeks. From 2 weeks to 3 months and 6 months onwards, females have a lower rate of revision. The cumulative percent revision at 20 years is 8.7% for males and 7.4% for females (Table HT18 and Figure HT8).

There is a difference in the rate of revision between age groups within gender. Males aged ≥75 years have a higher rate of revision when compared to those aged 55–64 years and aged 65–74 years, but when compared to those aged <55 years, the higher rate of revision is only for the period between 2 weeks and 3 months (Table HT18 and Figure HT9).

Females aged ≥75 years compared to all other age groups have a brief early period of a higher rate of revision but then have a lower rate of revision after 3 months compared to those aged <55 years, and after 6 months for those aged 55-64 and 65-74 years (Table HT18 and Figure HT10).

For both males and females <65 years of age, loosening is the most common reason for revision. For patients aged ≥65 years, the most common reason for revision is fracture (Figure HT11 and Figure HT12).

### ASA and BMI

ASA scores are an indication of comorbidity and have been collected since 2012. The definitions for these scores can be found in the introductory portion of this chapter. There are 363,901 primary total conventional hip replacement procedures for osteoarthritis with these scores.

The majority of patients have an ASA score of 2 or 3. There has been an increase in patients with an ASA score of 3 (Figure HT13). When compared to patients with an ASA score of 1, patients in all other ASA groups have a higher rate of revision (Table HT19 and Figure HT14). The difference in revision rate for each ASA score is partially due to an increase in revision for infection with increasing ASA score (Figure HT15).

When analysed by ASA score and gender, both males and females have similar rates of revision if they have no or little comorbidity (ASA score 1 or 2), and both genders have lower rates of revision when patients in these groups are compared to those with significant comorbidity (ASA scores 3-5). Males with ASA scores 3-5 have a higher rate of revision than females with similar scores after 6 months (Table HT20 and Figure HT16).

Patients with ASA scores 1 or 2 have lower rates of revision than those with scores 3-5 for regardless of age. Patients with ASA scores 1 or 2 aged <65 years have a lower rate of revision than those with the same ASA scores aged ≥65 years, while revision rates for those with ASA scores 3-5 varies little by age group (Table HT17 and Figure HT23).

BMI data have been collected since 2015. There are 320 primary total conventional hip replacement procedures for osteoarthritis with BMI data. Over 80% of patients are in the normal, pre-obese or obese class 1 category, and there has been little change in BMI over time (Figure HT18).

When compared to patients in the normal BMI category, there is no difference in the rate of revision for patients who are underweight or pre-obese. The rate of revision is increased for obese class 1, obese class 2 and obese class 3 compared to normal body weight (Table HT22 and Figure HT19).

The most common reasons for revision are shown in Figure HT18. There is an increasing rate of revision for infection with increasing obesity class. At 3 years, the cumulative incidence of revision for infection is 0.8% for obese class 1, 1.5% for obese class 2, and 2.3% for obese class 3.

# Primary Total Hip Replacement

The cumulative incidence of revision for infection for patients in obese class 3 is over 5-fold compared to patients with a normal BMI (Figure HT20).

An analysis of patient BMI dichotomised into 'not obese' (BMI <30) and 'obese' (BMI ≥30) with gender has been conducted. Obese females have a higher rate of revision than females classed as not obese while obese males have a higher revision rate compared to not obese males only for the first 1.5 years.

There is no difference in rate of revision for obese patients regarding gender. When the not obese groups are compared, males have a higher rate of revision than females (Table HT23 and Figure HT21).

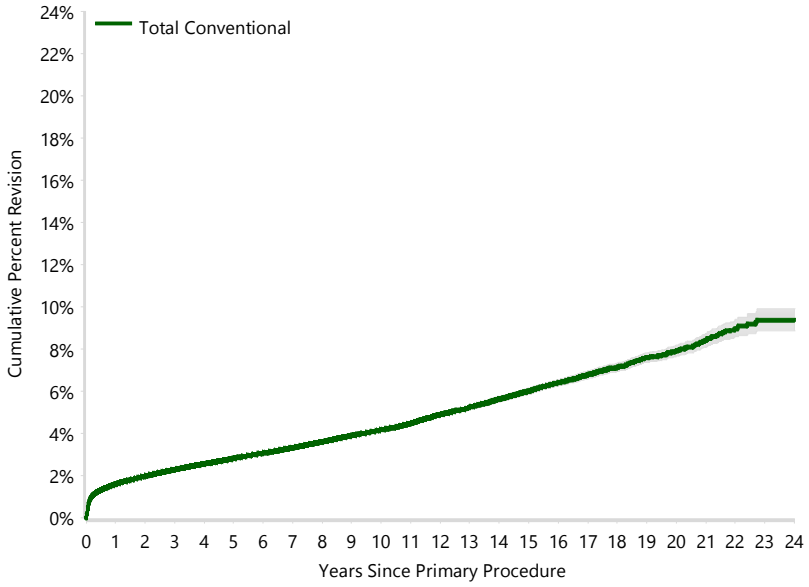
Patients who are not obese have a lower rate of revision than obese patients for both age groups (<65 years and ≥65 years) (Table HT24 and Figure HT22).

**Table HT14 Cumulative Percent Revision of Primary Total Conventional Hip Replacement (Primary Diagnosis OA)**

| Hip Class | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Total Conventional | 16159 | 483080 | 1.6 (1.6, 1.6) | 2.3 (2.3, 2.3) | 2.8 (2.8, 2.9) | 4.2 (4.1, 4.3) | 6.0 (5.9, 6.1) | 7.9 (7.7, 8.2) |
| **TOTAL** | **16159** | **483080** | | | | | | |

Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded

**Figure HT5 Cumulative Percent Revision of Primary Total Conventional Hip Replacement (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Total Conventional | 483080 | 429889 | 341258 | 264792 | 110429 | 34148 | 6519 |

Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded

**Table HT15 Primary Total Conventional Hip Replacement by Reason for Revision (Primary Diagnosis OA)**

| Reason for Revision | Number | Percent |
|---|---|---|
| Infection | 3997 | 24.7 |
| Fracture | 3622 | 22.4 |
| Prosthesis Dislocation/Instability | 3441 | 21.3 |
| Loosening | 3147 | 19.5 |
| Pain | 287 | 1.8 |
| Leg Length Discrepancy | 261 | 1.6 |
| Malposition | 242 | 1.5 |
| Lysis | 189 | 1.2 |
| Implant Breakage Stem | 172 | 1.1 |
| Implant Breakage Acetabular Insert | 112 | 0.7 |
| Wear Acetabular Insert | 95 | 0.6 |
| Incorrect Sizing | 86 | 0.5 |
| Metal Related Pathology | 78 | 0.5 |
| Implant Breakage Acetabular | 52 | 0.3 |
| Implant Breakage Head | 27 | 0.2 |
| Other | 351 | 2.2 |
| TOTAL | 16159 | 100.0 |

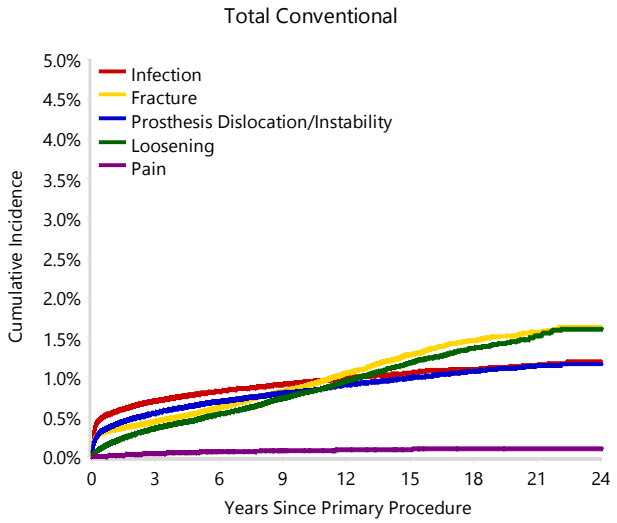
Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded

**Table HT16 Primary Total Conventional Hip Replacement by Type of Revision (Primary Diagnosis OA)**

| Type of Revision | Number | Percent |
|---|---|---|
| Femoral Component | 5515 | 34.1 |
| Head/Insert | 4241 | 26.2 |
| Acetabular Component | 2780 | 17.2 |
| THR (Femoral/Acetabular) | 1826 | 11.3 |
| Head Only | 781 | 4.8 |
| Cement Spacer | 512 | 3.2 |
| Minor Components | 258 | 1.6 |
| Insert Only | 139 | 0.9 |
| Removal of Prostheses | 68 | 0.4 |
| Reinsertion of Components | 22 | 0.1 |
| Bipolar Head and Femoral | 7 | 0.0 |
| Total Femoral | 7 | 0.0 |
| Cement Only | 1 | 0.0 |
| Head/Neck | 1 | 0.0 |
| Bipolar Only | 1 | 0.0 |
| TOTAL | 16159 | 100.0 |

Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded
Femoral heads are usually replaced when the acetabular component or femoral stem is revised

**Figure HT6 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

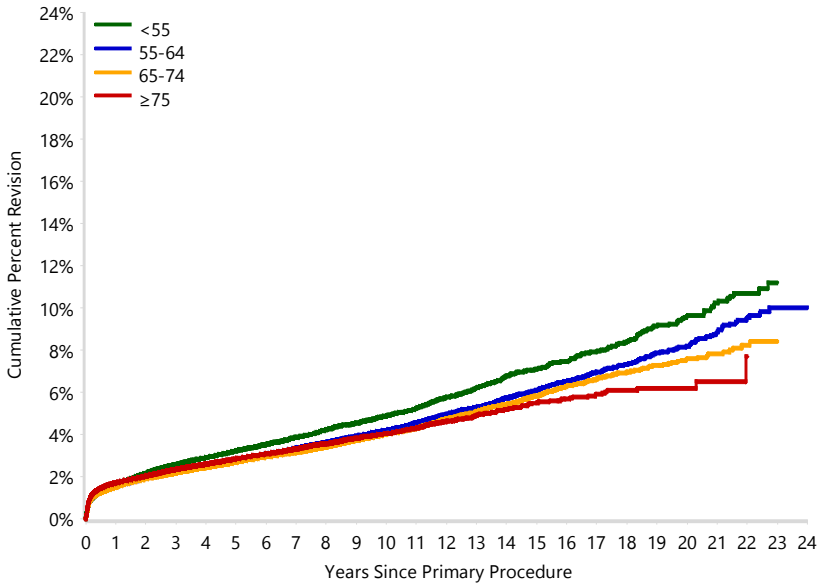
# Primary Total Hip Replacement

**Table HT17 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Age (Primary Diagnosis OA)**

| Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| <55 | 2051 | 49937 | 1.6 (1.5, 1.8) | 2.6 (2.4, 2.7) | 3.2 (3.1, 3.4) | 4.9 (4.6, 5.1) | 7.1 (6.7, 7.5) | 9.6 (8.9, 10.4) |
| 55-64 | 4038 | 113266 | 1.6 (1.5, 1.6) | 2.3 (2.2, 2.4) | 2.8 (2.7, 2.9) | 4.2 (4.1, 4.4) | 6.1 (5.9, 6.4) | 8.2 (7.7, 8.6) |
| 65-74 | 5661 | 173242 | 1.5 (1.5, 1.6) | 2.2 (2.1, 2.3) | 2.7 (2.6, 2.8) | 4.0 (3.9, 4.1) | 5.8 (5.6, 6.0) | 7.6 (7.2, 8.0) |
| ≥75 | 4409 | 146635 | 1.7 (1.6, 1.8) | 2.4 (2.3, 2.4) | 2.9 (2.8, 2.9) | 4.1 (3.9, 4.2) | 5.5 (5.2, 5.8) | 6.2 (5.8, 6.7) |
| TOTAL | 16159 | 483080 | | | | | | |

Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded

**Figure HT7 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Age (Primary Diagnosis OA)**




HR - adjusted for gender

<55 vs ≥75

0 - 2Wk: HR=1.10 (95% CI 0.92, 1.32), p=0.273
2Wk - 3Mth: HR=0.76 (95% CI 0.68, 0.85), p<0.001
3Mth+: HR=1.36 (95% CI 1.28, 1.45), p<0.001

55-64 vs ≥75

0 - 2Wk: HR=0.87 (95% CI 0.76, 1.01), p=0.063
2Wk - 1Mth: HR=0.76 (95% CI 0.67, 0.85), p<0.001
1Mth - 3Mth: HR=0.96 (95% CI 0.86, 1.07), p=0.452
3Mth - 9Mth: HR=0.97 (95% CI 0.86, 1.09), p=0.623
9Mth+: HR=1.14 (95% CI 1.07, 1.21), p<0.001

65-74 vs ≥75

0 - 1Mth: HR=0.81 (95% CI 0.75, 0.89), p<0.001
1Mth - 9Mth: HR=0.92 (95% CI 0.86, 0.99), p=0.032
9Mth - 1.5Yr: HR=1.19 (95% CI 1.07, 1.33), p=0.002
1.5Yr - 2Yr: HR=1.00 (95% CI 0.86, 1.17), p=0.998
2Yr - 7.5Yr: HR=1.00 (95% CI 0.94, 1.08), p=0.894
7.5Yr+: HR=1.13 (95% CI 1.04, 1.23), p=0.005

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| <55 | 49937 | 44814 | 36242 | 29047 | 13346 | 4699 | 1366 |
| 55-64 | 113266 | 101738 | 82308 | 65566 | 30603 | 11176 | 2518 |
| 65-74 | 173242 | 154742 | 124150 | 97410 | 42397 | 13636 | 2281 |
| ≥75 | 146635 | 128595 | 98558 | 72769 | 24083 | 4637 | 354 |

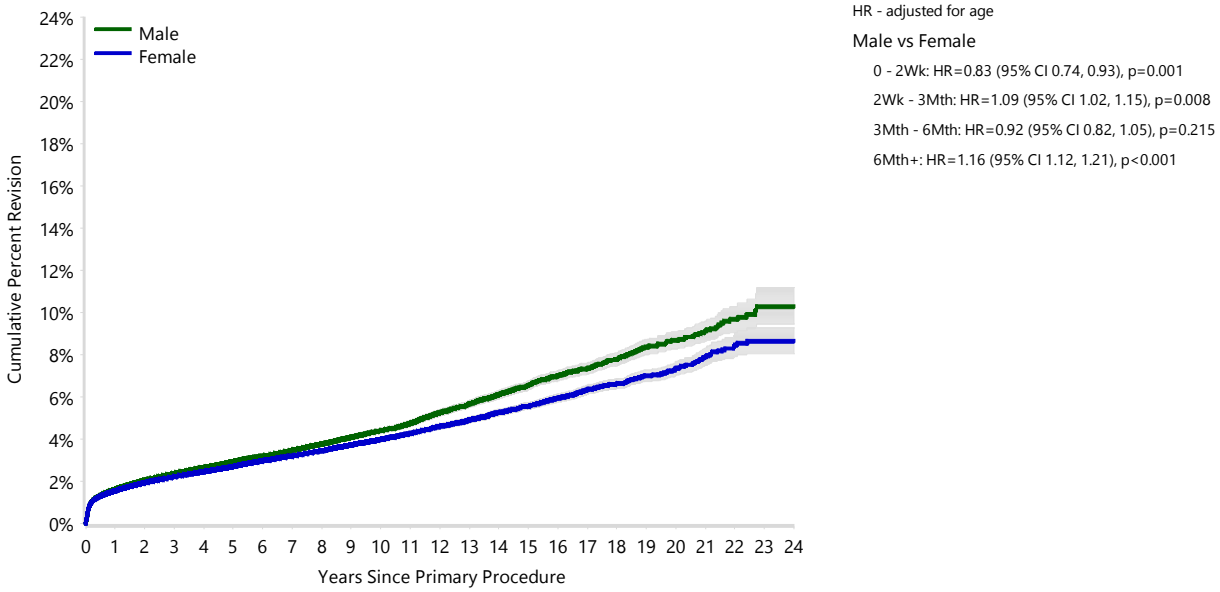
Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded

**Table HT18 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Gender and Age (Primary Diagnosis OA)**

| Gender | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| **Male** | | **7703** | **220749** | **1.6 (1.6, 1.7)** | **2.4 (2.3, 2.5)** | **2.9 (2.9, 3.0)** | **4.4 (4.3, 4.5)** | **6.6 (6.4, 6.8)** | **8.7 (8.3, 9.1)** |
| | **<55** | 1083 | 28069 | 1.5 (1.4, 1.7) | 2.4 (2.2, 2.6) | 3.0 (2.8, 3.2) | 4.6 (4.3, 4.9) | 6.9 (6.4, 7.5) | 9.7 (8.7, 10.8) |
| | **55-64** | 2043 | 57398 | 1.6 (1.5, 1.7) | 2.3 (2.2, 2.4) | 2.8 (2.6, 2.9) | 4.2 (4.0, 4.4) | 6.5 (6.1, 6.9) | 8.5 (7.9, 9.2) |
| | **65-74** | 2633 | 77303 | 1.6 (1.5, 1.7) | 2.3 (2.2, 2.4) | 2.8 (2.7, 2.9) | 4.3 (4.1, 4.4) | 6.2 (5.9, 6.6) | 8.2 (7.6, 8.9) |
| | **≥75** | 1944 | 57979 | 1.8 (1.7, 2.0) | 2.6 (2.5, 2.8) | 3.2 (3.1, 3.4) | 4.7 (4.5, 5.0) | 6.9 (6.4, 7.5) | 7.9 (6.9, 9.1) |
| **Female** | | **8456** | **262331** | **1.6 (1.5, 1.6)** | **2.2 (2.2, 2.3)** | **2.7 (2.6, 2.8)** | **4.0 (3.9, 4.1)** | **5.6 (5.4, 5.7)** | **7.4 (7.0, 7.7)** |
| | **<55** | 968 | 21868 | 1.8 (1.6, 2.0) | 2.8 (2.6, 3.0) | 3.5 (3.2, 3.8) | 5.3 (4.9, 5.7) | 7.3 (6.8, 7.9) | 9.7 (8.7, 10.7) |
| | **55-64** | 1995 | 55868 | 1.5 (1.4, 1.7) | 2.2 (2.1, 2.4) | 2.8 (2.6, 2.9) | 4.2 (4.0, 4.4) | 5.8 (5.5, 6.1) | 7.9 (7.3, 8.5) |
| | **65-74** | 3028 | 95939 | 1.5 (1.4, 1.5) | 2.1 (2.0, 2.2) | 2.6 (2.5, 2.7) | 3.8 (3.7, 4.0) | 5.5 (5.3, 5.8) | 7.1 (6.7, 7.7) |
| | **≥75** | 2465 | 88656 | 1.6 (1.5, 1.7) | 2.2 (2.1, 2.3) | 2.6 (2.5, 2.7) | 3.6 (3.5, 3.8) | 4.8 (4.5, 5.1) | 5.3 (4.9, 5.8) |
| **TOTAL** | | **16159** | **483080** | | | | | | |

Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded

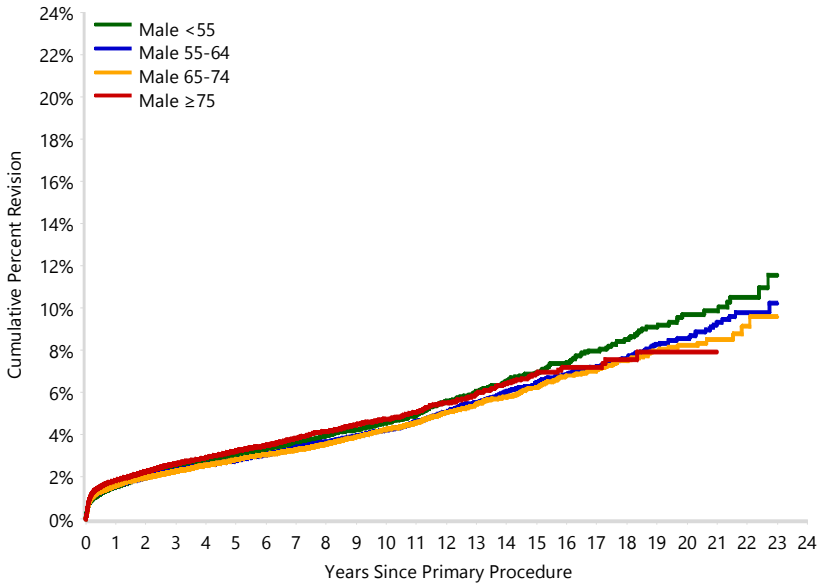
**Figure HT8 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Gender (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| **Male** | 220749 | 196264 | 154920 | 119183 | 47896 | 14226 | 2816 |
| **Female** | 262331 | 233625 | 186338 | 145609 | 62533 | 19922 | 3703 |

Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded

**Figure HT9 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Males by Age (Primary Diagnosis OA)**




Male <55 vs Male ≥75

0 - 2Wk: HR=1.22 (95% CI 0.96, 1.55), p=0.104

2Wk - 3Mth: HR=0.67 (95% CI 0.58, 0.78), p<0.001

3Mth+: HR=1.05 (95% CI 0.96, 1.14), p=0.302

Male 55-64 vs Male ≥75

Entire Period: HR=0.89 (95% CI 0.84, 0.95), p<0.001

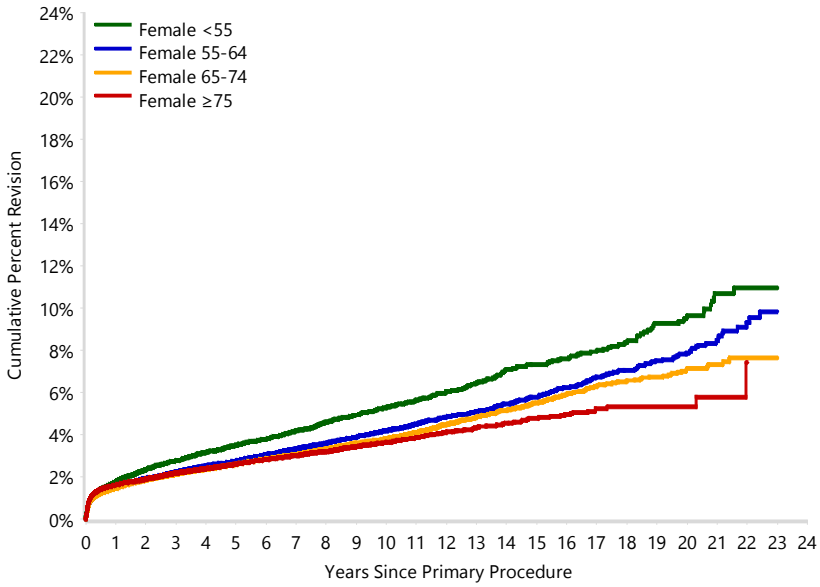
Male 65-74 vs Male ≥75

Entire Period: HR=0.88 (95% CI 0.83, 0.93), p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| **Male** | **<55** | 28069 | 25245 | 20423 | 16333 | 7145 | 2321 | 679 |
| | **55-64** | 57398 | 51450 | 41254 | 32549 | 14529 | 4932 | 1178 |
| | **65-74** | 77303 | 69036 | 55290 | 43180 | 18289 | 5626 | 865 |
| | **≥75** | 57979 | 50533 | 37953 | 27121 | 7933 | 1347 | 94 |

Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded

**Figure HT10 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Females by Age (Primary Diagnosis OA)**




Female <55 vs Female ≥75
- 0 - 2Wk: HR=1.10 (95% CI 0.86, 1.42), p=0.452
- 2Wk - 3Mth: HR=0.92 (95% CI 0.78, 1.08), p=0.290
- 3Mth+: HR=1.68 (95% CI 1.53, 1.83), p<0.001

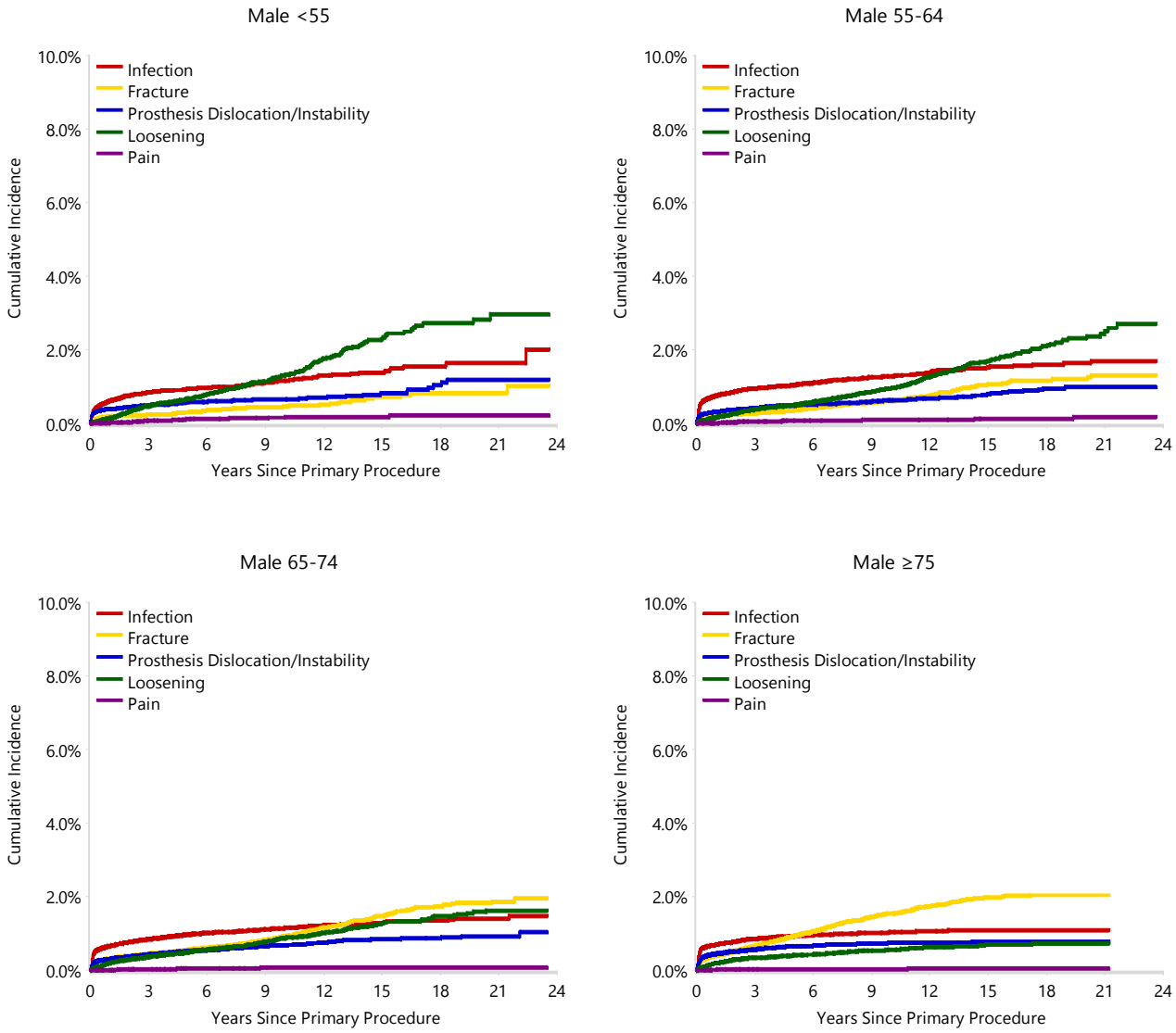
Female 55-64 vs Female ≥75
- 0 - 2Wk: HR=0.87 (95% CI 0.72, 1.06), p=0.167
- 2Wk - 1Mth: HR=0.75 (95% CI 0.63, 0.88), p<0.001
- 1Mth - 2Yr: HR=1.15 (95% CI 1.05, 1.26), p=0.003
- 2Yr - 2.5Yr: HR=0.87 (95% CI 0.64, 1.17), p=0.343
- 2.5Yr+: HR=1.36 (95% CI 1.24, 1.48), p<0.001

Female 65-74 vs Female ≥75
- 0 - 1Mth: HR=0.81 (95% CI 0.72, 0.90), p<0.001
- 1Mth - 3Mth: HR=0.99 (95% CI 0.87, 1.13), p=0.935
- 3Mth - 6Mth: HR=0.95 (95% CI 0.80, 1.14), p=0.602
- 6Mth+: HR=1.18 (95% CI 1.10, 1.26), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| **Female <55** | 21868 | 19569 | 15819 | 12714 | 6201 | 2378 | 687 |
| **55-64** | 55868 | 50288 | 41054 | 33017 | 16074 | 6244 | 1340 |
| **65-74** | 95939 | 85706 | 68860 | 54230 | 24108 | 8010 | 1416 |
| **≥75** | 88656 | 78062 | 60605 | 45648 | 16150 | 3290 | 260 |

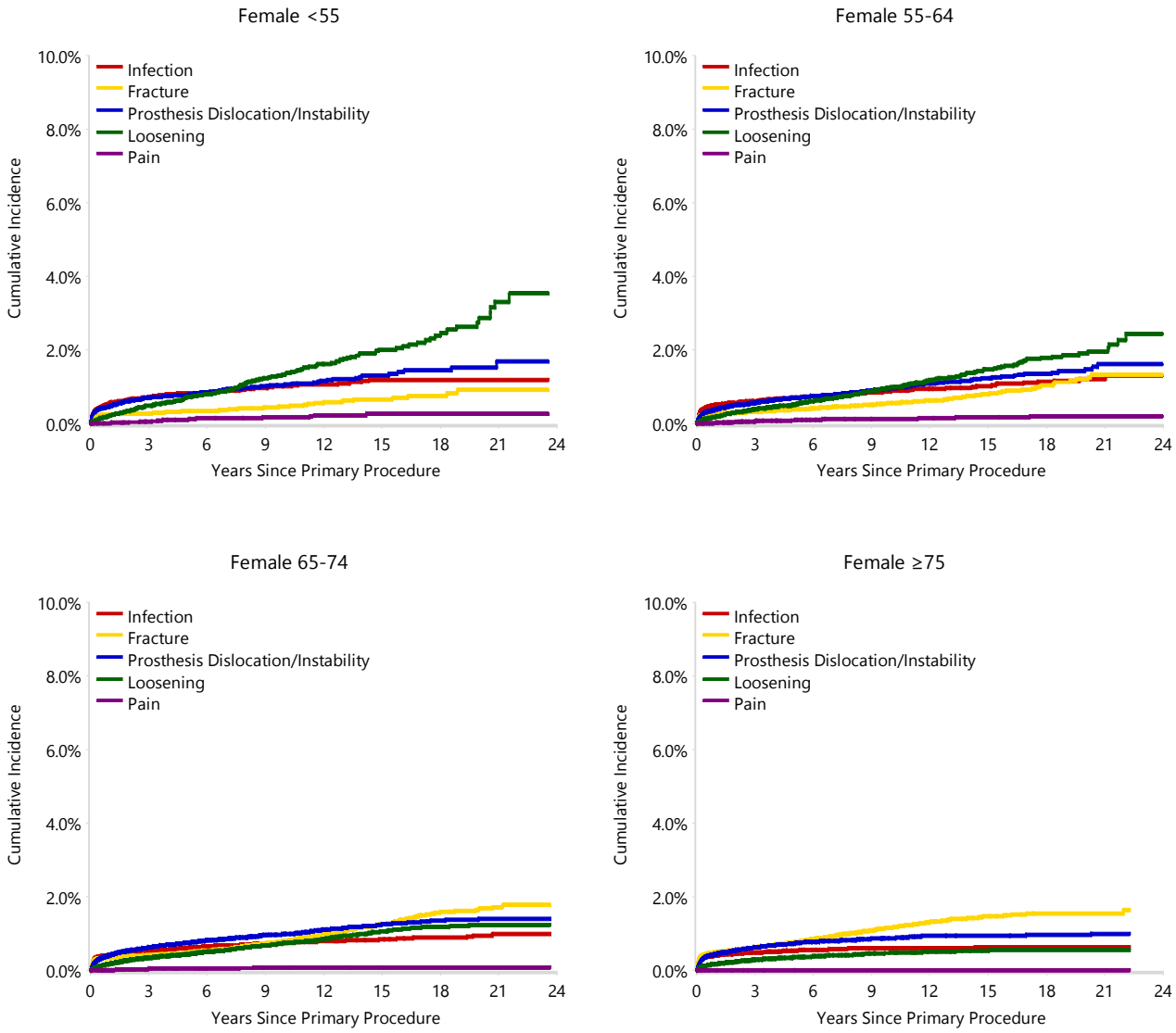
Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded

**Figure HT11 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement in Males by Age (Primary Diagnosis OA)**




Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded

**Figure HT12 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement in Females by Age (Primary Diagnosis OA)**




Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded

**Figure HT13 Primary Total Conventional Hip Replacement by ASA Score (Primary Diagnosis OA)**

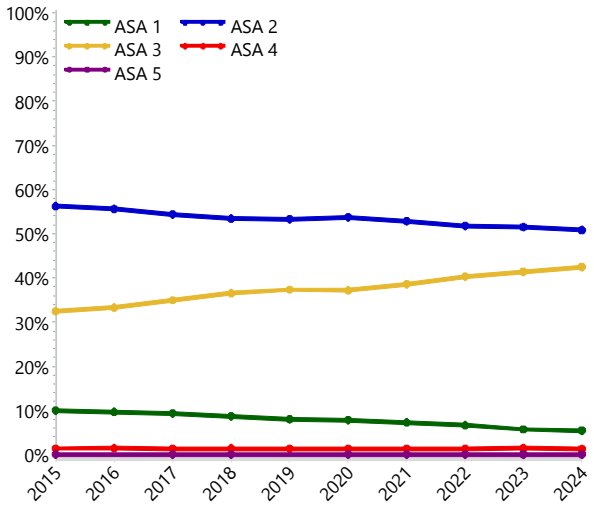
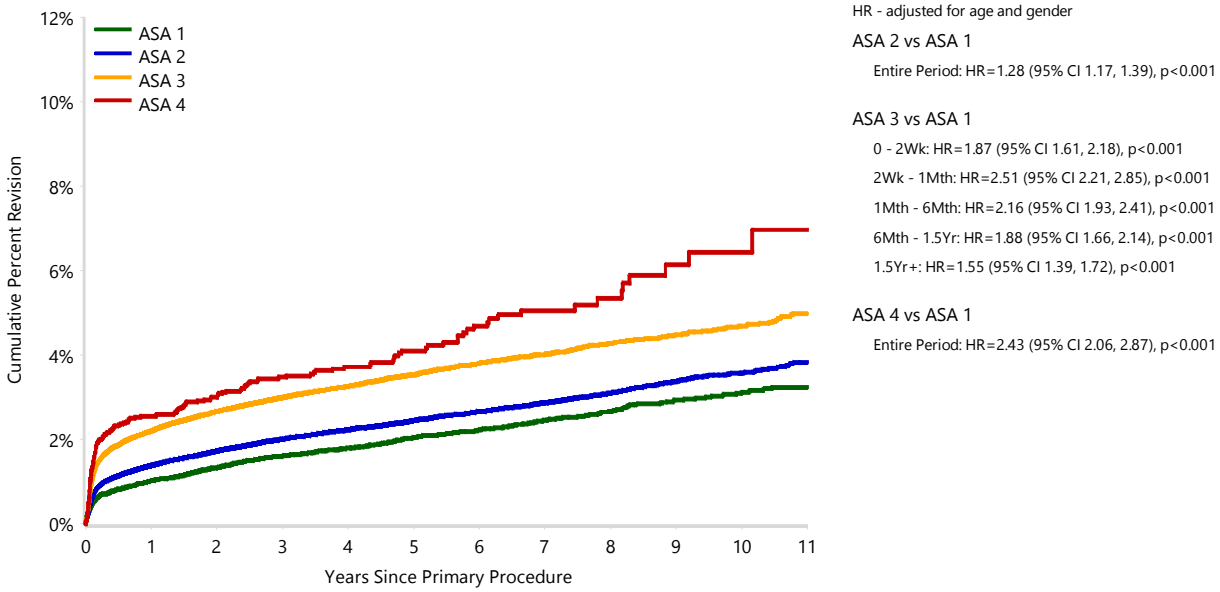


**Table HT19 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by ASA Score (Primary Diagnosis OA)**

| ASA Score | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| ASA 1 | 612 | 28517 | 1.0 (0.9, 1.1) | 1.3 (1.2, 1.5) | 1.6 (1.5, 1.8) | 2.0 (1.9, 2.2) | 2.5 (2.3, 2.7) | 2.9 (2.7, 3.2) | 3.2 (2.9, 3.6) |
| ASA 2 | 4667 | 194330 | 1.4 (1.3, 1.4) | 1.7 (1.7, 1.8) | 2.0 (1.9, 2.1) | 2.4 (2.4, 2.5) | 2.9 (2.8, 3.0) | 3.4 (3.3, 3.5) | 3.8 (3.7, 4.0) |
| ASA 3 | 4403 | 136039 | 2.2 (2.1, 2.3) | 2.7 (2.6, 2.8) | 3.0 (2.9, 3.1) | 3.5 (3.4, 3.6) | 4.0 (3.9, 4.1) | 4.5 (4.3, 4.6) | 5.0 (4.7, 5.2) |
| ASA 4 | 189 | 4991 | 2.6 (2.1, 3.0) | 3.0 (2.5, 3.5) | 3.5 (3.0, 4.1) | 4.1 (3.5, 4.8) | 5.1 (4.3, 6.0) | 6.1 (5.0, 7.4) | 7.0 (5.5, 8.9) |
| ASA 5 | 1 | 24 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 14.3 (2.1, 66.6) | | |
| TOTAL | 9872 | 363901 | | | | | | | |

Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded

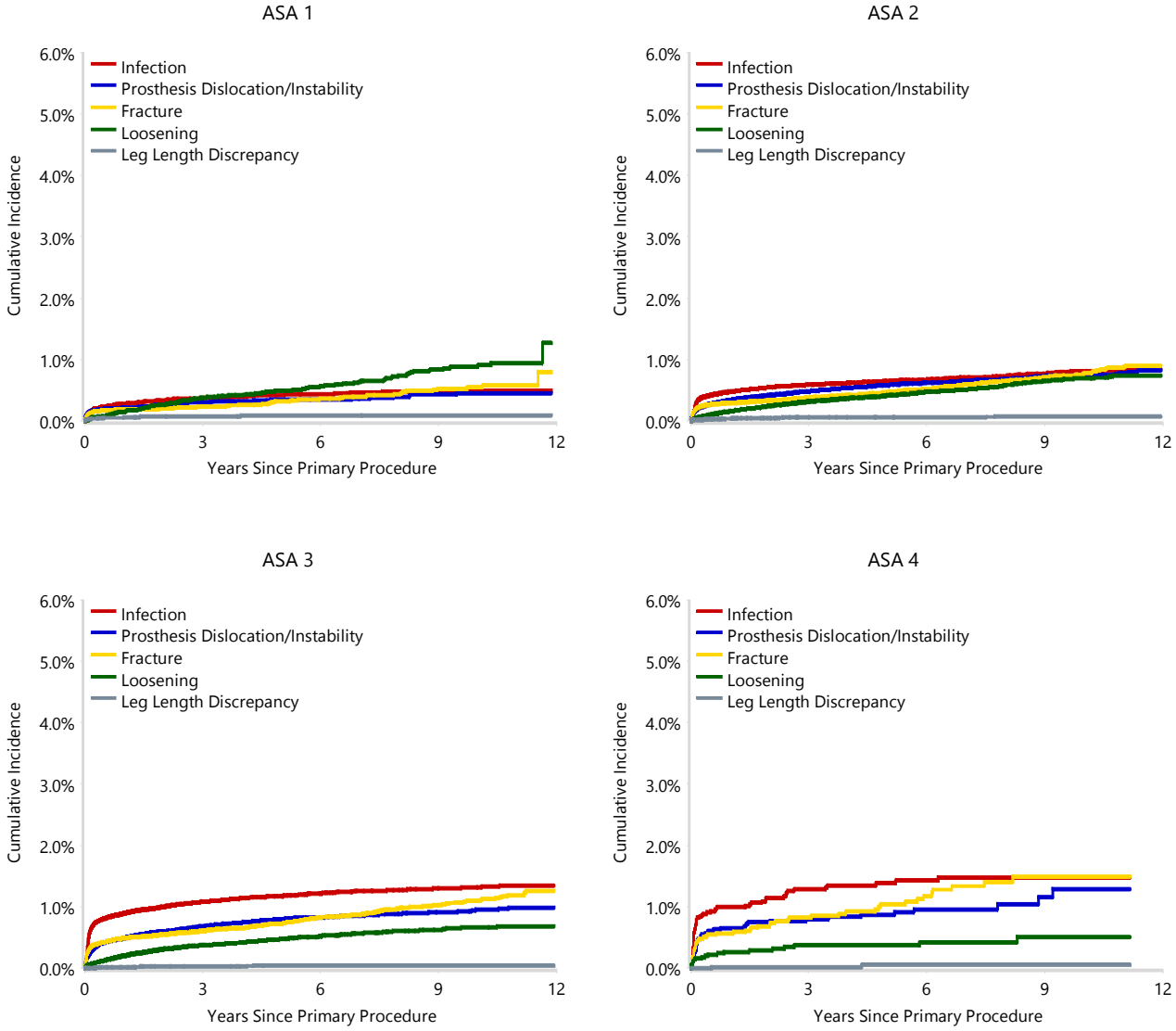
**Figure HT14 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by ASA Score (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|---|
| ASA 1 | 28517 | 25896 | 23411 | 20911 | 15791 | 10635 | 5478 | 1255 |
| ASA 2 | 194330 | 169751 | 147200 | 127390 | 90494 | 57006 | 27692 | 5584 |
| ASA 3 | 136039 | 113972 | 95084 | 78919 | 51479 | 28925 | 12558 | 2255 |
| ASA 4 | 4991 | 4097 | 3330 | 2668 | 1592 | 828 | 347 | 67 |

Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded
Excludes ASA 5 patients due to low numbers

**Figure HT15 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement by ASA Score (Primary Diagnosis OA)**



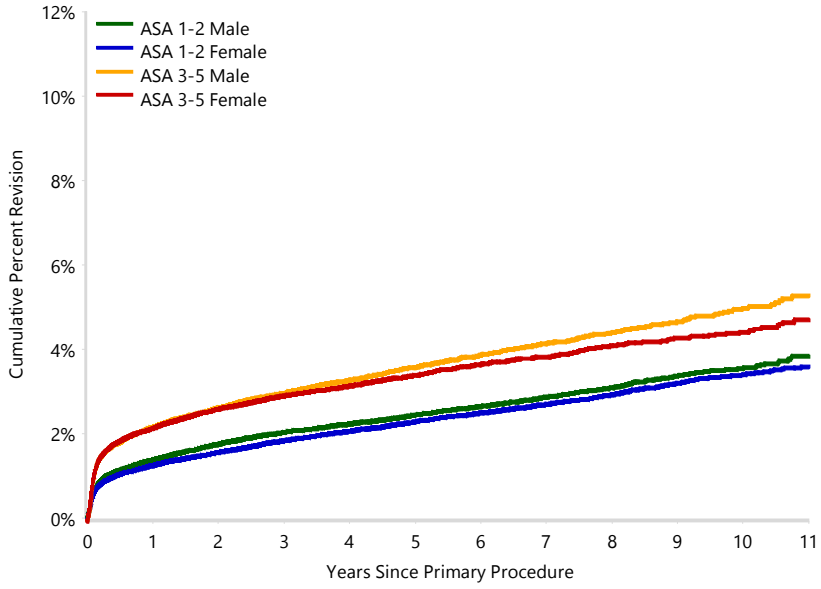

Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded

**Table HT20 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by ASA and Gender (Primary Diagnosis OA)**

| ASA Score | Gender | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| ASA 1-2 | Male | 2514 | 102701 | 1.4 (1.3, 1.5) | 2.1 (2.0, 2.1) | 2.5 (2.4, 2.6) | 2.9 (2.8, 3.0) | 3.4 (3.2, 3.6) | 3.9 (3.6, 4.1) |
| | Female | 2765 | 120146 | 1.3 (1.2, 1.4) | 1.9 (1.8, 2.0) | 2.3 (2.2, 2.4) | 2.7 (2.6, 2.9) | 3.3 (3.1, 3.4) | 3.6 (3.5, 3.8) |
| ASA 3-5 | Male | 2176 | 65416 | 2.2 (2.1, 2.3) | 3.0 (2.9, 3.2) | 3.6 (3.5, 3.8) | 4.2 (4.0, 4.4) | 4.7 (4.5, 5.0) | 5.3 (5.0, 5.7) |
| | Female | 2417 | 75638 | 2.2 (2.1, 2.3) | 3.0 (2.9, 3.1) | 3.5 (3.3, 3.6) | 3.9 (3.8, 4.1) | 4.4 (4.2, 4.6) | 4.8 (4.5, 5.1) |
| TOTAL | | 9872 | 363901 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT16 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by ASA and Gender (Primary Diagnosis OA)**




HR - adjusted for age

ASA 1-2 Male vs ASA 1-2 Female
Entire Period: HR=1.04 (95% CI 0.98, 1.10), p=0.165

ASA 1-2 Male vs ASA 3-5 Male
0 - 2Wk: HR=0.62 (95% CI 0.52, 0.74), p<0.001
2Wk - 1Mth: HR=0.52 (95% CI 0.46, 0.59), p<0.001
1Mth - 3Mth: HR=0.60 (95% CI 0.53, 0.68), p<0.001
3Mth+: HR=0.71 (95% CI 0.65, 0.76), p<0.001

ASA 1-2 Female vs ASA 3-5 Female
0 - 2Wk: HR=0.58 (95% CI 0.50, 0.68), p<0.001
2Wk - 1Mth: HR=0.49 (95% CI 0.43, 0.55), p<0.001
1Mth - 3Mth: HR=0.56 (95% CI 0.50, 0.62), p<0.001
3Mth - 9Mth: HR=0.61 (95% CI 0.53, 0.69), p<0.001
9Mth - 1.5Yr: HR=0.71 (95% CI 0.61, 0.83), p<0.001
1.5Yr - 2Yr: HR=0.74 (95% CI 0.60, 0.91), p=0.005
2Yr+: HR=0.85 (95% CI 0.77, 0.94), p=0.001

ASA 3-5 Male vs ASA 3-5 Female
0 - 3Mth: HR=0.97 (95% CI 0.90, 1.06), p=0.541
3Mth - 6Mth: HR=0.81 (95% CI 0.68, 0.96), p=0.017
6Mth+: HR=1.16 (95% CI 1.06, 1.26), p=0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|---|
| ASA 1-2 | Male | 102701 | 90384 | 68502 | 49086 | 31298 | 15226 | 3065 |
| | Female | 120146 | 105263 | 79799 | 57199 | 36343 | 17944 | 3774 |
| ASA 3-5 | Male | 65416 | 54723 | 37702 | 24239 | 13346 | 5675 | 1026 |
| | Female | 75638 | 63365 | 43895 | 28839 | 16412 | 7232 | 1296 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

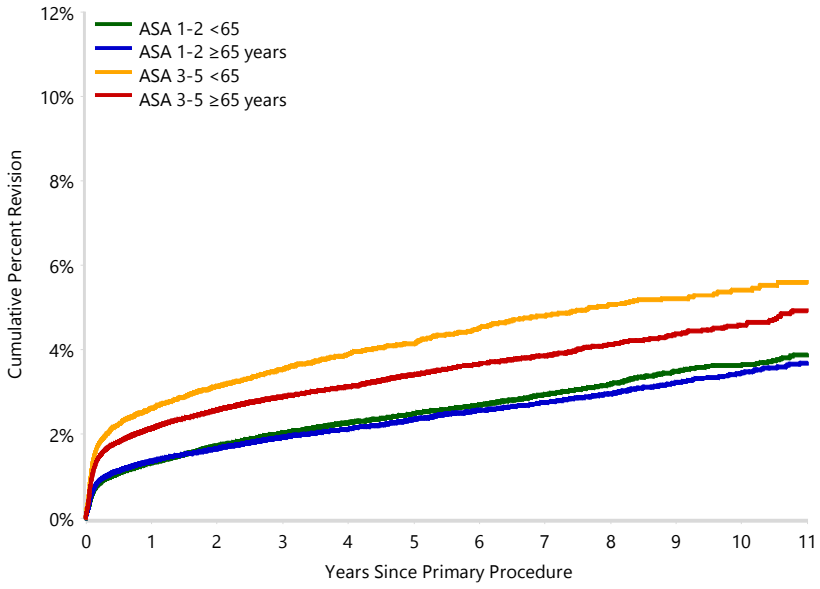
# Primary Total Hip Replacement

**Table HT21 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by ASA and Age (Primary Diagnosis OA)**

| ASA Score | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| ASA 1-2 | <65 | 2295 | 92705 | 1.3 (1.2, 1.4) | 2.0 (1.9, 2.1) | 2.5 (2.4, 2.6) | 2.9 (2.8, 3.1) | 3.5 (3.3, 3.6) | 3.9 (3.7, 4.1) |
| | ≥65 | 2984 | 130142 | 1.3 (1.3, 1.4) | 1.9 (1.8, 2.0) | 2.3 (2.2, 2.4) | 2.7 (2.6, 2.8) | 3.2 (3.1, 3.3) | 3.7 (3.5, 3.9) |
| ASA 3-5 | <65 | 1248 | 32307 | 2.6 (2.4, 2.8) | 3.5 (3.3, 3.7) | 4.1 (3.9, 4.4) | 4.8 (4.5, 5.1) | 5.2 (4.9, 5.5) | 5.6 (5.2, 6.0) |
| | ≥65 | 3345 | 108747 | 2.1 (2.0, 2.2) | 2.9 (2.7, 3.0) | 3.4 (3.3, 3.5) | 3.8 (3.7, 4.0) | 4.3 (4.2, 4.5) | 4.9 (4.6, 5.2) |
| TOTAL | | 9872 | 363901 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT17 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by ASA and Age (Primary Diagnosis OA)**




HR - adjusted for age and gender

ASA 1-2 <65 vs ASA 1-2 ≥65 years
Entire Period: HR=0.91 (95% CI 0.85, 0.99), p=0.018

ASA 1-2 <65 vs ASA 3-5 <65
0 - 2Wk: HR=0.52 (95% CI 0.43, 0.62), p<0.001
2Wk - 1Mth: HR=0.41 (95% CI 0.35, 0.49), p<0.001
1Mth - 3Mth: HR=0.51 (95% CI 0.43, 0.60), p<0.001
3Mth - 6Mth: HR=0.52 (95% CI 0.43, 0.63), p<0.001
6Mth - 9Mth: HR=0.56 (95% CI 0.44, 0.70), p<0.001
9Mth - 8.5Yr: HR=0.74 (95% CI 0.67, 0.81), p<0.001
8.5Yr+: HR=0.79 (95% CI 0.55, 1.15), p=0.220

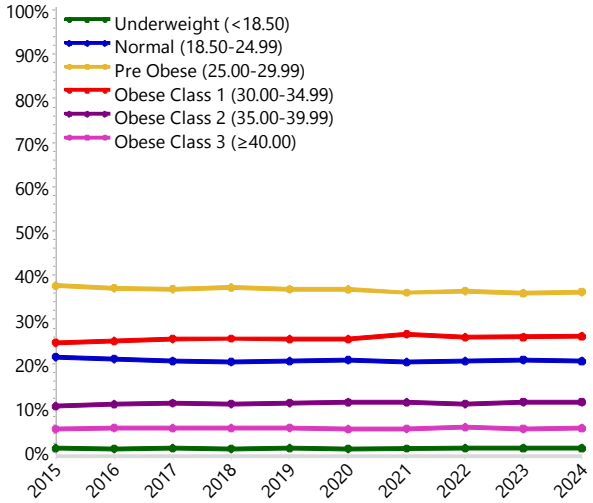
ASA 1-2 ≥65 years vs ASA 3-5 ≥65 years
0 - 2Wk: HR=0.68 (95% CI 0.59, 0.78), p<0.001
2Wk - 1Mth: HR=0.51 (95% CI 0.46, 0.57), p<0.001
1Mth - 3Mth: HR=0.59 (95% CI 0.53, 0.65), p<0.001
3Mth - 2.5Yr: HR=0.71 (95% CI 0.65, 0.77), p<0.001
2.5Yr+: HR=0.86 (95% CI 0.78, 0.94), p=0.001

ASA 3-5 <65 vs ASA 3-5 ≥65 years
0 - 2Wk: HR=1.21 (95% CI 1.02, 1.45), p=0.031
2Wk - 1Mth: HR=0.99 (95% CI 0.85, 1.15), p=0.882
1Mth - 3Mth: HR=1.00 (95% CI 0.86, 1.18), p=0.959
3Mth+: HR=1.06 (95% CI 0.95, 1.18), p=0.283

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|---|
| ASA 1-2 | <65 | 92705 | 81914 | 62554 | 45484 | 29834 | 15071 | 3208 |
| | ≥65 | 130142 | 113733 | 85747 | 60801 | 37807 | 18099 | 3631 |
| ASA 3-5 | <65 | 32307 | 27131 | 19255 | 13140 | 7902 | 3696 | 710 |
| | ≥65 | 108747 | 90957 | 62342 | 39938 | 21856 | 9211 | 1612 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT18 Primary Total Conventional Hip Replacement by BMI Category (Primary Diagnosis OA)**




Note: BMI has not been presented for patients aged ≤19 years

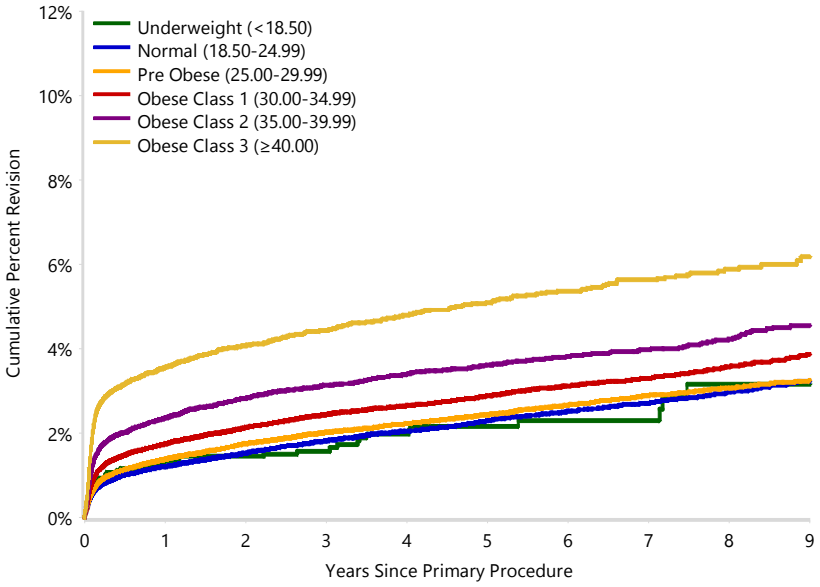
# Primary Total Hip Replacement

**Table HT22 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by BMI Category (Primary Diagnosis OA)**

| BMI Category | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Underweight | 46 | 2376 | 1.3 (0.9, 1.9) | 1.4 (1.0, 2.0) | 1.6 (1.1, 2.2) | 2.0 (1.4, 2.7) | 2.2 (1.6, 3.0) | 2.3 (1.7, 3.2) | 3.2 (2.2, 4.6) |
| Normal | 1353 | 66122 | 1.2 (1.1, 1.3) | 1.5 (1.4, 1.6) | 1.8 (1.7, 1.9) | 2.1 (1.9, 2.2) | 2.3 (2.2, 2.4) | 2.7 (2.6, 2.9) | 3.2 (3.0, 3.5) |
| Pre Obese | 2589 | 117221 | 1.4 (1.3, 1.5) | 1.8 (1.7, 1.8) | 2.0 (1.9, 2.1) | 2.2 (2.1, 2.3) | 2.4 (2.3, 2.5) | 2.9 (2.8, 3.0) | 3.3 (3.1, 3.4) |
| Obese Class 1 | 2170 | 82450 | 1.7 (1.7, 1.8) | 2.1 (2.0, 2.2) | 2.4 (2.3, 2.6) | 2.7 (2.5, 2.8) | 2.9 (2.8, 3.0) | 3.3 (3.2, 3.5) | 3.9 (3.7, 4.1) |
| Obese Class 2 | 1168 | 35311 | 2.4 (2.2, 2.5) | 2.8 (2.7, 3.0) | 3.1 (3.0, 3.3) | 3.4 (3.2, 3.6) | 3.6 (3.4, 3.8) | 4.0 (3.7, 4.2) | 4.6 (4.2, 4.9) |
| Obese Class 3 | 801 | 17026 | 3.6 (3.3, 3.8) | 4.1 (3.8, 4.4) | 4.4 (4.1, 4.8) | 4.8 (4.5, 5.2) | 5.1 (4.7, 5.5) | 5.6 (5.2, 6.1) | 6.2 (5.7, 6.7) |
| TOTAL | 8127 | 320506 | | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years

**Figure HT19 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by BMI Category (Primary Diagnosis OA)**




HR - adjusted for age and gender

Underweight (<18.50) vs Normal (18.50-24.99)
Entire Period: HR=0.99 (95% CI 0.74, 1.32), p=0.929

Pre Obese (25.00-29.99) vs Normal (18.50-24.99)
Entire Period: HR=1.06 (95% CI 0.99, 1.13), p=0.082

Obese Class 1 (30.00-34.99) vs Normal (18.50-24.99)
0 - 3Mth: HR=1.45 (95% CI 1.32, 1.58), p<0.001
3Mth+: HR=1.16 (95% CI 1.06, 1.26), p<0.001

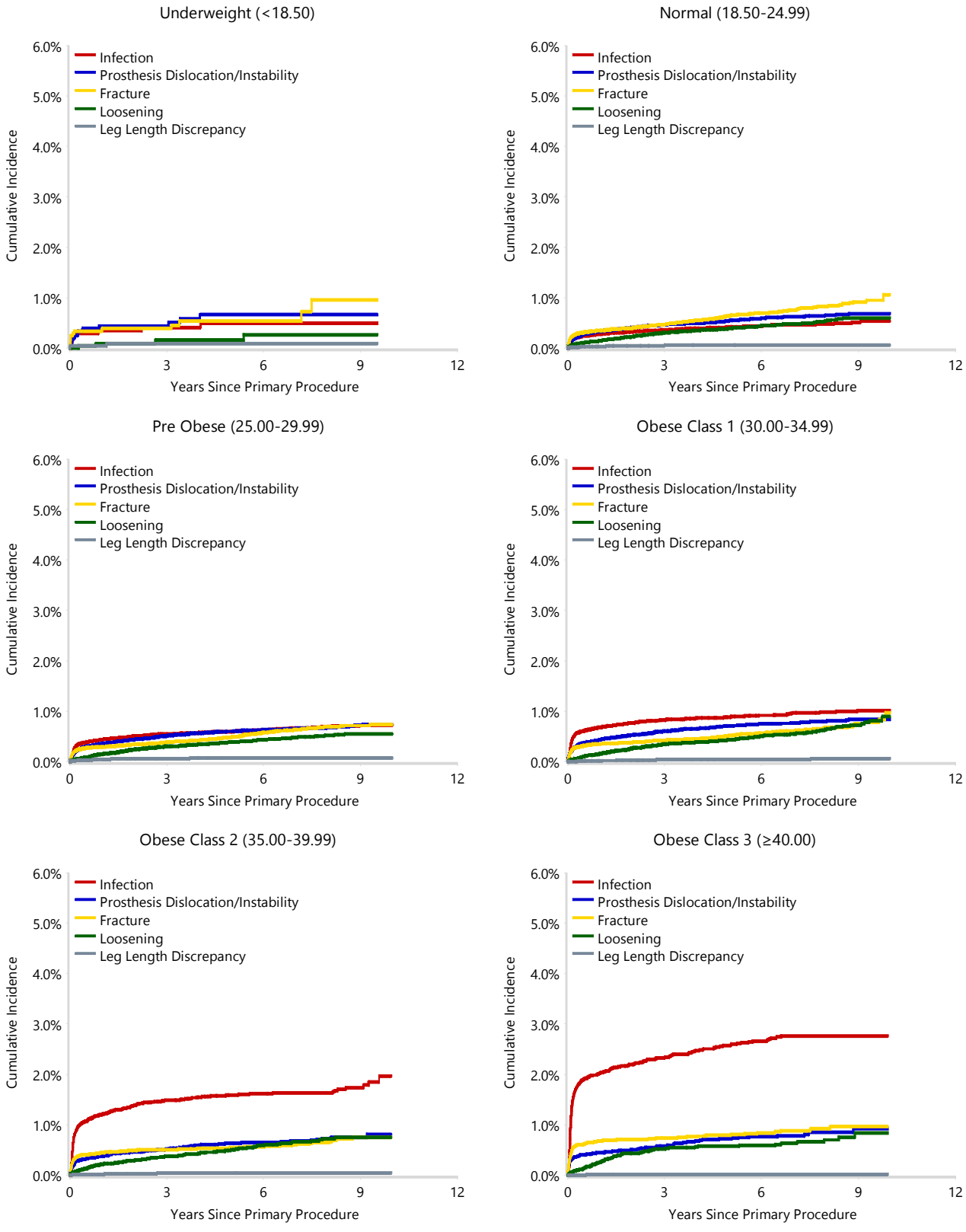
Obese Class 2 (35.00-39.99) vs Normal (18.50-24.99)
0 - 3Mth: HR=2.07 (95% CI 1.87, 2.30), p<0.001
3Mth - 6Mth: HR=1.28 (95% CI 1.01, 1.63), p=0.043
6Mth - 1.5Yr: HR=1.56 (95% CI 1.33, 1.84), p<0.001
1.5Yr+: HR=1.19 (95% CI 1.04, 1.36), p=0.013

Obese Class 3 (≥40.00) vs Normal (18.50-24.99)
0 - 3Mth: HR=3.36 (95% CI 3.01, 3.76), p<0.001
3Mth - 6Mth: HR=1.76 (95% CI 1.32, 2.35), p<0.001
6Mth - 1.5Yr: HR=1.81 (95% CI 1.47, 2.23), p<0.001
1.5Yr+: HR=1.47 (95% CI 1.25, 1.74), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|
| Underweight | 2376 | 1992 | 1642 | 1306 | 1033 | 805 | 401 | 99 |
| Normal | 66122 | 56278 | 47061 | 39131 | 31571 | 24981 | 12980 | 3564 |
| Pre Obese | 117221 | 99858 | 84098 | 70295 | 57118 | 45559 | 23812 | 6520 |
| Obese Class 1 | 82450 | 69833 | 58594 | 48805 | 39144 | 31138 | 16168 | 4325 |
| Obese Class 2 | 35311 | 29691 | 24804 | 20742 | 16728 | 13257 | 6882 | 1784 |
| Obese Class 3 | 17026 | 14181 | 11947 | 9888 | 8028 | 6460 | 3334 | 906 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years

**Figure HT20 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement by BMI Category (Primary Diagnosis OA)**




Note: All procedures using metal/metal prostheses have been excluded. Restricted to modern prostheses. BMI has not been presented for patients aged ≤19 years

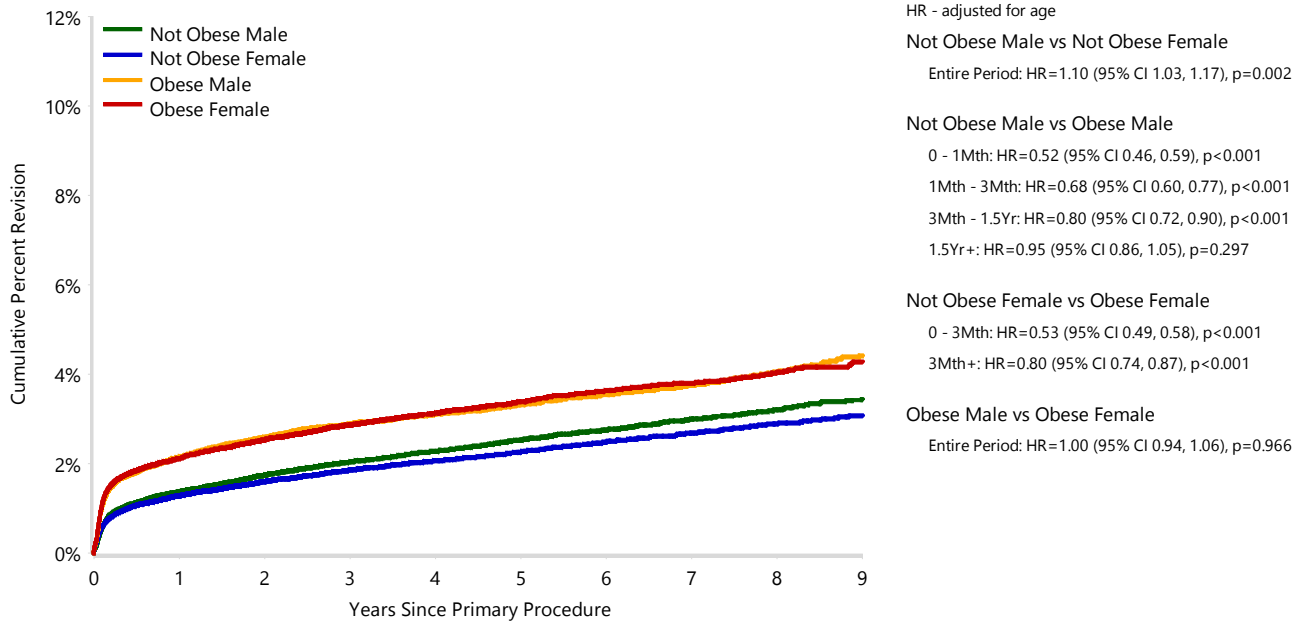
# Primary Total Hip Replacement

**Table HT23 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by BMI Category and Gender (Primary Diagnosis OA)**

| BMI Category | Gender | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|
| Not Obese | Male | 1907 | 84070 | 1.4 (1.3, 1.5) | 2.0 (1.9, 2.1) | 2.5 (2.4, 2.7) | 3.0 (2.8, 3.1) | 3.4 (3.3, 3.6) |
| | Female | 2083 | 101695 | 1.3 (1.2, 1.4) | 1.9 (1.8, 2.0) | 2.3 (2.2, 2.4) | 2.7 (2.6, 2.8) | 3.1 (2.9, 3.2) |
| Obese | Male | 1977 | 64435 | 2.2 (2.0, 2.3) | 2.9 (2.8, 3.0) | 3.3 (3.2, 3.5) | 3.7 (3.6, 3.9) | 4.4 (4.2, 4.7) |
| | Female | 2164 | 70372 | 2.1 (2.0, 2.2) | 2.9 (2.7, 3.0) | 3.4 (3.2, 3.5) | 3.8 (3.6, 4.0) | 4.3 (4.1, 4.5) |
| TOTAL | | 8131 | 320572 | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years

**Figure HT21 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by BMI Category and Gender (Primary Diagnosis OA)**




HR - adjusted for age

Not Obese Male vs Not Obese Female

Entire Period: HR=1.10 (95% CI 1.03, 1.17), p=0.002

Not Obese Male vs Obese Male

0 - 1Mth: HR=0.52 (95% CI 0.46, 0.59), p<0.001

1Mth - 3Mth: HR=0.68 (95% CI 0.60, 0.77), p<0.001

3Mth - 1.5Yr: HR=0.80 (95% CI 0.72, 0.90), p<0.001

1.5Yr+: HR=0.95 (95% CI 0.86, 1.05), p=0.297

Not Obese Female vs Obese Female

0 - 3Mth: HR=0.53 (95% CI 0.49, 0.58), p<0.001

3Mth+: HR=0.80 (95% CI 0.74, 0.87), p<0.001

Obese Male vs Obese Female

Entire Period: HR=1.00 (95% CI 0.94, 1.06), p=0.966

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|---|
| Not Obese | Male | 84070 | 71835 | 50429 | 32465 | 17024 | 4662 | 1 |
| | Female | 101695 | 86327 | 60327 | 38892 | 20176 | 5523 | 3 |
| Obese | Male | 64435 | 54355 | 37890 | 24182 | 12459 | 3318 | 1 |
| | Female | 70372 | 59363 | 41555 | 26676 | 13927 | 3698 | 4 |

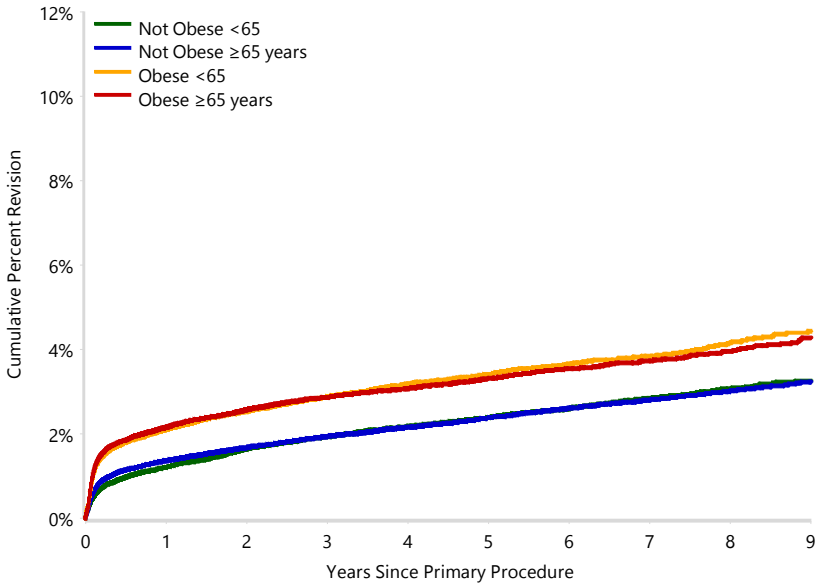
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years

**Table HT24 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by BMI Category and Age (Primary Diagnosis OA)**

| BMI Category | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|
| Not Obese | <65 | 1249 | 56937 | 1.2 (1.1, 1.3) | 1.9 (1.8, 2.1) | 2.4 (2.2, 2.5) | 2.9 (2.7, 3.0) | 3.2 (3.0, 3.5) |
| | ≥65 | 2741 | 128828 | 1.4 (1.3, 1.4) | 1.9 (1.9, 2.0) | 2.4 (2.3, 2.5) | 2.8 (2.7, 2.9) | 3.2 (3.1, 3.4) |
| Obese | <65 | 1678 | 53349 | 2.1 (2.0, 2.2) | 2.9 (2.7, 3.0) | 3.4 (3.2, 3.6) | 3.8 (3.7, 4.0) | 4.4 (4.2, 4.7) |
| | ≥65 | 2463 | 81458 | 2.2 (2.1, 2.3) | 2.9 (2.8, 3.0) | 3.3 (3.2, 3.5) | 3.7 (3.6, 3.9) | 4.3 (4.1, 4.5) |
| TOTAL | | 8131 | 320572 | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years

**Figure HT22 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by BMI Category and Age (Primary Diagnosis OA)**




HR - adjusted for age and gender

Not Obese <65 vs Not Obese ≥65 years
Entire Period: HR=0.98 (95% CI 0.89, 1.07), p=0.608

Not Obese <65 vs Obese <65
0 - 2Wk: HR=0.62 (95% CI 0.51, 0.76), p<0.001
2Wk - 1Mth: HR=0.39 (95% CI 0.33, 0.47), p<0.001
1Mth - 3Mth: HR=0.51 (95% CI 0.43, 0.59), p<0.001
3Mth+: HR=0.89 (95% CI 0.81, 0.97), p=0.007

Not Obese ≥65 years vs Obese ≥65 years
0 - 2Wk: HR=0.68 (95% CI 0.58, 0.79), p<0.001
2Wk - 1Mth: HR=0.47 (95% CI 0.42, 0.53), p<0.001
1Mth - 3Mth: HR=0.57 (95% CI 0.51, 0.64), p<0.001
3Mth+: HR=0.87 (95% CI 0.81, 0.93), p<0.001

Obese <65 vs Obese ≥65 years
Entire Period: HR=1.00 (95% CI 0.92, 1.09), p=0.964

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|---|
| Not Obese | <65 | 56937 | 49289 | 35595 | 23898 | 13216 | 3849 | 2 |
| | ≥65 | 128828 | 108873 | 75161 | 47459 | 23984 | 6336 | 2 |
| Obese | <65 | 53349 | 45409 | 32298 | 21244 | 11685 | 3274 | 2 |
| | ≥65 | 81458 | 68309 | 47147 | 29614 | 14701 | 3742 | 3 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years

## OUTCOME FOR OSTEOARTHRITIS – PROSTHESIS CHARACTERISTICS

### Fixation

The analysis of prosthesis fixation was performed for prosthesis combinations using only modern bearing surfaces with recorded use in 2024. These bearing surfaces include mixed ceramic/mixed ceramic and all femoral head materials used in conjunction with cross-linked polyethylene (XLPE). A small proportion of THR procedures in 2024 use other bearing surface combinations (2.8%), however, these have been excluded from further analysis.

There is no difference in the rate of revision for cemented compared to hybrid fixation. Cementless fixation has a higher rate of revision than hybrid fixation for the first month, no difference at 1-9 months and a higher rate of revision from 9 months to 3 years. From 3 years to 6.5 years, cementless fixation has a lower rate of revision compared to hybrid fixation, and after this time, cementless fixation has a higher rate of revision. Cementless fixation has a higher rate of revision than cemented fixation for the first month and after this time there is no difference (Table HT25 and Figure HT25).

**The outcome with respect to fixation varies with age.**

For patients aged <55 years, cemented fixation showed no difference when the rate of revision is compared to cementless and hybrid fixation. For patients aged 55–64 years there is a higher rate of revision in the first month for cementless fixation compared to hybrid fixation and after this time cementless fixation has a lower rate of revision. Cementless fixation has a higher rate of revision compared to hybrid fixation in the first 3 months for patients aged 65–74 years. After this time, there is no difference. Cementless fixation has a higher rate of revision for patients aged ≥75 years compared to hybrid and cemented fixation for all time periods. There is no difference between cemented and hybrid fixation for patients aged ≥75 years (Table HT26 to Figure HT29).

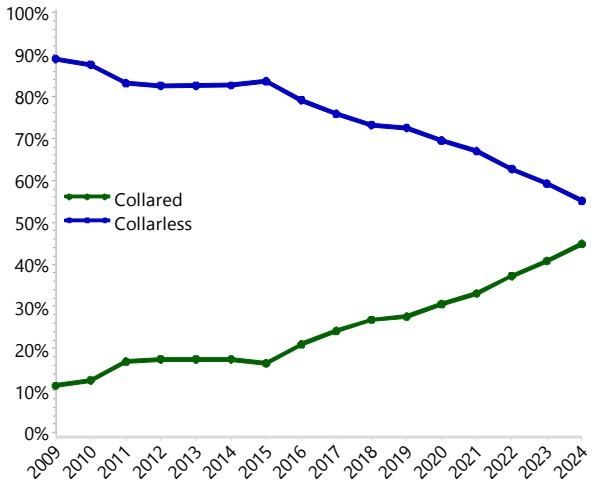
### Collared and Collarless Cementless Stems

Some cementless femoral stems offer a choice of components with and without a collar. There has been a steady increase in the use of collared cementless stems since 2015, with many prostheses having a short follow-up. Collared stems make up 26.8% of modern cementless stems, the majority of which are tapered wedge designs (Figure HT23). A comparison of collared stems has been made to all others without a collar. The cumulative percent revision at 15 years is 4.8% for collared stems and 6.1% for collarless stems. Collarless stems have a higher rate of revision compared to collared stems (Table HT27 and Figure HT30). Collarless stems have a higher rate of revision for fracture and loosening (Figure HT31). The types of revision are presented in Table HT28.

An additional analysis was undertaken to determine the effect of surgical approach on the outcome for collared versus collarless stems. For the lateral and posterior approaches, collarless stems have a higher rate of revision for the first 3 months, with no difference after this time (Table HT29, Figure HT32, Table HT30 and Figure HT33). For the anterior approach, collarless stems have a higher rate of revision for the entire period (Table HT31 and Figure HT34).

The outcome of cementless femoral components with and without collar use are listed in Table HT32 and Table HT33.

**Figure HT23 Primary Total Conventional Hip Replacement with Cementless Stems by Collar Use (Primary Diagnosis OA)**



**Mini Stems**

A mini stem is a short cementless femoral stem where fixation is designed to be entirely metaphyseal. These stems may enable femoral neck sparing. Mini stems were first used in 2009 and there have been 12,511 procedures using a mini stem prosthesis undertaken for osteoarthritis. This represents 2.6% of all primary total conventional hip procedures. There are 1,869 procedures recorded in 2024 using a mini stem prosthesis. This is an increase of 17.4% compared to 2023. The annual use of mini stems is shown in Figure HT24.

The 9 year cumulative percent revision for primary total conventional hip replacement using a mini stem is 2.8% compared to 4.0% for other cementless femoral stems. Mini stems have a reduced rate of revision from 2 years onwards, with no difference before this time point (Table HT34 and Figure HT35).

Patients aged <65 years have a lower rate of revision in the first month only compared to patients aged ≥65 years when a mini stem is used. From 1.5 years onwards, patients aged ≥65 years with a mini stem have a lower rate of revision compared to patients aged ≥65 years with other cementless femoral stems (Table HT35 and Figure HT36).

Obesity is a risk factor for revision when a mini stem is used (Table HT36 and Figure HT37).

The reasons for revision and type of revision are shown in Figure HT38 and Table HT37. Mini stems have an initial higher rate of revision for loosening compared with other cementless femoral stems. From 1 year onwards there is a lower rate of revision for loosening compared to other cementless femoral stems (Table HT38 and Figure HT39). Similarly, mini stems have an initial higher rate of revision for fracture (in the first 3 months) compared to other cementless femoral stems, but from 3 months onwards, mini stems have a lower rate of revision for fracture than other cementless femoral stems (Table HT28 and Figure HT40).

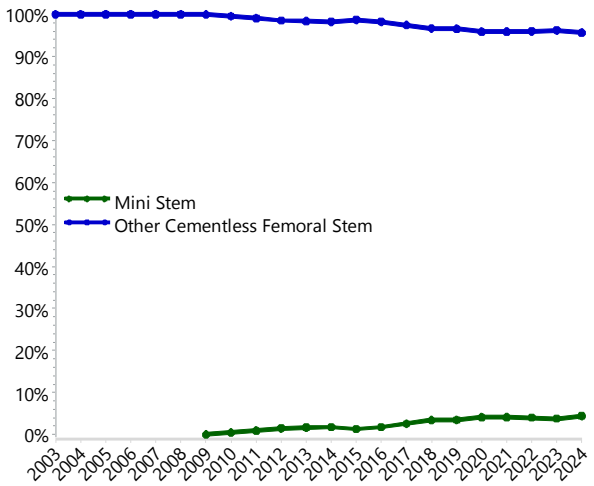
There were 6 different mini stem prostheses used in 2024. Rates of revision vary depending on the type of prosthesis used (Table HT40).

**Femoral Stems with Exchangeable Necks**

A femoral stem with an exchangeable neck has a separate neck that connects proximally to the stem. There were 10 procedures reported in 2024. Due to the very small utilisation of these prostheses, the analyses have been removed from the Annual Report and appear in the Supplementary Report 'Prostheses with No or Minimal Use'.

Detailed information on femoral stems with exchangeable neck is available in the supplementary report 'Prosthesis Types with No or Minimal Use' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2025

**Figure HT24 Cementless Primary Total Conventional Hip Replacement by Stem Type (Primary Diagnosis OA)**



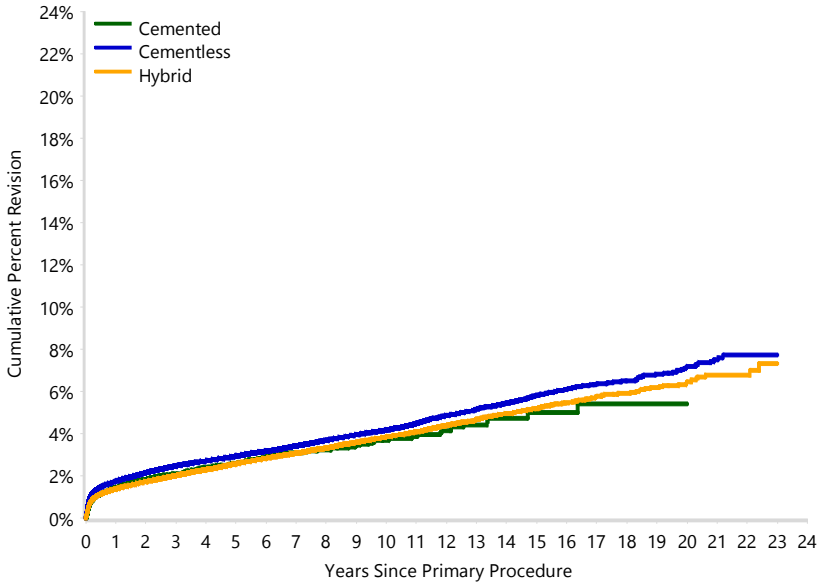
# Primary Total Hip Replacement

**Table HT25 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis OA)**

| Fixation | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cemented | 260 | 8545 | 1.5 (1.2, 1.7) | 2.1 (1.8, 2.4) | 2.6 (2.3, 3.0) | 3.7 (3.3, 4.2) | 5.0 (4.1, 6.1) | 5.4 (4.3, 6.8) |
| Cementless | 8856 | 273589 | 1.8 (1.7, 1.8) | 2.5 (2.4, 2.5) | 2.9 (2.9, 3.0) | 4.2 (4.1, 4.3) | 5.8 (5.6, 6.0) | 7.2 (6.8, 7.6) |
| Hybrid | 5046 | 169440 | 1.4 (1.3, 1.4) | 2.0 (2.0, 2.1) | 2.6 (2.5, 2.7) | 3.9 (3.7, 4.0) | 5.2 (5.0, 5.4) | 6.5 (6.1, 6.8) |
| TOTAL | 14162 | 451574 | | | | | | |

Note: Includes mixed ceramic/mixed ceramic and cross-linked polyethylene (XLPE) bearing surfaces
Restricted to modern prostheses

**Figure HT25 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis OA)**




HR - adjusted for age and gender

Cemented vs Hybrid

Entire Period: HR=0.99 (95% CI 0.87, 1.12), p=0.885

Cementless vs Cemented

0 - 2Wk: HR=1.96 (95% CI 1.64, 2.35), p<0.001
2Wk - 1Mth: HR=1.31 (95% CI 1.12, 1.52), p<0.001
1Mth+: HR=1.05 (95% CI 0.92, 1.19), p=0.466

Cementless vs Hybrid

0 - 2Wk: HR=1.95 (95% CI 1.70, 2.23), p<0.001
2Wk - 1Mth: HR=1.30 (95% CI 1.17, 1.43), p<0.001
1Mth - 3Mth: HR=1.08 (95% CI 0.99, 1.18), p=0.085
3Mth - 9Mth: HR=1.07 (95% CI 0.97, 1.19), p=0.186
9Mth - 3Yr: HR=1.12 (95% CI 1.04, 1.21), p=0.002
3Yr - 3.5Yr: HR=0.81 (95% CI 0.67, 0.98), p=0.029
3.5Yr - 6.5Yr: HR=0.86 (95% CI 0.78, 0.94), p=0.001
6.5Yr+: HR=1.09 (95% CI 1.00, 1.19), p=0.045

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Cemented | 8545 | 7927 | 6668 | 5402 | 2206 | 333 | 56 |
| Cementless | 273589 | 240571 | 186935 | 141857 | 52259 | 12842 | 1777 |
| Hybrid | 169440 | 151738 | 121007 | 93625 | 39049 | 11483 | 1775 |

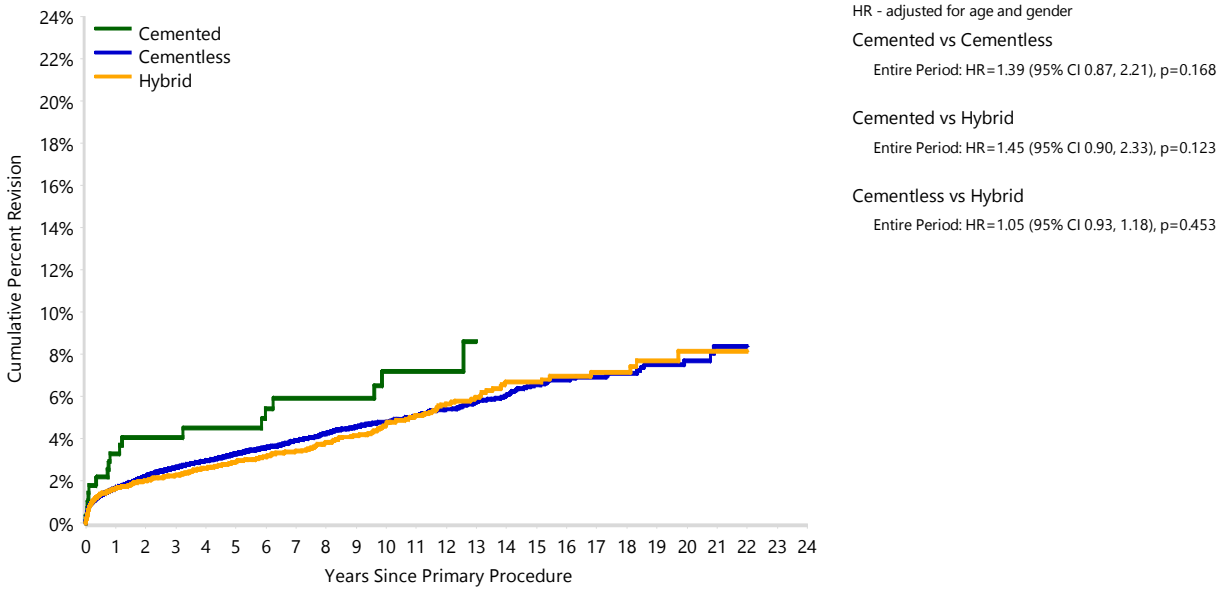
Note: Includes mixed ceramic/mixed ceramic and cross-linked polyethylene (XLPE) bearing surfaces
Restricted to modern prostheses

**Table HT26 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Age and Fixation (Primary Diagnosis OA)**

| Age | Fixation | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| **<55** | | **1706** | **45837** | **1.7 (1.6, 1.8)** | **2.6 (2.4, 2.7)** | **3.2 (3.0, 3.4)** | **4.8 (4.5, 5.0)** | **6.6 (6.2, 7.0)** | **7.8 (7.1, 8.6)** |
| | Cemented | 18 | 279 | 3.3 (1.7, 6.3) | 4.1 (2.3, 7.2) | 4.5 (2.6, 7.8) | 7.2 (4.5, 11.4) | | |
| | Cementless | 1358 | 36740 | 1.7 (1.5, 1.8) | 2.6 (2.5, 2.8) | 3.3 (3.1, 3.5) | 4.8 (4.5, 5.1) | 6.5 (6.1, 7.0) | 7.7 (6.9, 8.6) |
| | Hybrid | 330 | 8818 | 1.6 (1.4, 1.9) | 2.3 (2.0, 2.6) | 2.9 (2.5, 3.3) | 4.7 (4.1, 5.3) | 6.7 (5.8, 7.6) | 8.1 (6.7, 9.8) |
| **55-64** | | **3414** | **104903** | **1.6 (1.5, 1.7)** | **2.3 (2.2, 2.4)** | **2.8 (2.7, 2.9)** | **4.1 (3.9, 4.2)** | **5.5 (5.3, 5.8)** | **7.0 (6.6, 7.5)** |
| | Cemented | 32 | 848 | 1.8 (1.1, 3.0) | 2.6 (1.7, 3.9) | 3.0 (2.0, 4.4) | 3.7 (2.5, 5.3) | 4.8 (3.2, 7.0) | |
| | Cementless | 2398 | 77513 | 1.6 (1.5, 1.7) | 2.3 (2.2, 2.4) | 2.7 (2.6, 2.9) | 3.9 (3.7, 4.1) | 5.3 (5.0, 5.6) | 6.6 (6.0, 7.2) |
| | Hybrid | 984 | 26542 | 1.5 (1.4, 1.7) | 2.2 (2.0, 2.4) | 2.8 (2.6, 3.1) | 4.5 (4.2, 4.8) | 6.1 (5.7, 6.6) | 7.9 (7.1, 8.7) |
| **65-74** | | **4968** | **162806** | **1.5 (1.5, 1.6)** | **2.2 (2.1, 2.3)** | **2.7 (2.6, 2.8)** | **3.9 (3.8, 4.0)** | **5.4 (5.1, 5.6)** | **6.6 (6.2, 7.1)** |
| | Cemented | 90 | 2516 | 1.5 (1.1, 2.1) | 2.2 (1.7, 2.8) | 2.7 (2.1, 3.4) | 4.2 (3.3, 5.2) | 5.5 (4.2, 7.2) | |
| | Cementless | 3098 | 100932 | 1.7 (1.6, 1.8) | 2.3 (2.3, 2.4) | 2.8 (2.7, 2.9) | 3.9 (3.8, 4.1) | 5.6 (5.3, 5.9) | 7.1 (6.4, 7.9) |
| | Hybrid | 1780 | 59358 | 1.2 (1.1, 1.3) | 1.9 (1.8, 2.0) | 2.5 (2.3, 2.6) | 3.7 (3.5, 3.9) | 5.1 (4.8, 5.4) | 6.2 (5.6, 6.7) |
| **≥75** | | **4074** | **138028** | **1.7 (1.6, 1.8)** | **2.3 (2.3, 2.4)** | **2.8 (2.7, 2.9)** | **4.0 (3.8, 4.1)** | **5.4 (5.1, 5.7)** | **6.0 (5.6, 6.5)** |
| | Cemented | 120 | 4902 | 1.2 (1.0, 1.6) | 1.9 (1.5, 2.3) | 2.4 (2.0, 2.9) | 3.2 (2.6, 3.8) | 4.6 (2.8, 7.6) | |
| | Cementless | 2002 | 58404 | 2.1 (2.0, 2.3) | 2.8 (2.7, 2.9) | 3.3 (3.1, 3.4) | 4.6 (4.4, 4.8) | 6.9 (6.3, 7.5) | 7.6 (6.7, 8.6) |
| | Hybrid | 1952 | 74722 | 1.4 (1.3, 1.5) | 2.0 (1.9, 2.1) | 2.5 (2.4, 2.7) | 3.6 (3.4, 3.8) | 4.5 (4.2, 4.8) | 5.1 (4.6, 5.6) |
| TOTAL | | **14162** | **451574** | | | | | | |

Note: Includes mixed ceramic/mixed ceramic and cross-linked polyethylene (XLPE) bearing surfaces. Restricted to modern prostheses

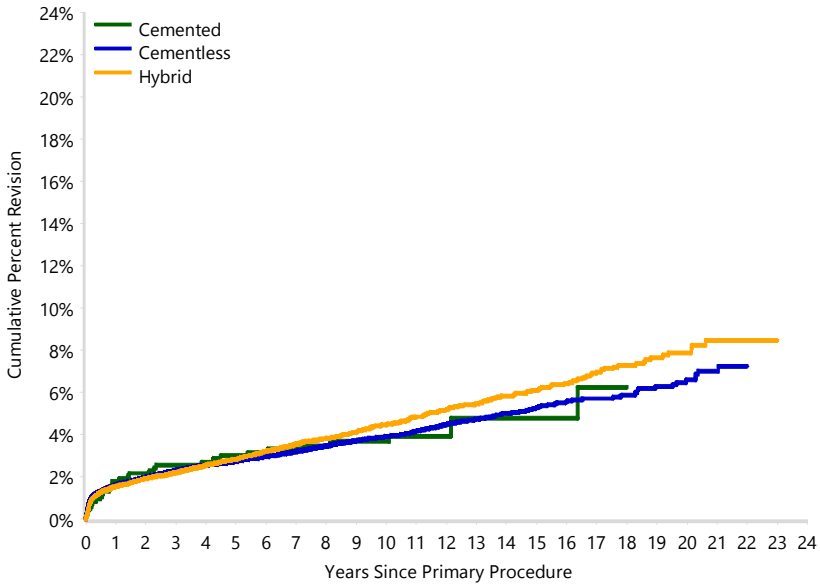
**Figure HT26 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years by Fixation (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| **Cemented** | 279 | 254 | 232 | 217 | 141 | 20 | 5 |
| **Cementless** | 36740 | 32636 | 25674 | 20024 | 8095 | 2171 | 419 |
| **Hybrid** | 8818 | 7958 | 6574 | 5275 | 2319 | 734 | 200 |

Note: Includes mixed ceramic/mixed ceramic and cross-linked polyethylene (XLPE) bearing surfaces. Restricted to modern prostheses

**Figure HT27 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged 55–64 Years by Fixation (Primary Diagnosis OA)**




HR - adjusted for age and gender

Cemented vs Cementless

Entire Period: HR=0.99 (95% CI 0.70, 1.41), p=0.960

Cemented vs Hybrid

Entire Period: HR=0.88 (95% CI 0.62, 1.26), p=0.488

Cementless vs Hybrid

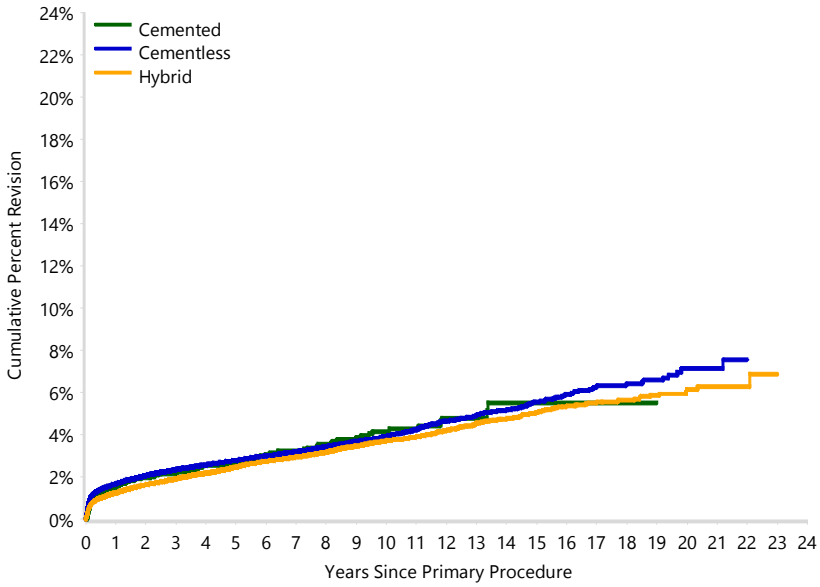
0 - 1Mth: HR=1.50 (95% CI 1.23, 1.83), p<0.001

1Mth+: HR=0.82 (95% CI 0.76, 0.89), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| **Cemented** | 848 | 806 | 711 | 656 | 401 | 83 | 17 |
| **Cementless** | 77513 | 68791 | 54243 | 41998 | 16909 | 4781 | 782 |
| **Hybrid** | 26542 | 24083 | 19796 | 15869 | 7685 | 2759 | 567 |

Note: Includes mixed ceramic/mixed ceramic and cross-linked polyethylene (XLPE) bearing surfaces
Restricted to modern prostheses

**Figure HT28 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged 65–74 Years by Fixation (Primary Diagnosis OA)**




HR - adjusted for age and gender

Cemented vs Hybrid

Entire Period: HR=1.12 (95% CI 0.90, 1.38), p=0.313

Cementless vs Cemented

Entire Period: HR=1.01 (95% CI 0.82, 1.24), p=0.958

Cementless vs Hybrid

0 - 2Wk: HR=2.23 (95% CI 1.75, 2.86), p<0.001

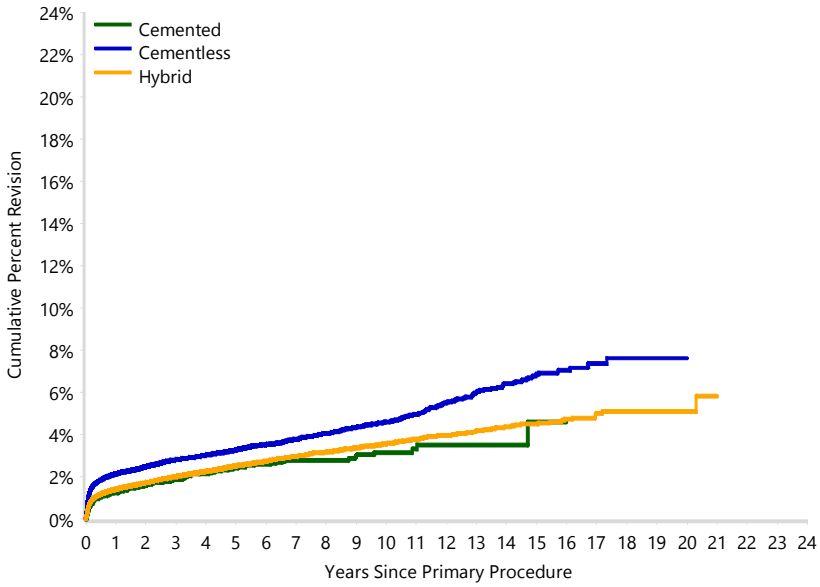
2Wk - 3Mth: HR=1.31 (95% CI 1.17, 1.47), p<0.001

3Mth+: HR=0.99 (95% CI 0.93, 1.07), p=0.889

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| **Cemented** | 2516 | 2386 | 2109 | 1792 | 861 | 153 | 28 |
| **Cementless** | 100932 | 88785 | 69168 | 52538 | 19307 | 4649 | 517 |
| **Hybrid** | 59358 | 53757 | 43990 | 35035 | 16419 | 5554 | 834 |

Note: Includes mixed ceramic/mixed ceramic and cross-linked polyethylene (XLPE) bearing surfaces
Restricted to modern prostheses

**Figure HT29 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged ≥75 Years by Fixation (Primary Diagnosis OA)**




HR - adjusted for age and gender

Cemented vs Hybrid

Entire Period: HR=0.92 (95% CI 0.76, 1.10), p=0.352

Cementless vs Cemented

0 - 2Wk: HR=2.58 (95% CI 1.96, 3.40), p<0.001

2Wk+: HR=1.39 (95% CI 1.15, 1.67), p<0.001

Cementless vs Hybrid

0 - 2Wk: HR=2.37 (95% CI 1.91, 2.93), p<0.001

2Wk - 1Mth: HR=1.58 (95% CI 1.35, 1.84), p<0.001

1Mth+: HR=1.21 (95% CI 1.13, 1.31), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| **Cemented** | 4902 | 4481 | 3616 | 2737 | 803 | 77 | 6 |
| **Cementless** | 58404 | 50359 | 37850 | 27297 | 7948 | 1241 | 59 |
| **Hybrid** | 74722 | 65940 | 50647 | 37446 | 12626 | 2436 | 174 |

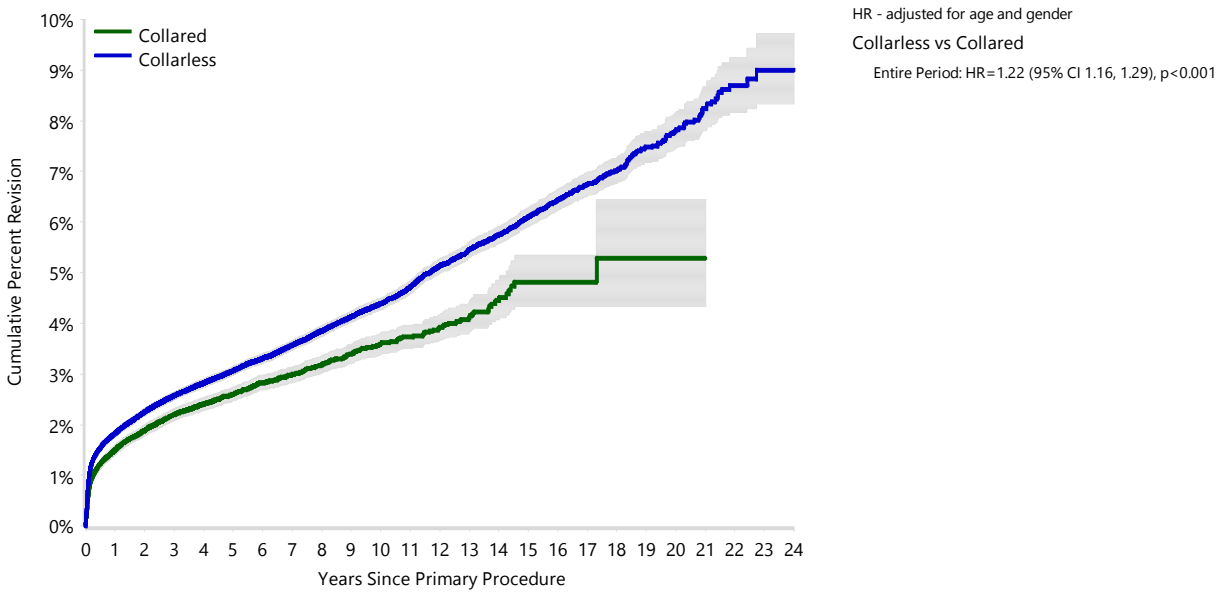
Note: Includes mixed ceramic/mixed ceramic and cross-linked polyethylene (XLPE) bearing surfaces
Restricted to modern prostheses

**Table HT27 Cumulative Percent Revision of Cementless Primary Total Conventional Hip Replacement by Stem Collar Use (Primary Diagnosis OA)**

| Stem Collar Use | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 9 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Collared | 1824 | 76852 | 1.5 (1.4, 1.6) | 2.2 (2.1, 2.3) | 2.6 (2.5, 2.7) | 3.4 (3.2, 3.6) | 4.8 (4.3, 5.3) | 5.3 (4.3, 6.4) |
| Collarless | 7740 | 210403 | 1.8 (1.8, 1.9) | 2.6 (2.5, 2.6) | 3.1 (3.0, 3.1) | 4.1 (4.0, 4.2) | 6.1 (5.9, 6.3) | 7.8 (7.5, 8.2) |
| TOTAL | 9564 | 287255 | | | | | | |

Note: Restricted to modern prostheses. All procedures using metal/metal prostheses have been excluded.

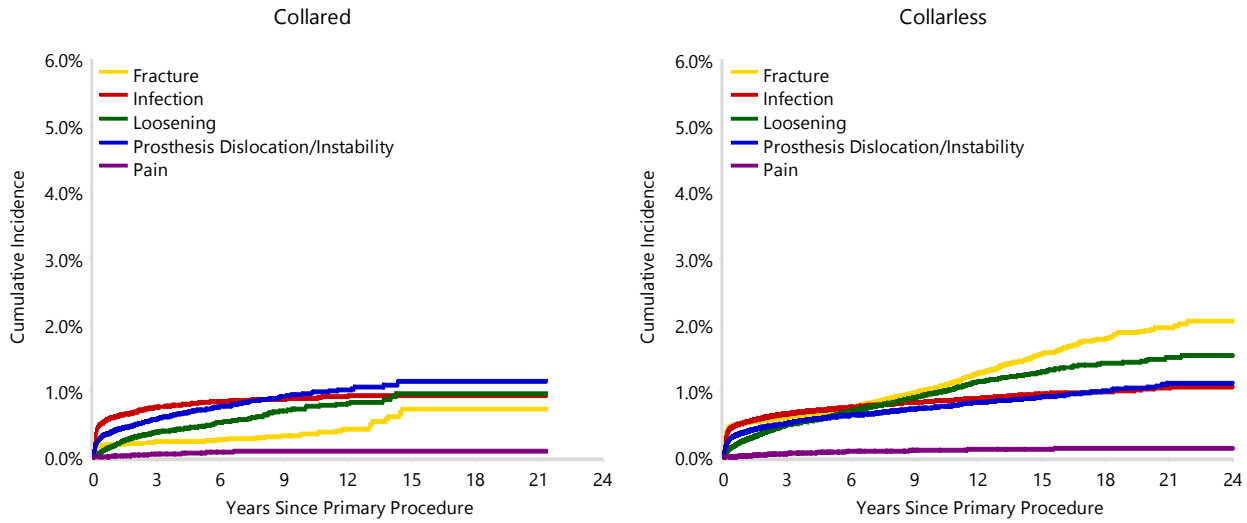
**Figure HT30 Cumulative Percent Revision of Cementless Primary Total Conventional Hip Replacement by Stem Collar Use (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 9 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Collared | 76852 | 62868 | 42157 | 27916 | 9543 | 900 | 88 |
| Collarless | 210403 | 190255 | 155722 | 123657 | 64678 | 16150 | 3220 |

Note: Restricted to modern prostheses

**Figure HT31 Cumulative Incidence Revision Diagnosis of Cementless Primary Total Conventional Hip Replacement by Stem Collar Use (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

**Table HT28 Cementless Primary Total Conventional Hip Replacement by Type of Revision and Stem Collar Use (Primary Diagnosis OA)**

| Type of Revision | Collared | | | Collarless | | |
|---|---|---|---|---|---|---|
| | Number | % Primaries Revised | % Revisions | Number | % Primaries Revised | % Revisions |
| Femoral Component | 429 | 0.6 | 23.5 | 3065 | 1.5 | 39.6 |
| Head/Insert | 703 | 0.9 | 38.5 | 1782 | 0.8 | 23.0 |
| Acetabular Component | 321 | 0.4 | 17.6 | 1335 | 0.6 | 17.2 |
| THR (Femoral/Acetabular) | 183 | 0.2 | 10.0 | 646 | 0.3 | 8.3 |
| Head Only | 79 | 0.1 | 4.3 | 443 | 0.2 | 5.7 |
| Cement Spacer | 57 | 0.1 | 3.1 | 243 | 0.1 | 3.1 |
| Minor Components | 19 | 0.0 | 1.0 | 126 | 0.1 | 1.6 |
| Insert Only | 21 | 0.0 | 1.2 | 59 | 0.0 | 0.8 |
| Removal of Prostheses | 7 | 0.0 | 0.4 | 25 | 0.0 | 0.3 |
| Reinsertion of Components | 2 | 0.0 | 0.1 | 9 | 0.0 | 0.1 |
| Bipolar Head and Femoral | 3 | 0.0 | 0.2 | 2 | 0.0 | 0.0 |
| Total Femoral | | | | 3 | 0.0 | 0.0 |
| Bipolar Only | | | | 1 | 0.0 | 0.0 |
| Head/Neck | | | | 1 | 0.0 | 0.0 |
| **N Revision** | **1824** | **2.4** | **100.0** | **7740** | **3.7** | **100.0** |
| **N Primary** | **76852** | | | **210403** | | |

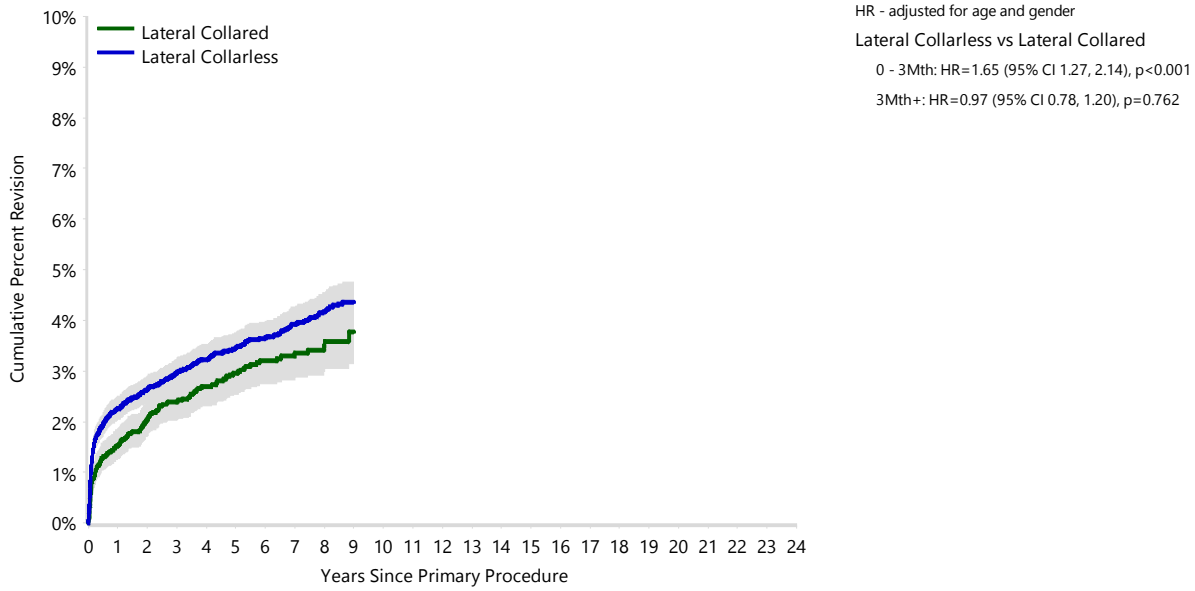
Note: Restricted to modern prostheses

**Table HT29 Cumulative Percent Revision of Cementless Primary Total Conventional Hip Replacement by Lateral Approach and Stem Collar Use (Primary Diagnosis OA)**

| Surgical Approach | Stem Collar Use | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|
| Lateral | Collared | 187 | 7000 | 1.5 (1.3, 1.9) | 2.4 (2.0, 2.8) | 3.0 (2.5, 3.4) | 3.3 (2.9, 3.9) | 3.5 (3.0, 4.1) |
| | Collarless | 584 | 16706 | 2.3 (2.0, 2.5) | 3.0 (2.7, 3.3) | 3.5 (3.2, 3.8) | 3.9 (3.6, 4.3) | 4.2 (3.8, 4.5) |
| TOTAL | | 771 | 23706 | | | | | |

Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded
Only procedures with a known surgical approach have been included

**Figure HT32 Cumulative Percent Revision of Cementless Primary Total Conventional Hip Replacement by Lateral Approach and Stem Collar Use (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|
| Lateral | Collared | 7000 | 6020 | 4383 | 3058 | 1732 | 1105 |
| | Collarless | 16706 | 15069 | 12168 | 9293 | 5967 | 4047 |

Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded
Only procedures with a known surgical approach have been included

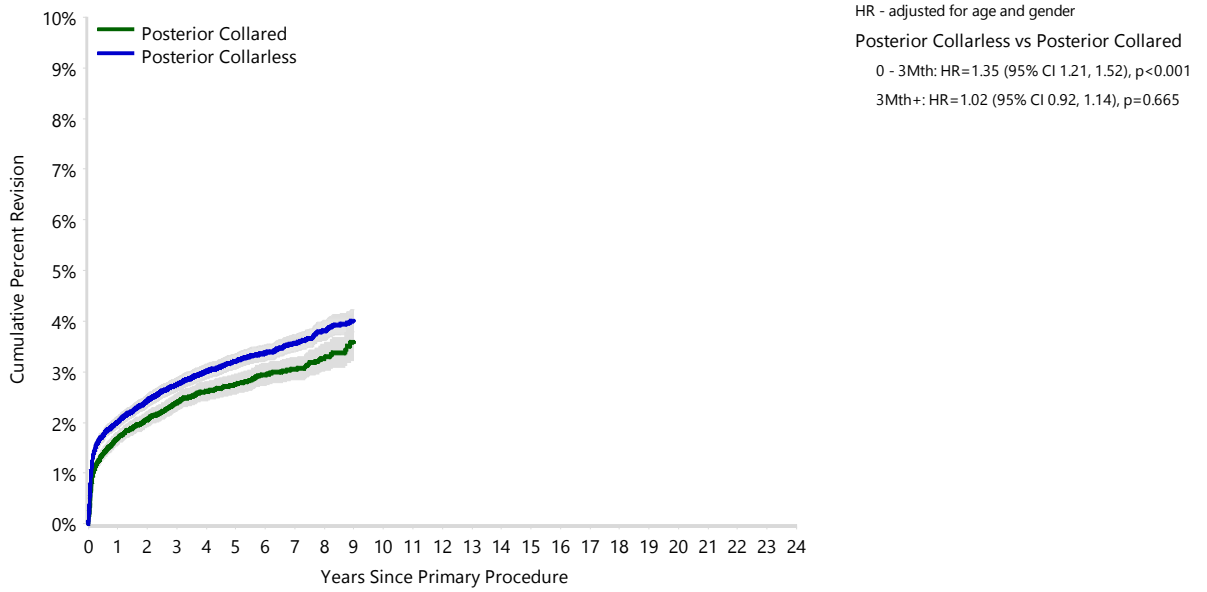
# Primary Total Hip Replacement

**Table HT30 Cumulative Percent Revision of Cementless Primary Total Conventional Hip Replacement by Posterior Approach and Stem Collar Use (Primary Diagnosis OA)**

| Surgical Approach | Stem Collar Use | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|
| Posterior | Collared | 888 | 37572 | 1.7 (1.6, 1.8) | 2.4 (2.2, 2.6) | 2.8 (2.6, 3.0) | 3.1 (2.8, 3.3) | 3.3 (3.0, 3.5) |
| | Collarless | 2003 | 68346 | 2.0 (1.9, 2.1) | 2.8 (2.6, 2.9) | 3.2 (3.1, 3.4) | 3.6 (3.4, 3.7) | 3.8 (3.6, 4.0) |
| TOTAL | | 2891 | 105918 | | | | | |

Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded
Only procedures with a known surgical approach have been included

**Figure HT33 Cumulative Percent Revision of Cementless Primary Total Conventional Hip Replacement by Posterior Approach and Stem Collar Use (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|
| Posterior | Collared | 37572 | 30380 | 19333 | 11412 | 5430 | 2953 |
| | Collarless | 68346 | 58284 | 40980 | 26408 | 14022 | 8504 |

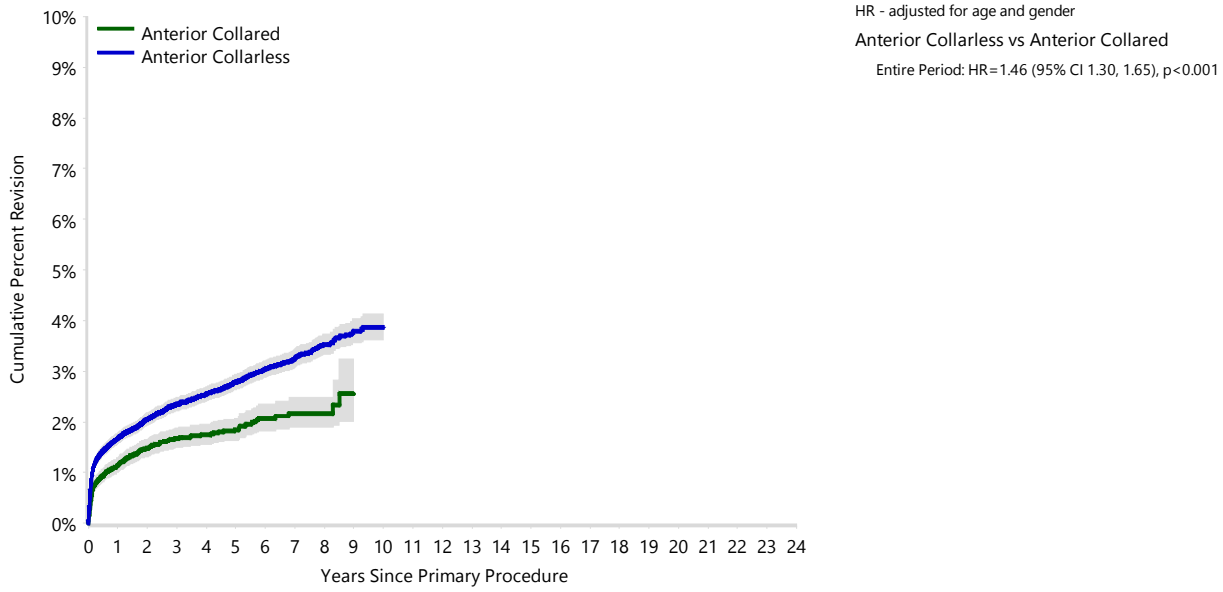
Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded
Only procedures with a known surgical approach have been included

**Table HT31 Cumulative Percent Revision of Cementless Primary Total Conventional Hip Replacement by Anterior Approach and Stem Collar Use (Primary Diagnosis OA)**

| Surgical Approach | Stem Collar Use | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|
| Anterior | Collared | 336 | 22294 | 1.1 (1.0, 1.3) | 1.7 (1.5, 1.9) | 1.8 (1.6, 2.1) | 2.2 (1.9, 2.5) | 2.2 (1.9, 2.5) |
| | Collarless | 1530 | 57046 | 1.7 (1.6, 1.8) | 2.3 (2.2, 2.5) | 2.8 (2.6, 2.9) | 3.2 (3.1, 3.4) | 3.5 (3.3, 3.7) |
| TOTAL | | 1866 | 79340 | | | | | |

Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded
Only procedures with a known surgical approach have been included

**Figure HT34 Cumulative Percent Revision of Cementless Primary Total Conventional Hip Replacement by Anterior Approach and Stem Collar Use (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|
| Anterior | Collared | 22294 | 16733 | 9029 | 4496 | 1640 | 757 |
| | Collarless | 57046 | 50238 | 37993 | 25824 | 14121 | 8852 |

Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded
Only procedures with a known surgical approach have been included

**Table HT32 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Cementless Femoral Component and Stem Collar Use (Primary Diagnosis OA)**

| Femoral Component | Stem Collar Use | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|---|
| AMIStem H | Collared | 45 | 2659 | 1.3 (1.0, 1.9) | 2.0 (1.5, 2.7) | 2.2 (1.6, 3.1) | | |
| | Collarless | 191 | 6814 | 1.5 (1.2, 1.8) | 2.0 (1.7, 2.4) | 2.9 (2.4, 3.3) | 3.6 (3.1, 4.2) | 3.7 (3.2, 4.3) |
| CORAIL | Collared | 1245 | 44536 | 1.5 (1.4, 1.6) | 2.3 (2.1, 2.4) | 2.7 (2.5, 2.9) | 3.1 (2.9, 3.3) | 3.3 (3.1, 3.5) |
| | Collarless | 1368 | 23769 | 1.7 (1.5, 1.9) | 2.6 (2.4, 2.8) | 3.3 (3.1, 3.5) | 4.0 (3.7, 4.2) | 4.4 (4.2, 4.7) |
| EVOK | Collared | 29 | 934 | 2.9 (2.0, 4.3) | 3.7 (2.5, 5.3) | | | |
| | Collarless | 40 | 1009 | 2.2 (1.5, 3.3) | 4.0 (2.9, 5.5) | 4.5 (3.3, 6.1) | 4.5 (3.3, 6.1) | 4.5 (3.3, 6.1) |
| HACTIV | Collared | 70 | 1495 | 3.0 (2.3, 4.1) | 4.3 (3.3, 5.5) | 4.8 (3.8, 6.2) | 6.8 (5.1, 9.1) | |
| | Collarless | 47 | 1338 | 2.2 (1.5, 3.1) | 2.8 (2.1, 3.9) | 3.2 (2.4, 4.4) | 3.5 (2.6, 4.7) | 3.9 (2.9, 5.2) |
| Metafix | Collared | 230 | 14325 | 1.2 (1.0, 1.4) | 1.8 (1.6, 2.1) | 2.0 (1.7, 2.3) | 2.1 (1.8, 2.5) | 2.1 (1.8, 2.5) |
| | Collarless | 237 | 7638 | 1.8 (1.6, 2.2) | 2.7 (2.3, 3.1) | 3.0 (2.6, 3.4) | 3.5 (3.0, 4.0) | 3.8 (3.3, 4.3) |
| Origin | Collared | 35 | 1899 | 1.8 (1.2, 2.5) | 2.2 (1.5, 3.2) | | | |
| | Collarless | 122 | 2947 | 2.6 (2.1, 3.2) | 3.5 (2.9, 4.3) | 4.2 (3.5, 5.0) | 4.7 (3.9, 5.6) | 5.4 (4.4, 6.6) |
| Paragon | Collared | 47 | 3271 | 1.3 (1.0, 1.8) | 1.6 (1.2, 2.3) | | | |
| | Collarless | 77 | 3695 | 1.7 (1.4, 2.2) | 2.1 (1.7, 2.6) | 2.1 (1.7, 2.6) | 2.5 (1.7, 3.7) | 2.5 (1.7, 3.7) |
| Polarstem | Collared | 47 | 2851 | 1.6 (1.2, 2.2) | 2.0 (1.5, 2.7) | 2.0 (1.5, 2.7) | | |
| | Collarless | 585 | 21905 | 1.8 (1.6, 2.0) | 2.2 (2.0, 2.4) | 2.6 (2.4, 2.8) | 2.9 (2.6, 3.1) | 3.0 (2.8, 3.3) |
| Quadra-P | Collared | 12 | 839 | 1.5 (0.8, 2.8) | 2.0 (1.0, 3.7) | | | |
| | Collarless | 14 | 935 | 1.5 (0.8, 2.6) | 1.9 (1.1, 3.3) | 1.9 (1.1, 3.3) | | |
| Other (1) | | 0 | 1 | | | | | |
| TOTAL | | 4441 | 142860 | | | | | |

Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded
Only prostheses with >500 procedures each have been included

**Table HT33 Comparisons of Revision Rates of Primary Total Conventional Hip Replacement by Cementless Femoral Component and Stem Collar Use**

| Diagnosis/Outcome | Comparison | Hazard Ratio - adjusted for age and gender |
|---|---|---|
| Primary Diagnosis OA/All Cause Revision | AMIStem H Collared vs AMIStem H Collarless | Entire Period: HR=0.95 (95% CI 0.68, 1.33), p=0.770 |
| Primary Diagnosis OA/All Cause Revision | CORAIL Collared vs CORAIL Collarless | 0 - 6Mth: HR=0.96 (95% CI 0.84, 1.11), p=0.609 |
| Primary Diagnosis OA/All Cause Revision | | 6Mth - 1.5Yr: HR=0.76 (95% CI 0.62, 0.94), p=0.009 |
| Primary Diagnosis OA/All Cause Revision | | 1.5Yr - 2Yr: HR=0.65 (95% CI 0.45, 0.94), p=0.021 |
| Primary Diagnosis OA/All Cause Revision | | 2Yr - 2.5Yr: HR=0.96 (95% CI 0.66, 1.41), p=0.847 |
| Primary Diagnosis OA/All Cause Revision | | 2.5Yr - 5.5Yr: HR=0.62 (95% CI 0.52, 0.75), p<0.001 |
| Primary Diagnosis OA/All Cause Revision | | 5.5Yr+: HR=0.46 (95% CI 0.39, 0.55), p<0.001 |
| Primary Diagnosis OA/All Cause Revision | HACTIV Collared vs HACTIV Collarless | 0 - 1Mth: HR=0.73 (95% CI 0.35, 1.53), p=0.408 |
| Primary Diagnosis OA/All Cause Revision | | 1Mth - 3Mth: HR=2.73 (95% CI 0.99, 7.53), p=0.051 |
| Primary Diagnosis OA/All Cause Revision | | 3Mth+: HR=2.13 (95% CI 1.27, 3.55), p=0.003 |
| Primary Diagnosis OA/All Cause Revision | Metafix Collared vs Metafix Collarless | Entire Period: HR=0.64 (95% CI 0.53, 0.77), p<0.001 |
| Primary Diagnosis OA/All Cause Revision | Origin Collared vs Origin Collarless | Entire Period: HR=0.60 (95% CI 0.41, 0.88), p=0.009 |
| Primary Diagnosis OA/All Cause Revision | Paragon Collared vs Paragon Collarless | Entire Period: HR=0.79 (95% CI 0.55, 1.15), p=0.216 |
| Primary Diagnosis OA/All Cause Revision | Polarstem Collared vs Polarstem Collarless | Entire Period: HR=0.88 (95% CI 0.65, 1.19), p=0.409 |

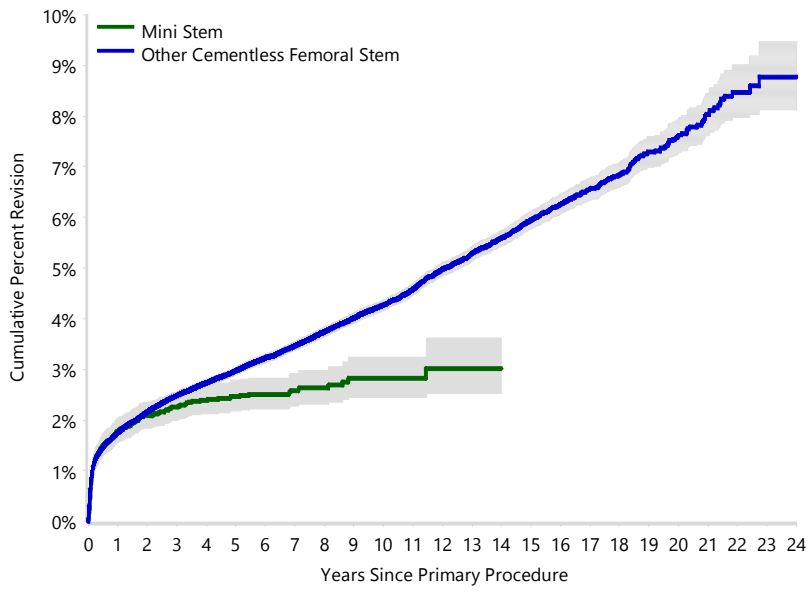
Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded
Only prostheses with >500 procedures each have been included

**Table HT34 Cumulative Percent Revision of Cementless Primary Total Conventional Hip Replacement by Stem Type (Primary Diagnosis OA)**

| Stem Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 9 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Mini Stem | 281 | 12511 | 1.8 (1.5, 2.0) | 2.3 (2.0, 2.5) | 2.5 (2.2, 2.8) | 2.8 (2.5, 3.3) | | |
| Other Cementless Femoral Stem | 9312 | 275304 | 1.7 (1.7, 1.8) | 2.5 (2.4, 2.5) | 3.0 (2.9, 3.0) | 4.0 (3.9, 4.1) | 5.9 (5.8, 6.1) | 7.6 (7.3, 8.0) |
| TOTAL | 9593 | 287815 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT35 Cumulative Percent Revision of Cementless Primary Total Conventional Hip Replacement by Stem Type (Primary Diagnosis OA)**




HR - adjusted for age and gender

Mini Stem vs Other Cementless Femoral Stem

0 - 1Mth: HR=0.96 (95% CI 0.78, 1.18), p=0.703

1Mth - 3Mth: HR=1.06 (95% CI 0.82, 1.36), p=0.679

3Mth - 6Mth: HR=1.20 (95% CI 0.83, 1.72), p=0.329

6Mth - 9Mth: HR=0.73 (95% CI 0.42, 1.27), p=0.265

9Mth - 2Yr: HR=0.88 (95% CI 0.66, 1.18), p=0.388

2Yr+: HR=0.39 (95% CI 0.28, 0.54), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 9 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Mini Stem | 12511 | 10401 | 7258 | 4496 | 1312 | 3 | 0 |
| Other Cementless Femoral Stem | 275304 | 243222 | 191022 | 147386 | 73039 | 17066 | 3314 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

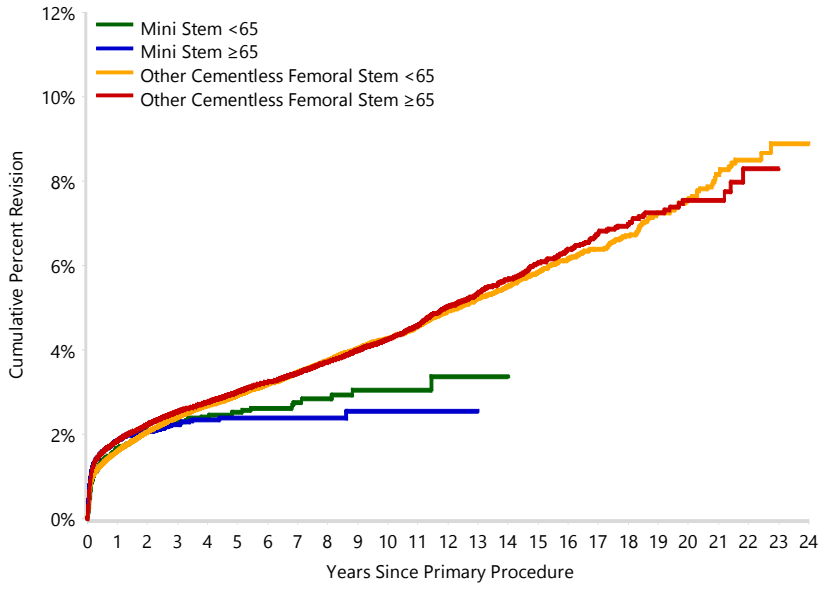
# Primary Total Hip Replacement

**Table HT35 Cumulative Percent Revision of Cementless Primary Total Conventional Hip Replacement by Stem Type and Age (Primary Diagnosis OA)**

| Stem Type | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 9 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Mini Stem | <65 | 133 | 5641 | 1.7 (1.4, 2.1) | 2.3 (1.9, 2.7) | 2.5 (2.1, 3.0) | 3.1 (2.5, 3.7) | | |
| | ≥65 | 148 | 6870 | 1.8 (1.6, 2.2) | 2.2 (1.9, 2.6) | 2.4 (2.0, 2.8) | 2.6 (2.1, 3.1) | | |
| Other Cementless Femoral Stem | <65 | 4027 | 115520 | 1.6 (1.5, 1.7) | 2.4 (2.3, 2.5) | 2.9 (2.8, 3.0) | 4.0 (3.9, 4.2) | 5.8 (5.6, 6.1) | 7.6 (7.2, 8.1) |
| | ≥65 | 5285 | 159784 | 1.8 (1.8, 1.9) | 2.5 (2.5, 2.6) | 3.0 (2.9, 3.1) | 4.0 (3.9, 4.1) | 6.1 (5.8, 6.3) | 7.6 (7.0, 8.1) |
| TOTAL | | 9593 | 287815 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT36 Cumulative Percent Revision of Cementless Primary Total Conventional Hip Replacement by Stem Type and Age (Primary Diagnosis OA)**




HR - adjusted for gender

Mini Stem <65 vs Mini Stem ≥65
0 - 1Mth: HR=0.63 (95% CI 0.42, 0.96), p=0.030
1Mth+: HR=1.25 (95% CI 0.97, 1.62), p=0.080

Mini Stem <65 vs Other Cementless Femoral Stem <65
Entire Period: HR=0.84 (95% CI 0.71, 1.00), p=0.048

Mini Stem ≥65 vs Other Cementless Femoral Stem ≥65
0 - 3Mth: HR=0.92 (95% CI 0.77, 1.10), p=0.339
3Mth - 1.5Yr: HR=0.99 (95% CI 0.81, 1.21), p=0.953
1.5Yr - 2.5Yr: HR=0.46 (95% CI 0.33, 0.64), p<0.001
2.5Yr - 3.5Yr: HR=0.48 (95% CI 0.34, 0.68), p<0.001
3.5Yr - 4Yr: HR=0.38 (95% CI 0.25, 0.57), p<0.001
4Yr+: HR=0.38 (95% CI 0.28, 0.53), p<0.001

Other Cementless Femoral Stem <65
vs Other Cementless Femoral Stem ≥65
0 - 2Wk: HR=0.90 (95% CI 0.78, 1.03), p=0.114
2Wk - 3Mth: HR=0.79 (95% CI 0.73, 0.85), p<0.001
3Mth+: HR=1.08 (95% CI 1.02, 1.13), p=0.005

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 9 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Mini Stem | <65 | 5641 | 4806 | 3502 | 2334 | 786 | 0 | 0 |
| | ≥65 | 6870 | 5595 | 3756 | 2162 | 526 | 3 | 0 |
| Other Cementless Femoral Stem | <65 | 115520 | 103199 | 82457 | 65200 | 35078 | 9810 | 2335 |
| | ≥65 | 159784 | 140023 | 108565 | 82186 | 37961 | 7256 | 979 |

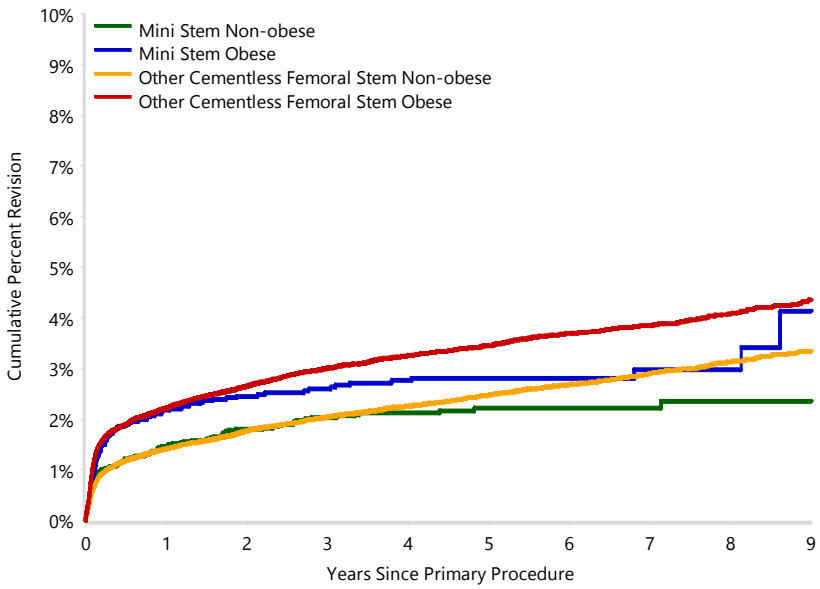
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT36 Cumulative Percent Revision of Cementless Primary Total Conventional Hip Replacement by Stem Type and BMI Category (Primary Diagnosis OA)**

| Stem Type | BMI Category | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|
| Mini Stem | Non-obese | 123 | 6473 | 1.5 (1.2, 1.8) | 2.0 (1.7, 2.4) | 2.2 (1.8, 2.7) | 2.2 (1.8, 2.7) | 2.4 (1.9, 2.9) |
| | Obese | 120 | 4670 | 2.2 (1.8, 2.6) | 2.6 (2.2, 3.1) | 2.8 (2.3, 3.4) | 3.0 (2.4, 3.6) | 4.1 (2.7, 6.3) |
| Other Cementless Femoral Stem | Non-obese | 2476 | 110165 | 1.4 (1.3, 1.5) | 2.0 (2.0, 2.1) | 2.5 (2.4, 2.6) | 2.9 (2.8, 3.0) | 3.3 (3.2, 3.5) |
| | Obese | 2668 | 84494 | 2.2 (2.1, 2.3) | 3.0 (2.9, 3.1) | 3.5 (3.3, 3.6) | 3.8 (3.7, 4.0) | 4.3 (4.1, 4.6) |
| TOTAL | | 5387 | 205802 | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT37 Cumulative Percent Revision of Cementless Primary Total Conventional Hip Replacement by Stem Type and BMI Category (Primary Diagnosis OA)**




HR - adjusted for age and gender

Mini Stem Non-obese vs Mini Stem Obese
Entire Period: HR=0.73 (95% CI 0.57, 0.94), p=0.013

Mini Stem Non-obese vs
Other Cementless Femoral Stem Non-obese
0 - 2Wk: HR=1.39 (95% CI 0.90, 2.13), p=0.133
2Wk+: HR=0.84 (95% CI 0.69, 1.03), p=0.089

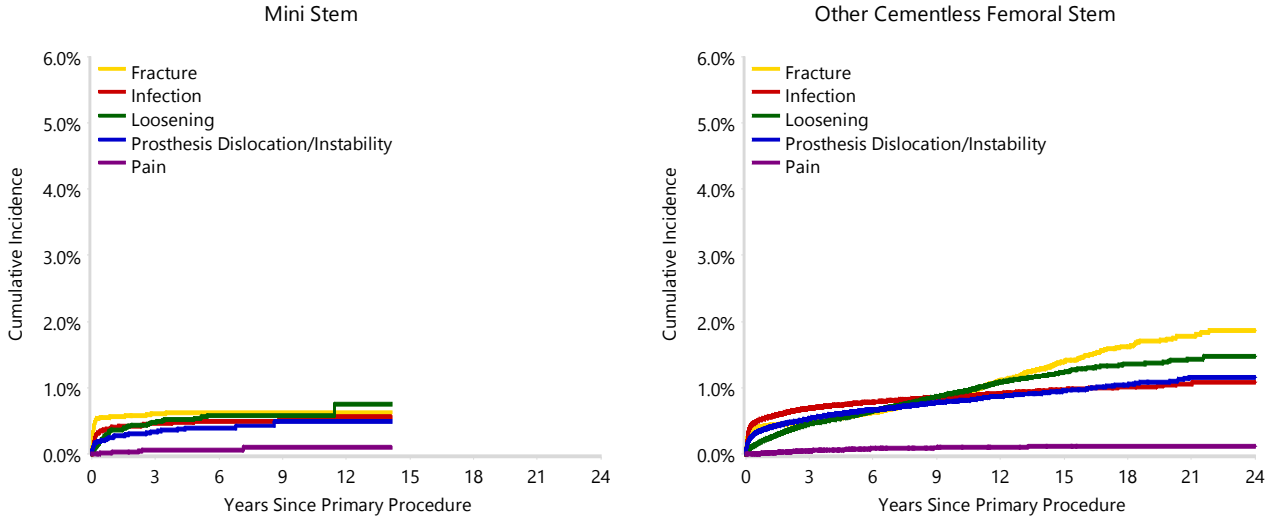
Mini Stem Obese vs
Other Cementless Femoral Stem Obese
Entire Period: HR=0.86 (95% CI 0.71, 1.03), p=0.098

Other Cementless Femoral Stem Non-obese vs
Other Cementless Femoral Stem Obese
0 - 3Mth: HR=0.59 (95% CI 0.54, 0.64), p<0.001
3Mth - 6Mth: HR=0.85 (95% CI 0.70, 1.04), p=0.106
6Mth - 1.5Yr: HR=0.71 (95% CI 0.62, 0.81), p<0.001
1.5Yr+: HR=0.88 (95% CI 0.79, 0.97), p=0.011

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|
| Mini Stem | Non-obese | 6473 | 5300 | 3487 | 1911 | 770 | 167 |
| | Obese | 4670 | 3782 | 2500 | 1365 | 538 | 76 |
| Other Cementless Femoral Stem | Non-obese | 110165 | 93711 | 65911 | 43100 | 23182 | 6361 |
| | Obese | 84494 | 70985 | 49407 | 31857 | 16820 | 4540 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT38 Cumulative Incidence Revision Diagnosis of Cementless Primary Total Conventional Hip Replacement by Stem Type (Primary Diagnosis OA)**




Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT37 Cementless Primary Total Conventional Hip Replacement by Type of Revision and Stem Type (Primary Diagnosis OA)**

| Type of Revision | Mini Stem | | | Other Cementless Femoral Stem | | |
|---|---|---|---|---|---|---|
| | Number | % Primaries Revised | % Revisions | Number | % Primaries Revised | % Revisions |
| Femoral Component | 119 | 1.0 | 42.3 | 3384 | 1.2 | 36.3 |
| Head/Insert | 47 | 0.4 | 16.7 | 2443 | 0.9 | 26.2 |
| Acetabular Component | 45 | 0.4 | 16.0 | 1618 | 0.6 | 17.4 |
| THR (Femoral/Acetabular) | 29 | 0.2 | 10.3 | 806 | 0.3 | 8.7 |
| Head Only | 32 | 0.3 | 11.4 | 492 | 0.2 | 5.3 |
| Cement Spacer | 5 | 0.0 | 1.8 | 295 | 0.1 | 3.2 |
| Minor Components | 2 | 0.0 | 0.7 | 143 | 0.1 | 1.5 |
| Other | 2 | 0.0 | 0.7 | 131 | 0.0 | 1.4 |
| **N Revision** | **281** | **2.2** | **100.0** | **9312** | **3.4** | **100.0** |
| **N Primary** | **12511** | | | **275304** | | |

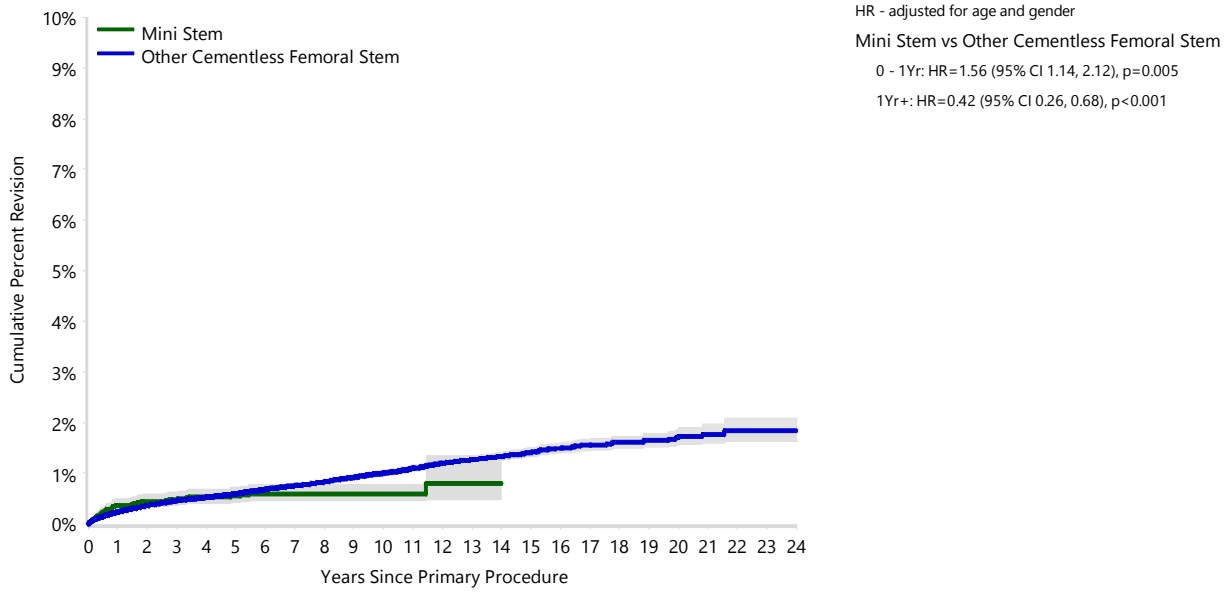
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT38 Cumulative Percent Revision of Cementless Primary Total Conventional Hip Replacement by Stem Type (Primary Diagnosis OA, Revision for Loosening)**

| Stem Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Mini Stem | 60 | 12511 | 0.4 (0.3, 0.5) | 0.5 (0.4, 0.6) | 0.6 (0.4, 0.7) | 0.6 (0.5, 0.8) | | |
| Other Cementless Femoral Stem | 1926 | 275304 | 0.2 (0.2, 0.3) | 0.5 (0.4, 0.5) | 0.6 (0.6, 0.6) | 1.0 (1.0, 1.1) | 1.4 (1.3, 1.5) | 1.7 (1.6, 1.9) |
| TOTAL | 1986 | 287815 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT39 Cumulative Percent Revision of Cementless Primary Total Conventional Hip Replacement by Stem Type (Primary Diagnosis OA, Revision for Loosening)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Mini Stem | 12511 | 10401 | 7258 | 4496 | 994 | 3 | 0 |
| Other Cementless Femoral Stem | 275304 | 243222 | 191022 | 147386 | 58073 | 17066 | 3314 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

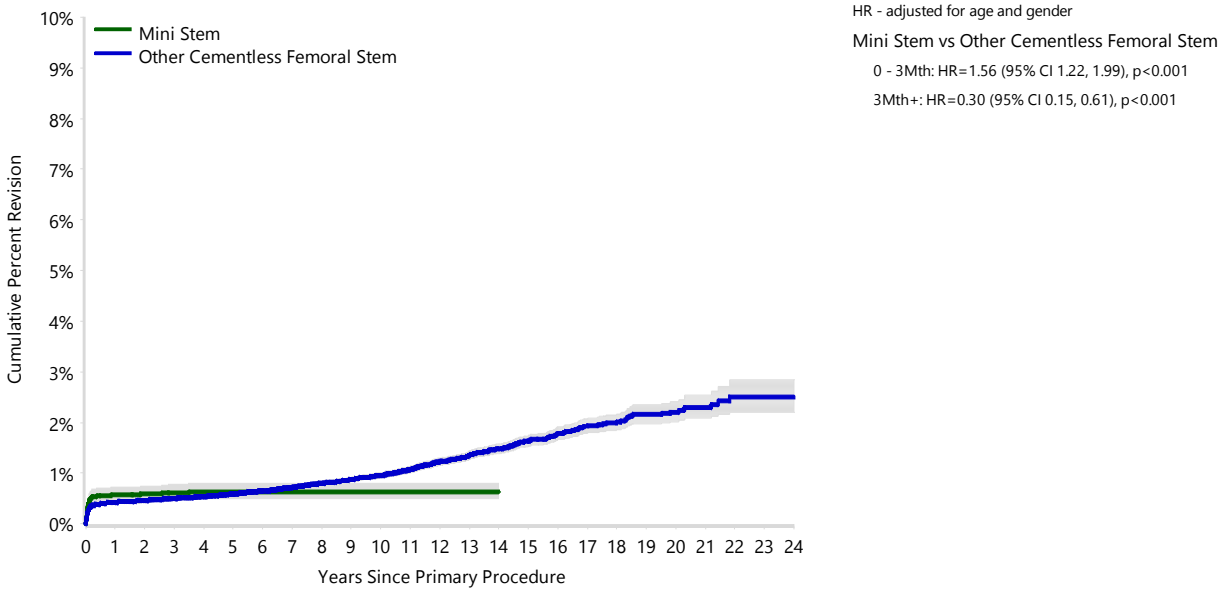
# Primary Total Hip Replacement

**Table HT39 Cumulative Percent Revision of Cementless Primary Total Conventional Hip Replacement by Stem Type (Primary Diagnosis OA, Revision for Fracture)**

| Stem Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Mini Stem | 75 | 12511 | 0.6 (0.4, 0.7) | 0.6 (0.5, 0.8) | 0.6 (0.5, 0.8) | 0.6 (0.5, 0.8) | | |
| Other Cementless Femoral Stem | 2117 | 275304 | 0.4 (0.4, 0.5) | 0.5 (0.5, 0.5) | 0.6 (0.6, 0.6) | 1.0 (0.9, 1.0) | 1.6 (1.5, 1.7) | 2.2 (2.0, 2.4) |
| TOTAL | 2192 | 287815 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT40 Cumulative Percent Revision of Cementless Primary Total Conventional Hip Replacement by Stem Type (Primary Diagnosis OA, Revision for Fracture)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Mini Stem | 12511 | 10401 | 7258 | 4496 | 994 | 3 | 0 |
| Other Cementless Femoral Stem | 275304 | 243222 | 191022 | 147386 | 58073 | 17066 | 3314 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT40 Cumulative Percent Revision of Cementless Primary Total Conventional Hip Replacement by Mini Stem Femoral Component (Primary Diagnosis OA)**

| Femoral Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Exacta RS | 0 | 8 | | | | | | |
| MiniHip | 48 | 1445 | 2.4 (1.7, 3.3) | 3.0 (2.2, 4.0) | 3.3 (2.5, 4.4) | 3.6 (2.7, 4.8) | | |
| MiniMax | 23 | 386 | 4.9 (3.2, 7.6) | 6.0 (4.0, 8.9) | 6.0 (4.0, 8.9) | | | |
| Nanos | 13 | 686 | 1.2 (0.6, 2.3) | 1.5 (0.8, 2.7) | 1.5 (0.8, 2.7) | 1.8 (1.0, 3.1) | | |
| Optimys | 70 | 3159 | 1.7 (1.3, 2.2) | 2.2 (1.7, 2.8) | 2.5 (2.0, 3.2) | 2.8 (2.1, 3.7) | | |
| Taperloc Microplasty | 127 | 6827 | 1.5 (1.3, 1.9) | 2.0 (1.6, 2.4) | 2.1 (1.8, 2.5) | 3.3 (2.1, 5.3) | | |
| TOTAL | 281 | 12511 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

# Primary Total Hip Replacement

### Bearing Surface

Bearing surface is a combination of the material used for the femoral head and the acetabular insert or cup. There are 3 femoral head materials (metal, ceramic, and ceramicised metal) and 4 acetabular articular surface materials (XLPE, non XLPE, ceramic, and metal). Metal/metal bearing surfaces include large head sizes >32mm and head sizes ≤32mm. The following analyses comprises all bearing surface combinations including those with no recorded use in 2024. XLPE is classified as ultra-high molecular weight polyethylene that has been irradiated by high dose (≥50kGy) gamma or electron beam radiation.

During the last 10 years, there has been an increase in the use of ceramic/XLPE bearing surfaces, while both ceramic/ceramic and metal/XLPE have decreased. The proportional use of bearing surfaces over time are shown in Figure HT41.

The change in use of head sizes with the 3 most common bearing surfaces (ceramic/ceramic, ceramic/XLPE and metal/XLPE) is shown in Figure HT42, Figure HT43 and Figure HT44. In 2024, head sizes >32mm are the most frequently used for all bearing couples.

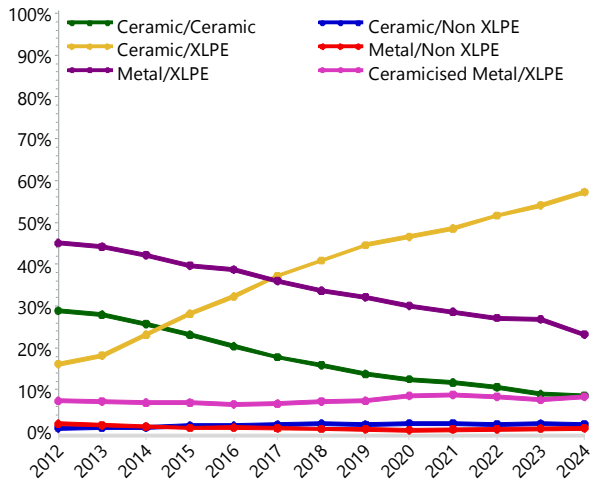
### Comparison of Bearing Surfaces

There are 10 bearing surfaces, 8 of which have been used in >5,000 procedures. Comparing the rates of revision for these bearings, ceramicised metal/XLPE has the lowest rate of revision at 20 years. However, the results should be interpreted with caution as this bearing is a single company product, used with a small number of femoral stem and acetabular component combinations. This may have a confounding effect, making it unclear if the lower rate of revision is an effect of the bearing surface or reflects the limited combinations of femoral and acetabular prostheses.

Ceramic/ceramic has a lower rate of revision compared to Ceramic/XLPE from 2 weeks to 3 months and a higher rate of revision from 9 months onwards. Similarly, when compared to ceramic/XLPE, metal/XLPE also has an early lower rate of revision (until 3 months), but after 6 months there is a higher rate of revision (Table HT41 and Figure HT45).

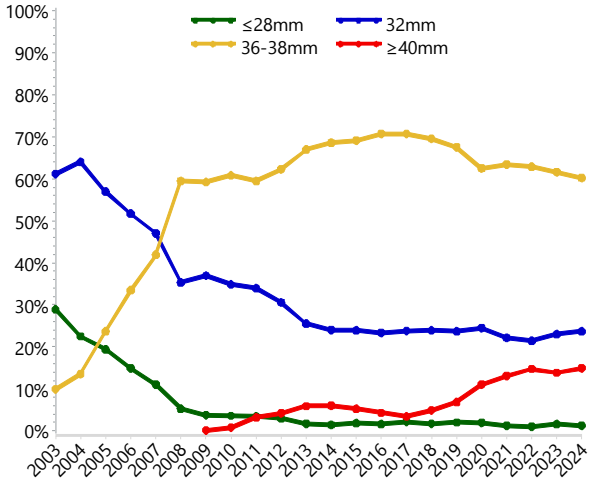
Detailed information on the analysis of metal/metal and metal/ceramic bearing surfaces are available in the supplementary reports 'Metal/Metal Bearing Surface in Total Conventional Hip Arthroplasty' and 'Prosthesis Types with No or Minimal Use' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2025

**Figure HT41 Proportion of Primary Total Conventional Hip Replacement by Bearing Surface (Primary Diagnosis OA)**



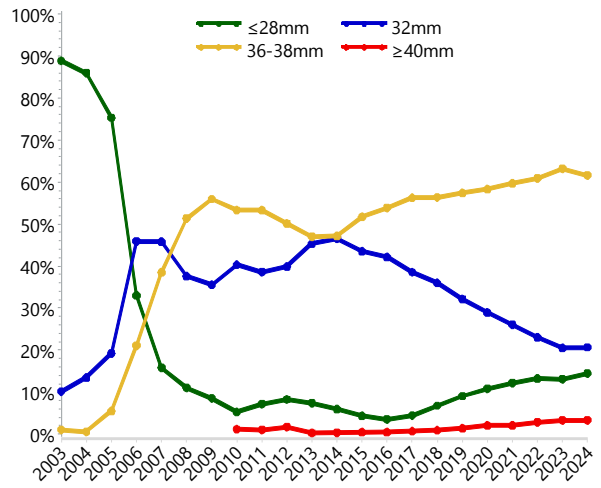

Note: Restricted to modern prostheses

**Figure HT42 Ceramic/Ceramic Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)**



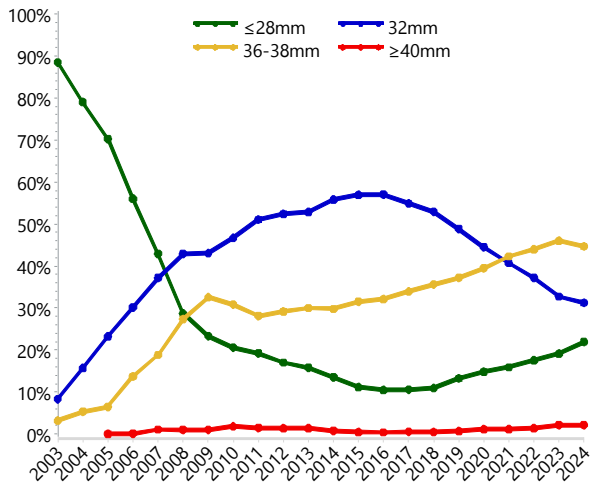

Note: Restricted to modern prostheses

**Figure HT43 Ceramic/XPLE Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

**Figure HT44 Metal/XPLE Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)**



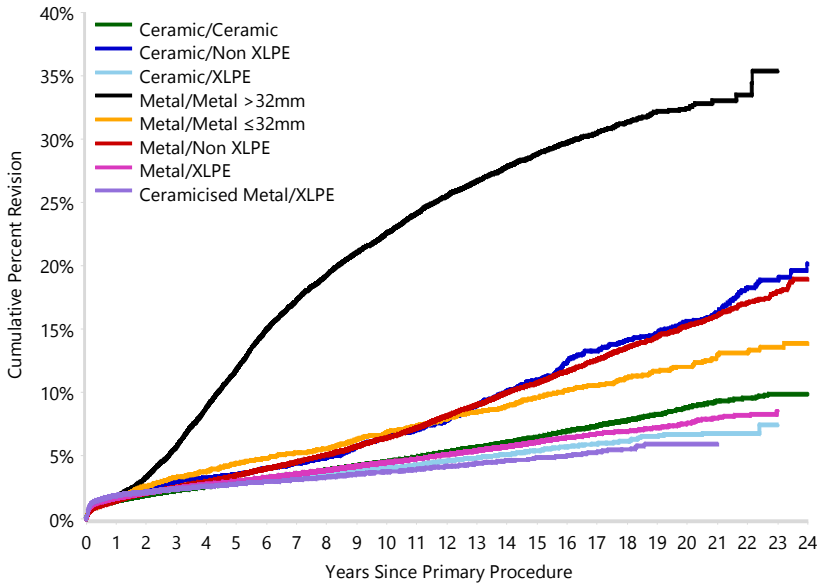

Note: Restricted to modern prostheses

**Table HT41 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Bearing Surface (Primary Diagnosis OA)**

| Bearing Surface | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Ceramic/Ceramic | 5437 | 114611 | 1.4 (1.4, 1.5) | 2.3 (2.2, 2.4) | 2.9 (2.8, 3.0) | 4.5 (4.4, 4.7) | 6.5 (6.3, 6.7) | 8.8 (8.5, 9.2) |
| Ceramic/Non XLPE | 799 | 11499 | 1.8 (1.5, 2.0) | 3.0 (2.7, 3.3) | 3.5 (3.2, 3.9) | 6.6 (6.0, 7.2) | 11.0 (10.1, 11.9) | 15.6 (14.4, 16.9) |
| Ceramic/XLPE | 5456 | 191223 | 1.7 (1.6, 1.7) | 2.4 (2.3, 2.5) | 2.8 (2.8, 2.9) | 4.0 (3.9, 4.1) | 5.4 (5.2, 5.7) | 6.7 (6.2, 7.2) |
| Ceramic/Metal | 31 | 299 | 1.7 (0.7, 4.0) | 3.7 (2.1, 6.6) | 4.4 (2.6, 7.4) | 8.3 (5.7, 12.2) | 11.4 (8.1, 15.9) | |
| Metal/Metal >32mm | 3931 | 14424 | 1.7 (1.5, 1.9) | 5.7 (5.3, 6.1) | 11.8 (11.3, 12.3) | 22.6 (21.9, 23.3) | 28.8 (28.0, 29.6) | 32.5 (31.5, 33.4) |
| Metal/Metal ≤32mm | 520 | 5143 | 1.6 (1.3, 2.0) | 3.3 (2.9, 3.8) | 4.4 (3.9, 5.0) | 6.8 (6.2, 7.6) | 9.6 (8.8, 10.5) | 12.0 (11.0, 13.1) |
| Metal/Non XLPE | 3348 | 36447 | 1.4 (1.3, 1.6) | 2.5 (2.3, 2.7) | 3.5 (3.3, 3.7) | 6.4 (6.1, 6.7) | 10.8 (10.4, 11.2) | 15.3 (14.7, 15.8) |
| Metal/XLPE | 8572 | 217882 | 1.7 (1.6, 1.7) | 2.4 (2.3, 2.5) | 3.0 (2.9, 3.1) | 4.5 (4.4, 4.6) | 6.1 (5.9, 6.2) | 7.6 (7.3, 7.9) |
| Ceramicised Metal/Non XLPE | 61 | 316 | 1.6 (0.7, 3.8) | 3.6 (2.0, 6.4) | 3.9 (2.2, 6.8) | 12.2 (8.7, 16.9) | 21.2 (16.3, 27.2) | 31.2 (24.5, 39.3) |
| Ceramicised Metal/XLPE | 1301 | 41361 | 1.9 (1.7, 2.0) | 2.4 (2.2, 2.5) | 2.8 (2.6, 2.9) | 3.7 (3.5, 4.0) | 4.8 (4.5, 5.2) | 5.9 (5.3, 6.5) |
| TOTAL | 29456 | 633205 | | | | | | |

Note: Excludes 292 procedures with an unknown bearing surface, 1 procedure with a ceramicised metal/ceramic bearing surface, and 8 procedures with a metal/ceramic bearing surface.

**Figure HT45 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Bearing Surface (Primary Diagnosis OA)**




HR - adjusted for age and gender

Ceramic/Ceramic vs Ceramic/XLPE
- 0 - 2Wk: HR=0.96 (95% CI 0.84, 1.09), p=0.525
- 2Wk - 3Mth: HR=0.74 (95% CI 0.68, 0.80), p<0.001
- 3Mth - 9Mth: HR=0.90 (95% CI 0.80, 1.01), p=0.063
- 9Mth - 2.5Yr: HR=1.16 (95% CI 1.07, 1.26), p<0.001
- 2.5Yr+: HR=1.35 (95% CI 1.27, 1.42), p<0.001

Ceramic/Non XLPE vs Ceramic/XLPE
- 0 - 3Mth: HR=0.94 (95% CI 0.79, 1.13), p=0.518
- 3Mth - 8Yr: HR=1.57 (95% CI 1.40, 1.76), p<0.001
- 8Yr+: HR=3.59 (95% CI 3.19, 4.04), p<0.001

Metal/Metal ≤32mm vs Ceramic/XLPE
- 0 - 2Wk: HR=1.17 (95% CI 0.72, 1.89), p=0.532
- 2Wk - 6Mth: HR=0.66 (95% CI 0.48, 0.91), p=0.010
- 6Mth+: HR=2.07 (95% CI 1.87, 2.28), p<0.001

Metal/Non XLPE vs Ceramic/XLPE
- 0 - 3Mth: HR=0.75 (95% CI 0.67, 0.85), p<0.001
- 3Mth - 6Mth: HR=0.99 (95% CI 0.78, 1.26), p=0.954
- 6Mth - 1.5Yr: HR=1.65 (95% CI 1.45, 1.88), p<0.001
- 1.5Yr - 3Yr: HR=1.54 (95% CI 1.34, 1.76), p<0.001
- 3Yr - 8Yr: HR=2.20 (95% CI 2.02, 2.40), p<0.001
- 8Yr+: HR=3.40 (95% CI 3.16, 3.66), p<0.001

Metal/XLPE vs Ceramic/XLPE
- 0 - 2Wk: HR=0.95 (95% CI 0.85, 1.07), p=0.394
- 2Wk - 1Mth: HR=1.13 (95% CI 1.04, 1.23), p=0.005
- 1Mth - 3Mth: HR=0.99 (95% CI 0.91, 1.07), p=0.737
- 3Mth - 3Yr: HR=1.12 (95% CI 1.06, 1.18), p<0.001
- 3Yr+: HR=1.24 (95% CI 1.17, 1.31), p<0.001

Ceramicised Metal/XLPE vs Ceramic/XLPE
- 0 - 3Mth: HR=1.16 (95% CI 1.05, 1.27), p=0.002
- 3Mth+: HR=0.83 (95% CI 0.77, 0.90), p<0.001

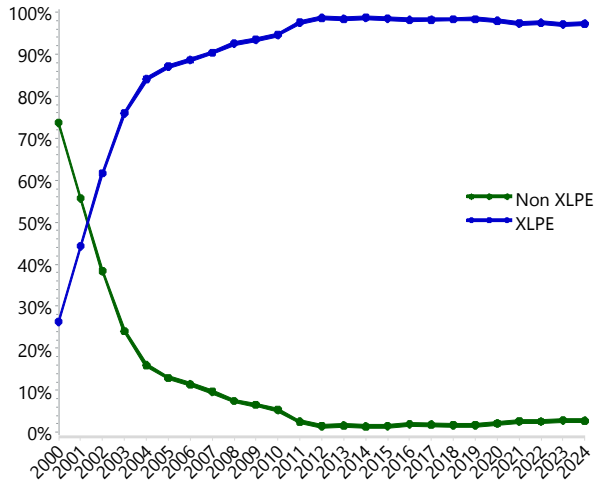
Metal/Metal >32mm vs Ceramic/XLPE
- 0 - 2Wk: HR=1.24 (95% CI 0.94, 1.65), p=0.132
- 2Wk - 1Mth: HR=0.45 (95% CI 0.31, 0.65), p<0.001
- 1Mth - 3Mth: HR=0.69 (95% CI 0.52, 0.92), p=0.010
- 3Mth - 9Mth: HR=1.20 (95% CI 0.94, 1.54), p=0.144
- 9Mth - 1.5Yr: HR=3.13 (95% CI 2.65, 3.71), p<0.001
- 1.5Yr - 2Yr: HR=4.95 (95% CI 4.11, 5.96), p<0.001
- 2Yr - 11Yr: HR=10.48 (95% CI 9.90, 11.09), p<0.001
- 11Yr+: HR=4.66 (95% CI 4.24, 5.13), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| **Ceramic/Ceramic** | 114611 | 108892 | 98951 | 88144 | 54363 | 21062 | 6019 |
| **Ceramic/Non XLPE** | 11499 | 10490 | 8760 | 7126 | 3924 | 2288 | 1177 |
| **Ceramic/XLPE** | 191223 | 163266 | 118949 | 83965 | 24624 | 5830 | 926 |
| **Metal/Metal >32mm** | 14424 | 14063 | 13212 | 11972 | 9298 | 6384 | 629 |
| **Metal/Metal ≤32mm** | 5143 | 5022 | 4841 | 4653 | 4020 | 3050 | 1339 |
| **Metal/Non XLPE** | 36447 | 34925 | 32329 | 29622 | 21301 | 12653 | 5076 |
| **Metal/XLPE** | 217882 | 201897 | 172790 | 144132 | 72096 | 23528 | 4284 |
| **Ceramicised Metal/XLPE** | 41361 | 36888 | 29950 | 23315 | 11085 | 3364 | 471 |

Note: Only bearing surfaces with >5,000 procedures have been listed

**Cross-linked Polyethylene (XLPE)**
XLPE has been used in 392,457 procedures. This includes 62,243 procedures that have XLPE with the addition of an antioxidant. In 2024, when polyethylene is used as a bearing surface in primary total conventional hip procedures, the proportion using XLPE is 97.2% (Figure HT46).

**Figure HT46 Primary Total Conventional Hip Replacement by Polyethylene Type (Primary Diagnosis OA)**




XLPE has a lower rate of revision compared to non XLPE after 6 months (Table HT42 and Figure HT47). The difference increases with time and at 20 years the cumulative percent revision is 6.9% for XLPE and 17.8% for non XLPE.

At 20 years the cumulative percent revision of total conventional hip replacement with XLPE is 6.9% compared to 17.8% for non XLPE.

The cumulative incidence of loosening and prosthesis dislocation/instability at 20 years is 1.0% and 1.2% for XLPE, compared to 4.9% and 1.3% for non XLPE, respectively (Figure HT48).

For non XLPE, there is no difference in the rate of revision between head sizes <32mm and 32mm. Head sizes >32mm are rarely used with non XLPE (Table HT42 and Figure HT49). The use of XLPE has been associated with an increased use of larger head sizes when compared to non XLPE. Head sizes ≥32mm have been used in 84.0% of XLPE procedures and in only 10.6% of non XLPE procedures.

For XLPE, 32mm has a lower rate of revision than <32mm after 1.5 years. When compared to >32mm head size, 32mm has a lower rate of revision after 1 month (Table HT42 and Figure HT50). Procedures using non XLPE have a higher incidence of loosening, fracture and infection regardless of head size (Figure HT51). XLPE and non XLPE are combined with three different femoral head bearing surfaces: ceramic, metal, and ceramicised metal. Within each bearing surface, XLPE has a lower rate of revision than non XLPE (Figure HT52).

**XLPE + Antioxidant**
Acetabular components that have both XLPE and XLPE with antioxidant have been compared. There has been a 0.8% increase in procedures using antioxidant compared to 2023. Non XLPE has a higher rate of revision compared to XLPE + antioxidant after 6 months. XLPE has a higher rate of revision compared to XLPE + antioxidant after 9 months (Table HT43 and Figure HT53). The reasons for revision are shown in Table HT44 and Figure HT54.

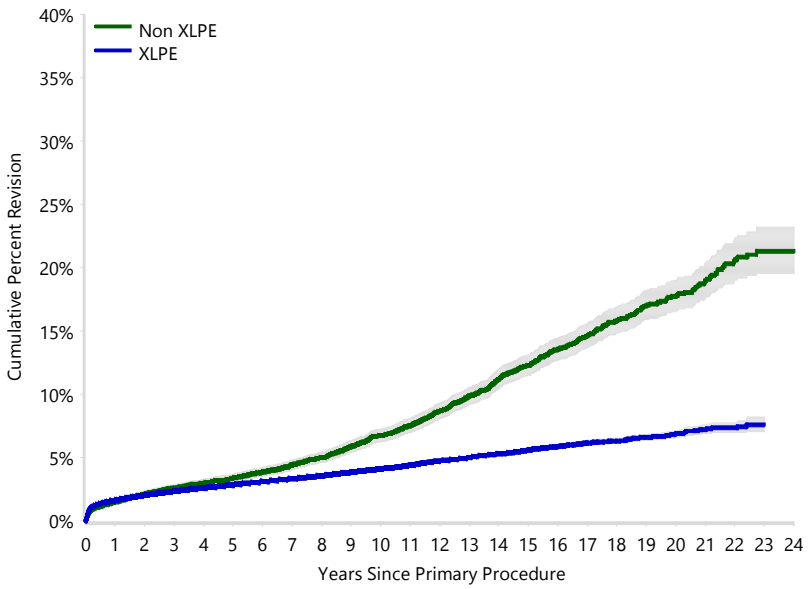
# Primary Total Hip Replacement

**Table HT42 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Polyethylene Type and Head Size (Primary Diagnosis OA)**

| Polyethylene Type | Head Size | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| **Non XLPE** | | **1171** | **16034** | **1.5 (1.3, 1.7)** | **2.6 (2.3, 2.9)** | **3.4 (3.1, 3.7)** | **6.7 (6.2, 7.2)** | **12.3 (11.5, 13.1)** | **17.8 (16.6, 19.0)** |
| | **<32mm** | 1074 | 14330 | 1.5 (1.3, 1.7) | 2.6 (2.3, 2.8) | 3.4 (3.1, 3.8) | 6.8 (6.3, 7.3) | 12.5 (11.7, 13.3) | 18.0 (16.8, 19.3) |
| | **32mm** | 95 | 1671 | 1.9 (1.3, 2.7) | 2.7 (2.0, 3.6) | 3.2 (2.5, 4.2) | 6.1 (4.8, 7.7) | 10.0 (7.9, 12.6) | |
| | **>32mm** | 2 | 33 | 0.0 (0.0, 0.0) | 8.0 (2.1, 28.5) | 8.0 (2.1, 28.5) | | | |
| **XLPE** | | **12367** | **392457** | **1.7 (1.6, 1.7)** | **2.3 (2.3, 2.4)** | **2.8 (2.8, 2.9)** | **4.1 (4.0, 4.2)** | **5.6 (5.5, 5.7)** | **6.9 (6.6, 7.2)** |
| | **<32mm** | 2383 | 62641 | 1.6 (1.5, 1.7) | 2.3 (2.2, 2.5) | 2.9 (2.8, 3.1) | 4.3 (4.1, 4.5) | 6.0 (5.7, 6.2) | 7.3 (6.9, 7.7) |
| | **32mm** | 4575 | 145567 | 1.6 (1.5, 1.7) | 2.3 (2.2, 2.3) | 2.7 (2.6, 2.8) | 3.9 (3.8, 4.0) | 5.2 (4.9, 5.4) | 6.0 (5.6, 6.5) |
| | **>32mm** | 5409 | 184242 | 1.7 (1.7, 1.8) | 2.4 (2.3, 2.5) | 2.9 (2.8, 3.0) | 4.3 (4.1, 4.4) | 5.8 (5.5, 6.1) | 7.4 (6.4, 8.5) |
| **TOTAL** | | **13538** | **408491** | | | | | | |

Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded

**Figure HT47 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Polyethylene Type (Primary Diagnosis OA)**




HR - adjusted for age and gender

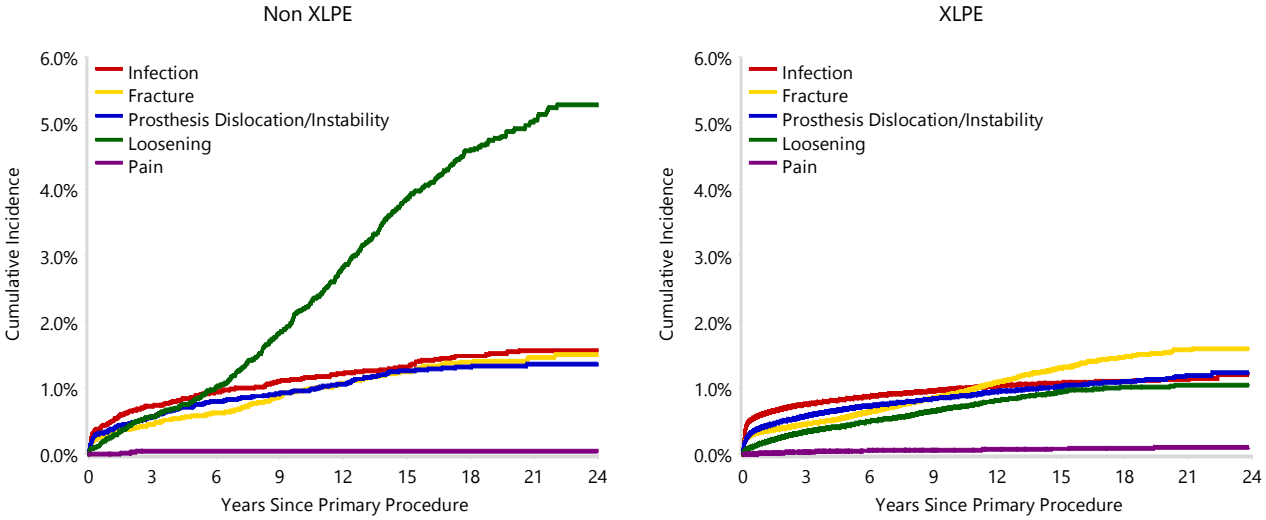
Non XLPE vs XLPE

0 - 3Mth: HR=0.84 (95% CI 0.72, 0.99), p=0.039
3Mth - 6Mth: HR=0.71 (95% CI 0.47, 1.07), p=0.100
6Mth - 1.5Yr: HR=1.59 (95% CI 1.31, 1.93), p<0.001
1.5Yr - 6.5Yr: HR=1.64 (95% CI 1.44, 1.86), p<0.001
6.5Yr - 8.5Yr: HR=2.71 (95% CI 2.21, 3.32), p<0.001
8.5Yr - 13.5Yr: HR=3.57 (95% CI 3.13, 4.07), p<0.001
13.5Yr+: HR=5.04 (95% CI 4.23, 6.01), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| **Non XLPE** | 16034 | 14503 | 11927 | 9830 | 5963 | 3183 | 1028 |
| **XLPE** | 392457 | 345699 | 268448 | 203223 | 78346 | 21417 | 3546 |

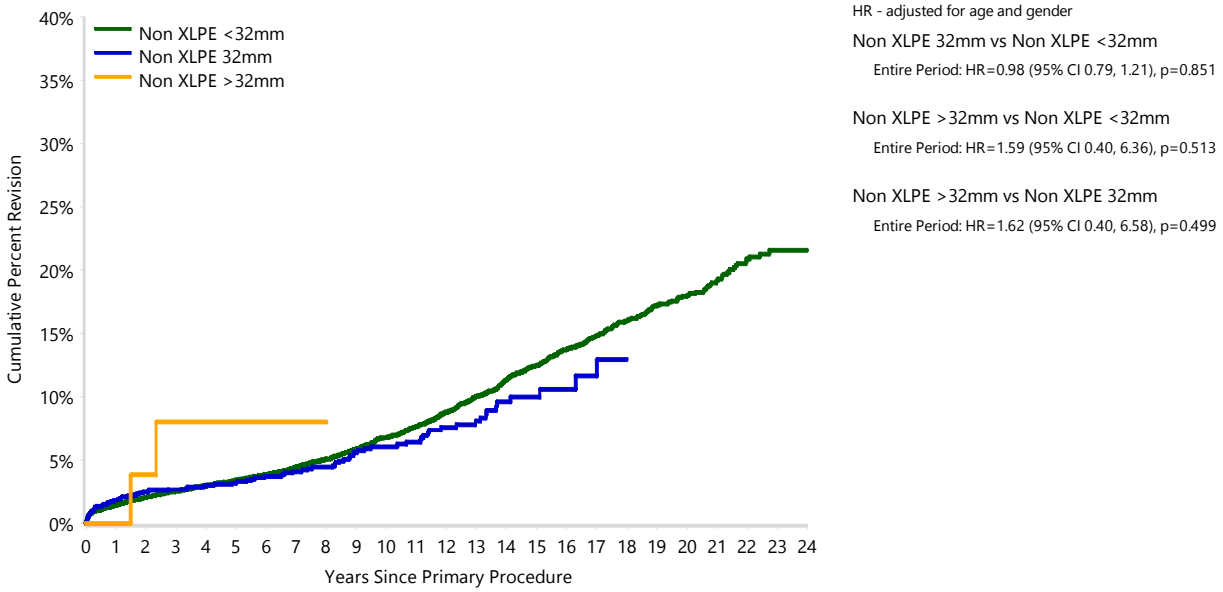
Note: Restricted to modern prostheses

**Figure HT48 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement by Polyethylene Type (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

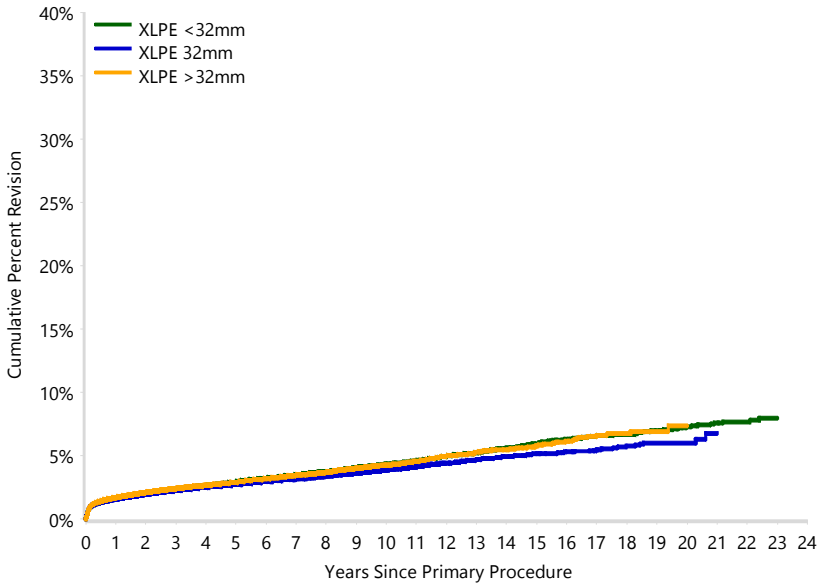
**Figure HT49 Cumulative Percent Revision of Primary Total Conventional Hip Replacement using Non XLPE by Head Size (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Non XLPE | <32mm | 14330 | 12894 | 10527 | 8627 | 5382 | 3033 | 1012 |
| | 32mm | 1671 | 1581 | 1381 | 1195 | 577 | 149 | 16 |
| | >32mm | 33 | 28 | 19 | 8 | 4 | 1 | 0 |

Note: Restricted to modern prostheses

**Figure HT50 Cumulative Percent Revision of Primary Total Conventional Hip Replacement using XLPE by Head Size (Primary Diagnosis OA)**




HR - adjusted for age and gender

XLPE <32mm vs XLPE 32mm

0 - 1Mth: HR=0.97 (95% CI 0.86, 1.09), p=0.585

1Mth - 1.5Yr: HR=1.08 (95% CI 0.99, 1.18), p=0.069

1.5Yr+: HR=1.19 (95% CI 1.11, 1.27), p<0.001

XLPE >32mm vs XLPE <32mm

Entire Period: HR=0.97 (95% CI 0.92, 1.02), p=0.226

XLPE >32mm vs XLPE 32mm

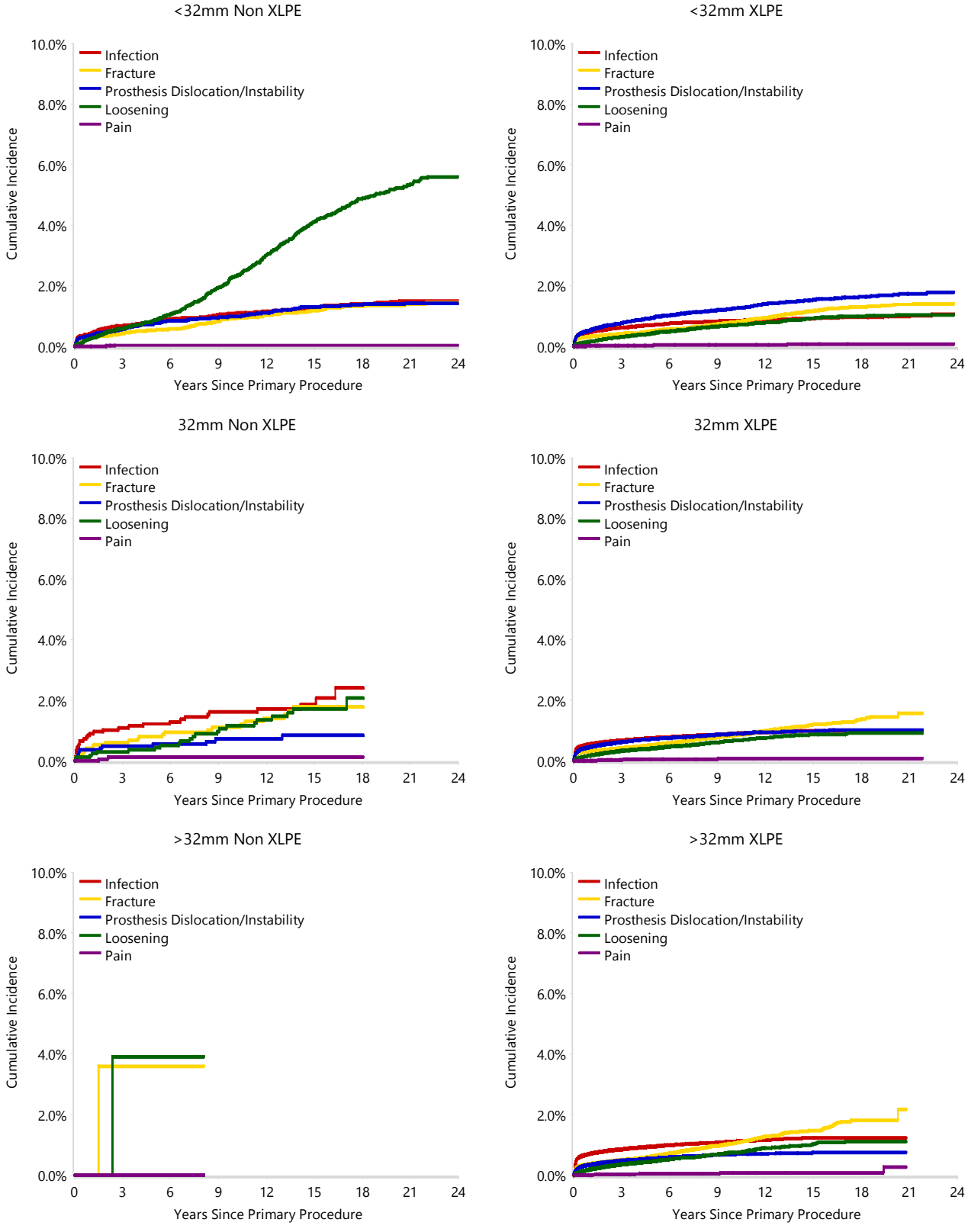
0 - 1Mth: HR=0.94 (95% CI 0.87, 1.02), p=0.164

1Mth+: HR=1.11 (95% CI 1.06, 1.16), p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| XLPE | <32mm | 62641 | 55176 | 44040 | 35467 | 21821 | 10699 | 3035 |
| | 32mm | 145567 | 133308 | 111737 | 89084 | 32880 | 6482 | 384 |
| | >32mm | 184242 | 157212 | 112671 | 78672 | 23645 | 4236 | 127 |

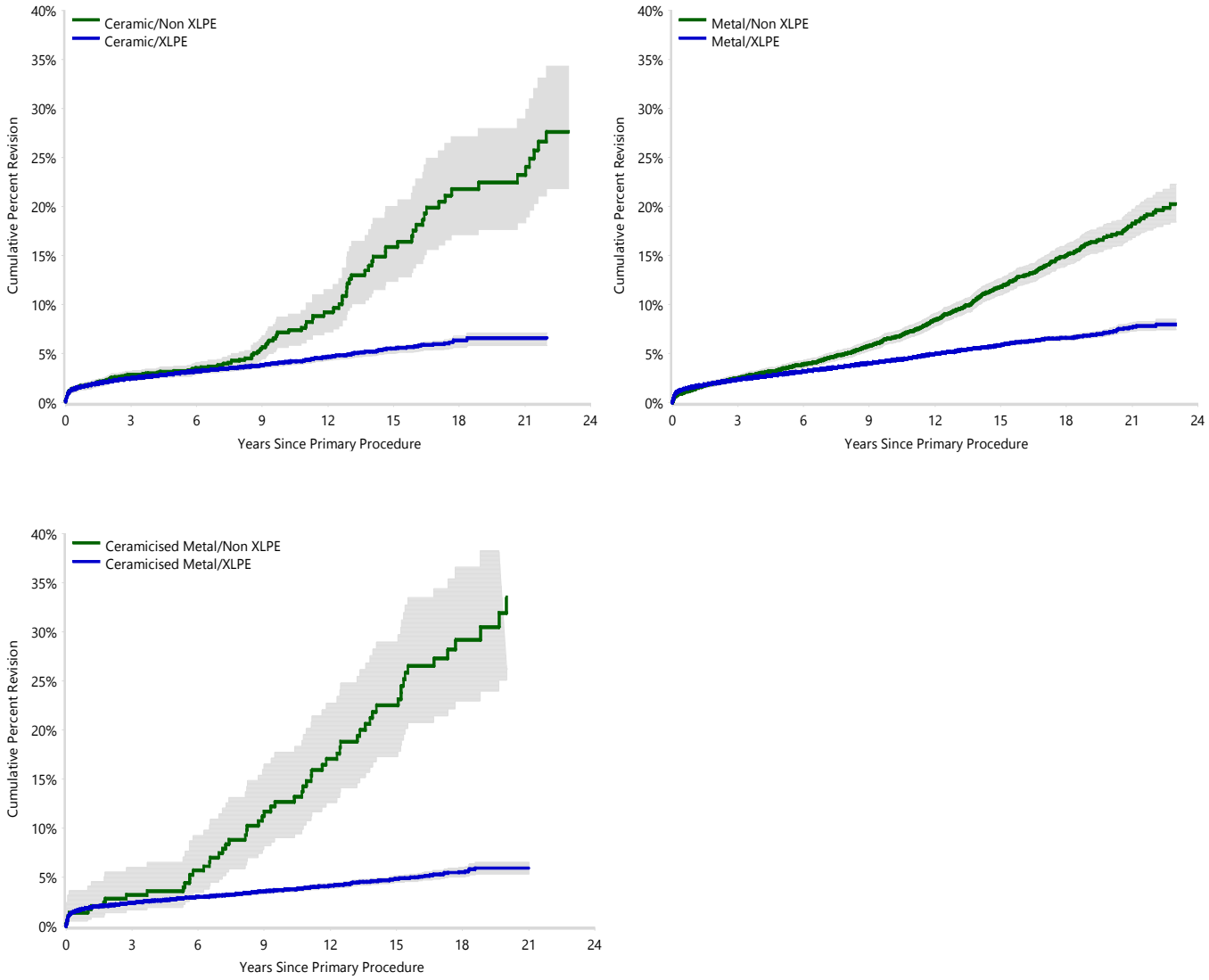
Note: Restricted to modern prostheses

**Figure HT51 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement by Head Size and Polyethylene Type (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

**Figure HT52 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Head Surface and Polyethylene Type (Primary Diagnosis OA)**



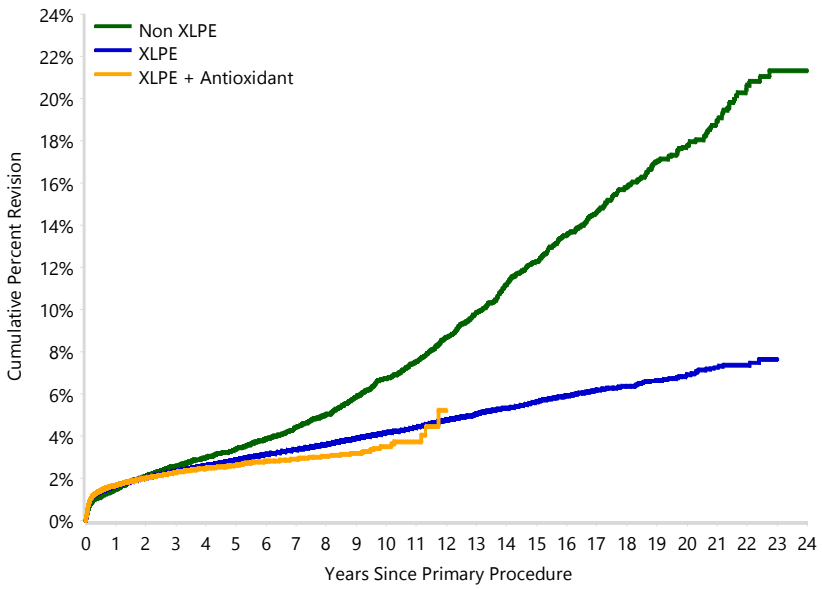

Note: Restricted to modern prostheses

**Table HT43 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Polyethylene Type (Primary Diagnosis OA)**

| Polyethylene Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Non XLPE | 1171 | 16034 | 1.5 (1.3, 1.7) | 2.6 (2.3, 2.9) | 3.4 (3.1, 3.7) | 6.7 (6.2, 7.2) | 12.3 (11.5, 13.1) | 17.8 (16.6, 19.0) |
| XLPE | 10981 | 330214 | 1.6 (1.6, 1.7) | 2.3 (2.3, 2.4) | 2.9 (2.8, 2.9) | 4.2 (4.1, 4.3) | 5.6 (5.5, 5.8) | 6.9 (6.6, 7.2) |
| XLPE + Antioxidant | 1386 | 62243 | 1.7 (1.6, 1.8) | 2.3 (2.2, 2.4) | 2.6 (2.5, 2.8) | 3.5 (3.2, 3.9) | | |
| TOTAL | 13538 | 408491 | | | | | | |

Note: Restricted to modern prostheses

**Figure HT53 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Polyethylene Type (Primary Diagnosis OA)**




HR - adjusted for age and gender

Non XLPE vs XLPE

0 - 9Mth: HR=0.89 (95% CI 0.77, 1.02), p=0.087
9Mth - 7Yr: HR=1.67 (95% CI 1.50, 1.86), p<0.001
7Yr - 12Yr: HR=3.12 (95% CI 2.74, 3.55), p<0.001
12Yr+: HR=4.69 (95% CI 4.06, 5.42), p<0.001

Non XLPE vs XLPE + Antioxidant

0 - 9Mth: HR=0.88 (95% CI 0.76, 1.02), p=0.084
9Mth - 4Yr: HR=1.77 (95% CI 1.50, 2.08), p<0.001
4Yr - 7Yr: HR=3.10 (95% CI 2.35, 4.10), p<0.001
7Yr - 12Yr: HR=5.05 (95% CI 3.90, 6.53), p<0.001
12Yr+: HR=7.61 (95% CI 5.83, 9.95), p<0.001

XLPE vs XLPE + Antioxidant

0 - 1Yr: HR=0.99 (95% CI 0.93, 1.06), p=0.837
1Yr - 4Yr: HR=1.16 (95% CI 1.03, 1.30), p=0.013
4Yr+: HR=1.62 (95% CI 1.30, 2.03), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Non XLPE | 16034 | 14503 | 11927 | 9830 | 5963 | 3183 | 1028 |
| XLPE | 330214 | 295814 | 239151 | 187968 | 77352 | 21417 | 3546 |
| XLPE + Antioxidant | 62243 | 49885 | 29297 | 15255 | 994 | 0 | 0 |

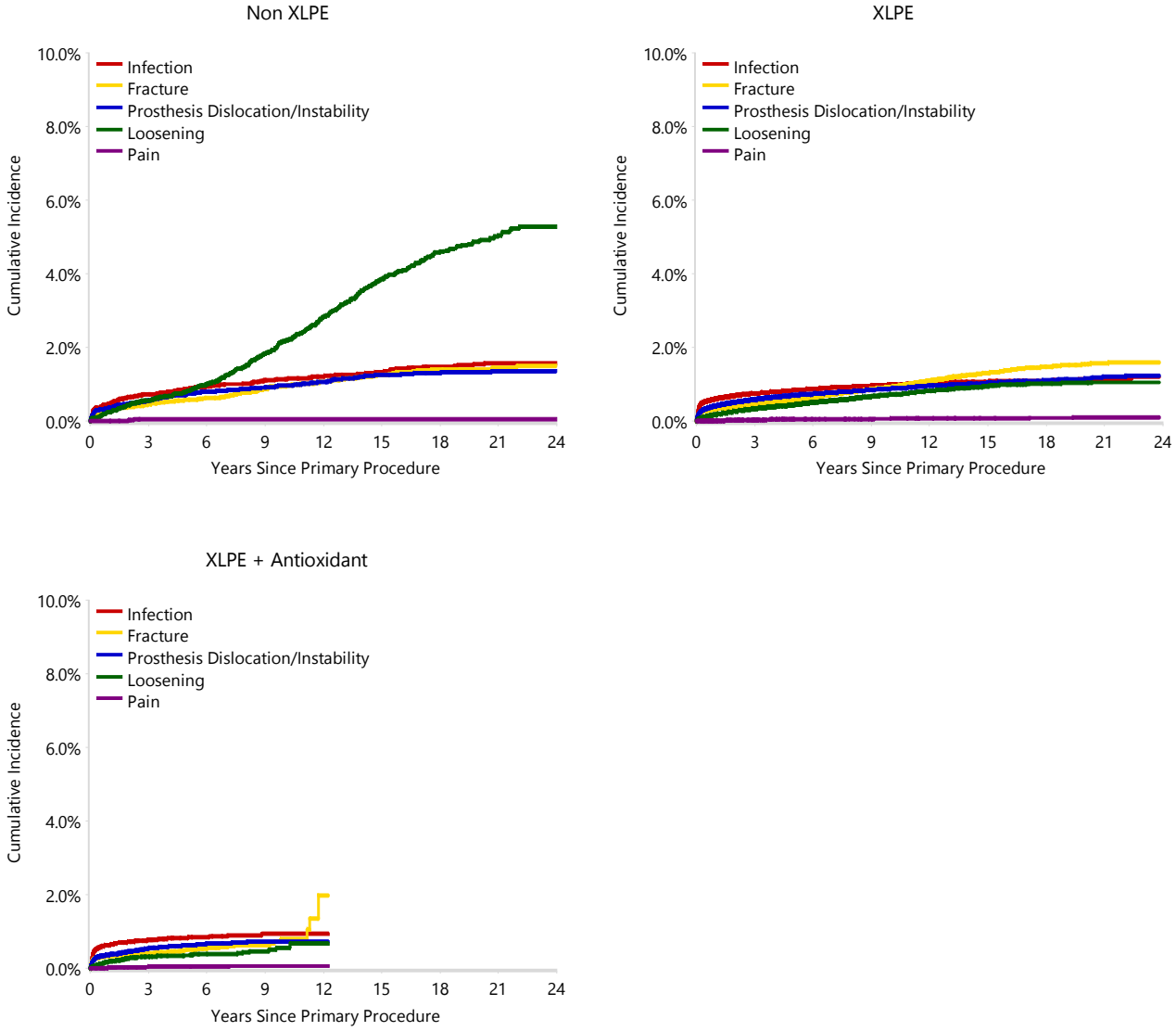
Note: Restricted to modern prostheses

**Table HT44 Revision Diagnosis of Primary Total Conventional Hip Replacement by Polyethylene Type (Primary Diagnosis OA, Follow-up Limited to 13.3 Years)**

| Revision Diagnosis | Non XLPE | | | XLPE | | | XLPE + Antioxidant | | |
|---|---|---|---|---|---|---|---|---|---|
| | Number | % Primaries Revised | % Revisions | Number | % Primaries Revised | % Revisions | Number | % Primaries Revised | % Revisions |
| Infection | 167 | 1.0 | 18.1 | 2877 | 0.9 | 26.9 | 464 | 0.7 | 33.5 |
| Fracture | 141 | 0.9 | 15.3 | 2494 | 0.8 | 23.3 | 272 | 0.4 | 19.6 |
| Prosthesis Dislocation/Instability | 148 | 0.9 | 16.1 | 2470 | 0.7 | 23.1 | 322 | 0.5 | 23.2 |
| Loosening | 349 | 2.2 | 37.9 | 1834 | 0.6 | 17.2 | 185 | 0.3 | 13.3 |
| Pain | 7 | 0.0 | 0.8 | 168 | 0.1 | 1.6 | 23 | 0.0 | 1.7 |
| Leg Length Discrepancy | 7 | 0.0 | 0.8 | 154 | 0.0 | 1.4 | 37 | 0.1 | 2.7 |
| Malposition | 4 | 0.0 | 0.4 | 139 | 0.0 | 1.3 | 32 | 0.1 | 2.3 |
| Implant Breakage Stem | 9 | 0.1 | 1.0 | 92 | 0.0 | 0.9 | 5 | 0.0 | 0.4 |
| Lysis | 45 | 0.3 | 4.9 | 69 | 0.0 | 0.6 | 1 | 0.0 | 0.1 |
| Incorrect Sizing | 3 | 0.0 | 0.3 | 54 | 0.0 | 0.5 | 6 | 0.0 | 0.4 |
| Implant Breakage Acetabular Insert | 4 | 0.0 | 0.4 | 41 | 0.0 | 0.4 | 5 | 0.0 | 0.4 |
| Metal Related Pathology | 4 | 0.0 | 0.4 | 40 | 0.0 | 0.4 | 3 | 0.0 | 0.2 |
| Wear Acetabular Insert | 18 | 0.1 | 2.0 | 30 | 0.0 | 0.3 | 1 | 0.0 | 0.1 |
| Implant Breakage Acetabular | 2 | 0.0 | 0.2 | 22 | 0.0 | 0.2 | 3 | 0.0 | 0.2 |
| Heterotopic Bone | 2 | 0.0 | 0.2 | 18 | 0.0 | 0.2 | 2 | 0.0 | 0.1 |
| Tumour | 1 | 0.0 | 0.1 | 11 | 0.0 | 0.1 | 1 | 0.0 | 0.1 |
| Implant Breakage Head | | | | 4 | 0.0 | 0.0 | | | |
| Wear Acetabulum | 2 | 0.0 | 0.2 | 4 | 0.0 | 0.0 | | | |
| Synovitis | | | | 1 | 0.0 | 0.0 | | | |
| Wear Head | | | | 1 | 0.0 | 0.0 | | | |
| Other | 8 | 0.0 | 0.9 | 161 | 0.0 | 1.5 | 24 | 0.0 | 1.7 |
| **N Revision** | **921** | **5.7** | **100.0** | **10684** | **3.2** | **100.0** | **1386** | **2.2** | **100.0** |
| **N Primary** | **16034** | | | **330214** | | | **62243** | | |

Note: Restricted to modern prostheses
Restricted to revisions within 13.3 years for all groups to allow a time-matched comparison of revisions

**Figure HT54 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement by Polyethylene Type (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

# Primary Total Hip Replacement

**Ceramic/Ceramic Bearings**

Ceramic/ceramic bearings have been used in 74,168 primary total conventional hip replacement procedures undertaken for osteoarthritis. This is the third most common bearing. This analysis has been restricted to procedures with mixed ceramic femoral heads and mixed ceramic acetabular bearing surfaces. In 2024, mixed ceramic accounted for 100.0% of all procedures with a ceramic/ceramic bearing surface.

**Head Size**

To evaluate the effect of head size, an analysis was undertaken comparing four head size groups (≤28mm, 32mm, 36–38mm, and ≥40mm). Head sizes 36mm and 38mm have been combined in this analysis. The proportional use of head sizes of mixed ceramic/mixed ceramic over time is shown in Figure HT55.

Mixed ceramic heads with head sizes 36-38mm have a higher rate of revision than ≥40mm heads. When compared to 32mm head sizes, there is no difference in the rate of revision for ≤28mm, 36–38mm and ≥40mm head sizes over the entire period (Table HT45 and Figure HT56).

At 1 year, the cumulative incidence of prosthesis dislocation/instability is 1.5% for head sizes ≤28mm compared to 0.3% for 32mm, 0.3% for 36–38mm, and 0.1% for head sizes ≥40mm (Figure HT57).

**Figure HT55 Mixed Ceramic/Mixed Ceramic Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)**

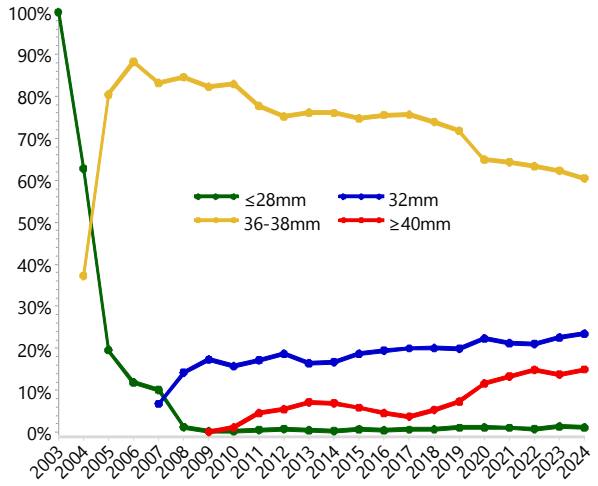
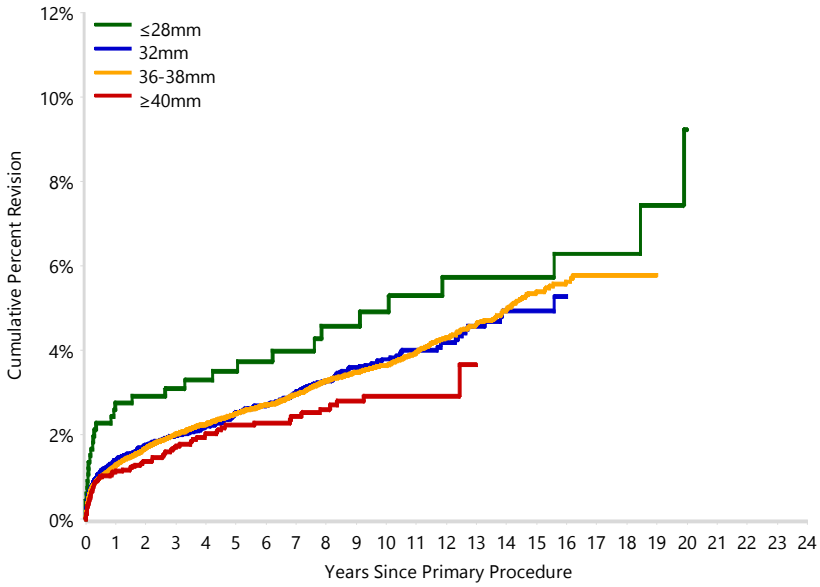



**Table HT45 Cumulative Percent Revision of Mixed Ceramic/Mixed Ceramic Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)**

| Head Size | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| ≤28mm | 32 | 665 | 2.8 (1.7, 4.3) | 3.1 (2.0, 4.8) | 3.5 (2.3, 5.3) | 4.9 (3.3, 7.2) | 5.7 (3.9, 8.4) | 9.2 (5.5, 15.3) |
| 32mm | 332 | 11375 | 1.4 (1.2, 1.6) | 2.0 (1.7, 2.3) | 2.5 (2.2, 2.8) | 3.8 (3.4, 4.3) | 4.9 (4.2, 5.7) | |
| 36-38mm | 1342 | 42579 | 1.3 (1.2, 1.4) | 2.0 (1.9, 2.2) | 2.5 (2.3, 2.7) | 3.6 (3.4, 3.8) | 5.4 (5.0, 5.8) | |
| ≥40mm | 89 | 4498 | 1.1 (0.8, 1.5) | 1.7 (1.3, 2.2) | 2.2 (1.8, 2.8) | 2.9 (2.3, 3.7) | | |
| TOTAL | 1795 | 59117 | | | | | | |

Note: Restricted to modern prostheses

**Figure HT56 Cumulative Percent Revision of Mixed Ceramic/Mixed Ceramic Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)**




HR - adjusted for age and gender

≤28mm vs 32mm

Entire Period: HR=1.32 (95% CI 0.92, 1.91), p=0.135

36-38mm vs 32mm

Entire Period: HR=0.99 (95% CI 0.87, 1.13), p=0.910

≥40mm vs 32mm

Entire Period: HR=0.80 (95% CI 0.62, 1.02), p=0.077

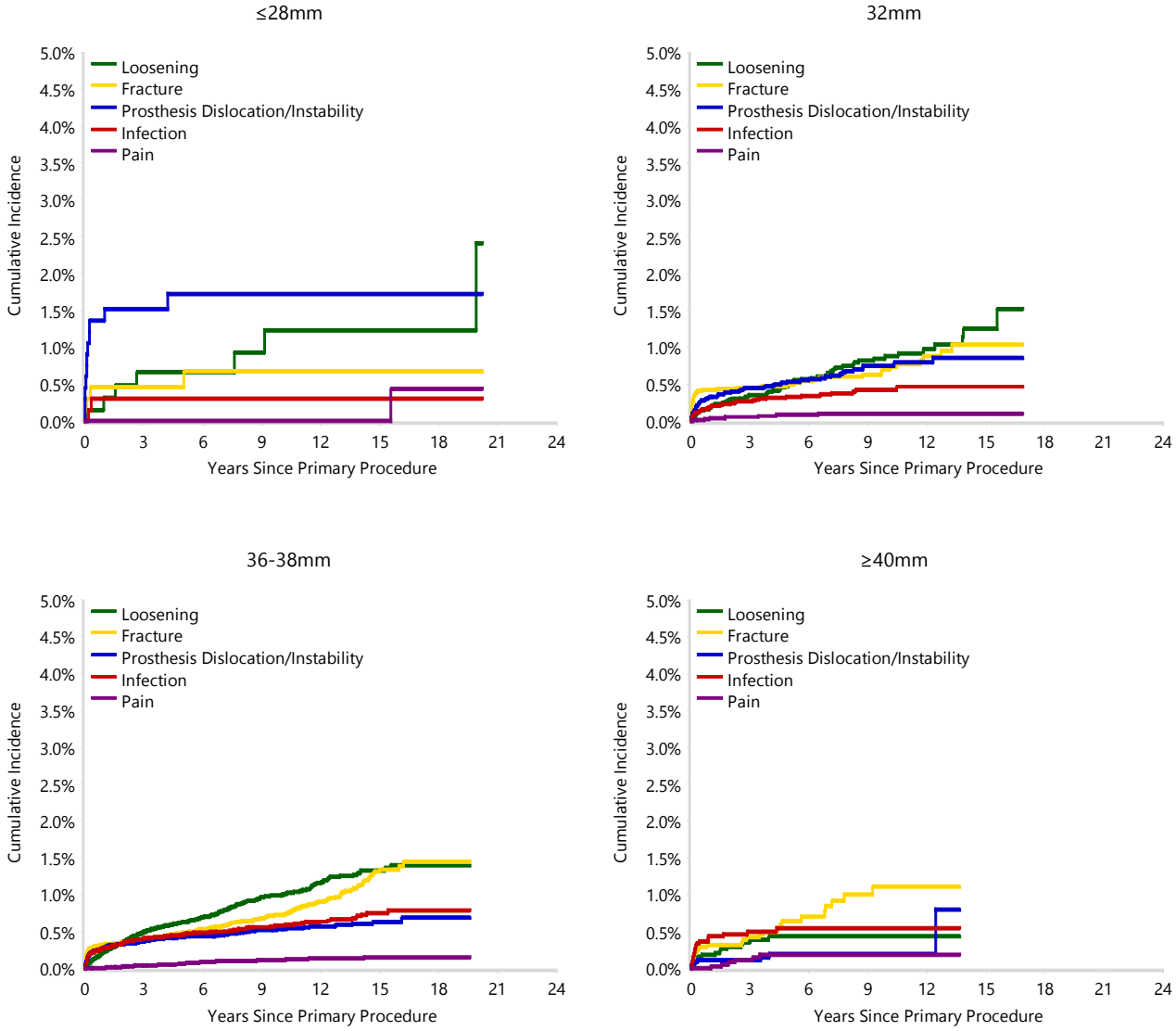
36-38mm vs ≥40mm

Entire Period: HR=1.24 (95% CI 1.00, 1.54), p=0.050

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| **≤28mm** | 665 | 604 | 519 | 429 | 252 | 174 | 48 |
| **32mm** | 11375 | 10348 | 8605 | 6817 | 2463 | 436 | 0 |
| **36-38mm** | 42579 | 39704 | 34282 | 28662 | 11856 | 2628 | 14 |
| **≥40mm** | 4498 | 3881 | 2756 | 1753 | 597 | 3 | 0 |

Note: Restricted to modern prostheses

**Figure HT57 Cumulative Incidence Revision Diagnosis of Mixed Ceramic/Mixed Ceramic Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

**Acetabular Size and Femoral Head Size**

This year there is an analysis of the combination of acetabular and femoral head size used in total conventional hip replacement. In this analysis, all modern bearing surfaces are combined. Acetabular size has been categorised <52mm, 52mm or >52mm according to the outer diameter.

When an acetabular component with outer diameter of <52mm is used, the rate of revision decreases as head size increases (Table HT46 and Figure HT58).

For acetabular size 52mm there is a higher rate of revision for heads size <32mm compared to 32mm after 2.5 years and after 1 year compared to head size >32mm. There is no revision rate difference between head sizes 32mm and >32mm with this acetabular size (Table HT46 and Figure HT59).

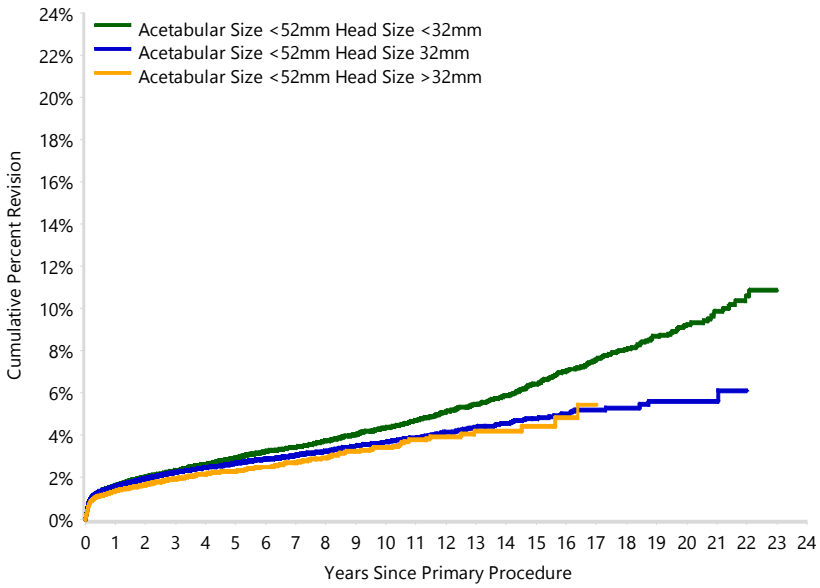
Where acetabular diameter is >52mm there is a higher rate of revision when femoral heads <32mm are used compared to both 32mm and >32mm, but there is no difference when head size 32mm is compared to >32mm (Table HT46 and Figure HT60).

**Table HT46 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Size and Head Size (Primary Diagnosis OA)**

| Acetabular Size | Head Size | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Acetabular Size <52mm | <32mm | 1379 | 34438 | 1.6 (1.5, 1.8) | 2.3 (2.2, 2.5) | 2.9 (2.7, 3.1) | 4.4 (4.1, 4.6) | 6.4 (6.0, 6.9) | 9.3 (8.5, 10.0) |
| | 32mm | 2154 | 76712 | 1.6 (1.5, 1.7) | 2.2 (2.1, 2.3) | 2.7 (2.6, 2.8) | 3.7 (3.5, 3.9) | 4.8 (4.5, 5.1) | 5.6 (5.0, 6.3) |
| | >32mm | 509 | 23538 | 1.4 (1.2, 1.5) | 1.9 (1.7, 2.1) | 2.3 (2.1, 2.5) | 3.4 (3.0, 3.8) | 4.4 (3.7, 5.3) | |
| Acetabular Size 52mm | <32mm | 633 | 15190 | 1.2 (1.0, 1.4) | 1.9 (1.7, 2.2) | 2.5 (2.3, 2.8) | 4.4 (4.0, 4.8) | 6.7 (6.1, 7.3) | 8.9 (8.1, 9.8) |
| | 32mm | 1152 | 35661 | 1.4 (1.3, 1.6) | 2.1 (1.9, 2.2) | 2.5 (2.3, 2.7) | 3.7 (3.5, 3.9) | 5.1 (4.7, 5.4) | 6.4 (5.7, 7.2) |
| | >32mm | 1651 | 59397 | 1.5 (1.4, 1.6) | 2.2 (2.0, 2.3) | 2.6 (2.5, 2.8) | 3.9 (3.7, 4.1) | 5.1 (4.7, 5.4) | |
| Acetabular Size >52mm | <32mm | 1626 | 30319 | 1.8 (1.6, 1.9) | 2.7 (2.5, 2.9) | 3.5 (3.3, 3.7) | 5.5 (5.2, 5.8) | 8.3 (7.9, 8.8) | 10.4 (9.8, 11.0) |
| | 32mm | 2185 | 56351 | 1.6 (1.5, 1.8) | 2.3 (2.2, 2.4) | 2.9 (2.7, 3.0) | 4.2 (4.0, 4.4) | 5.7 (5.4, 6.0) | 7.0 (6.5, 7.5) |
| | >32mm | 4861 | 151260 | 1.7 (1.6, 1.8) | 2.4 (2.4, 2.5) | 3.0 (2.9, 3.1) | 4.3 (4.2, 4.5) | 6.2 (5.9, 6.4) | 7.7 (7.0, 8.5) |
| TOTAL | | 16150 | 482866 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded. Restricted to modern prostheses

**Figure HT58 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Size <52mm and Head Size (Primary Diagnosis OA)**




HR - adjusted for age and gender

Acetabular Size <52mm Head Size <32mm vs
Acetabular Size <52mm Head Size 32mm

0 - 3Mth: HR=1.02 (95% CI 0.91, 1.15), p=0.751
3Mth - 1.5Yr: HR=1.15 (95% CI 0.99, 1.34), p=0.071
1.5Yr - 4Yr: HR=1.09 (95% CI 0.93, 1.29), p=0.293
4Yr - 4.5Yr: HR=1.97 (95% CI 1.28, 3.03), p=0.002
4.5Yr - 5Yr: HR=1.09 (95% CI 0.69, 1.74), p=0.705
5Yr - 7.5Yr: HR=1.35 (95% CI 1.07, 1.69), p=0.010
7.5Yr - 12Yr: HR=1.51 (95% CI 1.23, 1.86), p<0.001
12Yr+: HR=2.29 (95% CI 1.67, 3.14), p<0.001

Acetabular Size <52mm Head Size <32mm vs
Acetabular Size <52mm Head Size >32mm

Entire Period: HR=1.34 (95% CI 1.21, 1.49), p<0.001

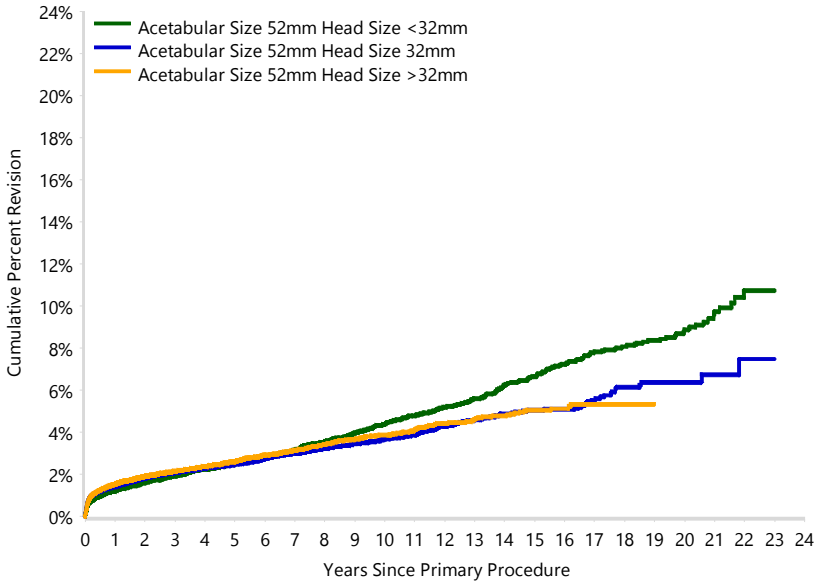
Acetabular Size <52mm Head Size 32mm vs
Acetabular Size <52mm Head Size >32mm

Entire Period: HR=1.12 (95% CI 1.01, 1.23), p=0.024

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Acetabular Size <52mm | <32mm | 34438 | 30681 | 24734 | 20019 | 11392 | 5003 | 1239 |
| | 32mm | 76712 | 68229 | 53494 | 39997 | 12703 | 2705 | 330 |
| | >32mm | 23538 | 19076 | 12836 | 8840 | 1930 | 321 | 1 |

Note: All procedures using metal/metal prostheses have been excluded. Restricted to modern prostheses

## Figure HT59 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Size 52mm by Head Size (Primary Diagnosis OA)




HR - adjusted for age and gender

Acetabular Size 52mm Head Size 32mm vs
Acetabular Size 52mm Head Size <32mm

0 - 6Mth: HR=1.25 (95% CI 1.03, 1.51), p=0.023
6Mth - 9Mth: HR=0.73 (95% CI 0.44, 1.20), p=0.213
9Mth - 2.5Yr: HR=0.96 (95% CI 0.78, 1.18), p=0.680
2.5Yr+: HR=0.64 (95% CI 0.56, 0.73), p<0.001

Acetabular Size 52mm Head Size >32mm vs
Acetabular Size 52mm Head Size <32mm

0 - 1Mth: HR=1.17 (95% CI 0.95, 1.45), p=0.139
1Mth - 3Mth: HR=1.47 (95% CI 1.16, 1.86), p=0.001
3Mth - 6Mth: HR=1.33 (95% CI 0.98, 1.79), p=0.067
6Mth - 9Mth: HR=0.97 (95% CI 0.62, 1.53), p=0.905
9Mth - 1Yr: HR=1.14 (95% CI 0.76, 1.70), p=0.536
1Yr - 5.5Yr: HR=0.83 (95% CI 0.71, 0.97), p=0.018
5.5Yr+: HR=0.59 (95% CI 0.50, 0.69), p<0.001

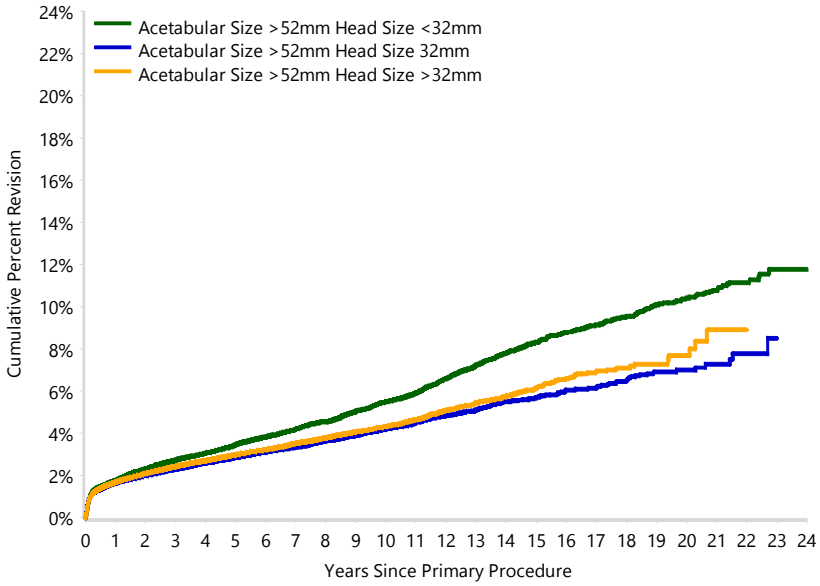
Acetabular Size 52mm Head Size >32mm vs
Acetabular Size 52mm Head Size 32mm

Entire Period: HR=1.03 (95% CI 0.96, 1.12), p=0.381

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Acetabular Size 52mm | <32mm | 15190 | 13467 | 10926 | 8943 | 5841 | 3151 | 916 |
| | 32mm | 35661 | 33467 | 29440 | 24498 | 10653 | 2787 | 346 |
| | >32mm | 59397 | 51749 | 39056 | 28760 | 9797 | 1839 | 13 |

Note: All procedures using metal/metal prostheses have been excluded. Restricted to modern prostheses

## Figure HT60 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Size >52mm by Head Size (Primary Diagnosis OA)




HR - adjusted for age and gender

Acetabular Size >52mm Head Size <32mm vs
Acetabular Size >52mm Head Size 32mm

0 - 3Mth: HR=1.14 (95% CI 1.02, 1.28), p=0.026
3Mth - 1Yr: HR=1.00 (95% CI 0.83, 1.19), p=0.960
1Yr - 1.5Yr: HR=1.61 (95% CI 1.28, 2.04), p<0.001
1.5Yr - 7.5Yr: HR=1.40 (95% CI 1.26, 1.56), p<0.001
7.5Yr+: HR=1.63 (95% CI 1.46, 1.83), p<0.001

Acetabular Size >52mm Head Size <32mm vs
Acetabular Size >52mm Head Size >32mm

0 - 3Mth: HR=1.09 (95% CI 0.97, 1.21), p=0.140
3Mth - 6Mth: HR=0.87 (95% CI 0.65, 1.14), p=0.308
6Mth - 1Yr: HR=1.02 (95% CI 0.81, 1.28), p=0.899
1Yr - 1.5Yr: HR=1.54 (95% CI 1.22, 1.94), p<0.001
1.5Yr - 4.5Yr: HR=1.21 (95% CI 1.06, 1.38), p=0.005
4.5Yr+: HR=1.55 (95% CI 1.42, 1.70), p<0.001

Acetabular Size >52mm Head Size >32mm vs
Acetabular Size >52mm Head Size 32mm

Entire Period: HR=1.05 (95% CI 1.00, 1.10), p=0.065

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Acetabular Size <52mm | <32mm | 34438 | 30681 | 24734 | 20019 | 11392 | 5003 | 1239 |
| | 32mm | 76712 | 68229 | 53494 | 39997 | 12703 | 2705 | 330 |
| | >32mm | 23538 | 19076 | 12836 | 8840 | 1930 | 321 | 1 |

Note: All procedures using metal/metal prostheses have been excluded. Restricted to modern prostheses

# Primary Total Hip Replacement

**Constrained Acetabular Prostheses**

Constrained acetabular prostheses have a mechanism to lock the femoral head into the acetabular component. Although often considered revision components, there have been 1,062 procedures using constrained acetabular prostheses for primary total conventional hip replacement. Of these, 837 procedures were constrained acetabular inserts and 225 procedures were constrained cups. There were 84 procedures reported in 2024. This is an increase of 29.2% compared to 2023. The most commonly used constrained prostheses are presented in Table HT47.

Constrained acetabular prostheses are proportionally used more frequently for fractured neck of femur, tumour, failed internal fixation, and fracture/dislocation compared to all other acetabular components (Table HT48).

When all diagnoses are included (Table HT49 and Figure HT61), and when used only for osteoarthritis (Table HT50), constrained acetabular prostheses have a higher rate of revision compared to other acetabular prostheses (Table HT53). Gender and age are not risk factors for revision (Table HT51 to Table HT53). The small number of cemented acetabular constrained prostheses and the low number of revisions make it difficult to compare outcomes of these devices based on acetabular fixation.

**Table HT47 Cumulative Percent Revision of Constrained Primary Total Conventional Hip Replacement by Component (All Diagnoses)**

| Constrained Prosthesis | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| G7/G7 | 12 | 197 | 5.6 (3.0, 10.1) | 6.3 (3.5, 11.2) | | | | |
| PINNACLE/PINNACLE | 10 | 147 | 5.0 (2.4, 10.2) | 6.6 (3.5, 12.3) | 7.9 (4.3, 14.6) | | | |
| Trabecular Metal (Shell)/Longevity | 5 | 94 | 2.2 (0.6, 8.6) | 4.6 (1.7, 11.7) | 6.4 (2.6, 14.9) | 6.4 (2.6, 14.9) | | |
| Trident (Cup) | 11 | 174 | 6.3 (3.4, 11.4) | 6.3 (3.4, 11.4) | | | | |
| Trident (Shell)/Trident | 14 | 194 | 5.0 (2.6, 9.4) | 5.7 (3.1, 10.5) | 7.6 (4.3, 13.1) | | | |
| Other Constrained Prosthesis | 22 | 256 | 4.4 (2.4, 8.0) | 8.7 (5.4, 13.7) | 11.9 (7.8, 18.0) | | | |
| TOTAL | 74 | 1062 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT48 Primary Total Conventional Hip Replacement by Primary Diagnosis and Acetabular Type**

| Primary Diagnosis | Constrained Prosthesis | | Other Acetabular Prosthesis | |
|---|---|---|---|---|
| | N | % | N | % |
| Osteoarthritis | 404 | 38.0 | 482676 | 87.6 |
| Fractured Neck Of Femur | 285 | 26.8 | 31185 | 5.7 |
| Osteonecrosis | 40 | 3.8 | 17691 | 3.2 |
| Developmental Dysplasia | 26 | 2.4 | 7609 | 1.4 |
| Rheumatoid Arthritis | 9 | 0.8 | 3988 | 0.7 |
| Tumour | 124 | 11.7 | 2687 | 0.5 |
| Other Inflammatory Arthritis | 4 | 0.4 | 2139 | 0.4 |
| Failed Internal Fixation | 126 | 11.9 | 2002 | 0.4 |
| Fracture/Dislocation | 37 | 3.5 | 779 | 0.1 |
| Arthrodesis Takedown | 3 | 0.3 | 86 | 0.0 |
| Other | 4 | 0.4 | 111 | 0.0 |
| TOTAL | 1062 | 100.0 | 550953 | 100.0 |

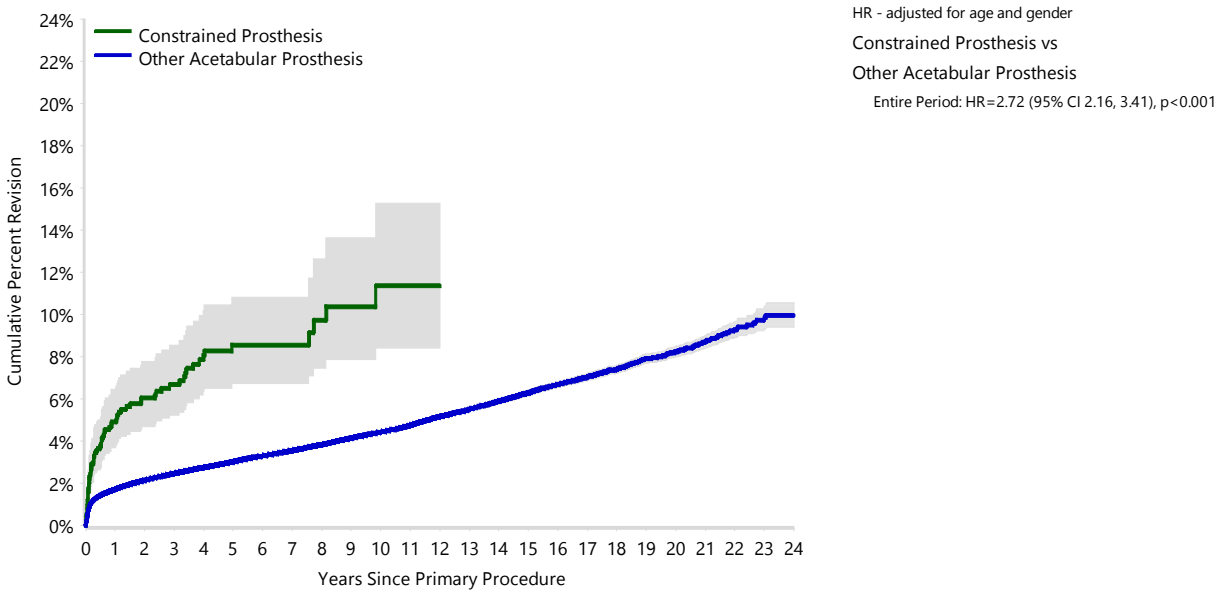
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT49 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Type (All Diagnoses)**

| Acetabular Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Constrained Prosthesis | 74 | 1062 | 4.9 (3.7, 6.5) | 6.7 (5.2, 8.5) | 8.6 (6.7, 10.8) | 11.4 (8.4, 15.3) | | |
| Other Acetabular Prosthesis | 19394 | 550953 | 1.7 (1.7, 1.8) | 2.5 (2.4, 2.5) | 3.0 (3.0, 3.1) | 4.4 (4.4, 4.5) | 6.3 (6.2, 6.4) | 8.3 (8.0, 8.5) |
| TOTAL | 19468 | 552015 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT61 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Type (All Diagnoses)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Constrained Prosthesis | 1062 | 791 | 531 | 313 | 85 | 21 | 4 |
| Other Acetabular Prosthesis | 550953 | 486790 | 383551 | 295373 | 121949 | 37816 | 7391 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

# Primary Total Hip Replacement

**Table HT50 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Type (Primary Diagnosis OA)**

| Acetabular Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Constrained Prosthesis | 21 | 404 | 2.6 (1.4, 4.8) | 4.5 (2.8, 7.3) | 5.9 (3.7, 9.1) | 8.0 (4.9, 13.0) | | |
| Other Acetabular Prosthesis | 16138 | 482676 | 1.6 (1.6, 1.6) | 2.3 (2.3, 2.3) | 2.8 (2.8, 2.9) | 4.2 (4.1, 4.3) | 6.0 (5.9, 6.1) | 7.9 (7.7, 8.2) |
| TOTAL | 16159 | 483080 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT51 Cumulative Percent Revision of Constrained Primary Total Conventional Hip Replacement by Gender (Primary Diagnosis OA)**

| Acetabular Type | Gender | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Constrained Prosthesis | Male | 10 | 148 | 3.6 (1.5, 8.5) | 6.4 (3.2, 12.6) | 9.1 (4.9, 16.7) | | | |
| | Female | 11 | 256 | 2.0 (0.8, 4.8) | 3.5 (1.7, 6.8) | 4.1 (2.1, 7.9) | 7.0 (3.6, 13.6) | | |
| TOTAL | | 21 | 404 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT52 Cumulative Percent Revision of Constrained Primary Total Conventional Hip Replacement by Age (Primary Diagnosis OA)**

| Acetabular Type | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Constrained Prosthesis | <70 | 7 | 96 | 2.2 (0.5, 8.4) | 6.2 (2.6, 14.4) | 7.7 (3.5, 16.6) | 10.5 (4.9, 21.9) | | |
| | ≥70 | 14 | 308 | 2.7 (1.4, 5.4) | 4.0 (2.2, 7.1) | 5.3 (3.0, 9.1) | | | |
| TOTAL | | 21 | 404 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT53 Comparisons of Primary Total Conventional Hip Replacement using Constrained Acetabular Components (Primary Diagnosis OA)**

| Comparison | HR - adjusted for age and gender |
|---|---|
| Constrained Prosthesis vs Other Acetabular Prosthesis | Entire Period: HR=1.90 (95% CI 1.24, 2.92), p=0.003 |
| Constrained Prosthesis Female vs Constrained Prosthesis Male | Entire Period: HR=0.59 (95% CI 0.25, 1.39), p=0.225 |
| Constrained Prosthesis ≥70 vs Constrained Prosthesis <70 | Entire Period: HR=0.70 (95% CI 0.28, 1.75), p=0.446 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

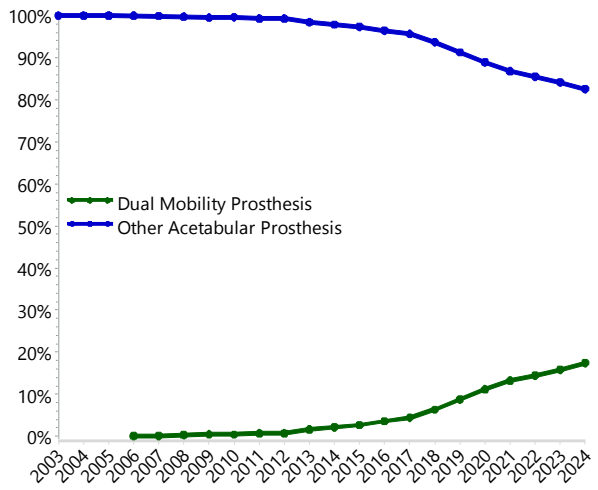
**Dual Mobility Acetabular Prostheses**
Dual mobility prostheses have a femoral head which moves within a polyethylene component, which also moves within a fixed acetabular shell.

There are 41,636 primary total conventional hip replacement procedures using dual mobility prostheses. This is an increase of 12.1% (n=8,494) since 2023. There has been an increase in annual use of dual mobility prostheses since 2012 (Figure HT62).

The commonly used dual mobility prostheses are presented in Table HT54. Compared to other acetabular prostheses, dual mobility acetabular prostheses are proportionally used more frequently for fractured neck of femur, tumour, and failed internal fixation (Table HT55).

When all diagnoses are included, dual mobility prostheses have a higher rate of revision compared to other acetabular prostheses (Table HT56 and Figure HT63).

**Figure HT62 Primary Total Conventional Hip Replacement by Dual Mobility (All Diagnoses)**




Note: Restricted to modern prostheses

In 2024, dual mobility prostheses are used in 6.1% of primary total hip procedures for osteoarthritis. For the diagnosis of osteoarthritis, there is no difference in the overall rate of revision when dual mobility prostheses are used (Table HT57 and Table HT62). Dual mobility prostheses have a lower rate of revision for dislocation/instability compared to all other acetabular prostheses (Table HT58 and Table HT62).

The reasons for revision for dual mobility and other acetabular components are shown in Figure HT64

Males have a higher risk of revision than females when dual mobility prostheses are used for a diagnosis of osteoarthritis (Table HT59 and Table HT62). However, age is not a risk factor for revision (Table HT60 and Table HT62).

The most common reasons for males and females when dual mobility prostheses are used are fracture and infection (Figure HT65).

The majority of dual mobility prostheses are inserted with cementless acetabular fixation. However, there is no difference in the rate of revision when types of acetabular fixation are compared (Table HT61 and Table HT62).

There is no difference in the rate of revision when dual mobility prostheses are compared to other acetabular prostheses for each surgical approach (Table HT63 and Figure HT66 to Figure HT68).

# Primary Total Hip Replacement

**Table HT54 Cumulative Percent Revision of Dual Mobility Primary Total Conventional Hip Replacement by Component (All Diagnoses)**

| Dual Mobility Insert | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| 2M | 29 | 555 | 2.6 (1.5, 4.3) | 4.2 (2.8, 6.3) | 4.6 (3.0, 6.8) | 8.4 (5.0, 13.8) | | |
| Active Articulation | 248 | 9677 | 2.0 (1.7, 2.3) | 2.8 (2.4, 3.2) | 3.1 (2.8, 3.6) | | | |
| Avantage | 21 | 488 | 3.8 (2.4, 6.0) | 4.5 (2.9, 7.0) | 5.6 (3.6, 8.8) | | | |
| BI-MENTUM | 41 | 1537 | 2.4 (1.7, 3.4) | 3.2 (2.3, 4.4) | | | | |
| G7 | 10 | 685 | | | | | | |
| MDM (Dual Mobility) | 200 | 8325 | 2.0 (1.7, 2.3) | 2.6 (2.2, 3.0) | 3.3 (2.8, 4.0) | 4.8 (3.8, 6.0) | | |
| MobiliT CUP | 4 | 219 | 2.0 (0.7, 5.2) | | | | | |
| Novae E | 21 | 877 | 1.2 (0.6, 2.2) | 1.9 (1.2, 3.2) | 2.3 (1.4, 4.0) | 5.7 (3.2, 9.9) | | |
| OR30 | 0 | 159 | 0.0 (0.0, 0.0) | | | | | |
| Polarcup | 60 | 1511 | 2.3 (1.6, 3.2) | 3.7 (2.8, 4.8) | 4.2 (3.2, 5.5) | 6.0 (4.3, 8.3) | | |
| Restoration | 231 | 5714 | 2.5 (2.1, 2.9) | 3.4 (2.9, 3.9) | 4.2 (3.7, 4.8) | 5.7 (4.6, 6.9) | | |
| Saturne | 48 | 1868 | 1.4 (0.9, 2.0) | 2.3 (1.7, 3.2) | 3.0 (2.2, 4.1) | | | |
| SignaSure | 23 | 1050 | 2.0 (1.3, 3.1) | 3.4 (2.0, 5.7) | | | | |
| Trinity | 114 | 6310 | 1.4 (1.1, 1.7) | 2.0 (1.6, 2.4) | 2.5 (2.0, 3.1) | | | |
| Versafit | 87 | 2626 | 2.4 (1.9, 3.1) | 3.3 (2.7, 4.2) | 3.8 (3.0, 4.7) | | | |
| Other (4) | 1 | 35 | 2.9 (0.4, 19.1) | 2.9 (0.4, 19.1) | | | | |
| **TOTAL** | **1138** | **41636** | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Only prostheses with >50 procedures have been listed
Restricted to modern prostheses

**Table HT55 Primary Total Conventional Hip Replacement by Primary Diagnosis and Acetabular Mobility**

| Primary Diagnosis | Dual Mobility Prosthesis | | Other Acetabular Prosthesis | |
|---|---|---|---|---|
| | N | Col% | N | Col% |
| Osteoarthritis | 29463 | 70.8 | 453617 | 88.9 |
| Fractured Neck Of Femur | 7670 | 18.4 | 23800 | 4.7 |
| Osteonecrosis | 1709 | 4.1 | 16022 | 3.1 |
| Developmental Dysplasia | 878 | 2.1 | 6757 | 1.3 |
| Rheumatoid Arthritis | 211 | 0.5 | 3786 | 0.7 |
| Tumour | 784 | 1.9 | 2027 | 0.4 |
| Other Inflammatory Arthritis | 141 | 0.3 | 2002 | 0.4 |
| Failed Internal Fixation | 525 | 1.3 | 1603 | 0.3 |
| Fracture/Dislocation | 215 | 0.5 | 601 | 0.1 |
| Arthrodesis Takedown | 17 | 0.0 | 72 | 0.0 |
| Other | 23 | 0.1 | 92 | 0.0 |
| **TOTAL** | **41636** | **100.0** | **510379** | **100.0** |

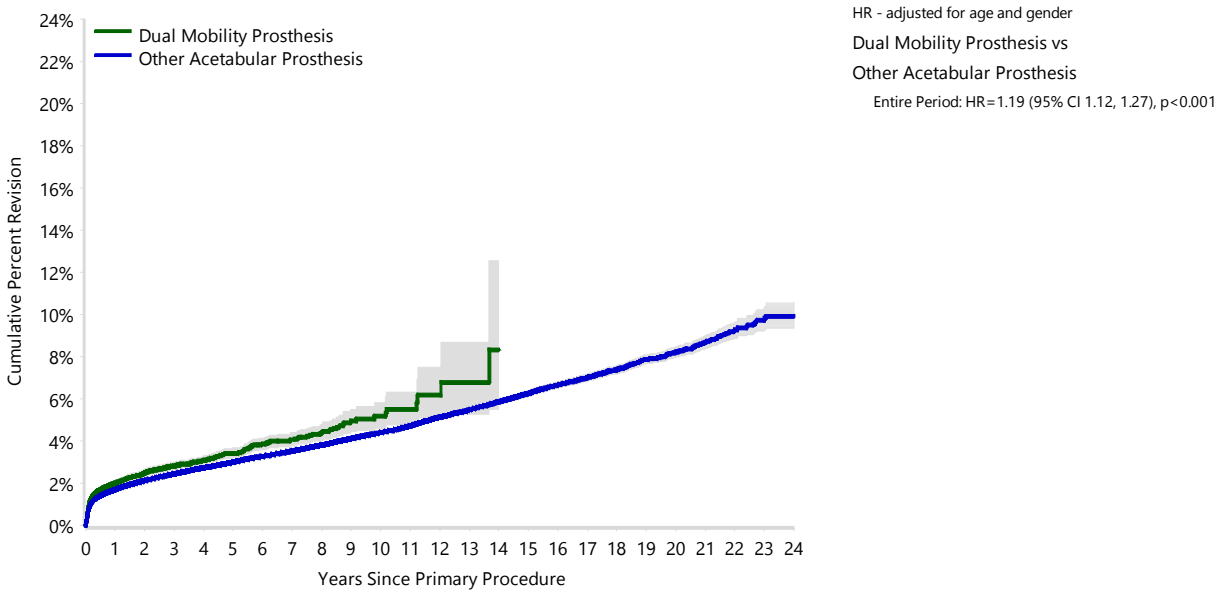
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT56 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Mobility (All Diagnoses)**

| Acetabular Mobility | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Dual Mobility Prosthesis | 1138 | 41636 | 2.0 (1.9, 2.2) | 2.8 (2.6, 3.0) | 3.4 (3.2, 3.7) | 5.2 (4.6, 5.8) | | |
| Other Acetabular Prosthesis | 18330 | 510379 | 1.7 (1.7, 1.7) | 2.5 (2.4, 2.5) | 3.0 (3.0, 3.1) | 4.4 (4.3, 4.5) | 6.3 (6.1, 6.4) | 8.2 (8.0, 8.5) |
| TOTAL | 19468 | 552015 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT63 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Mobility (All Diagnoses)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Dual Mobility Prosthesis | 41636 | 31487 | 17205 | 7874 | 626 | 34 | 0 |
| Other Acetabular Prosthesis | 510379 | 456094 | 366877 | 287812 | 121408 | 37803 | 7395 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

# Primary Total Hip Replacement

**Table HT57 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Mobility (Primary Diagnosis OA)**

| Acetabular Mobility | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Dual Mobility Prosthesis | 671 | 29463 | 1.6 (1.5, 1.8) | 2.3 (2.1, 2.5) | 2.9 (2.6, 3.1) | 4.3 (3.7, 5.1) | | |
| Other Acetabular Prosthesis | 15488 | 453617 | 1.6 (1.6, 1.6) | 2.3 (2.3, 2.3) | 2.8 (2.8, 2.9) | 4.2 (4.1, 4.2) | 6.0 (5.9, 6.1) | 7.9 (7.7, 8.2) |
| TOTAL | **16159** | **483080** | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT58 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Mobility (Primary Diagnosis OA, Revision for Prosthesis Dislocation/Instability)**

| Acetabular Mobility | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Dual Mobility Prosthesis | 97 | 29463 | 0.2 (0.2, 0.3) | 0.3 (0.3, 0.4) | 0.5 (0.4, 0.6) | 0.5 (0.4, 0.6) | | |
| Other Acetabular Prosthesis | 3344 | 453617 | 0.4 (0.4, 0.4) | 0.6 (0.5, 0.6) | 0.7 (0.7, 0.7) | 0.9 (0.9, 0.9) | 1.1 (1.1, 1.2) | 1.4 (1.3, 1.5) |
| TOTAL | **3441** | **483080** | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT59 Cumulative Percent Revision of Dual Mobility Primary Total Conventional Hip Replacement by Gender (Primary Diagnosis OA)**

| Acetabular Mobility | Gender | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Dual Mobility Prosthesis | Male | 282 | 10823 | 1.9 (1.6, 2.1) | 2.6 (2.3, 3.0) | 3.3 (2.9, 3.8) | 5.3 (4.1, 6.9) |
| | Female | 389 | 18640 | 1.5 (1.4, 1.7) | 2.1 (1.9, 2.4) | 2.6 (2.3, 2.9) | 3.8 (3.1, 4.6) |
| TOTAL | | **671** | **29463** | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT60 Cumulative Percent Revision of Dual Mobility Primary Total Conventional Hip Replacement by Age (Primary Diagnosis OA)**

| Acetabular Mobility | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Dual Mobility Prosthesis | <70 | 283 | 11631 | 1.7 (1.5, 2.0) | 2.4 (2.2, 2.8) | 3.0 (2.6, 3.4) | 4.0 (3.3, 4.8) |
| | ≥70 | 388 | 17832 | 1.6 (1.4, 1.8) | 2.2 (2.0, 2.5) | 2.8 (2.5, 3.1) | 4.7 (3.7, 5.9) |
| TOTAL | | **671** | **29463** | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT61 Cumulative Percent Revision of Dual Mobility Primary Total Conventional Hip Replacement by Acetabular Fixation (Primary Diagnosis OA)**

| Acetabular Mobility | Acetabular Fixation | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Dual Mobility Prosthesis | Cementless | 654 | 29005 | 1.6 (1.5, 1.8) | 2.3 (2.1, 2.5) | 2.9 (2.6, 3.1) | 4.3 (3.7, 5.0) | | |
| | Cemented | 17 | 458 | 2.0 (1.1, 3.8) | 2.7 (1.5, 4.9) | 3.9 (2.1, 6.9) | | | |
| TOTAL | | 671 | 29463 | | | | | | |

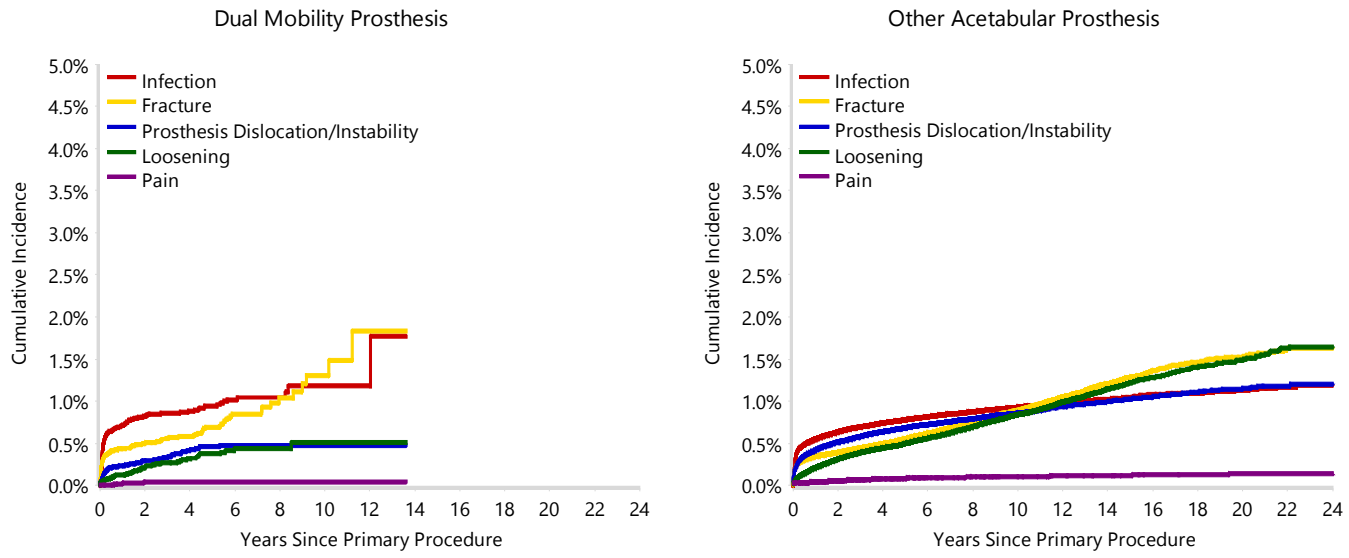
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT62 Comparisons of Revision Rates of Primary Total Conventional Hip Replacement by Acetabular Mobility (Primary Diagnosis OA)**

| Diagnosis/Outcome | Comparison | HR - adjusted for age and gender |
|---|---|---|
| All Cause Revision | Dual Mobility Prosthesis vs Other Acetabular Prosthesis | Entire Period: HR=1.06 (95% CI 0.98, 1.14), p=0.150 |
| Revision for Prosthesis Dislocation/Instability | Dual Mobility Prosthesis vs Other Acetabular Prosthesis | Entire Period: HR=0.60 (95% CI 0.49, 0.73), p<0.001 |
| All Cause Revision | Dual Mobility Prosthesis Female vs Dual Mobility Prosthesis Male | Entire Period: HR=0.80 (95% CI 0.68, 0.93), p=0.003 |
| | Dual Mobility Prosthesis ≥70 vs Dual Mobility Prosthesis <70 | Entire Period: HR=0.94 (95% CI 0.81, 1.10), p=0.445 |
| | Dual Mobility Prosthesis Cemented vs Dual Mobility Prosthesis Cementless | Entire Period: HR=1.61 (95% CI 1.00, 2.62), p=0.052 |

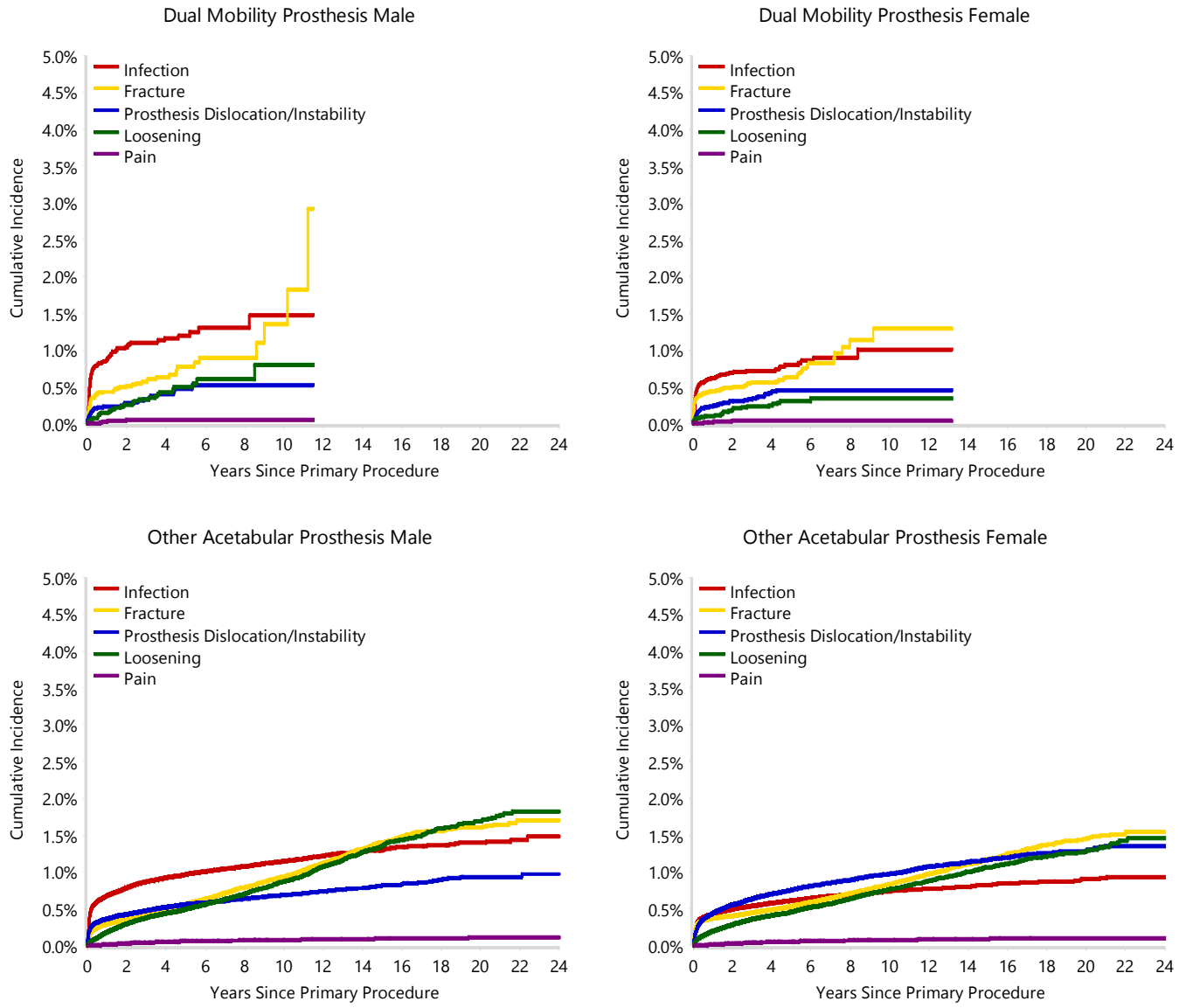
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT64 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement by Acetabular Mobility (Primary Diagnosis OA)**




Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT65 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement by Acetabular Mobility and Gender (Primary Diagnosis OA)**



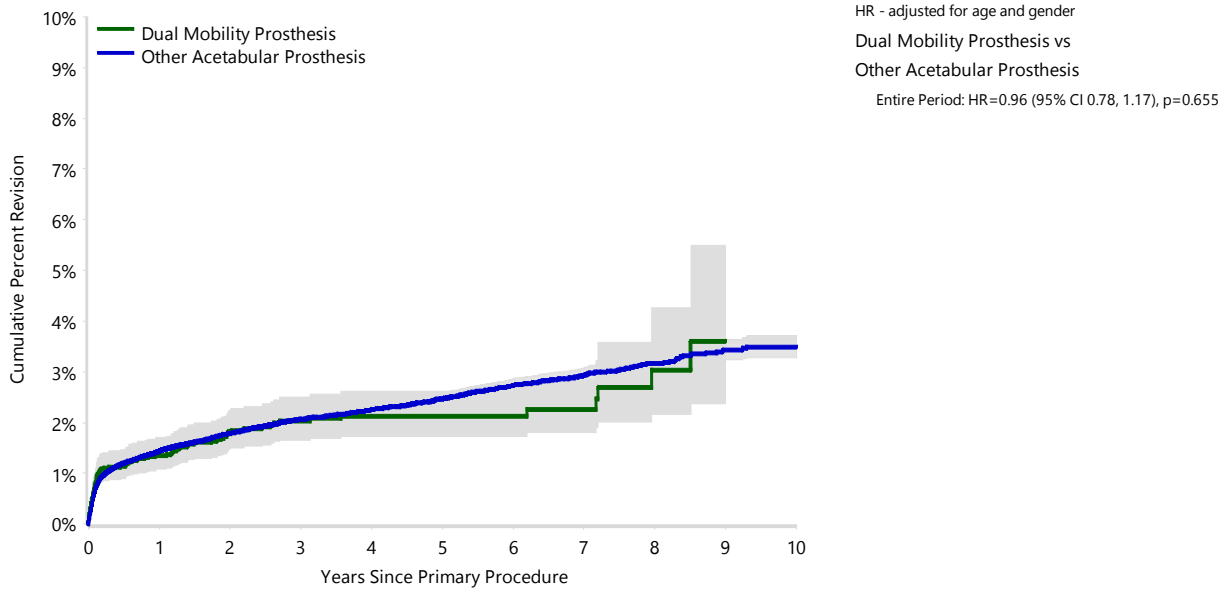

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT63 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Surgical Approach and Acetabular Mobility (Primary Diagnosis OA)**

| Surgical Approach | Acetabular Mobility | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 8 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Anterior | Dual Mobility Prosthesis | 102 | 5528 | 1.4 (1.1, 1.7) | 2.0 (1.7, 2.5) | 2.1 (1.7, 2.6) | 3.0 (2.2, 4.3) | |
| | Other Acetabular Prosthesis | 2097 | 93864 | 1.4 (1.4, 1.5) | 2.1 (2.0, 2.2) | 2.5 (2.4, 2.6) | 3.2 (3.0, 3.3) | 3.5 (3.3, 3.7) |
| Lateral | Dual Mobility Prosthesis | 74 | 2362 | 2.4 (1.8, 3.1) | 2.8 (2.2, 3.6) | 3.5 (2.7, 4.5) | 5.0 (3.8, 6.7) | |
| | Other Acetabular Prosthesis | 1244 | 40016 | 1.9 (1.8, 2.0) | 2.6 (2.5, 2.8) | 3.1 (3.0, 3.3) | 3.8 (3.6, 4.1) | |
| Posterior | Dual Mobility Prosthesis | 450 | 20735 | 1.6 (1.5, 1.8) | 2.3 (2.1, 2.6) | 3.0 (2.7, 3.3) | 3.5 (3.0, 4.1) | |
| | Other Acetabular Prosthesis | 4382 | 163472 | 1.8 (1.7, 1.8) | 2.5 (2.4, 2.5) | 2.9 (2.8, 3.0) | 3.6 (3.5, 3.7) | 4.1 (3.9, 4.4) |
| TOTAL | | 8349 | 325977 | | | | | |

Note: All procedures using metal/metal prostheses have been excluded. Restricted to modern prostheses.

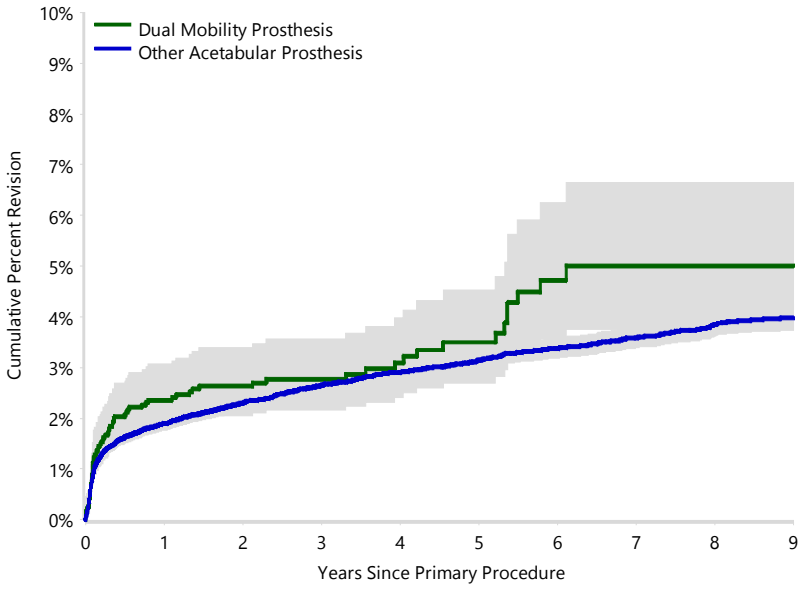
**Figure HT66 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Using the Anterior Surgical Approach and Acetabular Mobility (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 8 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|
| Dual Mobility Prosthesis | 5528 | 4203 | 2333 | 1130 | 269 | 2 |
| Other Acetabular Prosthesis | 93864 | 79082 | 54906 | 34711 | 10529 | 51 |

Note: All procedures using metal/metal prostheses have been excluded. Restricted to modern prostheses.

**Figure HT67 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Using the Lateral Surgical Approach and Acetabular Mobility (Primary Diagnosis OA)**

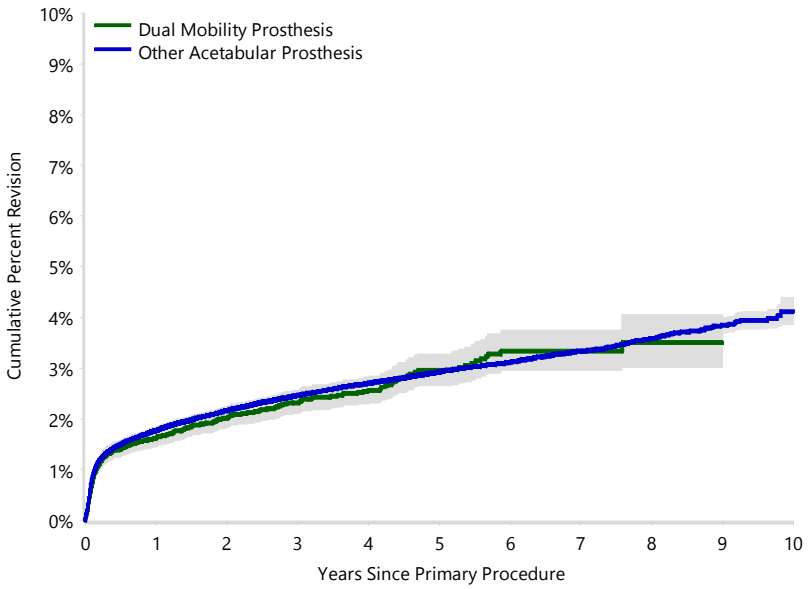



HR - adjusted for age and gender
Dual Mobility Prosthesis vs
Other Acetabular Prosthesis
Entire Period: HR=1.23 (95% CI 0.97, 1.55), p=0.090

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 8 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|
| Dual Mobility Prosthesis | 2362 | 1898 | 1092 | 556 | 110 | 0 |
| Other Acetabular Prosthesis | 40016 | 35971 | 28483 | 21059 | 8540 | 17 |

Note: All procedures using metal/metal prostheses have been excluded. Restricted to modern prostheses.

**Figure HT68 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Using the Posterior Surgical Approach and Acetabular Mobility (Primary Diagnosis OA)**




HR - adjusted for age and gender
Dual Mobility Prosthesis vs
Other Acetabular Prosthesis
Entire Period: HR=0.97 (95% CI 0.88, 1.07), p=0.578

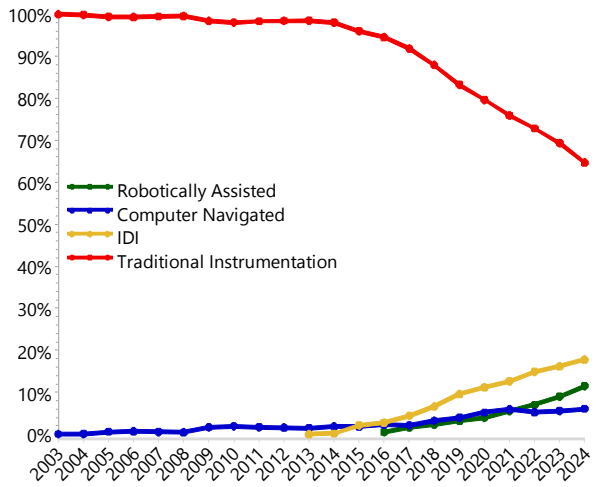
| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 8 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|
| Dual Mobility Prosthesis | 20735 | 15562 | 8141 | 3254 | 420 | 2 |
| Other Acetabular Prosthesis | 163472 | 140059 | 99296 | 64742 | 20115 | 53 |

Note: All procedures using metal/metal prostheses have been excluded. Restricted to modern prostheses.

## SURGEON ASSISTIVE TOOLS (SAT)

Computer navigation, image derived instrumentation (IDI) and robotic assistance, to aid implantation of hip replacements, have been labelled as 'surgeon assistive tools'. Procedures using traditional instrumentation have decreased to 64.6% of primary hip procedures in 2024. The increase in use of each assistive tool is shown in Figure HT69. Results for primary total hip replacement for osteoarthritis with the use of these techniques are presented, followed by a comparison of the assistive tools used with XLPE since 2016. Revision outcomes are analysed using each of these methods compared to traditional instrumentation.

**Figure HT69 Primary Total Conventional Hip Replacement by Surgeon Assistive Tools (Primary Diagnosis OA)**




### Computer Navigation

There have been 13,995 primary total hip replacement procedures using computer navigation. In 2024, computer navigation was used in 6.1% of all primary total hip replacement procedures.

When adjusted for age, gender, ASA, BMI, femoral fixation, head size, surgical approach, head material and surgeon volume there is no difference in the rate of revision when procedures using computer navigation are compared to procedures using traditional instrumentation (Table HT64, Figure HT70 and Figure HT71).

Using the same adjustments, there is no difference in the rate of revision for patients aged <65 years or ≥65 years when computer navigation is used compared to traditional instrumentation (Table HT65 and Figure HT72).

The outcomes of four prosthesis combinations used with computer navigation and traditional instrumentation with >1,000 procedures in each group are shown in Table HT66 and Table HT67.

### Image Derived Instrumentation (IDI)

IDI is the use of custom-made preparation and/or alignment guides derived from images by 3D printing specifically for each patient, to facilitate accurate placement of acetabular and femoral components.

There have been 35,436 primary total hip replacement procedures undertaken using IDI since 2013. In 2024, IDI was used in 17.8% of all primary total hip replacement procedures.

When procedures using IDI are compared to procedures using traditional instrumentation, adjusting for age, gender, ASA, BMI, femoral fixation, head size, surgical approach, head material and surgeon volume, IDI usage has a lower rate of revision (Table HT68 and Figure HT73). There is a decreased proportion of revision for dislocation/instability when IDI is used (Figure HT74).

Using the same adjustments, for patients aged ≥65 years where IDI is used, there is a lower rate of revision compared to traditional instrumentation, while a lower rate of revision is only for the first 3 months with IDI for patients aged <65 years (Table HT69 and Figure HT75).

The outcomes of 2 prosthesis combinations used with IDI and with traditional instrumentation, and that has >2,000 procedures in each group, are shown in Table HT70 and Table HT71.

### Robotic Assistance

Robotic assistance has been recorded for 16,784 total hip replacements since 2016. In 2024, robotic assistance was used in 11.5% of all primary total hip replacement procedures. There are 4 robotic systems that are used with a small number of prostheses, and many of these systems have limited follow-up.

When adjusted for age, gender, ASA, BMI, femoral fixation, head size, surgical approach, head material and surgeon volume, there is no difference in the rate of revision when procedures using robotic assistance are compared to procedures using traditional instrumentation until 1.5 years, after which time robotic assistance has a higher rate of revision (Table HT72 and Figure HT76). There are increased proportions of revisions for infection and fracture using robotic assistance (Figure HT77). Using the same adjustments, there is no difference in the rate of revision for patients aged <65 years or for patients aged ≥65 years when robotic assistance is used compared to traditional instrumentation (Table HT73 and Figure HT78).

The outcomes of three prosthesis combinations used with robotic assistance and traditional instrumentation with >1,000 procedures in each group are shown in Table HT74 and Table HT75.

### Surgeon Assistive Tools Compared

Total conventional hip procedures since 2016 for osteoarthritis using XLPE with the use of assistive tools and adjusted for age, gender, ASA, BMI, femoral fixation, head size, surgical approach, head material and surgeon volume are compared in Table HT76 and Figure HT79.

Procedures using robotic assistance have a higher rate of revision compared to where IDI is used.

**Prosthesis-Specific Analysis**

There are two prosthesis combinations using XLPE that have used at least three different assistive methods that have over 1,000 procedures in each group. The analyses for these two prostheses have been adjusted for age, gender, ASA, BMI, femoral fixation, head size, surgical approach, head material and surgeon volume.

There is no difference in the rate of revision when the Accolade II/Trident (Shell) combination is used with robotic assistance compared to when computer navigation is used, and when compared to procedures using traditional instrumentation (Table HT77 and Figure HT80).

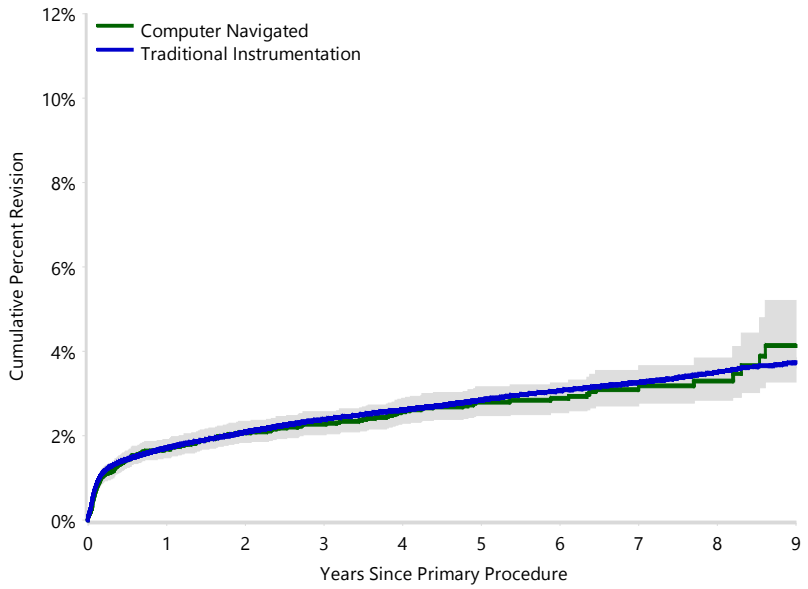
The Exeter V40/Trident (Shell) combination also shows no difference when procedures using any of the three types of assistive tools are compared (Table HT78 and Figure HT81).

**Table HT64 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Since 2015 by Computer Navigation (Primary Diagnosis OA)**

| Surgeon Assistive Tool | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|
| Computer Navigated | 321 | 13995 | 1.7 (1.5, 1.9) | 2.3 (2.0, 2.6) | 2.8 (2.5, 3.2) | 3.1 (2.7, 3.5) | 4.1 (3.3, 5.2) |
| Traditional Instrumentation | 6574 | 247345 | 1.7 (1.7, 1.8) | 2.4 (2.3, 2.5) | 2.8 (2.8, 2.9) | 3.3 (3.2, 3.4) | 3.7 (3.6, 3.8) |
| TOTAL | 6895 | 261340 | | | | | |

Note: All procedures using metal/metal prostheses have been excluded.
Restricted to modern prostheses.
Restricted to procedures with known ASA, BMI, femoral fixation, head size, surgical approach, head material and surgeon volume.

**Figure HT70 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Since 2015 by Computer Navigation (Primary Diagnosis OA)**




HR - adjusted for age, gender, ASA, BMI, head size, head material, femoral fixation, surgical approach and surgeon volume

Traditional Instrumentation vs Computer Navigated

Entire Period: HR=1.05 (95% CI 0.94, 1.17), p=0.425

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|
| Computer Navigated | 13995 | 11169 | 6900 | 3272 | 1212 | 256 |
| Traditional Instrumentation | 247345 | 215137 | 157078 | 104718 | 55776 | 14750 |

Note: All procedures using metal/metal prostheses have been excluded.
Restricted to modern prostheses.
Restricted to procedures with known ASA, BMI, femoral fixation, head size, surgical approach, head material and surgeon volume.

**Figure HT71 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement Since 2015 by Computer Navigation (Primary Diagnoses OA)**

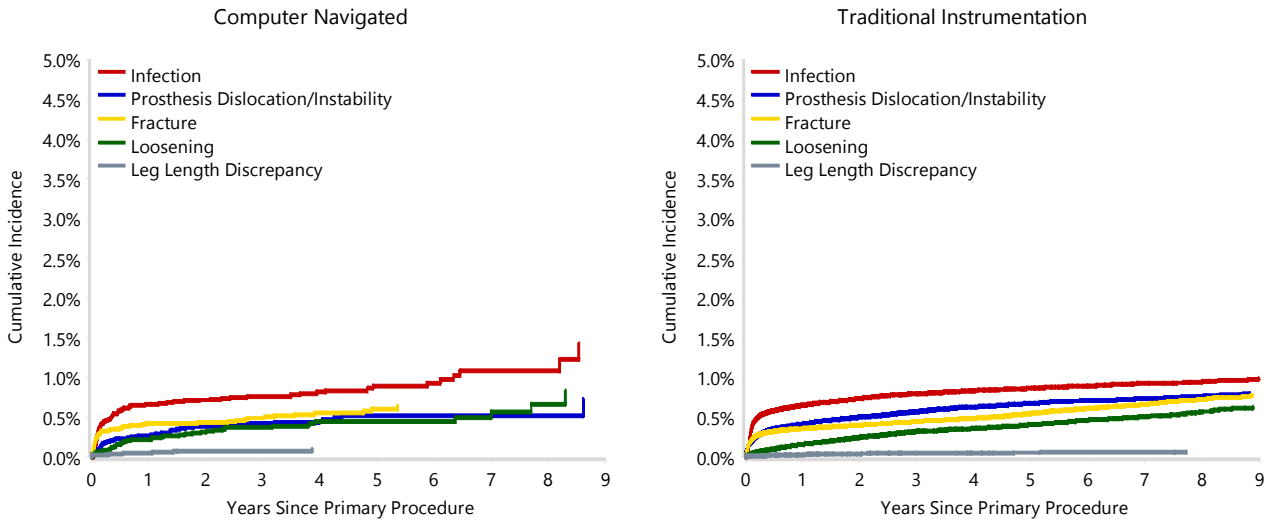
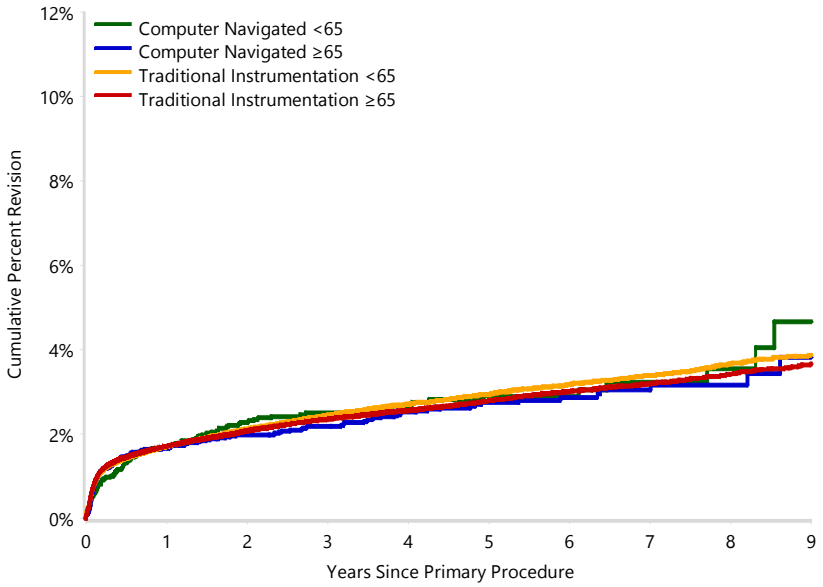


**Table HT65 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Since 2015 by Computer Navigation and Age (Primary Diagnosis OA)**

| Surgeon Assistive Tool | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|
| Computer Navigated | <65 | 108 | 4453 | 1.7 (1.4, 2.1) | 2.5 (2.0, 3.1) | 2.9 (2.4, 3.6) | 3.2 (2.6, 4.1) | 4.7 (3.2, 6.9) |
| | ≥65 | 213 | 9542 | 1.7 (1.4, 2.0) | 2.2 (1.9, 2.5) | 2.7 (2.4, 3.2) | 3.0 (2.6, 3.6) | 3.8 (2.9, 5.1) |
| Traditional Instrumentation | <65 | 2340 | 83504 | 1.7 (1.6, 1.8) | 2.4 (2.3, 2.6) | 2.9 (2.8, 3.1) | 3.4 (3.2, 3.5) | 3.9 (3.7, 4.1) |
| | ≥65 | 4234 | 163841 | 1.7 (1.7, 1.8) | 2.4 (2.3, 2.4) | 2.8 (2.7, 2.9) | 3.2 (3.1, 3.3) | 3.7 (3.5, 3.8) |
| TOTAL | | 6895 | 261340 | | | | | |

Note: All procedures using metal/metal prostheses have been excluded.
Restricted to modern prostheses.
Restricted to procedures with known gender, ASA, BMI, femoral fixation, head size, surgical approach, head material and surgeon volume.

**Figure HT72 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Since 2015 by Computer Navigation and Age (Primary Diagnosis OA)**




HR - adjusted for gender, ASA, BMI, head size, head material, femoral fixation, surgical approach and surgeon volume

Computer Navigated <65
vs Traditional Instrumentation <65
Entire Period: HR= 0.96 (95% CI 0.79, 1.16), p=0.676

Computer Navigated ≥65
vs Traditional Instrumentation ≥65
Entire Period: HR=0.95 (95% CI 0.83, 1.09), p=0.493

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|
| Computer Navigated | <65 | 4453 | 3580 | 2221 | 1069 | 414 | 89 |
| | ≥65 | 9542 | 7589 | 4679 | 2203 | 798 | 167 |
| Traditional Instrumentation | <65 | 83504 | 73550 | 55221 | 38269 | 21724 | 6088 |
| | ≥65 | 163841 | 141587 | 101857 | 66449 | 34052 | 8662 |

Note: All procedures using metal/metal prostheses have been excluded.
Restricted to modern prostheses.

**Table HT66 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Since 2015 by Prosthesis Combination and Computer Navigation (Primary Diagnosis OA)**

| Prosthesis Combination | Surgeon Assistive Tool | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Accolade II/Trident (Shell) | Computer Navigated | 47 | 1855 | 2.0 (1.5, 2.8) | 2.3 (1.7, 3.1) | 2.5 (1.9, 3.4) | 2.7 (2.0, 3.7) | 2.7 (2.0, 3.7) | 3.6 (2.1, 5.9) |
| | Traditional Instrumentation | 289 | 11485 | 1.8 (1.6, 2.1) | 2.2 (1.9, 2.5) | 2.4 (2.1, 2.7) | 2.7 (2.4, 3.0) | 2.9 (2.6, 3.3) | 3.2 (2.8, 3.7) |
| CORAIL/PINNACLE | Computer Navigated | 29 | 1584 | 1.2 (0.7, 1.8) | 1.3 (0.8, 2.0) | 1.5 (1.0, 2.3) | 2.3 (1.5, 3.6) | 3.2 (1.9, 5.3) | 4.8 (2.7, 8.3) |
| | Traditional Instrumentation | 1072 | 36775 | 1.6 (1.5, 1.8) | 2.1 (1.9, 2.2) | 2.4 (2.3, 2.6) | 2.9 (2.7, 3.1) | 3.3 (3.1, 3.5) | 4.0 (3.7, 4.2) |
| Exeter V40/Trident (Shell) | Computer Navigated | 38 | 1700 | 1.3 (0.9, 2.0) | 1.6 (1.1, 2.4) | 1.9 (1.3, 2.7) | 2.3 (1.7, 3.2) | 2.6 (1.9, 3.6) | 2.6 (1.9, 3.6) |
| | Traditional Instrumentation | 914 | 40757 | 1.3 (1.2, 1.4) | 1.6 (1.5, 1.8) | 1.9 (1.7, 2.0) | 2.3 (2.1, 2.4) | 2.7 (2.5, 2.9) | 3.1 (2.9, 3.4) |
| Taperloc/G7 | Computer Navigated | 25 | 1047 | 2.2 (1.4, 3.3) | 2.4 (1.6, 3.6) | 2.4 (1.6, 3.6) | 2.6 (1.8, 3.9) | | |
| | Traditional Instrumentation | 132 | 5181 | 2.0 (1.7, 2.4) | 2.2 (1.9, 2.7) | 2.6 (2.2, 3.1) | 2.8 (2.3, 3.3) | 3.0 (2.5, 3.6) | 3.1 (2.6, 3.8) |
| TOTAL | | 2546 | 100384 | | | | | | |

Note: Restricted to modern prostheses.
Only prosthesis combinations with >1,000 procedures in both groups have been listed.

**Table HT67 Comparisons of Revision Rates for Primary Total Conventional Hip Replacement Since 2015 by Prosthesis Combination and Computer Navigation (Primary Diagnosis OA)**

| Prothesis Combination | Comparison | HR – adjusted for age, gender, ASA, BMI, head size, head material, femoral fixation, surgical approach and surgeon volume. |
|---|---|---|
| Accolade II/Trident (Shell) | Computer Navigated vs Traditional Instrumentation | Entire Period: HR=1.10 (95% CI 0.78, 1.56), p=0.581 |
| CORAIL/PINNACLE | Computer Navigated vs Traditional Instrumentation | Entire Period: HR=0.88 (95% CI 0.59, 1.30), p=0.518 |
| Exeter V40/Trident (Shell) | Computer Navigated vs Traditional Instrumentation | Entire Period: HR=0.98 (95% CI 0.64, 1.50), p=0.923 |
| Taperloc/G7 | Computer Navigated vs Traditional Instrumentation | Entire Period: HR=1.06 (95% CI 0.68, 1.65), p=0.792 |

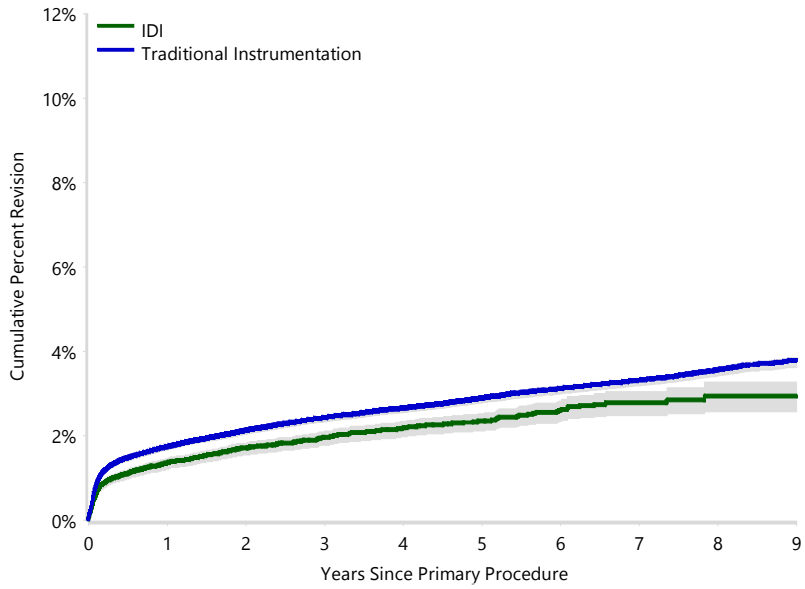
Note: Restricted to modern prostheses.
Only prosthesis combinations with >1,000 procedures in both groups have been listed.

**Table HT68 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Since 2015 by IDI Usage (Primary Diagnosis OA)**

| Surgeon Assistive Tool | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|
| IDI | 630 | 34719 | 1.3 (1.2, 1.5) | 1.9 (1.8, 2.1) | 2.3 (2.1, 2.5) | 2.8 (2.5, 3.1) | 2.9 (2.6, 3.3) | 2.9 (2.6, 3.3) |
| Traditional Instrumentation | 6574 | 247345 | 1.7 (1.7, 1.8) | 2.4 (2.3, 2.5) | 2.8 (2.8, 2.9) | 3.3 (3.2, 3.4) | 3.5 (3.4, 3.6) | 3.7 (3.6, 3.8) |
| TOTAL | 7204 | 282064 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded.
Restricted to modern prostheses.
Restricted to procedures with known ASA, BMI, femoral fixation, head size, surgical approach, head material and surgeon volume.

**Figure HT73 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Since 2015 by IDI Usage (Primary Diagnosis OA)**




HR - adjusted for age, gender, ASA, BMI, head size, head material, femoral fixation, surgical approach and surgeon volume

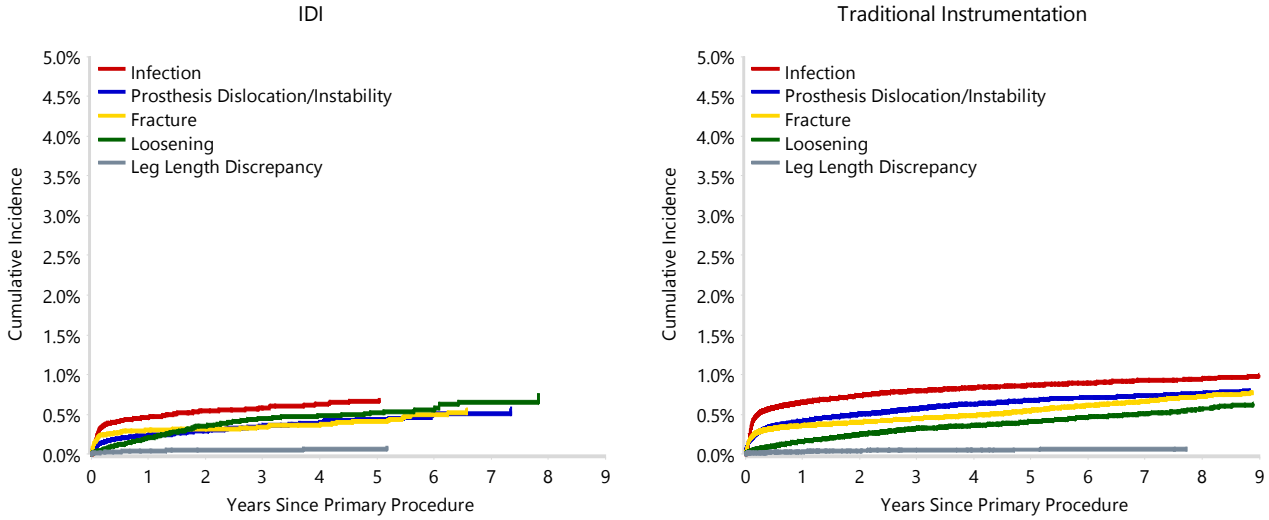
IDI vs Traditional Instrumentation

Entire Period: HR= 0.91 (95% CI 0.83, 0.99), p=0.025

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|
| IDI | 34719 | 26778 | 14592 | 6740 | 2061 | 956 | 376 |
| Traditional Instrumentation | 247345 | 215137 | 157078 | 104718 | 55776 | 33843 | 14750 |

Note: All procedures using metal/metal prostheses have been excluded.
Restricted to modern prostheses.

**Figure HT74 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement Since 2015 by IDI Usage (Primary Diagnosis OA)**



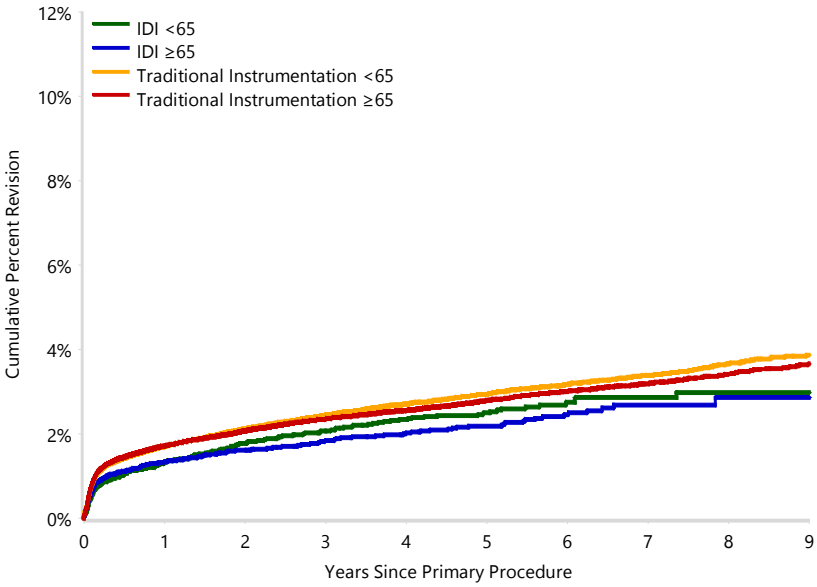

Note: All procedures using metal/metal prostheses have been excluded.
Restricted to modern prostheses.

**Table HT69 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Since 2015 by IDI Usage and Age (Primary Diagnosis OA)**

| Surgeon Assistive Tool | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| IDI | <65 | 268 | 13775 | 1.3 (1.1, 1.5) | 2.1 (1.8, 2.4) | 2.5 (2.2, 2.8) | 2.9 (2.5, 3.3) | 3.0 (2.5, 3.5) | 3.0 (2.5, 3.5) |
| | ≥65 | 362 | 20944 | 1.3 (1.2, 1.5) | 1.8 (1.6, 2.1) | 2.2 (1.9, 2.5) | 2.7 (2.3, 3.1) | 2.9 (2.4, 3.4) | 2.9 (2.4, 3.4) |
| Traditional Instrumentation | <65 | 2340 | 83504 | 1.7 (1.6, 1.8) | 2.4 (2.3, 2.6) | 2.9 (2.8, 3.1) | 3.4 (3.2, 3.5) | 3.7 (3.5, 3.8) | 3.9 (3.7, 4.1) |
| | ≥65 | 4234 | 163841 | 1.7 (1.7, 1.8) | 2.4 (2.3, 2.4) | 2.8 (2.7, 2.9) | 3.2 (3.1, 3.3) | 3.4 (3.3, 3.5) | 3.7 (3.5, 3.8) |
| TOTAL | | 7204 | 282064 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded.
Restricted to modern prostheses.
Restricted to procedures with known gender, ASA, BMI, femoral fixation, head size, surgical approach, head material and surgeon volume.

**Figure HT75 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Since 2015 by IDI Usage and Age (Primary Diagnosis OA)**




HR - adjusted for gender, ASA, BMI, head size, head material, femoral fixation, surgical approach and surgeon volume

IDI <65 vs Traditional Instrumentation <65
0-3 Mth: HR=0.80 (95% CI 0.66, 0.96), p=0.019
3Mth+: HR=1.10 (95% CI 0.93, 1.31), p=0.250

IDI≥65 vs Traditional Instrumentation ≥65
Entire Period: HR=0.88 (95% CI 0.79, 0.98), p=0.026

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|
| IDI | <65 | 13775 | 10891 | 6177 | 2964 | 978 | 453 | 188 |
| | ≥65 | 20944 | 15887 | 8415 | 3776 | 1083 | 503 | 188 |
| Traditional Instrumentation | <65 | 83504 | 73550 | 55221 | 38269 | 21724 | 13650 | 6088 |
| | ≥65 | 163841 | 141587 | 101857 | 66449 | 34052 | 20193 | 8662 |

Note: All procedures using metal/metal prostheses have been excluded.
Restricted to modern prostheses.

**Table HT70 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Prosthesis Combination and IDI Usage (Primary Diagnosis OA)**

| Prosthesis Combination | Surgeon Assistive Tool | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Metafix/Trinity | IDI | 217 | 11623 | 1.3 (1.1, 1.5) | 1.7 (1.5, 2.0) | 2.0 (1.7, 2.3) | 2.3 (2.0, 2.7) | 2.8 (2.4, 3.3) | 2.8 (2.4, 3.3) |
| | Traditional Instrumentation | 176 | 7909 | 1.5 (1.2, 1.8) | 1.9 (1.6, 2.2) | 2.2 (1.9, 2.5) | 2.4 (2.1, 2.8) | 2.7 (2.3, 3.1) | 2.9 (2.4, 3.6) |
| Taper Fit/Trinity | IDI | 50 | 2589 | 1.4 (1.0, 1.9) | 1.6 (1.2, 2.3) | 2.0 (1.5, 2.7) | 2.5 (1.8, 3.4) | 2.7 (1.9, 3.6) | |
| | Traditional Instrumentation | 57 | 2503 | 1.5 (1.1, 2.1) | 2.0 (1.5, 2.6) | 2.2 (1.7, 2.9) | 2.6 (2.0, 3.4) | 2.8 (2.1, 3.7) | 3.2 (2.2, 4.5) |
| TOTAL | | 500 | 24624 | | | | | | |

Note: Restricted to modern prostheses.
Only prosthesis combinations with >2,000 procedures in both groups have been listed.
Restricted to procedures with known gender, ASA, BMI, femoral fixation, head size, surgical approach, head material and surgeon volume.

**Table HT71 Comparisons of Revision Rates for Primary Total Conventional Hip Replacement Since 2015 by Prosthesis Combination and IDI Usage (Primary Diagnosis OA)**

| Prothesis Combination | Comparison | HR – adjusted for age, gender, ASA, BMI, head size, head material, femoral fixation, surgical approach and surgeon volume. |
|---|---|---|
| Metafix/Trinity | IDI vs Traditional Instrumentation | Entire Period: HR=0.93 (95% CI 0.76, 1.14), p=0.483 |
| Taper Fit/Trinity | IDI vs Traditional Instrumentation | Entire Period: HR=0.77 (95% CI 0.52, 1.15), p=0.201 |

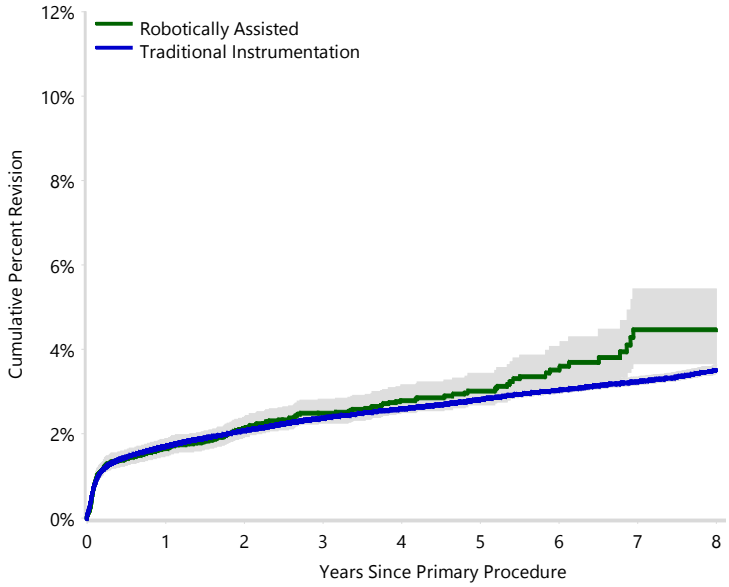
Note: Restricted to modern prostheses.
Only prosthesis combinations with >2,000 procedures in both groups have been listed.

**Table HT72 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Since 2016 by Robotic Assistance (Primary Diagnosis OA)**

| Surgeon Assistive Tool | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|
| Robotically Assisted | 365 | 16657 | 1.7 (1.5, 1.9) | 2.5 (2.2, 2.8) | 3.0 (2.7, 3.4) | 3.5 (3.1, 4.1) | 4.5 (3.7, 5.4) | 4.5 (3.7, 5.4) |
| Traditional Instrumentation | 5906 | 229057 | 1.7 (1.7, 1.8) | 2.4 (2.3, 2.5) | 2.8 (2.8, 2.9) | 3.1 (3.0, 3.1) | 3.3 (3.2, 3.4) | 3.5 (3.4, 3.6) |
| TOTAL | 6271 | 245714 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded.
Restricted to modern prostheses.
Restricted to procedures with known ASA, BMI, femoral fixation, head size, surgical approach, head material and surgeon volume.

**Figure HT76 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Since 2016 by Robotic Assistance (Primary Diagnosis OA)**




HR - adjusted for age, gender, ASA, BMI, head size, head material, femoral fixation, surgical approach and surgeon volume

Robotically Assisted vs Traditional Instrumentation

0 - 3Mth: HR=1.02 (95% CI 0.89, 1.18), p=0.755

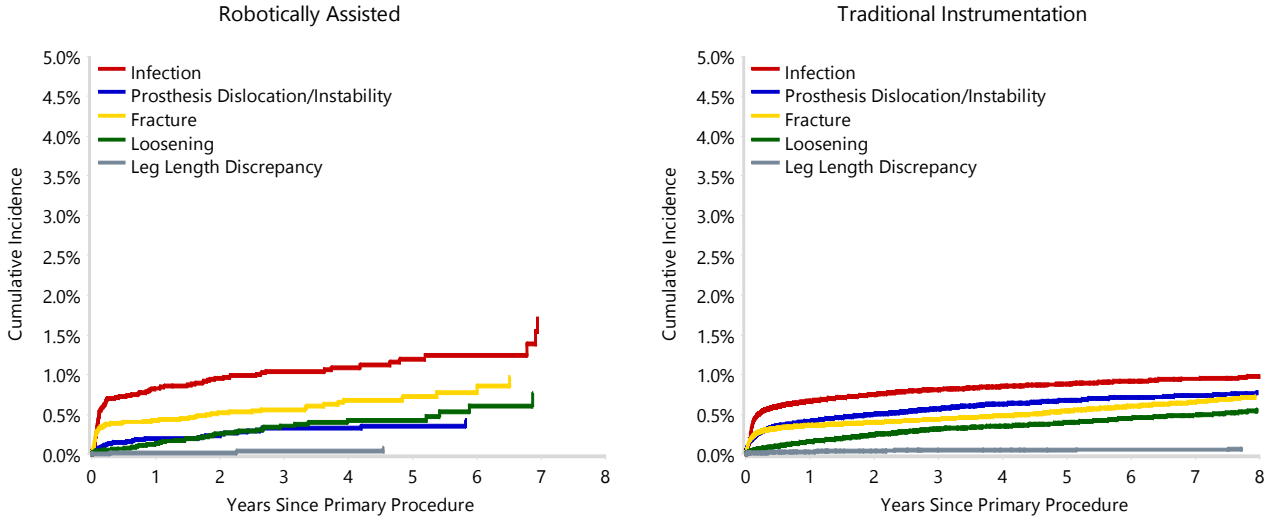
3Mth – 1.5Yrs: HR=0.81 (95% CI 0.64, 1.02), p=0.078

1.5Yr+: HR=1.45 (95% CI 1.16, 1.80), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|
| Robotically Assisted | 16657 | 11556 | 5279 | 2112 | 1160 | 515 | 116 |
| Traditional Instrumentation | 229057 | 197284 | 139795 | 88144 | 63315 | 40062 | 18611 |

Note: All procedures using metal/metal prostheses have been excluded.
Restricted to modern prostheses.

**Figure HT77 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement Since 2016 by Robotic Assistance (Primary Diagnoses OA)**



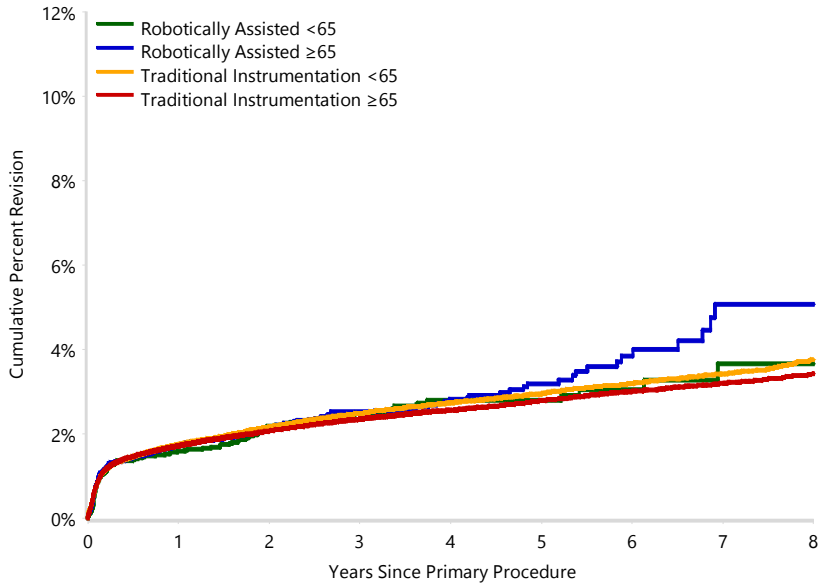

Note: All procedures using metal/metal prostheses have been excluded.
Restricted to modern prostheses.

**Table HT73 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Since 2016 by Robotic Assistance and Age (Primary Diagnosis OA)**

| Surgeon Assistive Tool | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Robotically Assisted | <65 | 126 | 5919 | 1.6 (1.3, 2.0) | 2.5 (2.1, 3.0) | 2.8 (2.3, 3.4) | 3.1 (2.5, 3.8) | 3.7 (2.7, 4.9) | 3.7 (2.7, 4.9) |
| | ≥65 | 239 | 10738 | 1.7 (1.5, 2.0) | 2.5 (2.2, 2.9) | 3.2 (2.7, 3.8) | 3.9 (3.2, 4.7) | 5.1 (3.9, 6.6) | 5.1 (3.9, 6.6) |
| Traditional Instrumentation | <65 | 2106 | 76889 | 1.7 (1.7, 1.8) | 2.5 (2.4, 2.6) | 2.9 (2.8, 3.1) | 3.2 (3.1, 3.3) | 3.4 (3.3, 3.6) | 3.7 (3.6, 3.9) |
| | ≥65 | 3800 | 152168 | 1.7 (1.6, 1.8) | 2.3 (2.3, 2.4) | 2.8 (2.7, 2.9) | 3.0 (2.9, 3.1) | 3.2 (3.1, 3.3) | 3.4 (3.3, 3.5) |
| TOTAL | | 6271 | 245714 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded.
Restricted to modern prostheses.
Restricted to procedures with known gender, ASA, BMI, femoral fixation, head size, surgical approach, head material and surgeon volume.

**Figure HT78 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Since 2016 by Robotic Assistance and Age (Primary Diagnosis OA)**




HR - adjusted for gender, ASA, BMI, head size, head material, femoral fixation, surgical approach and surgeon volume

Robotically Assisted <65
vs Traditional Instrumentation <65
Entire Period: HR=0.96 (95% CI 0.80, 1.15), p=0.677

Robotically Assisted ≥65
vs Traditional Instrumentation ≥65
Entire Period: HR=1.11 (95% CI 0.97, 1.26), p=0.131

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|
| Robotically Assisted | <65 | 5919 | 4226 | 2063 | 878 | 502 | 235 | 51 |
| | ≥65 | 10738 | 7330 | 3216 | 1234 | 658 | 280 | 65 |
| Traditional Instrumentation | <65 | 76889 | 67031 | 48815 | 31980 | 23752 | 15526 | 7510 |
| | ≥65 | 152168 | 130253 | 90980 | 56164 | 39563 | 24536 | 11101 |

Note: All procedures using metal/metal prostheses have been excluded.
Restricted to modern prostheses.

**Table HT74 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Since 2016 by Prosthesis Combination and Robotic Assistance (Primary Diagnosis OA)**

| Prosthesis Combination | Surgeon Assistive Tool | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Accolade II/Trident (Shell) | Robotically Assisted | 113 | 4743 | 1.7 (1.4, 2.2) | 2.7 (2.2, 3.3) | 3.0 (2.4, 3.7) | 3.0 (2.4, 3.7) | 4.0 (2.7, 5.8) | |
| | Traditional Instrumentation | 277 | 10695 | 1.9 (1.6, 2.1) | 2.5 (2.2, 2.8) | 2.8 (2.5, 3.2) | 2.9 (2.6, 3.3) | 3.1 (2.7, 3.5) | 3.4 (3.0, 4.0) |
| Accolade II/Trident/Tritanium (Shell) | Robotically Assisted | 78 | 2011 | 2.4 (1.9, 3.2) | 3.6 (2.9, 4.5) | 4.0 (3.2, 5.0) | 4.6 (3.6, 5.8) | 5.0 (3.8, 6.6) | 5.0 (3.8, 6.6) |
| | Traditional Instrumentation | 58 | 1718 | 2.0 (1.4, 2.8) | 3.0 (2.3, 4.0) | 3.5 (2.7, 4.6) | 3.8 (2.9, 4.9) | 4.1 (3.2, 5.4) | 4.1 (3.2, 5.4) |
| Exeter V40/Trident (Shell) | Robotically Assisted | 56 | 3341 | 1.2 (0.9, 1.7) | 1.7 (1.3, 2.3) | 2.3 (1.7, 3.2) | 2.7 (1.8, 3.8) | 4.0 (2.4, 6.6) | 4.0 (2.4, 6.6) |
| | Traditional Instrumentation | 836 | 37821 | 1.3 (1.2, 1.4) | 1.9 (1.7, 2.0) | 2.3 (2.1, 2.4) | 2.5 (2.4, 2.7) | 2.7 (2.5, 2.9) | 2.9 (2.7, 3.2) |
| TOTAL | | 1418 | 60329 | | | | | | |

Note: Restricted to modern prostheses
Restricted to prosthesis combinations with >1,000 procedures in both groups

**Table HT75 Comparisons of Revision Rates for Primary Total Conventional Hip Replacement Since 2016 by Prosthesis Combination and Robotic Assistance (Primary Diagnosis OA)**

| Prothesis Combination | Comparison | HR – adjusted for age, gender, ASA, BMI, head size, head material, femoral fixation, surgical approach and surgeon volume. |
|---|---|---|
| Accolade II/Trident (Shell) | Robotically Assisted vs Traditional Instrumentation | Entire Period: HR=1.07 (95% CI 0.83, 1.37), p=0.624 |
| Accolade II/Trident/Tritanium (Shell) | Robotically Assisted vs Traditional Instrumentation | Entire Period: HR=1.34 (95% CI 0.94, 1.93), p=0.110 |
| Exeter V40/Trident (Shell) | Robotically Assisted vs Traditional Instrumentation | Entire Period: HR=0.96 (95% CI 0.73, 1.27), p=0.770 |

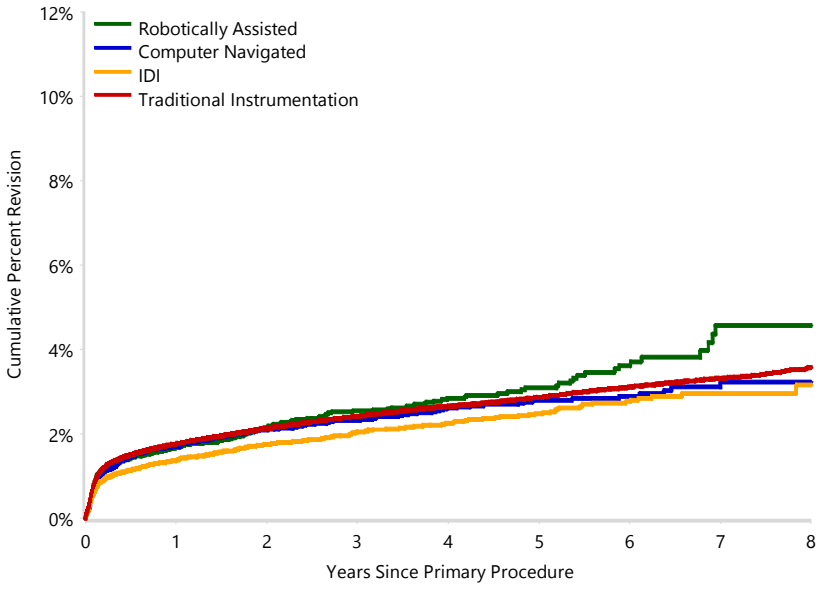
Note: Restricted to modern prostheses.
Only prosthesis combinations with >1,000 procedures in both groups have been listed.

**Table HT76 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Using XLPE Since 2016 by Surgeon Assistive Tool (Primary Diagnosis OA)**

| Surgeon Assistive Tool | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|
| Robotically Assisted | 362 | 16466 | 1.7 (1.5, 1.9) | 2.5 (2.3, 2.8) | 3.1 (2.7, 3.5) | 3.6 (3.1, 4.2) | 4.6 (3.7, 5.6) | 4.6 (3.7, 5.6) |
| Computer Navigated | 283 | 12411 | 1.7 (1.5, 2.0) | 2.3 (2.1, 2.6) | 2.8 (2.5, 3.2) | 2.9 (2.5, 3.3) | 3.1 (2.7, 3.6) | 3.2 (2.8, 3.8) |
| IDI | 460 | 24493 | 1.4 (1.2, 1.5) | 2.1 (1.9, 2.3) | 2.5 (2.2, 2.7) | 2.8 (2.5, 3.1) | 3.0 (2.6, 3.3) | 3.2 (2.7, 3.7) |
| Traditional Instrumentation | 5112 | 197301 | 1.8 (1.7, 1.8) | 2.4 (2.3, 2.5) | 2.9 (2.8, 2.9) | 3.1 (3.0, 3.2) | 3.3 (3.2, 3.4) | 3.6 (3.5, 3.7) |
| TOTAL | 6217 | 250671 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded.
Restricted to modern prostheses.
Restricted to procedures with known age, gender, ASA, BMI, femoral fixation, head size, surgical approach, head material and surgeon volume.

**Figure HT79 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Using XLPE Since 2016 by Surgeon Assistive Tool (Primary Diagnosis OA)**




HR - adjusted for age, gender, ASA, BMI, head size, head material, femoral fixation, surgical approach and surgeon volume

Computer Navigated vs IDI
Entire Period: HR=1.13 (95% CI 0.97, 1.31), p=0.119

Computer Navigated vs Traditional Instrumentation
Entire Period: HR=0.97 (95% CI 0.86, 1.10), p=0.652

IDI vs Traditional Instrumentation
0 - 3Mth: HR=0.84 (95% CI 0.74, 0.97), p=0.014
3Mth+: HR=1.01 (95% CI 0.88, 1.16), p=0.874

Robotically Assisted vs Computer Navigated
Entire Period: HR=1.12 (95% CI 0.96, 1.31), p=0.156

Robotically Assisted vs IDI
Entire Period: HR=1.26 (95% CI 1.10, 1.45), p=0.001

Robotically Assisted vs Traditional Instrumentation
0 - 3Mth: HR=1.02 (95% CI 0.89, 1.18), p=0.763
3Mths-1.5Yrs: HR=0.84 (95% CI 0.66, 1.07), p=0.157
1.5Yrs+: HR=1.56 (95% CI 1.25, 1.95), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|
| Robotically Assisted | 16466 | 11374 | 5107 | 1975 | 1054 | 444 | 91 |
| Computer Navigated | 12411 | 9793 | 5979 | 2762 | 1669 | 865 | 391 |
| IDI | 24493 | 18530 | 9662 | 4399 | 2486 | 1206 | 385 |
| Traditional Instrumentation | 197301 | 168713 | 117302 | 72061 | 50604 | 31391 | 14179 |

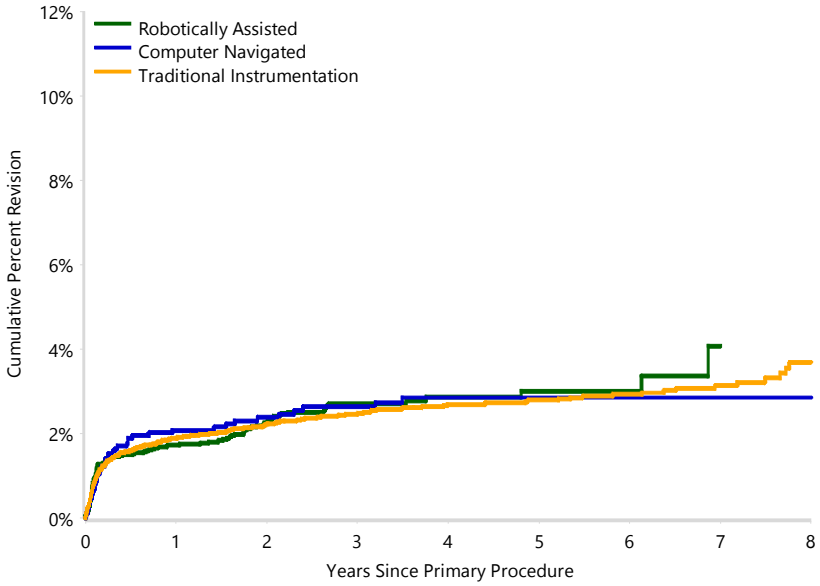
Note: All procedures using metal/metal prostheses have been excluded.
Restricted to modern prostheses.

**Table HT77 Cumulative Percent Revision of Accolade II/Trident (Shell) Primary Total Conventional Hip Replacement Using XLPE Since 2016 by Surgeon Assistive Tool (Primary Diagnosis OA)**

| Surgeon Assistive Tool | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|
| Robotically Assisted | 111 | 4662 | 1.7 (1.4, 2.1) | 2.7 (2.2, 3.3) | 3.0 (2.4, 3.7) | 3.0 (2.4, 3.7) | 4.1 (2.7, 6.1) | |
| Computer Navigated | 44 | 1723 | 2.1 (1.5, 2.9) | 2.6 (2.0, 3.6) | 2.9 (2.1, 3.8) | 2.9 (2.1, 3.8) | 2.9 (2.1, 3.8) | 2.9 (2.1, 3.8) |
| Traditional Instrumentation | 261 | 10188 | 1.9 (1.6, 2.2) | 2.5 (2.2, 2.8) | 2.8 (2.5, 3.2) | 2.9 (2.6, 3.3) | 3.1 (2.7, 3.6) | 3.7 (3.1, 4.4) |
| TOTAL | 416 | 16573 | | | | | | |

Note: Restricted to modern prostheses.
Restricted to procedures with known ASA, BMI, femoral fixation, head size, surgical approach, head material and surgeon volume.
Excludes 3 procedures using IDI.

**Figure HT80 Cumulative Percent Revision of Accolade II/Trident (Shell) Primary Total Conventional Hip Replacement Using XLPE Since 2016 by Surgeon Assistive Tool (Primary Diagnosis OA)**




HR - adjusted for age, gender, ASA, BMI, head size, head material, femoral fixation, surgical approach and surgeon volume

Robotically Assisted vs Traditional Instrumentation
Entire Period: HR=1.14 (95% CI 0.88, 1.46), p=0.319

Computer Navigated vs Traditional Instrumentation
Entire Period: HR=1.14 (95% CI 0.81, 1.59), p=0.462

Robotically Assisted vs Computer Navigated
Entire Period: HR=1.00 (95% CI 0.70, 1.43), p=0.997

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|
| Robotically Assisted | 4662 | 3673 | 1763 | 589 | 310 | 103 | 6 |
| Computer Navigated | 1723 | 1472 | 1002 | 453 | 291 | 134 | 58 |
| Traditional Instrumentation | 10188 | 8678 | 6029 | 3450 | 2292 | 1394 | 583 |

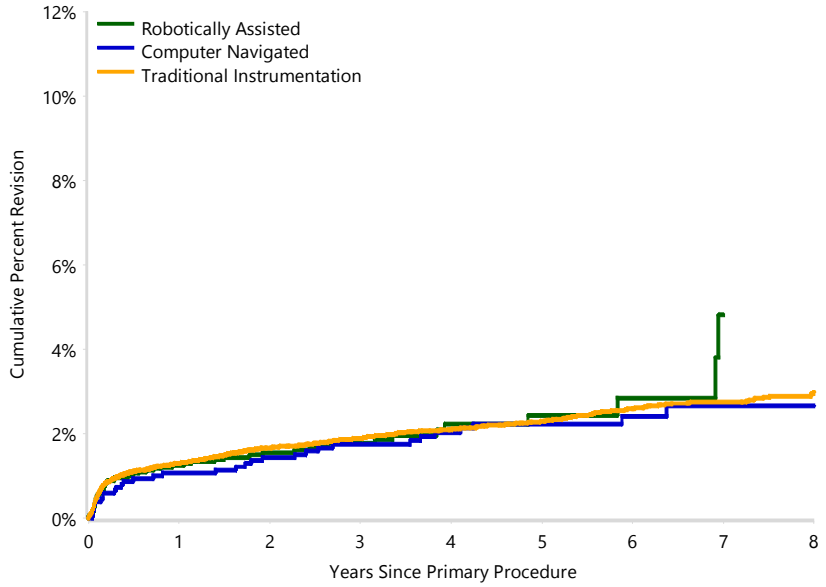
Note: Restricted to modern prostheses.
Restricted to procedures with known ASA, BMI, femoral fixation, head size, surgical approach, head material and surgeon volume.
Excludes 3 procedures using IDI.

**Table HT78 Cumulative Percent Revision of Exeter V40/Trident (Shell) Primary Total Conventional Hip Replacement Using XLPE Since 2016 by Surgeon Assistive Tool (Primary Diagnosis OA)**

| Surgeon Assistive Tool | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|
| Robotically Assisted | 56 | 3268 | 1.3 (0.9, 1.7) | 1.8 (1.3, 2.4) | 2.4 (1.8, 3.4) | 2.8 (1.9, 4.2) | 4.8 (2.6, 8.8) | |
| Computer Navigated | 32 | 1497 | 1.1 (0.7, 1.8) | 1.8 (1.2, 2.6) | 2.2 (1.6, 3.2) | 2.4 (1.7, 3.5) | 2.7 (1.8, 3.8) | 2.7 (1.8, 3.8) |
| Traditional Instrumentation | 734 | 34011 | 1.3 (1.2, 1.4) | 1.9 (1.7, 2.1) | 2.3 (2.1, 2.5) | 2.6 (2.4, 2.8) | 2.7 (2.5, 3.0) | 3.0 (2.7, 3.3) |
| TOTAL | 822 | 38776 | | | | | | |

Note: Restricted to modern prostheses.
Restricted to procedures with known ASA, BMI, femoral fixation, head size, surgical approach, head material and surgeon volume.
Excludes 5 procedures using IDI.

**Figure HT81 Cumulative Percent Revision of Exeter V40/Trident (Shell) Primary Total Conventional Hip Replacement Using XLPE Since 2016 by Surgeon Assistive Tool (Primary Diagnosis OA)**




HR - adjusted for age, gender, ASA, BMI, head size, head material, femoral fixation, surgical approach and surgeon volume

Robotically Assisted vs Traditional Instrumentation
Entire Period: HR=1.01 (95% CI 0.77, 1.34), p=0.921

Computer Navigated vs Traditional Instrumentation
Entire Period: HR=1.04 (95% CI 0.68, 1.60), p=0.840

Robotically Assisted vs Computer Navigated
Entire Period: HR=0.97 (95% CI 0.60, 1.57), p=0.903

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|
| Robotically Assisted | 3268 | 2399 | 1124 | 416 | 219 | 91 | 22 |
| Computer Navigated | 1497 | 1423 | 1195 | 756 | 508 | 293 | 120 |
| Traditional Instrumentation | 34011 | 30170 | 22031 | 13967 | 9765 | 6008 | 2776 |

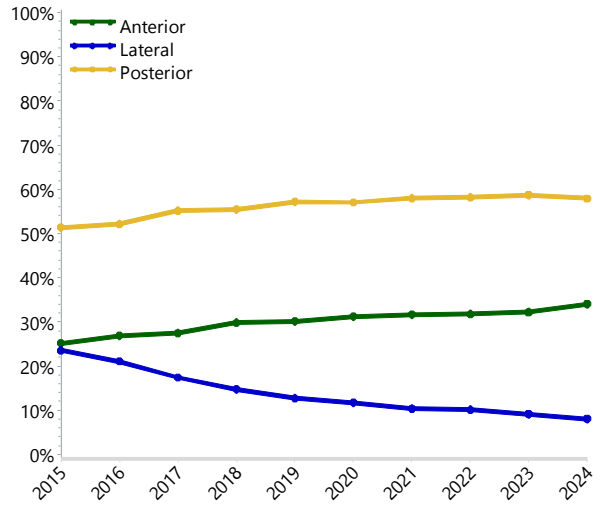
Note: Restricted to modern prostheses.
Restricted to procedures with known ASA, BMI, femoral fixation, head size, surgical approach, head material and surgeon volume.
Excludes 5 procedures using IDI.

# Primary Total Hip Replacement

## SURGICAL APPROACH

Collection of surgical approach data began in 2015 and the outcome of 99,392 anterior, 42,378 lateral, and 184,207 posterior total conventional hip replacement procedures for osteoarthritis can be compared. The proportional use of anterior, lateral and posterior approaches over time is shown in Figure HT82.

**Figure HT82 Primary Total Conventional Hip Replacement by Approach (Primary Diagnosis OA)**




The anterior approach is used more often in younger patients than the posterior and lateral approaches, and in a higher proportion of patients with lower BMI and ASA scores (Table HT79 to Table HT81).

The following analyses were performed with hazard ratios adjusted for age, gender, ASA score, BMI category, femoral fixation, and head size. When compared to the anterior approach, the lateral and posterior approaches have a higher rate of revision. The lateral approach also has a higher rate of revision compared to the posterior approach (Table HT82 and Figure HT83). There are also differences in the types of revision and reasons for revision between the approaches.

***Major Revisions***

The posterior approach has a lower rate of major revision compared to the anterior approach and the lateral approach. There is no difference between the lateral and anterior approaches (Table HT83 and Figure HT84).

***Reasons for Revision***

The most common reasons for revision of primary total hip replacement in the first 10 years include loosening, fracture, infection, and dislocation/instability (Figure HT85).

***Revision for Loosening***

The posterior approach has a lower rate of revision for loosening compared to the lateral approach and to the anterior approach. There is a higher rate of revision for loosening with the anterior approach compared to the lateral approach (Table HT84 and Figure HT86).

***Revision for Fracture***

The anterior approach also has a higher rate of revision for fracture in the first 3 months when compared to both the lateral approach and to the posterior approach. After this time, the anterior approach has a lower rate of revision compared to both of the other surgical approaches. There is no difference when the posterior approach is compared to the lateral approach (Table HT85 and Figure HT87).

***Revision for Infection***

There is a lower rate of revision for infection for the anterior approach compared to both the posterior approach and lateral approach. There is no difference between the posterior and lateral approaches (Table HT86 and Figure HT88).

***Revision for Dislocation/Instability***

The anterior approach has a lower rate of revision for dislocation/instability compared to both the posterior approach and the lateral approach. There is no difference when the posterior is compared to the lateral approach (Table HT87 and Figure HT89).

**Table HT79 Primary Total Conventional Hip Replacement by Age and Surgical Approach (Primary Diagnosis OA)**

| Age | Anterior | | Lateral | | Posterior | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| <55 | 12105 | 12.2 | 4179 | 9.9 | 18326 | 9.9 |
| 55-64 | 25177 | 25.3 | 9633 | 22.7 | 42444 | 23.0 |
| 65-74 | 35985 | 36.2 | 15384 | 36.3 | 66249 | 36.0 |
| ≥75 | 26125 | 26.3 | 13182 | 31.1 | 57188 | 31.0 |
| **TOTAL** | **99392** | **100.0** | **42378** | **100.0** | **184207** | **100.0** |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT80 Primary Total Conventional Hip Replacement by BMI Category and Surgical Approach (Primary Diagnosis OA)**

| BMI Category | Anterior | | Lateral | | Posterior | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| Underweight | 740 | 0.8 | 310 | 0.8 | 1311 | 0.7 |
| Normal | 23343 | 23.9 | 7836 | 19.2 | 34418 | 19.2 |
| Pre Obese | 38621 | 39.5 | 14297 | 35.1 | 63308 | 35.3 |
| Obese Class 1 | 23534 | 24.1 | 10898 | 26.7 | 47347 | 26.4 |
| Obese Class 2 | 8266 | 8.5 | 5025 | 12.3 | 21705 | 12.1 |
| Obese Class 3 | 3212 | 3.3 | 2412 | 5.9 | 11272 | 6.3 |
| **TOTAL** | **97716** | **100.0** | **40778** | **100.0** | **179361** | **100.0** |

Note: All procedures using metal/metal prostheses have been excluded
BMI has not been presented for patients aged ≤19 years
Restricted to modern prostheses

**Table HT81 Primary Total Conventional Hip Replacement by ASA Score and Surgical Approach (Primary Diagnosis OA)**

| ASA Score | Anterior | | Lateral | | Posterior | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| ASA 1 | 9897 | 10.0 | 2932 | 6.9 | 11924 | 6.5 |
| ASA 2 | 55480 | 55.9 | 21877 | 51.7 | 95382 | 51.8 |
| ASA 3 | 32892 | 33.1 | 16844 | 39.8 | 73849 | 40.1 |
| ASA 4 | 991 | 1.0 | 621 | 1.5 | 2798 | 1.5 |
| ASA 5 | 5 | 0.0 | 3 | 0.0 | 12 | 0.0 |
| **TOTAL** | **99265** | **100.0** | **42277** | **100.0** | **183965** | **100.0** |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

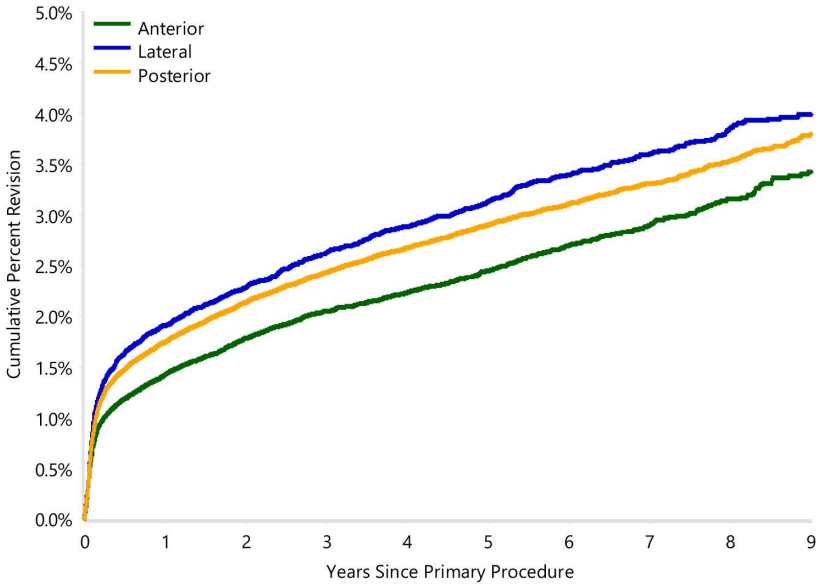
# Primary Total Hip Replacement

**Table HT82 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Surgical Approach (Primary Diagnosis OA)**

| Surgical Approach | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Anterior | 2141 | 97620 | 1.4 (1.4, 1.5) | 2.0 (2.0, 2.1) | 2.4 (2.3, 2.6) | 2.9 (2.8, 3.0) | 3.2 (3.0, 3.3) | 3.4 (3.2, 3.6) |
| Lateral | 1247 | 40702 | 1.9 (1.8, 2.0) | 2.6 (2.5, 2.8) | 3.1 (2.9, 3.3) | 3.6 (3.4, 3.8) | 3.9 (3.6, 4.1) | 4.0 (3.7, 4.2) |
| Posterior | 4639 | 179165 | 1.7 (1.7, 1.8) | 2.4 (2.4, 2.5) | 2.9 (2.8, 3.0) | 3.3 (3.2, 3.4) | 3.5 (3.4, 3.7) | 3.8 (3.6, 3.9) |
| TOTAL | 8027 | 317487 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses
Excludes procedures with unknown ASA Score, BMI category or head size

**Figure HT83 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Surgical Approach (Primary Diagnosis OA)**




HR - adjusted for age, gender, ASA score and BMI category, femoral fixation and head size.

Lateral vs Anterior
Entire Period: HR= HR=1.22 (1.14, 1.31),p<0.001

Posterior vs Anterior
Entire Period: HR=1.13 (1.07, 1.19),p<0.001

Posterior vs Lateral
Entire Period: HR=0.92 (0.87, 0.98),p=0.014

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|
| Anterior | 97620 | 81667 | 55860 | 34722 | 17184 | 10194 | 4289 |
| Lateral | 40702 | 36303 | 28171 | 20403 | 12135 | 7911 | 3654 |
| Posterior | 179165 | 151002 | 103508 | 64720 | 32266 | 18947 | 8124 |

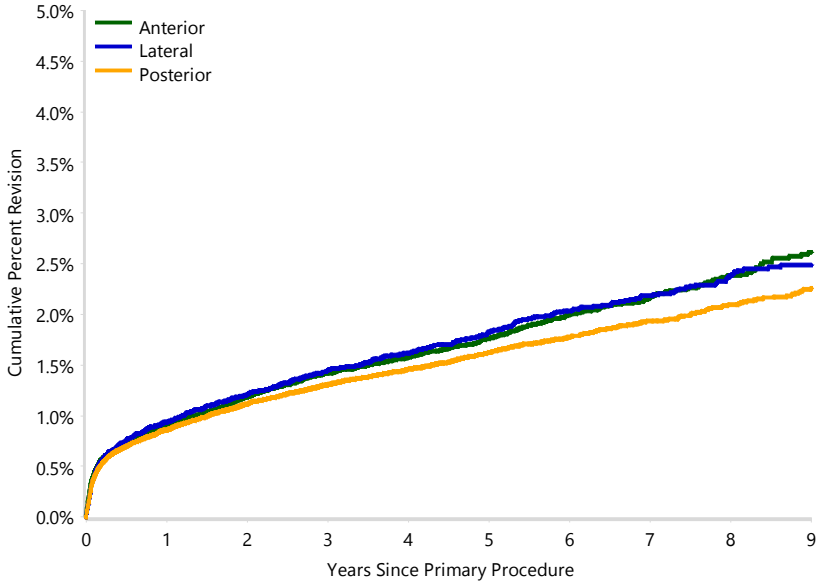
Note: All procedures using metal/metal prostheses have been excluded
Excludes procedures with unknown ASA score, BMI category or head size
Due to low numbers, ASA score 1–2 and 3–5 have been combined
Due to low numbers BMI category underweight and normal have been combined
Restricted to modern prostheses

**Table HT83 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Surgical Approach (Primary Diagnosis OA, Major Revisions)**

| Surgical Approach | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|
| Anterior | 1520 | 97620 | 0.9 (0.8, 1.0) | 1.4 (1.3, 1.5) | 1.8 (1.7, 1.9) | 2.2 (2.0, 2.3) | 2.4 (2.2, 2.5) | 2.6 (2.4, 2.8) |
| Lateral | 726 | 40702 | 0.9 (0.9, 1.0) | 1.5 (1.3, 1.6) | 1.8 (1.7, 2.0) | 2.2 (2.0, 2.4) | 2.4 (2.2, 2.6) | 2.5 (2.3, 2.7) |
| Posterior | 2558 | 179165 | 0.9 (0.8, 0.9) | 1.3 (1.3, 1.4) | 1.6 (1.6, 1.7) | 1.9 (1.9, 2.0) | 2.1 (2.0, 2.2) | 2.3 (2.1, 2.4) |
| TOTAL | 4804 | 317487 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses
Excludes procedures with unknown ASA Score, BMI category or head size

**Figure HT84 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Surgical Approach (Primary Diagnosis OA, Major Revisions)**




HR - adjusted for age, gender, ASA score and BMI category, femoral fixation and head size.

Lateral vs Anterior
Entire Period: HR=1.00 (95% CI 0.91, 1.09),p=0.986

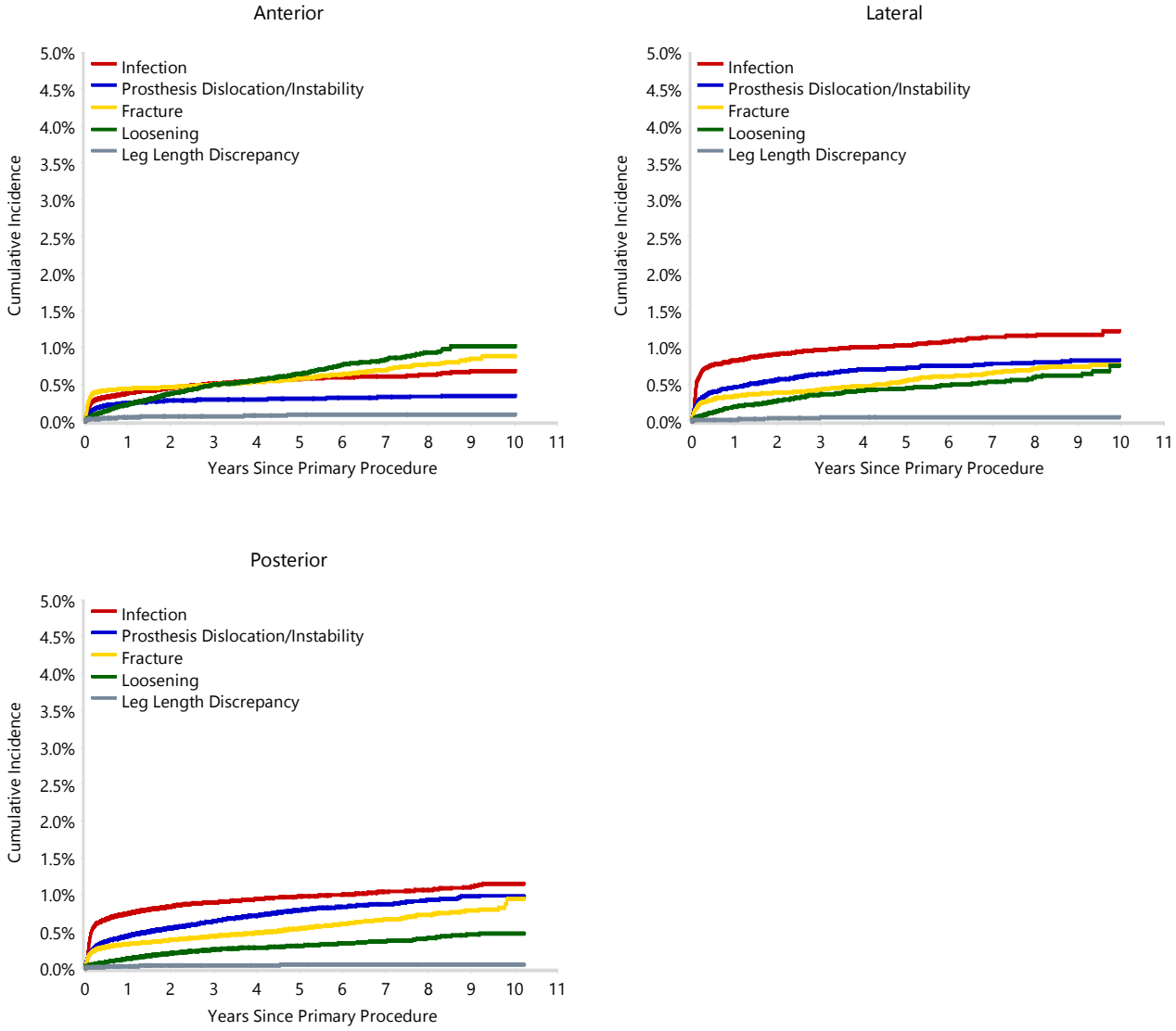
Posterior vs Anterior
Entire Period: HR=0.89 (95% CI 0.84, 0.96),p<0.001

Posterior vs Lateral
Entire Period: HR=0.89 (95% CI 0.82, 0.97),p=0.008

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|
| Anterior | 97620 | 81667 | 55860 | 34722 | 17184 | 10194 | 4289 |
| Lateral | 40702 | 36303 | 28171 | 20403 | 12135 | 7911 | 3654 |
| Posterior | 179165 | 151002 | 103508 | 64720 | 32266 | 18947 | 8124 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses
Excludes procedures with unknown ASA Score, BMI category or head size
Due to low numbers ASA score 1–2 and 3–5 have been combined
Due to low numbers BMI category underweight and normal have been combined

**Figure HT85 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement by Surgical Approach (Primary Diagnosis OA)**



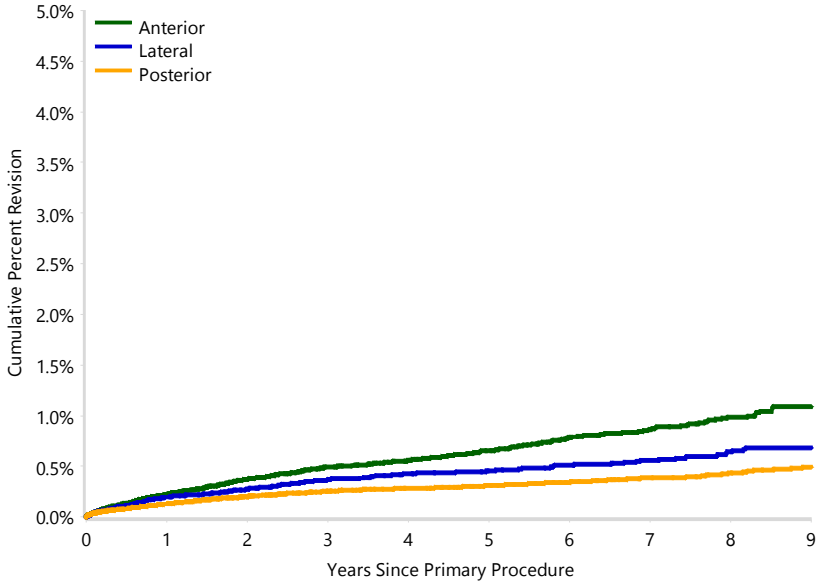

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT84 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Surgical Approach (Primary Diagnosis OA, Revision for Loosening)**

| Surgical Approach | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|
| Anterior | 539 | 97620 | 0.2 (0.2, 0.3) | 0.5 (0.4, 0.5) | 0.7 (0.6, 0.7) | 0.9 (0.8, 0.9) | 1.0 (0.9, 1.1) | 1.1 (1.0, 1.2) |
| Lateral | 184 | 40702 | 0.2 (0.2, 0.2) | 0.4 (0.3, 0.4) | 0.5 (0.4, 0.5) | 0.6 (0.5, 0.7) | 0.6 (0.5, 0.8) | 0.7 (0.6, 0.8) |
| Posterior | 486 | 179165 | 0.1 (0.1, 0.1) | 0.3 (0.2, 0.3) | 0.3 (0.3, 0.3) | 0.4 (0.3, 0.4) | 0.4 (0.4, 0.5) | 0.5 (0.4, 0.6) |
| TOTAL | 1209 | 317487 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Excludes procedures with unknown ASA score, BMI category or head size
Restricted to modern prostheses

**Figure HT86 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Surgical Approach (Primary Diagnosis OA, Revision for Loosening)**




HR - adjusted for age, gender, ASA score and BMI category, femoral fixation and head size

Lateral vs Posterior
Entire Period: HR=1.45 (95% CI 1.22, 1.71),p<0.001

Anterior vs Posterior
Entire Period: HR=1.93 (95% CI 1.70, 2.19),p<0.001

Anterior vs Lateral
Entire Period: HR=1.33 (95% CI 1.12, 1.58),p=0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|
| Anterior | 97620 | 81667 | 55860 | 34722 | 17184 | 10194 | 4289 |
| Lateral | 40702 | 36303 | 28171 | 20403 | 12135 | 7911 | 3654 |
| Posterior | 179165 | 151002 | 103508 | 64720 | 32266 | 18947 | 8124 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses
Excludes procedures with unknown ASA Score, BMI category or head size
Due to low numbers ASA score 1–2 and 3–5 have been combined
Due to low numbers BMI category underweight and normal have been combined

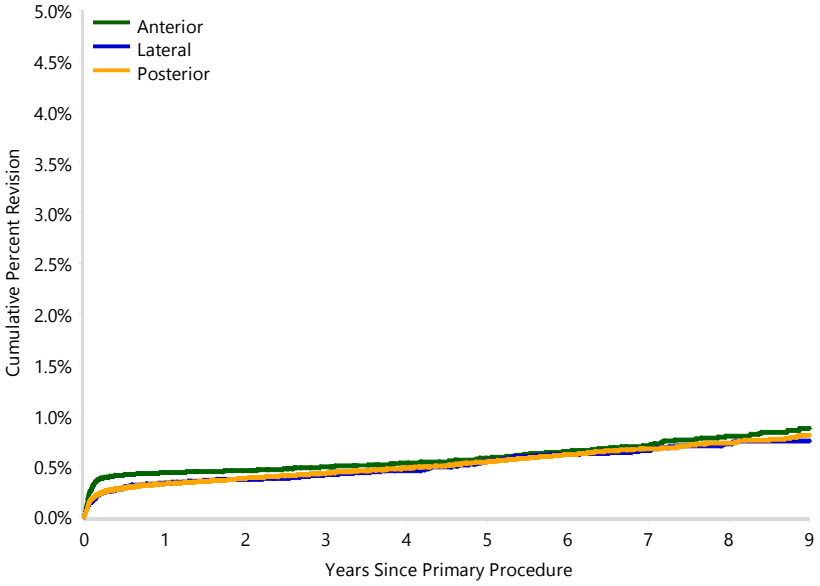
# Primary Total Hip Replacement

**Table HT85 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Surgical Approach (Primary Diagnosis OA, Revision for Fracture)**

| Surgical Approach | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|
| Anterior | 546 | 97620 | 0.4 (0.4, 0.5) | 0.5 (0.4, 0.5) | 0.6 (0.5, 0.6) | 0.7 (0.6, 0.8) | 0.8 (0.7, 0.9) | 0.9 (0.8, 1.0) |
| Lateral | 219 | 40702 | 0.3 (0.3, 0.4) | 0.4 (0.4, 0.5) | 0.5 (0.5, 0.6) | 0.7 (0.6, 0.8) | 0.7 (0.6, 0.8) | 0.7 (0.6, 0.9) |
| Posterior | 889 | 179165 | 0.3 (0.3, 0.4) | 0.4 (0.4, 0.5) | 0.5 (0.5, 0.6) | 0.7 (0.6, 0.7) | 0.7 (0.7, 0.8) | 0.8 (0.7, 0.9) |
| TOTAL | 1654 | 317487 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses
Excludes procedures with unknown ASA score, BMI category or head size

**Figure HT87 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Surgical Approach (Primary Diagnosis OA, Revision for Fracture)**




HR - adjusted for age, gender, ASA score and BMI category, femoral fixation and head size

Posterior vs Lateral
Entire Period: HR=1.04 (95% CI 0.90, 1.21),p=0.615

Anterior vs Lateral
0-3Mth: HR=1.63 (95% CI 1.35, 1.95),p<0.001
3Mth+: HR=0.76 (95% CI 0.61, 0.93),p=0.008

Anterior vs Posterior
0-3Mth: HR=1.56 (95% CI 1.36, 1.79),p<0.001
3Mth+: HR=0.73 (95% CI 0.61, 0.87),p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|
| Anterior | 97620 | 81667 | 55860 | 34722 | 17184 | 10194 | 4289 |
| Lateral | 40702 | 36303 | 28171 | 20403 | 12135 | 7911 | 3654 |
| Posterior | 179165 | 151002 | 103508 | 64720 | 32266 | 18947 | 8124 |

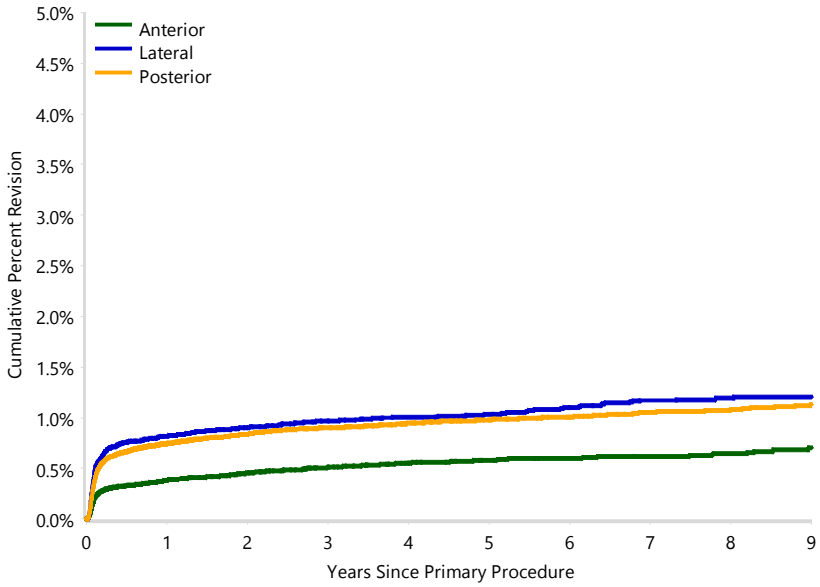
Note: All procedures using metal/metal prostheses have been excluded
Excludes procedures with unknown ASA Score, BMI category or head size
Due to low numbers ASA score 1–2 and 3–5 have been combined
Due to low numbers BMI category underweight and normal have been combined
Restricted to modern prostheses

**Table HT86 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Surgical Approach (Primary Diagnosis OA, Revision for Infection)**

| Surgical Approach | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|
| Anterior | 499 | 97620 | 0.4 (0.3, 0.4) | 0.5 (0.5, 0.6) | 0.6 (0.5, 0.6) | 0.6 (0.6, 0.7) | 0.6 (0.6, 0.7) | 0.7 (0.6, 0.8) |
| Lateral | 419 | 40702 | 0.8 (0.7, 0.9) | 1.0 (0.9, 1.1) | 1.0 (0.9, 1.1) | 1.2 (1.1, 1.3) | 1.2 (1.1, 1.3) | 1.2 (1.1, 1.3) |
| Posterior | 1617 | 179165 | 0.7 (0.7, 0.8) | 0.9 (0.9, 0.9) | 1.0 (0.9, 1.0) | 1.1 (1.0, 1.1) | 1.1 (1.0, 1.1) | 1.1 (1.1, 1.2) |
| TOTAL | 2535 | 317487 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Excludes procedures with unknown ASA score, BMI category or head size
Restricted to modern prostheses

**Figure HT88 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Surgical Approach (Primary Diagnosis OA, Revision for Infection)**




HR - adjusted for age, gender, ASA score and BMI category, femoral fixation and head size

Lateral vs Anterior
Entire Period: HR=1.63 (95% CI 1.43, 1.87),p<0.001

Posterior vs Anterior
Entire Period: HR=1.49 (95% CI 1.34, 1.65),p<0.001

Posterior vs Lateral
Entire Period: HR=0.91 (95% CI 0.82, 1.01),p=0.085

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|
| Anterior | 97620 | 81667 | 55860 | 34722 | 17184 | 10194 | 4289 |
| Lateral | 40702 | 36303 | 28171 | 20403 | 12135 | 7911 | 3654 |
| Posterior | 179165 | 151002 | 103508 | 64720 | 32266 | 18947 | 8124 |

Note: All procedures using metal/metal prostheses have been excluded
Excludes procedures with unknown ASA Score, BMI category or head size
Due to low numbers ASA score 1–2 and 3–5 have been combined
Due to low numbers BMI category underweight and normal have been combined
Restricted to modern prostheses

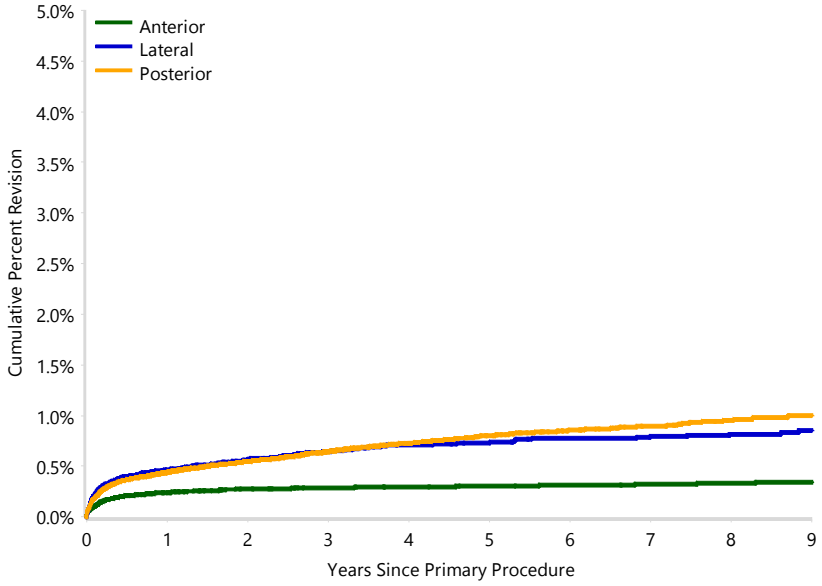
# Primary Total Hip Replacement

**Table HT87 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Surgical Approach (Primary Diagnosis OA, Revision for Dislocation/Instability)**

| Surgical Approach | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|
| Anterior | 274 | 97620 | 0.2 (0.2, 0.3) | 0.3 (0.3, 0.3) | 0.3 (0.3, 0.3) | 0.3 (0.3, 0.4) | 0.3 (0.3, 0.4) | 0.3 (0.3, 0.4) |
| Lateral | 281 | 40702 | 0.5 (0.4, 0.5) | 0.7 (0.6, 0.7) | 0.7 (0.6, 0.8) | 0.8 (0.7, 0.9) | 0.8 (0.7, 0.9) | 0.9 (0.7, 1.0) |
| Posterior | 1230 | 179165 | 0.4 (0.4, 0.5) | 0.6 (0.6, 0.7) | 0.8 (0.8, 0.9) | 0.9 (0.8, 1.0) | 1.0 (0.9, 1.0) | 1.0 (0.9, 1.1) |
| TOTAL | 1785 | 317487 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses
Excludes procedures with unknown ASA score, BMI category or head size

**Figure HT89 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Surgical Approach (Primary Diagnosis OA, Revision for Dislocation/Instability)**




HR - adjusted for age, gender, ASA score and BMI category, femoral fixation and head size

Lateral vs Anterior
- 0-2wk: HR=1.64 (95% CI 1.15, 2.36),p=0.007
- 2wk-1Mth: HR=2.49 (95% CI 1.74, 3.58),p<0.001
- 1Mth-6Mth: HR=1.83 (95% CI 1.40, 2.40),p<0.001
- 6Mth+: HR=3.03 (95% CI 2.30, 3.99),p<0.001

Posterior vs Anterior
- 0-3Mth: HR=1.72 (95% CI 1.45, 2.05),p<0.001
- 3Mth-9Mth: HR=2.12 (95% CI 1.62, 2.78),p<0.001
- 9Mth+: HR=4.35 (95% CI 3.41, 5.55),p<0.001

Posterior vs Lateral
- Entire Period: HR=1.10 (95% CI 0.96, 1.25),p=0.158

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|
| Anterior | 97620 | 81667 | 55860 | 34722 | 17184 | 10194 | 4289 |
| Lateral | 40702 | 36303 | 28171 | 20403 | 12135 | 7911 | 3654 |
| Posterior | 179165 | 151002 | 103508 | 64720 | 32266 | 18947 | 8124 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses
Excludes procedures with unknown ASA Score, BMI category or head size
Due to low numbers ASA score 1–2 and 3–5 have been combined
Due to low numbers BMI category underweight and normal have been combined

## OUTCOME FOR FRACTURED NECK OF FEMUR

There have been 31,470 primary total conventional hip replacement procedures undertaken for a diagnosis of fractured neck of femur.

The cumulative percent revision of primary total conventional hip replacement for fractured neck of femur is 10.5% at 20 years (Table HT88 and Figure HT90).

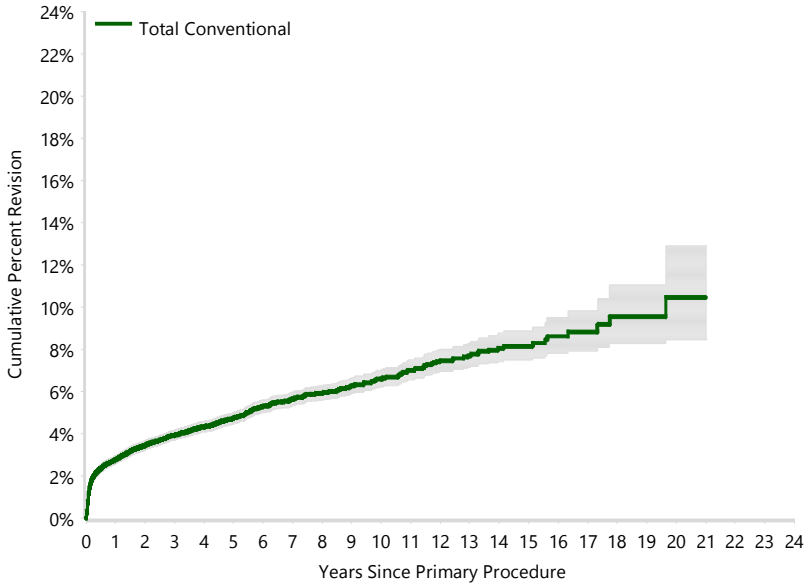
At 20 years, the cumulative percent survival of patients is 22.7% (Table HT89 and Figure HT91). This compares to the cumulative percent revision of 7.9% at 20 years when the diagnosis is osteoarthritis, which has a cumulative percent survival of 44.6% of patients at 20 years.

**Table HT88 Cumulative Percent Revision of Primary Total Conventional Hip Replacement (Primary Diagnosis Fractured NOF)**

| Hip Class | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Total Conventional | 1435 | 31470 | 2.8 (2.6, 3.0) | 3.9 (3.7, 4.2) | 4.8 (4.5, 5.0) | 6.6 (6.2, 7.0) | 8.2 (7.5, 8.9) | 10.5 (8.5, 12.9) |
| TOTAL | 1435 | 31470 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT90 Cumulative Percent Revision of Primary Total Conventional Hip Replacement (Primary Diagnosis Fractured NOF)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Total Conventional | 31470 | 25985 | 18538 | 12519 | 3560 | 705 | 86 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

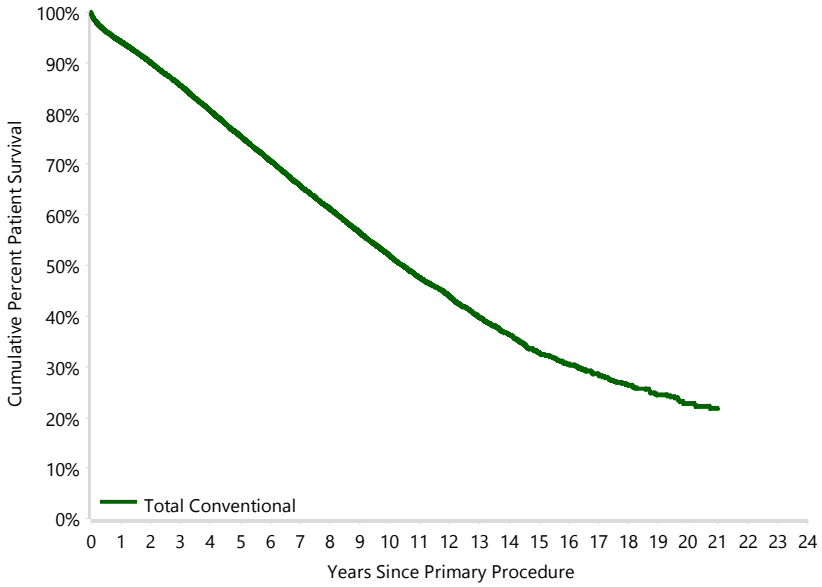
# Primary Total Hip Replacement

**Table HT89 Cumulative Percent Survival of Patients with Primary Total Conventional Hip Replacement (Primary Diagnosis Fractured NOF)**

| Hip Class | N Deceased | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Total Conventional | 9375 | 31470 | 94.2 (93.9, 94.4) | 85.5 (85.0, 85.9) | 75.5 (75.0, 76.1) | 51.9 (51.0, 52.8) | 32.8 (31.5, 34.0) | 22.7 (20.7, 24.8) |
| TOTAL | 9375 | 31470 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT91 Cumulative Percent Survival of Patients with Primary Total Conventional Hip Replacement (Primary Diagnosis Fractured NOF)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Total Conventional | 31470 | 25985 | 18538 | 12519 | 3560 | 705 | 86 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

### Reasons for Revision

Prosthesis dislocation/instability is the most common reason for revision, followed by fracture, infection, and loosening (Table HT90 and Figure HT92).

### Type of Revision

The most common type of revision is femoral component only, followed by head and insert, acetabular only, and total hip replacement (femoral/acetabular) (Table HT91).

**Table HT90 Primary Total Conventional Hip Replacement by Reason for Revision (Primary Diagnosis Fractured NOF)**

| Reason for Revision | Number | Percent |
|---|---|---|
| Prosthesis Dislocation/Instability | 474 | 33.0 |
| Fracture | 425 | 29.6 |
| Infection | 276 | 19.2 |
| Loosening | 181 | 12.6 |
| Leg Length Discrepancy | 13 | 0.9 |
| Pain | 10 | 0.7 |
| Implant Breakage Stem | 7 | 0.5 |
| Malposition | 7 | 0.5 |
| Implant Breakage Acetabular Insert | 7 | 0.5 |
| Lysis | 6 | 0.4 |
| Tumour | 5 | 0.3 |
| Implant Breakage Acetabular | 5 | 0.3 |
| Metal Related Pathology | 3 | 0.2 |
| Incorrect Sizing | 2 | 0.1 |
| Heterotopic Bone | 1 | 0.1 |
| Wear Head | 1 | 0.1 |
| Other | 12 | 0.8 |
| TOTAL | 1435 | 100.0 |

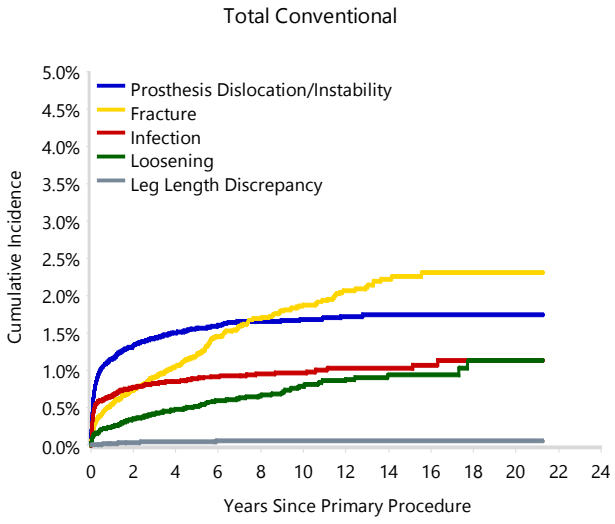
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT91 Primary Total Conventional Hip Replacement by Type of Revision (Primary Diagnosis Fractured NOF)**

| Type of Revision | Number | Percent |
|---|---|---|
| Femoral Component | 531 | 37.0 |
| Head/Insert | 375 | 26.1 |
| Acetabular Component | 220 | 15.3 |
| THR (Femoral/Acetabular) | 154 | 10.7 |
| Head Only | 61 | 4.3 |
| Cement Spacer | 34 | 2.4 |
| Minor Components | 26 | 1.8 |
| Insert Only | 20 | 1.4 |
| Removal of Prostheses | 9 | 0.6 |
| Total Femoral | 3 | 0.2 |
| Reinsertion of Components | 1 | 0.1 |
| Bipolar Head and Femoral | 1 | 0.1 |
| TOTAL | 1435 | 100.0 |

Note: Femoral heads are usually replaced when the acetabular component or femoral stem is revised
All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT92 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement (Primary Diagnosis Fractured NOF)**




Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

# Primary Total Hip Replacement

**Age and Gender**

There is a difference in the rate of revision with respect to age with patients aged <55 years having a higher rate of revision compared to patients aged ≥75 years. There are no differences between patients aged ≥75 years and the other two age groups (Table HT92 and Figure HT93). Males have a higher rate of revision compared to females except for the first month (Table HT93 and Figure HT94).

Males aged 75 years and older have a higher rate of revision compared to males aged 65-74 years from one month onwards, with no difference prior to this time. There are no other differences for males aged ≥75 years compared to the other age groups (Table HT93 and Figure HT95).

Females aged <55 years have a higher rate of revision compared to females aged ≥75 years. There are no differences when other age groups are compared to females aged ≥75 (Table HT93 and Figure HT96).

The most common reasons for revision by gender and age are shown in Figure HT97 and Figure HT98.

**ASA and BMI**

ASA scores are an indication of comorbidity and have been collected since 2012. The outcome of 25,249 primary total conventional hip replacement procedures for fractured neck of femur are reported in relation to these scores.

The majority of patients having a primary conventional hip replacement for fracture have an ASA score of 2 or 3, and this has changed little over time (Figure HT99).

When compared to patients with an ASA score of 1, patients with an ASA score of 2, 3 (up to 3.5 years only) and 4 have higher rates of revision (Table HT94 and Figure HT100). The most common reasons for revision for each ASA score are shown in Figure HT101. The difference in the rate of revision is partially due to an increase in revision for dislocation/ instability and infection with increasing ASA score.

There is a larger proportion of fractured neck of femur patients with an ASA score of 3 or 4 than patients with osteoarthritis (Figure HT105).

BMI data have been collected since 2015. The revision outcomes are reported for 16,529 primary total conventional hip replacement procedures for fractured neck of femur.

Over 75% of patients having a hip replacement for fracture are in the normal or pre-obese category, and there has been little change in BMI over time (Table HT92).

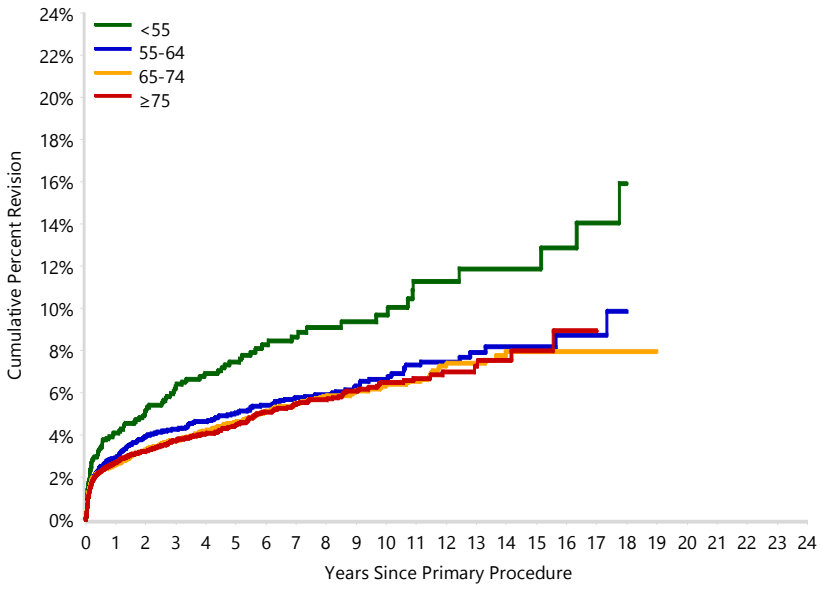
Patients in obese class 2 and 3 have a higher rate of revision compared to patients in the normal BMI class (Table HT96 and Figure HT103). The most common reasons for revision are shown in Figure HT104.

**Table HT92 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Age (Primary Diagnosis Fractured NOF)**

| Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| <55 | 105 | 1372 | 4.1 (3.2, 5.3) | 6.3 (5.0, 7.8) | 7.5 (6.0, 9.2) | 9.7 (7.8, 11.9) | 11.9 (9.4, 15.0) | |
| 55-64 | 231 | 4509 | 2.9 (2.5, 3.5) | 4.3 (3.7, 4.9) | 5.0 (4.4, 5.8) | 6.7 (5.8, 7.7) | 8.2 (6.9, 9.7) | |
| 65-74 | 452 | 9878 | 2.6 (2.3, 3.0) | 3.7 (3.4, 4.2) | 4.6 (4.2, 5.1) | 6.4 (5.8, 7.1) | 8.0 (6.9, 9.2) | |
| ≥75 | 647 | 15711 | 2.7 (2.5, 3.0) | 3.7 (3.4, 4.1) | 4.5 (4.1, 4.9) | 6.5 (5.9, 7.2) | 8.0 (6.7, 9.6) | |
| TOTAL | 1435 | 31470 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded. Restricted to modern prostheses

**Figure HT93 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Age (Primary Diagnosis Fractured NOF)**




HR - adjusted for gender

<55 vs ≥75

Entire Period: HR=1.50 (95% CI 1.22, 1.85), p<0.001

55-64 vs ≥75

Entire Period: HR=1.07 (95% CI 0.92, 1.24), p=0.413

65-74 vs ≥75

Entire Period: HR=1.00 (95% CI 0.89, 1.13), p=0.967

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| <55 | 1372 | 1118 | 825 | 620 | 258 | 93 | 24 |
| 55-64 | 4509 | 3805 | 2856 | 2110 | 766 | 200 | 20 |
| 65-74 | 9878 | 8345 | 6149 | 4383 | 1387 | 287 | 38 |
| ≥75 | 15711 | 12717 | 8708 | 5406 | 1149 | 125 | 4 |

Note: All procedures using metal/metal prostheses have been excluded. Restricted to modern prostheses

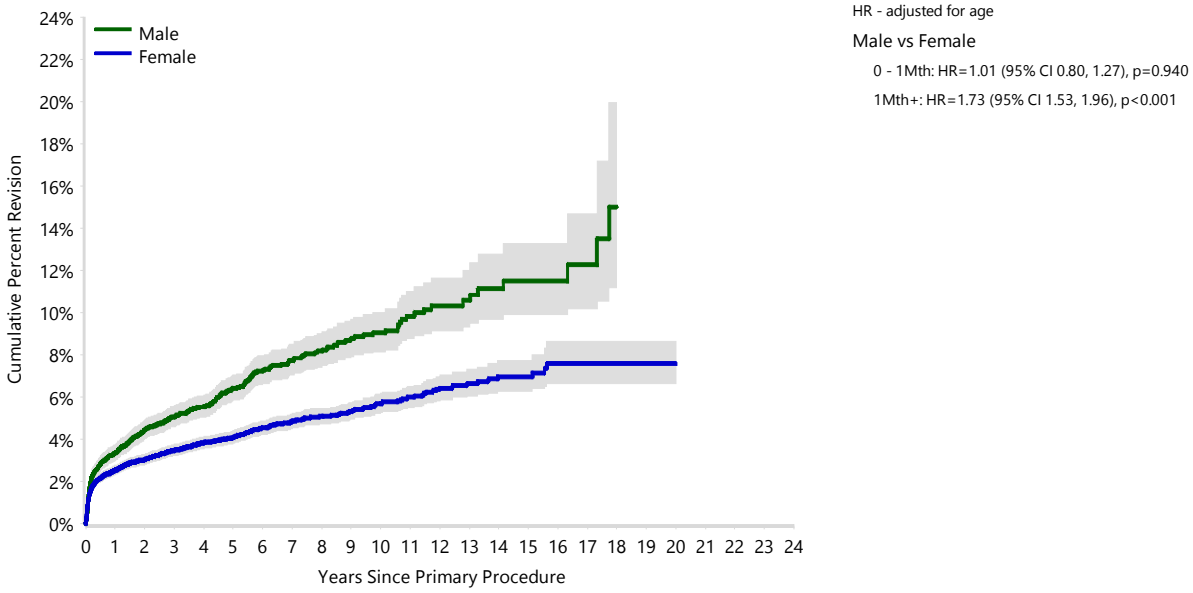
# Primary Total Hip Replacement

**Table HT93 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Gender and Age (Primary Diagnosis Fractured NOF)**

| Gender | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| **Male** | | **544** | **9500** | **3.4 (3.0, 3.8)** | **5.1 (4.6, 5.6)** | **6.4 (5.9, 7.1)** | **9.0 (8.2, 10.0)** | **11.5 (9.9, 13.3)** | |
| | **<55** | 56 | 656 | 4.6 (3.2, 6.6) | 7.3 (5.4, 9.8) | 9.0 (6.8, 11.8) | 10.2 (7.7, 13.5) | 12.1 (8.8, 16.4) | |
| | **55-64** | 92 | 1510 | 3.5 (2.7, 4.6) | 5.1 (4.1, 6.5) | 6.0 (4.8, 7.5) | 7.2 (5.7, 9.0) | 11.5 (8.3, 15.8) | |
| | **65-74** | 154 | 2817 | 3.1 (2.5, 3.9) | 4.6 (3.9, 5.5) | 6.0 (5.1, 7.1) | 8.5 (7.0, 10.2) | 9.5 (7.6, 11.8) | |
| | **≥75** | 242 | 4517 | 3.3 (2.8, 3.9) | 5.0 (4.3, 5.8) | 6.5 (5.7, 7.6) | 10.9 (9.1, 13.1) | | |
| **Female** | | **891** | **21970** | **2.5 (2.3, 2.8)** | **3.5 (3.2, 3.7)** | **4.1 (3.8, 4.4)** | **5.7 (5.3, 6.2)** | **7.0 (6.3, 7.7)** | **7.6 (6.6, 8.6)** |
| | **<55** | 49 | 716 | 3.6 (2.5, 5.3) | 5.4 (3.9, 7.5) | 6.1 (4.4, 8.4) | 9.2 (6.7, 12.5) | 11.7 (8.3, 16.5) | |
| | **55-64** | 139 | 2999 | 2.6 (2.1, 3.3) | 3.8 (3.2, 4.6) | 4.6 (3.8, 5.5) | 6.4 (5.3, 7.7) | 6.8 (5.6, 8.3) | |
| | **65-74** | 298 | 7061 | 2.4 (2.1, 2.8) | 3.4 (3.0, 3.9) | 4.1 (3.6, 4.7) | 5.7 (5.0, 6.5) | 7.4 (6.2, 8.9) | |
| | **≥75** | 405 | 11194 | 2.5 (2.2, 2.8) | 3.3 (3.0, 3.7) | 3.8 (3.4, 4.2) | 5.2 (4.6, 5.9) | 6.2 (5.2, 7.4) | |
| **TOTAL** | | **1435** | **31470** | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded. Restricted to modern prostheses

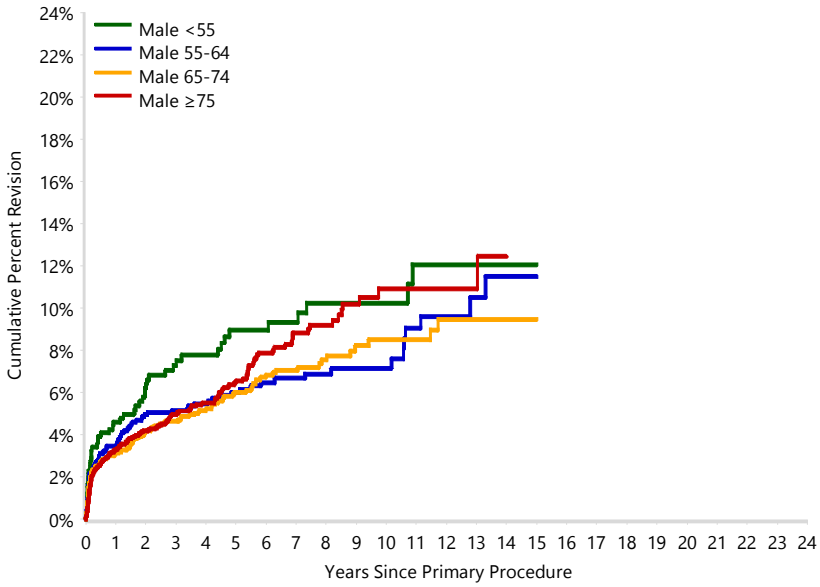
**Figure HT94 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Gender (Primary Diagnosis Fractured NOF)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| **Male** | 9500 | 7487 | 4999 | 3141 | 830 | 168 | 26 |
| **Female** | 21970 | 18498 | 13539 | 9378 | 2730 | 537 | 60 |

Note: All procedures using metal/metal prostheses have been excluded. Restricted to modern prostheses

**Figure HT95 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Males by Age (Primary Diagnosis Fractured NOF)**




Male <55 vs Male ≥75

Entire Period: HR=1.24 (95% CI 0.92, 1.66), p=0.155

Male 55-64 vs Male ≥75

0 - 1Mth: HR=1.59 (95% CI 0.96, 2.64), p=0.071

1Mth - 3Mth: HR=0.70 (95% CI 0.40, 1.24), p=0.223

3Mth+: HR=0.85 (95% CI 0.62, 1.15), p=0.283

Male 65-74 vs Male ≥75

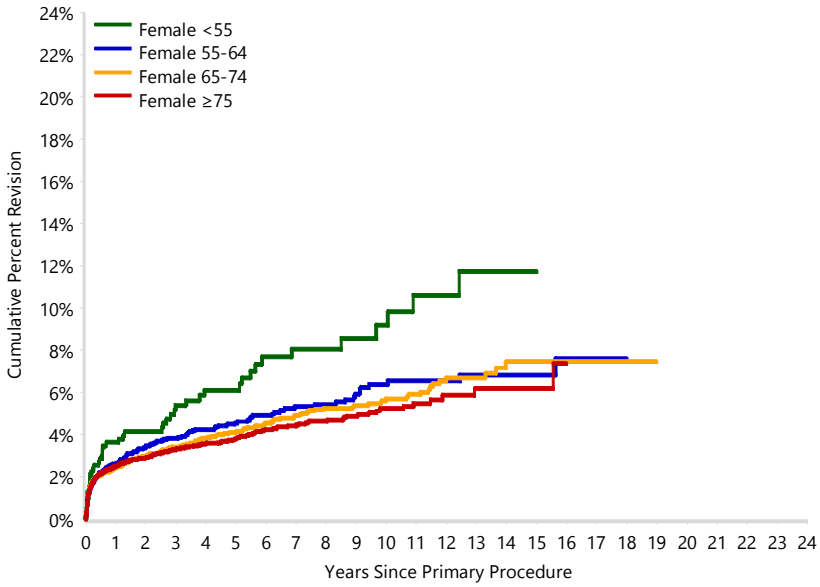
0 - 1Mth: HR=1.36 (95% CI 0.88, 2.11), p=0.165

1Mth+: HR=0.80 (95% CI 0.64, 1.00), p=0.049

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| **Male** | **<55** | 656 | 531 | 392 | 286 | 119 | 45 | 13 |
| | **55-64** | 1510 | 1249 | 903 | 646 | 223 | 44 | 4 |
| | **65-74** | 2817 | 2278 | 1597 | 1061 | 285 | 57 | 8 |
| | **≥75** | 4517 | 3429 | 2107 | 1148 | 203 | 22 | 1 |

Note: All procedures using metal/metal prostheses have been excluded. Restricted to modern prostheses

**Figure HT96 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Females by Age (Primary Diagnosis Fractured NOF)**




Female <55 vs Female ≥75
Entire Period: HR=1.73 (95% CI 1.29, 2.33), p<0.001

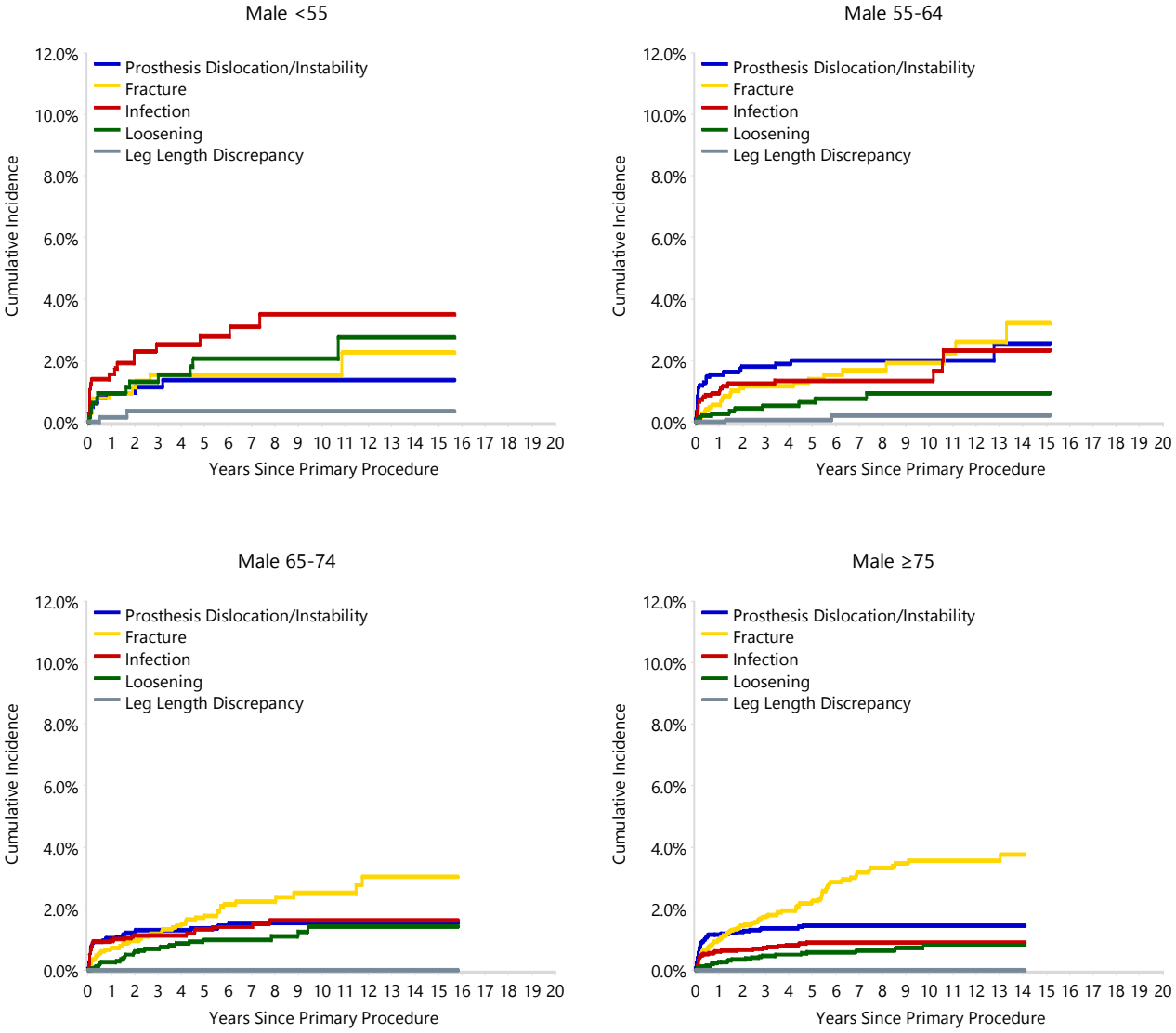
Female 55-64 vs Female ≥75
Entire Period: HR=1.15 (95% CI 0.95, 1.40), p=0.148

Female 65-74 vs Female ≥75
Entire Period: HR=1.07 (95% CI 0.92, 1.24), p=0.366

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| **Female** | **<55** | 716 | 587 | 433 | 334 | 139 | 48 | 11 |
| | **55-64** | 2999 | 2556 | 1953 | 1464 | 543 | 156 | 16 |
| | **65-74** | 7061 | 6067 | 4552 | 3322 | 1102 | 230 | 30 |
| | **≥75** | 11194 | 9288 | 6601 | 4258 | 946 | 103 | 3 |

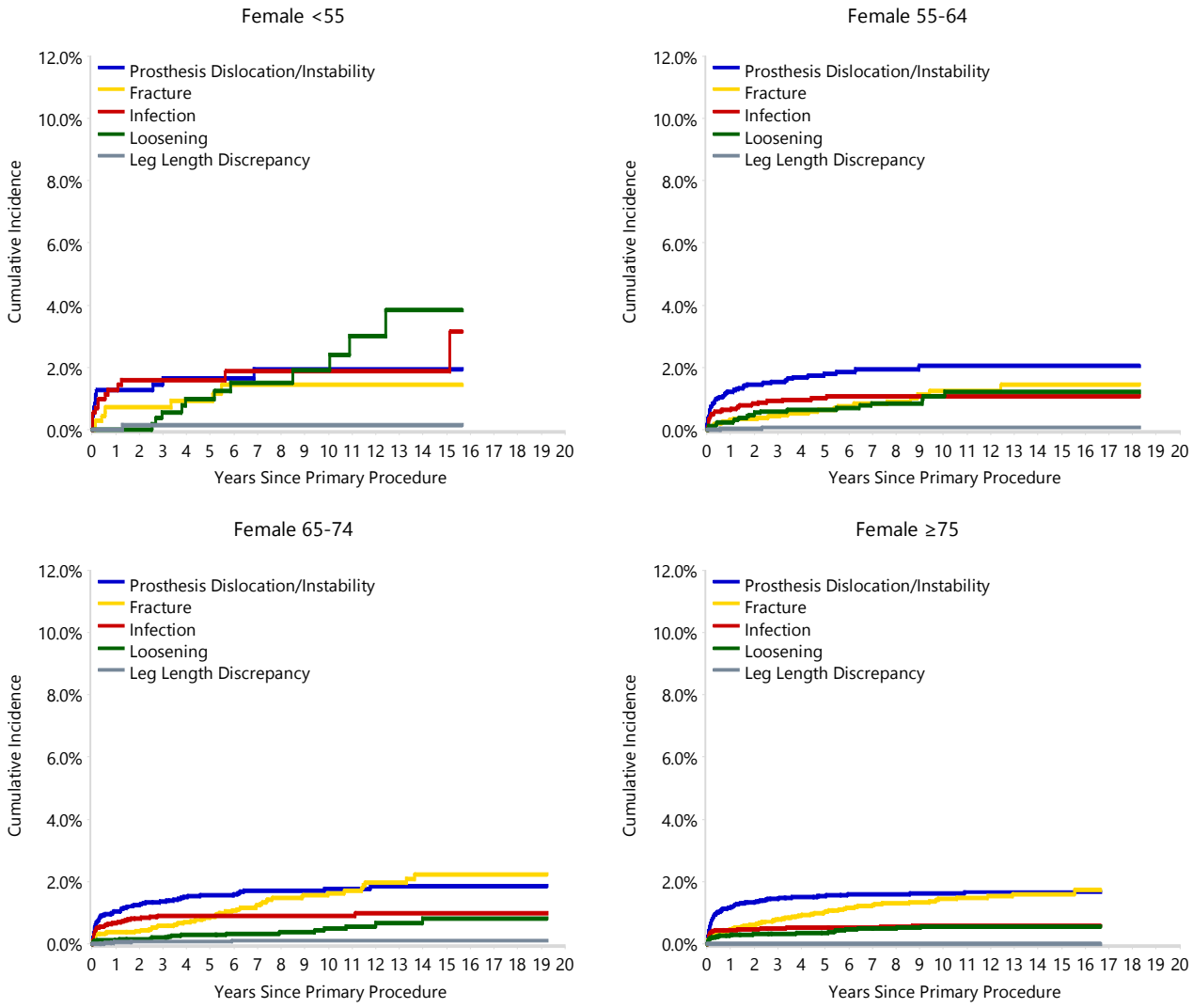
Note: All procedures using metal/metal prostheses have been excluded. Restricted to modern prostheses

**Figure HT97 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement in Males by Age (Primary Diagnosis Fractured NOF)**



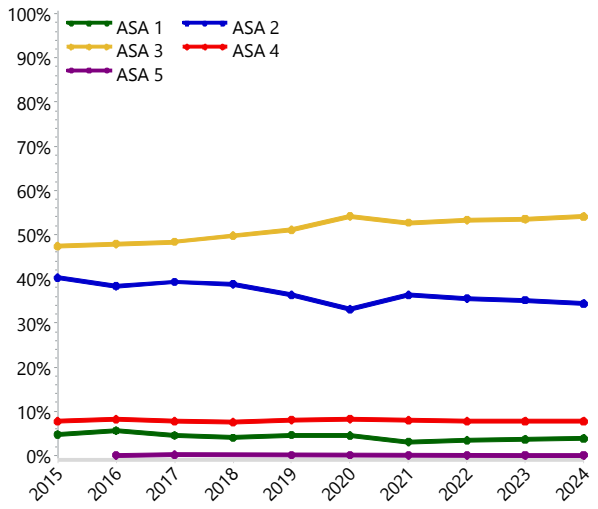

Note: All procedures using metal/metal prostheses have been excluded. Restricted to modern prostheses

**Figure HT98** **Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement in Females by Age (Primary Diagnosis Fractured NOF)**




Note: All procedures using metal/metal prostheses have been excluded. Restricted to modern prostheses

**Figure HT99** **Primary Total Conventional Hip Replacement by ASA Score (Primary Diagnosis Fractured NOF)**



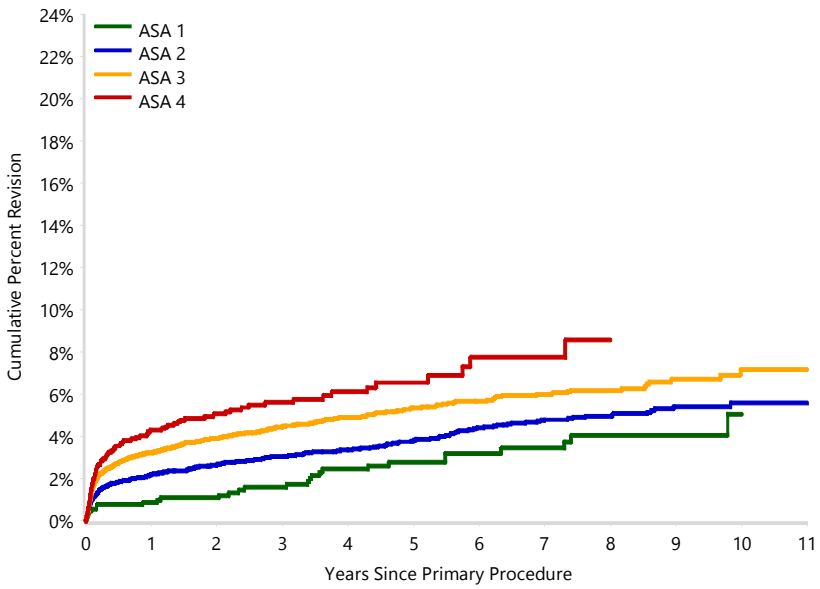

Note: All procedures using metal/metal prostheses have been excluded. Restricted to modern prostheses

**Table HT94 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by ASA Score (Primary Diagnosis Fractured NOF)**

| ASA Score | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 7 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| ASA 1 | 30 | 1054 | 0.9 (0.5, 1.7) | 1.1 (0.6, 2.0) | 1.6 (1.0, 2.6) | 2.4 (1.6, 3.8) | 2.8 (1.8, 4.2) | 3.4 (2.3, 5.1) | |
| ASA 2 | 336 | 9224 | 2.2 (1.9, 2.5) | 2.7 (2.3, 3.0) | 3.0 (2.7, 3.4) | 3.4 (3.0, 3.8) | 3.8 (3.4, 4.3) | 4.8 (4.3, 5.4) | 5.6 (4.9, 6.4) |
| ASA 3 | 588 | 12978 | 3.2 (2.9, 3.6) | 3.9 (3.6, 4.3) | 4.5 (4.1, 4.9) | 4.9 (4.5, 5.4) | 5.4 (4.9, 5.9) | 6.0 (5.5, 6.6) | 7.2 (6.3, 8.2) |
| ASA 4 | 99 | 1980 | 4.3 (3.5, 5.4) | 5.1 (4.1, 6.3) | 5.6 (4.6, 6.9) | 6.1 (5.0, 7.6) | 6.6 (5.3, 8.2) | 7.8 (6.0, 10.0) | |
| ASA 5 | 0 | 13 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | | | |
| **TOTAL** | **1053** | **25249** | | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT100 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by ASA Score (Primary Diagnosis Fractured NOF)**




HR - adjusted for age and gender

ASA 2 vs ASA 1

Entire Period: HR=1.50 (95% CI 1.03, 2.18), p=0.035

ASA 3 vs ASA 1

0 - 1Mth: HR=2.13 (95% CI 1.39, 3.26), p<0.001

1Mth - 1Yr: HR=2.41 (95% CI 1.60, 3.62), p<0.001

1Yr - 3.5Yr: HR=2.15 (95% CI 1.38, 3.34), p<0.001

3.5Yr+: HR=1.49 (95% CI 0.93, 2.40), p=0.096

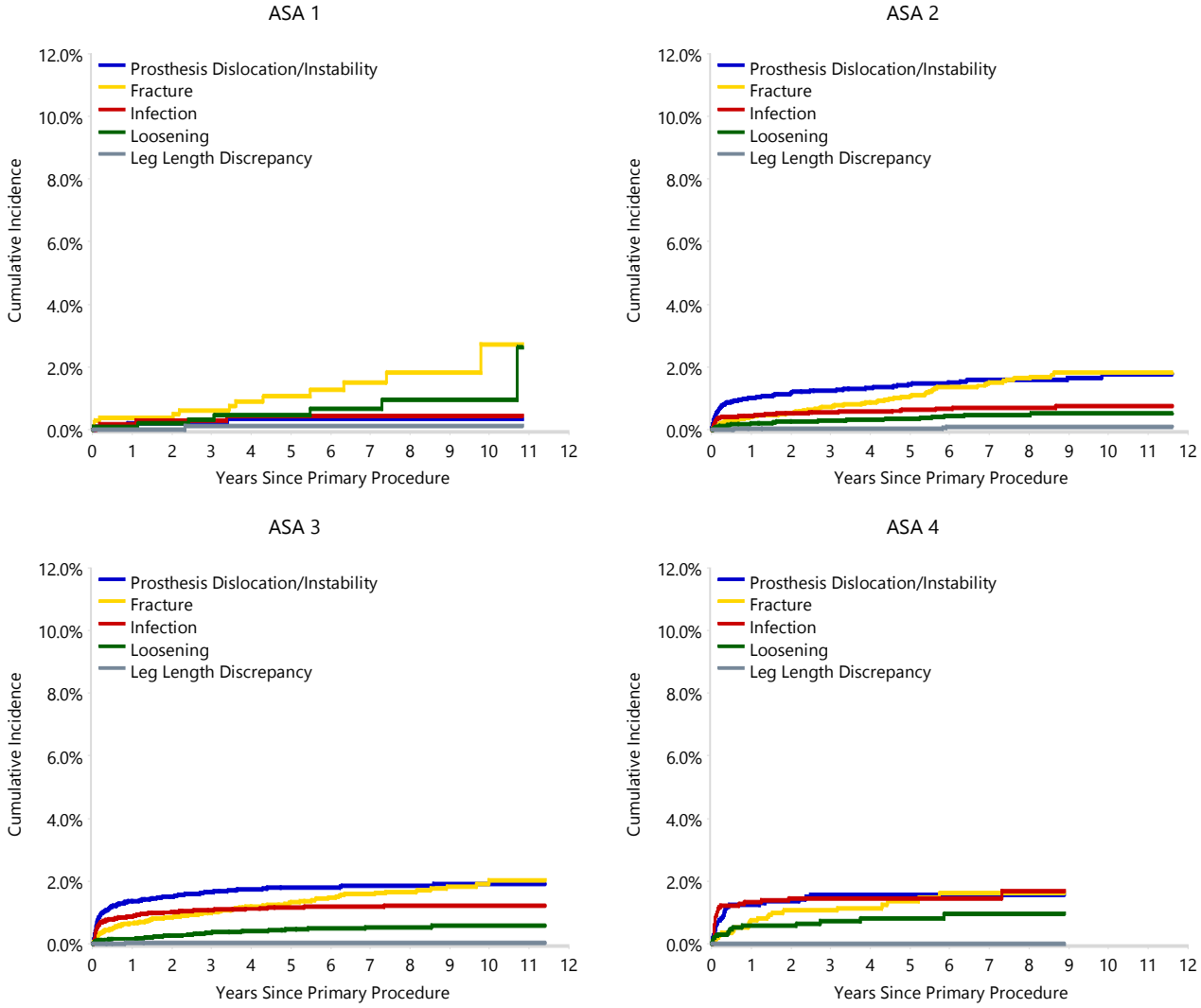
ASA 4 vs ASA 1

Entire Period: HR=2.82 (95% CI 1.86, 4.29), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 7 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|---|
| ASA 1 | 1054 | 929 | 820 | 719 | 633 | 526 | 335 | 28 |
| ASA 2 | 9224 | 7903 | 6817 | 5740 | 4748 | 3885 | 2218 | 167 |
| ASA 3 | 12978 | 10289 | 8331 | 6573 | 5040 | 3711 | 1830 | 101 |
| ASA 4 | 1980 | 1314 | 961 | 702 | 475 | 314 | 129 | 4 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT101 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement by ASA Score (Primary Diagnosis Fractured NOF)**



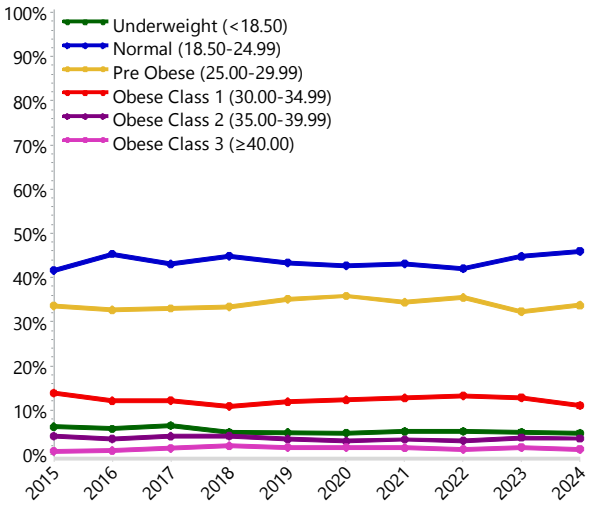

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT95 Primary Total Conventional Hip Replacement by ASA Score and Primary Diagnosis**

| ASA Score | Fractured Neck of Femur | | Osteoarthritis | | TOTAL | |
|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% |
| ASA 1 | 1054 | 4.2 | 28517 | 7.8 | 29571 | 7.6 |
| ASA 2 | 9224 | 36.5 | 194330 | 53.4 | 203554 | 52.3 |
| ASA 3 | 12978 | 51.4 | 136039 | 37.4 | 149017 | 38.3 |
| ASA 4 | 1980 | 7.8 | 4991 | 1.4 | 6971 | 1.8 |
| ASA 5 | 13 | 0.1 | 24 | 0.0 | 37 | 0.0 |
| **TOTAL** | **25249** | **100.0** | **363901** | **100.0** | **389150** | **100.0** |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT102 Primary Total Conventional Hip Replacement by BMI Category (Primary Diagnosis Fractured NOF)**



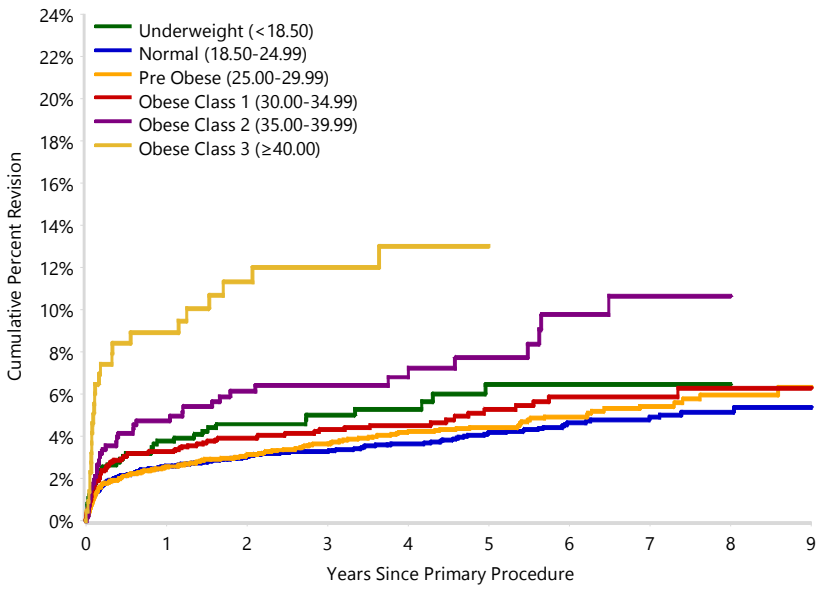
# Primary Total Hip Replacement

**Table HT96 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by BMI Category (Primary Diagnosis Fractured NOF)**

| BMI Category | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 6 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|
| Underweight | 41 | 854 | 3.8 (2.6, 5.4) | 4.6 (3.3, 6.3) | 5.0 (3.6, 6.9) | 5.3 (3.8, 7.3) | 6.5 (4.6, 9.0) | |
| Normal | 251 | 7235 | 2.6 (2.2, 3.0) | 3.0 (2.6, 3.5) | 3.3 (2.9, 3.8) | 3.7 (3.2, 4.2) | 4.6 (4.0, 5.3) | 5.4 (4.5, 6.3) |
| Pre Obese | 214 | 5621 | 2.6 (2.2, 3.0) | 3.1 (2.7, 3.6) | 3.6 (3.1, 4.2) | 4.2 (3.7, 4.9) | 4.9 (4.2, 5.7) | 6.3 (5.2, 7.8) |
| Obese Class 1 | 90 | 2017 | 3.3 (2.6, 4.1) | 3.9 (3.1, 4.9) | 4.3 (3.5, 5.4) | 4.5 (3.6, 5.6) | 5.9 (4.7, 7.4) | 6.3 (4.9, 8.1) |
| Obese Class 2 | 40 | 578 | 4.7 (3.2, 6.9) | 6.1 (4.4, 8.6) | 6.4 (4.6, 8.9) | 7.2 (5.2, 10.1) | 9.8 (6.9, 13.8) | |
| Obese Class 3 | 27 | 219 | 8.9 (5.8, 13.6) | 11.3 (7.6, 16.6) | 12.0 (8.2, 17.5) | 13.0 (8.9, 18.9) | | |
| TOTAL | 663 | 16524 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded. Restricted to modern prostheses. BMI has not been presented for patients aged ≤19 years

**Figure HT103 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by BMI Category (Primary Diagnosis Fractured NOF)**




HR - adjusted for age and gender

Underweight (<18.50) vs Normal (18.50-24.99)
Entire Period: HR=1.52 (95% CI 1.09, 2.12), p=0.013

Pre Obese (25.00-29.99) vs Normal (18.50-24.99)
Entire Period: HR=1.05 (95% CI 0.87, 1.26), p=0.604

Obese Class 1 (30.00-34.99) vs Normal (18.50-24.99)
Entire Period: HR=1.23 (95% CI 0.96, 1.56), p=0.096

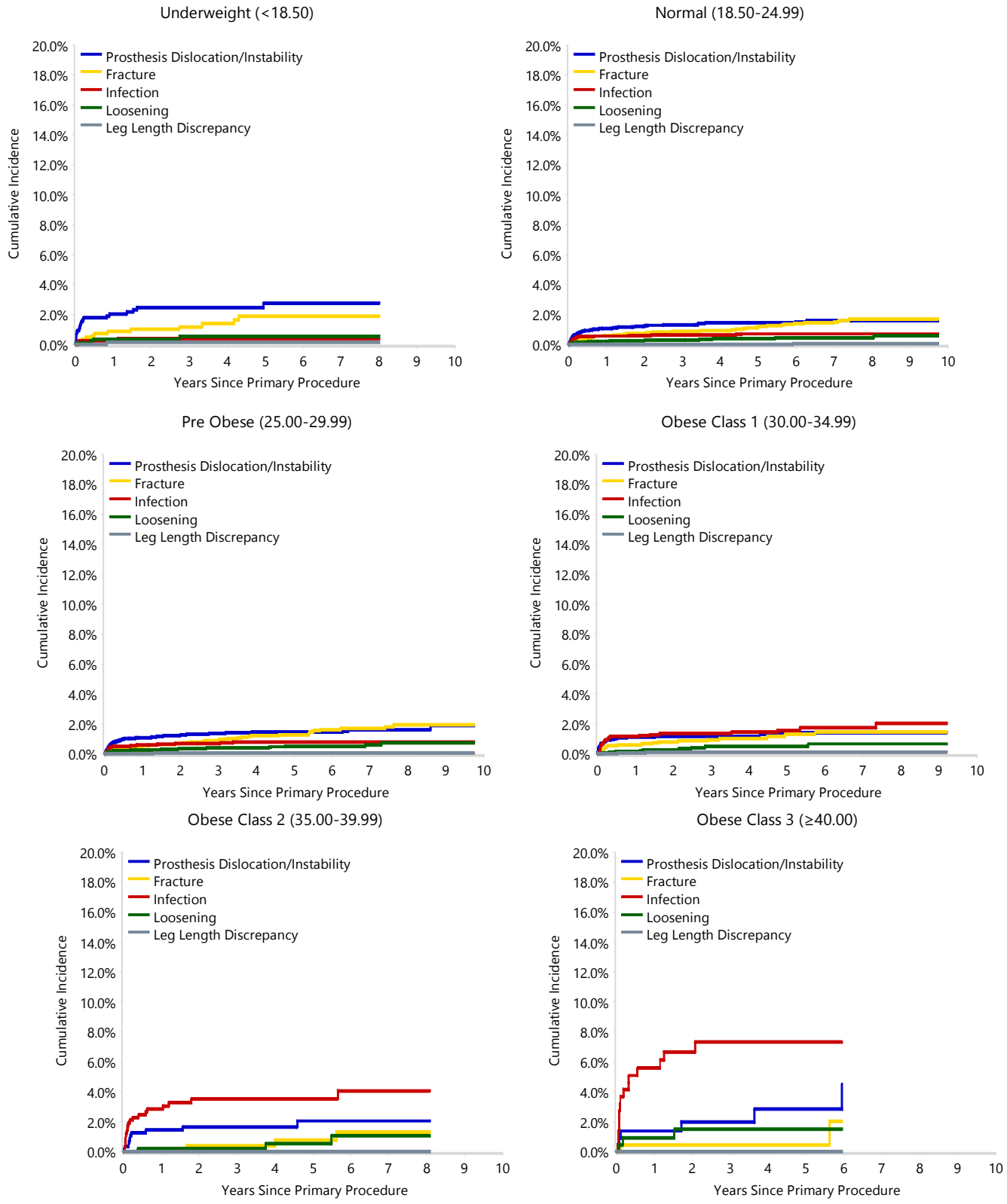
Obese Class 2 (35.00-39.99) vs Normal (18.50-24.99)
Entire Period: HR=1.98 (95% CI 1.42, 2.77), p<0.001

Obese Class 3 (≥40.00) vs Normal (18.50-24.99)
Entire Period: HR=3.68 (95% CI 2.47, 5.48), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 6 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|
| Underweight | 854 | 643 | 515 | 392 | 285 | 136 | 11 |
| Normal | 7235 | 5695 | 4557 | 3564 | 2734 | 1368 | 175 |
| Pre Obese | 5621 | 4505 | 3679 | 2856 | 2187 | 1098 | 149 |
| Obese Class 1 | 2017 | 1634 | 1308 | 1018 | 771 | 398 | 57 |
| Obese Class 2 | 578 | 446 | 354 | 289 | 219 | 117 | 20 |
| Obese Class 3 | 219 | 166 | 129 | 106 | 80 | 39 | 0 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years

**Figure HT104 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement by BMI Category (Primary Diagnosis Fractured NOF)**




Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years

**Fixation**

The analysis for fractured neck of femur and fixation has been performed for modern prostheses with modern bearing surfaces and restricted to mixed ceramic/mixed ceramic and all femoral head materials used in combination with XLPE.

There are 1,678 procedures with cemented fixation, 6,668 with cementless fixation and 21,215 with hybrid fixation. Procedures using cemented fixation do not have a different rate of revision compared to hybrid and cementless fixation. Cementless fixation has a higher rate of revision than hybrid fixation for the first 3 months only, with no difference after this time (Table HT97 and Figure HT105).

There are differences in outcome with respect to fixation and age. For patients aged <70 years, there is no difference in the rate of revision between cemented and cementless fixation. For the first month, cementless fixation has a higher rate of revision than hybrid fixation for this age group. From 1 month onwards, this reverses and hybrid fixation has a higher rate of revision compared to cementless fixation (Table HT98 and Figure HT106).

For patients aged ≥70 years, there is an 86% higher rate of revision for cementless fixation compared to hybrid fixation for the first 3 months.

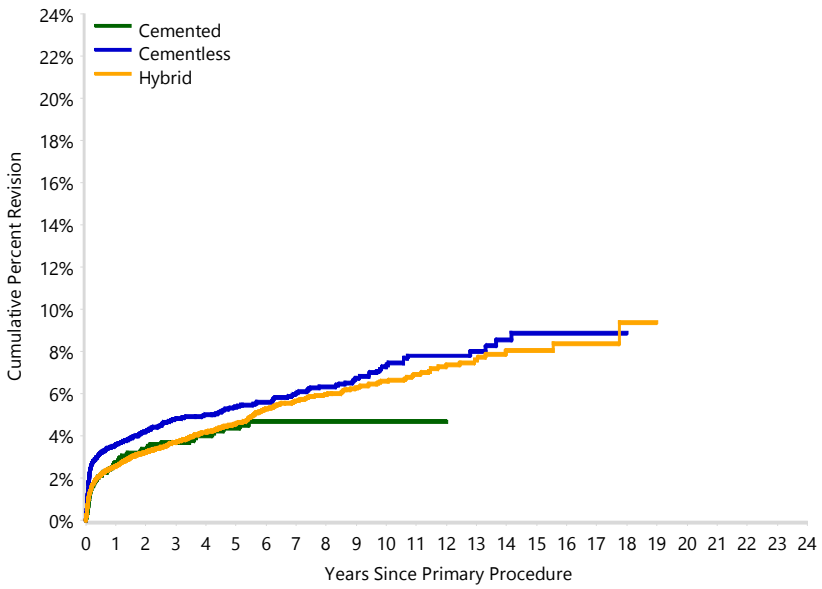
However, for patients aged ≥70 years, cementless fixation has a higher rate of revision than cemented fixation over the entire period, and for the first 3 months compared to hybrid fixation. There is no difference in the rate of revision when hybrid fixation is compared to cemented fixation (Table HT98 and Figure HT107).

**Table HT97 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis Fractured NOF)**

| Fixation | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cemented | 63 | 1678 | 2.8 (2.1, 3.7) | 3.4 (2.6, 4.4) | 3.7 (2.8, 4.8) | 4.4 (3.4, 5.6) | 4.7 (3.6, 6.0) | 4.7 (3.6, 6.0) |
| Cementless | 361 | 6668 | 3.6 (3.2, 4.1) | 4.2 (3.7, 4.7) | 4.8 (4.3, 5.4) | 5.4 (4.8, 6.0) | 6.0 (5.4, 6.7) | 7.4 (6.5, 8.3) |
| Hybrid | 916 | 21215 | 2.6 (2.4, 2.8) | 3.2 (3.0, 3.5) | 3.7 (3.4, 4.0) | 4.6 (4.3, 4.9) | 5.7 (5.3, 6.1) | 6.6 (6.1, 7.1) |
| TOTAL | 1340 | 29561 | | | | | | |

Note: Includes mixed ceramic/mixed ceramic and XLPE bearing surfaces
Restricted to modern prostheses

**Figure HT105 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis Fractured NOF)**




HR - adjusted for age and gender

Cemented vs Hybrid

Entire Period: HR=0.90 (95% CI 0.69, 1.16), p=0.404

Cementless vs Cemented

Entire Period: HR=1.25 (95% CI 0.95, 1.64), p=0.104

Cementless vs Hybrid

0 - 3Mth: HR=1.55 (95% CI 1.30, 1.85), p<0.001

3Mth+: HR=0.86 (95% CI 0.73, 1.02), p=0.092

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Cemented | 1678 | 1362 | 1174 | 1016 | 681 | 411 | 169 |
| Cementless | 6668 | 5602 | 4933 | 4277 | 3083 | 2069 | 958 |
| Hybrid | 21215 | 17468 | 14682 | 12158 | 7964 | 4884 | 2026 |

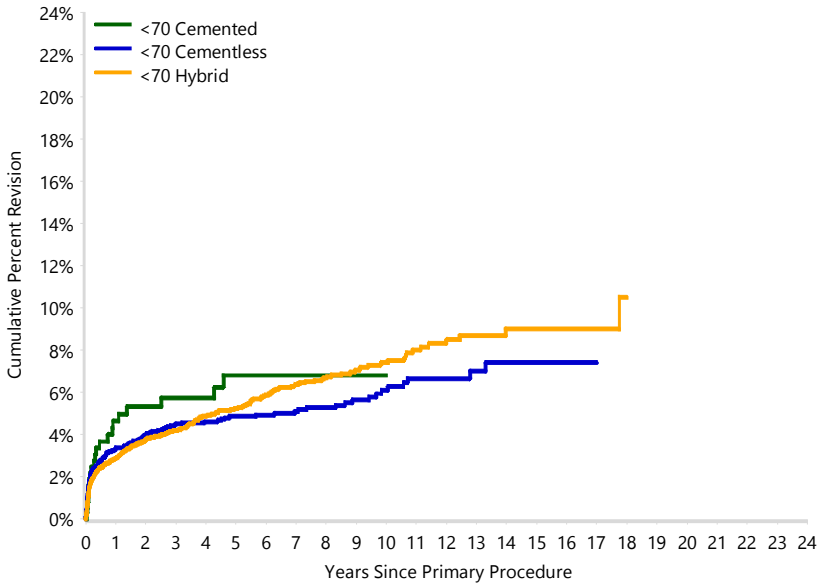
Note: Includes mixed ceramic/mixed ceramic and XLPE bearing surfaces
Restricted to modern prostheses

**Table HT98 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Age and Fixation (Primary Diagnosis Fractured NOF)**

| Age | Fixation | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| **<70** | | **501** | **9750** | **3.1 (2.7, 3.4)** | **3.9 (3.5, 4.3)** | **4.3 (3.9, 4.8)** | **5.2 (4.7, 5.7)** | **5.9 (5.4, 6.5)** | **6.9 (6.3, 7.7)** |
| | **Cemented** | 21 | 379 | 4.6 (2.9, 7.5) | 5.3 (3.4, 8.3) | 5.7 (3.7, 8.9) | 6.8 (4.4, 10.4) | 6.8 (4.4, 10.4) | 6.8 (4.4, 10.4) |
| | **Cementless** | 142 | 2870 | 3.4 (2.8, 4.1) | 4.0 (3.3, 4.8) | 4.5 (3.8, 5.4) | 4.9 (4.1, 5.8) | 5.1 (4.3, 6.0) | 6.1 (5.1, 7.3) |
| | **Hybrid** | 338 | 6501 | 2.9 (2.5, 3.3) | 3.8 (3.3, 4.3) | 4.2 (3.7, 4.7) | 5.2 (4.7, 5.9) | 6.4 (5.7, 7.1) | 7.4 (6.5, 8.4) |
| **≥70** | | **839** | **19811** | **2.7 (2.5, 2.9)** | **3.3 (3.0, 3.5)** | **3.8 (3.5, 4.1)** | **4.6 (4.2, 4.9)** | **5.5 (5.1, 6.0)** | **6.5 (6.0, 7.1)** |
| | **Cemented** | 42 | 1299 | 2.2 (1.5, 3.2) | 2.8 (2.0, 3.9) | 3.1 (2.3, 4.3) | 3.7 (2.7, 5.0) | 4.1 (3.0, 5.5) | 4.1 (3.0, 5.5) |
| | **Cementless** | 219 | 3798 | 3.8 (3.2, 4.5) | 4.4 (3.8, 5.1) | 5.1 (4.4, 5.8) | 5.8 (5.0, 6.7) | 6.8 (5.9, 7.8) | 8.6 (7.3, 10.1) |
| | **Hybrid** | 578 | 14714 | 2.4 (2.2, 2.7) | 3.0 (2.7, 3.3) | 3.5 (3.2, 3.8) | 4.3 (3.9, 4.7) | 5.3 (4.9, 5.9) | 6.2 (5.6, 6.8) |
| **TOTAL** | | **1340** | **29561** | | | | | | |

Note: Includes mixed ceramic/mixed ceramic and XLPE bearing surfaces
Restricted to modern prostheses

**Figure HT106 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <70 Years by Fixation (Primary Diagnosis Fractured NOF)**




HR - adjusted for gender

<70 Cemented vs <70 Cementless

Entire Period: HR=1.31 (95% CI 0.83, 2.08), p=0.246

<70 Cemented vs <70 Hybrid

Entire Period: HR=1.16 (95% CI 0.75, 1.81), p=0.506

<70 Cementless vs <70 Hybrid

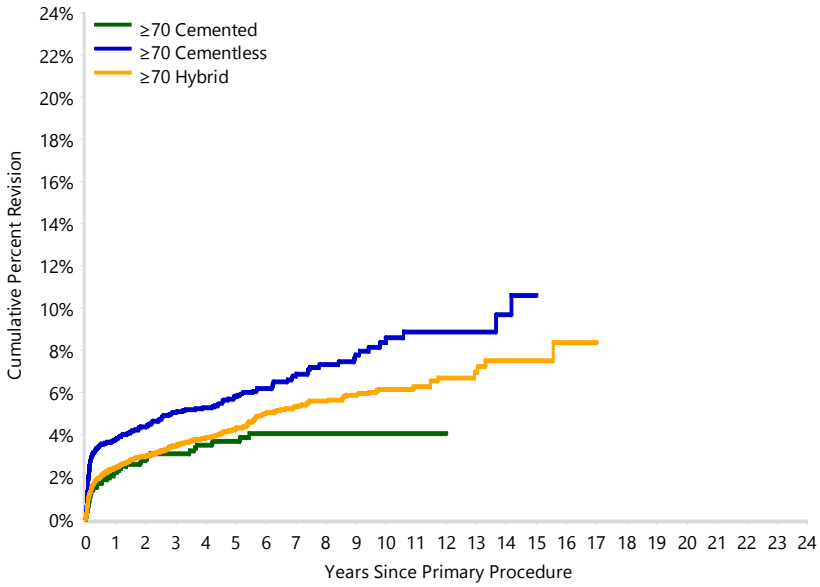
0 - 1Mth: HR=1.44 (95% CI 0.99, 2.11), p=0.056

1Mth+: HR=0.72 (95% CI 0.57, 0.91), p=0.006

| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| **<70** | **Cemented** | 379 | 290 | 245 | 218 | 162 | 107 | 45 |
| | **Cementless** | 2870 | 2451 | 2190 | 1945 | 1492 | 1081 | 564 |
| | **Hybrid** | 6501 | 5451 | 4642 | 3930 | 2804 | 1869 | 884 |

Note: Includes mixed ceramic/mixed ceramic and XLPE bearing surfaces
Restricted to modern prostheses

**Figure HT107 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged ≥70 Years by Fixation (Primary Diagnosis Fractured NOF)**




HR - adjusted for gender

≥70 Cementless vs ≥70 Cemented

Entire Period: HR=1.66 (95% CI 1.19, 2.31), p=0.002

≥70 Cementless vs ≥70 Hybrid

0 - 3Mth: HR=1.86 (95% CI 1.49, 2.31), p<0.001

3Mth+: HR=1.03 (95% CI 0.83, 1.28), p=0.794

≥70 Hybrid vs ≥70 Cemented

Entire Period: HR=1.22 (95% CI 0.89, 1.67), p=0.214

| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| ≥70 | Cemented | 1299 | 1072 | 929 | 798 | 519 | 304 | 124 |
| | Cementless | 3798 | 3151 | 2743 | 2332 | 1591 | 988 | 394 |
| | Hybrid | 14714 | 12017 | 10040 | 8228 | 5160 | 3015 | 1142 |

Note: Includes mixed ceramic/mixed ceramic and XLPE bearing surfaces
Restricted to modern prostheses

# Primary Total Hip Replacement

### Head Size

When used for fractured neck of femur, there is no difference in the overall rate of revision between head sizes <32mm, 32mm, and >32mm (Table HT99 and Figure HT108). However, there is higher rate of revision for prosthesis dislocation/instability for head size 32mm when compared to >32mm head sizes (Table HT100 and Figure HT109).

### Constrained Acetabular Prostheses

When used for fractured neck of femur, there is no difference in the rate of revision for constrained prostheses compared to other acetabular prostheses (Table HT101 and Figure HT110). However, constrained prostheses are used in less than 1% of procedures.

### Dual Mobility

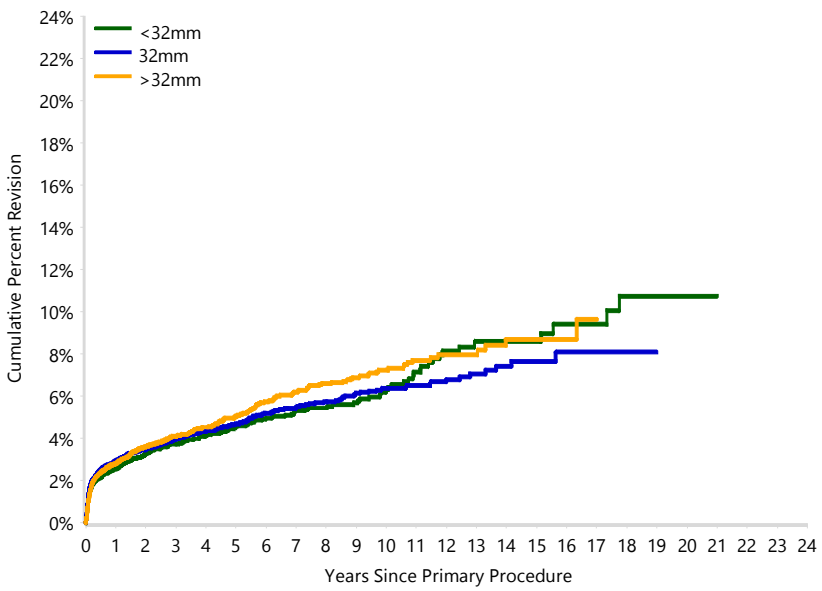
When used for fractured neck of femur, there is a lower rate of revision when dual mobility prostheses are used compared to other acetabular components (Table HT102 and Figure HT111).

**Table HT99 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis Fractured NOF)**

| Head Size | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| <32mm | 403 | 10040 | 2.6 (2.3, 2.9) | 3.3 (2.9, 3.7) | 3.7 (3.3, 4.2) | 4.6 (4.1, 5.1) | 5.3 (4.7, 6.0) | 6.3 (5.5, 7.2) |
| 32mm | 515 | 10595 | 2.9 (2.6, 3.3) | 3.5 (3.1, 3.9) | 4.0 (3.6, 4.4) | 4.7 (4.3, 5.1) | 5.5 (5.0, 6.0) | 6.4 (5.8, 7.0) |
| >32mm | 516 | 10810 | 2.8 (2.5, 3.1) | 3.6 (3.2, 4.0) | 4.1 (3.7, 4.5) | 5.0 (4.6, 5.5) | 6.2 (5.6, 6.8) | 7.2 (6.5, 8.0) |
| TOTAL | 1434 | 31445 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded, Restricted to modern prostheses. Excludes 25 procedures with unknown head size

**Figure HT108 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis Fractured NOF)**




HR - adjusted for age and gender

32mm vs <32mm

Entire Period: HR=1.06 (95% CI 0.93, 1.21), p=0.398

>32mm vs <32mm

Entire Period: HR=1.01 (95% CI 0.89, 1.15), p=0.872

>32mm vs 32mm

Entire Period: HR=0.96 (95% CI 0.84, 1.09), p=0.481

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| <32mm | 10040 | 7898 | 6303 | 4949 | 2877 | 1708 | 793 |
| 32mm | 10595 | 9246 | 8307 | 7376 | 5454 | 3637 | 1616 |
| >32mm | 10810 | 8823 | 7465 | 6198 | 4175 | 2603 | 1144 |

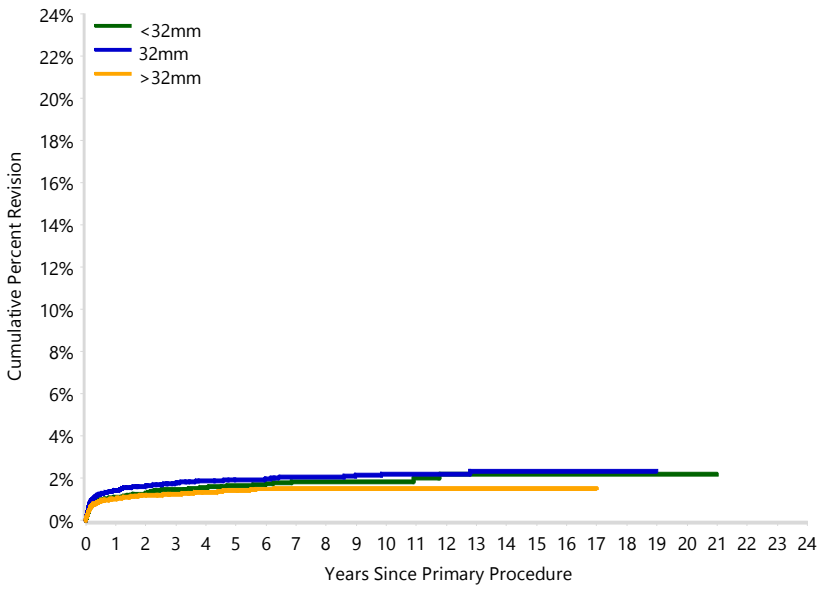
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT100 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis Fractured NOF, Revision for Prosthesis Dislocation/Instability)**

| Head Size | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| <32mm | 141 | 10040 | 1.1 (0.9, 1.3) | 1.3 (1.1, 1.6) | 1.4 (1.2, 1.7) | 1.6 (1.4, 2.0) | 1.8 (1.5, 2.2) | 1.8 (1.5, 2.2) |
| 32mm | 196 | 10595 | 1.4 (1.2, 1.7) | 1.6 (1.4, 1.9) | 1.8 (1.5, 2.1) | 1.9 (1.7, 2.2) | 2.0 (1.8, 2.4) | 2.2 (1.9, 2.6) |
| >32mm | 136 | 10810 | 1.0 (0.9, 1.2) | 1.2 (1.0, 1.4) | 1.3 (1.1, 1.5) | 1.4 (1.2, 1.7) | 1.5 (1.3, 1.8) | 1.5 (1.3, 1.8) |
| TOTAL | 473 | 31445 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT109 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis Fractured NOF, Revision for Prosthesis Dislocation/Instability)**




HR - adjusted for age and gender

<32mm vs >32mm

Entire Period: HR=1.18 (95% CI 0.93, 1.49), p=0.184

32mm vs <32mm

Entire Period: HR=1.21 (95% CI 0.97, 1.50), p=0.092

32mm vs >32mm

Entire Period: HR=1.42 (95% CI 1.13, 1.78), p=0.002

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| <32mm | 10040 | 7898 | 6303 | 4949 | 2877 | 1708 | 793 |
| 32mm | 10595 | 9246 | 8307 | 7376 | 5454 | 3637 | 1616 |
| >32mm | 10810 | 8823 | 7465 | 6198 | 4175 | 2603 | 1144 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

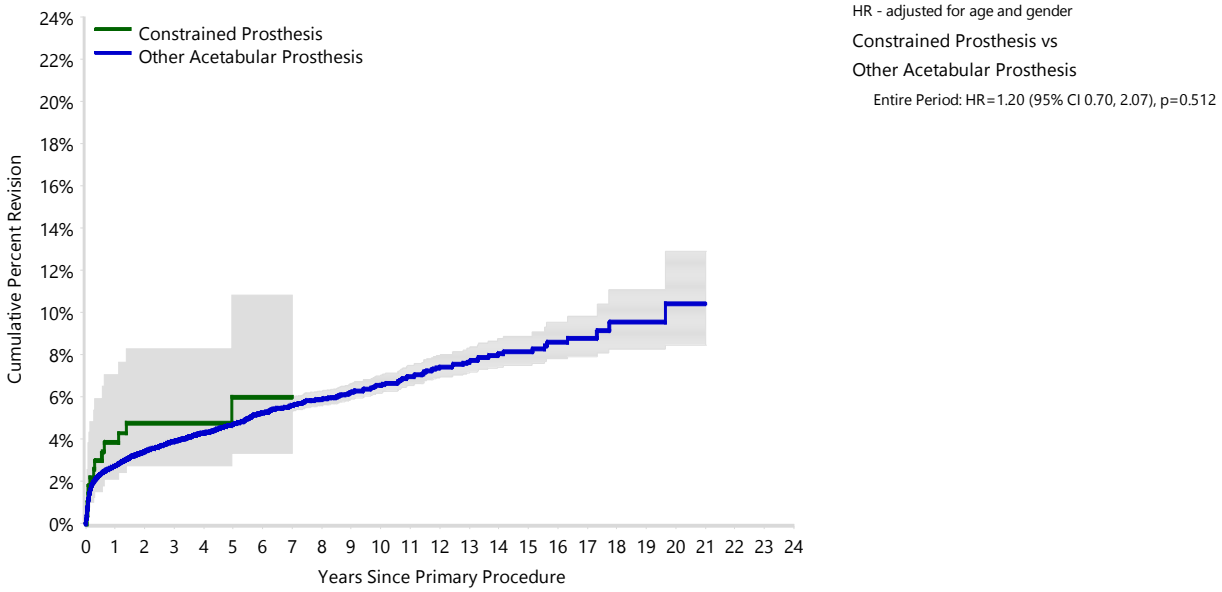
# Primary Total Hip Replacement

**Table HT101 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Type (Primary Diagnosis Fractured NOF)**

| Acetabular Type | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Constrained Prosthesis | 13 | 285 | 3.9 (2.1, 7.1) | 4.8 (2.7, 8.3) | 4.8 (2.7, 8.3) | 6.0 (3.3, 10.8) | 6.0 (3.3, 10.8) | |
| Other Acetabular Prosthesis | 1422 | 31185 | 2.8 (2.6, 3.0) | 3.4 (3.2, 3.7) | 3.9 (3.7, 4.2) | 4.7 (4.5, 5.0) | 5.6 (5.3, 6.0) | 6.6 (6.2, 7.0) |
| TOTAL | 1435 | 31470 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT110 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Type (Primary Diagnosis Fractured NOF)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Constrained Prosthesis | 285 | 216 | 180 | 135 | 74 | 42 | 17 |
| Other Acetabular Prosthesis | 31185 | 25769 | 21912 | 18403 | 12445 | 7917 | 3543 |

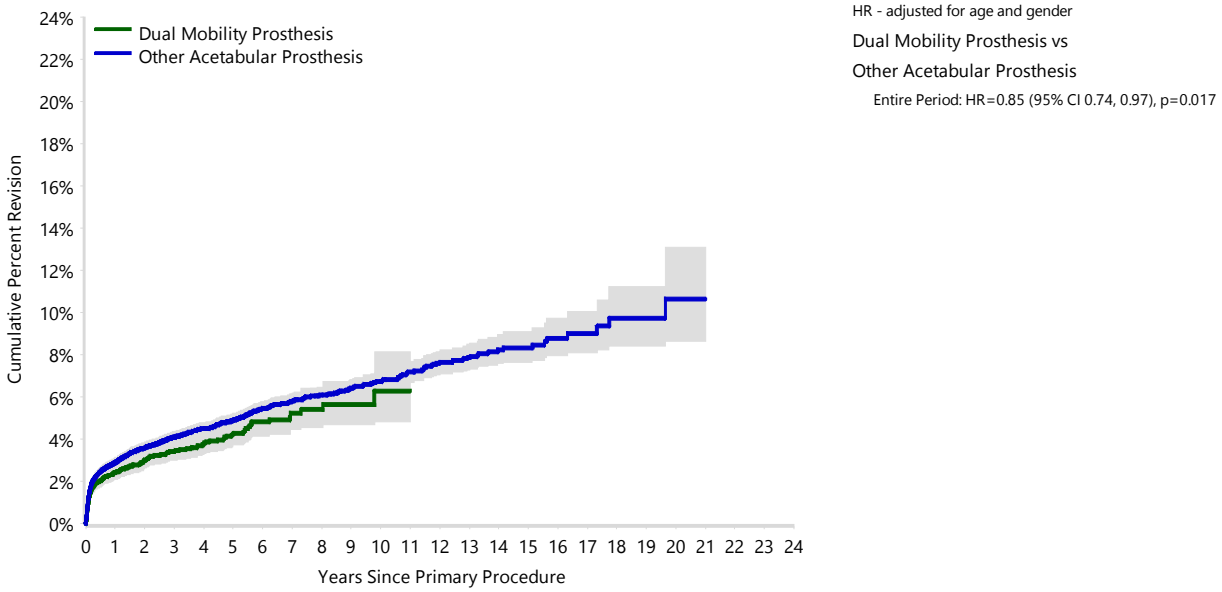
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT102 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Mobility (Primary Diagnosis Fractured NOF)**

| Acetabular Mobility | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Dual Mobility Prosthesis | 254 | 7670 | 2.4 (2.1, 2.8) | 3.0 (2.6, 3.5) | 3.4 (3.0, 3.9) | 4.3 (3.7, 4.9) | 5.2 (4.4, 6.2) | 6.3 (4.8, 8.2) |
| Other Acetabular Prosthesis | 1181 | 23800 | 2.9 (2.7, 3.1) | 3.6 (3.4, 3.8) | 4.1 (3.8, 4.4) | 4.9 (4.6, 5.2) | 5.8 (5.5, 6.2) | 6.8 (6.3, 7.2) |
| TOTAL | 1435 | 31470 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT111 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Mobility (Primary Diagnosis Fractured NOF)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Dual Mobility Prosthesis | 7670 | 5815 | 4397 | 3196 | 1485 | 616 | 131 |
| Other Acetabular Prosthesis | 23800 | 20170 | 17695 | 15342 | 11034 | 7343 | 3429 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

### OUTCOME OF TOTAL CONVENTIONAL COMPARED TO PARTIAL HIP REPLACEMENT FOR NECK OF FEMUR FRACTURE

The rate of revision for fractured neck of femur in primary total conventional hip replacement and in primary unipolar monoblock, primary unipolar modular, and primary bipolar partial hip replacement procedures are compared. These comparisons have not considered the competing risk of death, which increases with age.

Unipolar monoblock partial hip replacement (which is now infrequently used) has a lower rate of revision than total conventional hip only up to 1 month.

Unipolar modular partial hip replacement has a lower rate of revision than total conventional hip replacement for the first month but after 1.5 years unipolar modular has a higher rate of revision.

There is no difference in the rate of revision when comparing bipolar partial to total conventional hip replacement (Table HT103 and Figure HT112).

The rates of revision for each type of hip replacement for patients aged <70 years and ≥70 years are provided in Table HT104, Figure HT113 and Figure HT114.

For patients aged <70 years compared to total conventional hip replacement, bipolar partial hip replacement has a higher rate of revision as do unipolar modular procedures after 3 months. There are few unipolar monoblock implants used for this age group. Unipolar monoblock does not have a different rate of revision compared to total conventional hip replacement.

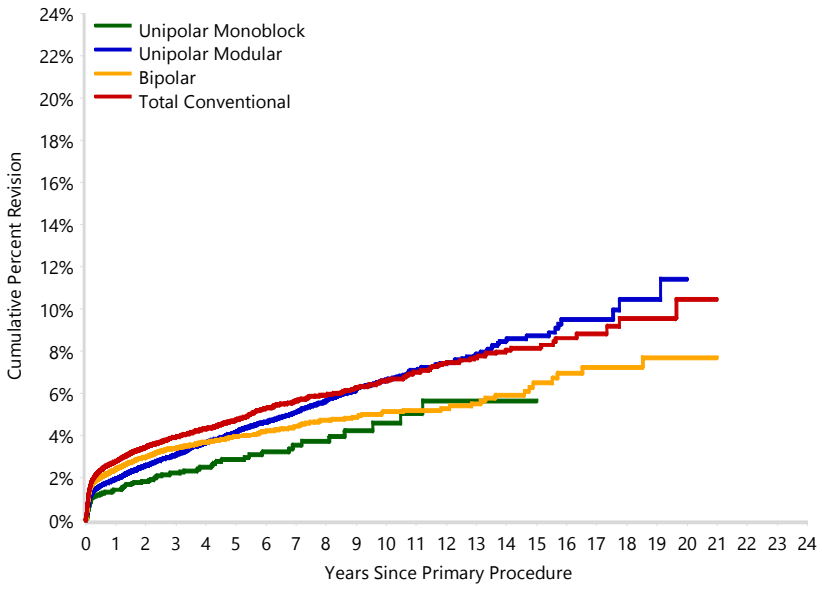
For patients aged ≥70 years, bipolar hip replacement has a lower rate of revision than total conventional hip replacement. Unipolar monoblock implants have a lower rate of revision compared to total conventional hip replacements, while unipolar modular implants have a lower rate of revision compared to total conventional hip replacement for the first 1.5 years, with no difference after this time.

**Table HT103 Cumulative Percent Revision of Primary Hip Replacement by Class (Primary Diagnosis Fractured NOF)**

| Hip Class | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Unipolar Monoblock | 82 | 3866 | 1.4 (1.1, 1.9) | 1.8 (1.4, 2.4) | 2.2 (1.7, 2.8) | 2.9 (2.2, 3.7) | 3.6 (2.7, 4.6) | 4.6 (3.4, 6.2) |
| Unipolar Modular | 1531 | 49089 | 2.0 (1.8, 2.1) | 2.6 (2.4, 2.7) | 3.1 (2.9, 3.3) | 4.2 (3.9, 4.4) | 5.1 (4.8, 5.4) | 6.6 (6.2, 7.1) |
| Bipolar | 1061 | 36182 | 2.4 (2.2, 2.6) | 3.0 (2.8, 3.2) | 3.4 (3.2, 3.6) | 3.9 (3.7, 4.2) | 4.4 (4.1, 4.8) | 5.1 (4.7, 5.6) |
| Total Conventional | 1435 | 31470 | 2.8 (2.6, 3.0) | 3.5 (3.2, 3.7) | 3.9 (3.7, 4.2) | 4.8 (4.5, 5.0) | 5.7 (5.3, 6.0) | 6.6 (6.2, 7.0) |
| TOTAL | 4109 | 120607 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT112 Cumulative Percent Revision of Primary Hip Replacement by Class (Primary Diagnosis Fractured NOF)**




HR - adjusted for age and gender

Unipolar Monoblock vs Total Conventional

0 - 1Mth: HR=0.53 (95% CI 0.32, 0.87), p=0.011
1Mth - 3Mth: HR=0.93 (95% CI 0.61, 1.43), p=0.749
3Mth - 6Mth: HR=0.38 (95% CI 0.12, 1.17), p=0.091
6Mth+: HR=0.91 (95% CI 0.67, 1.25), p=0.579

Unipolar Modular vs Total Conventional

0 - 1Mth: HR=0.77 (95% CI 0.66, 0.88), p<0.001
1Mth - 3Mth: HR=0.99 (95% CI 0.85, 1.15), p=0.893
3Mth - 1.5Yr: HR=0.97 (95% CI 0.84, 1.12), p=0.691
1.5Yr - 3Yr: HR=1.30 (95% CI 1.08, 1.56), p=0.005
3Yr+: HR=1.73 (95% CI 1.51, 1.99), p<0.001

Bipolar vs Total Conventional

Entire Period: HR=1.03 (95% CI 0.95, 1.12), p=0.518

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Unipolar Monoblock | 3866 | 2468 | 1963 | 1540 | 919 | 546 | 233 |
| Unipolar Modular | 49089 | 32943 | 26055 | 20216 | 12002 | 6952 | 2934 |
| Bipolar | 36182 | 23182 | 17191 | 12809 | 7002 | 3882 | 1528 |
| Total Conventional | 31470 | 25985 | 22092 | 18538 | 12519 | 7959 | 3560 |

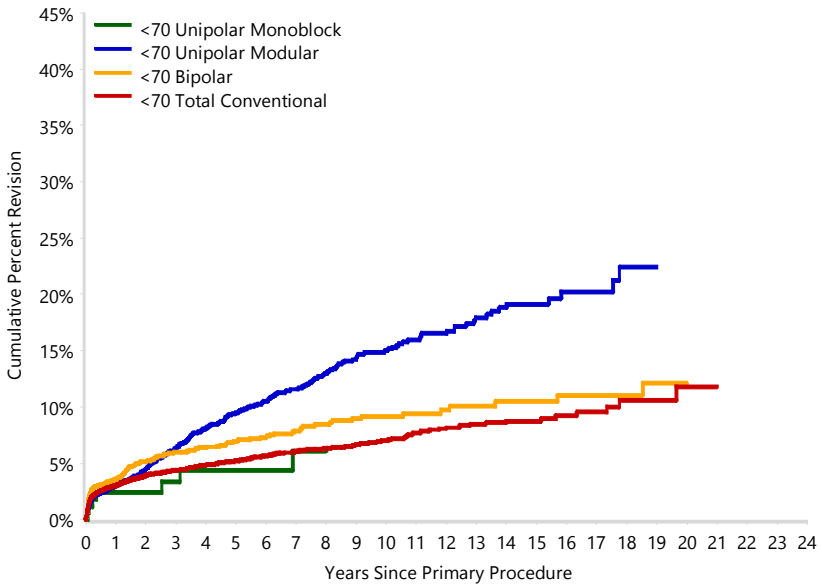
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT104 Cumulative Percent Revision of Primary Hip Replacement by Age and Class (Primary Diagnosis Fractured NOF)**

| Age | Hip Class | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| **<70** | | **1039** | **16917** | **3.1 (2.9, 3.4)** | **4.2 (3.9, 4.5)** | **5.0 (4.6, 5.4)** | **6.3 (5.9, 6.7)** | **7.4 (6.9, 7.9)** | **9.0 (8.4, 9.6)** |
| | **Unipolar Monoblock** | 11 | 180 | 2.4 (0.9, 6.3) | 2.4 (0.9, 6.3) | 3.4 (1.4, 8.0) | 4.4 (1.9, 9.7) | 6.1 (2.7, 13.2) | |
| | **Unipolar Modular** | 293 | 3225 | 3.0 (2.4, 3.7) | 4.5 (3.8, 5.3) | 6.3 (5.4, 7.4) | 9.5 (8.3, 10.8) | 11.6 (10.2, 13.1) | 15.0 (13.3, 16.9) |
| | **Bipolar** | 189 | 3225 | 3.6 (3.0, 4.3) | 5.1 (4.4, 6.0) | 5.9 (5.1, 7.0) | 6.9 (5.9, 8.0) | 7.9 (6.7, 9.2) | 9.2 (7.8, 10.8) |
| | **Total Conventional** | 546 | 10287 | 3.0 (2.7, 3.4) | 3.9 (3.5, 4.3) | 4.4 (4.0, 4.8) | 5.2 (4.8, 5.7) | 6.1 (5.5, 6.6) | 7.0 (6.4, 7.7) |
| **≥70** | | **3070** | **103690** | **2.2 (2.1, 2.3)** | **2.7 (2.6, 2.8)** | **3.1 (3.0, 3.2)** | **3.8 (3.7, 4.0)** | **4.6 (4.4, 4.8)** | **5.5 (5.2, 5.8)** |
| | **Unipolar Monoblock** | 71 | 3686 | 1.4 (1.0, 1.9) | 1.8 (1.4, 2.4) | 2.1 (1.7, 2.8) | 2.8 (2.1, 3.6) | 3.3 (2.5, 4.4) | 3.6 (2.7, 4.7) |
| | **Unipolar Modular** | 1238 | 45864 | 1.9 (1.8, 2.0) | 2.4 (2.3, 2.6) | 2.8 (2.6, 3.0) | 3.7 (3.4, 3.9) | 4.4 (4.1, 4.7) | 5.6 (5.1, 6.0) |
| | **Bipolar** | 872 | 32957 | 2.3 (2.1, 2.5) | 2.8 (2.6, 3.0) | 3.1 (2.9, 3.4) | 3.6 (3.3, 3.9) | 4.0 (3.7, 4.3) | 4.5 (4.1, 5.0) |
| | **Total Conventional** | 889 | 21183 | 2.7 (2.5, 2.9) | 3.2 (3.0, 3.5) | 3.7 (3.4, 4.0) | 4.5 (4.2, 4.9) | 5.5 (5.1, 5.9) | 6.4 (5.9, 7.0) |
| **TOTAL** | | **4109** | **120607** | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT113 Cumulative Percent Revision of Primary Hip Replacement in Patients Aged <70 Years by Class (Primary Diagnosis Fractured NOF)**




HR - adjusted for gender

<70 Unipolar Monoblock vs
<70 Total Conventional

Entire Period: HR=1.23 (95% CI 0.68, 2.24), p=0.491

<70 Unipolar Modular vs <70 Total Conventional

0 - 3Mth: HR=0.92 (95% CI 0.70, 1.22), p=0.579
3Mth - 2Yr: HR=1.36 (95% CI 1.02, 1.81), p=0.036
2Yr+: HR=3.34 (95% CI 2.73, 4.08), p<0.001

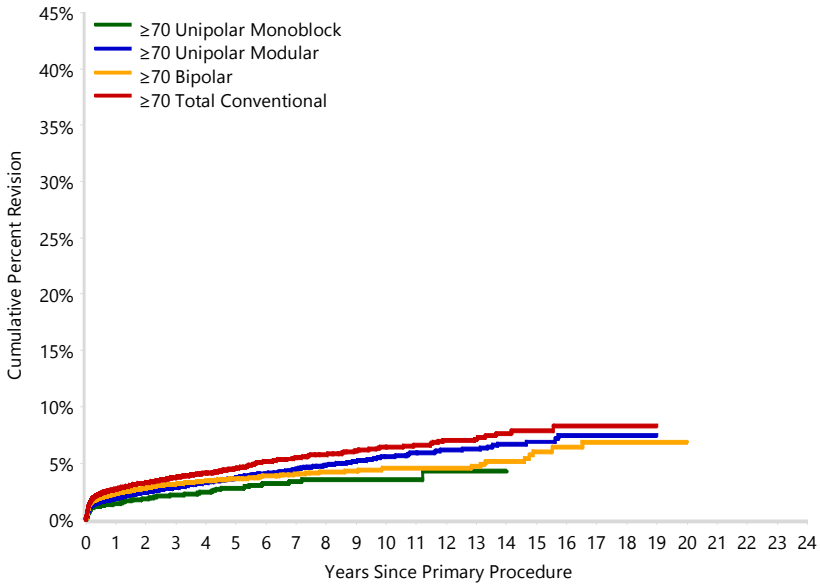
<70 Bipolar vs <70 Total Conventional

Entire Period: HR=1.27 (95% CI 1.08, 1.50), p=0.004

| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| **<70** | **Unipolar Monoblock** | 180 | 130 | 112 | 96 | 70 | 54 | 29 |
| | **Unipolar Modular** | 3225 | 2422 | 2058 | 1768 | 1309 | 966 | 566 |
| | **Bipolar** | 3225 | 2277 | 1798 | 1465 | 997 | 715 | 367 |
| | **Total Conventional** | 10287 | 8647 | 7472 | 6444 | 4747 | 3308 | 1697 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT114 Cumulative Percent Revision of Primary Hip Replacement in Patients Aged ≥70 Years by Class (Primary Diagnosis Fractured NOF)**




HR - adjusted for gender

≥70 Unipolar Monoblock vs ≥70 Total Conventional

Entire Period: HR=0.56 (95% CI 0.44, 0.72), p<0.001

≥70 Unipolar Modular vs ≥70 Total Conventional

0 - 3Mth: HR=0.67 (95% CI 0.59, 0.75), p<0.001

3Mth - 1.5Yr: HR=0.76 (95% CI 0.65, 0.90), p<0.001

1.5Yr+: HR=1.01 (95% CI 0.88, 1.16), p=0.925

≥70 Bipolar vs ≥70 Total Conventional

Entire Period: HR=0.79 (95% CI 0.72, 0.87), p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| ≥70 | **Unipolar Monoblock** | 3686 | 2338 | 1851 | 1444 | 849 | 492 | 204 |
| | **Unipolar Modular** | 45864 | 30521 | 23997 | 18448 | 10693 | 5986 | 2368 |
| | **Bipolar** | 32957 | 20905 | 15393 | 11344 | 6005 | 3167 | 1161 |
| | **Total Conventional** | 21183 | 17338 | 14620 | 12094 | 7772 | 4651 | 1863 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

# Primary Total Hip Replacement

## Primary Total Resurfacing Hip Replacement

### DEMOGRAPHICS

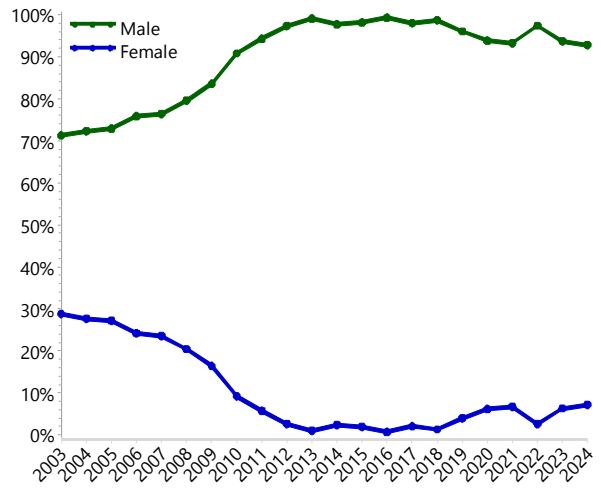
There are 21,173 primary total resurfacing hip replacement procedures. This is an additional 939 procedures compared to the previous report. With the restriction to modern prostheses, 4,365 (20.6%) hip resurfacing procedures have been excluded from the analysis in this year's Annual Report.

For further information on the **closure of the database** please see the Glossary of this report.

In 2024, the number of primary total resurfacing procedures is 5.7% more than in 2023, and 64.5% less than in 2005 when the use of hip resurfacing peaked. Primary total resurfacing hip replacement represents 1.1% of all hip replacements performed in 2024.

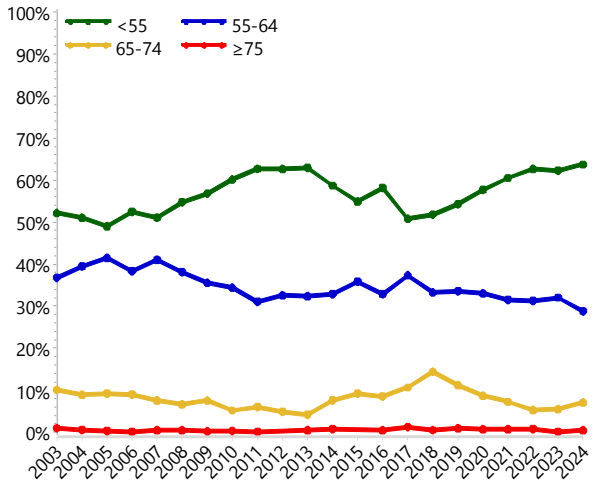
In 2024, 92.8% of primary total resurfacing hip replacements were undertaken in males (Table HT105 and Figure HT115).

**Figure HT115 Primary Total Resurfacing Hip Replacement by Gender**




The change in usage of primary total resurfacing hip replacement for each age group are provided in Figure HT116.

**Figure HT116 Primary Total Resurfacing Hip Replacement by Age**




There were only four types of resurfacing prostheses used in 2024, with the Adept the most commonly used. The ReCerf resurfacing head was used for the first time in 2018 (Table HT106).

**Table HT105 Age and Gender of Primary Total Resurfacing Hip Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 17392 | 82.1% | 13 | 84 | 54 | 53.1 | 9.2 |
| Female | 3781 | 17.9% | 14 | 81 | 52 | 51.4 | 8.7 |
| **TOTAL** | **21173** | **100.0%** | **13** | **84** | **53** | **52.8** | **9.1** |

**Table HT106 Most Used Resurfacing Heads in Primary Total Resurfacing Hip Replacement**

| 2003 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 1359 | BHR | 333 | Adept | 350 | Adept | 407 | Adept | 402 | Adept |
| 58 | Durom | 131 | ReCerf | 99 | BHR | 126 | ReCerf | 160 | ReCerf |
| 43 | ASR | 116 | BHR | 49 | ReCerf | 85 | BHR | 77 | BHR |
| 42 | Cormet | | | | | | | 14 | Polymotion |
| 38 | Cormet 2000 HAP | | | | | | | | |
| 7 | Conserve Plus | | | | | | | | |
| 10 Most Used | | | | | | | | | |
| 1547 | (6) 100.0% | 580 | (3) 100.0% | 498 | (3) 100.0% | 618 | (3) 100.0% | 653 | (4) 100.0% |

## OUTCOME FOR ALL DIAGNOSES

### Primary Diagnosis

Again, this analysis is restricted to modern resurfacing prostheses in current use. The principal diagnosis for primary total resurfacing hip replacement is osteoarthritis (95.7%), followed by developmental dysplasia (2.0%), and osteonecrosis (1.5%).

Primary total resurfacing hip replacement for osteoarthritis has a lower rate of revision compared to developmental dysplasia from 6 months up to 5 years. There is a higher rate of revision for osteonecrosis compared to osteoarthritis (Table HT107 and Figure HT117).

### Prosthesis Types

The cumulative percent revision of the three different primary total resurfacing hip prosthesis combinations with >100 procedures is listed in Table HT108.

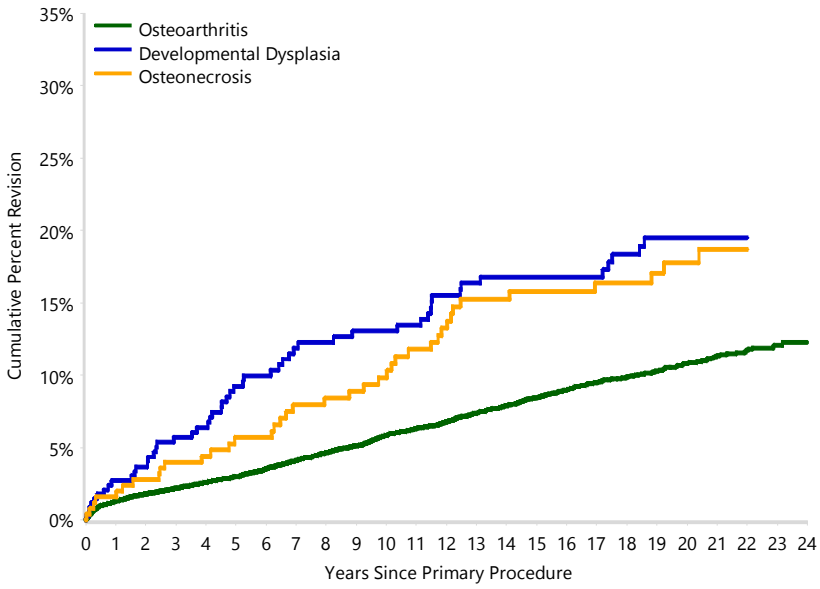
# Primary Total Hip Replacement

**Table HT107 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Primary Diagnosis**

| Primary Diagnosis | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | 1205 | 16093 | 1.3 (1.1, 1.5) | 2.2 (2.0, 2.4) | 3.0 (2.7, 3.3) | 5.8 (5.5, 6.3) | 8.4 (8.0, 9.0) | 10.8 (10.2, 11.4) |
| Developmental Dysplasia | 52 | 339 | 2.7 (1.4, 5.1) | 5.7 (3.6, 8.9) | 9.2 (6.5, 13.1) | 13.0 (9.6, 17.5) | 16.8 (12.8, 21.8) | 19.5 (15.1, 24.9) |
| Osteonecrosis | 39 | 254 | 1.6 (0.6, 4.1) | 4.0 (2.2, 7.3) | 5.7 (3.4, 9.4) | 9.8 (6.6, 14.5) | 15.8 (11.6, 21.3) | 17.8 (13.2, 23.7) |
| Other (6) | 17 | 122 | 2.5 (0.8, 7.4) | 3.4 (1.3, 8.7) | 6.0 (2.9, 12.3) | 12.3 (7.3, 20.4) | 14.8 (9.1, 23.5) | |
| TOTAL | 1313 | 16808 | | | | | | |

Note: Only primary diagnoses with >100 procedures have been listed
Restricted to modern prostheses

**Figure HT117 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Primary Diagnosis**




HR - adjusted for age and gender

Developmental Dysplasia vs Osteoarthritis

0 - 6Mth: HR=1.16 (95% CI 0.51, 2.64), p=0.714

6Mth - 2.5Yr: HR=2.25 (95% CI 1.22, 4.16), p=0.009

2.5Yr - 5Yr: HR=2.43 (95% CI 1.31, 4.50), p=0.004

5Yr+: HR=0.88 (95% CI 0.59, 1.33), p=0.555

Developmental Dysplasia vs Osteonecrosis

Entire Period: HR=0.70 (95% CI 0.46, 1.07), p=0.098

Osteonecrosis vs Osteoarthritis

Entire Period: HR=1.77 (95% CI 1.28, 2.45), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Osteoarthritis | 16093 | 15250 | 13989 | 12706 | 10150 | 7422 | 3160 |
| Developmental Dysplasia | 339 | 311 | 278 | 249 | 217 | 184 | 114 |
| Osteonecrosis | 254 | 245 | 234 | 221 | 187 | 157 | 96 |

Note: Only primary diagnoses with >100 procedures have been listed
Restricted to modern prostheses

**Table HT108 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Prosthesis Combination (All Diagnoses)**

| Head Component | Acetabular Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Adept | Adept | 116 | 3832 | 1.2 (0.9, 1.6) | 1.9 (1.5, 2.4) | 2.4 (1.9, 3.0) | 4.7 (3.8, 5.8) | 5.9 (4.6, 7.5) | |
| BHR | BHR | 1193 | 12318 | 1.4 (1.2, 1.6) | 2.5 (2.2, 2.8) | 3.4 (3.1, 3.8) | 6.4 (6.0, 6.9) | 9.2 (8.7, 9.8) | 11.5 (10.9, 12.2) |
| ReCerf | ReCerf | 2 | 643 | 0.2 (0.0, 1.1) | 0.4 (0.1, 1.9) | 0.4 (0.1, 1.9) | | | |
| Other (2) | | 2 | 15 | | | | | | |
| TOTAL | | 1313 | 16808 | | | | | | |

Note: Only combinations with >100 procedures have been listed
Restricted to modern prostheses

## OUTCOME FOR OSTEOARTHRITIS

The cumulative percent revision at 20 years for primary total resurfacing hip replacement undertaken for osteoarthritis is 10.8% (Table HT109 and Figure HT118).

### Reasons for Revision

The main reasons for revision of primary total resurfacing hip replacement are loosening, metal related pathology, and fracture (Table HT110).

Loosening is the most common reason for revision after 12 years.

The five most common reasons for revision are shown in Figure HT119. The cumulative incidence of fracture increases rapidly in the first year. After this time, the incidence increases at a slower rate. The cumulative incidence of loosening increases to become the most common reason for revision after 12 years.

### Type of Revision

The most common type of revision for total resurfacing hip replacement is revision of both the femoral and acetabular components. Femoral only revision is much less common and acetabular only revision is rarely undertaken (Table HT111).

### Age and Gender

In the first 6 months, patients aged ≥65 years have a higher rate of revision compared to patients aged <55 years and those 55-64 years. Patients aged 55-64 years do not have a different rate of revision compared to patients aged <55 years (Table HT112 and Figure HT120).

Females have a higher rate of revision compared to males (Table HT113 and Figure HT121). Males aged ≥65 years have a higher rate of revision compared to both males aged <55 years and those aged 55-64 years for the first 6 months only. After this time, there is no difference (Table HT113 and Figure HT122). Age is not a risk factor for revision for female patients (Table HT113 and Figure HT123).

### Head Size

The rate of revision decreases as the femoral component head size increases. Femoral head sizes ≥55mm have a lower rate of revision compared to all other head size groups. (Table HT114 and Figure HT124). This effect of femoral component head size is evident in both males and females (Table HT115 and Figure HT125).

The reason for revision varies with head size. Head sizes <50mm have a higher cumulative incidence of metal related pathology, loosening, fracture, infection, and lysis compared to head sizes ≥50mm (Figure HT126).

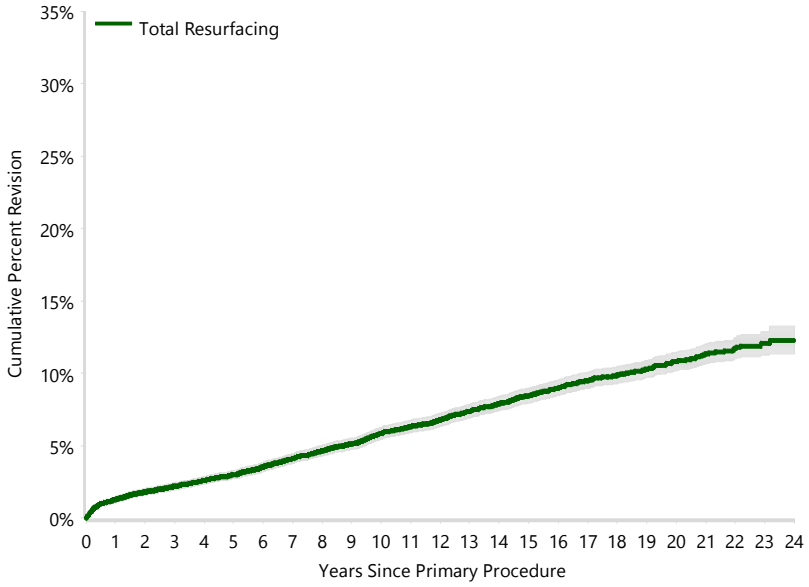
# Primary Total Hip Replacement

**Table HT109 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement (Primary Diagnosis OA)**

| Hip Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Total Resurfacing | 1205 | 16093 | 1.3 (1.1, 1.5) | 2.2 (2.0, 2.4) | 3.0 (2.7, 3.3) | 5.8 (5.5, 6.3) | 8.4 (8.0, 9.0) | 10.8 (10.2, 11.4) |
| TOTAL | 1205 | 16093 | | | | | | |

Note: Restricted to modern prostheses

**Figure HT118 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Total Resurfacing | 16093 | 15250 | 13989 | 12706 | 10150 | 7422 | 3160 |

Note: Restricted to modern prostheses

**Table HT110 Primary Total Resurfacing Hip Replacement by Reason for Revision (Primary Diagnosis OA)**

| Reason for Revision | Number | Percent |
|---|---|---|
| Loosening | 304 | 25.2 |
| Metal Related Pathology | 263 | 21.8 |
| Fracture | 246 | 20.4 |
| Lysis | 124 | 10.3 |
| Infection | 78 | 6.5 |
| Pain | 69 | 5.7 |
| Osteonecrosis | 32 | 2.7 |
| Prosthesis Dislocation/Instability | 30 | 2.5 |
| Malposition | 22 | 1.8 |
| Other | 20 | 1.7 |
| Other (8) | 17 | 1.4 |
| TOTAL | 1205 | 100.0 |

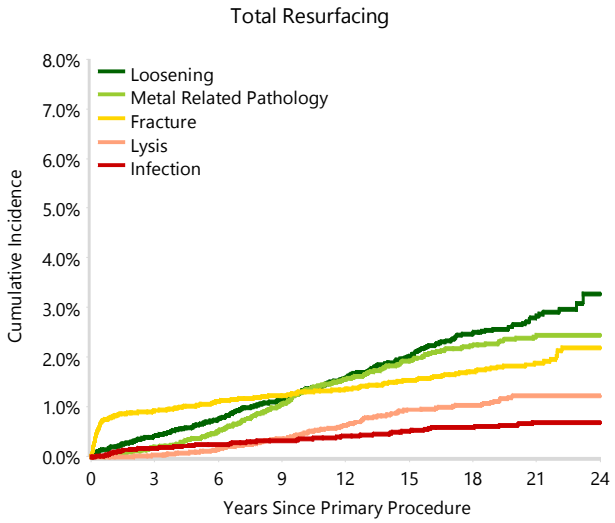
Note: Restricted to modern prostheses

**Table HT111 Primary Total Resurfacing Hip Replacement by Type of Revision (Primary Diagnosis OA)**

| Type of Revision | Number | Percent |
|---|---|---|
| THR (Femoral/Acetabular) | 809 | 67.1 |
| Femoral Component | 329 | 27.3 |
| Acetabular Component | 32 | 2.7 |
| Cement Spacer | 26 | 2.2 |
| Removal of Prostheses | 7 | 0.6 |
| Head/Insert | 1 | 0.1 |
| Minor Components | 1 | 0.1 |
| TOTAL | 1205 | 100.0 |

Note: Restricted to modern prostheses

**Figure HT119 Cumulative Incidence Revision Diagnosis of Primary Total Resurfacing Hip Replacement (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

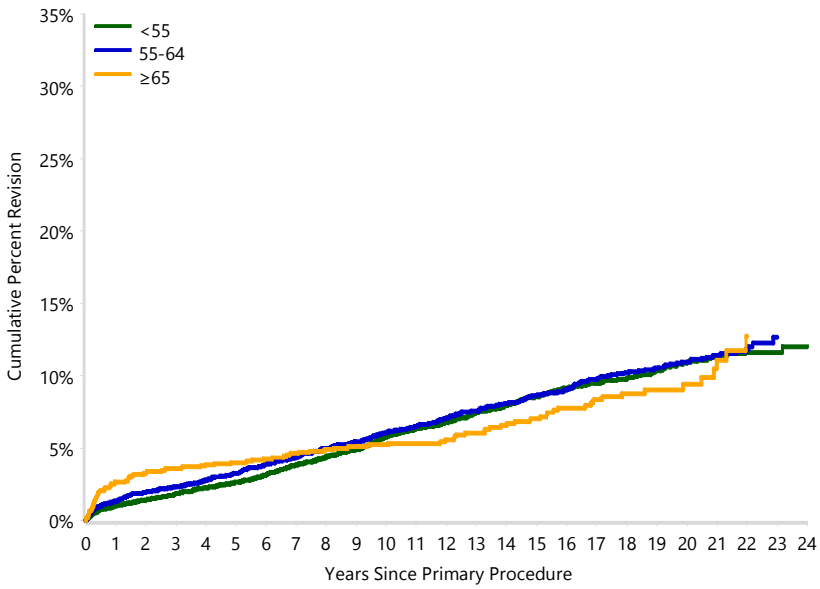
# Primary Total Hip Replacement

**Table HT112 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Age (Primary Diagnosis OA)**

| Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| <55 | 634 | 8701 | 1.0 (0.8, 1.3) | 1.9 (1.6, 2.2) | 2.6 (2.3, 3.0) | 5.8 (5.3, 6.4) | 8.5 (7.9, 9.3) | 10.9 (10.0, 11.8) |
| 55-64 | 470 | 5919 | 1.3 (1.1, 1.7) | 2.3 (2.0, 2.8) | 3.3 (2.9, 3.8) | 6.1 (5.4, 6.8) | 8.6 (7.9, 9.5) | 11.0 (10.0, 12.0) |
| ≥65 | 101 | 1473 | 2.7 (2.0, 3.7) | 3.6 (2.8, 4.7) | 4.0 (3.1, 5.2) | 5.2 (4.1, 6.6) | 7.0 (5.7, 8.7) | 9.4 (7.6, 11.7) |
| TOTAL | 1205 | 16093 | | | | | | |

Note: Restricted to modern prostheses

**Figure HT120 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Age (Primary Diagnosis OA)**




HR - adjusted for gender

55-64 vs <55

Entire Period: HR=1.06 (95% CI 0.94, 1.20), p=0.308

≥65 vs <55

0 - 3Mth: HR=2.17 (95% CI 1.27, 3.71), p=0.004

3Mth - 6Mth: HR=4.21 (95% CI 2.29, 7.76), p<0.001

6Mth+: HR=0.93 (95% CI 0.73, 1.19), p=0.572

≥65 vs 55-64

0 - 3Mth: HR=2.04 (95% CI 1.19, 3.50), p=0.009

3Mth - 6Mth: HR=3.96 (95% CI 2.14, 7.30), p<0.001

6Mth+: HR=0.88 (95% CI 0.68, 1.13), p=0.298

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| <55 | 8701 | 8220 | 7468 | 6748 | 5418 | 3898 | 1750 |
| 55-64 | 5919 | 5649 | 5227 | 4777 | 3871 | 2895 | 1186 |
| ≥65 | 1473 | 1381 | 1294 | 1181 | 861 | 629 | 224 |

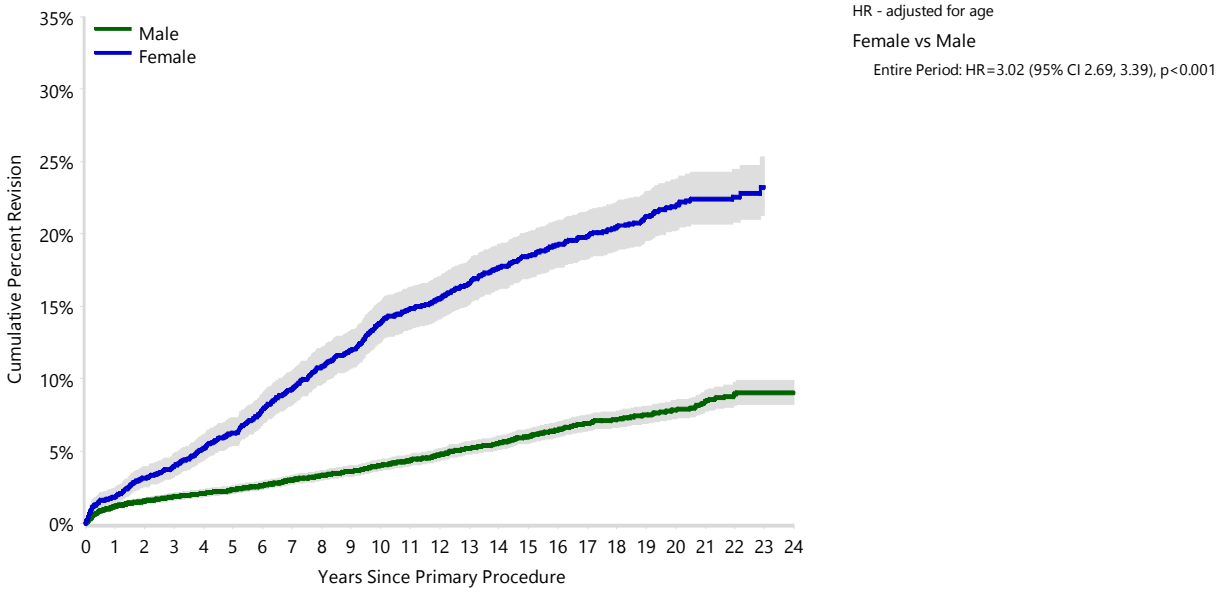
Note: Restricted to modern prostheses

**Table HT113 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender and Age (Primary Diagnosis OA)**

| Gender | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| **Male** | | **704** | **13542** | **1.2 (1.0, 1.4)** | **1.9 (1.6, 2.1)** | **2.3 (2.1, 2.6)** | **4.0 (3.7, 4.4)** | **6.0 (5.5, 6.5)** | **7.9 (7.3, 8.5)** |
| | **<55** | 350 | 7235 | 1.0 (0.8, 1.2) | 1.5 (1.3, 1.8) | 2.0 (1.7, 2.3) | 3.7 (3.3, 4.3) | 5.9 (5.3, 6.6) | 7.7 (6.9, 8.6) |
| | **55-64** | 267 | 4939 | 1.1 (0.9, 1.5) | 1.9 (1.5, 2.3) | 2.5 (2.1, 3.0) | 4.2 (3.6, 4.8) | 6.1 (5.3, 6.9) | 7.8 (6.9, 8.9) |
| | **≥65** | 87 | 1368 | 2.7 (1.9, 3.7) | 3.5 (2.7, 4.7) | 3.9 (3.0, 5.1) | 4.9 (3.8, 6.3) | 6.3 (5.0, 8.0) | 8.9 (7.0, 11.3) |
| **Female** | | **501** | **2551** | **1.9 (1.4, 2.5)** | **4.0 (3.3, 4.8)** | **6.2 (5.4, 7.3)** | **13.8 (12.5, 15.3)** | **18.5 (16.9, 20.1)** | **21.9 (20.2, 23.7)** |
| | **<55** | 284 | 1466 | 1.4 (0.9, 2.2) | 3.4 (2.6, 4.5) | 5.6 (4.5, 7.0) | 14.0 (12.2, 15.9) | 18.5 (16.5, 20.7) | 22.0 (19.8, 24.4) |
| | **55-64** | 203 | 980 | 2.4 (1.6, 3.5) | 4.7 (3.5, 6.2) | 7.2 (5.8, 9.1) | 14.2 (12.1, 16.6) | 18.9 (16.5, 21.6) | 22.6 (19.9, 25.6) |
| | **≥65** | 14 | 105 | 2.9 (0.9, 8.6) | 4.8 (2.0, 11.1) | 5.8 (2.6, 12.4) | 8.7 (4.6, 16.1) | 13.3 (7.9, 21.9) | |
| **TOTAL** | | **1205** | **16093** | | | | | | |

Note: Restricted to modern prostheses

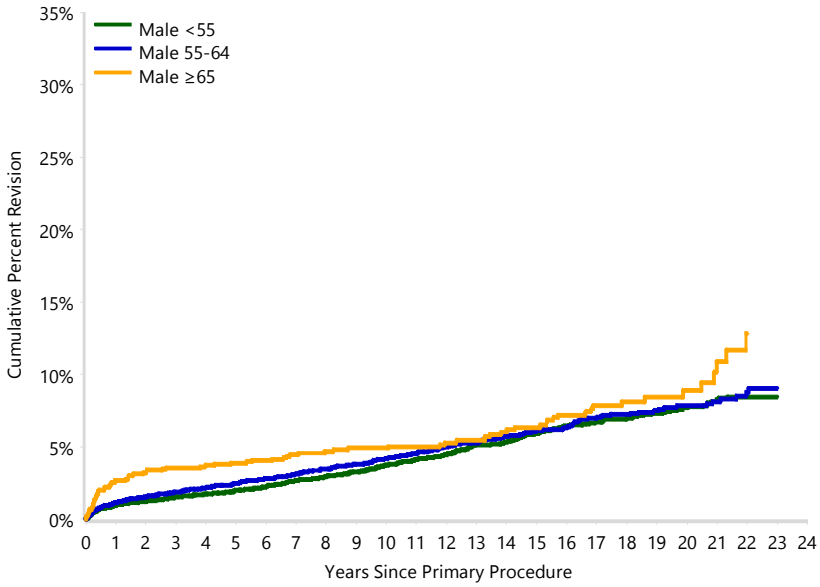
**Figure HT121 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| **Male** | 13542 | 12793 | 11641 | 10489 | 8180 | 5701 | 2301 |
| **Female** | 2551 | 2457 | 2348 | 2217 | 1970 | 1721 | 859 |

Note: Restricted to modern prostheses

**Figure HT122 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement in Males by Age (Primary Diagnosis OA)**




Male 55-64 vs Male <55
Entire Period: HR=1.07 (95% CI 0.91, 1.25), p=0.418

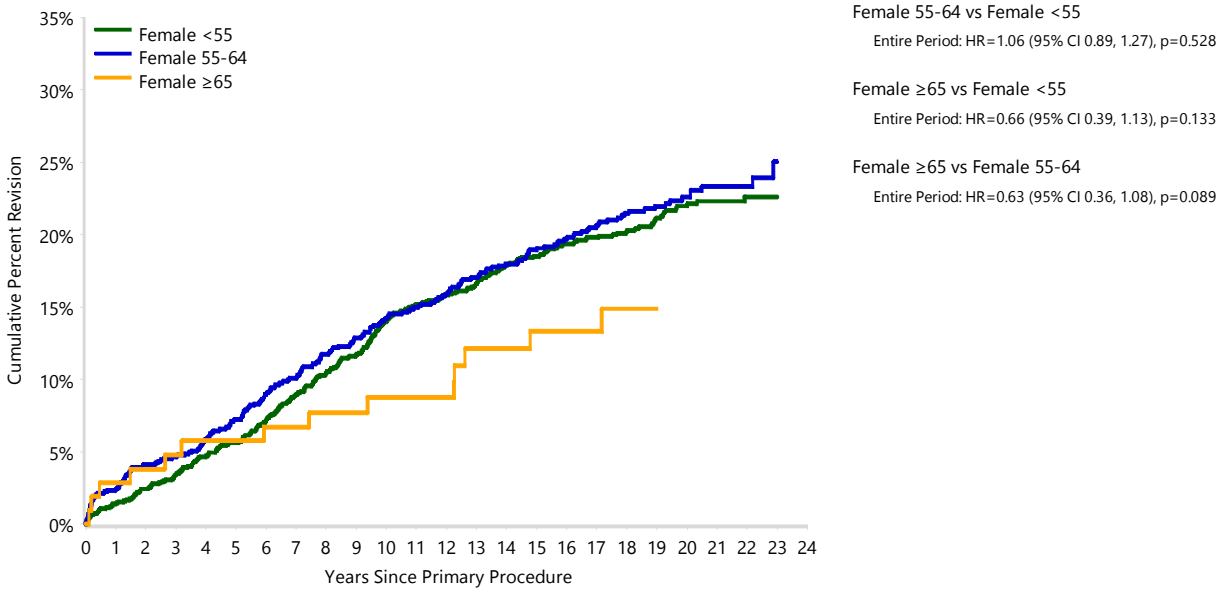
Male ≥65 vs Male <55
0 - 3Mth: HR=2.14 (95% CI 1.19, 3.85), p=0.010
3Mth - 6Mth: HR=3.87 (95% CI 2.02, 7.43), p<0.001
6Mth+: HR=1.09 (95% CI 0.82, 1.43), p=0.557

Male ≥65 vs Male 55-64
0 - 6Mth: HR=2.56 (95% CI 1.65, 3.97), p<0.001
6Mth+: HR=1.02 (95% CI 0.77, 1.35), p=0.907

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| **Male** | **<55** | 7235 | 6808 | 6118 | 5485 | 4300 | 2909 | 1258 |
| | **55-64** | 4939 | 4705 | 4327 | 3920 | 3105 | 2235 | 851 |
| | **≥65** | 1368 | 1280 | 1196 | 1084 | 775 | 557 | 192 |

Note: Restricted to modern prostheses

**Figure HT123 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement in Females by Age (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| **Female** | **<55** | 1466 | 1412 | 1350 | 1263 | 1118 | 989 | 492 |
| | **55-64** | 980 | 944 | 900 | 857 | 766 | 660 | 335 |
| | **≥65** | 105 | 101 | 98 | 97 | 86 | 72 | 32 |

Note: Restricted to modern prostheses

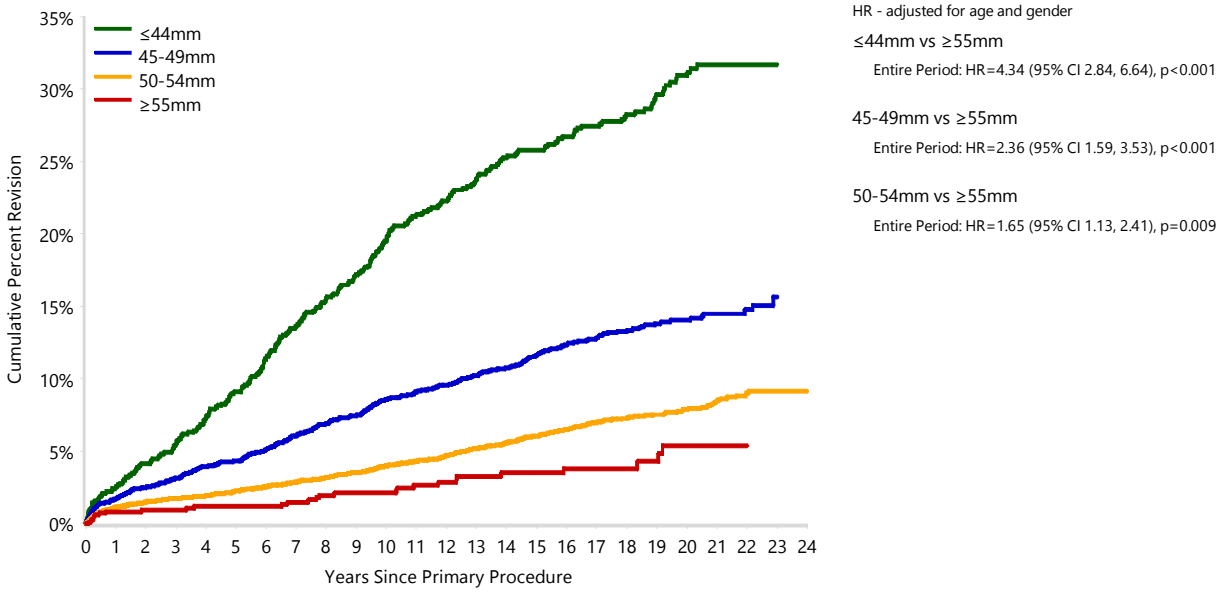
# Primary Total Hip Replacement

**Table HT114 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Head Size (Primary Diagnosis OA)**

| Head Size | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| ≤44mm | 251 | 914 | 2.5 (1.7, 3.8) | 5.5 (4.2, 7.2) | 9.1 (7.4, 11.2) | 19.5 (17.0, 22.3) | 25.8 (23.0, 28.9) | 30.9 (27.8, 34.4) |
| 45-49mm | 336 | 3153 | 1.7 (1.3, 2.2) | 3.1 (2.6, 3.8) | 4.3 (3.6, 5.1) | 8.6 (7.6, 9.7) | 11.6 (10.4, 13.0) | 14.0 (12.6, 15.6) |
| 50-54mm | 590 | 11042 | 1.1 (0.9, 1.3) | 1.8 (1.5, 2.0) | 2.2 (2.0, 2.5) | 4.0 (3.6, 4.4) | 6.1 (5.6, 6.6) | 7.9 (7.3, 8.6) |
| ≥55mm | 28 | 984 | 0.8 (0.4, 1.6) | 0.9 (0.5, 1.8) | 1.2 (0.7, 2.2) | 2.1 (1.3, 3.4) | 3.5 (2.3, 5.3) | 5.4 (3.5, 8.3) |
| TOTAL | 1205 | 16093 | | | | | | |

Note: Restricted to modern prostheses

**Figure HT124 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Head Size (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| ≤44mm | 914 | 871 | 827 | 770 | 664 | 569 | 279 |
| 45-49mm | 3153 | 3005 | 2781 | 2548 | 2069 | 1584 | 644 |
| 50-54mm | 11042 | 10459 | 9564 | 8664 | 6862 | 4920 | 2099 |
| ≥55mm | 984 | 915 | 817 | 724 | 555 | 349 | 138 |

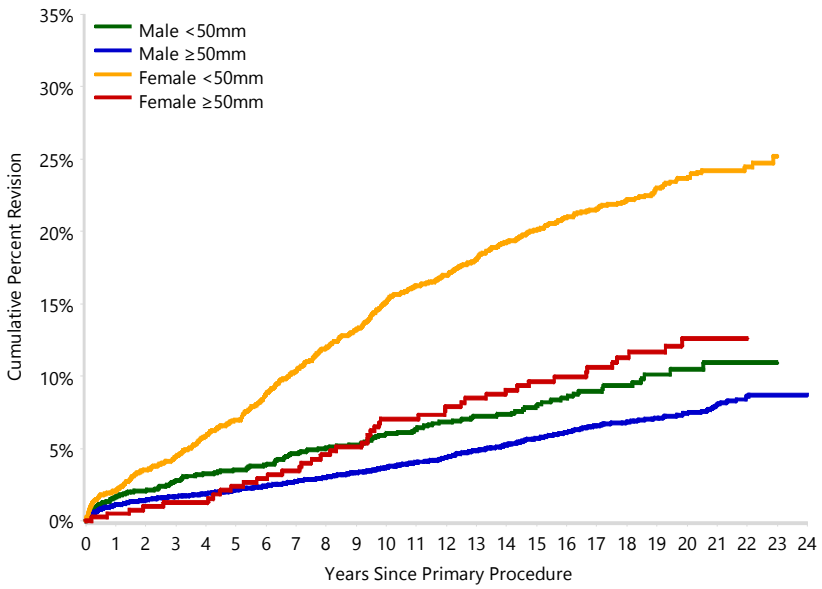
Note: Restricted to modern prostheses

**Table HT115 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender and Femoral Head Size (Primary Diagnosis OA)**

| Gender | Femoral Head Size | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| **Male** | | **704** | **13542** | **1.2 (1.0, 1.4)** | **1.9 (1.6, 2.1)** | **2.3 (2.1, 2.6)** | **4.0 (3.7, 4.4)** | **6.0 (5.5, 6.5)** | **7.9 (7.3, 8.5)** |
| | **<50mm** | 129 | 1907 | 1.6 (1.2, 2.3) | 2.8 (2.1, 3.7) | 3.5 (2.8, 4.5) | 6.0 (4.9, 7.3) | 7.9 (6.6, 9.5) | 10.5 (8.6, 12.7) |
| | **≥50mm** | 575 | 11635 | 1.1 (0.9, 1.3) | 1.7 (1.5, 2.0) | 2.1 (1.9, 2.4) | 3.7 (3.3, 4.1) | 5.7 (5.2, 6.2) | 7.5 (6.8, 8.1) |
| **Female** | | **501** | **2551** | **1.9 (1.4, 2.5)** | **4.0 (3.3, 4.8)** | **6.2 (5.4, 7.3)** | **13.8 (12.5, 15.3)** | **18.5 (16.9, 20.1)** | **21.9 (20.2, 23.7)** |
| | **<50mm** | 458 | 2160 | 2.1 (1.6, 2.8) | 4.4 (3.6, 5.4) | 7.0 (5.9, 8.1) | 15.1 (13.6, 16.7) | 20.1 (18.4, 21.9) | 23.6 (21.8, 25.7) |
| | **≥50mm** | 43 | 391 | 0.5 (0.1, 2.0) | 1.3 (0.5, 3.1) | 2.4 (1.2, 4.5) | 7.1 (4.9, 10.2) | 9.6 (7.0, 13.2) | 12.6 (9.5, 16.7) |
| **TOTAL** | | **1205** | **16093** | | | | | | |

Note: Restricted to modern prostheses

**Figure HT125 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender and Femoral Head Size (Primary Diagnosis OA)**




HR - adjusted for age

Male <50mm vs Male ≥50mm

Entire Period: HR=1.44 (95% CI 1.19, 1.75), p<0.001

Male <50mm vs Female <50mm

Entire Period: HR=0.41 (95% CI 0.34, 0.50), p<0.001

Male ≥50mm vs Female ≥50mm

Entire Period: HR=0.61 (95% CI 0.45, 0.83), p=0.001

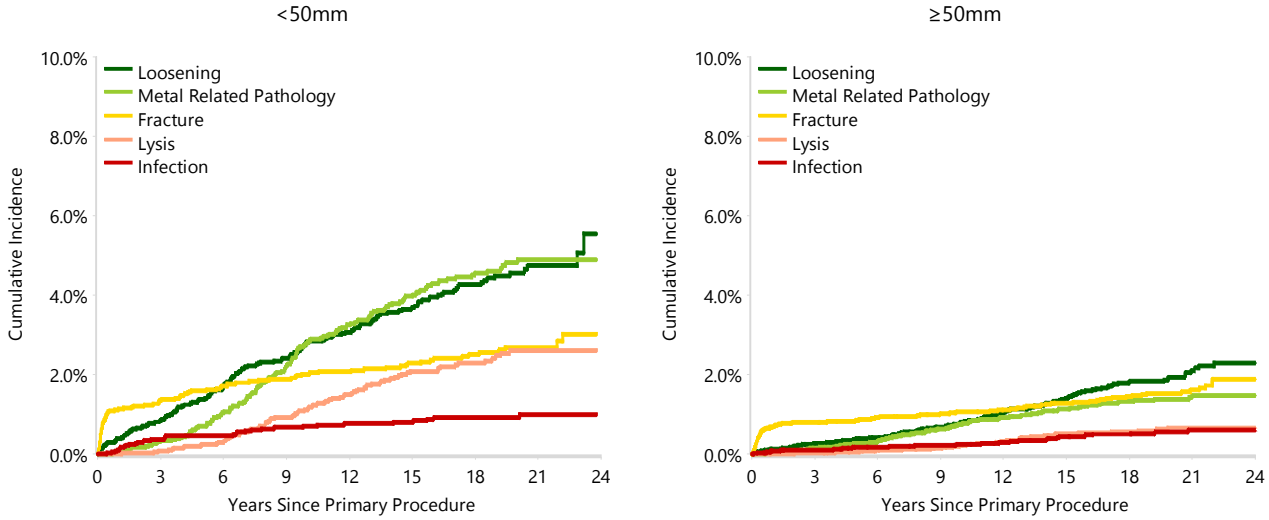
Female <50mm vs Female ≥50mm

Entire Period: HR=2.15 (95% CI 1.58, 2.95), p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| **Male** | **<50mm** | 1907 | 1805 | 1634 | 1462 | 1097 | 729 | 230 |
| | **≥50mm** | 11635 | 10988 | 10007 | 9027 | 7083 | 4972 | 2071 |
| **Female** | **<50mm** | 2160 | 2071 | 1974 | 1856 | 1636 | 1424 | 693 |
| | **≥50mm** | 391 | 386 | 374 | 361 | 334 | 297 | 166 |

Note: Restricted to modern prostheses

**Figure HT126 Cumulative Incidence Revision Diagnosis of Primary Total Resurfacing Hip Replacement by Head Size (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

## OUTCOME OF PRIMARY TOTAL RESURFACING COMPARED TO PRIMARY TOTAL CONVENTIONAL HIP REPLACEMENT

The rate of revision for osteoarthritis in primary total resurfacing and primary total conventional hip replacement are compared using only modern prostheses.

Primary total resurfacing has a lower rate of revision than primary total conventional hip replacement in the first month. After 3 months, primary total resurfacing has a higher rate of revision (Table HT116 and Figure HT127).

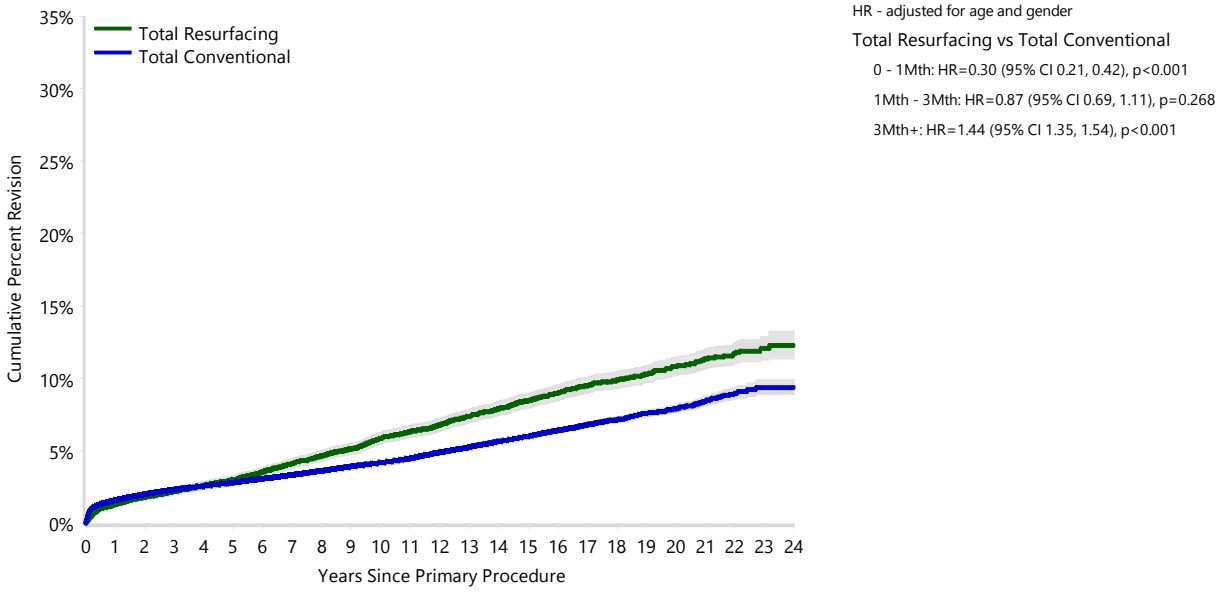
When analysed by gender, females with hip resurfacing have a higher rate of revision than females with total conventional hip replacement. Males with hip resurfacing have a lower rate of revision compared to males with a total conventional hip replacement for the first three months, with no difference after this time (Table HT117 and Figure HT128).

**Table HT116 Cumulative Percent Revision of Primary Total Hip Replacement by Class (Primary Diagnosis OA)**

| Total Hip Class | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| **Total Resurfacing** | 1205 | 16093 | 1.3 (1.1, 1.5) | 2.2 (2.0, 2.4) | 3.0 (2.7, 3.3) | 5.8 (5.5, 6.3) | 8.4 (8.0, 9.0) | 10.8 (10.2, 11.4) |
| **Total Conventional** | 16159 | 483080 | 1.6 (1.6, 1.6) | 2.3 (2.3, 2.3) | 2.8 (2.8, 2.9) | 4.2 (4.1, 4.3) | 6.0 (5.9, 6.1) | 7.9 (7.7, 8.2) |
| **TOTAL** | **17364** | **499173** | | | | | | |

Note: All primary total conventional procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT127 Cumulative Percent Revision of Primary Total Hip Replacement by Class (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| **Total Resurfacing** | 16093 | 15250 | 13989 | 12706 | 10150 | 7422 | 3160 |
| **Total Conventional** | 483080 | 429889 | 341258 | 264792 | 110429 | 34148 | 6519 |

Note: All primary total conventional procedures using metal/metal prostheses have been excluded
Restricted to modern prosthese

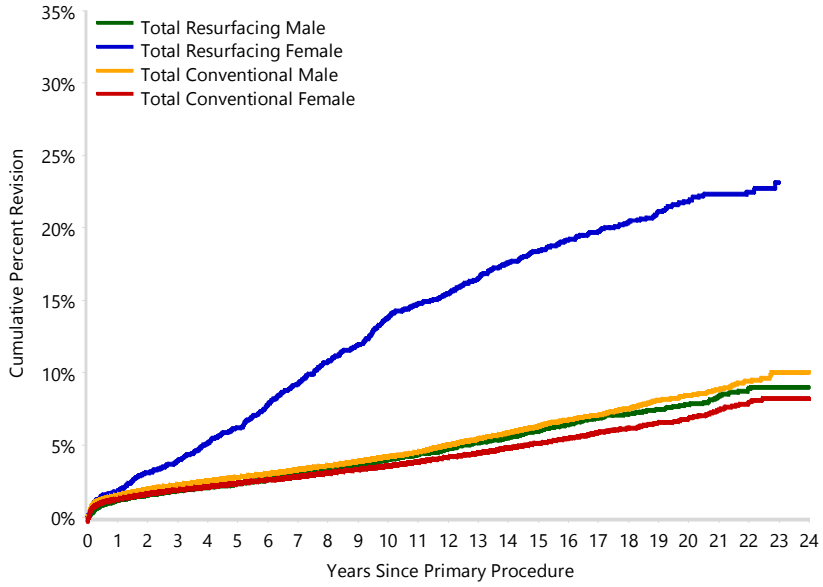
# Primary Total Hip Replacement

**Table HT117 Cumulative Percent Revision of Primary Total Hip Replacement by Class and Gender (Primary Diagnosis OA)**

| Total Hip Class | Gender | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| **Total Resurfacing** | | **1205** | **16093** | **1.3 (1.1, 1.5)** | **2.2 (2.0, 2.4)** | **3.0 (2.7, 3.3)** | **5.8 (5.5, 6.3)** | **8.4 (8.0, 9.0)** | **10.8 (10.2, 11.4)** |
| | Male | 704 | 13542 | 1.2 (1.0, 1.4) | 1.9 (1.6, 2.1) | 2.3 (2.1, 2.6) | 4.0 (3.7, 4.4) | 6.0 (5.5, 6.5) | 7.9 (7.3, 8.5) |
| | Female | 501 | 2551 | 1.9 (1.4, 2.5) | 4.0 (3.3, 4.8) | 6.2 (5.4, 7.3) | 13.8 (12.5, 15.3) | 18.5 (16.9, 20.1) | 21.9 (20.2, 23.7) |
| **Total Conventional** | | **16159** | **483080** | **1.6 (1.6, 1.6)** | **2.3 (2.3, 2.3)** | **2.8 (2.8, 2.9)** | **4.2 (4.1, 4.3)** | **6.0 (5.9, 6.1)** | **7.9 (7.7, 8.2)** |
| | Male | 7703 | 220749 | 1.6 (1.6, 1.7) | 2.4 (2.3, 2.5) | 2.9 (2.9, 3.0) | 4.4 (4.3, 4.5) | 6.6 (6.4, 6.8) | 8.7 (8.3, 9.1) |
| | Female | 8456 | 262331 | 1.6 (1.5, 1.6) | 2.2 (2.2, 2.3) | 2.7 (2.6, 2.8) | 4.0 (3.9, 4.1) | 5.6 (5.4, 5.7) | 7.4 (7.0, 7.7) |
| **TOTAL** | | **17364** | **499173** | | | | | | |

Note: Restricted to modern prostheses
All primary total conventional procedures using metal/metal prostheses have been excluded

**Figure HT128 Cumulative Percent Revision of Primary Total Hip Replacement by Class and Gender (Primary Diagnosis OA)**




HR - adjusted for age

Total Resurfacing Male vs Total Resurfacing Female
Entire Period: HR=0.34 (95% CI 0.30, 0.38), p<0.001

Total Resurfacing Male vs Total Conventional Male
0 - 1Mth: HR=0.25 (95% CI 0.16, 0.37), p<0.001
1Mth - 3Mth: HR=0.75 (95% CI 0.56, 0.99), p=0.040
3Mth+: HR=0.97 (95% CI 0.89, 1.06), p=0.468

Total Resurfacing Female vs Total Conventional Female
0 - 1Mth: HR=0.68 (95% CI 0.48, 0.97), p=0.030
1Mth - 6Mth: HR=2.92 (95% CI 2.60, 3.27), p<0.001
6Mth+: HR=3.29 (95% CI 2.99, 3.63), p<0.001

Total Conventional Male vs Total Conventional Female
0 - 2Wk: HR=0.84 (95% CI 0.75, 0.94), p=0.002
2Wk - 3Mth: HR=1.08 (95% CI 1.01, 1.14), p=0.019
3Mth - 6Mth: HR=0.94 (95% CI 0.84, 1.06), p=0.345
6Mth+: HR=1.16 (95% CI 1.12, 1.21), p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| **Total Resurfacing** | **Male** | 13542 | 12793 | 11641 | 10489 | 8180 | 5701 | 2301 |
| | **Female** | 2551 | 2457 | 2348 | 2217 | 1970 | 1721 | 859 |
| **Total Conventional** | **Male** | 220749 | 196264 | 154920 | 119183 | 47896 | 14226 | 2816 |
| | **Female** | 262331 | 233625 | 186338 | 145609 | 62533 | 19922 | 3703 |

Note: Restricted to modern prostheses
All primary total conventional procedures using metal/metal prostheses have been excluded

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# Knee Replacement

# Knee Replacement

## Categories of Knee Replacement

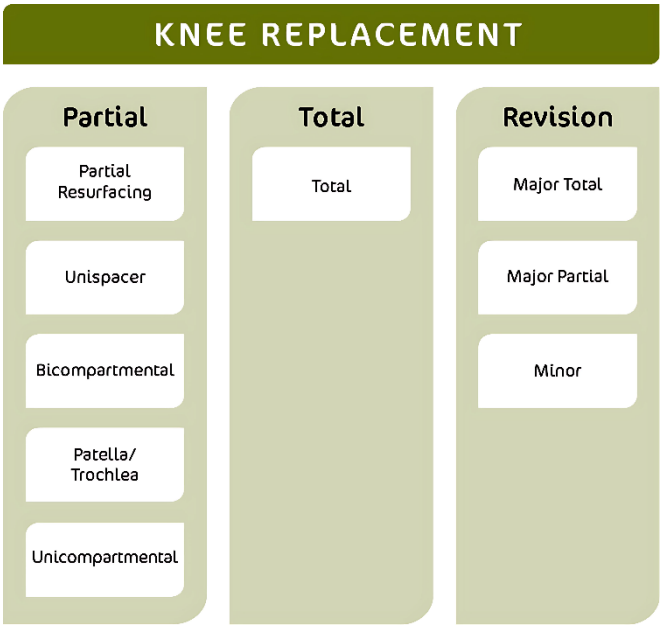
Knee replacement is grouped into three broad categories: primary partial, primary total and revision knee replacement.

A primary replacement is an initial replacement procedure undertaken on a joint and involves replacing either part (partial) or all (total) of the articular surface. The patella may or may not be resurfaced as part of a total replacement.

Primary partial knees are subcategorised into classes depending on the type of prosthesis used. The classes of primary partial knee replacement are partial resurfacing, unispacer, bicompartmental, patella/trochlea and unicompartmental. These are defined in the subsequent sections.

Revision knee replacements are re-operations of previous knee replacements where one or more of the prosthetic components are replaced, removed, or one or more components are added. Revisions include re-operations of primary partial, primary total or previous revision procedures. Knee revisions are subcategorised into three classes: major total, major partial, and minor revisions.

Detailed demographic information on knee replacement is available in the supplementary report 'Demographics of Hip, Knee and Shoulder Arthroplasty' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2025



## Executive Summary Reference Tables

Table K1 and Table K2 index the analyses within this chapter. Variables are listed, and where there is a significant finding for a comparison, a red diamond is shown in the table. New analyses for this year's report are noted with an Asterix. There are hyperlinks to the relevant tables and figures.

**Table K1 Indexing Significant Characteristic Comparisons: Partial Knee Replacements**

| Characteristic | Variable | Patella/Trochlear Knee Osteoarthritis | | Unicompartmental Knee Osteoarthritis | |
|---|---|---|---|---|---|
| | | Significant HR | Figure no. | Significant HR | Figure no. |
| Patient | | | | | |
| | Age | ♦ | Figure KP6 | ♦ | Figure KP19 |
| | Gender | ♦ | Figure KP7 | ♦ | Figure KP20 |
| | Gender by Age | ♦ | Figure KP8 | ♦ | Figure KP22<br>Figure KP23 |
| | ASA Score | | Figure KP9 | ♦ | Figure KP24 |
| | BMI | ♦ | Figure KP10 | | Figure KP26 |
| Prosthesis | | | | | |
| | Surgeon Assistive Tools | | Figure KP12 | ♦ | Figure KP31 |
| | Bearing Mobility | NT | | ♦ | Figure KP28 |
| | Fixation | NT | | ♦ | Figure KP30 |
| | Position | NT | | ♦ | Figure KP35 |
| | Position and Mobility | NT | | ♦ | Figure KP36 |

♦ Significant Hazard Ratio difference between categories where $p<0.05$

NT Not Tested: Insufficient numbers to make statistical comparisons or comparison not relevant

**Table K2 Indexing Significant Characteristic Comparisons: Total Knee Replacements**

| Characteristic | Variable | Total Knee Osteoarthritis | | Total Knee All Diagnoses | |
|---|---|---|---|---|---|
| | | Significant HR | Table/Figure no. | Significant HR | Table/Figure no. |
| | Diagnosis | NT | | ♦ | Figure KT6 |
| Patient | | | | | |
| | Age | ♦ | Figure KT9 | NT | |
| | Gender | ♦ | Figure KT10 | NT | |
| | Gender and Revision for Infection | ♦ | Figure KT12 | NT | |
| | Gender by Age | ♦ | Figure KT13<br>Figure KT14 | NT | |
| | ASA Score | ♦ | Figure KT15 | NT | |
| | ASA by Gender | ♦ | Figure KT17 | NT | |
| | ASA by Age* | ♦ | Figure KT18 | NT | |
| | BMI | ♦ | Figure KT19 | NT | |
| | BMI by Gender | ♦ | Figure KT21 | NT | |
| | BMI by Age* | ♦ | Figure KT22 | NT | |
| Prosthesis | | | | | |
| | Fixed Bearing Type | ♦ | Figure KT23 | NT | |
| | Bearing Mobility | ♦ | Figure KT24 | NT | |
| | Stability | ♦ | Figure KT26<br>Figure KT31 | ♦ | Figure KT30 |
| | Polyethylene Conformity | | Figure KT28 | NT | |
| | Polyethylene Insert Shape and Prosthesis Combinations | ♦ | Table KT30 | NT | |
| | Patella Component Usage | ♦ | Figure KT33 | NT | |
| | Patella Type | ♦ | Figure KT34 | NT | |
| | Patella Component Usage and Prosthesis Combination | ♦ | Table KT38 | NT | |
| | Patella Component Usage and Stability | ♦ | Figure KT35<br>Figure KT36 | NT | |
| | Stability and Fixation | ♦ | Figure KT38<br>Figure KT41 | NT | |
| | MPD by Fixation* | | Figure KT44 | | |
| | Stability and Fixation by Age | ♦ | Figure KT39<br>Figure KT42 | NT | |
| | Stability and Fixation by Gender | ♦ | Figure KT40<br>Figure KT43 | NT | |
| | Polyethylene Type | ♦ | Figure KT47 | NT | |
| | Polyethylene Type and Revision Diagnosis | ♦ | Figure KT49<br>Figure KT50 | NT | |
| | Polyethylene Type and Age | ♦ | Figure KT51 | NT | |
| | Polyethylene Type and Prosthesis Combination | ♦ | Table KT52 | NT | |
| | XLPE by Polyethylene Type | ♦ | Figure KT52 | NT | |
| | XLPE by Polyethylene Type and Stability* | ♦ | Table KT55<br>Table KT57 | NT | |
| | Femoral Bearing Surface | ♦ | Figure KT54 | NT | |
| | Femoral Bearing Surface and Stability* | ♦ | Table KT60 | NT | |

**Table K2** ***Cont.***

| Characteristic | Variable | Total Knee Osteoarthritis | | Total Knee All Diagnoses | |
|---|---|---|---|---|---|
| | | Significant HR | Table/Figure no. | Significant HR | Table/Figure no. |
| | Femoral Material | ♦ | Figure KT56 | NT | |
| | Femoral Material and Loosening* | ♦ | Figure KT58 | NT | |
| | Femoral Bearing Surface and Prosthesis Combination* | ♦ | Table KT64 | | |
| Surgeon Assistive Tools | | | | | |
| | Computer Navigation | | Figure KT60 | NT | |
| | Computer Navigation and Age | ♦ | Figure KT62 | NT | |
| | Computer Navigation with Patella by Prosthesis Combination | ♦ | Table KT68 | NT | |
| | IDI | ♦ | Figure KT63 | NT | |
| | IDI and Age | ♦ | Figure KT65 | NT | |
| | IDI with Patella by Prosthesis Combination | ♦ | Table KT72 | NT | |
| | Robotic Assistance | | Figure KT66 | NT | |
| | Robotic Assistance and Age | | Figure KT68 | NT | |
| | Robotic Assistance by Prosthesis Combination* | ♦ | Table KT76 | NT | |
| | XLPE by Surgeon Assistive Tool | | Figure KT69 | NT | |
| | Persona CR/Persona Prosthesis Combination with XLPE by Surgeon Assistive Tool | | Figure KT70 | NT | |
| | Triathlon CR/Triathlon Prosthesis Combination with XLPE by Surgeon Assistive Tool | | Figure KT71 | NT | |

♦ Significant Hazard Ratio difference between categories where $p<0.05$

NT Not Tested: Insufficient numbers to make statistical comparisons or comparison not relevant

*New analysis for this year's Annual Report

# Knee Replacement

## Use of Knee Replacement

This report analyses 1,205,616 knee replacements with a procedure date up to and including 31 December 2024. This is an additional 80,402 knee procedures since the last report. The relative frequency of each category of knee replacement is provided in Table K3.

For further information on the **closure of the database,** please see the **Glossary** of this report.

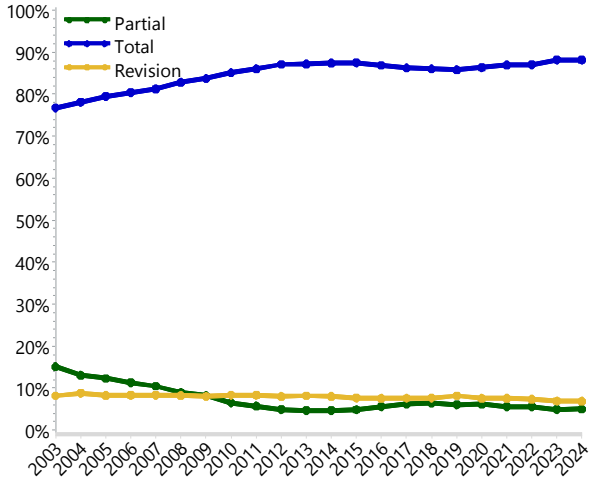
In 2024, primary total knee replacement accounted for 88.1% of all knee replacement procedures, primary partial knee replacement accounted for 5.0%, and the proportion of revision knee procedures was 6.9%. This equates to 1,552 fewer revision procedures in 2024 than would have been expected if the proportion of revision procedures had remained at the level reported in 2004 (Figure K1).

**Table K3 Number of Knee Replacements**

| Knee Category | Number | Percent |
|---|---|---|
| **Partial** | 84395 | 7.0 |
| **Total** | 1026935 | 85.2 |
| **Revision** | 94286 | 7.8 |
| **TOTAL** | **1205616** | **100.0** |

In 2024, the number of knee replacements undertaken has increased by 300 (0.4%) compared to 2023. During the last year, primary partial knee replacement increased by 2.3% and primary total knee replacement increased by 0.3%. Revision knee replacement decreased by 0.3%.

**Figure K1 Proportion of Knee Replacements**



## ASA Score and BMI in Knee Replacement

Data are reported on knee replacement procedures for both the American Society of Anesthesiologists Physical Status Classification (ASA score) and Body Mass Index (BMI). ASA score and BMI are both known to impact the outcome of knee replacement surgery. The Registry commenced the collection of ASA score in 2012 and BMI data in 2015.

There are ASA score data on 757,266 and BMI data on 644,992 knee replacement procedures. Since its initial collection, ASA score has been recorded for 97.6% of procedures. BMI has been recorded for 96.2% of procedures since collection commenced.

### ASA SCORE

There are five ASA score classifications:[1]

1. A normal healthy patient
2. A patient with mild systemic disease
3. A patient with severe systemic disease
4. A patient with severe systemic disease that is a constant threat to life
5. A moribund patient who is not expected to survive without the operation

Overall, in 93.4% of knee replacement procedures, patients have an ASA score of 2 or 3, 5.4% have a score of 1 and 1.3% have a score of 4. Very few procedures are recorded where patients have an ASA score of 5.

There is a difference in ASA score depending on the class of knee replacement. There are more patients undergoing partial knee replacement procedures with ASA scores 1 or 2, than those having primary total knee replacement procedures. For patients undergoing revision knee replacement surgery, there are lower proportions with ASA scores of 1 or 2 (Table K4).

### BMI CATEGORY

BMI for adults is classified into six main categories:[2]

| | |
|---|---|
| Underweight | <18.5 |
| Normal | 18.5–24.9 |
| Pre-obese | 25.0–29.9 |
| Obese Class 1 | 30.0–34.9 |
| Obese Class 2 | 35.0–39.9 |
| Obese Class 3 | ≥40.0 |

For all knee replacements, the majority of procedures are undertaken in patients who are either pre-obese or obese class 1. There is very little difference in BMI for patients when primary total and revision knee replacement are compared. However, for partial knee replacement, patients generally have a lower BMI (Table K5).

**Table K4 ASA Score for Knee Replacement**

| ASA Score | Partial | | Total | | Revision | | TOTAL | |
|---|---|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% | N | Col% |
| ASA 1 | 4712 | 11.3 | 34030 | 5.2 | 1787 | 3.2 | 40529 | 5.4 |
| ASA 2 | 25333 | 60.7 | 350449 | 53.2 | 22617 | 39.9 | 398399 | 52.6 |
| ASA 3 | 11532 | 27.6 | 267433 | 40.6 | 29756 | 52.5 | 308721 | 40.8 |
| ASA 4 | 187 | 0.4 | 6898 | 1.0 | 2488 | 4.4 | 9573 | 1.3 |
| ASA 5 | . | . | 24 | 0.0 | 20 | 0.0 | 44 | 0.0 |
| **TOTAL** | **41764** | **100.0** | **658834** | **100.0** | **56668** | **100.0** | **757266** | **100.0** |

Note: A further 448,350 procedures did not have ASA score recorded.

**Table K5 BMI Category for Knee Replacement**

| BMI Category | Partial | | Total | | Revision | | TOTAL | |
|---|---|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% | N | Col% |
| Underweight | 75 | 0.2 | 1160 | 0.2 | 162 | 0.4 | 1397 | 0.2 |
| Normal | 5509 | 15.0 | 59881 | 10.6 | 5098 | 11.2 | 70488 | 10.9 |
| Pre Obese | 14777 | 40.4 | 176294 | 31.3 | 13687 | 30.0 | 204758 | 31.7 |
| Obese Class 1 | 11068 | 30.2 | 173264 | 30.8 | 13908 | 30.5 | 198240 | 30.7 |
| Obese Class 2 | 3807 | 10.4 | 95121 | 16.9 | 7730 | 17.0 | 106658 | 16.5 |
| Obese Class 3 | 1369 | 3.7 | 57110 | 10.1 | 4972 | 10.9 | 63451 | 9.8 |
| **TOTAL** | **36605** | **100.0** | **562830** | **100.0** | **45557** | **100.0** | **644992** | **100.0** |

Note: BMI has not been presented for patients aged ≤19 years. A further 560,624 procedures did not have BMI recorded or the patient is aged ≤19 years.

[1] https://www.asahq.org/standards-and-practice-parameters/statement-on-asa-physical-status-classification-system

[2] https://www.aihw.gov.au/reports/overweight-obesity/overweight-and-obesity/contents/measuring-overweight-and-obesity

# Primary Partial Knee Replacement

## Classes of Partial Knee Replacement

Partial knee replacement is subcategorised into five classes. These are defined by the types of prostheses used.

**Partial resurfacing** involves the use of one or more button prostheses to replace part of the natural articulating surface on one or more sides of the joint, in one or more articular compartments of the knee.

**Unispacer** involves the use of a medial or lateral femorotibial compartment articular spacer.

**Bicompartmental** involves the replacement of the medial femoral and trochlear articular surface of the knee with a single femoral prosthesis, as well as the medial tibial articular surface with a unicompartmental tibial prosthesis. It may also include the use of a patellar prosthesis.

**Patella/trochlea** involves the use of a trochlear prosthesis to replace the femoral trochlear articular surface and, on most occasions, a patellar prosthesis.

**Unicompartmental** involves the replacement of the femoral and tibial articular surface of either the medial or lateral femorotibial compartment using unicompartmental femoral and tibial prostheses.

Detailed information on unispacer, bicompartmental and partial resurfacing knee replacement is available in the supplementary report 'Prosthesis Types with No or Minimal Use' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2025

## Use of Partial Knee Replacement

Unicompartmental knee replacement remains the most common class of primary partial knee replacement, accounting for 92.7% of all partial knee replacement procedures. The second most common class is patella/trochlear replacement (6.8%). Within the remaining three classes (partial resurfacing, unispacer and bicompartmental knee replacement), only small numbers of procedures have been reported (Table KP1).

**Table KP1 Partial Knee Replacement by Class**

| Partial Knee Class | Number | Percent |
|---|---|---|
| Partial Resurfacing | 248 | 0.3 |
| Unispacer | 40 | 0.0 |
| Bicompartmental | 166 | 0.2 |
| Patella/Trochlea | 5722 | 6.8 |
| Unicompartmental | 78219 | 92.7 |
| **TOTAL** | **84395** | **100.0** |

The unispacer procedure has not been used since 2005 and has the highest revision rate of any class of partial knee replacement. Bicompartmental knee replacement has not been used since 2012. There were no partial resurfacing procedures undertaken in 2024. These classes of partial knee replacement are not presented in detail in this report.

## Patella/Trochlear

### DEMOGRAPHICS

There are 5,722 patella/trochlear knee replacement procedures undertaken for all diagnoses. This is an additional 297 procedures compared to the previous report.

For further information on the **closure of the database** please see the **Glossary** of this report.

Patella/trochlear knee replacement accounted for 7.9% of all partial knee replacement procedures in 2024. Although the proportion of patella/trochlear knee replacements has increased from 2003 when it was 3.5%, it has changed little since 2016 (Figure KP1).

The principal diagnosis for patella/trochlea procedures is osteoarthritis. The proportion of males and females has remained relatively stable over the years (Figure KP2). The mean age of patients is 58.4 years, with this procedure undertaken more frequently in females (Table KP3). The age distribution has remained relatively stable since 2003 (Figure KP3).

In 2024, there were four resurfacing trochlea prostheses used in patella/trochlear knee replacement. The Gender Solutions and Restoris MCK are the most used prostheses in 2024 (Table KP4).

The outcomes of patella/trochlea knee prosthesis combinations used in 2024 are presented in Table KP5.

**Table KP2 Primary Patella/Trochlea Knee Replacement by Primary Diagnosis**

| Primary Diagnosis | N | Col% |
|---|---|---|
| Osteoarthritis | 5658 | 98.9 |
| Other Inflammatory Arthritis | 23 | 0.4 |
| Rheumatoid Arthritis | 9 | 0.2 |
| Osteonecrosis | 6 | 0.1 |
| Fracture | 4 | 0.1 |
| Tumour | 2 | 0.0 |
| Other | 20 | 0.3 |
| TOTAL | 5722 | 100.0 |

**Figure KP2 Primary Patella/Trochlea Knee Replacement by Gender and Year of Procedure**

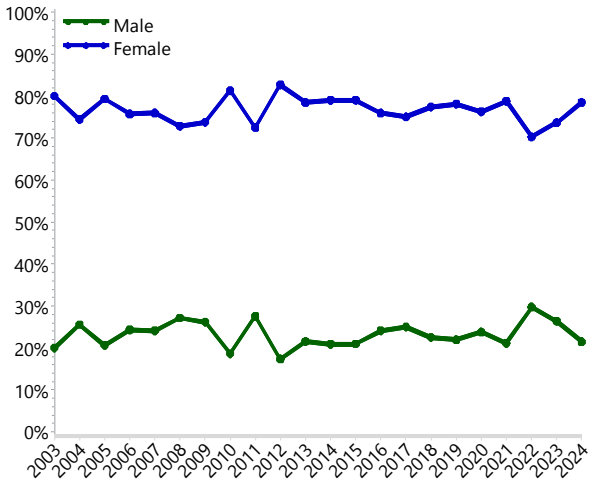



**Figure KP1 Primary Patella/Trochlea Knee Replacement by Year (All Diagnoses)**

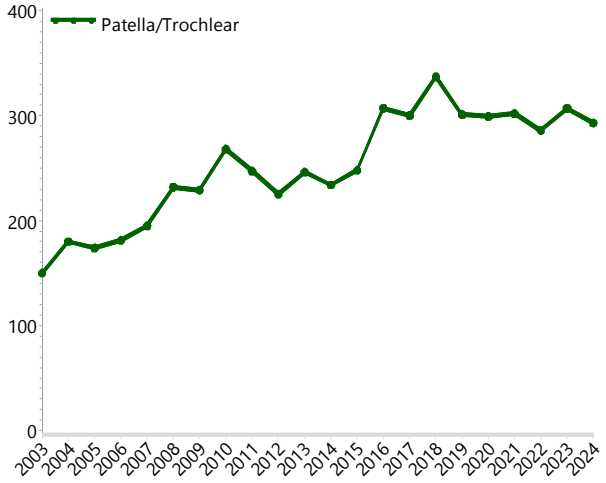
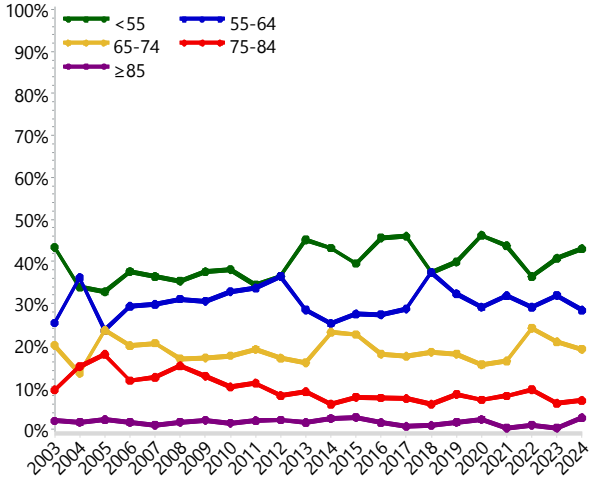



**Figure KP3 Primary Patella/Trochlea Knee Replacement by Age and Year of Procedure**



# Primary Partial Knee Replacement

**Table KP3 Age and Gender of Primary Patella/Trochlea Knee Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 1340 | 23.4% | 24 | 95 | 61 | 60.8 | 12.8 |
| Female | 4382 | 76.6% | 21 | 95 | 57 | 57.7 | 11.7 |
| **TOTAL** | **5722** | **100.0%** | **21** | **95** | **58** | **58.4** | **12.1** |

**Table KP4 Most Used Resurfacing Trochlea Prostheses used in Primary Patella/Trochlea Knee Replacement**

| 2003 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 56 | LCS | 160 | Gender Solutions | 128 | Restoris MCK | 147 | Gender Solutions | 123 | Gender Solutions |
| 43 | Avon | 93 | Restoris MCK | 115 | Gender Solutions | 113 | Restoris MCK | 121 | Restoris MCK |
| 29 | Lubinus | 39 | Journey | 41 | Journey | 46 | Journey | 47 | Journey |
| 13 | Themis | 7 | Avon | 2 | Avon | 1 | Avon | 2 | Moto |
| 8 | MOD III | 3 | RBK | | | | | | |
| 1 | RBK | | | | | | | | |
| **Most Used** | | | | | | | | | |
| 150 | (6) 100.0% | 302 | (5) 100.0% | 286 | (4) 100.0% | 307 | (4) 100.0% | 293 | (4) 100.0% |

**Table KP5 Cumulative Percent Revision of Primary Patella/Trochlea Knee Replacement by Prosthesis Combination**

| Resurfacing Trochlear | Patella | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Gender Solutions | Nexgen | 227 | 1554 | 1.3 (0.8, 2.0) | 6.1 (5.0, 7.4) | 9.2 (7.8, 10.8) | 14.4 (12.5, 16.5) | 20.5 (17.9, 23.4) | |
| | Persona | 8 | 316 | 0.8 (0.2, 3.1) | 4.0 (1.7, 9.5) | | | | |
| Journey | Genesis II | 177 | 790 | 2.4 (1.5, 3.7) | 8.2 (6.4, 10.4) | 12.8 (10.5, 15.6) | 17.9 (15.1, 21.2) | 25.4 (21.8, 29.5) | 41.6 (35.9, 47.8) |
| Restoris MCK | Restoris MCK | 54 | 564 | 1.0 (0.4, 2.3) | 6.1 (4.2, 8.8) | 10.5 (7.7, 14.2) | 18.8 (14.0, 25.0) | | |
| | Triathlon | 6 | 214 | 2.1 (0.8, 5.5) | 2.9 (1.2, 7.0) | | | | |
| Other (6) | | 6 | 30 | 3.4 (0.5, 22.1) | 24.9 (10.9, 50.9) | 24.9 (10.9, 50.9) | 24.9 (10.9, 50.9) | 37.5 (16.7, 70.1) | |
| **TOTAL** | | **478** | **3468** | | | | | | |

Note: Restricted to modern prostheses. Only prostheses with over 20 procedures have been listed.

## OUTCOME FOR OSTEOARTHRITIS - PATIENT CHARACTERISTICS

In order to keep Registry data contemporaneous, only procedures using prostheses that have been available and used in 2024 (described as modern prostheses) are included in the analyses, unless clearly specified.

There are 473 revisions of the 3,430 primary patella/trochlear knee replacement procedures for osteoarthritis for analysis this year. There are 2,228 further patella/trochlear procedures excluded from analyses as the prosthesis is no longer used or the initial diagnosis is not osteoarthritis.

The cumulative percent revision for patella/trochlear replacement at 15 years is 34.4% (Table KP6 and Figure KP4).

### Reasons for Revision

The main reasons for revision of patella/trochlear knee replacement are progression of disease, pain and loosening (Table KP7 and Table KP5). The main type of revision is to a total knee replacement (Table KP8).

### Age and Gender

Age and gender are factors affecting the outcome of primary patella/trochlear knee replacement. Patients aged <65 years have a higher rate of revision compared to patients aged ≥65 years (Table KP9 and Figure KP6). Males have a higher rate of revision than females for the first 5 years, with no difference after this time (Table KP10 and Figure KP7).

Males aged <65 years have a higher rate of revision than males ≥65 years and females <65 years, but only for the first 5 years. There is no difference in rate of revision when females aged <65 years are compared to females ≥65 years (Table KP10 and Figure KP8).

### ASA and BMI

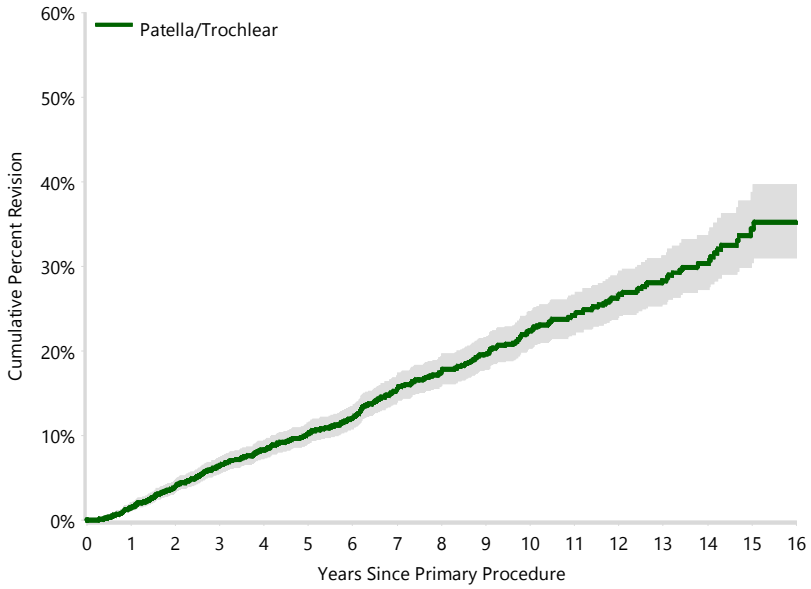
Patient ASA score is not a risk factor for revision (Table KP11 and Figure KP9). When patient BMI category was assessed, obese class 2 and 3 patients have a higher rate of revision compared to patients with a normal BMI (Table KP12 and Figure KP10).

**Table KP6 Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement (Primary Diagnosis OA)**

| Knee Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|---|
| Patella/Trochlear | 473 | 3430 | 1.5 (1.2, 2.0) | 6.5 (5.6, 7.4) | 10.2 (9.1, 11.5) | 15.5 (14.0, 17.1) | 22.5 (20.4, 24.7) | 34.4 (30.5, 38.7) |
| TOTAL | 473 | 3430 | | | | | | |

Note: Restricted to modern prostheses.

**Figure KP4 Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|
| Patella/Trochlear | 3430 | 3081 | 2358 | 1737 | 1146 | 578 | 85 |

Note: Restricted to modern prostheses.

# Primary Partial Knee Replacement

**Table KP7 Primary Patella/Trochlear Knee Replacement by Reason for Revision (Primary Diagnosis OA)**

| Reason for Revision | Number | Percent |
|---|---|---|
| Progression Of Disease | 304 | 64.3 |
| Pain | 54 | 11.4 |
| Loosening | 43 | 9.1 |
| Infection | 12 | 2.5 |
| Malalignment | 8 | 1.7 |
| Wear Patella | 9 | 1.9 |
| Lysis | 6 | 1.3 |
| Implant Breakage Patella | 3 | 0.6 |
| Implant Breakage Femoral | 1 | 0.2 |
| Arthrofibrosis | 1 | 0.2 |
| Patella Erosion | 1 | 0.2 |
| Other | 31 | 6.6 |
| TOTAL | 473 | 100.0 |

Note: Restricted to modern prostheses.

**Table KP8 Primary Patella/Trochlear Knee Replacement by Type of Revision (Primary Diagnosis OA)**

| Type of Revision | Number | Percent |
|---|---|---|
| TKR (Tibial/Femoral) | 417 | 88.2 |
| Patella Only | 30 | 6.3 |
| UKR (Uni Tibial/Uni Femoral) | 10 | 2.1 |
| Patella/Trochlear Resurfacing | 8 | 1.7 |
| Cement Spacer | 3 | 0.6 |
| Removal of Prostheses | 3 | 0.6 |
| Femoral Component | 1 | 0.2 |
| Minor Components | 1 | 0.2 |
| TOTAL | 473 | 100.0 |

Note: Restricted to modern prostheses.

**Figure KP5 Cumulative Incidence Revision Diagnosis of Primary Patella/Trochlear Knee Replacement by Reason for Revision (Primary Diagnosis OA)**

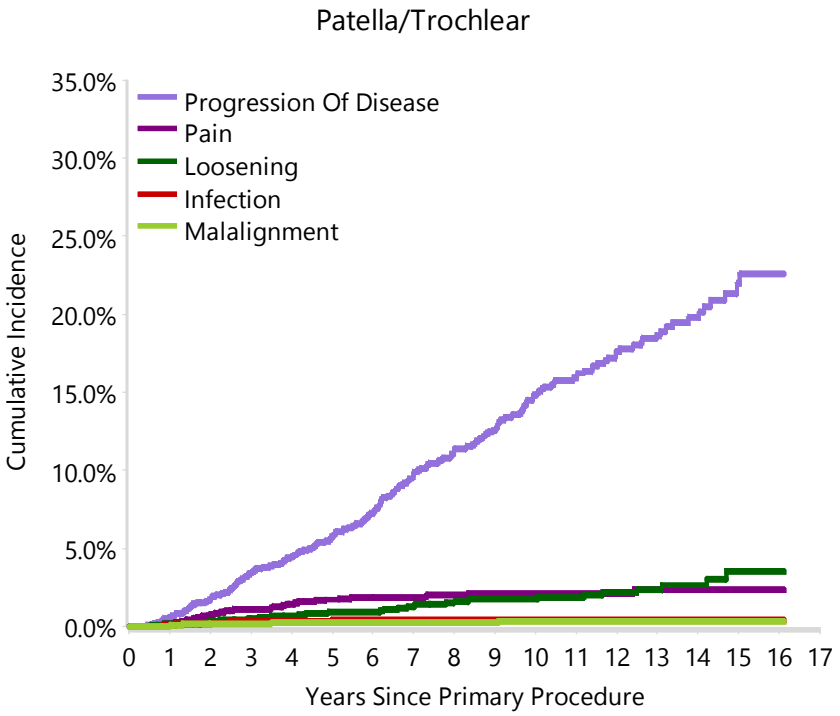
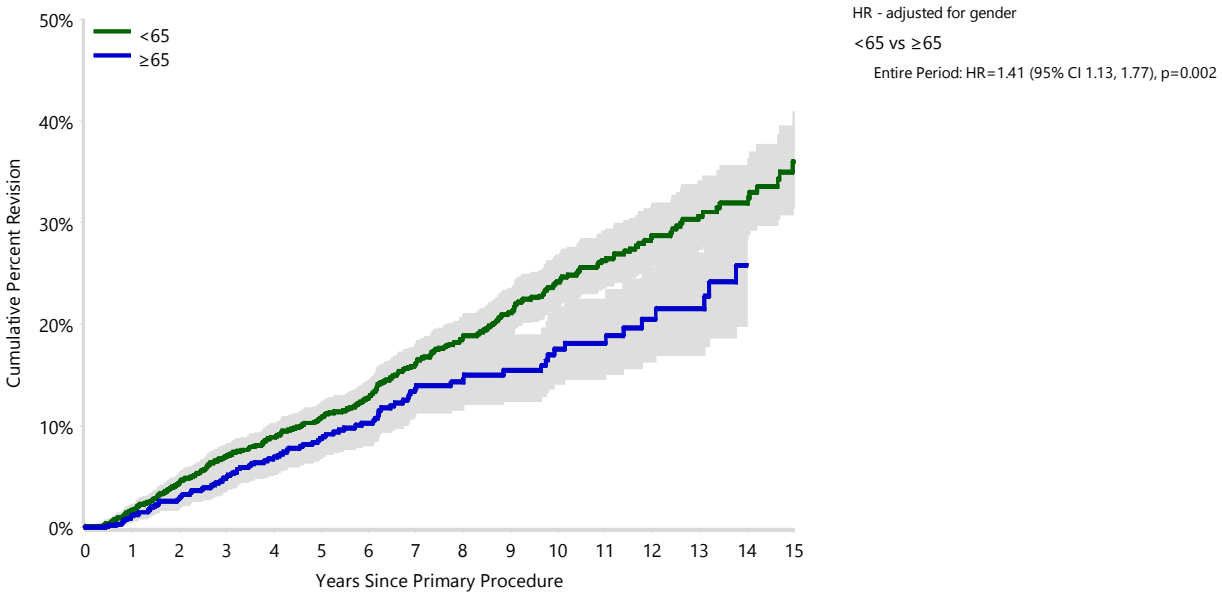


**Table KP9 Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement by Age (Primary Diagnosis OA)**

| Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|---|
| <65 | 373 | 2482 | 1.7 (1.3, 2.3) | 7.0 (6.0, 8.2) | 10.8 (9.5, 12.3) | 16.2 (14.4, 18.1) | 24.1 (21.7, 26.8) | 36.0 (31.5, 40.9) |
| ≥65 | 100 | 948 | 1.1 (0.6, 2.1) | 5.0 (3.7, 6.8) | 8.8 (6.8, 11.2) | 13.7 (11.0, 16.9) | 17.5 (14.1, 21.7) | |
| TOTAL | 473 | 3430 | | | | | | |

Note: Restricted to modern prostheses.

**Figure KP6 Cumulative Percent Revision of Primary Patella/Trochlea Knee Replacement by Age (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|
| <65 | 2482 | 2235 | 1733 | 1279 | 849 | 431 | 65 |
| ≥65 | 948 | 846 | 625 | 458 | 297 | 147 | 20 |

Note: Restricted to modern prostheses.

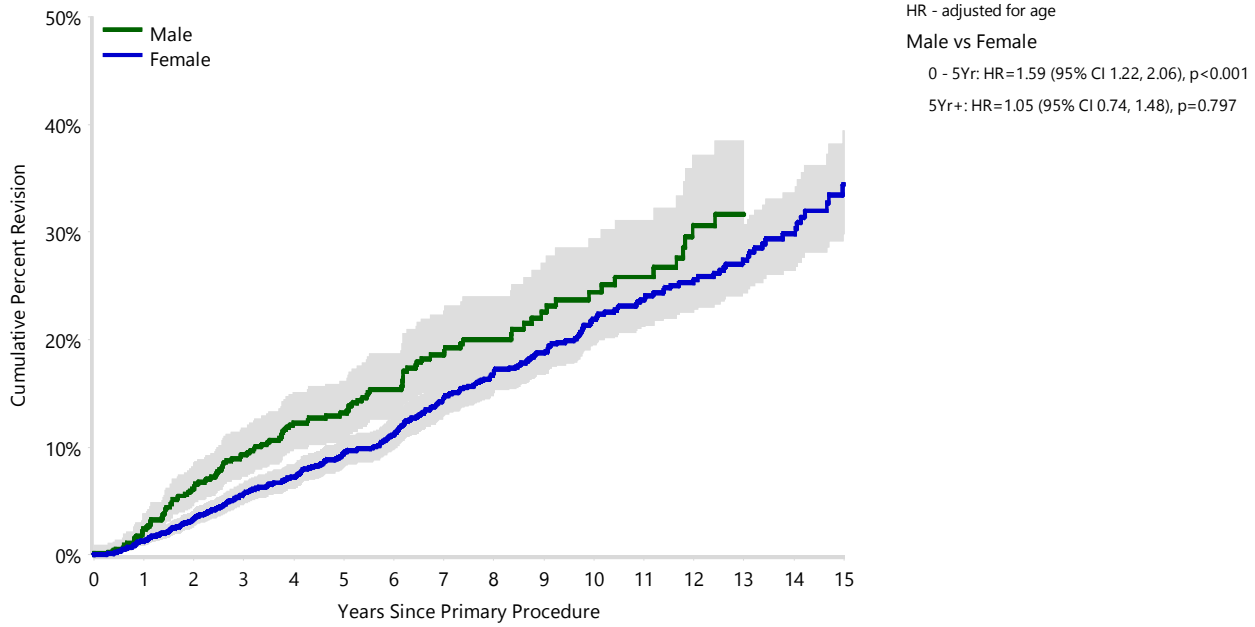
# Primary Partial Knee Replacement

**Table KP10 Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement by Gender and Age (Primary Diagnosis OA)**

| Gender | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| **Male** | | **122** | **789** | **2.4 (1.5, 3.8)** | **9.3 (7.3, 11.8)** | **13.1 (10.7, 16.1)** | **18.6 (15.4, 22.3)** | **24.4 (20.2, 29.3)** | |
| | <65 | 92 | 478 | 2.9 (1.7, 4.9) | 11.6 (8.8, 15.2) | 15.9 (12.5, 20.1) | 22.5 (18.2, 27.6) | 31.0 (25.1, 37.9) | |
| | ≥65 | 30 | 311 | 1.7 (0.7, 4.1) | 5.7 (3.5, 9.3) | 8.8 (5.8, 13.4) | 12.3 (8.4, 17.9) | 13.3 (9.1, 19.2) | |
| **Female** | | **351** | **2641** | **1.3 (0.9, 1.8)** | **5.7 (4.8, 6.7)** | **9.4 (8.2, 10.7)** | **14.6 (13.0, 16.4)** | **21.9 (19.5, 24.4)** | **34.4 (29.9, 39.4)** |
| | <65 | 281 | 2004 | 1.4 (1.0, 2.1) | 6.0 (5.0, 7.2) | 9.6 (8.2, 11.2) | 14.7 (12.9, 16.8) | 22.6 (20.0, 25.5) | 35.3 (30.1, 41.0) |
| | ≥65 | 70 | 637 | 0.8 (0.4, 2.0) | 4.6 (3.1, 6.8) | 8.7 (6.4, 11.7) | 14.2 (11.0, 18.4) | 19.3 (14.9, 24.8) | |
| **TOTAL** | | **473** | **3430** | | | | | | |

Note: Restricted to modern prostheses.

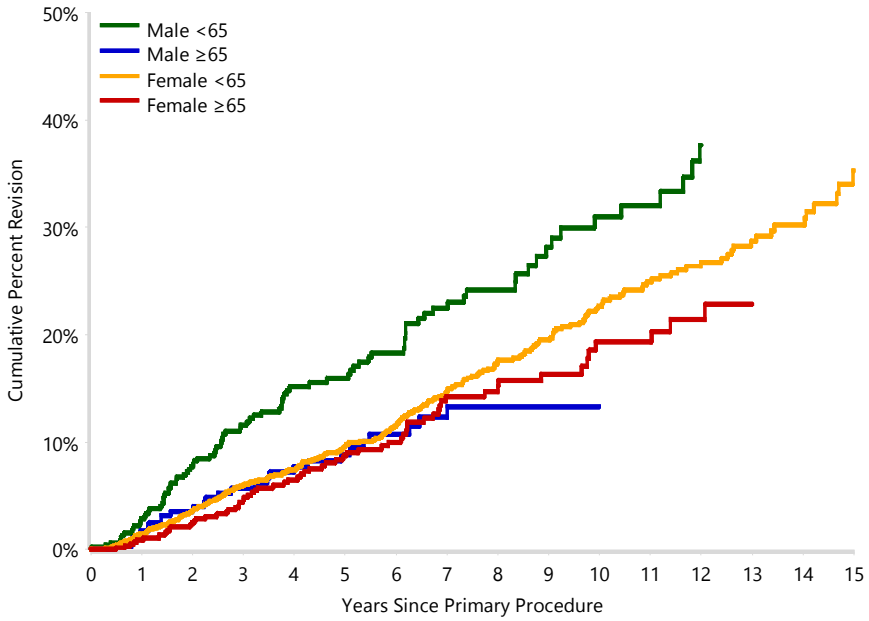
**Figure KP7 Cumulative Percent Revision of Primary Patella/Trochlea Knee Replacement by Gender (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|
| **Male** | 789 | 705 | 494 | 368 | 238 | 111 | 17 |
| **Female** | 2641 | 2376 | 1864 | 1369 | 908 | 467 | 68 |

Note: Restricted to modern prostheses.

**Figure KP8 Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement by Gender and Age (Primary Diagnosis OA)**




Male <65 vs Male ≥65
Entire Period: HR=2.02 (95% CI 1.34, 3.06), p<0.001

Male <65 vs Female <65
0 - 5Yr: HR=1.77 (95% CI 1.32, 2.38), p<0.001
5Yr+: HR=1.27 (95% CI 0.87, 1.87), p=0.213

Male ≥65 vs Female ≥65
Entire Period: HR=0.92 (95% CI 0.60, 1.41), p=0.709

Female <65 vs Female ≥65
Entire Period: HR=1.20 (95% CI 0.92, 1.55), p=0.179

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|---|
| **Male** | **<65** | 478 | 426 | 296 | 216 | 149 | 67 | 13 |
| | **≥65** | 311 | 279 | 198 | 152 | 89 | 44 | 4 |
| **Female** | **<65** | 2004 | 1809 | 1437 | 1063 | 700 | 364 | 52 |
| | **≥65** | 637 | 567 | 427 | 306 | 208 | 103 | 16 |

Note: Restricted to modern prostheses.

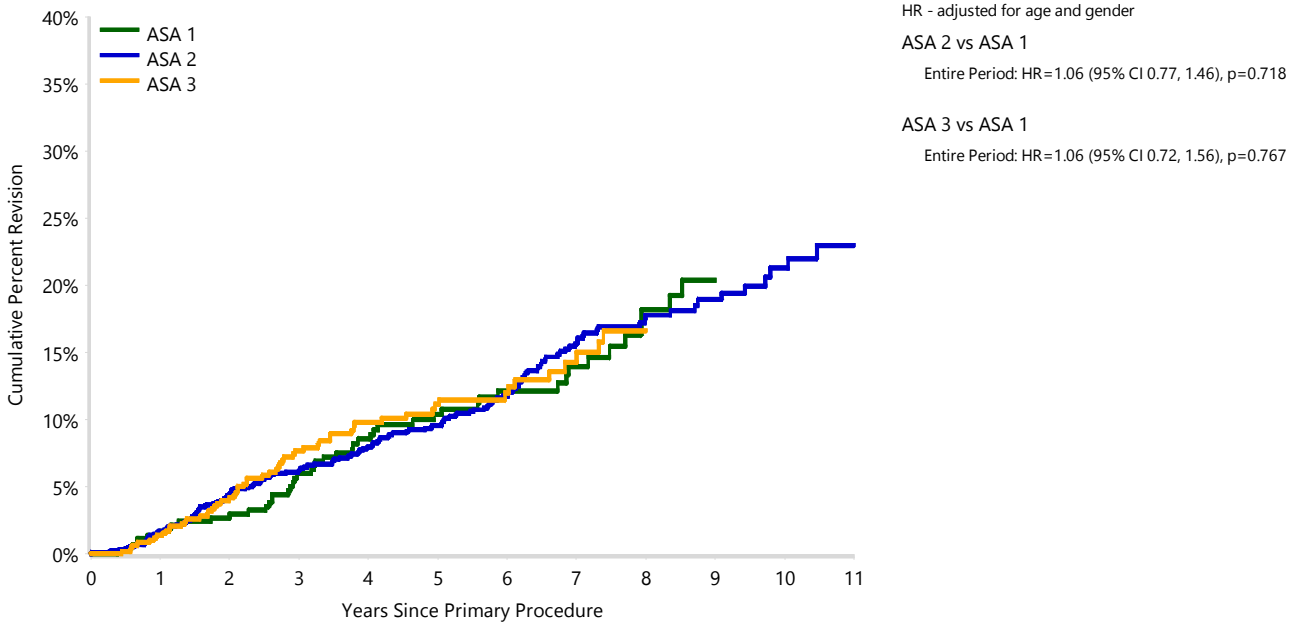
# Primary Partial Knee Replacement

**Table KP11 Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement by ASA Score (Primary Diagnosis OA)**

| ASA Score | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| ASA 1 | 50 | 442 | 1.7 (0.8, 3.5) | 6.0 (4.0, 8.9) | 10.4 (7.5, 14.2) | 14.0 (10.4, 18.7) | |
| ASA 2 | 180 | 1715 | 1.7 (1.2, 2.5) | 6.2 (5.0, 7.6) | 9.6 (8.1, 11.4) | 15.6 (13.4, 18.2) | 21.3 (17.8, 25.2) |
| ASA 3 | 61 | 656 | 1.3 (0.7, 2.7) | 7.7 (5.7, 10.4) | 11.1 (8.5, 14.5) | 14.3 (10.9, 18.6) | |
| ASA 4 | 2 | 8 | 0.0 (0.0, 0.0) | 28.6 (8.0, 74.2) | | | |
| TOTAL | 293 | 2821 | | | | | |

Note: Excludes 609 procedures with unknown ASA score.
Restricted to modern prostheses.

**Figure KP9 Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement by ASA Score (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|
| ASA 1 | 442 | 400 | 303 | 222 | 134 | 35 |
| ASA 2 | 1715 | 1514 | 1108 | 744 | 409 | 109 |
| ASA 3 | 656 | 562 | 384 | 245 | 118 | 16 |

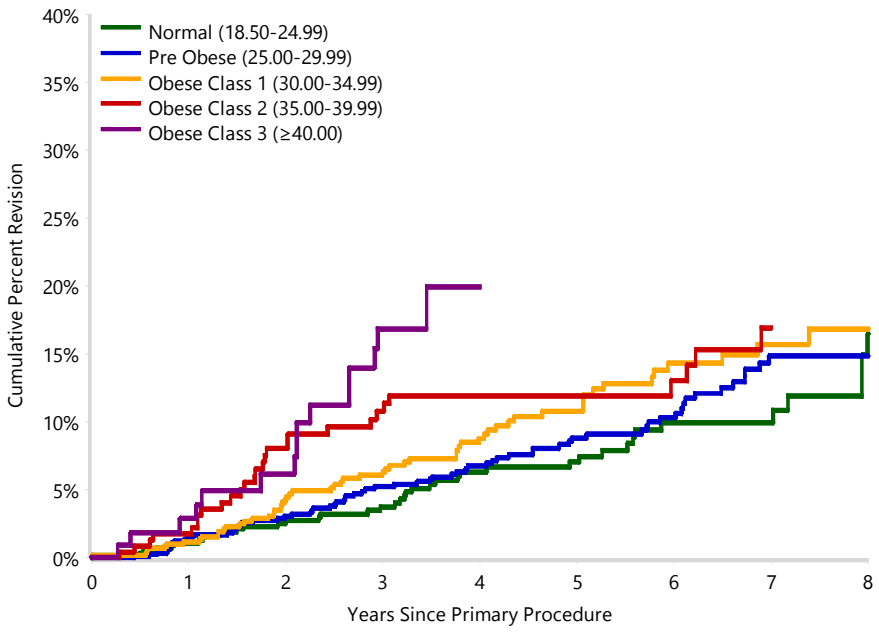
Note: Excludes 609 procedures with unknown ASA score.
Restricted to modern prostheses.
ASA 4 excluded due to low numbers.

**Table KP12 Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement by BMI Category (Primary Diagnosis OA)**

| BMI Category | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|
| Underweight | 1 | 23 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 9.1 (1.3, 49.2) | 9.1 (1.3, 49.2) | |
| Normal | 40 | 591 | 1.1 (0.5, 2.4) | 3.8 (2.4, 5.9) | 7.1 (4.9, 10.1) | 9.9 (7.1, 13.9) | 16.5 (11.1, 24.2) |
| Pre Obese | 74 | 904 | 1.6 (0.9, 2.7) | 5.2 (3.8, 7.1) | 8.8 (6.8, 11.4) | 14.8 (11.6, 18.9) | 14.8 (11.6, 18.9) |
| Obese Class 1 | 60 | 639 | 1.2 (0.6, 2.5) | 6.3 (4.5, 8.8) | 10.8 (8.1, 14.2) | 15.7 (12.0, 20.4) | 16.8 (12.7, 22.1) |
| Obese Class 2 | 31 | 241 | 1.7 (0.7, 4.6) | 10.8 (7.2, 15.9) | 11.9 (8.1, 17.3) | 16.9 (11.5, 24.5) | |
| Obese Class 3 | 16 | 112 | 2.9 (0.9, 8.6) | 16.8 (10.3, 27.0) | | | |
| TOTAL | 222 | 2510 | | | | | |

Note: BMI has not been presented for patients aged ≤19 years.
Excludes 920 procedures with unknown BMI.
Restricted to modern prostheses.

**Figure KP10 Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement by BMI Category (Primary Diagnosis OA)**




HR - adjusted for age and gender

Pre Obese (25.00-29.99) vs Normal (18.50-24.99)
Entire Period: HR=1.09 (95% CI 0.74, 1.61), p=0.676

Obese Class 1 (30.00-34.99) vs Normal (18.50-24.99)
Entire Period: HR=1.31 (95% CI 0.87, 1.97), p=0.199

Obese Class 2 (35.00-39.99) vs Normal (18.50-24.99)
Entire Period: HR=1.72 (95% CI 1.07, 2.77), p=0.024

Obese Class 3 (≥40.00) vs Normal (18.50-24.99)
Entire Period: HR=2.42 (95% CI 1.35, 4.35), p=0.003

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Underweight | 591 | 511 | 442 | 362 | 279 | 226 | 158 | 98 | 54 |
| Normal | 904 | 796 | 667 | 559 | 451 | 360 | 265 | 169 | 90 |
| Pre Obese | 639 | 553 | 464 | 380 | 302 | 224 | 163 | 94 | 53 |
| Obese Class 1 | 241 | 216 | 179 | 155 | 135 | 106 | 78 | 52 | 29 |
| Obese Class 2 | 112 | 96 | 74 | 58 | 42 | 30 | 22 | 15 | 8 |

Note: BMI has not been presented for patients aged ≤19 years.
Excludes 920 procedures with unknown BMI. Restricted to modern prostheses.
Underweight BMI category excluded due to low numbers.

# Primary Partial Knee Replacement

### Outcome by Prosthesis Characteristics

**Surgeon Assistive Tools**

Computer navigation, image derived instrumentation (IDI) and robotic assistance, to aid implantation of knee replacements, have been labelled as 'surgeon assistive tools'. Computer navigation and IDI are rarely used with patella/trochlea replacement.

Robotic assistance for patella/trochlea knee replacement was first recorded in 2015. Use of robotic assistance increased to 48.6% of patella/trochlea procedures in 2022.

In 2024, 40.1% of patella/trochlea knee procedures use robotic assistance (Figure KP11). There are 767 robotically assisted patella/trochlea knee replacement procedures undertaken for osteoarthritis. There are 9 patella/trochlea combinations that can be used with robotic assistance.

When adjusted for age, gender, ASA and BMI there is no difference in the rate of revision for patella/trochlea knee procedures using robotic assistance compared to patella/trochlea procedures using traditional instrumentation (Table KP13 and Figure KP12).

**Figure KP11 Primary Patella/Trochlear Knee Replacement by Surgeon Assistive Tools (Primary Diagnosis OA)**

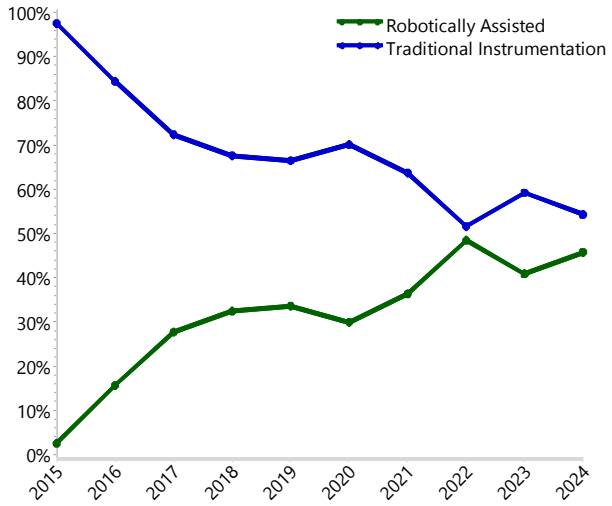
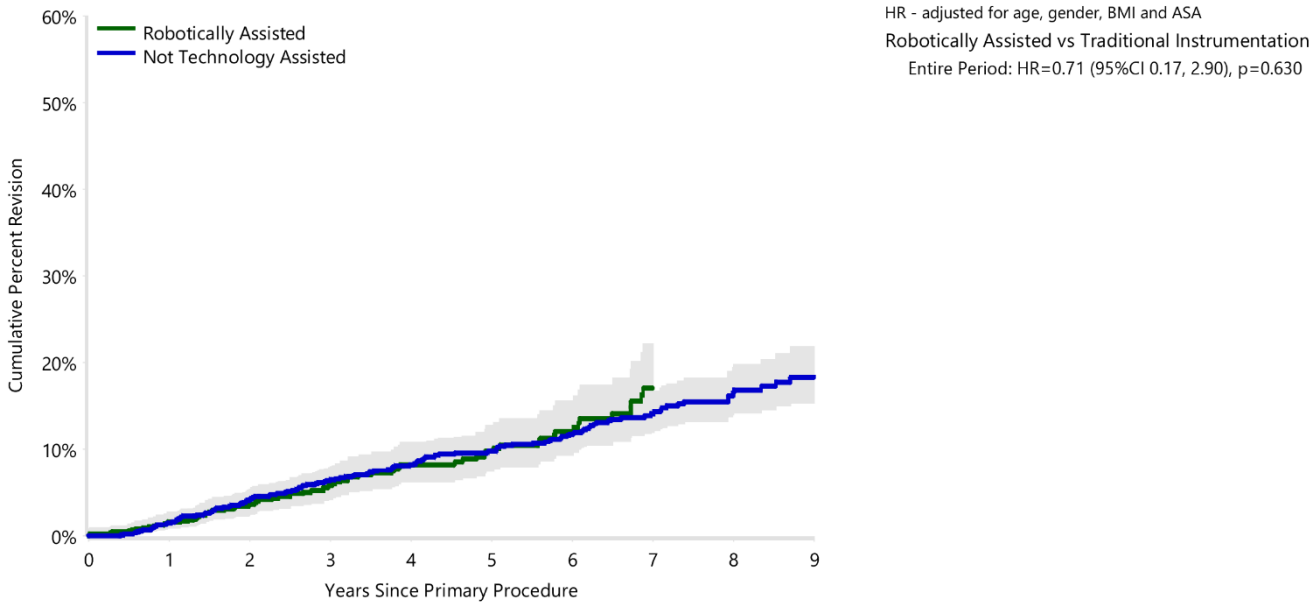


**Table KP13 Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement Since 2015 by Surgeon Assistive Tools (Primary Diagnosis OA)**

| Surgeon Assistive Tools | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Robotically Assisted | 72 | 901 | 1.6 (0.9, 2.7) | 3.6 (2.4, 5.1) | 5.8 (4.3, 7.9) | 8.3 (6.3, 10.8) | 9.8 (7.5, 12.7) | 12.1 (9.3, 15.6) | 17.1 (13.1, 22.1) |
| Traditional Instrumentation | 166 | 1691 | 1.5 (1.0, 2.3) | 4.2 (3.3, 5.3) | 6.5 (5.3, 7.9) | 8.2 (6.9, 9.9) | 9.8 (8.3, 11.7) | 11.8 (10.0, 13.8) | 14.1 (12.0, 16.5) |
| TOTAL | 238 | 2592 | | | | | | | |

Note: Restricted to modern prostheses.

**Figure KP12 Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement Since 2015 by Surgeon Assistive Tools (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|---|
| Robotically Assisted | 901 | 756 | 621 | 477 | 363 | 279 | 188 | 97 |
| Traditional Instrumentation | 1691 | 1504 | 1290 | 1121 | 926 | 740 | 566 | 387 |

Note: Restricted to modern prostheses.

# Primary Partial Knee Replacement

## Unicompartmental

### DEMOGRAPHICS

There are 78,219 primary unicompartmental knee procedures recorded. This is an additional 3,713 procedures compared to the last report.

For further information on the **closure of the database** please see the **Glossary** of this report.

The use of unicompartmental knee replacement has decreased to 4.5% of all knee procedures in 2024. Although the proportion of unicompartmental knee replacements has increased from 2014, when it was 4.2%, it is still considerably less than in 2003 (14.5%).

Osteoarthritis is the principal diagnosis (Table KP14). This procedure is undertaken more often in males (55.1%) (Table KP15). The proportion of males has decreased to 61.6% in 2024 (Figure KP13). Unicompartmental knee replacement is most frequently undertaken in patients aged 55–74 years. The age distribution has remained relatively stable since 2003 (Figure KP14). The mean age of patients is 65.5 years (Table KP15).

**Table KP14 Primary Unicompartmental Knee Replacement by Primary Diagnosis**

| Primary Diagnosis | N | % |
|---|---|---|
| Osteoarthritis | 77535 | 99.1 |
| Osteonecrosis | 460 | 0.6 |
| Rheumatoid Arthritis | 159 | 0.2 |
| Other Inflammatory Arthritis | 55 | 0.1 |
| Fracture | 5 | 0.0 |
| Osteochondritis Dissecans | 2 | 0.0 |
| Tumour | 1 | 0.0 |
| Other | 2 | 0.0 |
| TOTAL | 78219 | 100.0 |

**Figure KP13 Primary Unicompartmental Knee Replacement by Gender**

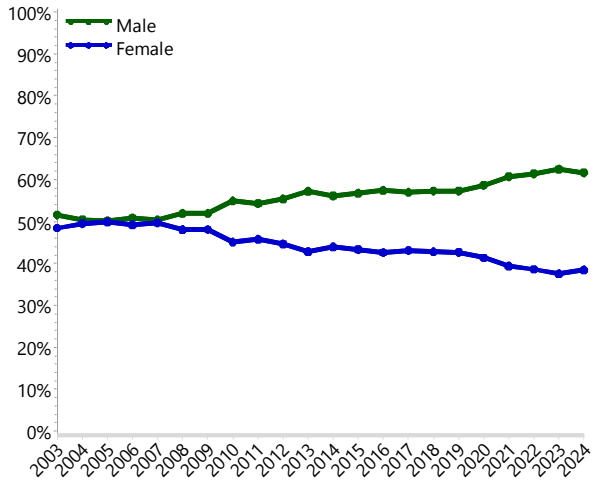
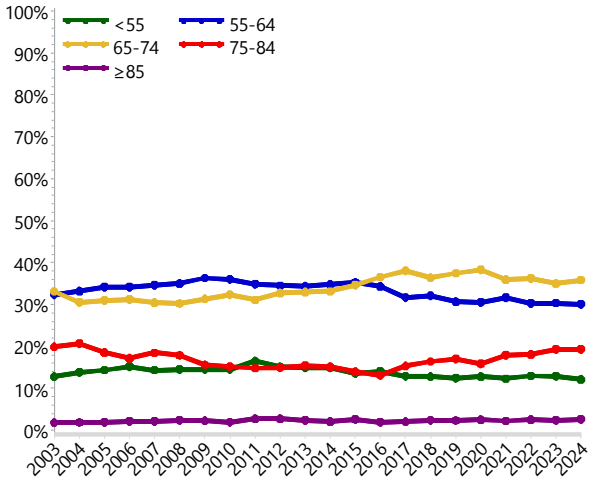



**Figure KP14 Primary Unicompartmental Knee Replacement by Age**




The use of mobile unicompartmental knee replacement has declined over time and in 2024 accounted for 21.3% of unicompartmental knee procedures (Figure KP15). The proportion of unicompartmental knee replacements using robotic assistance increased to 53.4% in 2024 (Figure KP16).

In 2024, the 10 most used tibial prostheses account for 99.8% of all unicompartmental procedures. The Restoris MCK, Persona and Oxford (cementless) are the most used prostheses in 2024 (Table KP16).

The outcomes of unicompartmental knee prosthesis combinations with >200 procedures are presented in Table KP17.

**Figure KP15 Primary Unicompartmental Knee Replacement by Mobility**

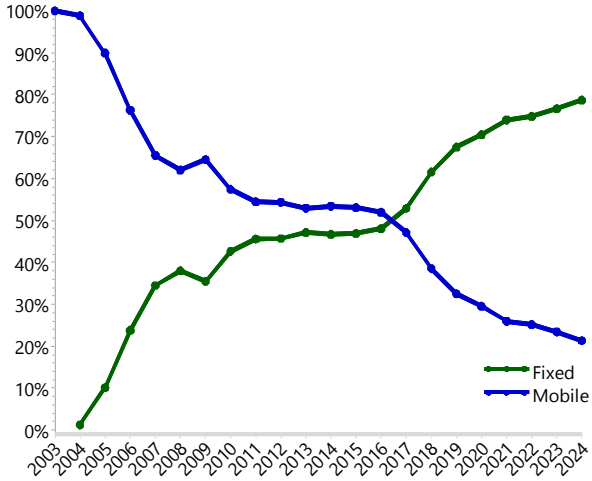
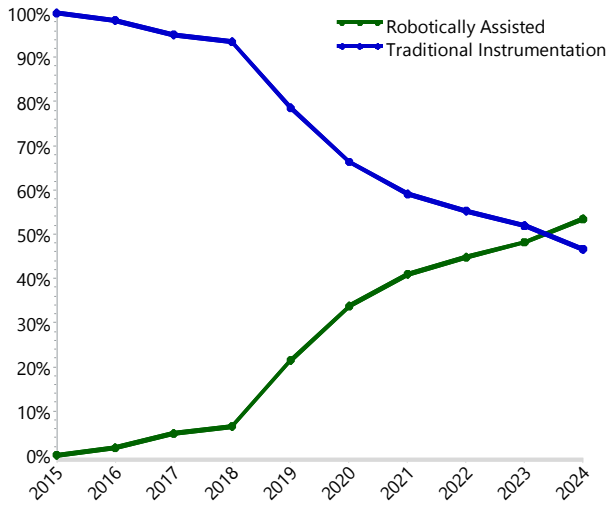


**Figure KP16 Primary Unicompartmental Knee Replacement by Surgeon Assistive Tool (Primary Diagnosis OA)**




Note: Restricted to modern prostheses.

**Table KP15 Age and Gender of Primary Unicompartmental Knee Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 43306 | 55.4% | 24 | 98 | 66 | 65.9 | 9.6 |
| Female | 34913 | 44.6% | 13 | 98 | 65 | 65.0 | 10.2 |
| **TOTAL** | **78219** | **100.0%** | **13** | **98** | **65** | **65.5** | **9.8** |

**Table KP16 10 Most Used Tibial Prostheses in Primary Unicompartmental Knee Replacement**

| 2003 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 1365 | Oxford (ctd) | 1200 | Restoris MCK | 1271 | Restoris MCK | 1360 | Restoris MCK | 1617 | Restoris MCK |
| 444 | Repicci II | 777 | Oxford (cless) | 745 | Oxford (cless) | 777 | Persona | 773 | Persona |
| 373 | Preservation Fixed | 533 | Persona | 698 | Persona | 751 | Oxford (cless) | 694 | Oxford (cless) |
| 353 | M/G | 281 | ZUK | 146 | Journey Uni (v2) | 194 | Journey Uni (v2) | 170 | Journey Uni (v2) |
| 336 | Allegretto Uni | 177 | Sigma HP | 134 | Sigma HP | 134 | Sigma HP | 109 | BalanSys Uni Fixed |
| 321 | GRU | 163 | BalanSys Uni Fixed | 125 | BalanSys Uni Fixed | 116 | BalanSys Uni Fixed | 100 | Sigma HP |
| 275 | Genesis | 158 | Journey Uni (v2) | 111 | Genus | 103 | Genus | 90 | Oxford (ctd) |
| 260 | Unix | 124 | Oxford (ctd) | 108 | Oxford (ctd) | 92 | Oxford (ctd) | 65 | Genus |
| 121 | Preservation Mobile | 107 | Genus | 31 | ZUK | 25 | ZUK | 38 | ZUK |
| 101 | Endo-Model Sled | 10 | Journey Uni All Poly | 17 | Moto | 23 | Moto | 20 | Moto |
| **10 Most Used** | | | | | | | | | |
| 3949 | (10) 96.2% | 3530 | (10) 99.3% | 3386 | (10) 99.6% | 3575 | (10) 99.8% | 3676 | (10) 99.8% |
| **Remainder** | | | | | | | | | |
| 158 | (7) 3.8% | 24 | (5) 0.7% | 14 | (5) 0.4% | 7 | (2) 0.2% | 7 | (2) 0.2% |
| **TOTAL** | | | | | | | | | |
| 4107 | (17) 100.0% | 3554 | (15) 100.0% | 3400 | (15) 100.0% | 3582 | (12) 100.0% | 3683 | (12) 100.0% |

# Primary Partial Knee Replacement

**Table KP17 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Prosthesis Combination**

| Uni Femoral | Uni Tibial | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| BalanSys Uni | BalanSys Uni Fixed | 89 | 1435 | 1.9 (1.3, 2.8) | 3.8 (2.9, 5.0) | 4.8 (3.8, 6.2) | 8.9 (6.9, 11.5) | 13.5 (10.1, 17.8) | |
| Genus | Genus | 35 | 675 | 3.2 (2.1, 4.9) | 4.7 (3.2, 6.7) | 7.0 (4.8, 10.2) | | | |
| Journey Uni | Journey Uni (v2) | 116 | 1719 | 2.3 (1.7, 3.2) | 5.2 (4.2, 6.5) | 6.9 (5.7, 8.4) | 11.3 (9.0, 14.2) | | |
| | Journey Uni All Poly | 51 | 352 | 1.4 (0.6, 3.4) | 6.4 (4.3, 9.6) | 9.2 (6.6, 12.9) | 15.1 (11.4, 19.9) | | |
| Oxford (cless) | Oxford (cless) | 826 | 10442 | 2.6 (2.3, 2.9) | 4.5 (4.1, 5.0) | 5.8 (5.3, 6.3) | 10.3 (9.6, 11.2) | 18.9 (17.0, 21.0) | |
| | Oxford (ctd) | 66 | 550 | 3.2 (2.0, 5.1) | 6.3 (4.5, 8.8) | 9.0 (6.7, 11.9) | 14.4 (11.1, 18.4) | | |
| Oxford (ctd) | Oxford (ctd) | 2911 | 13753 | 2.1 (1.9, 2.4) | 5.7 (5.3, 6.1) | 8.1 (7.6, 8.6) | 14.5 (13.9, 15.2) | 22.0 (21.2, 22.8) | 30.3 (29.3, 31.5) |
| Persona | Persona | 66 | 2847 | 1.3 (0.9, 1.9) | 3.6 (2.8, 4.8) | | | | |
| Restoris MCK | Restoris MCK | 145 | 6792 | 0.7 (0.5, 1.0) | 2.7 (2.3, 3.3) | 4.1 (3.4, 4.9) | | | |
| Sigma HP | Sigma HP | 116 | 2015 | 1.1 (0.7, 1.7) | 3.0 (2.3, 3.9) | 4.3 (3.5, 5.4) | 7.3 (5.9, 9.0) | 12.2 (9.6, 15.4) | |
| Triathlon PKR | Triathlon PKR | 40 | 386 | 3.1 (1.8, 5.4) | 6.8 (4.7, 9.9) | 8.2 (5.8, 11.5) | 11.8 (8.7, 16.0) | | |
| ZUK | ZUK | 772 | 9673 | 1.5 (1.3, 1.8) | 3.4 (3.1, 3.8) | 4.6 (4.2, 5.1) | 8.0 (7.4, 8.7) | 12.4 (11.5, 13.5) | |
| Other (5) | | 25 | 271 | 3.8 (2.1, 7.0) | 5.7 (3.4, 9.4) | 8.1 (5.1, 12.7) | | | |
| TOTAL | | 5258 | 50910 | | | | | | |

Note: Restricted to modern prostheses.
Only prostheses with >200 procedures have been listed.

## OUTCOME FOR OSTEOARTHRITIS – PATIENT CHARACTERISTICS

In order to keep Registry data contemporaneous, only procedures using prostheses that have been available and used in 2024 (described as modern prostheses) are included in the analyses, unless clearly specified.

There are 5,206 revisions of 50,481 primary unicompartmental knee replacement procedures with an initial diagnosis of osteoarthritis for analysis this year. There are 27,054 further unicompartmental procedures excluded from the analyses as the prosthesis is no longer used or the initial diagnosis is not osteoarthritis.

The cumulative percent revision for primary unicompartmental knee replacement undertaken for osteoarthritis is 11.3% at 10 years and 26.7% at 20 years (Table KP18 and Figure KT17).

### Reasons for Revision

The main reasons for revision of unicompartmental knee replacement are progression of disease, loosening and pain (Table KP19 and Figure KP18). The main type of revision is to a total knee replacement (Table KP20).

### Age and Gender

Age is a major factor affecting the outcome of primary unicompartmental knee replacement, with the rate of revision decreasing with increasing age (Table KP21 and Figure KP19). Females have a higher rate of revision than males (Table KP22 and Figure KP20). The main reason for this difference is an increased cumulative incidence for progression of disease (Figure KP21). The effect of age on the rate of revision is evident in both males and females (Table KP22, Figure KP22 and Figure KP23).

### ASA and BMI

ASA scores have been collected since 2012. There are 32,537 primary unicompartmental knee replacement procedures for osteoarthritis with these scores. When compared to patients with an ASA score of 1, patients with an ASA score of 3 have a higher rate of revision (Table KP23 and Figure KP24). The most common reasons for revision are shown in Figure KP25.

BMI data have been collected since 2015. There are revision outcomes for 28,769 primary unicompartmental knee replacement procedures for osteoarthritis in relation to BMI category. There is no difference in the rate of revision comparing normal BMI to other categories (Table KP24 and Figure KP26). The most common reasons for revision are shown in Figure KP27.

# Primary Partial Knee Replacement

**Table KP18 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement (Primary Diagnosis OA)**

| Knee Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Unicompartmental | 5206 | 50481 | 1.9 (1.8, 2.0) | 4.4 (4.2, 4.6) | 6.1 (5.9, 6.4) | 8.0 (7.8, 8.3) | 11.3 (10.9, 11.7) | 18.2 (17.7, 18.8) | 26.7 (25.7, 27.7) |
| TOTAL | 5206 | 50481 | | | | | | | |

Note: Restricted to modern prostheses.

**Figure KP17 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Unicompartmental | 50481 | 45754 | 37393 | 29802 | 23380 | 15653 | 6794 | 1724 |

Note: Restricted to modern prostheses.

**Table KP19 Primary Unicompartmental Knee Replacement by Reason for Revision (Primary Diagnosis OA)**

| Reason for Revision | Number | Percent |
|---|---|---|
| Progression Of Disease | 1997 | 38.4 |
| Loosening | 1572 | 30.2 |
| Pain | 372 | 7.1 |
| Infection | 263 | 5.1 |
| Bearing Dislocation | 201 | 3.9 |
| Fracture | 158 | 3.0 |
| Instability | 108 | 2.1 |
| Lysis | 97 | 1.9 |
| Wear Tibial Insert | 88 | 1.7 |
| Malalignment | 66 | 1.3 |
| Implant Breakage Tibial Insert | 61 | 1.2 |
| Other (13) | 223 | 4.3 |
| TOTAL | 5206 | 100.0 |

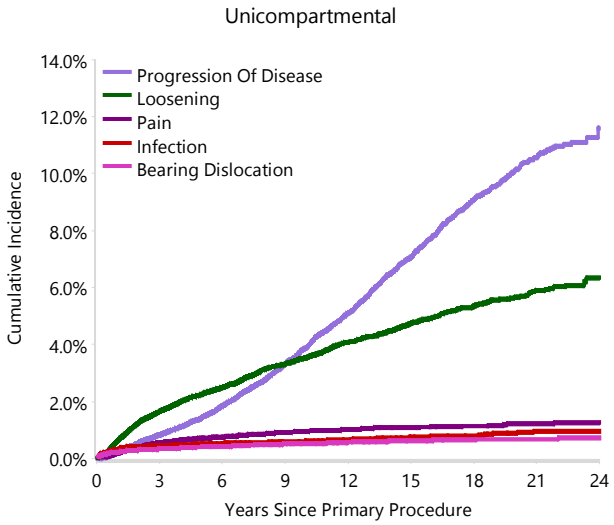
Note: Restricted to modern prostheses.

**Table KP20 Primary Unicompartmental Knee Replacement by Type of Revision (Primary Diagnosis OA)**

| Type of Revision | Number | Percent |
|---|---|---|
| TKR (Tibial/Femoral) | 4388 | 84.3 |
| Uni Insert Only | 572 | 11.0 |
| Uni Tibial Component | 95 | 1.8 |
| Uni Femoral Component | 46 | 0.9 |
| Cement Spacer | 40 | 0.8 |
| UKR (Uni Tibial/Uni Femoral) | 34 | 0.7 |
| Patella/Trochlear Resurfacing | 16 | 0.3 |
| Removal of Prostheses | 5 | 0.1 |
| Reinsertion of Components | 4 | 0.1 |
| Femoral Component* | 4 | 0.1 |
| Tibial Component | 1 | 0.0 |
| Patella Only | 1 | 0.0 |
| TOTAL | 5206 | 100.0 |

Note: Restricted to modern prostheses. *Bicompartmental component.

**Figure KP18 Cumulative Incidence Revision Diagnosis of Primary Unicompartmental Knee Replacement (Primary Diagnosis OA)**




Note: Restricted to modern prostheses.

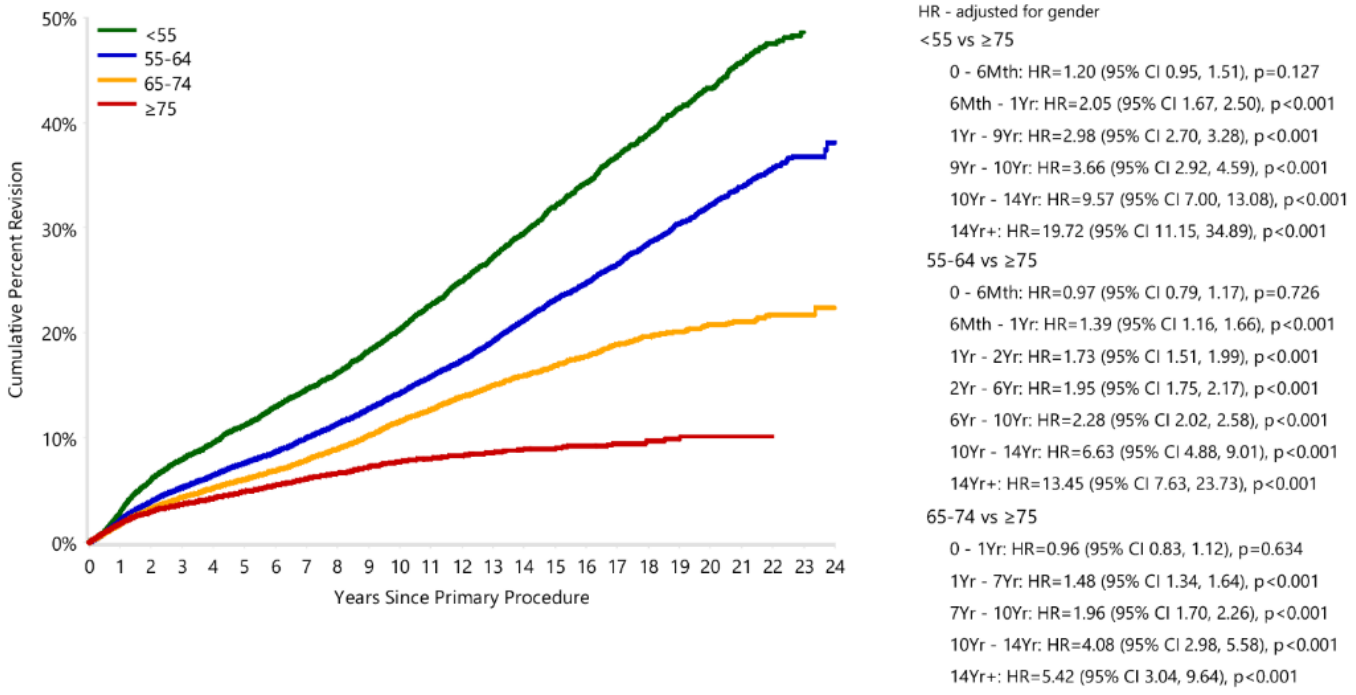
# Primary Partial Knee Replacement

**Table KP21 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Age (Primary Diagnosis OA)**

| Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| <55 | 1119 | 6582 | 2.6 (2.3, 3.1) | 6.7 (6.1, 7.4) | 9.3 (8.6, 10.1) | 16.8 (15.7, 18.0) | 26.7 (25.1, 28.4) | 39.1 (36.6, 41.7) |
| 55-64 | 2055 | 16494 | 1.9 (1.7, 2.1) | 4.6 (4.3, 4.9) | 6.6 (6.2, 7.0) | 11.9 (11.3, 12.5) | 20.3 (19.3, 21.3) | 30.3 (28.7, 31.9) |
| 65-74 | 1532 | 17651 | 1.6 (1.5, 1.8) | 3.8 (3.5, 4.1) | 5.3 (5.0, 5.7) | 10.4 (9.8, 11.0) | 15.9 (15.0, 16.8) | 20.7 (19.3, 22.2) |
| ≥75 | 500 | 9754 | 1.8 (1.5, 2.1) | 3.4 (3.1, 3.8) | 4.4 (4.0, 4.9) | 7.4 (6.8, 8.2) | 8.6 (7.8, 9.6) | 10.4 (8.7, 12.5) |
| TOTAL | 5206 | 50481 | | | | | | |

Note: Restricted to modern prostheses.

**Figure KP19 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Age (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| <55 | 10624 | 9881 | 8483 | 7339 | 4658 | 2715 | 873 |
| 55-64 | 25436 | 23784 | 20870 | 18146 | 11694 | 6923 | 2147 |
| 65-74 | 26334 | 24510 | 21234 | 18019 | 10515 | 5645 | 1527 |
| ≥75 | 15141 | 13917 | 11707 | 9572 | 4785 | 1715 | 257 |

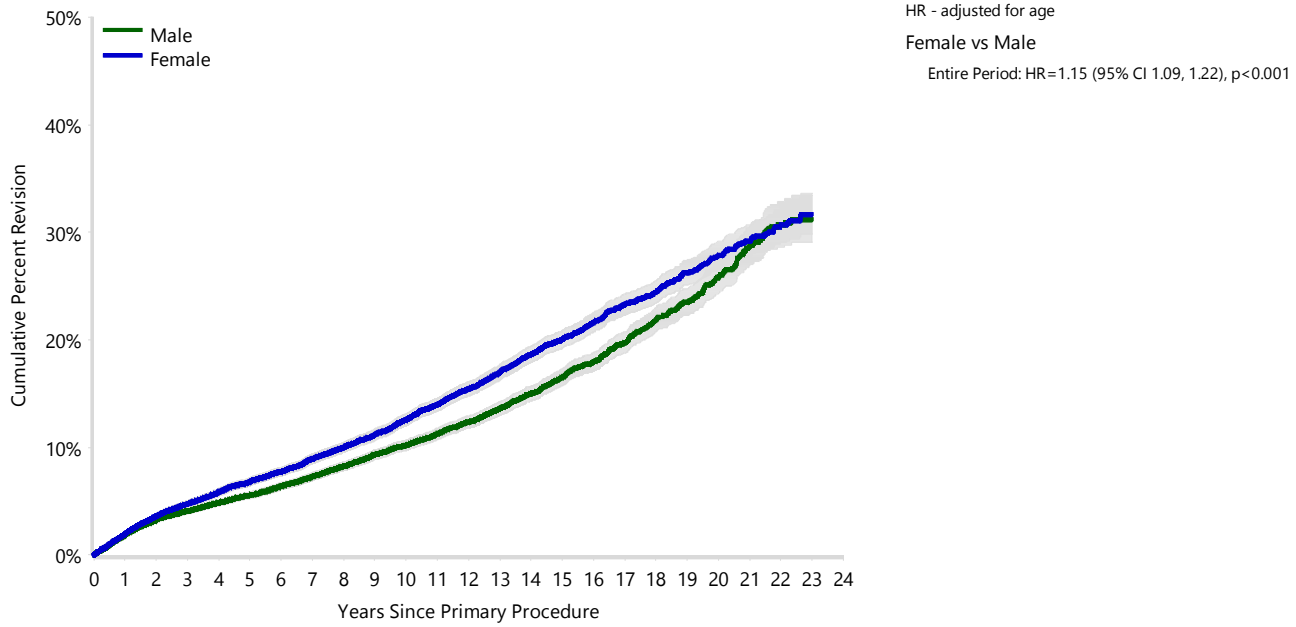
Note: Restricted to modern prostheses.

**Table KP22 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Gender and Age (Primary Diagnosis OA)**

| Gender | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| **Male** | | **2509** | **28369** | **1.8 (1.7, 2.0)** | **4.1 (3.9, 4.4)** | **5.6 (5.3, 5.9)** | **10.2 (9.7, 10.7)** | **16.5 (15.7, 17.3)** | **25.7 (24.3, 27.3)** |
| | **<55** | 488 | 3186 | 2.7 (2.2, 3.3) | 6.3 (5.5, 7.3) | 8.5 (7.5, 9.7) | 16.5 (14.8, 18.3) | 26.5 (24.0, 29.3) | 40.7 (36.5, 45.2) |
| | **55-64** | 1031 | 9346 | 1.9 (1.6, 2.2) | 4.4 (3.9, 4.8) | 6.1 (5.6, 6.7) | 11.2 (10.5, 12.1) | 18.8 (17.5, 20.1) | 29.5 (27.3, 31.9) |
| | **65-74** | 747 | 10281 | 1.6 (1.3, 1.8) | 3.6 (3.2, 4.0) | 4.9 (4.4, 5.4) | 8.9 (8.2, 9.7) | 13.7 (12.6, 14.9) | 18.9 (16.9, 21.1) |
| | **≥75** | 243 | 5556 | 1.7 (1.4, 2.1) | 3.3 (2.8, 3.8) | 4.1 (3.5, 4.7) | 6.4 (5.6, 7.3) | 7.6 (6.4, 8.9) | |
| **Female** | | **2697** | **22112** | **2.0 (1.8, 2.1)** | **4.8 (4.5, 5.1)** | **6.8 (6.4, 7.1)** | **12.5 (12.0, 13.1)** | **20.0 (19.2, 20.9)** | **27.8 (26.5, 29.1)** |
| | **<55** | 631 | 3396 | 2.6 (2.1, 3.2) | 7.1 (6.3, 8.1) | 10.0 (8.9, 11.1) | 17.2 (15.7, 18.8) | 27.0 (24.9, 29.2) | 38.3 (35.2, 41.6) |
| | **55-64** | 1024 | 7148 | 1.9 (1.6, 2.2) | 4.9 (4.4, 5.5) | 7.2 (6.6, 7.9) | 12.6 (11.7, 13.6) | 21.9 (20.5, 23.3) | 31.2 (29.1, 33.4) |
| | **65-74** | 785 | 7370 | 1.8 (1.5, 2.1) | 4.1 (3.7, 4.6) | 5.9 (5.3, 6.5) | 12.3 (11.3, 13.3) | 18.5 (17.2, 19.9) | 22.9 (21.0, 24.9) |
| | **≥75** | 257 | 4198 | 1.9 (1.5, 2.3) | 3.6 (3.1, 4.3) | 4.9 (4.2, 5.7) | 8.6 (7.5, 9.8) | 9.8 (8.5, 11.2) | 11.2 (9.2, 13.6) |
| **TOTAL** | | **5206** | **50481** | | | | | | |

Note: Restricted to modern prostheses.

**Figure KP20 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Gender (Primary Diagnosis OA)**

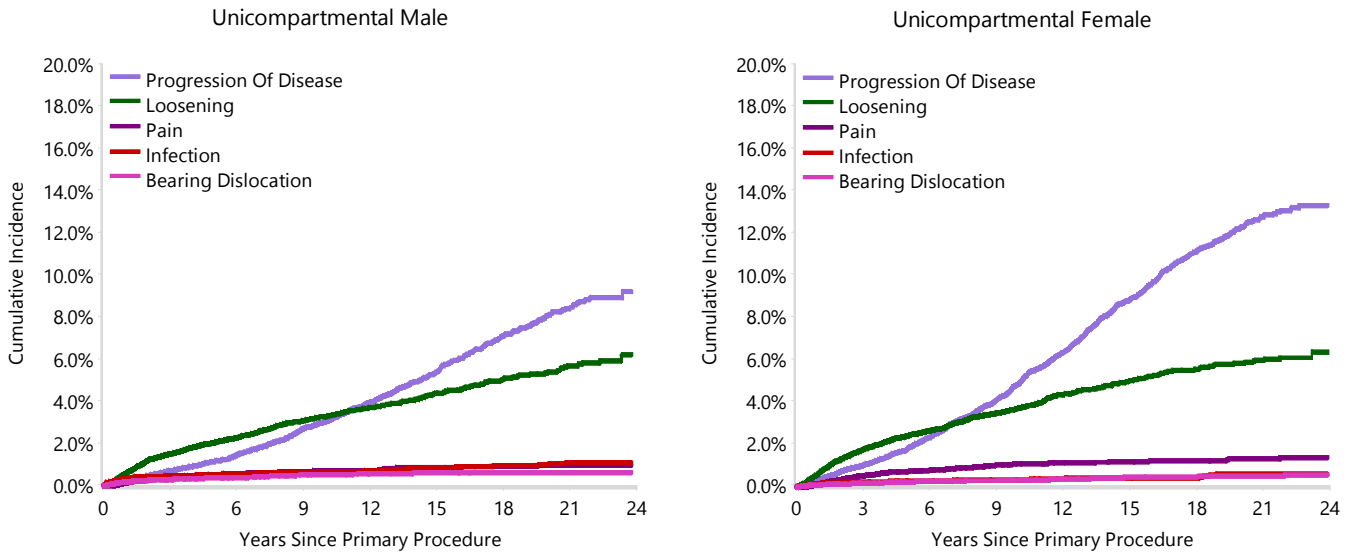



| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| **Male** | 28369 | 25502 | 20415 | 15915 | 7904 | 3208 | 750 |
| **Female** | 22112 | 20252 | 16978 | 13887 | 7749 | 3586 | 974 |

Note: Restricted to modern prostheses.

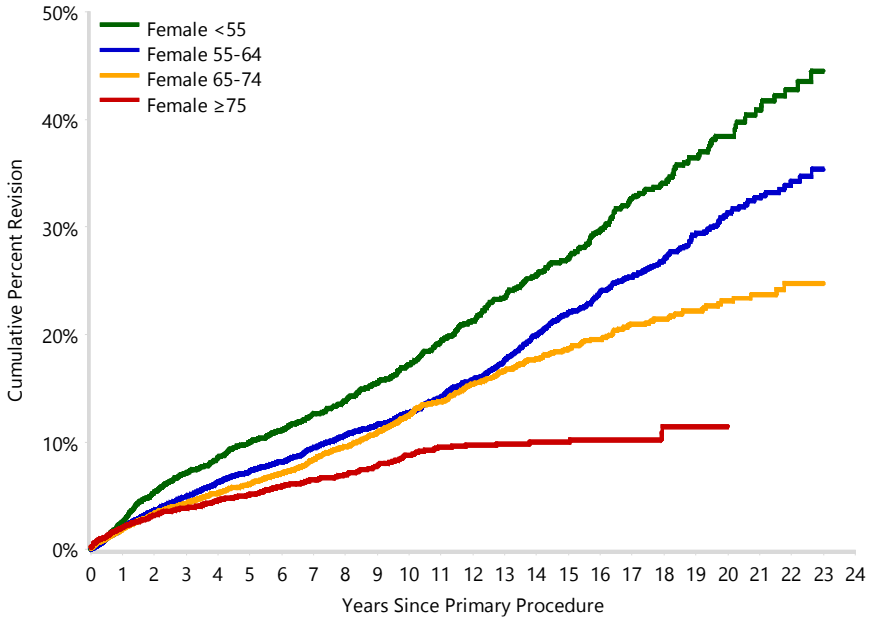
# Primary Partial Knee Replacement

**Figure KP21 Cumulative Incidence Revision Diagnosis of Primary Unicompartmental Knee Replacement by Gender (Primary Diagnosis OA)**




Note: Restricted to modern prostheses.

**Figure KP22 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement for Females by Age (Primary Diagnosis OA)**




Female <55 vs Female ≥75
- 0 - 1Yr: HR=1.38 (95% CI 1.01, 1.87), p=0.043
- 1Yr - 11Yr: HR=2.40 (95% CI 2.01, 2.88), p<0.001
- 11Yr - 12Yr: HR=8.93 (95% CI 3.71, 21.49), p<0.001
- 12Yr+: HR=18.11 (95% CI 8.40, 39.01), p<0.001

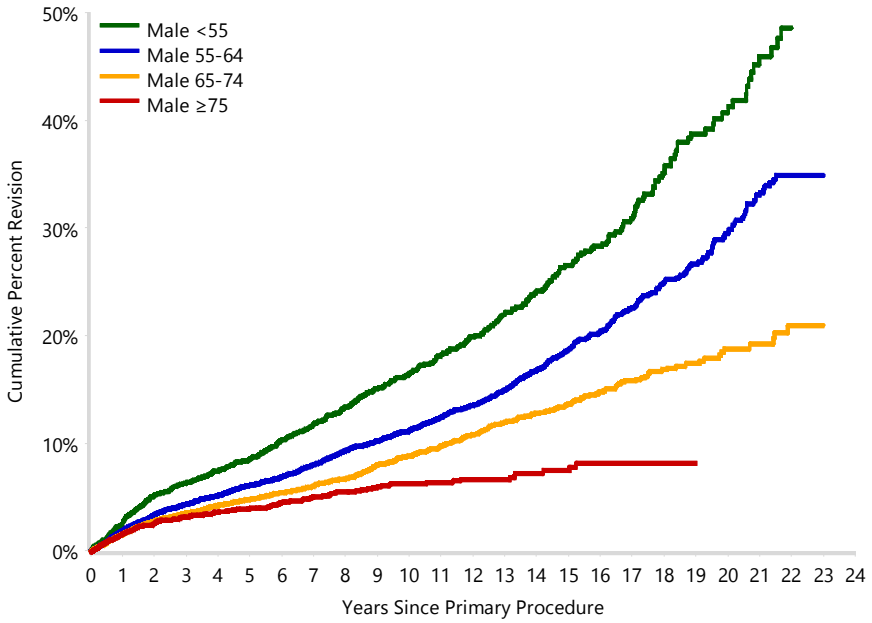
Female 55-64 vs Female ≥75
- 0 - 1Yr: HR=1.00 (95% CI 0.75, 1.33), p=0.998
- 1Yr - 11Yr: HR=1.70 (95% CI 1.43, 2.01), p<0.001
- 11Yr - 12Yr: HR=7.45 (95% CI 3.24, 17.14), p<0.001
- 12Yr+: HR=14.41 (95% CI 6.74, 30.80), p<0.001

Female 65-74 vs Female ≥75
- 0 - 1Yr: HR=0.94 (95% CI 0.70, 1.24), p=0.650
- 1Yr - 11Yr: HR=1.57 (95% CI 1.32, 1.86), p<0.001
- 11Yr+: HR=7.29 (95% CI 3.41, 15.58), p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| **Female** | **<55** | 3396 | 3098 | 2584 | 2170 | 1266 | 624 | 199 |
| | **55-64** | 7148 | 6608 | 5651 | 4731 | 2873 | 1428 | 405 |
| | **65-74** | 7370 | 6749 | 5668 | 4550 | 2457 | 1137 | 305 |
| | **≥75** | 4198 | 3797 | 3075 | 2436 | 1153 | 397 | 65 |

Note: Restricted to modern prostheses.

**Figure KP23 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement for Males by Age (Primary Diagnosis OA)**




Male <55 vs Male ≥75

0 - 1Yr: HR=1.74 (95% CI 1.32, 2.30), p<0.001

1Yr - 3Yr: HR=2.33 (95% CI 1.82, 2.99), p<0.001

3Yr - 9Yr: HR=3.03 (95% CI 2.40, 3.82), p<0.001

9Yr - 10Yr: HR=3.56 (95% CI 1.99, 6.39), p<0.001

10Yr+: HR=10.60 (95% CI 5.58, 20.15), p<0.001

Male 55-64 vs Male ≥75

0 - 2Yr: HR=1.29 (95% CI 1.07, 1.56), p=0.007

2Yr - 10Yr: HR=1.99 (95% CI 1.65, 2.40), p<0.001

10Yr+: HR=6.91 (95% CI 3.68, 12.97), p<0.001

Male 65-74 vs Male ≥75

0 - 1Yr: HR=1.01 (95% CI 0.80, 1.28), p=0.924

1Yr - 8Yr: HR=1.30 (95% CI 1.09, 1.55), p=0.003

8Yr - 10Yr: HR=2.15 (95% CI 1.54, 2.99), p<0.001

10Yr+: HR=3.96 (95% CI 2.09, 7.52), p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| **Male** | **<55** | 3186 | 2876 | 2261 | 1769 | 901 | 399 | 106 |
| | **55-64** | 9346 | 8464 | 6912 | 5546 | 3028 | 1382 | 364 |
| | **65-74** | 10281 | 9265 | 7474 | 5845 | 2893 | 1144 | 248 |
| | **≥75** | 5556 | 4897 | 3768 | 2755 | 1082 | 283 | 32 |

Note: Restricted to modern prostheses.

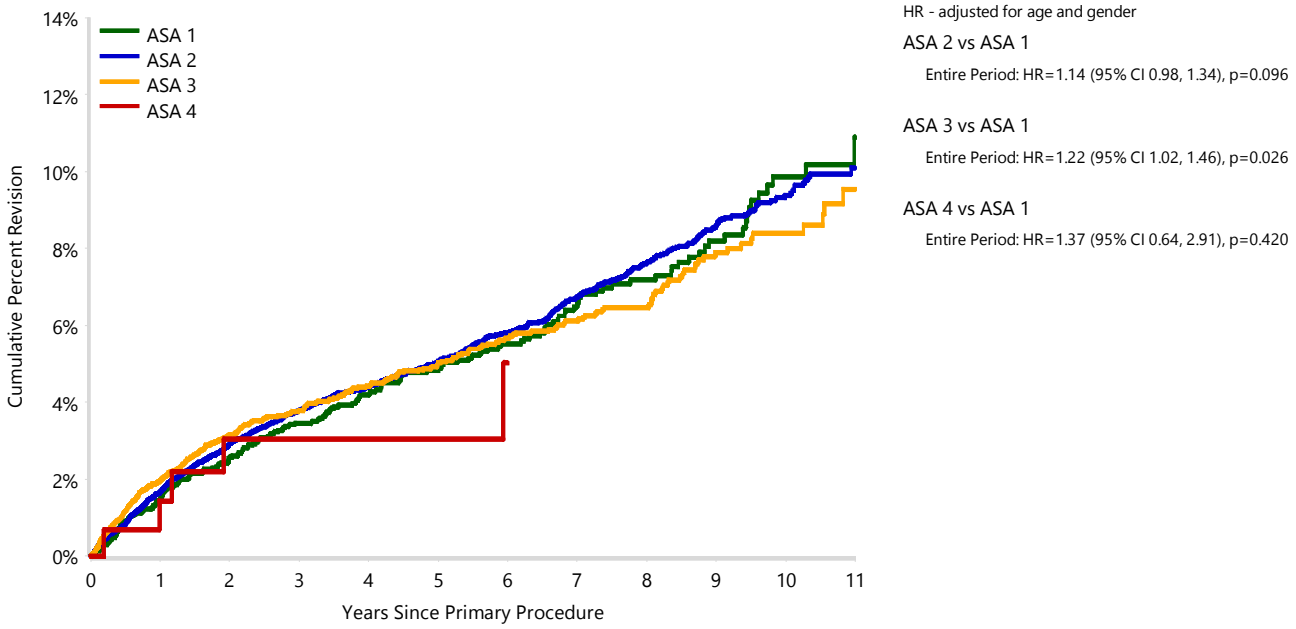
# Primary Partial Knee Replacement

**Table KP23 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by ASA Score (Primary Diagnosis OA)**

| ASA Score | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|---|
| ASA 1 | 189 | 3384 | 1.5 (1.1, 1.9) | 3.5 (2.9, 4.2) | 4.8 (4.1, 5.7) | 6.5 (5.5, 7.6) | 9.9 (8.3, 11.7) | 10.9 (8.8, 13.4) |
| ASA 2 | 1016 | 19772 | 1.7 (1.5, 1.9) | 3.8 (3.5, 4.1) | 5.1 (4.7, 5.4) | 6.7 (6.3, 7.2) | 9.4 (8.7, 10.1) | 10.1 (9.3, 11.0) |
| ASA 3 | 423 | 9232 | 2.0 (1.7, 2.3) | 3.8 (3.4, 4.2) | 5.0 (4.5, 5.6) | 6.1 (5.5, 6.8) | 8.4 (7.4, 9.5) | 9.6 (8.1, 11.2) |
| ASA 4 | 7 | 149 | 1.4 (0.4, 5.7) | 3.1 (1.2, 8.0) | 3.1 (1.2, 8.0) | | | |
| TOTAL | 1635 | 32537 | | | | | | |

Note: Excludes 17,944 procedures with unknown ASA score.
Restricted to modern prostheses.

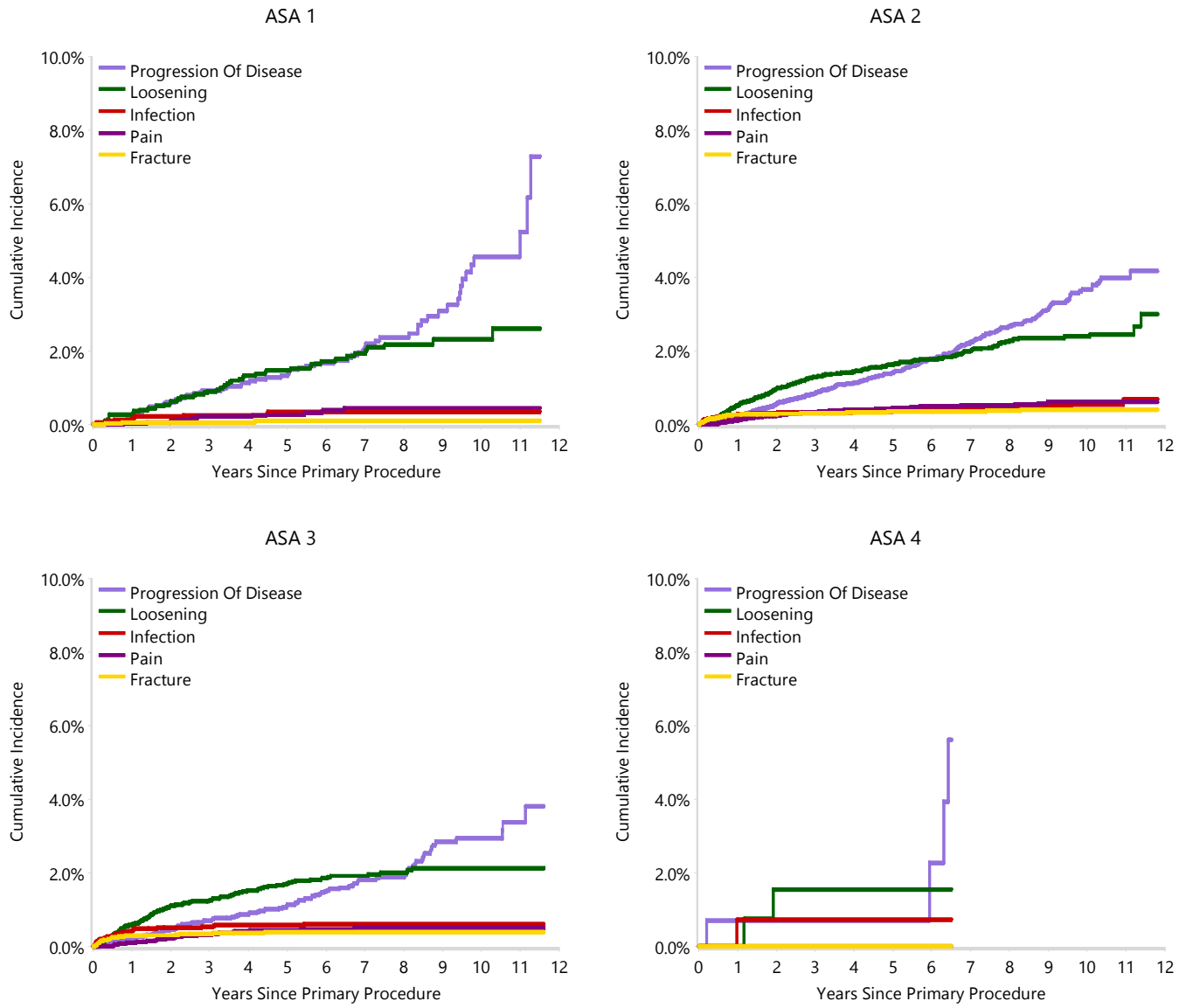
**Figure KP24 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by ASA Score (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|
| ASA 1 | 3384 | 3076 | 2416 | 1758 | 1148 | 372 | 125 |
| ASA 2 | 19772 | 17239 | 12814 | 8743 | 5319 | 1498 | 535 |
| ASA 3 | 9232 | 7827 | 5453 | 3431 | 1948 | 518 | 207 |
| ASA 4 | 149 | 132 | 100 | 62 | 35 | 9 | 3 |

Note: Excludes 17,944 procedures with unknown ASA score.
Restricted to modern prostheses.

**Figure KP25 Cumulative Incidence Revision Diagnosis of Primary Unicompartmental Knee Replacement by ASA Score (Primary Diagnosis OA)**




Note: Excludes 17,944 procedures with unknown ASA score.
Restricted to modern prostheses.

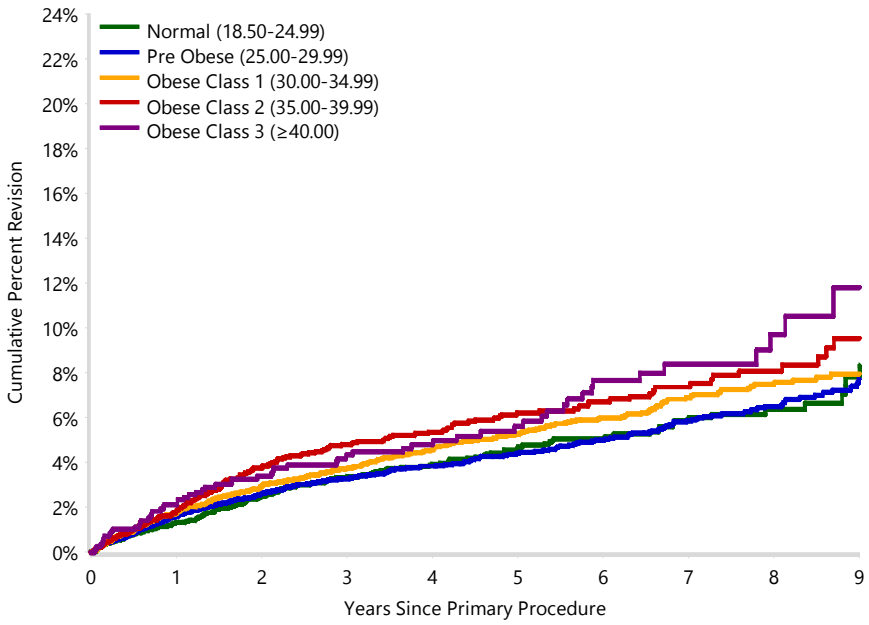
# Primary Partial Knee Replacement

**Table KP24 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by BMI Category (Primary Diagnosis OA)**

| BMI Category | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|
| Underweight | 3 | 45 | 2.2 (0.3, 14.7) | 5.1 (1.3, 19.1) | 5.1 (1.3, 19.1) | 5.1 (1.3, 19.1) | |
| Normal | 159 | 4092 | 1.3 (1.0, 1.7) | 3.4 (2.8, 4.0) | 4.6 (3.9, 5.5) | 6.0 (5.0, 7.2) | 8.3 (6.5, 10.6) |
| Pre Obese | 467 | 11694 | 1.6 (1.4, 1.8) | 3.3 (3.0, 3.7) | 4.4 (4.0, 4.9) | 5.9 (5.3, 6.5) | 7.7 (6.8, 8.8) |
| Obese Class 1 | 410 | 8805 | 1.8 (1.5, 2.1) | 3.8 (3.3, 4.2) | 5.3 (4.8, 5.9) | 6.9 (6.2, 7.7) | 8.0 (7.1, 9.0) |
| Obese Class 2 | 163 | 3061 | 1.8 (1.4, 2.4) | 4.8 (4.0, 5.7) | 6.2 (5.3, 7.4) | 7.4 (6.3, 8.7) | 9.6 (7.8, 11.8) |
| Obese Class 3 | 62 | 1072 | 2.2 (1.4, 3.3) | 4.4 (3.2, 5.9) | 5.6 (4.2, 7.5) | 8.4 (6.4, 11.1) | 11.8 (8.3, 16.7) |
| TOTAL | 1264 | 28769 | | | | | |

Note: Excludes 21,712 procedures with unknown BMI.
BMI has not been presented for patients aged ≤19 years.
Restricted to modern prostheses

**Figure KP26 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by BMI Category (Primary Diagnosis OA)**




HR - adjusted for age and gender

Pre Obese (25.00-29.99) vs Normal (18.50-24.99)
Entire Period: HR=0.98 (95% CI 0.82, 1.18), p=0.832

Obese Class 1 (30.00-34.99) vs Normal (18.50-24.99)
Entire Period: HR=1.09 (95% CI 0.91, 1.31), p=0.362

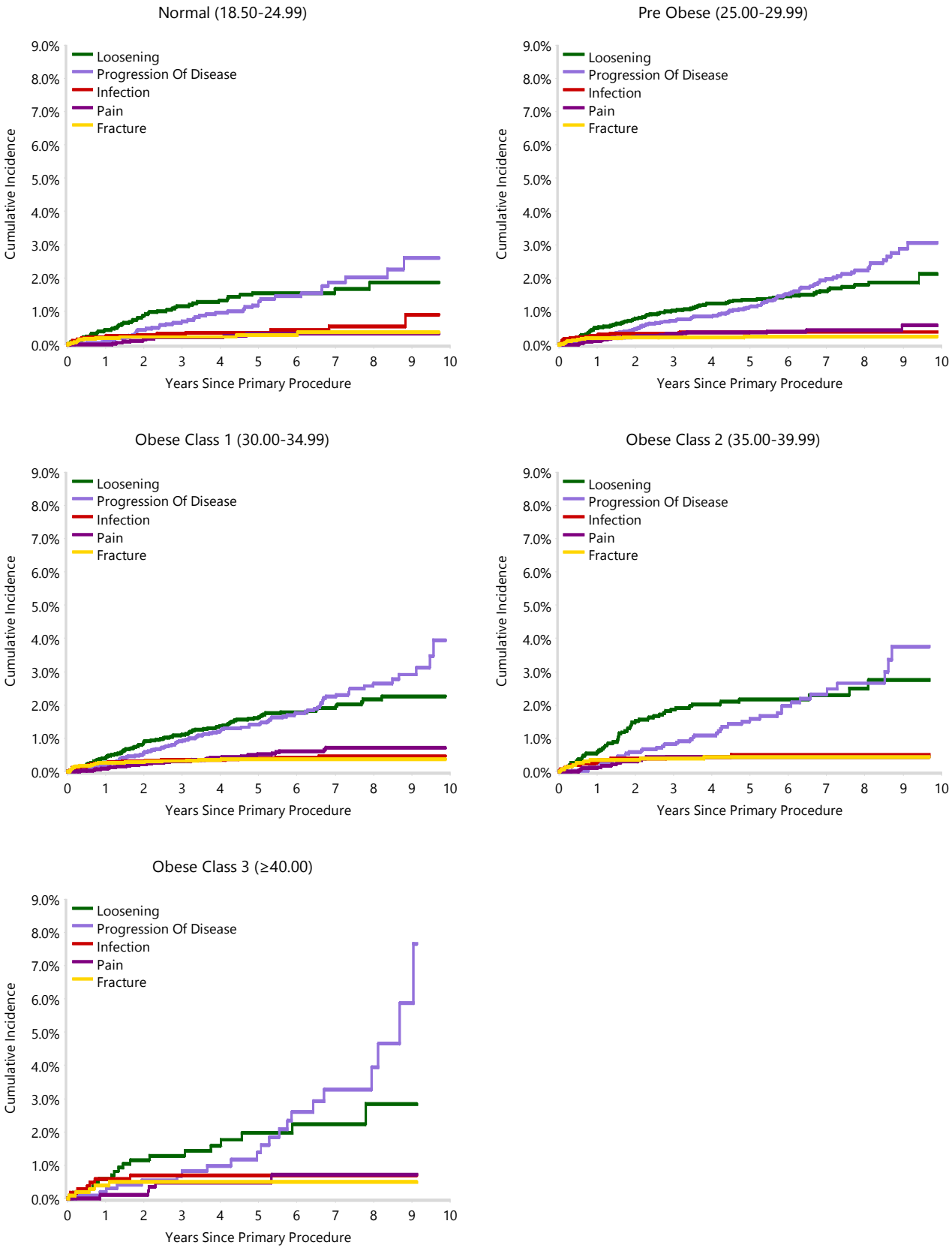
Obese Class 2 (35.00-39.99) vs Normal (18.50-24.99)
Entire Period: HR=1.21 (95% CI 0.97, 1.51), p=0.092

Obese Class 3 (≥40.00) vs Normal (18.50-24.99)
Entire Period: HR=1.22 (95% CI 0.90, 1.64), p=0.196

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|---|---|
| Normal | 4092 | 3476 | 2929 | 2410 | 1900 | 1447 | 987 | 695 | 415 | 196 |
| Pre Obese | 11694 | 10024 | 8456 | 7027 | 5647 | 4371 | 3201 | 2217 | 1303 | 573 |
| Obese Class 1 | 8805 | 7545 | 6422 | 5364 | 4284 | 3288 | 2432 | 1664 | 1013 | 452 |
| Obese Class 2 | 3061 | 2620 | 2185 | 1835 | 1471 | 1148 | 834 | 583 | 358 | 159 |
| Obese Class 3 | 1072 | 917 | 772 | 655 | 530 | 417 | 315 | 209 | 124 | 47 |

Note: Excludes 21,712 procedures with unknown BMI. BMI has not been presented for patients aged ≤19 years.
Restricted to modern prostheses.
Underweight BMI category excluded due to low numbers.

**Figure KP27 Cumulative Incidence Revision Diagnosis of Primary Unicompartmental Knee Replacement by BMI Category (Primary Diagnosis OA)**




Note: Excludes 21,712 procedures with unknown BMI. BMI has not been presented for patients aged ≤19 years. Restricted to modern prostheses.

# Primary Partial Knee Replacement

## OUTCOME BY PROSTHESIS CHARACTERISTICS

### Bearing Mobility

Fixed bearings are used in 51.1% of unicompartmental knee replacements, while in the remainder the bearing insert is mobile.

There are two prostheses using mobile bearings in 2024. Fixed bearing prostheses have a lower rate of revision compared to mobile bearing prostheses (Table KP25 and Figure KP28).

### Bearing Surface

XLPE is used for 26.1% of unicompartmental procedures. When compared to XLPE, procedures using non XLPE have a higher rate of revision (Table KP26 and Figure KP29).

### Fixation

Cement fixation is used for 76.8% of unicompartmental knee replacements, cementless fixation for 21.6%, with hybrid fixation used rarely. In 2024, there are 2 prostheses used with cementless fixation. For the first 6 months, cemented fixation has a lower rate of revision, but after 6 months, cementless fixation has a lower rate of revision (Table KP27 and Figure KP30).

### Surgeon Assistive Tools

Computer navigation, image derived instrumentation (IDI) and robotic assistance, to aid implantation of knee replacements, have been labelled as 'surgeon assistive tools'. Computer navigation and IDI are rarely used for unicompartmental knee replacement.

There are 7,743 robotically assisted unicompartmental knee replacement procedures undertaken for osteoarthritis recorded since 2015. In 2024, 53.4% of unicompartmental knee procedures use robotic assistance.

When adjusted for age, gender, ASA, BMI, surgeon volume and mobility, unicompartmental knee procedures using robotic assistance have a lower rate of revision compared to unicompartmental procedures using traditional instrumentation after 3.5 years (Table KP28 and Figure KP31).

The most common reasons for revision with and without robotic assistance are shown in Table KP29 and Figure KP32.

There are only two unicompartmental combinations that can be used both with and without robotic assistance. The results of these combinations are shown in Table KP30.

### Position

There are 1,143 lateral unicompartmental knee procedures undertaken for osteoarthritis. For the first three months, the lateral unicompartmental knee has a higher rate of revision compared to medial unicompartmental knee replacement, but after 3 months, there is no difference (Table KP31 and Figure KP35). When lateral unicompartmental knee replacement is assessed for bearing mobility, fixed bearing prostheses have a lower rate of revision compared to mobile bearings (Table KP32 and Figure KP36).

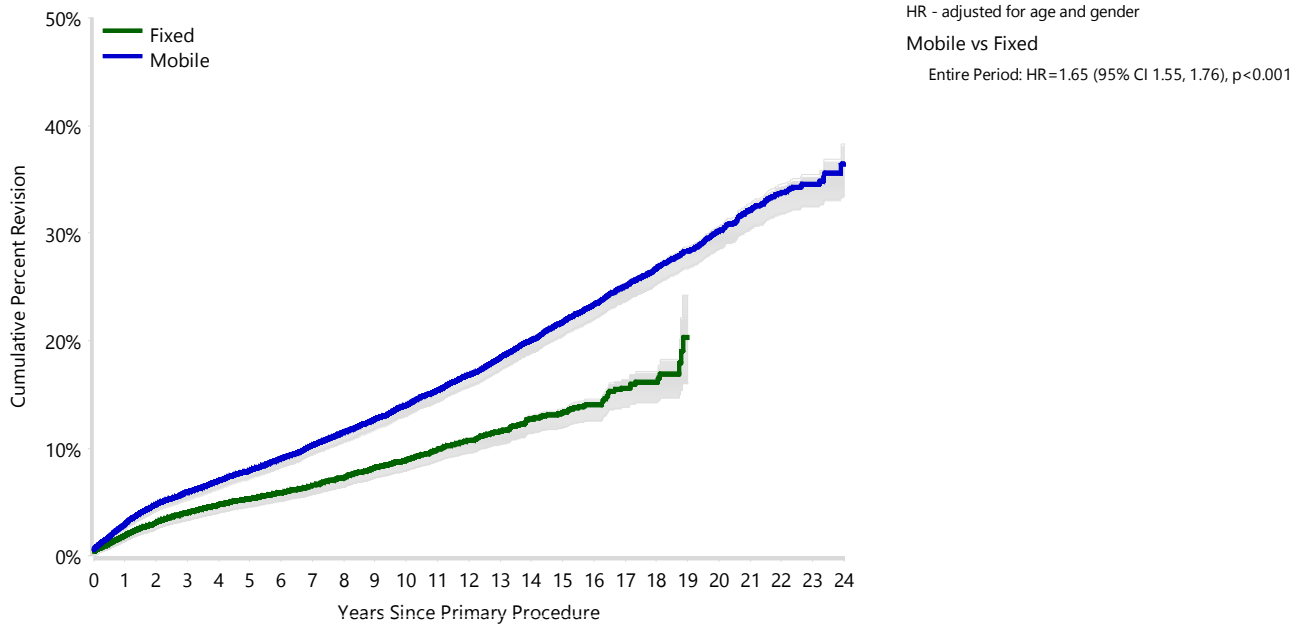
The most common reasons for revision of both lateral and medial unicompartmental knees are progression of disease and loosening (Table KP33 and Figure KP37).

**Table KP25 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Mobility (Primary Diagnosis OA)**

| Mobility | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Fixed | 1414 | 25783 | 1.4 (1.3, 1.6) | 3.5 (3.3, 3.7) | 4.8 (4.5, 5.1) | 8.3 (7.8, 8.9) | 12.7 (11.8, 13.6) | |
| Mobile | 3791 | 24695 | 2.4 (2.2, 2.6) | 5.3 (5.0, 5.5) | 7.3 (6.9, 7.6) | 13.2 (12.7, 13.7) | 20.9 (20.2, 21.6) | 29.3 (28.2, 30.3) |
| TOTAL | 5205 | 50478 | | | | | | |

Note: Excludes 3 primary unicompartmental knee procedures with unknown/missing mobility.
Restricted to modern prostheses.

**Figure KP28 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Mobility (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Fixed | 25783 | 22494 | 16748 | 11753 | 4721 | 1313 | 3 |
| Mobile | 24695 | 23258 | 20645 | 18049 | 10932 | 5481 | 1721 |

Note: Restricted to modern prostheses.

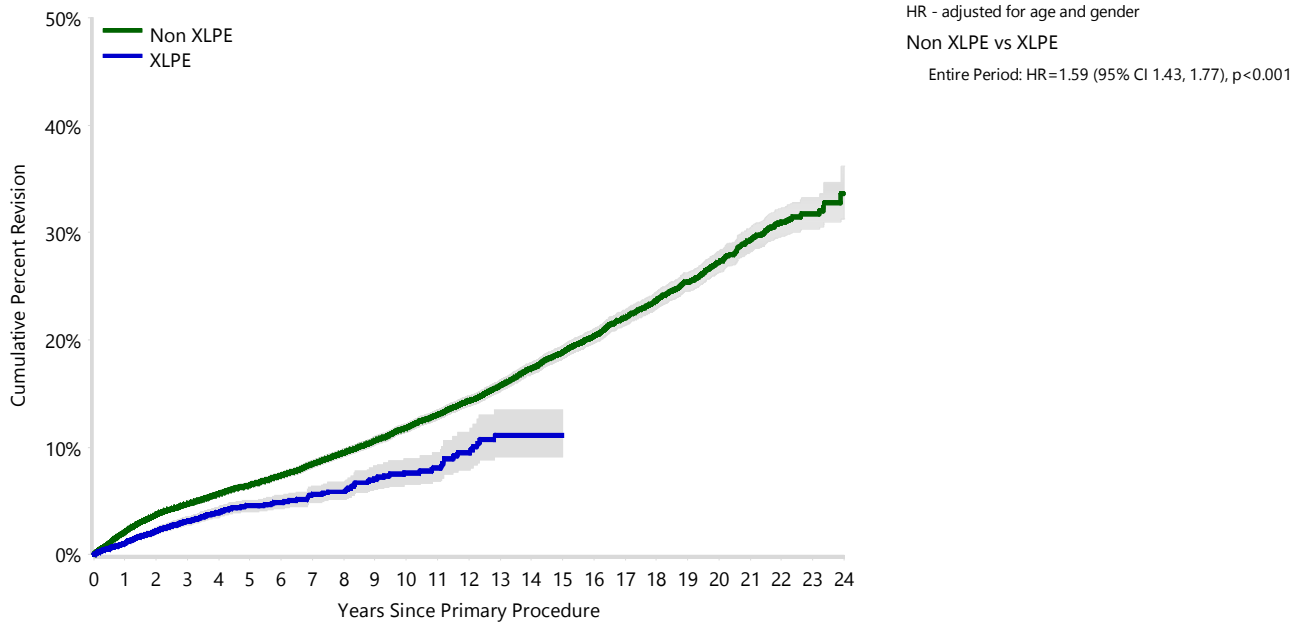
# Primary Partial Knee Replacement

**Table KP26 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Polyethylene Type (Primary Diagnosis OA)**

| Polyethylene Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Non XLPE | 4660 | 36109 | 2.1 (2.0, 2.3) | 4.7 (4.5, 5.0) | 6.5 (6.2, 6.7) | 11.8 (11.4, 12.2) | 18.8 (18.2, 19.4) | 27.2 (26.3, 28.2) |
| XLPE | 384 | 12730 | 1.0 (0.9, 1.2) | 3.1 (2.8, 3.5) | 4.5 (4.0, 5.1) | 7.6 (6.5, 8.9) | 11.1 (9.1, 13.5) | |
| TOTAL | 5044 | 48839 | | | | | | |

Note: Excludes 1,642 primary unicompartmental knee procedures with unknown/missing polyethylene type.
Restricted to modern prostheses.

**Figure KP29 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Polyethylene Type (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Non XLPE | 36109 | 34231 | 30840 | 26743 | 14533 | 6563 | 1724 |
| XLPE | 12730 | 9998 | 5307 | 2119 | 559 | 63 | 0 |

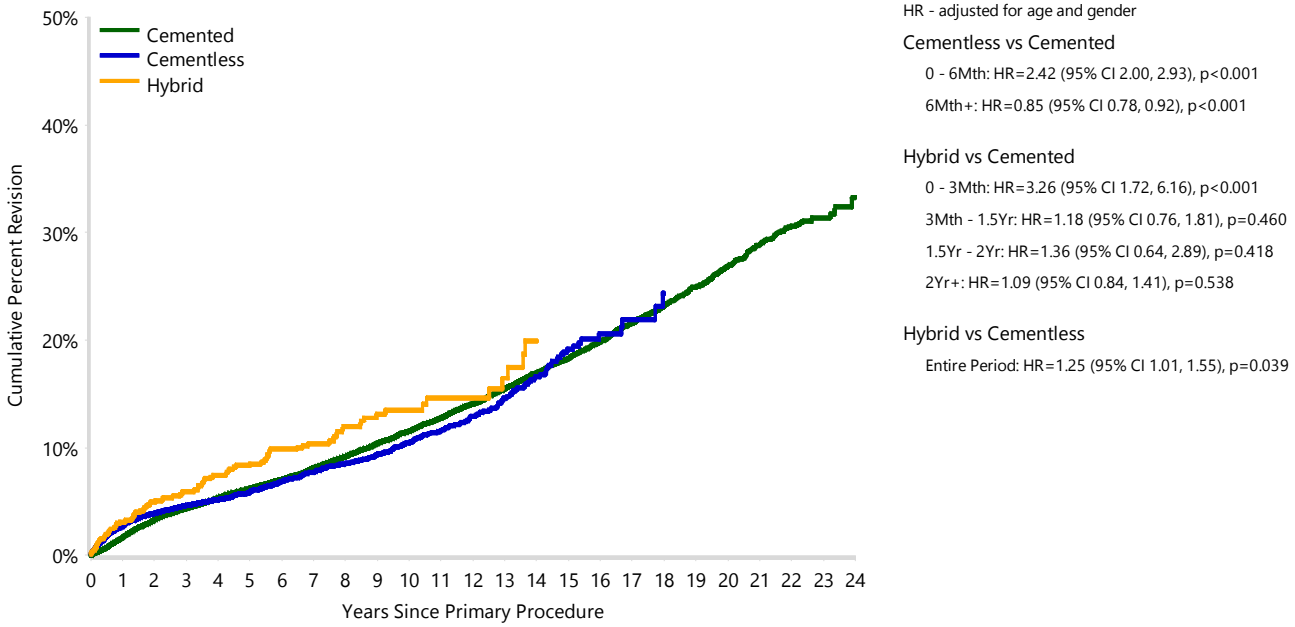
Note: Restricted to modern prostheses.

**Table KP27 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Fixation (Primary Diagnosis OA)**

| Fixation | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cemented | 4267 | 38745 | 1.7 (1.5, 1.8) | 4.3 (4.1, 4.5) | 6.2 (5.9, 6.4) | 11.5 (11.1, 11.9) | 18.2 (17.6, 18.8) | 26.7 (25.7, 27.8) |
| Cementless | 844 | 10914 | 2.6 (2.3, 2.9) | 4.5 (4.1, 4.9) | 5.8 (5.4, 6.3) | 10.4 (9.6, 11.2) | 19.0 (17.1, 21.2) | |
| Hybrid | 95 | 822 | 3.0 (2.0, 4.4) | 5.8 (4.4, 7.7) | 8.4 (6.6, 10.6) | 13.3 (10.8, 16.4) | | |
| TOTAL | 5206 | 50481 | | | | | | |

Note: Restricted to modern prostheses.

**Figure KP30 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Fixation (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Cemented | 38745 | 35137 | 28753 | 23101 | 13344 | 6446 | 1716 |
| Cementless | 10914 | 9864 | 7989 | 6130 | 2128 | 318 | 4 |
| Hybrid | 822 | 753 | 651 | 571 | 181 | 30 | 4 |

Note: Restricted to modern prostheses.

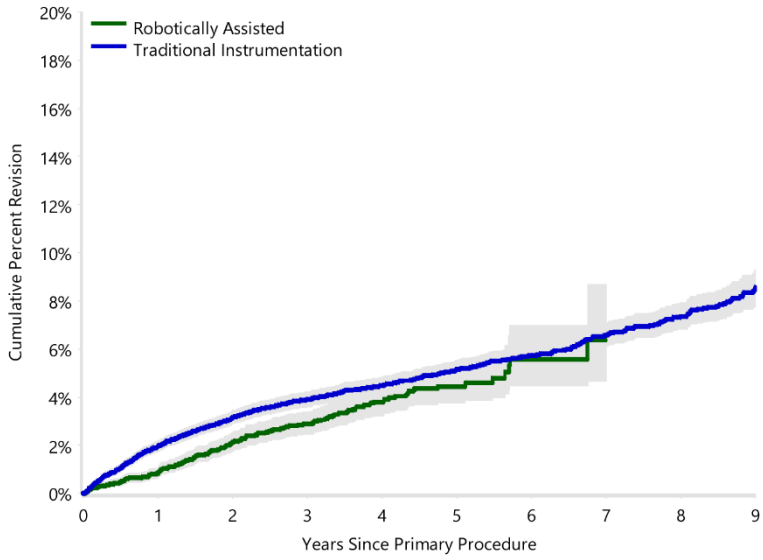
# Primary Partial Knee Replacement

**Table KP28 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement Since 2015 by Robotic Assistance (Primary Diagnosis OA)**

| Surgeon Assistive Tool | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Robotically Assisted | 200 | 7743 | 0.9 (0.7, 1.1) | 2.1 (1.8, 2.5) | 3.1 (2.7, 3.6) | 4.0 (3.5, 4.7) | 4.7 (4.0, 5.5) | 5.7 (4.6, 7.1) | 6.5 (4.8, 8.6) |
| Traditional Instrumentation | 955 | 18361 | 1.9 (1.7, 2.1) | 3.1 (2.9, 3.4) | 3.9 (3.6, 4.2) | 4.5 (4.2, 4.8) | 5.1 (4.8, 5.5) | 5.7 (5.4, 6.1) | 6.6 (6.1, 7.0) |
| TOTAL | 1155 | 26104 | | | | | | | |

Note: Restricted to modern prostheses.

**Figure KP31 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement Since 2015 by Robotic Assistance (Primary Diagnosis OA)**




HR - age, gender, BMI, ASA, surgeon volume and mobility

Robotically Assisted vs Traditional Instrumentation

0-1.5Yr: HR=1.10 (95% CI 0.88, 1.38), p=0.402

1.5-3.5Yr: HR=0.96 (95% CI 0.75, 1.24), p=0.781

3.5Yr+: HR=0.64 (95% CI 0.43, 0.95), p=0.029

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|---|
| Robotically Assisted | 7665 | 5828 | 4262 | 2903 | 1673 | 773 | 230 | 102 |
| Traditional Instrumentation | 17449 | 15556 | 13750 | 11971 | 10112 | 8253 | 6199 | 4280 |

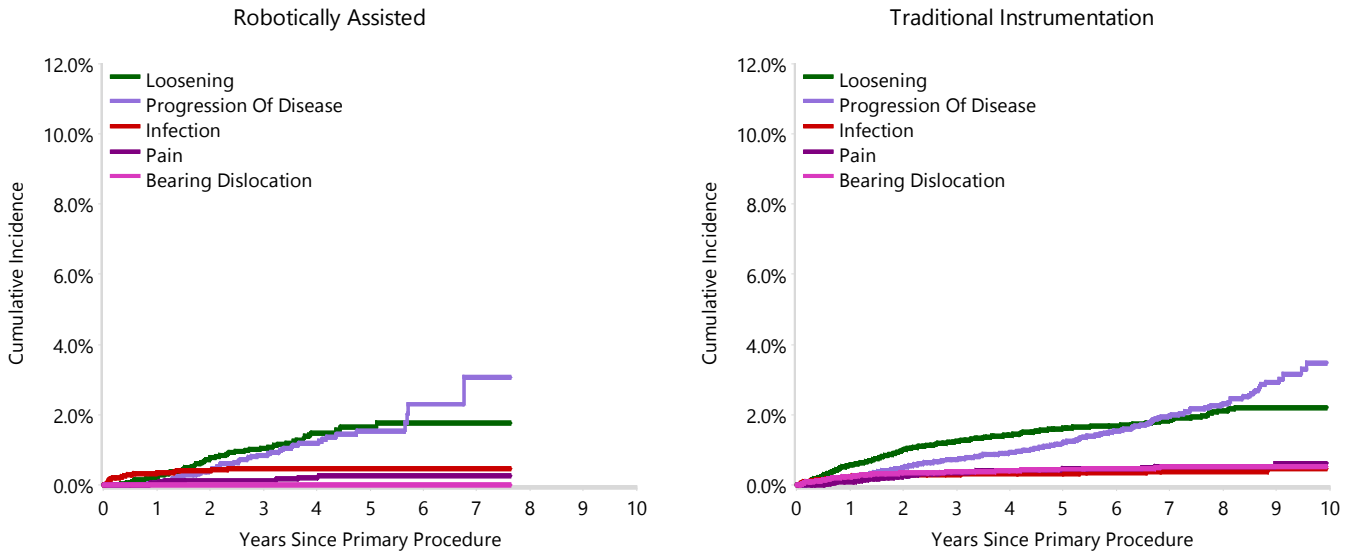
Note: Restricted to modern prostheses.
Excludes 2 procedures with unknown mobility.

**Table KP29 Revision Diagnosis of Primary Unicompartmental Knee Replacement Since 2015 by Robotic Assistance (Primary Diagnosis OA)**

| Revision Diagnosis | Robotically Assisted | | | Traditional Instrumentation | | |
|---|---|---|---|---|---|---|
| | Number | % Primaries Revised | % Revisions | Number | % Primaries Revised | % Revisions |
| Loosening | 66 | 0.9 | 34.9 | 261 | 1.5 | 29.4 |
| Progression Of Disease | 56 | 0.7 | 29.6 | 244 | 1.4 | 27.5 |
| Bearing Dislocation | | | | 73 | 0.4 | 8.2 |
| Pain | 11 | 0.1 | 5.8 | 71 | 0.4 | 8.0 |
| Fracture | 6 | 0.1 | 3.2 | 64 | 0.4 | 7.2 |
| Infection | 31 | 0.4 | 16.4 | 58 | 0.3 | 6.5 |
| Instability | 4 | 0.1 | 2.1 | 35 | 0.2 | 3.9 |
| Malalignment | 3 | 0.0 | 1.6 | 21 | 0.1 | 2.4 |
| Lysis | 3 | 0.0 | 1.6 | 8 | 0.0 | 0.9 |
| Prosthesis Dislocation | | | | 8 | 0.0 | 0.9 |
| Incorrect Sizing | | | | 7 | 0.0 | 0.8 |
| Patellofemoral Pain | | | | 5 | 0.0 | 0.6 |
| Implant Breakage Tibial Insert | 1 | 0.0 | 0.5 | 4 | 0.0 | 0.5 |
| Wear Tibial Insert | | | | 4 | 0.0 | 0.5 |
| Metal Related Pathology | 1 | 0.0 | 0.5 | 3 | 0.0 | 0.3 |
| Osteonecrosis | 1 | 0.0 | 0.5 | 3 | 0.0 | 0.3 |
| Synovitis | | | | 3 | 0.0 | 0.3 |
| Arthrofibrosis | 2 | 0.0 | 1.1 | 2 | 0.0 | 0.2 |
| Implant Breakage Tibial | 2 | 0.0 | 1.1 | 2 | 0.0 | 0.2 |
| Patella Erosion | | | | 1 | 0.0 | 0.1 |
| Other | 2 | 0.0 | 1.1 | 10 | 0.1 | 1.1 |
| Loosening | 66 | 0.9 | 34.9 | 261 | 1.5 | 29.4 |
| **N Revision** | **189** | **2.5** | **100.0** | **887** | **5.1** | **100.0** |
| **N Primary** | **7665** | | | **17449** | | |

Note: Restricted to modern prostheses.

**Figure KP32 Cumulative Incidence Revision Diagnosis of Primary Unicompartmental Knee Replacement Since 2015 by Robotic Assistance (Primary Diagnosis OA)**



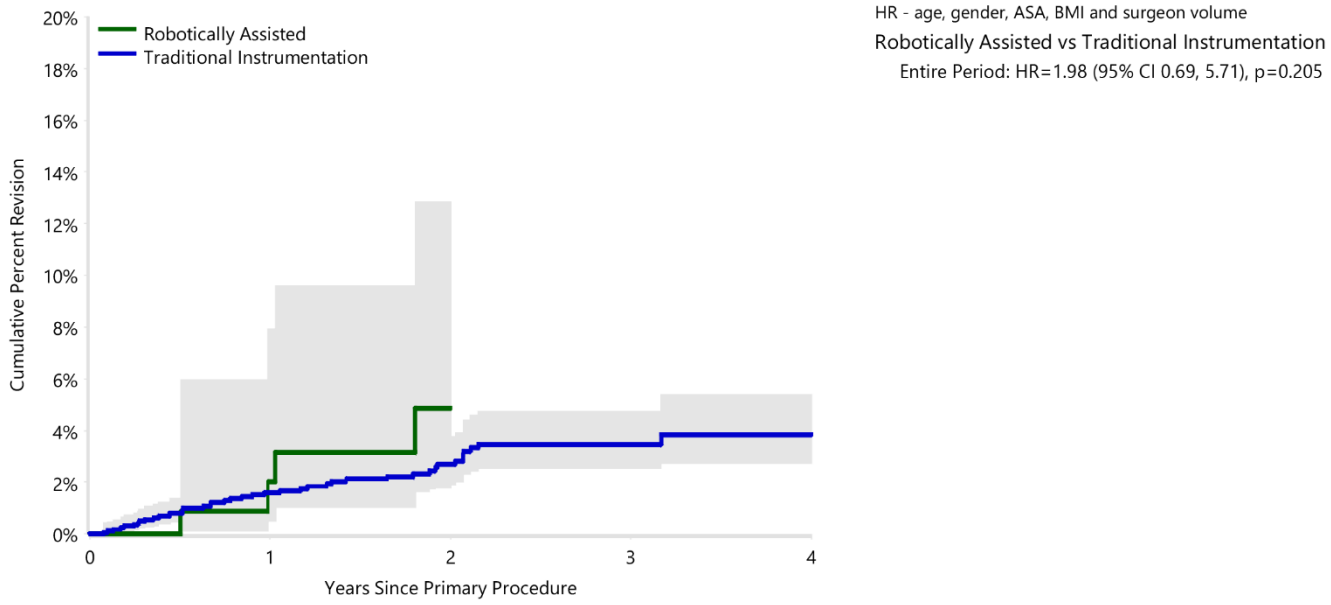

Note: Restricted to modern prostheses.

**Table KP30 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement Since 2015 by Prosthesis Combination and Robotic Assistance (Primary Diagnosis OA)**

| Prosthesis Combination | Robotic Assistance | N Revised | N Total | 1 Yr | 2 Yrs | 4 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Journey Uni/ Journey Uni | Robotically Assisted | 53 | 835 | 1.8 (1.1, 3.0) | 3.9 (2.6, 5.6) | 7.5 (5.6, 9.9) | 10.3 (7.7, 13.7) | 11.3 (8.3, 15.4) | |
| | Traditional Instrumentation | 53 | 797 | 2.6 (1.7, 4.0) | 4.0 (2.8, 5.7) | 5.8 (4.3, 7.8) | 7.2 (5.4, 9.4) | 8.0 (6.1, 10.4) | 8.0 (6.1, 10.4) |
| Persona/ Persona | Robotically Assisted | 4 | 147 | 2.0 (0.5, 7.9) | 4.8 (1.8, 12.7) | | | | |
| | Traditional Instrumentation | 44 | 1747 | 1.6 (1.1, 2.4) | 2.8 (2.0, 3.9) | 3.9 (2.8, 5.5) | | | |
| TOTAL | | 154 | 3526 | | | | | | |

Note: Restricted to modern prostheses.

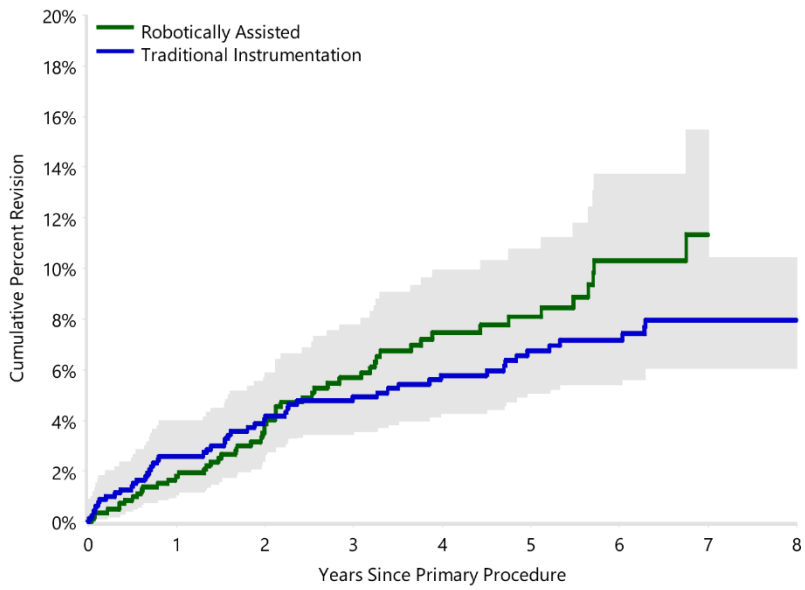
**Figure KP33 Cumulative Percent Revision of Persona/Persona Primary Unicompartmental Knee Replacement Since 2015 by Robotic Assistance (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs |
|---|---|---|---|---|---|
| Robotically Assisted | 146 | 85 | 52 | 37 | 1 |
| Traditional Instrumentation | 1732 | 1242 | 780 | 322 | 44 |

Note: Restricted to modern prostheses.

**Figure KP34 Cumulative Percent Revision of Journey Uni/Journey Uni Primary Unicompartmental Knee Replacement Since 2015 by Robotic Assistance (Primary Diagnosis OA)**




HR - age, gender, ASA, BMI and surgeon volume
Robotically Assisted vs Traditional Instrumentation
0-9Mth: HR=0.55 (95% CI 0.25, 1.19), p=0.131
9+Mth: HR=1.67 (95% CI 1.03, 2.71), p=0.037

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|---|---|
| Robotically Assisted | 835 | 709 | 561 | 466 | 363 | 261 | 160 | 76 | 26 | 0 |
| Traditional Instrumentation | 797 | 716 | 646 | 591 | 530 | 470 | 371 | 243 | 136 | 36 |

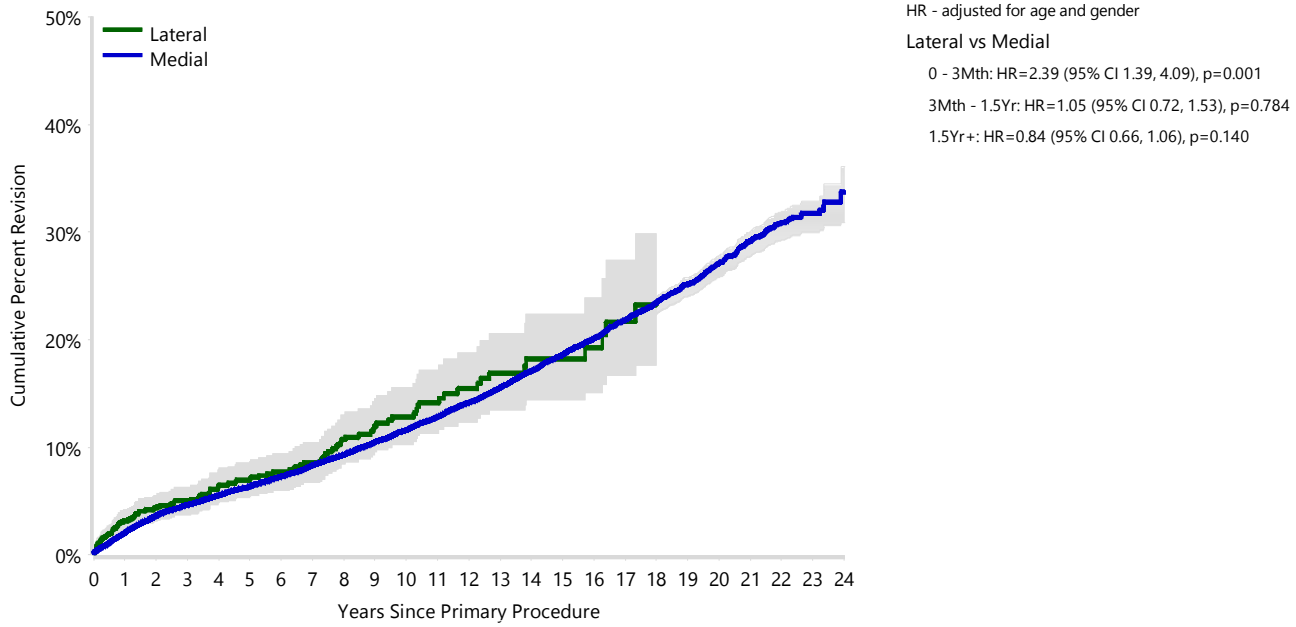
Note: Restricted to modern prostheses.

**Table KP31 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Position (Primary Diagnosis OA)**

| Position | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Lateral | 111 | 1143 | 3.0 (2.1, 4.2) | 4.8 (3.7, 6.3) | 6.9 (5.4, 8.7) | 12.6 (10.2, 15.5) | 18.0 (14.5, 22.4) | |
| Medial | 5087 | 49078 | 1.9 (1.7, 2.0) | 4.4 (4.2, 4.6) | 6.1 (5.9, 6.3) | 11.3 (10.9, 11.6) | 18.2 (17.7, 18.8) | 26.7 (25.7, 27.7) |
| TOTAL | 5198 | 50221 | | | | | | |

Note: Excludes 260 primary unicompartmental knee procedures with unknown/missing position.
Restricted to modern prostheses.

**Figure KP35 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Position (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Lateral | 1143 | 1021 | 824 | 637 | 279 | 95 | 30 |
| Medial | 49078 | 44516 | 36418 | 29092 | 15374 | 6699 | 1694 |

Note: Restricted to modern prostheses.

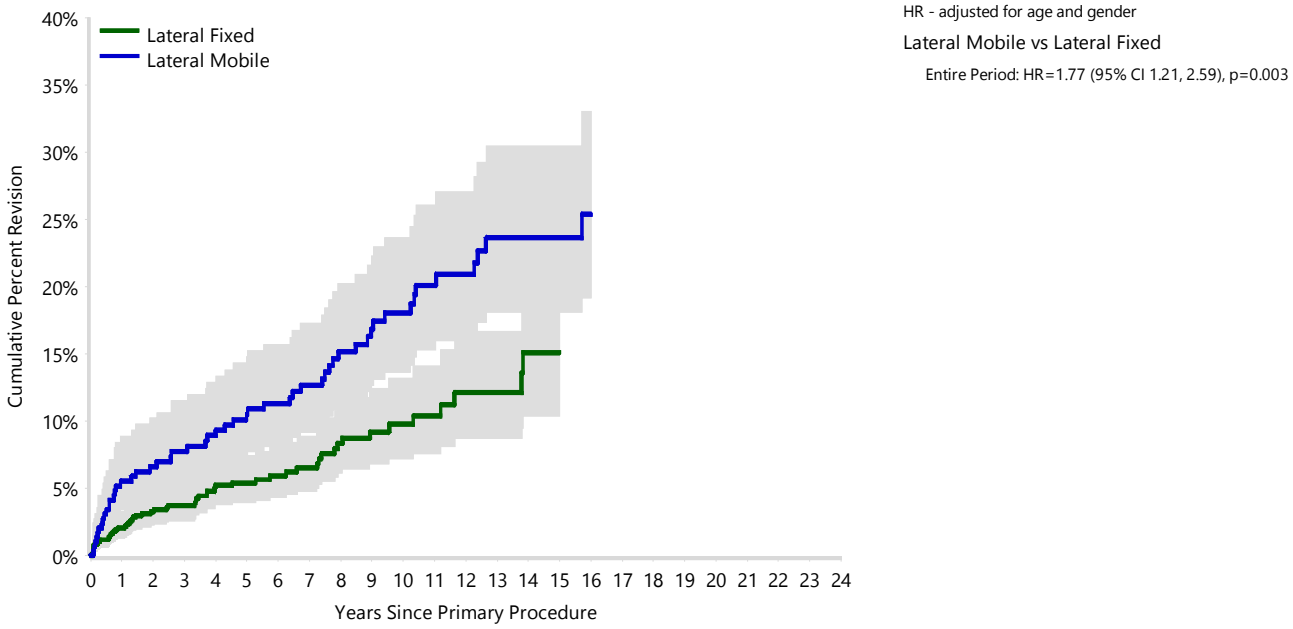
# Primary Partial Knee Replacement

**Table KP32 Cumulative Percent Revision of Lateral Primary Unicompartmental Knee Replacement by Mobility (Primary Diagnosis OA)**

| Position | Mobility | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|---|
| Lateral | Fixed | 58 | 849 | 2.1 (1.3, 3.3) | 3.8 (2.6, 5.4) | 5.4 (3.9, 7.4) | 9.8 (7.2, 13.2) | 15.1 (10.4, 21.7) |
| | Mobile | 53 | 292 | 5.5 (3.4, 8.9) | 7.8 (5.2, 11.6) | 10.5 (7.4, 14.8) | 18.1 (13.7, 23.7) | 23.6 (18.1, 30.4) |
| TOTAL | | 111 | 1141 | | | | | |

Note: Excludes 263 primary unicompartmental knee procedures with unknown/missing position or mobility.
Restricted to modern prostheses.

**Figure KP36 Cumulative Percent Revision of Lateral Primary Unicompartmental Knee Replacement by Mobility (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Lateral | Fixed | 849 | 753 | 580 | 415 | 152 | 42 | 1 |
| | Mobile | 292 | 266 | 244 | 222 | 127 | 53 | 29 |

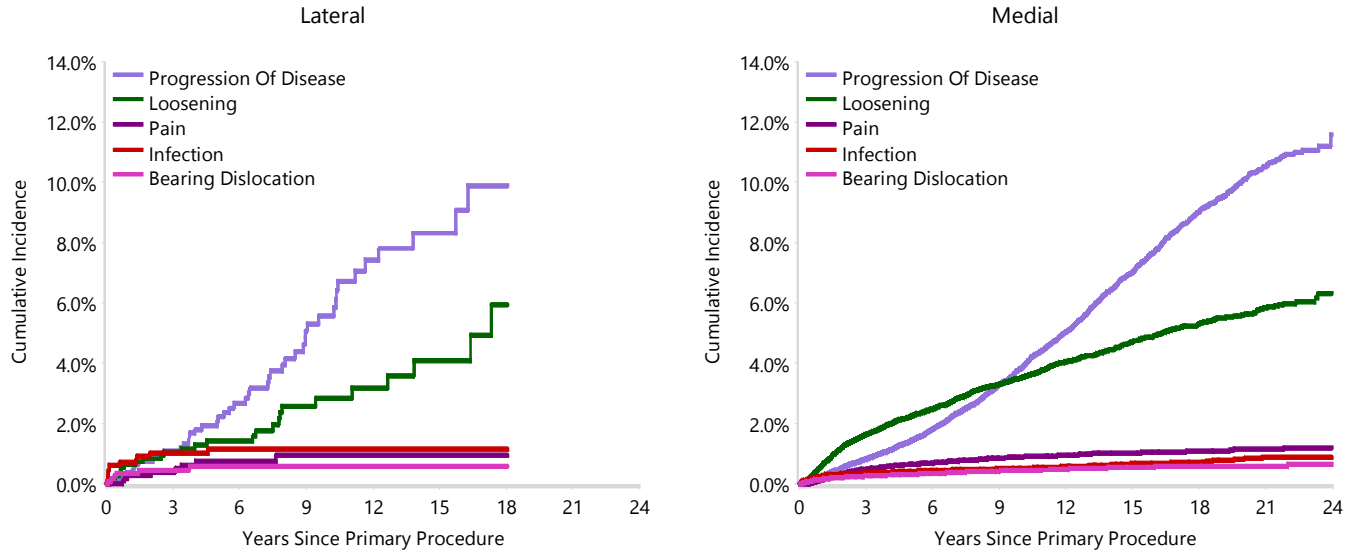
Note: Restricted to modern prostheses.

**Table KP33 Reason for Revision of Primary Unicompartmental Knee Replacement by Position (Primary Diagnosis OA)**

| Revision Diagnosis | Lateral | | | Medial | | |
|---|---|---|---|---|---|---|
| | Number | % Primaries Revised | % Revisions | Number | % Primaries Revised | % Revisions |
| Progression Of Disease | 48 | 4.2 | 43.2 | 1947 | 4.0 | 38.3 |
| Loosening | 26 | 2.3 | 23.4 | 1544 | 3.1 | 30.4 |
| Pain | 8 | 0.7 | 7.2 | 363 | 0.7 | 7.1 |
| Infection | 12 | 1.0 | 10.8 | 250 | 0.5 | 4.9 |
| Bearing Dislocation | 6 | 0.5 | 5.4 | 194 | 0.4 | 3.8 |
| Fracture | 2 | 0.2 | 1.8 | 155 | 0.3 | 3.0 |
| Instability | 3 | 0.3 | 2.7 | 105 | 0.2 | 2.1 |
| Lysis | | | | 97 | 0.2 | 1.9 |
| Wear Tibial Insert | 1 | 0.1 | 0.9 | 87 | 0.2 | 1.7 |
| Malalignment | 3 | 0.3 | 2.7 | 63 | 0.1 | 1.2 |
| Other | 2 | 0.2 | 1.8 | 282 | 0.6 | 5.5 |
| **N Revision** | **111** | **9.7** | **100.0** | **5087** | **10.4** | **100.0** |
| **N Primary** | **1143** | | | **49078** | | |

Note: Restricted to modern prostheses.

**Figure KP37 Cumulative Incidence Revision Diagnosis of Primary Unicompartmental Knee Replacement by Position (Primary Diagnosis OA)**




Note: Restricted to modern prostheses.

# Primary Total Knee Replacement

## Class of Total Knee Replacement

Total knee replacement is defined as a replacement of the entire femorotibial articulation using a single femoral and a single tibial prosthesis. This may or may not be combined with a patella resurfacing replacement.

In this report, the outcome of total knee replacement based on specific patient, prosthesis and technique factors is shown. In addition, the outcome for different types of total knee prostheses is presented.

Most total knee systems have a variety of individual prostheses within the system that vary based on distinguishing prosthesis characteristics. Where possible, knee systems are subdivided into the specific prosthesis types. The initial characteristic used is fixation. Further subdivision is based on stability and bearing mobility. However, subdivision is not uniformly applied to all knee systems and is dependent on the number of procedures reported for each system.

**DEMOGRAPHICS**

There are 1,026,935 primary total knee replacement procedures recorded. This is an additional 70,760 procedures compared to the last report.

For further information on the **closure of the database** please see the **Glossary** of this report.

In 2024, there is an increase of 0.3% in primary total knee replacement procedures when compared to 2023. As a proportion of all knee replacement procedures, primary total knee replacement increased to 85.2% in 2024.

Osteoarthritis is the most common diagnosis for primary total knee replacement.

Primary total knee replacement remains more common in females (55.8%). This proportion has shown little change from 2003. The mean age of patients is 68.5 years (Table KT1 and Figure KT1).

**Figure KT1 Primary Total Knee Replacement by Gender**

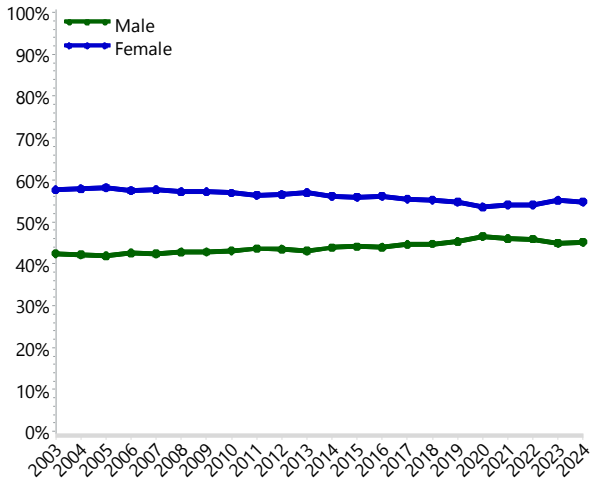


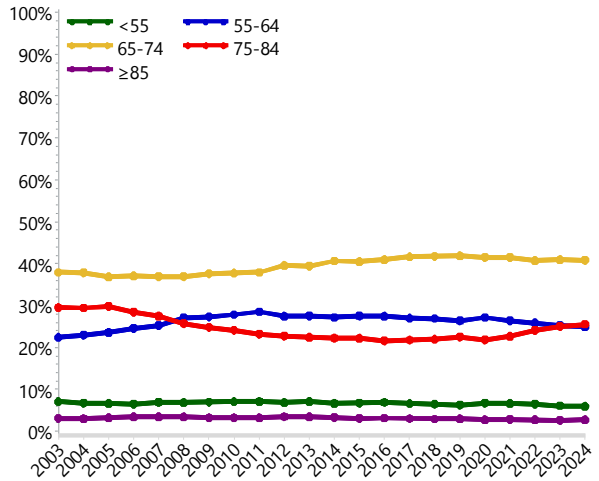

**Table KT1 Age and Gender of Primary Total Knee Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 453947 | 44.2% | 8 | 101 | 68 | 68.1 | 9.0 |
| Female | 572988 | 55.8% | 8 | 107 | 69 | 68.8 | 9.3 |
| **TOTAL** | **1026935** | **100.0%** | **8** | **107** | **69** | **68.5** | **9.2** |

There are 1,026,935 primary total knee replacement procedures.
This is an increase of 70,760 procedures compared to the last report.

There has been little change in the proportion of patients in different age groups undergoing primary total knee replacement. The proportion of patients aged <55 years remains small (Figure KT2).

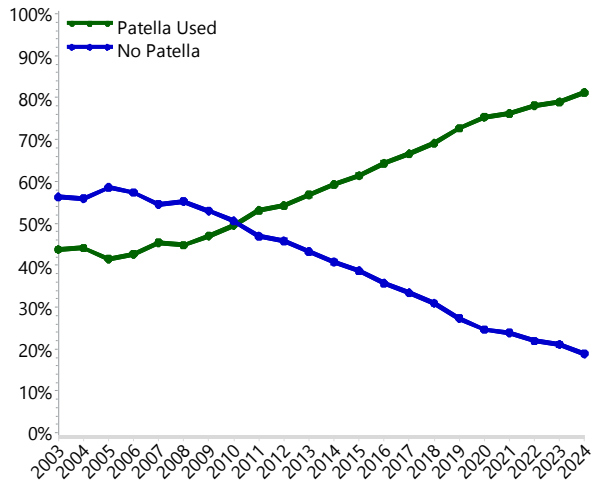
**Figure KT2 Primary Total Knee Replacement by Age**




Detailed demographic information on primary total knee replacement is available in the supplementary report 'Demographics of Hip, Knee and Shoulder Arthroplasty' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2025

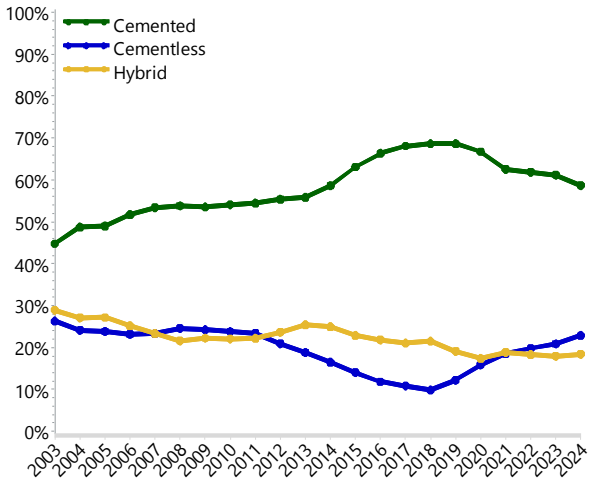
Patella resurfacing at the time of the primary total knee replacement has increased to 81.2% in 2024 (Figure KT3).

**Figure KT3 Primary Total Knee Replacement by Patella Component Usage**



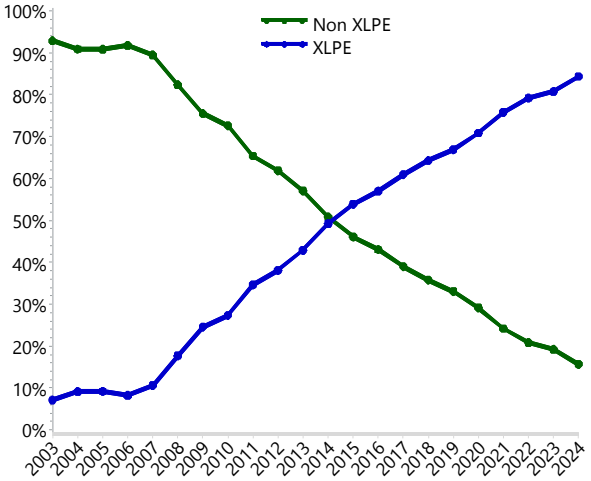

The most common method of fixation is cemented fixation for both femoral and tibial components. This accounts for 58.7% of procedures in 2024. The use of cementless fixation decreased to 9.8% of all primary total knee replacement in 2018 but has increased to 22.9% in 2024 (Figure KT4). Hybrid fixation for primary total knee replacement (femoral cementless) was used in 18.4% of procedures in 2024.

**Figure KT4 Primary Total Knee Replacement by Fixation**




The use of cross-linked polyethylene (XLPE) in primary total knee replacement increased to 84.3% in 2024 (Figure KT5).

**Figure KT5 Primary Total Knee Replacement by Polyethylene Type**



# Primary Total Knee Replacement

Cruciate retaining (CR) and posterior stabilised (PS) prostheses are reported separately for the majority of total knee prostheses. This reporting is based on the design of the femoral component. In 2024, the most commonly used femoral prostheses are the Triathlon CR, Persona CR, and GMK Sphere Primary (Table KT2).

The most used cemented and cementless femoral components are listed in Table KT3 and Table KT4, respectively. The most used tibial components in 2023 are the Triathlon, Persona and Attune (Table KT5). The most used tibial prostheses are also reported based on fixation in Table KT6 and Table KT7.

**Table KT2 10 Most Used Femoral Prostheses in Primary Total Knee Replacement**

| 2003 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 3183 | LCS CR | 16442 | Triathlon CR | 17076 | Triathlon CR | 22600 | Triathlon CR | 23314 | Triathlon CR |
| 2846 | Duracon | 11613 | Persona CR | 13076 | Persona CR | 16669 | Persona CR | 16960 | Persona CR |
| 2150 | Nexgen CR | 4213 | Attune CR | 4373 | Attune CR | 5201 | Attune CR | 5294 | GMK Sphere Primary |
| 1419 | PFC Sigma CR | 3677 | GMK Sphere Primary | 3779 | GMK Sphere Primary | 4960 | GMK Sphere Primary | 5205 | Attune CR |
| 1354 | Scorpio CR | 2240 | Attune PS | 2055 | Attune PS | 2365 | Attune PS | 2180 | Attune PS |
| 1058 | Genesis II CR | 1690 | Nexgen CR Flex | 1520 | Apex Knee CR | 1697 | Apex Knee CR | 1715 | Apex Knee CR |
| 1002 | Natural Knee II | 1628 | Apex Knee CR | 1250 | Legion Oxinium CR | 1464 | Legion Oxinium CR | 1708 | Journey II Oxinium |
| 902 | Nexgen LPS | 1601 | Legion Oxinium CR | 1120 | Legion Oxinium PS | 1327 | Evolution | 1320 | Legion Oxinium CR |
| 883 | Profix | 1228 | Legion Oxinium PS | 1080 | Columbus | 1249 | Journey II Oxinium | 1127 | Legion Oxinium PS |
| 751 | Scorpio PS | 1116 | Legion CR | 1061 | Evolution | 1196 | Legion Oxinium PS | 1067 | Columbus |
| **10 Most Used** | | | | | | | | | |
| 15548 | (10) 71.5% | 45448 | (10) 76.1% | 46390 | (10) 81.1% | 58728 | (10) 84.3% | 59890 | (10) 85.7% |
| **Remainder** | | | | | | | | | |
| 6185 | (47) 28.5% | 14282 | (66) 23.9% | 10805 | (65) 18.9% | 10954 | (60) 15.7% | 10021 | (54) 14.3% |
| **TOTAL** | | | | | | | | | |
| 21733 | (57) 100.0% | 59730 | (76) 100.0% | 57195 | (75) 100.0% | 69682 | (70) 100.0% | 69911 | (64) 100.0% |

**Table KT3 10 Most Used Cemented Femoral Prostheses in Primary Total Knee Replacement**

| 2003 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 1222 | Duracon | 7177 | Triathlon CR | 7168 | Triathlon CR | 9538 | Triathlon CR | 8893 | Triathlon CR |
| 942 | LCS CR | 6373 | Persona CR | 6738 | Persona CR | 8349 | Persona CR | 8263 | Persona CR |
| 827 | Nexgen LPS | 3677 | GMK Sphere Primary | 3779 | GMK Sphere Primary | 4960 | GMK Sphere Primary | 5113 | GMK Sphere Primary |
| 765 | Nexgen CR | 2322 | Attune CR | 2304 | Attune CR | 2508 | Attune CR | 2551 | Attune CR |
| 693 | Nexgen LPS Flex | 2137 | Attune PS | 1926 | Attune PS | 2220 | Attune PS | 2030 | Attune PS |
| 645 | Genesis II CR | 1601 | Legion Oxinium CR | 1250 | Legion Oxinium CR | 1464 | Legion Oxinium CR | 1708 | Journey II Oxinium |
| 515 | PFC Sigma PS | 1228 | Legion Oxinium PS | 1120 | Legion Oxinium PS | 1306 | Evolution | 1320 | Legion Oxinium CR |
| 497 | Profix | 1105 | Columbus | 1080 | Columbus | 1249 | Journey II Oxinium | 1127 | Legion Oxinium PS |
| 479 | Genesis II Oxinium CR | 1010 | Evolution | 1020 | Evolution | 1196 | Legion Oxinium PS | 1067 | Columbus |
| 419 | Genesis II PS | 886 | Genesis II Oxinium PS | 868 | Apex Knee CR | 1084 | Columbus | 985 | Apex Knee CR |
| **10 Most Used** | | | | | | | | | |
| 7004 | (10) 71.6% | 27516 | (10) 72.2% | 27253 | (10) 75.9% | 33874 | (10) 78.9% | 33057 | (10) 79.8% |
| **Remainder** | | | | | | | | | |
| 2778 | (38) 28.4% | 10618 | (64) 27.8% | 8641 | (60) 24.1% | 9053 | (57) 21.1% | 8353 | (52) 20.2% |
| **TOTAL** | | | | | | | | | |
| 9782 | (48) 100.0% | 38134 | (74) 100.0% | 35894 | (70) 100.0% | 42927 | (67) 100.0% | 41410 | (62) 100.0% |

**Table KT4 10 Most Used Cementless Femoral Prostheses in Primary Total Knee Replacement**

| 2003 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 2241 | LCS CR | 9265 | Triathlon CR | 9908 | Triathlon CR | 13062 | Triathlon CR | 14421 | Triathlon CR |
| 1624 | Duracon | 5240 | Persona CR | 6338 | Persona CR | 8320 | Persona CR | 8697 | Persona CR |
| 1385 | Nexgen CR | 1891 | Attune CR | 2069 | Attune CR | 2693 | Attune CR | 2654 | Attune CR |
| 1075 | PFC Sigma CR | 808 | Nexgen CR Flex | 652 | Apex Knee CR | 774 | Apex Knee CR | 730 | Apex Knee CR |
| 1059 | Scorpio CR | 786 | Apex Knee CR | 499 | Legion CR | 503 | Legion CR | 443 | Legion CR |
| 746 | Natural Knee II | 587 | LCS CR | 294 | GMK Primary | 320 | GMK Primary | 311 | GMK Primary |
| 633 | Active Knee | 514 | Legion CR | 280 | Nexgen CR Flex | 181 | ACS | 240 | Anatomic |
| 425 | Maxim | 393 | Score | 202 | Genesis II CR | 176 | Triathlon PS | 181 | GMK Sphere Primary |
| 413 | Genesis II CR | 291 | GMK Primary | 184 | Triathlon PS | 168 | Anatomic | 160 | Triathlon PS |
| 386 | Profix | 246 | Genesis II CR | 142 | BalanSys | 145 | Attune PS | 150 | Attune PS |
| **10 Most Used** | | | | | | | | | |
| 9987 | (10) 83.6% | 20021 | (10) 92.7% | 20568 | (10) 96.6% | 26342 | (10) 98.5% | 27987 | (10) 98.2% |
| **Remainder** | | | | | | | | | |
| 1964 | (28) 16.4% | 1575 | (24) 7.3% | 733 | (26) 3.4% | 413 | (18) 1.5% | 514 | (12) 1.8% |
| **TOTAL** | | | | | | | | | |
| 11951 | (38) 100.0% | 21596 | (34) 100.0% | 21301 | (36) 100.0% | 26755 | (28) 100.0% | 28501 | (22) 100.0% |

**Table KT5 10 Most Used Tibial Components in Primary Total Knee Replacement**

| 2003 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 3755 | Nexgen | 17141 | Triathlon | 17821 | Triathlon | 23466 | Triathlon | 24075 | Triathlon |
| 2843 | Duracon | 12194 | Persona | 13826 | Persona | 17701 | Persona | 17979 | Persona |
| 2039 | Genesis II | 6964 | Genesis II | 6516 | Attune | 7640 | Attune | 7476 | Attune |
| 1364 | MBT | 6503 | Attune | 5254 | Genesis II | 5654 | Genesis II | 5010 | GMK Primary |
| 1362 | LCS | 3519 | GMK Primary | 3642 | GMK Primary | 4691 | GMK Primary | 4875 | Genesis II |
| 1360 | Series 7000 | 2363 | Apex Knee | 2109 | Apex Knee | 2499 | Apex Knee | 2389 | Apex Knee |
| 1168 | PFC Sigma | 2218 | Nexgen | 1080 | Columbus | 1298 | Evolution | 1707 | Journey |
| 1060 | MBT Duofix | 1105 | Columbus | 1029 | Evolution | 1249 | Journey | 1067 | Columbus |
| 1002 | Natural Knee II | 1017 | Evolution | 793 | Journey | 1084 | Columbus | 1015 | Evolution |
| 894 | Profix | 937 | MBT | 749 | Nexgen | 651 | SAIPH | 709 | SAIPH |
| **10 Most Used** | | | | | | | | | |
| 16847 | (10) 77.5% | 53961 | (10) 90.3% | 52819 | (10) 92.3% | 65933 | (10) 94.6% | 66302 | (10) 94.8% |
| **Remainder** | | | | | | | | | |
| 4886 | (38) 22.5% | 5769 | (48) 9.7% | 4376 | (45) 7.7% | 3749 | (45) 5.4% | 3609 | (38) 5.2% |
| **TOTAL** | | | | | | | | | |
| 21733 | (48) 100.0% | 59730 | (58) 100.0% | 57195 | (55) 100.0% | 69682 | (55) 100.0% | 69911 | (48) 100.0% |

# Primary Total Knee Replacement

**Table KT6 10 Most Used Cemented Tibial Components in Primary Total Knee Replacement**

| 2003 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 3010 | Nexgen | 10724 | Triathlon | 11151 | Persona | 14288 | Persona | 14799 | Persona |
| 2348 | Duracon | 10023 | Persona | 10829 | Triathlon | 13969 | Triathlon | 13000 | Triathlon |
| 1992 | Genesis II | 6962 | Genesis II | 5253 | Genesis II | 5663 | Attune | 5386 | Attune |
| 1168 | PFC Sigma | 4544 | Attune | 4642 | Attune | 5653 | Genesis II | 4875 | Genesis II |
| 1067 | MBT | 3324 | GMK Primary | 3426 | GMK Primary | 4458 | GMK Primary | 4798 | GMK Primary |
| 1033 | LCS | 2339 | Apex Knee | 2061 | Apex Knee | 2492 | Apex Knee | 2388 | Apex Knee |
| 1007 | Series 7000 | 2088 | Nexgen | 1080 | Columbus | 1298 | Evolution | 1707 | Journey |
| 719 | Profix | 1105 | Columbus | 1029 | Evolution | 1249 | Journey | 1067 | Columbus |
| 587 | AGC | 1017 | Evolution | 793 | Journey | 1084 | Columbus | 1015 | Evolution |
| 478 | Natural Knee II | 789 | MBT | 673 | Nexgen | 651 | SAIPH | 709 | SAIPH |
| **10 Most Used** | | | | | | | | | |
| 13409 | (10) 84.9% | 42915 | (10) 90.3% | 40937 | (10) 91.3% | 50805 | (10) 93.7% | 49744 | (10) 93.7% |
| **Remainder** | | | | | | | | | |
| 2382 | (31) 15.1% | 4603 | (42) 9.7% | 3915 | (42) 8.7% | 3440 | (41) 6.3% | 3359 | (37) 6.3% |
| **TOTAL** | | | | | | | | | |
| 15791 | (41) 100.0% | 47518 | (52) 100.0% | 44852 | (52) 100.0% | 54245 | (51) 100.0% | 53103 | (47) 100.0% |

**Table KT7 10 Most Used Cementless Tibial Components in Primary Total Knee Replacement**

| 2003 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 1060 | MBT Duofix | 6417 | Triathlon | 6992 | Triathlon | 9497 | Triathlon | 11075 | Triathlon |
| 745 | Nexgen | 2171 | Persona | 2675 | Persona | 3413 | Persona | 3180 | Persona |
| 524 | Natural Knee II | 1959 | Attune | 1874 | Attune | 1977 | Attune | 2090 | Attune |
| 495 | Duracon | 362 | Nexgen TM CR | 216 | GMK Primary | 233 | GMK Primary | 212 | GMK Primary |
| 487 | Active Knee | 296 | Score | 125 | Nexgen TM CR | 129 | ACS Fixed | 97 | ACS Fixed |
| 353 | Series 7000 | 195 | GMK Primary | 93 | Legion | 91 | Legion | 89 | Legion |
| 329 | LCS | 148 | MBT | 90 | Score | 72 | Score | 62 | Score |
| 305 | RBK | 130 | Nexgen | 78 | ACS Fixed | 8 | Nexgen TM CR | 1 | Apex Knee |
| 297 | MBT | 98 | Legion | 76 | Nexgen | 7 | Apex Knee | 1 | LCS |
| 242 | Profix Mobile | 90 | RBK | 48 | Apex Knee | 3 | LCS | 1 | Mutars |
| **10 Most Used** | | | | | | | | | |
| 4837 | (10) 81.4% | 11866 | (10) 97.2% | 12267 | (10) 99.4% | 15430 | (10) 100.0% | 16808 | (10) 100.0% |
| **Remainder** | | | | | | | | | |
| 1105 | (18) 18.6% | 346 | (14) 2.8% | 76 | (10) 0.6% | 7 | (7) 0.0% | 0 | (0) 0% |
| **TOTAL** | | | | | | | | | |
| 5942 | (28) 100.0% | 12212 | (24) 100.0% | 12343 | (20) 100.0% | 15437 | (17) 100.0% | 16808 | (10) 100.0% |

## OUTCOME FOR ALL DIAGNOSES

### Primary Diagnosis

Usage and availability of knee prostheses change with time. In order to keep data contemporaneous, only procedures using prostheses that have been available and used in 2024 (described as modern prostheses) are included in the analyses, unless clearly specified. This has resulted in 305,874 (29.7%) procedures being excluded from the analysis for this year's Annual Report. The most common primary diagnosis for total knee replacement is osteoarthritis. Comparisons of revision rates for other primary diagnoses compared to osteoarthritis are shown in Table KT8 and Figure KT6.

There are variations in the rate of revision when comparing osteoarthritis to other primary diagnoses.

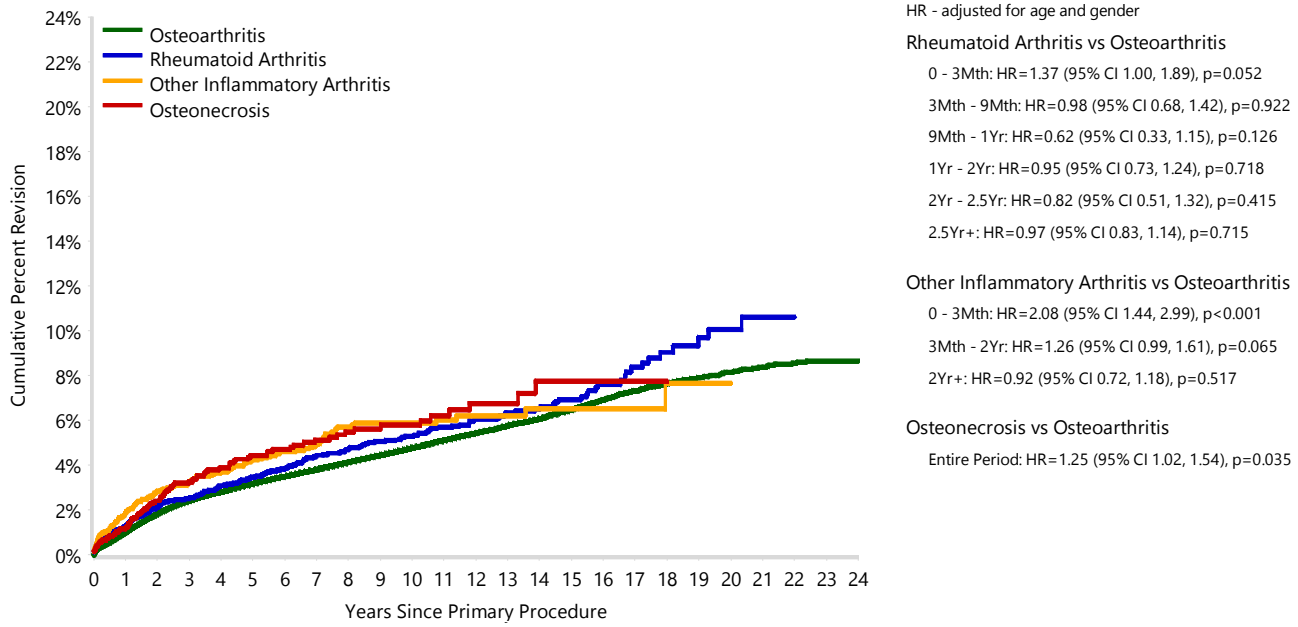
Detailed information on those prostheses that are no longer used is available in the supplementary report 'Comparative Prosthesis Performance' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2025

**Table KT8 Cumulative Percent Revision of Primary Total Knee Replacement by Primary Diagnosis**

| Primary Diagnosis | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | 23890 | 706349 | 1.0 (1.0, 1.0) | 2.4 (2.3, 2.4) | 3.1 (3.1, 3.2) | 4.7 (4.6, 4.7) | 6.3 (6.2, 6.5) | 8.0 (7.8, 8.2) |
| Rheumatoid Arthritis | 301 | 6957 | 1.1 (0.9, 1.4) | 2.4 (2.1, 2.8) | 3.3 (2.9, 3.8) | 5.2 (4.6, 5.8) | 6.8 (5.9, 7.8) | 9.9 (8.2, 12.0) |
| Other Inflammatory Arthritis | 158 | 3747 | 1.8 (1.4, 2.3) | 3.1 (2.6, 3.7) | 4.1 (3.5, 4.9) | 5.7 (4.8, 6.7) | 6.4 (5.3, 7.7) | 7.5 (5.3, 10.5) |
| Osteonecrosis | 90 | 2004 | 1.1 (0.7, 1.7) | 3.1 (2.4, 4.0) | 4.3 (3.4, 5.4) | 5.6 (4.5, 7.0) | 7.6 (5.8, 9.9) | |
| Other (4) | 268 | 2004 | 4.6 (3.7, 5.6) | 9.6 (8.3, 11.2) | 13.6 (11.9, 15.5) | 21.3 (18.7, 24.2) | 30.5 (26.3, 35.3) | |
| TOTAL | 24707 | 721061 | | | | | | |

Note: Restricted to modern prostheses. Only primary diagnoses with >1,500 procedures have been listed.

**Figure KT6 Cumulative Percent Revision of Primary Total Knee Replacement by Primary Diagnosis**




HR - adjusted for age and gender

Rheumatoid Arthritis vs Osteoarthritis

0 - 3Mth: HR=1.37 (95% CI 1.00, 1.89), p=0.052
3Mth - 9Mth: HR=0.98 (95% CI 0.68, 1.42), p=0.922
9Mth - 1Yr: HR=0.62 (95% CI 0.33, 1.15), p=0.126
1Yr - 2Yr: HR=0.95 (95% CI 0.73, 1.24), p=0.718
2Yr - 2.5Yr: HR=0.82 (95% CI 0.51, 1.32), p=0.415
2.5Yr+: HR=0.97 (95% CI 0.83, 1.14), p=0.715

Other Inflammatory Arthritis vs Osteoarthritis

0 - 3Mth: HR=2.08 (95% CI 1.44, 2.99), p<0.001
3Mth - 2Yr: HR=1.26 (95% CI 0.99, 1.61), p=0.065
2Yr+: HR=0.92 (95% CI 0.72, 1.18), p=0.517

Osteonecrosis vs Osteoarthritis

Entire Period: HR=1.25 (95% CI 1.02, 1.54), p=0.035

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Osteoarthritis | 706349 | 627600 | 487721 | 371992 | 150981 | 40301 | 6544 |
| Rheumatoid Arthritis | 6957 | 6357 | 5264 | 4303 | 2091 | 770 | 182 |
| Other Inflammatory Arthritis | 3747 | 3345 | 2628 | 2014 | 749 | 208 | 47 |
| Osteonecrosis | 2004 | 1837 | 1479 | 1146 | 481 | 139 | 23 |

Note: Restricted to modern prostheses. Only primary diagnoses with >1,500 procedures have been listed; Restricted to modern prostheses.

# Primary Total Knee Replacement

## PROSTHESIS TYPES

Overall, there are 205 femoral and tibial prosthesis combinations that meet the definition of a modern prosthesis in primary total knee replacement.

The cumulative percent revision of the 84 combinations with >400 procedures by fixation are listed in Table KT9 to Table KT11. Although the listed combinations are a small proportion of all possible combinations, they represent 98.9% of all primary total knee replacement procedures. The 'other' group is the combined outcome of the remaining 121 prosthesis combinations with ≤400 procedures per combination.

There are 47 cemented femoral and tibial prosthesis combinations with >400 procedures (Table KT9).

There are 17 cementless femoral and tibial prosthesis combinations with >400 procedures (Table KT10).

There are 20 combinations of primary total knee replacement using hybrid fixation with >400 procedures (Table KT11).

**Table KT9 Cumulative Percent Revision of Cemented Primary Total Knee Replacement by Prosthesis Combination**

| Femoral Component | Tibial Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| ACS | ACS Fixed | 29 | 870 | 1.7 (1.0, 2.8) | 2.7 (1.8, 4.1) | 3.3 (2.3, 4.8) | 4.0 (2.7, 5.7) | | |
| | ACS Mobile | 54 | 1720 | 1.1 (0.7, 1.8) | 2.1 (1.5, 3.0) | 3.3 (2.5, 4.4) | 4.2 (3.2, 5.5) | | |
| Active Knee | Active Knee | 156 | 4001 | 0.8 (0.6, 1.2) | 2.6 (2.1, 3.1) | 3.5 (2.9, 4.2) | 5.2 (4.4, 6.2) | 6.3 (5.0, 7.9) | |
| Anatomic | Anatomic | 62 | 1762 | 1.3 (0.9, 2.0) | 3.4 (2.6, 4.4) | 4.1 (3.2, 5.3) | | | |
| Apex Knee CR | Apex Knee | 117 | 7714 | 0.6 (0.4, 0.8) | 1.3 (1.1, 1.7) | 1.9 (1.6, 2.3) | 2.6 (2.0, 3.4) | | |
| Apex Knee PS | Apex Knee | 229 | 7632 | 0.8 (0.6, 1.0) | 2.2 (1.9, 2.6) | 3.1 (2.7, 3.6) | 5.0 (4.3, 5.9) | | |
| Attune CR | Attune | 692 | 27734 | 0.9 (0.8, 1.0) | 2.1 (1.9, 2.3) | 2.7 (2.5, 2.9) | 3.5 (3.3, 3.9) | | |
| Attune PS | Attune | 383 | 15990 | 0.8 (0.7, 1.0) | 2.0 (1.8, 2.3) | 2.6 (2.3, 2.9) | 4.7 (4.0, 5.4) | | |
| BalanSys | BalanSys | 82 | 2550 | 0.6 (0.3, 1.0) | 1.7 (1.3, 2.4) | 2.2 (1.7, 2.9) | 3.8 (3.0, 4.8) | 4.9 (3.8, 6.4) | |
| Columbus | Columbus | 180 | 7711 | 1.0 (0.8, 1.3) | 2.2 (1.9, 2.6) | 3.1 (2.6, 3.6) | 4.4 (3.4, 5.8) | 4.4 (3.4, 5.8) | |
| E.Motion | E.Motion | 33 | 626 | 1.9 (1.1, 3.4) | 3.8 (2.5, 5.6) | 4.0 (2.7, 5.8) | 6.8 (4.8, 9.7) | | |
| Evolis | Evolis | 31 | 1294 | 0.3 (0.1, 0.8) | 1.0 (0.6, 1.8) | 1.6 (1.0, 2.5) | 3.1 (2.1, 4.5) | 3.9 (2.5, 5.9) | |
| Evolution | Evolution | 377 | 13311 | 0.9 (0.7, 1.0) | 2.3 (2.0, 2.5) | 2.9 (2.6, 3.3) | 4.2 (3.7, 4.8) | | |
| GMK Primary | GMK Primary | 31 | 830 | 1.1 (0.6, 2.1) | 2.6 (1.7, 4.0) | 3.6 (2.5, 5.3) | 4.4 (3.1, 6.2) | | |
| GMK Sphere Primary | GMK Primary | 666 | 26510 | 1.2 (1.1, 1.4) | 2.6 (2.4, 2.9) | 3.2 (2.9, 3.5) | 4.4 (3.9, 5.0) | | |
| | GMK Sphere Primary | 114 | 4070 | 0.7 (0.5, 1.0) | 2.6 (2.1, 3.2) | 3.7 (3.0, 4.5) | 4.9 (3.9, 6.2) | | |
| GMRS | MRH | 59 | 417 | 4.1 (2.5, 6.6) | 9.2 (6.5, 13.0) | 15.4 (11.5, 20.4) | | | |
| Genesis II CR | Genesis II | 741 | 17658 | 0.9 (0.8, 1.0) | 2.3 (2.0, 2.5) | 2.9 (2.7, 3.2) | 4.4 (4.0, 4.7) | 5.4 (5.0, 5.8) | 6.4 (5.8, 7.1) |
| Genesis II Oxinium CR | Genesis II | 682 | 11584 | 1.1 (0.9, 1.3) | 2.7 (2.4, 3.0) | 3.4 (3.1, 3.8) | 5.9 (5.4, 6.4) | 8.3 (7.7, 9.1) | 10.5 (9.6, 11.6) |
| Genesis II Oxinium PS | Genesis II | 1600 | 23196 | 1.4 (1.3, 1.6) | 3.5 (3.3, 3.8) | 4.8 (4.5, 5.1) | 7.0 (6.6, 7.3) | 9.3 (8.8, 9.8) | 11.9 (10.8, 13.1) |
| Genesis II PS | Genesis II | 928 | 20484 | 1.1 (1.0, 1.3) | 2.6 (2.4, 2.8) | 3.5 (3.2, 3.7) | 4.7 (4.4, 5.0) | 5.9 (5.5, 6.3) | 6.7 (6.1, 7.2) |
| Genus | Genus | 9 | 554 | 1.1 (0.4, 2.6) | 2.8 (1.3, 6.3) | | | | |
| Journey II Oxinium | Journey | 34 | 3952 | 0.5 (0.3, 0.8) | 2.2 (1.3, 3.6) | 4.4 (2.4, 8.1) | 4.4 (2.4, 8.1) | | |
| LCS CR | LCS | 342 | 3943 | 1.0 (0.7, 1.4) | 3.7 (3.2, 4.4) | 5.1 (4.4, 5.8) | 7.3 (6.5, 8.2) | 9.4 (8.5, 10.5) | 10.7 (9.6, 11.9) |
| | MBT* | 681 | 13326 | 0.9 (0.7, 1.0) | 2.6 (2.4, 2.9) | 3.6 (3.3, 3.9) | 5.3 (4.9, 5.7) | 6.3 (5.8, 6.8) | 7.8 (6.8, 8.9) |
| Legion CR | Genesis II | 149 | 5292 | 1.1 (0.9, 1.5) | 2.3 (1.9, 2.7) | 3.3 (2.8, 3.9) | 3.9 (3.2, 4.7) | 5.2 (3.7, 7.2) | |

**Table KT9** ***Cont***

| Femoral Component | Tibial Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Legion Oxinium CR | Genesis II | 371 | 12896 | 0.9 (0.7, 1.0) | 2.4 (2.1, 2.7) | 3.2 (2.8, 3.5) | 4.3 (3.8, 4.9) | 5.7 (4.8, 6.7) | |
| Legion Oxinium FS | Legion | 38 | 416 | 5.4 (3.6, 8.1) | 7.4 (5.2, 10.6) | 9.2 (6.6, 12.8) | 11.7 (8.3, 16.2) | | |
| Legion Oxinium PS | Genesis II | 832 | 19716 | 1.0 (0.9, 1.2) | 2.9 (2.6, 3.1) | 3.7 (3.5, 4.0) | 5.1 (4.8, 5.5) | 8.0 (6.9, 9.1) | |
| Legion PS | Genesis II | 240 | 6589 | 1.4 (1.1, 1.7) | 2.6 (2.2, 3.0) | 3.1 (2.7, 3.6) | 4.2 (3.7, 4.8) | 6.2 (4.5, 8.5) | |
| MRK | MRK | 28 | 774 | 1.0 (0.5, 2.1) | 2.3 (1.4, 3.7) | 2.9 (1.9, 4.4) | 4.5 (3.0, 6.6) | 5.7 (3.7, 8.7) | |
| Mutars | Mutars | 69 | 425 | 7.5 (5.3, 10.6) | 17.5 (13.7, 22.3) | 23.3 (18.3, 29.4) | | | |
| Nexgen LCCK | Nexgen | 67 | 1122 | 2.1 (1.4, 3.1) | 3.7 (2.7, 5.0) | 4.9 (3.7, 6.3) | 6.1 (4.7, 7.9) | 9.5 (6.9, 13.1) | |
| Nexgen LPS Flex | Nexgen | 1484 | 30441 | 1.0 (0.9, 1.1) | 2.4 (2.2, 2.5) | 3.1 (2.9, 3.3) | 4.9 (4.7, 5.2) | 6.5 (6.1, 6.9) | 8.3 (7.4, 9.3) |
| Nexgen RH | Nexgen | 51 | 958 | 2.1 (1.3, 3.3) | 4.0 (2.8, 5.6) | 5.3 (3.9, 7.2) | 8.3 (6.2, 11.2) | | |
| ORIGIN | ORIGIN | 2 | 567 | 0.4 (0.1, 1.5) | | | | | |
| Persona CR | Persona | 656 | 41362 | 0.9 (0.8, 1.0) | 1.9 (1.7, 2.0) | 2.4 (2.2, 2.6) | 2.6 (2.4, 2.9) | | |
| Persona PS | Persona | 157 | 6737 | 1.1 (0.9, 1.4) | 2.2 (1.9, 2.7) | 2.8 (2.4, 3.3) | 3.4 (2.8, 4.0) | | |
| SAIPH | SAIPH | 122 | 6791 | 0.6 (0.4, 0.8) | 1.6 (1.3, 2.0) | 2.1 (1.7, 2.5) | 2.8 (2.1, 3.6) | | |
| Score | Score | 57 | 1385 | 1.5 (1.0, 2.3) | 3.0 (2.2, 4.2) | 4.0 (3.0, 5.3) | 5.4 (4.2, 7.1) | | |
| Trekking | Trekking | 32 | 429 | 2.4 (1.3, 4.3) | 4.9 (3.2, 7.5) | 6.5 (4.5, 9.4) | 8.4 (6.0, 11.8) | | |
| Triathlon CR | Triathlon | 2104 | 89227 | 0.8 (0.7, 0.8) | 1.8 (1.7, 1.9) | 2.3 (2.2, 2.4) | 3.5 (3.3, 3.6) | 4.5 (4.2, 4.8) | |
| Triathlon FS | Triathlon | 36 | 576 | 2.7 (1.6, 4.4) | 5.6 (3.9, 8.0) | 6.8 (4.8, 9.5) | 8.0 (5.6, 11.4) | | |
| Triathlon PS | Triathlon | 510 | 11481 | 1.4 (1.2, 1.6) | 2.9 (2.6, 3.2) | 3.7 (3.3, 4.0) | 5.3 (4.8, 5.8) | 6.6 (5.9, 7.3) | |
| Unity Knee | Unity Knee | 9 | 1129 | 0.6 (0.3, 1.3) | 0.8 (0.4, 1.6) | 1.0 (0.5, 1.9) | | | |
| Vanguard CR | Vanguard | 530 | 12383 | 0.7 (0.6, 0.9) | 2.1 (1.9, 2.4) | 2.7 (2.4, 3.0) | 4.4 (4.0, 4.8) | 6.8 (6.0, 7.5) | |
| iTotal | iTotal | 11 | 747 | 0.8 (0.4, 1.8) | 1.7 (0.9, 3.4) | 2.4 (1.2, 4.9) | | | |
| Other (51) | | 289 | 3946 | 2.8 (2.3, 3.4) | 6.1 (5.3, 6.9) | 7.9 (7.0, 9.0) | 11.6 (10.1, 13.3) | 17.8 (14.5, 21.7) | |
| TOTAL | | 16156 | 474828 | | | | | | |

Note: Restricted to modern prostheses.
Some cementless components have been cemented.
Only combinations with >400 procedures have been listed.
* denotes prosthesis combinations that have not had any reported use in primary total knee procedures in 2024.

**Table KT10 Cumulative Percent Revision of Cementless Primary Total Knee Replacement by Prosthesis Combination**

| Femoral Component | Tibial Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| ACS | ACS Fixed | 63 | 1397 | 1.5 (0.9, 2.3) | 3.8 (2.9, 5.0) | 4.4 (3.4, 5.7) | 5.5 (4.3, 7.1) | | |
| Active Knee | Active Knee | 622 | 4899 | 1.3 (1.1, 1.7) | 4.0 (3.4, 4.5) | 5.6 (5.0, 6.3) | 9.6 (8.8, 10.5) | 13.2 (12.2, 14.2) | 16.2 (15.0, 17.6) |
| Apex Knee CR | Apex Knee | 32 | 525 | 2.5 (1.4, 4.2) | 5.0 (3.4, 7.3) | 5.7 (4.0, 8.1) | 6.5 (4.7, 9.2) | | |
| Attune CR | Attune | 91 | 6506 | 0.9 (0.7, 1.2) | 1.9 (1.5, 2.3) | 2.2 (1.7, 2.7) | | | |
| Attune PS | Attune | 6 | 498 | 0.2 (0.0, 1.5) | 1.8 (0.8, 4.0) | | | | |
| Columbus | Columbus | 72 | 500 | 3.2 (2.0, 5.2) | 7.7 (5.6, 10.4) | 9.7 (7.4, 12.7) | 13.1 (10.4, 16.5) | 15.9 (12.6, 19.9) | |
| GMK Primary | GMK Primary | 81 | 2134 | 1.1 (0.8, 1.7) | 3.0 (2.3, 3.8) | 3.7 (2.9, 4.7) | 5.7 (4.5, 7.3) | | |
| Genesis II CR | Genesis II | 51 | 749 | 1.5 (0.8, 2.6) | 3.8 (2.6, 5.4) | 4.7 (3.4, 6.5) | 6.9 (5.3, 9.1) | 8.3 (6.1, 11.2) | |
| Genesis II PS | Genesis II | 36 | 420 | 1.7 (0.8, 3.5) | 3.3 (2.0, 5.6) | 4.1 (2.5, 6.5) | 6.3 (4.3, 9.1) | 9.3 (6.6, 12.8) | |
| LCS CR | LCS | 176 | 2388 | 1.4 (1.0, 2.0) | 3.4 (2.8, 4.2) | 4.4 (3.6, 5.3) | 6.2 (5.3, 7.3) | 7.4 (6.3, 8.6) | 8.8 (7.6, 10.1) |
| | MBT* | 547 | 9395 | 1.1 (0.9, 1.3) | 3.4 (3.1, 3.8) | 4.1 (3.8, 4.6) | 5.4 (5.0, 5.9) | 7.4 (6.6, 8.1) | 9.9 (8.7, 11.3) |
| Nexgen LPS Flex | Nexgen | 54 | 1199 | 2.6 (1.8, 3.7) | 3.9 (3.0, 5.2) | 4.2 (3.2, 5.5) | 4.8 (3.7, 6.3) | | |
| Persona CR | Persona | 209 | 11385 | 1.1 (0.9, 1.3) | 2.5 (2.1, 2.8) | 3.0 (2.5, 3.6) | | | |
| Score | Score | 264 | 2990 | 1.5 (1.1, 2.0) | 4.7 (4.0, 5.5) | 6.3 (5.5, 7.3) | 10.1 (8.9, 11.4) | 12.3 (10.7, 14.0) | |
| Triathlon CR | Triathlon | 1354 | 57628 | 1.0 (0.9, 1.1) | 2.1 (2.0, 2.2) | 2.7 (2.5, 2.9) | 4.0 (3.8, 4.3) | 5.4 (5.0, 5.8) | |
| Triathlon PS | Triathlon | 78 | 1601 | 1.8 (1.2, 2.6) | 3.2 (2.5, 4.3) | 4.1 (3.2, 5.3) | 5.2 (4.1, 6.6) | 6.5 (5.1, 8.3) | |
| Vanguard CR | Vanguard | 119 | 1695 | 1.4 (1.0, 2.1) | 4.1 (3.3, 5.2) | 4.8 (3.9, 6.0) | 6.4 (5.3, 7.7) | 10.1 (7.7, 13.1) | |
| Other (22) | | 144 | 1768 | 2.5 (1.9, 3.4) | 6.4 (5.3, 7.7) | 7.7 (6.4, 9.1) | 9.2 (7.8, 10.9) | 10.9 (8.9, 13.4) | |
| TOTAL | | 3999 | 107677 | | | | | | |

Note: Restricted to modern prostheses
Only combinations with >400 procedures have been listed
* denotes prosthesis combinations that have not had any reported use in primary total knee procedures in 2024

**Table KT11 Cumulative Percent Revision of Hybrid Primary Total Knee Replacement by Prosthesis Combination**

| Femoral Component | Tibial Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| ACS | ACS Fixed | 79 | 1630 | 1.2 (0.8, 1.9) | 3.5 (2.7, 4.5) | 4.3 (3.4, 5.5) | 5.8 (4.6, 7.3) | | |
| Active Knee | Active Knee | 178 | 2424 | 0.6 (0.4, 1.0) | 2.7 (2.1, 3.5) | 3.8 (3.1, 4.7) | 6.7 (5.7, 7.9) | 10.0 (8.6, 11.8) | 11.5 (9.7, 13.6) |
| Anatomic | Anatomic | 16 | 760 | 1.6 (0.8, 2.9) | 2.3 (1.3, 4.0) | 2.7 (1.5, 4.6) | | | |
| Apex Knee CR | Apex Knee | 122 | 6320 | 0.8 (0.6, 1.1) | 1.7 (1.4, 2.0) | 2.1 (1.7, 2.6) | 3.3 (2.6, 4.3) | | |
| Attune CR | Attune | 45 | 3454 | 0.8 (0.5, 1.2) | 2.0 (1.4, 2.7) | 2.1 (1.5, 2.9) | | | |
| Attune PS | Attune | 39 | 1342 | 1.6 (1.0, 2.5) | 3.6 (2.6, 5.0) | | | | |
| BalanSys | BalanSys | 76 | 2540 | 1.0 (0.7, 1.5) | 2.1 (1.6, 2.8) | 2.8 (2.2, 3.5) | 3.9 (3.1, 5.1) | | |
| GMK Primary | GMK Primary | 40 | 1074 | 1.3 (0.8, 2.2) | 3.5 (2.5, 4.9) | 4.0 (2.9, 5.5) | 4.7 (3.4, 6.4) | | |
| Genesis II CR | Genesis II | 553 | 8888 | 1.0 (0.8, 1.2) | 3.3 (2.9, 3.7) | 4.4 (3.9, 4.8) | 6.0 (5.5, 6.5) | 7.4 (6.8, 8.1) | 9.1 (8.1, 10.1) |
| Genesis II PS | Genesis II | 72 | 707 | 1.7 (1.0, 3.0) | 4.4 (3.1, 6.2) | 5.6 (4.1, 7.6) | 8.9 (7.0, 11.4) | 10.7 (8.5, 13.5) | 12.4 (9.8, 15.6) |
| LCS CR | LCS | 156 | 2364 | 1.0 (0.7, 1.5) | 2.7 (2.1, 3.5) | 3.8 (3.1, 4.7) | 5.5 (4.6, 6.6) | 6.9 (5.8, 8.1) | 8.1 (6.9, 9.5) |
| | MBT* | 439 | 11102 | 0.7 (0.6, 0.9) | 2.2 (1.9, 2.5) | 2.8 (2.5, 3.1) | 4.0 (3.6, 4.4) | 4.8 (4.3, 5.3) | 6.2 (5.4, 7.2) |
| Legion CR | Genesis II | 227 | 5168 | 1.3 (1.0, 1.7) | 3.3 (2.8, 3.9) | 4.3 (3.7, 4.9) | 6.7 (5.8, 7.9) | | |
| Nexgen LPS Flex | Nexgen | 58 | 933 | 2.3 (1.5, 3.4) | 4.3 (3.2, 5.8) | 5.4 (4.1, 7.1) | 6.8 (5.2, 8.7) | | |
| Persona CR | Persona | 359 | 24529 | 0.9 (0.7, 1.0) | 1.9 (1.7, 2.1) | 2.3 (2.1, 2.6) | | | |
| Score | Score | 135 | 2055 | 1.3 (0.9, 1.9) | 3.7 (2.9, 4.7) | 5.5 (4.5, 6.7) | 9.1 (7.6, 10.9) | | |
| Trekking | Trekking | 24 | 564 | 1.1 (0.5, 2.4) | 2.9 (1.8, 4.6) | 3.4 (2.2, 5.3) | 4.4 (2.9, 6.5) | | |
| Triathlon CR | Triathlon | 985 | 43631 | 0.7 (0.6, 0.7) | 1.6 (1.4, 1.7) | 2.1 (2.0, 2.3) | 3.1 (2.9, 3.3) | 4.5 (4.0, 5.1) | |
| Triathlon PS | Triathlon | 142 | 3256 | 1.6 (1.2, 2.1) | 2.7 (2.2, 3.3) | 3.5 (2.9, 4.3) | 4.9 (4.2, 5.8) | 5.6 (4.7, 6.7) | |
| Vanguard CR | Vanguard | 595 | 13484 | 0.8 (0.6, 0.9) | 2.2 (2.0, 2.5) | 2.9 (2.6, 3.2) | 4.6 (4.2, 5.0) | 6.8 (6.1, 7.6) | |
| Other (48) | | 212 | 2331 | 3.2 (2.5, 4.1) | 7.0 (5.9, 8.2) | 8.5 (7.4, 9.9) | 10.9 (9.5, 12.5) | 12.7 (11.1, 14.6) | |
| **TOTAL** | | **4552** | **138556** | | | | | | |

Note: Restricted to modern prostheses
Only combinations with >400 procedures have been listed
* denotes prosthesis combinations that have not had any reported use in primary total knee procedures in 2024

# Primary Total Knee Replacement

## OUTCOME FOR OSTEOARTHRITIS – PATIENT CHARACTERISTICS

Primary total knee replacement has the lowest rate of revision compared to all other classes of primary knee replacement. At 20 years, the cumulative percent revision of all primary total knee replacement procedures undertaken for osteoarthritis is 8.0% (Table KT12 and Figure KT7).

### Reasons for Revision

Infection is the most common reason for revision, followed by loosening, instability, patella erosion, and pain (Table KT13 and Figure KT8).

### Types of Revision

The most common types of revision are insert only, both femoral and tibial components, and patella only (Table KT14).

### Age and Gender

The rate of revision decreases with increasing age. This difference becomes more evident with time. Compared to patients aged ≥75 years, patients aged <55 years have almost 3 times the rate of revision after 6 months and this increases to nearly 7 times after 12 years (Table KT15 and Figure KT9).

Males have a higher rate of revision compared to females (Table KT16 and Figure KT10). Loosening is the most common reason for revision in females. Males have a higher incidence of revision for infection (Figure KT11,Table KT17 and Figure KT12).

Age-related differences in the rate of revision are evident for both males and females (Table KT16, Figure KT13 and Figure KT14).

### ASA and BMI

ASA scores are an indication of comorbidity and have been collected since 2012. There are 536,722 primary total knee replacement procedures for osteoarthritis with these scores. When compared to patients with an ASA score of 1, patients in all other ASA groups have a higher rate of revision (Table KT18 and Figure KT15). The difference in the rate of revision for each ASA score is partially due to an increase in the cumulative incidence of infection with increasing ASA score (Figure KT16).

When patients with ASA scores 3-5 are compared, males have a higher rate of revision than females. Male patients with ASA scores 1-2 have a higher rate of revision compared to female patients with these scores only until 1.5 years, and after this time, there is no longer a difference (Table KT19 and Figure KT17).

Patients aged <65 years have higher rates of revision compared to patients ≥65 years when compared by comorbidity scores, which are grouped ASA 1-2 and ASA 3-5 (Table KT20 and Figure KT18).

BMI data have been collected since 2015. There are revision outcomes for 460,298 primary total knee replacement procedures for osteoarthritis in relation to BMI category. When compared to patients with normal BMI, there is no difference in the rate of revision for patients who are pre-obese or obese class 1. However, there is an early increase in the rate of revision for patients in obese class 2 and obese class 3 (Table KT20 and Figure KT19).

The most common reasons for revision are shown in Figure KT20.

Compared to patients who have BMI <30, patients in obese classes 1-3 have an increased rate of early revision until 3 months for females, and until 2 years for males. There is an increased rate of revision for obese male patients compared to obese female patients (Table KT22 and Figure KT21).

Patients aged <65 years have higher rates of revision than patients aged ≥65 years irrespective of obesity (Table KT23 and Figure KT22).

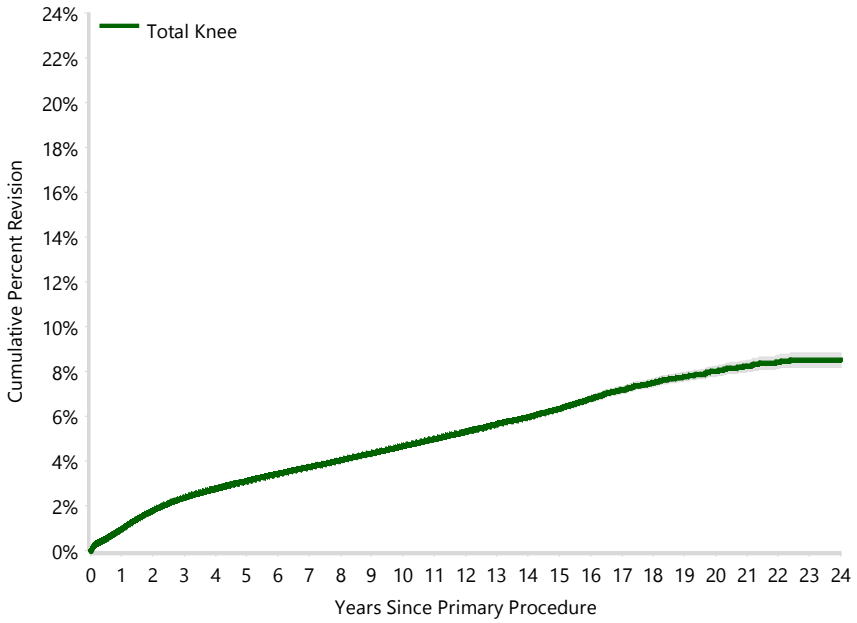
Males have a higher rate of revision which is largely due to an increased incidence of infection.

**Table KT12 Cumulative Percent Revision of Primary Total Knee Replacement (Primary Diagnosis OA)**

| Knee Class | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Total Knee | 23890 | 706349 | 1.0 (1.0, 1.0) | 2.4 (2.3, 2.4) | 3.1 (3.1, 3.2) | 4.7 (4.6, 4.7) | 6.3 (6.2, 6.5) | 8.0 (7.8, 8.2) |
| TOTAL | 23890 | 706349 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT7 Cumulative Percent Revision of Primary Total Knee Replacement (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Total Knee | 706349 | 627600 | 487721 | 371992 | 150981 | 40301 | 6544 |

Note: Restricted to modern prostheses

# Primary Total Knee Replacement

**Table KT13 Primary Total Knee Replacement by Reason for Revision (Primary Diagnosis OA)**

| Reason for Revision | Number | Percent |
|---|---|---|
| Infection | 6816 | 28.5 |
| Loosening | 5090 | 21.3 |
| Instability | 2475 | 10.4 |
| Patella Erosion | 1774 | 7.4 |
| Pain | 1727 | 7.2 |
| Patellofemoral Pain | 1435 | 6.0 |
| Arthrofibrosis | 1039 | 4.3 |
| Fracture | 963 | 4.0 |
| Malalignment | 469 | 2.0 |
| Wear Tibial Insert | 311 | 1.3 |
| Lysis | 256 | 1.1 |
| Incorrect Sizing | 204 | 0.9 |
| Metal Related Pathology | 97 | 0.4 |
| Other | 1234 | 5.2 |
| TOTAL | 23890 | 100.0 |

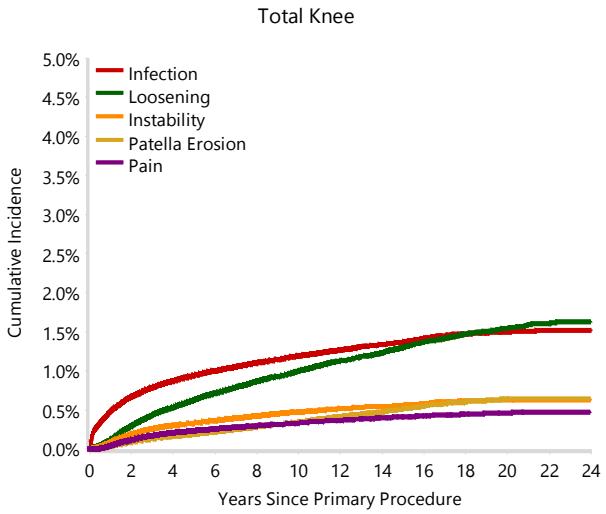
Note: Restricted to modern prostheses

**Table KT14 Primary Total Knee Replacement by Type of Revision (Primary Diagnosis OA)**

| Type of Revision | Number | Percent |
|---|---|---|
| Insert Only | 7431 | 31.1 |
| TKR (Tibial/Femoral) | 5741 | 24.0 |
| Patella Only | 4054 | 17.0 |
| Insert/Patella | 2610 | 10.9 |
| Tibial Component | 1740 | 7.3 |
| Femoral Component | 1081 | 4.5 |
| Cement Spacer | 1043 | 4.4 |
| Removal of Prostheses | 115 | 0.5 |
| Minor Components | 50 | 0.2 |
| Total Femoral | 13 | 0.1 |
| Reinsertion of Components | 7 | 0.0 |
| Cement Only | 5 | 0.0 |
| TOTAL | 23890 | 100.0 |

Note: Restricted to modern prostheses

**Figure KT8 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement (Primary Diagnosis OA)**



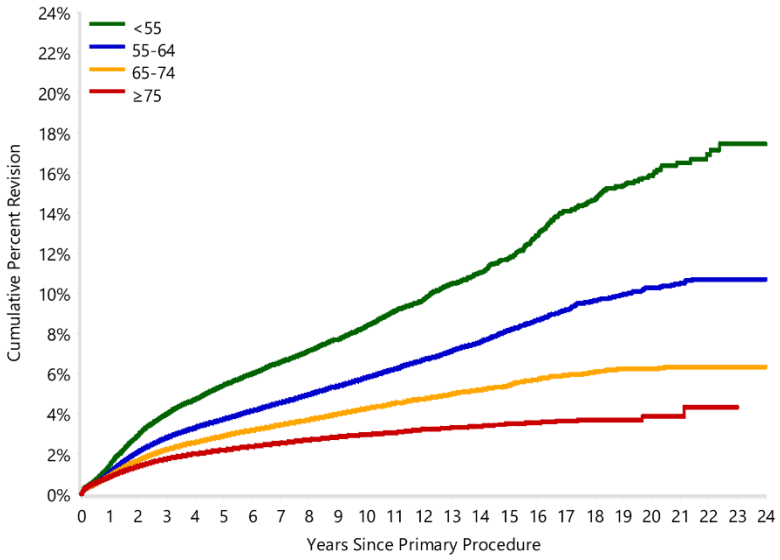

Note: Restricted to modern prostheses

**Table KT15 Cumulative Percent Revision of Primary Total Knee Replacement by Age (Primary Diagnosis OA)**

| Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| <55 | 2983 | 45534 | 1.5 (1.3, 1.6) | 4.0 (3.8, 4.2) | 5.4 (5.2, 5.7) | 8.4 (8.0, 8.7) | 11.8 (11.2, 12.3) | 15.8 (14.9, 16.8) |
| 55-64 | 8238 | 187339 | 1.1 (1.0, 1.1) | 2.8 (2.7, 2.9) | 3.7 (3.6, 3.8) | 5.8 (5.7, 5.9) | 8.2 (7.9, 8.4) | 10.3 (9.9, 10.7) |
| 65-74 | 8742 | 285944 | 0.9 (0.9, 1.0) | 2.2 (2.2, 2.3) | 2.9 (2.8, 3.0) | 4.3 (4.2, 4.4) | 5.4 (5.3, 5.6) | 6.3 (6.0, 6.5) |
| ≥75 | 3927 | 187532 | 0.9 (0.8, 0.9) | 1.8 (1.7, 1.8) | 2.2 (2.1, 2.3) | 3.0 (2.9, 3.1) | 3.5 (3.3, 3.7) | 3.9 (3.5, 4.3) |
| TOTAL | 23890 | 706349 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT9 Cumulative Percent Revision of Primary Total Knee Replacement by Age (Primary Diagnosis OA)**




HR - adjusted for gender

<55 vs ≥75

- 0 - 3Mth: HR=1.12 (95% CI 0.96, 1.31), p=0.152
- 3Mth - 6Mth: HR=1.52 (95% CI 1.25, 1.84), p<0.001
- 6Mth - 1.5Yr: HR=2.59 (95% CI 2.34, 2.86), p<0.001
- 1.5Yr - 2Yr: HR=2.97 (95% CI 2.56, 3.45), p<0.001
- 2Yr - 2.5Yr: HR=2.82 (95% CI 2.40, 3.31), p<0.001
- 2.5Yr - 4Yr: HR=3.24 (95% CI 2.87, 3.67), p<0.001
- 4Yr - 12Yr: HR=3.85 (95% CI 3.52, 4.22), p<0.001
- 12Yr+: HR=6.97 (95% CI 5.85, 8.30), p<0.001

55-64 vs ≥75

- 0 - 6Mth: HR=0.94 (95% CI 0.86, 1.03), p=0.176
- 6Mth - 1.5Yr: HR=1.85 (95% CI 1.71, 1.99), p<0.001
- 1.5Yr - 2Yr: HR=2.01 (95% CI 1.79, 2.25), p<0.001
- 2Yr - 2.5Yr: HR=1.72 (95% CI 1.52, 1.94), p<0.001
- 2.5Yr - 3Yr: HR=2.14 (95% CI 1.84, 2.49), p<0.001
- 3Yr - 4Yr: HR=2.24 (95% CI 2.01, 2.49), p<0.001
- 4Yr - 5.5Yr: HR=2.21 (95% CI 1.99, 2.46), p<0.001
- 5.5Yr - 12Yr: HR=2.69 (95% CI 2.48, 2.92), p<0.001
- 12Yr - 13Yr: HR=3.55 (95% CI 2.78, 4.53), p<0.001
- 13Yr+: HR=4.05 (95% CI 3.43, 4.79), p<0.001

65-74 vs ≥75

- 0 - 6Mth: HR=0.91 (95% CI 0.84, 0.99), p=0.024
- 6Mth - 1.5Yr: HR=1.38 (95% CI 1.28, 1.49), p<0.001
- 1.5Yr - 2.5Yr: HR=1.42 (95% CI 1.30, 1.56), p<0.001
- 2.5Yr - 3Yr: HR=1.60 (95% CI 1.38, 1.85), p<0.001
- 3Yr+: HR=1.66 (95% CI 1.55, 1.77), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| <55 | 45534 | 40826 | 32307 | 25125 | 11711 | 3803 | 870 |
| 55-64 | 187339 | 167976 | 133159 | 103888 | 46827 | 14556 | 2744 |
| 65-74 | 285944 | 254290 | 198178 | 151584 | 61915 | 16523 | 2478 |
| ≥75 | 187532 | 164508 | 124077 | 91395 | 30528 | 5419 | 452 |

Note: Restricted to modern prostheses

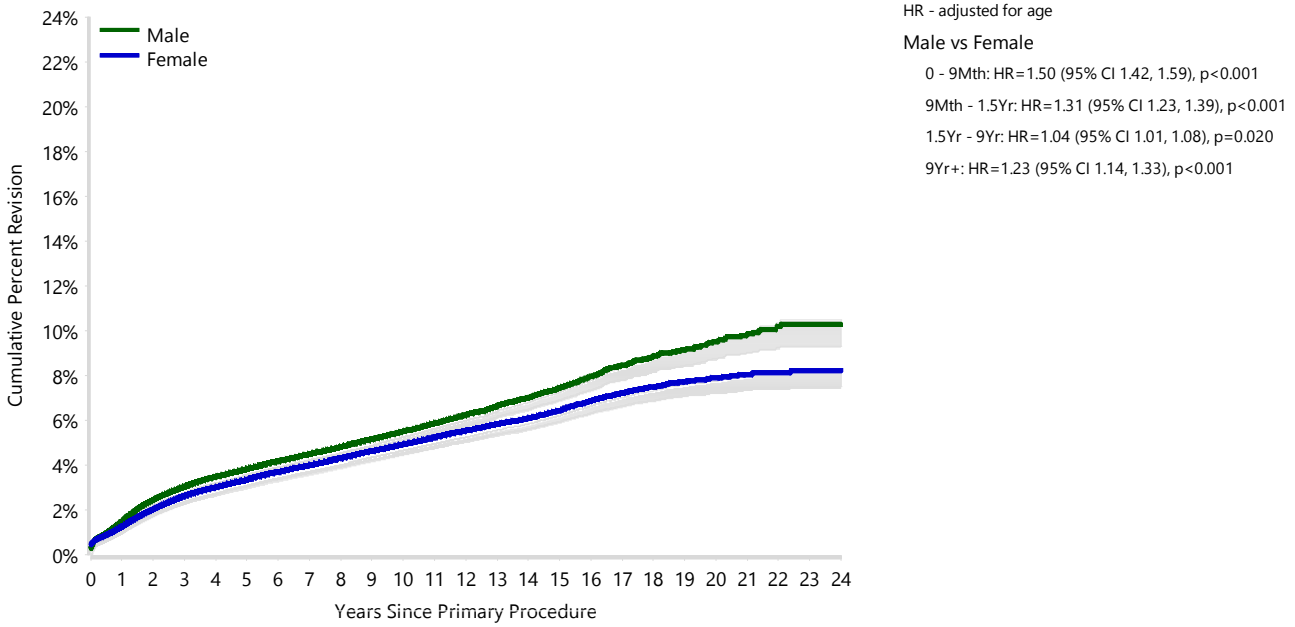
# Primary Total Knee Replacement

**Table KT16 Cumulative Percent Revision of Primary Total Knee Replacement by Gender and Age (Primary Diagnosis OA)**

| Gender | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| **Male** | | **11595** | **315153** | **1.2 (1.2, 1.2)** | **2.7 (2.6, 2.8)** | **3.5 (3.4, 3.5)** | **5.1 (5.0, 5.2)** | **7.0 (6.8, 7.2)** | **9.1 (8.7, 9.4)** |
| | **<55** | 1360 | 19711 | 1.8 (1.6, 2.0) | 4.4 (4.1, 4.7) | 5.8 (5.4, 6.1) | 8.7 (8.2, 9.2) | 12.1 (11.3, 12.9) | 16.4 (15.0, 17.9) |
| | **55-64** | 4116 | 88899 | 1.3 (1.2, 1.3) | 3.1 (3.0, 3.2) | 4.0 (3.9, 4.2) | 6.1 (5.9, 6.4) | 8.8 (8.5, 9.2) | 11.5 (10.9, 12.3) |
| | **65-74** | 4324 | 129601 | 1.1 (1.1, 1.2) | 2.5 (2.4, 2.6) | 3.2 (3.1, 3.3) | 4.7 (4.5, 4.8) | 6.0 (5.7, 6.2) | 6.8 (6.4, 7.2) |
| | **≥75** | 1795 | 76942 | 1.0 (1.0, 1.1) | 2.1 (2.0, 2.2) | 2.5 (2.4, 2.7) | 3.3 (3.1, 3.4) | 3.8 (3.6, 4.1) | 4.5 (3.4, 5.9) |
| **Female** | | **12295** | **391196** | **0.8 (0.8, 0.8)** | **2.1 (2.1, 2.2)** | **2.8 (2.8, 2.9)** | **4.4 (4.3, 4.4)** | **5.8 (5.7, 6.0)** | **7.3 (7.0, 7.5)** |
| | **<55** | 1623 | 25823 | 1.2 (1.1, 1.4) | 3.7 (3.5, 3.9) | 5.2 (4.9, 5.5) | 8.1 (7.7, 8.6) | 11.5 (10.8, 12.2) | 15.4 (14.2, 16.7) |
| | **55-64** | 4122 | 98440 | 0.9 (0.8, 1.0) | 2.5 (2.4, 2.7) | 3.5 (3.3, 3.6) | 5.5 (5.3, 5.7) | 7.6 (7.3, 7.9) | 9.3 (8.8, 9.7) |
| | **65-74** | 4418 | 156343 | 0.7 (0.7, 0.8) | 2.0 (1.9, 2.1) | 2.6 (2.5, 2.7) | 4.0 (3.8, 4.1) | 5.0 (4.8, 5.2) | 5.8 (5.5, 6.2) |
| | **≥75** | 2132 | 110590 | 0.7 (0.7, 0.8) | 1.5 (1.5, 1.6) | 2.0 (1.9, 2.1) | 2.8 (2.6, 2.9) | 3.3 (3.1, 3.5) | 3.5 (3.2, 3.8) |
| TOTAL | | 23890 | 706349 | | | | | | |

Note: Restricted to modern prostheses

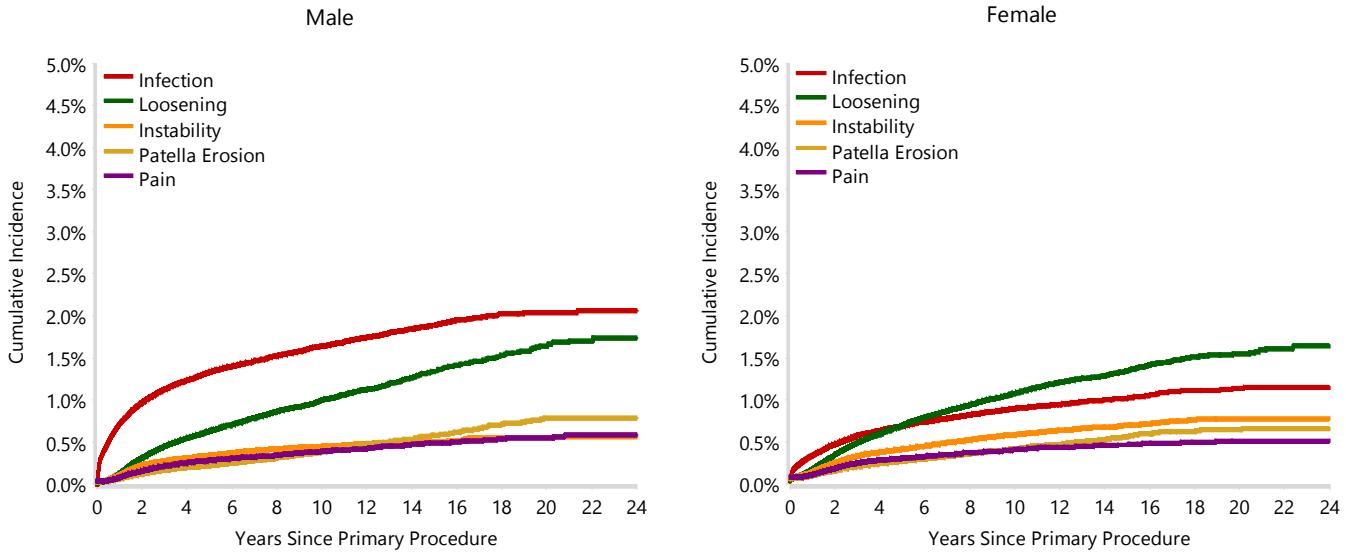
**Figure KT10 Cumulative Percent Revision of Primary Total Knee Replacement by Gender (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| **Male** | 315153 | 278550 | 213911 | 159906 | 62303 | 16039 | 2543 |
| **Female** | 391196 | 349050 | 273810 | 212086 | 88678 | 24262 | 4001 |

Note: Restricted to modern prostheses

**Figure KT11 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by Gender (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

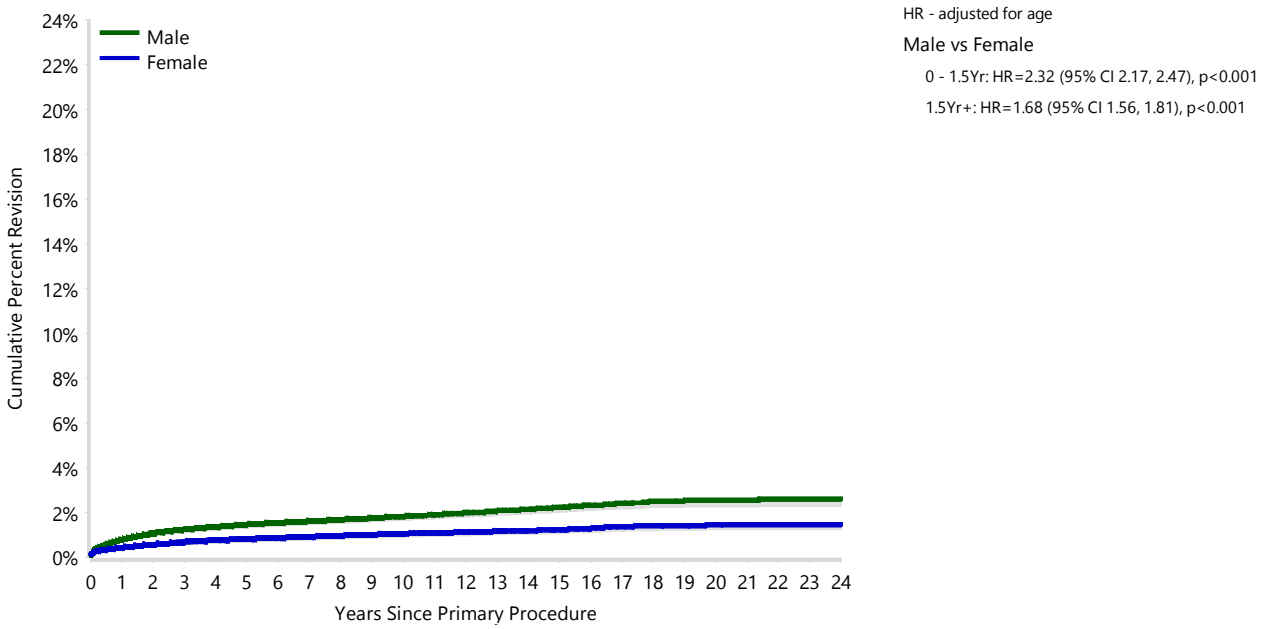
# Primary Total Knee Replacement

**Table KT17 Cumulative Percent Revision of Primary Total Knee Replacement by Gender (Primary Diagnosis OA, Revision for Infection)**

| Gender | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Male | 4186 | 315153 | 0.7 (0.7, 0.7) | 1.1 (1.1, 1.2) | 1.4 (1.3, 1.4) | 1.7 (1.7, 1.8) | 2.1 (2.0, 2.2) | 2.4 (2.3, 2.6) |
| Female | 2630 | 391196 | 0.3 (0.3, 0.3) | 0.5 (0.5, 0.6) | 0.7 (0.6, 0.7) | 0.9 (0.9, 0.9) | 1.1 (1.0, 1.1) | 1.3 (1.2, 1.4) |
| TOTAL | 6816 | 706349 | | | | | | |

Note: Restricted to modern prostheses

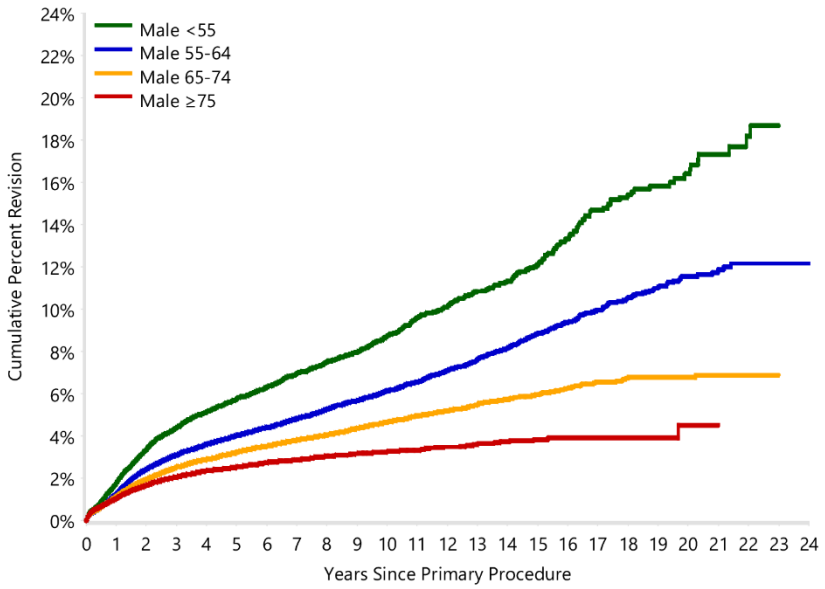
**Figure KT12 Cumulative Percent Revision of Primary Total Knee Replacement by Gender (Primary Diagnosis OA, Revision for Infection)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Male | 315153 | 278550 | 213911 | 159906 | 62303 | 16039 | 2543 |
| Female | 391196 | 349050 | 273810 | 212086 | 88678 | 24262 | 4001 |

Note: Restricted to modern prostheses

**Figure KT13 Cumulative Percent Revision of Primary Total Knee Replacement in Males by Age (Primary Diagnosis OA)**




Male <55 vs Male ≥75
- 0 - 3Mth: HR=1.10 (95% CI 0.89, 1.37), p=0.386
- 3Mth - 1.5Yr: HR=2.21 (95% CI 1.96, 2.50), p<0.001
- 1.5Yr - 2Yr: HR=2.93 (95% CI 2.36, 3.64), p<0.001
- 2Yr - 4Yr: HR=2.67 (95% CI 2.28, 3.11), p<0.001
- 4Yr - 7Yr: HR=3.88 (95% CI 3.22, 4.68), p<0.001
- 7Yr - 9Yr: HR=3.73 (95% CI 2.85, 4.89), p<0.001
- 9Yr - 11Yr: HR=5.96 (95% CI 4.58, 7.76), p<0.001
- 11Yr - 12.5Yr: HR=4.53 (95% CI 3.11, 6.61), p<0.001
- 12.5Yr - 14Yr: HR=4.15 (95% CI 2.66, 6.48), p<0.001
- 14Yr+: HR=9.11 (95% CI 6.51, 12.74), p<0.001

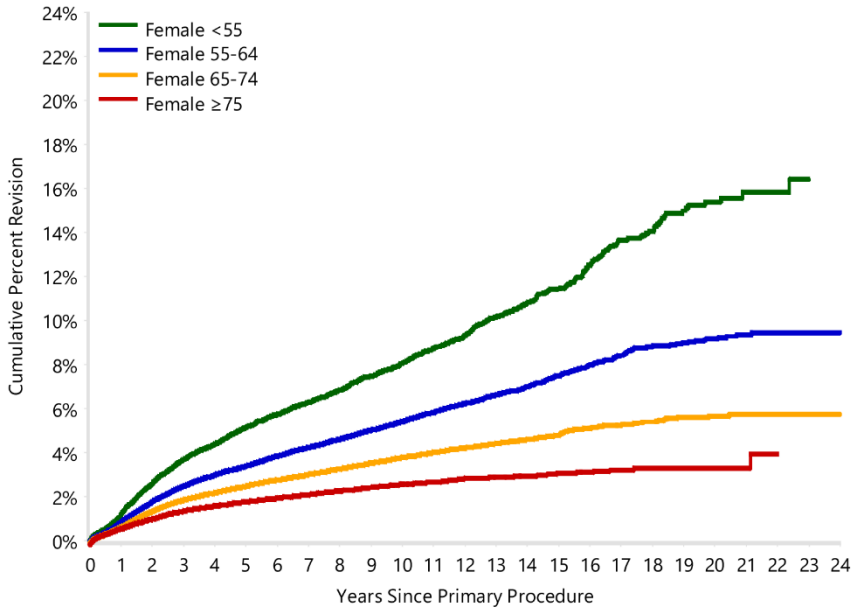
Male 55-64 vs Male ≥75
- 0 - 6Mth: HR=0.96 (95% CI 0.86, 1.08), p=0.513
- 6Mth - 1.5Yr: HR=1.73 (95% CI 1.56, 1.92), p<0.001
- 1.5Yr - 2Yr: HR=1.92 (95% CI 1.63, 2.26), p<0.001
- 2Yr - 2.5Yr: HR=1.64 (95% CI 1.38, 1.95), p<0.001
- 2.5Yr - 4Yr: HR=1.78 (95% CI 1.53, 2.06), p<0.001
- 4Yr - 7Yr: HR=2.54 (95% CI 2.19, 2.95), p<0.001
- 7Yr - 13Yr: HR=3.27 (95% CI 2.80, 3.83), p<0.001
- 13Yr+: HR=5.07 (95% CI 3.88, 6.62), p<0.001

Male 65-74 vs Male ≥75
- 0 - 6Mth: HR=0.95 (95% CI 0.86, 1.06), p=0.391
- 6Mth - 1.5Yr: HR=1.30 (95% CI 1.18, 1.44), p<0.001
- 1.5Yr - 2.5Yr: HR=1.32 (95% CI 1.16, 1.51), p<0.001
- 2.5Yr - 4Yr: HR=1.44 (95% CI 1.24, 1.66), p<0.001
- 4Yr+: HR=1.93 (95% CI 1.69, 2.20), p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| **Male** | **<55** | 19711 | 17580 | 13906 | 10746 | 4947 | 1650 | 388 |
| | **55-64** | 88899 | 79203 | 62053 | 47548 | 20649 | 6209 | 1137 |
| | **65-74** | 129601 | 114683 | 88480 | 66415 | 26084 | 6548 | 895 |
| | **≥75** | 76942 | 67084 | 49472 | 35197 | 10623 | 1632 | 123 |

Note: Restricted to modern prostheses

**Figure KT14 Cumulative Percent Revision of Primary Total Knee Replacement in Females by Age (Primary Diagnosis OA)**




Female <55 vs Female ≥75
- 0 - 6Mth: HR=1.17 (95% CI 0.97, 1.42), p=0.095
- 6Mth - 2.5Yr: HR=2.88 (95% CI 2.59, 3.20), p<0.001
- 2.5Yr - 4Yr: HR=3.31 (95% CI 2.82, 3.89), p<0.001
- 4Yr - 12Yr: HR=4.04 (95% CI 3.59, 4.54), p<0.001
- 12Yr+: HR=7.70 (95% CI 6.09, 9.74), p<0.001

Female 55-64 vs Female ≥75
- 0 - 6Mth: HR=0.92 (95% CI 0.80, 1.04), p=0.188
- 6Mth - 1.5Yr: HR=1.91 (95% CI 1.72, 2.12), p<0.001
- 1.5Yr - 2Yr: HR=2.13 (95% CI 1.82, 2.49), p<0.001
- 2Yr - 2.5Yr: HR=1.73 (95% CI 1.46, 2.04), p<0.001
- 2.5Yr - 3Yr: HR=2.28 (95% CI 1.91, 2.74), p<0.001
- 3Yr - 5.5Yr: HR=2.32 (95% CI 2.08, 2.58), p<0.001
- 5.5Yr - 12Yr: HR=2.74 (95% CI 2.46, 3.05), p<0.001
- 12Yr - 13Yr: HR=3.44 (95% CI 2.44, 4.83), p<0.001
- 13Yr+: HR=3.87 (95% CI 3.08, 4.87), p<0.001

Female 65-74 vs Female ≥75
- 0 - 6Mth: HR=0.87 (95% CI 0.77, 0.98), p=0.021
- 6Mth - 1.5Yr: HR=1.43 (95% CI 1.29, 1.58), p<0.001
- 1.5Yr - 2Yr: HR=1.59 (95% CI 1.37, 1.85), p<0.001
- 2Yr - 2.5Yr: HR=1.42 (95% CI 1.21, 1.66), p<0.001
- 2.5Yr - 3.5Yr: HR=1.46 (95% CI 1.26, 1.68), p<0.001
- 3.5Yr+: HR=1.67 (95% CI 1.52, 1.83), p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| **Female** | **<55** | 25823 | 23246 | 18401 | 14379 | 6764 | 2153 | 482 |
| | **55-64** | 98440 | 88773 | 71106 | 56340 | 26178 | 8347 | 1607 |
| | **65-74** | 156343 | 139607 | 109698 | 85169 | 35831 | 9975 | 1583 |
| | **≥75** | 110590 | 97424 | 74605 | 56198 | 19905 | 3787 | 329 |

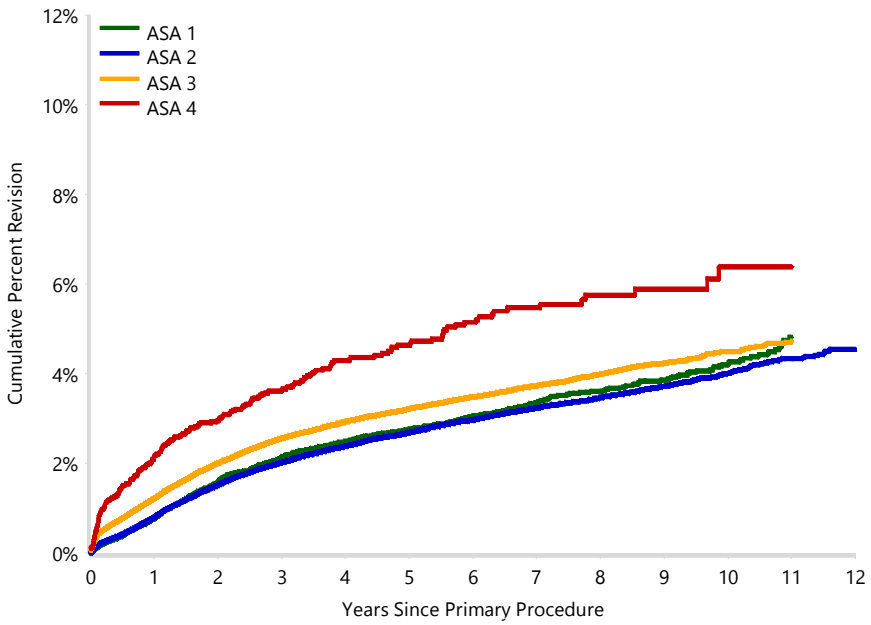
Note: Restricted to modern prostheses

**Table KT18 Cumulative Percent Revision of Primary Total Knee Replacement by ASA Score (Primary Diagnosis OA)**

| ASA Score | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|---|
| ASA 1 | 788 | 28454 | 0.8 (0.7, 0.9) | 2.1 (2.0, 2.3) | 2.7 (2.5, 3.0) | 3.4 (3.1, 3.6) | 3.9 (3.6, 4.2) | 4.8 (4.3, 5.3) |
| ASA 2 | 7096 | 294284 | 0.8 (0.7, 0.8) | 2.0 (1.9, 2.0) | 2.6 (2.6, 2.7) | 3.2 (3.1, 3.3) | 3.7 (3.6, 3.7) | 4.3 (4.1, 4.4) |
| ASA 3 | 5966 | 225884 | 1.2 (1.1, 1.2) | 2.5 (2.4, 2.5) | 3.1 (3.0, 3.2) | 3.6 (3.5, 3.7) | 4.1 (4.0, 4.3) | 4.6 (4.4, 4.8) |
| ASA 4 | 218 | 5558 | 2.0 (1.7, 2.5) | 3.5 (3.0, 4.1) | 4.5 (3.9, 5.2) | 5.4 (4.6, 6.2) | 5.8 (5.0, 6.7) | 6.3 (5.3, 7.5) |
| ASA 5 | 1 | 21 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 9.1 (1.3, 49.2) | 9.1 (1.3, 49.2) | | |
| TOTAL | 14069 | 554201 | | | | | | |

Note: Restricted to modern prostheses
Excludes 152,148 procedures with unknown ASA score

**Figure KT15 Cumulative Percent Revision of Primary Total Knee Replacement by ASA Score (Primary Diagnosis OA)**




HR - adjusted for age and gender

ASA 2 vs ASA 1

Entire Period: HR=1.12 (95% CI 1.04, 1.20), p=0.003

ASA 3 vs ASA 1

0 - 2Wk: HR=2.37 (95% CI 1.88, 3.00), p<0.001
2Wk - 1Mth: HR=2.79 (95% CI 2.36, 3.30), p<0.001
1Mth - 6Mth: HR=1.90 (95% CI 1.70, 2.13), p<0.001
6Mth - 2Yr: HR=1.36 (95% CI 1.25, 1.48), p<0.001
2Yr+: HR=1.21 (95% CI 1.11, 1.32), p<0.001

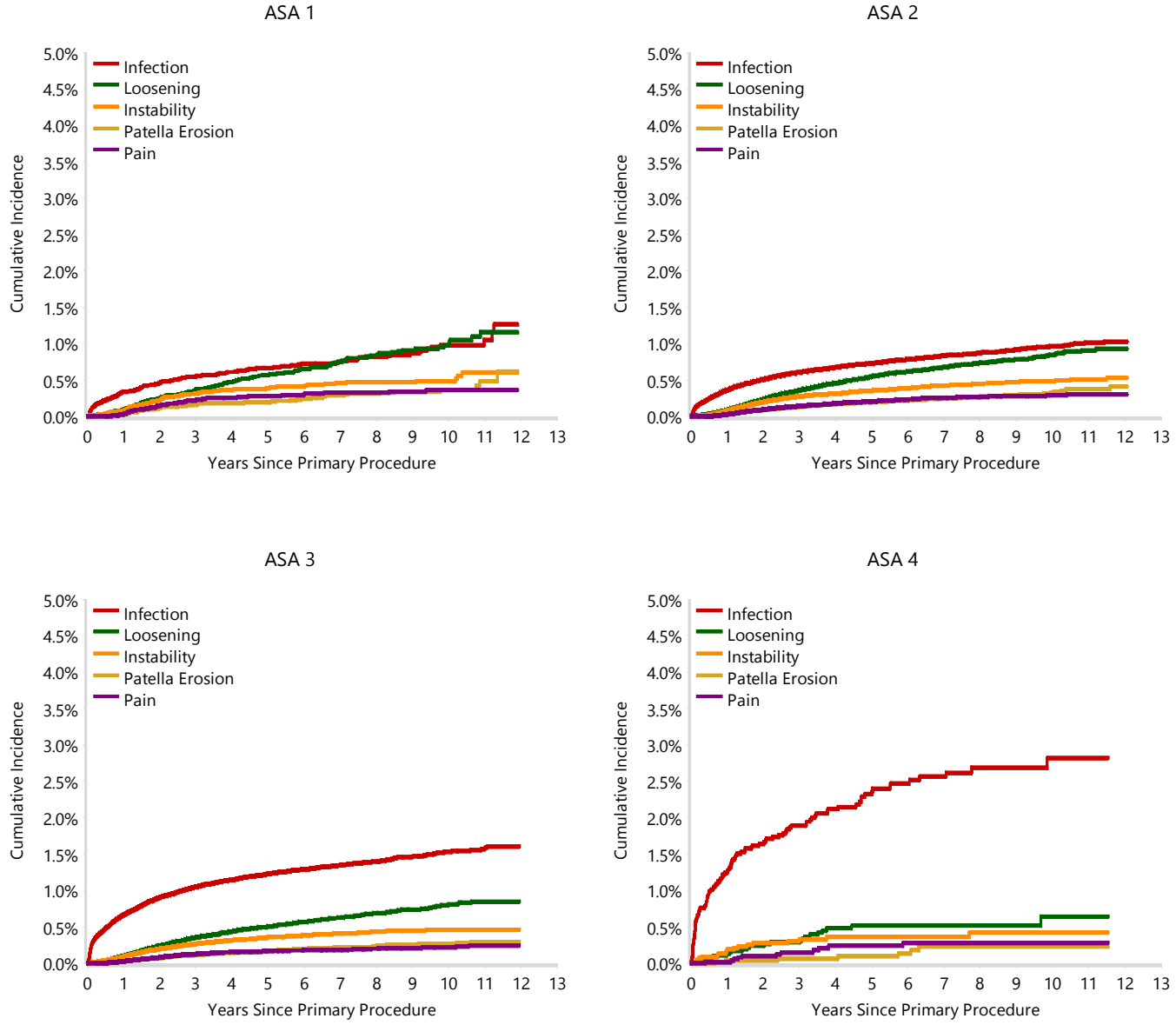
ASA 4 vs ASA 1

0 - 1Mth: HR=4.21 (95% CI 2.73, 6.51), p<0.001
1Mth - 3Mth: HR=5.67 (95% CI 3.99, 8.05), p<0.001
3Mth - 1.5Yr: HR=2.29 (95% CI 1.81, 2.89), p<0.001
1.5Yr+: HR=1.63 (95% CI 1.30, 2.04), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|
| ASA 1 | 28454 | 25782 | 20296 | 14838 | 9695 | 5045 | 1201 |
| ASA 2 | 294284 | 257296 | 190269 | 133046 | 82941 | 41428 | 8812 |
| ASA 3 | 225884 | 190574 | 131193 | 86168 | 49059 | 21896 | 4263 |
| ASA 4 | 5558 | 4684 | 3189 | 2055 | 1178 | 570 | 124 |

Note: Restricted to modern prostheses
Excludes 152,148 procedures with unknown ASA score; ASA 5 excluded due to low numbers.

**Figure KT16 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by ASA Score (Primary Diagnosis OA)**



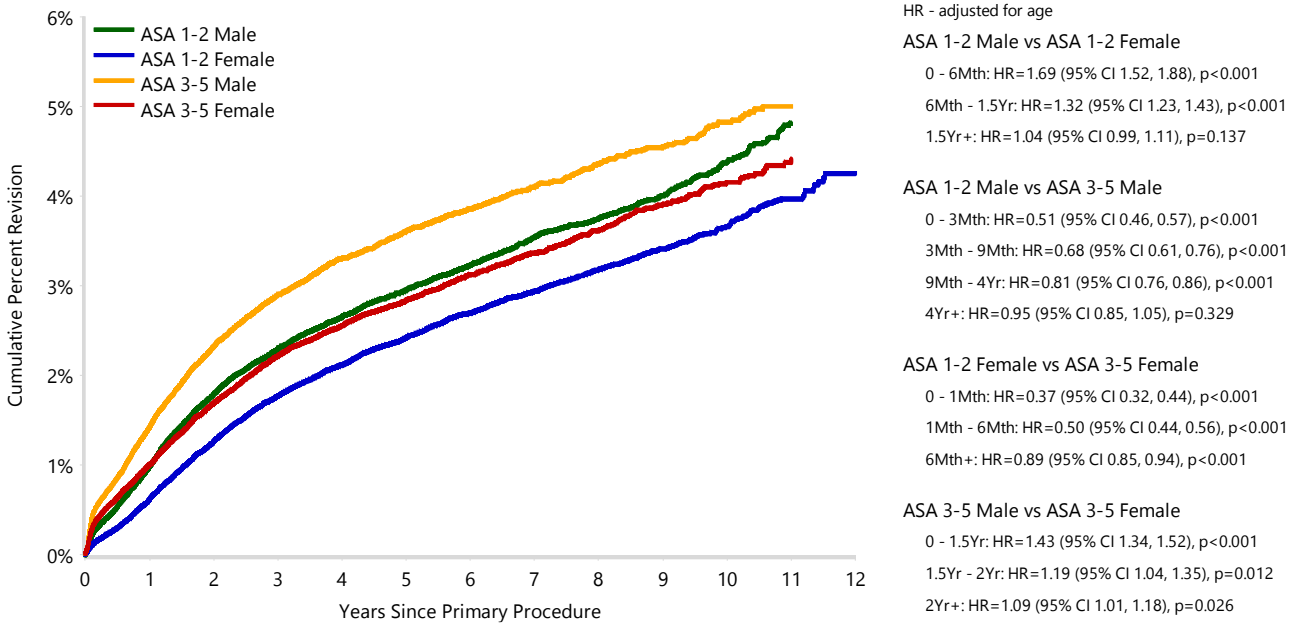

Note: Restricted to modern prostheses
Excludes 152,148 procedures with unknown ASA score; ASA 5 excluded due to low numbers.

**Table KT19 Cumulative Percent Revision of Primary Total Knee Replacement by Gender and ASA Score (Primary Diagnosis OA)**

| ASA Category | Gender | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| ASA 1-2 | Male | 3968 | 146764 | 1.0 (0.9, 1.0) | 2.3 (2.2, 2.4) | 2.9 (2.8, 3.0) | 3.5 (3.4, 3.7) | 4.0 (3.9, 4.1) | 4.8 (4.6, 5.0) |
| | Female | 3916 | 175974 | 0.6 (0.6, 0.7) | 1.8 (1.7, 1.8) | 2.4 (2.3, 2.5) | 2.9 (2.8, 3.0) | 3.4 (3.3, 3.5) | 4.0 (3.8, 4.1) |
| ASA 3-5 | Male | 3076 | 103000 | 1.4 (1.3, 1.5) | 2.9 (2.8, 3.0) | 3.6 (3.5, 3.7) | 4.1 (3.9, 4.2) | 4.5 (4.3, 4.7) | 5.0 (4.7, 5.2) |
| | Female | 3109 | 128463 | 1.0 (0.9, 1.0) | 2.2 (2.1, 2.3) | 2.8 (2.7, 2.9) | 3.3 (3.2, 3.5) | 3.9 (3.7, 4.1) | 4.4 (4.2, 4.6) |
| TOTAL | | 14069 | 554201 | | | | | | |

Note: Restricted to modern prostheses
Excludes 152,148 procedures with unknown ASA score

**Figure KT17 Cumulative Percent Revision of Primary Total Knee Replacement by Gender and ASA Score (Primary Diagnosis OA)**




HR - adjusted for age

ASA 1-2 Male vs ASA 1-2 Female
0 - 6Mth: HR=1.69 (95% CI 1.52, 1.88), p<0.001
6Mth - 1.5Yr: HR=1.32 (95% CI 1.23, 1.43), p<0.001
1.5Yr+: HR=1.04 (95% CI 0.99, 1.11), p=0.137

ASA 1-2 Male vs ASA 3-5 Male
0 - 3Mth: HR=0.51 (95% CI 0.46, 0.57), p<0.001
3Mth - 9Mth: HR=0.68 (95% CI 0.61, 0.76), p<0.001
9Mth - 4Yr: HR=0.81 (95% CI 0.76, 0.86), p<0.001
4Yr+: HR=0.95 (95% CI 0.85, 1.05), p=0.329

ASA 1-2 Female vs ASA 3-5 Female
0 - 1Mth: HR=0.37 (95% CI 0.32, 0.44), p<0.001
1Mth - 6Mth: HR=0.50 (95% CI 0.44, 0.56), p<0.001
6Mth+: HR=0.89 (95% CI 0.85, 0.94), p<0.001

ASA 3-5 Male vs ASA 3-5 Female
0 - 1.5Yr: HR=1.43 (95% CI 1.34, 1.52), p<0.001
1.5Yr - 2Yr: HR=1.19 (95% CI 1.04, 1.35), p=0.012
2Yr+: HR=1.09 (95% CI 1.01, 1.18), p=0.026

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|---|
| ASA 1-2 | Male | 146764 | 128269 | 94569 | 65179 | 40214 | 19798 | 4192 |
| | Female | 175974 | 154809 | 115996 | 82705 | 52422 | 26675 | 5821 |
| ASA 3-5 | Male | 103000 | 86428 | 58737 | 37599 | 20857 | 9146 | 1717 |
| | Female | 128463 | 108844 | 75656 | 50631 | 29386 | 13323 | 2670 |

Note: Restricted to modern prostheses
Excludes 152,148 procedures with unknown ASA score

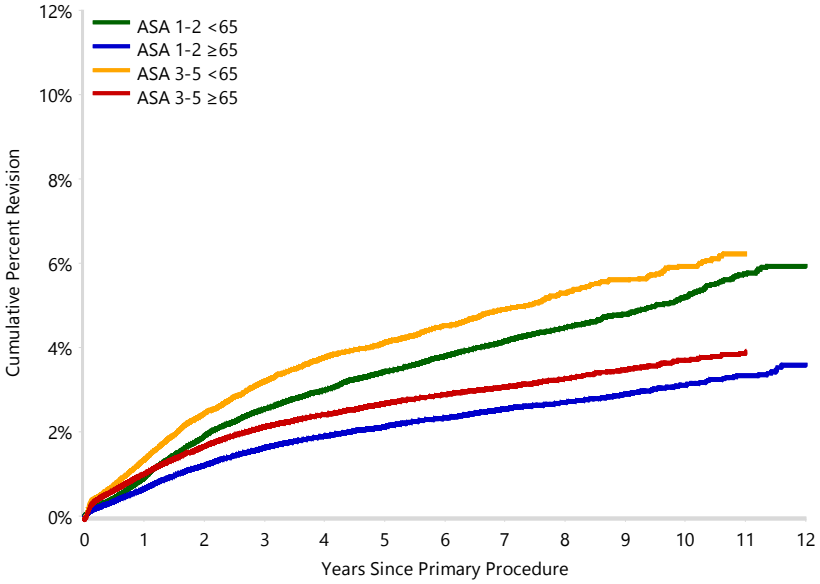
# Primary Total Knee Replacement

**Table KT20 Cumulative Percent Revision of Primary Total Knee Replacement by ASA Score and Age**

| ASA Score | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| ASA 1-2 | <65 | 3902 | 120190 | 0.9 (0.9, 1.0) | 2.6 (2.5, 2.7) | 3.5 (3.3, 3.6) | 4.2 (4.0, 4.3) | 4.8 (4.7, 5.0) | 5.8 (5.5, 6.0) |
| | ≥65 | 3982 | 202548 | 0.7 (0.7, 0.7) | 1.7 (1.6, 1.7) | 2.2 (2.1, 2.2) | 2.6 (2.5, 2.7) | 2.9 (2.8, 3.1) | 3.4 (3.2, 3.5) |
| ASA 3-5 | <65 | 2260 | 61921 | 1.4 (1.3, 1.5) | 3.3 (3.1, 3.4) | 4.2 (4.0, 4.4) | 5.0 (4.8, 5.2) | 5.7 (5.4, 6.0) | 6.3 (5.9, 6.7) |
| | ≥65 | 3925 | 169542 | 1.1 (1.0, 1.1) | 2.2 (2.1, 2.3) | 2.8 (2.7, 2.9) | 3.2 (3.1, 3.3) | 3.6 (3.4, 3.7) | 4.0 (3.8, 4.2) |
| TOTAL | | 14069 | 554201 | | | | | | |

Note: Excludes 152,148 procedures with unknown ASA score; Restricted to modern prostheses.

**Figure KT18 Cumulative Percent Revision of Primary Total Knee Replacement by ASA Score and Age**




HR - adjusted for gender

ASA 1-2 <65 vs ASA 1-2 ≥65 years
- 0 - 6Mth: HR=1.08 (95% CI 0.97, 1.20), p=0.153
- 6Mth - 1.5Yr: HR=1.69 (95% CI 1.56, 1.83), p<0.001
- 1.5Yr - 2Yr: HR=1.82 (95% CI 1.60, 2.06), p<0.001
- 2Yr - 2.5Yr: HR=1.47 (95% CI 1.28, 1.68), p<0.001
- 2.5Yr+: HR=1.74 (95% CI 1.62, 1.87), p<0.001

ASA 1-2 <65 vs ASA 3-5 <65
- 0 - 6Mth: HR=0.53 (95% CI 0.48, 0.59), p<0.001
- 6Mth - 9Mth: HR=0.73 (95% CI 0.63, 0.85), p<0.001
- 9Mth - 4Yr: HR=0.85 (95% CI 0.80, 0.91), p<0.001
- 4Yr+: HR=1.02 (95% CI 0.93, 1.12), p=0.702

ASA 1-2 ≥65 years vs ASA 3-5 ≥65 years
- 0 - 3Mth: HR=0.51 (95% CI 0.46, 0.56), p<0.001
- 3Mth - 9Mth: HR=0.70 (95% CI 0.63, 0.78), p<0.001
- 9Mth - 1.5Yr: HR=0.84 (95% CI 0.77, 0.92), p<0.001
- 1.5Yr - 2Yr: HR=0.83 (95% CI 0.73, 0.95), p=0.005
- 2Yr+: HR=0.93 (95% CI 0.87, 1.00), p=0.054

ASA 3-5 <65 vs ASA 3-5 ≥65 years
- 0 - 3Mth: HR=1.04 (95% CI 0.94, 1.15), p=0.416
- 3Mth - 6Mth: HR=1.39 (95% CI 1.20, 1.61), p<0.001
- 6Mth - 2Yr: HR=1.67 (95% CI 1.55, 1.80), p<0.001
- 2Yr+: HR=1.71 (95% CI 1.58, 1.85), p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|---|
| ASA 1-2 | <65 | 120190 | 106208 | 80131 | 56883 | 36631 | 18892 | 4319 |
| | ≥65 | 202548 | 176870 | 130434 | 91001 | 56005 | 27581 | 5694 |
| ASA 3-5 | <65 | 61921 | 52662 | 37071 | 25098 | 15115 | 7187 | 1602 |
| | ≥65 | 169542 | 142610 | 97322 | 63132 | 35128 | 15282 | 2785 |

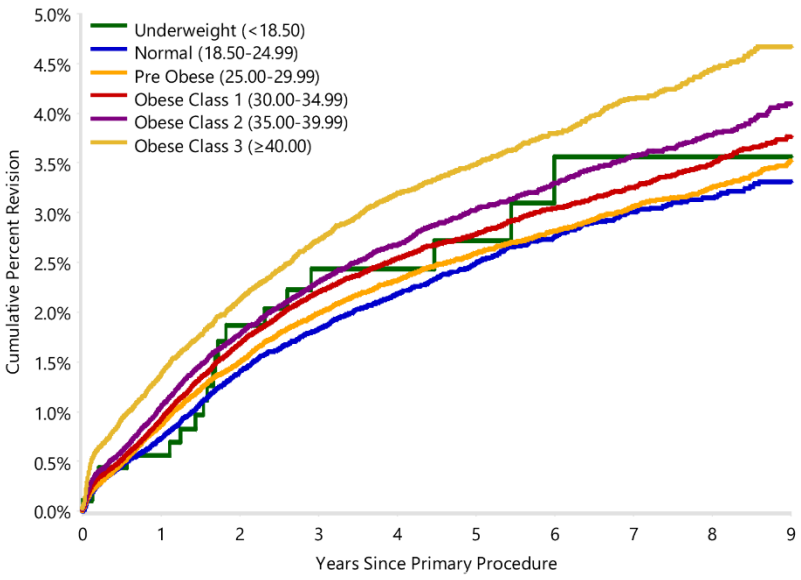
Note: Excludes 152,148 procedures with unknown ASA score; Restricted to modern prostheses.

**Table KT21 Cumulative Percent Revision of Primary Total Knee Replacement by BMI Category (Primary Diagnosis OA)**

| BMI Category | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|
| Underweight | 21 | 924 | 0.6 (0.2, 1.3) | 2.4 (1.5, 3.9) | 2.7 (1.7, 4.4) | 3.6 (2.2, 5.8) | 3.6 (2.2, 5.8) |
| Normal | 1029 | 52046 | 0.7 (0.7, 0.8) | 1.8 (1.7, 2.0) | 2.5 (2.3, 2.7) | 3.0 (2.8, 3.2) | 3.3 (3.1, 3.6) |
| Pre Obese | 3237 | 154081 | 0.9 (0.8, 0.9) | 2.0 (1.9, 2.1) | 2.6 (2.5, 2.7) | 3.0 (2.9, 3.2) | 3.5 (3.4, 3.7) |
| Obese Class 1 | 3458 | 151675 | 0.9 (0.9, 1.0) | 2.2 (2.1, 2.3) | 2.8 (2.7, 2.9) | 3.2 (3.1, 3.3) | 3.7 (3.6, 3.9) |
| Obese Class 2 | 2029 | 82670 | 1.0 (1.0, 1.1) | 2.3 (2.2, 2.4) | 3.0 (2.9, 3.1) | 3.5 (3.4, 3.7) | 4.1 (3.8, 4.3) |
| Obese Class 3 | 1451 | 49595 | 1.3 (1.2, 1.5) | 2.7 (2.5, 2.9) | 3.5 (3.3, 3.6) | 4.1 (3.9, 4.3) | 4.6 (4.4, 4.9) |
| TOTAL | 11225 | 490991 | | | | | |

Note: Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years
Excludes 215,358 procedures with an unknown BMI

**Figure KT19 Cumulative Percent Revision of Primary Total Knee Replacement by BMI Category (Primary Diagnosis OA)**

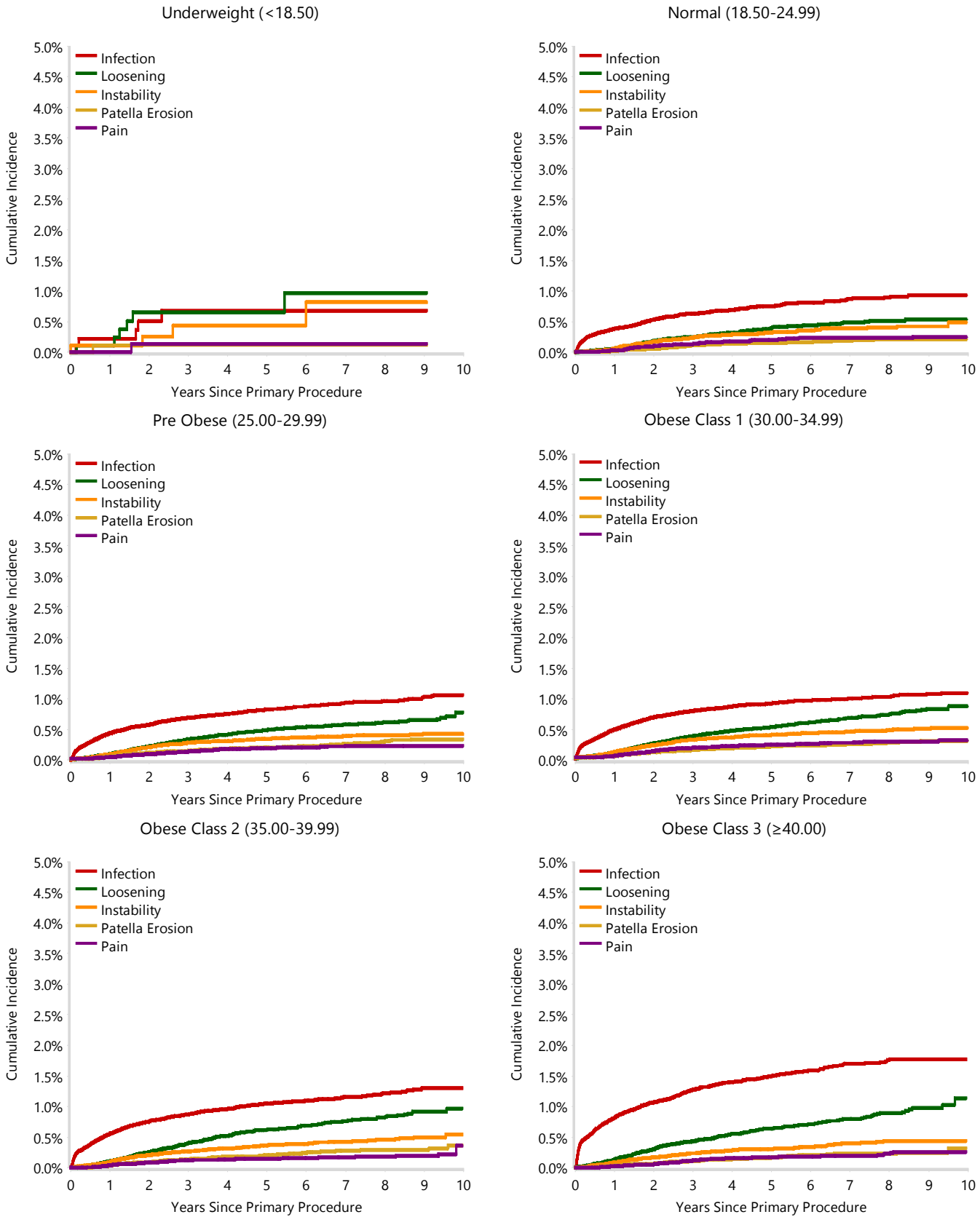



HR - adjusted for age and gender
Underweight (<18.50) vs Normal (18.50-24.99)
Entire Period: HR=1.28 (95% CI 0.83, 1.97), p=0.264
Pre Obese (25.00-29.99) vs Normal (18.50-24.99)
Entire Period: HR=0.98 (95% CI 0.91, 1.05), p=0.495
Obese Class 1 (30.00-34.99) vs Normal (18.50-24.99)
0 - 1.5Yr: HR=1.05 (95% CI 0.96, 1.14), p=0.277
1.5Yr+: HR=0.98 (95% CI 0.90, 1.07), p=0.676
Obese Class 2 (35.00-39.99) vs Normal (18.50-24.99)
0 - 1Mth: HR=1.30 (95% CI 1.08, 1.55), p=0.005
1Mth - 6Mth: HR=1.07 (95% CI 0.93, 1.24), p=0.326
6Mth - 1.5Yr: HR=1.11 (95% CI 1.00, 1.23), p=0.060
1.5Yr+: HR=1.02 (95% CI 0.93, 1.12), p=0.690
Obese Class 3 (≥40.00) vs Normal (18.50-24.99)
0 - 1Mth: HR=2.25 (95% CI 1.88, 2.69), p<0.001
1Mth - 3Mth: HR=1.49 (95% CI 1.22, 1.81), p<0.001
3Mth - 6Mth: HR=1.50 (95% CI 1.22, 1.84), p<0.001
6Mth - 1Yr: HR=1.10 (95% CI 0.93, 1.29), p=0.265
1Yr+: HR=1.09 (95% CI 0.99, 1.20), p=0.065

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|
| Underweight | 924 | 767 | 476 | 297 | 147 | 44 |
| Normal | 52046 | 44087 | 29702 | 18312 | 9128 | 2538 |
| Pre Obese | 154081 | 130529 | 89549 | 56138 | 28561 | 7689 |
| Obese Class 1 | 151675 | 128967 | 88859 | 56069 | 28529 | 7646 |
| Obese Class 2 | 82670 | 70049 | 48137 | 30505 | 15441 | 4135 |
| Obese Class 3 | 49595 | 42097 | 29356 | 19020 | 9729 | 2498 |

Note: Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years
Excludes 215,358 procedures with an unknown BMI

**Figure KT20 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by BMI Category (Primary Diagnosis OA)**



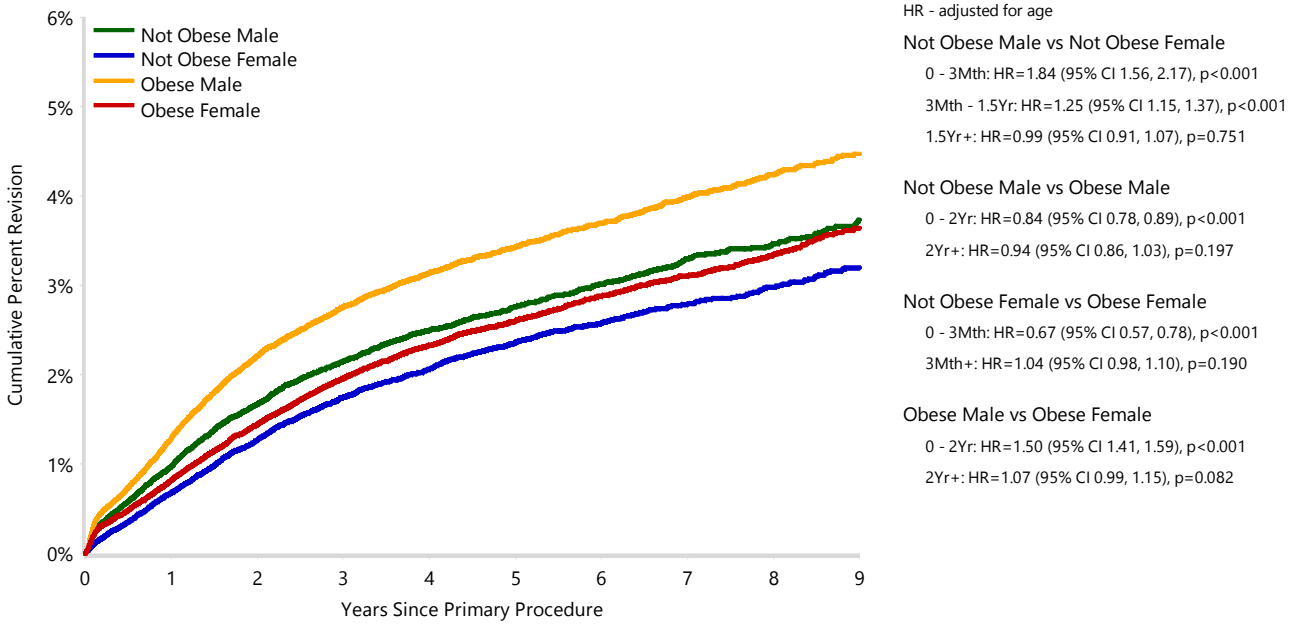

Note: Restricted to modern prostheses. BMI has not been presented for patients aged ≤19 years. Excludes 215,358 procedures with an unknown BMI

**Table KT22 Cumulative Percent Revision of Primary Total Knee Replacement by Gender and Obesity (Primary Diagnosis OA)**

| Obesity | Gender | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|
| Not Obese | Male | 2312 | 102068 | 1.0 (0.9, 1.0) | 2.1 (2.0, 2.2) | 2.8 (2.6, 2.9) | 3.3 (3.1, 3.4) | 3.7 (3.5, 3.9) |
| | Female | 1975 | 104983 | 0.7 (0.6, 0.7) | 1.7 (1.7, 1.8) | 2.4 (2.3, 2.5) | 2.8 (2.7, 2.9) | 3.2 (3.0, 3.4) |
| Obese | Male | 3409 | 120337 | 1.3 (1.2, 1.4) | 2.8 (2.7, 2.9) | 3.4 (3.3, 3.6) | 4.0 (3.8, 4.1) | 4.5 (4.3, 4.7) |
| | Female | 3529 | 163603 | 0.8 (0.8, 0.9) | 2.0 (1.9, 2.0) | 2.6 (2.5, 2.7) | 3.1 (3.0, 3.2) | 3.6 (3.5, 3.8) |
| TOTAL | | 11225 | 490991 | | | | | |

Note: Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years
Excludes 215,358 procedures with an unknown BMI
Not Obese group includes underweight, normal and pre-obese
Obese group includes obese class 1, 2 and 3

**Figure KT21 Cumulative Percent Revision of Primary Total Knee Replacement by Gender and Obesity (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|
| Not obese | Male | 102068 | 86298 | 58836 | 36195 | 18255 | 4865 |
| | Female | 104983 | 89085 | 60891 | 38552 | 19581 | 5406 |
| Obese | Male | 120337 | 101733 | 69253 | 42880 | 21179 | 5546 |
| | Female | 163603 | 139380 | 97099 | 62714 | 32520 | 8733 |

Note: Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years
Excludes 215,358 procedures with an unknown BMI
Not Obese group includes underweight, normal and pre-obese
Obese group includes obese class 1, 2 and 3

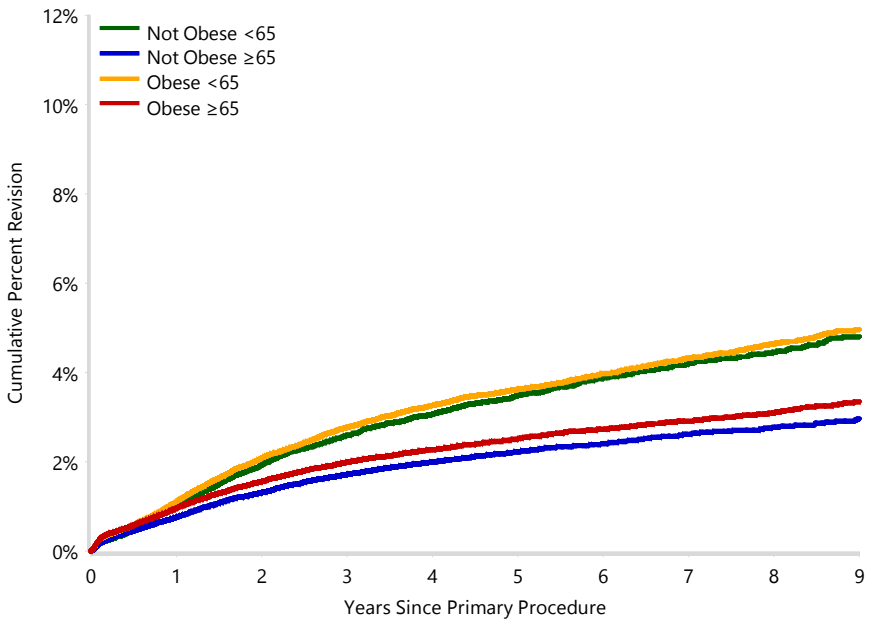
# Primary Total Knee Replacement

**Table KT23 Cumulative Percent Revision of Primary Total Knee Replacement by Obesity and Age (Primary Diagnosis OA)**

| Obesity | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Not Obese | <65 | 1498 | 51542 | 1.0 (0.9, 1.1) | 2.6 (2.4, 2.7) | 3.5 (3.3, 3.7) | 4.2 (4.0, 4.4) | 4.5 (4.2, 4.7) | 4.8 (4.5, 5.1) |
| | ≥65 | 2789 | 155509 | 0.8 (0.7, 0.8) | 1.7 (1.6, 1.8) | 2.2 (2.1, 2.3) | 2.6 (2.5, 2.7) | 2.8 (2.7, 2.9) | 3.0 (2.8, 3.1) |
| Obese | <65 | 3319 | 109232 | 1.1 (1.0, 1.2) | 2.8 (2.7, 2.9) | 3.6 (3.5, 3.8) | 4.3 (4.2, 4.5) | 4.6 (4.5, 4.8) | 5.0 (4.8, 5.2) |
| | ≥65 | 3619 | 174708 | 1.0 (0.9, 1.0) | 2.0 (1.9, 2.1) | 2.5 (2.4, 2.6) | 2.9 (2.8, 3.0) | 3.1 (3.0, 3.2) | 3.3 (3.2, 3.5) |
| TOTAL | | 11225 | 490991 | | | | | | |

Note: BMI has not been presented for patients aged ≤ 19 years
Excludes 215,358 procedures with unknown BMI
Restricted to modern prostheses.
Not obese group includes underweight, normal and pre-obese. Obese group includes obese class 1, 2 and 3

**Figure KT22 Cumulative Percent Revision of Primary Total Knee Replacement by Obesity and Age (Primary Diagnosis OA)**




HR - adjusted for gender

Not Obese <65 vs Not Obese ≥65
0 - 6Mth: HR=1.01 (95% CI 0.88, 1.17), p=0.883
6Mth+: HR=1.70 (95% CI 1.58, 1.82), p<0.001

Not Obese <65 vs Obese <65
0 - 6Mth: HR=0.76 (95% CI 0.66, 0.88), p<0.001
6Mth - 9Mth: HR=1.17 (95% CI 0.97, 1.42), p=0.106
9Mth+: HR=0.95 (95% CI 0.88, 1.02), p=0.141

Not Obese ≥65 vs Obese ≥65
0 - 3Mth: HR=0.71 (95% CI 0.63, 0.79), p<0.001
3Mth+: HR=0.89 (95% CI 0.85, 0.94), p<0.001

Obese <65 vs Obese ≥65
0 - 3Mth: HR=0.95 (95% CI 0.85, 1.06), p=0.326
3Mth - 9Mth: HR=1.23 (95% CI 1.10, 1.38), p<0.001
9Mth - 1.5Yr: HR=1.50 (95% CI 1.36, 1.64), p<0.001
1.5Yr - 2Yr: HR=1.71 (95% CI 1.49, 1.96), p<0.001
2Yr+: HR=1.63 (95% CI 1.51, 1.76), p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|
| Not Obese | <65 | 51542 | 44333 | 31300 | 20001 | 10736 | 6657 | 3069 |
| | ≥65 | 155509 | 131050 | 88427 | 54746 | 27100 | 16248 | 7202 |
| Obese | <65 | 109232 | 93612 | 65781 | 42462 | 22446 | 13834 | 6157 |
| | ≥65 | 174708 | 147501 | 100571 | 63132 | 31253 | 18497 | 8122 |

Note: BMI has not been presented for patients aged ≤ 19 years
Excludes 215,358 procedures with unknown BMI
Restricted to modern prostheses.
Not obese group includes underweight, normal and pre-obese. Obese group includes obese class 1, 2 and 3

## OUTCOME FOR OSTEOARTHRITIS – PROSTHESIS CHARACTERISTICS

### Bearing Mobility

Tibial prostheses are either modular or non-modular. Modular prostheses have a metal baseplate and tibial insert, which may be fixed or mobile. Non-modular prostheses are either all-polyethylene or polyethylene moulded to a metal baseplate. In 2024, few all-polyethylene and non-modular tibial components were used. Moulded non-modular components have a lower rate of revision for the first 3 months compared to all polyethylene prostheses and for the first 1.5 years compared to fixed modular designs, with no differences outside of these time periods (Table KT24 and Figure KT23).

Mobile bearing prostheses have a modular design where the tibial insert is designed to move relative to the baseplate. Fixed bearings include non-modular tibial prostheses, as well as modular designs with fixed inserts that do not move relative to the baseplate.

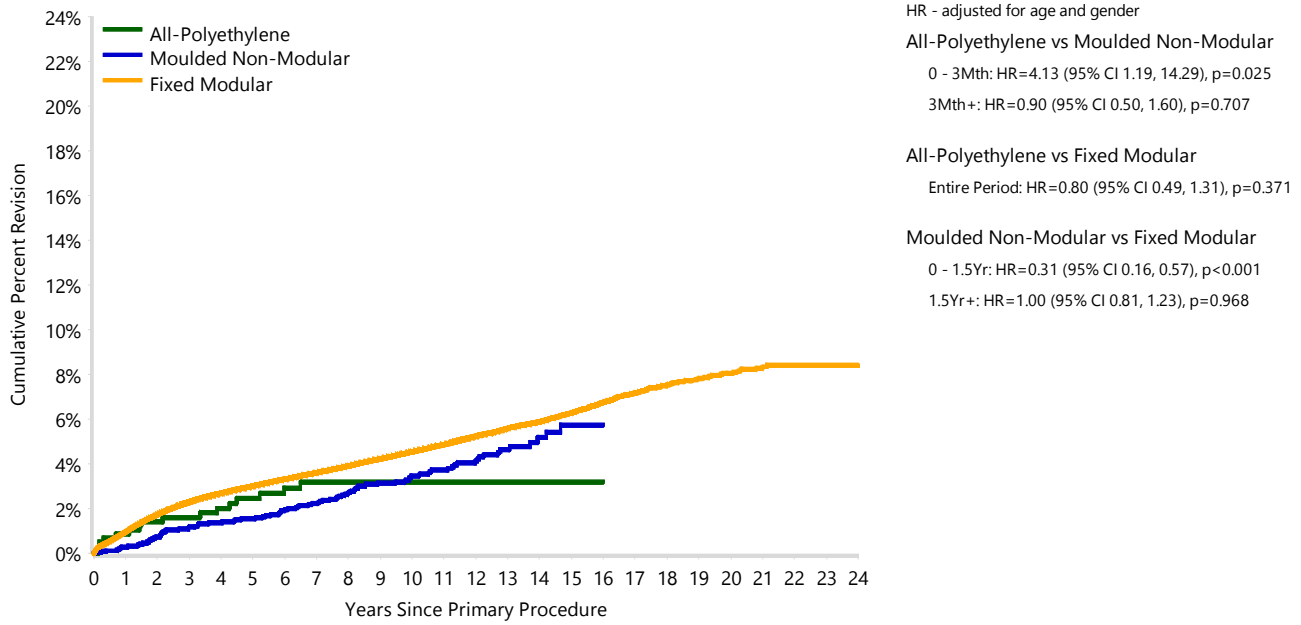
When adjusted for age, gender, fixation, and patella component usage, fixed bearing prostheses have a lower rate of revision compared to mobile bearing prostheses for the majority of the early period, but after 7 years, mobile designs have a lower rate of revision (Table KT25 and Figure KT24).

**Table KT24 Cumulative Percent Revision of Primary Total Knee Replacement by Fixed Bearing Type (Primary Diagnosis OA)**

| Fixed Bearing Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| All-Polyethylene | 16 | 576 | 0.9 (0.4, 2.1) | 1.6 (0.8, 3.1) | 2.4 (1.4, 4.2) | 3.2 (2.0, 5.2) | 3.2 (2.0, 5.2) | |
| Moulded Non-Modular | 96 | 2426 | 0.3 (0.1, 0.6) | 1.2 (0.8, 1.7) | 1.6 (1.1, 2.1) | 3.5 (2.8, 4.3) | 5.7 (4.5, 7.3) | |
| Fixed Modular | 19624 | 610347 | 1.0 (0.9, 1.0) | 2.3 (2.3, 2.3) | 3.0 (3.0, 3.1) | 4.6 (4.5, 4.6) | 6.3 (6.2, 6.4) | 8.1 (7.8, 8.3) |
| TOTAL | 19736 | 613349 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT23 Cumulative Percent Revision of Primary Total Knee Replacement by Fixed Bearing Type (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| All-Polyethylene | 576 | 552 | 504 | 430 | 99 | 51 | 7 |
| Moulded Non-Modular | 2426 | 2403 | 2325 | 2227 | 1713 | 228 | 0 |
| Fixed Modular | 610347 | 538417 | 412682 | 311333 | 121140 | 30115 | 3401 |

Note: Restricted to modern prostheses

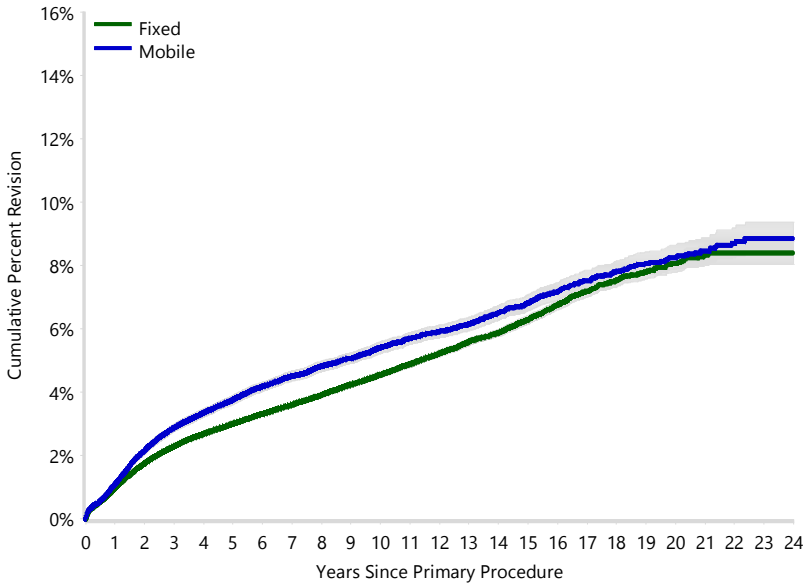
# Primary Total Knee Replacement

**Table KT25 Cumulative Percent Revision of Primary Total Knee Replacement by Bearing Mobility (Primary Diagnosis OA)**

| Bearing Mobility | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Fixed | 19736 | 613349 | 1.0 (0.9, 1.0) | 2.3 (2.3, 2.3) | 3.0 (3.0, 3.1) | 4.6 (4.5, 4.6) | 6.3 (6.2, 6.4) | 8.1 (7.8, 8.3) |
| Mobile | 4147 | 92852 | 1.1 (1.0, 1.1) | 2.9 (2.8, 3.0) | 3.8 (3.6, 3.9) | 5.4 (5.2, 5.6) | 6.8 (6.6, 7.1) | 8.2 (7.9, 8.6) |
| TOTAL | 23883 | 706201 | | | | | | |

Note: Excludes 148 procedures with unknown bearing mobility
Restricted to modern prostheses

**Figure KT24 Cumulative Percent Revision of Primary Total Knee Replacement by Bearing Mobility (Primary Diagnosis OA)**




HR - adjusted for age, gender, fixation, and patella usage

Mobile vs Fixed

0 - 1Yr: HR=1.07 (95% CI 1.00, 1.15), p=0.040
1 - 1.5Yr: HR=1.33 (95% CI 1.21, 1.47), p<0.001
1.5 – 3Yr: HR=1.13 1.27 (95% CI 1.18, 1.36), p<0.001
3 – 3.5Yr: HR=1.10 (95% CI 0.93, 1.29), p=0.271
3.5 - 7Yr: HR=1.22 (95% CI 1.13, 1.32), p<0.001
7Yr+: HR=0.83 (95% CI 0.76, 0.90), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Fixed | 613349 | 541372 | 415511 | 313990 | 122952 | 30394 | 3408 |
| Mobile | 92852 | 86084 | 72107 | 57925 | 27978 | 9888 | 3132 |

Note: Excludes 148 procedures with unknown bearing mobility
Restricted to modern prostheses

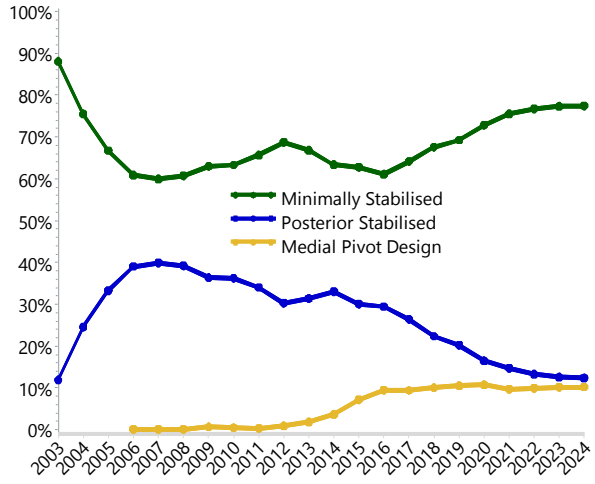
**Stability**

Stability refers to particular prosthetic features intended to substitute for the intrinsic stability of knee ligaments. In 2018, the classification of stability was expanded to include medial pivot design. The five categories are: minimally stabilised, medial pivot design, posterior stabilised, fully stabilised, and hinged prostheses.

Minimally stabilised prostheses are defined as those that have a flat or dished tibial articulation, regardless of congruency. Medial pivot design prostheses have a ball-and-socket medial portion of the articulation. Posterior stabilised prostheses provide additional posterior stability, most commonly using a peg and box design.

The use of minimally stabilised prostheses has remained relatively constant over the last 10 years. In 2024, these accounted for 77.4% of primary procedures. The use of posterior stabilised prostheses has declined to 12.4% in 2024. The use of medial pivot design prostheses has increased since 2014. In 2024, medial pivot design prostheses accounted for 10.2% of primary procedures (Figure KT25).

**Figure KT25 Primary Total Knee Replacement by Stability (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

Posterior stabilised prostheses have higher rates of revision compared to minimally stabilised prostheses. Medial pivot design prostheses have a lower rate of revision compared to posterior stabilised prostheses. Medial pivot design prostheses have a higher rate of revision compared to minimally stabilised prostheses in the first 1.5 years, no difference between 1.5 and 3 years, and a lower rate after 3 years. (Table KT26 and Figure KT26).

The cumulative incidence for the different reasons for revision varies depending on stability. Posterior stabilised prostheses have a higher cumulative incidence of revision for infection and for loosening when compared to minimally stabilised and medial pivot design prostheses.

Medial pivot design prostheses have a higher cumulative incidence of revision for instability compared to minimally stabilised prostheses (Figure KT27). The outcomes of the 4 different prostheses within the medial pivot design group are shown in Table KT27.

Prosthesis performance can also be analysed by polyethylene insert shape. Some prostheses offer tibial polyethylene inserts with differing levels of conformity to be used with a cruciate retaining femoral component. Conceptually, these sit between the minimally stabilised and posterior stabilised designs. These are described as 'anterior lipped', 'anterior stabilised', 'asymmetrically stabilised', 'medially stabilised', 'deep dish' or 'ultra-congruent' designs, which are intended to provide additional stability.

When prostheses with low polyethylene conformity are compared to those with high polyethylene conformity using XLPE, there is no difference in the rate of revision (Table KT28 and Figure KT28). The most common reasons for revision are shown in Figure KT29. The outcome of total knee replacement with XLPE by prosthesis combination and polyethylene insert shape is presented in Table KT29 and Table KT30.

**Fully Stabilised and Hinged Prostheses**

Fully stabilised (large peg and box design) and hinged knees are uncommonly used prostheses that provide additional collateral, as well as posterior ligament stability. While these designs of knee prostheses are usually considered to be revision components, they can also be used in complex primary clinical situations.

Fully constrained and hinged knee designs are used in 0.8% of primary procedures. Whereas osteoarthritis is the major diagnosis for all primary total knee replacements, fully stabilised prostheses are used in a higher proportion for rheumatoid arthritis. Hinged prostheses are used proportionally more for tumour, fracture, osteonecrosis, and other inflammatory arthritis (Table KT31).

Fully stabilised prostheses have been used in 3,277 primary procedures and hinged prostheses in 2,117 primary procedures. For these two knee designs, the cumulative percent revision for all diagnoses is shown in Table KT32 and Figure KT30.

When the outcome for osteoarthritis is considered, fully stabilised and hinged knee prostheses both have higher rates of revision compared to minimally stabilised prostheses (Table KT26 and Figure KT31). For both of these designs, infection is the most common reason for revision, followed by loosening, and instability for fully stabilised prostheses and fracture for hinged prostheses (Table KT33 and Figure KT32).

When used for osteoarthritis, fully stabilised and hinged prostheses have a higher revision rate than MS prostheses.

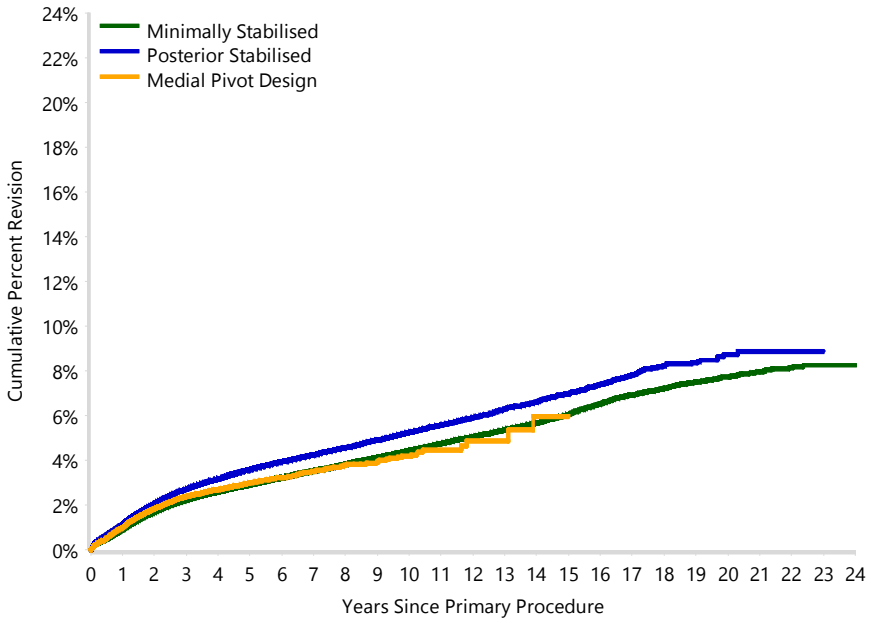
# Primary Total Knee Replacement

**Table KT26 Cumulative Percent Revision of Primary Total Knee Replacement by Stability (Primary Diagnosis OA)**

| Stability | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Minimally Stabilised | 15311 | 492259 | 0.9 (0.9, 0.9) | 2.2 (2.2, 2.3) | 2.9 (2.9, 3.0) | 4.4 (4.4, 4.5) | 6.1 (5.9, 6.2) | 7.7 (7.5, 8.0) |
| Posterior Stabilised | 6933 | 157016 | 1.2 (1.1, 1.2) | 2.7 (2.6, 2.8) | 3.6 (3.5, 3.7) | 5.3 (5.1, 5.4) | 7.0 (6.8, 7.2) | 8.7 (8.3, 9.2) |
| Medial Pivot Design | 1304 | 51532 | 1.0 (0.9, 1.1) | 2.4 (2.2, 2.5) | 3.0 (2.8, 3.2) | 4.2 (3.9, 4.5) | 6.0 (4.5, 7.9) | |
| Fully Stabilised | 179 | 3277 | 2.6 (2.1, 3.2) | 4.5 (3.8, 5.4) | 5.7 (4.8, 6.6) | 7.2 (6.1, 8.4) | 9.4 (7.6, 11.7) | |
| Hinged | 156 | 2117 | 3.0 (2.4, 3.9) | 6.3 (5.3, 7.6) | 8.2 (6.9, 9.7) | 11.9 (9.9, 14.1) | | |
| TOTAL | 23883 | 706201 | | | | | | |

Note: Excludes 148 procedures with unknown stability
Restricted to modern prostheses

**Figure KT26 Cumulative Percent Revision of Primary Total Knee Replacement by Stability (Primary Diagnosis OA)**




HR - adjusted for age and gender

Posterior Stabilised vs Minimally Stabilised

0 - 6Mth: HR=1.36 (95% CI 1.27, 1.46), p<0.001

6Mth - 2Yr: HR=1.18 (95% CI 1.12, 1.24), p<0.001

2Yr - 2.5Yr: HR=1.24 (95% CI 1.12, 1.38), p<0.001

2.5Yr - 5Yr: HR=1.24 (95% CI 1.16, 1.32), p<0.001

5Yr+: HR=1.09 (95% CI 1.03, 1.15), p=0.002

Posterior Stabilised vs Medial Pivot Design

Entire Period: HR=1.21 (95% CI 1.14, 1.28), p<0.001

Medial Pivot Design vs Minimally Stabilised

0 - 1.5Yr: HR=1.10 (95% CI 1.02, 1.19), p=0.018

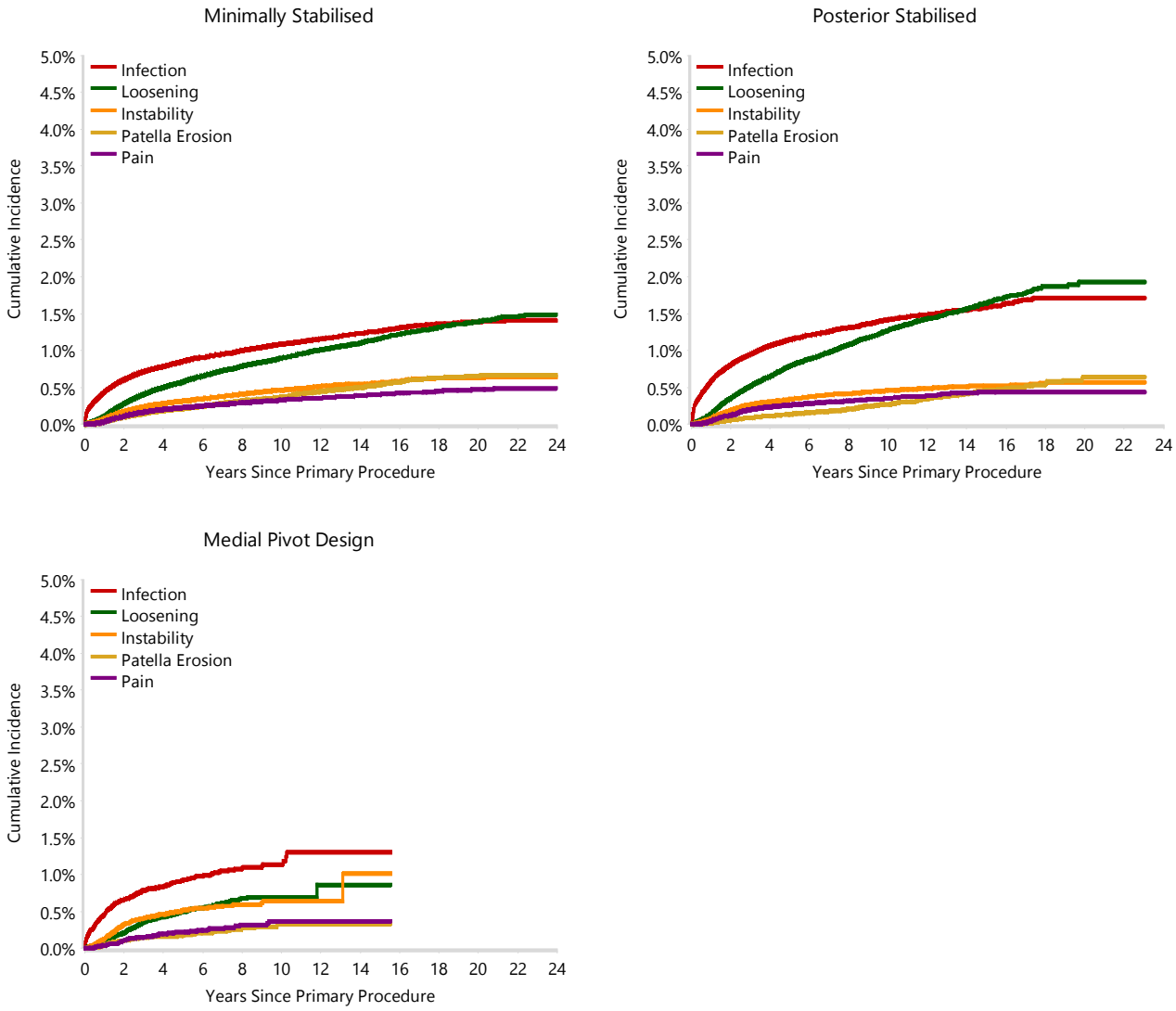
1.5Yr - 3Yr: HR=1.02 (95% CI 0.92, 1.15), p=0.670

3Yr+: HR=0.83 (95% CI 0.74, 0.94), p=0.002

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Minimally Stabilised | 492259 | 433023 | 328075 | 244273 | 100497 | 27678 | 5672 |
| Posterior Stabilised | 157016 | 145866 | 125413 | 105322 | 48082 | 12419 | 862 |
| Medial Pivot Design | 51532 | 43930 | 30745 | 19979 | 1719 | 88 | 0 |

Note: Restricted to modern prostheses

**Figure KT27 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by Stability (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

**Table KT27 Cumulative Percent Revision of Primary Total Knee Replacement with Medial Pivot Design by Insert (Primary Diagnosis OA)**

| Insert | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|
| Evolution | 378 | 13656 | 0.8 (0.7, 1.0) | 2.2 (2.0, 2.5) | 2.9 (2.6, 3.2) | 4.2 (3.7, 4.8) | |
| GMK Sphere Primary | 771 | 30312 | 1.2 (1.0, 1.3) | 2.6 (2.4, 2.8) | 3.3 (3.0, 3.5) | 4.5 (4.0, 5.0) | |
| MRK | 35 | 855 | 1.1 (0.6, 2.0) | 2.6 (1.7, 3.9) | 3.1 (2.1, 4.5) | 4.6 (3.2, 6.6) | 6.6 (4.4, 9.6) |
| SAIPH | 120 | 6709 | 0.6 (0.4, 0.8) | 1.6 (1.3, 2.0) | 2.1 (1.7, 2.5) | 2.8 (2.1, 3.6) | |
| **TOTAL** | **1304** | **51532** | | | | | |

Note: Restricted to modern prostheses

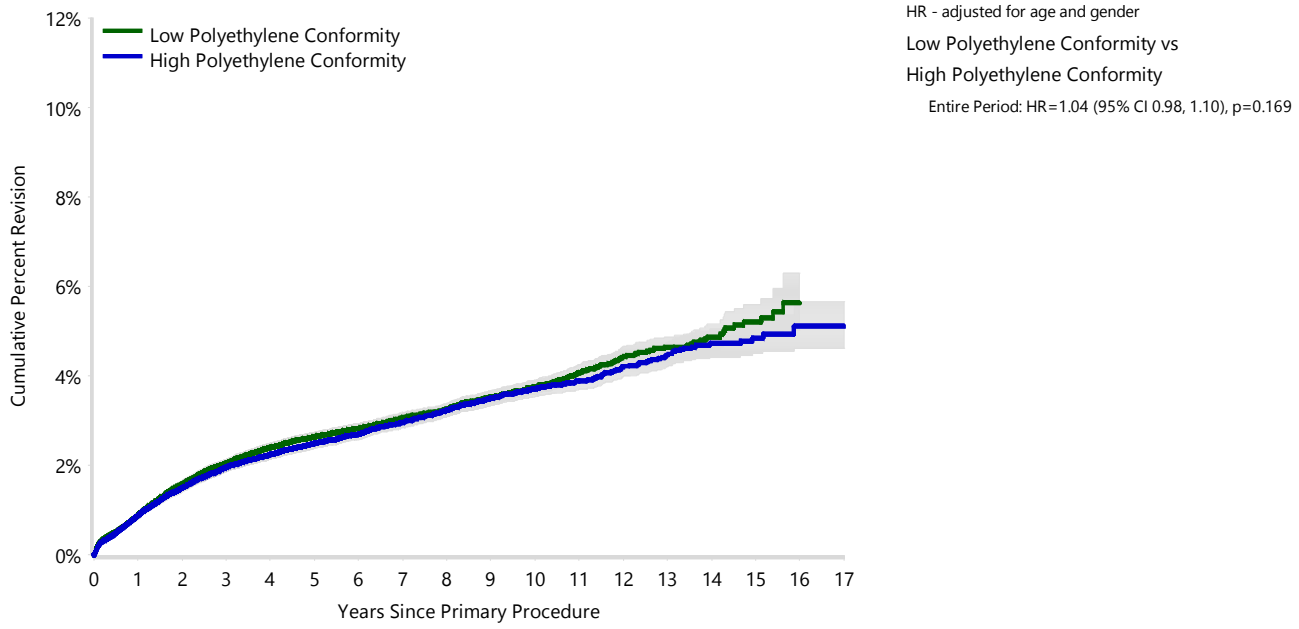
# Primary Total Knee Replacement

**Table KT28 Cumulative Percent Revision of Minimally Stabilised Primary Total Knee Replacement with XLPE by Polyethylene Conformity (Primary Diagnosis OA)**

| Polyethylene Conformity | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Low Polyethylene Conformity | 3049 | 113020 | 0.9 (0.8, 0.9) | 2.0 (2.0, 2.1) | 2.6 (2.5, 2.7) | 3.7 (3.6, 3.9) | 5.2 (4.8, 5.6) | |
| High Polyethylene Conformity | 2426 | 105911 | 0.9 (0.8, 0.9) | 2.0 (1.9, 2.1) | 2.5 (2.4, 2.6) | 3.7 (3.5, 3.9) | 4.9 (4.5, 5.2) | |
| **TOTAL** | **5475** | **218931** | | | | | | |

Note: Restricted to modern prostheses

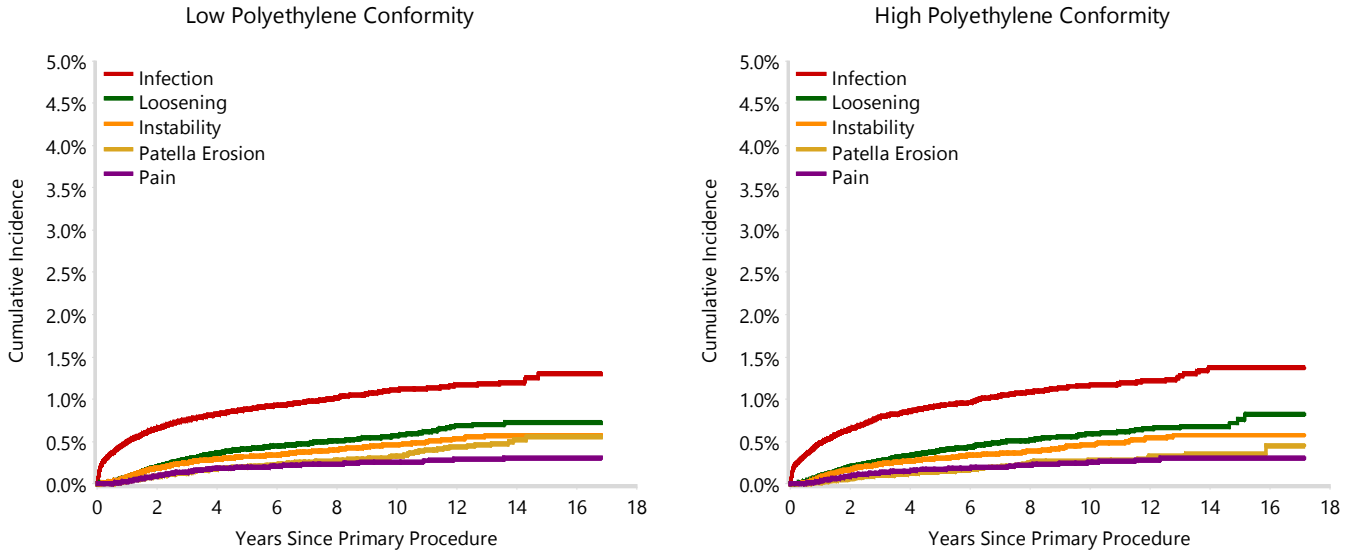
**Figure KT28 Cumulative Percent Revision of Minimally Stabilised Primary Total Knee Replacement with XLPE by Polyethylene Conformity (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Low Polyethylene Conformity | 113020 | 102884 | 83430 | 64229 | 16138 | 1123 | 0 |
| High Polyethylene Conformity | 105911 | 90932 | 65442 | 43914 | 12299 | 1256 | 0 |

Note: Restricted to modern prostheses

**Figure KT29 Cumulative Incidence Revision Diagnosis of Minimally Stabilised Primary Total Knee Replacement with XLPE by Polyethylene Conformity (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

**Table KT29 Cumulative Percent Revision of Minimally Stabilised Primary Total Knee Replacement with XLPE by Prosthesis Combination and Polyethylene Insert Shape (Primary Diagnosis OA)**

| Prothesis Combination | Polyethylene Shape | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Genesis II/Genesis II | CR High Flex | 278 | 8937 | 1.1 (0.9, 1.3) | 2.4 (2.1, 2.7) | 2.9 (2.6, 3.3) | 3.4 (3.0, 3.9) | 4.9 (4.2, 5.7) | |
| | Deep Dish | 16 | 1238 | 0.7 (0.4, 1.4) | 1.7 (1.0, 2.9) | 2.3 (1.2, 4.6) | | | |
| Legion Oxinium/ Genesis II | Cruciate Retaining | 259 | 9523 | 0.8 (0.7, 1.1) | 2.3 (2.0, 2.7) | 3.2 (2.8, 3.7) | 3.8 (3.3, 4.4) | 4.6 (3.9, 5.4) | |
| | Ultra-Congruent | 22 | 1122 | 0.9 (0.5, 1.7) | 2.6 (1.7, 4.0) | 2.6 (1.7, 4.0) | | | |
| Legion/Genesis II | Cruciate Retaining | 204 | 6662 | 1.2 (0.9, 1.4) | 2.7 (2.3, 3.1) | 3.6 (3.1, 4.2) | 4.0 (3.5, 4.6) | 4.1 (3.6, 4.8) | |
| | Ultra-Congruent | 34 | 1315 | 1.3 (0.8, 2.1) | 2.9 (2.0, 4.2) | 4.6 (3.1, 6.7) | | | |
| Persona | Cruciate Retaining | 443 | 24297 | 1.0 (0.8, 1.1) | 2.0 (1.8, 2.2) | 2.4 (2.2, 2.7) | 2.7 (2.4, 3.0) | 2.8 (2.4, 3.2) | |
| | Medial-Congruent | 642 | 45755 | 0.8 (0.7, 0.9) | 1.9 (1.8, 2.1) | 2.6 (2.3, 3.0) | | | |
| | Ultra-Congruent | 113 | 6226 | 1.0 (0.8, 1.3) | 2.0 (1.6, 2.4) | 2.4 (2.0, 2.9) | 2.7 (2.1, 3.4) | | |
| Triathlon/Triathlon | Condylar Stabilising | 2065 | 96651 | 0.8 (0.8, 0.9) | 1.8 (1.7, 1.9) | 2.3 (2.2, 2.5) | 2.8 (2.7, 3.0) | 3.6 (3.4, 3.8) | 4.7 (4.4, 5.1) |
| | Cruciate Retaining | 1866 | 78718 | 0.8 (0.8, 0.9) | 1.8 (1.7, 1.9) | 2.4 (2.2, 2.5) | 2.8 (2.7, 2.9) | 3.5 (3.3, 3.7) | 4.9 (4.5, 5.3) |
| TOTAL | | 5942 | 280444 | | | | | | |

Note: Restricted to modern prostheses. Only prosthesis that have >500 procedures in each conformity category with a follow-up of >3 years are shown

**Table KT30 Comparisons of Revision Rates for Minimally Stabilised Primary Total Knee Replacement with XLPE by Prosthesis Combination and Polyethylene Insert Shape (Primary Diagnosis OA)**

| Prothesis Combination | Comparison | Hazard Ratio – adjusted for age and gender |
|---|---|---|
| Genesis II/Genesis | CR High Flex vs Deep Dish | 0 - 1Mth: HR=0.22 (95% CI 0.09, 0.55), p=0.001 |
| | | 1Mth - 1Yr: HR=4.63 (95% CI 1.14, 18.85), p=0.032 |
| | | 1Yr - 1.5Yr: HR=3.24 (95% CI 0.44, 23.69), p=0.246 |
| | | 1.5Yr+: HR=1.19 (95% CI 0.52, 2.71), p=0.678 |
| Legion Oxinium/Genesis II | Cruciate Retaining vs Ultra-Congruent | Entire Period: HR=1.02 (95% CI 0.66, 1.59), p=0.912 |
| Legion/Genesis II | Cruciate Retaining vs Ultra-Congruent | Entire Period: HR=0.92 (95% CI 0.64, 1.33), p=0.657 |
| Persona | Cruciate Retaining vs Ultra-Congruent | Entire Period: HR=1.02 (95% CI 0.83, 1.26), p=0.823 |
| | Cruciate Retaining vs Medial-Congruent | 0 - 2.5Yr: HR=1.12 (95% CI 0.98, 1.27), p=0.087 |
| | | 2.5Yr+: HR=0.71 (95% CI 0.51, 0.97), p=0.032 |
| Triathlon/Triathlon | Cruciate Retaining vs Condylar Stabilising | Entire Period: HR=1.00 (95% CI 0.94, 1.06), p=0.978 |

Note: Restricted to modern prostheses

**Table KT31 Primary Total Knee Replacement by Primary Diagnosis and Stability**

| Primary Diagnosis | Fully Stabilised | | Hinged | | TOTAL | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| Osteoarthritis | 3277 | 91.9 | 2117 | 60.1 | 5394 | 76.1 |
| Tumour | 9 | 0.3 | 772 | 21.9 | 781 | 11.0 |
| Fracture | 50 | 1.4 | 360 | 10.2 | 410 | 5.8 |
| Rheumatoid Arthritis | 142 | 4.0 | 95 | 2.7 | 237 | 3.3 |
| Other Inflammatory Arthritis | 38 | 1.1 | 50 | 1.4 | 88 | 1.2 |
| Osteonecrosis | 31 | 0.9 | 52 | 1.5 | 83 | 1.2 |
| Other | 20 | 0.6 | 75 | 2.1 | 95 | 1.3 |
| **TOTAL** | **3567** | **100.0** | **3521** | **100.0** | **7088** | **100.0** |

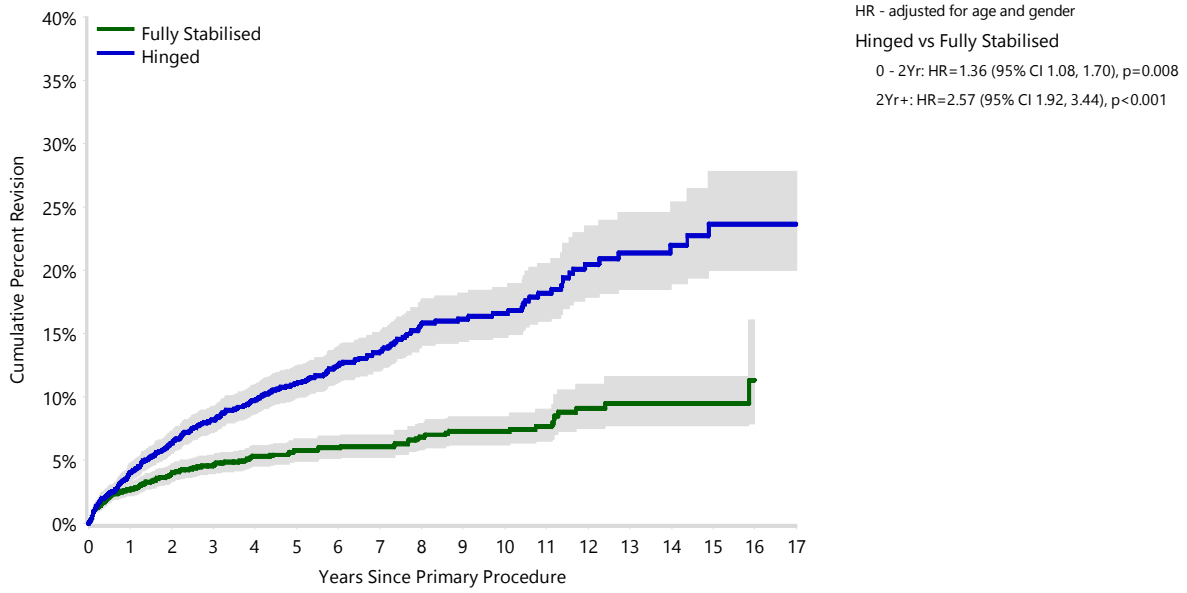
Note: Restricted to modern prostheses

**Table KT32 Cumulative Percent Revision of Primary Total Knee Replacement by Stability (All Diagnoses)**

| Stability | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|---|
| Fully Stabilised | 199 | 3567 | 2.7 (2.2, 3.3) | 4.6 (4.0, 5.4) | 5.8 (5.0, 6.7) | 6.1 (5.2, 7.0) | 7.3 (6.2, 8.5) | 9.5 (7.8, 11.6) |
| Hinged | 359 | 3521 | 4.0 (3.4, 4.8) | 8.2 (7.2, 9.2) | 11.1 (9.9, 12.4) | 13.6 (12.2, 15.2) | 16.6 (14.7, 18.7) | 23.6 (20.0, 27.8) |
| **TOTAL** | **558** | **7088** | | | | | | |

Note: Restricted to modern prostheses

**Figure KT30 Cumulative Percent Revision of Primary Total Knee Replacement by Stability (All Diagnoses)**

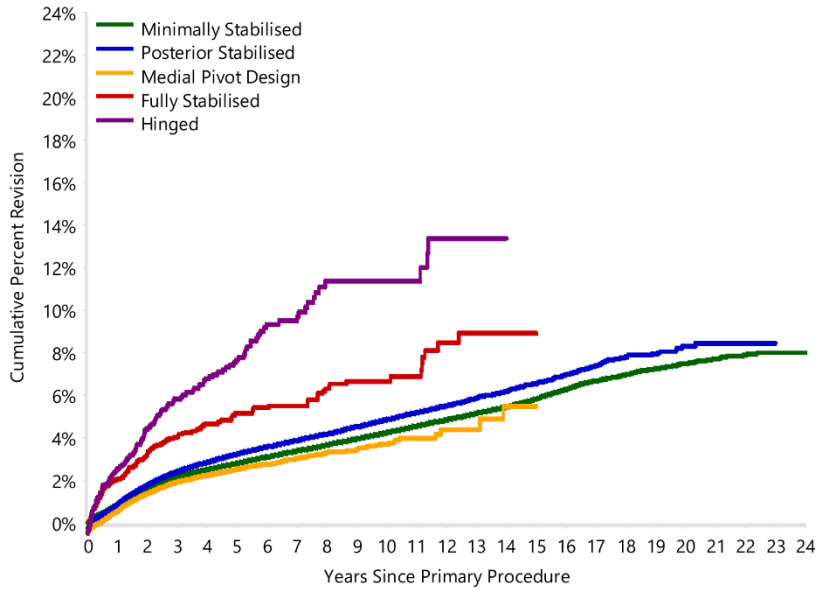



| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|
| Fully Stabilised | 3567 | 3095 | 2373 | 1720 | 1133 | 491 | 78 |
| Hinged | 3521 | 2888 | 1935 | 1244 | 756 | 357 | 82 |

Note: Restricted to modern prostheses

# Primary Total Knee Replacement

**Figure KT31 Cumulative Percent Revision of Primary Total Knee Replacement by Stability (Primary Diagnosis OA)**




HR - adjusted for age and gender

Posterior Stabilised vs Minimally Stabilised
- 0 - 6Mth: HR=1.36 (95% CI 1.27, 1.46), p<0.001
- 6Mth - 2Yr: HR=1.18 (95% CI 1.12, 1.24), p<0.001
- 2Yr - 2.5Yr: HR=1.24 (95% CI 1.12, 1.38), p<0.001
- 2.5Yr - 5Yr: HR=1.24 (95% CI 1.16, 1.32), p<0.001
- 5Yr+: HR=1.09 (95% CI 1.03, 1.15), p=0.001

Medial Pivot Design vs Minimally Stabilised
- 0 - 1.5Yr: HR=1.10 (95% CI 1.02, 1.19), p=0.018
- 1.5Yr - 3Yr: HR=1.02 (95% CI 0.91, 1.14), p=0.692
- 3Yr+: HR=0.84 (95% CI 0.74, 0.94), p=0.003

Fully Stabilised vs Minimally Stabilised
- 0 - 6Mth: HR=4.13 (95% CI 3.22, 5.30), p<0.001
- 6Mth - 1.5Yr: HR=1.37 (95% CI 0.97, 1.93), p=0.073
- 1.5Yr+: HR=1.53 (95% CI 1.23, 1.90), p<0.001

Hinged vs Minimally Stabilised
- 0 - 6Mth: HR=4.69 (95% CI 3.49, 6.30), p<0.001
- 6Mth - 1.5Yr: HR=1.89 (95% CI 1.30, 2.74), p<0.001
- 1.5Yr+: HR=2.94 (95% CI 2.37, 3.65), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| **Minimally Stabilised** | 492259 | 433023 | 328075 | 244273 | 100497 | 27678 | 5672 |
| **Posterior Stabilised** | 157016 | 145866 | 125413 | 105322 | 48082 | 12419 | 862 |
| **Medial Pivot Design** | 51532 | 43930 | 30745 | 19979 | 1719 | 88 | 0 |
| **Fully Stabilised** | 3277 | 2843 | 2176 | 1590 | 442 | 66 | 4 |
| **Hinged** | 2117 | 1794 | 1209 | 751 | 190 | 31 | 2 |

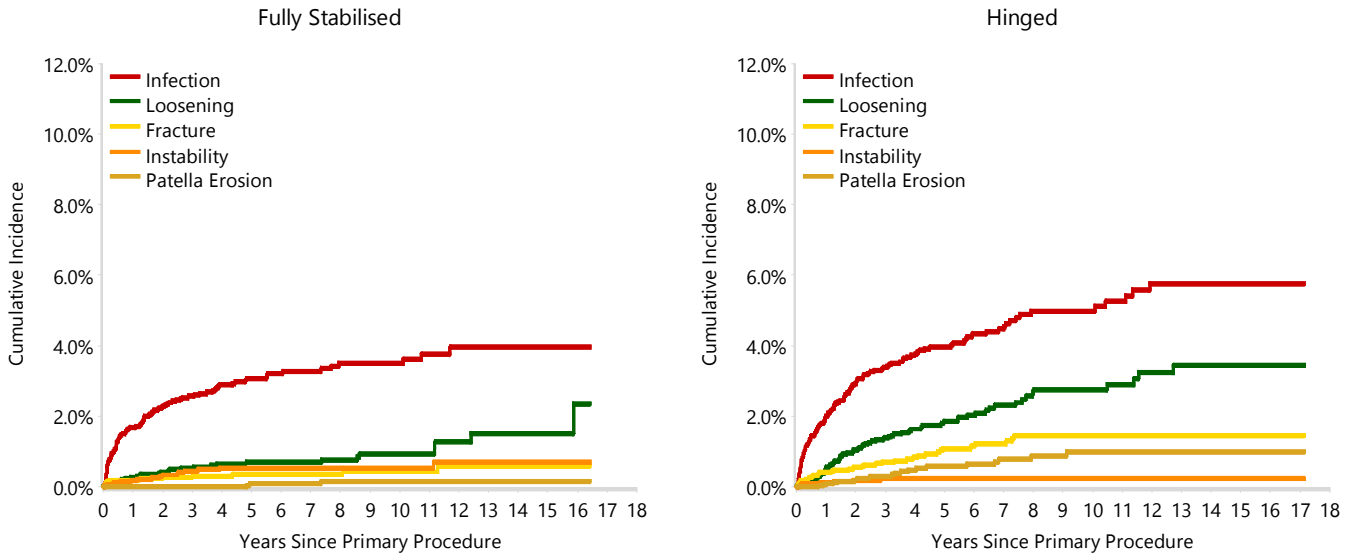
Note: Restricted to modern prostheses

**Table KT33 Revision Diagnosis of Primary Total Knee Replacement by Stability (Primary Diagnosis OA)**

| Revision Diagnosis | Fully Stabilised | | | Hinged | | |
|---|---|---|---|---|---|---|
| | Number | % Primaries Revised | % Revisions | Number | % Primaries Revised | % Revisions |
| Infection | 107 | 3.0 | 53.8 | 140 | 4.0 | 39.0 |
| Loosening | 28 | 0.8 | 14.1 | 69 | 2.0 | 19.2 |
| Fracture | 13 | 0.4 | 6.5 | 35 | 1.0 | 9.7 |
| Patella Erosion | 3 | 0.1 | 1.5 | 20 | 0.6 | 5.6 |
| Instability | 17 | 0.5 | 8.5 | 7 | 0.2 | 1.9 |
| Bearing Dislocation | 8 | 0.2 | 4.0 | 5 | 0.1 | 1.4 |
| Other | 23 | 0.6 | 11.6 | 83 | 2.4 | 23.1 |
| **N Revision** | **199** | **5.6** | **100.0** | **359** | **10.2** | **100.0** |
| **N Primary** | **3567** | | | **3521** | | |

Note: Restricted to modern prostheses

**Figure KT32 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by Stability (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

# Primary Total Knee Replacement

**Patellar Resurfacing**

Primary total knee replacement procedures with patellar resurfacing have a lower rate of revision compared to procedures without patellar resurfacing from 6 months onwards (Table KT34 and Figure KT33).

When the type of patella replacement is assessed, metal backed patella components have a higher rate of revision compared to all polyethylene patella components (Table KT35 and Figure KT34).

Procedures with patellar resurfacing have a lower rate of revision for each of the three common stability types. When resurfacing the patella, the rate of revision is lower for minimally stabilised compared to posterior stabilised prostheses. Posterior stabilised without patellar resurfacing has the highest rate of revision (Table KT36 and Figure KT35).

When the patella is resurfaced, there is no difference in the rate of revision for medial pivot design prostheses compared to minimally stabilised prostheses. When the patella is not resurfaced, medial pivot design prostheses have a higher rate of revision than minimally stabilised knee prostheses (Table KT36 and Figure KT36).

There are five prosthesis combinations that are used with and without patella resurfacing with >10,000 procedures in each patella usage group. There is prosthesis specific variation with patella use. These are shown in Table KT37 and Table KT38.

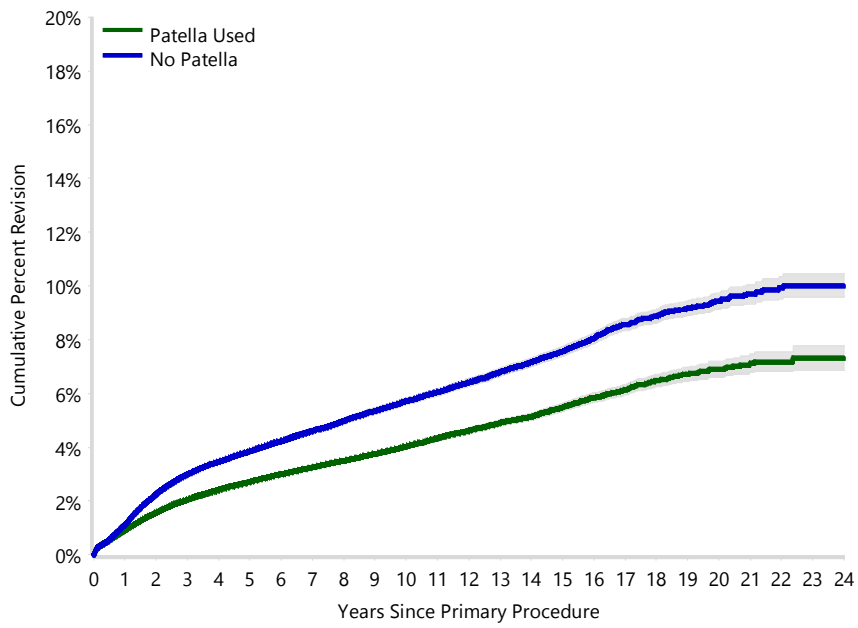
Procedures with a patella component have a lower rate of revision after 6 months.

**Table KT34 Cumulative Percent Revision of Primary Total Knee Replacement by Patella Component Usage (Primary Diagnosis OA)**

| Patella Usage | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Patella Used | 12944 | 478626 | 0.9 (0.9, 0.9) | 2.1 (2.0, 2.1) | 2.7 (2.7, 2.8) | 4.0 (4.0, 4.1) | 5.5 (5.3, 5.6) | 6.9 (6.6, 7.2) |
| No Patella | 10946 | 227723 | 1.1 (1.1, 1.2) | 3.0 (2.9, 3.1) | 3.9 (3.8, 3.9) | 5.7 (5.6, 5.8) | 7.6 (7.4, 7.7) | 9.4 (9.1, 9.7) |
| TOTAL | 23890 | 706349 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT33 Cumulative Percent Revision of Primary Total Knee Replacement by Patella Component Usage (Primary Diagnosis OA)**




HR - adjusted for age and gender

No Patella vs Patella Used

0 - 6Mth: HR=1.01 (95% CI 0.94, 1.08), p=0.860

6Mth - 1Yr: HR=1.52 (95% CI 1.41, 1.63), p<0.001

1Yr - 1.5Yr: HR=1.73 (95% CI 1.61, 1.87), p<0.001

1.5Yr - 2Yr: HR=1.63 (95% CI 1.50, 1.77), p<0.001

2Yr+: HR=1.38 (95% CI 1.33, 1.43), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Patella Used | 478626 | 416637 | 310398 | 224800 | 77792 | 18290 | 2863 |
| No Patella | 227723 | 210963 | 177323 | 147192 | 73189 | 22011 | 3681 |

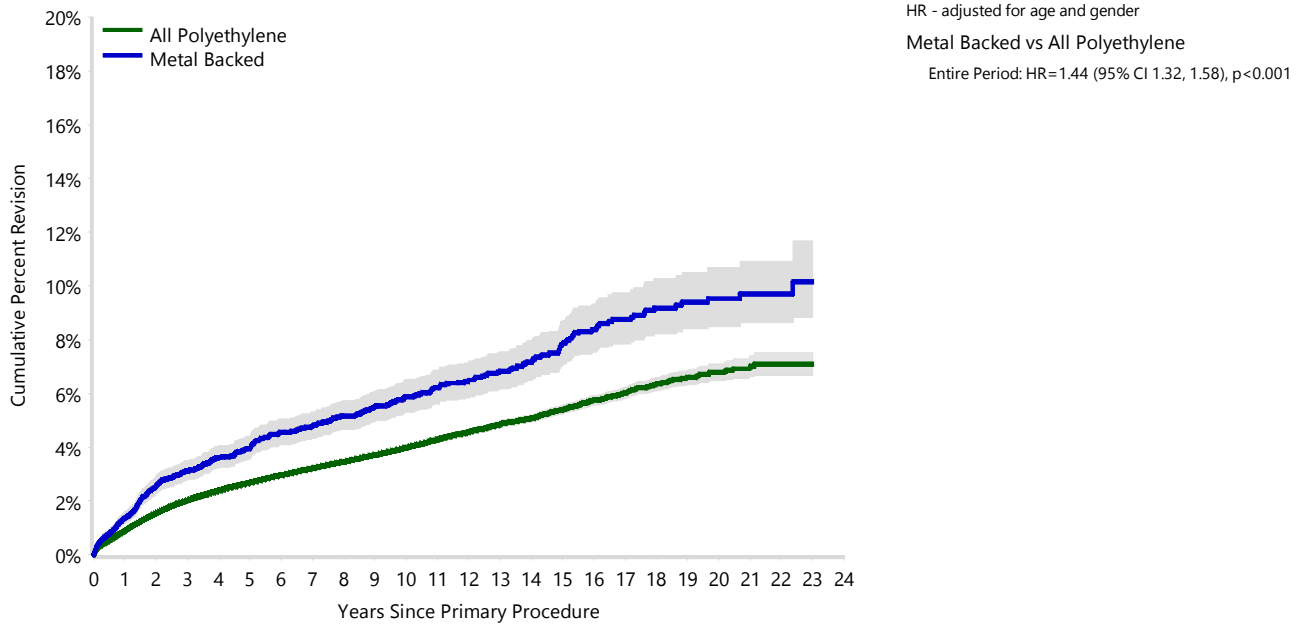
Note: Restricted to modern prostheses

**Table KT35 Cumulative Percent Revision of Primary Total Knee Replacement by Patella Type (Primary Diagnosis OA)**

| Patella Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| All Polyethylene | 12441 | 464688 | 0.9 (0.9, 0.9) | 2.0 (2.0, 2.1) | 2.7 (2.6, 2.7) | 4.0 (3.9, 4.1) | 5.4 (5.2, 5.5) | 6.8 (6.5, 7.1) |
| Metal Backed | 503 | 13919 | 1.4 (1.2, 1.6) | 3.1 (2.8, 3.5) | 4.0 (3.6, 4.4) | 5.9 (5.3, 6.5) | 7.9 (7.1, 8.7) | 9.5 (8.5, 10.7) |
| TOTAL | 12944 | 478607 | | | | | | |

Note: Restricted to modern prostheses. Excludes 19 procedures with unknown patella type

**Figure KT34 Cumulative Percent Revision of Primary Total Knee Replacement by Patella Type (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| All Polyethylene | 464688 | 407042 | 303921 | 219696 | 74751 | 16778 | 2245 |
| Metal Backed | 13919 | 9579 | 6472 | 5100 | 3041 | 1512 | 618 |

Note: Restricted to modern prostheses. Excludes 19 procedures with unknown patella type

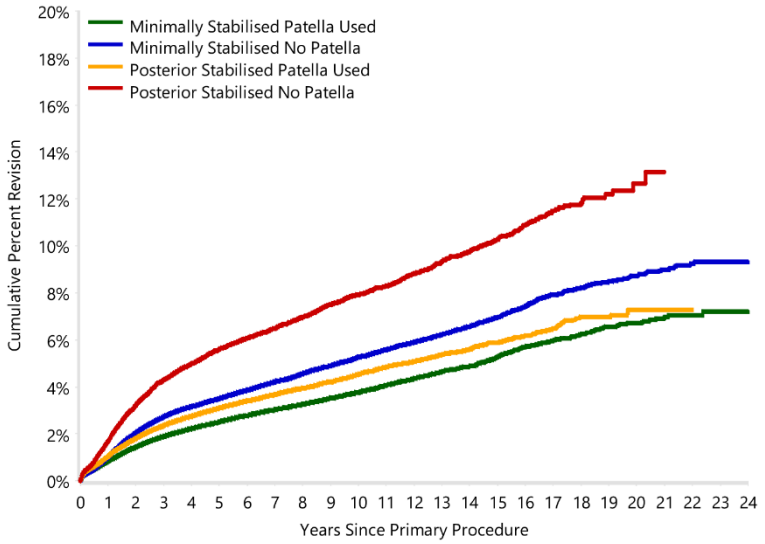
# Primary Total Knee Replacement

**Table KT36 Cumulative Percent Revision of Primary Total Knee Replacement by Stability and Patella Component Usage (Primary Diagnosis OA)**

| Stability | Patella Usage | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Minimally Stabilised | Patella Used | 7372 | 310513 | 0.8 (0.8, 0.9) | 1.9 (1.8, 1.9) | 2.5 (2.4, 2.6) | 3.8 (3.7, 3.9) | 5.3 (5.1, 5.5) | 6.7 (6.3, 7.1) |
| | No Patella | 7939 | 181746 | 1.0 (1.0, 1.1) | 2.7 (2.6, 2.8) | 3.5 (3.4, 3.6) | 5.3 (5.1, 5.4) | 7.0 (6.8, 7.1) | 8.7 (8.4, 9.1) |
| Posterior Stabilised | Patella Used | 4647 | 128436 | 1.0 (1.0, 1.1) | 2.4 (2.3, 2.4) | 3.1 (3.0, 3.2) | 4.5 (4.4, 4.7) | 5.9 (5.7, 6.1) | 7.3 (6.8, 7.8) |
| | No Patella | 2286 | 28580 | 1.7 (1.5, 1.8) | 4.3 (4.1, 4.5) | 5.6 (5.3, 5.9) | 7.9 (7.6, 8.3) | 10.3 (9.8, 10.7) | 12.7 (11.7, 13.7) |
| Medial Pivot Design | Patella Used | 697 | 35454 | 0.9 (0.8, 1.0) | 2.0 (1.8, 2.1) | 2.5 (2.3, 2.7) | 3.2 (2.9, 3.6) | | |
| | No Patella | 607 | 16078 | 1.3 (1.1, 1.4) | 3.3 (3.0, 3.6) | 4.1 (3.7, 4.4) | 5.7 (5.2, 6.3) | 7.1 (5.6, 8.9) | |
| TOTAL | | 23548 | 700807 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT35 Cumulative Percent Revision of Primary Total Knee Replacement by Stability and Patella Component Usage (Primary Diagnosis OA)**




HR - adjusted for age and gender

Minimally Stabilised Patella Used vs Minimally Stabilised No Patella

- 0 - 3Mth: HR=1.05 (95% CI 0.95, 1.15), p=0.346
- 3Mth - 6Mth: HR=0.89 (95% CI 0.78, 1.01), p=0.074
- 6Mth - 1.5Yr: HR=0.62 (95% CI 0.59, 0.66), p<0.001
- 1.5Yr - 2Yr: HR=0.63 (95% CI 0.57, 0.69), p<0.001
- 2Yr - 3.5Yr: HR=0.69 (95% CI 0.64, 0.74), p<0.001
- 3.5Yr+: HR=0.78 (95% CI 0.74, 0.83), p<0.001

Minimally Stabilised Patella Used vs Posterior Stabilised Patella Used

- 0 - 6Mth: HR=0.84 (95% CI 0.77, 0.91), p<0.001
- 6Mth - 9Mth: HR=0.85 (95% CI 0.76, 0.96), p=0.008
- 9Mth - 1.5Yr: HR=0.75 (95% CI 0.70, 0.81), p<0.001
- 1.5Yr - 2Yr: HR=0.78 (95% CI 0.71, 0.86), p<0.001
- 2Yr - 2.5Yr: HR=0.77 (95% CI 0.68, 0.87), p<0.001
- 2.5Yr - 3.5Yr: HR=0.81 (95% CI 0.73, 0.90), p<0.001
- 3.5Yr - 4Yr: HR=0.92 (95% CI 0.79, 1.08), p=0.302
- 4Yr - 5Yr: HR=0.81 (95% CI 0.71, 0.92), p<0.001
- 5Yr+: HR=0.95 (95% CI 0.88, 1.02), p=0.128

Minimally Stabilised No Patella vs Posterior Stabilised No Patella

- 0 - 2Yr: HR=0.64 (95% CI 0.59, 0.69), p<0.001
- 2Yr - 3.5Yr: HR=0.63 (95% CI 0.56, 0.70), p<0.001
- 3.5Yr+: HR=0.69 (95% CI 0.65, 0.74), p<0.001

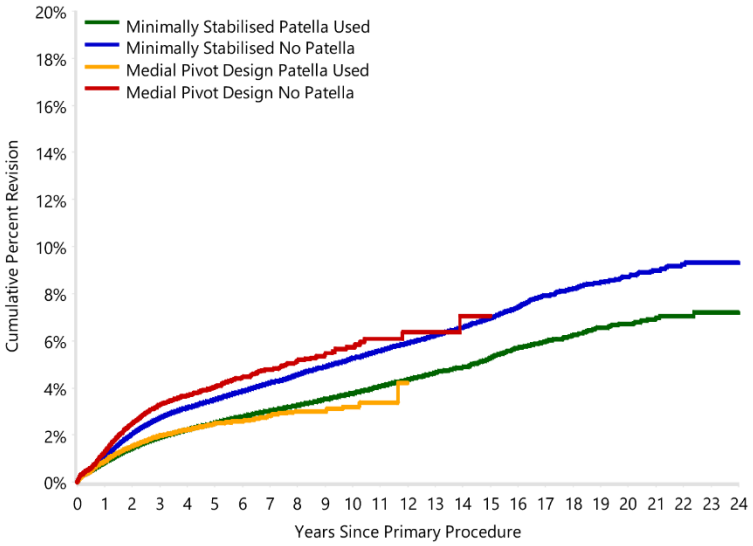
Posterior Stabilised Patella Used vs Posterior Stabilised No Patella

- Entire Period: HR=0.57 (95% CI 0.55, 0.60), p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Minimally Stabilised | Patella Used | 310513 | 264924 | 187431 | 128488 | 42782 | 10624 | 2251 |
| | No Patella | 181746 | 168099 | 140644 | 115785 | 57715 | 17054 | 3421 |
| Posterior Stabilised | Patella Used | 128436 | 118408 | 100226 | 82378 | 33845 | 7603 | 607 |
| | No Patella | 28580 | 27458 | 25187 | 22944 | 14237 | 4816 | 255 |

Note: Restricted to modern prostheses

**Figure KT36 Cumulative Percent Revision of Primary Total Knee Replacement by Stability and Patella Component Usage (Primary Diagnosis OA)**




HR - adjusted for age and gender

Minimally Stabilised Patella Used vs Minimally Stabilised No Patella

- 0 - 3Mth: HR=1.07 (95% CI 0.97, 1.17), p=0.204
- 3Mth - 6Mth: HR=0.87 (95% CI 0.76, 1.00), p=0.047
- 6Mth - 1Yr: HR=0.68 (95% CI 0.63, 0.75), p<0.001
- 1Yr - 1.5Yr: HR=0.57 (95% CI 0.52, 0.62), p<0.001
- 1.5Yr - 2Yr: HR=0.61 (95% CI 0.55, 0.68), p<0.001
- 2Yr - 3.5Yr: HR=0.68 (95% CI 0.63, 0.73), p<0.001
- 3.5Yr+: HR=0.79 (95% CI 0.75, 0.83), p<0.001

Minimally Stabilised Patella Used vs Medial Pivot Design Patella Used

- Entire Period: HR=1.05 (95% CI 0.97, 1.13), p=0.246

Minimally Stabilised No Patella vs Medial Pivot Design No Patella

- 0 - 1.5Yr: HR=0.82 (95% CI 0.72, 0.92), p<0.001
- 1.5Yr+: HR=0.95 (95% CI 0.85, 1.07), p=0.382

Medial Pivot Design Patella Used vs Medial Pivot Design No Patella

- Entire Period: HR=0.62 (95% CI 0.56, 0.69), p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Minimally Stabilised | Patella Used | 310513 | 264924 | 187431 | 128488 | 42782 | 10624 | 2251 |
| | No Patella | 181746 | 168099 | 140644 | 115785 | 57715 | 17054 | 3421 |
| Medial Pivot Design | Patella Used | 35454 | 29722 | 20179 | 12232 | 756 | 11 | 0 |
| | No Patella | 16078 | 14208 | 10566 | 7747 | 963 | 77 | 0 |

Note: Restricted to modern prostheses

**Table KT37 Cumulative Percent Revision of Primary Total Knee Replacement by Prosthesis Type and Patella Component Usage (Primary Diagnosis OA)**

| Prosthesis Combination | Patella Usage | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Genesis II CR/Genesis II | Patella Used | 474 | 11779 | 0.9 (0.8, 1.1) | 2.2 (1.9, 2.4) | 2.8 (2.5, 3.1) | 4.2 (3.8, 4.6) | 5.1 (4.6, 5.6) | 6.2 (5.5, 7.1) |
| | No Patella | 839 | 14893 | 0.9 (0.8, 1.1) | 3.0 (2.7, 3.3) | 3.9 (3.6, 4.2) | 5.6 (5.2, 6.0) | 6.9 (6.4, 7.4) | 8.2 (7.5, 8.9) |
| LCS CR/MBT | Patella Used | 605 | 10532 | 1.1 (0.9, 1.3) | 3.1 (2.8, 3.5) | 4.1 (3.7, 4.5) | 5.8 (5.3, 6.3) | 7.3 (6.7, 8.1) | 9.3 (8.2, 10.5) |
| | No Patella | 1021 | 22471 | 0.8 (0.7, 0.9) | 2.5 (2.3, 2.7) | 3.2 (3.0, 3.4) | 4.5 (4.2, 4.8) | 5.5 (5.2, 5.9) | 7.3 (6.6, 8.1) |
| Persona CR/Persona | Patella Used | 853 | 56999 | 0.9 (0.8, 0.9) | 1.8 (1.7, 2.0) | 2.3 (2.1, 2.5) | 2.6 (2.3, 3.0) | | |
| | No Patella | 342 | 19214 | 0.9 (0.8, 1.1) | 2.2 (2.0, 2.5) | 2.8 (2.5, 3.1) | | | |
| Triathlon CR/Triathlon | Patella Used | 2101 | 123128 | 0.7 (0.7, 0.8) | 1.5 (1.4, 1.5) | 1.9 (1.8, 2.0) | 2.8 (2.6, 2.9) | 4.0 (3.6, 4.3) | |
| | No Patella | 2259 | 64300 | 1.0 (0.9, 1.1) | 2.4 (2.3, 2.5) | 3.0 (2.9, 3.2) | 4.5 (4.3, 4.7) | 5.7 (5.4, 6.1) | |
| Vanguard CR/Vanguard | Patella Used | 508 | 13791 | 0.8 (0.6, 0.9) | 2.0 (1.7, 2.2) | 2.5 (2.3, 2.8) | 3.9 (3.5, 4.3) | 5.7 (5.1, 6.5) | |
| | No Patella | 716 | 13389 | 0.8 (0.7, 1.0) | 2.6 (2.4, 2.9) | 3.3 (3.0, 3.6) | 5.3 (4.9, 5.8) | 7.9 (7.2, 8.7) | |
| TOTAL | | 9718 | 350496 | | | | | | |

Note: Restricted to modern prostheses
Only prosthesis combinations with >10,000 procedures in both patella usage groups are listed

**Table KT38 Comparisons of Revision Rates for Primary Total Knee Replacement by Prosthesis Combination and Patella Usage (Primary Diagnosis OA)**

| Comparison | HR -adjusted for age and gender |
|---|---|
| Genesis II CR/Genesis II Patella Used vs Genesis II CR/Genesis II No Patella | Entire Period: HR=0.77 (95% CI 0.69, 0.86), p<0.001 |
| LCS CR/MBT Patella Used vs LCS CR/MBT No Patella | Entire Period: HR=1.33 (95% CI 1.20, 1.47), p<0.001 |
| Persona CR/Persona Patella Used vs Persona CR/Persona No Patella | Entire Period: HR=0.85 (95% CI 0.75, 0.97), p=0.014 |
| Triathlon CR/Triathlon Patella Used vs Triathlon CR/Triathlon No Patella | Entire Period: HR=0.64 (95% CI 0.60, 0.68), p<0.001 |
| Vanguard CR/Vanguard Patella Used vs Vanguard CR/Vanguard No Patella | 0 - 1Mth: HR=1.21 (95% CI 0.65, 2.24), p=0.545 |
| | 1Mth+: HR=0.71 (95% CI 0.63, 0.80), p<0.001 |

**Fixation**

When fixation types for all modern total knee replacements are compared, procedures using hybrid fixation have a lower rate of revision compared to cementless fixation and compared to cemented fixation (except for a period from 6 months until 1.5 years). Procedures using cementless fixation have a higher rate of revision than when both components are cemented (Table KT39 and Figure KT37). However, the effect of fixation varies depending on prosthesis stability. For minimally stabilised prostheses, hybrid fixation has a lower revision rate for the first 6 months compared to cemented fixation, with no difference after. Cementless fixation has a higher rate of revision compared to both cemented fixation and hybrid fixation (Table KT39 and Figure KT38).

When minimally stabilised prostheses are further analysed by tibial fixation and age, patients aged <65 years with cementless tibial fixation have the highest rates of revision (Table KT40 and Figure KT39). Patients with minimally stabilised knees using cementless tibial fixation have a higher rate of revision regardless of gender. Males with cemented tibial fixation have a higher rate of revision compared to females with cemented tibial fixation in the first 1.5 years (Table KT42 and Figure KT40).

When a posterior stabilised knee is used, cemented fixation has a lower initial rate of revision compared to cementless fixation. After 1.5 years, cementless fixation has a lower rate of revision than cemented fixation. Cemented fixation has a lower rate of revision compared to hybrid fixation in the first 1.5 years only, with no difference after this time. There is no difference in the rate of revision when cementless fixation and hybrid fixation are compared (Table KT43 and Figure KT41).

When posterior stabilised prostheses are further analysed by tibial fixation and age, patients aged <65 years have a higher rate of revision with both fixation types compared to patients 65 years and over. The early higher rate of revision with cementless fixation is seen for both <65 years and 65 years and over, but only those <65 years have a later lower rate of revision. Females with cemented tibial fixation have the lowest rate of revision, while males with cementless tibial fixation have a lower rate of revision after 1.5 years.

Cementing the tibial component gives the best outcome for minimally stabilised knee replacement.

When a medial pivot design prosthesis is used, there is no difference in rate of revision between cemented and hybrid fixation. There are too few revisions of cementless fixation for an analysis to be undertaken (Table KT46 and Figure KT44).

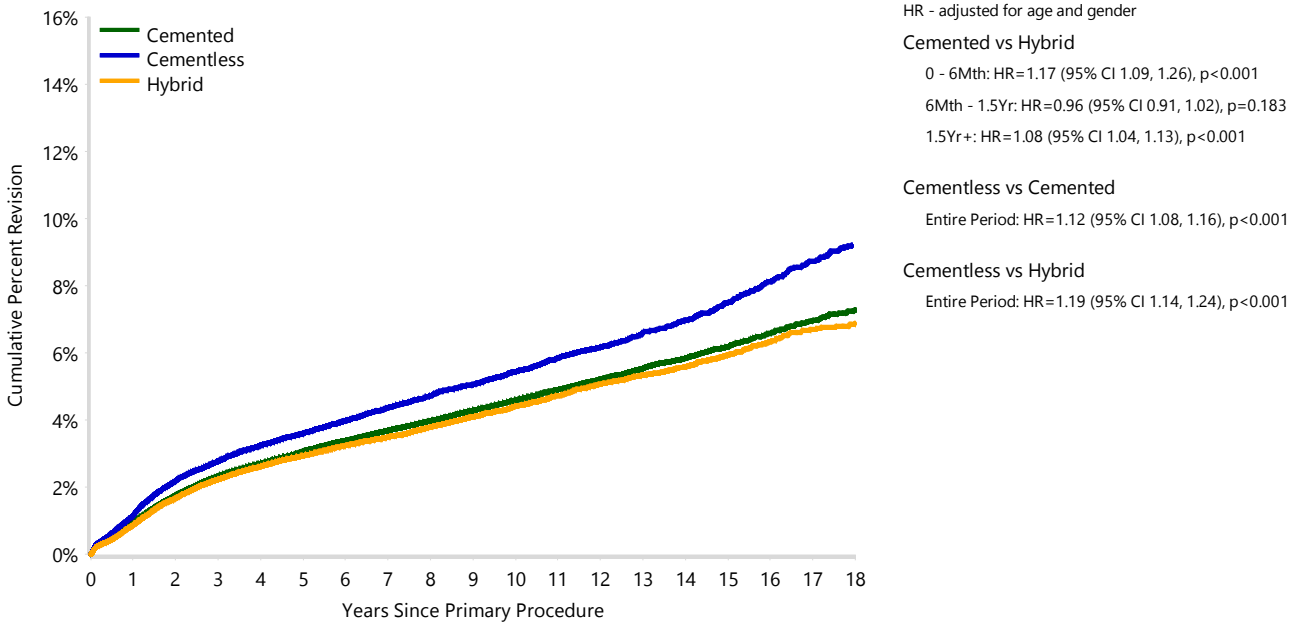
# Primary Total Knee Replacement

**Table KT39 Cumulative Percent Revision of Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)**

| Fixation | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cemented | 15531 | 463525 | 1.0 (0.9, 1.0) | 2.3 (2.3, 2.4) | 3.1 (3.0, 3.1) | 4.6 (4.5, 4.7) | 6.2 (6.1, 6.3) | 7.8 (7.5, 8.1) |
| Cementless | 3931 | 106429 | 1.2 (1.1, 1.2) | 2.8 (2.7, 2.9) | 3.6 (3.5, 3.7) | 5.4 (5.2, 5.6) | 7.5 (7.2, 7.8) | 9.7 (9.2, 10.3) |
| Hybrid | 4428 | 136395 | 0.9 (0.8, 0.9) | 2.2 (2.2, 2.3) | 2.9 (2.8, 3.0) | 4.4 (4.3, 4.6) | 5.9 (5.7, 6.2) | 7.3 (6.9, 7.7) |
| TOTAL | 23890 | 706349 | | | | | | |

Note: Restricted to modern prostheses.

**Figure KT37 Cumulative Percent Revision of Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Cemented | 463525 | 416644 | 329465 | 252959 | 95275 | 25295 | 3473 |
| Cementless | 106429 | 89098 | 61867 | 43322 | 24485 | 7248 | 1670 |
| Hybrid | 136395 | 121858 | 96389 | 75711 | 31221 | 7758 | 1401 |

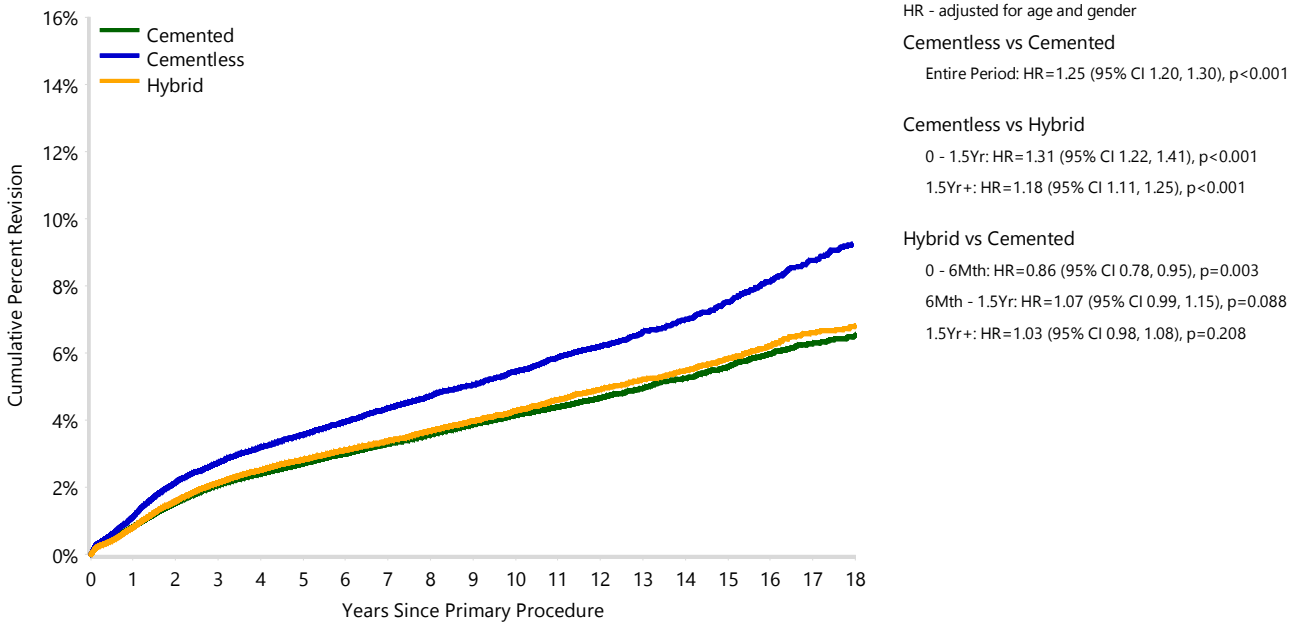
Note: Restricted to modern prostheses.

**Table KT40 Cumulative Percent Revision of Minimally Stabilised Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)**

| Fixation | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cemented | 7520 | 261102 | 0.8 (0.8, 0.9) | 2.1 (2.0, 2.1) | 2.7 (2.6, 2.8) | 4.1 (4.0, 4.3) | 5.6 (5.4, 5.8) | 7.1 (6.8, 7.5) |
| Cementless | 3715 | 102365 | 1.1 (1.1, 1.2) | 2.7 (2.6, 2.9) | 3.6 (3.4, 3.7) | 5.4 (5.2, 5.6) | 7.5 (7.2, 7.8) | 9.8 (9.2, 10.3) |
| Hybrid | 4029 | 128686 | 0.8 (0.8, 0.9) | 2.1 (2.1, 2.2) | 2.8 (2.7, 2.9) | 4.3 (4.1, 4.4) | 5.8 (5.6, 6.1) | 7.2 (6.7, 7.6) |
| TOTAL | 15264 | 492153 | | | | | | |

Note: Excludes cementless Genesis II Oxinium femoral prostheses. Restricted to modern prostheses

**Figure KT38 Cumulative Percent Revision of Minimally Stabilised Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Cemented | 261102 | 232427 | 178540 | 132389 | 48619 | 13667 | 2668 |
| Cementless | 102365 | 85337 | 58642 | 40579 | 22993 | 6798 | 1662 |
| Hybrid | 128686 | 115167 | 90832 | 71245 | 28838 | 7179 | 1321 |

Note: Restricted to modern prostheses

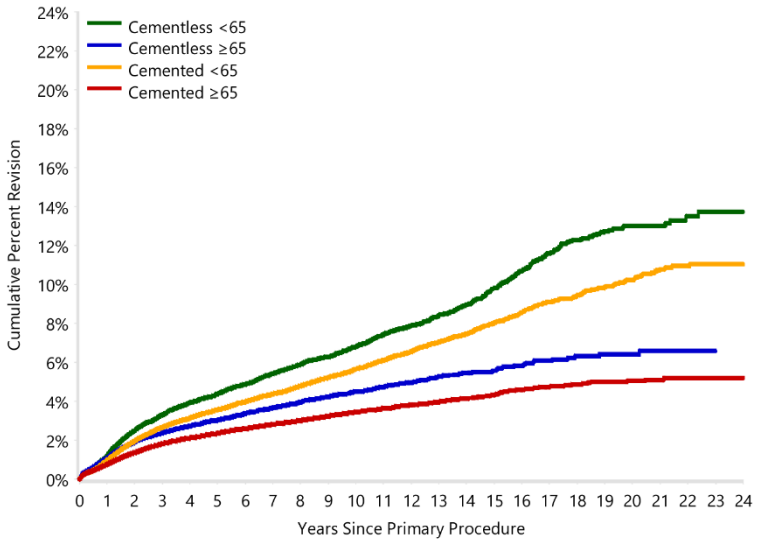
# Primary Total Knee Replacement

**Table KT41 Cumulative Percent Revision of Minimally Stabilised Primary Total Knee Replacement by Tibial Fixation and Age (Primary Diagnosis OA)**

| Tibial Fixation | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Cementless | <65 | 3779 | 81358 | 1.1 (1.0, 1.1) | 3.0 (2.9, 3.1) | 4.0 (3.8, 4.2) | 6.2 (6.0, 6.4) | 8.9 (8.6, 9.3) | 11.6 (11.0, 12.2) |
| | ≥65 | 3960 | 148126 | 0.9 (0.9, 1.0) | 2.1 (2.0, 2.2) | 2.7 (2.6, 2.8) | 3.9 (3.8, 4.1) | 4.9 (4.7, 5.1) | 5.7 (5.3, 6.0) |
| Cemented | <65 | 3319 | 80309 | 1.0 (0.9, 1.1) | 2.6 (2.5, 2.8) | 3.5 (3.4, 3.7) | 5.6 (5.4, 5.9) | 8.0 (7.6, 8.3) | 10.3 (9.7, 11.0) |
| | ≥65 | 4253 | 182466 | 0.8 (0.7, 0.8) | 1.8 (1.7, 1.9) | 2.3 (2.3, 2.4) | 3.4 (3.3, 3.5) | 4.3 (4.1, 4.5) | 5.0 (4.7, 5.3) |
| TOTAL | | 15311 | 492259 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT39 Cumulative Percent Revision of Minimally Stabilised Primary Total Knee Replacement by Tibial Fixation and Age (Primary Diagnosis OA)**




HR - adjusted for gender

Cementless <65 vs Cementless ≥65

- 0 - 6Mth: HR=0.93 (95% CI 0.81, 1.08), p=0.367
- 6Mth - 1Yr: HR=1.48 (95% CI 1.28, 1.72), p<0.001
- 1Yr - 1.5Yr: HR=1.70 (95% CI 1.48, 1.96), p<0.001
- 1.5Yr - 2.5Yr: HR=1.46 (95% CI 1.28, 1.67), p<0.001
- 2.5Yr - 4Yr: HR=1.63 (95% CI 1.41, 1.89), p<0.001
- 4Yr - 5.5Yr: HR=1.49 (95% CI 1.23, 1.79), p<0.001
- 5.5Yr - 6Yr: HR=1.38 (95% CI 0.94, 2.03), p=0.100
- 6Yr - 10Yr: HR=1.77 (95% CI 1.53, 2.04), p<0.001
- 10Yr - 15Yr: HR=2.59 (95% CI 2.18, 3.07), p<0.001
- 15Yr - 15.5Yr: HR=2.61 (95% CI 1.44, 4.71), p=0.001
- 15.5Yr+: HR=3.47 (95% CI 2.56, 4.69), p<0.001

Cementless <65 vs Cemented <65

- Entire Period: HR=1.23 (95% CI 1.17, 1.30), p<0.001

Cementless ≥65 vs Cemented ≥65

- Entire Period: HR=1.30 (95% CI 1.24, 1.37), p<0.001

Cemented <65 vs Cemented ≥65

- 0 - 6Mth: HR=1.02 (95% CI 0.93, 1.11), p=0.722
- 6Mth - 1.5Yr: HR=1.64 (95% CI 1.53, 1.76), p<0.001
- 1.5Yr - 2Yr: HR=1.70 (95% CI 1.53, 1.90), p<0.001
- 2Yr - 2.5Yr: HR=1.42 (95% CI 1.26, 1.60), p<0.001
- 2.5Yr - 4Yr: HR=1.63 (95% CI 1.49, 1.79), p<0.001
- 4Yr - 5.5Yr: HR=1.66 (95% CI 1.48, 1.86), p<0.001
- 5.5Yr - 6Yr: HR=2.12 (95% CI 1.69, 2.65), p<0.001
- 6Yr - 7Yr: HR=1.89 (95% CI 1.61, 2.23), p<0.001
- 7Yr - 8Yr: HR=2.12 (95% CI 1.76, 2.56), p<0.001
- 8Yr - 9Yr: HR=1.75 (95% CI 1.44, 2.12), p<0.001
- 9Yr - 12Yr: HR=2.31 (95% CI 1.99, 2.67), p<0.001
- 12Yr+: HR=3.03 (95% CI 2.54, 3.62), p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cementless | <65 | 40217 | 34082 | 23829 | 16861 | 10593 | 3689 | 1071 |
| | ≥65 | 63846 | 52699 | 35700 | 24129 | 12670 | 3211 | 611 |
| Cemented | <65 | 121450 | 109547 | 87160 | 67676 | 28261 | 8840 | 2087 |
| | ≥65 | 266746 | 236695 | 181386 | 135607 | 48973 | 11938 | 1903 |

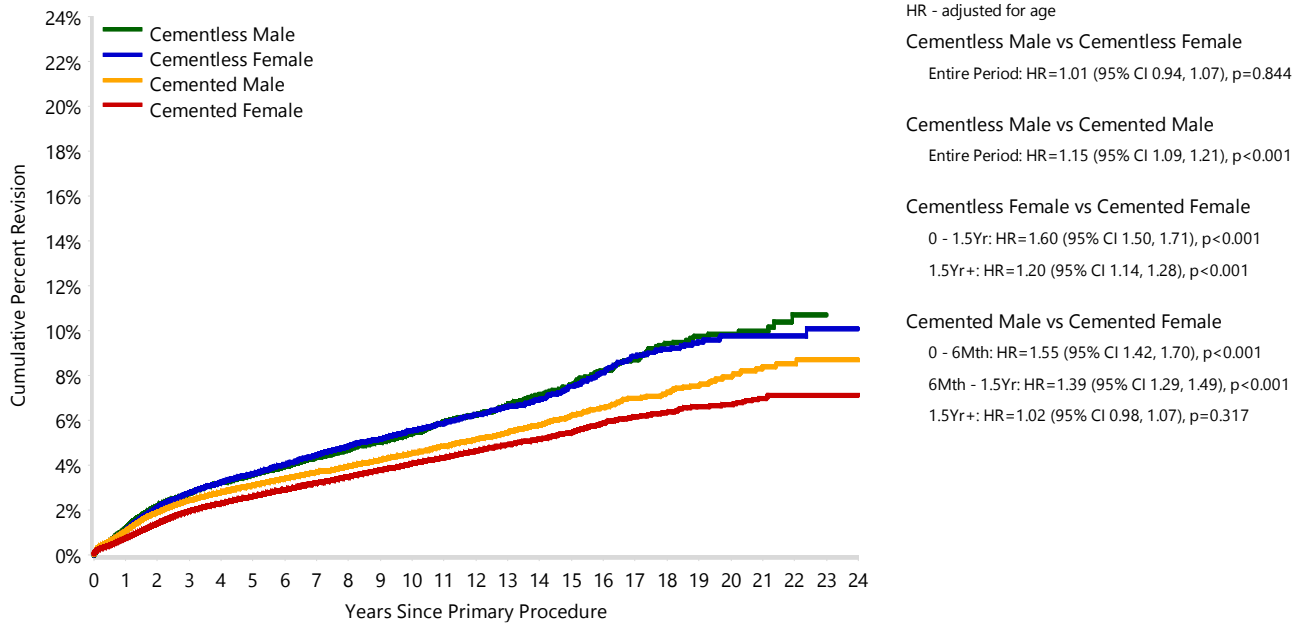
Note: Restricted to modern prostheses

**Table KT42 Cumulative Percent Revision of Minimally Stabilised Primary Total Knee Replacement by Tibial Fixation and Gender (Primary Diagnosis OA)**

| Tibial Fixation | Gender | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Cementless | Male | 3775 | 110917 | 1.1 (1.0, 1.2) | 2.6 (2.5, 2.7) | 3.3 (3.2, 3.4) | 4.9 (4.7, 5.0) | 6.8 (6.5, 7.1) | 8.8 (8.2, 9.4) |
| | Female | 3964 | 118567 | 0.8 (0.8, 0.9) | 2.3 (2.2, 2.4) | 3.0 (2.9, 3.1) | 4.7 (4.5, 4.8) | 6.4 (6.1, 6.6) | 8.0 (7.6, 8.5) |
| Cemented | Male | 3499 | 109459 | 1.1 (1.0, 1.1) | 2.4 (2.3, 2.5) | 3.0 (2.9, 3.2) | 4.5 (4.3, 4.7) | 6.2 (5.9, 6.5) | 7.9 (7.3, 8.6) |
| | Female | 4073 | 153316 | 0.7 (0.6, 0.7) | 1.8 (1.8, 1.9) | 2.5 (2.4, 2.6) | 3.9 (3.8, 4.0) | 5.2 (5.0, 5.4) | 6.6 (6.2, 7.0) |
| TOTAL | | 15311 | 492259 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT40 Cumulative Percent Revision of Minimally Stabilised Primary Total Knee Replacement by Tibial Fixation and Gender (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cementless | Male | 55230 | 45786 | 30816 | 20534 | 11184 | 3216 | 731 |
| | Female | 48833 | 40995 | 28713 | 20456 | 12079 | 3684 | 951 |
| Cemented | Male | 165146 | 147151 | 113747 | 84870 | 30397 | 7809 | 1491 |
| | Female | 223050 | 199091 | 154799 | 118413 | 46837 | 12969 | 2499 |

Note: Restricted to modern prostheses

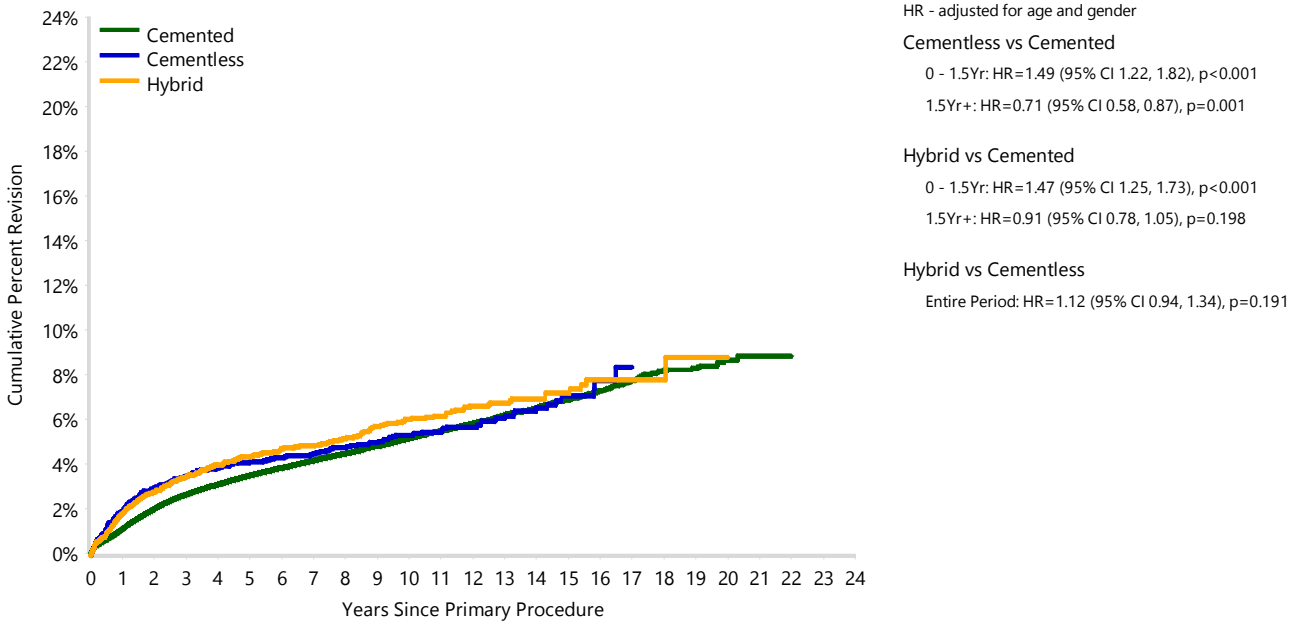
# Primary Total Knee Replacement

**Table KT43 Cumulative Percent Revision of Posterior Stabilised Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)**

| Fixation | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cemented | 6391 | 146096 | 1.1 (1.1, 1.2) | 2.7 (2.6, 2.8) | 3.5 (3.4, 3.6) | 5.2 (5.1, 5.4) | 7.0 (6.7, 7.2) | 8.7 (8.2, 9.3) |
| Cementless | 197 | 3962 | 2.0 (1.6, 2.5) | 3.5 (3.0, 4.2) | 4.2 (3.6, 4.9) | 5.4 (4.6, 6.2) | 7.1 (6.0, 8.4) | |
| Hybrid | 345 | 6958 | 1.9 (1.6, 2.2) | 3.5 (3.1, 4.0) | 4.4 (3.9, 5.0) | 6.1 (5.5, 6.8) | 7.3 (6.4, 8.2) | 8.9 (7.3, 10.8) |
| TOTAL | 6933 | 157016 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT41 Cumulative Percent Revision of Posterior Stabilised Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Cemented | 146096 | 135955 | 117032 | 98385 | 44355 | 11454 | 797 |
| Cementless | 3962 | 3683 | 3172 | 2693 | 1450 | 416 | 3 |
| Hybrid | 6958 | 6228 | 5209 | 4244 | 2277 | 549 | 62 |

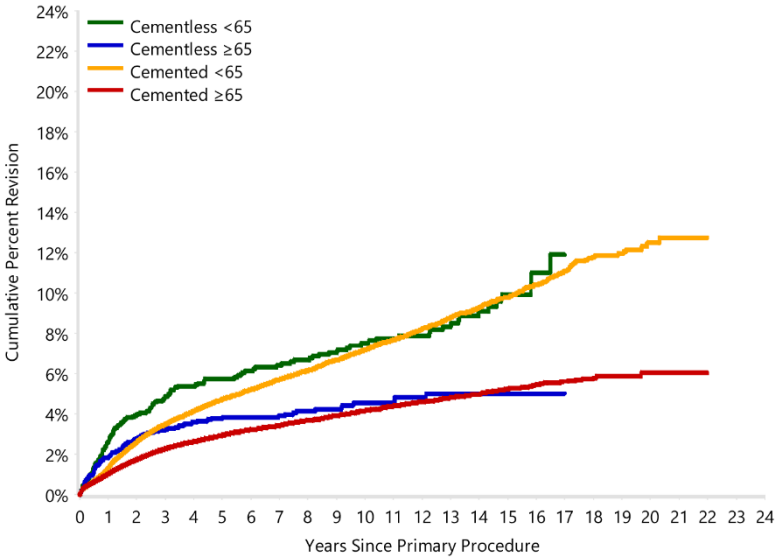
Note: Restricted to modern prostheses

**Table KT44 Cumulative Percent Revision of Posterior Stabilised Primary Total Knee Replacement by Tibial Fixation and Age (Primary Diagnosis OA)**

| Tibial Fixation | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Cementless | <65 | 144 | 2128 | 2.6 (2.0, 3.4) | 4.9 (4.0, 5.9) | 5.7 (4.8, 6.9) | 7.5 (6.3, 8.9) | 9.9 (8.2, 12.0) | |
| | ≥65 | 122 | 3323 | 1.8 (1.4, 2.4) | 3.2 (2.6, 3.9) | 3.8 (3.2, 4.6) | 4.5 (3.8, 5.5) | 5.0 (4.1, 6.2) | |
| Cemented | <65 | 3235 | 50615 | 1.3 (1.2, 1.4) | 3.5 (3.3, 3.7) | 4.7 (4.5, 4.9) | 7.2 (6.9, 7.5) | 9.8 (9.4, 10.2) | 12.5 (11.7, 13.3) |
| | ≥65 | 3432 | 100950 | 1.0 (1.0, 1.1) | 2.3 (2.2, 2.4) | 2.9 (2.8, 3.1) | 4.2 (4.0, 4.3) | 5.2 (5.0, 5.5) | 6.0 (5.6, 6.6) |
| TOTAL | | 6933 | 157016 | | | | | | |

Note: Restricted to modern prostheses.

**Figure KT42 Cumulative Percent Revision of Posterior Stabilised Primary Total Knee Replacement by Tibial Fixation and Age (Primary Diagnosis OA)**




HR - adjusted for gender

Cementless <65 vs Cementless ≥65
- 0 - 3Mth: HR=0.91 (95% CI 0.50, 1.66), p=0.752
- 3Mth - 6Mth: HR=2.92 (95% CI 1.70, 5.02), p<0.001
- 6Mth - 9Mth: HR=1.93 (95% CI 1.02, 3.63), p=0.042
- 9Mth+: HR=1.71 (95% CI 1.31, 2.23), p<0.001

Cementless <65 vs Cemented <65
- 0 - 1.5Yr: HR=1.73 (95% CI 1.37, 2.20), p<0.001
- 1.5Yr+: HR=0.76 (95% CI 0.60, 0.96), p=0.023

Cementless ≥65 vs Cemented ≥65
- 0 - 2.5Yr: HR=1.36 (95% CI 1.11, 1.66), p=0.002
- 2.5Yr+: HR=0.82 (95% CI 0.62, 1.07), p=0.140

Cemented <65 vs Cemented ≥65
- 0 - 3Mth: HR=0.94 (95% CI 0.80, 1.10), p=0.413
- 3Mth - 1Yr: HR=1.51 (95% CI 1.34, 1.71), p<0.001
- 1Yr - 2Yr: HR=1.80 (95% CI 1.61, 2.01), p<0.001
- 2Yr - 2.5Yr: HR=1.70 (95% CI 1.43, 2.03), p<0.001
- 2.5Yr - 5Yr: HR=1.81 (95% CI 1.63, 2.02), p<0.001
- 5Yr - 5.5Yr: HR=1.36 (95% CI 1.02, 1.82), p=0.036
- 5.5Yr+: HR=2.29 (95% CI 2.08, 2.52), p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cementless | <65 | 2128 | 1936 | 1589 | 1220 | 798 | 255 | 5 |
| | ≥65 | 3323 | 2974 | 2366 | 1698 | 788 | 206 | 1 |
| Cemented | <65 | 50615 | 47274 | 41283 | 35611 | 17977 | 5472 | 444 |
| | ≥65 | 100950 | 93682 | 80175 | 66793 | 28519 | 6486 | 412 |

Note: Restricted to modern prostheses.

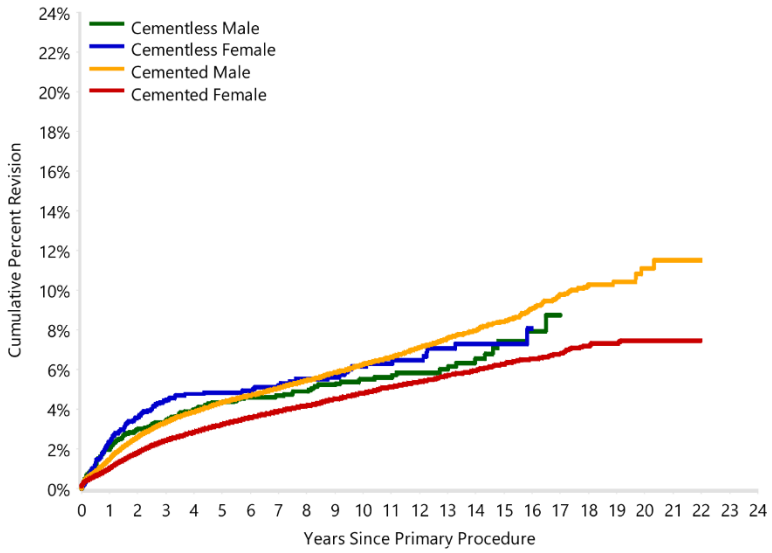
# Primary Total Knee Replacement

**Table KT45 Cumulative Percent Revision of Posterior Stabilised Primary Total Knee Replacement by Tibial Fixation and Gender (Primary Diagnosis OA)**

| Tibial Fixation | Gender | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Cementless | Male | 142 | 2980 | 2.0 (1.5, 2.6) | 3.4 (2.8, 4.2) | 4.4 (3.6, 5.2) | 5.5 (4.6, 6.5) | 7.4 (6.0, 9.1) | |
| | Female | 124 | 2471 | 2.3 (1.8, 3.0) | 4.4 (3.6, 5.3) | 4.8 (4.0, 5.8) | 6.1 (5.1, 7.4) | 7.3 (6.0, 8.9) | |
| Cemented | Male | 3358 | 65290 | 1.4 (1.4, 1.5) | 3.3 (3.1, 3.4) | 4.3 (4.1, 4.4) | 6.1 (5.9, 6.4) | 8.3 (7.9, 8.7) | 11.0 (10.0, 12.0) |
| | Female | 3309 | 86275 | 0.9 (0.8, 0.9) | 2.2 (2.1, 2.3) | 3.0 (2.9, 3.1) | 4.6 (4.4, 4.7) | 6.0 (5.8, 6.3) | 7.2 (6.8, 7.7) |
| TOTAL | | 6933 | 157016 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT43 Cumulative Percent Revision of Posterior Stabilised Primary Total Knee Replacement by Tibial Fixation and Gender (Primary Diagnosis OA)**




HR - adjusted for age

Cementless Male vs Cementless Female
- Entire Period: HR=0.86 (95% CI 0.68, 1.10), p=0.224

Cementless Male vs Cemented Male
- 0 - 1.5Yr: HR=1.24 (95% CI 0.99, 1.56), p=0.063
- 1.5Yr+: HR=0.66 (95% CI 0.52, 0.85), p<0.001

Cementless Female vs Cemented Female
- 0 - 1Mth: HR=2.18 (95% CI 1.65, 2.89), p<0.001
- 1Mth - 6Mth: HR=2.08 (95% CI 1.64, 2.64), p<0.001
- 6Mth - 9Mth: HR=2.30 (95% CI 1.74, 3.05), p<0.001
- 9Mth - 1Yr: HR=1.78 (95% CI 1.36, 2.32), p<0.001
- 1Yr - 1.5Yr: HR=1.85 (95% CI 1.46, 2.33), p<0.001
- 1.5Yr - 2Yr: HR=1.66 (95% CI 1.30, 2.12), p<0.001
- 2Yr - 3.5Yr: HR=1.51 (95% CI 1.22, 1.88), p<0.001
- 3.5Yr+: HR=0.81 (95% CI 0.60, 1.08), p=0.152

Cemented Male vs Cemented Female
- 0 - 3Mth: HR=1.78 (95% CI 1.53, 2.08), p<0.001
- 3Mth - 1.5Yr: HR=1.50 (95% CI 1.37, 1.65), p<0.001
- 1.5Yr - 2Yr: HR=1.35 (95% CI 1.14, 1.59), p<0.001
- 2Yr - 2.5Yr: HR=1.12 (95% CI 0.94, 1.34), p=0.192
- 2.5Yr+: HR=1.27 (95% CI 1.18, 1.36), p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cementless | Male | 2980 | 2724 | 2237 | 1718 | 935 | 260 | 1 |
| | Female | 2471 | 2186 | 1718 | 1200 | 651 | 201 | 5 |
| Cemented | Male | 65290 | 60348 | 51362 | 42653 | 18737 | 4665 | 317 |
| | Female | 86275 | 80608 | 70096 | 59751 | 27759 | 7293 | 539 |

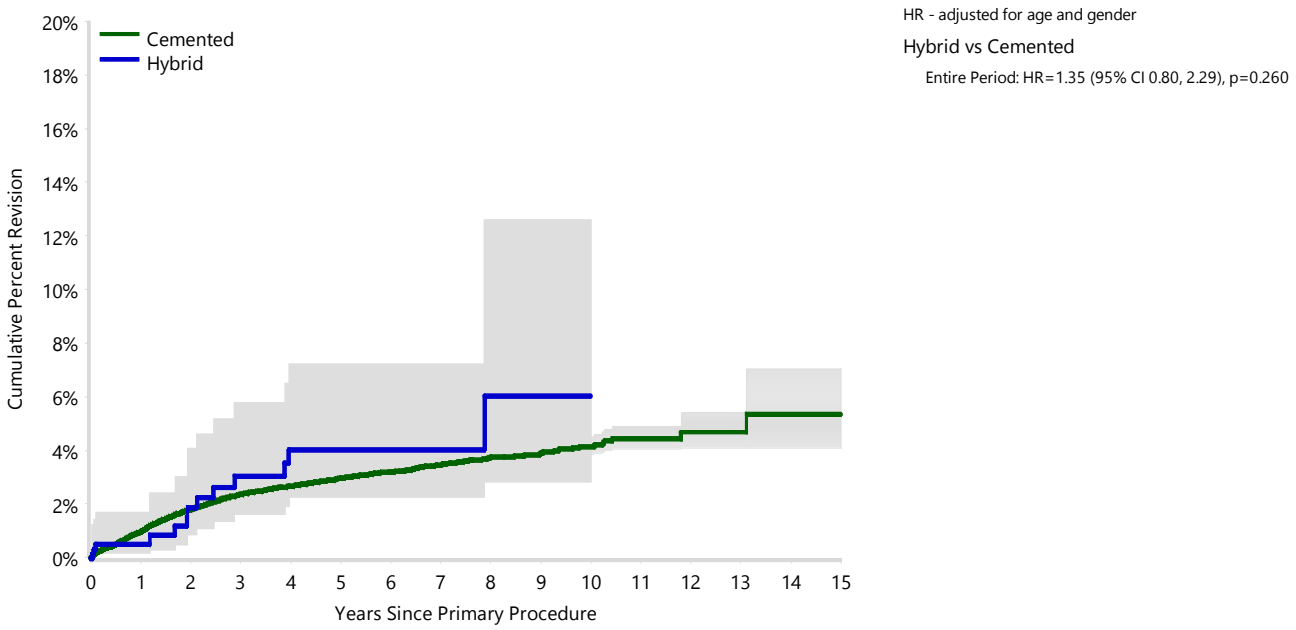
Note: Restricted to modern prostheses

**Table KT46 Cumulative Percent Revision of Medial Pivot Design Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)**

| Fixation | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cemented | 1288 | 50919 | 1.0 (0.9, 1.1) | 2.4 (2.2, 2.5) | 3.0 (2.8, 3.2) | 4.2 (3.9, 4.5) | 5.4 (4.1, 7.0) | |
| Cementless | 2 | 54 | 2.0 (0.3, 13.1) | 2.0 (0.3, 13.1) | 2.0 (0.3, 13.1) | 2.0 (0.3, 13.1) | 5.7 (1.4, 22.4) | |
| Hybrid | 14 | 559 | 0.6 (0.2, 1.7) | 3.1 (1.6, 5.8) | 4.1 (2.3, 7.2) | 6.1 (2.9, 12.6) | | |
| TOTAL | 1304 | 51532 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT44 Cumulative Percent Revision of Medial Pivot Design Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Cemented | 50919 | 43591 | 30482 | 19830 | 1645 | 63 | 0 |
| Hybrid | 559 | 305 | 230 | 117 | 45 | 1 | 0 |

Note: Restricted to modern prostheses. Cementless procedures excluded due to low numbers.

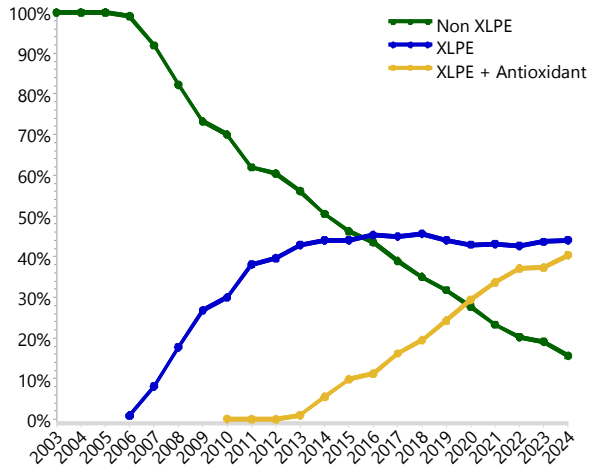
# Primary Total Knee Replacement

## BEARING SURFACE

### Tibial Bearing Surface

There are two main polyethylene types used in primary total knee replacement procedures: cross-linked polyethylene (XLPE) and non cross-linked polyethylene (non XLPE). XLPE has been classified as ultrahigh molecular weight polyethylene that has been irradiated by high dose (≥50kGy) gamma or electron beam radiation. XLPE includes a sub-group which has antioxidant added. Use of non XLPE has decreased with time and in 2024 only 15.6% of procedures use non XLPE (Figure KT45).

**Figure KT45 Primary Total Knee Replacement by Polyethylene Type**




There are 421,851 primary total knee procedures for osteoarthritis that have used XLPE. When adjusted for age, gender, fixation, bearing mobility, and patella usage, non XLPE group has a lower rate of revision compared to the XLPE group for the first 3 months. After 3 months, this reverses and the XLPE group has a lower rate of revision compared to the non XLPE group (Table KT47 and Figure KT47). The major reason for this later difference is a reduced cumulative incidence of loosening (Figure KT48).

Primary total knee procedures that use non XLPE have a higher rate of revision for loosening than procedures that use XLPE (Table KT48 and Figure KT49). Procedures with XLPE have a higher rate of revision for infection in the first 6 months compared to non XLPE. From 6 months onwards XLPE has a lower rate of revision for infection compared to non XLPE (Table KT49 and Figure KT50).

The difference between XLPE and non XLPE is more evident in younger patients. The 15-year cumulative percent revision rate for patients aged <65 years for XLPE is 7.1% and for non XLPE is 10.0%. For patients aged ≥65 years, the 15 year cumulative percent revision for XLPE is 4.2% and for non XLPE is 5.2% (Table KT50 and Figure KT51).

When XLPE and non XLPE are compared by prosthesis stability, there is a higher rate of revision for non XLPE after 3 months for both minimally and posterior stabilised designs.

The outcomes of two prosthesis combinations used with both XLPE and non XLPE and with >10,000 procedures in each group are shown in Table KT51 and Table KT52.

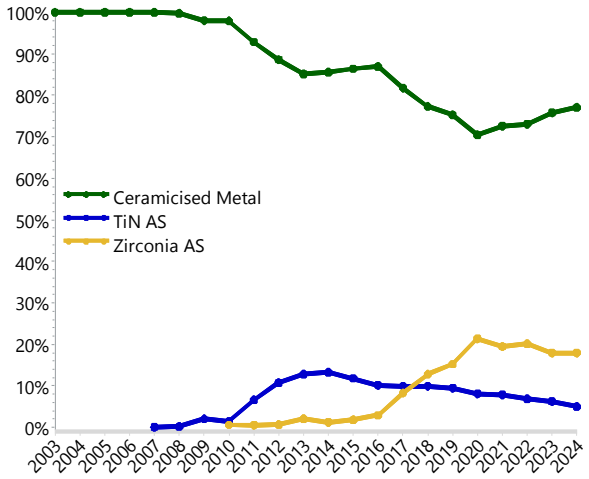
When considering the XLPE sub-types there is no difference when XLPE is compared to XLPE with antioxidant (Table KT53 and Figure KT52). The most common reasons for revision of XLPE and XLPE with antioxidant are shown in Figure KT53.

When the subtypes of XLPE are compared by prosthesis stability, there is a higher early rate of revision for XLPE with antioxidant for minimally stabilised designs (before 3 months and between 1 and 1.5 years only) and no difference outside of these times, while XLPE has a higher rate of revision when posterior stabilised designs are considered (Table KT54 and Table KT55; Table KT56 and Table KT57).

### Femoral Bearing Surface

In addition to the regularly used cobalt chrome metal, there are different materials used for the femoral bearing surface. These are often referred to as 'alternate surface' (AS) or 'ceramic surface' components. These can be made of a ceramicised metal or have a zirconia or titanium nitride coating. They are suggested for use in patients who have a metal allergy. The use of primary total knee procedures with an AS femoral component is shown in Figure KT46.

**Figure KT46 Primary Total Knee Replacement by AS Femoral Material**




Note: TiN (titanium nitride) surface

There are 86,257 procedures with an AS femoral component. When adjusted for age, gender, fixation, stability, bearing mobility, patella usage, and polyethylene type, procedures using an AS femoral component have a higher rate of revision compared to when these are not used (Table KT58 and Figure KT54). There are more revisions for loosening, pain and for patella erosion where an AS femoral component is used (Figure KT55).

When femoral bearing surface is analysed by prosthesis stability, there is a higher rate of revision for both minimally stabilised and posterior stabilised components with an AS,

but no difference is seen with medial pivot designs (where there are few for comparison) (Table KT59 and Table KT60).

There is variation in the revision rate depending on the type of material used in the AS. In 2024, there were 4 femoral prostheses used that used a zirconia-based AS, 11 that used a TiN (titanium nitride) surface, and 6 with a ceramicised metal surface.

Compared to non AS femoral components ceramicised metal prostheses have a higher rate of revision. TiN AS femoral prostheses also have a higher rate of revision compared to non AS femoral components, but only for the first 1.5 years. There is little difference when Zirconia AS prostheses are compared to non AS femoral components (Table KT61 and Figure KT56).

The types of revision are shown in Figure KT57. The most common reasons for revision are loosening and infection for all femoral bearing surface materials.

When revision for loosening is assessed, compared to non AS femoral components, ceramicised metal has a higher rate of revision for the first 5 years only, TiN AS has a higher rate of revision for the first 2.5 years only, and there is no difference for Zirconia AS. However, Zirconia AS has a lower rate of revision compared to ceramicised metal and when compared to TiN AS (Table KT62 and Figure KT58).

There are two prosthesis combinations that have >300 procedures in both AS and non AS femoral component groups. The outcomes of these components are shown in Table KT63 and Table KT64.

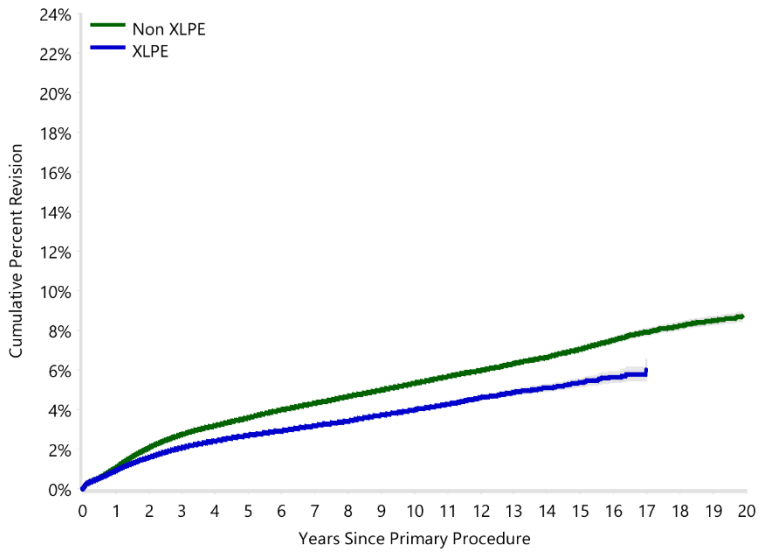
# Primary Total Knee Replacement

**Table KT47 Cumulative Percent Revision of Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA)**

| Polyethylene Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Non XLPE | 13604 | 283046 | 1.1 (1.0, 1.1) | 2.7 (2.7, 2.8) | 3.6 (3.5, 3.7) | 5.3 (5.2, 5.4) | 7.1 (6.9, 7.2) | 8.7 (8.5, 9.0) |
| XLPE | 10266 | 421851 | 0.9 (0.9, 0.9) | 2.1 (2.0, 2.1) | 2.7 (2.6, 2.8) | 4.0 (3.9, 4.1) | 5.4 (5.1, 5.6) | |
| TOTAL | 23870 | 704897 | | | | | | |

Note: Restricted to modern prostheses. Includes 143,220 procedures using cross-linked polyethylene with antioxidant
Excludes 1,452 procedures with unknown polyethylene

**Figure KT47 Cumulative Percent Revision of Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA)**

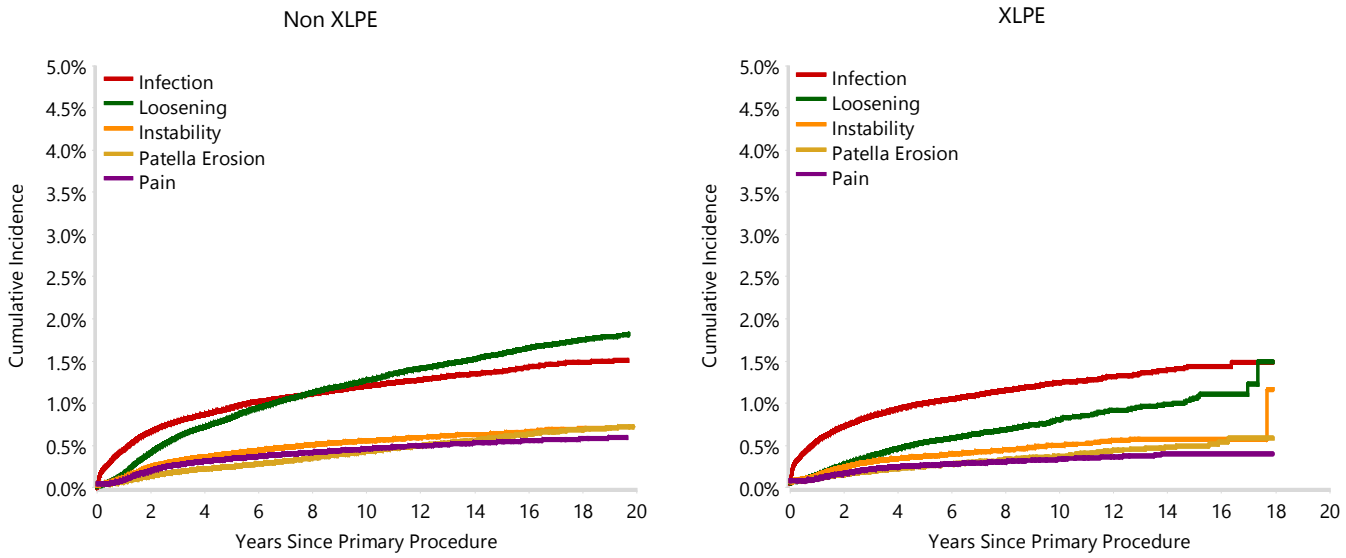



HR - age, gender, fixation, bearing mobility, and patella usage
Non XLPE vs XLPE
0 - 3Mth: HR=0.89 (95% CI 0.82, 0.96), p=0.005
3Mth-1Yr: HR=1.23 (95% CI 1.16, 1.31), p<0.001
1-1.5Yr: HR=1.49 (95% CI 1.39, 1.61), p<0.001
1.5Yr+: HR=1.33 (95% CI 1.28, 1.38), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Non XLPE | 283046 | 267792 | 234376 | 199999 | 105145 | 35991 | 6540 |
| XLPE | 421851 | 358861 | 253083 | 171828 | 45785 | 4291 | 0 |

Note: Restricted to modern prostheses

**Figure KT48 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

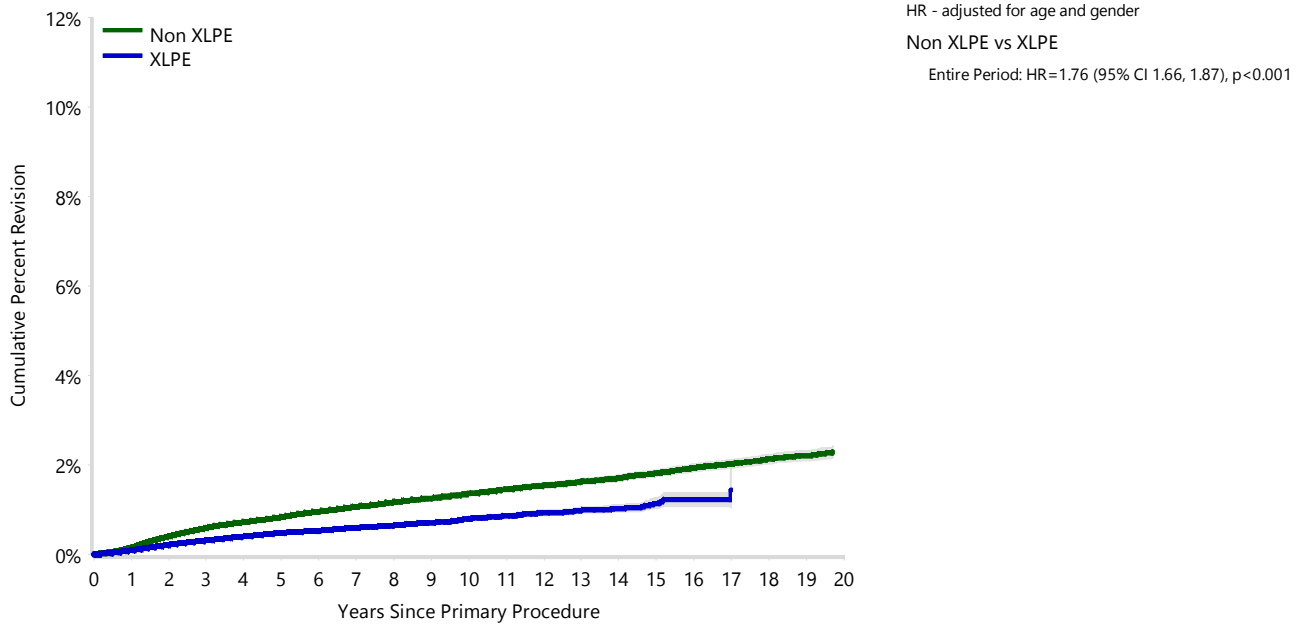
# Primary Total Knee Replacement

**Table KT48 Cumulative Percent Revision of Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA, Revision for Loosening)**

| Polyethylene Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Non XLPE | 3309 | 283046 | 0.2 (0.1, 0.2) | 0.6 (0.6, 0.6) | 0.8 (0.8, 0.9) | 1.4 (1.3, 1.4) | 1.8 (1.7, 1.9) | 2.3 (2.2, 2.4) |
| XLPE | 1774 | 421851 | 0.1 (0.1, 0.1) | 0.3 (0.3, 0.3) | 0.5 (0.5, 0.5) | 0.8 (0.7, 0.8) | 1.1 (1.0, 1.3) | |
| TOTAL | 5083 | 704897 | | | | | | |

Note: Restricted to modern prostheses
Includes 143,220 procedures using cross-linked polyethylene with antioxidant
Excludes 1,452 procedures with unknown polyethylene

**Figure KT49 Cumulative Percent Revision of Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA, Revision for Loosening)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Non XLPE | 283046 | 267792 | 234376 | 199999 | 105145 | 35991 | 6540 |
| XLPE | 421851 | 358861 | 253083 | 171828 | 45785 | 4291 | 0 |

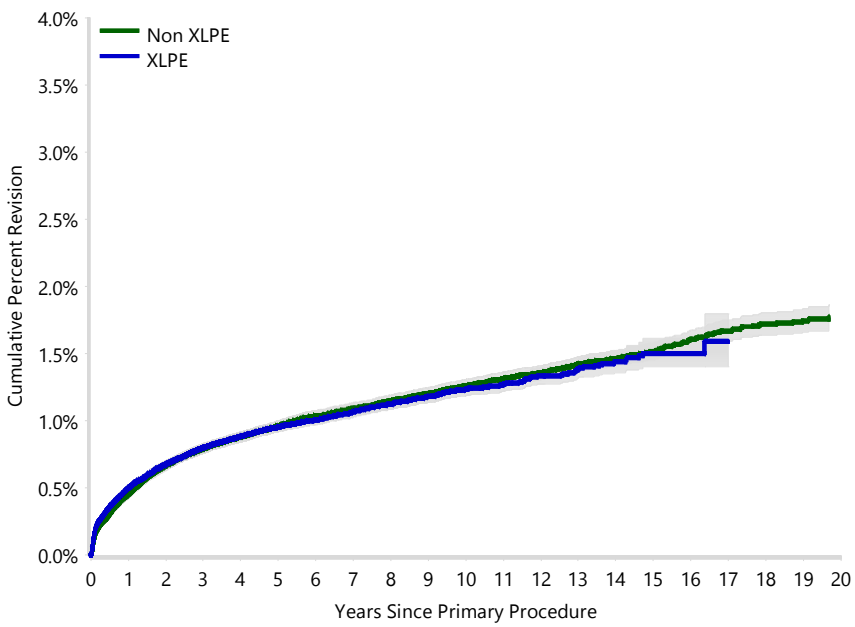
Note: Restricted to modern prostheses
Includes 143,220 procedures using cross-linked polyethylene with antioxidant
Excludes 1,452 procedures with unknown polyethylene

**Table KT49 Cumulative Percent Revision of Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA, Revision for Infection)**

| Polyethylene Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Non XLPE | 3200 | 283046 | 0.5 (0.4, 0.5) | 0.8 (0.8, 0.8) | 1.0 (0.9, 1.0) | 1.3 (1.2, 1.3) | 1.5 (1.5, 1.6) | 1.8 (1.7, 1.9) |
| XLPE | 3609 | 421851 | 0.5 (0.5, 0.5) | 0.8 (0.8, 0.8) | 1.0 (0.9, 1.0) | 1.2 (1.2, 1.3) | 1.5 (1.4, 1.6) | |
| TOTAL | 6809 | 704897 | | | | | | |

Note: Restricted to modern prostheses. Includes 143,220 procedures using cross-linked polyethylene with antioxidant. Excludes 1,452 procedures with unknown polyethylene

**Figure KT50 Cumulative Percent Revision of Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA, Revision for Infection)**




HR - adjusted for age and gender

XLPE vs Non XLPE

0 - 6Mth: HR=1.17 (95% CI 1.08, 1.27), p<0.001

6Mth+: HR=0.90 (95% CI 0.85, 0.96), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Non XLPE | 283046 | 267792 | 234376 | 199999 | 105145 | 35991 | 6540 |
| XLPE | 421851 | 358861 | 253083 | 171828 | 45785 | 4291 | 0 |

Note: Restricted to modern prostheses. Includes 143,220 procedures using cross-linked polyethylene with antioxidant. Excludes 1,452 procedures with unknown polyethylene

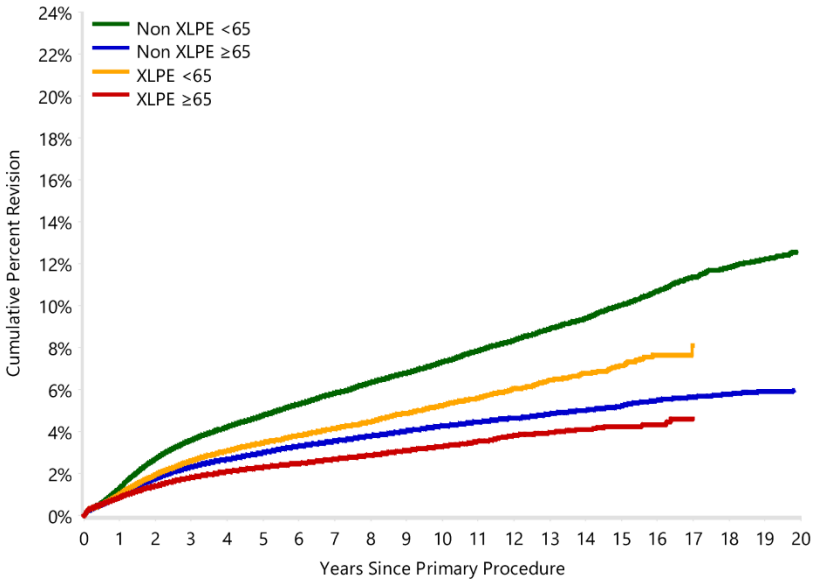
# Primary Total Knee Replacement

**Table KT50 Cumulative Percent Revision of Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)**

| Polyethylene Type | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| **Non XLPE** | | **13604** | **283046** | **1.1 (1.0, 1.1)** | **2.7 (2.7, 2.8)** | **3.6 (3.5, 3.7)** | **5.3 (5.2, 5.4)** | **7.1 (6.9, 7.2)** | **8.7 (8.5, 9.0)** |
| | **<65** | 6701 | 93594 | 1.3 (1.2, 1.4) | 3.6 (3.5, 3.7) | 4.8 (4.6, 4.9) | 7.3 (7.1, 7.5) | 10.0 (9.8, 10.3) | 12.6 (12.2, 13.0) |
| | **≥65** | 6903 | 189452 | 0.9 (0.9, 1.0) | 2.3 (2.2, 2.4) | 3.0 (2.9, 3.1) | 4.3 (4.2, 4.4) | 5.2 (5.1, 5.4) | 6.0 (5.7, 6.2) |
| **XLPE** | | **10266** | **421851** | **0.9 (0.9, 0.9)** | **2.1 (2.0, 2.1)** | **2.7 (2.6, 2.8)** | **4.0 (3.9, 4.1)** | **5.4 (5.1, 5.6)** | |
| | **<65** | 4508 | 138660 | 1.0 (1.0, 1.1) | 2.6 (2.5, 2.7) | 3.5 (3.4, 3.6) | 5.2 (5.1, 5.4) | 7.1 (6.8, 7.5) | |
| | **≥65** | 5758 | 283191 | 0.9 (0.8, 0.9) | 1.8 (1.8, 1.9) | 2.3 (2.2, 2.4) | 3.3 (3.2, 3.4) | 4.2 (4.0, 4.5) | |
| **TOTAL** | | **23870** | **704897** | | | | | | |

Note: Restricted to modern prostheses. Includes 143,220 procedures using cross-linked polyethylene with antioxidant. Excludes 1,452 procedures with unknown polyethylene

**Figure KT51 Cumulative Percent Revision of Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)**




HR - adjusted for age and gender

Non XLPE <65 vs Non XLPE ≥65
- 0 - 6Mth: HR=1.16 (95% CI 1.06, 1.28), p=0.002
- 6Mth - 9Mth: HR=1.57 (95% CI 1.38, 1.79), p<0.001
- 9Mth - 1.5Yr: HR=1.70 (95% CI 1.58, 1.83), p<0.001
- 1.5Yr - 2Yr: HR=1.80 (95% CI 1.62, 1.99), p<0.001
- 2Yr - 2.5Yr: HR=1.60 (95% CI 1.42, 1.79), p<0.001
- 2.5Yr - 3.5Yr: HR=1.65 (95% CI 1.50, 1.82), p<0.001
- 3.5Yr - 6Yr: HR=1.85 (95% CI 1.72, 2.00), p<0.001
- 6Yr - 10Yr: HR=2.07 (95% CI 1.91, 2.23), p<0.001
- 10Yr - 12.5Yr: HR=2.54 (95% CI 2.23, 2.89), p<0.001
- 12.5Yr - 15.5Yr: HR=2.62 (95% CI 2.24, 3.07), p<0.001
- 15.5Yr+: HR=3.92 (95% CI 3.01, 5.09), p<0.001

Non XLPE <65 vs XLPE <65
- 0 - 6Mth: HR=1.09 (95% CI 0.99, 1.21), p=0.077
- 6Mth - 1Yr: HR=1.49 (95% CI 1.35, 1.64), p<0.001
- 1Yr - 2.5Yr: HR=1.48 (95% CI 1.38, 1.57), p<0.001
- 2.5Yr+: HR=1.44 (95% CI 1.36, 1.52), p<0.001

Non XLPE ≥65 vs XLPE ≥65
- 0 - 3Mth: HR=0.86 (95% CI 0.79, 0.93), p<0.001
- 3Mth+: HR=1.36 (95% CI 1.31, 1.42), p<0.001

XLPE <65 vs XLPE ≥65
- 0 - 3Mth: HR=0.93 (95% CI 0.85, 1.01), p=0.093
- 3Mth - 6Mth: HR=1.27 (95% CI 1.12, 1.44), p<0.001
- 6Mth - 1Yr: HR=1.41 (95% CI 1.28, 1.54), p<0.001
- 1Yr - 2Yr: HR=1.72 (95% CI 1.60, 1.85), p<0.001
- 2Yr+: HR=1.72 (95% CI 1.63, 1.82), p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| **Non XLPE** | **<65** | 93594 | 88991 | 79079 | 68894 | 40429 | 16326 | 3612 |
| | **≥65** | 189452 | 178801 | 155297 | 131105 | 64716 | 19665 | 2928 |
| **XLPE** | **<65** | 138660 | 119388 | 86256 | 60036 | 18086 | 2023 | 0 |
| | **≥65** | 283191 | 239473 | 166827 | 111792 | 27699 | 2268 | 0 |

Note: Restricted to modern prostheses.

**Table KT51 Cumulative Percent Revision of Primary Total Knee Replacement by Prosthesis Combination and Polyethylene Type (Primary Diagnosis OA)**

| Prosthesis Combination | Polyethylene Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Genesis II Oxinium PS/ Genesis II | Non XLPE | 1028 | 11643 | 1.6 (1.4, 1.8) | 3.9 (3.6, 4.3) | 5.3 (4.9, 5.7) | 7.4 (7.0, 8.0) | 9.8 (9.2, 10.4) | 12.3 (11.2, 13.5) |
| | XLPE | 552 | 11058 | 1.3 (1.1, 1.5) | 3.3 (2.9, 3.6) | 4.4 (4.0, 4.8) | 6.6 (6.0, 7.2) | | |
| Triathlon CR/Triathlon | Non XLPE | 431 | 12064 | 0.7 (0.6, 0.9) | 1.8 (1.6, 2.1) | 2.3 (2.1, 2.6) | 3.4 (3.0, 3.7) | 4.5 (4.0, 4.9) | |
| | XLPE | 3929 | 175353 | 0.8 (0.8, 0.9) | 1.8 (1.7, 1.9) | 2.3 (2.3, 2.4) | 3.5 (3.4, 3.7) | 4.8 (4.5, 5.1) | |
| TOTAL | | 5940 | 210118 | | | | | | |

Note: Restricted to modern prostheses. Only prosthesis combinations have more than 10,000 procedures in both groups are listed

**Table KT52 Comparisons of Revision Rates for Primary Total Knee Replacement by Prosthesis Combination and Polyethylene Type (Primary Diagnosis OA)**

| Comparison | HR- adjusted for age and gender |
|---|---|
| Genesis II Oxinium PS/Genesis II Non XLPE vs Genesis II Oxinium PS/Genesis II XLPE | Entire Period: HR=1.13 (95% CI 1.01, 1.26), p=0.026 |
| Triathlon CR/Triathlon Non XLPE vs Triathlon CR/Triathlon XLPE | Entire Period: HR=0.97 (95% CI 0.87, 1.07), p=0.524 |

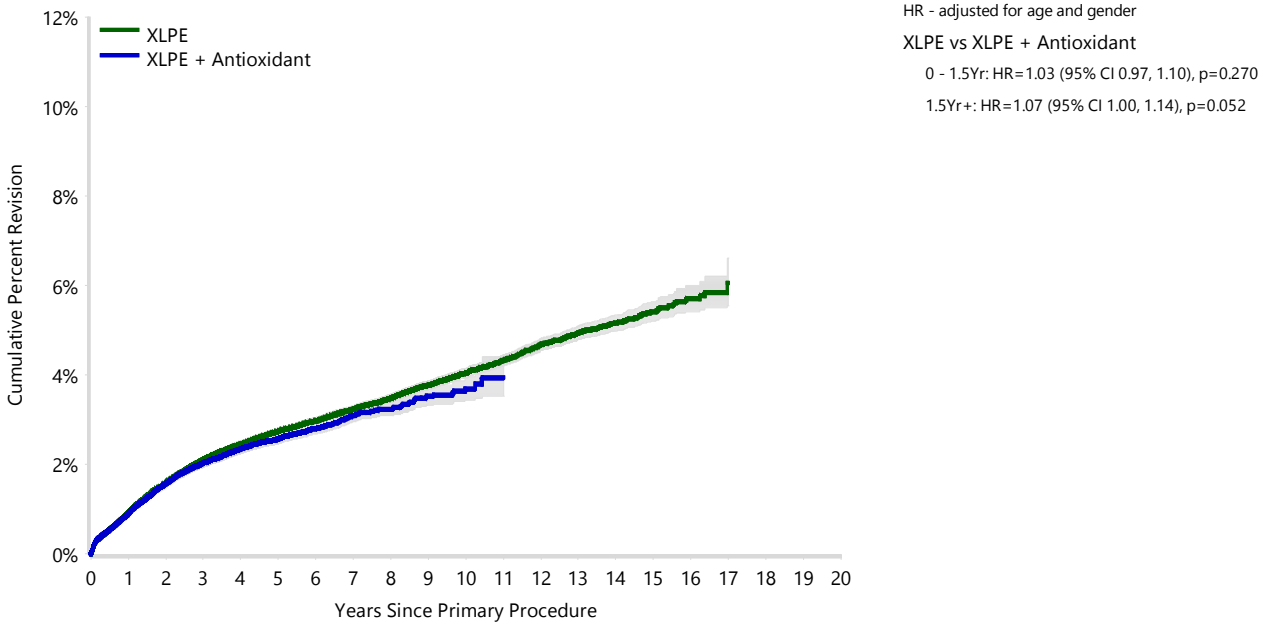
# Primary Total Knee Replacement

**Table KT53 Cumulative Percent Revision of XLPE Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA)**

| Polyethylene Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| XLPE | 7583 | 278631 | 0.9 (0.9, 1.0) | 2.1 (2.1, 2.2) | 2.7 (2.7, 2.8) | 4.0 (3.9, 4.1) | 5.4 (5.2, 5.6) | |
| XLPE + Antioxidant | 2683 | 143220 | 0.9 (0.9, 1.0) | 2.0 (1.9, 2.1) | 2.6 (2.5, 2.7) | 3.7 (3.4, 4.0) | | |
| TOTAL | 10266 | 421851 | | | | | | |

Note: Restricted to modern prostheses.

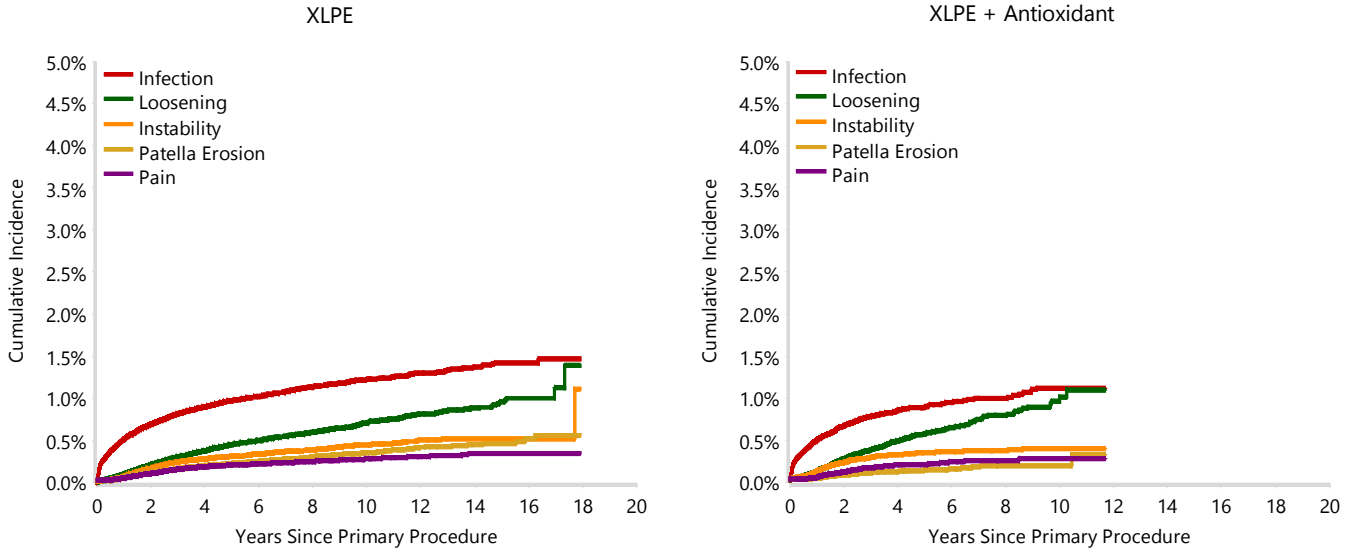
**Figure KT52 Cumulative Percent Revision of XLPE Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| XLPE | 278631 | 244852 | 186285 | 137812 | 44188 | 4291 | 0 |
| XLPE + Antioxidant | 143220 | 114009 | 66798 | 34016 | 1597 | 0 | 0 |

Note: Restricted to modern prostheses.

**Figure KT53 Cumulative Incidence Revision Diagnosis of XLPE Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA)**




Note: Restricted to modern prostheses.

# Primary Total Knee Replacement

**Table KT54 Cumulative Percent Revision of Primary Total Knee Replacement by Polyethylene Type and Stability (Primary Diagnosis OA)**

| Stability | Polyethylene Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| **Minimally Stabilised** | | **15299** | **491102** | **0.9 (0.9, 0.9)** | **2.2 (2.2, 2.3)** | **2.9 (2.9, 3.0)** | **4.4 (4.4, 4.5)** | **6.1 (5.9, 6.2)** | **7.7 (7.5, 8.0)** |
| | **Non XLPE** | 8467 | 168644 | 1.0 (0.9, 1.0) | 2.7 (2.6, 2.7) | 3.5 (3.4, 3.6) | 5.2 (5.1, 5.3) | 6.9 (6.7, 7.1) | 8.6 (8.3, 8.8) |
| | **XLPE** | 6832 | 322458 | 0.9 (0.8, 0.9) | 1.9 (1.9, 2.0) | 2.5 (2.4, 2.6) | 3.7 (3.5, 3.8) | 5.0 (4.7, 5.2) | |
| **Posterior Stabilised** | | **6932** | **156865** | **1.2 (1.1, 1.2)** | **2.7 (2.6, 2.8)** | **3.6 (3.5, 3.7)** | **5.3 (5.1, 5.4)** | **7.0 (6.8, 7.2)** | **8.7 (8.3, 9.2)** |
| | **Non XLPE** | 3557 | 59048 | 1.3 (1.2, 1.4) | 3.1 (2.9, 3.2) | 4.1 (3.9, 4.3) | 5.9 (5.7, 6.1) | 7.7 (7.4, 8.0) | 9.4 (8.9, 10.0) |
| | **XLPE** | 3375 | 97817 | 1.1 (1.0, 1.2) | 2.5 (2.4, 2.6) | 3.2 (3.1, 3.4) | 4.7 (4.6, 4.9) | 6.2 (5.8, 6.6) | |
| **Medial Pivot Design** | | **1304** | **51532** | **1.0 (0.9, 1.1)** | **2.4 (2.2, 2.5)** | **3.0 (2.8, 3.2)** | **4.2 (3.9, 4.5)** | **6.0 (4.5, 7.9)** | |
| | **Non XLPE** | 1301 | 51220 | 1.0 (0.9, 1.1) | 2.4 (2.2, 2.5) | 3.0 (2.8, 3.2) | 4.2 (3.9, 4.5) | 6.0 (4.5, 7.9) | |
| | **XLPE** | 3 | 312 | | | | | | |
| **TOTAL** | | **23535** | **699499** | | | | | | |

Note: Restricted to modern prostheses.
XLPE includes 143,220 procedures using XLPE with Antioxidant.
Excludes 1,452 procedures with unknown polyethylene.

**Table KT55 Comparisons of Revision Rates for Primary Total Knee Replacement by Polyethylene Type and Stability (Primary Diagnosis OA)**

| Comparison | HR -adjusted for age and gender |
|---|---|
| **Minimally Stabilised Non XLPE vs Minimally Stabilised XLPE** | 0 - 3Mth: HR=0.87 (95% CI 0.78, 0.97), p=0.011 |
| | 3Mth – 1Yr: HR= 1.27 (95% CI 1.17, 1.37), p<0.001 |
| | 1Yr – 1.5Yr: 1.69 (95% CI 1.54, 1.85), p<0.001 |
| | 1.5Yr+: HR= 1.52 (95% CI 1.46, 1.59), p<0.001 |
| **Posterior Stabilised Non XLPE vs Posterior Stabilised XLPE** | 0 - 3Mth: HR= 0.94 (95% CI 0.81, 1.10), p=0.460 |
| | 3Mth – 1.5Yr: HR= 1.40 (95% CI 1.28, 1.54), p<0.001 |
| | 1.5Yr+: HR= 1.29 (95% CI 1.21, 1.37), p<0.001 |

Note: Restricted to modern prostheses.
XLPE includes 143,220 procedures using XLPE with Antioxidant.
Excludes 1,452 procedures with unknown polyethylene

**Table KT56 Cumulative Percent Revision of Primary Total Knee Replacement by Polyethylene Type and Stability (Primary Diagnosis OA)**

| Stability | Polyethylene Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|---|
| **Minimally Stabilised** | | **6832** | **322458** | **0.9 (0.8, 0.9)** | **1.9 (1.9, 2.0)** | **2.5 (2.4, 2.6)** | **3.7 (3.5, 3.8)** | **5.0 (4.7, 5.2)** |
| | **XLPE** | 4754 | 204671 | 0.8 (0.8, 0.9) | 1.9 (1.8, 2.0) | 2.5 (2.4, 2.6) | 3.7 (3.6, 3.8) | 5.0 (4.7, 5.3) |
| | **XLPE + Antioxidant** | 2078 | 117787 | 0.9 (0.8, 0.9) | 2.0 (1.9, 2.1) | 2.5 (2.4, 2.6) | 3.3 (3.1, 3.5) | |
| **Posterior Stabilised** | | **3375** | **97817** | **1.1 (1.0, 1.2)** | **2.5 (2.4, 2.6)** | **3.2 (3.1, 3.4)** | **4.7 (4.6, 4.9)** | **6.2 (5.8, 6.6)** |
| | **XLPE** | 2792 | 73066 | 1.1 (1.1, 1.2) | 2.6 (2.5, 2.7) | 3.4 (3.2, 3.5) | 4.8 (4.6, 5.0) | 6.3 (5.9, 6.7) |
| | **XLPE + Antioxidant** | 583 | 24751 | 1.0 (0.8, 1.1) | 2.2 (2.0, 2.4) | 2.7 (2.5, 3.0) | 4.7 (4.0, 5.4) | |
| **TOTAL** | | **10207** | **420275** | | | | | |

Note: Restricted to modern prostheses.
Excludes 1,452 procedures with unknown polyethylene

**Table KT57 Comparisons of Revision Rates for Primary Total Knee Replacement by Polyethylene Type and Stability (Primary Diagnosis OA)**

| Comparison | HR -adjusted for age and gender |
|---|---|
| **Minimally Stabilised XLPE vs Minimally Stabilised XLPE + Antioxidant** | 0 - 3Mth: HR=0.85 (95% CI 0.75, 0.96), p=0.009 |
| | 3Mth – 1.5Yr: HR= 1.05 (95% CI 0.97, 1.14), p=0.255 |
| | 1.5Yr – 2Yr: 0.81 (95% CI 0.69, 0.95), p=0.009 |
| | 2Yr – 2.5Yr: HR= 0.97 (95% CI 0.80, 1.17), p=0.732 |
| | 2.5Yr+: HR= 1.11 (95% CI 0.99, 1.24), p=0.064 |
| **Posterior Stabilised XLPE vs Posterior Stabilised XLPE+ Antioxidant** | Entire Period: HR= 1.13 (95% CI 1.03, 1.24), p=0.008 |

Note: Restricted to modern prostheses.
Excludes 1,452 procedures with unknown polyethylene

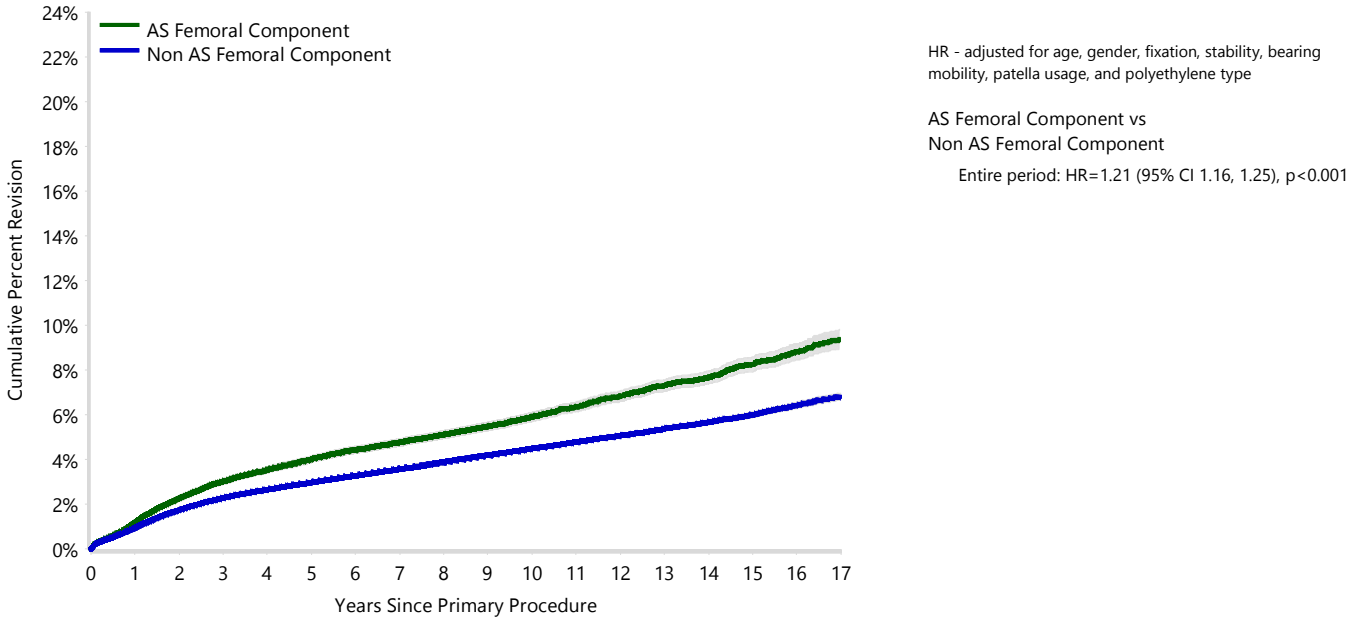
# Primary Total Knee Replacement

**Table KT58 Cumulative Percent Revision of Primary Total Knee Replacement by Femoral Bearing Surface (Primary Diagnosis OA)**

| Femoral Bearing Surface | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| AS Femoral Component | 4109 | 86257 | 1.2 (1.1, 1.3) | 3.0 (2.9, 3.2) | 4.0 (3.9, 4.2) | 5.9 (5.7, 6.1) | 8.3 (7.9, 8.6) | 10.6 (10.0, 11.3) |
| Non AS Femoral Component | 19781 | 620092 | 0.9 (0.9, 1.0) | 2.3 (2.2, 2.3) | 3.0 (2.9, 3.0) | 4.5 (4.4, 4.6) | 6.0 (5.9, 6.1) | 7.5 (7.3, 7.8) |
| TOTAL | 23890 | 706349 | | | | | | |

Note: Restricted to modern prostheses.

**Figure KT54 Cumulative Percent Revision of Primary Total Knee Replacement by Femoral Bearing Surface (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| AS Femoral Component | 86257 | 78621 | 64324 | 51596 | 23433 | 6672 | 890 |
| Non AS Femoral Component | 620092 | 548979 | 423397 | 320396 | 127548 | 33629 | 5654 |

Note: Restricted to modern prostheses.

**Table KT59 Cumulative Percent Revision of Primary Total Knee Replacement by Femoral Bearing Surface and Stability (Primary Diagnosis OA)**

| Stability | Femoral Bearing Surface | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| **Minimally Stabilised** | | **15311** | **492259** | **0.9 (0.9, 0.9)** | **2.2 (2.2, 2.3)** | **2.9 (2.9, 3.0)** | **4.4 (4.4, 4.5)** | **6.1 (5.9, 6.2)** | **7.7 (7.5, 8.0)** |
| | AS Femoral Component | 1551 | 38284 | 1.1 (1.0, 1.2) | 2.7 (2.6, 2.9) | 3.5 (3.3, 3.7) | 5.5 (5.2, 5.8) | 7.8 (7.2, 8.3) | 9.9 (9.1, 10.8) |
| | Non AS Femoral Component | 13760 | 453975 | 0.9 (0.9, 0.9) | 2.2 (2.1, 2.2) | 2.9 (2.8, 2.9) | 4.4 (4.3, 4.4) | 5.9 (5.8, 6.1) | 7.5 (7.2, 7.7) |
| **Posterior Stabilised** | | **6933** | **157016** | **1.2 (1.1, 1.2)** | **2.7 (2.6, 2.8)** | **3.6 (3.5, 3.7)** | **5.3 (5.1, 5.4)** | **7.0 (6.8, 7.2)** | **8.7 (8.3, 9.2)** |
| | AS Femoral Component | 2486 | 46722 | 1.2 (1.1, 1.3) | 3.2 (3.1, 3.4) | 4.3 (4.1, 4.5) | 6.2 (5.9, 6.5) | 8.6 (8.1, 9.0) | 11.2 (10.1, 12.4) |
| | Non AS Femoral Component | 4447 | 110294 | 1.1 (1.1, 1.2) | 2.5 (2.4, 2.6) | 3.3 (3.2, 3.4) | 4.9 (4.7, 5.0) | 6.3 (6.1, 6.5) | 7.6 (7.2, 8.1) |
| **Medial Pivot Design** | | **1304** | **51532** | **1.0 (0.9, 1.1)** | **2.4 (2.2, 2.5)** | **3.0 (2.8, 3.2)** | **4.2 (3.9, 4.5)** | **6.0 (4.5, 7.9)** | |
| | AS Femoral Component | 7 | 164 | 0.6 (0.1, 4.3) | 2.9 (1.1, 7.5) | 2.9 (1.1, 7.5) | 4.1 (1.7, 9.8) | | |
| | Non AS Femoral Component | 1297 | 51368 | 1.0 (0.9, 1.1) | 2.4 (2.2, 2.5) | 3.0 (2.8, 3.2) | 4.2 (3.9, 4.5) | 5.4 (4.1, 7.1) | |
| **TOTAL** | | **23548** | **700807** | | | | | | |

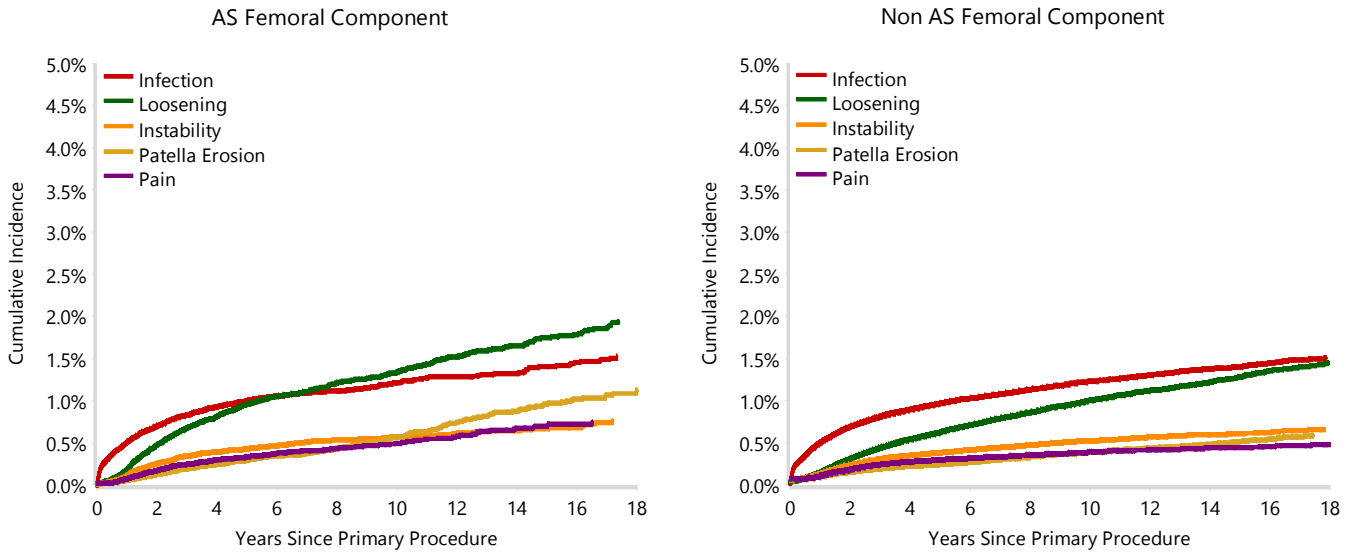
Note: Restricted to modern prostheses. Excludes 1,452 procedures with unknown polyethylene.

**Table KT60 Comparisons of Revision Rates for Primary Total Knee Replacement by Stability and Femoral Bearing Surface (Primary Diagnosis OA)**

| Comparison | HR- adjusted for age and gender |
|---|---|
| **Minimally Stabilised AS Femoral Component vs Minimally Stabilised Non AS Femoral Component** | Entire Period: HR=1.18 (95% CI 1.12, 1.25), p<0.001 |
| **Posterior Stabilised AS Femoral Component vs Posterior Stabilised Non AS Femoral Component** | 0 - 9Mth: HR=0.86 (95% CI 0.76, 0.96), p=0.009 |
| | 9Mth - 1.5Yr: HR=1.36 (95% CI 1.20, 1.53), p<0.001 |
| | 1.5Yr - 2Yr: HR=1.43 (95% CI 1.21, 1.69), p<0.001 |
| | 2Yr+: HR=1.23 (95% CI 1.15, 1.32), p<0.001 |
| **Medial Pivot Design AS Femoral Component vs Medial Pivot Design Non AS Femoral Component** | Entire Period: HR=1.15 (95% CI 0.54, 2.45), p=0.720 |

Note: Restricted to modern prostheses. Excludes 1,452 procedures with unknown polyethylene.

**Figure KT55 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by Femoral Bearing Surface (Primary Diagnosis OA)**



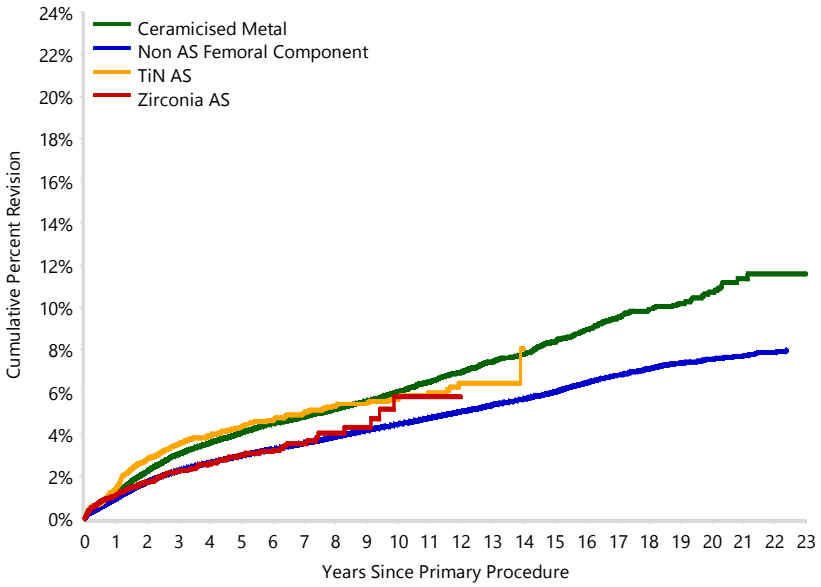

Note: Restricted to modern prostheses.

**Table KT61 Cumulative Percent Revision of Primary Total Knee Replacement by Femoral Material (Primary Diagnosis OA)**

| Femoral Material | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Ceramicised Metal | 3599 | 71264 | 1.2 (1.1, 1.2) | 3.1 (2.9, 3.2) | 4.1 (3.9, 4.2) | 6.0 (5.8, 6.2) | 8.4 (8.1, 8.7) | 10.7 (10.1, 11.4) |
| Non AS Femoral Component | 19781 | 620092 | 0.9 (0.9, 1.0) | 2.3 (2.2, 2.3) | 3.0 (2.9, 3.0) | 4.5 (4.4, 4.6) | 6.0 (5.9, 6.1) | 7.5 (7.3, 7.8) |
| TiN AS | 312 | 6735 | 1.4 (1.2, 1.8) | 3.5 (3.1, 4.0) | 4.4 (3.9, 4.9) | 5.7 (5.0, 6.3) | | |
| Zirconia AS | 198 | 8258 | 1.1 (0.9, 1.4) | 2.3 (1.9, 2.6) | 3.0 (2.6, 3.5) | 5.8 (4.1, 8.0) | | |
| TOTAL | 23890 | 706349 | | | | | | |

Note: Restricted to modern prostheses.

**Figure KT56 Cumulative Percent Revision of Primary Total Knee Replacement by Femoral Material (Primary Diagnosis OA)**




HR - adjusted for age and gender

Ceramicised Metal vs Non AS Femoral Component
Entire Period: HR=1.26 (95% CI 1.21, 1.30), p<0.001

TiN AS vs Non AS Femoral Component
0 - 1.5Yr: HR=1.70 (95% CI 1.45, 2.00), p<0.001
1.5Yr+: HR=1.13 (95% CI 0.97, 1.32), p=0.122

Zirconia AS vs Non AS Femoral Component
0 - 6Mth: HR=1.50 (95% CI 1.17, 1.92), p=0.001
6Mth - 2Yr: HR=0.75 (95% CI 0.58, 0.95), p=0.019
2Yr+: HR=0.98 (95% CI 0.77, 1.24), p=0.849

TiN AS vs Ceramicised Metal
0 - 1.5Yr: HR=1.35 (95% CI 1.15, 1.59), p<0.001
1.5Yr+: HR=0.90 (95% CI 0.77, 1.06), p=0.194

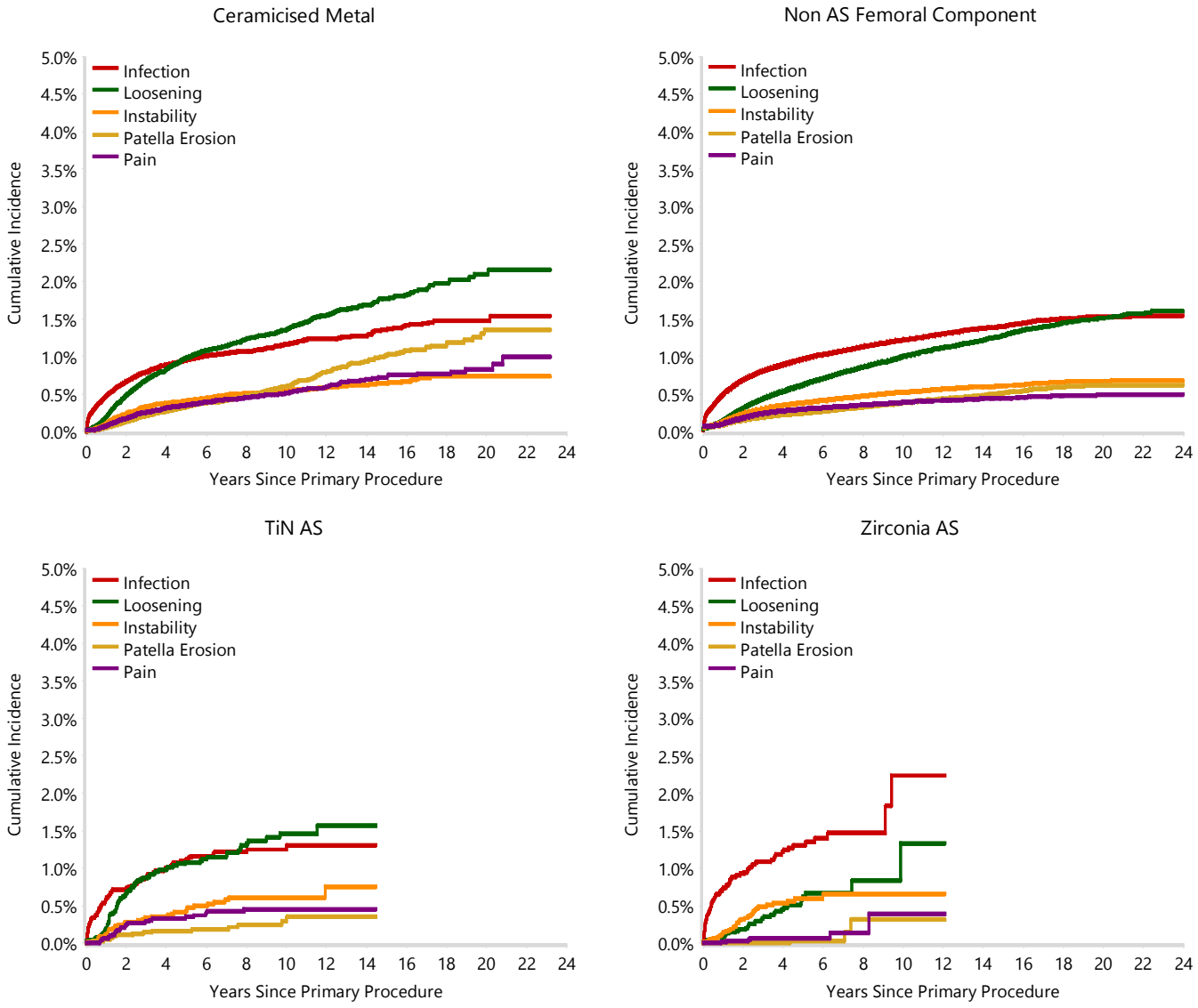
Zirconia AS vs Ceramicised Metal
0 - 6Mth: HR=1.19 (95% CI 0.93, 1.53), p=0.162
6Mth - 2Yr: HR=0.59 (95% CI 0.46, 0.76), p<0.001

TiN AS vs Zirconia AS
Entire Period: HR=1.43 (95% CI 1.19, 1.71), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Ceramicised Metal | 71264 | 65315 | 54438 | 45042 | 21811 | 6643 | 890 |
| Non AS Femoral Component | 620092 | 548979 | 423397 | 320396 | 127548 | 33629 | 5654 |
| TiN AS | 6735 | 6294 | 5272 | 4239 | 1464 | 29 | 0 |
| Zirconia AS | 8258 | 7012 | 4614 | 2315 | 158 | 0 | 0 |

Note: Restricted to modern prostheses.

**Figure KT57 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by Femoral Material (Primary Diagnosis OA)**



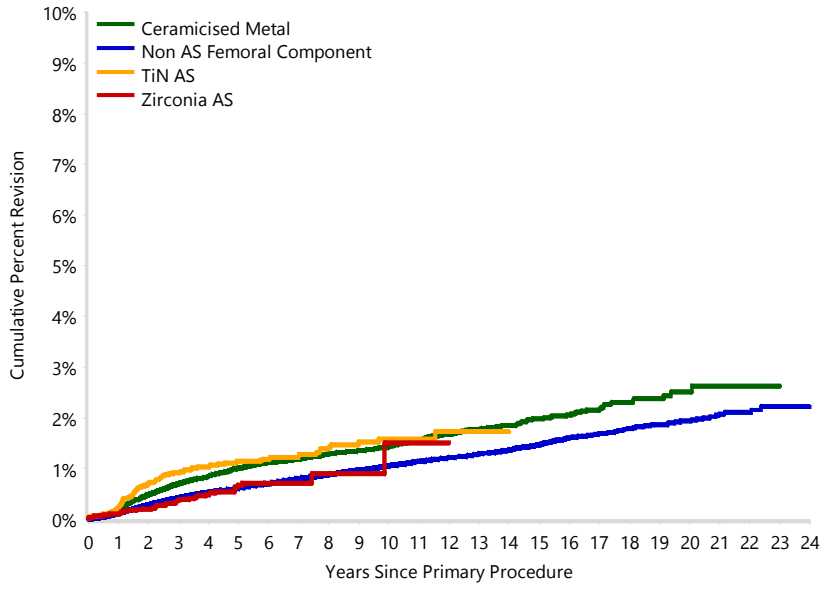

Note: Restricted to modern prostheses.

**Table KT62 Cumulative Percent Revision of AS Primary Total Knee Replacement by Femoral Material (Primary Diagnosis OA, Revision for Loosening)**

| AS Femoral Material | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Ceramicised Metal | 828 | 71264 | 0.2 (0.2, 0.2) | 0.7 (0.6, 0.8) | 1.0 (0.9, 1.1) | 1.4 (1.3, 1.5) | 2.0 (1.8, 2.2) | 2.5 (2.2, 2.8) |
| Non AS Femoral Component | 4150 | 620092 | 0.1 (0.1, 0.1) | 0.4 (0.4, 0.4) | 0.6 (0.6, 0.6) | 1.0 (1.0, 1.1) | 1.4 (1.4, 1.5) | 1.9 (1.8, 2.1) |
| TiN AS | 78 | 6735 | 0.2 (0.1, 0.3) | 0.9 (0.7, 1.2) | 1.1 (0.9, 1.4) | 1.6 (1.2, 2.0) | | |
| Zirconia AS | 34 | 8258 | 0.1 (0.0, 0.2) | 0.3 (0.2, 0.5) | 0.6 (0.4, 0.9) | 1.5 (0.6, 3.5) | | |
| TOTAL | 5090 | 706349 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT58 Cumulative Percent Revision of AS Primary Total Knee Replacement by Femoral Material (Primary Diagnosis OA, Revision for Loosening)**




HR - adjusted for age and gender

Ceramicised Metal vs Non AS Femoral Component
- 0 - 1.5Yr: HR=1.65 (95% CI 1.43, 1.90), p<0.001
- 1.5Yr - 2.5Yr: HR=1.32 (95% CI 1.10, 1.59), p=0.003
- 2.5Yr - 5Yr: HR=1.46 (95% CI 1.26, 1.69), p<0.001
- 5Yr+: HR=0.94 (95% CI 0.82, 1.08), p=0.414

TiN AS vs Non AS Femoral Component
- 0 - 1.5Yr: HR=2.42 (95% CI 1.70, 3.46), p<0.001
- 1.5Yr - 2.5Yr: HR=2.23 (95% CI 1.43, 3.47), p<0.001
- 2.5Yr+: HR=0.97 (95% CI 0.67, 1.42), p=0.893

Zirconia AS vs Non AS Femoral Component
- Entire Period: HR=0.88 (95% CI 0.63, 1.23), p=0.454

TiN AS vs Ceramicised Metal
- Entire Period: HR=1.18 (95% CI 0.94, 1.49), p=0.154

Zirconia AS vs Ceramicised Metal
- Entire Period: HR=0.61 (95% CI 0.43, 0.86), p=0.005

TiN AS vs Zirconia AS
- Entire Period: HR=1.82 (95% CI 1.22, 2.73), p=0.003

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Ceramicised Metal | 71264 | 65315 | 54438 | 45042 | 21811 | 6643 | 890 |
| Non AS Femoral Component | 620092 | 548979 | 423397 | 320396 | 127548 | 33629 | 5654 |
| TiN AS | 6735 | 6294 | 5272 | 4239 | 1464 | 29 | 0 |
| Zirconia AS | 8258 | 7012 | 4614 | 2315 | 158 | 0 | 0 |

Note: Restricted to modern prostheses

**Table KT63 Cumulative Percent Revision of Primary Total Knee Replacement by Prosthesis Type and Femoral Bearing Surface (Primary Diagnosis OA)**

| Prosthesis Combination | Femoral Bearing Surface | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|---|
| Columbus/Columbus | AS Femoral Component | 164 | 7394 | 1.0 (0.8, 1.3) | 2.1 (1.8, 2.5) | 3.0 (2.5, 3.5) | | |
| | Non AS Femoral Component | 112 | 1008 | 2.0 (1.3, 3.1) | 6.5 (5.1, 8.2) | 7.9 (6.4, 9.8) | 10.7 (8.9, 12.9) | 13.0 (10.8, 15.7) |
| E.Motion/E.Motion | AS Femoral Component | 24 | 489 | 1.9 (1.0, 3.5) | 3.8 (2.4, 6.0) | 3.8 (2.4, 6.0) | 7.0 (4.5, 10.9) | |
| | Non AS Femoral Component | 53 | 545 | 3.1 (2.0, 5.0) | 7.3 (5.4, 9.8) | 8.8 (6.7, 11.6) | 10.2 (7.9, 13.2) | |
| TOTAL | | 353 | 9436 | | | | | |

Note: Restricted to modern prostheses.

**Table KT64 Comparisons of Revision Rates for Primary Total Knee Replacement by Prosthesis Combination and Femoral Bearing Surface (Primary Diagnosis OA)**

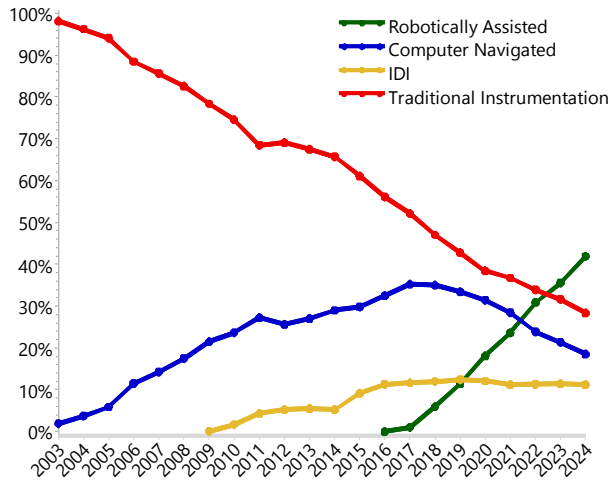
| Comparison | HR- adjusted for age and gender |
|---|---|
| Columbus/Columbus AS Femoral Component vs Columbus/Columbus Non AS Femoral Component | Entire Period: HR=0.36 (95% CI 0.27, 0.46), p<0.001 |
| E.Motion/E.Motion AS Femoral Component vs E.Motion/E.Motion Non AS Femoral Component | Entire Period: HR=0.56 (95% CI 0.35, 0.91), p=0.020 |

Note: Restricted to modern prostheses

## SURGEON ASSISTIVE TOOLS

Computer navigation, image derived instrumentation (IDI) and robotic assistance, to aid implantation of knee replacements, have been labelled as 'surgeon assistive tools'. Procedures using traditional instrumentation have decreased to 28.3% of primary total knee procedures in 2024. The change in use of each assistive tool is shown in Figure KT59. Results for primary total knee replacement for osteoarthritis with the use of these techniques are presented, followed by a comparison of the assistive tools used with XLPE since 2016 (when robotic assistance was introduced). Revision outcomes are analysed using each of these methods compared to traditional instrumentation.

**Figure KT59 Primary Total Knee Replacement by Surgeon Assistive Tool (Primary Diagnosis OA)**




Note: Restricted to modern prostheses.

### Computer Navigation

There have been 183,685 primary total knee replacement procedures using computer navigation. In 2024, computer navigation was used in 18.5% of all primary total knee replacement procedures.

When adjusted for age, gender, ASA, BMI, bearing surface, patella component usage, surgeon volume and stability, there is no difference in the rate of revision when procedures using computer navigation are compared to procedures using traditional instrumentation. Comparisons are made from 2015 when BMI data collection commenced (Table KT65, Figure KT60 and Figure KT61).

Using the same adjustments, there is a lower rate of revision for patients aged <65 years when computer navigation is used compared to traditional instrumentation. There is no difference when these comparisons are repeated for patients aged ≥65 years (Table KT66 and Figure KT62).

The outcomes of five prosthesis combinations used with computer navigation and with traditional instrumentation, and that have >5,000 procedures in each group, are shown in Table KT67 and Table KT68.

### Image Derived Instrumentation (IDI)

IDI is the use of custom-made pin guides or cutting blocks derived from CT or MRI images by 3D printing specifically for each patient.

There have been 63,510 primary total knee replacement procedures undertaken using IDI since 2009. In 2024, IDI was used in 11.2% of all primary total knee replacement procedures.

When procedures using IDI are compared to procedures using traditional instrumentation with adjustment for age, gender, ASA, BMI, bearing surface, patella component usage, surgeon volume and stability, IDI usage has a higher rate of revision. Comparisons are made from 2015 when BMI data collection commenced (Table KT69 and Figure KT63). There is an increased proportion of revision for loosening when IDI is used (Figure KT64).

The effect of IDI on revision varies with age. Using the same adjustments, for patients aged ≥65 years where IDI is used, there is a higher rate of revision compared to traditional instrumentation. There is no difference with IDI use for patients aged <65 years (Table KT70 and Figure KT65).

The outcomes of three prosthesis combinations used with IDI and with traditional instrumentation, and that have >5,000 procedures in each group, are shown in Table KT71 and Table KT72.

### Robotic Assistance

Robotic assistance has been recorded for 100,753 total knee replacements since 2016. In 2024, robotic assistance was used in 41.9% of all primary total knee replacement procedures. There are 5 robotic systems that are used with a small number of prostheses, and many of these systems have limited follow-up.

When adjusted for age, gender, ASA, BMI, bearing surface, patella component usage and stability, there is no difference in the rate of revision when procedures using robotic assistance are compared to procedures using traditional instrumentation. Comparisons are made from 2016 when robotic assistance commenced (Table KT73 and Figure KT66). Reasons for revision when robotic assistance is used are shown in Figure KT67. Using the same adjustments, there is no difference in the rate of revision for patients aged <65 years or for patients aged ≥65 years when robotic assistance is used compared to traditional instrumentation (Table KT74 and Figure KT68).

The outcomes of two prosthesis combinations used with robotic assistance and traditional instrumentation with >5000 procedures in each group are shown in Table KT75 and Table KT76.

## Primary Total Knee Replacement

When adjusted for age, gender, ASA, BMI, bearing surface, patella component usage and stability, there is no difference in the rate of revision when procedures using robotic assistance are compared to procedures using traditional instrumentation.

**Surgeon Assistive Tools Compared**

Total knee procedures since 2016 for osteoarthritis using XLPE with the use of assistive tools and adjusted for age, gender, ASA, BMI, patella component usage and stability are compared in Table KT75 and Figure KT69.

With these restrictions, there is no difference in the rate of revision when procedures using computer navigation, IDI, robotic assistance and traditional instrumentation are compared.

**Prosthesis-Specific Analysis**

There are two prosthesis combinations using XLPE that have used at least three assistive methods that have over 10,000 procedures in each group. The analyses for these two prostheses have been adjusted for age, gender, ASA, BMI, patella component usage and tibial fixation.

There is no difference in the rate of revision when the Persona CR/Persona combination is used with robotic assistance compared to when computer navigation is used, and when compared to procedures using traditional instrumentation (Table KT78 and Figure KT70).

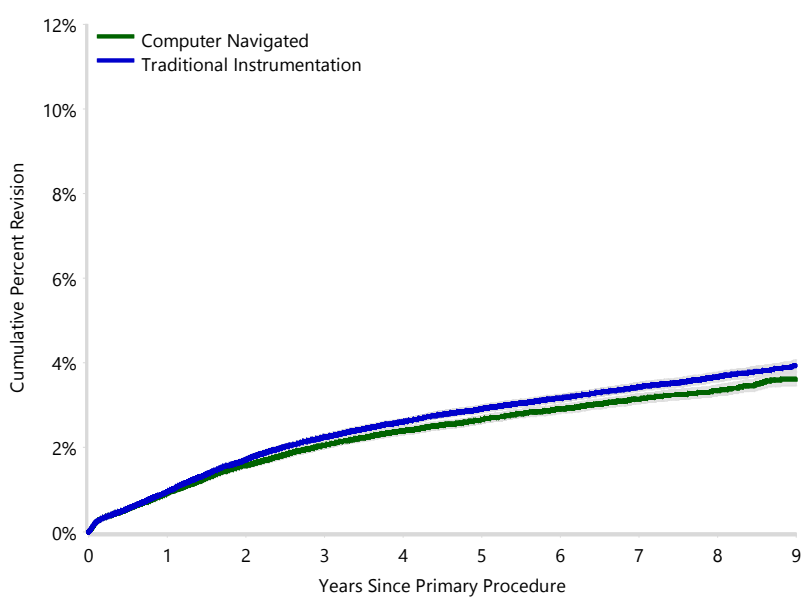
The Triathlon CR/Triathlon combination also shows no difference when procedures using any of the types of assistive tools are compared (Table KT79 and Figure KT71).

**Table KT65 Cumulative Percent Revision of Primary Total Knee Replacement Since 2015 by Computer Navigation (Primary Diagnosis OA)**

| Surgeon Assistive Tool | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|
| Computer Navigated | 3243 | 136187 | 0.9 (0.9, 1.0) | 2.1 (2.0, 2.1) | 2.7 (2.6, 2.8) | 3.2 (3.0, 3.3) | 3.6 (3.5, 3.8) |
| Traditional Instrumentation | 4969 | 191216 | 1.0 (0.9, 1.0) | 2.2 (2.2, 2.3) | 2.9 (2.8, 3.0) | 3.4 (3.3, 3.5) | 3.9 (3.8, 4.1) |
| TOTAL | 8212 | 327403 | | | | | |

Note: Restricted to modern prostheses. Restricted to procedures with known ASA, BMI, bearing surface, patella component usage, surgeon volume and stability.

**Figure KT60 Cumulative Percent Revision of Primary Total Knee Replacement Since 2015 by Computer Navigation (Primary Diagnosis OA)**




HR - adjusted for age, gender, ASA, BMI, bearing surface, patella component usage, surgeon volume and stability

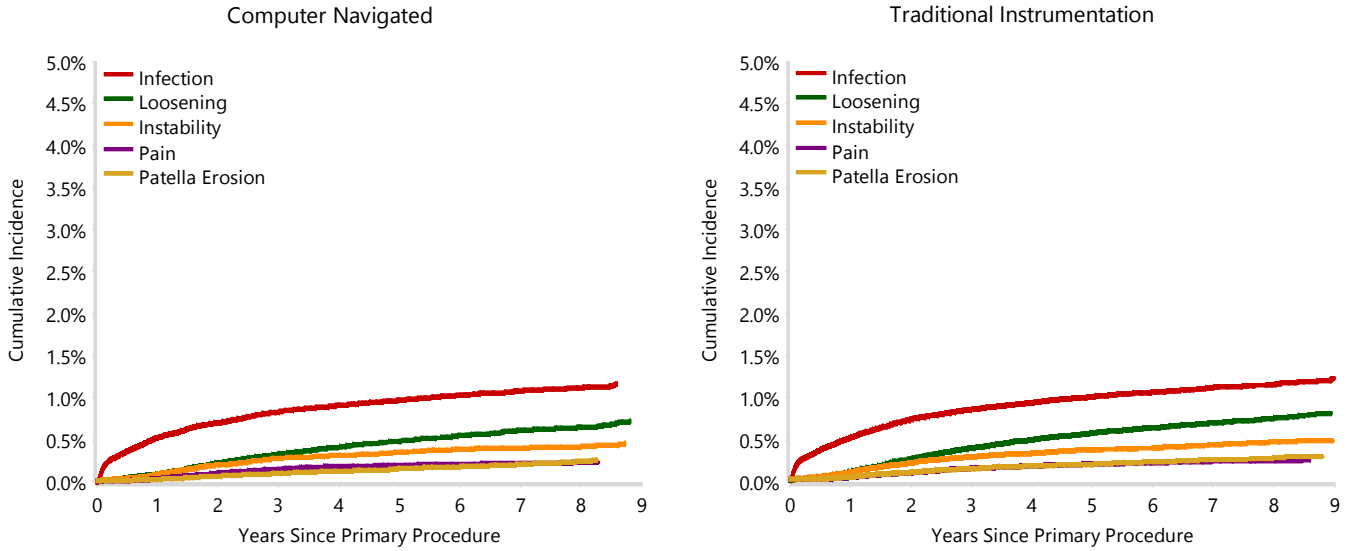
Traditional Instrumentation vs Computer Navigated

Entire period: HR=1.02 (95% CI 0.98, 1.07), p=0.336

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|
| Computer Navigated | 136187 | 121911 | 91940 | 60356 | 30303 | 7488 |
| Traditional Instrumentation | 191216 | 169607 | 126209 | 86304 | 47452 | 13483 |

Note: Restricted to modern prostheses. Restricted to procedures with known ASA, BMI, bearing surface, patella component usage, surgeon volume and stability.

**Figure KT61 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement Since 2015 by Computer Navigation (Primary Diagnoses OA)**



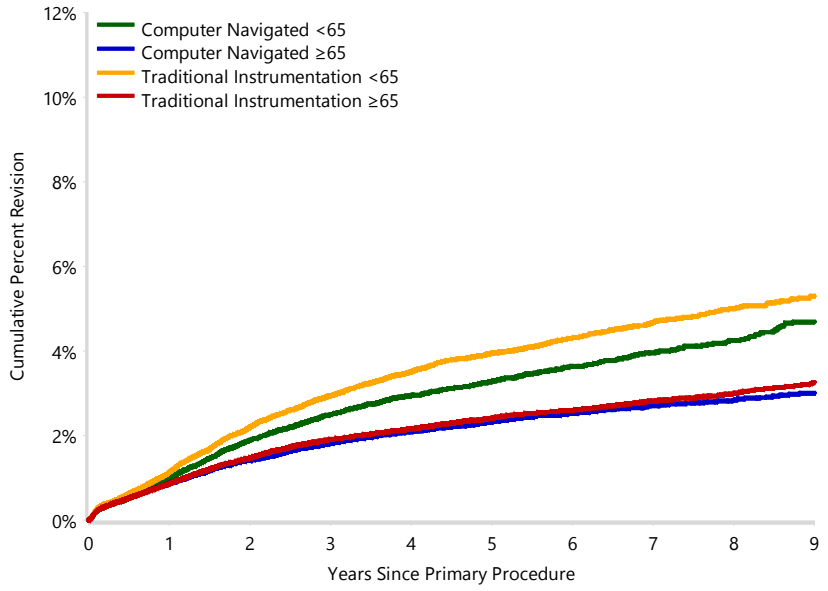

Note: Restricted to modern prostheses. Restricted to procedures with known ASA, BMI, bearing surface, patella component usage, surgeon volume and stability.

**Table KT66 Cumulative Percent Revision of Primary Total Knee Replacement Since 2015 by Computer Navigation and Age (Primary Diagnosis OA)**

| Surgeon Assistive Tool | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|
| Computer Navigated | <65 | 1395 | 45655 | 1.0 (0.9, 1.1) | 2.5 (2.4, 2.7) | 3.3 (3.1, 3.5) | 4.0 (3.7, 4.2) | 4.7 (4.4, 5.0) |
| | ≥65 | 1848 | 90532 | 0.9 (0.8, 0.9) | 1.8 (1.7, 1.9) | 2.3 (2.2, 2.4) | 2.7 (2.6, 2.8) | 3.0 (2.8, 3.2) |
| Traditional Instrumentation | <65 | 2170 | 60526 | 1.1 (1.1, 1.2) | 2.9 (2.8, 3.1) | 4.0 (3.8, 4.1) | 4.7 (4.5, 4.9) | 5.3 (5.0, 5.6) |
| | ≥65 | 2799 | 130690 | 0.9 (0.8, 0.9) | 1.9 (1.8, 2.0) | 2.4 (2.3, 2.5) | 2.8 (2.7, 2.9) | 3.3 (3.1, 3.4) |
| TOTAL | | 8212 | 327403 | | | | | |

Note: Restricted to modern prostheses. Restricted to procedures with known ASA, BMI, bearing surface, patella component usage, surgeon volume and stability.

**Figure KT62 Cumulative Percent Revision of Primary Total Knee Replacement Since 2015 by Computer Navigation and Age (Primary Diagnosis OA)**




HR - adjusted for gender, ASA, BMI, bearing surface, patella component usage, surgeon volume and stability

Computer Navigated <65 vs Traditional Instrumentation <65

Entire period: HR=0.92 (95% CI 0.86, 0.98), p=0.016

Computer Navigated ≥65 vs Traditional Instrumentation ≥65

Entire period: HR=1.03 (95% CI 0.97, 1.10), p=0.262

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|
| Computer Navigated | <65 | 45655 | 41312 | 31983 | 21726 | 11463 | 2912 |
| | ≥65 | 90532 | 80599 | 59957 | 38630 | 18840 | 4576 |
| Traditional Instrumentation | <65 | 60526 | 54271 | 41257 | 28742 | 16640 | 4918 |
| | ≥65 | 130690 | 115336 | 84952 | 57562 | 30812 | 8565 |

Note: Restricted to modern prostheses. Restricted to procedures with known ASA, BMI, bearing surface, patella component usage, surgeon volume and stability.

**Table KT67 Cumulative Percent Revision of Primary Total Knee Replacement by Prosthesis Combination and Computer Navigation (Primary Diagnosis OA)**

| Prosthesis Combination | Surgeon Assistive Tool | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Apex Knee CR/Apex Knee | Computer Navigated | 89 | 5485 | 0.8 (0.6, 1.1) | 1.5 (1.1, 1.8) | 1.7 (1.4, 2.2) | 2.2 (1.7, 2.7) | 2.4 (1.9, 3.1) | 2.4 (1.9, 3.1) |
| | Traditional Instrumentation | 123 | 7204 | 0.7 (0.5, 0.9) | 1.1 (0.9, 1.4) | 1.4 (1.1, 1.7) | 1.8 (1.5, 2.2) | 2.2 (1.8, 2.7) | 2.8 (2.2, 3.6) |
| Attune CR/Attune | Computer Navigated | 210 | 10460 | 0.8 (0.7, 1.0) | 1.4 (1.2, 1.7) | 1.8 (1.5, 2.1) | 2.3 (2.0, 2.6) | 2.7 (2.3, 3.1) | 3.0 (2.5, 3.6) |
| | Traditional Instrumentation | 502 | 20049 | 0.9 (0.8, 1.0) | 1.6 (1.5, 1.8) | 2.1 (1.9, 2.4) | 2.8 (2.6, 3.1) | 3.4 (3.1, 3.8) | 3.8 (3.4, 4.3) |
| Attune PS/Attune | Computer Navigated | 158 | 6670 | 1.0 (0.7, 1.2) | 1.7 (1.4, 2.0) | 2.2 (1.9, 2.6) | 2.6 (2.2, 3.1) | 3.3 (2.7, 4.0) | 4.1 (3.0, 5.6) |
| | Traditional Instrumentation | 217 | 8294 | 0.8 (0.7, 1.1) | 1.6 (1.3, 1.9) | 2.2 (1.9, 2.5) | 2.8 (2.4, 3.2) | 3.8 (3.3, 4.4) | 4.4 (3.8, 5.2) |
| Persona CR/Persona | Computer Navigated | 316 | 18046 | 0.9 (0.7, 1.0) | 1.5 (1.4, 1.7) | 1.8 (1.6, 2.0) | 2.3 (2.0, 2.6) | 2.7 (2.3, 3.1) | 3.0 (2.3, 3.7) |
| | Traditional Instrumentation | 398 | 24930 | 0.9 (0.8, 1.0) | 1.5 (1.4, 1.7) | 2.0 (1.8, 2.2) | 2.5 (2.3, 2.8) | 2.7 (2.3, 3.1) | 2.7 (2.3, 3.1) |
| Triathlon CR/Triathlon | Computer Navigated | 1158 | 55572 | 0.8 (0.8, 0.9) | 1.4 (1.3, 1.5) | 1.8 (1.7, 1.9) | 2.3 (2.2, 2.4) | 2.7 (2.5, 2.9) | 3.1 (2.9, 3.3) |
| | Traditional Instrumentation | 731 | 31425 | 0.8 (0.7, 0.9) | 1.4 (1.3, 1.6) | 1.9 (1.7, 2.0) | 2.5 (2.3, 2.7) | 2.9 (2.7, 3.1) | 3.3 (3.0, 3.6) |
| TOTAL | | 3902 | 188135 | | | | | | |

Note: Restricted to modern prostheses.
Only prosthesis combinations with >5,000 procedures in both groups have been listed.
Restricted to procedures with known ASA, BMI, bearing surface, patella component usage, surgeon volume and stability.

**Table KT68 Comparisons of Revision Rates for Primary Total Knee Replacement by Prosthesis Combination and Computer Navigation (Primary Diagnosis OA)**

| Comparison | HR – adjusted for age, gender, ASA, BMI, patella component usage and surgeon volume |
|---|---|
| **Apex Knee CR/Apex Knee Computer Navigated vs Apex Knee CR/Apex Knee Traditional Instrumentation** | Entire Period: HR=1.02 (95% CI 0.75, 1.38), p=0.914 |
| **Attune CR/Attune Computer Navigated vs Attune CR/Attune Traditional Instrumentation** | Entire Period: HR=0.83 (95% CI 0.70, 0.99), p=0.033 |
| **Attune PS/Attune Computer Navigated vs Attune PS/Attune Traditional Instrumentation** | Entire Period: HR=0.99 (95% CI 0.79, 1.23), p=0.901 |
| **Persona CR/Persona Computer Navigated vs Persona CR/Persona Traditional Instrumentation** | Entire Period: HR=1.00 (95% CI 0.86, 1.16), p=0.975 |
| **Triathlon CR/Triathlon Computer Navigated vs Triathlon CR/Triathlon Traditional Instrumentation** | Entire Period: HR=0.92 (95% CI 0.83, 1.01), p=0.087 |

Note: Restricted to modern prostheses.
Only prosthesis combinations with >5,000 procedures in both groups have been listed.
In addition, Apex Knee CR/Apex Knee and Triathlon CR/Triathlon adjusted for bearing surface.

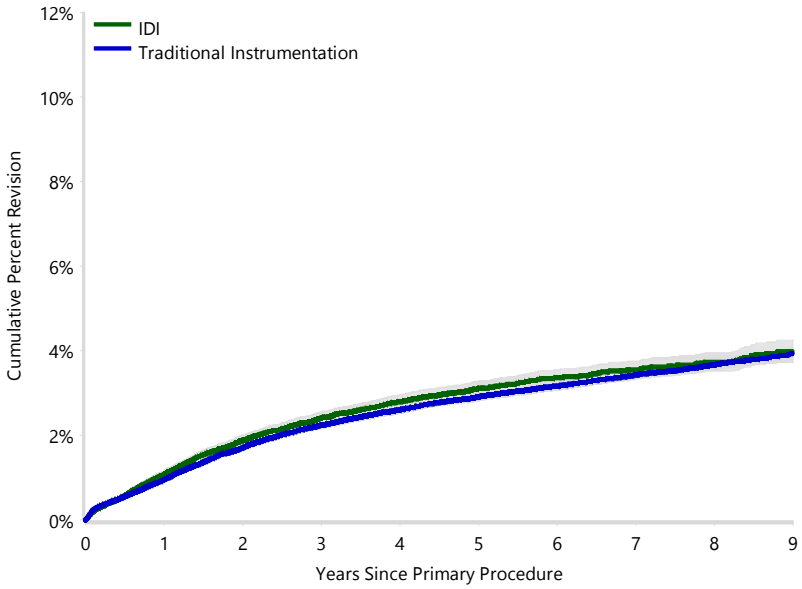
# Primary Total Knee Replacement

**Table KT69 Cumulative Percent Revision of Primary Total Knee Replacement Since 2015 by IDI Usage (Primary Diagnosis OA)**

| Surgeon Assistive Tool | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|
| IDI | 1403 | 55017 | 1.1 (1.0, 1.2) | 2.4 (2.3, 2.6) | 3.1 (2.9, 3.3) | 3.6 (3.4, 3.8) | 3.7 (3.5, 4.0) | 4.0 (3.7, 4.3) |
| Traditional Instrumentation | 4969 | 191216 | 1.0 (0.9, 1.0) | 2.2 (2.2, 2.3) | 2.9 (2.8, 3.0) | 3.4 (3.3, 3.5) | 3.7 (3.6, 3.8) | 3.9 (3.8, 4.1) |
| TOTAL | 6372 | 246233 | | | | | | |

Note: Restricted to modern prostheses. Restricted to procedures with known ASA, BMI, bearing surface, patella component usage, surgeon volume and stability.

**Figure KT63 Cumulative Percent Revision of Primary Total Knee Replacement Since 2015 by IDI Usage (Primary Diagnosis OA)**




HR - adjusted for age, gender, ASA, BMI, bearing surface, patella component usage, surgeon volume and stability

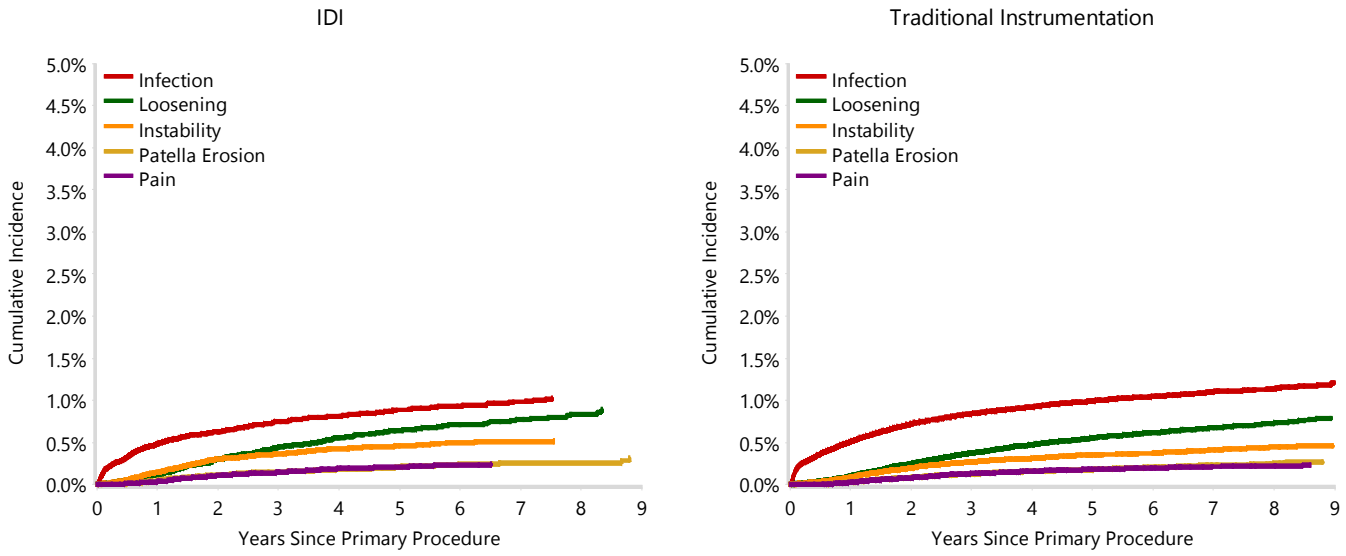
IDI vs Traditional Instrumentation

Entire period: HR=1.07 (95% CI 1.00, 1.14), p=0.047

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|
| IDI | 55017 | 47133 | 33063 | 21048 | 10293 | 5977 | 2426 |
| Traditional Instrumentation | 191216 | 169607 | 126209 | 86304 | 47452 | 29491 | 13483 |

Note: Restricted to modern prostheses. Restricted to procedures with known ASA, BMI, bearing surface, patella component usage, surgeon volume and stability.

**Figure KT64 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement Since 2015 by IDI Usage (Primary Diagnosis OA)**




Note: Restricted to modern prostheses.

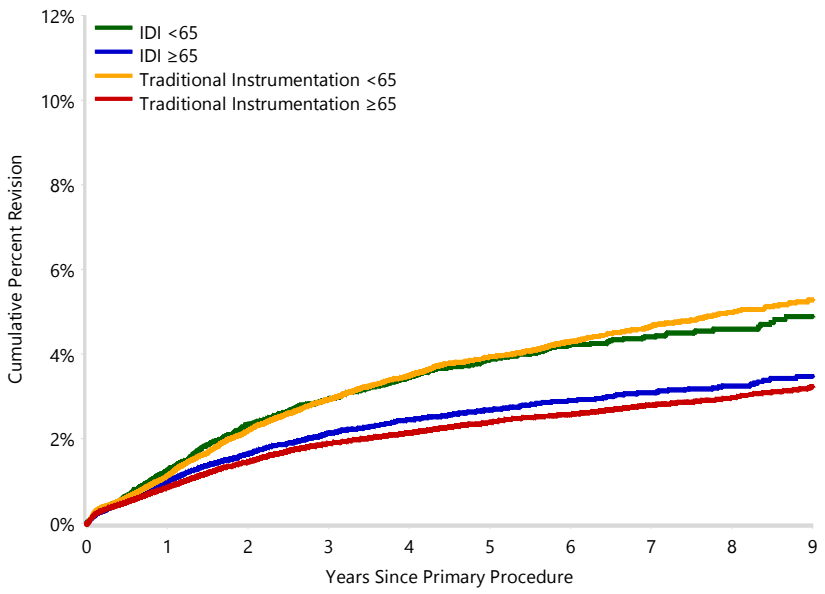
# Primary Total Knee Replacement

**Table KT70 Cumulative Percent Revision of Primary Total Knee Replacement Since 2015 by IDI Usage and Age (Primary Diagnosis OA)**

| Surgeon Assistive Tool | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| IDI | <65 | 596 | 18457 | 1.2 (1.1, 1.4) | 2.9 (2.7, 3.2) | 3.9 (3.6, 4.2) | 4.4 (4.1, 4.8) | 4.6 (4.2, 5.0) | 4.9 (4.4, 5.4) |
| | ≥65 | 807 | 36560 | 1.0 (0.9, 1.1) | 2.1 (2.0, 2.3) | 2.7 (2.5, 2.9) | 3.1 (2.9, 3.3) | 3.3 (3.0, 3.5) | 3.5 (3.2, 3.8) |
| Traditional Instrumentation | <65 | 2170 | 60526 | 1.1 (1.1, 1.2) | 2.9 (2.8, 3.1) | 4.0 (3.8, 4.1) | 4.7 (4.5, 4.9) | 5.0 (4.8, 5.2) | 5.3 (5.0, 5.6) |
| | ≥65 | 2799 | 130690 | 0.9 (0.8, 0.9) | 1.9 (1.8, 2.0) | 2.4 (2.3, 2.5) | 2.8 (2.7, 2.9) | 3.0 (2.9, 3.1) | 3.3 (3.1, 3.4) |
| TOTAL | | 6372 | 246233 | | | | | | |

Note: Restricted to modern prostheses. Restricted to procedures with known ASA, BMI, bearing surface, patella component usage, surgeon volume and stability.

**Figure KT65 Cumulative Percent Revision of Primary Total Knee Replacement Since 2015 by IDI Usage and Age (Primary Diagnosis OA)**




HR - adjusted for gender, ASA, BMI, bearing surface, patella component usage, surgeon volume and stability

IDI <65 vs Traditional Instrumentation <65

Entire period: HR=1.00 (95% CI 0.91, 1.10), p=0.998

IDI ≥65 vs Traditional Instrumentation ≥65

Entire period: HR=1.13 (95% CI 1.04, 1.23), p=0.003

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|
| IDI | <65 | 18457 | 15988 | 11618 | 7582 | 3842 | 2275 | 954 |
| | ≥65 | 36560 | 31145 | 21445 | 13466 | 6451 | 3702 | 1472 |
| Traditional Instrumentation | <65 | 60526 | 54271 | 41257 | 28742 | 16640 | 10632 | 4918 |
| | ≥65 | 130690 | 115336 | 84952 | 57562 | 30812 | 18859 | 8565 |

Note: Restricted to modern prostheses. Restricted to procedures with known ASA, BMI, bearing surface, patella component usage, surgeon volume and stability.

**Table KT71 Cumulative Percent Revision of Primary Total Knee Replacement by Prosthesis Combination and IDI Usage (Primary Diagnosis OA)**

| Prosthesis Combination | Surgeon Assistive Tool | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Evolution/Evolution | IDI | 161 | 5084 | 1.1 (0.8, 1.4) | 1.9 (1.6, 2.3) | 2.6 (2.2, 3.1) | 3.2 (2.7, 3.8) | 3.7 (3.2, 4.4) | 3.9 (3.3, 4.7) |
| | Traditional Instrumentation | 96 | 5085 | 0.7 (0.5, 0.9) | 1.4 (1.1, 1.8) | 1.8 (1.4, 2.2) | 2.1 (1.7, 2.6) | 2.3 (1.9, 2.8) | 2.7 (2.1, 3.5) |
| GMK Sphere Primary/GMK Primary | IDI | 418 | 18067 | 1.2 (1.1, 1.4) | 2.0 (1.8, 2.2) | 2.5 (2.3, 2.8) | 3.1 (2.8, 3.4) | 3.6 (3.2, 4.0) | 3.8 (3.4, 4.3) |
| | Traditional Instrumentation | 194 | 7006 | 1.2 (0.9, 1.5) | 2.3 (1.9, 2.7) | 2.8 (2.4, 3.3) | 3.5 (3.0, 4.1) | 4.3 (3.6, 5.0) | 4.7 (3.9, 5.6) |
| Persona CR/Persona | IDI | 145 | 8537 | 1.0 (0.8, 1.2) | 1.5 (1.2, 1.8) | 1.9 (1.6, 2.3) | 2.4 (2.0, 2.8) | 2.4 (2.1, 2.9) | |
| | Traditional Instrumentation | 398 | 24930 | 0.9 (0.8, 1.0) | 1.5 (1.4, 1.7) | 2.0 (1.8, 2.2) | 2.5 (2.3, 2.8) | 2.7 (2.3, 3.1) | 2.7 (2.3, 3.1) |
| TOTAL | | 1412 | 68709 | | | | | | |

Note: Restricted to modern prostheses.
Only prosthesis combinations with >5,000 procedures in both groups are listed.
Restricted to procedures with known ASA, BMI, bearing surface, patella component usage, surgeon volume and stability.

**Table KT72 Comparisons of Revision Rates for Primary Total Knee Replacement by Prosthesis Combination and IDI Usage (Primary Diagnosis OA)**

| Comparison | HR -adjusted for age, gender, ASA, BMI, bearing surface, patella component usage and surgeon volume. |
|---|---|
| Evolution/Evolution IDI vs Evolution/ Evolution Traditional Instrumentation | Entire Period: HR=1.59 (95% CI 1.19, 2.13, p=0.002 |
| GMK Sphere Primary/GMK Primary IDI vs GMK Sphere Primary/ GMK Primary Traditional Instrumentation | 0-9Mth: HR=1.37 (95% CI 1.00, 1.88), p=0.051 |
| | 9Mth+: HR=0.72 (95% CI 0.58, 0.88), p=0.002 |
| Persona CR/Persona IDI vs Persona CR/ Persona Traditional Instrumentation | Entire Period: HR=0.95 (95% CI 0.78, 1.15), p=0.584 |

Note: Restricted to modern prostheses.
Only prosthesis combinations with >5,000 procedures in both groups are listed.
In addition, GMK Sphere Primary/GMK Primary adjusted for bearing surface.

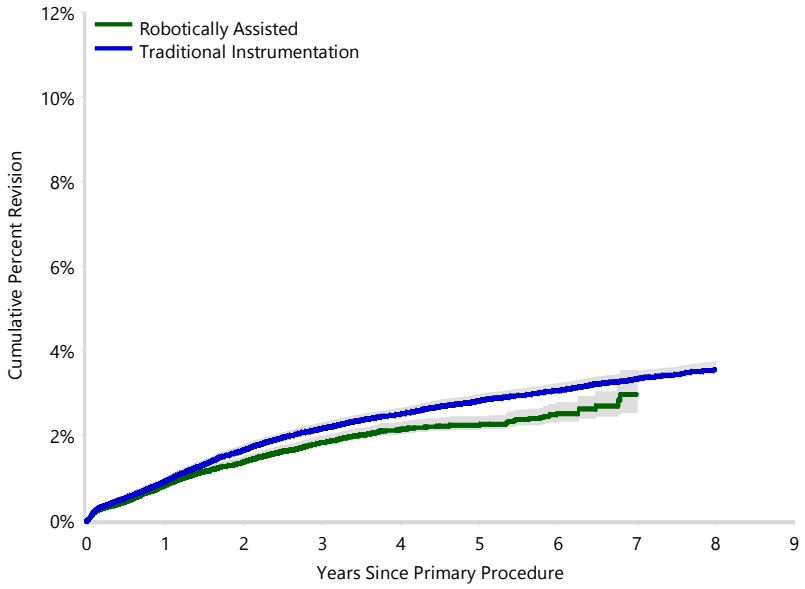
# Primary Total Knee Replacement

**Table KT73 Cumulative Percent Revision of Primary Total Knee Replacement Since 2016 by Robotic Assistance (Primary Diagnosis OA)**

| Surgeon Assistive Tool | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|
| Robotically Assisted | 1355 | 100081 | 0.8 (0.8, 0.9) | 1.9 (1.8, 2.0) | 2.3 (2.1, 2.4) | 2.6 (2.4, 2.8) | 3.0 (2.6, 3.5) | |
| Traditional Instrumentation | 4268 | 174552 | 1.0 (0.9, 1.0) | 2.2 (2.1, 2.3) | 2.9 (2.8, 3.0) | 3.1 (3.0, 3.2) | 3.4 (3.3, 3.5) | 3.6 (3.5, 3.7) |
| TOTAL | 5623 | 274633 | | | | | | |

Note: Restricted to modern prostheses. Restricted to procedures with known ASA, BMI, bearing surface, patella component usage, surgeon volume and stability

**Figure KT66 Cumulative Percent Revision of Primary Total Knee Replacement Since 2016 by Robotic Assistance (Primary Diagnosis OA)**




HR - adjusted for age, gender, ASA, BMI, bearing surface, patella component usage, surgeon volume and stability

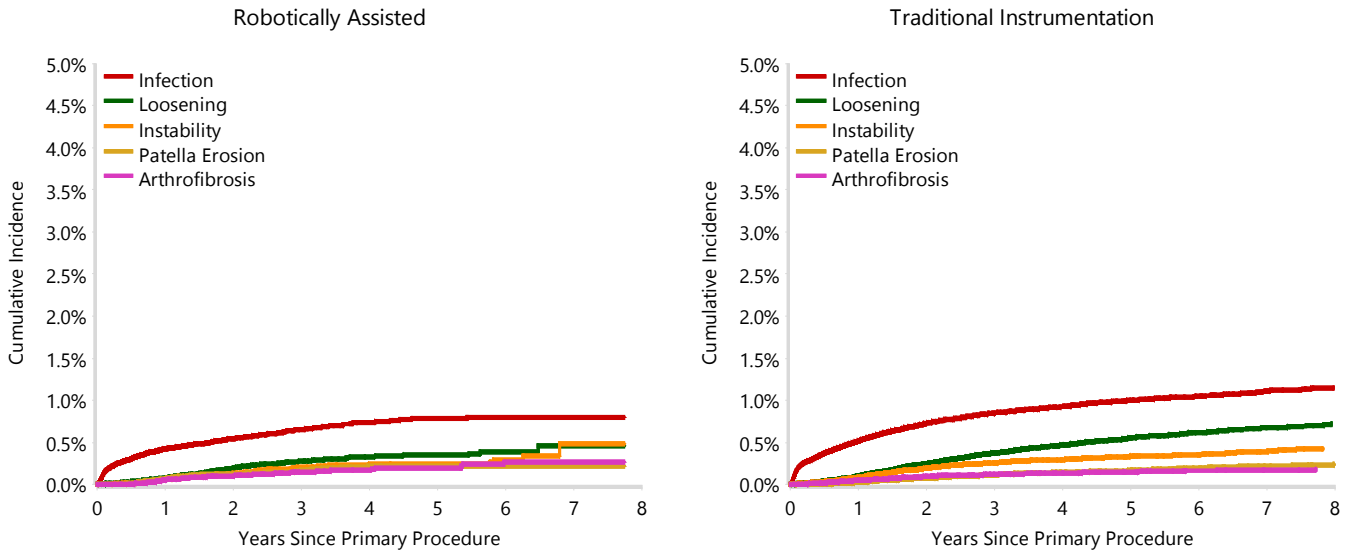
Robotically Assisted vs Traditional Instrumentation

Entire period: HR=1.00 (95% CI 0.93, 1.07), p=0.972

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|
| Robotically Assisted | 100081 | 70532 | 29120 | 7934 | 2809 | 372 | 8 |
| Traditional Instrumentation | 174552 | 153191 | 110369 | 71099 | 51626 | 33071 | 15573 |

Note: Restricted to modern prostheses. Restricted to procedures with known ASA, BMI, bearing surface, patella component usage, surgeon volume and stability

**Figure KT67 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement Since 2016 by Robotic Assistance (Primary Diagnoses OA)**




Note: Restricted to modern prostheses. Restricted to procedures with known ASA, BMI, bearing surface, patella component usage, surgeon volume and stability

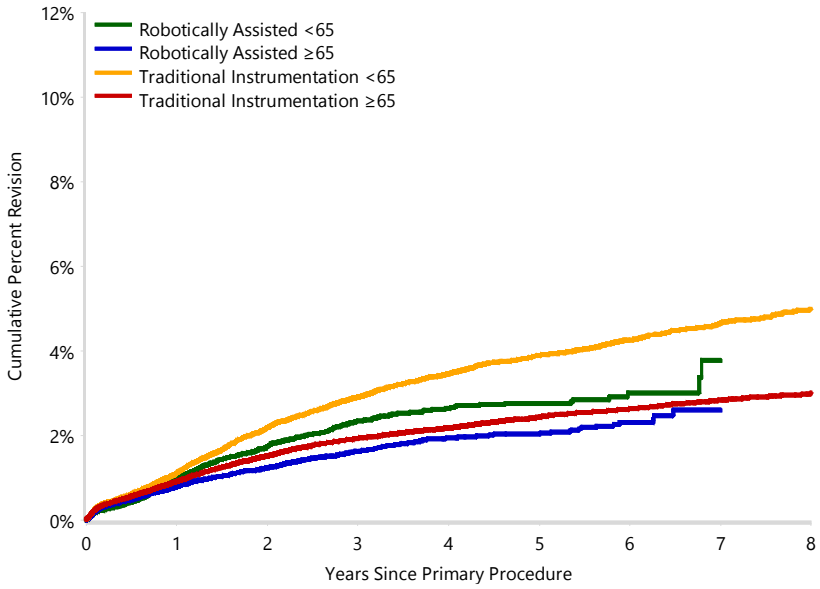
# Primary Total Knee Replacement

**Table KT74 Cumulative Percent Revision of Primary Total Knee Replacement Since 2016 by Robotic Assistance and Age (Primary Diagnosis OA)**

| Surgeon Assistive Tool | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Robotically Assisted | <65 | 550 | 33193 | 1.0 (0.9, 1.1) | 2.3 (2.1, 2.6) | 2.8 (2.5, 3.0) | 3.0 (2.7, 3.4) | 3.8 (2.8, 5.1) | |
| | ≥65 | 805 | 66888 | 0.8 (0.7, 0.9) | 1.6 (1.5, 1.8) | 2.0 (1.9, 2.2) | 2.3 (2.1, 2.6) | 2.6 (2.2, 3.0) | |
| Traditional Instrumentation | <65 | 1845 | 55035 | 1.1 (1.0, 1.2) | 2.9 (2.7, 3.0) | 3.9 (3.7, 4.1) | 4.2 (4.0, 4.4) | 4.6 (4.4, 4.8) | 5.0 (4.7, 5.2) |
| | ≥65 | 2423 | 119517 | 0.9 (0.8, 0.9) | 1.9 (1.8, 2.0) | 2.4 (2.3, 2.5) | 2.6 (2.5, 2.7) | 2.8 (2.7, 2.9) | 3.0 (2.8, 3.1) |
| TOTAL | | 5623 | 274633 | | | | | | |

Note: Restricted to modern prostheses. Restricted to procedures with known ASA, BMI, bearing surface, patella usage and mobility

**Figure KT68 Cumulative Percent Revision of Primary Total Knee Replacement Since 2016 by Robotic Assistance and Age (Primary Diagnosis OA)**




HR - adjusted for gender, ASA, BMI, bearing surface, patella component usage, surgeon volume and stability

Robotically Assisted <65 vs Traditional Instrumentation <65

Entire period: HR=0.91 (95% CI 0.82, 1.00), p=0.062

Robotically Assisted ≥65 vs Traditional Instrumentation ≥65

Entire period: HR=1.09 (95% CI 1.00, 1.19), p=0.060

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|
| Robotically Assisted | <65 | 33193 | 23853 | 10260 | 2788 | 1038 | 147 | 5 |
| | ≥65 | 66888 | 46679 | 18860 | 5146 | 1771 | 225 | 3 |
| Traditional Instrumentation | <65 | 55035 | 48865 | 35999 | 23605 | 17614 | 11602 | 5661 |
| | ≥65 | 119517 | 104326 | 74370 | 47494 | 34012 | 21469 | 9912 |

Note: Restricted to modern prostheses. Restricted to procedures with known ASA, BMI, bearing surface, patella component usage, surgeon volume and stability

**Table KT75 Cumulative Percent Revision of Primary Total Knee Replacement Since 2016 by Prosthesis Combination and Robotic Assistance (Primary Diagnosis OA)**

| Prosthesis Combination | Surgeon Assistive Tools | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Persona CR/Persona | Robotically Assisted | 334 | 24575 | 0.8 (0.7, 1.0) | 1.5 (1.3, 1.7) | 2.1 (1.9, 2.4) | 2.4 (2.1, 2.8) | | |
| | Traditional Instrumentation | 398 | 24930 | 0.9 (0.8, 1.0) | 1.5 (1.4, 1.7) | 2.0 (1.8, 2.2) | 2.5 (2.3, 2.8) | 2.7 (2.3, 3.1) | 2.7 (2.3, 3.1) |
| Triathlon CR/Triathlon | Robotically Assisted | 728 | 58421 | 0.8 (0.7, 0.9) | 1.3 (1.2, 1.4) | 1.6 (1.5, 1.8) | 2.0 (1.8, 2.1) | 2.3 (2.0, 2.8) | |
| | Traditional Instrumentation | 731 | 31425 | 0.8 (0.7, 0.9) | 1.4 (1.3, 1.6) | 1.9 (1.7, 2.0) | 2.5 (2.3, 2.7) | 2.9 (2.7, 3.1) | 3.3 (3.0, 3.6) |
| TOTAL | | 2191 | 139351 | | | | | | |

Note: Restricted to modern prostheses. Restricted to procedures with known ASA, BMI, bearing surface, patella component usage, surgeon volume and stability
Only prosthesis combinations with >5,000 procedures in both groups have been listed

**Table KT76 Comparisons of Revision Rates for Primary Total Knee Replacement Since 2016 by Prosthesis Combination and Robotic Assistance (Primary Diagnosis OA)**

| Comparison | HR -adjusted for age, gender, ASA, BMI, bearing surface, patella component usage and surgeon volume |
|---|---|
| Persona CR/Persona Robotically Assisted vs Persona CR/Persona Traditional Instrumentation | Entire Period: HR=1.03 (95% CI 0.87, 1.21), p=0.766 |
| Triathlon CR/Triathlon Robotically Assisted vs Triathlon CR/Triathlon Traditional Instrumentation | 0 - 1.5Yr: HR=1.07 (95% CI 0.93, 1.23), p=0.371 |
| | 1.5Yr+: HR=0.75 (95% CI 0.63, 0.90), p=0.002 |

Note: Restricted to modern prostheses. Restricted to procedures with known ASA, BMI, bearing surface, patella component usage, surgeon volume and stability
Only prosthesis combinations with >5,000 procedures in both groups have been listed

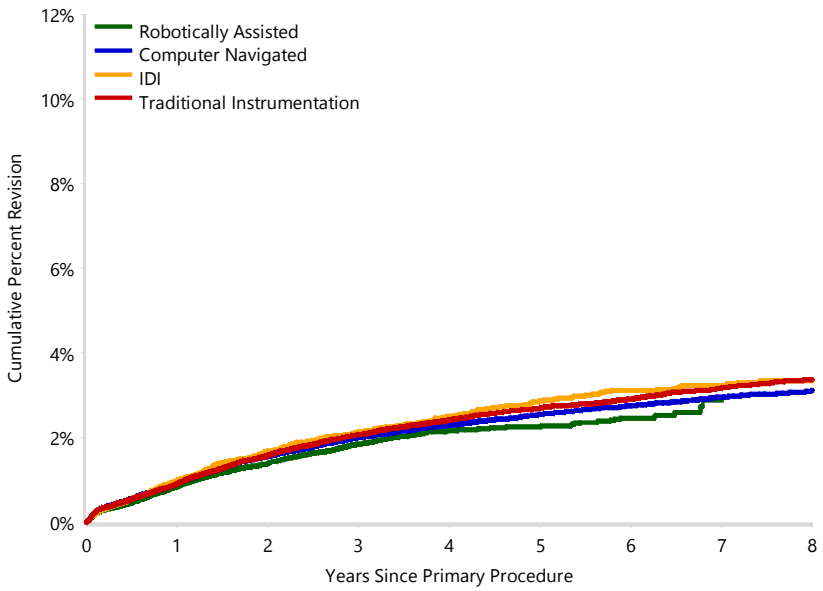
# Primary Total Knee Replacement

**Table KT77 Cumulative Percent Revision of Primary Total Knee Replacement Using XLPE Since 2016 by Surgeon Assistive Tool (Primary Diagnosis OA)**

| Surgeon Assistive Tool | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|
| Robotically Assisted | 1328 | 99426 | 0.8 (0.8, 0.9) | 1.9 (1.7, 2.0) | 2.3 (2.1, 2.4) | 2.5 (2.3, 2.7) | 2.9 (2.4, 3.4) | |
| Computer Navigated | 2259 | 104945 | 0.9 (0.9, 1.0) | 2.0 (1.9, 2.1) | 2.5 (2.4, 2.7) | 2.8 (2.6, 2.9) | 3.0 (2.8, 3.1) | 3.1 (3.0, 3.3) |
| IDI | 451 | 19584 | 1.0 (0.9, 1.1) | 2.1 (1.9, 2.4) | 2.9 (2.6, 3.2) | 3.1 (2.8, 3.4) | 3.2 (2.9, 3.6) | 3.3 (3.0, 3.7) |
| Traditional Instrumentation | 2363 | 108742 | 0.9 (0.9, 1.0) | 2.1 (2.0, 2.2) | 2.7 (2.6, 2.8) | 2.9 (2.8, 3.0) | 3.2 (3.0, 3.3) | 3.4 (3.2, 3.5) |
| TOTAL | 6401 | 332697 | | | | | | |

Note: Restricted to modern prostheses.
Only procedures with known ASA, BMI, patella component usage, surgeon volume and stability are included
Excludes 344 medial pivot design and hinged prostheses due to small numbers of revisions

**Figure KT69 Cumulative Percent Revision of Primary Total Knee Replacement Using XLPE Since 2016 by Surgeon Assistive Tool (Primary Diagnosis OA)**




HR - adjusted for age, gender, ASA, BMI, patella component usage, surgeon volume and stability

Computer Navigated vs IDI
Entire Period: HR=0.94 (95% CI 0.85, 1.04), p=0.241

Computer Navigated vs Traditional Instrumentation
Entire Period: HR=0.98 (95% CI 0.92, 1.04), p=0.461

IDI vs Traditional Instrumentation
Entire Period: HR=1.04 (95% CI 0.94, 1.15), p=0.450

Robotically Assisted vs Computer Navigated
Entire Period: HR=1.03 (95% CI 0.96, 1.11), p=0.362

Robotically Assisted vs IDI
Entire Period: HR=0.97 (95% CI 0.87, 1.08), p=0.615

Robotically Assisted vs Traditional Instrumentation
Entire Period: HR=1.01 (95% CI 0.94, 1.09), p=0.764

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|
| Robotically Assisted | 99426 | 69982 | 28670 | 7670 | 2726 | 367 | 8 |
| Computer Navigated | 104945 | 92262 | 66843 | 40781 | 28248 | 16835 | 7136 |
| IDI | 19584 | 16886 | 11920 | 7353 | 5082 | 3088 | 1355 |
| Traditional Instrumentation | 108742 | 93081 | 63234 | 38107 | 26829 | 16627 | 7439 |

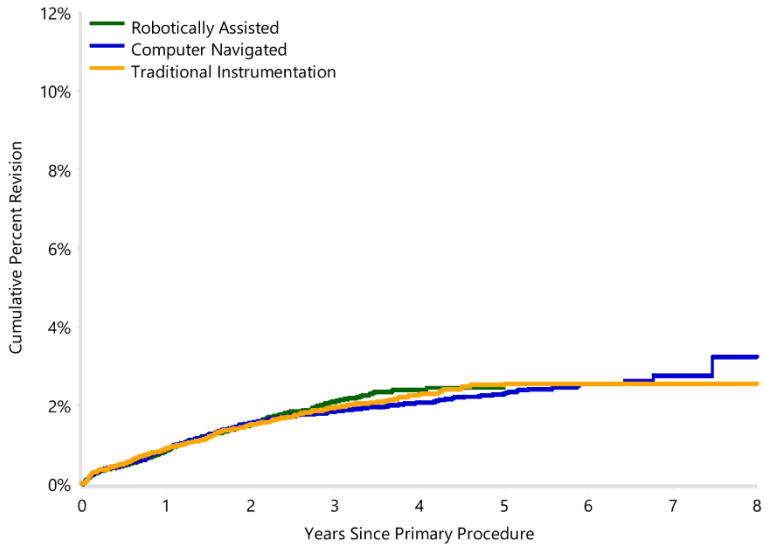
Note: Restricted to modern prostheses.

**Table KT78 Cumulative Percent Revision of Persona CR/Persona Primary Total Knee Replacement Using XLPE Since 2016 by Surgeon Assistive Tool (Primary Diagnosis OA)**

| Surgeon Assistive Tool | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|
| Robotically Assisted | 333 | 24439 | 0.8 (0.7, 1.0) | 2.1 (1.9, 2.4) | 2.4 (2.1, 2.8) | | | |
| Computer Navigated | 311 | 17556 | 0.9 (0.7, 1.0) | 1.8 (1.6, 2.1) | 2.3 (2.0, 2.6) | 2.5 (2.2, 2.9) | 2.8 (2.3, 3.2) | 3.2 (2.4, 4.4) |
| Traditional Instrumentation | 375 | 24057 | 0.9 (0.8, 1.0) | 1.9 (1.7, 2.2) | 2.5 (2.2, 2.8) | 2.6 (2.3, 2.9) | 2.6 (2.3, 2.9) | 2.6 (2.3, 2.9) |
| TOTAL | 1019 | 66052 | | | | | | |

Note: Restricted to modern prostheses.
Restricted to procedures with known ASA, BMI, tibial fixation, patella component usage, surgeon volume and stability
Excludes 8,410 procedures using IDI and 1 posterior stabilised procedure.

**Figure KT70 Cumulative Percent Revision of Persona CR/Persona Primary Total Knee Replacement Using XLPE Since 2016 by Surgeon Assistive Tool (Primary Diagnosis OA)**




HR - adjusted for age, gender, ASA, BMI, patella component usage, surgeon volume, and tibial fixation

Computer Navigated vs Traditional Instrumentation
Entire Period: HR=0.97 (95% CI 0.83, 1.13), p=0.690

Robotically Assisted vs Computer Navigated
Entire Period: HR=1.03 (95% CI 0.88, 1.22), p=0.703

Robotically Assisted vs Traditional Instrumentation
Entire Period: HR=1.00 (95% CI 0.85, 1.18), p=0.990

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Robotically Assisted | 24439 | 17007 | 10335 | 5073 | 1752 | 144 | 1 | 0 | 0 |
| Computer Navigated | 17556 | 14607 | 11745 | 9828 | 7174 | 4381 | 1954 | 552 | 60 |
| Traditional Instrumentation | 24057 | 18645 | 13088 | 8586 | 4787 | 2390 | 1031 | 350 | 89 |

Note: Restricted to modern prostheses.

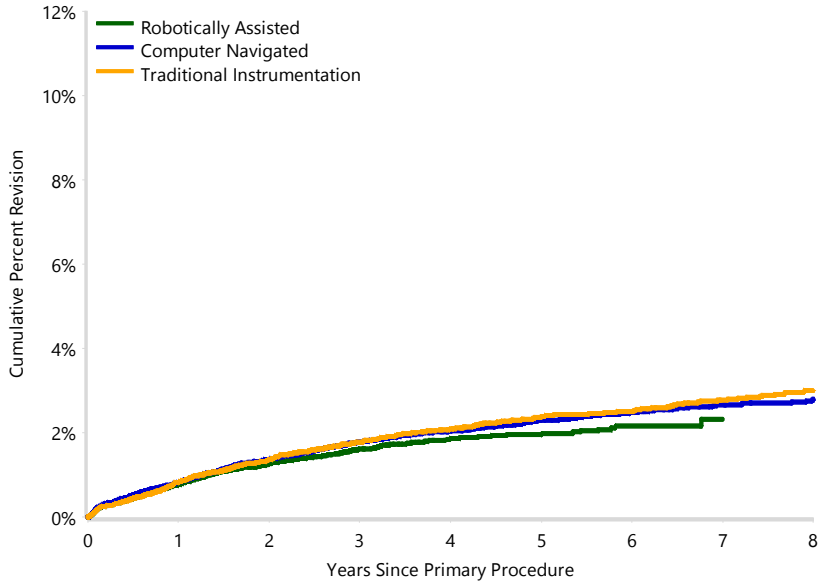
# Primary Total Knee Replacement

**Table KT79 Cumulative Percent Revision of Triathlon CR/Triathlon XLPE Primary Total Knee Replacement Since 2016 by Surgeon Assistive Tool (Primary Diagnosis OA)**

| Surgeon Assistive Tool | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|
| Robotically Assisted | 720 | 57971 | 0.8 (0.7, 0.9) | 1.3 (1.2, 1.4) | 1.6 (1.5, 1.7) | 2.0 (1.8, 2.1) | 2.3 (2.0, 2.8) |
| Computer Navigated | 929 | 47478 | 0.8 (0.7, 0.9) | 1.4 (1.3, 1.5) | 1.8 (1.7, 1.9) | 2.3 (2.1, 2.5) | 2.7 (2.5, 2.8) |
| Traditional Instrumentation | 526 | 25103 | 0.8 (0.7, 1.0) | 1.4 (1.2, 1.5) | 1.8 (1.6, 2.0) | 2.4 (2.2, 2.6) | 2.8 (2.5, 3.1) |
| TOTAL | 2175 | 130552 | | | | | |

Note: Restricted to modern prostheses
Excludes 45 procedures using IDI and 10 posterior stabilised procedures
Restricted to procedures with known ASA, BMI, tibial fixation, patella component usage, surgeon volume and stability.

**Figure KT71 Cumulative Percent Revision of Triathlon CR/Triathlon XLPE Primary Total Knee Replacement Since 2016 by Surgeon Assistive Tool (Primary Diagnosis OA)**




HR - adjusted for age, gender, ASA, BMI, patella component usage, surgeon volume and tibial fixation

Computer Navigated vs Traditional Instrumentation
Entire Period: HR=0.95 (95% CI 0.85, 1.06), p=0.331

Robotically Assisted vs Computer Navigated
Entire Period: HR=0.95 (95% CI 0.85, 1.06), p=0.329

Robotically Assisted vs Traditional Instrumentation
Entire Period: HR=0.90 (95% CI 0.79, 1.02), p=0.089

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|
| Robotically Assisted | 57971 | 42271 | 28874 | 19493 | 5881 | 318 | 7 |
| Computer Navigated | 47478 | 41933 | 35625 | 30410 | 20034 | 9230 | 4133 |
| Traditional Instrumentation | 25103 | 22332 | 19332 | 16910 | 11853 | 5545 | 2679 |

Note: Restricted to modern prostheses
Excludes 45 procedures using IDI and 10 posterior stabilised procedures
Restricted to procedures with known ASA, BMI, tibial fixation, patella component usage, surgeon volume and stability.

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# Shoulder Replacement

# Shoulder Replacement

## Categories of Shoulder Replacement

Shoulder replacement is grouped into three broad categories: primary partial, primary total, and revision shoulder replacement.

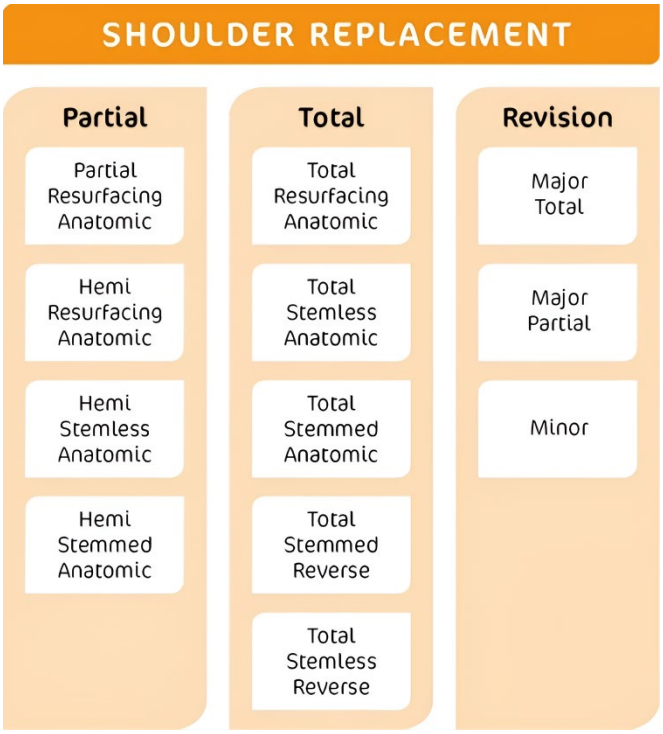
A primary replacement is an initial procedure undertaken on a joint and involves replacing either part (partial) or all (total) of the articular surface.

Primary partial and primary total shoulder replacements are further categorised into subclasses depending on the type of prosthesis used. Partial shoulder subclasses include partial resurfacing anatomic, hemi resurfacing anatomic, hemi stemless anatomic and hemi stemmed anatomic.

Primary total shoulder replacement is subcategorised into five classes. These are defined by the type of prosthesis used. The use of stemless anatomic shoulder replacement has been growing considerably. As such mid head humeral prostheses are now classified as stemless anatomic and stemless reverse to reflect their differing polarity.

Total shoulder subclasses include total resurfacing anatomic, total stemless anatomic, total stemmed anatomic, total stemmed reverse and total stemless reverse. Definitions for each of these classes are detailed in the subsequent sections.

Revision shoulder replacements are re-operations of previous shoulder replacements where one or more of the prosthetic components are replaced, removed, or another component is added. Revisions include subsequent operations of primary partial, primary total, or previous revision procedures. Shoulder revision procedures are categorised into three subclasses: major total, major partial and minor shoulder replacement.




Detailed demographic information on shoulder replacement is available in the supplementary report 'Demographics of Hip, Knee and Shoulder Arthroplasty' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2025

## Executive Summary Reference Tables

Table S1 and Table ST2 index the analyses within this chapter. Variables are listed, and where there is a significant finding for a comparison, a red diamond is shown in the table. There are hyperlinks to the relevant tables and figures.

Throughout this chapter, CPR figures showing no significant differences will not be displayed. This will be noted at the foot of the relevant CPR table.

These figures and their corresponding tables will instead be published in the **Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report**.

**Table S1 Indexing Significant Characteristic Comparisons: Total Shoulder Anatomic Replacements**

| Characteristic | Variable | Total Stemless Anatomic | | Total Stemmed Anatomic | |
|---|---|---|---|---|---|
| | | Significant HR | Figure No. | Significant HR | Figure No. |
| | Primary Diagnosis | | | | |
| | Procedure Year | NT | | | |
| | Procedure Year and Cemented All Polyethylene Glenoid* | NT | | | |
| Patient | | | | | |
| | Age | | | ♦ | Figure ST23 |
| | Gender | ♦ | Figure ST10 | ♦ | Figure ST24 |
| | Gender by Age | ♦ | Figure ST12 | ♦ | Figure ST25 |
| | ASA Score | | | | |
| | ASA by Gender | NT | | ♦ | Figure ST26 |
| | BMI Category | | | | |
| | BMI by Gender* | ♦ | Figure ST13 | ♦ | Figure ST27 |
| | Glenoid Morphology | | | | |
| Prosthesis | | | | | |
| | Fixation | ♦ | Figure ST14 | | |
| | Glenoid Type | ♦ | Figure ST15 | ♦ | Figure ST28 |
| | Bearing Surface | | | ♦ | Figure ST29 |
| | Humeral Head Size | | | ♦ | Figure ST30 |
| | Humeral Head Size and Bearing Surface* | NT | | ♦ | Figure ST31<br>Figure ST32 |
| Implant Sizing Variations | | | | | |
| | Augmented Glenoid | | | ♦ | Figure ST34 |
| | Glenoid Morphology by Augmented Glenoid | | | | |
| | Humeral Stem Length | NT | | ♦ | Figure ST36 |
| Surgeon Assistive Tools | | | | | |
| | IDI | | | ♦ | Figure ST38 |
| | IDI by Glenoid Morphology* | ♦ | Figure ST16 | | |
| Operative Technique | | | | | |
| | Rotator Cuff Repair* | | | | |

♦ Significant Hazard Ratio difference between categories where $p<0.05$

N T Not tested: Insufficient numbers to make statistical comparisons

*New analysis for this year's Annual Report

**Table S2 Indexing Significant Characteristic Comparisons: Total Stemmed Reverse Shoulder Replacements**

| Characteristic | Variable | Total Stemmed Reverse | | | | | |
|---|---|---|---|---|---|---|---|
| | | Osteoarthritis | | Rotator Cuff Arthropathy | | Fracture | |
| | | Significant HR | Figure No. | Significant HR | Figure No. | Significant HR | Figure No. |
| | Primary Diagnosis | ♦ | Figure ST45 | ♦ | Figure ST45 | ♦ | Figure ST45 |
| | Procedure year | ♦ | Figure ST46 | ♦ | Figure ST47 | | |
| Patient | | | | | | | |
| | Age | ♦ | Figure ST49 | ♦ | Figure ST50 | ♦ | Figure ST51 |
| | Gender | ♦ | Figure ST52 | ♦ | Figure ST53 | ♦ | Figure ST54 |
| | ASA Score | ♦ | Figure ST56 | ♦ | Figure ST57 | ♦ | Figure ST58 |
| | BMI Category | ♦ | Figure ST59 | ♦ | Figure ST60 | ♦ | Figure ST61 |
| | Glenoid Morphology | | | | | | |
| Prosthesis | | | | | | | |
| | Fixation | | | ♦ | Figure ST62 | | |
| | Bearing Surface | ♦ | Figure ST63 | | | | |
| | Glenosphere Size | ♦ | Figure ST64 | | | ♦ | Figure ST65 |
| Implant Sizing Variations | | | | | | | |
| | Glenoid Augmentation | ♦ | Figure ST66 | | | | |
| | Glenoid Augmentation and Glenoid Morphology | ♦ | Figure ST67<br>Figure ST68 | ♦ | Figure ST69 | | |
| | Humeral Stem Type | NT | | NT | | ♦ | Figure ST70 |
| | Humeral Stem Type and Fixation | NT | | NT | | ♦ | Figure ST71 |
| | Humeral Stem Length | ♦ | Figure ST72 | | | | |
| | Glenosphere Lateralisation | | | | | | |
| Surgeon Assistive Tools | | | | | | | |
| | IDI | ♦ | Figure ST74 | | | | |
| Operative Technique | | | | | | | |
| | Rotator Cuff Repair* | | | ♦ | Figure ST75 | ♦ | Figure ST76 |

♦ Significant Hazard Ratio difference between categories where $p<0.05$

N T Not tested: Insufficient numbers to make statistical comparisons

*New analysis for this year's Annual Report

## Use of Shoulder Replacement

There are 107,581 shoulder replacements with a procedure date up to and including 31 December 2024. This is an additional 11,795 shoulder procedures since the last report.

For further information on the **closure of the database** please see the **Glossary** of this report.

Registry shoulder data collection commenced in 2004, and full national collection was implemented by November 2007.

The number of shoulder replacement procedures undertaken in 2024 increased by 730 (6.9%) compared to the previous year and has increased by 328.9% since 2008.

When considering all shoulder replacement procedures currently recorded by the Registry, primary total shoulder replacement is the most common, followed by primary partial and revision procedures (Table S3).

In 2024, the proportion of revision procedures has declined to 7.5%. This equates to 383 fewer revisions compared to the peak of 10.9% in 2012.

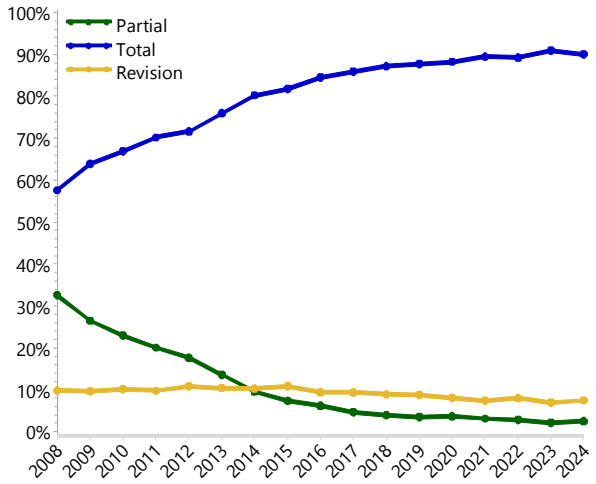
**Table S3 Number of Shoulder Replacements**

| Shoulder Category | Number | Percent |
|---|---|---|
| Partial | 8404 | 7.8 |
| Total | 89719 | 83.4 |
| Revision | 9458 | 8.8 |
| TOTAL | 107581 | 100.0 |

Since 2008, there has been a proportional increase in the use of total shoulder replacement, a decline in the use of partial shoulder replacement and a decrease in the proportion of revision procedures (Figure S1).

The proportion of total shoulder replacements has increased from 57.6% in 2008 to 90.0% in 2024.

**Figure S1 Proportion of Shoulder Replacements**



# Shoulder Replacement

## ASA and BMI in Shoulder Replacement

Data are reported on shoulder replacement procedures for both the American Society of Anaesthesiologists Physical Status Classification (ASA score) and Body Mass Index (BMI). ASA score and BMI are both known to impact the outcome of shoulder replacement surgery. The Registry commenced collection of ASA score in 2012 and BMI data in 2015.

There are ASA score data on 86,095 and BMI data on 74,380 shoulder replacement procedures. Since its initial collection, ASA score has been recorded for 96.6% of procedures. BMI has been recorded for 92.8% of procedures since collection commenced.

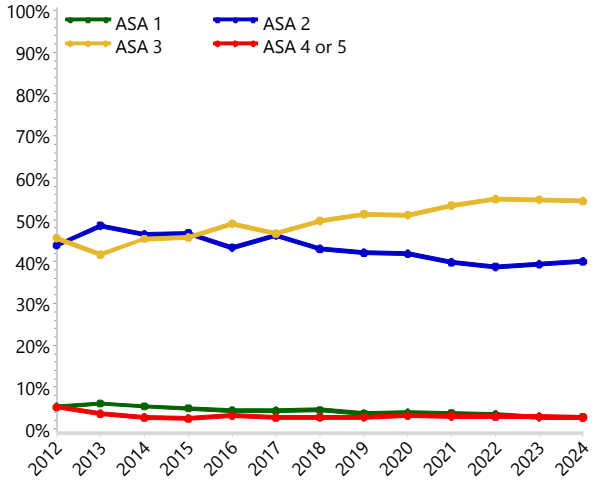
### ASA SCORE

There are five ASA score classifications: [5]

1. A normal healthy patient
2. A patient with mild systemic disease
3. A patient with severe systemic disease
4. A patient with severe systemic disease that is a constant threat to life
5. A moribund patient who is not expected to survive without the operation

Whilst the proportions of normal and severely ill are not changing, ASA 3 is increasing with time (Figure S2).

**Figure S2 Proportion of Shoulder Replacements by ASA Score**




### BMI CATEGORY

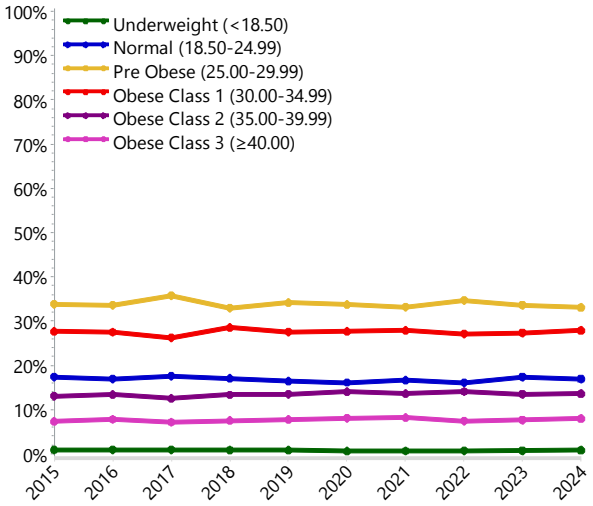
BMI for adults is classified into six main categories: [6]

| | |
|---|---|
| Underweight | <18.5 |
| Normal | 18.5 – 24.9 |
| Pre-obese | 25.0 – 29.9 |
| Obese Class 1 | 30.0 – 34.9 |
| Obese Class 2 | 35.0 – 39.9 |
| Obese Class 3 | ≥40.0 |

For all shoulder replacements, the majority of procedures the proportions of BMI classes over time are not changing (Figure S3).

Additional ASA and BMI data can be found in the Primary Partial, Primary Total and Revision Shoulder Data Supplementary Report

**Figure S3 Proportion of Shoulder Replacements by BMI Category**




[5] https://www.asahq.org/standards-and-practice-parameters/statement-on-asa-physical-status-classification-system

[6] https://www.aihw.gov.au/reports/overweight-obesity/overweight-and-obesity/contents/measuring-overweight-and-obesity

## CT Scan and Glenoid Morphology

Data are reported on shoulder replacement procedures for both CT scans and glenoid morphology. The Registry commenced collection of CT scan usage and glenoid morphology in January 2017.

### CT SCANS

There is a difference depending on the class of shoulder replacement. Total shoulder replacement procedures have a higher proportion of CT scans compared to revision shoulder replacement and partial shoulder replacement. CT utilisation for shoulder replacement cases has risen from under 60% in 2017 to 84% in 2024 (Figure S4). In contrast, the relative percentages of glenoid morphology categories have not changed (Figure S5).

A CT scan was undertaken in 74.2% of all reported shoulder replacements.

### GLENOID MORPHOLOGY

There are 5 glenoid morphology categories based on the Walch classification:[7]

A1. Humeral head centred – minor erosion

A2. Humeral head centred – major erosion

B1. Humeral head posteriorly subluxated narrowing of the posterior joint space, subchondral sclerosis and osteophytes

B2. Humeral head posteriorly subluxated – posterior rim erosion with a biconcave glenoid

C. Glenoid retroversion of more than 25 degrees, regardless of the erosion

The most common glenoid morphology category is A1 for all shoulder procedure categories. The second most common is A2 for total and revision shoulder replacement with A2 and B2 for partial shoulder replacement (Figure S5).

Additional CT scan and glenoid morphology data can be found in the Primary **Partial, Primary Total and Revision Shoulder Data Supplementary Report**

**Figure S4 Proportion of Shoulder Replacements by CT Scan Usage**

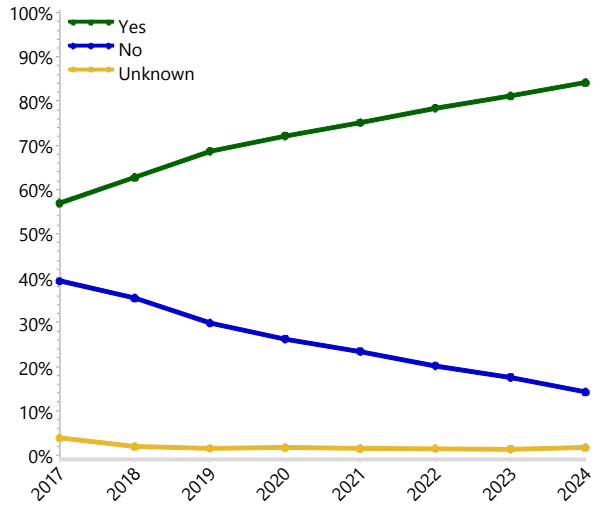
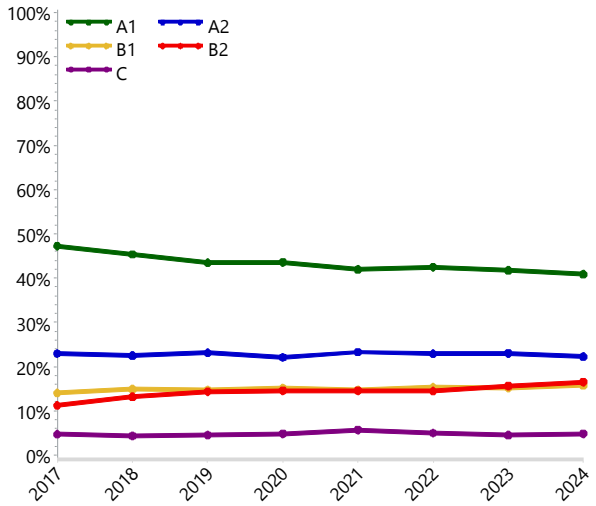



**Figure S5 Proportion of Shoulder Replacements by Glenoid Morphology**




[7] Walch G, Badet R, Boulahia A, Khoury A. Morphologic study of the glenoid in primary glenohumeral osteoarthritis. J Arthroplasty. 1999 Sep 1;14(6):756-60.

# Primary Partial Shoulder Replacement Summary

## Introduction

This section provides summary information on partial shoulder replacement. Detailed information on partial shoulders is available on the AOANJRR website as a separate supplementary report.

## Classes of Partial Shoulder Replacement

Primary partial shoulder replacement is subcategorised into four main classes. These are defined by the type of prostheses used.

**Partial resurfacing anatomic** involves the use of one or more button prostheses to replace part of the natural articulating surface, on one or both sides of the shoulder joint.

**Hemi resurfacing anatomic** involves the use of a humeral prosthesis that replaces the humeral articular surface only, without resecting the humeral head.

**Hemi stemless anatomic** involves resection of part of the humeral head and replacement with a humeral head and an epiphyseal fixation prosthesis.

**Hemi stemmed anatomic** involves the resection of the humeral head and replacement with a humeral head and a humeral stem prosthesis. A humeral stem prosthesis may have either metaphyseal or diaphyseal fixation.

## Use of Partial Shoulder Replacement

There are 8,404 primary partial shoulder replacement procedures. This is an additional 297 procedures compared to the number reported last year.

For further information on the **closure of the database** please see the **Glossary** of this report.

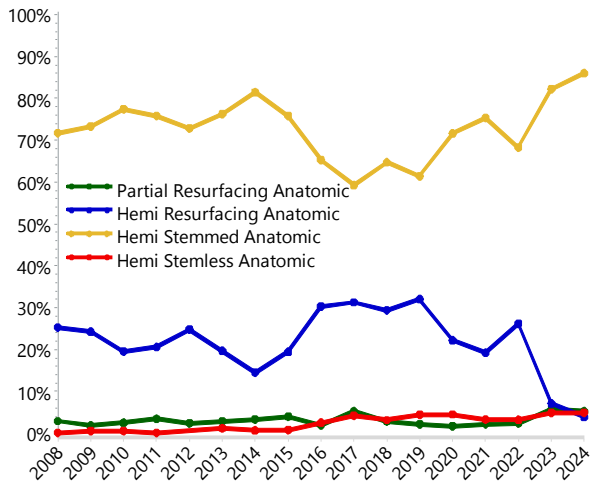
The most common class of primary partial shoulder replacement is hemi stemmed anatomic. This accounts for 73.3% of all partial shoulder replacements, followed by hemi resurfacing anatomic (22.4%), partial resurfacing anatomic (2.8%), and hemi stemless anatomic (1.5%) (Table SP1).

Over the last 9 years hemi stemmed anatomic replacements increased in use by 10.2% while hemi resurfacing anatomic declined by 15.6%. The number of hemi stemmed anatomic procedures decreased from 616 in 2008 to 246 in 2024. The number of hemi resurfacing anatomic procedures decreased from 217 in 2008 to 11 in 2024 (Figure SP1).

**Table SP1 Primary Partial Shoulder Replacement by Class**

| Shoulder Class | Number | Percent |
|---|---|---|
| Partial Resurfacing Anatomic | 239 | 2.8 |
| Hemi Resurfacing Anatomic | 1885 | 22.4 |
| Hemi Stemmed Anatomic | 6158 | 73.3 |
| Hemi Stemless Anatomic | 122 | 1.5 |
| **TOTAL** | **8404** | **100.0** |

**Figure SP1 Primary Partial Shoulder Replacement by Class**




Detailed demographic information on primary partial shoulder replacement is available in the supplementary report 'Demographics of Hip, Knee and Shoulder Arthroplasty' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2025

## Primary Hemi Stemmed Anatomic Shoulder Replacement

There are 6,158 primary hemi stemmed anatomic shoulder replacement procedures. This is an additional 251 procedures compared to the last report.

For further information on the **closure of the database** please see the **Glossary** of this report.

This procedure is more commonly undertaken in females (65.5%). The mean age is 71.4 years for females and 61.6 years for males (Table SP2 and Figure SP2).

The most common primary diagnosis is fracture (52.2%), followed by osteoarthritis (32.3%). In 2024, the number of primary hemi stemmed anatomic shoulder replacements undertaken for fracture decreased by 92.1% compared to 2008. In 2024, the number of primary hemi stemmed anatomic shoulder replacements undertaken for osteoarthritis decreased by 9.6% compared to 2008 (Figure SP3).

In order to keep Registry data contemporaneous, only procedures using prostheses that have been available and used in 2024 (described as modern prostheses) are included in the following analyses, unless clearly specified.

The cumulative percent revision at 16 years for primary hemi stemmed anatomic shoulder replacement procedures undertaken for fracture is 17.0% and osteoarthritis is 12.3%. There is a higher rate of revision in the first 1.5 years when primary hemi stemmed anatomic shoulder replacement is performed for fracture compared to osteoarthritis. After this time, there is no difference (Table SP4 and Figure SP4).

There are 418 revisions of primary hemi stemmed anatomic shoulder replacement. Reasons for revision vary depending on the primary diagnosis. Revision for rotator cuff insufficiency occurs more frequently in primary hemi stemmed anatomic shoulder replacement undertaken for fracture (27.8%), whereas revision for glenoid erosion occurs more frequently in procedures undertaken for osteoarthritis (27.7%).

The most common type of revision is to a total shoulder replacement for both primary diagnoses (71.8% for fracture and 65.3% for osteoarthritis). Most are revised to a total reverse shoulder replacement (97.8% when used for fracture and 86.4% for osteoarthritis). Glenoid component only revision occurs more frequently in procedures undertaken for osteoarthritis (18.8% compared to 3.9% for fracture).

The outcomes of 12 prosthesis combinations with more than 20 procedures used in primary hemi stemmed anatomic shoulder replacement are listed in Table SP5.

A special clinical assessment including hemi stemmed anatomic implants with pyrocarbon humeral heads for patients with osteoarthritis under the age of 60 years is detailed in Figure ST77.

**Figure SP2 Primary Hemi Stemmed Anatomic Shoulder Replacement by Gender**

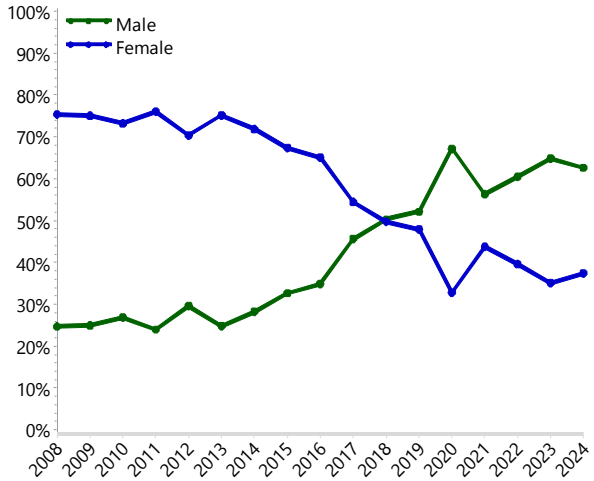



**Table SP2 Age and Gender of Primary Hemi Stemmed Anatomic Shoulder Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 2127 | 34.5% | 14 | 94 | 62 | 61.6 | 13.8 |
| Female | 4031 | 65.5% | 13 | 101 | 73 | 71.4 | 11.8 |
| **TOTAL** | **6158** | **100.0%** | **13** | **101** | **69** | **68.0** | **13.4** |

# Primary Partial Shoulder Replacement Summary

**Figure SP3** **Primary Hemi Stemmed Anatomic Shoulder Replacement by Primary Diagnosis**

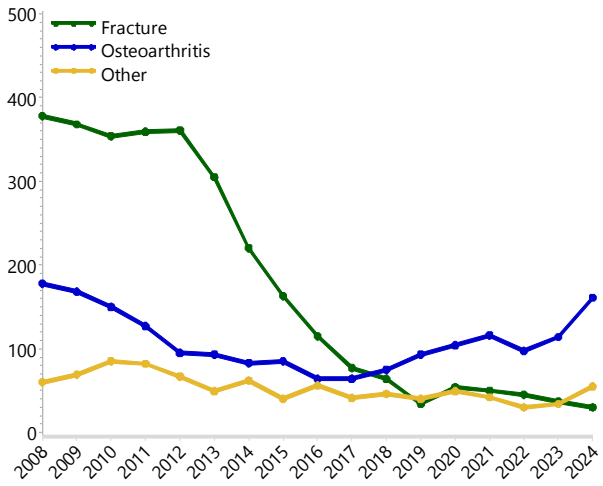



**Table SP3** **Primary Hemi Stemmed Anatomic Shoulder Replacement by Primary Diagnosis**

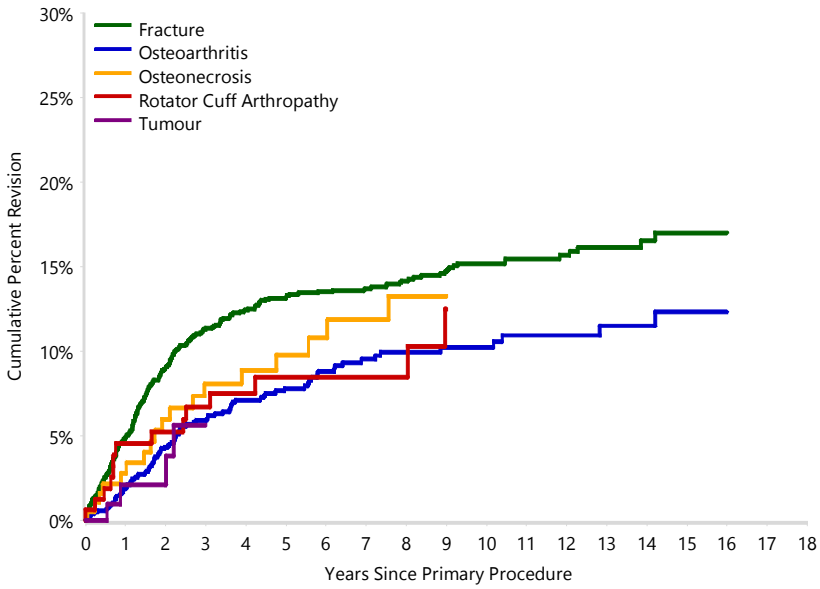
| Primary Diagnosis | Number | Percent |
|---|---|---|
| Fracture | 3213 | 52.2 |
| Osteoarthritis | 1986 | 32.3 |
| Rotator Cuff Arthropathy | 273 | 4.4 |
| Osteonecrosis | 249 | 4.0 |
| Tumour | 210 | 3.4 |
| Rheumatoid Arthritis | 105 | 1.7 |
| Instability | 89 | 1.4 |
| Other Inflammatory Arthritis | 30 | 0.5 |
| Other | 3 | 0.0 |
| **TOTAL** | **6158** | **100.0** |

**Table SP4 Cumulative Percent Revision of Primary Hemi Stemmed Anatomic Shoulder Replacement by Primary Diagnosis**

| Primary Diagnosis | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Fracture | 255 | 1895 | 4.9 (4.0, 6.0) | 11.4 (10.0, 12.9) | 13.2 (11.7, 14.9) | 13.7 (12.1, 15.4) | 15.2 (13.5, 17.1) | 16.5 (14.6, 18.8) |
| Osteoarthritis | 101 | 1388 | 2.0 (1.3, 2.9) | 5.9 (4.7, 7.4) | 7.8 (6.3, 9.6) | 9.5 (7.8, 11.7) | 10.2 (8.4, 12.5) | 11.5 (9.2, 14.3) |
| Osteonecrosis | 20 | 192 | 2.8 (1.2, 6.6) | 8.1 (4.8, 13.5) | 9.8 (6.0, 15.8) | 11.9 (7.4, 18.7) | | |
| Rotator Cuff Arthropathy | 15 | 159 | 4.6 (2.2, 9.3) | 6.7 (3.7, 12.1) | 8.5 (4.9, 14.5) | 8.5 (4.9, 14.5) | | |
| Tumour | 8 | 142 | 2.1 (0.5, 8.2) | 5.6 (2.1, 14.8) | | | | |
| Other (4) | 19 | 151 | 4.9 (2.4, 10.1) | 9.7 (5.7, 16.1) | 10.5 (6.4, 17.2) | 11.9 (7.3, 19.2) | | |
| TOTAL | 418 | 3927 | | | | | | |

Note: Only primary diagnoses with >100 procedures have been listed. Restricted to modern prostheses

**Figure SP4 Cumulative Percent Revision of Primary Hemi Stemmed Anatomic Shoulder Replacement by Primary Diagnosis**




HR - adjusted for age and gender

Fracture vs Osteoarthritis

0 - 6Mth: HR=3.48 (95% CI 1.92, 6.31), p<0.001

6Mth - 1.5Yr: HR=2.41 (95% CI 1.61, 3.62), p<0.001

1.5Yr+: HR=1.13 (95% CI 0.84, 1.52), p=0.427

Osteonecrosis vs Osteoarthritis

Entire Period: HR=1.01 (95% CI 0.61, 1.65), p=0.976

Rotator Cuff Arthropathy vs Osteoarthritis

Entire Period: HR=1.44 (95% CI 0.83, 2.49), p=0.196

Tumour vs Osteoarthritis

Entire Period: HR=1.03 (95% CI 0.49, 2.14), p=0.937

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Fracture | 1895 | 1706 | 1389 | 1159 | 956 | 638 | 189 |
| Osteoarthritis | 1388 | 1183 | 895 | 636 | 444 | 278 | 119 |
| Osteonecrosis | 192 | 160 | 128 | 94 | 69 | 39 | 19 |
| Rotator Cuff Arthropathy | 159 | 144 | 115 | 87 | 62 | 33 | 6 |
| Tumour | 142 | 83 | 43 | 28 | 16 | 6 | 1 |

Note: Only primary diagnoses with >100 procedures have been listed. Restricted to modern prostheses

# Primary Partial Shoulder Replacement Summary

**Table SP5 Cumulative Percent Revision of Primary Hemi Stemmed Anatomic Shoulder Replacement by Prosthesis Combinations**

| Humeral Head | Humeral Stem | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Aequalis | Aequalis | 56 | 671 | 2.4 (1.5, 3.9) | 6.6 (4.9, 8.8) | 7.3 (5.5, 9.6) | 8.1 (6.2, 10.6) | 8.9 (6.8, 11.5) | 9.9 (7.6, 12.8) |
| Affinis | Affinis | 10 | 64 | 8.0 (3.4, 18.2) | 13.3 (6.9, 24.9) | 17.6 (9.8, 30.5) | 17.6 (9.8, 30.5) | 17.6 (9.8, 30.5) | |
| Ascend Flex | Ascend Flex | 4 | 53 | 6.7 (2.2, 19.3) | 6.7 (2.2, 19.3) | 10.3 (3.9, 25.8) | 10.3 (3.9, 25.8) | | |
| Ascend Flex PyC | Aequalis Flex Revive | 5 | 24 | 21.3 (9.4, 43.9) | 21.3 (9.4, 43.9) | | | | |
| | Ascend Flex | 37 | 892 | 1.1 (0.6, 2.1) | 4.2 (2.9, 6.1) | 5.9 (4.1, 8.4) | 8.0 (5.3, 11.8) | | |
| Comprehensive | Comprehensive | 16 | 178 | 4.2 (2.0, 8.7) | 10.2 (6.2, 16.4) | 10.2 (6.2, 16.4) | 11.5 (7.1, 18.3) | | |
| Delta Xtend | Delta Xtend | 14 | 79 | 6.4 (2.7, 14.7) | 16.0 (9.4, 26.5) | 16.0 (9.4, 26.5) | 17.9 (10.8, 29.0) | 20.5 (12.4, 32.7) | |
| Equinoxe | Equinoxe | 13 | 99 | 6.5 (3.0, 13.9) | 13.5 (7.9, 22.7) | 15.7 (9.2, 25.8) | 15.7 (9.2, 25.8) | | |
| Global Unite | Global Unite | 43 | 227 | 6.8 (4.1, 11.0) | 16.8 (12.3, 22.6) | 20.1 (15.2, 26.3) | 20.1 (15.2, 26.3) | 22.0 (16.6, 28.8) | |
| Mutars | Mutars | 3 | 67 | 0.0 (0.0, 0.0) | 3.0 (0.4, 19.6) | 8.4 (2.0, 31.2) | 16.0 (5.1, 44.6) | | |
| SMR | SMR | 186 | 1290 | 4.0 (3.0, 5.2) | 10.2 (8.6, 12.0) | 12.6 (10.9, 14.7) | 13.7 (11.8, 15.8) | 16.0 (13.9, 18.3) | 17.8 (15.4, 20.6) |
| SMR CTA | SMR | 28 | 271 | 5.0 (2.9, 8.4) | 9.4 (6.3, 13.8) | 10.9 (7.6, 15.7) | 10.9 (7.6, 15.7) | 13.3 (9.1, 19.4) | |
| Other (4) | | 3 | 12 | 28.7 (10.2, 65.6) | | | | | |
| TOTAL | | 418 | 3927 | | | | | | |

Note: Only prostheses with >20 procedures have been listed. Restricted to modern prostheses

More information regarding partial shoulder procedures is available in the 'Partial Shoulder Arthroplasty Supplementary Report' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2025

# Primary Total Shoulder Replacement

## Classes of Total Shoulder Replacement

Primary total shoulder replacement is subcategorised into five classes. These are defined by the type of prosthesis used. The stemless anatomic class of shoulder replacement has increased considerably. As such, mid head humeral prostheses are now classified as stemless anatomic and stemless reverse to reflect their differing polarity.

**Total Resurfacing Anatomic** involves glenoid replacement and the use of a humeral prosthesis that replaces the humeral articular surface without resecting the humeral head.

**Total Stemless Anatomic** involves glenoid replacement combined with resection of the humeral head and replacement with a humeral head and an epiphyseal fixation prosthesis.

**Total Stemmed Anatomic** involves glenoid replacement combined with resection of the humeral head and replacement with humeral head and humeral stem prostheses. A humeral stem prosthesis may have metaphyseal or diaphyseal fixation.

**Total Stemmed Reverse** involves glenoid replacement with a glenosphere prosthesis combined with resection of the humeral head and replacement with humeral cup and humeral stem prosthesis. A humeral stem prosthesis may have metaphyseal or diaphyseal fixation.

**Total Stemless Reverse** involves glenoid replacement with a glenosphere combined with resection of the humeral head and replacement by a humeral cup and an epiphyseal fixation humeral prosthesis.

Primary total resurfacing anatomic shoulder replacement is no longer used. Therefore, detailed information on primary total resurfacing anatomic shoulder replacement is available in the supplementary report 'Prosthesis Types with No or Minimal Use' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2025

Primary total stemmed reverse shoulder replacement accounts for 74.4% of all primary total shoulder replacements.

## Use of Total Shoulder Replacement

There are 89,484 primary total shoulder replacement procedures. Of these, total stemmed reverse is the most common, followed by total stemmed anatomic and total stemless anatomic. There have been no total resurfacing anatomic replacements in 2024.

The use of different prosthesis classes has changed over time with a major increase in the use of total stemmed reverse shoulder and a corresponding decline in the use of total stemmed anatomic shoulder replacement (**Table ST1**). Total stemless reverse replacements have been undertaken in Australia since 2016 (Figure ST1).

**Figure ST1 Primary Total Shoulder Replacement by Class**

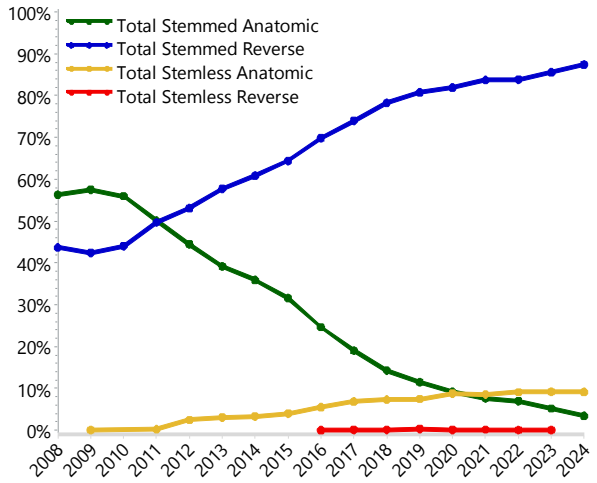



**Table ST1 Primary Total Shoulder Replacement by Class**

| Shoulder Class | Number | Percent |
|---|---|---|
| Total Stemmed Anatomic | 16893 | 18.9 |
| Total Stemmed Reverse | 66607 | 74.4 |
| Total Stemless Anatomic | 5916 | 6.6 |
| Total Stemless Reverse | 68 | 0.1 |
| TOTAL | 89484 | 100.0 |

Note: Excludes 235 total resurfacing procedures

# Primary Total Shoulder Replacement

Primary total shoulder replacement is undertaken more often in females, and this is true of all classes except for total stemless reverse, although numbers in this class are small (Table ST2). The percentage of males undergoing primary total shoulder replacement has increased by 3.1% since 2016. The mean age for females is higher than for males (Table ST3).

Most patients are aged ≥65 years. The proportion of the class of shoulder replacement varies between age groups, with total stemmed reverse predominating in the older age cohorts (Table ST4).

Osteoarthritis is the most common primary diagnosis followed by rotator cuff arthropathy and fracture (Table ST5).

Since 2016, the primary diagnosis osteoarthritis has decreased in proportion by 9.9% and rotator cuff arthropathy has increased by 10.6%.

The percentage of prostheses utilising highly cross-linked polyethylene (XLPE) and non-highly cross-linked polyethylene (non XLPE) in 2024 for primary total shoulder replacement was 39.4% and 50.7%, respectively. The relative percentages had XLPE increase (6.3%) and non XLPE decrease (4.5%) compared to 2023 proportions.

To keep Registry data contemporaneous, only procedures using prostheses that have been available and used in 2024 (described as modern prostheses) are included in the analyses, unless clearly specified.

The rate of revision varies by class with total stemmed reverse and total stemless anatomic having a lower cumulative percent revision at 10 years than total stemmed anatomic shoulder replacement with a polyethylene glenoid. A polyethylene glenoid includes all glenoid types except modular metal backed glenoids (Table ST6 and Figure ST2). There are no primary total stemmed anatomic shoulder replacements with modular metal backed glenoids undertaken in 2024.

Detailed demographic information on primary total shoulder replacement is available in the supplementary report 'Demographics of Hip, Knee & Shoulder Arthroplasty' on the AOANJRR website:
https://aoanjrr.sahmri.com/annual-reports-2025

**Table ST2 Primary Total Shoulder Replacement by Class and Gender**

| Shoulder Class | Male | | Female | | TOTAL | |
|---|---|---|---|---|---|---|
| | N | Row% | N | Row% | N | Row% |
| Total Stemmed Anatomic | 7284 | 43.1 | 9609 | 56.9 | 16893 | 100.0 |
| Total Stemmed Reverse | 25664 | 38.5 | 40943 | 61.5 | 66607 | 100.0 |
| Total Stemless Anatomic | 2955 | 49.9 | 2961 | 50.1 | 5916 | 100.0 |
| Total Stemless Reverse | 47 | 69.1 | 21 | 30.9 | 68 | 100.0 |
| **TOTAL** | **35950** | **40.2** | **53534** | **59.8** | **89484** | **100.0** |

**Table ST3 Age and Gender of Primary Total Shoulder Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 35950 | 40.2% | 14 | 100 | 71 | 70.1 | 9.0 |
| Female | 53534 | 59.8% | 12 | 103 | 74 | 73.4 | 8.3 |
| **TOTAL** | **89484** | **100.0%** | **12** | **103** | **73** | **72.1** | **8.7** |

**Table ST4 Primary Total Shoulder Replacement by Class and Age**

| Shoulder Class | <55 | | 55-64 | | 65-74 | | ≥75 | | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|
| | N | Row% | N | Row% | N | Row% | N | Row% | N | Row% |
| Total Stemmed Anatomic | 995 | 5.9 | 4045 | 23.9 | 7435 | 44.0 | 4418 | 26.2 | 16893 | 100.0 |
| Total Stemmed Reverse | 1156 | 1.7 | 7639 | 11.5 | 26223 | 39.4 | 31589 | 47.4 | 66607 | 100.0 |
| Total Stemless Anatomic | 640 | 10.8 | 1680 | 28.4 | 2505 | 42.3 | 1091 | 18.4 | 5916 | 100.0 |
| **TOTAL** | **2791** | **3.1** | **13364** | **14.9** | **36163** | **40.4** | **37098** | **41.5** | **89416** | **100.0** |

Note: Restricted to modern prostheses

**Table ST5 Primary Total Shoulder Replacement by Primary Diagnosis**

| Primary Diagnosis | Number | Percent |
|---|---|---|
| Osteoarthritis | 50453 | 56.4 |
| Rotator Cuff Arthropathy | 24922 | 27.9 |
| Fracture | 10053 | 11.2 |
| Rheumatoid Arthritis | 1390 | 1.6 |
| Osteonecrosis | 1138 | 1.3 |
| Instability | 737 | 0.8 |
| Other Inflammatory Arthritis | 469 | 0.5 |
| Tumour | 302 | 0.3 |
| Other | 20 | 0.0 |
| **TOTAL** | **89484** | **100.0** |

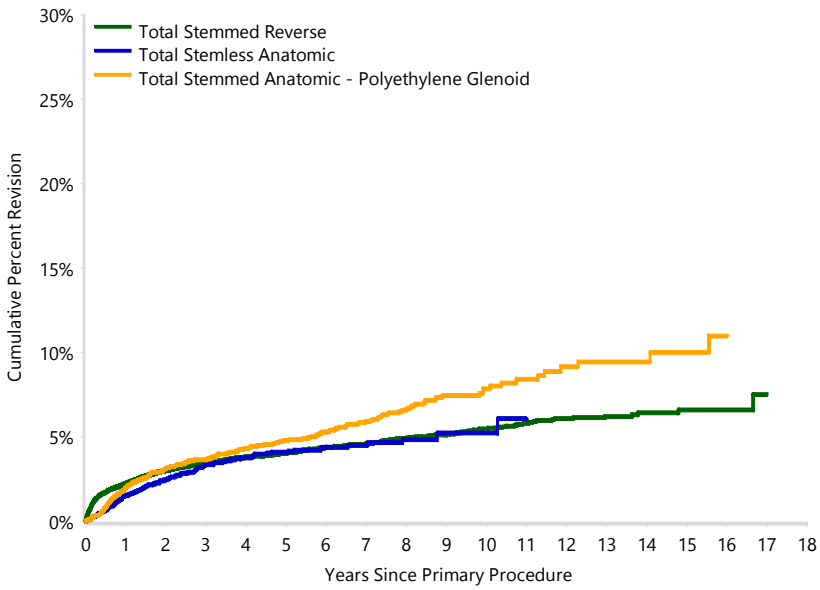
# Primary Total Shoulder Replacement

**Table ST6 Cumulative Percent Revision of Primary Total Shoulder Replacement by Class (All Diagnoses)**

| Shoulder Class | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Total Stemmed Reverse | 2363 | 64636 | 2.2 (2.1, 2.4) | 3.4 (3.3, 3.6) | 4.0 (3.9, 4.2) | 4.6 (4.4, 4.8) | 5.5 (5.2, 5.8) | 6.4 (5.9, 7.0) |
| Total Stemless Anatomic | 172 | 5547 | 1.5 (1.2, 1.9) | 3.4 (2.8, 3.9) | 4.1 (3.5, 4.8) | 4.5 (3.8, 5.3) | 5.2 (4.2, 6.5) | |
| Total Stemmed Anatomic - Polyethylene Glenoid | 288 | 5413 | 2.0 (1.6, 2.4) | 3.7 (3.2, 4.2) | 4.8 (4.2, 5.5) | 5.9 (5.2, 6.7) | 7.9 (6.9, 9.0) | 9.5 (8.0, 11.2) |
| TOTAL | 2823 | 75596 | | | | | | |

Note: Restricted to modern prostheses.

**Figure ST2 Cumulative Percent Revision of Primary Total Shoulder Replacement by Class (All Diagnoses)**




HR - adjusted for age and gender

Total Stemmed Reverse vs
Total Stemless Anatomic

0 - 3Mth: HR=6.00 (95% CI 4.22, 8.52), p<0.001

3Mth+: HR=0.98 (95% CI 0.83, 1.16), p=0.818

Total Stemmed Anatomic - Polyethylene Glenoid vs
Total Stemmed Reverse

0 - 3Mth: HR=0.21 (95% CI 0.13, 0.33), p<0.001

3Mth+: HR=1.41 (95% CI 1.24, 1.61), p<0.001

Total Stemmed Anatomic - Polyethylene Glenoid vs
Total Stemless Anatomic

Entire Period: HR=1.38 (95% CI 1.14, 1.66), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Total Stemmed Reverse | 64636 | 53660 | 36956 | 23672 | 13305 | 4641 | 724 |
| Total Stemless Anatomic | 5547 | 4533 | 2863 | 1601 | 720 | 122 | 0 |
| Total Stemmed Anatomic - Polyethylene Glenoid | 5413 | 4943 | 3941 | 2944 | 1859 | 632 | 169 |

Note: Restricted to modern prostheses.

## Demographics of Total Shoulder Replacement Over Time

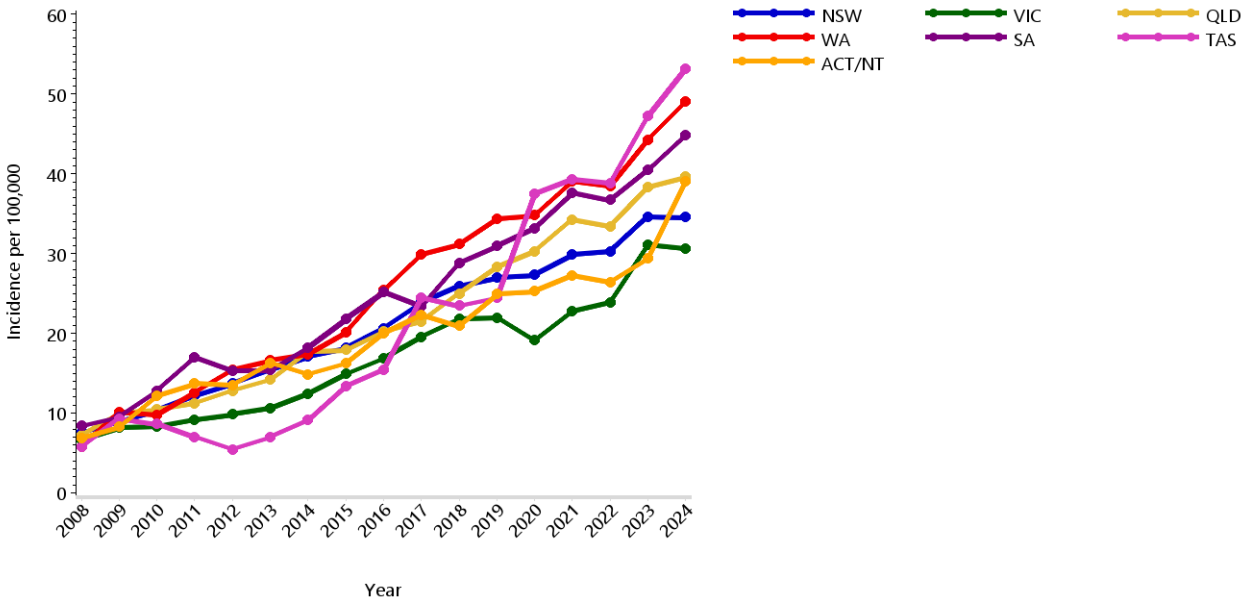
The overall population-based incidence of primary total shoulder replacement has steadily increased from 7.1 per 100,000 in 2008 to 37.4 per 100,000 in 2024. The incidence by state and territory confirms similar increases across the country (Figure ST3).

In 2024, primary total shoulder replacement is undertaken more commonly in private hospitals with (75.1%) which has remained consistent since 2008 (Figure ST4). However, when assessed by volume of primary total shoulder replacement per hospital, the lowest 2 quartiles of hospitals represented 36.7% of cases in 2008 and reduced to 4.1% in 2024 (Figure ST5).

The proportion of primary total shoulder replacements per surgeon has also changed, with the highest quartile of surgeon volume undertaking 52.2% of all cases in 2024, in comparison to 9.6% in 2008 (Figure ST6).

As volumes of surgeons performing total primary shoulder replacement and numbers of procedures have increased over time, the experience (number of years since first reported shoulder replacement procedure) of orthopaedic surgeons performing most of the shoulder replacement has also grown. In 2024, 81% of primary total shoulder replacements are completed by orthopaedic surgeons with ≥8 years' experience (Figure ST7).

**Figure ST3 Incidence of Primary Total Shoulder Replacement per 100,000 from 2008 to 2024**



# Primary Total Shoulder Replacement

**Figure ST4 Primary Total Shoulder Replacement by Hospital Setting**

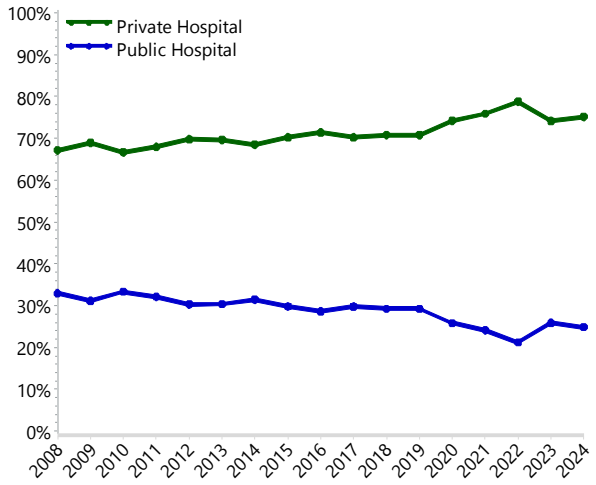



**Figure ST5 Primary Total Shoulder Replacement by Hospital Volume**

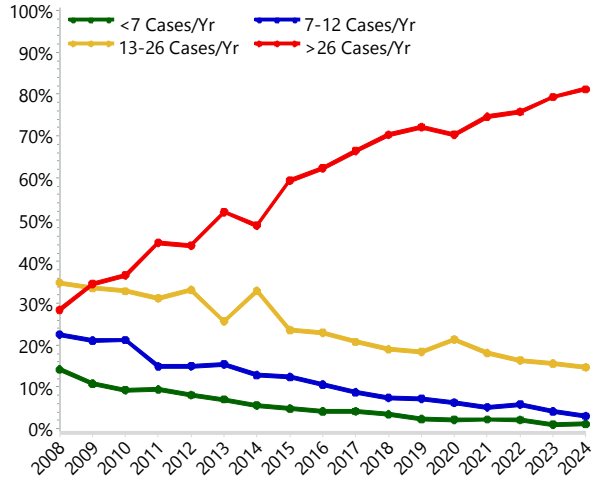



**Figure ST6 Primary Total Shoulder Replacement by Surgeon Volume**

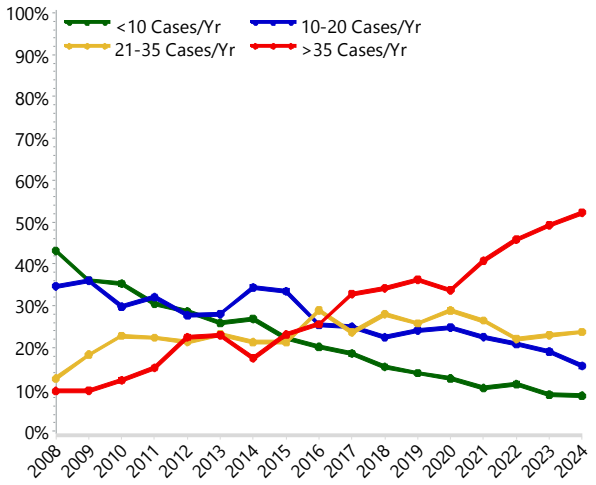
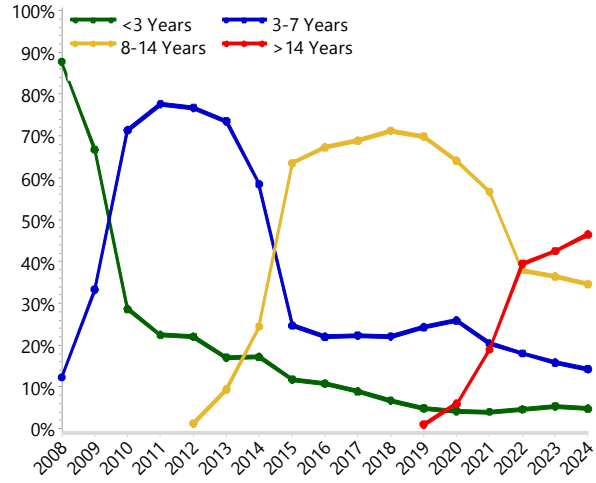



**Figure ST7 Primary Total Shoulder Replacement by Surgeon Experience**



## Primary Total Stemless Anatomic Shoulder Replacement

### DEMOGRAPHICS

There are 5,916 primary total stemless anatomic shoulder replacements. This is an additional 929 procedures compared to the previous report.

For further information on the **closure of the database** please see the **Glossary** of this report.

The use of primary total stemless anatomic shoulder replacement has increased by 1208.45% since its first full year of use in 2012.

Primary total stemless anatomic shoulder replacement is more commonly performed in patients aged 65–74 years. Primary total stemless anatomic shoulder replacements are undertaken more often in females who are older on average than males (Table ST7). However, in 2024 52% of primary total stemless shoulder replacements are undertaken in men. In 2024, 33.3% of total stemless shoulder replacements are cementless, 66.3% are hybrid (glenoid cemented) and 0.3% are cemented.

XLPE is more common in 2024 for total stemless anatomic replacement glenoid components (57.2%), compared to 42.8% for non XLPE.

Osteoarthritis is the most common primary diagnosis.

The most used total stemless anatomic prostheses are listed in Table ST8 and Table ST9.

**Table ST7 Age and Gender of Primary Total Stemless Anatomic Shoulder Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 2955 | 49.9% | 31 | 95 | 65 | 64.1 | 9.4 |
| Female | 2961 | 50.1% | 32 | 94 | 69 | 68.6 | 8.4 |
| **TOTAL** | **5916** | **100.0%** | **31** | **95** | **67** | **66.3** | **9.2** |

# Primary Total Shoulder Replacement

**Table ST8 Most Used Humeral Stem Prostheses in Primary Total Stemless Anatomic Shoulder Replacement**

| 2011 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 2 | Simpliciti | 378 | Affinis | 400 | Affinis | 467 | Affinis | 481 | Affinis |
| 2 | TESS | 202 | Simpliciti | 216 | Simpliciti | 266 | Simpliciti | 284 | Simpliciti |
| 1 | Affinis | 58 | Comprehensive | 48 | Comprehensive | 72 | Global Icon | 66 | Comprehensive |
| | | 21 | Global Icon | 37 | Global Icon | 50 | Comprehensive | 53 | Global Icon |
| | | 6 | Equinoxe | 19 | Equinoxe | 25 | Equinoxe | 43 | Equinoxe |
| | | 6 | SMR | 6 | SMR | 4 | SMR | 2 | SMR |
| **Most Used** | | | | | | | | | |
| 5 | (3) 100.0% | 671 | (6) 100.0% | 726 | (6) 100.0% | 884 | (6) 100.0% | 929 | (6) 100.0% |

**Table ST9 Most Used Glenoid Prostheses in Primary Total Stemless Anatomic Shoulder Replacement**

| 2011 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 2 | Aequalis | 349 | Affinis | 365 | Affinis | 435 | Affinis | 441 | Affinis |
| 1 | Affinis | 202 | Perform | 216 | Perform | 266 | Perform | 287 | Perform |
| 1 | Comprehensive | 51 | Comprehensive | 72 | Global | 104 | Global | 89 | Global |
| 1 | TESS | 50 | Global | 37 | Comprehensive | 36 | Comprehensive | 44 | Comprehensive |
| | | 6 | Alliance | 19 | Equinoxe | 25 | Equinoxe | 43 | Equinoxe |
| | | 6 | Equinoxe | 11 | Alliance | 14 | Alliance | 22 | Alliance |
| | | 4 | SMR | 4 | SMR L1 | 2 | SMR | 3 | SMR |
| | | 2 | SMR L1 | 2 | SMR | 2 | SMR L1 | | |
| | | 1 | Custom Made (Comprehensive) | | | | | | |
| **Most Used** | | | | | | | | | |
| 5 | (4) 100.0% | 671 | (9) 100.0% | 726 | (8) 100.0% | 884 | (8) 100.0% | 929 | (7) 100.0% |

## OUTCOME FOR ALL DIAGNOSES

### Primary Diagnosis

The usage and availability of prostheses change with time, reflecting design change and surgeon preference. In order to keep Registry data contemporaneous, only procedures utilising prostheses that have been available and used in 2024 (described as modern prostheses) are included in the analyses, unless clearly specified.

At 10 years, the cumulative percent revision for primary total stemless anatomic shoulder replacement undertaken for osteoarthritis is 5.2%.

The most common diagnosis for primary total stemless shoulder replacement is osteoarthritis. There is no difference in the rate of revision when osteonecrosis is compared to osteoarthritis. The number of procedures undertaken for other diagnoses is small (Table ST10).

### Reason for Revision

The main reasons for revision are instability/dislocation, rotator cuff insufficiency, loosening and infection (Table ST11 and Figure ST8). Males have a higher cumulative incidence of rotator cuff insufficiency after 7 years, whereas females have a higher cumulative incidence of instability/dislocation. Compared to 2016, instability/dislocation has increased by 37.9%, and loosening by 16.7%, while infection decreased by 27.3%, and rotator cuff insufficiency reduced by 18.2%.

### Type of Revision

The most common types of revision involve replacement of both the humeral and glenoid components (Table ST12). Overall, 89.7% of total stemless anatomic shoulder replacements are revised to a total reverse shoulder replacement. A humeral/glenoid 1st revision has increased in proportion by 3.0% and humeral alone revisions have reduced in proportion by 9.1% since 2016.

### Prosthesis Types

The outcomes of humeral stem and glenoid prosthesis combinations with >30 procedures used in primary total stemless anatomic shoulder replacement are listed in Table ST13.

# Primary Total Shoulder Replacement

**Table ST10 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement by Primary Diagnosis**

| Primary Diagnosis | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | 161 | 5318 | 1.5 (1.2, 1.9) | 3.3 (2.8, 3.9) | 4.0 (3.4, 4.7) | 4.4 (3.7, 5.2) | 5.2 (4.1, 6.5) | |
| Osteonecrosis | 6 | 97 | 1.1 (0.2, 7.6) | 5.3 (2.0, 13.7) | 10.0 (4.4, 21.6) | 10.0 (4.4, 21.6) | | |
| Other (5) | 5 | 132 | 4.0 (1.7, 9.4) | 4.0 (1.7, 9.4) | 4.0 (1.7, 9.4) | | | |
| TOTAL | 172 | 5547 | | | | | | |

Note: Restricted to modern prostheses
Only primary diagnoses with >50 procedures have been listed
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Table ST11 Primary Total Stemless Anatomic Shoulder Replacement by Reason for Revision (All Diagnoses)**

| Reason for Revision | Number | Percent |
|---|---|---|
| Instability/Dislocation | 60 | 34.9 |
| Rotator Cuff Insufficiency | 44 | 25.6 |
| Loosening | 28 | 16.3 |
| Infection | 24 | 14.0 |
| Pain | 6 | 3.5 |
| Fracture | 3 | 1.7 |
| Lysis | 2 | 1.2 |
| Arthrofibrosis | 2 | 1.2 |
| Malposition | 2 | 1.2 |
| Other | 1 | 0.6 |
| TOTAL | 172 | 100.0 |

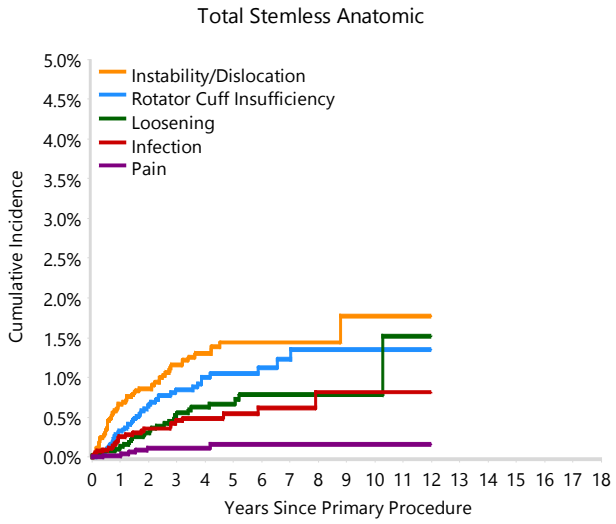
Note: Restricted to modern prostheses

**Table ST12 Primary Total Stemless Anatomic Shoulder Replacement by Type of Revision (All Diagnoses)**

| Type of Revision | Number | Percent |
|---|---|---|
| Humeral/Glenoid | 138 | 80.2 |
| Cement Spacer | 12 | 7.0 |
| Head Only | 11 | 6.4 |
| Humeral Component | 7 | 4.1 |
| Removal of Prostheses | 2 | 1.2 |
| Cement Only | 1 | 0.6 |
| Reoperation | 1 | 0.6 |
| TOTAL | 172 | 100.0 |

Note: Restricted to modern prostheses

**Figure ST8 Cumulative Incidence Revision Diagnosis of Primary Total Stemless Anatomic Shoulder Replacement (All Diagnoses)**




Note: Restricted to modern prostheses

**Table ST13 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement by Prosthesis Combination**

| Humeral Stem | Glenoid | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Affinis | Affinis | 114 | 3253 | 1.6 (1.2, 2.1) | 3.6 (3.0, 4.4) | 4.3 (3.5, 5.2) | 4.6 (3.8, 5.5) | 5.3 (4.2, 6.7) | |
| | Global | 1 | 184 | 0.6 (0.1, 4.2) | 0.6 (0.1, 4.2) | | | | |
| Comprehensive | Alliance | 0 | 53 | 0.0 (0.0, 0.0) | | | | | |
| | Comprehensive | 24 | 321 | 4.9 (3.0, 8.0) | 7.5 (4.9, 11.4) | 9.5 (6.3, 14.1) | | | |
| Equinoxe | Equinoxe | 2 | 95 | 0.0 (0.0, 0.0) | | | | | |
| Global Icon | Global | 3 | 226 | 1.1 (0.3, 4.2) | 2.1 (0.6, 6.8) | | | | |
| SMR | SMR | 6 | 59 | 3.5 (0.9, 13.2) | 8.9 (3.8, 20.0) | 8.9 (3.8, 20.0) | 13.4 (5.7, 29.8) | | |
| Simpliciti | Perform | 22 | 1350 | 0.9 (0.5, 1.6) | 1.7 (1.0, 2.7) | 2.6 (1.6, 4.2) | | | |
| Other (3) | | 0 | 6 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | | |
| TOTAL | | 172 | 5547 | | | | | | |

Note: Restricted to modern prostheses. Only prostheses with >30 procedures have been listed

## OUTCOME FOR OSTEOARTHRITIS – PATIENT CHARACTERISTICS

There are 5,318 (95.9%) primary total stemless anatomic shoulder replacement procedures with a primary diagnosis of osteoarthritis.

The cumulative percent revision of primary total stemless anatomic shoulder replacement for osteoarthritis at 10 years is 5.2% (Table ST14).

The main reasons for revision are instability/dislocation (34.2%), rotator cuff insufficiency (25.5%), loosening (17.4%) and infection (14.3%) (Table ST15 and Figure ST9). The most common types of revision involve replacement of both the humeral and glenoid component with 93.8% being revised to a total stemmed reverse shoulder replacement (Table ST16).

### Age and Gender

Females have a higher rate of revision for total stemless anatomic shoulder replacement compared to males (Table ST17 and Figure ST10). Males are more commonly revised for rotator cuff insufficiency after 7 years and females for instability/dislocation (Figure ST11).

Age alone is not a risk factor for revision (Table ST17). When gender is stratified by age, younger males have higher rates of revision compared males aged 65-74 years (Table ST17 and Figure ST12). There is no difference in the risk of revision risk for females.

> The rate of revision is higher for females compared to males for osteoarthritis.

### ASA and BMI

Most patients have an ASA score of 2 or 3. The cumulative percent revision at 7 years is 4.1% for ASA 2 patients and 5.3% for ASA 3 patients (Table ST18). ASA score is not a risk factor for revision.

The most common BMI categories are pre-obese and obese class 1. BMI is not a risk factor for revision (Table ST19). However, when BMI is stratified by gender, obese females have a higher rate of revision than obese males (Table ST20 and Figure ST13).

### Glenoid Morphology

Glenoid morphology is not a risk factor for revision (Table ST21).

**Table ST14 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement (Primary Diagnosis OA)**

| Shoulder Class | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Total Stemless Anatomic | 161 | 5318 | 1.5 (1.2, 1.9) | 3.3 (2.8, 3.9) | 4.0 (3.4, 4.7) | 4.4 (3.7, 5.2) | 5.2 (4.1, 6.5) | |
| TOTAL | 161 | 5318 | | | | | | |

Note: Restricted to modern prostheses

# Primary Total Shoulder Replacement

**Table ST15 Primary Total Stemless Anatomic Shoulder Replacement by Reason for Revision (Primary Diagnosis OA)**

| Reason for Revision | Number | Percent |
|---|---|---|
| Instability/Dislocation | 55 | 34.2 |
| Rotator Cuff Insufficiency | 41 | 25.5 |
| Loosening | 28 | 17.4 |
| Infection | 23 | 14.3 |
| Pain | 5 | 3.1 |
| Fracture | 3 | 1.9 |
| Lysis | 2 | 1.2 |
| Arthrofibrosis | 2 | 1.2 |
| Malposition | 2 | 1.2 |
| TOTAL | 161 | 100.0 |

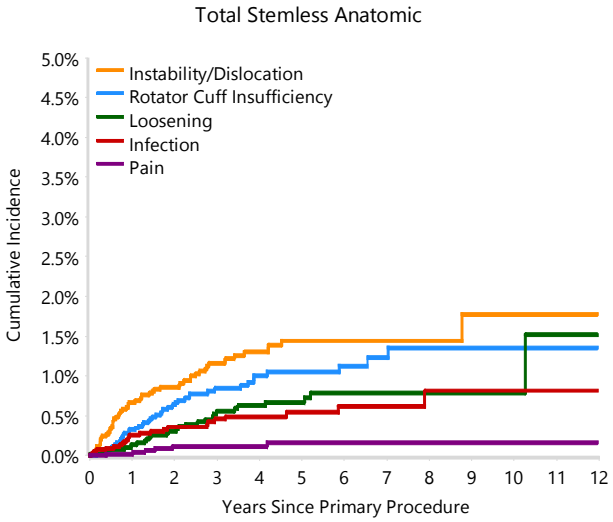
Note: Restricted to modern prostheses

**Table ST16 Primary Total Stemless Anatomic Shoulder Replacement by Type of Revision (Primary Diagnosis OA)**

| Type of Revision | Number | Percent |
|---|---|---|
| Humeral/Glenoid | 130 | 80.7 |
| Head Only | 11 | 6.8 |
| Cement Spacer | 11 | 6.8 |
| Humeral Component | 7 | 4.3 |
| Cement Only | 1 | 0.6 |
| Removal of Prostheses | 1 | 0.6 |
| TOTAL | 161 | 100.0 |

Note: Restricted to modern prostheses

**Figure ST9 Cumulative Incidence Revision Diagnosis of Primary Total Stemless Anatomic Shoulder Replacement (Primary Diagnosis OA)**



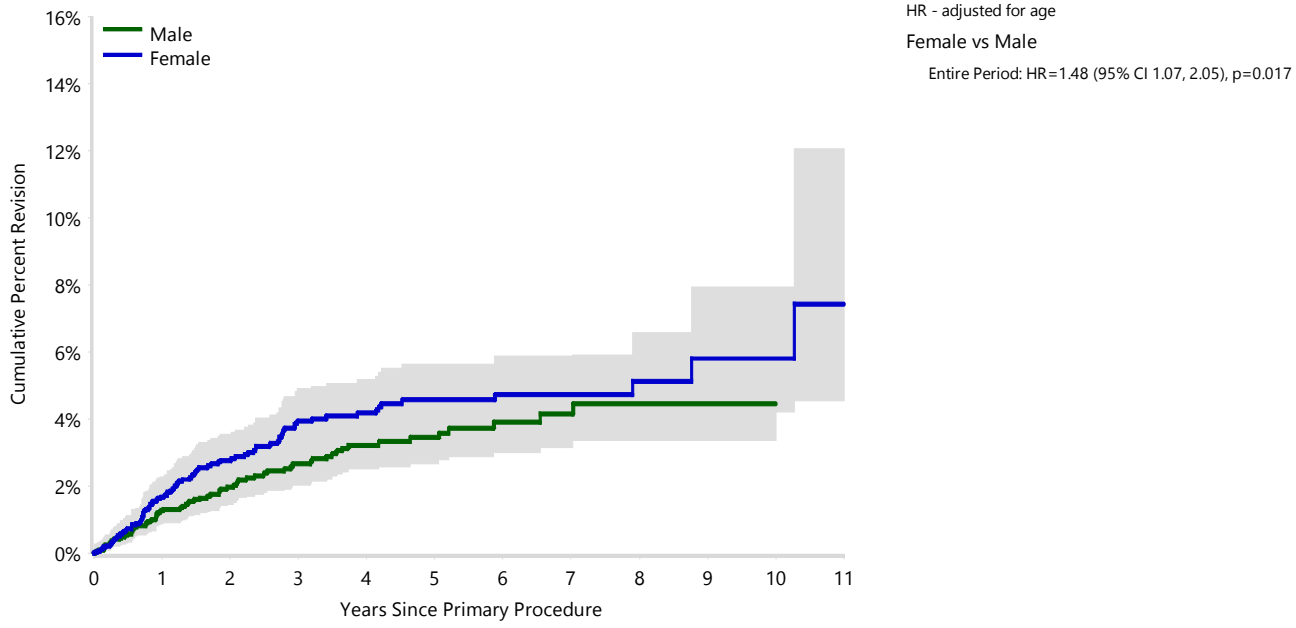

Note: Restricted to modern prostheses

**Table ST17 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement by Age and Gender (Primary Diagnosis OA)**

| Gender | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| **Male** | | **70** | **2699** | **1.3 (0.9, 1.8)** | **2.7 (2.0, 3.5)** | **3.4 (2.7, 4.4)** | **4.2 (3.2, 5.4)** | **4.5 (3.4, 5.9)** | |
| | <65 | 41 | 1322 | 1.4 (0.8, 2.2) | 3.2 (2.2, 4.6) | 4.4 (3.2, 6.1) | 5.6 (3.9, 8.0) | | |
| | ≥65 | 29 | 1377 | 1.2 (0.7, 2.0) | 2.2 (1.5, 3.2) | 2.6 (1.7, 3.8) | 2.8 (1.9, 4.2) | | |
| **Female** | | **91** | **2619** | **1.7 (1.2, 2.3)** | **3.9 (3.2, 4.9)** | **4.6 (3.7, 5.7)** | **4.7 (3.8, 5.9)** | **5.8 (4.2, 8.0)** | |
| | <65 | 28 | 733 | 1.6 (0.8, 2.9) | 4.8 (3.2, 7.1) | 5.5 (3.8, 8.1) | 5.5 (3.8, 8.1) | | |
| | ≥65 | 63 | 1886 | 1.7 (1.2, 2.5) | 3.6 (2.8, 4.7) | 4.2 (3.3, 5.5) | 4.4 (3.4, 5.8) | 5.3 (3.6, 7.7) | |
| TOTAL | | **161** | **5318** | | | | | | |

Note: Restricted to modern prostheses
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Figure ST10 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement by Gender (Primary Diagnosis OA)**

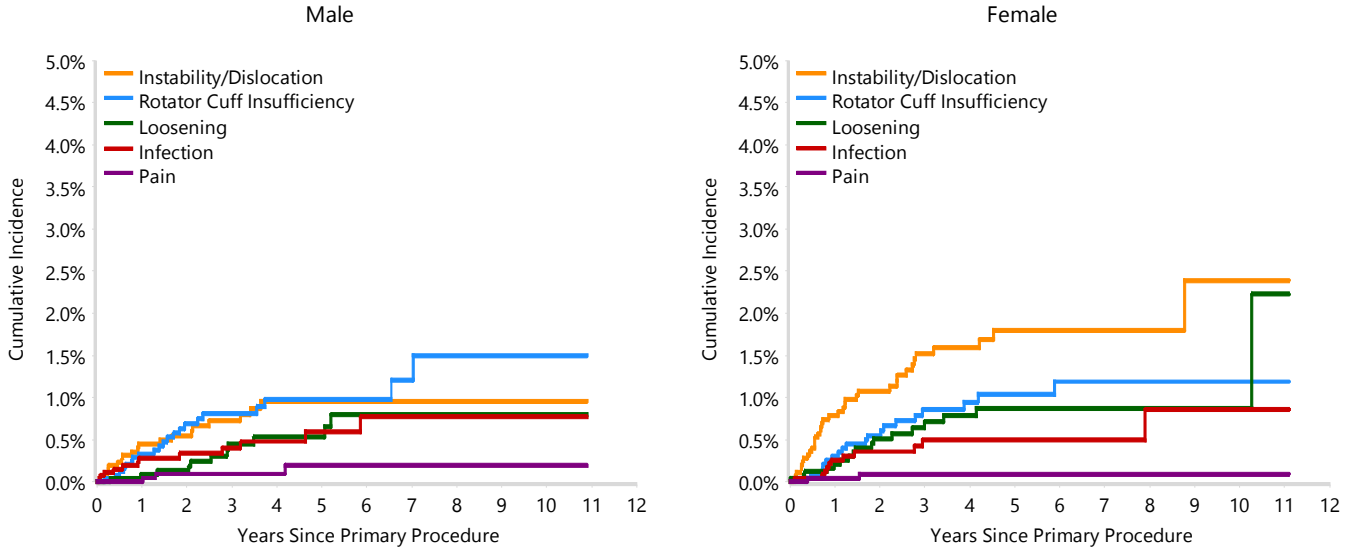



| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| **Male** | 2699 | 2201 | 1367 | 722 | 314 | 49 | 0 |
| **Female** | 2619 | 2144 | 1375 | 806 | 377 | 67 | 0 |

Note: Restricted to modern prostheses

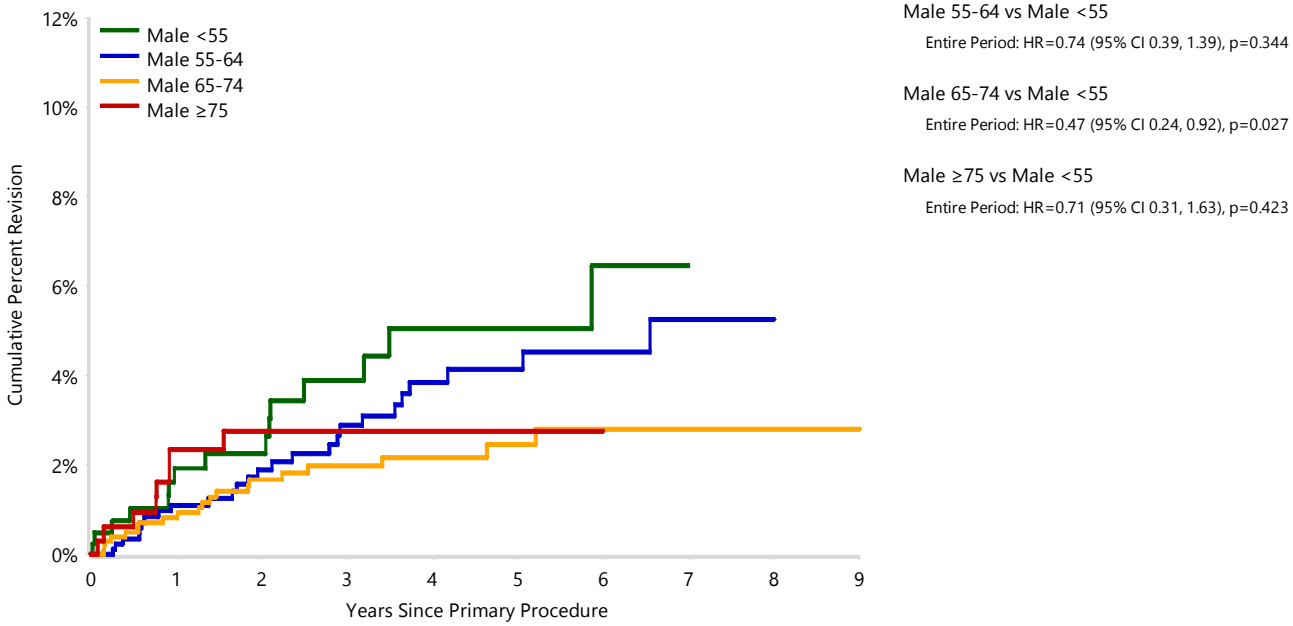
# Primary Total Shoulder Replacement

**Figure ST11 Cumulative Incidence Revision Diagnosis of Primary Total Stemless Anatomic Shoulder Replacement by Gender (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

**Figure ST12 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement in Males by Age (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| **Male** | **<55** | 412 | 321 | 185 | 90 | 45 | 5 | 0 |
| | **55-64** | 910 | 734 | 464 | 250 | 104 | 15 | 0 |
| | **65-74** | 1044 | 881 | 556 | 302 | 132 | 22 | 0 |
| | **≥75** | 333 | 265 | 162 | 80 | 33 | 7 | 0 |

Note: Restricted to modern prostheses

**Table ST18 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement by ASA Score (Primary Diagnosis OA)**

| ASA Score | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|
| ASA 1 | 8 | 361 | 0.9 (0.3, 2.8) | 1.6 (0.7, 3.8) | 2.4 (1.1, 5.0) | 2.9 (1.4, 5.7) | 2.9 (1.4, 5.7) | |
| ASA 2 | 70 | 2600 | 1.2 (0.8, 1.7) | 2.3 (1.7, 3.0) | 3.0 (2.3, 3.9) | 3.8 (2.9, 4.8) | 4.1 (3.2, 5.3) | 4.1 (3.2, 5.3) |
| ASA 3 | 79 | 2201 | 1.9 (1.4, 2.6) | 2.7 (2.0, 3.5) | 3.9 (3.1, 5.0) | 4.7 (3.7, 6.0) | 5.3 (4.2, 6.8) | 6.3 (4.7, 8.6) |
| ASA 4 | 2 | 56 | 3.8 (1.0, 14.5) | 3.8 (1.0, 14.5) | 3.8 (1.0, 14.5) | 3.8 (1.0, 14.5) | | |
| TOTAL | 159 | 5218 | | | | | | |

Note: Restricted to modern prostheses
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Table ST19 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement by BMI Category (Primary Diagnosis OA)**

| BMI Category | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|---|
| Underweight | 0 | 16 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) |
| Normal | 19 | 697 | 1.1 (0.5, 2.3) | 2.6 (1.6, 4.3) | 3.1 (1.9, 5.0) | 3.1 (1.9, 5.0) | 3.5 (2.2, 5.6) | 3.5 (2.2, 5.6) |
| Pre Obese | 45 | 1758 | 1.1 (0.7, 1.8) | 1.8 (1.3, 2.7) | 2.9 (2.1, 4.0) | 3.4 (2.5, 4.6) | 3.7 (2.7, 5.0) | 4.0 (2.9, 5.5) |
| Obese Class 1 | 51 | 1487 | 1.6 (1.0, 2.4) | 2.7 (2.0, 3.8) | 3.7 (2.7, 5.0) | 4.3 (3.2, 5.8) | 4.7 (3.5, 6.3) | 5.3 (3.9, 7.2) |
| Obese Class 2 | 27 | 715 | 2.6 (1.6, 4.1) | 3.4 (2.2, 5.1) | 4.3 (2.9, 6.4) | 4.3 (2.9, 6.4) | 4.7 (3.2, 7.0) | 5.2 (3.5, 7.8) |
| Obese Class 3 | 9 | 365 | 1.5 (0.6, 3.6) | 1.5 (0.6, 3.6) | 2.9 (1.4, 5.9) | 3.5 (1.8, 6.8) | 3.5 (1.8, 6.8) | 3.5 (1.8, 6.8) |
| TOTAL | 151 | 5038 | | | | | | |

Note: Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

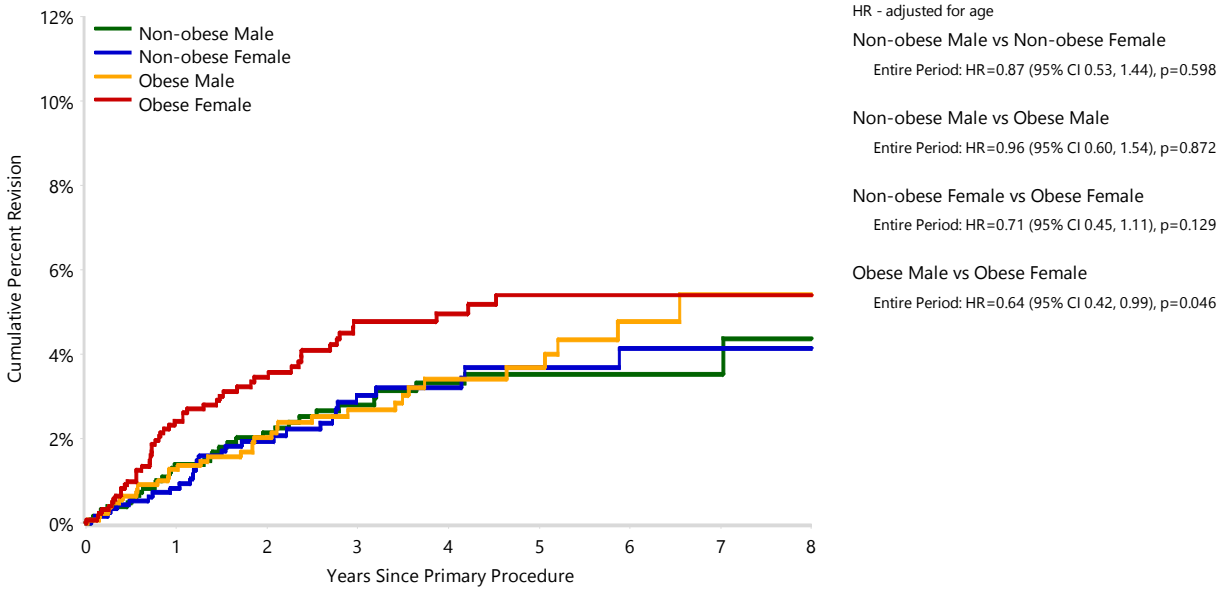
# Primary Total Shoulder Replacement

**Table ST20 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement by BMI Category and Gender (Primary Diagnosis OA)**

| BMI Category | Gender | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Non-obese | Male | 33 | 1281 | 1.4 (0.9, 2.3) | 2.1 (1.4, 3.2) | 2.8 (1.9, 4.1) | 3.3 (2.3, 4.7) | 3.5 (2.5, 5.0) | 3.5 (2.5, 5.0) |
| | Female | 31 | 1190 | 0.8 (0.4, 1.6) | 1.9 (1.2, 3.0) | 3.0 (2.1, 4.5) | 3.2 (2.2, 4.7) | 3.7 (2.5, 5.4) | 4.1 (2.8, 6.1) |
| Obese | Male | 36 | 1298 | 1.3 (0.8, 2.1) | 2.0 (1.3, 3.1) | 2.7 (1.8, 3.9) | 3.4 (2.4, 4.9) | 3.7 (2.6, 5.3) | 4.8 (3.3, 7.0) |
| | Female | 51 | 1269 | 2.4 (1.7, 3.5) | 3.5 (2.5, 4.7) | 4.8 (3.6, 6.3) | 5.0 (3.7, 6.6) | 5.4 (4.1, 7.1) | 5.4 (4.1, 7.1) |
| TOTAL | | 151 | 5038 | | | | | | |

Note: Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years
Non-obese group includes underweight, normal and pre-obese
Obese group includes obese class 1, 2 and 3

**Figure ST13 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement by BMI Category and Gender (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|---|
| Non-obese | Male | 1281 | 1034 | 809 | 638 | 477 | 312 | 204 |
| | Female | 1190 | 953 | 736 | 570 | 435 | 314 | 203 |
| Obese | Male | 1298 | 1050 | 831 | 620 | 453 | 313 | 204 |
| | Female | 1269 | 1038 | 822 | 662 | 504 | 365 | 239 |

Note: Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years
Non-obese group includes underweight, normal and pre-obese
Obese group includes obese class 1, 2 and 3

**Table ST21 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement by Glenoid Morphology (Primary Diagnosis OA)**

| Glenoid Morphology | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|
| A1 | 43 | 1665 | 1.2 (0.8, 1.9) | 1.9 (1.3, 2.8) | 3.0 (2.1, 4.2) | 3.3 (2.4, 4.7) | 4.2 (3.0, 5.8) |
| A2 | 29 | 820 | 2.2 (1.4, 3.6) | 3.0 (2.0, 4.6) | 4.1 (2.8, 5.9) | 4.4 (3.0, 6.3) | 4.7 (3.2, 6.9) |
| B1 | 23 | 945 | 1.3 (0.7, 2.3) | 2.1 (1.3, 3.4) | 3.0 (2.0, 4.6) | 3.3 (2.2, 5.0) | 3.3 (2.2, 5.0) |
| B2 | 21 | 847 | 1.1 (0.5, 2.2) | 2.0 (1.1, 3.4) | 2.8 (1.7, 4.6) | 3.5 (2.2, 5.5) | 3.5 (2.2, 5.5) |
| C | 2 | 113 | 1.2 (0.2, 8.1) | 2.4 (0.6, 9.1) | 2.4 (0.6, 9.1) | | |
| **TOTAL** | **118** | **4390** | | | | | |

Note: Restricted to modern prostheses
Excludes 17 procedures where a glenoid morphology of B3 was recorded
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

# Primary Total Shoulder Replacement

## OUTCOME FOR OSTEOARTHRITIS – PROSTHESIS CHARACTERISTICS

### Fixation

The majority of primary total stemless anatomic shoulder replacement procedures utilise hybrid (cementless humeral component with a cemented glenoid) fixation. Cemented primary stemless anatomic prostheses have a higher revision rate than hybrid fixation procedures (Table ST22 and Figure ST14).

### Glenoid Types

There are four types of glenoids: all with polyethylene bearing surface but differing methods of fixation to bone. Non-modular metal back glenoids have a polyethylene bearing surface with backside integrated metallic coating. Hybrid metal/polyethylene glenoids have a polyethylene bearing surface and one or more metallic fixation pegs. Cemented polyethylene glenoids with a modified central peg are all polyethylene but the central peg is further engineered for additional fixation to bone. All polyethylene glenoids are polyethylene fixed by cemented pegs or keels alone without further fixation features.

Cemented all polyethylene glenoids are the most common type of glenoid used (Table ST23). Non modular metal backed glenoids have a higher risk of revision than both cemented all polyethylene glenoids and modified central peg glenoids (Figure ST15).

### Bearing Surface

There is no difference in the rate of revision when ceramic/non XLPE, ceramic/XLPE, metal/XLPE and metal/non XLPE bearing surfaces (humeral head/glenoid) are compared (Table ST24).

### Humeral Heads

Humeral head size is not a risk factor for revision of primary total stemless anatomic shoulder replacement (Table ST25).

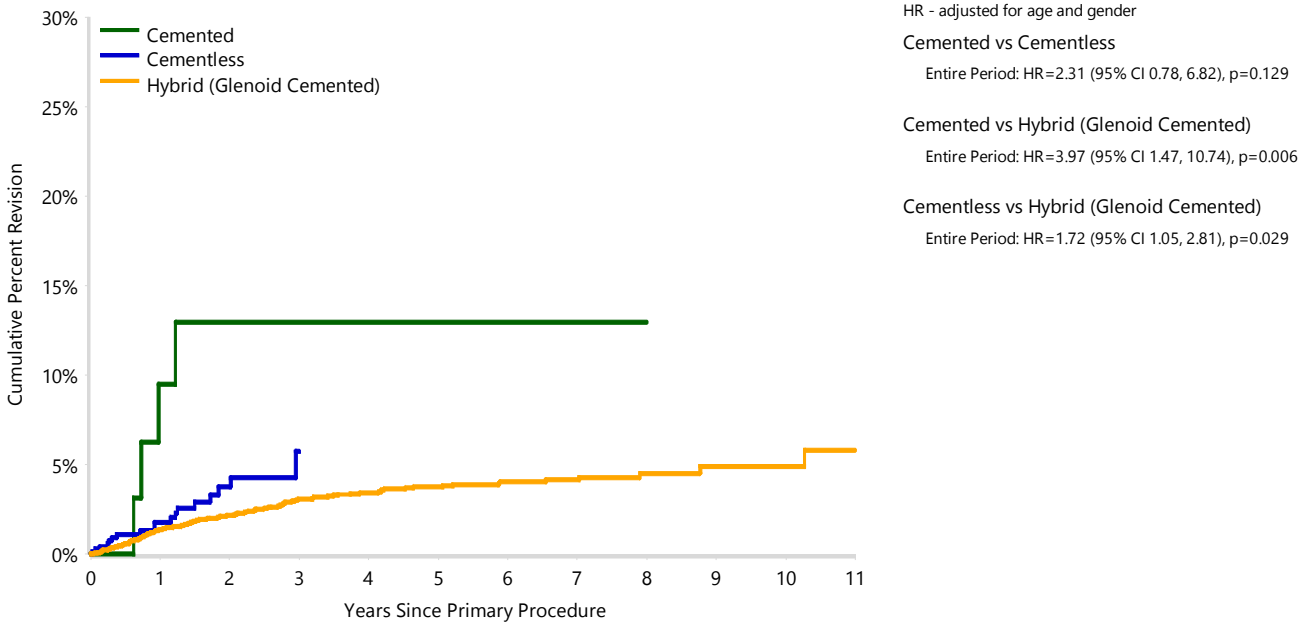
Humeral head size is not a risk factor for revision of primary total stemless anatomic shoulder replacement.

**Table ST22 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement by Fixation (Primary Diagnosis OA)**

| Fixation | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cemented | 4 | 34 | 9.5 (3.2, 26.6) | 13.0 (5.1, 31.0) | 13.0 (5.1, 31.0) | 13.0 (5.1, 31.0) | | |
| Cementless | 19 | 708 | 1.8 (1.0, 3.3) | 5.7 (3.1, 10.6) | | | | |
| Hybrid (Glenoid Cemented) | 138 | 4576 | 1.4 (1.1, 1.8) | 3.1 (2.5, 3.7) | 3.7 (3.1, 4.4) | 4.2 (3.5, 5.0) | 4.9 (3.9, 6.3) | |
| TOTAL | 161 | 5318 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST14 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement by Fixation (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Cemented | 34 | 28 | 19 | 10 | 7 | 0 | 0 |
| Cementless | 708 | 407 | 64 | 0 | 0 | 0 | 0 |
| Hybrid (Glenoid Cemented) | 4576 | 3910 | 2659 | 1518 | 684 | 116 | 0 |

Note: Restricted to modern prostheses

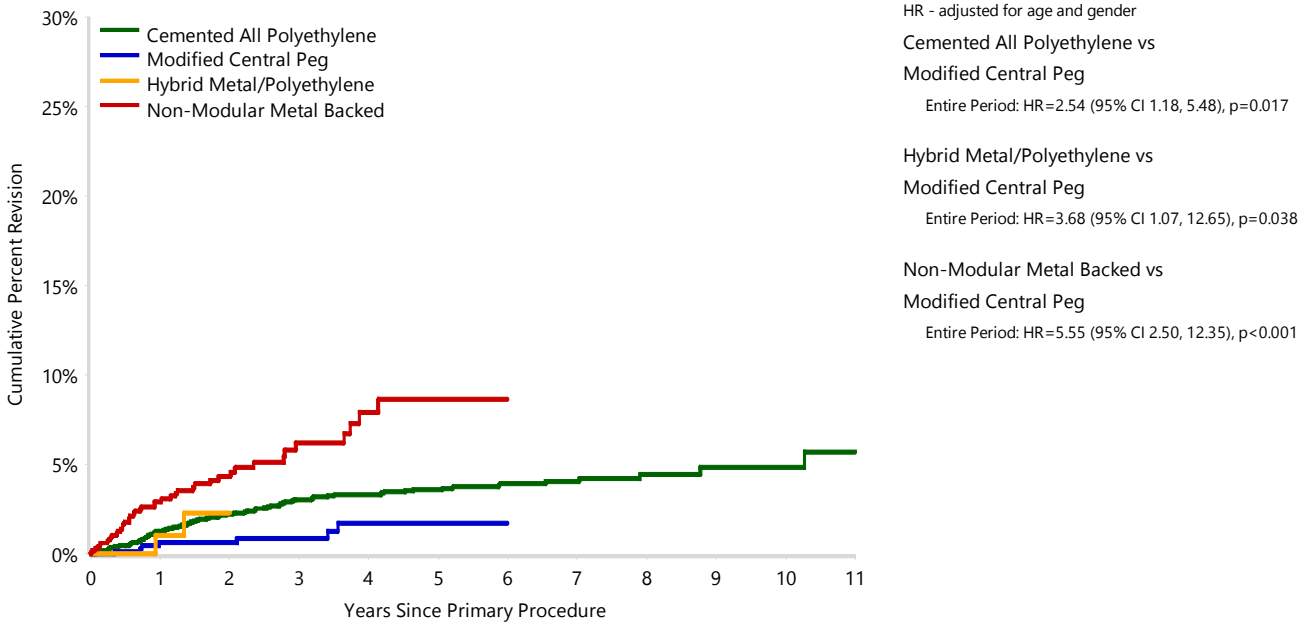
# Primary Total Shoulder Replacement

**Table ST23 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement by Glenoid Type (Primary Diagnosis OA)**

| Glenoid Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cemented All Polyethylene | 107 | 3367 | 1.3 (0.9, 1.7) | 3.0 (2.5, 3.8) | 3.6 (2.9, 4.4) | 4.1 (3.3, 5.0) | 4.8 (3.7, 6.2) | |
| Modified Central Peg | 7 | 782 | 0.6 (0.2, 1.7) | 0.9 (0.4, 2.1) | 1.7 (0.8, 3.9) | | | |
| Hybrid Metal/Polyethylene | 4 | 154 | 1.0 (0.1, 7.1) | | | | | |
| Non-Modular Metal Backed | 43 | 1015 | 2.9 (2.0, 4.3) | 6.2 (4.4, 8.7) | 8.6 (6.0, 12.4) | | | |
| TOTAL | 161 | 5318 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST15 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement by Glenoid Type (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Cemented All Polyethylene | 3367 | 3005 | 2206 | 1322 | 661 | 116 | 0 |
| Modified Central Peg | 782 | 587 | 272 | 105 | 3 | 0 | 0 |
| Hybrid Metal/Polyethylene | 154 | 93 | 25 | 3 | 0 | 0 | 0 |
| Non-Modular Metal Backed | 1015 | 660 | 239 | 98 | 27 | 0 | 0 |

Note: Restricted to modern prostheses

**Table ST24 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement by Bearing Surface (Primary Diagnosis OA)**

| Bearing Surface | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Ceramic/Non XLPE | 27 | 523 | 1.2 (0.5, 2.5) | 3.7 (2.4, 5.7) | 4.5 (3.0, 6.6) | 5.1 (3.5, 7.4) | 5.1 (3.5, 7.4) | |
| Ceramic/XLPE | 80 | 2759 | 1.5 (1.1, 2.0) | 3.3 (2.6, 4.2) | 3.8 (3.1, 4.8) | 3.8 (3.1, 4.8) | | |
| Metal/Non XLPE | 48 | 1776 | 1.6 (1.1, 2.4) | 3.1 (2.3, 4.3) | 4.2 (3.1, 5.7) | 4.6 (3.3, 6.3) | | |
| Metal/XLPE | 6 | 260 | 1.3 (0.4, 4.1) | 2.7 (1.1, 6.4) | 2.7 (1.1, 6.4) | | | |
| TOTAL | 161 | 5318 | | | | | | |

Note: Restricted to modern prostheses. Reported as humeral head/glenoid
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Table ST25 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement by Humeral Head Size (Primary Diagnosis OA)**

| Humeral Head Size | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| <44mm | 62 | 1655 | 1.7 (1.2, 2.5) | 4.4 (3.4, 5.7) | 4.6 (3.6, 6.0) | 4.9 (3.7, 6.3) | 6.2 (4.3, 9.1) | |
| 44-50mm | 70 | 2688 | 1.3 (0.9, 1.8) | 2.8 (2.2, 3.6) | 3.6 (2.8, 4.6) | 3.8 (3.0, 4.9) | 4.1 (3.2, 5.4) | |
| >50mm | 29 | 970 | 1.5 (0.9, 2.6) | 2.9 (1.9, 4.4) | 4.2 (2.8, 6.3) | 5.5 (3.5, 8.6) | | |
| TOTAL | 161 | 5313 | | | | | | |

Note: Restricted to modern prostheses
Excludes 5 procedures with unknown head size
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

## IMPLANT SIZING VARIATIONS (ISV)

ISV are modifications to a prosthesis design range beyond simple size change.

### Glenoid Augmentation

A glenoid component is categorised as augmented if the backside has been modified for glenoid deformity (e.g. wedged, stepped, angulated, or lateralised). Augmented glenoids are not a revision risk factor (Table ST26). When stratified by glenoid morphology there continued to be no difference in revision rates between augmented and non-augmented glenoids (Table ST27).

**Table ST26 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement by Glenoid Augmentation (Primary Diagnosis OA, Excluding Modular Metal Backed Glenoids)**

| Glenoid Augmentation | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Augmented | 2 | 163 | 0.0 (0.0, 0.0) | 1.9 (0.5, 7.6) | | | | |
| Non-augmented | 159 | 5141 | 1.5 (1.2, 1.9) | 3.3 (2.8, 4.0) | 4.0 (3.4, 4.8) | 4.5 (3.8, 5.3) | 5.2 (4.2, 6.5) | |
| TOTAL | 161 | 5304 | | | | | | |

Note: Excludes 941 procedures with unknown glenoid augmentation or glenoid morphology. Restricted to modern prostheses. Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Table ST27 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement by Glenoid Morphology and Glenoid Augmentation (Primary Diagnosis OA, Excluding Modular Metal Backed Glenoids)**

| Glenoid Morphology | Glenoid Augmentation | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|---|
| A | Augmented | 0 | 10 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | |
| | Non-augmented | 72 | 2469 | 1.6 (1.1, 2.2) | 2.3 (1.7, 3.0) | 3.4 (2.6, 4.3) | 3.7 (2.9, 4.7) | 4.4 (3.4, 5.6) |
| B | Augmented | 2 | 129 | 0.0 (0.0, 0.0) | 1.1 (0.2, 7.4) | 2.5 (0.6, 9.7) | | |
| | Non-augmented | 42 | 1658 | 1.3 (0.8, 2.0) | 2.1 (1.5, 3.0) | 3.0 (2.1, 4.1) | 3.4 (2.5, 4.7) | 3.4 (2.5, 4.7) |
| C | Augmented | 0 | 12 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | |
| | Non-augmented | 2 | 99 | 1.4 (0.2, 9.2) | 2.7 (0.7, 10.4) | 2.7 (0.7, 10.4) | 2.7 (0.7, 10.4) | 2.7 (0.7, 10.4) |
| TOTAL | | 118 | 4377 | | | | | |

Note: Excludes 941 procedures with unknown glenoid augmentation or glenoid morphology. Restricted to modern prostheses. Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

## SURGEON ASSISTIVE TOOLS

An image derived instrument (IDI) is defined as custom made pin guides or cutting blocks derived from CT or MRI images by 3D printing specifically for each patient. There are 1,643 total stemless anatomic shoulder replacements for osteoarthritis utilising an IDI since their first use in 2016. In 2024, IDI are used in 46.7% of all total stemless anatomic shoulder replacement procedures. There is no difference in the rate of revision when IDI is used compared to when IDI is not used (Table ST28).

When stratified by glenoid morphology, the use of an IDI increases the rate of revision for glenoid morphology class A. There is no difference in revision rates for glenoid morphology class B. There are insufficient numbers to analyse IDI usage in glenoid morphology class C (Table ST29, Table ST30, Figure ST16 and Table ST31).

**Table ST28 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement Since 2016 by IDI Usage (Primary Diagnosis OA)**

| IDI Use | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|
| IDI Used | 51 | 1734 | 1.9 (1.3, 2.7) | 3.0 (2.2, 4.1) | 4.3 (3.3, 5.8) | 4.3 (3.3, 5.8) | |
| Traditional Instrumentation | 95 | 3331 | 1.3 (0.9, 1.7) | 2.0 (1.5, 2.6) | 2.7 (2.2, 3.4) | 3.6 (2.9, 4.4) | 4.2 (3.3, 5.2) |
| TOTAL | 146 | 5065 | | | | | |

Note: Restricted to modern prostheses
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Table ST29 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement Since 2016 by IDI and Glenoid Morphology Usage (Primary Diagnosis OA)**

| IDI Use | Glenoid Morphology | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|---|
| IDI Used | | 49 | 1643 | 1.9 (1.3, 2.8) | 3.0 (2.2, 4.2) | 4.5 (3.3, 6.0) | 4.5 (3.3, 6.0) | |
| | A1 | 20 | 616 | 2.1 (1.2, 3.7) | 3.3 (2.0, 5.4) | 5.2 (3.2, 8.2) | 5.2 (3.2, 8.2) | |
| | A2 | 10 | 236 | 2.9 (1.3, 6.3) | 3.5 (1.7, 7.2) | 6.2 (3.3, 11.6) | | |
| | B1 | 8 | 371 | 1.3 (0.5, 3.3) | 2.5 (1.2, 5.3) | 3.2 (1.6, 6.4) | 3.2 (1.6, 6.4) | |
| | B2 | 10 | 382 | 1.6 (0.6, 3.7) | 2.8 (1.4, 5.5) | 3.7 (2.0, 6.8) | 3.7 (2.0, 6.8) | |
| | C | 1 | 38 | 4.5 (0.7, 28.1) | 4.5 (0.7, 28.1) | 4.5 (0.7, 28.1) | | |
| Traditional Instrumentation | | 69 | 2747 | 1.1 (0.8, 1.6) | 1.7 (1.3, 2.3) | 2.5 (1.9, 3.3) | 3.5 (2.7, 4.5) | 4.3 (3.3, 5.8) |
| | A1 | 23 | 1049 | 0.7 (0.3, 1.5) | 1.1 (0.6, 2.1) | 2.0 (1.2, 3.3) | 3.5 (2.2, 5.5) | 5.0 (2.9, 8.4) |
| | A2 | 19 | 584 | 2.0 (1.1, 3.6) | 2.9 (1.7, 4.7) | 3.4 (2.1, 5.4) | 4.2 (2.6, 6.7) | |
| | B1 | 15 | 574 | 1.3 (0.6, 2.7) | 1.9 (1.0, 3.6) | 3.0 (1.8, 5.0) | 3.3 (2.0, 5.5) | |
| | B2 | 11 | 465 | 0.7 (0.2, 2.2) | 1.3 (0.6, 3.2) | 2.1 (1.0, 4.5) | 3.1 (1.6, 6.1) | |
| | C | 1 | 75 | 0.0 (0.0, 0.0) | 1.6 (0.2, 10.9) | 1.6 (0.2, 10.9) | 1.6 (0.2, 10.9) | |
| TOTAL | | 118 | 4390 | | | | | |

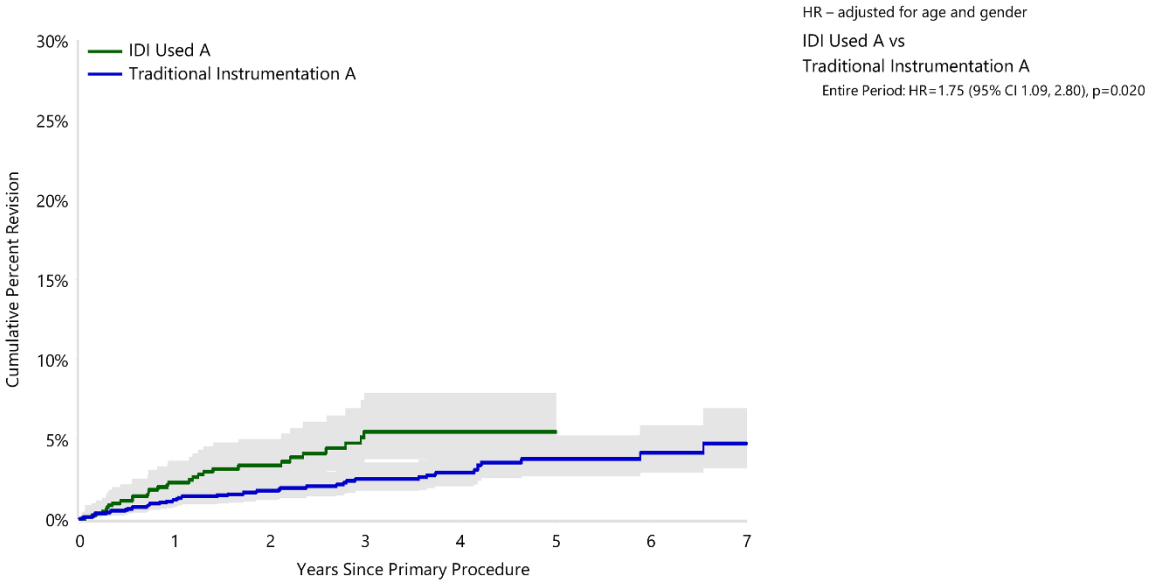
Note: Restricted to modern prostheses

**Table ST30 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement Since 2016 by IDI Usage and Glenoid Morphology (Primary Diagnosis OA)**

| IDI Use | Glenoid Morphology | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|---|
| IDI Used | A | 30 | 852 | 2.3 (1.4, 3.7) | 3.4 (2.2, 5.0) | 5.5 (3.7, 7.9) | 5.5 (3.7, 7.9) | |
| Traditional Instrumentation | A | 42 | 1633 | 1.2 (0.8, 1.9) | 1.7 (1.2, 2.6) | 2.5 (1.8, 3.5) | 3.8 (2.7, 5.2) | 4.7 (3.2, 6.9) |
| TOTAL | | 72 | 2485 | | | | | |

Note: Restricted to modern prostheses

**Figure ST16 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement Since 2016 by IDI Usage and Glenoid Morphology (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|
| IDI Used | A | 852 | 631 | 429 | 268 | 93 | 8 |
| Traditional Instrumentation | A | 1633 | 1355 | 1064 | 840 | 405 | 102 |

Note: Restricted to modern prostheses

**Table ST31 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement Since 2016 by IDI Usage and Glenoid Morphology (Primary Diagnosis OA)**

| IDI Use | Glenoid Morphology | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|---|
| IDI Used | B | 18 | 753 | 1.4 (0.7, 2.7) | 2.7 (1.6, 4.4) | 3.5 (2.2, 5.5) | 3.5 (2.2, 5.5) | |
| Traditional Instrumentation | B | 26 | 1039 | 1.0 (0.6, 1.9) | 1.7 (1.0, 2.8) | 2.6 (1.7, 4.0) | 3.2 (2.1, 4.8) | 3.9 (2.6, 6.0) |
| TOTAL | | 44 | 1792 | | | | | |

Note: Restricted to modern prostheses
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

## OPERATIVE TECHNIQUE

### Rotator Cuff Repair

A rotator cuff repair undertaken during the implantation of a primary total stemless anatomic shoulder replacement does not change the early rate of revision (Table ST32).

**Table ST32 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement by Rotator Cuff Repair (Primary Diagnosis OA)**

| Rotator Cuff Repair | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs |
|---|---|---|---|---|---|
| Yes | 11 | 607 | 1.6 (0.8, 3.4) | 2.4 (1.2, 4.8) | |
| No | 27 | 1418 | 1.4 (0.8, 2.3) | 2.3 (1.6, 3.5) | 3.6 (2.2, 5.7) |
| TOTAL | 38 | 2025 | | | |

Note: Restricted to modern prostheses

Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

## PROSTHESIS COMBINATIONS BY PRIMARY DIAGNOSIS

The outcome of the most used primary total stemless anatomic prosthesis combinations >30 procedures are listed in Table ST33

**Table ST33 Cumulative Percent Revision of Primary Total Stemless Anatomic Shoulder Replacement by Prosthesis Combination (Primary Diagnosis OA)**

| Humeral Stem | Glenoid | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|---|
| Affinis | Affinis | 106 | 3101 | 1.5 (1.1, 2.0) | 2.5 (2.0, 3.2) | 3.5 (2.9, 4.4) | 4.2 (3.4, 5.1) | 4.5 (3.7, 5.5) |
| | Global | 1 | 178 | 0.6 (0.1, 4.4) | 0.6 (0.1, 4.4) | 0.6 (0.1, 4.4) | | |
| Comprehensive | Alliance | 0 | 53 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | |
| | Comprehensive | 24 | 312 | 5.0 (3.1, 8.2) | 5.8 (3.7, 9.2) | 7.8 (5.1, 11.7) | 9.8 (6.6, 14.6) | |
| Equinoxe | Equinoxe | 2 | 86 | 0.0 (0.0, 0.0) | 2.7 (0.4, 17.7) | | | |
| Global Icon | Global | 3 | 219 | 1.1 (0.3, 4.3) | 1.1 (0.3, 4.3) | 2.2 (0.7, 7.1) | | |
| SMR | SMR | 5 | 57 | 3.6 (0.9, 13.5) | 5.4 (1.8, 15.8) | 7.2 (2.8, 18.2) | 7.2 (2.8, 18.2) | 11.9 (4.6, 28.8) |
| Simpliciti | Perform | 20 | 1306 | 0.8 (0.4, 1.6) | 1.4 (0.8, 2.3) | 1.7 (1.0, 2.7) | 2.3 (1.4, 3.7) | |
| Other (3) | | 0 | 6 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | |
| TOTAL | | 161 | 5318 | | | | | |

Note: Restricted to modern prostheses.

Only prostheses with >30 procedures have been listed

# Primary Total Shoulder Replacement

## Primary Total Stemmed Anatomic Shoulder Replacement

### DEMOGRAPHICS

There are 16,893 total stemmed anatomic shoulder replacement procedures. This is an additional 374 procedures compared to the previous report.

The majority of procedures are undertaken in females. However, the proportion of males has increased 0.3% since 2016. The mean age of females is older than males (Table ST34).

The majority of procedures are undertaken in the 65–74 year age group. The proportional use in patients aged ≥75 years has declined from 23.0% in 2022 to 19.4% in 2024.

**Hybrid fixation with a cemented glenoid has increased from 55.8% in 2010 to 87.5% in 2024.**

In 2024, non XLPE polyethylene is more commonly used (67.5%) in total stemmed anatomic replacement glenoids than XLPE (32.5%) (Figure ST17).

The most common type of fixation is hybrid fixation (cementless humerus and cemented glenoid) (Figure ST18).

The 10 most used humeral stem and glenoid prostheses are listed in Table ST35 and Table ST36.

**Table ST34 Age and Gender of Primary Total Stemmed Anatomic Shoulder Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 7284 | 43.1% | 21 | 93 | 67 | 66.6 | 9.0 |
| Female | 9609 | 56.9% | 19 | 96 | 71 | 70.2 | 8.5 |
| **TOTAL** | **16893** | **100.0%** | **19** | **96** | **69** | **68.6** | **8.9** |

**Figure ST17 Primary Total Stemmed Anatomic Shoulder Replacement by Polyethylene Type**

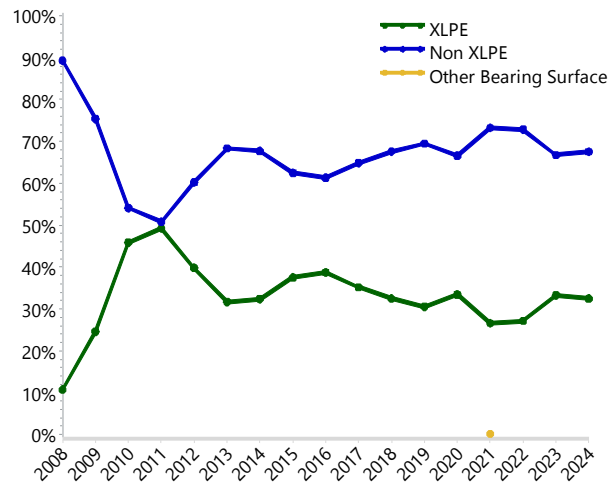



**Figure ST18 Primary Total Stemmed Anatomic Shoulder Replacement by Fixation**

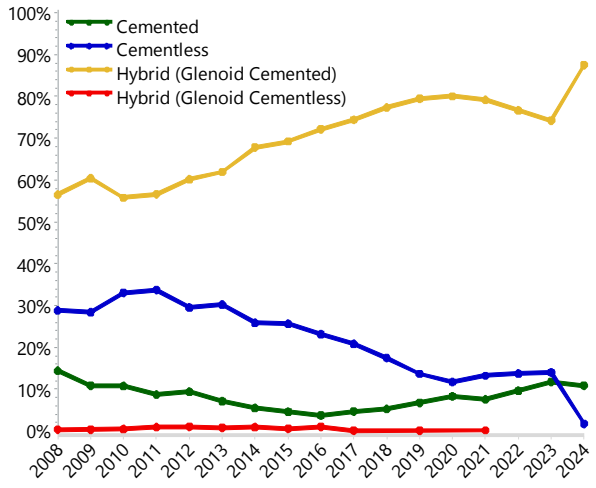


**Table ST35 Most Used Humeral Stem Prostheses in Primary Total Stemmed Anatomic Shoulder Replacement**

| 2008 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 298 | SMR | 179 | Ascend Flex | 186 | Ascend Flex | 158 | Ascend Flex | 129 | Ascend Flex |
| 167 | Aequalis | 92 | Equinoxe | 103 | Global Unite | 127 | Global Unite | 74 | Global Unite |
| 117 | Global Advantage | 92 | Global Unite | 86 | Equinoxe | 79 | SMR | 72 | Comprehensive |
| 91 | Global AP | 86 | Comprehensive | 77 | SMR | 62 | Comprehensive | 35 | SMR |
| 40 | Bigliani/Flatow | 83 | SMR | 71 | Comprehensive | 48 | Equinoxe | 23 | Equinoxe |
| 37 | Bigliani/Flatow TM | 56 | Global AP | 30 | Global AP | 23 | Global AP | 10 | Affinis |
| 32 | Solar | 4 | Bigliani/Flatow TM | 4 | Affinis | 1 | Affinis | 8 | MSS |
| 27 | Affinis | 3 | Delta Xtend | 2 | Delta Xtend | 1 | Delta Xtend | | |
| 11 | Univers 3D | 2 | Global Advantage | 1 | Bigliani/Flatow TM | 1 | MSS | | |
| 10 | Cofield 2 | 1 | Affinis | | | | | | |
| **10 Most Used** | | | | | | | | | |
| 830 | (10) 97.9% | 598 | (10) 100.0% | 560 | (9) 100.0% | 500 | (9) 100.0% | 351 | (7) 100.0% |
| **Remainder** | | | | | | | | | |
| 18 | (7) 2.1% | 0 | (0) 0% | 0 | (0) 0% | 0 | (0) 0% | 0 | (0) 0% |
| **TOTAL** | | | | | | | | | |
| 848 | (17) 100.0% | 598 | (10) 100.0% | 560 | (9) 100.0% | 500 | (9) 100.0% | 351 | (7) 100.0% |

**Table ST36 Most Used Glenoid Prostheses in Primary Total Stemmed Anatomic Shoulder Replacement**

| 2008 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 237 | SMR L1 | 180 | Perform | 185 | Perform | 158 | Perform | 129 | Perform |
| 209 | Global | 151 | Global | 135 | Global | 151 | Global | 74 | Global |
| 167 | Aequalis | 92 | Equinoxe | 86 | Equinoxe | 65 | SMR L1 | 55 | Comprehensive |
| 79 | Bigliani/Flatow | 73 | Comprehensive | 65 | SMR L1 | 48 | Comprehensive | 35 | SMR |
| 57 | SMR | 70 | SMR L1 | 61 | Comprehensive | 48 | Equinoxe | 23 | Equinoxe |
| 32 | Solar | 13 | Alliance | 12 | SMR | 14 | Alliance | 17 | Alliance |
| 27 | Affinis | 10 | SMR | 10 | Alliance | 14 | SMR | 10 | Affinis |
| 11 | Univers 3D | 3 | Bigliani/Flatow | 5 | Affinis | 1 | Affinis | 8 | MSS |
| 10 | Cofield 2 | 2 | SMR Axioma | 1 | Bigliani/Flatow | 1 | MSS | | |
| 7 | Promos | 1 | Affinis | | | | | | |
| **10 Most Used** | | | | | | | | | |
| 836 | (10) 98.6% | 595 | (10) 99.5% | 560 | (9) 100.0% | 500 | (9) 100.0% | 351 | (8) 100.0% |
| **Remainder** | | | | | | | | | |
| 12 | (6) 1.4% | 3 | (3) 0.5% | 0 | (0) 0% | 0 | (0) 0% | 0 | (0) 0% |
| **TOTAL** | | | | | | | | | |
| 848 | (16) 100.0% | 598 | (13) 100.0% | 560 | (9) 100.0% | 500 | (9) 100.0% | 351 | (8) 100.0% |

# Primary Total Shoulder Replacement

## OUTCOME FOR ALL DIAGNOSES

### Primary Diagnosis

The usage and availability of prostheses change with time, reflecting design change and surgeon preference. In order to keep Registry data contemporaneous, only procedures utilising prostheses that have been available and used in 2024 (described as modern prostheses) are included in the analyses, unless clearly specified.

This year, modern prostheses do not include modular metal backed glenoids with total stemmed anatomic shoulder replacements.

The most common diagnosis for primary total stemmed anatomic shoulder replacement is osteoarthritis (94.6%) (Table ST37). There is no difference in the rate of revision between osteoarthritis, osteonecrosis and rheumatoid arthritis (Table ST38).

### Reason for Revision

The main reasons for revision are loosening, rotator cuff insufficiency, and instability/dislocation (Table ST39 and Figure ST19). Since 2016, revision for instability/dislocation increased in proportion by 42.1%. In contrast, loosening decreased by 25%, rotator cuff insufficiency by 8.6% and infection by 7.1%. The predominant reason for revision for both males and females is loosening (Figure ST20).

## TYPE OF REVISION

The most common type of revision involves replacement of the humeral and glenoid components (75.3%) (Table ST40). Since 2016, isolated humeral or glenoid component, and head only revisions decreased by 10.7%, 3.6%, and 7.1%, respectively. Humeral/glenoid revisions have increased by 21.4%.

The majority of total stemmed anatomic replacements are revised to reverse replacements (89.4%) with 56.3% retaining the humeral stem.

**Table ST37 Primary Total Stemmed Anatomic Shoulder Replacement by Primary Diagnosis**

| Primary Diagnosis | Number | Percent |
|---|---|---|
| Osteoarthritis | 5120 | 94.6 |
| Osteonecrosis | 103 | 1.9 |
| Rheumatoid Arthritis | 70 | 1.3 |
| Fracture | 35 | 0.6 |
| Other Inflammatory Arthritis | 32 | 0.6 |
| Rotator Cuff Arthropathy | 30 | 0.6 |
| Instability | 17 | 0.3 |
| Tumour | 6 | 0.1 |
| TOTAL | 5413 | 100.0 |

**Table ST38 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Primary Diagnosis**

| Primary Diagnosis | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|
| Osteoarthritis | 268 | 5120 | 2.0 (1.6, 2.4) | 3.0 (2.6, 3.6) | 3.6 (3.1, 4.1) | 4.7 (4.1, 5.4) | 5.8 (5.1, 6.6) |
| Osteonecrosis | 4 | 103 | 1.0 (0.1, 7.0) | 3.5 (1.1, 10.5) | 3.5 (1.1, 10.5) | 5.3 (2.0, 13.9) | |
| Rheumatoid Arthritis | 5 | 70 | 2.9 (0.7, 11.1) | 4.4 (1.4, 13.1) | 4.4 (1.4, 13.1) | 6.3 (2.4, 15.9) | 6.3 (2.4, 15.9) |
| Fracture | 5 | 35 | 3.1 (0.4, 20.2) | 13.4 (5.2, 32.0) | 17.0 (7.4, 36.3) | 17.0 (7.4, 36.3) | 17.0 (7.4, 36.3) |
| Other Inflammatory Arthritis | 4 | 32 | 3.1 (0.4, 20.2) | 3.1 (0.4, 20.2) | 7.0 (1.8, 25.4) | 11.7 (3.8, 32.4) | 11.7 (3.8, 32.4) |
| Rotator Cuff Arthropathy | 1 | 30 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 10.0 (1.5, 52.7) |
| Other (2) | 1 | 23 | 0.0 (0.0, 0.0) | 5.9 (0.9, 35.0) | 5.9 (0.9, 35.0) | 5.9 (0.9, 35.0) | 5.9 (0.9, 35.0) |
| TOTAL | 288 | 5413 | | | | | |

Note: Only primary diagnoses with >30 procedures have been listed
Restricted to modern prostheses
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Table ST39 Primary Total Stemmed Anatomic Shoulder Replacement by Reason for Revision (All Diagnoses)**

| Reason for Revision | Number | Percent |
|---|---|---|
| Loosening | 82 | 28.5 |
| Rotator Cuff Insufficiency | 81 | 28.1 |
| Instability/Dislocation | 64 | 22.2 |
| Infection | 14 | 4.9 |
| Pain | 12 | 4.2 |
| Fracture | 8 | 2.8 |
| Lysis | 6 | 2.1 |
| Incorrect Sizing | 5 | 1.7 |
| Arthrofibrosis | 4 | 1.4 |
| Implant Breakage Glenoid | 4 | 1.4 |
| Malposition | 3 | 1.0 |
| Implant Breakage Glenoid Insert | 1 | 0.3 |
| Dissociation | 1 | 0.3 |
| Wear Glenoid Insert | 1 | 0.3 |
| Other | 2 | 0.7 |
| TOTAL | 288 | 100.0 |

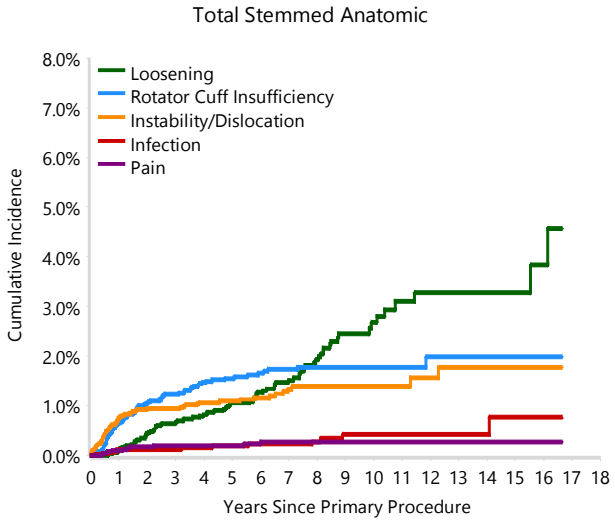
Note: Restricted to modern prostheses

**Table ST40 Primary Total Stemmed Anatomic Shoulder Replacement by Type of Revision (All Diagnoses)**

| Type of Revision | Number | Percent |
|---|---|---|
| Humeral/Glenoid | 217 | 75.3 |
| Head Only | 29 | 10.1 |
| Glenoid Component | 14 | 4.9 |
| Humeral Component | 14 | 4.9 |
| Cement Spacer | 11 | 3.8 |
| Removal of Prostheses | 2 | 0.7 |
| Reoperation | 1 | 0.3 |
| TOTAL | 288 | 100.0 |

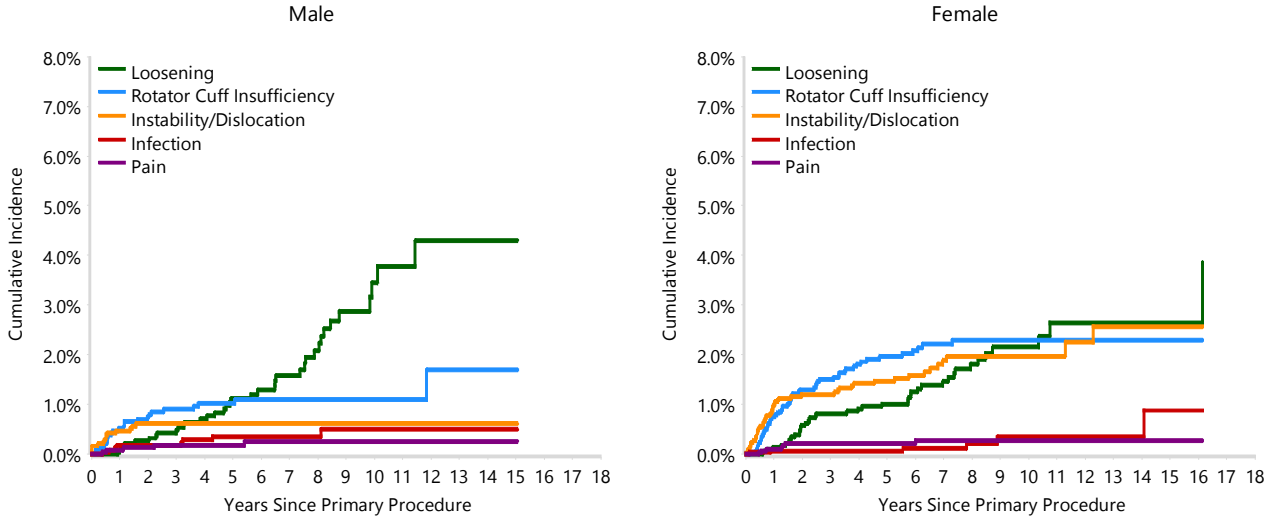
Note: Restricted to modern prostheses
Humeral heads are replaced when the humeral component is revised

**Figure ST19 Cumulative Incidence Revision Diagnosis of Primary Total Stemmed Anatomic Shoulder Replacement (All Diagnoses)**




Note: Restricted to modern prostheses

**Figure ST20 Cumulative Incidence Revision Diagnosis of Primary Total Stemmed Anatomic Shoulder Replacement by Gender**




Note: Restricted to modern prostheses

## PROSTHESIS TYPES

The outcome of the most used humeral stem and glenoid prosthesis combinations >50 procedures used in primary total stemmed anatomic shoulder replacement are listed in Table ST41.

The most commonly used cementless prosthesis combinations are listed in Table ST42. Prosthesis combinations with hybrid (glenoid cemented) fixation are listed in Table ST43.

**Table ST41 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Prosthesis Combination**

| Humeral Stem | Glenoid | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|---|
| Affinis | Affinis | 22 | 208 | 0.0 (0.0, 0.0) | 1.5 (0.5, 4.7) | 2.6 (1.1, 6.1) | 5.3 (2.9, 9.7) | 6.5 (3.7, 11.1) |
| Ascend Flex | Perform | 48 | 1473 | 0.9 (0.5, 1.5) | 1.8 (1.2, 2.7) | 2.4 (1.7, 3.4) | 3.2 (2.3, 4.4) | 4.5 (3.2, 6.1) |
| Comprehensive | Alliance | 2 | 56 | 4.5 (1.1, 16.9) | 4.5 (1.1, 16.9) | 4.5 (1.1, 16.9) | | |
| | Comprehensive | 56 | 977 | 3.7 (2.7, 5.1) | 4.6 (3.4, 6.1) | 4.8 (3.6, 6.4) | 5.5 (4.2, 7.2) | 6.2 (4.7, 8.1) |
| Equinoxe | Equinoxe | 84 | 758 | 3.0 (2.0, 4.5) | 5.1 (3.7, 6.9) | 6.3 (4.7, 8.4) | 9.6 (7.5, 12.3) | 13.3 (10.4, 16.8) |
| Global Unite | Global | 37 | 1360 | 1.4 (0.9, 2.2) | 1.9 (1.3, 2.9) | 2.2 (1.5, 3.2) | 2.7 (2.0, 3.9) | 3.3 (2.4, 4.6) |
| SMR | SMR | 37 | 562 | 2.2 (1.2, 3.8) | 4.3 (2.9, 6.4) | 4.7 (3.2, 6.9) | 5.4 (3.7, 7.7) | 6.1 (4.3, 8.6) |
| Other (4) | | 2 | 19 | 16.9 (4.5, 52.8) | 16.9 (4.5, 52.8) | 16.9 (4.5, 52.8) | 16.9 (4.5, 52.8) | |
| TOTAL | | 288 | 5413 | | | | | |

Note: Restricted to modern prostheses.
Only prostheses with >50 procedures have been listed

**Table ST42 Cumulative Percent Revision of Cementless Primary Total Stemmed Anatomic Shoulder Replacement by Prosthesis Combination**

| Humeral Stem | Glenoid | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|---|
| Equinoxe | Equinoxe | 10 | 57 | 7.0 (2.7, 17.6) | 10.8 (5.0, 22.4) | 10.8 (5.0, 22.4) | 13.6 (6.6, 26.7) | 13.6 (6.6, 26.7) |
| Other (3) | | 0 | 9 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | |
| TOTAL | | 10 | 66 | | | | | |

Note: Restricted to modern prostheses.
Only prostheses with >10 procedures have been listed

**Table ST43 Cumulative Percent Revision of Hybrid (Glenoid Cemented) Primary Total Stemmed Anatomic Shoulder Replacement by Prosthesis Combination**

| Humeral Stem | Glenoid | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|---|
| Affinis | Affinis | 20 | 193 | 0.0 (0.0, 0.0) | 0.5 (0.1, 3.8) | 1.6 (0.5, 5.0) | 4.5 (2.3, 8.8) | 5.7 (3.1, 10.3) |
| Ascend Flex | Perform | 42 | 1255 | 0.8 (0.4, 1.5) | 1.8 (1.2, 2.8) | 2.6 (1.8, 3.7) | 3.4 (2.5, 4.8) | 4.3 (3.1, 6.0) |
| Comprehensive | Alliance | 2 | 55 | 4.6 (1.2, 17.3) | 4.6 (1.2, 17.3) | 4.6 (1.2, 17.3) | | |
| | Comprehensive | 56 | 962 | 3.7 (2.7, 5.2) | 4.7 (3.5, 6.2) | 4.9 (3.7, 6.5) | 5.6 (4.3, 7.3) | 6.3 (4.8, 8.2) |
| Equinoxe | Equinoxe | 71 | 670 | 2.6 (1.6, 4.1) | 4.5 (3.1, 6.4) | 5.7 (4.2, 7.9) | 9.3 (7.1, 12.1) | 13.5 (10.4, 17.5) |
| Global Unite | Global | 32 | 1217 | 1.2 (0.7, 2.0) | 1.7 (1.1, 2.7) | 2.0 (1.4, 3.1) | 2.6 (1.8, 3.8) | 3.2 (2.3, 4.6) |
| SMR | SMR | 34 | 538 | 2.3 (1.3, 4.0) | 4.1 (2.7, 6.2) | 4.5 (3.0, 6.7) | 5.2 (3.6, 7.5) | 5.7 (4.0, 8.2) |
| Other (4) | | 2 | 19 | 16.9 (4.5, 52.8) | 16.9 (4.5, 52.8) | 16.9 (4.5, 52.8) | 16.9 (4.5, 52.8) | |
| TOTAL | | 259 | 4909 | | | | | |

Note: Restricted to modern prostheses.
Only prostheses with >50 procedures have been listed

# Primary Total Shoulder Replacement

## OUTCOME FOR OSTEOARTHRITIS – PATIENT CHARACTERISTICS

There are 5,120 primary total stemmed anatomic shoulder replacement procedures with a primary diagnosis of osteoarthritis.

The cumulative percent revision of primary total stemmed anatomic shoulder replacement with a polyethylene glenoid for osteoarthritis at 14 years is 9.4%. A polyethylene glenoid includes all glenoid types except modular metal backed glenoids. There are no primary total stemmed anatomic shoulder replacements with modular metal backed glenoids undertaken in 2024 (Table ST44).

For primary total stemmed anatomic shoulder replacements undertaken prior to 2016, there is no difference in the rate of revision compared to those procedures performed in the period 2016-2024 (Table ST45). The most common reasons for revision are loosening (29.1%), rotator cuff insufficiency (27.6%), and instability/dislocation (23.1%) (Table ST46 and Figure ST21). Males are predominately revised for rotator cuff insufficiency while the reason for revision varies for females (Figure ST22).

The most common type of revision is of the humeral/glenoid component combination (75.4%) (Table ST47). Of note, a humeral component revision may include epiphysis and/or humeral stem and additional minor components, such as the humeral head/glenosphere and/or removal of the glenoid component. Primary total stemmed anatomic undertaken for osteoarthritis are revised to a total stemmed reverse shoulder replacement (89%) with retention of the original stem in 58.1% of occasions.

### Age and Gender

Patients aged ≥65 years have a lower rate of revision compared to patients aged <65 years (Table ST48 and Figure ST23). Females have a higher rate of revision than males (Table ST49 and Figure ST24). When age is stratified by gender the rate of revision difference between age groups remains the same for males (Figure ST25). Females aged ≥65 years have a lower rate of revision compared to females aged <65 years.

**Females have a higher rate of revision compared to males.**

### ASA and BMI

Most patients have an ASA score of 2 or 3. ASA score is not a risk factor for revision (Table ST50). Males with ASA scores 3-5 have a lower rate of revision than females with the same ASA scores (Table ST51 and Figure ST26).

The most common BMI categories are pre-obese and obese class 1. BMI is not a risk factor for revision (Table ST52). However, when gender is considered, obese and non-obese females had a higher rate of revision than their male counterparts (Table ST53 and Figure ST27).

### Glenoid Morphology

The category of glenoid morphology is not a risk factor for revision (Table ST54).

**Table ST44 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Glenoid Type (Primary Diagnosis OA)**

| Glenoid Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Polyethylene Glenoid | 268 | 5120 | 2.0 (1.6, 2.4) | 3.6 (3.1, 4.1) | 4.7 (4.1, 5.4) | 5.8 (5.1, 6.6) | 7.7 (6.7, 8.9) | 9.4 (7.8, 11.1) |
| **TOTAL** | **268** | **5120** | | | | | | |

Note: Restricted to modern prostheses
There were no procedures with metal-backed glenoids recorded in 2024

**Table ST45 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Procedure Year (Primary Diagnosis OA)**

| Procedure Year | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|
| Pre 2016 | 87 | 1211 | 1.4 (0.9, 2.3) | 2.6 (1.8, 3.7) | 3.1 (2.2, 4.2) | 4.4 (3.4, 5.7) | 4.9 (3.8, 6.3) |
| 2016-2024 | 181 | 3909 | 2.2 (1.7, 2.7) | 3.2 (2.7, 3.8) | 3.7 (3.1, 4.4) | 4.7 (4.0, 5.5) | 6.4 (5.5, 7.5) |
| **TOTAL** | **268** | **5120** | | | | | |

Note: Restricted to modern prostheses
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Table ST46 Primary Total Stemmed Anatomic Shoulder Replacement by Reason for Revision (Primary Diagnosis OA)**

| Reason for Revision | Number | Percent |
|---|---|---|
| Loosening | 78 | 29.1 |
| Rotator Cuff Insufficiency | 74 | 27.6 |
| Instability/Dislocation | 62 | 23.1 |
| Pain | 11 | 4.1 |
| Infection | 11 | 4.1 |
| Fracture | 7 | 2.6 |
| Lysis | 6 | 2.2 |
| Incorrect Sizing | 5 | 1.9 |
| Implant Breakage Glenoid | 4 | 1.5 |
| Malposition | 3 | 1.1 |
| Arthrofibrosis | 2 | 0.7 |
| Implant Breakage Glenoid Insert | 1 | 0.4 |
| Dissociation | 1 | 0.4 |
| Wear Glenoid Insert | 1 | 0.4 |
| Other | 2 | 0.7 |
| TOTAL | 268 | 100.0 |

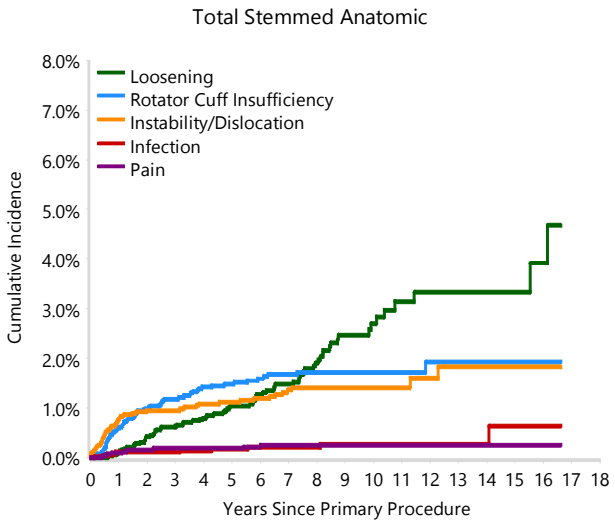
Note: Restricted to modern prostheses

**Table ST47 Primary Total Stemmed Anatomic Shoulder Replacement by Type of Revision (Primary Diagnosis OA)**

| Type of Revision | Number | Percent |
|---|---|---|
| Humeral/Glenoid | 202 | 75.4 |
| Head Only | 28 | 10.4 |
| Glenoid Component | 13 | 4.9 |
| Humeral Component | 12 | 4.5 |
| Cement Spacer | 11 | 4.1 |
| Removal of Prostheses | 1 | 0.4 |
| Reoperation | 1 | 0.4 |
| TOTAL | 268 | 100.0 |

Note: Restricted to modern prostheses
Humeral heads are replaced when the humeral component is revised

**Figure ST21 Cumulative Incidence Revision Diagnosis of Primary Total Stemmed Anatomic Shoulder Replacement (Primary Diagnosis OA)**




Note: Restricted to modern prostheses.

# Primary Total Shoulder Replacement

**Figure ST22 Cumulative Incidence Revision Diagnosis of Primary Total Stemmed Anatomic Shoulder Replacement by Gender (Primary Diagnosis OA)**

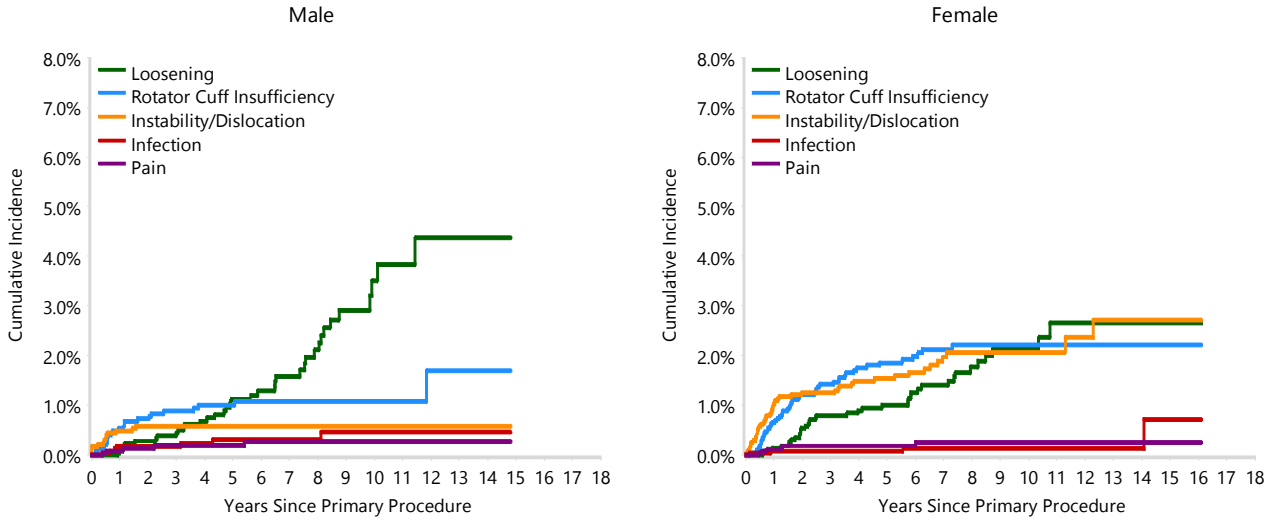
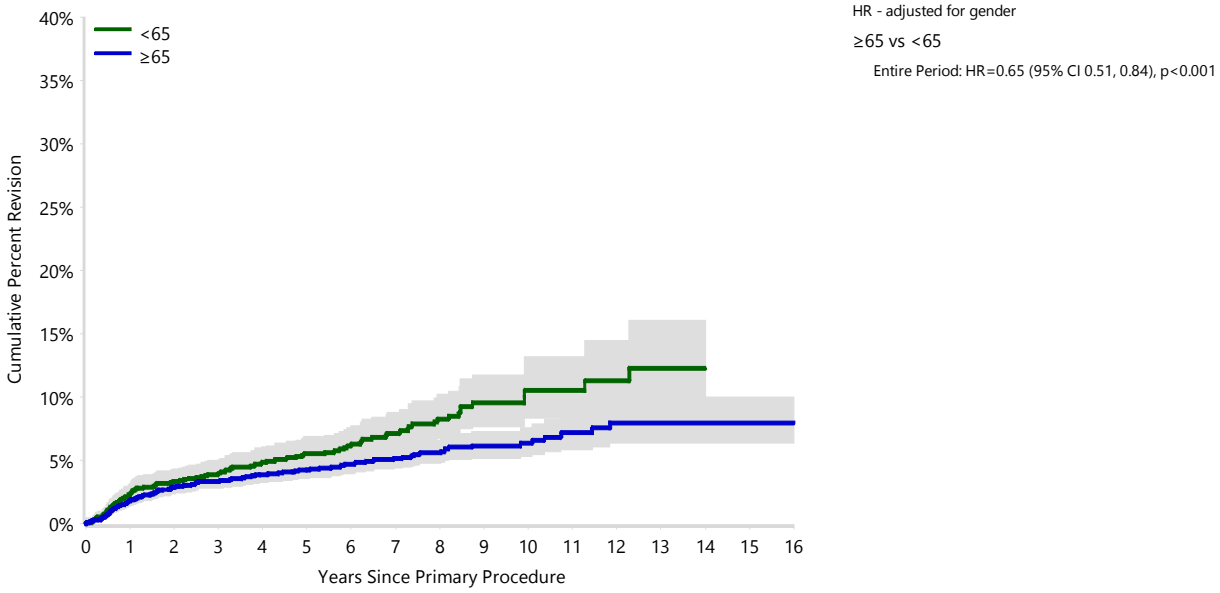



**Table ST48 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Age (Primary Diagnosis OA)**

| Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| <65 | 109 | 1698 | 2.3 (1.7, 3.2) | 4.0 (3.1, 5.1) | 5.5 (4.4, 6.9) | 7.2 (5.8, 8.8) | 10.5 (8.3, 13.2) | 12.3 (9.3, 16.1) |
| ≥65 | 159 | 3422 | 1.8 (1.4, 2.3) | 3.4 (2.8, 4.1) | 4.3 (3.6, 5.1) | 5.2 (4.4, 6.1) | 6.4 (5.3, 7.6) | 8.0 (6.4, 10.0) |
| TOTAL | 268 | 5120 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST23 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Age (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| <65 | 1698 | 1523 | 1214 | 885 | 558 | 178 | 53 |
| ≥65 | 3422 | 3158 | 2532 | 1914 | 1217 | 424 | 106 |

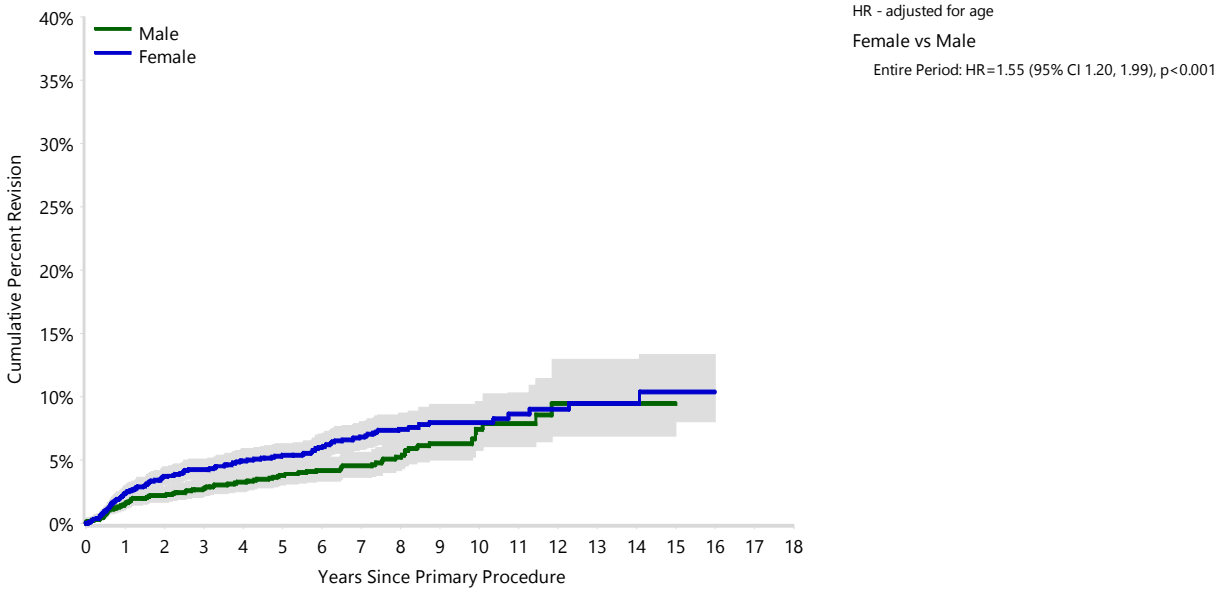
Note: Restricted to modern prostheses

**Table ST49 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Gender and Age (Primary Diagnosis OA)**

| Gender | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| **Male** | | **99** | **2296** | **1.5 (1.1, 2.1)** | **2.8 (2.1, 3.5)** | **3.8 (3.1, 4.8)** | **4.5 (3.6, 5.6)** | **7.5 (5.8, 9.6)** | **9.5 (6.9, 13.0)** |
| | <65 | 49 | 979 | 1.5 (0.9, 2.5) | 3.3 (2.3, 4.8) | 4.7 (3.4, 6.5) | 5.5 (4.0, 7.5) | 9.8 (6.7, 14.0) | |
| | ≥65 | 50 | 1317 | 1.6 (1.0, 2.4) | 2.3 (1.6, 3.3) | 3.2 (2.3, 4.4) | 3.9 (2.8, 5.3) | 5.9 (4.1, 8.3) | |
| **Female** | | **169** | **2824** | **2.3 (1.8, 3.0)** | **4.2 (3.5, 5.1)** | **5.4 (4.5, 6.3)** | **6.8 (5.8, 8.0)** | **8.0 (6.8, 9.4)** | **9.5 (7.7, 11.7)** |
| | <65 | 60 | 719 | 3.5 (2.3, 5.1) | 4.9 (3.5, 6.8) | 6.6 (4.9, 8.9) | 9.3 (7.0, 12.2) | 11.6 (8.8, 15.3) | |
| | ≥65 | 109 | 2105 | 2.0 (1.4, 2.7) | 4.0 (3.2, 5.0) | 4.9 (4.0, 6.0) | 6.0 (4.9, 7.3) | 6.8 (5.5, 8.2) | 7.6 (6.0, 9.6) |
| **TOTAL** | | **268** | **5120** | | | | | | |

Note: Restricted to modern prostheses

**Figure ST24 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Gender (Primary Diagnosis OA)**

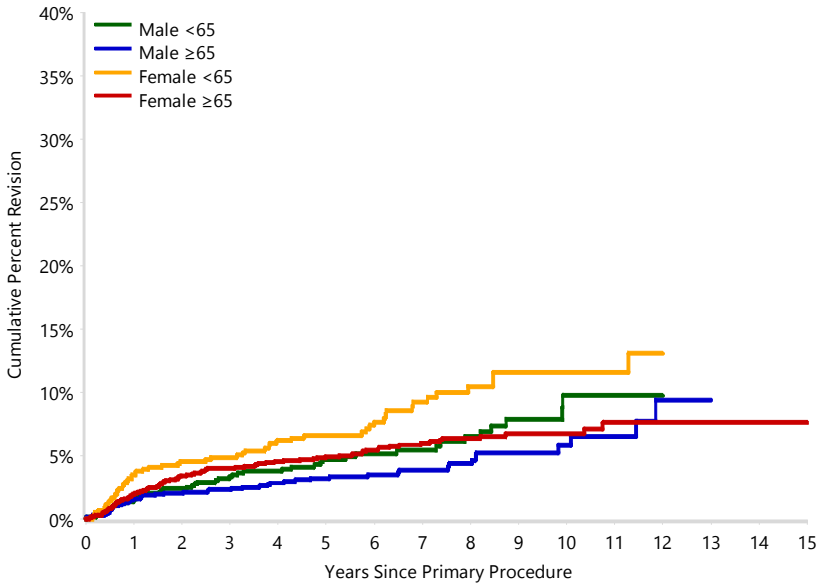



| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| **Male** | 2296 | 2101 | 1658 | 1203 | 754 | 235 | 56 |
| **Female** | 2824 | 2580 | 2088 | 1596 | 1021 | 367 | 103 |

Note: Restricted to modern prostheses

# Primary Total Shoulder Replacement

**Figure ST25 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Gender and Age (Primary Diagnosis OA)**




Male <65 vs Male ≥65
Entire Period: HR=1.39 (95% CI 0.93, 2.06), p=0.104

Male <65 vs Female <65
Entire Period: HR=0.64 (95% CI 0.44, 0.93), p=0.019

Male ≥65 vs Female ≥65
Entire Period: HR=0.75 (95% CI 0.54, 1.05), p=0.090

Female <65 vs Female ≥65
Entire Period: HR=1.63 (95% CI 1.19, 2.23), p=0.002

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Male | <65 | 979 | 881 | 672 | 477 | 302 | 92 | 26 |
| | ≥65 | 1317 | 1220 | 986 | 726 | 452 | 143 | 30 |
| Female | <65 | 719 | 642 | 542 | 408 | 256 | 86 | 27 |
| | ≥65 | 2105 | 1938 | 1546 | 1188 | 765 | 281 | 76 |

Note: Restricted to modern prostheses

**Table ST50 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by ASA Score (Primary Diagnosis OA)**

| ASA Score | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|
| ASA 1 | 14 | 295 | 2.5 (1.2, 5.1) | 3.2 (1.7, 6.1) | 3.6 (2.0, 6.7) | 4.6 (2.6, 8.1) | 5.3 (3.1, 9.1) | 5.3 (3.1, 9.1) |
| ASA 2 | 119 | 2433 | 1.9 (1.4, 2.6) | 3.0 (2.3, 3.8) | 3.5 (2.8, 4.4) | 4.4 (3.6, 5.4) | 5.9 (4.8, 7.1) | 6.5 (5.3, 7.9) |
| ASA 3 | 77 | 1757 | 2.1 (1.5, 2.9) | 3.2 (2.4, 4.2) | 3.7 (2.9, 4.8) | 4.8 (3.8, 6.0) | 5.7 (4.5, 7.2) | 5.9 (4.7, 7.5) |
| ASA 4 | 2 | 49 | 2.2 (0.3, 14.4) | 2.2 (0.3, 14.4) | 2.2 (0.3, 14.4) | 2.2 (0.3, 14.4) | 8.3 (1.8, 33.3) | |
| ASA 5 | 0 | 1 | | | | | | |
| TOTAL | 212 | 4535 | | | | | | |

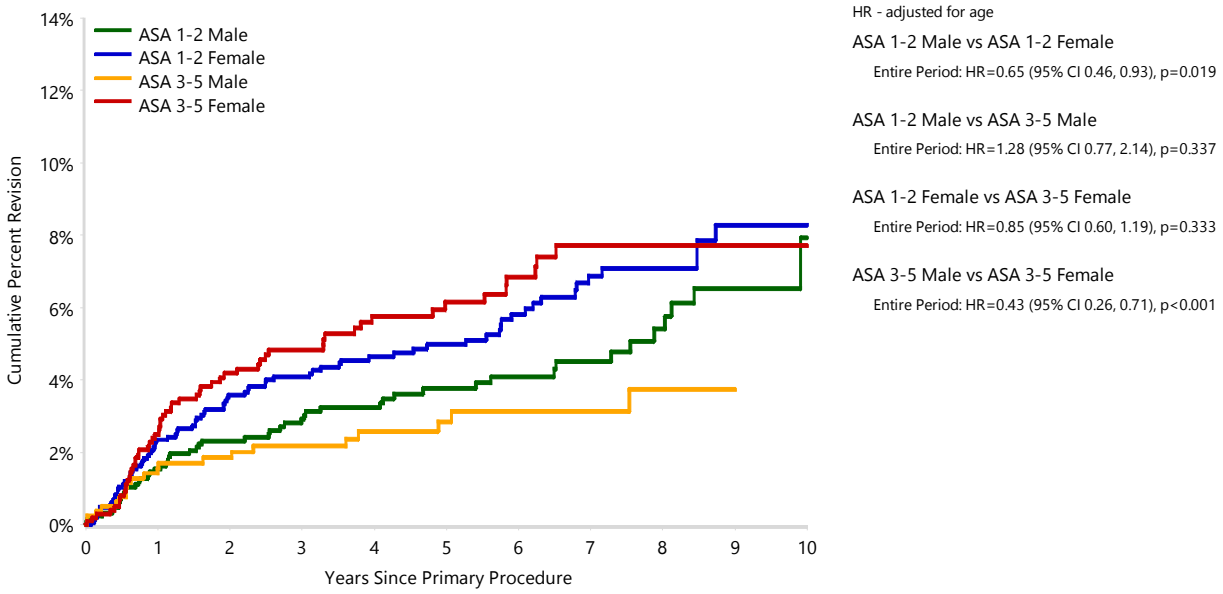
Note: Restricted to modern prostheses
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Table ST51 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by ASA Score and Gender (Primary Diagnosis OA)**

| ASA Score | Gender | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| ASA 1 | Male | 9 | 176 | 1.7 (0.6, 5.3) | 3.0 (1.3, 7.0) | 3.0 (1.3, 7.0) | 4.7 (2.2, 9.7) | 5.9 (2.9, 11.7) | 5.9 (2.9, 11.7) |
| | Female | 5 | 119 | 3.5 (1.3, 9.1) | 3.5 (1.3, 9.1) | 4.6 (1.9, 10.7) | 4.6 (1.9, 10.7) | | |
| ASA 2 | Male | 44 | 1101 | 1.5 (0.9, 2.5) | 2.2 (1.5, 3.3) | 2.9 (2.0, 4.2) | 3.6 (2.6, 5.0) | 4.3 (3.1, 6.0) | 5.4 (3.8, 7.6) |
| | Female | 75 | 1332 | 2.2 (1.6, 3.2) | 3.6 (2.7, 4.8) | 4.0 (3.1, 5.3) | 5.0 (3.9, 6.4) | 7.1 (5.6, 9.0) | 7.3 (5.7, 9.3) |
| ASA 3 | Male | 20 | 772 | 1.5 (0.8, 2.6) | 1.8 (1.0, 3.0) | 2.1 (1.3, 3.5) | 2.8 (1.8, 4.5) | 3.1 (1.9, 4.9) | 3.7 (2.2, 6.1) |
| | Female | 57 | 985 | 2.6 (1.7, 3.8) | 4.3 (3.1, 5.8) | 4.9 (3.7, 6.6) | 6.3 (4.8, 8.2) | 7.6 (5.8, 9.9) | 7.6 (5.8, 9.9) |
| ASA 4 or 5 | Male | 1 | 23 | 4.3 (0.6, 27.1) | 4.3 (0.6, 27.1) | 4.3 (0.6, 27.1) | 4.3 (0.6, 27.1) | 4.3 (0.6, 27.1) | |
| | Female | 1 | 27 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 10.0 (1.5, 52.7) | |
| TOTAL | | 212 | 4535 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST26 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by ASA Score and Gender (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|
| ASA 1-2 | Male | 1277 | 1167 | 1059 | 929 | 654 | 387 | 269 |
| | Female | 1451 | 1329 | 1203 | 1074 | 795 | 455 | 304 |
| ASA 3-5 | Male | 795 | 717 | 620 | 523 | 355 | 192 | 132 |
| | Female | 1012 | 899 | 794 | 675 | 482 | 265 | 190 |

Note: Restricted to modern prostheses

**Table ST52 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by BMI Category (Primary Diagnosis OA)**

| BMI Category | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|---|
| Underweight | 0 | 13 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | |
| Normal | 37 | 590 | 2.8 (1.8, 4.6) | 4.4 (3.0, 6.5) | 5.3 (3.7, 7.6) | 5.8 (4.1, 8.3) | 5.8 (4.1, 8.3) | 7.5 (5.3, 10.5) |
| Pre Obese | 53 | 1291 | 1.4 (0.9, 2.3) | 2.7 (1.9, 3.8) | 3.1 (2.2, 4.3) | 3.7 (2.7, 5.0) | 4.1 (3.0, 5.5) | 4.6 (3.5, 6.2) |
| Obese Class 1 | 61 | 1241 | 2.5 (1.8, 3.6) | 3.3 (2.4, 4.5) | 3.9 (2.9, 5.1) | 4.2 (3.2, 5.6) | 4.8 (3.7, 6.3) | 5.2 (4.0, 6.8) |
| Obese Class 2 | 27 | 633 | 2.0 (1.1, 3.5) | 2.7 (1.6, 4.3) | 2.9 (1.8, 4.6) | 3.9 (2.5, 5.9) | 4.2 (2.7, 6.3) | 5.5 (3.6, 8.2) |
| Obese Class 3 | 15 | 341 | 2.2 (1.0, 4.5) | 3.2 (1.7, 5.8) | 3.9 (2.2, 6.8) | 4.8 (2.9, 8.1) | 4.8 (2.9, 8.1) | 4.8 (2.9, 8.1) |
| TOTAL | 193 | 4109 | | | | | | |

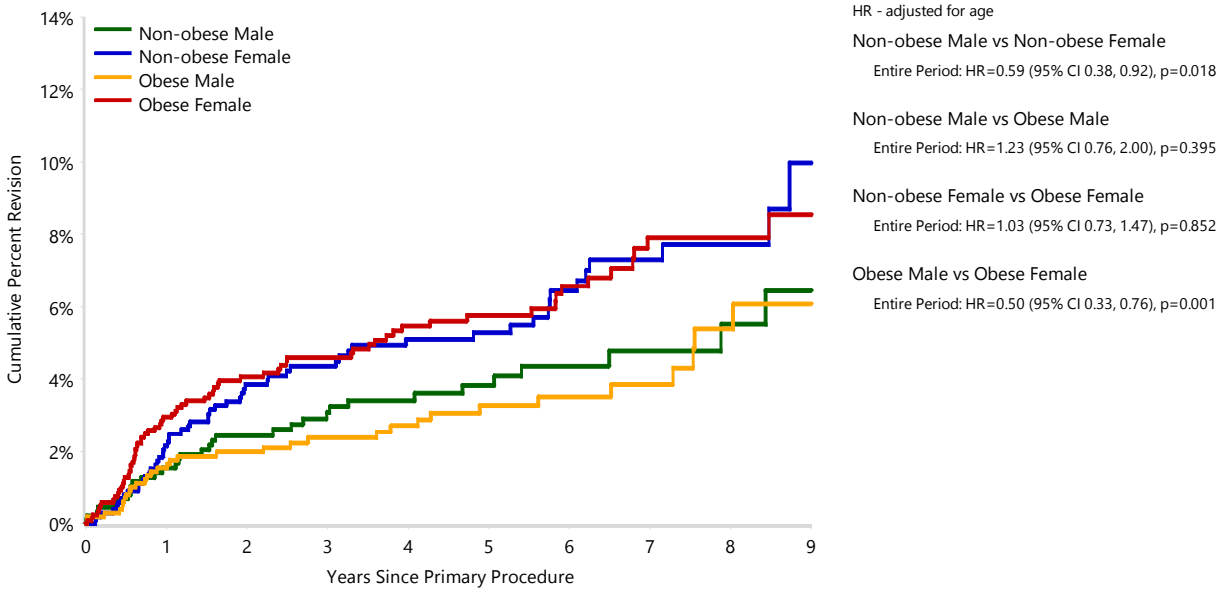
Note: Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Table ST53 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by BMI Category and Gender (Primary Diagnosis OA)**

| BMI Category | Gender | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Non-obese | Male | 33 | 875 | 1.5 (0.9, 2.6) | 2.4 (1.6, 3.8) | 3.1 (2.1, 4.6) | 3.4 (2.3, 5.0) | 3.8 (2.6, 5.5) | 4.4 (3.0, 6.3) |
| | Female | 57 | 1019 | 2.2 (1.4, 3.3) | 3.8 (2.8, 5.3) | 4.4 (3.2, 5.9) | 5.1 (3.8, 6.8) | 5.3 (4.0, 7.0) | 6.4 (4.9, 8.5) |
| Obese | Male | 33 | 1010 | 1.5 (0.9, 2.6) | 2.0 (1.3, 3.1) | 2.4 (1.6, 3.6) | 2.7 (1.8, 4.0) | 3.3 (2.2, 4.8) | 3.5 (2.4, 5.1) |
| | Female | 70 | 1205 | 2.9 (2.1, 4.1) | 4.1 (3.1, 5.4) | 4.6 (3.5, 6.0) | 5.5 (4.2, 7.0) | 5.8 (4.5, 7.4) | 6.6 (5.1, 8.4) |
| TOTAL | | 193 | 4109 | | | | | | |

Note: Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years

**Figure ST27 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by BMI Category and Gender (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|---|
| Non-obese | Male | 875 | 788 | 694 | 593 | 486 | 391 | 283 |
| | Female | 1019 | 916 | 811 | 692 | 576 | 485 | 356 |
| Obese | Male | 1010 | 913 | 806 | 683 | 571 | 457 | 343 |
| | Female | 1205 | 1078 | 958 | 833 | 711 | 584 | 439 |

Note: Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years

**Table ST54 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Glenoid Morphology (Primary Diagnosis OA)**

| Glenoid Morphology | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|
| A1 | 54 | 1084 | 2.8 (1.9, 4.0) | 3.7 (2.7, 5.1) | 4.0 (2.9, 5.4) | 4.4 (3.3, 6.0) | 4.9 (3.6, 6.6) |
| A2 | 28 | 748 | 1.5 (0.9, 2.8) | 2.8 (1.8, 4.4) | 3.6 (2.4, 5.4) | 4.1 (2.8, 6.1) | 4.4 (3.0, 6.5) |
| B1 | 25 | 589 | 2.3 (1.4, 4.0) | 3.4 (2.1, 5.3) | 3.6 (2.3, 5.6) | 4.8 (3.2, 7.3) | 4.8 (3.2, 7.3) |
| B2 | 14 | 474 | 1.1 (0.5, 2.7) | 1.9 (1.0, 3.8) | 2.8 (1.6, 5.1) | 3.2 (1.8, 5.7) | 3.8 (2.2, 6.7) |
| C | 1 | 88 | 1.2 (0.2, 8.4) | 1.2 (0.2, 8.4) | 1.2 (0.2, 8.4) | 1.2 (0.2, 8.4) | 1.2 (0.2, 8.4) |
| TOTAL | 122 | 2983 | | | | | |

Note: Restricted to modern prostheses
Excludes 3 procedures with a recorded glenoid morphology of B3
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

## OUTCOME FOR OSTEOARTHRITIS – PROSTHESIS CHARACTERISTICS

### Fixation

There is no difference in the rate of revision when cemented and hybrid (glenoid cemented) fixation are compared. There are too few procedures using cementless fixation for a comparative analysis to be undertaken (analysis restricted to >100 procedures) (Table ST55).

Non-modular metal backed glenoids have a higher rate of revision than other polyethylene glenoids.

### Glenoid Types and Bearing Surfaces

There are four types of glenoids, all with polyethylene bearing surface but differing methods of fixation to bone. Non-modular metal back glenoids have a polyethylene bearing surface with backside integrated metallic coating. Hybrid metal/polyethylene glenoids have a polyethylene bearing surface and one or more metallic fixation pegs. Cemented polyethylene glenoids with a modified central peg are all polyethylene but the central peg is further engineered for additional fixation to bone. All polyethylene glenoids are polyethylene fixed by cemented pegs or keels alone without further fixation features.

Modified central peg glenoids have a lower rate of revision compared to hybrid metal/polyethylene glenoids, cemented all polyethylene glenoids and non-modular metal backed glenoids for the first 6 months only (Table ST56 and Figure ST28).

Procedures with a metal/XLPE bearing surface (humeral head/glenoid) have a lower rate of revision compared to procedures with a metal/non XLPE bearing surface (Table ST57 and Figure ST29).

Metal/XLPE bearing surface has a lower rate of revision than metal/non XLPE.

### Humeral Head Size

Humeral heads >50mm have a lower rate of revision compared to both <44mm and 44–50mm (Table ST58 and Figure ST30). When stratified by polyethylene type, both humeral sizes 44-50mm and >50mm, when combined with non XLPE polyethylene glenoids, have higher rates of revision than similar head sizes articulating with XLPE polyethylene glenoids (Table ST59, Figure ST31 and Figure ST32). The cumulative incidence revision diagnosis for the most common reasons for humeral head size revision is shown in Figure ST33.

Humeral head sizes <44mm have the highest rate of revision compared to ≥44mm head sizes.

**Table ST55 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Fixation (Primary Diagnosis OA)**

| Fixation | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cemented | 15 | 393 | 1.3 (0.6, 3.2) | 3.1 (1.8, 5.6) | 3.1 (1.8, 5.6) | 6.2 (3.3, 11.5) | | |
| Cementless | 10 | 65 | 6.5 (2.5, 16.5) | 10.2 (4.7, 21.3) | 13.0 (6.3, 25.8) | 13.0 (6.3, 25.8) | | |
| Hybrid (Glenoid Cemented) | 243 | 4662 | 2.0 (1.6, 2.4) | 3.5 (3.0, 4.1) | 4.7 (4.1, 5.4) | 5.8 (5.0, 6.6) | 7.4 (6.4, 8.6) | 9.1 (7.6, 11.0) |
| TOTAL | 268 | 5120 | | | | | | |

Note: Restricted to modern prostheses

Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

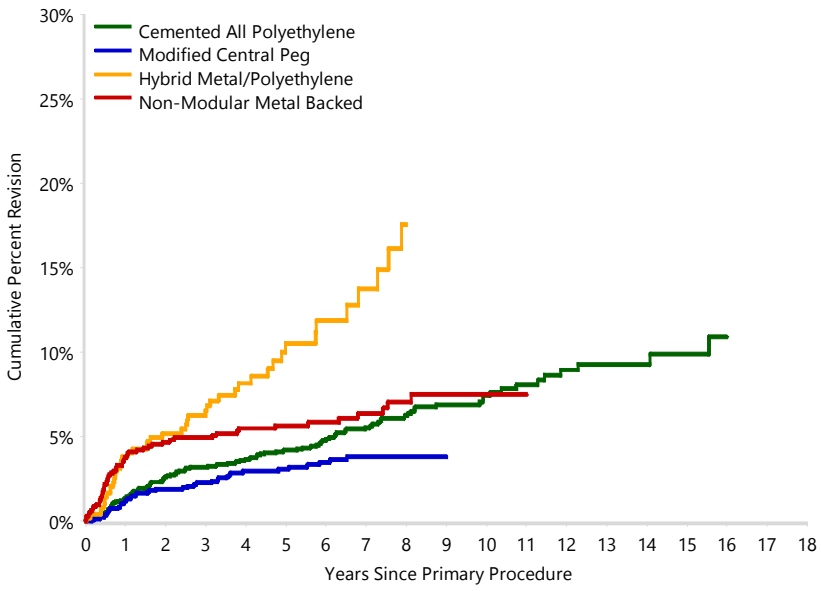
# Primary Total Shoulder Replacement

**Table ST56 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Glenoid Type (Primary Diagnosis OA)**

| Glenoid Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cemented All Polyethylene | 121 | 2293 | 1.4 (0.9, 1.9) | 3.2 (2.5, 4.1) | 4.2 (3.4, 5.2) | 5.5 (4.5, 6.8) | 7.4 (6.1, 9.1) | 9.3 (7.5, 11.5) |
| Modified Central Peg | 42 | 1393 | 1.2 (0.7, 1.9) | 2.3 (1.6, 3.2) | 3.1 (2.2, 4.2) | 3.8 (2.8, 5.2) | | |
| Hybrid Metal/Polyethylene | 50 | 497 | 3.8 (2.4, 6.0) | 6.5 (4.6, 9.3) | 10.5 (7.6, 14.4) | 13.8 (9.9, 19.0) | | |
| Non-Modular Metal Backed | 55 | 937 | 3.8 (2.7, 5.2) | 4.9 (3.7, 6.6) | 5.7 (4.3, 7.4) | 6.4 (4.8, 8.3) | 7.5 (5.6, 10.0) | |
| TOTAL | 268 | 5120 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST28 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Glenoid Type (Primary Diagnosis OA)**




HR - adjusted for age and gender

Cemented All Polyethylene vs Modified Central Peg

Entire Period: HR=1.59 (95% CI 1.11, 2.27), p=0.011

Hybrid Metal/Polyethylene vs Modified Central Peg

Entire Period: HR=3.69 (95% CI 2.43, 5.59), p<0.001

Non-Modular Metal Backed vs Modified Central Peg

0 - 6Mth: HR=6.01 (95% CI 3.13, 11.55), p<0.001

6Mth+: HR=1.32 (95% CI 0.84, 2.08), p=0.224

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Cemented All Polyethylene | 2293 | 2110 | 1679 | 1292 | 865 | 500 | 158 |
| Modified Central Peg | 1393 | 1294 | 1030 | 785 | 500 | 15 | 0 |
| Hybrid Metal/Polyethylene | 497 | 435 | 320 | 173 | 86 | 10 | 0 |
| Non-Modular Metal Backed | 937 | 842 | 717 | 549 | 324 | 77 | 1 |

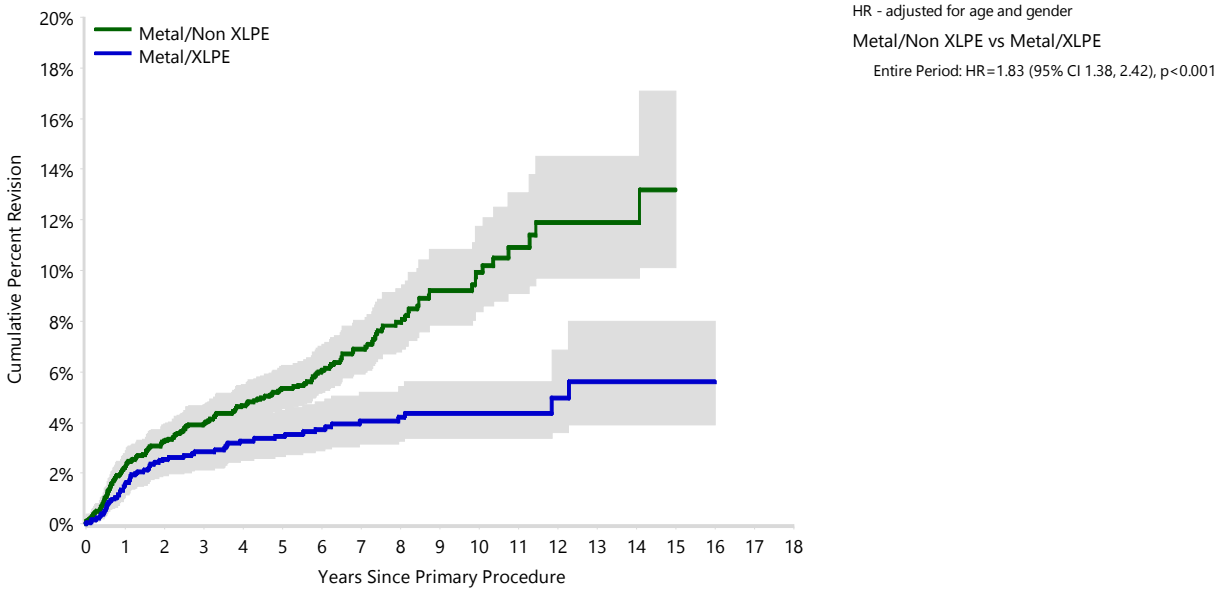
Note: Restricted to modern prostheses

**Table ST57 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Bearing Surface (Primary Diagnosis OA)**

| Polyethylene Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Ceramic/XLPE | 1 | 1 | | | | | | |
| Metal/Non XLPE | 201 | 3338 | 2.2 (1.8, 2.8) | 3.9 (3.3, 4.7) | 5.4 (4.6, 6.3) | 6.9 (5.9, 8.0) | 9.9 (8.4, 11.7) | 11.9 (9.7, 14.5) |
| Metal/XLPE | 66 | 1781 | 1.6 (1.1, 2.3) | 2.8 (2.1, 3.8) | 3.4 (2.7, 4.5) | 4.1 (3.2, 5.2) | 4.4 (3.4, 5.6) | 5.6 (3.9, 8.0) |
| TOTAL | 268 | 5120 | | | | | | |

Note: Restricted to modern prostheses. Reported as humeral head/glenoid.

**Figure ST29 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Bearing Surface (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Metal/Non XLPE | 3338 | 3036 | 2383 | 1694 | 978 | 362 | 68 |
| Metal/XLPE | 1781 | 1644 | 1363 | 1105 | 797 | 240 | 91 |

Note: Restricted to modern prostheses. Reported as humeral head/glenoid.

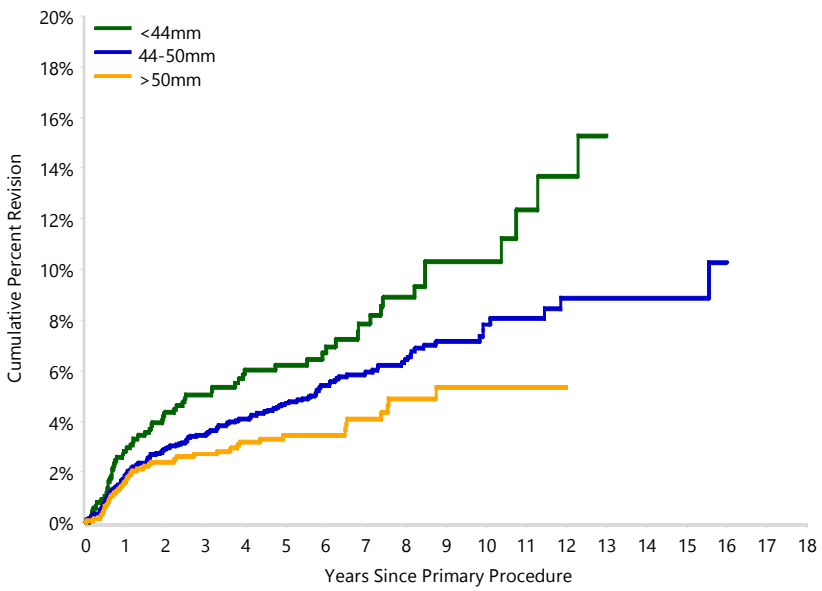
# Primary Total Shoulder Replacement

**Table ST58 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Humeral Head Size (Primary Diagnosis OA)**

| Humeral Head Size | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| <44mm | 66 | 879 | 2.8 (1.9, 4.2) | 5.0 (3.7, 6.8) | 6.2 (4.7, 8.2) | 7.9 (6.0, 10.3) | 10.3 (7.8, 13.6) | |
| 44-50mm | 158 | 3005 | 1.9 (1.5, 2.5) | 3.5 (2.9, 4.2) | 4.7 (4.0, 5.6) | 5.9 (5.0, 7.0) | 7.8 (6.5, 9.4) | 8.9 (7.2, 10.9) |
| >50mm | 44 | 1234 | 1.6 (1.0, 2.5) | 2.7 (1.9, 3.8) | 3.5 (2.5, 4.8) | 4.1 (3.0, 5.6) | 5.3 (3.8, 7.5) | |
| TOTAL | 268 | 5118 | | | | | | |

Note: Restricted to modern prostheses
Excludes 2 procedures with unknown head size

**Figure ST30 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Humeral Head Size (Primary Diagnosis OA)**




HR - adjusted for age and gender

<44mm vs 44-50mm

Entire Period: HR=1.43 (95% CI 1.05, 1.94), p=0.022

<44mm vs >50mm

Entire Period: HR=1.93 (95% CI 1.23, 3.04), p=0.004

44-50mm vs >50mm

Entire Period: HR=1.35 (95% CI 0.94, 1.94), p=0.100

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| <44mm | 879 | 793 | 630 | 463 | 281 | 116 | 28 |
| 44-50mm | 3005 | 2764 | 2222 | 1685 | 1093 | 393 | 109 |
| >50mm | 1234 | 1123 | 893 | 651 | 401 | 93 | 22 |

Note: Restricted to modern prostheses
Excludes 2 procedures with unknown head size

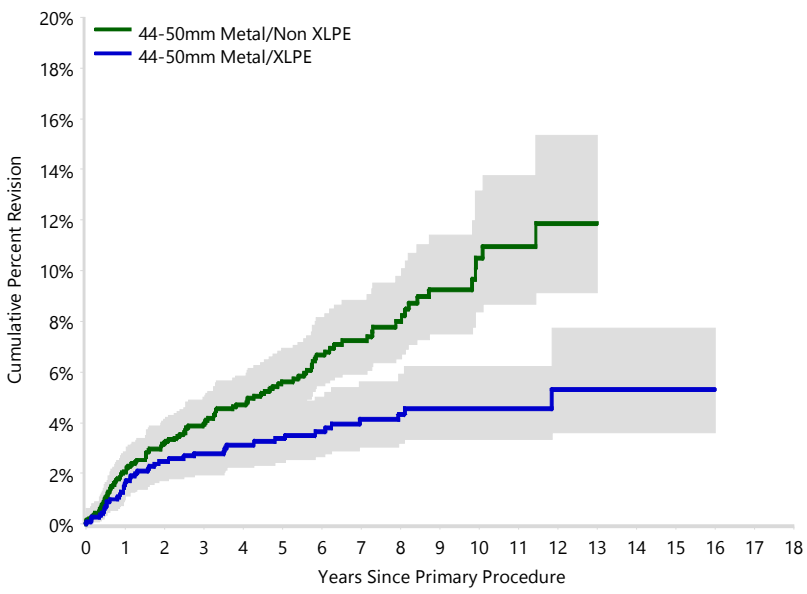
**Table ST59 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Humeral Head Size and Bearing Surface (Primary Diagnosis OA)**

| Humeral Head Size | Polyethylene Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| <44mm | Ceramic/XLPE | 1 | 1 | | | | | | |
| | Metal/Non XLPE | 54 | 764 | 2.8 (1.9, 4.3) | 4.7 (3.3, 6.5) | 5.9 (4.3, 8.0) | 7.5 (5.5, 10.2) | 10.4 (7.7, 14.1) | |
| | Metal/XLPE | 11 | 114 | 2.7 (0.9, 8.1) | 6.5 (3.2, 13.2) | 7.7 (3.9, 14.8) | 9.2 (4.8, 17.1) | | |
| 44-50mm | Metal/Non XLPE | 115 | 1856 | 2.1 (1.5, 2.8) | 3.9 (3.1, 5.0) | 5.6 (4.6, 6.9) | 7.2 (5.9, 8.8) | 10.5 (8.4, 13.1) | |
| | Metal/XLPE | 43 | 1149 | 1.6 (1.0, 2.6) | 2.8 (2.0, 4.0) | 3.4 (2.4, 4.7) | 4.1 (3.0, 5.6) | 4.6 (3.3, 6.2) | 5.3 (3.6, 7.7) |
| >50mm | Metal/Non XLPE | 32 | 717 | 1.9 (1.1, 3.2) | 3.2 (2.1, 4.8) | 4.1 (2.8, 6.1) | 5.3 (3.6, 7.9) | 7.8 (5.1, 11.7) | |
| | Metal/XLPE | 12 | 517 | 1.2 (0.5, 2.7) | 2.1 (1.1, 3.9) | 2.6 (1.5, 4.6) | 2.6 (1.5, 4.6) | | |
| TOTAL | | 268 | 5118 | | | | | | |

Note: Restricted to modern prostheses

<44mm head size comparison Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Figure ST31 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Humeral Head Size and Bearing Surface (Primary Diagnosis OA)**




HR - adjusted for age and gender

44-50mm Metal/Non XLPE vs 44-50mm Metal/XLPE

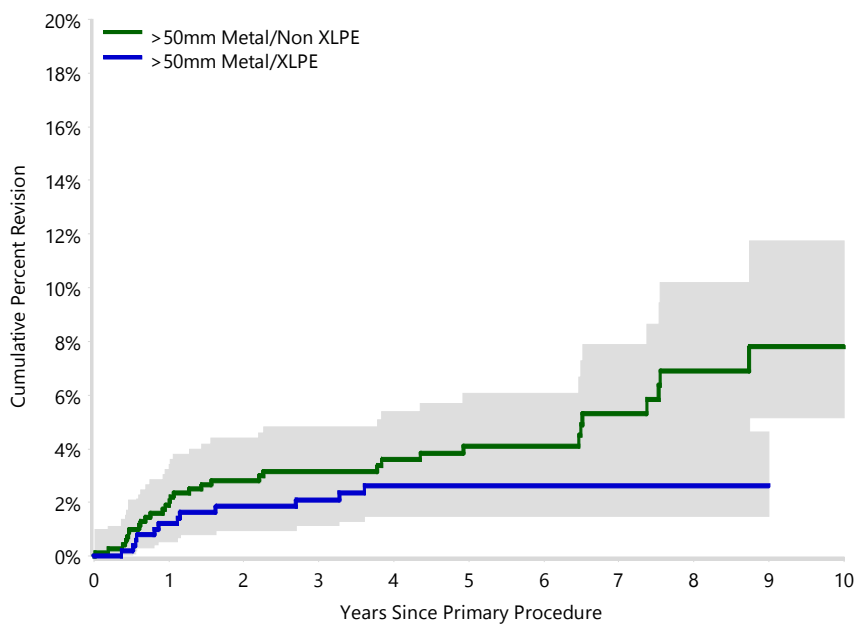
Entire Period: HR=1.95 (95% CI 1.37, 2.79), p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| 44-50mm | Metal/Non XLPE | 1856 | 1699 | 1331 | 942 | 541 | 205 | 39 |
| | Metal/XLPE | 1149 | 1065 | 891 | 743 | 552 | 188 | 70 |

Note: Restricted to modern prostheses

# Primary Total Shoulder Replacement

**Figure ST32 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Humeral Head Size and Bearing Surface (Primary Diagnosis OA)**




HR - adjusted for age and gender

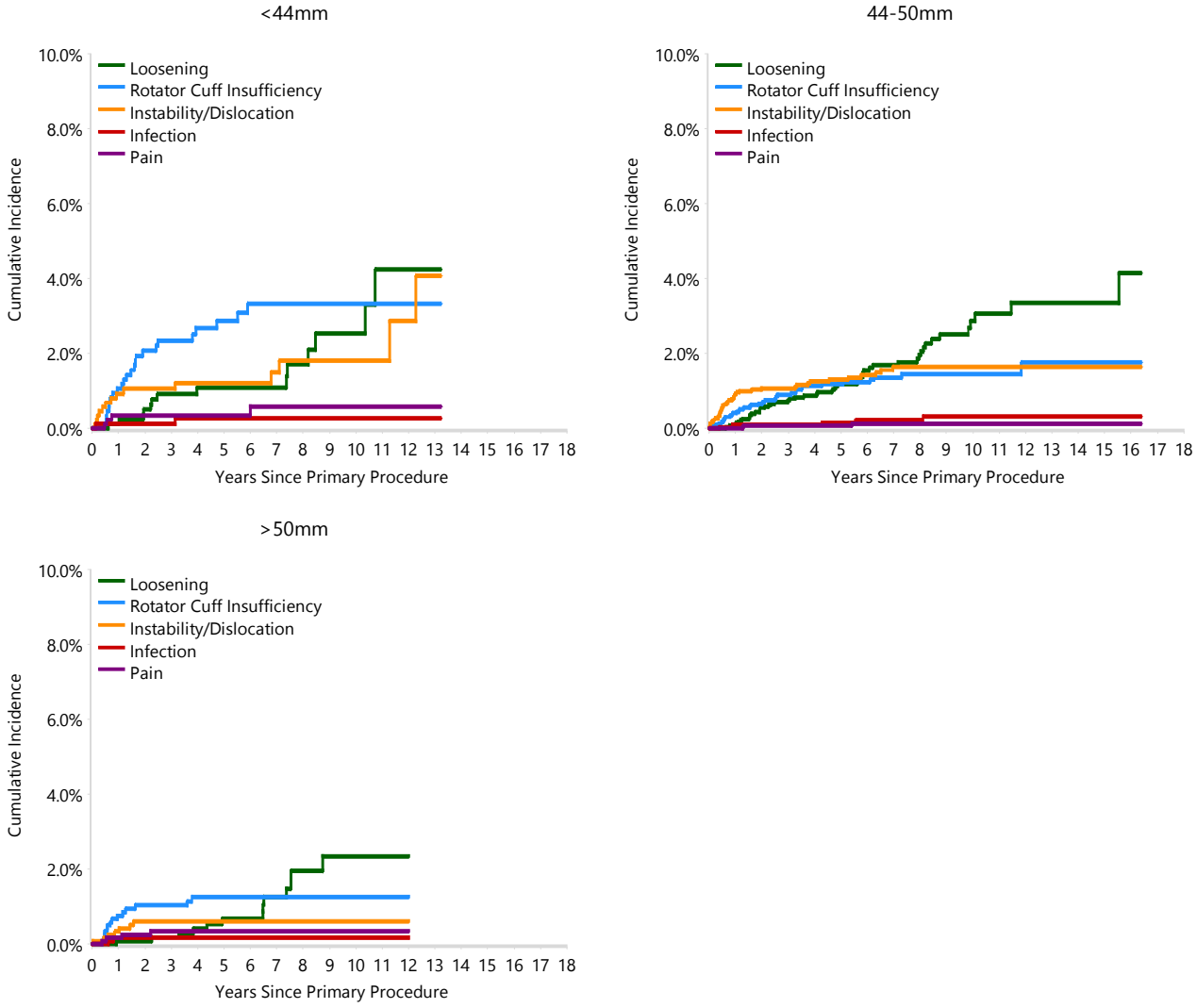
>50mm Metal/Non XLPE vs >50mm Metal/XLPE

Entire Period: HR=2.04 (95% CI 1.03, 4.03), p=0.040

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| >50mm | Metal/Non XLPE | 717 | 648 | 512 | 355 | 201 | 56 | 8 |
| | Metal/XLPE | 517 | 475 | 381 | 296 | 200 | 37 | 14 |

Note: Restricted to modern prostheses

**Figure ST33 Cumulative Incidence Revision Diagnosis of Primary Total Stemmed Anatomic Shoulder Replacement by Humeral Head Size (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

# Primary Total Shoulder Replacement

## IMPLANT SIZING VARIATIONS (ISV)

ISV are modifications to a prosthesis design range beyond simple size change.

### Glenoid Augmentation

A glenoid component is categorised as augmented if the backside has been modified for glenoid deformity (e.g. wedged, stepped, angulated, or lateralised). Augmented glenoids have a higher rate of revision than non-augmented prostheses (Table ST60 and Figure ST34). The reasons for revision are shown in Figure ST35. There is no difference between augmented and non-augmented glenoids with differing glenoid morphology classes (Table ST61).

### Humeral Stem Length

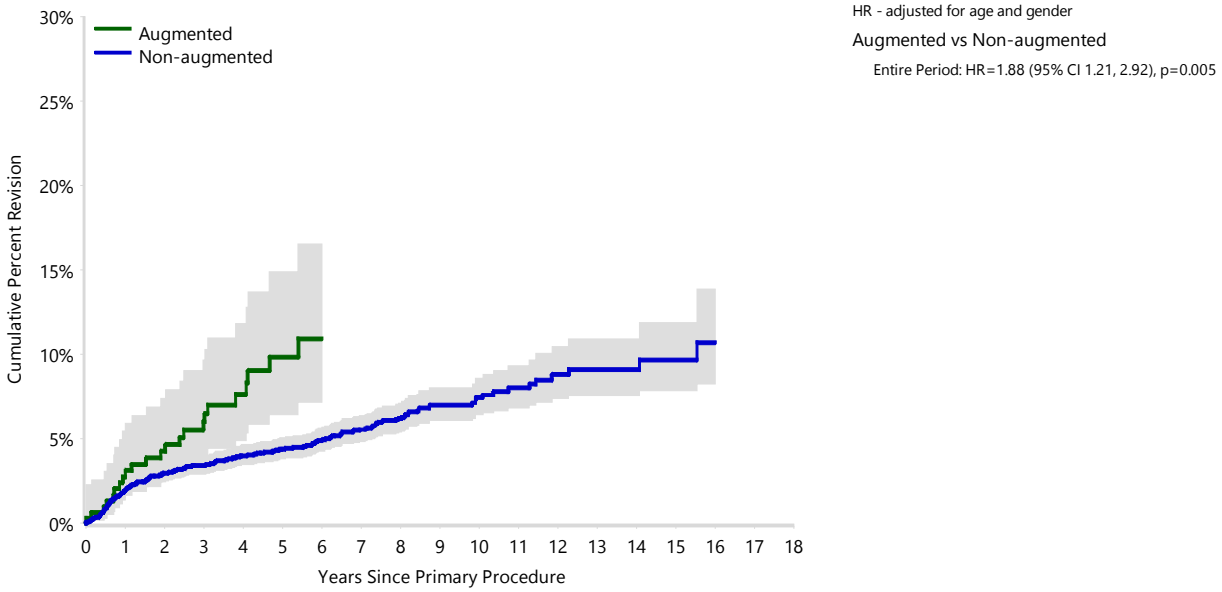
Humeral stem length is categorised as short if the size is <100mm or conventional if the size is ≥100mm. Humeral stem length is a revision risk for a short stem up to 9 months and a conventional stem after 1.5 years (Table ST62, Figure ST36 and Figure ST37).

**Table ST60 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Glenoid Augmentation (Primary Diagnosis OA)**

| Glenoid Augmentation | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Augmented | 23 | 307 | 2.8 (1.4, 5.4) | 6.0 (3.7, 9.7) | 9.8 (6.4, 14.9) | | | |
| Non-augmented | 245 | 4799 | 1.9 (1.6, 2.4) | 3.4 (2.9, 4.0) | 4.4 (3.8, 5.1) | 5.6 (4.8, 6.4) | 7.4 (6.4, 8.6) | 9.1 (7.6, 10.9) |
| TOTAL | 268 | 5106 | | | | | | |

Note: Restricted to modern prostheses.

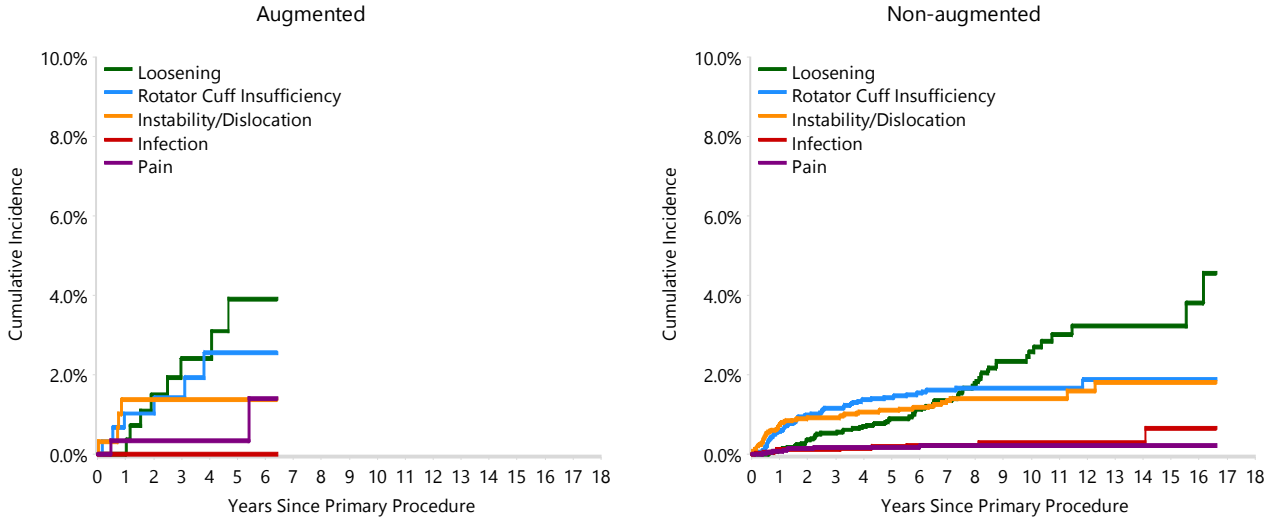
**Figure ST34 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Glenoid Augmentation (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Augmented | 307 | 271 | 192 | 103 | 27 | 0 | 0 |
| Non-augmented | 4799 | 4407 | 3554 | 2696 | 1748 | 602 | 159 |

Note: Restricted to modern prostheses

**Figure ST35 Cumulative Incidence Revision Diagnosis of Primary Total Stemmed Anatomic Shoulder Replacement by Glenoid Augmentation (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

**Table ST61 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Glenoid Morphology and Glenoid Augmentation (Primary Diagnosis OA)**

| Glenoid Morphology | Glenoid Augmentation | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|---|
| A | Augmented | 5 | 54 | 1.9 (0.3, 12.6) | 6.0 (2.0, 17.4) | 8.6 (3.3, 21.5) | 8.6 (3.3, 21.5) | 12.9 (5.3, 29.9) |
| | Non-augmented | 77 | 1767 | 2.3 (1.7, 3.1) | 3.3 (2.5, 4.3) | 3.7 (2.9, 4.8) | 4.2 (3.3, 5.3) | 4.5 (3.5, 5.7) |
| B | Augmented | 9 | 179 | 1.8 (0.6, 5.6) | 2.5 (1.0, 6.6) | 3.3 (1.4, 7.9) | 5.5 (2.6, 11.5) | 7.1 (3.4, 14.3) |
| | Non-augmented | 30 | 881 | 1.8 (1.1, 3.0) | 2.8 (1.8, 4.2) | 3.2 (2.2, 4.8) | 3.9 (2.7, 5.6) | 3.9 (2.7, 5.6) |
| C | Augmented | 0 | 25 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) |
| | Non-augmented | 1 | 63 | 1.7 (0.2, 11.4) | 1.7 (0.2, 11.4) | 1.7 (0.2, 11.4) | 1.7 (0.2, 11.4) | 1.7 (0.2, 11.4) |
| TOTAL | | 122 | 2969 | | | | | |

Note: Restricted to modern prostheses
Excludes 2,151 procedures with unknown glenoid augmentation or glenoid morphology
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

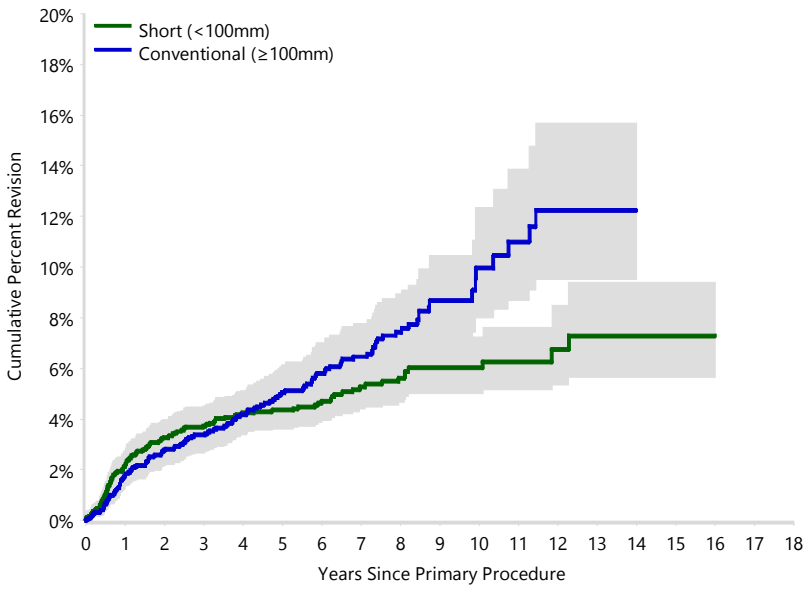
# Primary Total Shoulder Replacement

**Table ST62 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Humeral Stem Length (Primary Diagnosis OA)**

| Humeral Stem Length | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Short (<100mm) | 132 | 2889 | 2.2 (1.7, 2.8) | 3.7 (3.1, 4.5) | 4.3 (3.6, 5.2) | 5.3 (4.4, 6.3) | 6.0 (5.0, 7.3) | 7.3 (5.6, 9.4) |
| Conventional (≥100mm) | 136 | 2226 | 1.8 (1.3, 2.4) | 3.4 (2.7, 4.2) | 5.1 (4.1, 6.2) | 6.5 (5.4, 7.8) | 10.0 (8.0, 12.4) | 12.2 (9.5, 15.7) |
| TOTAL | 268 | 5115 | | | | | | |

Note: Excludes 5 procedures with unknown humeral stem length
Restricted to modern prostheses

**Figure ST36 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Humeral Stem Length (Primary Diagnosis OA)**

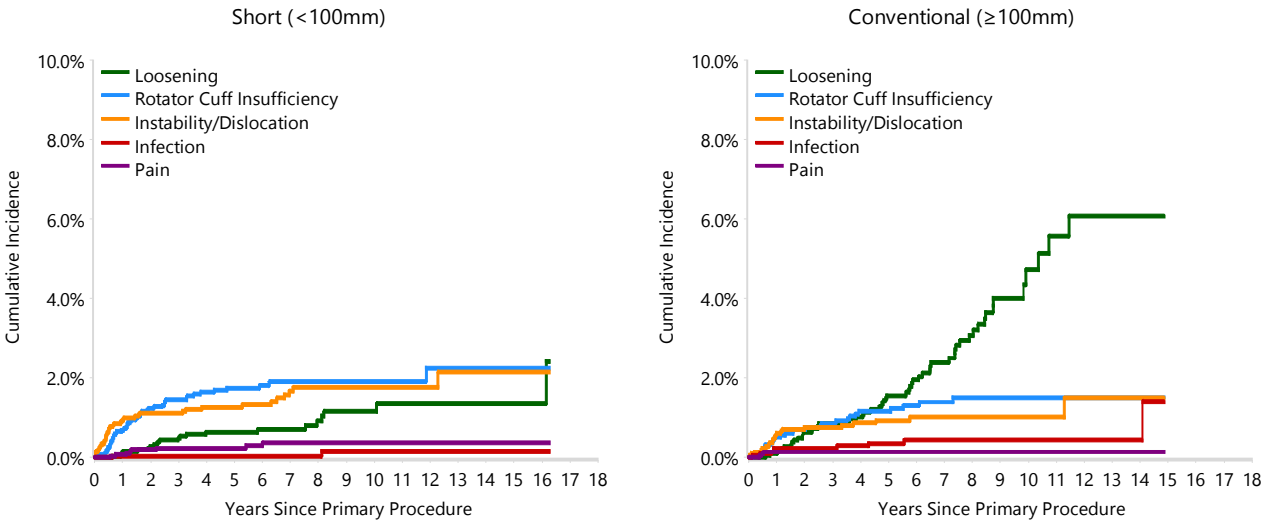



HR - adjusted for age and gender
Short (<100mm) vs Conventional (≥100mm)
0 - 9Mth: HR=1.61 (95% CI 1.00, 2.60), p=0.049
9Mth - 1.5Yr: HR=0.96 (95% CI 0.54, 1.70), p=0.891
1.5Yr+: HR=0.51 (95% CI 0.36, 0.71), p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Short (<100mm) | 2889 | 2592 | 2056 | 1510 | 918 | 399 | 100 |
| Conventional (≥100mm) | 2226 | 2088 | 1690 | 1289 | 857 | 203 | 59 |

Note: Excludes 5 procedures with unknown humeral stem length
Restricted to modern prostheses

**Figure ST37 Cumulative Incidence Revision Diagnosis of Primary Total Stemmed Anatomic Shoulder Replacement by Humeral Stem Length (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

# Primary Total Shoulder Replacement

## SURGEON ASSISTIVE TOOLS (SAT)

An image derived instrument (IDI) is defined as custom made pin guides or cutting blocks derived from CT or MRI images by 3D printing specifically for each patient. There are 863 total stemmed anatomic shoulder replacements for osteoarthritis utilising an IDI since their first use in 2014.

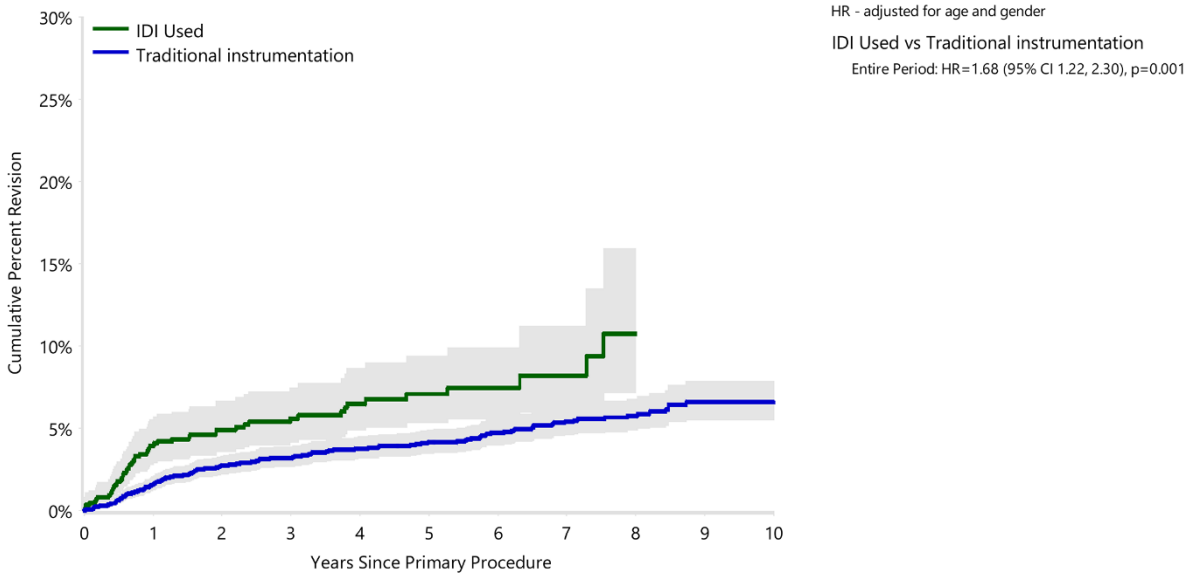
In 2024, IDI are used in 30.2% of total stemmed anatomic shoulder replacement procedures. There is an increase in the revision rate associated with IDI usage (Table ST63 and Figure ST38). IDI usage and glenoid morphology are listed in Table ST64. There is no difference in the rate of revision for IDI by glenoid morphology.

**Table ST63 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement Since 2014 by IDI Usage (Primary Diagnosis OA)**

| IDI Use | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| IDI Used | 53 | 863 | 3.9 (2.8, 5.5) | 4.9 (3.6, 6.7) | 5.6 (4.2, 7.5) | 7.1 (5.3, 9.4) | 8.2 (6.0, 11.2) | 10.7 (7.2, 15.9) | |
| Traditional instrumentation | 164 | 3685 | 1.6 (1.2, 2.1) | 2.7 (2.2, 3.3) | 3.2 (2.7, 3.9) | 4.1 (3.5, 4.9) | 5.4 (4.6, 6.4) | 5.8 (4.9, 6.8) | 6.6 (5.5, 7.8) |
| TOTAL | 217 | 4548 | | | | | | | |

Note: Restricted to modern prostheses

**Figure ST38 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement Since 2014 by IDI Usage (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|
| IDI Used | 863 | 734 | 634 | 503 | 264 | 89 | 43 | 22 |
| Traditional Instrumentation | 3685 | 3388 | 3050 | 2705 | 2026 | 1205 | 844 | 483 |

Note: Restricted to modern prostheses

**Table ST64 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement Since 2014 by IDI Usage and Glenoid Morphology (Primary Diagnosis OA)**

| IDI Use | Glenoid Morphology | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs | 9 Yrs |
|---|---|---|---|---|---|---|---|---|---|---|
| IDI Used | A1 | 10 | 195 | 4.4 (2.2, 8.6) | 5.0 (2.6, 9.4) | 5.0 (2.6, 9.4) | 5.0 (2.6, 9.4) | | | |
| | A2 | 12 | 199 | 3.2 (1.4, 7.0) | 4.4 (2.2, 8.6) | 5.3 (2.8, 10.1) | 8.1 (4.3, 14.9) | | | |
| | B1 | 10 | 137 | 3.9 (1.7, 9.2) | 3.9 (1.7, 9.2) | 4.9 (2.2, 10.7) | | | | |
| | B2 | 8 | 170 | 2.6 (1.0, 6.8) | 3.4 (1.4, 8.1) | 5.3 (2.5, 10.8) | 7.2 (3.4, 14.7) | | | |
| | C | 0 | 34 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | |
| Traditional Instrumentation | A1 | 44 | 889 | 2.5 (1.6, 3.7) | 3.5 (2.4, 5.0) | 3.8 (2.7, 5.3) | 4.8 (3.5, 6.7) | 7.5 (5.3, 10.4) | | |
| | A2 | 16 | 549 | 1.0 (0.4, 2.3) | 2.2 (1.2, 4.0) | 3.0 (1.8, 5.1) | 3.3 (2.0, 5.5) | 4.3 (2.4, 7.7) | | |
| | B1 | 15 | 452 | 1.9 (0.9, 3.7) | 3.2 (1.9, 5.4) | 3.2 (1.9, 5.4) | 3.6 (2.1, 6.1) | 5.3 (2.6, 10.8) | | |
| | B2 | 6 | 304 | 0.4 (0.1, 2.5) | 1.1 (0.4, 3.4) | 1.6 (0.6, 4.2) | 2.2 (0.9, 5.2) | | | |
| | C | 1 | 54 | 2.0 (0.3, 13.4) | 2.0 (0.3, 13.4) | 2.0 (0.3, 13.4) | 2.0 (0.3, 13.4) | | | |
| TOTAL | | 122 | 2983 | | | | | | | |

Note: Restricted to modern prostheses

Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

## OPERATIVE TECHNIQUE

### Rotator Cuff Repair

When the rotator cuff is repaired as part of a primary total stemmed anatomic replacement procedure, there is no difference in the rate of revision compared to when it is not repaired (Table ST65).

**Table ST65 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Rotator Cuff Repair (Primary Diagnosis OA)**

| Rotator Cuff Repair | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Yes | 6 | 226 | 2.7 (1.1, 6.5) | | | | | |
| No | 13 | 566 | 2.1 (1.2, 4.0) | 3.0 (1.8, 5.2) | | | | |
| TOTAL | 19 | 792 | | | | | | |

Note: Restricted to modern prostheses
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

## PROSTHESIS COMBINATIONS BY PRIMARY DIAGNOSIS

The outcome of the most used (>50 procedures) prosthesis combinations are listed in Table ST66. The most commonly used cementless prosthesis combinations are listed in Table ST67. The most commonly used prosthesis combinations with hybrid (glenoid cemented) fixation are listed in Table ST68.

**Table ST66 Cumulative Percent Revision of Primary Total Stemmed Anatomic Shoulder Replacement by Prosthesis Combination (Primary Diagnosis OA)**

| Humeral Stem | Glenoid | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Affinis | Affinis | 21 | 198 | 0.0 (0.0, 0.0) | 2.2 (0.8, 5.7) | 5.0 (2.7, 9.5) | 6.3 (3.5, 11.0) | 8.9 (5.4, 14.3) | 12.0 (7.8, 18.3) |
| Ascend Flex | Perform | 40 | 1385 | 0.9 (0.5, 1.6) | 2.2 (1.5, 3.2) | 2.7 (1.9, 3.9) | 4.1 (2.8, 5.8) | 4.9 (3.3, 7.0) | |
| Comprehensive | Alliance | 2 | 54 | 4.6 (1.2, 17.3) | 4.6 (1.2, 17.3) | | | | |
| | Comprehensive | 55 | 930 | 3.8 (2.7, 5.2) | 5.0 (3.7, 6.6) | 5.7 (4.3, 7.5) | 6.4 (4.8, 8.4) | 7.5 (5.6, 10.0) | |
| Equinoxe | Equinoxe | 80 | 726 | 3.1 (2.0, 4.6) | 6.3 (4.7, 8.4) | 9.6 (7.4, 12.3) | 12.8 (10.0, 16.4) | 24.2 (18.1, 32.0) | |
| Global Unite | Global | 32 | 1277 | 1.1 (0.7, 1.9) | 1.9 (1.3, 2.9) | 2.5 (1.7, 3.6) | 3.1 (2.2, 4.4) | | |
| SMR | SMR | 36 | 533 | 2.3 (1.3, 4.0) | 4.9 (3.4, 7.2) | 5.6 (3.9, 8.0) | 6.4 (4.5, 9.0) | 7.0 (5.0, 9.7) | 8.0 (5.7, 11.3) |
| Other (4) | | 2 | 17 | 19.2 (5.1, 57.7) | 19.2 (5.1, 57.7) | 19.2 (5.1, 57.7) | | | |
| TOTAL | | 268 | 5120 | | | | | | |

Note: Restricted to modern prostheses
Only prostheses with >50 procedures have been listed

**Table ST67 Cumulative Percent Revision of Cementless Primary Total Stemmed Anatomic Shoulder Replacement by Prosthesis Combination (Primary Diagnosis OA)**

| Humeral Stem | Glenoid | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Equinoxe | Equinoxe | 10 | 56 | 7.1 (2.7, 17.9) | 11.0 (5.1, 22.8) | 13.8 (6.7, 27.3) | 13.8 (6.7, 27.3) | | |
| Other (3) | | 0 | 9 | 0.0 (0.0, 0.0) | | | | | |
| TOTAL | | 10 | 65 | | | | | | |

Note: Restricted to modern prostheses
Only prostheses with >10 procedures have been listed

**Table ST68 Cumulative Percent Revision of Hybrid (Glenoid Cemented) Primary Total Stemmed Anatomic Shoulder Replacement by Prosthesis Combination (Primary Diagnosis OA)**

| Humeral Stem | Glenoid | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Affinis | Affinis | 20 | 186 | 0.0 (0.0, 0.0) | 1.7 (0.6, 5.2) | 4.7 (2.4, 9.1) | 5.9 (3.2, 10.7) | 8.6 (5.2, 14.1) | 11.7 (7.5, 18.1) |
| Ascend Flex | Perform | 34 | 1189 | 0.9 (0.5, 1.6) | 2.2 (1.5, 3.3) | 2.9 (2.0, 4.1) | 3.8 (2.6, 5.4) | 4.1 (2.8, 6.0) | |
| Comprehensive | Alliance | 2 | 53 | 4.7 (1.2, 17.7) | 4.7 (1.2, 17.7) | | | | |
| | Comprehensive | 55 | 919 | 3.8 (2.7, 5.3) | 5.0 (3.8, 6.7) | 5.7 (4.4, 7.5) | 6.5 (4.9, 8.5) | 7.6 (5.7, 10.1) | |
| Equinoxe | Equinoxe | 68 | 640 | 2.7 (1.7, 4.3) | 5.8 (4.2, 8.0) | 9.3 (7.1, 12.2) | 13.1 (10.1, 17.1) | 24.2 (17.5, 32.9) | |
| Global Unite | Global | 29 | 1145 | 1.1 (0.6, 1.9) | 1.9 (1.2, 2.9) | 2.5 (1.7, 3.7) | 3.1 (2.2, 4.5) | | |
| SMR | SMR | 33 | 513 | 2.4 (1.4, 4.2) | 4.7 (3.2, 7.0) | 5.4 (3.7, 7.8) | 5.9 (4.1, 8.5) | 6.5 (4.6, 9.3) | 7.7 (5.3, 10.9) |
| Other (4) | | 2 | 17 | 19.2 (5.1, 57.7) | 19.2 (5.1, 57.7) | 19.2 (5.1, 57.7) | | | |
| TOTAL | | 243 | 4662 | | | | | | |

Note: Restricted to modern prostheses
Only prostheses with >50 procedures have been listed

# Primary Total Shoulder Replacement

## Primary Total Stemless Reverse Shoulder Replacement

There are 68 total stemless reverse shoulder replacements performed since 2015 (Table ST69). This procedure is predominantly undertaken in males for the treatment of osteoarthritis or rotator cuff arthropathy (Table ST70). CPR at 4 years is 3.1% and there have been 2 revisions (Table ST71).

**Table ST69 Age and Gender of Primary Total Stemless Reverse Shoulder Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 47 | 69.1% | 44 | 79 | 69 | 68.3 | 6.0 |
| Female | 21 | 30.9% | 52 | 82 | 70 | 70.0 | 6.3 |
| **TOTAL** | **68** | **100.0%** | **44** | **82** | **69** | **68.8** | **6.1** |

**Table ST70 Primary Total Stemless Reverse Shoulder Replacement by Primary Diagnosis**

| Primary Diagnosis | Number | Percent |
|---|---|---|
| Osteoarthritis | 36 | 52.9 |
| Rotator Cuff Arthropathy | 30 | 44.1 |
| Fracture | 1 | 1.5 |
| Rheumatoid Arthritis | 1 | 1.5 |
| **TOTAL** | **68** | **100.0** |

**Table ST71 Cumulative Percent Revision of Primary Total Stemless Reverse Shoulder Replacement (All Diagnoses)**

| Shoulder Class | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs |
|---|---|---|---|---|---|---|
| Total Stemless Reverse | 2 | 68 | 1.5 (0.2, 10.0) | 3.0 (0.8, 11.4) | 3.0 (0.8, 11.4) | 3.0 (0.8, 11.4) |
| **TOTAL** | **2** | **68** | | | | |

## Primary Total Stemmed Reverse Shoulder Replacement

**DEMOGRAPHICS**

There are 66,607 primary total stemmed reverse shoulder replacement procedures. This is an increase of 9,257 procedures compared to the previous report.

For further information on the closure of the database please see the **Glossary** of this report.

Osteoarthritis is the most common diagnosis for primary total stemmed reverse shoulder replacement followed by rotator cuff arthropathy, and fracture (Figure ST39).

Primary total stemmed reverse shoulder replacement is more commonly undertaken in females, with females older on average than males (Table ST72). The percentage of male patients has increased by 5.2% compared to 2016.

The proportional use in patients aged ≥75 years has declined in recent years and is now similar to the proportional use in the 65–74 year age group.

The majority of procedures use cementless fixation followed by hybrid (humerus cemented) fixation. There has been little variation in the type of fixation used since 2008 (Figure ST40).

The polyethylene type used in total stemmed reverse shoulder replacement in 2024 is now almost equal in proportion between XLPE (49.2%) and non XLPE (50.8%) (Figure ST41).

The most commonly used humeral stems are listed in Table ST73. The most used glenoid prostheses are listed in Table ST74.

The most common primary diagnoses are osteoarthritis, rotator cuff arthropathy, and fracture.

**Figure ST39 Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis**

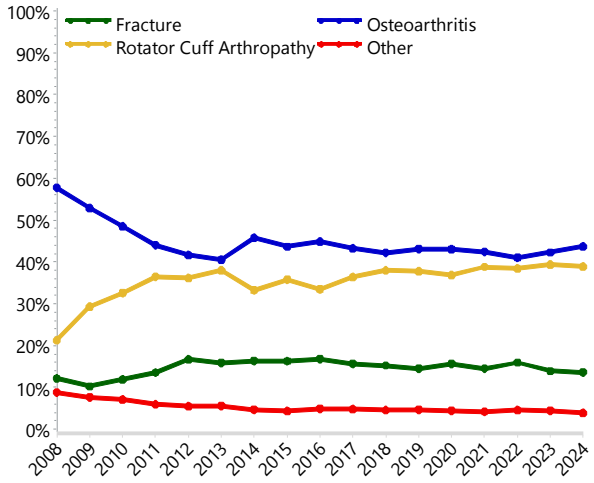



**Table ST72 Age and Gender of Primary Total Stemmed Reverse Shoulder Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 25664 | 38.5% | 14 | 100 | 72 | 71.9 | 8.3 |
| Female | 40943 | 61.5% | 12 | 103 | 75 | 74.5 | 7.9 |
| **TOTAL** | **66607** | **100.0%** | **12** | **103** | **74** | **73.5** | **8.2** |

# Primary Total Shoulder Replacement

**Figure ST40 Total Stemmed Reverse Shoulder Replacement by Fixation**

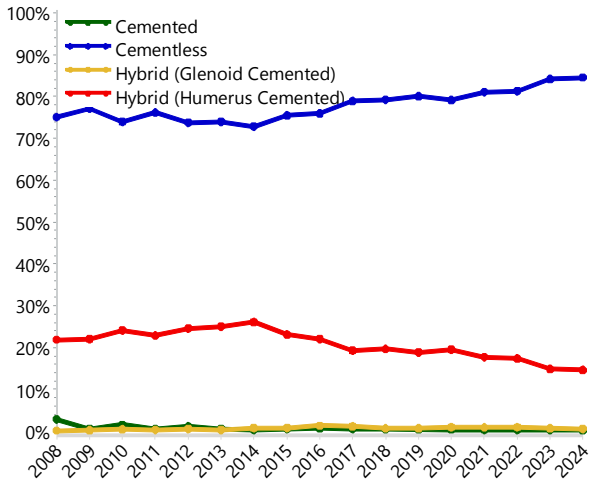



**Figure ST41 Primary Total Stemmed Reverse Shoulder Replacement by Polyethylene Type**

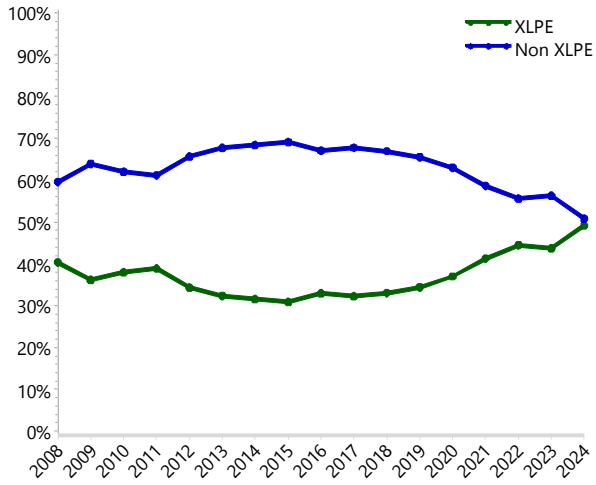



**Table ST73 10 Most Used Humeral Stem Prostheses in Primary Total Stemmed Reverse Shoulder Replacement**

| 2008 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 263 | SMR | 1234 | SMR | 1290 | Comprehensive | 1736 | Comprehensive | 2080 | Comprehensive |
| 252 | Delta Xtend | 1068 | Comprehensive | 1118 | SMR | 1359 | Ascend Flex | 1545 | Ascend Flex |
| 76 | Aequalis | 958 | Equinoxe | 1058 | Equinoxe | 1347 | Equinoxe | 1257 | Equinoxe |
| 42 | Trabecular Metal | 761 | Ascend Flex | 895 | Ascend Flex | 1088 | SMR | 1076 | SMR |
| 21 | Delta CTA | 711 | Delta Xtend | 692 | Delta Xtend | 773 | Delta Xtend | 821 | AltiVate Reverse |
| 2 | Custom Made (Lima) | 536 | AltiVate Reverse | 549 | AltiVate Reverse | 714 | AltiVate Reverse | 791 | Delta Xtend |
| 1 | Generic Humeral Stem | 344 | Aequalis | 387 | Aequalis | 363 | Aequalis | 332 | Aequalis |
| 1 | Promos | 294 | Affinis | 193 | Global Unite | 250 | Global Unite | 324 | Global Unite |
| | | 246 | Global Unite | 149 | Trabecular Metal | 212 | Trabecular Metal | 296 | MSS |
| | | 174 | RSP | 141 | Affinis | 114 | Affinis | 190 | Trabecular Metal |
| **10 Most Used** | | | | | | | | | |
| 658 | (8) 100.0% | 6326 | (10) 96.1% | 6472 | (10) 96.7% | 7956 | (10) 96.7% | 8712 | (10) 98.0% |
| **Remainder** | | | | | | | | | |
| 0 | (0) 0% | 254 | (8) 3.9% | 224 | (7) 3.3% | 269 | (8) 3.3% | 182 | (8) 2.0% |
| **TOTAL** | | | | | | | | | |
| 658 | (8) 100.0% | 6580 | (18) 100.0% | 6696 | (17) 100.0% | 8225 | (18) 100.0% | 8894 | (18) 100.0% |

**Table ST74 10 Most Used Glenoid Prostheses in Primary Total Stemmed Reverse Shoulder Replacement**

| 2008 | | 2021 | | 2022 | | 2023 | | 2024 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 264 | SMR L1 | 1191 | SMR L1 | 1337 | Comprehensive Reverse | 1844 | Comprehensive Reverse | 2171 | Comprehensive Reverse |
| 252 | Delta Xtend | 1115 | Comprehensive Reverse | 1057 | Equinoxe | 1347 | Equinoxe | 1257 | Equinoxe |
| 76 | Aequalis | 956 | Delta Xtend | 1034 | SMR L1 | 1021 | Delta Xtend | 1135 | Perform Reversed |
| 42 | Trabecular Metal | 956 | Equinoxe | 912 | Aequalis | 944 | SMR L1 | 1114 | Delta Xtend |
| 21 | Delta CTA | 920 | Aequalis | 886 | Delta Xtend | 936 | Aequalis | 913 | RSP |
| 1 | Generic Metaglene | 733 | RSP | 691 | RSP | 826 | RSP | 902 | SMR L1 |
| 1 | Promos | 293 | Affinis | 392 | Perform Reversed | 820 | Perform Reversed | 777 | Aequalis |
| 1 | SMR | 200 | Perform Reversed | 140 | Affinis | 118 | SMR | 296 | MSS |
| | | 114 | Trabecular Metal | 95 | Trabecular Metal | 114 | Affinis | 155 | SMR |
| | | 32 | SMR Axioma | 42 | MSS | 100 | MSS | 83 | Trabecular Metal |
| **10 Most Used** | | | | | | | | | |
| 658 | (8) 100.0% | 6510 | (10) 98.9% | 6586 | (10) 98.4% | 8070 | (10) 98.1% | 8803 | (10) 99.0% |
| **Remainder** | | | | | | | | | |
| 0 | (0) 0% | 70 | (8) 1.1% | 110 | (7) 1.6% | 155 | (12) 1.9% | 91 | (12) 1.0% |
| **TOTAL** | | | | | | | | | |
| 658 | (8) 100.0% | 6580 | (18) 100.0% | 6696 | (17) 100.0% | 8225 | (22) 100.0% | 8894 | (22) 100.0% |

## OUTCOME FOR ALL DIAGNOSES

### Primary Diagnosis

In order to keep Registry data contemporaneous, only procedures using prostheses that have been available and used in 2024 (described as modern prostheses) are included in the analyses, unless clearly specified.

Procedures undertaken for instability, rheumatoid arthritis and rotator cuff arthropathy have a higher risk of revision compared to those undertaken for osteoarthritis. Fracture also has a higher rate of revision compared to osteoarthritis, but only in the first 3 months (Table ST75 and Figure ST42).

### Reason for Revision

The main reasons for revision are instability/dislocation, infection, loosening, and fracture (Table ST76, Figure ST43 and Figure ST44). Since 2016, the proportion of revisions for instability/dislocation has increased by 16.6%, but infection and loosening have decreased by 12.2% and 9.3%, respectively.

### Type of Revision

The most common types of revision involve replacement of the humeral component, replacement of the cup/head, cup only, and replacement of the humeral/glenoid (Table ST77). The majority of total stemmed reverse revisions are to a total stemmed reverse (87.2%) with 12.8% to anatomic shoulder replacement categories. Compared to 2016, humeral component revision increased by 12.3% and humerus/glenoid by 5.5%. In contrast, cup/head only revisions decreased by 1.7% and isolated glenoid components also decreased by 4.1%.

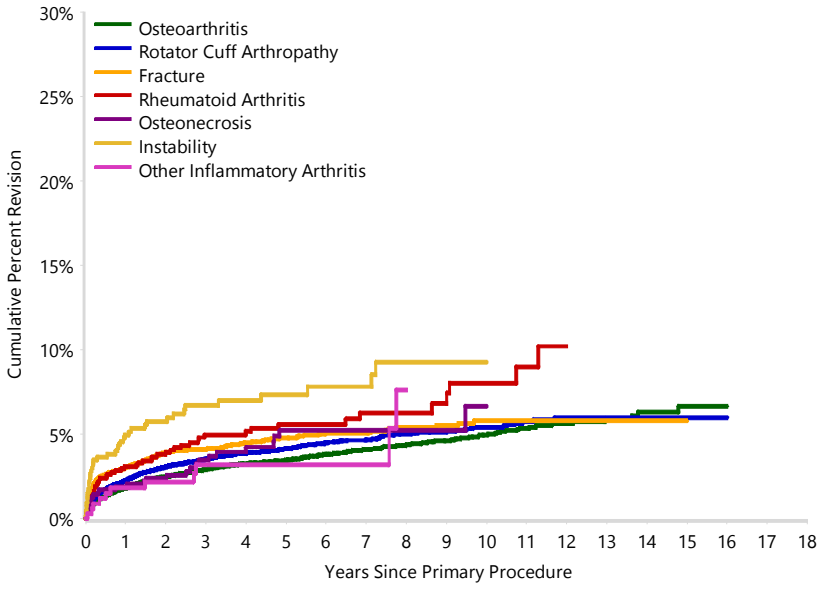
# Primary Total Shoulder Replacement

**Table ST75 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis**

| Primary Diagnosis | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | 898 | 27934 | 1.8 (1.7, 2.0) | 2.9 (2.7, 3.2) | 3.5 (3.2, 3.7) | 4.1 (3.8, 4.4) | 5.0 (4.6, 5.4) | 6.3 (5.5, 7.3) |
| Rotator Cuff Arthropathy | 885 | 24122 | 2.3 (2.1, 2.5) | 3.5 (3.3, 3.8) | 4.2 (3.9, 4.5) | 4.7 (4.3, 5.0) | 5.4 (5.0, 5.9) | 6.0 (5.4, 6.6) |
| Fracture | 406 | 9589 | 3.1 (2.7, 3.4) | 4.1 (3.7, 4.6) | 4.8 (4.3, 5.3) | 5.1 (4.6, 5.6) | 5.8 (5.1, 6.6) | 5.8 (5.1, 6.6) |
| Rheumatoid Arthritis | 54 | 1012 | 3.1 (2.2, 4.4) | 5.0 (3.7, 6.6) | 5.6 (4.2, 7.4) | 6.3 (4.6, 8.4) | 8.0 (5.7, 11.2) | |
| Osteonecrosis | 29 | 710 | 1.9 (1.1, 3.2) | 3.5 (2.3, 5.3) | 5.2 (3.5, 7.7) | 5.2 (3.5, 7.7) | 6.7 (4.0, 11.1) | |
| Instability | 44 | 637 | 5.0 (3.5, 7.0) | 6.7 (4.9, 9.1) | 7.4 (5.4, 10.0) | 7.8 (5.7, 10.6) | 9.3 (6.6, 12.9) | |
| Other Inflammatory Arthritis | 11 | 340 | 1.8 (0.8, 4.0) | 3.2 (1.7, 6.2) | 3.2 (1.7, 6.2) | 3.2 (1.7, 6.2) | | |
| Other (2) | 36 | 292 | 6.1 (3.8, 9.8) | 14.0 (9.8, 19.9) | 17.1 (12.0, 23.9) | | | |
| TOTAL | 2363 | 64636 | | | | | | |

Note: Only primary diagnoses with >300 procedures have been listed
Restricted to modern prostheses

**Figure ST42 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis**




HR - adjusted for age and gender

Rotator Cuff Arthropathy vs Osteoarthritis
Entire Period: HR=1.13 (95% CI 1.03, 1.24), p=0.010

Fracture vs Osteoarthritis
0 - 3Mth: HR=2.65 (95% CI 2.25, 3.12), p<0.001
3Mth+: HR=1.16 (95% CI 0.99, 1.36), p=0.075

Rheumatoid Arthritis vs Osteoarthritis
Entire Period: HR=1.64 (95% CI 1.24, 2.16), p<0.001

Osteonecrosis vs Osteoarthritis
Entire Period: HR=1.33 (95% CI 0.92, 1.93), p=0.129

Instability vs Osteoarthritis
0 - 3Mth: HR=3.30 (95% CI 2.15, 5.06), p<0.001
3Mth+: HR=1.58 (95% CI 1.03, 2.41), p=0.035

Other Inflammatory Arthritis vs Osteoarthritis
Entire Period: HR=1.07 (95% CI 0.59, 1.94), p=0.817

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Osteoarthritis | 27934 | 23352 | 16436 | 10750 | 6155 | 2235 | 388 |
| Rotator Cuff Arthropathy | 24122 | 19987 | 13594 | 8566 | 4691 | 1566 | 203 |
| Fracture | 9589 | 7875 | 5288 | 3272 | 1816 | 589 | 75 |
| Rheumatoid Arthritis | 1012 | 862 | 604 | 413 | 251 | 118 | 29 |
| Osteonecrosis | 710 | 600 | 410 | 284 | 159 | 50 | 11 |
| Instability | 637 | 503 | 341 | 226 | 138 | 56 | 12 |
| Other Inflammatory Arthritis | 340 | 290 | 184 | 104 | 57 | 18 | 4 |

Note: Only primary diagnoses with >300 procedures have been listed
Restricted to modern prostheses

**Table ST76 Primary Total Stemmed Reverse Shoulder Replacement by Reason for Revision (All Diagnoses)**

| Reason for Revision | Number | Percent |
|---|---|---|
| Instability/Dislocation | 747 | 31.6 |
| Infection | 608 | 25.7 |
| Loosening | 378 | 16.0 |
| Fracture | 257 | 10.9 |
| Dissociation | 84 | 3.6 |
| Pain | 49 | 2.1 |
| Lysis | 27 | 1.1 |
| Arthrofibrosis | 26 | 1.1 |
| Malposition | 25 | 1.1 |
| Implant Breakage Glenoid | 18 | 0.8 |
| Incorrect Sizing | 17 | 0.7 |
| Heterotopic Bone | 14 | 0.6 |
| Metal Related Pathology | 13 | 0.6 |
| Rotator Cuff Insufficiency | 9 | 0.4 |
| Wear Humeral Cup | 8 | 0.3 |
| Implant Breakage Humeral | 6 | 0.3 |
| Tumour | 5 | 0.2 |
| Implant Breakage Glenoid Insert | 3 | 0.1 |
| Glenoid Erosion | 2 | 0.1 |
| Wear Glenoid Insert | 1 | 0.0 |
| Other | 66 | 2.8 |
| TOTAL | 2363 | 100.0 |

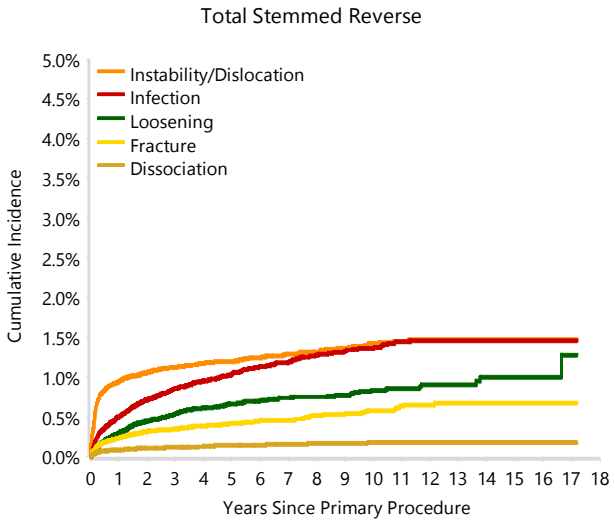
Note: Restricted to modern prostheses

**Table ST77 Primary Total Stemmed Reverse Shoulder Replacement by Type of Revision (All Diagnoses)**

| Type of Revision | Number | Percent |
|---|---|---|
| Humeral Component | 625 | 26.4 |
| Cup/Head | 447 | 18.9 |
| Cup Only | 370 | 15.7 |
| Humeral/Glenoid | 234 | 9.9 |
| Cement Spacer | 217 | 9.2 |
| Humeral Head Only | 201 | 8.5 |
| Glenoid Component | 173 | 7.3 |
| Removal of Prostheses | 39 | 1.7 |
| Minor Components | 16 | 0.7 |
| Glenosphere Only | 15 | 0.6 |
| Reoperation | 10 | 0.4 |
| Cement Only | 10 | 0.4 |
| Reinsertion of Components | 4 | 0.2 |
| Head/Insert | 2 | 0.1 |
| TOTAL | 2363 | 100.0 |

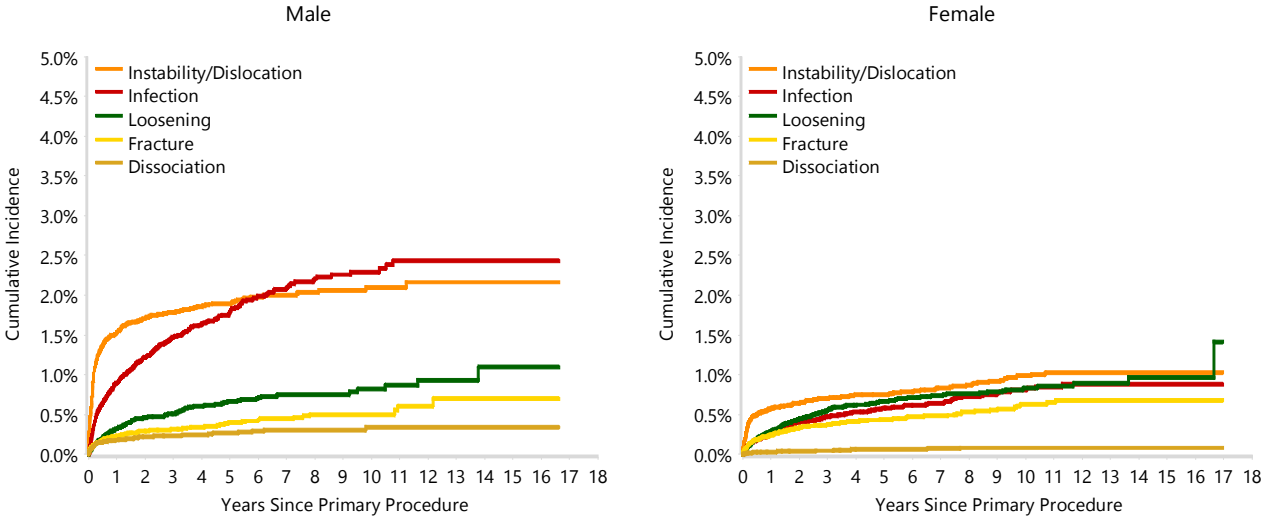
Note: Restricted to modern prostheses

**Figure ST43 Cumulative Incidence Revision Diagnosis of Primary Total Stemmed Reverse Shoulder Replacement (All Diagnoses)**




Note: Restricted to modern prostheses

**Figure ST44 Cumulative Incidence Revision Diagnosis of Primary Total Stemmed Reverse Shoulder Replacement by Gender**




Note: Restricted to modern prostheses

## PROSTHESIS TYPES

The outcomes of humeral stem and glenoid prosthesis combinations (>50 procedures) used in primary total stemmed reverse shoulder replacement are listed in Table ST78. The most commonly used cementless prosthesis combinations are listed in Table ST79. The most commonly used prosthesis combinations with hybrid (humerus cemented) fixation are listed in Table ST80.

**Table ST78 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Prosthesis Combination**

| Humeral Stem | Glenoid Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Aequalis | Aequalis | 219 | 4555 | 2.1 (1.7, 2.6) | 3.5 (3.0, 4.1) | 4.4 (3.8, 5.1) | 5.3 (4.6, 6.1) | 6.7 (5.8, 7.7) | 7.2 (6.1, 8.4) |
| | Perform Reversed | 8 | 438 | 1.1 (0.4, 2.9) | 2.4 (1.1, 5.3) | 2.4 (1.1, 5.3) | | | |
| Aequalis Flex Revive | Perform Reversed | 3 | 82 | 2.8 (0.7, 10.6) | 5.6 (1.7, 17.7) | | | | |
| Affinis | Affinis | 79 | 2030 | 1.7 (1.3, 2.4) | 3.4 (2.7, 4.3) | 4.1 (3.3, 5.1) | 4.7 (3.7, 6.0) | | |
| AltiVate | RSP | 3 | 150 | 2.2 (0.7, 6.7) | | | | | |
| AltiVate Reverse | RSP | 82 | 2953 | 2.2 (1.7, 2.8) | 3.6 (2.9, 4.6) | 4.0 (3.1, 5.1) | | | |
| Ascend Flex | Aequalis | 157 | 4084 | 2.5 (2.0, 3.0) | 4.1 (3.5, 4.8) | 4.9 (4.2, 5.8) | 5.3 (4.4, 6.4) | 5.7 (4.6, 7.2) | |
| | Perform Reversed | 47 | 2299 | 2.1 (1.6, 2.9) | 3.0 (2.2, 4.2) | 3.0 (2.2, 4.2) | | | |
| Comprehensive | Comprehensive Reverse | 159 | 8747 | 1.3 (1.0, 1.5) | 2.0 (1.7, 2.3) | 2.5 (2.1, 3.0) | 2.7 (2.2, 3.3) | 3.4 (2.2, 5.2) | |
| | Custom Made (Comprehensive) | 6 | 87 | 6.0 (2.5, 13.8) | 6.0 (2.5, 13.8) | 7.8 (3.5, 16.8) | 7.8 (3.5, 16.8) | | |
| | Trabecular Metal | 2 | 89 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 2.7 (0.7, 10.2) | | | |
| Delta Xtend | Delta Xtend | 490 | 12331 | 2.2 (1.9, 2.5) | 3.2 (2.9, 3.5) | 3.7 (3.4, 4.1) | 4.2 (3.9, 4.6) | 5.0 (4.5, 5.5) | 6.2 (5.3, 7.1) |
| Equinoxe | Equinoxe | 271 | 7297 | 2.3 (2.0, 2.7) | 3.6 (3.1, 4.1) | 4.5 (3.9, 5.1) | 6.2 (5.3, 7.2) | | |
| Global Unite | Delta Xtend | 53 | 1816 | 1.6 (1.1, 2.4) | 3.0 (2.2, 4.0) | 3.7 (2.8, 5.0) | 4.2 (3.1, 5.7) | | |
| MSS | MSS | 8 | 530 | 1.5 (0.6, 3.7) | 2.4 (1.1, 5.1) | | | | |
| Mets | Mets | 24 | 135 | 12.0 (7.4, 19.1) | 17.7 (11.7, 26.5) | | | | |
| RSP | RSP | 84 | 1855 | 2.8 (2.1, 3.6) | 4.2 (3.4, 5.2) | 4.9 (3.9, 6.0) | 4.9 (3.9, 6.0) | | |
| SMR | Custom Made (Lima) | 6 | 80 | 5.2 (2.0, 13.2) | 6.6 (2.8, 15.2) | 10.3 (4.3, 23.9) | | | |
| | SMR | 4 | 306 | 1.0 (0.3, 3.1) | | | | | |
| | SMR Axioma | 13 | 209 | 3.4 (1.6, 6.9) | 6.8 (4.0, 11.5) | 6.8 (4.0, 11.5) | | | |
| | SMR L1 | 504 | 11869 | 2.9 (2.6, 3.2) | 3.9 (3.6, 4.3) | 4.3 (3.9, 4.7) | 4.6 (4.2, 5.1) | 5.3 (4.8, 5.8) | 6.0 (5.2, 6.9) |
| Trabecular Metal | Comprehensive Reverse | 21 | 551 | 3.3 (2.0, 5.2) | 4.6 (3.0, 7.1) | 4.6 (3.0, 7.1) | | | |
| | Trabecular Metal | 105 | 1988 | 2.5 (1.9, 3.3) | 4.4 (3.5, 5.4) | 5.1 (4.2, 6.3) | 5.6 (4.6, 6.7) | 6.4 (5.2, 7.9) | 8.1 (5.6, 11.6) |
| Verso | Verso | 7 | 40 | 15.3 (7.2, 31.0) | 18.6 (9.3, 35.3) | 18.6 (9.3, 35.3) | | | |
| Other (27) | | 8 | 115 | 5.6 (2.5, 12.0) | 8.1 (4.1, 15.6) | | | | |
| TOTAL | | 2363 | 64636 | | | | | | |

Note: Restricted to modern prostheses
Only prostheses with >50 procedures have been listed

**Table ST79 Cumulative Percent Revision of Cementless Primary Total Stemmed Reverse Shoulder Replacement by Prosthesis Combination**

| Humeral Stem | Glenoid Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Aequalis | Aequalis | 143 | 2537 | 2.1 (1.6, 2.8) | 3.9 (3.2, 4.7) | 4.9 (4.0, 5.8) | 5.9 (4.9, 7.0) | 7.5 (6.2, 8.9) | 8.2 (6.8, 9.9) |
| | Perform Reversed | 2 | 229 | 0.5 (0.1, 3.3) | 0.5 (0.1, 3.3) | | | | |
| Aequalis Flex Revive | Perform Reversed | 1 | 67 | 1.7 (0.2, 11.4) | 1.7 (0.2, 11.4) | | | | |
| Affinis | Affinis | 41 | 1006 | 1.6 (1.0, 2.6) | 3.5 (2.5, 4.9) | 4.3 (3.1, 5.8) | 5.1 (3.6, 7.3) | | |
| AltiVate | RSP | 3 | 141 | 2.3 (0.8, 7.1) | | | | | |
| AltiVate Reverse | RSP | 66 | 2451 | 2.1 (1.5, 2.8) | 3.6 (2.8, 4.7) | 4.0 (3.1, 5.3) | | | |
| Ascend Flex | Aequalis | 142 | 3550 | 2.5 (2.0, 3.1) | 4.3 (3.6, 5.1) | 5.1 (4.3, 6.0) | 5.6 (4.6, 6.7) | 6.0 (4.8, 7.6) | |
| | Perform Reversed | 42 | 2007 | 2.3 (1.7, 3.1) | 2.9 (2.1, 4.1) | 2.9 (2.1, 4.1) | | | |
| Comprehensive | Comprehensive Reverse | 123 | 7447 | 1.1 (0.9, 1.4) | 1.9 (1.5, 2.2) | 2.3 (1.9, 2.8) | 2.5 (2.0, 3.1) | 2.5 (2.0, 3.1) | |
| | Custom Made (Comprehensive) | 4 | 78 | 3.9 (1.3, 11.6) | 3.9 (1.3, 11.6) | 5.9 (2.2, 15.2) | 5.9 (2.2, 15.2) | | |
| | Trabecular Metal | 2 | 73 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 3.2 (0.8, 12.1) | | | |
| Delta Xtend | Delta Xtend | 346 | 8936 | 2.0 (1.7, 2.3) | 3.1 (2.7, 3.5) | 3.7 (3.3, 4.1) | 4.2 (3.8, 4.7) | 5.1 (4.5, 5.7) | 6.6 (5.5, 8.0) |
| Equinoxe | Equinoxe | 223 | 6276 | 2.2 (1.8, 2.6) | 3.3 (2.8, 3.8) | 4.2 (3.7, 4.9) | 5.9 (4.9, 7.0) | | |
| Global Unite | Delta Xtend | 31 | 1192 | 1.2 (0.7, 2.0) | 2.5 (1.7, 3.7) | 3.5 (2.4, 5.2) | 3.8 (2.6, 5.6) | | |
| MSS | MSS | 7 | 507 | 1.4 (0.5, 3.7) | 2.3 (1.0, 5.1) | | | | |
| RSP | RSP | 59 | 1470 | 2.5 (1.8, 3.5) | 3.7 (2.8, 4.8) | 4.3 (3.3, 5.5) | 4.3 (3.3, 5.5) | | |
| SMR | Custom Made (Lima) | 5 | 77 | 4.0 (1.3, 12.0) | 5.6 (2.1, 14.2) | 9.3 (3.6, 23.4) | | | |
| | SMR | 4 | 302 | 1.0 (0.3, 3.1) | | | | | |
| | SMR Axioma | 11 | 203 | 3.0 (1.3, 6.5) | 6.0 (3.3, 10.6) | 6.0 (3.3, 10.6) | | | |
| | SMR L1 | 466 | 11294 | 2.7 (2.5, 3.1) | 3.8 (3.4, 4.2) | 4.1 (3.8, 4.5) | 4.5 (4.1, 5.0) | 5.2 (4.7, 5.8) | 6.0 (5.1, 6.9) |
| Trabecular Metal | Comprehensive Reverse | 14 | 391 | 2.7 (1.5, 5.0) | 4.5 (2.6, 7.6) | 4.5 (2.6, 7.6) | | | |
| | Trabecular Metal | 88 | 1600 | 2.7 (2.0, 3.7) | 4.6 (3.7, 5.8) | 5.4 (4.3, 6.6) | 5.8 (4.7, 7.1) | 6.6 (5.3, 8.2) | 7.0 (5.5, 8.8) |
| Verso | Verso | 7 | 38 | 16.2 (7.6, 32.5) | 19.7 (9.8, 37.1) | 19.7 (9.8, 37.1) | | | |
| Other (23) | | 7 | 79 | 6.7 (2.8, 15.3) | 10.2 (4.9, 20.3) | 10.2 (4.9, 20.3) | | | |
| TOTAL | | 1837 | 51951 | | | | | | |

Note: Restricted to modern prostheses
Only prostheses with >50 procedures have been listed

**Table ST80 Cumulative Percent Revision of Hybrid (Humerus Cemented) Primary Total Stemmed Reverse Shoulder Replacement by Prosthesis Combination**

| Humeral Stem | Glenoid Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Aequalis | Aequalis | 75 | 1965 | 2.1 (1.6, 2.9) | 3.0 (2.3, 3.9) | 3.7 (2.9, 4.7) | 4.4 (3.5, 5.6) | 5.5 (4.2, 7.0) | |
| | Perform Reversed | 6 | 206 | 1.9 (0.6, 6.1) | | | | | |
| Affinis | Affinis | 36 | 965 | 2.0 (1.3, 3.1) | 3.3 (2.3, 4.7) | 4.0 (2.9, 5.5) | 4.2 (3.0, 5.8) | | |
| AltiVate Reverse | RSP | 14 | 458 | 2.6 (1.5, 4.7) | 3.7 (2.2, 6.3) | | | | |
| Ascend Flex | Aequalis | 12 | 496 | 1.9 (1.0, 3.6) | 2.7 (1.5, 4.7) | 2.7 (1.5, 4.7) | | | |
| | Perform Reversed | 4 | 275 | 1.0 (0.2, 4.0) | | | | | |
| Comprehensive | Comprehensive Reverse | 30 | 1217 | 1.9 (1.2, 2.8) | 2.7 (1.8, 3.9) | 3.5 (2.4, 5.2) | 3.5 (2.4, 5.2) | | |
| Delta Xtend | Delta Xtend | 139 | 3285 | 2.7 (2.2, 3.3) | 3.5 (2.9, 4.2) | 3.9 (3.3, 4.7) | 4.3 (3.6, 5.1) | 4.9 (4.1, 5.8) | 5.4 (4.4, 6.6) |
| Equinoxe | Equinoxe | 42 | 964 | 2.8 (1.9, 4.1) | 5.1 (3.7, 7.0) | 5.5 (4.0, 7.6) | 7.8 (4.9, 12.4) | | |
| Global Unite | Delta Xtend | 21 | 578 | 2.6 (1.5, 4.4) | 4.1 (2.6, 6.3) | 4.1 (2.6, 6.3) | | | |
| Mets | Mets | 23 | 129 | 12.5 (7.7, 19.9) | 18.6 (12.2, 27.7) | | | | |
| RSP | RSP | 25 | 357 | 4.0 (2.4, 6.6) | 6.8 (4.5, 10.0) | 7.6 (5.2, 11.1) | 7.6 (5.2, 11.1) | | |
| SMR | SMR L1 | 22 | 422 | 4.2 (2.6, 6.6) | 5.6 (3.7, 8.5) | 5.6 (3.7, 8.5) | 5.6 (3.7, 8.5) | 5.6 (3.7, 8.5) | |
| Trabecular Metal | Comprehensive Reverse | 7 | 152 | 4.8 (2.3, 9.8) | 4.8 (2.3, 9.8) | | | | |
| | Trabecular Metal | 15 | 354 | 1.7 (0.8, 3.8) | 3.4 (1.9, 6.1) | 4.3 (2.5, 7.4) | 4.9 (2.9, 8.3) | 6.3 (3.5, 11.3) | |
| Other (22) | | 8 | 109 | 6.9 (3.4, 14.1) | | | | | |
| TOTAL | | 479 | 11932 | | | | | | |

Note: Restricted to modern prostheses
Only prostheses with >50 procedures have been listed

# Primary Total Shoulder Replacement

## OUTCOME FOR OSTEOARTHRITIS, ROTATOR CUFF ARTHROPATHY AND FRACTURE– PATIENT CHARACTERISTICS

There are 27,934 primary total stemmed reverse shoulder replacement procedures with a primary diagnosis of osteoarthritis, 24,122 for rotator cuff arthropathy, and 9,589 for fracture. This year the 3 predominate primary diagnoses are being presented concurrently for the purpose of comparison.

The cumulative percent revision of primary total stemmed reverse shoulder replacement for osteoarthritis at 14 years is 6.3%, 6.0% for rotator cuff arthropathy, and 5.8% for fracture (Table ST81 and Figure ST45).

Compared to the pre-2016 period, total stemmed reverse replacements 2016-2023 have a lower rate of revision for osteoarthritis and for rotator cuff arthropathy, but not for fracture (Table ST82 and Figure ST46, and Figure ST47).

The most common reasons for revision are instability/dislocation (10.8% for osteoarthritis, 12% rotator cuff arthropathy and 8.2% for fracture), infection (11.7%, 9.7%, and 4.5%) and loosening (7.6%, 6.3%, and 2.3%, respectively) (Table ST83 and Figure ST48).

The most common types of revision are humeral component only (10.1% for osteoarthritis, 9.5% for rotator cuff arthropathy and 6.4% for fracture), replacement of both cup (liner) and glenosphere (8%, 7.7% and 3.4%), and cup only revisions (5.7%, 6.3%, and 3.9%, respectively) (Table ST84).

When only the humeral component is revised, this may be associated with exchange of the epiphysis and/or humeral stem and additional minor components such as the liner. Most revisions are to a total stemmed reverse replacement (84.7% for osteoarthritis, 87.2% for rotator cuff arthropathy and 94% for fracture).

### Age and Gender

Primary total stemmed reverse shoulder replacement, when used for the management of osteoarthritis, is most common in patients aged ≥65 years. Patients aged ≥65 years have a lower rate of revision compared to patients aged <65 years for all three most common primary diagnoses (Table ST85, Figure ST49, Figure ST50 and Figure ST51).

Males have a higher rate of revision than females for osteoarthritis, rotator cuff arthropathy and fracture (Table ST81, Figure ST52, Figure ST53 and Figure ST54). Males are predominately revised for instability/dislocation and infection compared to loosening in females (Figure ST55).

Males have a higher rate of revision compared to females.

### ASA and BMI

Patients with ASA scores 3-5 have higher rates of revision compared to patients with an ASA score of 1-2 for all primary diagnoses (Table ST87, Figure ST56, Figure ST57 and Figure ST58).

When the primary diagnosis is osteoarthritis, patients who are obese have a higher rate of revision compared to non-obese patients w for the first 9 months only. After this time, obese patients have a lower rate of revision than non-obese patients.

Obese patients undergoing total stemmed reverse shoulder replacement for fracture have a higher rate of revision than non-obese patients.

Obese patients undergoing a total stemmed reverse for rotator cuff arthropathy have an increased rate of revision for the first 3 months, and after this time there is no difference compared to non-obese patients (Table ST88, Figure ST59, Figure ST60 and Figure ST61).

### Glenoid Morphology

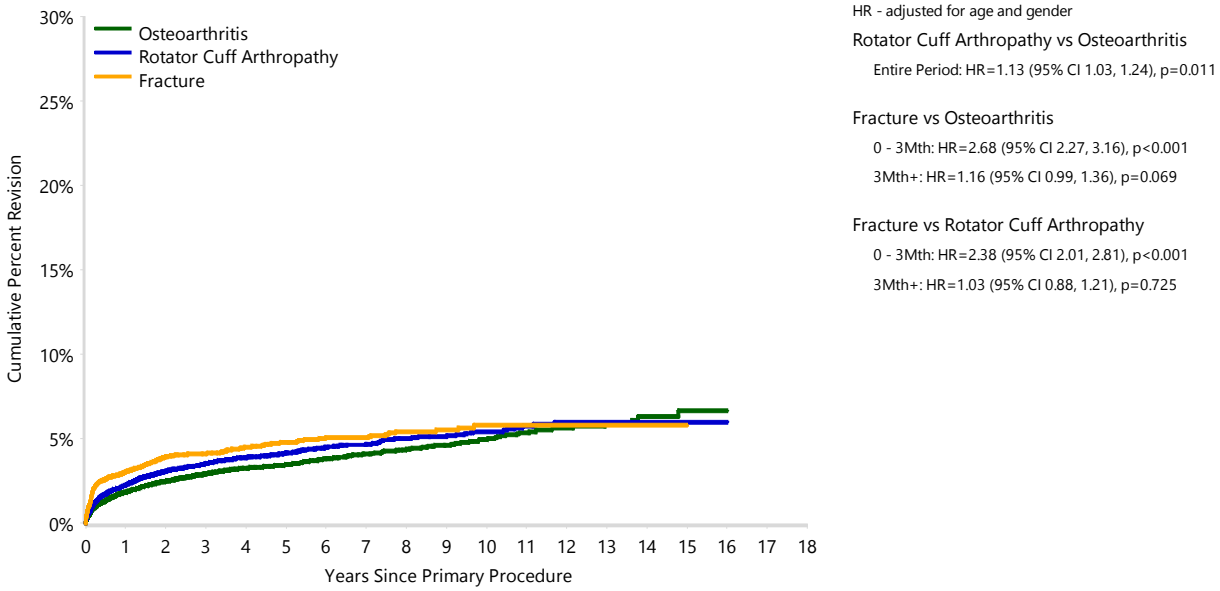
The outcome of the different morphology categories is presented in Table ST89. The category of glenoid morphology is not a risk factor for revision for any of the three primary diagnoses for total stemmed reverse shoulder replacement.

**Table ST81 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis**

| Primary Diagnosis | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Fracture | 406 | 9589 | 3.1 (2.7, 3.4) | 4.1 (3.7, 4.6) | 4.8 (4.3, 5.3) | 5.1 (4.6, 5.6) | 5.8 (5.1, 6.6) | 5.8 (5.1, 6.6) |
| Osteoarthritis | 898 | 27934 | 1.8 (1.7, 2.0) | 2.9 (2.7, 3.2) | 3.5 (3.2, 3.7) | 4.1 (3.8, 4.4) | 5.0 (4.6, 5.4) | 6.3 (5.5, 7.3) |
| Rotator Cuff Arthropathy | 885 | 24122 | 2.3 (2.1, 2.5) | 3.5 (3.3, 3.8) | 4.2 (3.9, 4.5) | 4.7 (4.3, 5.0) | 5.4 (5.0, 5.9) | 6.0 (5.4, 6.6) |
| TOTAL | 2189 | 61645 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST45 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Osteoarthritis | 27934 | 23352 | 16436 | 10750 | 6155 | 2235 | 388 |
| Rotator Cuff Arthropathy | 24122 | 19987 | 13594 | 8566 | 4691 | 1566 | 203 |
| Fracture | 9589 | 7875 | 5288 | 3272 | 1816 | 589 | 75 |

Note: Restricted to modern prostheses

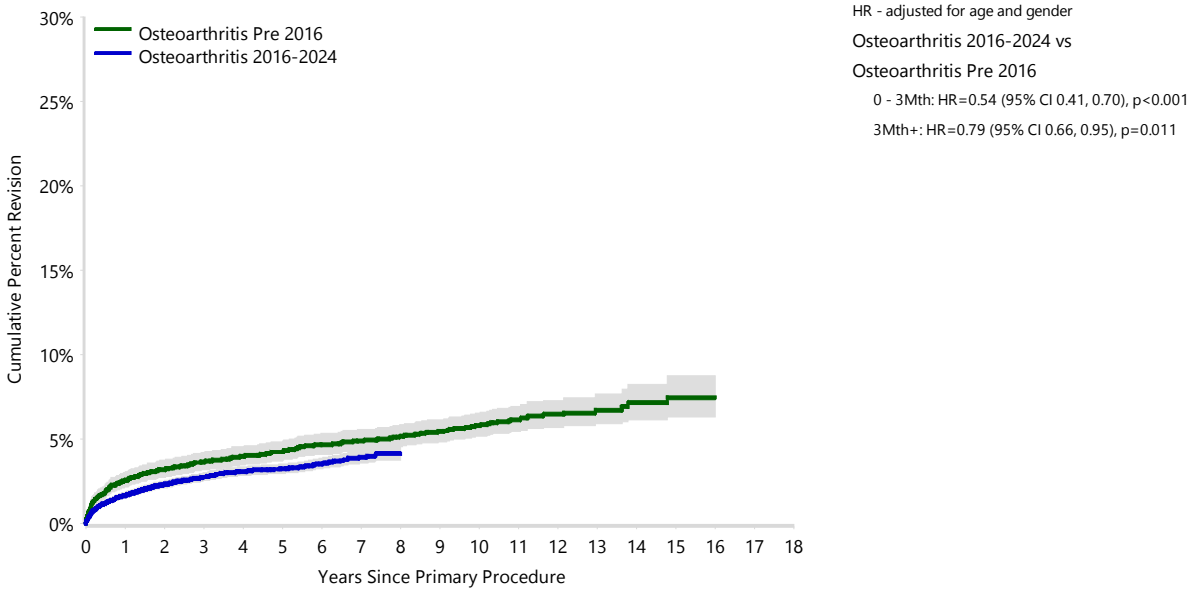
# Primary Total Shoulder Replacement

**Table ST82 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis and Procedure Year**

| Primary Diagnosis | Procedure Year | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | | | | | | | | | |
| | Pre 2016 | 277 | 4923 | 2.6 (2.2, 3.1) | 3.7 (3.2, 4.2) | 4.2 (3.7, 4.9) | 4.9 (4.3, 5.6) | 5.8 (5.2, 6.6) | 7.1 (6.2, 8.3) |
| | 2016-2024 | 621 | 23011 | 1.7 (1.5, 1.8) | 2.8 (2.5, 3.0) | 3.3 (3.0, 3.5) | 3.9 (3.6, 4.3) | | |
| Rotator Cuff Arthropathy | | | | | | | | | |
| | Pre 2016 | 217 | 3703 | 2.8 (2.3, 3.4) | 4.1 (3.5, 4.8) | 5.0 (4.3, 5.8) | 5.4 (4.7, 6.2) | 6.2 (5.4, 7.0) | 6.7 (5.8, 7.7) |
| | 2016-2024 | 668 | 20419 | 2.2 (2.0, 2.4) | 3.4 (3.1, 3.7) | 3.9 (3.6, 4.3) | 4.5 (4.2, 4.9) | | |
| Fracture | | | | | | | | | |
| | Pre 2016 | 68 | 1592 | 2.5 (1.8, 3.4) | 3.3 (2.5, 4.3) | 3.7 (2.8, 4.7) | 4.0 (3.1, 5.1) | 4.8 (3.8, 6.1) | 4.8 (3.8, 6.1) |
| | 2016-2024 | 338 | 7997 | 3.2 (2.8, 3.6) | 4.3 (3.9, 4.8) | 5.1 (4.5, 5.7) | 5.3 (4.8, 6.0) | | |
| TOTAL | | 2189 | 61645 | | | | | | |

Note: Restricted to modern prostheses.
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

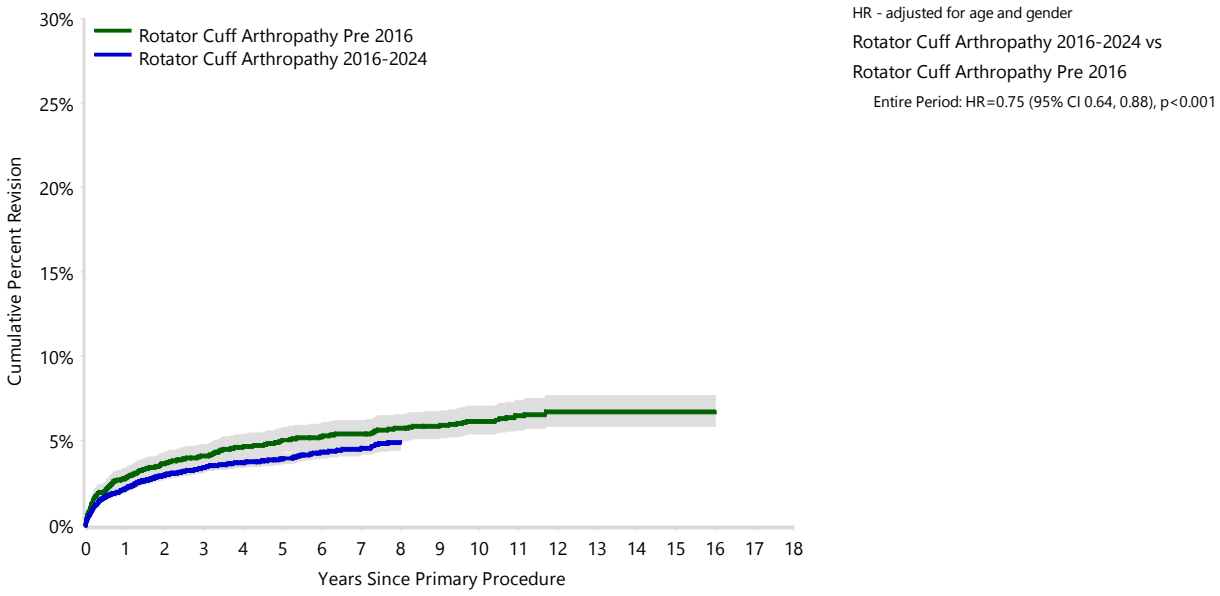
**Figure ST46 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Procedure Year (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | Pre 2016 | 4923 | 4727 | 4450 | 4098 | 3622 | 2235 | 388 |
| | 2016-2024 | 23011 | 18625 | 11986 | 6652 | 2533 | 0 | 0 |

Note: Restricted to modern prostheses.

**Figure ST47 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis and Procedure Year (Primary Diagnosis Rotator Cuff Arthropathy)**




| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Rotator Cuff Arthropathy | Pre 2016 | 3703 | 3547 | 3307 | 3013 | 2699 | 1566 | 203 |
| | 2016-2024 | 20419 | 16440 | 10287 | 5553 | 1992 | 0 | 0 |

Note: Restricted to modern prostheses.

**Table ST83 Primary Total Stemmed Reverse Shoulder Replacement by Reason for Revision and Primary Diagnosis**

| Reason for Revision | Osteoarthritis | | Rotator Cuff Arthropathy | | Fracture | |
|---|---|---|---|---|---|---|
| | N | Percent | N | Percent | N | Percent |
| Instability/Dislocation | 237 | 10.8 | 180 | 8.2 | 262 | 12.0 |
| Infection | 256 | 11.7 | 99 | 4.5 | 212 | 9.7 |
| Loosening | 166 | 7.6 | 50 | 2.3 | 138 | 6.3 |
| Fracture | 91 | 4.2 | 45 | 2.1 | 104 | 4.8 |
| Dissociation | 28 | 1.3 | 6 | 0.3 | 41 | 1.9 |
| Pain | 20 | 0.9 | 4 | 0.2 | 24 | 1.1 |
| Arthrofibrosis | 12 | 0.5 | 8 | 0.4 | 5 | 0.2 |
| Malposition | 10 | 0.5 | 2 | 0.1 | 12 | 0.5 |
| Lysis | 12 | 0.5 | 2 | 0.1 | 10 | 0.5 |
| Implant Breakage Glenoid | 8 | 0.4 | 2 | 0.1 | 8 | 0.4 |
| Incorrect Sizing | 4 | 0.2 | 1 | 0.0 | 12 | 0.5 |
| Heterotopic Bone | 7 | 0.3 | 3 | 0.1 | 4 | 0.2 |
| Metal Related Pathology | 5 | 0.2 | . | . | 8 | 0.4 |
| Rotator Cuff Insufficiency | 5 | 0.2 | . | . | 4 | 0.2 |
| Wear Humeral Cup | 5 | 0.2 | . | . | 3 | 0.1 |
| Implant Breakage Humeral | 2 | 0.1 | . | . | 3 | 0.1 |
| Glenoid Erosion | 1 | 0.0 | . | . | 1 | 0.0 |
| Implant Breakage Glenoid Insert | . | . | 1 | 0.0 | 1 | 0.0 |
| Tumour | . | . | 1 | 0.0 | . | . |
| Other | 29 | 1.3 | 2 | 0.1 | 33 | 1.5 |
| **TOTAL** | **898** | **41.0** | **406** | **18.5** | **885** | **40.4** |

Note: Restricted to modern prostheses

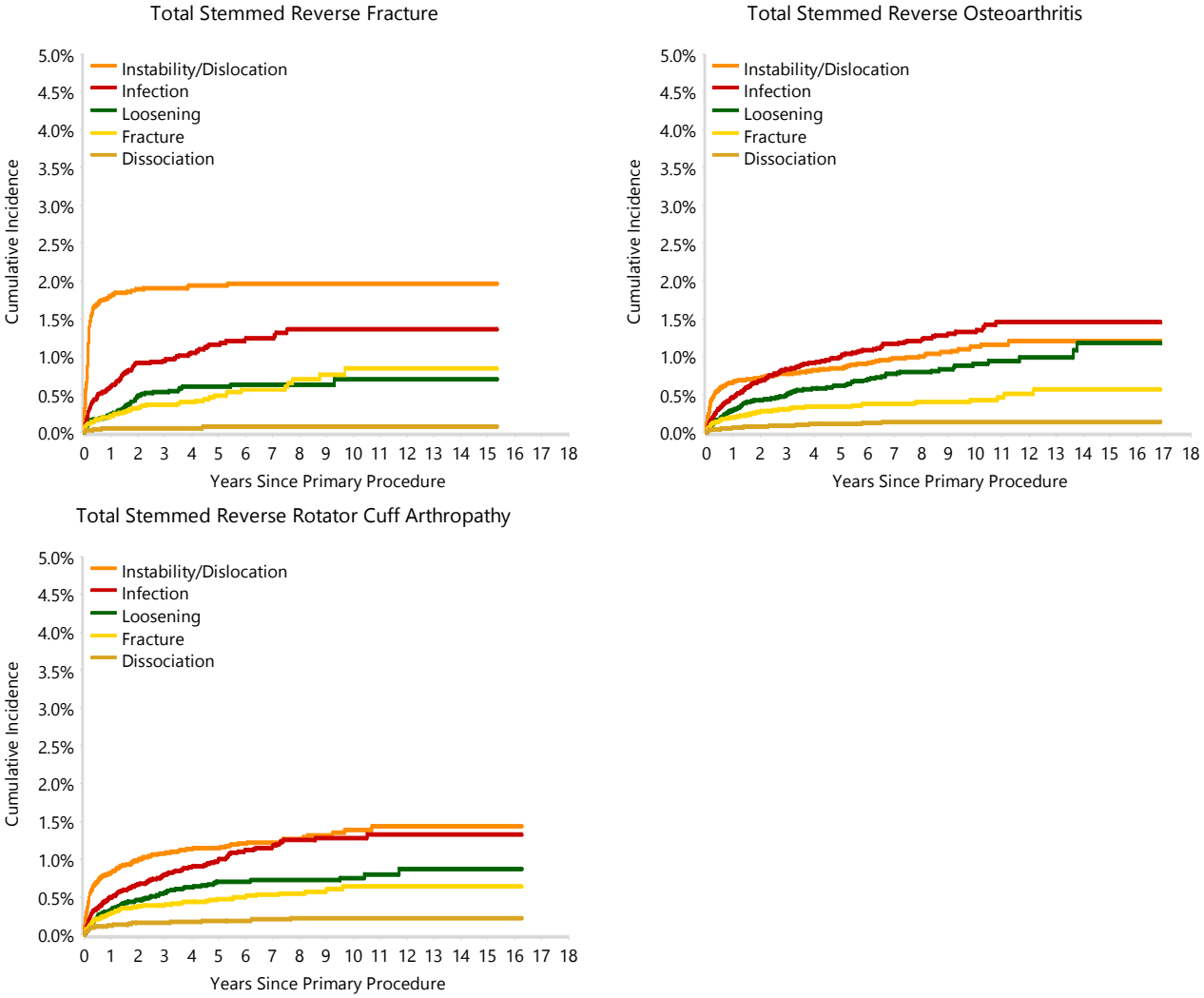
# Primary Total Shoulder Replacement

**Table ST84 Primary Total Stemmed Reverse Shoulder Replacement by Type of Revision and Primary Diagnosis**

| Type of Revision | Osteoarthritis | | Rotator Cuff Arthropathy | | Fracture | |
|---|---|---|---|---|---|---|
| | N | Total% | N | Total% | N | Total% |
| Humeral Component | 220 | 10.1 | 141 | 6.4 | 207 | 9.5 |
| Cup/Head | 176 | 8.0 | 75 | 3.4 | 169 | 7.7 |
| Cup Only | 125 | 5.7 | 86 | 3.9 | 137 | 6.3 |
| Humeral/Glenoid | 90 | 4.1 | 33 | 1.5 | 97 | 4.4 |
| Cement Spacer | 102 | 4.7 | 31 | 1.4 | 68 | 3.1 |
| Humeral Head Only | 94 | 4.3 | 11 | 0.5 | 77 | 3.5 |
| Glenoid Component | 66 | 3.0 | 10 | 0.5 | 89 | 4.1 |
| Removal of Prostheses | 11 | 0.5 | 8 | 0.4 | 15 | 0.7 |
| Glenosphere Only | 3 | 0.1 | 1 | 0.0 | 10 | 0.5 |
| Minor Components | 5 | 0.2 | 6 | 0.3 | 3 | 0.1 |
| Cement Only | 5 | 0.2 | 1 | 0.0 | 4 | 0.2 |
| Reoperation | 1 | 0.0 | 2 | 0.1 | 5 | 0.2 |
| Reinsertion of Components | . | . | . | . | 3 | 0.1 |
| Head/Insert | . | . | 1 | 0.0 | 1 | 0.0 |
| **TOTAL** | **898** | **41.0** | **406** | **18.5** | **885** | **40.4** |

Note: Restricted to modern prostheses

**Figure ST48 Cumulative Incidence Revision Diagnosis of Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis**




Note: Restricted to modern prostheses

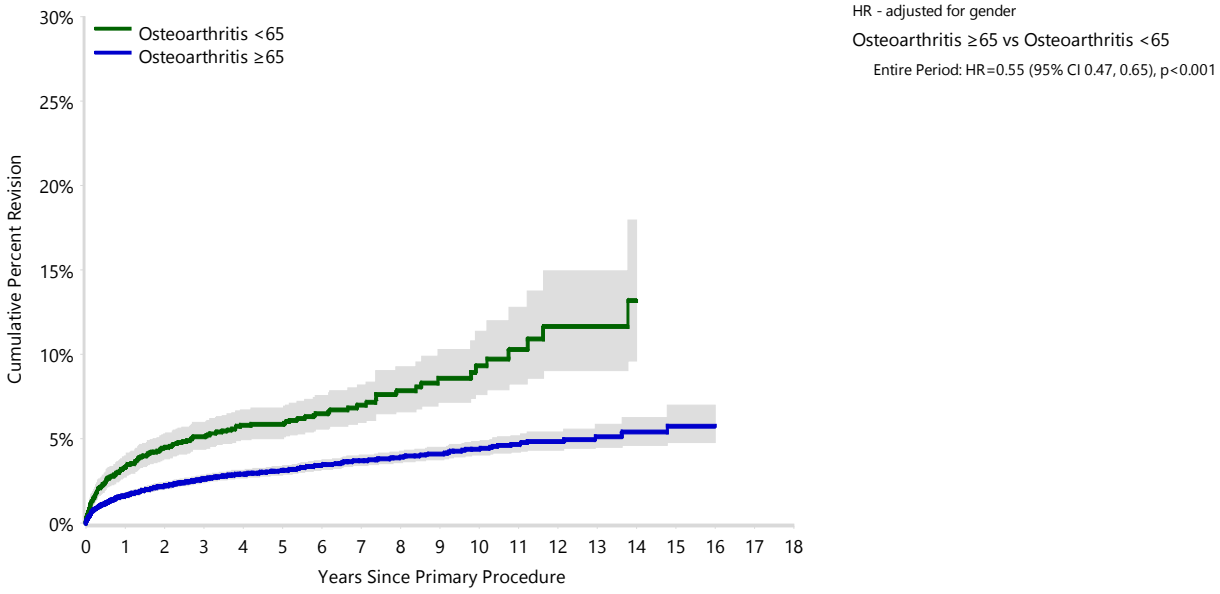
# Primary Total Shoulder Replacement

**Table ST85 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis and Age**

| Primary Diagnosis | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | | | | | | | | | |
| | <65 | 192 | 3439 | 3.3 (2.8, 4.0) | 5.1 (4.4, 6.0) | 5.9 (5.0, 6.8) | 7.0 (6.0, 8.2) | 9.3 (7.6, 11.4) | 13.2 (9.6, 17.9) |
| | ≥65 | 706 | 24495 | 1.6 (1.5, 1.8) | 2.6 (2.4, 2.9) | 3.1 (2.9, 3.4) | 3.7 (3.4, 4.0) | 4.4 (4.0, 4.8) | 5.4 (4.6, 6.3) |
| Rotator Cuff Arthropathy | | | | | | | | | |
| | <65 | 152 | 2929 | 2.9 (2.3, 3.6) | 5.4 (4.5, 6.4) | 6.2 (5.2, 7.3) | 6.8 (5.8, 8.1) | 8.1 (6.5, 10.1) | |
| | ≥65 | 733 | 21193 | 2.2 (2.0, 2.4) | 3.3 (3.0, 3.5) | 3.9 (3.6, 4.2) | 4.4 (4.1, 4.7) | 5.1 (4.6, 5.6) | 5.4 (4.8, 6.0) |
| Fracture | | | | | | | | | |
| | <65 | 107 | 1436 | 5.0 (4.0, 6.3) | 7.0 (5.8, 8.6) | 8.5 (7.0, 10.4) | 9.2 (7.5, 11.3) | 12.1 (9.1, 16.1) | |
| | ≥65 | 299 | 8153 | 2.7 (2.4, 3.1) | 3.6 (3.2, 4.1) | 4.1 (3.7, 4.6) | 4.3 (3.9, 4.9) | 4.7 (4.2, 5.4) | 4.7 (4.2, 5.4) |
| TOTAL | | 2189 | 61645 | | | | | | |

Note: Restricted to modern prostheses

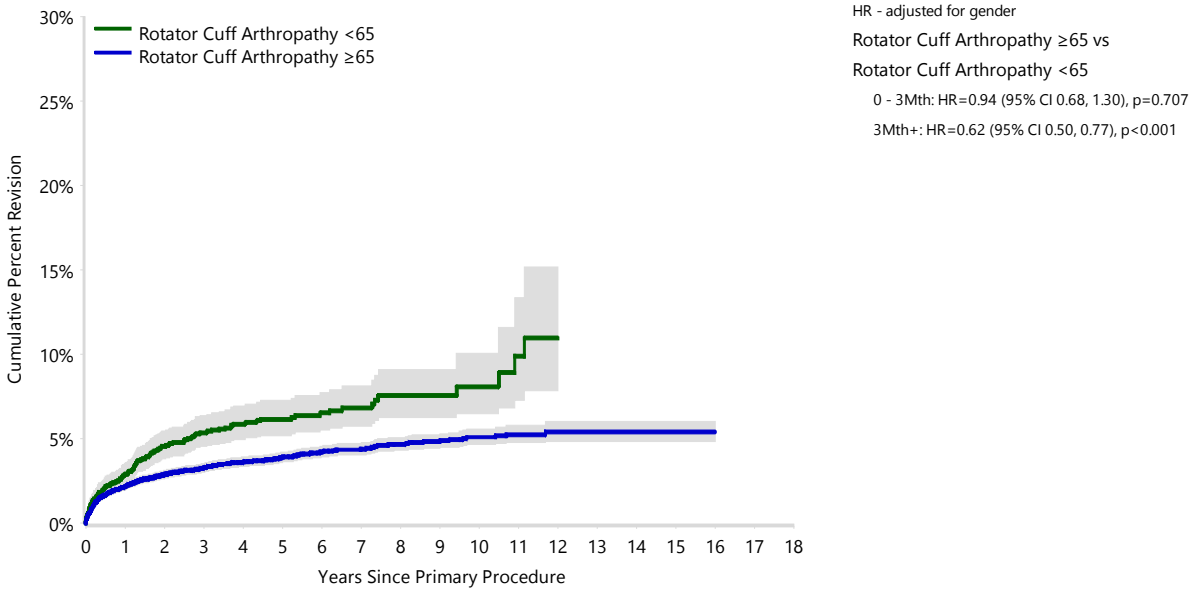
**Figure ST49 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Age (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | <65 | 3439 | 2771 | 1895 | 1154 | 636 | 233 | 53 |
| | ≥65 | 24495 | 20581 | 14541 | 9596 | 5519 | 2002 | 335 |

Note: Restricted to modern prostheses

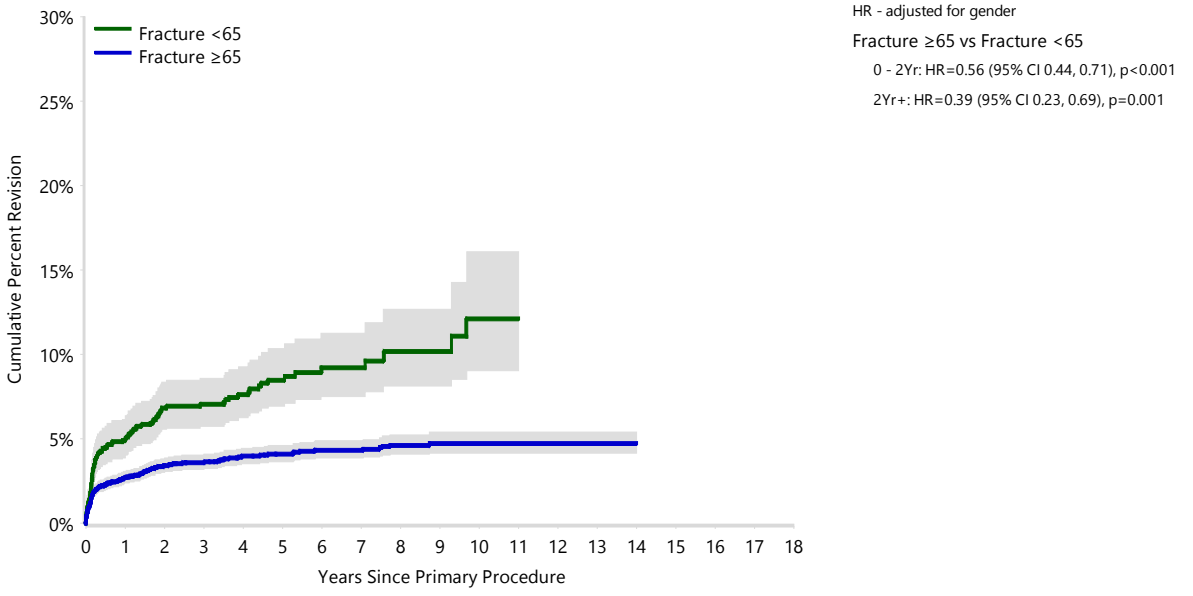
**Figure ST50 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Age (Primary Diagnosis Rotator Cuff Arthropathy)**




| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Rotator Cuff Arthropathy | <65 | 2929 | 2353 | 1443 | 876 | 458 | 132 | 22 |
| | ≥65 | 21193 | 17634 | 12151 | 7690 | 4233 | 1434 | 181 |

Note: Restricted to modern prostheses

**Figure ST51 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Age (Primary Diagnosis Fracture)**




| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Fracture | <65 | 1436 | 1139 | 746 | 432 | 227 | 68 | 18 |
| | ≥65 | 8153 | 6736 | 4542 | 2840 | 1589 | 521 | 57 |

Note: Restricted to modern prostheses

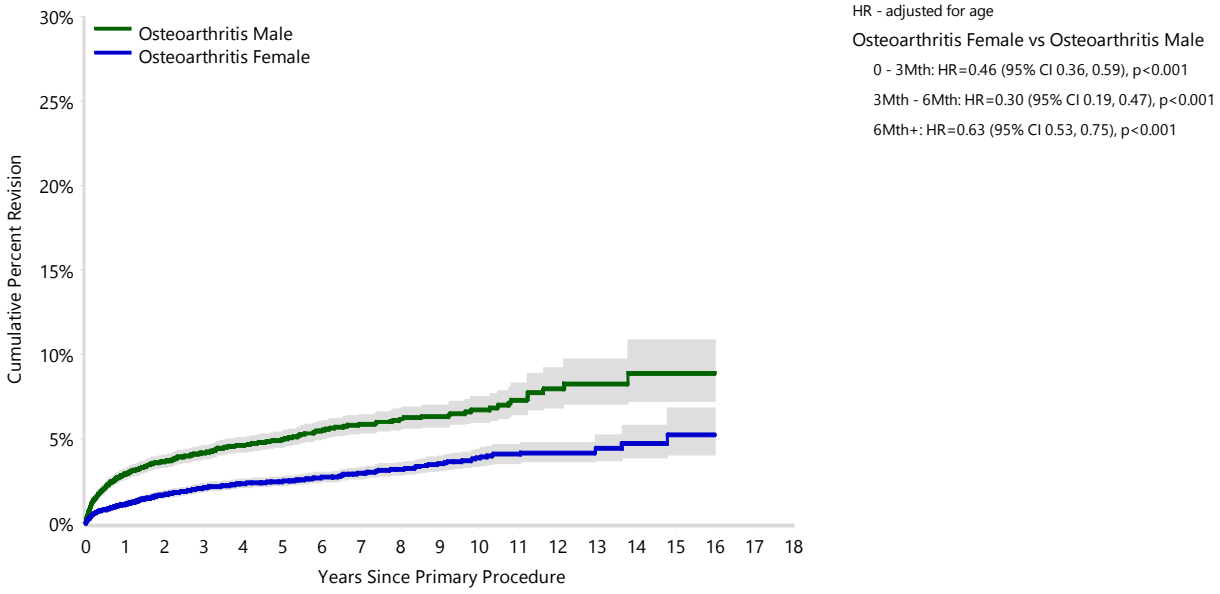
# Primary Total Shoulder Replacement

**Table ST86 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis and Gender**

| Primary Diagnosis | Gender | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | | | | | | | | | |
| | Male | 508 | 11176 | 2.9 (2.6, 3.3) | 4.2 (3.8, 4.6) | 4.9 (4.5, 5.4) | 5.9 (5.3, 6.4) | 6.7 (6.0, 7.5) | 8.9 (7.3, 10.9) |
| | Female | 390 | 16758 | 1.1 (1.0, 1.3) | 2.1 (1.9, 2.4) | 2.5 (2.2, 2.8) | 3.0 (2.6, 3.3) | 3.9 (3.4, 4.4) | 4.7 (3.9, 5.8) |
| Rotator Cuff Arthropathy | | | | | | | | | |
| | Male | 560 | 11390 | 3.1 (2.8, 3.4) | 4.7 (4.3, 5.2) | 5.7 (5.2, 6.2) | 6.6 (6.0, 7.2) | 7.3 (6.6, 8.1) | 7.7 (6.8, 8.8) |
| | Female | 325 | 12732 | 1.5 (1.3, 1.8) | 2.4 (2.2, 2.8) | 2.9 (2.5, 3.2) | 3.0 (2.7, 3.4) | 3.9 (3.3, 4.4) | 4.5 (3.7, 5.3) |
| Fracture | | | | | | | | | |
| | Male | 136 | 1635 | 7.0 (5.9, 8.4) | 8.4 (7.1, 9.9) | 9.4 (7.9, 11.1) | 9.4 (7.9, 11.1) | 10.2 (8.4, 12.3) | |
| | Female | 270 | 7954 | 2.2 (1.9, 2.6) | 3.3 (2.9, 3.7) | 3.8 (3.4, 4.3) | 4.2 (3.7, 4.7) | 4.9 (4.2, 5.7) | 4.9 (4.2, 5.7) |
| TOTAL | | 2189 | 61645 | | | | | | |

Note: Restricted to modern prostheses

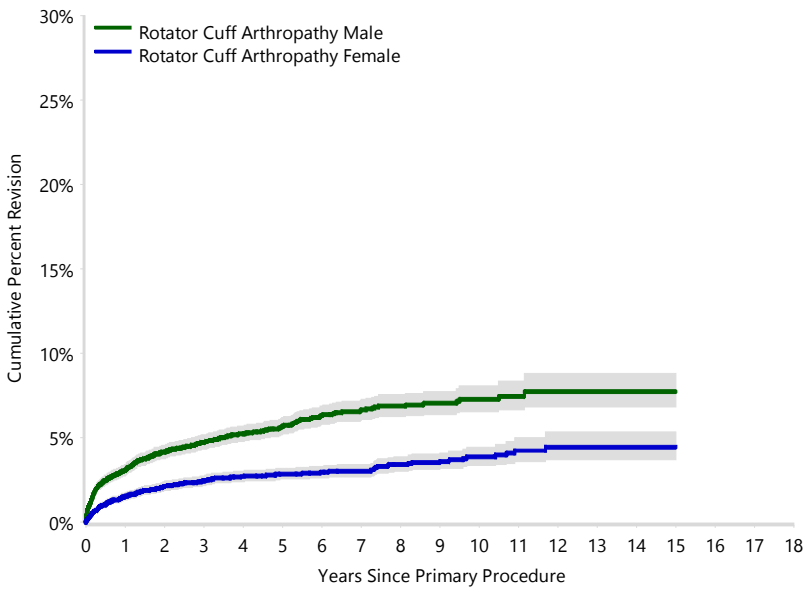
**Figure ST52 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Gender (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | Male | 11176 | 9224 | 6333 | 4010 | 2202 | 790 | 131 |
| | Female | 16758 | 14128 | 10103 | 6740 | 3953 | 1445 | 257 |

Note: Restricted to modern prostheses

**Figure ST53 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Gender (Primary Diagnosis Rotator Cuff Arthropathy)**

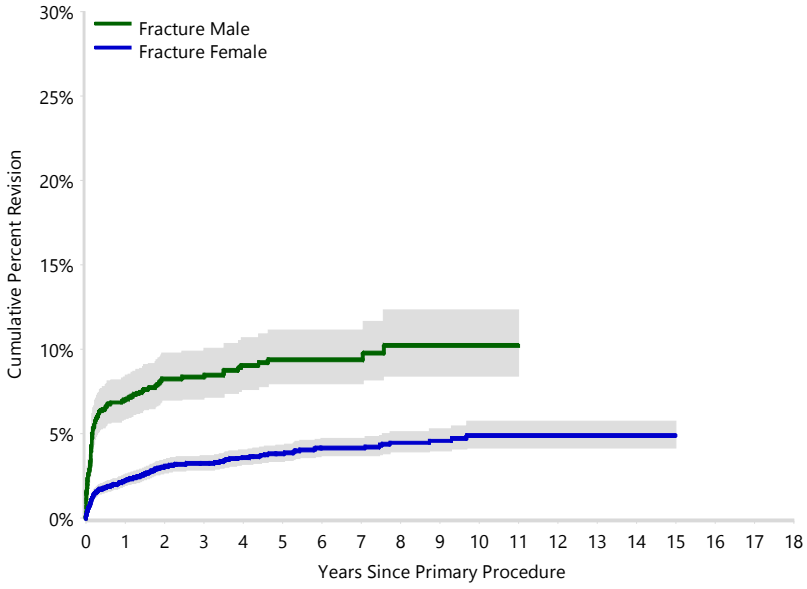



HR - adjusted for age
Rotator Cuff Arthropathy Female vs Rotator Cuff Arthropathy Male
0 - 3Mth: HR=0.38 (95% CI 0.29, 0.48), p<0.001
3Mth+: HR=0.60 (95% CI 0.51, 0.71), p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Rotator Cuff Arthropathy | Male | 11390 | 9254 | 6109 | 3662 | 1905 | 593 | 72 |
| | Female | 12732 | 10733 | 7485 | 4904 | 2786 | 973 | 131 |

Note: Restricted to modern prostheses

**Figure ST54 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Gender (Primary Diagnosis Fracture)**

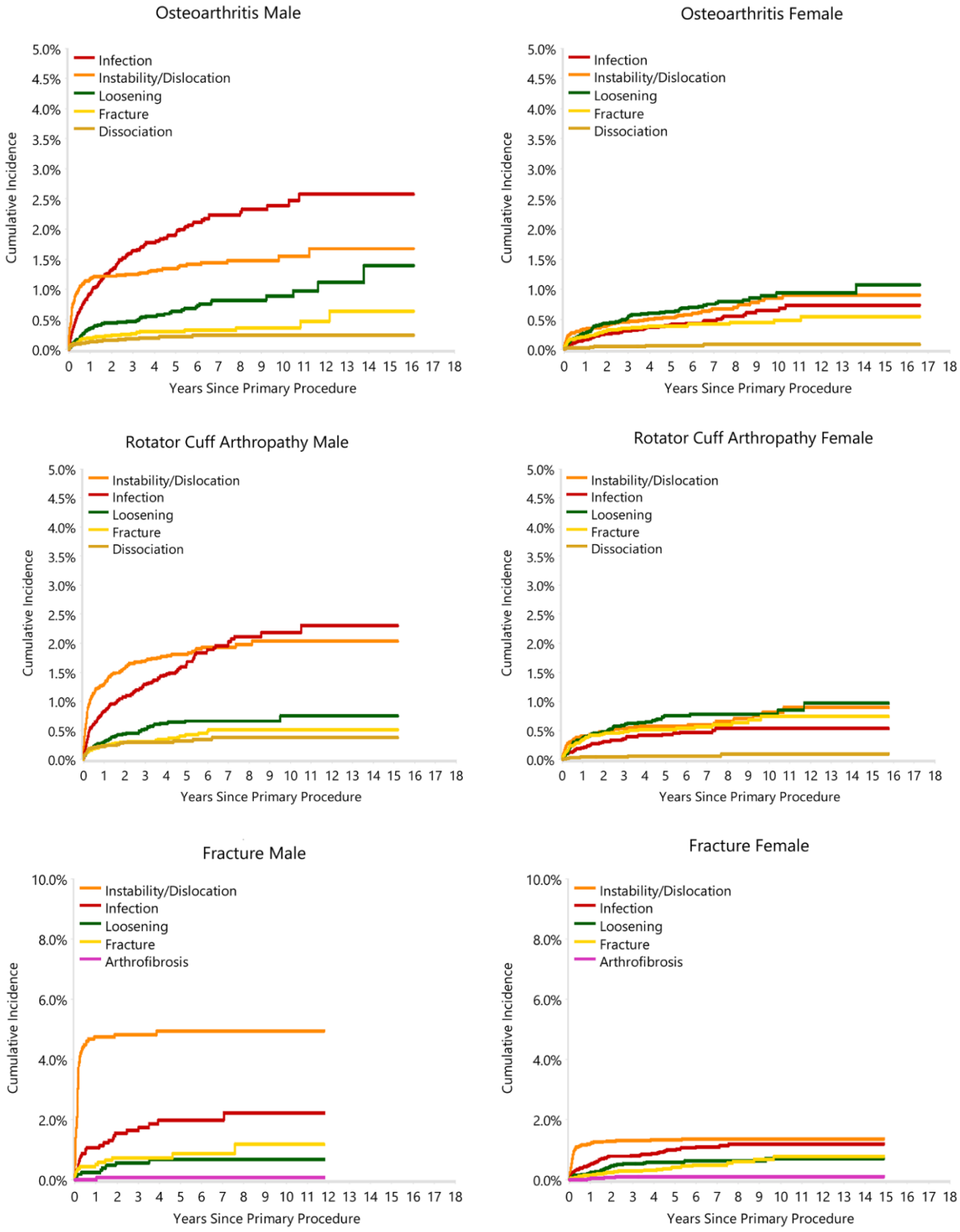



HR - adjusted for age
Fracture Female vs Fracture Male
0 - 2Wk: HR=0.21 (95% CI 0.12, 0.35), p<0.001
2Wk - 3Mth: HR=0.31 (95% CI 0.23, 0.43), p<0.001
3Mth+: HR=0.71 (95% CI 0.50, 0.99), p=0.046

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Fracture | Male | 1635 | 1240 | 769 | 447 | 257 | 82 | 12 |
| | Female | 7954 | 6635 | 4519 | 2825 | 1559 | 507 | 63 |

Note: Restricted to modern prostheses

**Figure ST55 Cumulative Incidence Revision Diagnosis of Primary Total Stemmed Anatomic Shoulder Replacement by Primary Diagnosis and Gender**



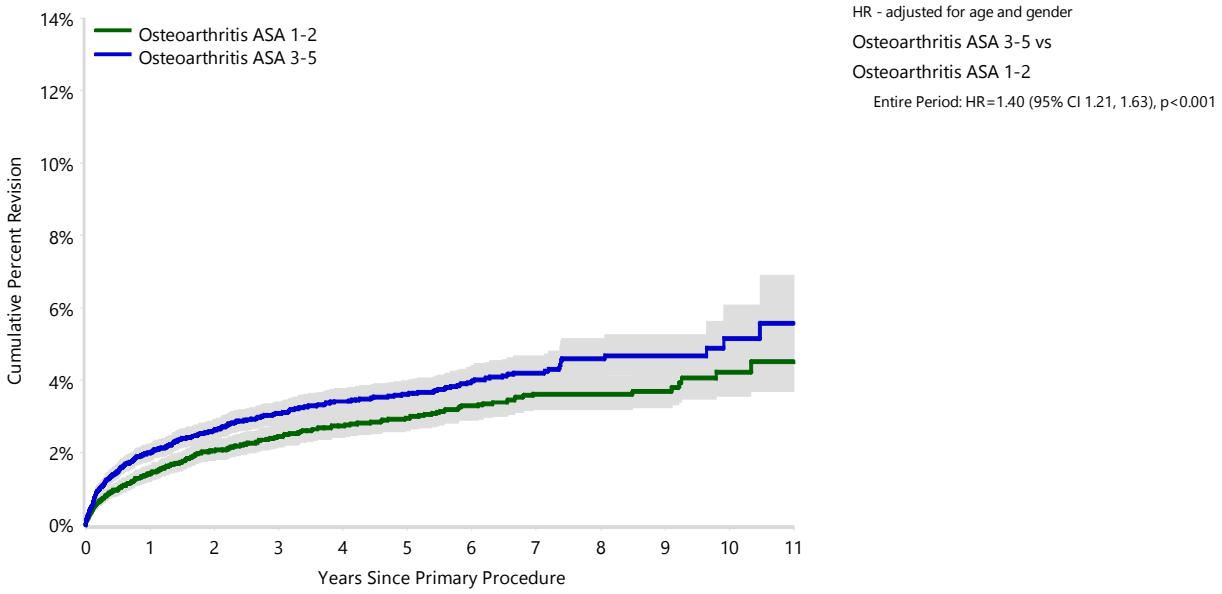

Note: Restricted to modern prostheses

**Table ST87 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis and ASA Score**

| Primary Diagnosis | ASA Score | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 8 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | | | | | | | | | |
| | ASA 1-2 | 291 | 11139 | 1.4 (1.2, 1.7) | 2.1 (1.8, 2.4) | 2.5 (2.2, 2.8) | 3.0 (2.6, 3.3) | 3.6 (3.2, 4.1) | 4.2 (3.6, 5.0) |
| | ASA 3-5 | 438 | 14104 | 2.0 (1.8, 2.2) | 2.6 (2.4, 2.9) | 3.1 (2.8, 3.4) | 3.6 (3.3, 4.0) | 4.6 (4.1, 5.2) | 5.1 (4.4, 6.1) |
| Rotator Cuff Arthropathy | | | | | | | | | |
| | ASA 1-2 | 305 | 9797 | 2.0 (1.7, 2.3) | 2.6 (2.3, 3.0) | 3.0 (2.6, 3.4) | 3.6 (3.2, 4.0) | 4.4 (3.8, 5.0) | 4.8 (4.1, 5.6) |
| | ASA 3-5 | 470 | 12543 | 2.5 (2.2, 2.7) | 3.4 (3.1, 3.7) | 3.9 (3.6, 4.3) | 4.5 (4.1, 4.9) | 5.2 (4.7, 5.8) | 5.3 (4.8, 6.0) |
| Fracture | | | | | | | | | |
| | ASA 1-2 | 123 | 3305 | 2.5 (2.0, 3.1) | 3.4 (2.8, 4.1) | 3.6 (3.0, 4.3) | 4.4 (3.6, 5.2) | 4.8 (3.9, 5.7) | 4.8 (3.9, 5.7) |
| | ASA 3-5 | 239 | 5442 | 3.4 (2.9, 3.9) | 4.3 (3.7, 4.9) | 4.5 (3.9, 5.1) | 5.1 (4.5, 5.8) | 5.5 (4.7, 6.3) | 6.4 (5.0, 8.0) |
| TOTAL | | 1866 | 56330 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST56 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by ASA Score (Primary Diagnosis OA)**

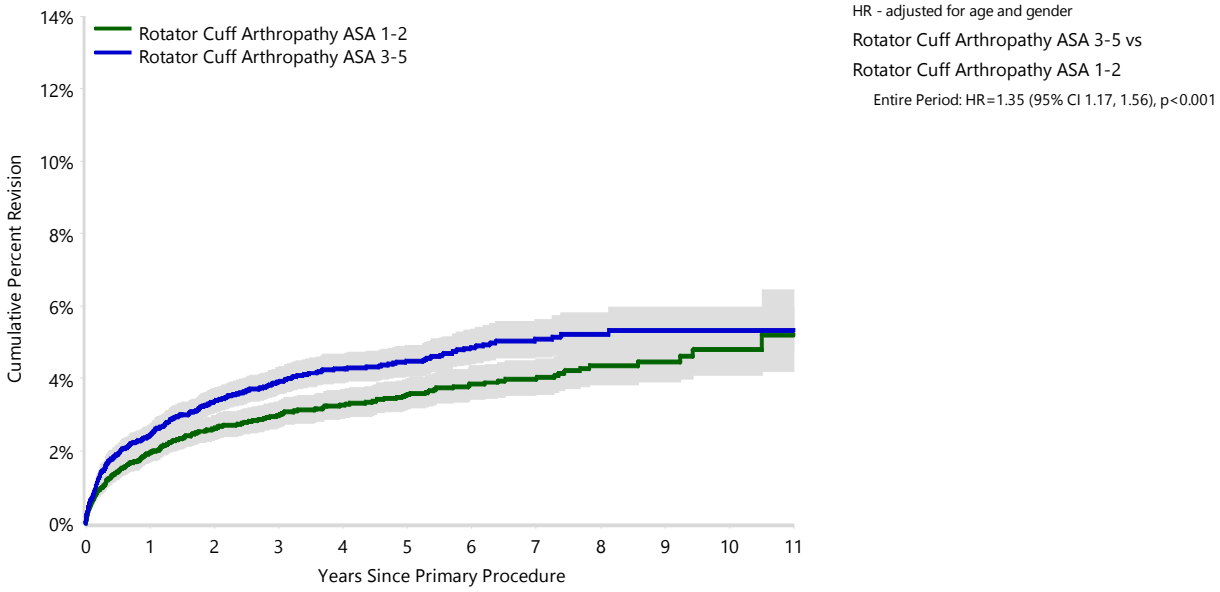



| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 8 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | ASA 1-2 | 11139 | 9319 | 7804 | 6568 | 4243 | 1483 | 474 |
| | ASA 3-5 | 14102 | 11467 | 9238 | 7472 | 4328 | 1234 | 348 |

Note: Restricted to modern prostheses

# Primary Total Shoulder Replacement

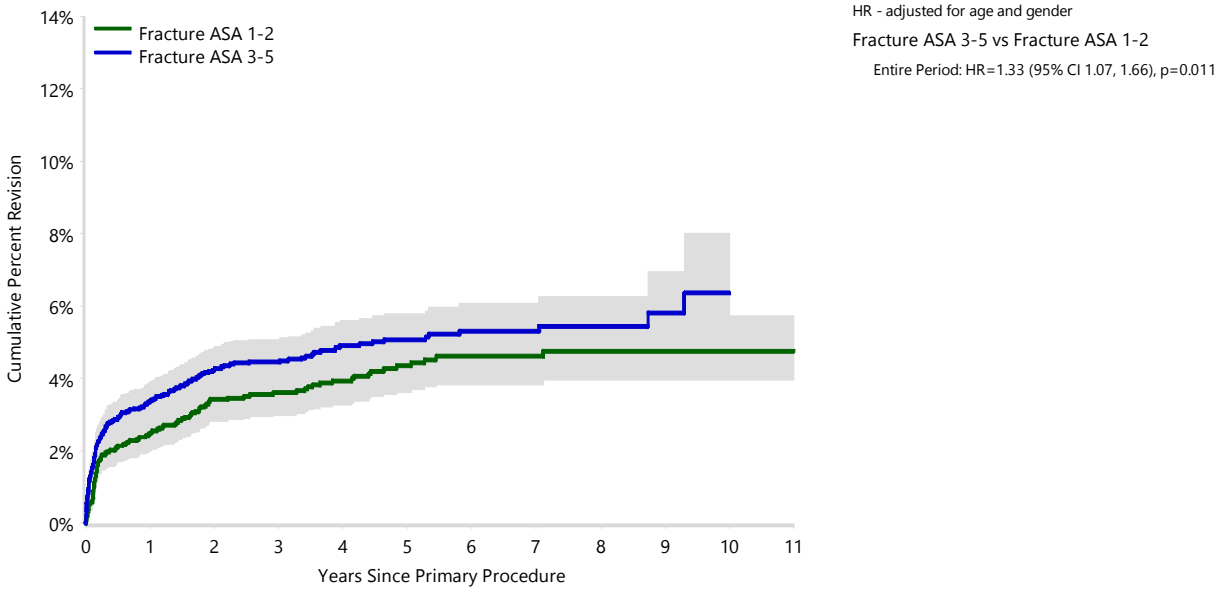
**Figure ST57 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis and ASA Score (Primary Diagnosis Rotator Cuff Arthropathy)**




| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 8 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Rotator Cuff Arthropathy | ASA 1-2 | 9797 | 8128 | 6723 | 5619 | 3542 | 1161 | 347 |
| | ASA 3-5 | 12542 | 10148 | 8060 | 6381 | 3583 | 953 | 286 |

Note: Restricted to modern prostheses

**Figure ST58 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis and ASA Score (Primary Diagnosis Fracture)**




| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 8 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|
| Fracture | ASA 1-2 | 3305 | 2742 | 2303 | 1907 | 1198 | 396 | 128 |
| | ASA 3-5 | 5441 | 4355 | 3462 | 2689 | 1471 | 408 | 105 |

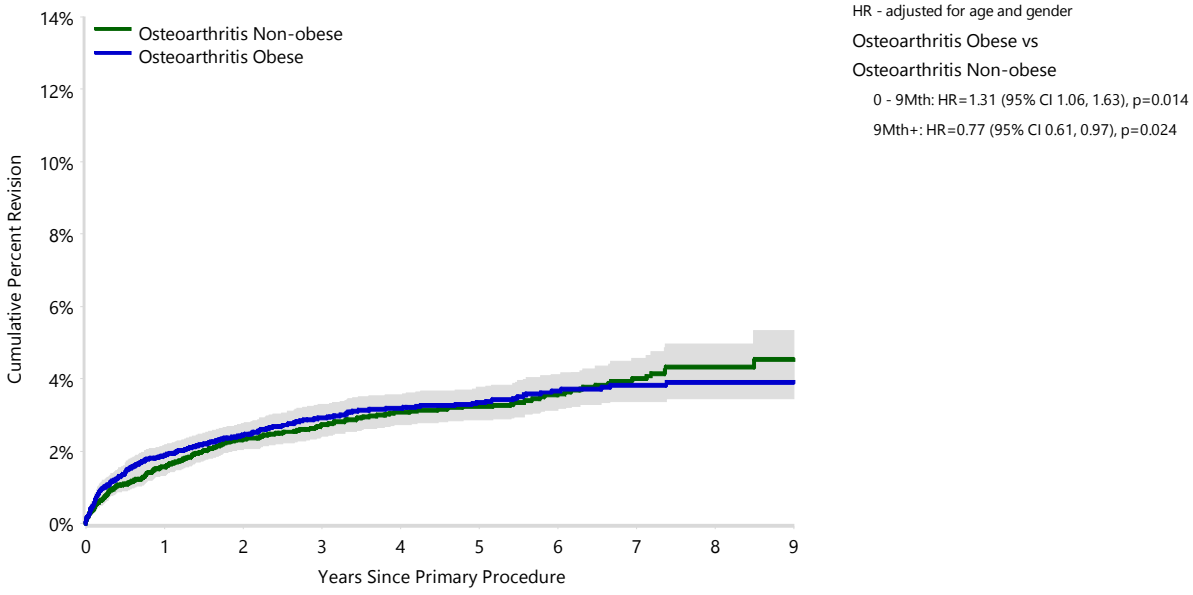
Note: Restricted to modern prostheses

**Table ST88 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis and BMI Category**

| Primary Diagnosis | BMI Category | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | | | | | | | | | |
| | Non-obese | 309 | 11354 | 1.6 (1.3, 1.8) | 2.3 (2.0, 2.6) | 2.7 (2.4, 3.1) | 3.1 (2.7, 3.5) | 3.2 (2.9, 3.7) | 3.6 (3.2, 4.1) |
| | Obese | 324 | 11591 | 1.9 (1.6, 2.2) | 2.4 (2.2, 2.8) | 2.9 (2.6, 3.3) | 3.2 (2.8, 3.6) | 3.4 (3.0, 3.8) | 3.7 (3.3, 4.1) |
| Rotator Cuff Arthropathy | | | | | | | | | |
| | Non-obese | 316 | 10991 | 1.9 (1.6, 2.2) | 2.7 (2.4, 3.0) | 3.0 (2.7, 3.4) | 3.2 (2.9, 3.6) | 3.4 (3.0, 3.8) | 3.7 (3.3, 4.2) |
| | Obese | 362 | 9552 | 2.5 (2.2, 2.8) | 3.3 (3.0, 3.7) | 3.9 (3.5, 4.3) | 4.3 (3.9, 4.8) | 4.6 (4.2, 5.2) | 5.0 (4.5, 5.6) |
| Fracture | | | | | | | | | |
| | Non-obese | 128 | 3786 | 2.5 (2.0, 3.0) | 3.3 (2.8, 4.0) | 3.4 (2.8, 4.1) | 3.7 (3.1, 4.4) | 4.0 (3.4, 4.9) | 4.4 (3.6, 5.3) |
| | Obese | 155 | 3059 | 3.8 (3.2, 4.6) | 4.9 (4.2, 5.8) | 5.2 (4.5, 6.2) | 5.8 (5.0, 6.8) | 6.1 (5.2, 7.2) | 6.1 (5.2, 7.2) |
| TOTAL | | 1594 | 50333 | | | | | | |

Note: BMI has not been presented for patients aged ≤19 years
Restricted to modern prostheses

**Figure ST59 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by BMI Category (Primary Diagnosis OA)**

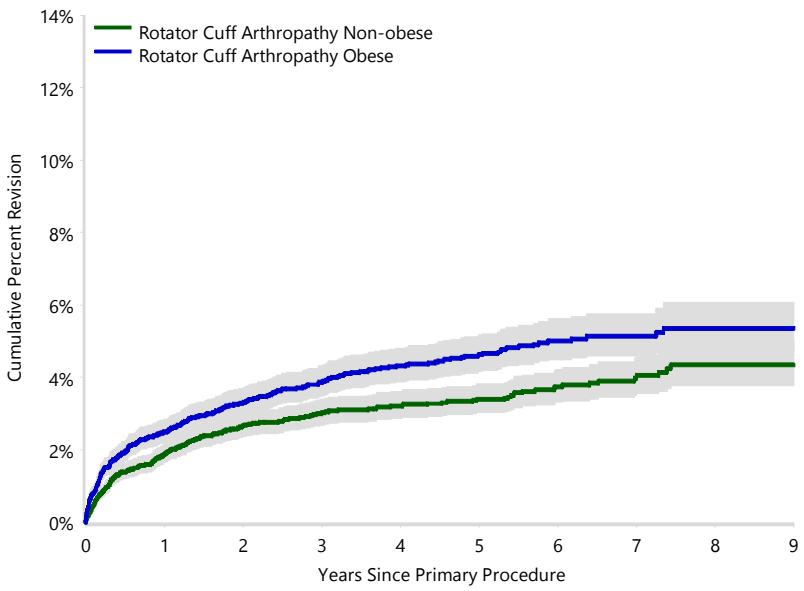



| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | Non-obese | 11354 | 9255 | 7414 | 5993 | 4587 | 3437 | 2356 |
| | Obese | 11591 | 9341 | 7533 | 6054 | 4622 | 3379 | 2264 |

Note: BMI has not been presented for patients aged ≤19 years
Restricted to modern prostheses

# Primary Total Shoulder Replacement

**Figure ST60 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by BMI Category (Primary Diagnosis Rotator Cuff Arthropathy)**




HR - adjusted for age and gender

Rotator Cuff Arthropathy Obese vs Rotator Cuff Arthropathy Non-obese

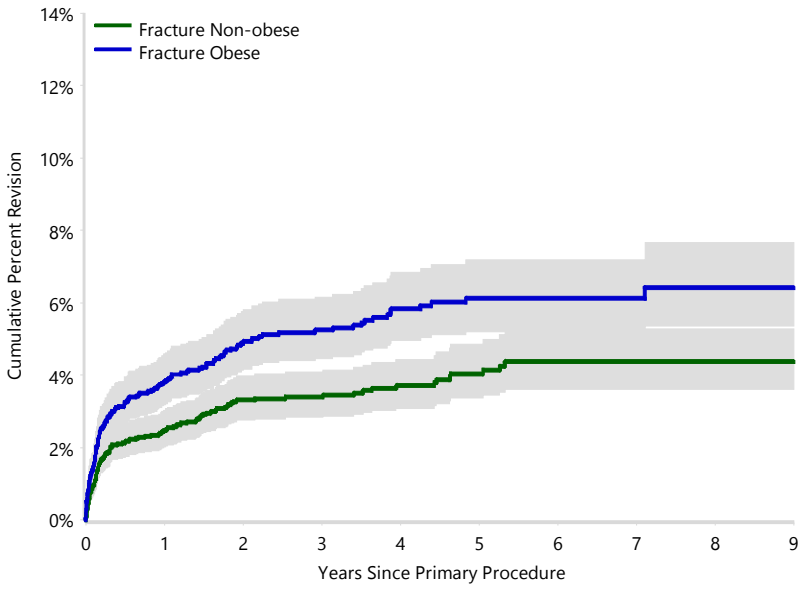
0 - 3Mth: HR=1.61 (95% CI 1.25, 2.09), p<0.001

3Mth+: HR=1.16 (95% CI 0.96, 1.41), p=0.118

| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|---|
| Rotator Cuff Arthropathy | Non-obese | 10991 | 8870 | 7049 | 5582 | 4220 | 3141 | 2116 |
| | Obese | 9552 | 7719 | 6128 | 4903 | 3666 | 2656 | 1775 |

Note: BMI has not been presented for patients aged ≤19 years. Restricted to modern prostheses

**Figure ST61 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by BMI Category (Primary Diagnosis Fracture)**




HR - adjusted for age and gender

Fracture Obese vs Fracture Non-obese

Entire Period: HR=1.38 (95% CI 1.09, 1.76), p=0.007

| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|---|
| Fracture | Non-obese | 3786 | 3018 | 2371 | 1813 | 1369 | 978 | 654 |
| | Obese | 3059 | 2433 | 1948 | 1535 | 1143 | 811 | 580 |

Note: BMI has not been presented for patients aged ≤19 years. Restricted to modern prostheses

**Table ST89 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis and Glenoid Morphology**

| Primary Diagnosis | Glenoid Morphology | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | | | | | | | | |
| | A1 | 122 | 4786 | 1.6 (1.3, 2.1) | 2.4 (2.0, 3.0) | 2.8 (2.3, 3.4) | 3.1 (2.5, 3.7) | 3.3 (2.7, 3.9) |
| | A2 | 123 | 4533 | 1.6 (1.3, 2.1) | 2.6 (2.2, 3.2) | 3.1 (2.6, 3.8) | 3.3 (2.7, 3.9) | 3.4 (2.9, 4.2) |
| | B1 | 69 | 3133 | 1.7 (1.3, 2.3) | 2.1 (1.7, 2.8) | 2.4 (1.9, 3.1) | 2.7 (2.1, 3.5) | 2.7 (2.1, 3.5) |
| | B2 | 93 | 3740 | 1.4 (1.1, 1.9) | 1.9 (1.5, 2.5) | 2.7 (2.2, 3.4) | 3.4 (2.7, 4.3) | 3.6 (2.9, 4.5) |
| | C | 34 | 1231 | 1.8 (1.2, 2.8) | 2.4 (1.6, 3.5) | 2.7 (1.9, 3.9) | 3.2 (2.3, 4.6) | 4.2 (2.9, 6.1) |
| Rotator Cuff Arthropathy | | | | | | | | |
| | A1 | 262 | 8336 | 2.1 (1.8, 2.4) | 2.8 (2.5, 3.3) | 3.3 (2.9, 3.8) | 3.8 (3.3, 4.3) | 4.0 (3.5, 4.5) |
| | A2 | 129 | 4046 | 2.3 (1.8, 2.8) | 3.3 (2.8, 4.0) | 3.6 (3.0, 4.3) | 3.8 (3.2, 4.5) | 3.9 (3.3, 4.7) |
| | B1 | 65 | 2364 | 1.9 (1.4, 2.6) | 2.8 (2.1, 3.6) | 3.1 (2.4, 4.0) | 3.1 (2.4, 4.0) | 3.5 (2.6, 4.6) |
| | B2 | 51 | 1806 | 1.9 (1.4, 2.7) | 2.6 (1.9, 3.5) | 3.2 (2.4, 4.3) | 3.6 (2.7, 4.8) | 3.9 (2.9, 5.2) |
| | C | 20 | 673 | 2.3 (1.4, 3.8) | 2.9 (1.8, 4.6) | 3.2 (2.0, 5.0) | 3.2 (2.0, 5.0) | 4.5 (2.7, 7.5) |
| Fracture | | | | | | | | |
| | A1 | 181 | 4792 | 3.0 (2.5, 3.5) | 3.9 (3.3, 4.5) | 4.0 (3.5, 4.7) | 4.3 (3.7, 5.0) | 4.7 (4.0, 5.5) |
| | A2 | 19 | 518 | 2.4 (1.4, 4.2) | 3.6 (2.2, 5.9) | 3.6 (2.2, 5.9) | 4.8 (2.9, 7.8) | 4.8 (2.9, 7.8) |
| | B1 | 9 | 248 | 3.0 (1.4, 6.1) | 3.7 (1.8, 7.5) | 3.7 (1.8, 7.5) | 4.9 (2.4, 9.8) | 4.9 (2.4, 9.8) |
| | B2 | 8 | 148 | 3.5 (1.5, 8.3) | 5.5 (2.6, 11.3) | 5.5 (2.6, 11.3) | 7.0 (3.4, 14.0) | |
| | C | 1 | 55 | 1.9 (0.3, 12.9) | 1.9 (0.3, 12.9) | 1.9 (0.3, 12.9) | 1.9 (0.3, 12.9) | 1.9 (0.3, 12.9) |
| TOTAL | | 1186 | 40409 | | | | | |

Note: Restricted to modern prostheses
Excludes 119 procedures with a recorded glenoid morphology of B3
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

## OUTCOME FOR OSTEOARTHRITIS, ROTATOR CUFF ARTHROPATHY AND FRACTURE – PROSTHESIS CHARACTERISTICS

### Fixation

Fixation of either the glenoid or humeral components are not risk factors for revision of total stemmed reverse shoulder replacement procedures when undertaken for osteoarthritis or fracture. Cementing the glenoid component increases the rate of revision compared to cementless fixation for the primary diagnosis rotator cuff arthropathy (Table ST90 and Figure ST62).

### Polyethylene Type and Bearing Surface

Non XLPE glenospheres increase the risk of revision in procedures for osteoarthritis but not rotator cuff arthropathy or fracture. Non XLPE humeral cups have an increased rate of revision compared to XLPE humeral cups for osteoarthritis only (Table ST91 and Figure ST63).

### Glenosphere Size

Glenosphere sizes >40mm have a lower rate of revision compared to <38mm over the entire period for osteoarthritis, in contrast to fracture where <38mm humeral heads have the lower revision rate compared to >40mm (Table ST92, Figure ST64 and Figure ST65). Varying glenosphere size does not change the rate of revision in total stemmed reverse procedures for rotator cuff arthropathy.

Glenosphere sizes <38mm have a higher rate of revision compared to sizes >40mm.

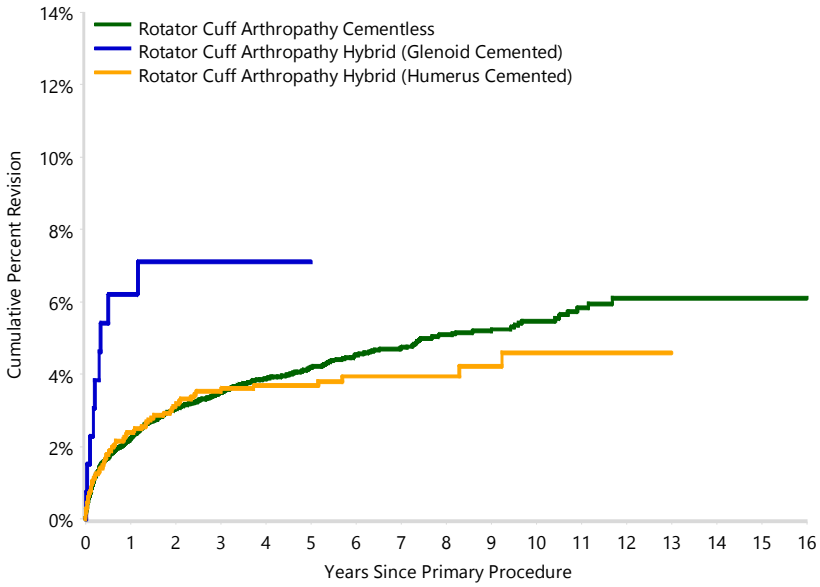
# Primary Total Shoulder Replacement

**Table ST90 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis and Fixation**

| Primary Diagnosis | Fixation | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | | | | | | | | |
| | Cemented | 4 | 113 | 0.9 (0.1, 6.1) | 1.9 (0.5, 7.4) | 1.9 (0.5, 7.4) | 1.9 (0.5, 7.4) | 3.2 (1.0, 9.8) |
| | Cementless | 785 | 24803 | 1.8 (1.7, 2.0) | 2.5 (2.3, 2.7) | 2.9 (2.7, 3.2) | 3.3 (3.0, 3.5) | 3.5 (3.2, 3.7) |
| | Hybrid (Glenoid Cemented) | 5 | 115 | 1.8 (0.5, 7.1) | 2.8 (0.9, 8.6) | 2.8 (0.9, 8.6) | 4.5 (1.6, 11.9) | 4.5 (1.6, 11.9) |
| | Hybrid (Humerus Cemented) | 104 | 2903 | 1.9 (1.4, 2.4) | 2.7 (2.2, 3.4) | 3.1 (2.5, 3.8) | 3.3 (2.7, 4.1) | 3.4 (2.8, 4.2) |
| Rotator Cuff Arthropathy | | | | | | | | |
| | Cemented | 4 | 32 | 6.4 (1.6, 23.1) | 6.4 (1.6, 23.1) | 6.4 (1.6, 23.1) | 10.4 (3.4, 29.2) | 10.4 (3.4, 29.2) |
| | Cementless | 803 | 22007 | 2.2 (2.0, 2.4) | 3.1 (2.8, 3.3) | 3.5 (3.2, 3.8) | 3.9 (3.6, 4.2) | 4.2 (3.9, 4.5) |
| | Hybrid (Glenoid Cemented) | 9 | 132 | 6.2 (3.2, 12.1) | 7.1 (3.8, 13.2) | 7.1 (3.8, 13.2) | 7.1 (3.8, 13.2) | 7.1 (3.8, 13.2) |
| | Hybrid (Humerus Cemented) | 69 | 1951 | 2.4 (1.8, 3.2) | 3.1 (2.4, 4.0) | 3.5 (2.8, 4.5) | 3.7 (2.9, 4.7) | 3.7 (2.9, 4.7) |
| Fracture | | | | | | | | |
| | Cemented | 6 | 120 | 3.4 (1.3, 8.8) | 3.4 (1.3, 8.8) | 3.4 (1.3, 8.8) | 5.1 (2.0, 12.3) | 7.1 (3.0, 16.1) |
| | Cementless | 140 | 2921 | 3.6 (2.9, 4.3) | 4.6 (3.8, 5.4) | 4.7 (4.0, 5.6) | 5.0 (4.2, 5.9) | 5.3 (4.4, 6.2) |
| | Hybrid (Glenoid Cemented) | 12 | 184 | 5.6 (3.0, 10.1) | 6.3 (3.5, 11.1) | 6.3 (3.5, 11.1) | 7.7 (4.3, 13.5) | |
| | Hybrid (Humerus Cemented) | 248 | 6364 | 2.7 (2.4, 3.2) | 3.6 (3.1, 4.1) | 3.8 (3.3, 4.3) | 4.2 (3.7, 4.8) | 4.4 (3.9, 5.0) |
| TOTAL | | 2189 | 61645 | | | | | |

Note: Restricted to modern prostheses. Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Figure ST62 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Fixation (Primary Diagnosis Rotator Cuff Arthropathy)**




HR - adjusted for age and gender

Rotator Cuff Arthropathy Hybrid (Glenoid Cemented)
Rotator Cuff Arthropathy Cementless
Entire Period: HR=2.52 (95% CI 1.30, 4.87), p=0.006

Rotator Cuff Arthropathy Hybrid (Humerus Cemented
Rotator Cuff Arthropathy Cementless
Entire Period: HR=1.04 (95% CI 0.81, 1.33), p=0.774

| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|
| Rotator Cuff Arthropathy | Cementless | 22007 | 18155 | 14833 | 12196 | 9695 | 7655 |
| | Hybrid (Glenoid Cemented) | 132 | 108 | 97 | 88 | 74 | 52 |
| | Hybrid (Humerus Cemented) | 1951 | 1696 | 1479 | 1286 | 1049 | 843 |

Note: Restricted to modern prostheses. Only combinations with >100 procedures have been listed

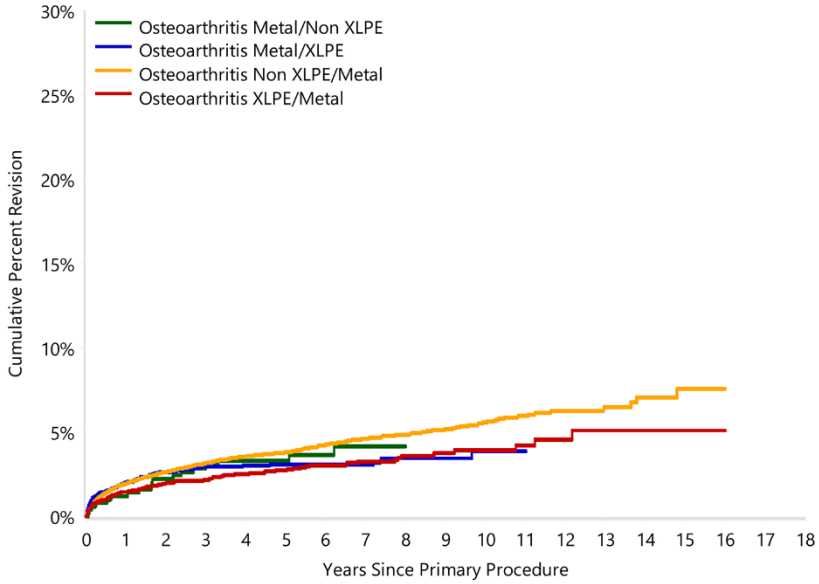
**Table ST91 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis and Bearing Surface**

| Primary Diagnosis | Bearing Surface | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | | | | | | | | | |
| | Ceramic/Non XLPE | 0 | 5 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | |
| | Ceramic/XLPE | 3 | 75 | 1.4 (0.2, 9.6) | 4.7 (1.5, 13.9) | | | | |
| | Metal/Non XLPE | 19 | 502 | 1.2 (0.5, 2.7) | 3.1 (1.9, 5.1) | 3.3 (2.0, 5.3) | 4.2 (2.6, 6.7) | | |
| | Metal/XLPE | 128 | 4490 | 2.0 (1.6, 2.4) | 2.9 (2.5, 3.5) | 3.1 (2.6, 3.7) | 3.1 (2.6, 3.7) | 3.9 (2.9, 5.1) | |
| | Non XLPE/Metal | 604 | 16522 | 2.0 (1.8, 2.2) | 3.2 (2.9, 3.5) | 3.8 (3.5, 4.1) | 4.6 (4.2, 5.0) | 5.6 (5.0, 6.1) | 7.1 (6.0, 8.3) |
| | XLPE/Metal | 144 | 6331 | 1.5 (1.2, 1.8) | 2.2 (1.8, 2.6) | 2.7 (2.3, 3.3) | 3.3 (2.7, 4.0) | 3.9 (3.2, 4.9) | 5.1 (3.7, 7.0) |
| Rotator Cuff Arthropathy | | | | | | | | | |
| | Ceramic/Non XLPE | 0 | 10 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | |
| | Ceramic/XLPE | 1 | 71 | 0.0 (0.0, 0.0) | 1.5 (0.2, 10.3) | 1.5 (0.2, 10.3) | | | |
| | Metal/Non XLPE | 22 | 467 | 2.4 (1.3, 4.2) | 3.9 (2.5, 6.1) | 4.7 (3.1, 7.2) | 6.0 (3.5, 10.1) | | |
| | Metal/XLPE | 139 | 3804 | 2.5 (2.0, 3.1) | 3.6 (3.0, 4.2) | 3.8 (3.2, 4.5) | 4.3 (3.6, 5.1) | 4.9 (3.8, 6.2) | |
| | Non XLPE/Metal | 579 | 14493 | 2.3 (2.1, 2.6) | 3.7 (3.4, 4.0) | 4.4 (4.0, 4.8) | 4.9 (4.5, 5.4) | 5.8 (5.2, 6.4) | 6.3 (5.5, 7.0) |
| | XLPE/Metal | 144 | 5265 | 1.9 (1.6, 2.3) | 2.9 (2.5, 3.5) | 3.7 (3.1, 4.5) | 4.1 (3.3, 4.9) | 4.8 (3.8, 6.2) | 5.9 (4.3, 8.1) |
| Fracture | | | | | | | | | |
| | Ceramic/XLPE | 0 | 4 | 0.0 (0.0, 0.0) | | | | | |
| | Metal/Non XLPE | 13 | 285 | 1.8 (0.7, 4.2) | 3.6 (2.0, 6.7) | 5.0 (2.9, 8.6) | 5.0 (2.9, 8.6) | | |
| | Metal/XLPE | 85 | 1592 | 4.0 (3.2, 5.2) | 5.4 (4.3, 6.7) | 5.7 (4.6, 7.1) | 6.1 (4.9, 7.6) | 6.1 (4.9, 7.6) | |
| | Non XLPE/Metal | 242 | 5631 | 3.0 (2.5, 3.4) | 4.0 (3.5, 4.6) | 4.7 (4.2, 5.4) | 5.1 (4.5, 5.8) | 6.2 (5.3, 7.4) | 6.2 (5.3, 7.4) |
| | XLPE/Metal | 65 | 2065 | 2.7 (2.1, 3.5) | 3.4 (2.7, 4.4) | 3.8 (3.0, 4.9) | 3.8 (3.0, 4.9) | 3.8 (3.0, 4.9) | |
| | TOTAL | 2188 | 61612 | | | | | | |

Note: Restricted to modern prostheses. Reported as humeral cup/glenosphere. Excludes procedures with unknown bearing surface
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

# Primary Total Shoulder Replacement

**Figure ST63 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Bearing Surface (Primary Diagnosis OA)**




HR – adjusted for age and gender

Osteoarthritis Metal/XLPE vs
Osteoarthritis Metal/Non XLPE
0-1.5 Yr: HR=1.35 (95% CI 0.66, 2.78), p=0.412
1.5 Yr +: HR=0.31 (95% CI 0.15, 0.63), p=0.001

Osteoarthritis XLPE/Metal vs
Osteoarthritis Non XLPE/Metal
Entire Period: HR= 0.75 (95% CI 0.62, 0.90), p=0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | Metal/Non XLPE | 502 | 484 | 447 | 281 | 146 | 7 | 0 |
| | Metal/XLPE | 4490 | 3921 | 2896 | 1837 | 864 | 192 | 4 |
| | Non XLPE/Metal | 16522 | 14111 | 10166 | 6883 | 4086 | 1595 | 265 |
| | XLPE/Metal | 6331 | 4764 | 2890 | 1739 | 1055 | 440 | 119 |

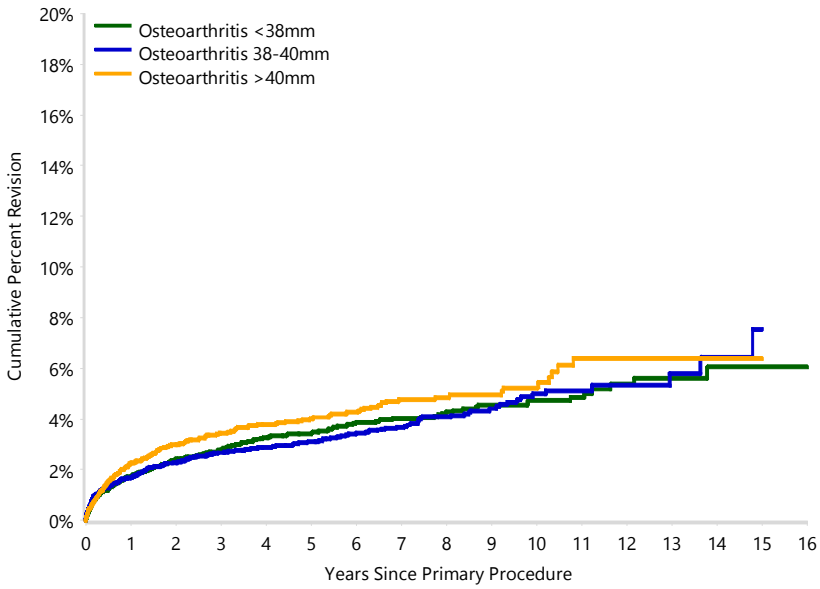
Note: Restricted to modern prostheses. Reported as humeral cup/glenosphere.

**Table ST92 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Glenosphere Size (Primary Diagnosis OA)**

| Primary Diagnosis | Glenosphere Size | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 8 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | | | | | | | | | |
| | <38mm | 306 | 9868 | 1.7 (1.5, 2.0) | 2.4 (2.1, 2.8) | 2.8 (2.5, 3.2) | 3.4 (3.0, 3.9) | 4.3 (3.8, 4.9) | 4.7 (4.1, 5.4) |
| | 38-40mm | 314 | 10127 | 1.7 (1.4, 2.0) | 2.3 (2.0, 2.6) | 2.7 (2.4, 3.0) | 3.1 (2.7, 3.5) | 4.1 (3.6, 4.6) | 5.0 (4.3, 5.8) |
| | >40mm | 237 | 6199 | 2.3 (1.9, 2.7) | 3.0 (2.6, 3.5) | 3.5 (3.0, 4.0) | 4.0 (3.5, 4.6) | 4.9 (4.2, 5.6) | 5.3 (4.5, 6.1) |
| Rotator Cuff Arthropathy | | | | | | | | | |
| | <38mm | 283 | 8378 | 2.1 (1.8, 2.5) | 2.9 (2.5, 3.3) | 3.3 (2.9, 3.8) | 4.0 (3.5, 4.5) | 4.7 (4.1, 5.4) | 5.5 (4.7, 6.5) |
| | 38-40mm | 314 | 8635 | 2.3 (2.0, 2.6) | 3.1 (2.7, 3.5) | 3.4 (3.1, 3.9) | 4.0 (3.5, 4.5) | 4.7 (4.2, 5.3) | 4.8 (4.2, 5.4) |
| | >40mm | 250 | 5811 | 2.4 (2.1, 2.9) | 3.4 (3.0, 3.9) | 3.9 (3.4, 4.4) | 4.6 (4.1, 5.3) | 5.8 (5.1, 6.7) | 6.2 (5.3, 7.2) |
| Fracture | | | | | | | | | |
| | <38mm | 135 | 4078 | 2.3 (1.8, 2.8) | 3.0 (2.5, 3.7) | 3.2 (2.7, 3.8) | 3.8 (3.2, 4.6) | 4.7 (3.9, 5.7) | 4.7 (3.9, 5.7) |
| | 38-40mm | 153 | 3658 | 3.1 (2.6, 3.7) | 3.8 (3.2, 4.5) | 4.0 (3.4, 4.7) | 4.5 (3.8, 5.3) | 5.0 (4.2, 5.9) | 5.9 (4.7, 7.4) |
| | >40mm | 105 | 1442 | 5.1 (4.1, 6.4) | 6.6 (5.4, 8.1) | 7.0 (5.7, 8.5) | 8.0 (6.6, 9.6) | 8.6 (7.0, 10.4) | 8.6 (7.0, 10.4) |
| TOTAL | | 2097 | 58196 | | | | | | |

Note: Excludes procedures with unknown glenosphere sizes
Restricted to modern prostheses
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Figure ST64 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Glenosphere Size (Primary Diagnosis OA)**




HR - adjusted for age and gender

Osteoarthritis <38mm vs Osteoarthritis 38-40mm
Entire Period: HR=1.09 (95% CI 0.93, 1.27), p=0.304

Osteoarthritis >40mm vs Osteoarthritis <38mm
Entire Period: HR=0.79 (95% CI 0.65, 0.94), p=0.009

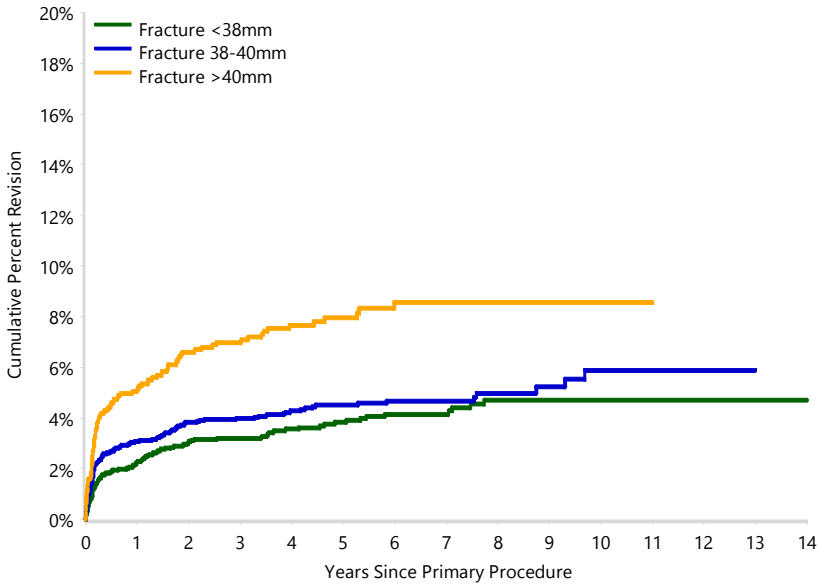
Osteoarthritis >40mm vs Osteoarthritis 38-40mm
0 - 3Mth: HR=0.65 (95% CI 0.48, 0.89), p=0.007
3Mth+: HR=0.94 (95% CI 0.77, 1.15), p=0.568

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | <38mm | 9868 | 8140 | 5648 | 3739 | 2261 | 951 | 198 |
| | 38-40mm | 10127 | 8762 | 6411 | 4262 | 2437 | 807 | 128 |
| | >40mm | 6199 | 5372 | 3979 | 2651 | 1457 | 477 | 62 |

Note: Restricted to modern prostheses

# Primary Total Shoulder Replacement

**Figure ST65 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Glenosphere Size (Primary Diagnosis Fracture)**




HR - adjusted for age and gender

Fracture 38-40mm vs Fracture <38mm

Entire Period: HR=1.18 (95% CI 0.94, 1.49), p=0.160

Fracture >40mm vs Fracture <38mm

Entire Period: HR=1.46 (95% CI 1.11, 1.92), p=0.007

Fracture >40mm vs Fracture 38-40mm

Entire Period: HR=1.24 (95% CI 0.95, 1.62), p=0.118

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| **Fracture** | **<38mm** | 4078 | 3297 | 2126 | 1309 | 780 | 284 | 47 |
| | **38-40mm** | 3658 | 3117 | 2221 | 1411 | 758 | 223 | 23 |
| | **>40mm** | 1442 | 1221 | 892 | 547 | 277 | 81 | 5 |

Note: Restricted to modern prostheses

## IMPLANT SIZING VARIATIONS (ISV)

ISV are modifications to a prosthesis design range beyond simple size change.

### Glenoid Baseplate Augmentation

A glenoid baseplate is categorised as augmented if the backside has been modified for glenoid deformity (eg. wedged, stepped, angulated, or lateralised). When stratified by primary diagnosis, there is no difference in the rate of revision when augmented and non-augmented glenoid baseplates are compared amongst all common primary diagnoses except for osteoarthritis in the first 3 months, where a non-augmented glenoid is at higher revision risk (Table ST93 and Figure ST66).

When stratified by glenoid morphology, glenoid base plate augmentation varies with differing primary diagnoses. In osteoarthritis, while there is no difference when utilised for type A glenoids, glenoid morphology B augmented glenoid replacement has a higher rate of revision from 9 months onwards with no difference prior to this time (Table ST94 and Figure ST67). In contrast, glenoid morphology C non-augmented glenoid replacement has a higher rate of revision for the entire period (Table ST94 and Figure ST68). Glenoid morphology B non-augmented glenoid for rotator cuff arthropathy has a higher rate of revision for the first month only, with no difference after this time (Table ST94 and Figure ST69).

### Humeral, Stem Type and Stem Length

There is an increased rate of revision for non-fracture humeral stems compared to fracture humeral stems (Table ST95 and Figure ST70). When compared by fixation, a cemented fracture stem has a lower rate of revision than a cemented non fracture stem (Table ST96 and Figure ST71). There is no difference in the rate of revision when cementless fixation stems are used.

A short humeral stem (<100 mm) has a lower rate of revision compared to a conventional stem (≥100mm) from 3 months onwards in osteoarthritis patients only (Table ST97 and Figure ST72). Conventional stem lengths have higher cumulative incidence of infection compared to short stems (Figure ST73).

### Glenosphere Lateralisation

If the radius of curvature of the articular surface of the glenosphere is displaced laterally by design, it is categorised as a lateralised glenosphere. There is no difference in the rate of revision for total stemmed reverse shoulder replacements with lateralised glenospheres when compared to total stemmed reverse shoulder replacements with standard glenospheres for all primary diagnoses analysed (Table ST98).

# Primary Total Shoulder Replacement

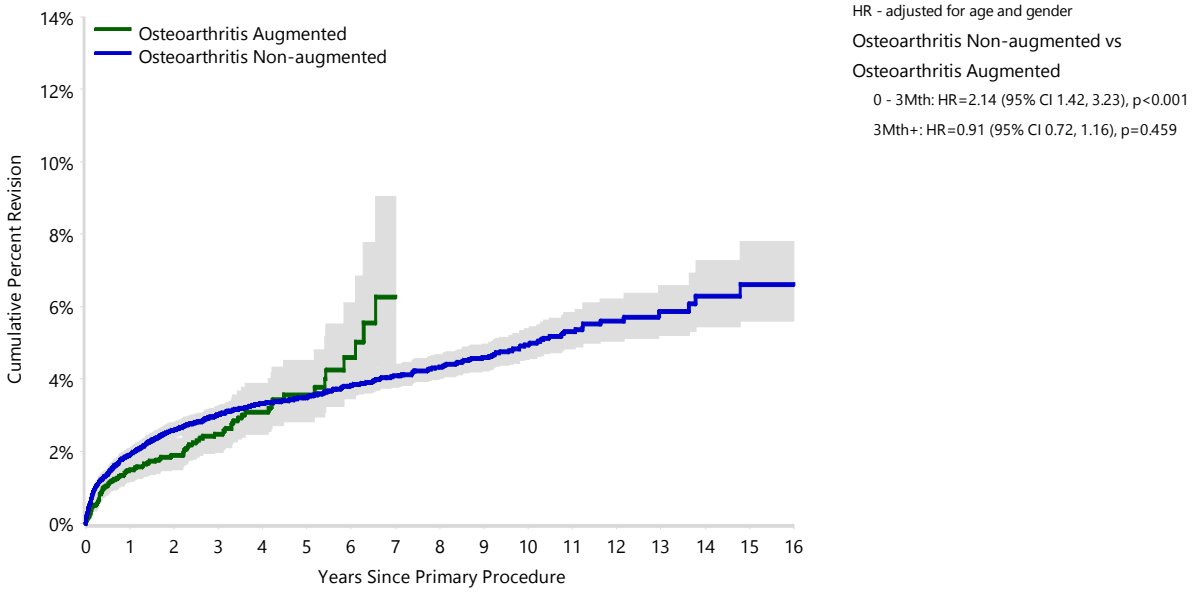
**Table ST93 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis and Glenoid Augmentation**

| Primary Diagnosis | Glenoid Augmentation | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | | | | | | | | |
| | Augmented | 105 | 4765 | 1.5 (1.2, 1.9) | 1.9 (1.5, 2.4) | 2.5 (2.0, 3.1) | 3.1 (2.5, 3.9) | 3.6 (2.8, 4.5) |
| | Non-augmented | 792 | 23154 | 1.9 (1.7, 2.1) | 2.6 (2.4, 2.8) | 3.0 (2.8, 3.3) | 3.3 (3.1, 3.6) | 3.5 (3.2, 3.8) |
| Rotator Cuff Arthropathy | | | | | | | | |
| | Augmented | 93 | 3800 | 1.9 (1.5, 2.4) | 2.7 (2.2, 3.4) | 3.0 (2.4, 3.7) | 3.2 (2.5, 4.0) | 3.4 (2.7, 4.5) |
| | Non-augmented | 792 | 20316 | 2.3 (2.1, 2.6) | 3.1 (2.9, 3.4) | 3.6 (3.3, 3.9) | 4.0 (3.7, 4.3) | 4.3 (4.0, 4.6) |
| Fracture | | | | | | | | |
| | Augmented | 18 | 771 | 1.9 (1.1, 3.3) | 2.9 (1.7, 4.9) | 2.9 (1.7, 4.9) | 4.0 (2.1, 7.6) | |
| | Non-augmented | 388 | 8816 | 3.1 (2.8, 3.5) | 4.0 (3.6, 4.5) | 4.2 (3.8, 4.7) | 4.6 (4.1, 5.1) | 4.8 (4.4, 5.3) |
| TOTAL | | 2188 | 61622 | | | | | |

Note: Restricted to modern prostheses

Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Figure ST66 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Glenoid Augmentation (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|
| Osteoarthritis | Augmented | 4765 | 3268 | 2176 | 1465 | 949 | 538 |
| | Non-augmented | 23154 | 20082 | 17340 | 14971 | 12436 | 10212 |

Note: Restricted to modern prostheses

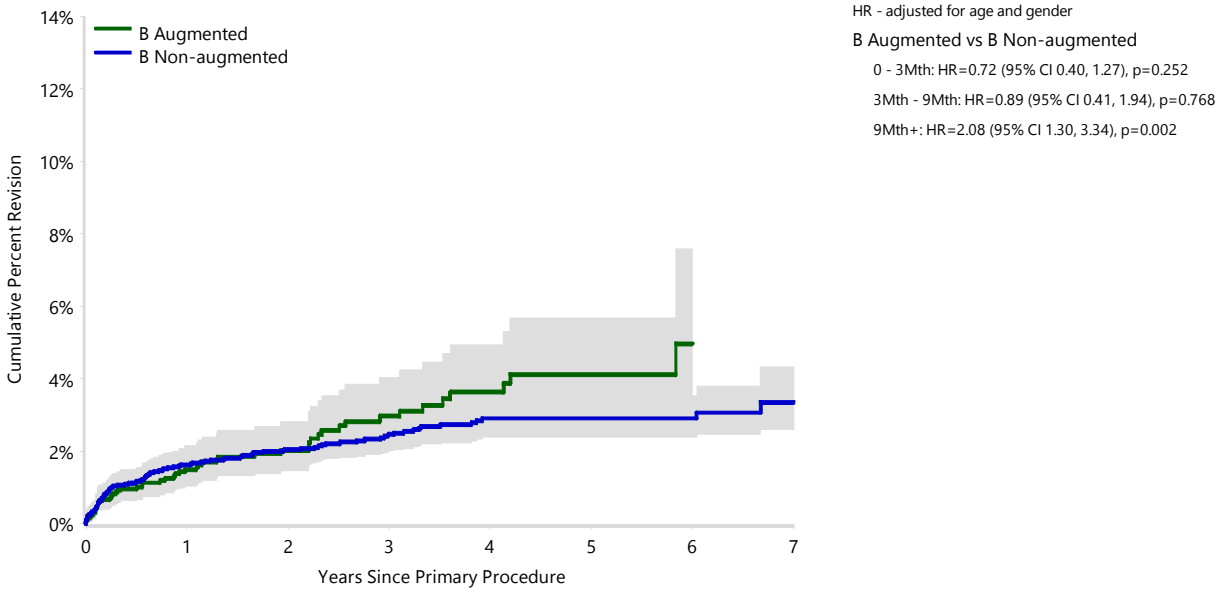
**Table ST94 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis, Glenoid Morphology and Glenoid Augmentation**

| Primary Diagnosis | Glenoid Morphology | Glenoid Augmentation | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | | | | | | | | | |
| | A | Augmented | 27 | 1378 | 1.6 (1.0, 2.5) | 2.1 (1.3, 3.2) | 2.3 (1.5, 3.6) | 3.1 (1.9, 5.0) | 3.1 (1.9, 5.0) |
| | | Non-augmented | 216 | 7939 | 1.6 (1.4, 1.9) | 2.6 (2.2, 3.0) | 3.0 (2.6, 3.5) | 3.2 (2.8, 3.7) | 3.4 (3.0, 3.9) |
| | B | Augmented | 55 | 2255 | 1.5 (1.0, 2.1) | 2.0 (1.5, 2.8) | 3.0 (2.2, 4.0) | 3.6 (2.7, 4.9) | 4.1 (3.0, 5.7) |
| | | Non-augmented | 107 | 4618 | 1.6 (1.3, 2.1) | 2.0 (1.6, 2.5) | 2.5 (2.0, 3.0) | 2.9 (2.4, 3.5) | 2.9 (2.4, 3.5) |
| | C | Augmented | 6 | 496 | 0.7 (0.2, 2.1) | 0.7 (0.2, 2.1) | 0.7 (0.2, 2.1) | 1.3 (0.4, 3.9) | 3.6 (1.4, 9.4) |
| | | Non-augmented | 28 | 732 | 2.6 (1.6, 4.0) | 3.4 (2.3, 5.1) | 3.9 (2.6, 5.7) | 4.4 (3.0, 6.4) | 4.8 (3.3, 7.1) |
| Rotator Cuff Arthropathy | | | | | | | | | |
| | A | Augmented | 41 | 1748 | 1.8 (1.3, 2.6) | 2.7 (1.9, 3.8) | 2.9 (2.1, 4.0) | 3.5 (2.4, 5.1) | 3.5 (2.4, 5.1) |
| | | Non-augmented | 350 | 10632 | 2.2 (1.9, 2.5) | 3.0 (2.7, 3.4) | 3.5 (3.1, 3.9) | 3.8 (3.4, 4.3) | 4.0 (3.6, 4.5) |
| | B | Augmented | 29 | 1425 | 1.5 (0.9, 2.3) | 2.3 (1.5, 3.4) | 2.6 (1.8, 4.0) | 2.6 (1.8, 4.0) | 3.3 (2.0, 5.4) |
| | | Non-augmented | 87 | 2745 | 2.2 (1.7, 2.8) | 2.9 (2.3, 3.6) | 3.4 (2.7, 4.2) | 3.6 (2.9, 4.5) | 3.9 (3.1, 4.8) |
| | C | Augmented | 8 | 310 | 2.4 (1.2, 5.0) | 2.9 (1.5, 5.8) | 2.9 (1.5, 5.8) | 2.9 (1.5, 5.8) | |
| | | Non-augmented | 12 | 360 | 2.1 (1.0, 4.4) | 2.8 (1.5, 5.4) | 3.2 (1.7, 5.9) | 3.2 (1.7, 5.9) | 4.9 (2.6, 9.0) |
| Fracture | | | | | | | | | |
| | A | Augmented | 14 | 532 | 2.0 (1.0, 3.9) | 3.5 (1.9, 6.4) | 3.5 (1.9, 6.4) | | |
| | | Non-augmented | 186 | 4774 | 3.0 (2.5, 3.5) | 3.9 (3.4, 4.6) | 4.1 (3.5, 4.7) | 4.4 (3.8, 5.0) | 4.7 (4.0, 5.4) |
| | B | Augmented | 3 | 110 | 3.0 (1.0, 8.9) | | | | |
| | | Non-augmented | 14 | 286 | 3.3 (1.7, 6.2) | 4.8 (2.8, 8.5) | 4.8 (2.8, 8.5) | 6.3 (3.7, 10.7) | 6.3 (3.7, 10.7) |
| | C | Augmented | 0 | 17 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | |
| | | Non-augmented | 1 | 38 | 2.8 (0.4, 18.1) | 2.8 (0.4, 18.1) | 2.8 (0.4, 18.1) | 2.8 (0.4, 18.1) | 2.8 (0.4, 18.1) |
| TOTAL | | | 1184 | 40395 | | | | | |

Note: Excludes 21,255 procedures with unknown glenoid augmentation or glenoid morphology
Restricted to modern prostheses.
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

# Primary Total Shoulder Replacement

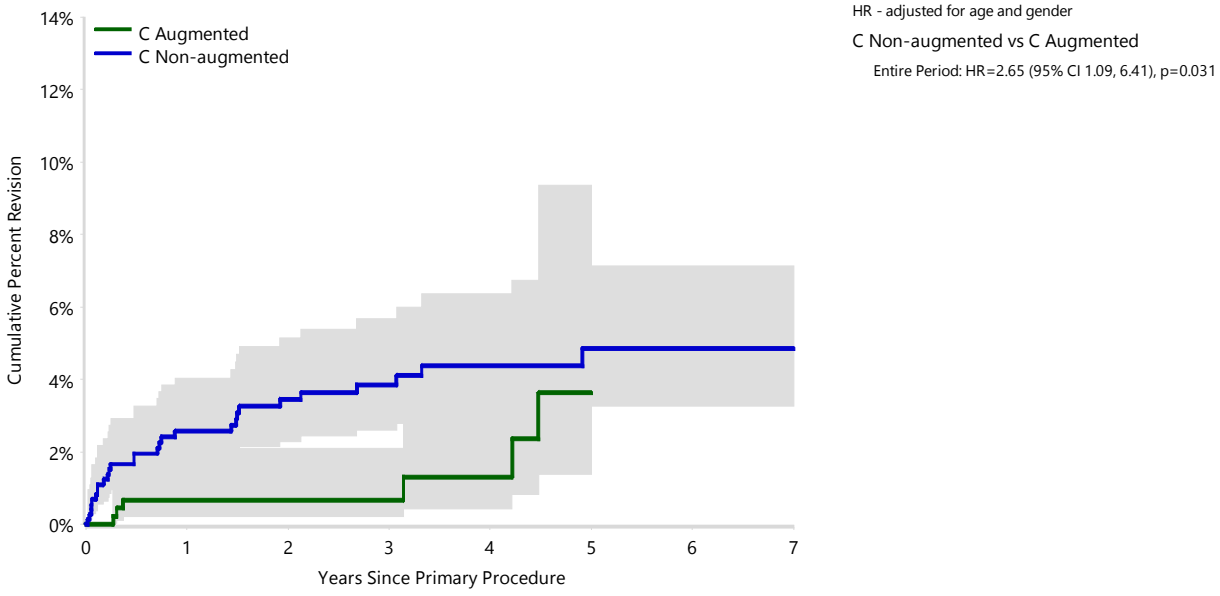
**Figure ST67 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Glenoid Morphology B and Glenoid Augmentation (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|
| B | Augmented | 2255 | 1533 | 1017 | 688 | 427 | 221 |
| | Non-augmented | 4618 | 3710 | 2935 | 2292 | 1608 | 1091 |

Note: Restricted to modern prostheses.

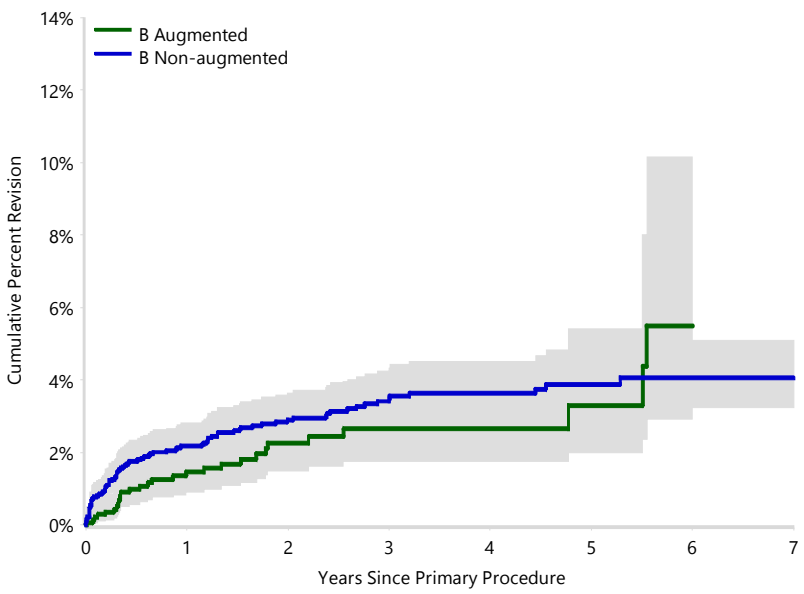
**Figure ST68 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Glenoid Morphology C and Glenoid Augmentation (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|
| C | Augmented | 496 | 357 | 243 | 167 | 112 | 59 |
| | Non-augmented | 732 | 616 | 507 | 399 | 283 | 190 |

Note: Restricted to modern prostheses.

**Figure ST69 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Glenoid Morphology B and Glenoid Augmentation (Primary Diagnosis Rotator Cuff Arthropathy)**




HR - adjusted for age and gender

B Non-augmented vs B Augmented

0 - 1Mth: HR=5.52 (95% CI 1.29, 23.55), p=0.020

1Mth+: HR=1.01 (95% CI 0.64, 1.58), p=0.973

| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|
| B | Augmented | 1425 | 955 | 593 | 386 | 240 | 130 |
| | Non-augmented | 2745 | 2242 | 1756 | 1346 | 953 | 637 |

Note: Restricted to modern prostheses.

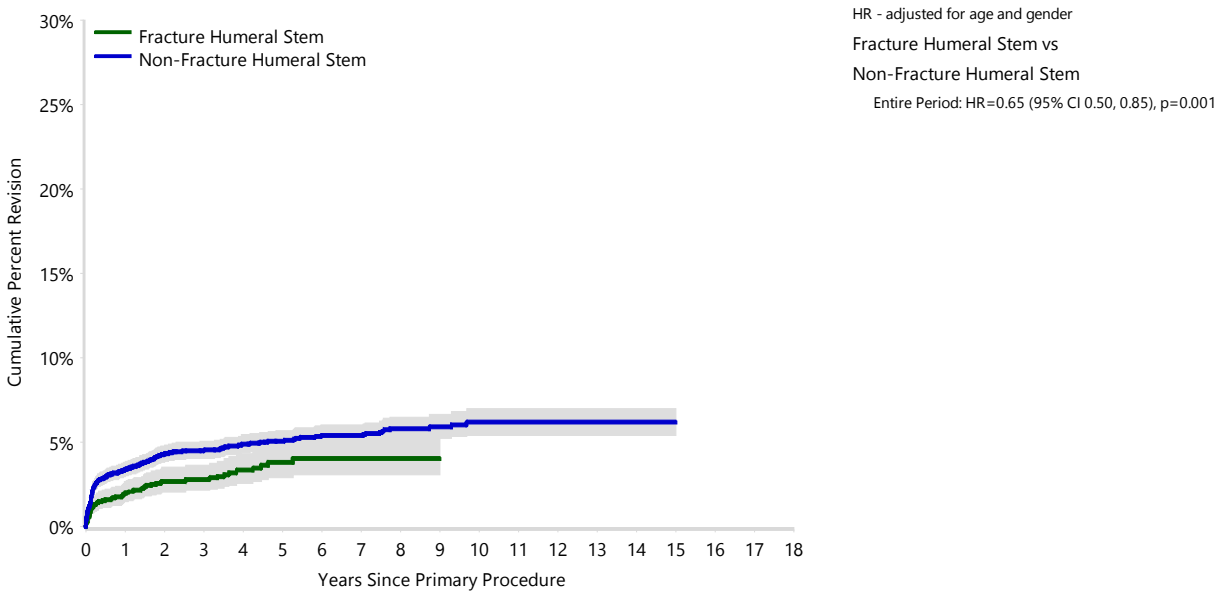
# Primary Total Shoulder Replacement

**Table ST95 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Stem Type (Primary Diagnosis Fracture)**

| Stem Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Fracture Humeral Stem | 65 | 2305 | 2.0 (1.5, 2.7) | 2.8 (2.1, 3.6) | 3.8 (2.9, 5.0) | 4.0 (3.1, 5.3) | | |
| Non-Fracture Humeral Stem | 341 | 7284 | 3.4 (3.0, 3.8) | 4.5 (4.0, 5.1) | 5.1 (4.6, 5.7) | 5.4 (4.8, 6.0) | 6.2 (5.4, 7.0) | 6.2 (5.4, 7.0) |
| TOTAL | 406 | 9589 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST70 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Stem Type (Primary Diagnosis Fracture)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Fracture Humeral Stem | 2305 | 1814 | 1042 | 502 | 175 | 14 | 0 |
| Non-Fracture Humeral Stem | 7284 | 6061 | 4246 | 2770 | 1641 | 575 | 75 |

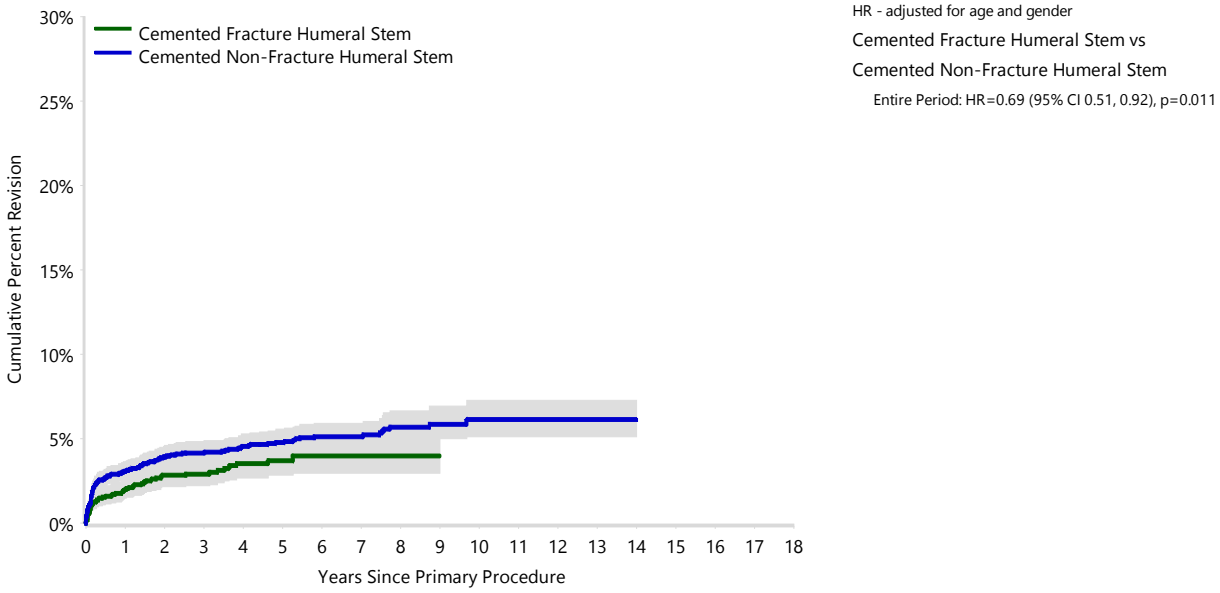
Note: Restricted to modern prostheses

**Table ST96 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Humeral Fixation and Stem Type (Primary Diagnosis Fracture)**

| Humeral Fixation | Stem Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Cementless | Fracture Humeral Stem | 6 | 238 | 1.7 (0.6, 4.5) | 1.7 (0.6, 4.5) | 4.4 (1.7, 10.7) | | | |
| | Non-Fracture Humeral Stem | 146 | 2867 | 3.8 (3.2, 4.6) | 5.1 (4.3, 6.0) | 5.5 (4.7, 6.5) | 5.8 (4.9, 6.9) | 6.3 (5.2, 7.6) | |
| Cemented | Fracture Humeral Stem | 59 | 2067 | 2.0 (1.5, 2.7) | 2.9 (2.2, 3.8) | 3.7 (2.8, 4.9) | 4.0 (3.0, 5.3) | | |
| | Non-Fracture Humeral Stem | 195 | 4417 | 3.1 (2.6, 3.7) | 4.2 (3.6, 4.8) | 4.8 (4.2, 5.6) | 5.1 (4.4, 5.9) | 6.1 (5.1, 7.3) | 6.1 (5.1, 7.3) |
| TOTAL | | 406 | 9589 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST71 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement with Cemented Humeral Fixation by Stem Type (Primary Diagnosis Fracture)**




| | Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cemented | Fracture Humeral Stem | 2067 | 1615 | 928 | 438 | 151 | 11 | 0 |
| | Non-Fracture Humeral Stem | 4417 | 3685 | 2582 | 1651 | 962 | 343 | 40 |

Note: Restricted to modern prostheses

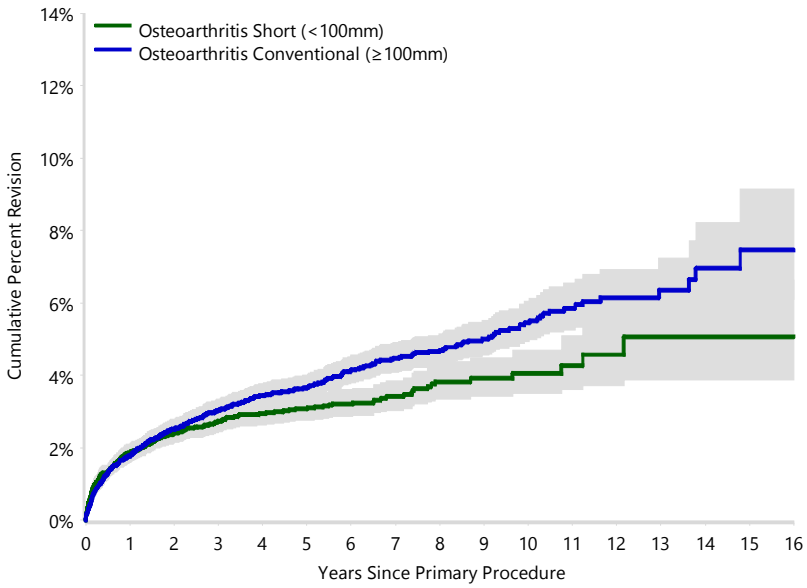
# Primary Total Shoulder Replacement

**Table ST97 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis and Humeral Stem Length**

| Primary Diagnosis | Humeral Stem Length | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | | | | | | | | | |
| | Short (<100mm) | 338 | 12636 | 1.9 (1.6, 2.1) | 2.7 (2.4, 3.1) | 3.1 (2.8, 3.4) | 3.4 (3.0, 3.9) | 4.1 (3.5, 4.7) | 5.1 (3.9, 6.6) |
| | Conventional (≥100mm) | 555 | 15152 | 1.8 (1.6, 2.0) | 3.0 (2.8, 3.3) | 3.7 (3.4, 4.0) | 4.5 (4.1, 4.9) | 5.5 (4.9, 6.1) | 7.0 (5.9, 8.2) |
| Rotator Cuff Arthropathy | | | | | | | | | |
| | Short (<100mm) | 359 | 10896 | 2.3 (2.0, 2.6) | 3.4 (3.1, 3.8) | 4.0 (3.6, 4.5) | 4.4 (3.9, 4.9) | 5.0 (4.3, 5.9) | 5.8 (4.6, 7.2) |
| | Conventional (≥100mm) | 521 | 13091 | 2.3 (2.0, 2.5) | 3.5 (3.2, 3.9) | 4.2 (3.9, 4.6) | 4.8 (4.4, 5.3) | 5.6 (5.1, 6.2) | 6.1 (5.4, 6.9) |
| Fracture | | | | | | | | | |
| | Short (<100mm) | 128 | 2631 | 3.8 (3.1, 4.6) | 5.1 (4.3, 6.1) | 5.5 (4.6, 6.5) | 5.6 (4.7, 6.7) | 5.6 (4.7, 6.7) | |
| | Conventional (≥100mm) | 278 | 6948 | 2.8 (2.4, 3.2) | 3.8 (3.3, 4.3) | 4.5 (4.0, 5.1) | 4.9 (4.3, 5.5) | 5.9 (5.0, 6.9) | 5.9 (5.0, 6.9) |
| TOTAL | | 2179 | 61354 | | | | | | |

Note: Excludes procedures with unknown humeral stem length
Restricted to modern prostheses
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Figure ST72 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Humeral Stem Length (Primary Diagnosis OA)**

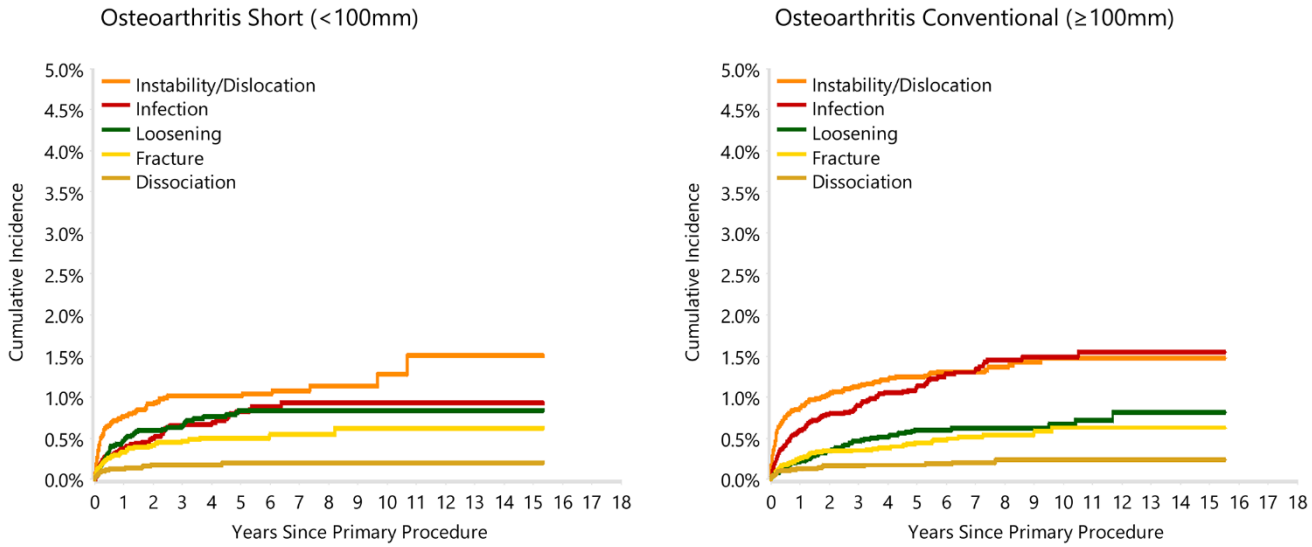



HR - adjusted for age and gender
Osteoarthritis Conventional (≥100mm) vs Osteoarthritis Short (<100mm)
0 - 3Mth: HR=0.88 (95% CI 0.69, 1.12), p=0.283
3Mth - 6Mth: HR=1.46 (95% CI 0.96, 2.23), p=0.077
6Mth - 3.5Yr: HR=1.25 (95% CI 1.02, 1.54), p=0.034
3.5Yr+: HR=2.14 (95% CI 1.43, 3.19), p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | Short (<100mm) | 12636 | 10022 | 6523 | 3911 | 1985 | 632 | 121 |
| | Conventional (≥100mm) | 15152 | 13281 | 9902 | 6834 | 4170 | 1603 | 267 |

Note: Excludes procedures with unknown humeral stem length
Restricted to modern prostheses

**Figure ST73 Cumulative Incidence Revision Diagnosis of Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis and Humeral Stem Length**




Note: Restricted to modern prostheses

**Table ST98 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis and Glenosphere Lateralisation**

| Primary Diagnosis | Glenoid Lateralisation | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | | | | | | | | |
| | Lateralised | 18 | 1047 | 1.5 (0.8, 2.5) | 2.0 (1.2, 3.4) | 2.4 (1.4, 4.1) | 3.2 (1.7, 5.9) | 3.2 (1.7, 5.9) |
| | Standard | 878 | 26764 | 1.8 (1.7, 2.0) | 2.5 (2.3, 2.7) | 2.9 (2.7, 3.2) | 3.3 (3.0, 3.5) | 3.5 (3.2, 3.7) |
| Rotator Cuff Arthropathy | | | | | | | | |
| | Lateralised | 23 | 876 | 2.6 (1.6, 4.0) | 3.3 (2.2, 5.1) | 3.3 (2.2, 5.1) | 4.4 (2.5, 7.6) | 4.4 (2.5, 7.6) |
| | Standard | 858 | 23108 | 2.2 (2.1, 2.5) | 3.1 (2.8, 3.3) | 3.5 (3.3, 3.8) | 3.9 (3.6, 4.1) | 4.1 (3.9, 4.5) |
| Fracture | | | | | | | | |
| | Lateralised | 17 | 361 | 4.6 (2.8, 7.6) | 5.2 (3.2, 8.4) | 5.2 (3.2, 8.4) | | |
| | Standard | 388 | 9195 | 3.0 (2.7, 3.4) | 3.9 (3.5, 4.3) | 4.1 (3.7, 4.5) | 4.5 (4.0, 4.9) | 4.7 (4.3, 5.2) |
| TOTAL | | 2182 | 61351 | | | | | |

Note: Excludes procedures with unknown lateralisation
Restricted to modern prostheses.
Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

# Primary Total Shoulder Replacement

## SURGEON ASSISTIVE TOOLS (SAT)

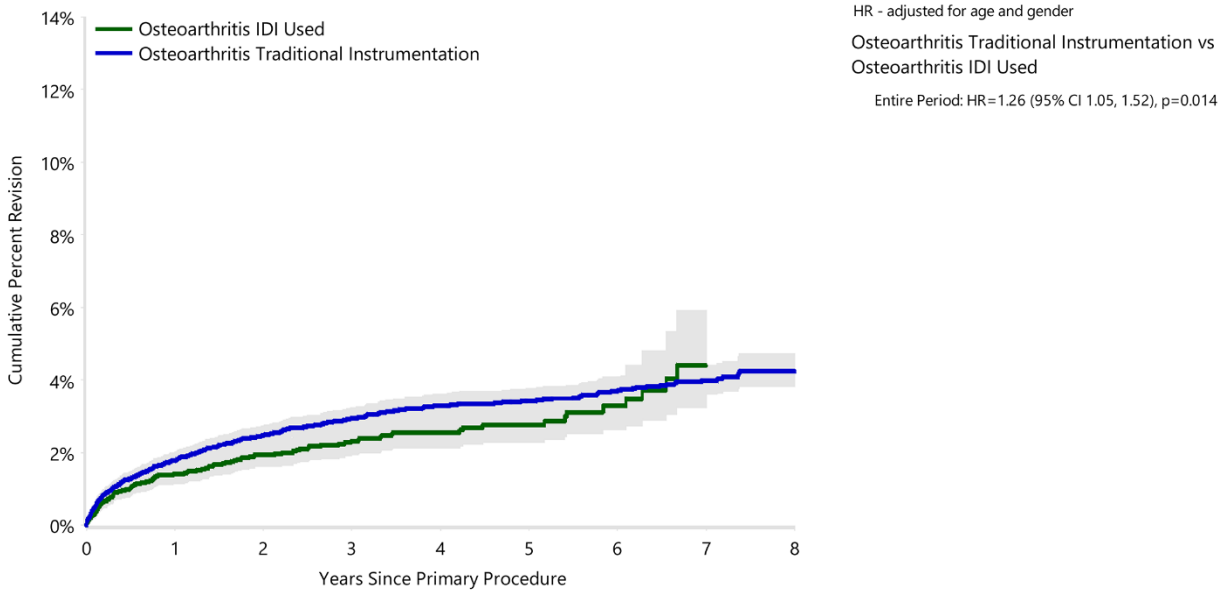
An image derived instrument (IDI) is defined as custom made pin guides or cutting blocks derived from CT or MRI images by 3D printing specifically for each patient.
There are 6,977 total stemmed reverse shoulder replacements for osteoarthritis, 6,213 for rotator cuff arthropathy, and 582 for fracture utilising an IDI since their first use in 2014. In 2024, IDI are used in 42% of osteoarthritis procedures, 40.8% of rotator cuff arthropathy and 13.7% of fracture (Table ST99 and Figure ST74).

**Table ST99 Cumulative Percent Revision of Primary Total Stemmed Reverse Replacement Since 2016 by Primary Diagnosis and IDI Usage**

| Primary Diagnosis | IDI Use | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | | | | | | | | |
| | IDI Used | 144 | 6977 | 1.4 (1.1, 1.7) | 1.9 (1.6, 2.3) | 2.3 (1.9, 2.8) | 2.6 (2.1, 3.1) | 2.8 (2.3, 3.3) |
| | Traditional Instrumentation | 477 | 16034 | 1.8 (1.6, 2.0) | 2.5 (2.2, 2.7) | 2.9 (2.7, 3.2) | 3.3 (3.0, 3.6) | 3.4 (3.1, 3.8) |
| Rotator Cuff Arthropathy | | | | | | | | |
| | IDI Used | 201 | 6213 | 2.2 (1.9, 2.7) | 3.0 (2.6, 3.5) | 3.6 (3.1, 4.2) | 4.1 (3.5, 4.7) | 4.4 (3.8, 5.2) |
| | Traditional Instrumentation | 467 | 14206 | 2.1 (1.9, 2.4) | 2.9 (2.7, 3.3) | 3.3 (3.0, 3.7) | 3.6 (3.3, 3.9) | 3.8 (3.5, 4.2) |
| Fracture | | | | | | | | |
| | IDI Used | 23 | 582 | 2.8 (1.8, 4.6) | 4.5 (2.9, 6.9) | 4.5 (2.9, 6.9) | 4.5 (2.9, 6.9) | 6.8 (3.9, 11.7) |
| | Traditional Instrumentation | 315 | 7415 | 3.2 (2.8, 3.6) | 4.1 (3.7, 4.6) | 4.3 (3.8, 4.8) | 4.8 (4.3, 5.3) | 5.0 (4.5, 5.6) |
| TOTAL | | 1627 | 51427 | | | | | |

Note: Restricted to modern prostheses. Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report.

**Figure ST74 Cumulative Percent Revision of Primary Total Stemmed Reverse Replacement Since 2016 by IDI Usage (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|
| Osteoarthritis | IDI Used | 6977 | 5223 | 3781 | 2668 | 1730 | 1015 |
| | Traditional Instrumentation | 16034 | 13402 | 11147 | 9318 | 7362 | 5637 |

Note: Restricted to modern prostheses

## OPERATIVE TECHNIQUE

### Rotator Cuff Repair

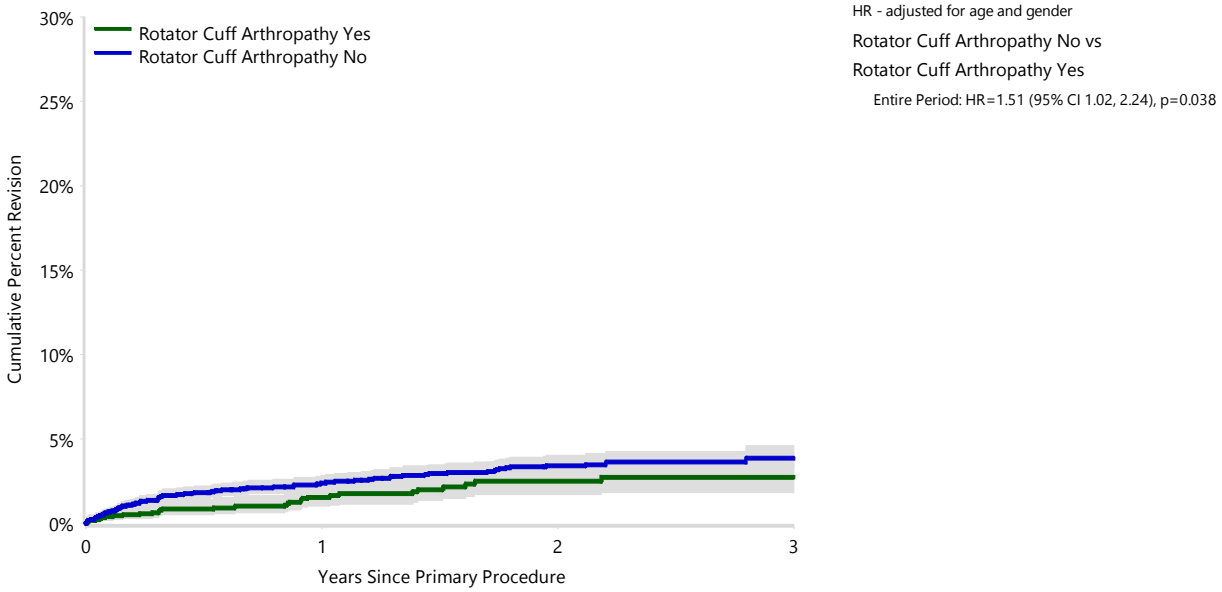
When a rotator cuff repair is not undertaken as part of the implantation of a total stemmed reverse shoulder replacement there is an increased rate of revision for rotator cuff arthropathy and fracture but no difference for osteoarthritis (Table ST100, Figure ST75 and Figure ST76).

**Table ST100 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Primary Diagnosis and Rotator Cuff Repair**

| Primary Diagnosis | Rotator Cuff Repair | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | | | | | | | | |
| | Yes | 24 | 1940 | 1.1 (0.7, 1.8) | 1.9 (1.3, 3.0) | 1.9 (1.3, 3.0) | | |
| | No | 99 | 5262 | 1.6 (1.3, 2.0) | 2.3 (1.9, 2.9) | 2.8 (2.2, 3.5) | 3.8 (2.6, 5.5) | |
| Rotator Cuff Arthropathy | | | | | | | | |
| | Yes | 30 | 1747 | 1.6 (1.0, 2.4) | 2.5 (1.7, 3.6) | 2.8 (1.9, 4.1) | | |
| | No | 156 | 5667 | 2.4 (2.0, 2.8) | 3.4 (2.9, 4.1) | 3.9 (3.2, 4.6) | | |
| Fracture | | | | | | | | |
| | Yes | 20 | 896 | 2.2 (1.4, 3.5) | 2.7 (1.7, 4.3) | 2.7 (1.7, 4.3) | | |
| | No | 49 | 1200 | 3.9 (2.9, 5.2) | 5.1 (3.9, 6.9) | 5.1 (3.9, 6.9) | | |
| TOTAL | | 378 | 16712 | | | | | |

Note: Restricted to modern prostheses. Figures (with sufficient revisions) are not shown where the results are not statistically significant (p >0.05). They are available in the Shoulder Arthroplasty Comparative Analyses: No Difference Observed Supplementary Report. .

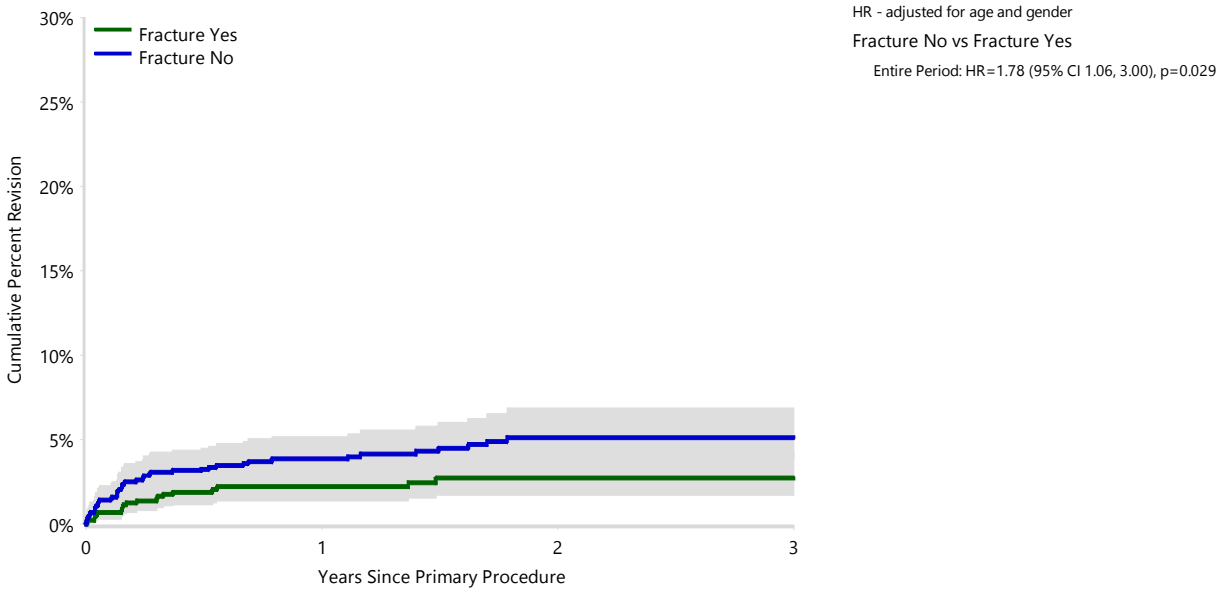
**Figure ST75 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Rotator Cuff Repair (Primary Diagnosis Rotator Cuff Arthropathy)**




| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|
| Rotator Cuff Arthropathy | Yes | 1747 | 1014 | 437 | 118 | 8 | 0 |
| | No | 5667 | 3517 | 1795 | 655 | 38 | 0 |

Note: Restricted to modern prostheses

**Figure ST76 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Rotator Cuff Repair (Primary Diagnosis Fracture)**




| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|
| **Fracture** | **Yes** | 896 | 511 | 242 | 73 | 3 | 0 |
| | **No** | 1200 | 705 | 361 | 131 | 14 | 0 |

Note: Restricted to modern prostheses

## PROSTHESIS COMBINATIONS BY PRIMARY DIAGNOSIS

The outcomes of the most commonly used prosthesis combinations are listed in Table ST101 to Table ST103. The most commonly used cementless prosthesis combinations are listed in Table ST104 to Table ST106. The most commonly used hybrid (humerus cemented) prosthesis combinations are listed in Table ST107 to Table ST109.

**Table ST101 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Prosthesis Combination (Primary Diagnosis OA)**

| Humeral Stem | Glenoid Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Aequalis | Aequalis | 79 | 1606 | 2.0 (1.4, 2.8) | 3.3 (2.6, 4.4) | 3.9 (3.0, 5.0) | 5.3 (4.2, 6.7) | 6.1 (4.8, 7.7) | 7.1 (5.5, 9.3) |
| | Perform Reversed | 4 | 133 | 0.8 (0.1, 5.5) | 3.4 (1.0, 10.7) | | | | |
| Affinis | Affinis | 28 | 826 | 1.4 (0.8, 2.4) | 3.1 (2.1, 4.7) | 3.3 (2.2, 4.9) | 4.0 (2.7, 6.0) | | |
| AltiVate Reverse | RSP | 22 | 1166 | 1.4 (0.8, 2.4) | 2.8 (1.8, 4.3) | | | | |
| Ascend Flex | Aequalis | 69 | 1983 | 2.2 (1.6, 2.9) | 3.7 (2.9, 4.7) | 4.3 (3.3, 5.5) | 5.1 (3.8, 7.0) | | |
| | Perform Reversed | 21 | 1018 | 2.4 (1.6, 3.7) | 2.6 (1.7, 4.0) | | | | |
| Comprehensive | Comprehensive Reverse | 48 | 3788 | 0.9 (0.6, 1.2) | 1.3 (1.0, 1.8) | 1.7 (1.3, 2.4) | 1.7 (1.3, 2.4) | 3.0 (1.3, 7.0) | |
| Delta Xtend | Delta Xtend | 199 | 5465 | 1.8 (1.5, 2.2) | 2.8 (2.4, 3.3) | 3.2 (2.8, 3.8) | 3.8 (3.2, 4.4) | 4.7 (4.0, 5.5) | 6.1 (4.9, 7.7) |
| Equinoxe | Equinoxe | 123 | 3506 | 1.9 (1.5, 2.5) | 3.1 (2.6, 3.9) | 4.1 (3.4, 5.0) | 6.4 (5.1, 8.1) | | |
| Global Unite | Delta Xtend | 16 | 621 | 1.1 (0.5, 2.4) | 3.0 (1.8, 5.1) | 3.6 (2.1, 6.0) | 4.2 (2.4, 7.2) | | |
| MSS | MSS | 1 | 275 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | | |
| RSP | RSP | 34 | 787 | 2.4 (1.6, 3.8) | 3.8 (2.6, 5.4) | 4.6 (3.3, 6.4) | 4.6 (3.3, 6.4) | | |
| SMR | SMR | 1 | 173 | 0.6 (0.1, 4.3) | | | | | |
| | SMR Axioma | 5 | 117 | 1.7 (0.4, 6.8) | 4.8 (2.0, 11.1) | | | | |
| | SMR L1 | 188 | 5177 | 2.4 (2.0, 2.8) | 3.3 (2.8, 3.8) | 3.5 (3.0, 4.1) | 3.9 (3.4, 4.5) | 4.6 (3.9, 5.4) | 5.6 (4.3, 7.3) |
| Trabecular Metal | Comprehensive Reverse | 3 | 212 | 1.0 (0.3, 4.0) | 2.0 (0.6, 6.6) | 2.0 (0.6, 6.6) | | | |
| | Trabecular Metal | 38 | 823 | 1.6 (0.9, 2.8) | 3.6 (2.5, 5.2) | 4.7 (3.4, 6.6) | 5.0 (3.6, 6.9) | 5.9 (4.1, 8.3) | |
| Other (27) | | 19 | 258 | 6.5 (4.0, 10.4) | 6.5 (4.0, 10.4) | 9.5 (5.8, 15.2) | | | |
| TOTAL | | 898 | 27934 | | | | | | |

Note: Restricted to modern prostheses
Only prostheses with >100 procedures have been listed

**Table ST102 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Prosthesis Combination (Primary Diagnosis Rotator Cuff Arthropathy)**

| Humeral Stem | Glenoid Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Aequalis | Aequalis | 70 | 1327 | 2.2 (1.5, 3.2) | 3.8 (2.9, 5.0) | 4.9 (3.8, 6.3) | 5.4 (4.2, 6.9) | 7.2 (5.6, 9.3) | 7.2 (5.6, 9.3) |
| | Perform Reversed | 0 | 117 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | | |
| Affinis | Affinis | 27 | 748 | 1.6 (0.9, 2.8) | 3.0 (1.9, 4.5) | 3.9 (2.6, 5.7) | 4.9 (2.9, 8.0) | | |
| AltiVate | RSP | 2 | 77 | 3.0 (0.8, 11.7) | 3.0 (0.8, 11.7) | | | | |
| AltiVate Reverse | RSP | 48 | 1329 | 2.7 (1.9, 3.8) | 4.6 (3.4, 6.2) | | | | |
| Ascend Flex | Aequalis | 78 | 1845 | 2.7 (2.0, 3.6) | 4.5 (3.6, 5.7) | 5.7 (4.5, 7.2) | 5.7 (4.5, 7.2) | | |
| | Perform Reversed | 21 | 1095 | 1.8 (1.1, 3.0) | 3.0 (1.8, 4.8) | | | | |
| Comprehensive | Comprehensive Reverse | 66 | 3226 | 1.3 (1.0, 1.8) | 2.3 (1.8, 3.0) | 3.0 (2.2, 3.9) | 3.1 (2.4, 4.2) | | |
| | Trabecular Metal | 1 | 40 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 3.0 (0.4, 19.6) | | | |
| Delta Xtend | Delta Xtend | 182 | 4811 | 2.0 (1.6, 2.4) | 3.1 (2.6, 3.6) | 3.7 (3.1, 4.3) | 4.3 (3.7, 5.0) | 4.7 (4.0, 5.4) | 5.4 (4.5, 6.6) |
| Equinoxe | Equinoxe | 93 | 2703 | 2.2 (1.7, 2.8) | 3.3 (2.6, 4.1) | 4.1 (3.3, 5.2) | 5.2 (4.0, 6.7) | | |
| Global Unite | Delta Xtend | 14 | 492 | 1.5 (0.7, 3.1) | 2.8 (1.6, 4.9) | 3.6 (2.1, 6.1) | 3.6 (2.1, 6.1) | | |
| MSS | MSS | 6 | 218 | 3.3 (1.2, 8.8) | | | | | |
| RSP | RSP | 31 | 762 | 2.9 (1.9, 4.4) | 3.9 (2.7, 5.6) | 4.3 (3.1, 6.1) | 4.3 (3.1, 6.1) | | |
| SMR | SMR | 3 | 107 | 1.9 (0.5, 7.4) | | | | | |
| | SMR Axioma | 5 | 56 | 5.4 (1.8, 15.7) | 9.4 (4.0, 21.1) | 9.4 (4.0, 21.1) | | | |
| | SMR L1 | 173 | 4197 | 2.8 (2.3, 3.3) | 3.8 (3.2, 4.4) | 4.2 (3.6, 4.9) | 4.6 (3.9, 5.4) | 5.3 (4.4, 6.4) | 6.1 (4.8, 7.7) |
| Trabecular Metal | Comprehensive Reverse | 15 | 173 | 7.5 (4.3, 12.8) | 10.4 (6.3, 17.0) | 10.4 (6.3, 17.0) | | | |
| | Trabecular Metal | 47 | 736 | 3.7 (2.6, 5.4) | 5.3 (3.9, 7.3) | 5.9 (4.3, 7.9) | 6.5 (4.8, 8.6) | 7.8 (5.7, 10.5) | |
| Other (19) | | 3 | 63 | 3.6 (0.9, 13.5) | 5.5 (1.8, 16.2) | 5.5 (1.8, 16.2) | | | |
| TOTAL | | 885 | 24122 | | | | | | |

Note Restricted to modern prostheses
Only prostheses with >25 procedures have been listed

**Table ST103 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Prosthesis Combination (Primary Diagnosis Fracture)**

| Humeral Stem | Glenoid Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Aequalis | Aequalis | 52 | 1428 | 2.0 (1.4, 2.9) | 2.8 (2.0, 3.8) | 3.8 (2.8, 5.1) | 4.3 (3.2, 5.8) | 5.6 (4.1, 7.7) | |
| | Perform Reversed | 4 | 163 | 2.6 (0.8, 8.3) | | | | | |
| Aequalis Flex Revive | Perform Reversed | 3 | 72 | 3.2 (0.8, 12.2) | 6.4 (2.0, 20.0) | | | | |
| Affinis | Affinis | 17 | 373 | 2.2 (1.1, 4.3) | 3.7 (2.1, 6.2) | 5.2 (3.2, 8.3) | 5.2 (3.2, 8.3) | | |
| AltiVate Reverse | RSP | 9 | 338 | 2.6 (1.3, 5.2) | 3.2 (1.6, 6.0) | | | | |
| Ascend Flex | Aequalis | 3 | 82 | 2.5 (0.6, 9.6) | 4.1 (1.3, 12.2) | 4.1 (1.3, 12.2) | 4.1 (1.3, 12.2) | | |
| | Perform Reversed | 3 | 81 | 4.9 (1.6, 14.7) | | | | | |
| Comprehensive | Comprehensive Reverse | 29 | 1293 | 1.9 (1.3, 2.9) | 2.3 (1.6, 3.4) | 3.1 (2.1, 4.6) | 3.1 (2.1, 4.6) | | |
| Delta Xtend | Delta Xtend | 87 | 1532 | 4.2 (3.3, 5.3) | 5.1 (4.1, 6.4) | 5.6 (4.5, 6.9) | 5.8 (4.7, 7.2) | 6.9 (5.4, 8.7) | |
| Equinoxe | Equinoxe | 39 | 830 | 3.2 (2.1, 4.6) | 5.0 (3.6, 7.0) | 6.6 (4.6, 9.4) | 6.6 (4.6, 9.4) | | |
| Global Unite | Delta Xtend | 20 | 634 | 2.3 (1.4, 3.9) | 3.0 (1.9, 4.8) | 4.1 (2.5, 6.9) | 5.0 (2.9, 8.6) | | |
| RSP | RSP | 14 | 220 | 3.2 (1.6, 6.7) | 5.8 (3.3, 10.0) | 7.4 (4.4, 12.3) | | | |
| SMR | SMR L1 | 111 | 1995 | 4.3 (3.5, 5.3) | 5.7 (4.7, 6.9) | 5.9 (4.9, 7.0) | 6.1 (5.1, 7.4) | 6.1 (5.1, 7.4) | |
| Trabecular Metal | Comprehensive Reverse | 3 | 139 | 2.2 (0.7, 6.6) | 2.2 (0.7, 6.6) | | | | |
| | Trabecular Metal | 9 | 304 | 2.0 (0.9, 4.4) | 2.8 (1.4, 5.5) | 2.8 (1.4, 5.5) | 3.4 (1.8, 6.6) | 3.4 (1.8, 6.6) | |
| Other (12) | | 3 | 105 | 3.0 (1.0, 9.0) | | | | | |
| TOTAL | | 406 | 9589 | | | | | | |

Note Restricted to modern prostheses
Only prostheses with >50 procedures have been listed

**Table ST104 Cumulative Percent Revision of Cementless Primary Total Stemmed Reverse Shoulder Replacement by Prosthesis Combination (Primary Diagnosis OA)**

| Humeral Stem | Glenoid Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Aequalis | Aequalis | 65 | 1215 | 1.9 (1.3, 2.9) | 3.7 (2.7, 4.9) | 4.2 (3.1, 5.5) | 5.7 (4.4, 7.4) | 6.5 (5.0, 8.4) | 7.9 (5.9, 10.7) |
| | Perform Reversed | 2 | 114 | 0.9 (0.1, 6.4) | 0.9 (0.1, 6.4) | | | | |
| Affinis | Affinis | 19 | 517 | 1.2 (0.5, 2.6) | 3.4 (2.1, 5.5) | 3.7 (2.3, 5.9) | 4.3 (2.6, 7.1) | | |
| AltiVate Reverse | RSP | 19 | 1069 | 1.4 (0.8, 2.5) | 2.6 (1.6, 4.2) | | | | |
| Ascend Flex | Aequalis | 64 | 1767 | 2.2 (1.6, 3.0) | 3.8 (2.9, 5.0) | 4.5 (3.5, 5.8) | 5.4 (3.9, 7.5) | | |
| | Perform Reversed | 20 | 902 | 2.5 (1.6, 4.0) | 2.8 (1.8, 4.3) | | | | |
| Comprehensive | Comprehensive Reverse | 46 | 3643 | 0.9 (0.6, 1.3) | 1.4 (1.0, 1.9) | 1.7 (1.3, 2.3) | 1.7 (1.3, 2.3) | 1.7 (1.3, 2.3) | |
| Delta Xtend | Delta Xtend | 157 | 4213 | 1.9 (1.5, 2.3) | 2.9 (2.4, 3.5) | 3.4 (2.9, 4.1) | 3.9 (3.3, 4.6) | 5.1 (4.3, 6.1) | 7.2 (5.3, 9.8) |
| Equinoxe | Equinoxe | 115 | 3335 | 1.9 (1.5, 2.5) | 3.1 (2.5, 3.8) | 4.1 (3.3, 5.0) | 6.1 (4.8, 7.8) | | |
| Global Unite | Delta Xtend | 12 | 549 | 0.8 (0.3, 2.2) | 2.5 (1.3, 4.7) | 3.1 (1.7, 5.8) | 3.8 (2.0, 7.1) | | |
| MSS | MSS | 1 | 273 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | | |
| RSP | RSP | 29 | 680 | 2.5 (1.6, 4.0) | 3.6 (2.4, 5.4) | 4.6 (3.2, 6.5) | 4.6 (3.2, 6.5) | | |
| SMR | SMR | 1 | 171 | 0.6 (0.1, 4.3) | | | | | |
| | SMR Axioma | 4 | 115 | 1.8 (0.4, 6.9) | 3.9 (1.5, 10.1) | | | | |
| | SMR L1 | 180 | 5055 | 2.3 (1.9, 2.8) | 3.2 (2.8, 3.8) | 3.4 (3.0, 4.0) | 3.8 (3.3, 4.5) | 4.5 (3.8, 5.4) | 5.6 (4.3, 7.3) |
| Trabecular Metal | Comprehensive Reverse | 2 | 196 | 0.5 (0.1, 3.7) | 1.6 (0.4, 6.7) | 1.6 (0.4, 6.7) | | | |
| | Trabecular Metal | 33 | 751 | 1.6 (0.9, 2.8) | 3.5 (2.3, 5.1) | 4.6 (3.2, 6.5) | 4.8 (3.4, 6.8) | 5.8 (4.0, 8.4) | |
| Other (23) | | 16 | 238 | 5.7 (3.4, 9.7) | 5.7 (3.4, 9.7) | 8.9 (5.2, 14.9) | | | |
| TOTAL | | 785 | 24803 | | | | | | |

Note Restricted to modern prostheses
Only prostheses with >25 procedures have been listed

**Table ST105 Cumulative Percent Revision of Cementless Primary Total Stemmed Reverse Shoulder Replacement by Prosthesis Combination (Primary Diagnosis Rotator Cuff Arthropathy)**

| Humeral Stem | Glenoid Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Aequalis | Aequalis | 59 | 1122 | 2.1 (1.4, 3.1) | 3.7 (2.7, 5.0) | 5.0 (3.8, 6.5) | 5.5 (4.2, 7.2) | 7.4 (5.6, 9.7) | |
| | Perform Reversed | 0 | 95 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | |
| Affinis | Affinis | 18 | 446 | 1.6 (0.8, 3.3) | 3.1 (1.8, 5.3) | 4.4 (2.7, 7.0) | 5.7 (3.2, 10.2) | | |
| AltiVate | RSP | 2 | 77 | 3.0 (0.8, 11.7) | 3.0 (0.8, 11.7) | | | | |
| AltiVate Reverse | RSP | 44 | 1250 | 2.5 (1.8, 3.7) | 4.6 (3.4, 6.2) | | | | |
| Ascend Flex | Aequalis | 71 | 1614 | 2.8 (2.1, 3.8) | 4.7 (3.7, 6.0) | 5.8 (4.6, 7.4) | 5.8 (4.6, 7.4) | | |
| | Perform Reversed | 20 | 987 | 2.0 (1.3, 3.3) | 3.1 (1.9, 5.1) | | | | |
| Comprehensive | Comprehensive Reverse | 62 | 3140 | 1.3 (0.9, 1.8) | 2.2 (1.7, 2.9) | 2.9 (2.1, 3.8) | 3.1 (2.3, 4.1) | | |
| | Trabecular Metal | 1 | 40 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 3.0 (0.4, 19.6) | | | |
| Delta Xtend | Delta Xtend | 162 | 4125 | 2.0 (1.6, 2.5) | 3.2 (2.7, 3.8) | 3.8 (3.2, 4.5) | 4.5 (3.8, 5.3) | 4.9 (4.1, 5.7) | 5.8 (4.7, 7.2) |
| Equinoxe | Equinoxe | 88 | 2607 | 2.2 (1.6, 2.8) | 3.2 (2.5, 4.0) | 4.0 (3.2, 5.1) | 5.2 (4.0, 6.7) | | |
| Global Unite | Delta Xtend | 13 | 446 | 1.6 (0.8, 3.4) | 2.8 (1.6, 5.1) | 3.7 (2.1, 6.4) | 3.7 (2.1, 6.4) | | |
| MSS | MSS | 6 | 212 | 3.4 (1.2, 9.0) | | | | | |
| RSP | RSP | 28 | 700 | 2.7 (1.8, 4.3) | 3.8 (2.6, 5.6) | 4.3 (3.0, 6.2) | 4.3 (3.0, 6.2) | | |
| SMR | SMR | 3 | 106 | 1.9 (0.5, 7.5) | | | | | |
| | SMR Axioma | 4 | 55 | 3.6 (0.9, 13.8) | 7.7 (3.0, 19.4) | 7.7 (3.0, 19.4) | | | |
| | SMR L1 | 163 | 4087 | 2.6 (2.2, 3.2) | 3.6 (3.1, 4.3) | 4.0 (3.4, 4.7) | 4.5 (3.8, 5.3) | 5.2 (4.3, 6.4) | 6.0 (4.7, 7.7) |
| Trabecular Metal | Comprehensive Reverse | 12 | 154 | 6.3 (3.3, 11.8) | 9.4 (5.4, 16.2) | 9.4 (5.4, 16.2) | | | |
| | Trabecular Metal | 45 | 688 | 3.8 (2.6, 5.6) | 5.6 (4.1, 7.6) | 6.1 (4.5, 8.3) | 6.8 (5.1, 9.1) | 7.7 (5.6, 10.4) | |
| Other (16) | | 2 | 56 | 2.0 (0.3, 13.4) | 4.2 (1.1, 15.9) | 4.2 (1.1, 15.9) | | | |
| TOTAL | | 803 | 22007 | | | | | | |

Note Restricted to modern prostheses
Only prostheses with >25 procedures have been listed

**Table ST106 Cumulative Percent Revision of Cementless Primary Total Stemmed Reverse Shoulder Replacement by Prosthesis Combination (Primary Diagnosis Fracture)**

| Humeral Stem | Glenoid Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Aequalis | Aequalis | 6 | 66 | 3.0 (0.8, 11.6) | 3.0 (0.8, 11.6) | 9.0 (3.8, 20.5) | 9.0 (3.8, 20.5) | 12.5 (5.6, 26.9) | |
| Aequalis Flex Revive | Perform Reversed | 1 | 59 | 2.0 (0.3, 13.1) | 2.0 (0.3, 13.1) | | | | |
| Comprehensive | Comprehensive Reverse | 7 | 298 | 2.3 (1.0, 5.0) | 3.0 (1.4, 6.3) | 3.0 (1.4, 6.3) | | | |
| Delta Xtend | Delta Xtend | 9 | 230 | 2.2 (0.9, 5.2) | 3.7 (1.8, 7.2) | 3.7 (1.8, 7.2) | 4.4 (2.3, 8.4) | | |
| Equinoxe | Equinoxe | 9 | 141 | 4.4 (2.0, 9.4) | 5.6 (2.6, 11.5) | | | | |
| Global Unite | Delta Xtend | 4 | 140 | 1.4 (0.4, 5.7) | 1.4 (0.4, 5.7) | 5.3 (1.8, 14.9) | | | |
| SMR | SMR L1 | 95 | 1696 | 4.3 (3.4, 5.4) | 5.7 (4.7, 6.9) | 5.9 (4.8, 7.2) | 6.2 (5.0, 7.5) | 6.2 (5.0, 7.5) | |
| Trabecular Metal | Trabecular Metal | 2 | 59 | 3.4 (0.9, 12.9) | 3.4 (0.9, 12.9) | 3.4 (0.9, 12.9) | 3.4 (0.9, 12.9) | 3.4 (0.9, 12.9) | |
| Other (15) | | 7 | 232 | 2.8 (1.3, 6.1) | 3.5 (1.7, 7.2) | 3.5 (1.7, 7.2) | | | |
| TOTAL | | 140 | 2921 | | | | | | |

Note Restricted to modern prostheses
Only prostheses with >50 procedures have been listed

**Table ST107 Cumulative Percent Revision of Hybrid (Humerus Cemented) Primary Total Stemmed Reverse Shoulder Replacement by Prosthesis Combination (Primary Diagnosis OA)**

| Humeral Stem | Glenoid Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Aequalis | Aequalis | 14 | 367 | 2.2 (1.1, 4.4) | 2.5 (1.3, 4.8) | 3.3 (1.8, 5.9) | 4.3 (2.5, 7.5) | 5.1 (2.9, 8.9) | |
| Affinis | Affinis | 8 | 288 | 1.7 (0.7, 4.1) | 2.5 (1.2, 5.3) | 2.5 (1.2, 5.3) | 3.3 (1.6, 6.8) | | |
| Ascend Flex | Aequalis | 5 | 193 | 2.1 (0.8, 5.6) | 2.8 (1.2, 6.5) | | | | |
| | Perform Reversed | 1 | 110 | 1.5 (0.2, 10.1) | | | | | |
| Comprehensive | Comprehensive Reverse | 1 | 135 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | | |
| Delta Xtend | Delta Xtend | 41 | 1189 | 1.6 (1.0, 2.5) | 2.5 (1.7, 3.6) | 2.8 (2.0, 3.9) | 3.4 (2.5, 4.7) | 3.8 (2.7, 5.2) | 4.5 (3.2, 6.3) |
| Equinoxe | Equinoxe | 7 | 158 | 1.9 (0.6, 5.9) | 3.8 (1.6, 9.2) | | | | |
| RSP | RSP | 5 | 101 | 2.0 (0.5, 7.7) | 5.2 (2.2, 12.1) | 5.2 (2.2, 12.1) | | | |
| Other (20) | | 22 | 362 | 3.2 (1.8, 5.7) | 6.9 (4.6, 10.5) | 7.7 (5.0, 11.7) | 7.7 (5.0, 11.7) | | |
| TOTAL | | 104 | 2903 | | | | | | |

Note Restricted to modern prostheses
Only prostheses with >25 procedures have been listed

**Table ST108 Cumulative Percent Revision of Hybrid (Humerus Cemented) Primary Total Stemmed Reverse Shoulder Replacement by Prosthesis Combination (Primary Diagnosis Rotator Cuff Arthropathy)**

| Humeral Stem | Glenoid Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Aequalis | Aequalis | 11 | 201 | 3.0 (1.4, 6.6) | 4.6 (2.4, 8.6) | 4.6 (2.4, 8.6) | 5.3 (2.9, 9.7) | 6.7 (3.6, 12.4) | |
| Affinis | Affinis | 9 | 279 | 1.8 (0.8, 4.3) | 3.0 (1.5, 5.9) | 3.4 (1.8, 6.5) | | | |
| AltiVate Reverse | RSP | 2 | 70 | 3.1 (0.8, 11.7) | 3.1 (0.8, 11.7) | | | | |
| Ascend Flex | Aequalis | 4 | 223 | 0.9 (0.2, 3.6) | 2.2 (0.8, 5.9) | | | | |
| | Perform Reversed | 1 | 103 | 0.0 (0.0, 0.0) | | | | | |
| Comprehensive | Comprehensive Reverse | 4 | 81 | 3.7 (1.2, 11.1) | 6.0 (2.2, 15.8) | | | | |
| Delta Xtend | Delta Xtend | 19 | 667 | 1.8 (1.0, 3.2) | 2.6 (1.6, 4.2) | 2.8 (1.8, 4.5) | 3.1 (2.0, 4.9) | 3.1 (2.0, 4.9) | |
| Equinoxe | Equinoxe | 4 | 84 | 3.9 (1.3, 11.7) | 5.6 (2.1, 14.4) | 5.6 (2.1, 14.4) | | | |
| Global Unite | Delta Xtend | 1 | 43 | 0.0 (0.0, 0.0) | 2.8 (0.4, 18.1) | 2.8 (0.4, 18.1) | 2.8 (0.4, 18.1) | | |
| RSP | RSP | 3 | 59 | 5.1 (1.7, 15.0) | 5.1 (1.7, 15.0) | 5.1 (1.7, 15.0) | 5.1 (1.7, 15.0) | | |
| SMR | SMR L1 | 4 | 44 | 6.8 (2.3, 19.7) | 9.2 (3.6, 22.7) | 9.2 (3.6, 22.7) | 9.2 (3.6, 22.7) | 9.2 (3.6, 22.7) | |
| Trabecular Metal | Trabecular Metal | 2 | 43 | 2.3 (0.3, 15.4) | 2.3 (0.3, 15.4) | 2.3 (0.3, 15.4) | 2.3 (0.3, 15.4) | 11.2 (2.3, 45.1) | |
| Other (10) | | 5 | 54 | 9.9 (4.3, 22.3) | 9.9 (4.3, 22.3) | 9.9 (4.3, 22.3) | | | |
| TOTAL | | 69 | 1951 | | | | | | |

Note Restricted to modern prostheses
Only prostheses with >25 procedures have been listed

**Table ST109 Cumulative Percent Revision of Hybrid (Humerus Cemented) Primary Total Stemmed Reverse Shoulder Replacement by Prosthesis Combination (Primary Diagnosis Fracture)**

| Humeral Stem | Glenoid Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Aequalis | Aequalis | 45 | 1339 | 2.0 (1.4, 2.9) | 2.8 (2.0, 3.9) | 3.3 (2.4, 4.5) | 3.9 (2.8, 5.3) | 5.0 (3.5, 7.1) | |
| | Perform Reversed | 4 | 159 | 2.7 (0.9, 8.5) | | | | | |
| Affinis | Affinis | 16 | 349 | 2.0 (1.0, 4.2) | 3.6 (2.1, 6.3) | 5.3 (3.2, 8.5) | 5.3 (3.2, 8.5) | | |
| AltiVate Reverse | RSP | 8 | 278 | 2.8 (1.4, 5.9) | 3.5 (1.7, 6.9) | | | | |
| Comprehensive | Comprehensive Reverse | 19 | 934 | 1.7 (1.0, 2.9) | 2.1 (1.3, 3.4) | 2.8 (1.7, 4.5) | 2.8 (1.7, 4.5) | | |
| Delta Xtend | Delta Xtend | 75 | 1279 | 4.4 (3.4, 5.6) | 5.2 (4.1, 6.6) | 5.8 (4.6, 7.3) | 5.9 (4.7, 7.4) | 7.2 (5.6, 9.3) | |
| Equinoxe | Equinoxe | 26 | 661 | 2.6 (1.6, 4.2) | 4.7 (3.2, 7.0) | 5.4 (3.5, 8.1) | | | |
| Global Unite | Delta Xtend | 15 | 454 | 2.6 (1.5, 4.7) | 3.6 (2.1, 6.0) | 3.6 (2.1, 6.0) | | | |
| RSP | RSP | 14 | 176 | 4.1 (2.0, 8.3) | 7.3 (4.2, 12.5) | 9.2 (5.5, 15.2) | | | |
| SMR | SMR L1 | 10 | 265 | 3.1 (1.6, 6.1) | 4.1 (2.2, 7.6) | 4.1 (2.2, 7.6) | 4.1 (2.2, 7.6) | | |
| Trabecular Metal | Comprehensive Reverse | 3 | 117 | 2.6 (0.8, 7.9) | 2.6 (0.8, 7.9) | | | | |
| | Trabecular Metal | 7 | 228 | 1.8 (0.7, 4.7) | 2.8 (1.3, 6.2) | 2.8 (1.3, 6.2) | 3.8 (1.8, 8.2) | | |
| Other (12) | | 6 | 125 | 4.2 (1.8, 9.7) | | | | | |
| TOTAL | | 248 | 6364 | | | | | | |

Note Restricted to modern prostheses

Only prostheses with >50 procedures have been listed

# Primary Total Shoulder Replacement

## Special Clinical Assessment – Shoulder Implant Choice

The purpose of the following analyses is to inform surgeons about the outcome of specific clinical options across several shoulder prosthesis categories. There are two new special clinical analyses that evaluate prosthesis class choices for the surgical management of primary diagnoses in shoulder replacement.

The first analysis examines patients aged <60 years with osteoarthritis, comparing outcomes for hemi stemmed anatomic with a pyrocarbon humeral head, total stemmed anatomic with a polyethylene glenoid, total stemless anatomic with a polyethylene glenoid and a primary stemmed reverse replacement. A polyethylene glenoid is all polyethylene glenoids excluding modular metal backed glenoids in total shoulder anatomic procedures (Table ST110 and Figure ST77).

The second assessment compares total stemmed reverse replacements for all primary diagnoses, stratified by glenoid component type – custom, augmented or standard (Table ST111 and Figure ST78).

It is important to recognise that there are patient and prosthesis factors that may further confound the results beyond that which are presented here.

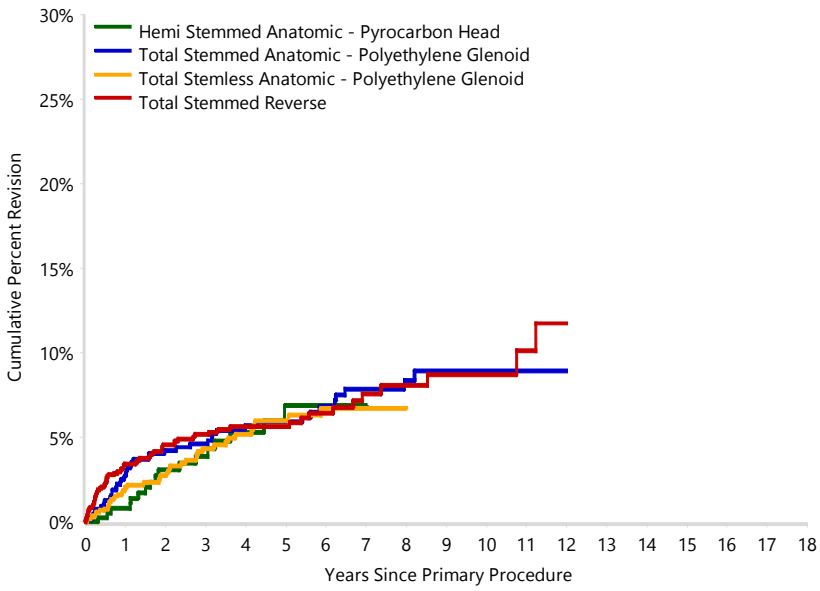
Peer reviewed journal articles that are based on AOANJRR shoulder replacement data, from the first publication to the present, are available on the AOANJRR website: https://aoanjrr.sahmri.com/publications-2025

**Table ST110 Cumulative Percent Revision of Primary Shoulder Replacement in Patients Aged <60 Years by Class (Primary Diagnosis OA)**

| Shoulder Class | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Hemi Stemmed Anatomic - Pyrocarbon Head | 17 | 432 | 0.8 (0.3, 2.4) | 3.9 (2.2, 6.8) | 6.9 (4.2, 11.2) | 6.9 (4.2, 11.2) | | |
| Total Stemmed Anatomic - Polyethylene Glenoid | 46 | 658 | 2.9 (1.8, 4.5) | 4.6 (3.2, 6.6) | 5.9 (4.2, 8.2) | 7.9 (5.7, 10.7) | 8.9 (6.5, 12.2) | |
| Total Stemless Anatomic - Polyethylene Glenoid | 44 | 1072 | 2.1 (1.3, 3.2) | 4.4 (3.1, 6.1) | 6.0 (4.4, 8.1) | 6.7 (4.9, 9.2) | | |
| Total Stemmed Reverse | 68 | 1241 | 3.4 (2.5, 4.7) | 5.2 (4.0, 6.7) | 5.6 (4.4, 7.3) | 7.6 (5.7, 10.0) | 8.7 (6.4, 11.8) | |
| TOTAL | 175 | 3403 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST77 Cumulative Percent Revision of Primary Shoulder Replacement in Patients Aged <60 Years by Class (Primary Diagnosis OA)**




HR - adjusted for age and gender

Total Stemmed Anatomic - Polyethylene Glenoid vs Hemi Stemmed Anatomic - Pyrocarbon Head

Entire Period: HR=1.28 (95% CI 0.71, 2.29), p=0.407

Total Stemless Anatomic - Polyethylene Glenoid vs Hemi Stemmed Anatomic - Pyrocarbon Head

Entire Period: HR=1.08 (95% CI 0.61, 1.92), p=0.791

Total Stemmed Reverse vs Hemi Stemmed Anatomic - Pyrocarbon Head

0 - 6Mth: HR=3.32 (95% CI 1.56, 7.07), p=0.001

6Mth+: HR=0.93 (95% CI 0.51, 1.70), p=0.811

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Hemi Stemmed Anatomic - Pyrocarbon Head | 432 | 335 | 221 | 107 | 49 | 10 | 0 |
| Total Stemmed Anatomic - Polyethylene Glenoid | 658 | 587 | 471 | 348 | 227 | 80 | 26 |
| Total Stemless Anatomic - Polyethylene Glenoid | 1072 | 859 | 523 | 284 | 123 | 17 | 0 |
| Total Stemmed Reverse | 1241 | 990 | 668 | 399 | 212 | 88 | 23 |

Note: Restricted to modern prostheses

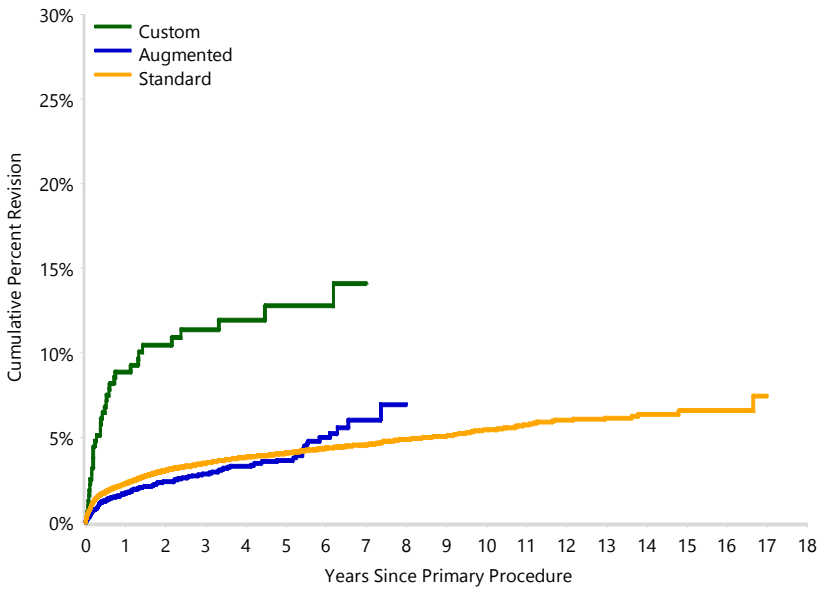
# Primary Total Shoulder Replacement

**Table ST111 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Glenoid Augmentation (All Diagnoses)**

| Glenoid Augmentation | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Custom | 39 | 317 | 8.9 (6.2, 12.7) | 11.4 (8.2, 15.7) | 12.8 (9.2, 17.6) | 14.1 (10.0, 19.8) | | |
| Augmented | 232 | 9803 | 1.7 (1.5, 2.0) | 2.8 (2.5, 3.3) | 3.7 (3.1, 4.3) | 6.0 (4.6, 7.8) | | |
| Standard | 2092 | 54516 | 2.3 (2.2, 2.4) | 3.5 (3.3, 3.7) | 4.1 (3.9, 4.3) | 4.6 (4.4, 4.8) | 5.4 (5.2, 5.7) | 6.4 (5.9, 7.0) |
| TOTAL | 2363 | 64636 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST78 Cumulative Percent Revision of Primary Total Stemmed Reverse Shoulder Replacement by Glenoid Augmentation (All Diagnoses)**




HR - adjusted for age and gender

Custom vs Augmented

0 - 6Mth: HR=4.18 (95% CI 2.63, 6.64), p<0.001

6Mth+: HR=2.10 (95% CI 1.28, 3.44), p=0.003

Custom vs Standard

Entire Period: HR=2.38 (95% CI 1.72, 3.29), p<0.001

Standard vs Augmented

0 - 3Mth: HR=1.94 (95% CI 1.54, 2.45), p<0.001

3Mth+: HR=0.97 (95% CI 0.82, 1.14), p=0.705

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Custom | 317 | 247 | 166 | 97 | 43 | 8 | 1 |
| Augmented | 9803 | 6562 | 2693 | 914 | 144 | 10 | 0 |
| Standard | 54516 | 46851 | 34097 | 22661 | 13118 | 4623 | 723 |

Note: Restricted to modern prostheses

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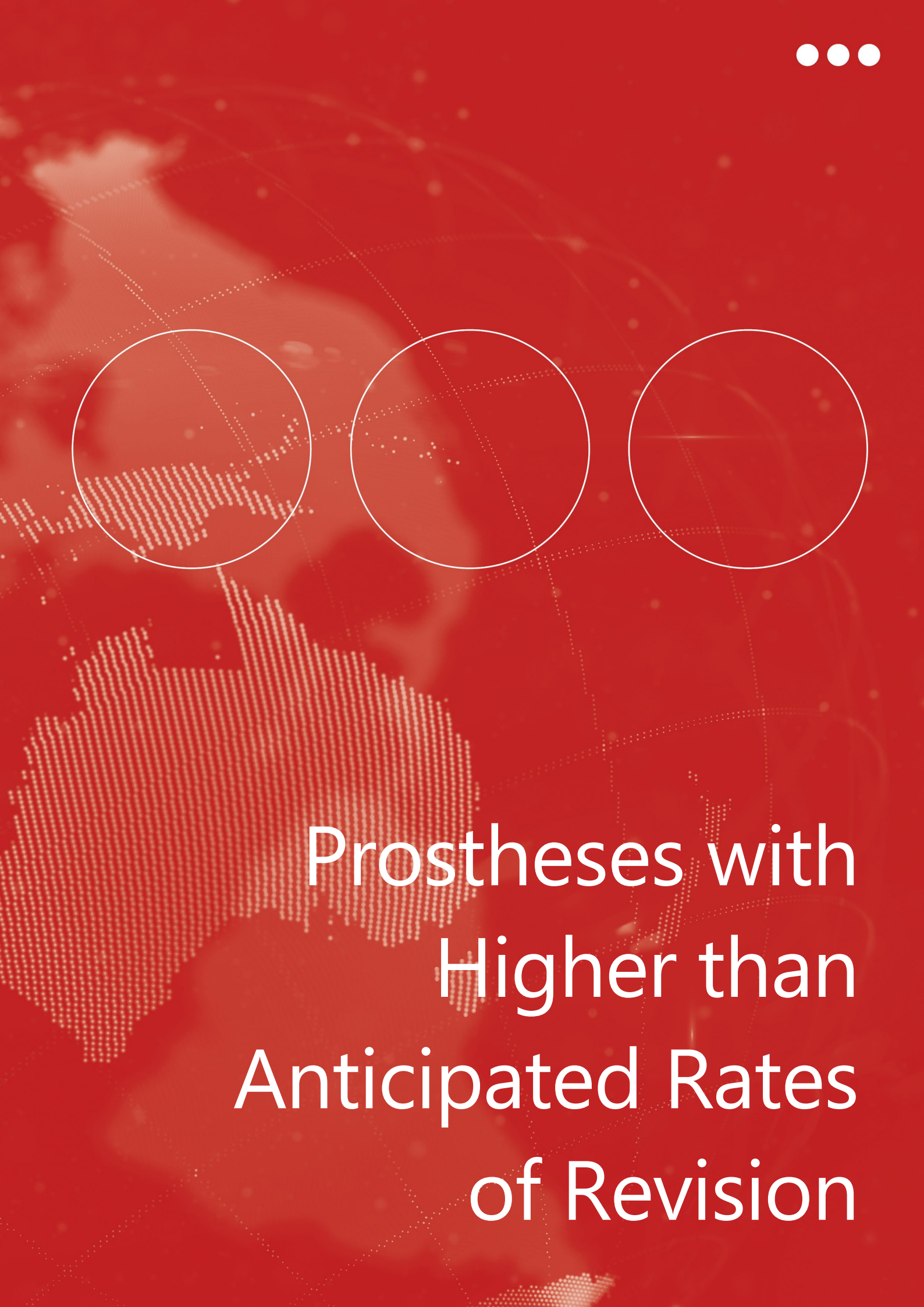
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# Prostheses with Higher than Anticipated Rates of Revision

# Prostheses with Higher than Anticipated Rates of Revision

## Introduction

A unique and important function of registries is that they can provide population-based data on the comparative outcome of individual prostheses in a community. Outcome data are necessary to enable an evidence-based approach to prosthesis selection. For many prostheses, the only source of outcome data are Registry reports.

It is evident from Registry data that most prostheses have similar outcomes. However, a number have a rate of revision that is statistically higher than other prostheses in the same class. The Registry identifies these as 'prostheses with a higher than anticipated rate of revision'.

The Registry has developed a standardised three-stage approach to identify prostheses that are outliers with respect to rate of revision. In order to keep Registry data contemporaneous, only procedures using prostheses that have been available and used in 2024 (described as modern prostheses) are included as the comparator within the class. This is a more pragmatic approach than comparing to a select group of prostheses with the lowest rate of revision.

## Stage 1

The first stage is a screening test to identify prostheses that differ significantly from the combined revisions per 100 observed component years of all other modern prostheses in the same class. The analysis is automated and identifies prostheses based on set criteria. These include:

The revision rate (per 100 component years) exceeds twice that for the group,
and

The Poisson probability of observing that number of revisions, given the rate of the group is significant ($p<0.05$),
and either:

There are at least 10 primary procedures for that component, or

The proportion revised is at least 75% and there have been at least two revisions.

The Registry has the capacity to assess the outcome of individual prostheses or combinations of prostheses used in a procedure. It is apparent from previous reports that individual prostheses that perform well in one combination, may not perform well in another.

Therefore, the outcome of an individual prosthesis is partly dependent on the combination of the different prostheses used.

Consequently, the Registry undertakes two different analyses in Stage 1. The first assesses the outcome of all combinations. The second assesses all individual prostheses regardless of the combination. Both analyses are reviewed to determine if a higher revision rate is identified with a single combination, multiple combinations, or uniformly with all combinations. If prostheses are identified in a single combination, that combination progresses to Stage 2. An individual prosthesis progresses to Stage 2 if it is identified in multiple combinations or uniformly across all combinations.

If a prosthesis is identified in more than two combinations with 10 or more procedures in Stage 1, an additional analysis of the individual prosthesis is undertaken for review at Stage 2, regardless of whether the individual prosthesis was identified in Stage 1. The purpose of this is to simplify the reporting of an individual prosthesis and to avoid identifying the same prosthesis in multiple combinations when it may be more appropriate to identify it individually.

A prosthesis or combination may also be brought to the attention of the Registry by the Therapeutic Goods Administration (TGA) or a member of the AOA. A further investigation may then be undertaken as outlined in Stage 2.

It has been apparent that the revision rates for total stemmed anatomic shoulder replacements have been confounded by the higher than anticipated rate of revision of modular metal backed glenoid prostheses in this class. The Clinical Directors have decided to re-analyse Stage 1 for total stemmed anatomic combinations in comparison to the total stemmed anatomic class excluding modular metal backed glenoids. The new comparator only applied to Newly Identified prostheses. Re-identified and Still Used and Identified and no longer used are compared to all other procedures in this class. The new comparator will apply to all sections in subsequent reports.

## Stage 2

In Stage 2, the AOANJRR Clinical Director, Deputy Clinical Directors, and Assistant Deputy Clinical Directors in conjunction with SAHMRI staff, review the identified prostheses and undertake further investigation. This includes examining the impact of confounders and calculating age and gender adjusted hazard ratios. In addition, all prostheses identified in previous reports are re-analysed as part of the Stage 2 analysis. This is not dependent on re-identification in Stage 1. If there is a significant difference compared to the combined hazard rate of all other modern prostheses in the same class, then the prosthesis or prosthesis combination progresses to Stage 3. The possible exception to this is the presence of confounding factors, such as use in complex primary procedures.

## Stage 3

The final stage involves review by a panel of independent orthopaedic surgeons from the AOA and the Arthroplasty Society of Australia or the Shoulder and Elbow Society. The panel meets with Registry staff at joint specific workshops to review the Stage 2 analysis and determine which prostheses will be identified in the Annual Report.

## Identified Prostheses

Identified prostheses are listed in one of three groups. The first group 'Newly Identified', lists prostheses that are identified for the first time and are still used.

The second group is 'Re-Identified and Still Used'. This listing identifies prostheses that continue to have a higher than anticipated rate of revision and provides information on their continued use. Most identified or re-identified prostheses decline in use. This is usually evident only after the first year because almost a full year of use has occurred prior to identification in the Annual Report.

Prostheses that have a higher rate of revision but are no longer used in Australia make up the third group: 'Identified and No Longer Used'. These are listed to provide ongoing information on the rate of revision. This also enables comparison of other prostheses to the discontinued group. This group may include prostheses that are no longer used in Australia that are identified for the first time.

The Registry does not make a recommendation or otherwise on the continued use of identified prostheses. Identification is made to ensure that prostheses with a higher rate of revision, compared to others in the same class, are highlighted.

On occasion, a prosthesis previously identified no longer meets the criteria for inclusion. In this situation, the prosthesis is not subsequently re-identified. The Registry monitors the continual real-time performance of prostheses within a community and the Annual Report provides the outcome at a particular time. It is necessary to appreciate that outcomes are continually changing and that many factors may influence that change, including identification in the Annual Report.

The current approach used by the Registry is most effective at identifying the relative performance of recently introduced prostheses. As the Registry's follow-up period increases, it is becoming evident that prostheses with a delayed onset of higher rates of revision are not as readily identified by this approach. The Registry will develop further strategies in the future to identify these prostheses.

Prior to publication, three workshops were held to review, comment, and provide advice on all sections of the report. Members of the AOA, Arthroplasty Society of Australia, and Shoulder and Elbow Society are invited to attend these surgeon workshops.

The hip, knee and shoulder surgeon workshops were held in Adelaide on the weekend of the 2 and 3 August 2025. In addition to AOANJRR and SAHMRI staff, 17 hip, 16 knee and 4 shoulder arthroplasty specialists from the AOA membership attended the workshops.

Investigations of prostheses identified as having a higher than anticipated rate of revision are available on the Registry website:

# Prostheses with Higher than Anticipated Rates of Revision

## Primary Partial Hip Replacement

### UNIPOLAR MODULAR

There are no newly identified unipolar modular hip prostheses.

**Table IP1 Revision Rate of Unipolar Modular Hip Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| Head/Femoral Stem | N Revised | N Total | Obs. Years | Revisions/ 100 Obs. Yrs | Hazard Ratio, P Value |
|---|---|---|---|---|---|
| Re-Identified and Still Used | . | . | . | . | |
| **Avenir | 8 | 69 | 246 | 3.25 | Entire Period: HR=2.90 (95% CI 1.45, 5.82), p=0.002 |
| Identified and No Longer Used | . | . | . | . | |
| Unipolar Head (JRI)/Furlong LOL | 11 | 132 | 556 | 1.98 | Entire Period: HR=2.13 (95% CI 1.18, 3.85), p=0.012 |

Note: Components have been compared to all other modern unipolar modular hip components. Note: **Femoral Stem Component

**Table IP2 Cumulative Percent Revision of Unipolar Modular Hip Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| CPR | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 20 Yrs |
|---|---|---|---|---|---|
| Re-Identified and Still Used | | | | | |
| **Avenir | 7.6 (3.2, 17.3) | 9.8 (4.5, 20.7) | 13.0 (6.1, 26.4) | | |
| Identified and No Longer Used | | | | | |
| Unipolar Head (JRI)/Furlong LOL | 6.4 (3.1, 13.0) | 9.8 (5.3, 17.5) | 11.2 (6.3, 19.6) | | |

Note: **Femoral Stem Component

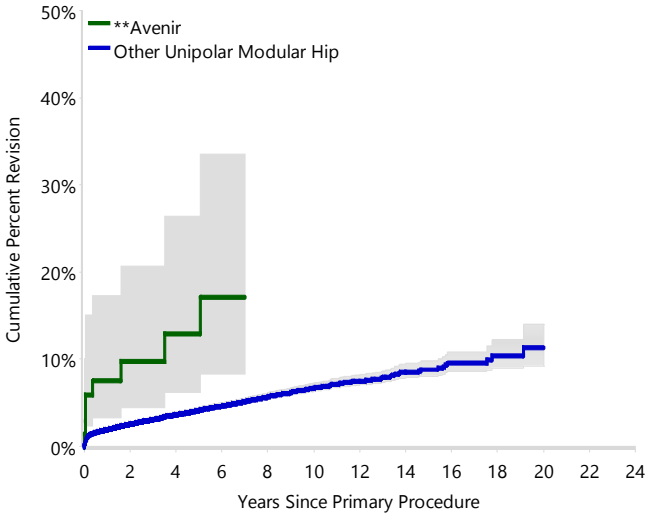
**Table IP3 Yearly Usage of Unipolar Modular Hip Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| Year of Implant | ≤2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Re-Identified and Still Used | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **Avenir | . | . | . | . | 8 | 8 | 5 | 7 | 3 | 6 | 8 | 10 | . | 1 | 3 | 3 | 5 | 2 |
| Identified and No Longer Used | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Unipolar Head (JRI)/Furlong LOL | 12 | 18 | 10 | 13 | 10 | 8 | 7 | 34 | 16 | 4 | . | . | . | . | . | . | . | . |

Note: **Femoral Stem Component

**Figure IP1 Cumulative Percent Revision of Re-Identified and Still Used Unipolar Modular Hip Prostheses**

**Re-Identified and Still Used**



# Prostheses with Higher than Anticipated Rates of Revision

## BIPOLAR

There are no newly identified bipolar hip prostheses.

**Table IP4 Revision Rate of Bipolar Hip Prostheses identified as having a Higher than Anticipated Rate of Revision**

| Bipolar/Femoral Stem | N Revised | N Total | Obs. Years | Revisions/ 100 Obs. Yrs | Hazard Ratio, P Value |
|---|---|---|---|---|---|
| Re-Identified and Still Used | . | . | . | . | |
| **Quadra-H | 7 | 87 | 247 | 2.84 | Entire Period: HR=3.04 (95% CI 1.45, 6.40), p=0.003 |
| Identified and No Longer Used | . | . | . | . | |
| UHR/ABGII | 23 | 177 | 1020 | 2.25 | 0 - 2Wk: HR=4.44 (95% CI 1.09, 18.03), p=0.037 |
| | . | . | . | . | 2Wk - 9Mth: HR=0.87 (95% CI 0.28, 2.71), p=0.810 |
| | . | . | . | . | 9Mth - 3.5Yr: HR=2.11 (95% CI 0.79, 5.67), p=0.137 |
| | . | . | . | . | 3.5Yr+: HR=8.69 (95% CI 4.97, 15.18), p<0.001 |
| UHR/Omnifit (class) | 8 | 40 | 286 | 2.79 | Entire Period: HR=3.85 (95% CI 1.92, 7.73), p<0.001 |
| **Basis | 18 | 156 | 876 | 2.06 | 0 - 1Yr: HR=0.48 (95% CI 0.12, 1.93), p=0.302 |
| | . | . | . | . | 1Yr - 1.5Yr: HR=6.06 (95% CI 1.91, 19.19), p=0.002 |
| | . | . | . | . | 1.5Yr+: HR=4.92 (95% CI 2.80, 8.62), p<0.001 |
| **Synergy | 9 | 55 | 460 | 1.96 | Entire Period: HR=2.66 (95% CI 1.38, 5.15), p=0.003 |

Note: Components have been compared to all other modern bipolar hip components
**Femoral Stem Component

**Table IP5 Cumulative Percent Revision of Bipolar Hip Prostheses identified as having a Higher than Anticipated Rate of Revision**

| CPR | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 20 Yrs |
|---|---|---|---|---|---|
| Re-Identified and Still Used | | | | | |
| **Quadra-H | 6.2 (2.3, 15.7) | 10.5 (4.8, 22.3) | 13.6 (6.5, 27.3) | | |
| Identified and No Longer Used | | | | | |
| UHR/ABGII | 4.3 (2.1, 8.9) | 5.1 (2.6, 10.0) | 10.8 (6.5, 17.9) | | |
| UHR/Omnifit (class) | 18.3 (9.1, 34.6) | 18.3 (9.1, 34.6) | 18.3 (9.1, 34.6) | 18.3 (9.1, 34.6) | |
| **Basis | 1.5 (0.4, 5.8) | 10.1 (5.9, 17.2) | 12.6 (7.6, 20.6) | | |
| **Synergy | 7.3 (2.8, 18.4) | 9.5 (4.1, 21.4) | 12.2 (5.6, 25.4) | 18.0 (9.2, 33.4) | |

Note: **Femoral Stem Component

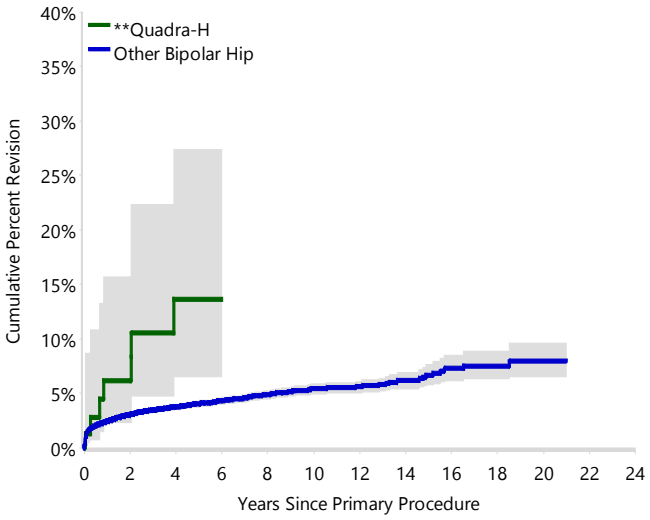
**Table IP6 Yearly Usage of Bipolar Hip Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| Year of Implant | ≤2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Re-Identified and Still Used** | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **Quadra-H | . | . | 11 | 7 | 5 | 6 | 4 | 11 | 9 | 7 | 4 | 7 | 5 | 7 | 1 | . | . | 3 |
| **Identified and No Longer Used** | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| UHR/ABGII | 145 | 20 | 7 | 5 | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| UHR/Omnifit (cless) | 38 | 2 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **Basis | 74 | 11 | 4 | 7 | 8 | 21 | 24 | 6 | 1 | . | . | . | . | . | . | . | . | . |
| **Synergy | 49 | 1 | 1 | . | 1 | . | 2 | . | . | . | 1 | . | . | . | . | . | . | . |

Note: **Femoral Stem Component

**Figure IP2 Cumulative Percent Revision of Re-Identified and Still Used Bipolar Hip Prostheses**

**Re-Identified and Still Used**



# Prostheses with Higher than Anticipated Rates of Revision

## Primary Total Hip Replacement

### TOTAL CONVENTIONAL

There is one newly identified total conventional hip replacement that is still used.

The Echelon femoral stem is identified as having a higher than anticipated rate of revision. It has been used since 2001 in 479 procedures of which 37 have been revised. The cumulative percent revision is 9.9% at 13 years. Major revisions account for 29 of the 37 revisions. There are 12 revisions for dislocation/instability, 10 for loosening, 6 for infection and 3 for stem breakage.

When the cemented Echelon stems are separately analysed there are 281 procedures with 20 revised. This subgroup has a higher rate of revision than other total conventional hips. With the cementless Echelon stem there are 198 procedures with 17 revised. This subgroup also has a higher rate of revision.

As this stem is often used for diagnoses other than osteoarthritis, a comparison was also made with other stems often used for revision procedures. In this analysis the Echelon stem also has a higher rate of revision.

Due to concerns raised from surgeons regarding pelvic osteolysis, investigation was carried out for the Lima dual mobility acetabular component. This prosthesis was used between 2011 and 2016. This prosthesis has a higher rate of revision than other total hip replacements after 6 years. There are 129 procedures with 15 revisions. The cumulative percent revision is 11.4% at 12 years. Of the 15 revisions 10 are major revisions. There are 7 revisions for loosening and 5 for osteolysis. This component used non-XLPE. When compared to other dual mobility prostheses the Lima acetabular component also has a higher rate of revision after 6 years.

This year there are 4 femoral components that are identified for the first time but are no longer used. These are the CBC stem (not used since 2011), the Silent stem (not used since 2014) and the Trifit stem (not used since 2008). In addition, the MBA (exchangeable neck) femoral component is individually identified for the first time, whereas it had previously been identified in combination with the PINNACLE acetabular component.

The Corail/Trident and the Friendly/Delta TT combinations are no longer identified.

**Table IP7 Revision Rate of Total Conventional Hip Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| Femoral Stem/Acetabular | N Revised | N Total | Obs. Years | Revisions/ 100 Obs. Yrs | Hazard Ratio, P Value |
|---|---|---|---|---|---|
| Newly Identified | . | . | . | . | |
| *Echelon | 37 | 479 | 2462 | 1.50 | Entire Period: HR=2.57 (95% CI 1.86, 3.55), p<0.001 |
| Re-Identified and Still Used | . | . | . | . | |
| Accolade II/Trident Tritanium (Shell) | 163 | 4366 | 19326 | 0.84 | Entire Period: HR=1.27 (95% CI 1.09, 1.48), p=0.002 |
| CORAIL/Trabecular Metal (Shell) | 11 | 99 | 868 | 1.27 | Entire Period: HR=2.61 (95% CI 1.45, 4.70), p=0.001 |
| *CPT | 1334 | 25572 | 190107 | 0.70 | Entire Period: HR=1.41 (95% CI 1.33, 1.49), p<0.001 |
| *Excia (cless) | 30 | 463 | 3843 | 0.78 | 0 - 3Mth: HR=2.72 (95% CI 1.64, 4.51), p<0.001 |
| | . | . | . | . | 3Mth+: HR=1.12 (95% CI 0.68, 1.86), p=0.657 |
| *HACTIV | 126 | 3052 | 14993 | 0.84 | Entire Period: HR=1.37 (95% CI 1.15, 1.64), p<0.001 |
| *MiniMax | 23 | 417 | 2284 | 1.01 | 0 - 2Wk: HR=6.08 (95% CI 2.89, 12.76), p<0.001 |
| | . | . | . | . | 2Wk - 3Mth: HR=2.04 (95% CI 1.02, 4.09), p=0.043 |
| | . | . | . | . | 3Mth - 1.5Yr: HR=1.91 (95% CI 0.86, 4.26), p=0.112 |
| | . | . | . | . | 1.5Yr+: HR=0.37 (95% CI 0.09, 1.49), p=0.163 |
| *Revision Hip | 11 | 118 | 654 | 1.68 | Entire Period: HR=2.87 (95% CI 1.59, 5.18), p<0.001 |
| *Taper Fit | 223 | 7192 | 28111 | 0.79 | 0 - 6Mth: HR=0.95 (95% CI 0.77, 1.16), p=0.611 |
| | . | . | . | . | 6Mth - 9Mth: HR=1.56 (95% CI 0.95, 2.56), p=0.078 |
| | . | . | . | . | 9Mth - 1.5Yr: HR=0.82 (95% CI 0.51, 1.32), p=0.406 |
| | . | . | . | . | 1.5Yr - 5.5Yr: HR=1.47 (95% CI 1.15, 1.89), p=0.002 |
| | . | . | . | . | 5.5Yr+: HR=2.27 (95% CI 1.62, 3.17), p<0.001 |
| **Atlas (Shell) | 61 | 595 | 5053 | 1.21 | Entire Period: HR=2.41 (95% CI 1.88, 3.10), p<0.001 |
| **Continuum | 675 | 14064 | 117123 | 0.58 | 0 - 1Mth: HR=1.82 (95% CI 1.57, 2.12), p<0.001 |
| | . | . | . | . | 1Mth - 1.5Yr: HR=1.28 (95% CI 1.12, 1.46), p<0.001 |
| | . | . | . | . | 1.5Yr - 2Yr: HR=1.46 (95% CI 1.05, 2.02), p=0.023 |
| | . | . | . | . | 2Yr+: HR=0.84 (95% CI 0.73, 0.95), p=0.006 |

# Prostheses with Higher than Anticipated Rates of Revision

| Femoral Stem/Acetabular | N Revised | N Total | Obs. Years | Revisions/ 100 Obs. Yrs | Hazard Ratio, P Value |
|---|---|---|---|---|---|
| **Delta-One-TT | 17 | 208 | 1240 | 1.37 | Entire Period: HR=2.43 (95% CI 1.51, 3.90), p<0.001 |
| **Fin II | 189 | 2580 | 24428 | 0.77 | Entire Period: HR=1.60 (95% CI 1.38, 1.84), p<0.001 |
| **Fixa | 79 | 1554 | 9684 | 0.82 | 0 - 3Mth: HR=1.73 (95% CI 1.22, 2.45), p=0.002 |
| | . | . | . | . | 3Mth - 2Yr: HR=1.83 (95% CI 1.24, 2.71), p=0.002 |
| | . | . | . | . | 2Yr+: HR=1.05 (95% CI 0.69, 1.60), p=0.812 |
| **G7 Multihole | 81 | 1588 | 3846 | 2.11 | Entire Period: HR=2.38 (95% CI 1.91, 2.96), p<0.001 |
| **Mueller | 12 | 63 | 551 | 2.18 | Entire Period: HR=4.43 (95% CI 2.51, 7.79), p<0.001 |
| **Versafitcup DM | 83 | 2447 | 9701 | 0.86 | Entire Period: HR=1.26 (95% CI 1.02, 1.56), p=0.035 |
| Identified and no longer used | . | . | . | . | |
| +**Total Hip Replacement (Lima) | 15 | 129 | 1392 | 1.08 | 0 - 6Yr: HR=1.56 (95% CI 0.74, 3.26), p=0.242 |
| | . | . | . | . | 6Yr+: HR=3.72 (95% CI 1.86, 7.44), p<0.001 |
| +*CBC Stem | 49 | 290 | 4309 | 1.14 | Entire Period: HR=2.48 (95% CI 1.87, 3.28), p<0.001 |
| +*MBA (exch neck) | 79 | 567 | 6814 | 1.16 | 0 - 2.5Yr: HR=1.22 (95% CI 0.75, 2.00), p=0.417 |
| | . | . | . | . | 2.5Yr+: HR=3.45 (95% CI 2.70, 4.42), p<0.001 |
| +*Silent | 12 | 74 | 911 | 1.32 | Entire Period: HR=2.67 (95% CI 1.51, 4.70), p<0.001 |
| +*Tri-Fit | 17 | 58 | 672 | 2.53 | Entire Period: HR=5.44 (95% CI 3.38, 8.75), p<0.001 |
| Anatomic II/Duraloc Option | 13 | 60 | 789 | 1.65 | Entire Period: HR=3.60 (95% CI 2.09, 6.18), p<0.001 |
| Anca-Fit/PINNACLE | 16 | 101 | 1120 | 1.43 | Entire Period: HR=3.09 (95% CI 1.89, 5.05), p<0.001 |
| Avenir/Fitmore | 21 | 373 | 1766 | 1.19 | 0 - 1Mth: HR=5.06 (95% CI 2.94, 8.71), p<0.001 |
| | . | . | . | . | 1Mth+: HR=0.95 (95% CI 0.47, 1.89), p=0.876 |
| CPCS/Reflection (Non XLPE Cup) | 77 | 407 | 4767 | 1.62 | 0 - 2Yr: HR=0.71 (95% CI 0.32, 1.58), p=0.397 |
| | . | . | . | . | 2Yr - 3Yr: HR=4.10 (95% CI 1.70, 9.85), p=0.001 |
| | . | . | . | . | 3Yr - 7Yr: HR=1.92 (95% CI 0.91, 4.03), p=0.084 |
| | . | . | . | . | 7Yr+: HR=7.14 (95% CI 5.52, 9.23), p<0.001 |
| Esop/Delta-PF | 12 | 59 | 795 | 1.51 | 0 - 4Yr: HR=1.20 (95% CI 0.30, 4.78), p=0.800 |
| | . | . | . | . | 4Yr+: HR=5.01 (95% CI 2.70, 9.29), p<0.001 |
| Evolve/Acetabular Shell (Global) | 9 | 139 | 835 | 1.08 | Entire Period: HR=2.04 (95% CI 1.06, 3.93), p=0.032 |
| F2L/Delta-PF | 20 | 107 | 1385 | 1.44 | Entire Period: HR=3.15 (95% CI 2.03, 4.88), p<0.001 |
| Friendly Hip/Cup (Exactech) | 17 | 97 | 1155 | 1.47 | Entire Period: HR=3.26 (95% CI 2.03, 5.25), p<0.001 |
| M-Cor/Equator+ Cup | 11 | 77 | 974 | 1.13 | Entire Period: HR=2.49 (95% CI 1.38, 4.48), p=0.002 |
| Meridian/ABGII | 22 | 143 | 1839 | 1.20 | Entire Period: HR=2.55 (95% CI 1.68, 3.88), p<0.001 |
| Omnifit/Vitalock | 15 | 66 | 906 | 1.66 | Entire Period: HR=3.57 (95% CI 2.16, 5.92), p<0.001 |
| Secur-Fit Plus HA/Secur-Fit | 33 | 197 | 2788 | 1.18 | Entire Period: HR=2.57 (95% CI 1.83, 3.62), p<0.001 |
| Taperloc/M2a$^{MoM}$ | 77 | 515 | 7300 | 1.05 | Entire Period: HR=2.32 (95% CI 1.86, 2.90), p<0.001 |
| *ABGII (exch neck) | 109 | 246 | 2262 | 4.82 | 0 - 1Mth: HR=4.13 (95% CI 1.97, 8.66), p<0.001 |
| | . | . | . | . | 1Mth - 1.5Yr: HR=2.68 (95% CI 1.34, 5.36), p=0.005 |
| | . | . | . | . | 1.5Yr - 2.5Yr: HR=8.26 (95% CI 3.94, 17.35), p<0.001 |
| | . | . | . | . | 2.5Yr - 4Yr: HR=14.03 (95% CI 8.13, 24.22), p<0.001 |
| | . | . | . | . | 4Yr - 4.5Yr: HR=43.63 (95% CI 23.98, 79.38), p<0.001 |
| | . | . | . | . | 4.5Yr - 5Yr: HR=11.29 (95% CI 3.63, 35.14), p<0.001 |
| | . | . | . | . | 5Yr - 6Yr: HR=36.87 (95% CI 23.11, 58.82), p<0.001 |
| | . | . | . | . | 6Yr+: HR=12.30 (95% CI 9.07, 16.67), p<0.001 |
| *Adapter (cless) | 160 | 744 | 7841 | 2.04 | 0 - 2Wk: HR=3.96 (95% CI 1.98, 7.93), p<0.001 |
| | . | . | . | . | 2Wk - 1Mth: HR=1.58 (95% CI 0.66, 3.79), p=0.308 |
| | . | . | . | . | 1Mth - 6Mth: HR=0.73 (95% CI 0.28, 1.96), p=0.536 |
| | . | . | . | . | 6Mth+: HR=5.43 (95% CI 4.60, 6.41), p<0.001 |
| *Adapter (ctd) | 34 | 148 | 1354 | 2.51 | 0 - 6Mth: HR=1.94 (95% CI 0.73, 5.17), p=0.184 |
| | . | . | . | . | 6Mth+: HR=6.89 (95% CI 4.82, 9.86), p<0.001 |
| *Apex | 204 | 2591 | 28167 | 0.72 | Entire Period: HR=1.55 (95% CI 1.35, 1.77), p<0.001 |

# Prostheses with Higher than Anticipated Rates of Revision

| Femoral Stem/Acetabular | N Revised | N Total | Obs. Years | Revisions/ 100 Obs. Yrs | Hazard Ratio, P Value |
|---|---|---|---|---|---|
| *BMHR VST | 42 | 260 | 3231 | 1.30 | Entire Period: HR=2.62 (95% CI 1.93, 3.55), p<0.001 |
| *CBH Stem | 44 | 274 | 2894 | 1.52 | Entire Period: HR=3.25 (95% CI 2.42, 4.37), p<0.001 |
| *Custom Made (MSA) | 44 | 224 | 2403 | 1.83 | Entire Period: HR=3.73 (95% CI 2.77, 5.02), p<0.001 |
| *Edinburgh | 19 | 138 | 1137 | 1.67 | Entire Period: HR=3.52 (95% CI 2.25, 5.51), p<0.001 |
| *Elite Plus | 281 | 2841 | 33708 | 0.83 | 0 - 3Mth: HR=0.45 (95% CI 0.27, 0.75), p=0.002 |
| | . | . | . | . | 3Mth+: HR=2.23 (95% CI 1.97, 2.52), p<0.001 |
| *Emperion | 59 | 507 | 5596 | 1.05 | Entire Period: HR=2.20 (95% CI 1.70, 2.84), p<0.001 |
| *Furlong Evolution | 42 | 521 | 2954 | 1.42 | Entire Period: HR=2.43 (95% CI 1.80, 3.29), p<0.001 |
| *GHE | 13 | 114 | 1051 | 1.24 | Entire Period: HR=2.66 (95% CI 1.55, 4.57), p<0.001 |
| *K2 | 92 | 601 | 6851 | 1.34 | Entire Period: HR=2.90 (95% CI 2.37, 3.57), p<0.001 |
| *LYDERIC II | 16 | 164 | 1530 | 1.05 | Entire Period: HR=2.23 (95% CI 1.37, 3.65), p=0.001 |
| *Linear | 21 | 290 | 2396 | 0.88 | Entire Period: HR=1.79 (95% CI 1.17, 2.74), p=0.007 |
| *ML Taper Kinectiv | 220 | 3532 | 36715 | 0.60 | Entire Period: HR=1.29 (95% CI 1.13, 1.47), p<0.001 |
| *Margron | 126 | 688 | 9712 | 1.30 | Entire Period: HR=2.81 (95% CI 2.35, 3.35), p<0.001 |
| *Mayo | 20 | 168 | 2164 | 0.92 | Entire Period: HR=2.04 (95% CI 1.31, 3.16), p=0.001 |
| *Metha (exch neck) | 16 | 88 | 1051 | 1.52 | Entire Period: HR=3.23 (95% CI 1.98, 5.26), p<0.001 |
| *Novation | 94 | 1423 | 11615 | 0.81 | 0 - 3Mth: HR=2.29 (95% CI 1.67, 3.14), p<0.001 |
| | . | . | . | . | 3Mth+: HR=1.37 (95% CI 1.05, 1.78), p=0.021 |
| *Profemur Z | 33 | 186 | 2256 | 1.46 | Entire Period: HR=3.16 (95% CI 2.24, 4.44), p<0.001 |
| *Proxima | 15 | 51 | 921 | 1.63 | Entire Period: HR=3.41 (95% CI 2.06, 5.66), p<0.001 |
| *Trabecular Metal | 131 | 1904 | 20582 | 0.64 | 0 - 1Mth: HR=2.58 (95% CI 1.85, 3.59), p<0.001 |
| | . | . | . | . | 1Mth - 1.5Yr: HR=1.74 (95% CI 1.29, 2.36), p<0.001 |
| | . | . | . | . | 1.5Yr - 2Yr: HR=0.83 (95% CI 0.27, 2.58), p=0.748 |
| | . | . | . | . | 2Yr - 3.5Yr: HR=1.36 (95% CI 0.77, 2.40), p=0.290 |
| | . | . | . | . | 3.5Yr - 4Yr: HR=2.06 (95% CI 0.86, 4.98), p=0.106 |
| | . | . | . | . | 4Yr - 7Yr: HR=1.34 (95% CI 0.85, 2.10), p=0.206 |
| | . | . | . | . | 7Yr+: HR=0.51 (95% CI 0.30, 0.84), p=0.008 |
| *UniSyn | 73 | 466 | 5409 | 1.35 | Entire Period: HR=2.87 (95% CI 2.28, 3.61), p<0.001 |
| **2000 Plus | 20 | 135 | 1406 | 1.42 | Entire Period: HR=3.02 (95% CI 1.95, 4.68), p<0.001 |
| **ASR | 2099 | 4421 | 43133 | 4.87 | 0 - 2Wk: HR=1.29 (95% CI 0.79, 2.12), p=0.305 |
| | . | . | . | . | 2Wk - 1Mth: HR=0.21 (95% CI 0.08, 0.55), p=0.001 |
| | . | . | . | . | 1Mth - 3Mth: HR=0.74 (95% CI 0.46, 1.20), p=0.220 |
| | . | . | . | . | 3Mth - 6Mth: HR=1.02 (95% CI 0.57, 1.85), p=0.939 |
| | . | . | . | . | 6Mth - 9Mth: HR=1.89 (95% CI 1.11, 3.20), p=0.018 |
| | . | . | . | . | 9Mth - 1.5Yr: HR=4.29 (95% CI 3.37, 5.46), p<0.001 |
| | . | . | . | . | 1.5Yr - 2Yr: HR=7.54 (95% CI 5.85, 9.71), p<0.001 |
| | . | . | . | . | 2Yr - 2.5Yr: HR=13.25 (95% CI 10.78, 16.29), p<0.001 |
| | . | . | . | . | 2.5Yr - 3Yr: HR=18.59 (95% CI 15.28, 22.62), p<0.001 |
| | . | . | . | . | 3Yr - 5Yr: HR=31.31 (95% CI 28.61, 34.28), p<0.001 |
| | . | . | . | . | 5Yr - 6Yr: HR=36.45 (95% CI 31.99, 41.53), p<0.001 |
| | . | . | . | . | 6Yr - 7Yr: HR=25.53 (95% CI 21.67, 30.07), p<0.001 |
| | . | . | . | . | 7Yr - 8Yr: HR=19.72 (95% CI 16.37, 23.77), p<0.001 |
| | . | . | . | . | 8Yr - 8.5Yr: HR=15.65 (95% CI 11.74, 20.86), p<0.001 |
| | . | . | . | . | 8.5Yr - 10Yr: HR=12.00 (95% CI 9.86, 14.61), p<0.001 |
| | . | . | . | . | 10Yr - 10.5Yr: HR=9.29 (95% CI 6.15, 14.05), p<0.001 |
| | . | . | . | . | 10.5Yr - 12Yr: HR=6.84 (95% CI 5.40, 8.67), p<0.001 |
| | . | . | . | . | 12Yr - 12.5Yr: HR=4.41 (95% CI 2.54, 7.63), p<0.001 |
| | . | . | . | . | 12.5Yr - 13.5Yr: HR=7.13 (95% CI 5.19, 9.80), p<0.001 |
| | . | . | . | . | 13.5Yr+: HR=3.58 (95% CI 2.85, 4.50), p<0.001 |

# Prostheses with Higher than Anticipated Rates of Revision

| Femoral Stem/Acetabular | N Revised | N Total | Obs. Years | Revisions/ 100 Obs. Yrs | Hazard Ratio, P Value |
|---|---|---|---|---|---|
| **Adept | 27 | 121 | 1465 | 1.84 | Entire Period: HR=3.80 (95% CI 2.60, 5.54), p<0.001 |
| **Artek | 76 | 179 | 2520 | 3.02 | 0 - 1Yr: HR=1.54 (95% CI 0.64, 3.71), p=0.331 |
| | . | . | . | . | 1Yr - 1.5Yr: HR=4.80 (95% CI 1.20, 19.21), p=0.026 |
| | . | . | . | . | 1.5Yr - 2.5Yr: HR=6.08 (95% CI 2.28, 16.21), p<0.001 |
| | . | . | . | . | 2.5Yr - 4Yr: HR=15.01 (95% CI 8.29, 27.16), p<0.001 |
| | . | . | . | . | 4Yr - 4.5Yr: HR=4.87 (95% CI 0.68, 34.64), p=0.113 |
| | . | . | . | . | 4.5Yr - 6Yr: HR=18.98 (95% CI 10.75, 33.52), p<0.001 |
| | . | . | . | . | 6Yr+: HR=6.52 (95% CI 4.76, 8.94), p<0.001 |
| **BHR | 593 | 2988 | 37920 | 1.56 | 0 - 2Wk: HR=0.83 (95% CI 0.40, 1.75), p=0.626 |
| | . | . | . | . | 2Wk - 1Mth: HR=0.15 (95% CI 0.04, 0.60), p=0.007 |
| | . | . | . | . | 1Mth - 3Mth: HR=1.03 (95% CI 0.63, 1.68), p=0.916 |
| | . | . | . | . | 3Mth - 1Yr: HR=0.55 (95% CI 0.29, 1.06), p=0.074 |
| | . | . | . | . | 1Yr - 1.5Yr: HR=1.71 (95% CI 0.97, 3.01), p=0.065 |
| | . | . | . | . | 1.5Yr+: HR=4.68 (95% CI 4.29, 5.11), p<0.001 |
| **Bionik | 158 | 608 | 6357 | 2.49 | 0 - 2Wk: HR=3.04 (95% CI 1.26, 7.31), p=0.013 |
| | . | . | . | . | 2Wk - 3Mth: HR=1.07 (95% CI 0.48, 2.37), p=0.875 |
| | . | . | . | . | 3Mth+: HR=6.46 (95% CI 5.49, 7.60), p<0.001 |
| **Conserve Plus | 25 | 135 | 1832 | 1.36 | 0 - 1Yr: HR=0.83 (95% CI 0.21, 3.31), p=0.789 |
| | . | . | . | . | 1Yr+: HR=3.79 (95% CI 2.51, 5.70), p<0.001 |
| **Cormet | 162 | 803 | 10237 | 1.58 | 0 - 3Mth: HR=0.60 (95% CI 0.27, 1.34), p=0.214 |
| | . | . | . | . | 3Mth - 1.5Yr: HR=1.91 (95% CI 1.09, 3.37), p=0.024 |
| | . | . | . | . | 1.5Yr+: HR=4.55 (95% CI 3.86, 5.37), p<0.001 |
| **DeltaLox | 31 | 222 | 2082 | 1.49 | Entire Period: HR=3.17 (95% CI 2.23, 4.51), p<0.001 |
| **Duraloc | 680 | 5354 | 67963 | 1.00 | 0 - 3Mth: HR=0.77 (95% CI 0.58, 1.02), p=0.071 |
| | . | . | . | . | 3Mth - 9Mth: HR=1.43 (95% CI 1.00, 2.05), p=0.051 |
| | . | . | . | . | 9Mth - 2Yr: HR=1.94 (95% CI 1.48, 2.53), p<0.001 |
| | . | . | . | . | 2Yr - 2.5Yr: HR=0.88 (95% CI 0.44, 1.78), p=0.730 |
| | . | . | . | . | 2.5Yr - 5.5Yr: HR=1.96 (95% CI 1.57, 2.45), p<0.001 |
| | . | . | . | . | 5.5Yr+: HR=3.17 (95% CI 2.88, 3.50), p<0.001 |
| **Durom | 223 | 1245 | 16901 | 1.32 | 0 - 1.5Yr: HR=0.74 (95% CI 0.47, 1.17), p=0.199 |
| | . | . | . | . | 1.5Yr - 2Yr: HR=4.47 (95% CI 2.47, 8.11), p<0.001 |
| | . | . | . | . | 2Yr - 6Yr: HR=3.57 (95% CI 2.70, 4.72), p<0.001 |
| | . | . | . | . | 6Yr - 7.5Yr: HR=8.64 (95% CI 6.27, 11.90), p<0.001 |
| | . | . | . | . | 7.5Yr - 8.5Yr: HR=4.03 (95% CI 2.28, 7.15), p<0.001 |
| | . | . | . | . | 8.5Yr - 11Yr: HR=5.42 (95% CI 3.97, 7.41), p<0.001 |
| | . | . | . | . | 11Yr+: HR=2.28 (95% CI 1.72, 3.02), p<0.001 |
| **Dynasty | 118 | 2127 | 14370 | 0.82 | 0 - 3Mth: HR=1.90 (95% CI 1.43, 2.51), p<0.001 |
| | . | . | . | . | 3Mth - 6Mth: HR=1.39 (95% CI 0.66, 2.93), p=0.383 |
| | . | . | . | . | 6Mth - 1.5Yr: HR=1.81 (95% CI 1.17, 2.81), p=0.008 |
| | . | . | . | . | 1.5Yr - 2.5Yr: HR=1.29 (95% CI 0.69, 2.41), p=0.416 |
| | . | . | . | . | 2.5Yr - 3Yr: HR=2.60 (95% CI 1.30, 5.20), p=0.006 |
| | . | . | . | . | 3Yr+: HR=0.99 (95% CI 0.66, 1.48), p=0.966 |
| **ExpanSys | 15 | 71 | 891 | 1.68 | Entire Period: HR=3.72 (95% CI 2.25, 6.16), p<0.001 |
| **Furlong | 73 | 970 | 7994 | 0.91 | 0 - 3Mth: HR=1.96 (95% CI 1.30, 2.95), p=0.001 |
| | . | . | . | . | 3Mth - 1.5Yr: HR=3.61 (95% CI 2.46, 5.30), p<0.001 |
| | . | . | . | . | 1.5Yr+: HR=1.13 (95% CI 0.76, 1.69), p=0.553 |
| **Hedrocel | 13 | 46 | 631 | 2.06 | Entire Period: HR=4.36 (95% CI 2.53, 7.51), p<0.001 |
| **Icon | 118 | 401 | 4584 | 2.57 | 0 - 2.5Yr: HR=2.55 (95% CI 1.71, 3.80), p<0.001 |
| | . | . | . | . | 2.5Yr - 3Yr: HR=10.35 (95% CI 4.63, 23.13), p<0.001 |

# Prostheses with Higher than Anticipated Rates of Revision

| Femoral Stem/Acetabular | N Revised | N Total | Obs. Years | Revisions/ 100 Obs. Yrs | Hazard Ratio, P Value |
|---|---|---|---|---|---|
| | . | . | . | . | 3Yr - 3.5Yr: HR=3.72 (95% CI 0.93, 14.92), p=0.063 |
| | . | . | . | . | 3.5Yr - 8.5Yr: HR=9.21 (95% CI 6.77, 12.53), p<0.001 |
| | . | . | . | . | 8.5Yr - 9Yr: HR=20.91 (95% CI 10.75, 40.65), p<0.001 |
| | . | . | . | . | 9Yr+: HR=5.40 (95% CI 3.89, 7.51), p<0.001 |
| **Inter-Op | 9 | 33 | 384 | 2.34 | Entire Period: HR=5.10 (95% CI 2.66, 9.79), p<0.001 |
| **MBA | 18 | 124 | 1148 | 1.57 | Entire Period: HR=3.35 (95% CI 2.11, 5.31), p<0.001 |
| **Mitch TRH | 181 | 731 | 8949 | 2.02 | 0 - 3Mth: HR=0.55 (95% CI 0.23, 1.33), p=0.185 |
| | . | . | . | . | 3Mth - 2Yr: HR=2.55 (95% CI 1.61, 4.05), p<0.001 |
| | . | . | . | . | 2Yr+: HR=6.17 (95% CI 5.27, 7.23), p<0.001 |
| **Plasmacup | 42 | 482 | 5331 | 0.79 | Entire Period: HR=1.71 (95% CI 1.26, 2.32), p<0.001 |
| **SPH-Blind | 134 | 952 | 13809 | 0.97 | Entire Period: HR=2.12 (95% CI 1.79, 2.52), p<0.001 |
| **Universal | 22 | 167 | 1978 | 1.11 | Entire Period: HR=2.45 (95% CI 1.61, 3.72), p<0.001 |
| **seleXys (excluding seleXys PC) | 52 | 391 | 4104 | 1.27 | Entire Period: HR=2.69 (95% CI 2.05, 3.53), p<0.001 |

Note: Components have been compared to all other modern total conventional hip components

*Femoral Stem Component

**Acetabular Component

+ Newly identified and no longer used

**Table IP8 Cumulative Percent Revision of Total Conventional Hip Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| CPR | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 20 Yrs |
|---|---|---|---|---|---|
| **Newly Identified** | | | | | |
| *Echelon | 5.2 (3.5, 7.7) | 8.0 (5.8, 11.2) | 8.4 (6.1, 11.6) | 9.9 (7.2, 13.6) | |
| **Re-Identified and Still Used** | | | | | |
| Accolade II/Trident Tritanium (Shell) | 2.3 (1.9, 2.8) | 3.4 (2.9, 4.0) | 3.9 (3.3, 4.6) | | |
| CORAIL/Trabecular Metal (Shell) | 6.1 (2.8, 13.1) | 9.5 (5.0, 17.4) | 11.9 (6.7, 20.4) | 11.9 (6.7, 20.4) | |
| *CPT | 2.3 (2.1, 2.5) | 3.3 (3.1, 3.6) | 4.3 (4.0, 4.5) | 6.3 (5.9, 6.6) | 9.5 (8.7, 10.4) |
| *Excia (cless) | 4.1 (2.7, 6.4) | 5.0 (3.4, 7.5) | 5.5 (3.8, 8.1) | 7.1 (4.9, 10.2) | |
| *HACTIV | 2.6 (2.1, 3.2) | 3.6 (2.9, 4.3) | 4.0 (3.3, 4.8) | 6.0 (4.7, 7.7) | |
| *MiniMax | 4.6 (2.9, 7.1) | 5.5 (3.7, 8.2) | 5.5 (3.7, 8.2) | | |
| *Revision Hip | 3.6 (1.4, 9.4) | 8.6 (4.3, 16.6) | 12.1 (6.5, 21.8) | | |
| *Taper Fit | 1.6 (1.4, 2.0) | 2.5 (2.1, 2.9) | 3.3 (2.8, 3.8) | 6.3 (5.0, 8.0) | |
| **Atlas (Shell) | 3.3 (2.1, 5.1) | 4.1 (2.7, 6.0) | 4.7 (3.2, 6.9) | 9.4 (6.9, 12.9) | |
| **Continuum | 2.6 (2.4, 2.9) | 3.5 (3.2, 3.8) | 4.0 (3.6, 4.3) | 5.2 (4.8, 5.6) | |
| **Delta-One-TT | 3.4 (1.6, 7.0) | 6.1 (3.5, 10.5) | 7.5 (4.5, 12.5) | 9.8 (5.9, 16.0) | |
| **Fin II | 2.5 (2.0, 3.2) | 3.4 (2.7, 4.2) | 4.4 (3.7, 5.4) | 7.6 (6.5, 8.8) | |
| **Fixa | 3.2 (2.4, 4.2) | 4.2 (3.3, 5.4) | 4.6 (3.7, 5.9) | 6.1 (4.8, 7.7) | |
| **G7 Multihole | 4.7 (3.7, 5.9) | 5.7 (4.6, 7.2) | 6.2 (4.9, 7.7) | | |
| **Mueller | 1.6 (0.2, 10.9) | 11.9 (5.5, 24.7) | 14.0 (6.9, 27.3) | 22.9 (12.8, 39.1) | |
| **Versafitcup DM | 2.4 (1.8, 3.1) | 3.4 (2.7, 4.2) | 3.9 (3.1, 4.9) | | |
| **Identified and no longer used** | | | | | |
| +**Total Hip Replacement (Lima) | 0.0 (0.0, 0.0) | 2.4 (0.8, 7.1) | 2.4 (0.8, 7.1) | 8.0 (4.4, 14.4) | |
| +*CBC Stem | 2.4 (1.2, 5.0) | 4.6 (2.7, 7.7) | 6.4 (4.1, 10.0) | 10.0 (6.9, 14.2) | 19.6 (14.9, 25.5) |
| +*MBA (exch neck) | 2.1 (1.2, 3.7) | 3.9 (2.6, 5.9) | 6.2 (4.5, 8.6) | 11.0 (8.6, 14.1) | 21.1 (16.3, 27.1) |
| +*Silent | 2.7 (0.7, 10.4) | 4.1 (1.3, 12.0) | 9.5 (4.6, 18.8) | 16.2 (9.6, 26.8) | |
| +*Tri-Fit | 3.4 (0.9, 13.1) | 3.4 (0.9, 13.1) | 5.3 (1.7, 15.5) | 23.6 (14.1, 38.0) | |
| Anatomic II/Duraloc Option | 1.7 (0.2, 11.2) | 6.7 (2.6, 16.8) | 10.1 (4.7, 21.1) | 14.2 (7.3, 26.5) | |
| Anca-Fit/PINNACLE | 6.0 (2.7, 12.8) | 8.0 (4.1, 15.4) | 11.1 (6.3, 19.2) | 16.4 (10.1, 25.8) | |
| Avenir/Fitmore | 5.1 (3.3, 7.9) | 5.4 (3.5, 8.2) | 5.7 (3.8, 8.7) | | |
| CPCS/Reflection (Non XLPE Cup) | 1.0 (0.4, 2.7) | 2.9 (1.6, 5.1) | 3.4 (2.0, 5.8) | 10.0 (7.2, 13.8) | 33.6 (27.0, 41.2) |
| Esop/Delta-PF | 0.0 (0.0, 0.0) | 1.8 (0.3, 12.0) | 5.6 (1.8, 16.3) | 7.8 (3.0, 19.4) | |
| Evolve/Acetabular Shell (Global) | 2.9 (1.1, 7.5) | 3.7 (1.5, 8.6) | 5.4 (2.6, 11.1) | | |
| F2L/Delta-PF | 5.6 (2.6, 12.1) | 10.3 (5.9, 17.9) | 12.3 (7.3, 20.2) | 16.5 (10.6, 25.3) | |
| Friendly Hip/Cup (Exactech) | 2.1 (0.5, 8.0) | 3.2 (1.0, 9.5) | 6.5 (3.0, 14.0) | 14.1 (8.2, 23.6) | |
| M-Cor/Equator+ Cup | 0.0 (0.0, 0.0) | 2.7 (0.7, 10.4) | 4.1 (1.3, 12.1) | 11.6 (6.0, 21.9) | |
| Meridian/ABGII | 2.1 (0.7, 6.4) | 5.0 (2.4, 10.1) | 6.4 (3.4, 12.0) | 8.3 (4.6, 14.5) | |
| Omnifit/Vitalock | 1.5 (0.2, 10.3) | 6.2 (2.4, 15.8) | 6.2 (2.4, 15.8) | 14.8 (8.0, 26.7) | 28.6 (18.0, 43.6) |
| Secur-Fit Plus HA/Secur-Fit | 3.1 (1.4, 6.7) | 7.3 (4.4, 11.9) | 7.8 (4.8, 12.6) | 10.1 (6.5, 15.3) | 19.4 (13.9, 26.8) |
| Taperloc/M2a$^{MoM}$ | 1.8 (0.9, 3.3) | 4.3 (2.9, 6.5) | 7.4 (5.4, 10.0) | 12.4 (9.7, 15.6) | 17.3 (13.9, 21.6) |
| *ABGII (exch neck) | 4.5 (2.5, 8.0) | 11.1 (7.8, 15.8) | 20.5 (15.9, 26.2) | 37.2 (31.2, 43.9) | |
| *Adapter (cless) | 3.2 (2.2, 4.8) | 6.9 (5.2, 8.9) | 11.7 (9.5, 14.3) | 20.1 (17.2, 23.3) | |
| *Adapter (ctd) | 4.1 (1.9, 8.9) | 9.1 (5.4, 15.2) | 16.2 (11.0, 23.6) | 23.6 (17.0, 32.2) | |
| *Apex | 2.2 (1.7, 2.9) | 3.3 (2.7, 4.0) | 4.5 (3.8, 5.4) | 7.2 (6.3, 8.4) | |
| *BMHR VST | 1.9 (0.8, 4.6) | 4.6 (2.7, 8.0) | 7.0 (4.5, 10.8) | 12.1 (8.7, 16.8) | |
| *CBH Stem | 4.0 (2.3, 7.2) | 7.4 (4.9, 11.3) | 9.8 (6.8, 14.1) | 15.0 (11.1, 20.1) | |
| *Custom Made (MSA) | 5.8 (3.4, 9.8) | 9.5 (6.3, 14.1) | 11.3 (7.8, 16.3) | 17.8 (13.3, 23.6) | |
| *Edinburgh | 6.0 (3.1, 11.7) | 9.6 (5.6, 16.4) | 12.5 (7.7, 20.0) | 16.8 (10.7, 25.8) | |
| *Elite Plus | 1.5 (1.1, 2.0) | 2.8 (2.3, 3.5) | 4.2 (3.5, 5.1) | 7.8 (6.8, 9.0) | 15.4 (13.6, 17.4) |
| *Emperion | 4.8 (3.2, 7.0) | 6.0 (4.2, 8.4) | 7.2 (5.2, 9.8) | 10.8 (8.3, 14.0) | |

# Prostheses with Higher than Anticipated Rates of Revision

| CPR | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 20 Yrs |
|---|---|---|---|---|---|
| *Furlong Evolution | 5.2 (3.6, 7.5) | 7.3 (5.4, 9.9) | 8.2 (6.1, 11.0) | 8.2 (6.1, 11.0) | |
| *GHE | 2.6 (0.9, 8.0) | 5.3 (2.4, 11.5) | 8.2 (4.3, 15.2) | 12.6 (7.5, 20.8) | |
| *K2 | 5.2 (3.7, 7.3) | 7.5 (5.7, 10.0) | 9.8 (7.7, 12.6) | 13.8 (11.2, 17.0) | |
| *LYDERIC II | 3.1 (1.3, 7.2) | 5.7 (3.0, 10.6) | 7.1 (4.0, 12.5) | 12.2 (7.2, 20.1) | |
| *Linear | 2.8 (1.4, 5.4) | 5.9 (3.7, 9.3) | 7.0 (4.6, 10.6) | 7.6 (5.0, 11.4) | |
| *ML Taper Kinectiv | 2.4 (2.0, 3.0) | 3.5 (3.0, 4.2) | 4.3 (3.7, 5.0) | 6.0 (5.3, 6.9) | |
| *Margron | 5.8 (4.3, 7.9) | 8.6 (6.7, 10.9) | 10.6 (8.5, 13.1) | 15.7 (13.1, 18.8) | 20.5 (17.4, 24.0) |
| *Mayo | 3.0 (1.3, 7.0) | 6.6 (3.7, 11.6) | 6.6 (3.7, 11.6) | 8.6 (5.2, 14.2) | |
| *Metha (exch neck) | 12.5 (7.1, 21.4) | 13.6 (8.0, 22.8) | 13.6 (8.0, 22.8) | 16.0 (9.8, 25.5) | |
| *Novation | 3.7 (2.9, 4.9) | 4.4 (3.5, 5.7) | 5.2 (4.2, 6.5) | 7.3 (6.0, 9.0) | |
| *Profemur Z | 6.0 (3.4, 10.5) | 10.4 (6.8, 15.8) | 11.0 (7.2, 16.5) | 12.2 (8.2, 18.0) | |
| *Proxima | 3.9 (1.0, 14.8) | 3.9 (1.0, 14.8) | 3.9 (1.0, 14.8) | 12.0 (5.6, 24.7) | 25.4 (15.2, 40.6) |
| *Trabecular Metal | 3.5 (2.8, 4.5) | 4.8 (3.9, 5.8) | 5.4 (4.5, 6.6) | 6.8 (5.7, 8.1) | |
| *UniSyn | 3.2 (2.0, 5.3) | 5.9 (4.1, 8.5) | 6.6 (4.7, 9.3) | 12.5 (9.7, 16.1) | |
| **2000 Plus | 3.0 (1.1, 7.8) | 6.8 (3.6, 12.7) | 9.2 (5.3, 15.7) | 14.1 (9.0, 21.8) | |
| **ASR | 1.9 (1.5, 2.3) | 9.6 (8.8, 10.5) | 24.5 (23.3, 25.9) | 45.1 (43.6, 46.7) | |
| **Adept | 4.1 (1.7, 9.6) | 8.4 (4.6, 15.0) | 9.3 (5.3, 16.2) | 15.9 (10.3, 24.0) | |
| **Artek | 2.8 (1.2, 6.7) | 8.0 (4.8, 13.1) | 16.1 (11.4, 22.5) | 27.1 (21.0, 34.4) | 44.2 (36.8, 52.4) |
| **BHR | 1.1 (0.8, 1.6) | 3.2 (2.6, 3.9) | 6.1 (5.3, 7.0) | 14.3 (13.0, 15.7) | 26.9 (24.4, 29.7) |
| **Bionik | 3.6 (2.4, 5.5) | 7.7 (5.8, 10.2) | 14.3 (11.7, 17.4) | 24.3 (20.9, 28.1) | |
| **Conserve Plus | 1.5 (0.4, 5.8) | 3.0 (1.1, 7.8) | 3.8 (1.6, 8.8) | 11.6 (7.0, 18.8) | |
| **Cormet | 1.5 (0.9, 2.6) | 3.5 (2.4, 5.1) | 5.2 (3.9, 7.0) | 13.7 (11.4, 16.5) | 28.4 (24.3, 33.1) |
| **DeltaLox | 5.9 (3.5, 9.9) | 8.7 (5.6, 13.3) | 10.1 (6.8, 15.0) | 14.2 (10.1, 19.9) | |
| **Duraloc | 1.8 (1.5, 2.2) | 3.0 (2.6, 3.5) | 4.1 (3.6, 4.7) | 8.4 (7.6, 9.2) | 19.4 (18.0, 21.0) |
| **Durom | 1.1 (0.7, 1.9) | 3.6 (2.7, 4.8) | 5.5 (4.3, 6.9) | 13.6 (11.7, 15.7) | 21.4 (18.9, 24.2) |
| **Dynasty | 3.3 (2.7, 4.2) | 4.5 (3.7, 5.4) | 5.0 (4.2, 6.1) | 5.9 (4.9, 7.1) | |
| **ExpanSys | 2.8 (0.7, 10.8) | 5.7 (2.2, 14.5) | 10.3 (5.0, 20.3) | 16.8 (9.7, 28.4) | |
| **Furlong | 4.2 (3.1, 5.7) | 6.1 (4.8, 7.8) | 6.7 (5.3, 8.5) | 7.5 (5.9, 9.5) | |
| **Hedrocel | 4.3 (1.1, 16.3) | 6.6 (2.2, 19.2) | 6.6 (2.2, 19.2) | 23.4 (12.8, 40.4) | 36.3 (22.6, 54.7) |
| **Icon | 3.0 (1.7, 5.3) | 7.8 (5.5, 10.9) | 12.7 (9.7, 16.5) | 24.5 (20.4, 29.4) | |
| **Inter-Op | 12.1 (4.7, 29.1) | 15.2 (6.6, 32.6) | 21.4 (10.8, 39.8) | 28.3 (15.8, 47.4) | 28.3 (15.8, 47.4) |
| **MBA | 4.0 (1.7, 9.4) | 8.2 (4.5, 14.8) | 10.2 (5.9, 17.2) | 16.0 (9.9, 25.5) | |
| **Mitch TRH | 1.5 (0.8, 2.7) | 4.6 (3.3, 6.4) | 7.7 (6.0, 10.0) | 15.6 (13.1, 18.6) | |
| **Plasmacup | 4.4 (2.9, 6.6) | 5.6 (3.9, 8.1) | 5.8 (4.1, 8.3) | 8.1 (6.0, 11.0) | |
| **SPH-Blind | 3.8 (2.8, 5.2) | 5.8 (4.5, 7.5) | 7.3 (5.8, 9.2) | 10.4 (8.6, 12.6) | 16.7 (14.2, 19.6) |
| **Universal | 4.8 (2.4, 9.4) | 4.8 (2.4, 9.4) | 5.4 (2.9, 10.2) | 11.6 (7.3, 18.2) | |
| **seleXys (excluding seleXys PC) | 4.6 (2.9, 7.2) | 7.8 (5.5, 11.0) | 10.6 (7.9, 14.1) | 13.3 (10.2, 17.2) | |

Note: Components have been compared to all other total conventional hip components

Note: *Femoral Stem Component

Note: **Acetabular Component

Note: + Newly identified and no longer used

**Table IP9 Yearly Usage of Total Conventional Hip Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| Year of Implant | ≤2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Newly Identified** | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| *Echelon | 97 | 27 | 19 | 30 | 21 | 40 | 31 | 30 | 32 | 47 | 43 | 41 | 10 | 3 | 3 | 2 | 1 | 2 |
| **Re-Identified and Still Used** | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Accolade II/Trident Tritanium (Shell) | . | . | . | . | . | 1 | 1 | 30 | 119 | 258 | 484 | 402 | 510 | 584 | 810 | 670 | 348 | 149 |
| CORAIL/Trabecular Metal (Shell) | 5 | 10 | 17 | 20 | 9 | 8 | 8 | 6 | 1 | 6 | 2 | 4 | 1 | 1 | . | . | . | 1 |
| *CPT | 3812 | 1070 | 1049 | 1196 | 1241 | 1295 | 1462 | 1566 | 1303 | 1233 | 1240 | 1159 | 1275 | 1339 | 1409 | 1333 | 1566 | 1024 |
| *Excia (cless) | . | 6 | 34 | 8 | 47 | 58 | 38 | 17 | 42 | 35 | 65 | 66 | 10 | . | . | 18 | 6 | 13 |
| *HACTIV | . | . | . | 2 | 19 | 63 | 61 | 117 | 146 | 96 | 240 | 452 | 388 | 418 | 406 | 194 | 225 | 225 |
| *MiniMax | . | . | . | . | . | . | . | . | . | 4 | 43 | 170 | 133 | 41 | 19 | 5 | . | 2 |
| *Revision Hip | 23 | 1 | 3 | 3 | 3 | 7 | 6 | 13 | 6 | 5 | 10 | 4 | 5 | 2 | 2 | 11 | 12 | 2 |
| *Taper Fit | 271 | 18 | 6 | 8 | 17 | 55 | 45 | 110 | 161 | 227 | 315 | 592 | 790 | 789 | 798 | 853 | 1204 | 933 |
| **Atlas (Shell) | 234 | 16 | 13 | 6 | 7 | 4 | 8 | 28 | 23 | 13 | 27 | 26 | 26 | 35 | 23 | 27 | 29 | 50 |
| **Continuum | . | . | 175 | 1117 | 1245 | 1331 | 1505 | 1492 | 1359 | 1327 | 1293 | 1197 | 850 | 513 | 294 | 182 | 156 | 28 |
| **Delta-One-TT | . | . | . | 4 | 7 | 7 | 15 | 37 | 13 | 12 | 14 | 14 | 23 | 15 | 14 | 13 | 11 | 9 |
| **Fin II | 342 | 251 | 269 | 318 | 286 | 205 | 247 | 101 | 6 | . | . | 9 | 76 | 94 | 96 | 88 | 95 | 97 |
| **Fixa | . | . | . | . | 44 | 161 | 153 | 99 | 134 | 100 | 91 | 78 | 84 | 95 | 134 | 162 | 133 | 86 |
| **G7 Multihole | . | . | . | . | . | . | . | . | . | . | 15 | 49 | 169 | 222 | 244 | 236 | 334 | 319 |
| **Mueller | 48 | 2 | . | . | . | 1 | . | 1 | 1 | . | 1 | 1 | 3 | . | . | 1 | 3 | 1 |
| **Versafitcup DM | . | . | . | . | 10 | 12 | 4 | 19 | 146 | 193 | 199 | 194 | 188 | 229 | 249 | 271 | 381 | 352 |
| **Identified and no longer used** | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| +**Total Hip Replacement (Lima) | . | . | . | . | 18 | 37 | 41 | 28 | 3 | 2 | . | . | . | . | . | . | . | . |
| +*CBC Stem | 283 | 3 | 2 | 1 | 1 | . | . | . | . | . | . | . | . | . | . | . | . | . |
| +*MBA (exch neck) | 321 | 46 | 31 | 43 | 46 | 36 | 44 | . | . | . | . | . | . | . | . | . | . | . |
| +*Silent | 19 | . | . | 21 | 21 | 3 | 6 | 4 | . | . | . | . | . | . | . | . | . | . |
| +*Tri-Fit | 54 | 4 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Anatomic II/Duraloc Option | 60 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Anca-Fit/PINNACLE | 85 | 16 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Avenir/Fitmore | . | . | . | . | . | . | 2 | 7 | 5 | 46 | 44 | 42 | 56 | 41 | 55 | 41 | 34 | . |
| CPCS/Reflection (Non XLPE Cup) | 373 | 19 | 13 | . | 2 | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Esop/Delta-PF | 59 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Evolve/Acetabular Shell (Global) | . | . | . | . | . | . | . | 1 | 13 | 43 | 32 | 15 | 11 | 10 | 12 | 2 | . | . |
| F2L/Delta-PF | 107 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Friendly Hip/Cup (Exactech) | 89 | 2 | 6 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| M-Cor/Equator+ Cup | 6 | 70 | 1 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Meridian/ABGII | 143 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Omnifit/Vitalock | 66 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Secur-Fit Plus HA/Secur-Fit | 197 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Taperloc/M2a$^{MoM}$ | 365 | 76 | 49 | 23 | 2 | . | . | . | . | . | . | . | . | . | . | . | . | . |
| *ABGII (exch neck) | 10 | 39 | 69 | 58 | 63 | 7 | . | . | . | . | . | . | . | . | . | . | . | . |
| *Adapter (cless) | 290 | 122 | 158 | 115 | 58 | . | 1 | . | . | . | . | . | . | . | . | . | . | . |
| *Adapter (ctd) | 100 | 33 | 8 | 7 | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| *Apex | 545 | 265 | 197 | 169 | 190 | 219 | 246 | 188 | 193 | 168 | 88 | 61 | 44 | 18 | . | . | . | . |
| *BMHR VST | . | 2 | 65 | 81 | 71 | 22 | 13 | 5 | 1 | . | . | . | . | . | . | . | . | . |
| *CBH Stem | 70 | 28 | 27 | 45 | 53 | 43 | 7 | . | 1 | . | . | . | . | . | . | . | . | . |
| *Custom Made (MSA) | 2 | 3 | 11 | 57 | 77 | 46 | 21 | 7 | . | . | . | . | . | . | . | . | . | . |
| *Edinburgh | 86 | 18 | 23 | 10 | 1 | . | . | . | . | . | . | . | . | . | . | . | . | . |
| *Elite Plus | 2814 | 26 | . | . | 1 | . | . | . | . | . | . | . | . | . | . | . | . | . |

# Prostheses with Higher than Anticipated Rates of Revision

| Year of Implant | ≤2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Emperion | 35 | 26 | 65 | 87 | 72 | 44 | 53 | 38 | 41 | 34 | 12 | . | . | . | . | . | . | . |
| *Furlong Evolution | . | . | . | . | . | . | 29 | 25 | 32 | 11 | 54 | 102 | 106 | 83 | 75 | 4 | . | . |
| *GHE | . | . | . | 9 | 4 | 47 | 28 | 14 | 12 | . | . | . | . | . | . | . | . | . |
| *K2 | 23 | 80 | 172 | 204 | 122 | . | . | . | . | . | . | . | . | . | . | . | . | . |
| *LYDERIC II | 156 | 8 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| *Linear | . | . | . | . | . | 23 | 31 | 31 | 88 | 70 | 27 | 12 | 5 | 3 | . | . | . | . |
| *ML Taper Kinectiv | . | 36 | 341 | 647 | 576 | 515 | 384 | 345 | 256 | 199 | 159 | 74 | . | . | . | . | . | . |
| *Margron | 686 | 2 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| *Mayo | 107 | 29 | 30 | 2 | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| *Metha (exch neck) | . | . | 20 | 53 | 15 | . | . | . | . | . | . | . | . | . | . | . | . | . |
| *Novation | . | . | 4 | 32 | 53 | 130 | 137 | 226 | 266 | 148 | 90 | 101 | 145 | 51 | 19 | 21 | . | . |
| *Profemur Z | 182 | 1 | 2 | 1 | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| *Proxima | 50 | 1 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| *Trabecular Metal | 107 | 148 | 198 | 242 | 272 | 276 | 186 | 220 | 112 | 106 | 32 | 5 | . | . | . | . | . | . |
| *UniSyn | 200 | 46 | 48 | 36 | 22 | 19 | 23 | 27 | 23 | 17 | 5 | . | . | . | . | . | . | . |
| **2000 Plus | 76 | 14 | 18 | 25 | 2 | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **ASR | 2811 | 1180 | 430 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **Adept | 39 | 29 | 30 | 11 | 12 | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **Artek | 179 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **BHR | 1651 | 477 | 404 | 276 | 134 | 27 | 13 | 5 | 1 | . | . | . | . | . | . | . | . | . |
| **Bionik | 294 | 138 | 134 | 38 | 4 | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **Conserve Plus | 105 | 15 | 14 | 1 | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **Cormet | 426 | 129 | 124 | 93 | 26 | 4 | 1 | . | . | . | . | . | . | . | . | . | . | . |
| **DeltaLox | . | . | . | 34 | 84 | 72 | 24 | 8 | . | . | . | . | . | . | . | . | . | . |
| **Duraloc | 4687 | 293 | 187 | 82 | 84 | 18 | 3 | . | . | . | . | . | . | . | . | . | . | . |
| **Durom | 928 | 218 | 85 | 13 | 1 | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **Dynasty | . | . | . | . | 40 | 31 | 49 | 178 | 298 | 317 | 306 | 307 | 272 | 241 | 39 | 32 | 17 | . |
| **ExpanSys | 70 | 1 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **Furlong | 35 | 7 | 61 | 90 | 85 | 73 | 76 | 64 | 66 | 12 | 55 | 100 | 82 | 65 | 71 | 21 | 7 | . |
| **Hedrocel | 46 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **Icon | 207 | 68 | 78 | 37 | 11 | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **Inter-Op | 33 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **MBA | 122 | 2 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **Mitch TRH | 318 | 164 | 130 | 82 | 37 | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **Plasmacup | 39 | 7 | 54 | 60 | 59 | 77 | 70 | 44 | 51 | 21 | . | . | . | . | . | . | . | . |
| **SPH-Blind | 952 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **Universal | 139 | 11 | 6 | 7 | 4 | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **seleXys (excluding seleXys PC) | 68 | 20 | 21 | 53 | 70 | 89 | 57 | 13 | . | . | . | . | . | . | . | . | . | . |

Note: *Femoral Stem Component
**Acetabular Component
+ Newly identified and no longer used

**Figure IP3 Cumulative Percent Revision of Newly Identified Total Conventional Hip Prostheses**

**Newly Identified**

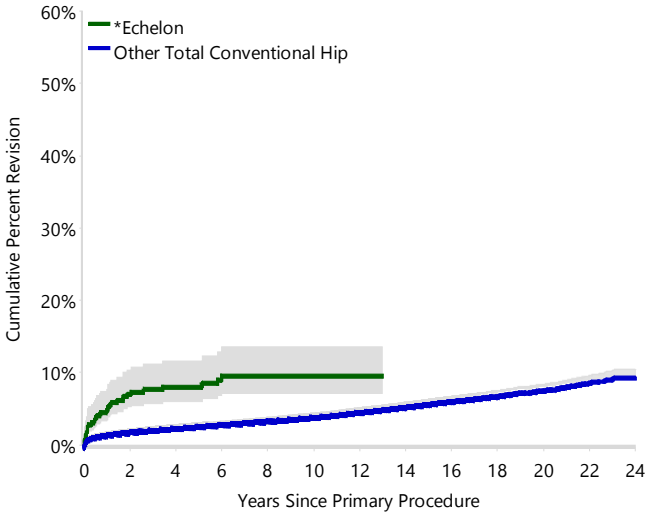
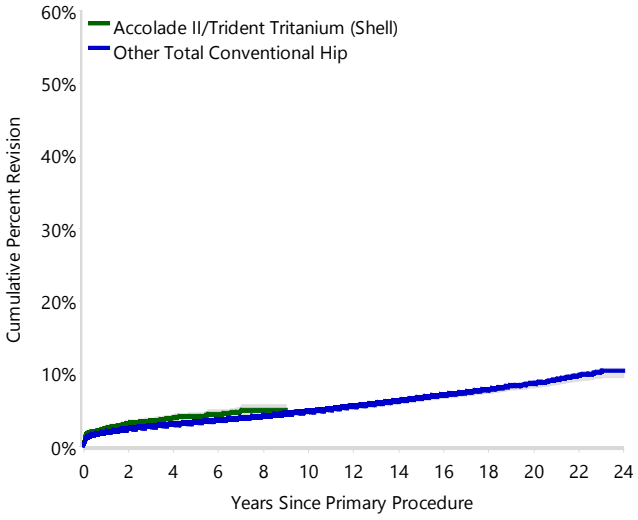
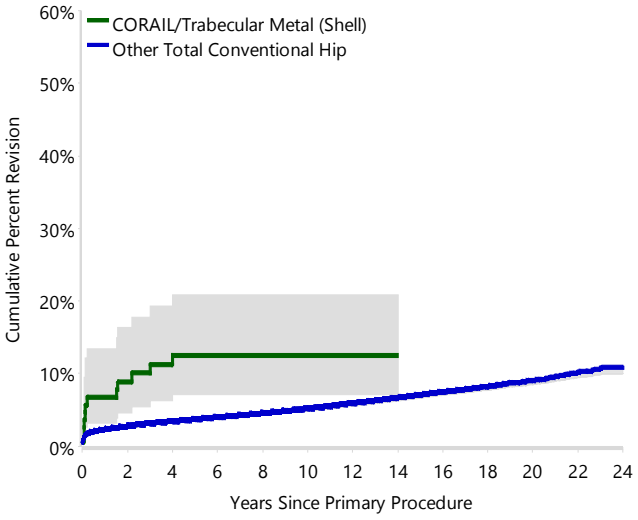


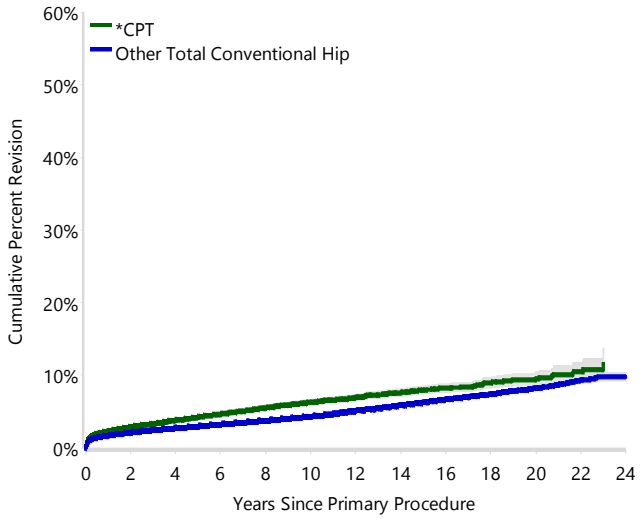

**Figure IP4 Cumulative Percent Revision of Re-Identified and Still Used Total Conventional Hip Prostheses**

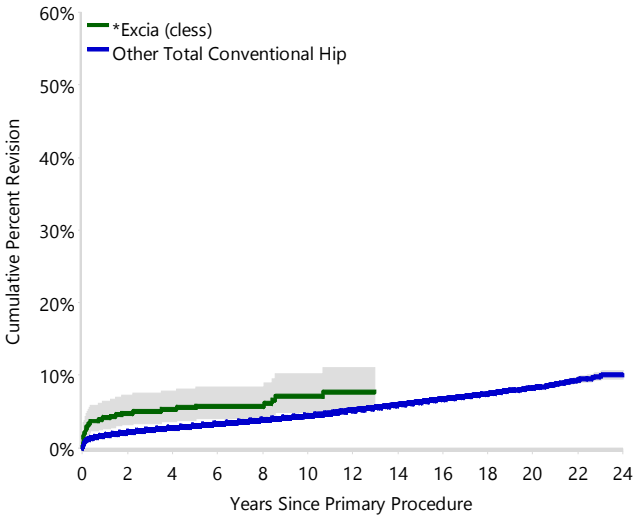
**Re-Identified and Still Used**

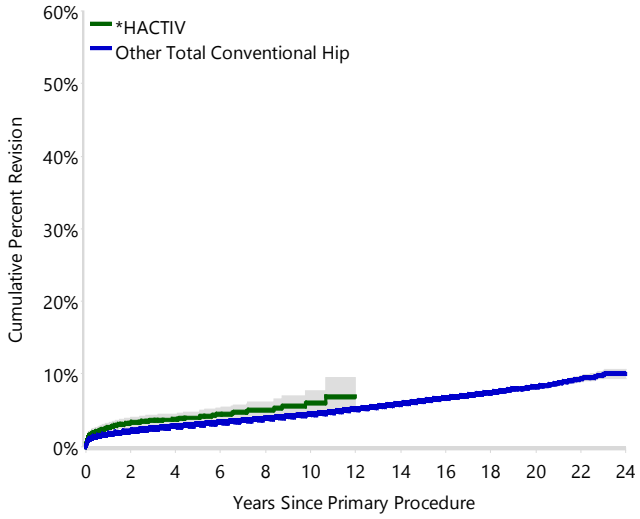


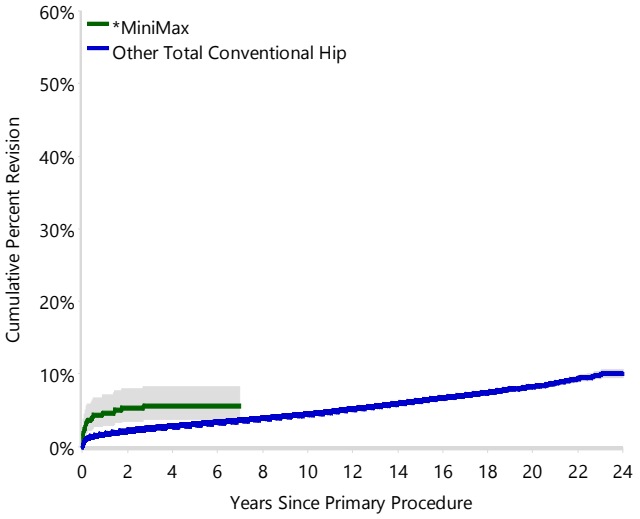



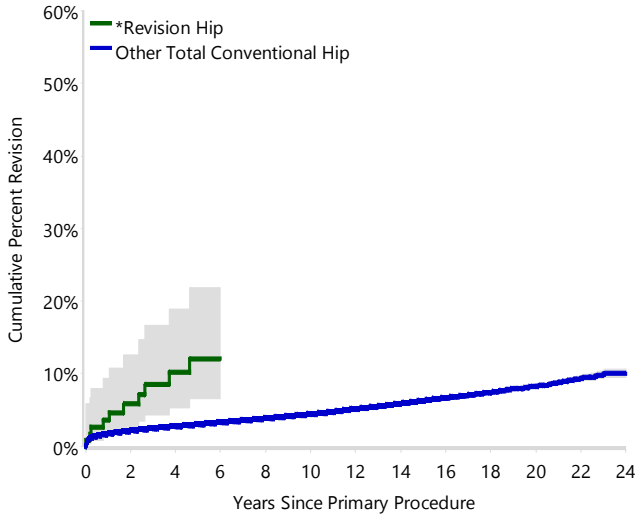
# Prostheses with Higher than Anticipated Rates of Revision

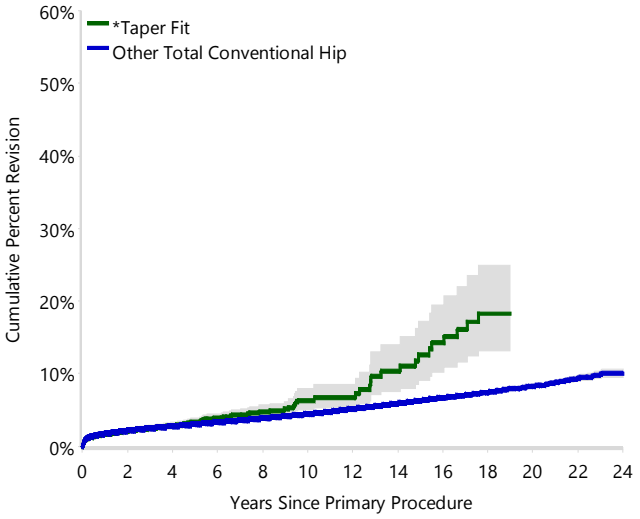


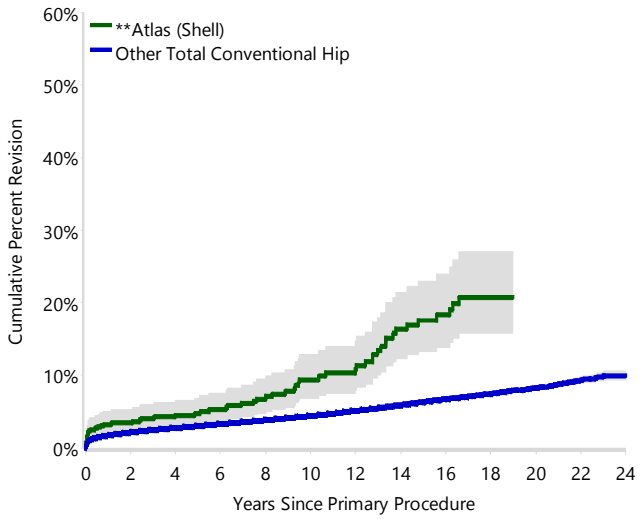



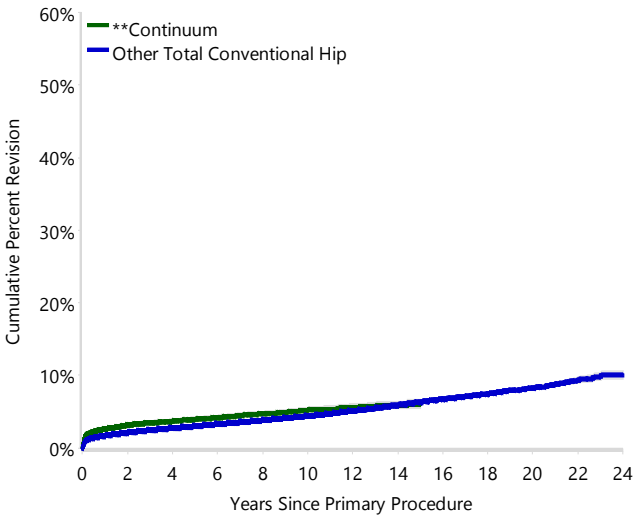



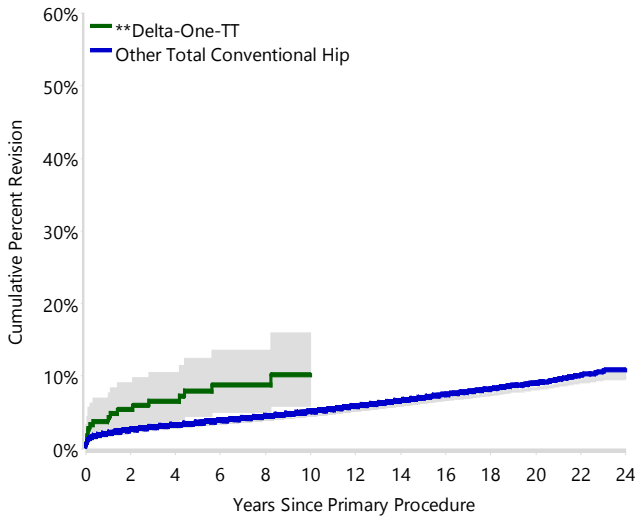



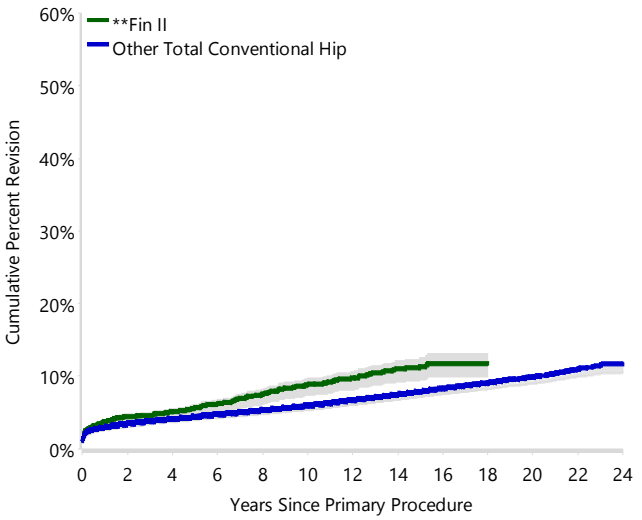



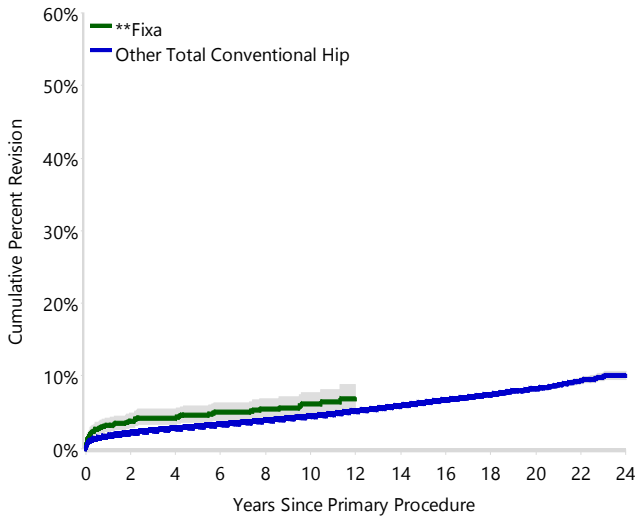
# Prostheses with Higher than Anticipated Rates of Revision

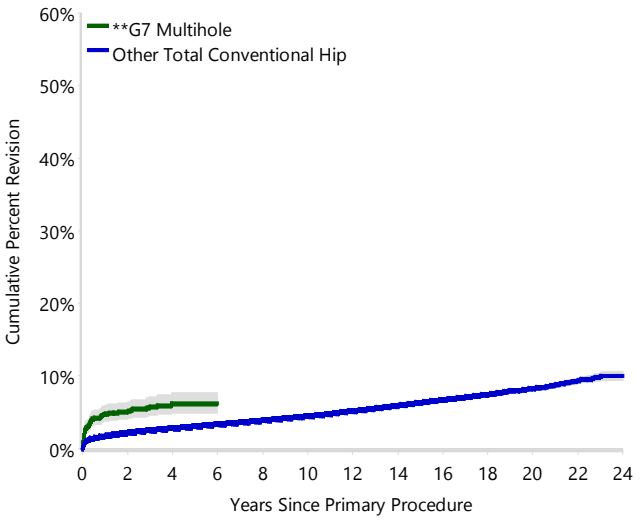


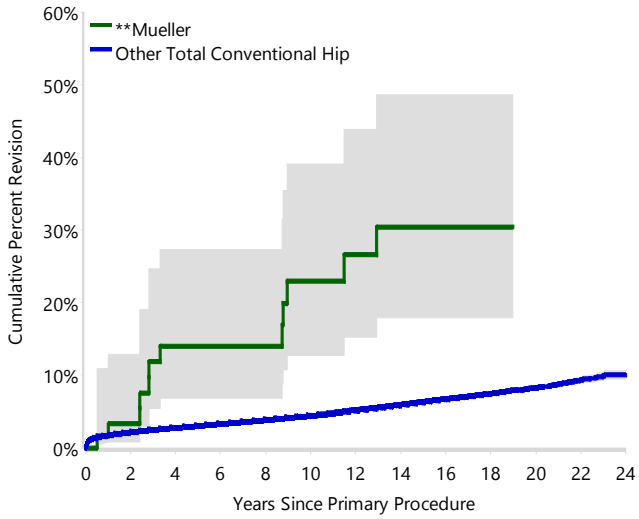



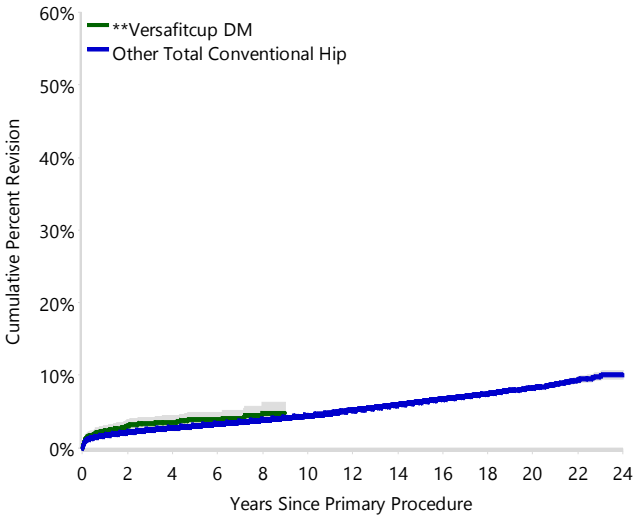



# Prostheses with Higher than Anticipated Rates of Revision



## TOTAL RESURFACING

There are no newly identified total resurfacing hip prostheses.

**Table IP10 Revision Rate of Total Resurfacing Hip Prostheses Identified as having a Higher than Anticipated Rate of Revision**

| Head/Acetabular | N Revised | N Total | Obs. Years | Revisions/ 100 Obs. Yrs | Hazard Ratio, P Value |
|---|---|---|---|---|---|
| Identified and no longer used | . | . | . | . | |
| ASR/ASR | 426 | 1168 | 15824 | 2.69 | Entire Period: HR=4.14 (95% CI 3.71, 4.61), p<0.001 |
| Bionik/Bionik | 64 | 200 | 2526 | 2.53 | Entire Period: HR=4.24 (95% CI 3.30, 5.45), p<0.001 |
| Conserve Plus/Conserve Plus | 17 | 63 | 1011 | 1.68 | Entire Period: HR=2.29 (95% CI 1.42, 3.70), p<0.001 |
| Cormet/Cormet | 157 | 626 | 9096 | 1.73 | Entire Period: HR=2.63 (95% CI 2.23, 3.10), p<0.001 |
| Durom/Durom | 126 | 847 | 13542 | 0.93 | 0 - 4.5Yr: HR=2.50 (95% CI 1.92, 3.26), p<0.001 |
| | . | . | . | . | 4.5Yr+: HR=1.14 (95% CI 0.88, 1.47), p=0.314 |
| Recap/Recap | 31 | 196 | 2811 | 1.10 | 0 - 6Mth: HR=2.85 (95% CI 1.26, 6.43), p=0.011 |
| | . | . | . | . | 6Mth - 1.5Yr: HR=6.66 (95% CI 3.24, 13.69), p<0.001 |
| | . | . | . | . | 1.5Yr+: HR=1.22 (95% CI 0.76, 1.97), p=0.415 |
| *Cormet 2000 HAP | 31 | 95 | 1537 | 2.02 | Entire Period: HR=3.55 (95% CI 2.49, 5.07), p<0.001 |

Note: Components have been compared to all other total resurfacing hip components
*Head Component

**Table IP11 Cumulative Percent Revision of Total Resurfacing Hip Prostheses Identified as having a Higher than Anticipated Rate of Revision**

| CPR | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 20 Yrs |
|---|---|---|---|---|---|
| Identified and No Longer Used | | | | | |
| ASR/ASR | 3.4 (2.5, 4.6) | 7.2 (5.9, 8.8) | 15.5 (13.5, 17.7) | 29.9 (27.4, 32.7) | 37.9 (35.1, 40.9) |
| Bionik/Bionik | 3.5 (1.7, 7.2) | 12.5 (8.7, 18.0) | 18.6 (13.8, 24.7) | 27.8 (22.1, 34.6) | |
| Conserve Plus/Conserve Plus | 4.8 (1.6, 14.0) | 6.4 (2.4, 16.1) | 9.6 (4.4, 20.1) | 14.4 (7.8, 25.9) | 27.9 (18.3, 41.0) |
| Cormet/Cormet | 2.1 (1.2, 3.6) | 5.9 (4.3, 8.1) | 10.0 (7.9, 12.6) | 17.4 (14.6, 20.7) | 29.3 (25.1, 34.1) |
| Durom/Durom | 3.3 (2.3, 4.8) | 5.6 (4.2, 7.3) | 7.7 (6.1, 9.7) | 11.0 (9.0, 13.3) | 15.4 (13.1, 18.1) |
| Recap/Recap | 5.1 (2.8, 9.3) | 8.7 (5.5, 13.6) | 10.2 (6.7, 15.4) | 14.5 (10.2, 20.3) | |
| *Cormet 2000 HAP | 6.3 (2.9, 13.5) | 8.4 (4.3, 16.1) | 9.5 (5.0, 17.4) | 21.1 (14.2, 30.7) | 32.6 (24.0, 43.2) |

Note: Components have been compared to all other total resurfacing hip components
*Head Component

**Table IP12 Yearly Usage of Total Resurfacing Hip Prostheses Identified as having a Higher than Anticipated Rate of Revision**

| Year of Implant | ≤2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Identified and No Longer Used | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| ASR/ASR | 944 | 133 | 91 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Bionik/Bionik | 78 | 46 | 54 | 20 | 2 | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Conserve Plus/Conserve Plus | 62 | . | 1 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Cormet/Cormet | 389 | 94 | 75 | 50 | 10 | 4 | 4 | . | . | . | . | . | . | . | . | . | . | . |
| Durom/Durom | 679 | 88 | 46 | 24 | 10 | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Recap/Recap | 93 | 46 | 38 | 16 | 3 | . | . | . | . | . | . | . | . | . | . | . | . | . |
| *Cormet 2000 HAP | 95 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |

Note: Components have been compared to all other total resurfacing hip components
*Head Component

# Prostheses with Higher than Anticipated Rates of Revision

## Primary Partial Knee Replacement

### PATELLA/TROCHLEA

There are no newly identified patella/trochlea prostheses.

**Table IP13 Revision Rate of Patella-Trochlear Knee Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| Patella/Trochlear | N Revised | N Total | Obs. Years | Revisions/ 100 Obs. Yrs | Hazard Ratio, P Value |
|---|---|---|---|---|---|
| Identified and No Longer Used | | | | | |
| Lubinus/Lubinus | 23 | 39 | 413 | 5.56 | Entire Period: HR=2.30 (95% CI 1.48, 3.59), p<0.001 |
| PFC Sigma/Sigma HP | 50 | 117 | 1009 | 4.95 | Entire Period: HR=1.98 (95% CI 1.48, 2.66), p<0.001 |
| **LCS | 231 | 413 | 4426 | 5.22 | Entire Period: HR=2.04 (95% CI 1.73, 2.41), p<0.001 |

Note: Components have been compared to all other modern patella-trochlear knee components
**Trochlear Component

**Table IP14 Cumulative Percent Revision of Patella-Trochlear Knee Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| CPR | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 20 Yrs |
|---|---|---|---|---|---|
| Identified and No Longer Used | | | | | |
| Lubinus/Lubinus | 5.1 (1.3, 19.0) | 18.1 (9.1, 34.3) | 20.9 (11.0, 37.6) | 35.0 (22.0, 52.7) | |
| PFC Sigma/Sigma HP | 4.3 (1.8, 10.0) | 14.7 (9.4, 22.6) | 20.9 (14.5, 29.6) | 38.3 (29.9, 48.2) | |
| **LCS | 3.9 (2.4, 6.2) | 11.9 (9.1, 15.4) | 20.7 (17.1, 25.0) | 40.9 (36.2, 46.0) | |

Note: **Trochlear Component

**Table IP15 Yearly Usage of Patella-Trochlear Knee Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| Year of Implant | ≤2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Identified and No Longer Used | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Lubinus/Lubinus | 37 | . | 2 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| PFC Sigma/Sigma HP | 14 | 6 | 5 | 16 | 15 | 12 | 20 | 7 | 7 | 7 | 8 | . | . | . | . | . | . | . |
| **LCS | 326 | 60 | 27 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |

Note: **Trochlear Component

## UNICOMPARTMENTAL

There are no newly identified unicompartmental prostheses.

**Table IP16 Revision Rate of Unicompartmental Knee Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| Femoral/Tibial | N Revised | N Total | Obs. Years | Revisions/ 100 Obs. Yrs | Hazard Ratio, P Value |
|---|---|---|---|---|---|
| Identified and no longer used | . | . | . | . | |
| Advance/Advance | 16 | 37 | 357 | 4.48 | 0 - 2Yr: HR=6.07 (95% CI 2.89, 12.72), p<0.001 |
| | . | . | . | . | 2Yr - 4.5Yr: HR=6.46 (95% CI 2.43, 17.20), p<0.001 |
| | . | . | . | . | 4.5Yr+: HR=1.64 (95% CI 0.68, 3.94), p=0.270 |
| BalanSys Uni/BalanSys Uni Convex | 21 | 54 | 625 | 3.36 | Entire Period: HR=2.20 (95% CI 1.43, 3.37), p<0.001 |
| BalanSys Uni/BalanSys Uni Mobile | 70 | 199 | 2609 | 2.68 | 0 - 2Yr: HR=3.16 (95% CI 2.08, 4.82), p<0.001 |
| | . | . | . | . | 2Yr+: HR=1.49 (95% CI 1.12, 1.99), p=0.005 |
| Eius/Eius | 55 | 142 | 1897 | 2.90 | 0 - 2Yr: HR=1.97 (95% CI 1.12, 3.48), p=0.019 |
| | . | . | . | . | 2Yr - 2.5Yr: HR=5.63 (95% CI 2.32, 13.67), p<0.001 |
| | . | . | . | . | 2.5Yr+: HR=1.39 (95% CI 1.01, 1.91), p=0.045 |
| Freedom PKR Active/Freedom PKR Active | 531 | 1505 | 17214 | 3.08 | 0 - 6Mth: HR=0.49 (95% CI 0.23, 1.03), p=0.059 |
| | . | . | . | . | 6Mth - 9Mth: HR=1.11 (95% CI 0.57, 2.16), p=0.755 |
| | . | . | . | . | 9Mth - 1.5Yr: HR=2.17 (95% CI 1.60, 2.94), p<0.001 |
| | . | . | . | . | 1.5Yr - 2Yr: HR=1.68 (95% CI 1.03, 2.74), p=0.037 |
| | . | . | . | . | 2Yr - 3.5Yr: HR=2.50 (95% CI 1.89, 3.31), p<0.001 |
| | . | . | . | . | 3.5Yr - 7Yr: HR=3.38 (95% CI 2.84, 4.02), p<0.001 |
| | . | . | . | . | 7Yr - 8.5Yr: HR=2.18 (95% CI 1.58, 2.99), p<0.001 |
| | . | . | . | . | 8.5Yr - 9Yr: HR=4.33 (95% CI 2.89, 6.50), p<0.001 |
| | . | . | . | . | 9Yr - 10Yr: HR=3.43 (95% CI 2.45, 4.79), p<0.001 |
| | . | . | . | . | 10Yr - 13.5Yr: HR=2.09 (95% CI 1.67, 2.61), p<0.001 |
| | . | . | . | . | 13.5Yr+: HR=1.45 (95% CI 1.10, 1.90), p=0.007 |
| GMK-UNI/GMK-UNI | 48 | 168 | 1233 | 3.89 | Entire Period: HR=2.70 (95% CI 2.03, 3.59), p<0.001 |
| Uniglide/Uniglide | 208 | 756 | 9449 | 2.20 | 0 - 2Yr: HR=2.21 (95% CI 1.71, 2.86), p<0.001 |
| | . | . | . | . | 2Yr - 2.5Yr: HR=3.21 (95% CI 1.84, 5.62), p<0.001 |
| | . | . | . | . | 2.5Yr+: HR=1.21 (95% CI 1.02, 1.44), p=0.028 |
| **Preservation Mobile | 169 | 400 | 5436 | 3.11 | 0 - 1.5Yr: HR=2.72 (95% CI 1.95, 3.81), p<0.001 |
| | . | . | . | . | 1.5Yr - 3Yr: HR=3.73 (95% CI 2.54, 5.48), p<0.001 |
| | . | . | . | . | 3Yr+: HR=1.48 (95% CI 1.22, 1.80), p<0.001 |

Note: Components have been compared to all other modern unicompartmental knee components
**Tibial Component

# Prostheses with Higher than Anticipated Rates of Revision

**Table IP17 Cumulative Percent Revision of Unicompartmental Knee Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| CPR | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 20 Yrs |
|---|---|---|---|---|---|
| Identified and No Longer Used | | | | | |
| Advance/Advance | 10.8 (4.2, 26.3) | 27.0 (15.6, 44.4) | 35.8 (22.5, 53.6) | 41.6 (27.5, 59.4) | |
| BalanSys Uni/BalanSys Uni Convex | 1.9 (0.3, 12.4) | 7.4 (2.8, 18.5) | 7.4 (2.8, 18.5) | 24.9 (15.3, 39.0) | |
| BalanSys Uni/BalanSys Uni Mobile | 7.0 (4.2, 11.6) | 13.1 (9.1, 18.6) | 14.6 (10.4, 20.4) | 21.7 (16.5, 28.2) | |
| Eius/Eius | 4.9 (2.4, 10.1) | 12.8 (8.3, 19.5) | 17.8 (12.4, 25.2) | 22.3 (16.3, 30.2) | |
| Freedom PKR Active/Freedom PKR Active | 1.9 (1.3, 2.7) | 8.0 (6.7, 9.5) | 13.8 (12.1, 15.6) | 27.2 (24.9, 29.6) | |
| GMK-UNI/GMK-UNI | 6.5 (3.7, 11.5) | 17.3 (12.4, 23.9) | 24.7 (18.9, 32.1) | 28.9 (22.6, 36.6) | |
| Uniglide/Uniglide | 4.8 (3.5, 6.6) | 10.8 (8.8, 13.3) | 13.0 (10.8, 15.6) | 19.8 (17.1, 22.9) | 34.6 (30.5, 39.2) |
| **Preservation Mobile | 5.3 (3.5, 7.9) | 15.5 (12.3, 19.5) | 19.1 (15.6, 23.3) | 27.2 (23.1, 31.9) | 45.1 (40.0, 50.5) |

Note: **Tibial Component

**Table IP18 Yearly Usage of Unicompartmental Knee Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| Year of Implant | ≤2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Identified and No Longer Used | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Advance/Advance | 36 | 1 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| BalanSys Uni/BalanSys Uni Convex | 12 | 10 | 4 | 7 | 9 | 1 | 3 | 3 | 5 | . | . | . | . | . | . | . | . | . |
| BalanSys Uni/BalanSys Uni Mobile | 184 | 9 | 2 | 4 | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Eius/Eius | 125 | 8 | 7 | 2 | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Freedom PKR Active/Freedom PKR Active | 787 | 162 | 149 | 102 | 75 | 68 | 63 | 51 | 31 | 12 | 5 | . | . | . | . | . | . | . |
| GMK-UNI/GMK-UNI | . | 5 | 10 | 2 | . | 21 | 22 | 16 | 19 | 17 | 12 | 29 | 3 | 8 | 3 | 1 | . | . |
| Uniglide/Uniglide | 460 | 93 | 61 | 30 | 38 | 25 | 22 | 9 | 5 | 8 | 3 | . | 1 | 1 | . | . | . | . |
| **Preservation Mobile | 400 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |

Note: **Tibial Component

## Primary Total Knee Replacement

There is one newly identified total knee replacement.

The E.motion/E.motion total knee combination has been identified since 2012 and is still used. This year the E.motion (cementless)/E.motion Pro (cemented) combination is identified as having a higher than anticipated rate of revision. There are 205 procedures with 10 revisions. The cumulative percent revision at 5 years is 6.4%. There are 6 major revisions with 5 revisions for loosening. The tibial polyethylene is non-XLPE.

The Mutars/Mutars combination has been identified since 2023. This prosthesis is often used for difficult or uncommon primary diagnoses. When first identified, the hinged subgroup was found to have a higher rates of revision compared to other hinged devices, and when restricted to procedures for osteoarthritis. The Mutars/Mutars hinged devices continue to be identified.

This year the distal femoral replacement subgroup also has a higher rate of revision compared to other total knee replacements, and also when compared to other distal femoral replacements. There have been 230 Mutars/Mutars distal femoral replacement procedures of which 58 have been revised. The cumulative percent revision at 5 years is 33.7%. There are 38 (65.5%) revisions where the primary diagnosis is tumour, but this proportion is lower than that for other revised distal femoral replacement procedures. There are 46 major revisions. There are 18 revisions for loosening, 13 for infection, 7 for femoral component breakage, 5 for fracture and 4 for metal related pathology.

**Table IP19 Revision Rate of Total Knee Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| Femoral/Tibial | N Revised | N Total | Obs. Years | Revisions/ 100 Obs. Yrs | Hazard Ratio, P Value |
|---|---|---|---|---|---|
| **Newly Identified** | . | . | . | . | |
| E.Motion (class)/E.Motion Pro (ctd) | 10 | 205 | 753 | 1.33 | Entire Period: HR=1.92 (95% CI 1.03, 3.56), p=0.039 |
| **Re-Identified and Still Used** | . | . | . | . | |
| ACS (class)/ACS Fixed | 142 | 3021 | 19709 | 0.72 | Entire Period: HR=1.26 (95% CI 1.07, 1.49), p=0.005 |
| Active Knee (class)/Active Knee | 796 | 7315 | 90865 | 0.88 | 0 - 1Yr: HR=1.05 (95% CI 0.84, 1.31), p=0.663 |
| | . | . | . | . | 1Yr - 2.5Yr: HR=1.74 (95% CI 1.48, 2.04), p<0.001 |
| | . | . | . | . | 2.5Yr - 3Yr: HR=1.16 (95% CI 0.76, 1.77), p=0.480 |
| | . | . | . | . | 3Yr+: HR=2.17 (95% CI 1.98, 2.36), p<0.001 |
| Apex Knee CR (class)/Apex Knee (class) | 32 | 529 | 4138 | 0.77 | Entire Period: HR=1.45 (95% CI 1.02, 2.05), p=0.036 |
| Attune PS (ctd)/Attune (class) | 38 | 1210 | 2950 | 1.29 | Entire Period: HR=1.61 (95% CI 1.17, 2.21), p=0.003 |
| Columbus/Columbus | 283 | 8502 | 37432 | 0.76 | Entire Period: HR=1.20 (95% CI 1.06, 1.35), p=0.002 |
| E.Motion/E.Motion | 77 | 1041 | 8956 | 0.86 | 0 - 1.5Yr: HR=2.53 (95% CI 1.84, 3.46), p<0.001 |
| | . | . | . | . | 1.5Yr+: HR=1.21 (95% CI 0.88, 1.66), p=0.240 |
| Mutars/Mutars | 82 | 482 | 1400 | 5.86 | Entire Period: HR=4.49 (95% CI 3.60, 5.59), p<0.001 |
| Trekking/Trekking | 78 | 1304 | 10358 | 0.75 | 0 - 1.5Yr: HR=1.90 (95% CI 1.37, 2.63), p<0.001 |
| | . | . | . | . | 1.5Yr+: HR=1.16 (95% CI 0.86, 1.57), p=0.332 |
| *Legion Oxinium FS | 48 | 545 | 3268 | 1.47 | 0 - 3Mth: HR=7.24 (95% CI 4.36, 12.01), p<0.001 |
| | . | . | . | . | 3Mth - 6Mth: HR=5.99 (95% CI 2.68, 13.35), p<0.001 |
| | . | . | . | . | 6Mth - 1.5Yr: HR=1.92 (95% CI 1.00, 3.69), p=0.050 |
| | . | . | . | . | 1.5Yr+: HR=1.55 (95% CI 0.97, 2.46), p=0.064 |
| **Legion Revision Tibial Baseplate | 84 | 1444 | 7598 | 1.11 | 0 - 6Mth: HR=3.74 (95% CI 2.64, 5.29), p<0.001 |
| | . | . | . | . | 6Mth+: HR=1.25 (95% CI 0.95, 1.64), p=0.106 |
| **Identified and no longer used** | . | . | . | . | |
| ACS/ACS Mobile PC (class) | 31 | 131 | 1152 | 2.69 | Entire Period: HR=5.14 (95% CI 3.62, 7.32), p<0.001 |
| AMK/AMK | 26 | 203 | 2594 | 1.00 | Entire Period: HR=2.36 (95% CI 1.61, 3.46), p<0.001 |
| Advance/Advance | 82 | 1009 | 9376 | 0.87 | Entire Period: HR=1.68 (95% CI 1.36, 2.09), p<0.001 |
| Buechel-Pappas/Buechel-Pappas | 59 | 479 | 5894 | 1.00 | Entire Period: HR=2.07 (95% CI 1.60, 2.67), p<0.001 |
| Eska RP/Eska RP | 9 | 40 | 414 | 2.17 | Entire Period: HR=4.86 (95% CI 2.53, 9.33), p<0.001 |
| Evolis (class)/Evolis (class) | 10 | 87 | 966 | 1.04 | Entire Period: HR=2.03 (95% CI 1.09, 3.77), p=0.025 |
| Gemini MK II/Gemini MK II | 8 | 21 | 226 | 3.54 | Entire Period: HR=7.32 (95% CI 3.66, 14.63), p<0.001 |
| Genesis (ctd)/Genesis (ctd) | 11 | 62 | 732 | 1.50 | Entire Period: HR=3.63 (95% CI 2.01, 6.54), p<0.001 |
| Genesis II CR (class)/Profix Mobile (ctd) | 39 | 241 | 3152 | 1.24 | Entire Period: HR=2.90 (95% CI 2.12, 3.97), p<0.001 |

# Prostheses with Higher than Anticipated Rates of Revision

| Femoral/Tibial | N Revised | N Total | Obs. Years | Revisions/ 100 Obs. Yrs | Hazard Ratio, P Value |
|---|---|---|---|---|---|
| Genesis II Oxinium CR (class)/Genesis II | 48 | 110 | 1065 | 4.51 | 0 - 9Mth: HR=9.41 (95% CI 4.89, 18.09), p<0.001 |
| | . | . | . | . | 9Mth - 1Yr: HR=15.86 (95% CI 5.95, 42.32), p<0.001 |
| | . | . | . | . | 1Yr - 1.5Yr: HR=23.61 (95% CI 13.06, 42.68), p<0.001 |
| | . | . | . | . | 1.5Yr - 2.5Yr: HR=25.34 (95% CI 15.26, 42.08), p<0.001 |
| | . | . | . | . | 2.5Yr+: HR=2.81 (95% CI 1.46, 5.41), p=0.001 |
| Genesis II Oxinium CR (class)/Profix Mobile | 57 | 88 | 663 | 8.60 | 0 - 6Mth: HR=7.09 (95% CI 2.66, 18.90), p<0.001 |
| | . | . | . | . | 6Mth - 1.5Yr: HR=45.39 (95% CI 32.07, 64.25), p<0.001 |
| | . | . | . | . | 1.5Yr - 2Yr: HR=33.74 (95% CI 16.07, 70.81), p<0.001 |
| | . | . | . | . | 2Yr+: HR=6.35 (95% CI 3.76, 10.74), p<0.001 |
| Genesis II Oxinium PS (ctd)/Genesis II (class) | 17 | 56 | 569 | 2.99 | 0 - 1Yr: HR=17.35 (95% CI 9.60, 31.34), p<0.001 |
| | . | . | . | . | 1Yr - 1.5Yr: HR=8.21 (95% CI 2.05, 32.82), p=0.002 |
| | . | . | . | . | 1.5Yr - 3Yr: HR=4.17 (95% CI 1.04, 16.66), p=0.043 |
| | . | . | . | . | 3Yr+: HR=1.16 (95% CI 0.29, 4.65), p=0.831 |
| Genesis II Oxinium PS (ctd)/Genesis II (keel) | 71 | 269 | 3265 | 2.17 | Entire Period: HR=4.61 (95% CI 3.65, 5.82), p<0.001 |
| HLS Noetos/HLS Noetos | 45 | 294 | 3368 | 1.34 | Entire Period: HR=2.77 (95% CI 2.07, 3.71), p<0.001 |
| IB II/IB II | 41 | 199 | 2667 | 1.54 | 0 - 2Yr: HR=0.91 (95% CI 0.29, 2.83), p=0.876 |
| | . | . | . | . | 2Yr - 2.5Yr: HR=5.27 (95% CI 1.70, 16.29), p=0.003 |
| | . | . | . | . | 2.5Yr+: HR=5.36 (95% CI 3.85, 7.47), p<0.001 |
| Interax/Interax | 12 | 52 | 532 | 2.26 | 0 - 3Yr: HR=0.88 (95% CI 0.12, 6.26), p=0.899 |
| | . | . | . | . | 3Yr+: HR=9.56 (95% CI 5.29, 17.26), p<0.001 |
| Journey Oxinium/Journey | 434 | 3033 | 35699 | 1.22 | 0 - 3Mth: HR=0.26 (95% CI 0.08, 0.81), p=0.020 |
| | . | . | . | . | 3Mth - 1.5Yr: HR=2.32 (95% CI 1.85, 2.90), p<0.001 |
| | . | . | . | . | 1.5Yr - 2.5Yr: HR=2.10 (95% CI 1.56, 2.83), p<0.001 |
| | . | . | . | . | 2.5Yr - 3Yr: HR=1.59 (95% CI 0.90, 2.80), p=0.111 |
| | . | . | . | . | 3Yr+: HR=3.07 (95% CI 2.73, 3.44), p<0.001 |
| Maxim (class)/Vanguard (ctd) | 75 | 413 | 5765 | 1.30 | 0 - 2Yr: HR=1.58 (95% CI 0.90, 2.78), p=0.114 |
| | . | . | . | . | 2Yr - 3Yr: HR=1.27 (95% CI 0.41, 3.95), p=0.676 |
| | . | . | . | . | 3Yr - 4.5Yr: HR=3.48 (95% CI 1.74, 6.97), p<0.001 |
| | . | . | . | . | 4.5Yr - 6Yr: HR=1.07 (95% CI 0.27, 4.30), p=0.919 |
| | . | . | . | . | 6Yr - 9.5Yr: HR=2.12 (95% CI 1.06, 4.24), p=0.033 |
| | . | . | . | . | 9.5Yr+: HR=5.02 (95% CI 3.70, 6.82), p<0.001 |
| Nexgen LPS Flex (class)/Nexgen | 119 | 2114 | 17167 | 0.69 | 0 - 1.5Yr: HR=2.00 (95% CI 1.56, 2.58), p<0.001 |
| | . | . | . | . | 1.5Yr - 2Yr: HR=1.70 (95% CI 0.98, 2.93), p=0.056 |
| | . | . | . | . | 2Yr+: HR=0.88 (95% CI 0.66, 1.18), p=0.401 |
| Optetrak Logic CR/Optetrak Logic | 210 | 1887 | 11007 | 1.91 | 0 - 1.5Yr: HR=1.09 (95% CI 0.75, 1.58), p=0.657 |
| | . | . | . | . | 1.5Yr - 2Yr: HR=2.32 (95% CI 1.39, 3.85), p=0.001 |
| | . | . | . | . | 2Yr - 3.5Yr: HR=3.71 (95% CI 2.80, 4.91), p<0.001 |
| | . | . | . | . | 3.5Yr+: HR=7.87 (95% CI 6.56, 9.45), p<0.001 |
| Optetrak-CR (ctd)/Optetrak (ctd) | 12 | 92 | 982 | 1.22 | Entire Period: HR=2.78 (95% CI 1.58, 4.87), p<0.001 |
| Optetrak-PS/Optetrak | 390 | 2410 | 29114 | 1.34 | 0 - 1Mth: HR=0.22 (95% CI 0.03, 1.57), p=0.131 |
| | . | . | . | . | 1Mth - 1.5Yr: HR=1.88 (95% CI 1.45, 2.44), p<0.001 |
| | . | . | . | . | 1.5Yr - 2.5Yr: HR=2.78 (95% CI 2.07, 3.72), p<0.001 |
| | . | . | . | . | 2.5Yr - 3Yr: HR=1.89 (95% CI 1.04, 3.42), p=0.035 |
| | . | . | . | . | 3Yr - 5.5Yr: HR=2.22 (95% CI 1.65, 2.97), p<0.001 |
| | . | . | . | . | 5.5Yr+: HR=4.05 (95% CI 3.55, 4.63), p<0.001 |
| Optetrak-PS/Optetrak RBK | 110 | 1127 | 11949 | 0.92 | Entire Period: HR=1.95 (95% CI 1.62, 2.35), p<0.001 |
| Optetrak-PS/Optetrak-PS | 14 | 55 | 580 | 2.41 | Entire Period: HR=5.53 (95% CI 3.28, 9.34), p<0.001 |

# Prostheses with Higher than Anticipated Rates of Revision

| Femoral/Tibial | N Revised | N Total | Obs. Years | Revisions/ 100 Obs. Yrs | Hazard Ratio, P Value |
|---|---|---|---|---|---|
| PFC Sigma PS (ctd)/MBT (cless) | 26 | 316 | 3396 | 0.77 | Entire Period: HR=1.52 (95% CI 1.03, 2.22), p=0.032 |
| Profix Oxinium (cless)/Profix | 33 | 75 | 779 | 4.24 | 0 - 9Mth: HR=5.96 (95% CI 2.24, 15.88), p<0.001 |
| | . | . | . | . | 9Mth - 2Yr: HR=28.92 (95% CI 18.84, 44.38), p<0.001 |
| | . | . | . | . | 2Yr+: HR=3.15 (95% CI 1.58, 6.31), p=0.001 |
| Profix Oxinium (cless)/Profix Mobile | 71 | 158 | 1451 | 4.89 | 0 - 9Mth: HR=3.10 (95% CI 1.16, 8.26), p=0.023 |
| | . | . | . | . | 9Mth - 1.5Yr: HR=28.71 (95% CI 19.93, 41.36), p<0.001 |
| | . | . | . | . | 1.5Yr - 2Yr: HR=19.24 (95% CI 10.00, 37.02), p<0.001 |
| | . | . | . | . | 2Yr - 2.5Yr: HR=37.76 (95% CI 22.32, 63.88), p<0.001 |
| | . | . | . | . | 2.5Yr - 3Yr: HR=23.76 (95% CI 10.65, 52.98), p<0.001 |
| | . | . | . | . | 3Yr+: HR=2.39 (95% CI 1.24, 4.60), p=0.008 |
| Profix Oxinium (ctd)/Profix (cless) | 15 | 100 | 1397 | 1.07 | Entire Period: HR=2.08 (95% CI 1.26, 3.45), p=0.004 |
| Profix Oxinium (ctd)/Profix Mobile | 30 | 228 | 3377 | 0.89 | Entire Period: HR=1.78 (95% CI 1.25, 2.55), p=0.001 |
| Profix/Profix Mobile | 117 | 1005 | 13662 | 0.86 | 0 - 1.5Yr: HR=2.81 (95% CI 2.06, 3.83), p<0.001 |
| | . | . | . | . | 1.5Yr - 2.5Yr: HR=3.23 (95% CI 2.10, 4.96), p<0.001 |
| | . | . | . | . | 2.5Yr - 3Yr: HR=1.29 (95% CI 0.41, 3.99), p=0.664 |
| | . | . | . | . | 3Yr - 6.5Yr: HR=2.05 (95% CI 1.35, 3.11), p<0.001 |
| | . | . | . | . | 6.5Yr+: HR=1.14 (95% CI 0.80, 1.62), p=0.475 |
| Rotaglide Plus/Rotaglide Plus | 89 | 631 | 8333 | 1.07 | 0 - 1.5Yr: HR=1.34 (95% CI 0.76, 2.37), p=0.305 |
| | . | . | . | . | 1.5Yr - 2Yr: HR=3.64 (95% CI 1.82, 7.27), p<0.001 |
| | . | . | . | . | 2Yr+: HR=2.63 (95% CI 2.08, 3.34), p<0.001 |
| SAL/SAL | 15 | 56 | 771 | 1.94 | 0 - 8.5Yr: HR=1.65 (95% CI 0.62, 4.40), p=0.315 |
| | . | . | . | . | 8.5Yr+: HR=9.86 (95% CI 5.45, 17.84), p<0.001 |
| Score (cless)/Score (cless) | 267 | 3026 | 25072 | 1.06 | Entire Period: HR=1.90 (95% CI 1.68, 2.14), p<0.001 |
| Score (cless)/Score (ctd) | 128 | 1679 | 12245 | 1.05 | Entire Period: HR=1.89 (95% CI 1.59, 2.24), p<0.001 |
| Scorpio NRG PS (cless)/Series 7000 (cless) | 96 | 1172 | 13166 | 0.73 | Entire Period: HR=1.33 (95% CI 1.09, 1.63), p=0.005 |
| TC-Plus (cless)/TC-Plus (ctd) | 8 | 63 | 764 | 1.05 | Entire Period: HR=2.48 (95% CI 1.24, 4.95), p=0.010 |
| Trac/Trac | 27 | 138 | 1730 | 1.56 | Entire Period: HR=3.38 (95% CI 2.32, 4.92), p<0.001 |
| Vanguard PS/Regenerex | 45 | 465 | 4257 | 1.06 | 0 - 1.5Yr: HR=2.52 (95% CI 1.59, 4.00), p<0.001 |
| | . | . | . | . | 1.5Yr - 2Yr: HR=2.78 (95% CI 1.16, 6.68), p=0.022 |
| | . | . | . | . | 2Yr+: HR=1.60 (95% CI 1.06, 2.44), p=0.026 |
| Vanguard PS/Vanguard | 392 | 5405 | 52140 | 0.75 | 0 - 1.5Yr: HR=1.94 (95% CI 1.65, 2.27), p<0.001 |
| | . | . | . | . | 1.5Yr+: HR=1.32 (95% CI 1.16, 1.50), p<0.001 |
| *LCS Duofix | 709 | 4866 | 60743 | 1.17 | Entire Period: HR=2.49 (95% CI 2.31, 2.69), p<0.001 |
| *LCS PS | 78 | 638 | 6891 | 1.13 | Entire Period: HR=2.45 (95% CI 1.96, 3.06), p<0.001 |
| *Renasys | 20 | 121 | 1602 | 1.25 | Entire Period: HR=2.80 (95% CI 1.80, 4.33), p<0.001 |

Note: Components have been compared to all other modern total knee components

*Femoral Component

**Tibial Component

# Prostheses with Higher than Anticipated Rates of Revision

**Table IP20 Cumulative Percent Revision of Total Knee Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| CPR | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 20 Yrs |
|---|---|---|---|---|---|
| **Newly Identified** | | | | | |
| E.Motion (class)/E.Motion Pro (ctd) | 2.0 (0.8, 5.2) | 4.6 (2.3, 9.0) | 6.4 (3.4, 11.8) | | |
| **Re-Identified and Still Used** | | | | | |
| ACS (class)/ACS Fixed | 1.3 (1.0, 1.8) | 3.7 (3.0, 4.4) | 4.4 (3.7, 5.2) | 5.7 (4.8, 6.8) | |
| Active Knee (class)/Active Knee | 1.1 (0.9, 1.4) | 3.5 (3.1, 4.0) | 5.0 (4.5, 5.6) | 8.7 (8.0, 9.4) | 15.0 (13.9, 16.2) |
| Apex Knee CR (class)/Apex Knee (class) | 2.5 (1.4, 4.2) | 5.0 (3.4, 7.2) | 5.6 (4.0, 8.0) | 6.5 (4.6, 9.1) | |
| Attune PS (ctd)/Attune (class) | 1.7 (1.1, 2.6) | 3.9 (2.8, 5.3) | | | |
| Columbus/Columbus | 1.2 (1.0, 1.4) | 2.8 (2.4, 3.2) | 3.8 (3.4, 4.4) | 6.2 (5.2, 7.2) | |
| E.Motion/E.Motion | 2.5 (1.7, 3.7) | 5.6 (4.4, 7.2) | 6.5 (5.1, 8.2) | 8.4 (6.7, 10.5) | |
| Mutars/Mutars | 7.7 (5.6, 10.6) | 17.0 (13.5, 21.4) | 22.9 (18.3, 28.5) | | |
| Trekking/Trekking | 2.2 (1.6, 3.2) | 4.1 (3.1, 5.3) | 5.0 (3.9, 6.3) | 6.3 (5.0, 7.9) | |
| *Legion Oxinium FS | 5.1 (3.5, 7.3) | 7.0 (5.1, 9.6) | 8.5 (6.3, 11.4) | 10.7 (7.9, 14.3) | |
| **Legion Revision Tibial Baseplate | 2.8 (2.1, 3.9) | 4.4 (3.4, 5.7) | 5.7 (4.4, 7.2) | 8.3 (6.5, 10.6) | |
| **Identified and no longer used** | | | | | |
| ACS/ACS Mobile PC (class) | 7.7 (4.2, 13.8) | 19.3 (13.5, 27.2) | 20.1 (14.2, 28.2) | 24.5 (17.9, 33.0) | |
| AMK/AMK | 1.0 (0.2, 3.9) | 5.0 (2.7, 9.1) | 6.6 (3.9, 11.1) | 11.4 (7.5, 16.9) | 18.3 (12.1, 27.1) |
| Advance/Advance | 2.0 (1.3, 3.1) | 5.3 (4.1, 6.9) | 6.4 (5.0, 8.1) | 8.5 (6.9, 10.6) | |
| Buechel-Pappas/Buechel-Pappas | 1.9 (1.0, 3.6) | 5.7 (3.9, 8.2) | 7.9 (5.8, 10.7) | 10.5 (8.0, 13.7) | |
| Eska RP/Eska RP | 7.5 (2.5, 21.5) | 12.7 (5.5, 27.9) | 18.2 (9.1, 34.5) | 21.1 (11.1, 37.9) | |
| Evolis (class)/Evolis (class) | 2.3 (0.6, 8.9) | 8.0 (3.9, 16.1) | 10.3 (5.5, 18.9) | 11.5 (6.4, 20.4) | |
| Gemini MK II/Gemini MK II | 9.5 (2.5, 33.0) | 14.3 (4.8, 38.0) | 23.8 (10.7, 48.1) | 23.8 (10.7, 48.1) | |
| Genesis (ctd)/Genesis (ctd) | 0.0 (0.0, 0.0) | 6.7 (2.6, 16.8) | 10.0 (4.6, 20.9) | 16.1 (8.6, 28.9) | 24.1 (13.3, 41.4) |
| Genesis II CR (class)/Profix Mobile (ctd) | 2.9 (1.4, 6.1) | 7.7 (4.9, 11.9) | 9.4 (6.3, 14.0) | 14.7 (10.7, 20.1) | 17.4 (12.8, 23.3) |
| Genesis II Oxinium CR (class)/Genesis II | 11.8 (7.0, 19.5) | 38.9 (30.4, 48.7) | 39.8 (31.3, 49.7) | 42.8 (34.0, 52.7) | |
| Genesis II Oxinium CR (class)/Profix Mobile | 24.0 (16.3, 34.4) | 52.8 (42.8, 63.5) | 57.4 (47.4, 67.9) | 61.1 (51.0, 71.3) | 67.1 (56.7, 77.1) |
| Genesis II Oxinium PS (ctd)/Genesis II (class) | 19.6 (11.4, 32.7) | 26.8 (17.1, 40.4) | 30.4 (20.1, 44.2) | 30.4 (20.1, 44.2) | |
| Genesis II Oxinium PS (ctd)/Genesis II (keel) | 4.5 (2.6, 7.7) | 14.9 (11.1, 19.7) | 19.0 (14.8, 24.3) | 22.6 (18.0, 28.2) | |
| HLS Noetos/HLS Noetos | 3.4 (1.8, 6.2) | 8.6 (5.9, 12.4) | 10.7 (7.7, 14.9) | 13.5 (10.0, 18.1) | |
| IB II/IB II | 0.0 (0.0, 0.0) | 3.6 (1.7, 7.3) | 7.8 (4.8, 12.7) | 15.9 (11.3, 22.1) | 27.2 (20.1, 36.1) |
| Interax/Interax | 0.0 (0.0, 0.0) | 2.0 (0.3, 13.4) | 8.3 (3.2, 20.7) | 13.0 (6.0, 26.8) | |
| Journey Oxinium/Journey | 1.4 (1.0, 1.9) | 4.6 (3.9, 5.4) | 6.5 (5.6, 7.4) | 11.2 (10.1, 12.4) | |
| Maxim (class)/Vanguard (ctd) | 1.2 (0.5, 2.9) | 3.7 (2.2, 6.0) | 6.0 (4.0, 8.8) | 9.4 (6.9, 12.8) | 24.6 (19.8, 30.2) |
| Nexgen LPS Flex (class)/Nexgen | 2.4 (1.8, 3.2) | 4.3 (3.6, 5.3) | 5.0 (4.1, 6.0) | 6.2 (5.1, 7.4) | |
| Optetrak Logic CR/Optetrak Logic | 1.1 (0.7, 1.6) | 4.4 (3.5, 5.4) | 8.2 (6.9, 9.6) | | |
| Optetrak-CR (ctd)/Optetrak (ctd) | 0.0 (0.0, 0.0) | 6.6 (3.0, 14.0) | 10.1 (5.4, 18.5) | 12.8 (7.3, 22.0) | |
| Optetrak-PS/Optetrak | 1.5 (1.1, 2.0) | 4.8 (4.0, 5.7) | 6.4 (5.5, 7.5) | 12.2 (10.9, 13.6) | 21.7 (19.5, 24.0) |
| Optetrak-PS/Optetrak RBK | 1.8 (1.2, 2.7) | 4.6 (3.5, 6.0) | 6.0 (4.7, 7.5) | 8.7 (7.1, 10.6) | |
| Optetrak-PS/Optetrak-PS | 1.8 (0.3, 12.2) | 16.4 (8.9, 29.1) | 20.0 (11.6, 33.3) | 24.4 (14.9, 38.5) | |
| PFC Sigma PS (ctd)/MBT (class) | 2.2 (1.1, 4.6) | 5.4 (3.4, 8.6) | 7.1 (4.7, 10.5) | 7.4 (5.0, 10.9) | |
| Profix Oxinium (class)/Profix | 13.3 (7.4, 23.4) | 36.1 (26.4, 48.1) | 37.5 (27.6, 49.5) | 42.0 (31.7, 54.2) | 46.0 (35.1, 58.5) |
| Profix Oxinium (class)/Profix Mobile | 9.0 (5.4, 14.6) | 40.2 (32.9, 48.3) | 41.5 (34.2, 49.7) | 46.0 (38.4, 54.3) | |
| Profix Oxinium (ctd)/Profix (class) | 4.0 (1.5, 10.3) | 8.0 (4.1, 15.4) | 9.0 (4.8, 16.6) | 11.2 (6.4, 19.4) | 16.6 (10.3, 26.2) |
| Profix Oxinium (ctd)/Profix Mobile | 2.2 (0.9, 5.2) | 7.2 (4.4, 11.4) | 9.4 (6.3, 14.1) | 11.8 (8.2, 16.8) | 14.4 (10.2, 20.0) |
| Profix/Profix Mobile | 2.3 (1.5, 3.4) | 6.5 (5.1, 8.2) | 8.2 (6.6, 10.1) | 10.0 (8.3, 12.1) | 13.6 (11.3, 16.3) |
| Rotaglide Plus/Rotaglide Plus | 0.8 (0.3, 1.9) | 4.1 (2.8, 6.0) | 5.8 (4.2, 8.0) | 11.1 (8.8, 14.0) | 18.3 (14.9, 22.3) |
| SAL/SAL | 0.0 (0.0, 0.0) | 1.9 (0.3, 12.6) | 1.9 (0.3, 12.6) | 14.8 (7.3, 28.6) | 37.5 (24.0, 55.2) |
| Score (class)/Score (class) | 1.5 (1.1, 2.0) | 4.6 (3.9, 5.4) | 6.3 (5.5, 7.3) | 10.1 (8.9, 11.4) | |
| Score (class)/Score (ctd) | 1.5 (1.0, 2.2) | 3.8 (3.0, 4.9) | 5.6 (4.6, 6.9) | 9.3 (7.7, 11.1) | |

| CPR | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 20 Yrs |
|---|---|---|---|---|---|
| Scorpio NRG PS (class)/Series 7000 (class) | 1.2 (0.7, 2.0) | 4.9 (3.8, 6.3) | 6.2 (4.9, 7.7) | 7.4 (6.0, 9.1) | |
| TC-Plus (class)/TC-Plus (ctd) | 1.6 (0.2, 10.7) | 8.4 (3.6, 19.1) | 8.4 (3.6, 19.1) | 14.4 (7.4, 26.9) | |
| Trac/Trac | 2.2 (0.7, 6.6) | 5.9 (3.0, 11.4) | 9.0 (5.2, 15.2) | 15.1 (9.9, 22.8) | |
| Vanguard PS/Regenerex | 3.2 (2.0, 5.3) | 7.1 (5.1, 9.9) | 7.8 (5.7, 10.6) | 9.6 (7.2, 12.9) | |
| Vanguard PS/Vanguard | 1.8 (1.5, 2.2) | 4.2 (3.7, 4.8) | 5.3 (4.7, 5.9) | 7.3 (6.6, 8.1) | |
| *LCS Duofix | 1.5 (1.2, 1.9) | 5.9 (5.3, 6.6) | 9.7 (8.9, 10.6) | 13.0 (12.1, 14.1) | |
| *LCS PS | 2.1 (1.2, 3.5) | 6.7 (5.0, 9.0) | 8.5 (6.6, 11.0) | 12.0 (9.6, 14.8) | |
| *Renasys | 2.5 (0.8, 7.5) | 4.2 (1.8, 9.8) | 8.5 (4.6, 15.1) | 11.2 (6.7, 18.5) | |

Note: *Femoral Component
**Tibial Component

**Table IP21 Yearly Usage of Total Knee Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| Year of Implant | ≤2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Newly Identified** | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| E.Motion (class)/E.Motion Pro (ctd) | . | . | . | . | . | . | . | 1 | 6 | . | 6 | 24 | 24 | 36 | 29 | 23 | 36 | 20 |
| **Re-Identified and Still Used** | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| ACS (class)/ACS Fixed | . | . | . | . | 41 | 118 | 284 | 337 | 331 | 238 | 266 | 259 | 319 | 209 | 169 | 127 | 181 | 142 |
| Active Knee (class)/Active Knee | 3293 | 483 | 412 | 479 | 601 | 500 | 427 | 319 | 336 | 176 | 91 | 35 | 21 | 24 | 17 | 1 | 37 | 63 |
| Apex Knee CR (class)/Apex Knee (class) | . | . | . | . | . | 69 | 83 | 118 | 78 | 11 | 3 | 29 | 53 | 6 | 23 | 48 | 7 | 1 |
| Attune PS (ctd)/Attune (class) | . | . | . | . | . | . | . | . | . | . | . | . | 1 | 38 | 530 | 287 | 136 | 218 |
| Columbus/Columbus | 230 | 148 | 156 | 135 | 135 | 108 | 69 | 36 | 60 | 118 | 358 | 670 | 828 | 1115 | 1105 | 1080 | 1084 | 1067 |
| E.Motion/E.Motion | . | . | 12 | 87 | 114 | 129 | 171 | 71 | 93 | 87 | 101 | 64 | 45 | 12 | 15 | 14 | 13 | 13 |
| Mutars/Mutars | . | . | . | . | . | 2 | 12 | 8 | 15 | 14 | 26 | 32 | 63 | 56 | 62 | 71 | 75 | 46 |
| Trekking/Trekking | . | . | . | 35 | 102 | 133 | 107 | 108 | 106 | 129 | 216 | 143 | 100 | 65 | 20 | 18 | 10 | 12 |
| *Legion Oxinium FS | 29 | 19 | 28 | 28 | 24 | 31 | 30 | 18 | 23 | 25 | 24 | 37 | 30 | 37 | 53 | 38 | 41 | 30 |
| **Legion Revision Tibial Baseplate | 49 | 48 | 40 | 56 | 47 | 63 | 54 | 47 | 38 | 50 | 50 | 87 | 93 | 129 | 173 | 144 | 151 | 125 |
| **Identified and no longer used** | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| ACS/ACS Mobile PC (class) | . | . | . | . | 20 | 37 | 57 | 17 | . | . | . | . | . | . | . | . | . | . |
| AMK/AMK | 203 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Advance/Advance | 91 | 5 | 43 | 115 | 138 | 74 | 7 | 92 | 92 | 100 | 90 | 69 | 58 | 17 | 13 | 5 | . | . |
| Buechel-Pappas/Buechel-Pappas | 91 | 84 | 100 | 148 | 44 | 4 | . | 7 | 1 | . | . | . | . | . | . | . | . | . |
| Eska RP/Eska RP | 38 | . | 2 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Evolis (class)/Evolis (class) | . | 17 | 5 | 11 | 9 | 20 | 7 | 11 | 7 | . | . | . | . | . | . | . | . | . |
| Gemini MK II/Gemini MK II | 21 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Genesis (ctd)/Genesis (ctd) | 62 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Genesis II CR (class)/Profix Mobile (ctd) | 173 | 12 | 6 | 9 | 17 | 2 | 22 | . | . | . | . | . | . | . | . | . | . | . |
| Genesis II Oxinium CR (class)/Genesis II | 110 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Genesis II Oxinium CR (class)/Profix Mobile | 88 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Genesis II Oxinium PS (ctd)/Genesis II (class) | 4 | 4 | 11 | 35 | 1 | 1 | . | . | . | . | . | . | . | . | . | . | . | . |
| Genesis II Oxinium PS (ctd)/Genesis II (keel) | 269 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| HLS Noetos/HLS Noetos | 96 | 45 | 56 | 48 | 28 | 20 | 1 | . | . | . | . | . | . | . | . | . | . | . |
| IB II/IB II | 199 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Interax/Interax | 52 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |

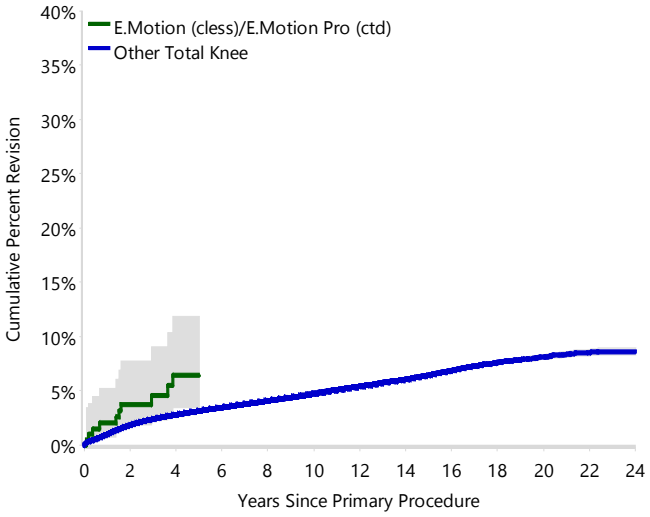
# Prostheses with Higher than Anticipated Rates of Revision

| Year of Implant | ≤2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Journey Oxinium/Journey | 471 | 541 | 555 | 464 | 334 | 343 | 325 | . | . | . | . | . | . | . | . | . | . | . |
| Maxim (cless)/Vanguard (ctd) | 403 | 10 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Nexgen LPS Flex (cless)/Nexgen | . | . | . | 73 | 78 | 149 | 312 | 238 | 280 | 225 | 252 | 221 | 188 | 82 | 12 | 4 | . | . |
| Optetrak Logic CR/Optetrak Logic | . | . | . | . | . | . | . | 21 | 171 | 234 | 321 | 339 | 286 | 195 | 226 | 83 | 11 | . |
| Optetrak-CR (ctd)/Optetrak (ctd) | 38 | 7 | 4 | . | 5 | 6 | 8 | 24 | . | . | . | . | . | . | . | . | . | . |
| Optetrak-PS/Optetrak | 1132 | 168 | 202 | 198 | 202 | 200 | 151 | 115 | 30 | 3 | 5 | 3 | 1 | . | . | . | . | . |
| Optetrak-PS/Optetrak RBK | 255 | 166 | 119 | 82 | 40 | 37 | 50 | 100 | 56 | 46 | 88 | 75 | 13 | . | . | . | . | . |
| Optetrak-PS/Optetrak-PS | 55 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| PFC Sigma PS (ctd)/MBT (class) | 49 | . | . | . | 25 | 89 | 110 | 42 | . | 1 | . | . | . | . | . | . | . | . |
| Profix Oxinium (class)/Profix | 75 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Profix Oxinium (class)/Profix Mobile | 158 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Profix Oxinium (ctd)/Profix (class) | 79 | 10 | 8 | 2 | . | 1 | . | . | . | . | . | . | . | . | . | . | . | . |
| Profix Oxinium (ctd)/Profix Mobile | 225 | 1 | 2 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Profix/Profix Mobile | 980 | 11 | 12 | 2 | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Rotaglide Plus/Rotaglide Plus | 616 | 15 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| SAL/SAL | 56 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Score (class)/Score (class) | 12 | 135 | 212 | 187 | 204 | 195 | 239 | 273 | 263 | 170 | 160 | 214 | 151 | 252 | 354 | 5 | . | . |
| Score (class)/Score (ctd) | 6 | 3 | 3 | . | 5 | 15 | 90 | 181 | 324 | 300 | 267 | 122 | 205 | 114 | 44 | . | . | . |
| Scorpio NRG PS (class)/Series 7000 (class) | 76 | 185 | 171 | 166 | 114 | 67 | 71 | 76 | 72 | 77 | 69 | 28 | . | . | . | . | . | . |
| TC-Plus (class)/TC-Plus (ctd) | 63 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Trac/Trac | 138 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Vanguard PS/Regenerex | . | . | 4 | 121 | 54 | 27 | 15 | 21 | 18 | 76 | 59 | 56 | 14 | . | . | . | . | . |
| Vanguard PS/Vanguard | 248 | 321 | 430 | 478 | 607 | 561 | 451 | 523 | 445 | 331 | 310 | 205 | 186 | 136 | 117 | 56 | . | . |
| *LCS Duofix | 2480 | 1532 | 854 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| *LCS PS | . | 8 | 157 | 203 | 109 | 51 | 69 | 39 | 2 | . | . | . | . | . | . | . | . | . |
| *Renasys | 107 | 14 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |

Note: *Femoral Component
**Tibial Component

**Figure IP5 Cumulative Percent Revision of Newly Identified Total Knee Prostheses**

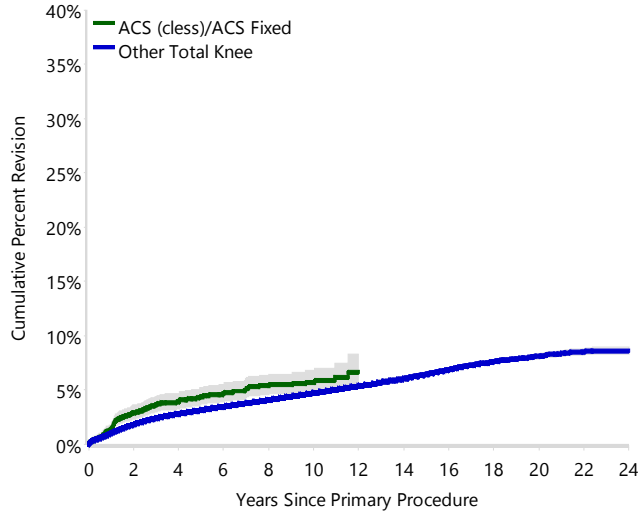
**Newly Identified**

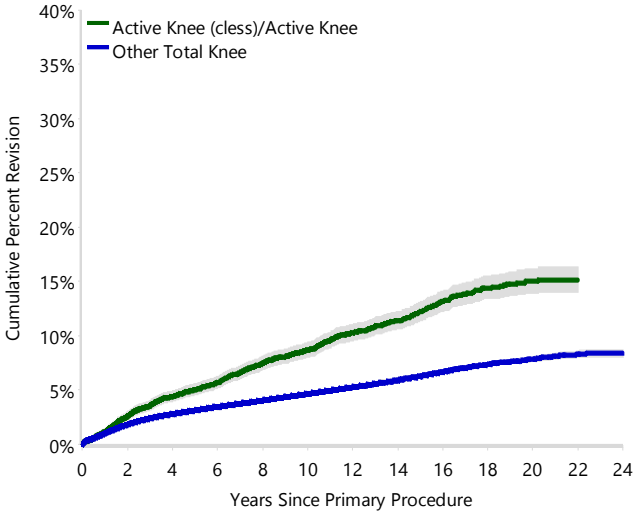


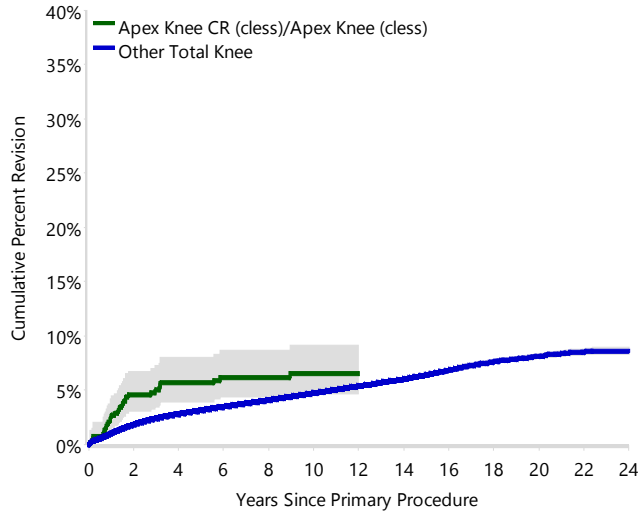
# Prostheses with Higher than Anticipated Rates of Revision

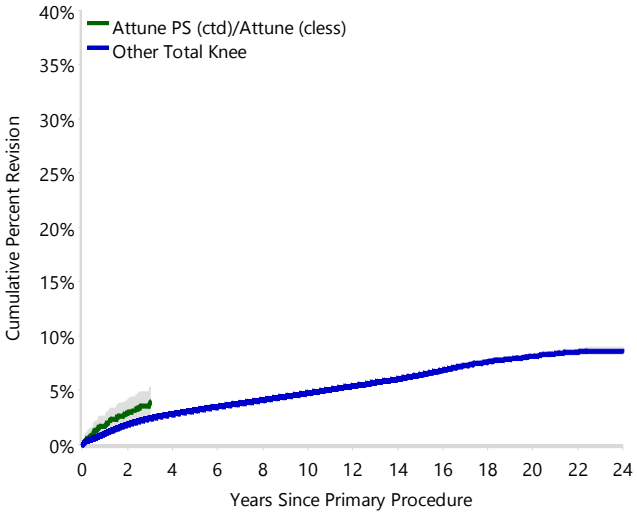
**Figure IP6 Cumulative Percent Revision of Re-Identified and Still Used Total Knee Prostheses**

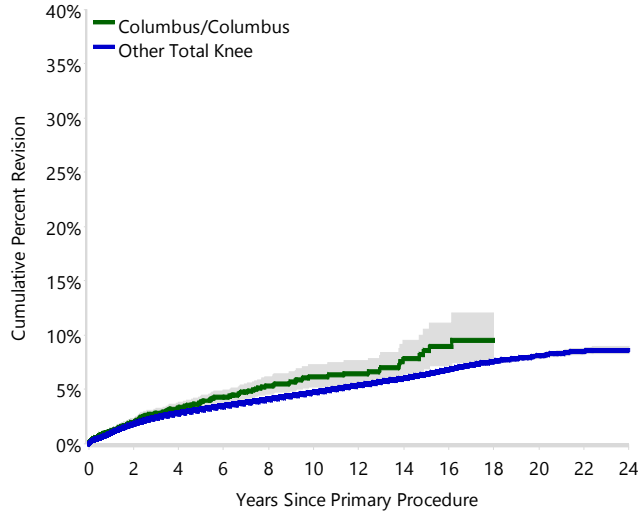
**Re-Identified and Still Used**

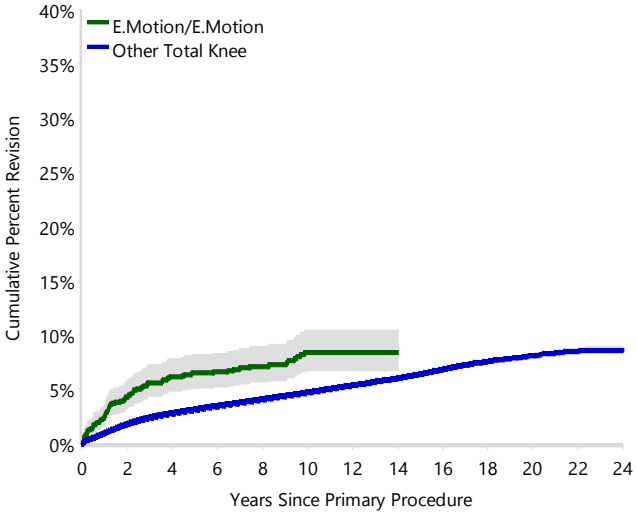


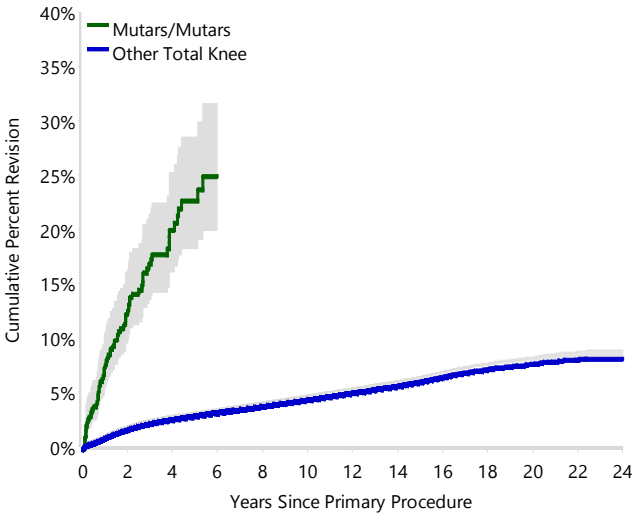



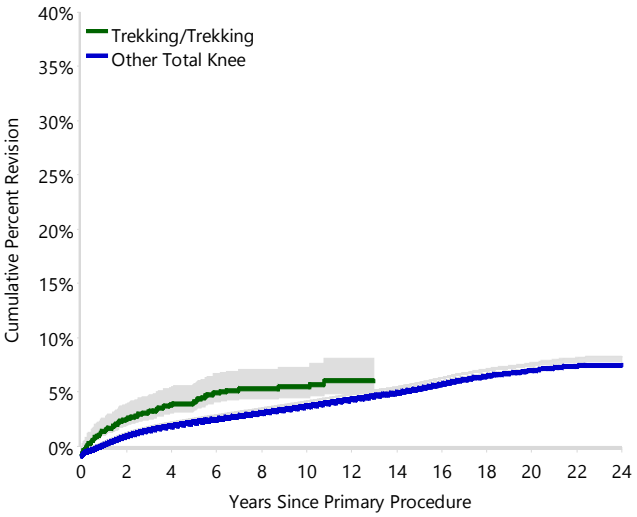



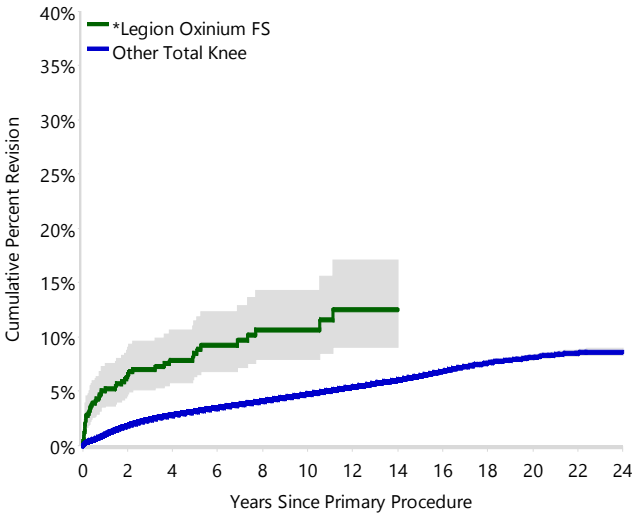



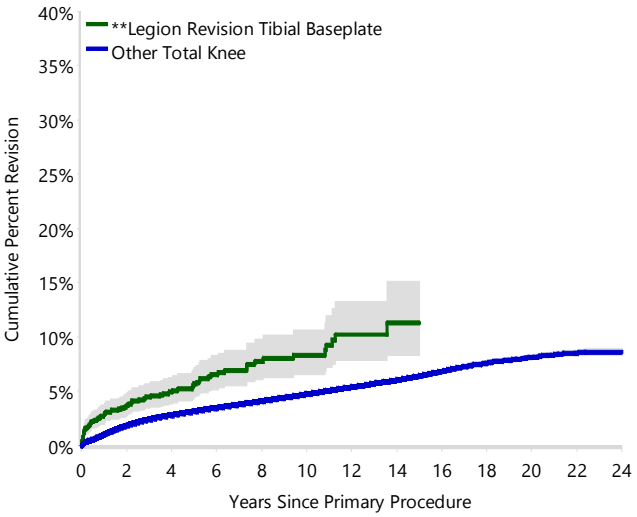



# Prostheses with Higher than Anticipated Rates of Revision



# Prostheses with Higher than Anticipated Rates of Revision

## Primary Partial Shoulder Replacement

### HEMI STEMMED ANATOMIC

There are no newly identified hemi stemmed anatomic shoulder prostheses.

**Table IP22 Revision Rate of Hemi Stemmed Anatomic Shoulder Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| Humeral Stem/Head | N Revised | N Total | Obs. Years | Revisions/ 100 Obs. Yrs | Hazard Ratio, P Value |
|---|---|---|---|---|---|
| Re-Identified and Still Used | | | | | |
| Delta Xtend/Delta Xtend | 14 | 79 | 524 | 2.67 | Entire Period: HR=1.83 (95% CI 1.07, 3.13), p=0.026 |
| Global Unite/Global Unite | 43 | 227 | 1374 | 3.13 | Entire Period: HR=1.77 (95% CI 1.29, 2.43), p<0.001 |

Note: Components have been compared to all other modern hemi stemmed anatomic shoulder components

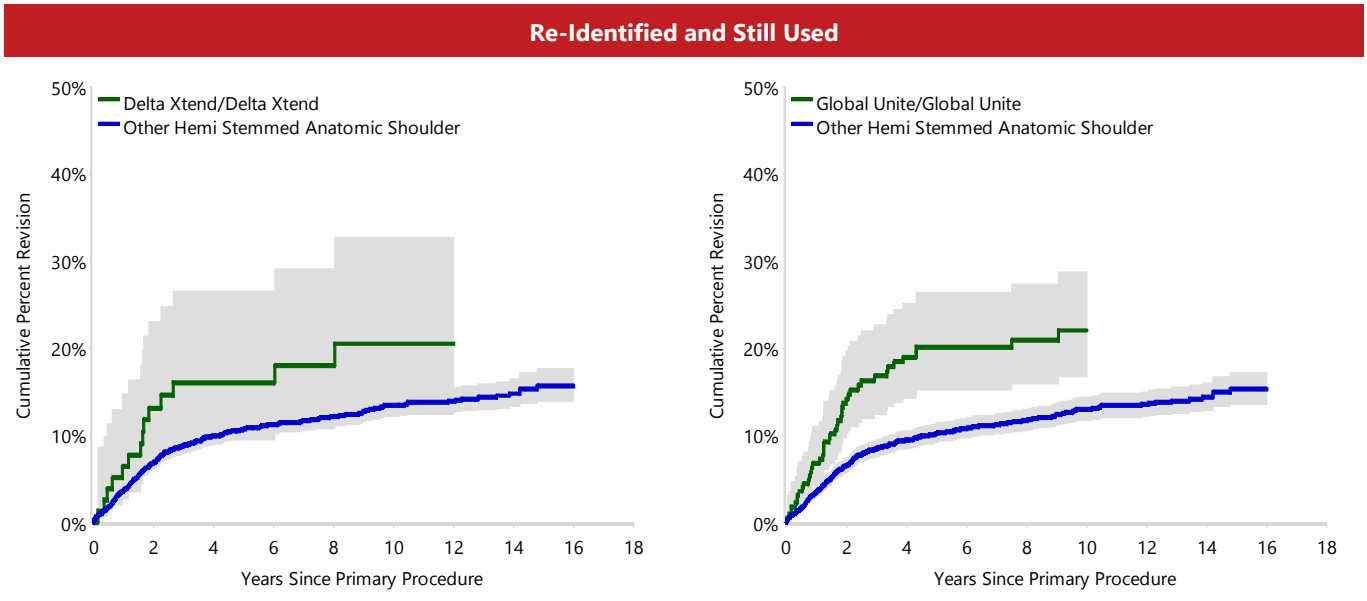
**Table IP23 Cumulative Percent Revision of Hemi Stemmed Anatomic Shoulder Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| CPR | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 13 Yrs |
|---|---|---|---|---|---|
| Re-Identified and Still Used | | | | | |
| Delta Xtend/Delta Xtend | 6.4 (2.7, 14.7) | 16.0 (9.4, 26.5) | 16.0 (9.4, 26.5) | 17.9 (10.8, 29.0) | |
| Global Unite/Global Unite | 6.8 (4.1, 11.0) | 16.8 (12.3, 22.6) | 20.1 (15.2, 26.3) | 20.1 (15.2, 26.3) | |

**Table IP24 Yearly Usage of Hemi Stemmed Anatomic Shoulder Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| Year of Implant | ≤2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Re-Identified and Still Used | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Delta Xtend/Delta Xtend | 7 | 9 | 9 | 5 | 10 | 7 | 6 | 5 | 4 | 3 | 6 | 3 | 1 | . | 1 | 2 | 1 |
| Global Unite/Global Unite | . | . | . | . | 15 | 37 | 25 | 38 | 37 | 14 | 12 | 11 | 12 | 6 | 2 | 7 | 11 |

**Figure IP7 Cumulative Percent Revision of Re-Identified and Still Used Hemi Stemmed Anatomic Shoulder Prostheses**



## Primary Total Shoulder Replacement

### TOTAL STEMMED ANATOMIC

There are no newly identified total stemmed anatomic shoulder prostheses

**Table IP25 Revision Rate of Total Stemmed Anatomic Shoulder Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| Humeral Stem/Glenoid | N Revised | N Total | Obs. Years | Revisions/ 100 Obs. Yrs | Hazard Ratio, P Value |
|---|---|---|---|---|---|
| **Re-Identified and Still Used** | . | . | . | . | |
| Equinoxe/Equinoxe (All Poly) | 35 | 305 | 1739 | 2.01 | 0 - 1.5Yr: HR=1.40 (95% CI 0.73, 2.66), p=0.309 |
| | . | . | . | . | 1.5Yr+: HR=3.55 (95% CI 2.31, 5.46), p<0.001 |
| Equinoxe/Equinoxe (Hybrid Glenoid) | 49 | 453 | 2093 | 2.34 | 0 - 2.5Yr: HR=1.59 (95% CI 1.03, 2.46), p=0.036 |
| | . | . | . | . | 2.5Yr+: HR=4.81 (95% CI 3.05, 7.59), p<0.001 |
| **Identified and no longer used** | . | . | . | . | |
| Comprehensive/Custom Made (Comprehensive) | 7 | 18 | 75 | 9.35 | Entire Period: HR=8.52 (95% CI 4.00, 18.16), p<0.001 |
| SMR/SMR L1 | 481 | 2440 | 19517 | 2.46 | Entire Period: HR=2.94 (95% CI 2.54, 3.41), p<0.001 |
| SMR/SMR L2 | 328 | 856 | 7108 | 4.61 | Entire Period: HR=6.55 (95% CI 5.57, 7.70), p<0.001 |
| Univers 3D/Univers 3D | 17 | 34 | 305 | 5.57 | Entire Period: HR=7.46 (95% CI 4.53, 12.27), p<0.001 |
| Vaios/Vaios | 19 | 36 | 227 | 8.36 | Entire Period: HR=9.61 (95% CI 6.02, 15.33), p<0.001 |

Note: Components have been compared to all other modern total stemmed anatomic shoulder components

**Table IP26 Cumulative Percent Revision of Total Stemmed Anatomic Shoulder Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| CPR | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 13 Yrs |
|---|---|---|---|---|---|
| **Re-Identified and Still Used** | | | | | |
| Equinoxe/Equinoxe (All Poly) | 2.0 (0.9, 4.4) | 6.2 (3.9, 9.7) | 8.5 (5.7, 12.6) | 12.6 (8.7, 18.0) | |
| Equinoxe/Equinoxe (Hybrid Glenoid) | 3.6 (2.2, 5.8) | 6.4 (4.4, 9.2) | 10.5 (7.7, 14.4) | 13.7 (9.9, 18.8) | |
| **Identified and no longer used** | | | | | |
| Comprehensive/Custom Made (Comprehensive) | 16.7 (5.7, 43.2) | 27.8 (12.6, 54.4) | 33.8 (16.8, 60.4) | | |
| SMR/SMR L1 | 5.9 (5.1, 6.9) | 11.4 (10.2, 12.7) | 13.7 (12.4, 15.2) | 16.2 (14.7, 17.7) | 26.2 (23.8, 28.9) |
| SMR/SMR L2 | 9.5 (7.7, 11.7) | 22.2 (19.6, 25.2) | 29.8 (26.9, 33.1) | 34.1 (31.0, 37.4) | 40.1 (36.8, 43.7) |
| Univers 3D/Univers 3D | 5.9 (1.5, 21.5) | 14.7 (6.4, 31.8) | 21.2 (10.7, 39.4) | 31.0 (18.0, 50.1) | 48.9 (32.7, 68.0) |
| Vaios/Vaios | 13.9 (6.0, 30.2) | 27.8 (16.0, 45.5) | 39.1 (25.3, 57.0) | 48.7 (33.6, 66.4) | 57.0 (40.5, 74.6) |

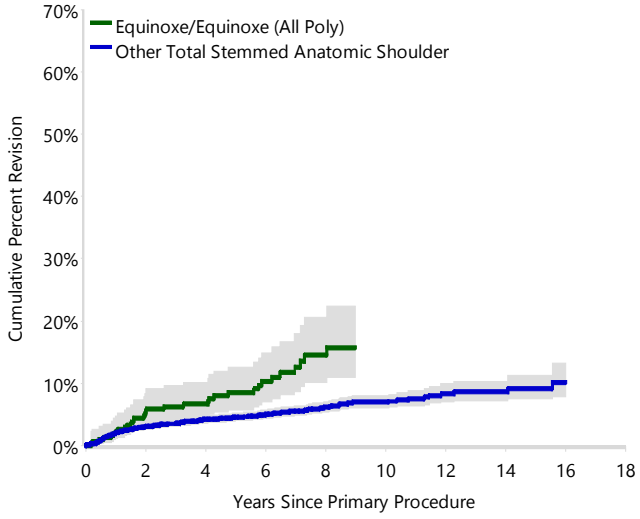
# Prostheses with Higher than Anticipated Rates of Revision

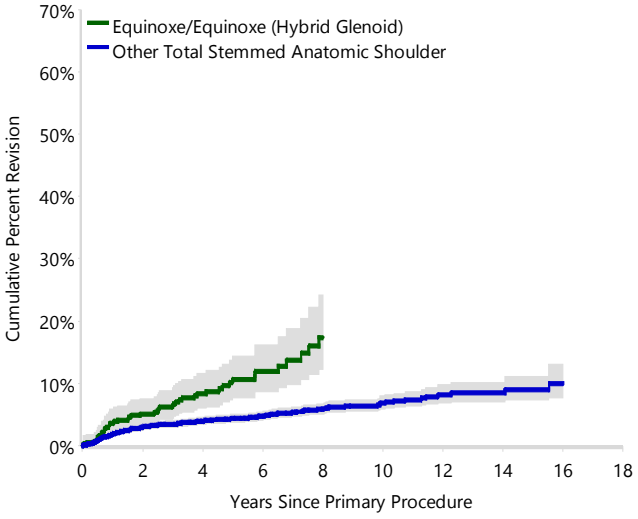
**Table IP27 Yearly Usage of Total Stemmed Anatomic Shoulder Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| Year of Implant | ≤2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Re-Identified and Still Used** | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Equinoxe/Equinoxe (All Poly) | . | . | . | 6 | 10 | 26 | 18 | 8 | 23 | 36 | 45 | 37 | 18 | 28 | 24 | 24 | 2 |
| Equinoxe/Equinoxe (Hybrid Glenoid) | . | . | . | . | . | . | 14 | 38 | 19 | 35 | 34 | 68 | 74 | 64 | 62 | 24 | 21 |
| **Identified and no longer used** | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Comprehensive/Custom Made (Comprehensive) | . | . | . | . | . | . | . | . | 1 | 4 | 7 | 5 | 1 | . | . | . | . |
| SMR/SMR L1 | 372 | 247 | . | . | 156 | 302 | 256 | 242 | 195 | 172 | 128 | 98 | 72 | 70 | 65 | 65 | . |
| SMR/SMR L2 | . | 43 | 343 | 336 | 134 | . | . | . | . | . | . | . | . | . | . | . | . |
| Univers 3D/Univers 3D | 34 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Vaios/Vaios | . | . | . | 16 | 17 | 2 | 1 | . | . | . | . | . | . | . | . | . | . |

**Figure IP8 Cumulative Percent Revision of Re-Identified and Still Used Total Stemmed Anatomic Shoulder Prostheses**

**Re-Identified and Still Used**



### TOTAL STEMMED REVERSE

There is one newly identified total stemmed reverse shoulder prostheses.

The Equinoxe/Equinoxe total stemmed reverse combination was first used in 2011 and is categorised as total stemmed reverse with a polyethylene humeral insert and a modular metal glenosphere and glenoid base plate. There have been 7,299 procedures, of which 45.4% were for osteoarthritis, 34.3% rotator cuff arthropathy and 14.4% for fracture. The cumulative percent revision at 9 years is 7.3%. Of the 271 revisions, 90 have been for infection, 78 for instability/dislocation and 39 for loosening. The majority (181/271) have been major revisions. The bearing surface of this implant combination is (humeral/glenoid) non-XLPE/metal.

The previously identified Trabecular Metal/Comprehensive combination no longer fulfils the criteria for identification in 2024.

**Table IP28 Revision Rate of Total Stemmed Reverse Shoulder Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| Humeral Stem/Glenoid | N Revised | N Total | Obs. Years | Revisions/100 Obs. Yrs | Hazard Ratio, P Value |
|---|---|---|---|---|---|
| Newly Identified | . | . | . | . | |
| Equinoxe/Equinoxe | 271 | 7299 | 22812 | 1.19 | 0 - 2Wk: HR=1.17 (95% CI 0.79, 1.73), p=0.439 |
| | . | . | . | . | 2Wk - 3Mth: HR=0.75 (95% CI 0.57, 0.99), p=0.038 |
| | . | . | . | . | 3Mth - 1.5Yr: HR=1.12 (95% CI 0.90, 1.38), p=0.310 |
| | . | . | . | . | 1.5Yr - 2Yr: HR=1.49 (95% CI 0.96, 2.32), p=0.078 |
| | . | . | . | . | 2Yr - 3.5Yr: HR=0.92 (95% CI 0.60, 1.41), p=0.705 |
| | . | . | . | . | 3.5Yr+: HR=2.57 (95% CI 1.84, 3.59), p<0.001 |
| Re-Identified and Still Used | . | . | . | . | |
| SMR/SMR L1 | 505 | 11877 | 61575 | 0.82 | 0 - 3Mth: HR=1.61 (95% CI 1.38, 1.88), p<0.001 |
| | . | . | . | . | 3Mth - 1.5Yr: HR=1.10 (95% CI 0.92, 1.31), p=0.281 |
| | . | . | . | . | 1.5Yr+: HR=0.64 (95% CI 0.52, 0.78), p<0.001 |
| Verso/Verso | 7 | 40 | 107 | 6.52 | Entire Period: HR=4.76 (95% CI 2.27, 9.99), p<0.001 |

Note: Components have been compared to all other modern total stemmed reverse shoulder components.
This combination is one of two that have reached the 'non-inferior' 10 year performance benchmark (for further information refer to the 10, 15, 20 Year Prosthesis Outcomes chapter in this report).

**Table IP29 Cumulative Percent Revision of Total Stemmed Reverse Shoulder Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| CPR | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 13 Yrs |
|---|---|---|---|---|---|
| Newly Identified | | | | | |
| Equinoxe/Equinoxe | 2.3 (2.0, 2.7) | 3.6 (3.1, 4.1) | 4.5 (3.9, 5.1) | 6.2 (5.2, 7.2) | |
| Re-Identified and Still Used | | | | | |
| SMR/SMR L1 | 2.9 (2.6, 3.2) | 3.9 (3.6, 4.3) | 4.3 (3.9, 4.7) | 4.7 (4.3, 5.1) | 6.0 (5.2, 6.9) |
| Verso/Verso | 15.3 (7.2, 31.0) | 18.6 (9.3, 35.3) | 18.6 (9.3, 35.3) | | |

# Prostheses with Higher than Anticipated Rates of Revision

**Table IP30 Yearly Usage of Total Stemmed Reverse Shoulder Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| Year of Implant | ≤2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Newly Identified** | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Equinoxe/Equinoxe | . | . | . | 1 | 9 | 14 | 32 | 103 | 168 | 332 | 495 | 675 | 855 | 955 | 1057 | 1346 | 1257 |
| **Re-Identified and Still Used** | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| SMR/SMR L1 | 407 | 271 | . | . | 248 | 563 | 633 | 732 | 914 | 930 | 1046 | 1055 | 1009 | 1191 | 1034 | 943 | 901 |
| Verso/Verso | . | . | . | . | . | . | . | . | . | . | 5 | 8 | 1 | 6 | 5 | 13 | 2 |

**Figure IP9 Cumulative Percent Revision of Newly Identified Total Stemmed Reverse Shoulder Prostheses**

**Newly Identified**

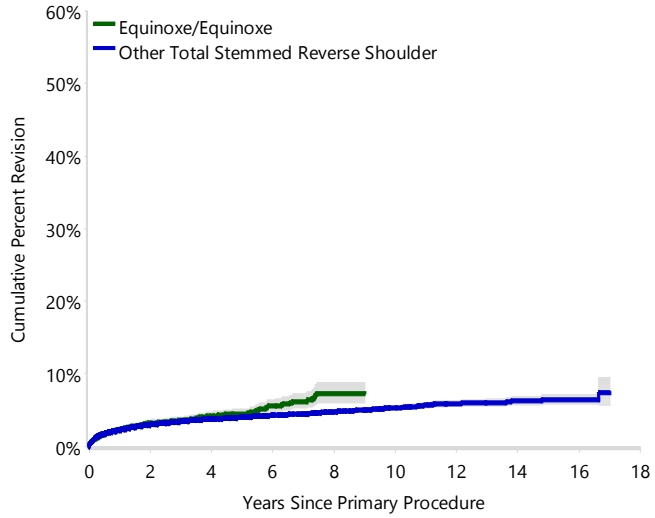
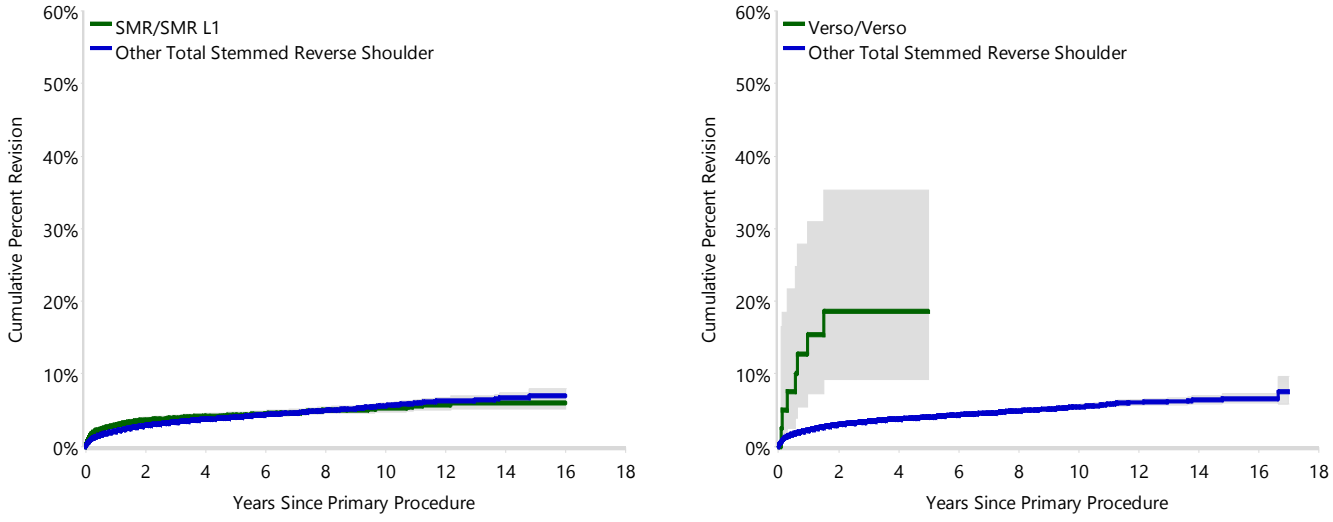



**Figure IP10 Cumulative Percent Revision of Re-Identified and Still Used Total Stemmed Reverse Shoulder Prostheses**

**Re-Identified and Still Used**



## Primary Total Ankle Replacement

There are no newly identified total ankle replacement prostheses.

**Table IP31 Revision Rate of Total Ankle Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| Talar/Tibial Tray | N Revised | N Total | Obs. Years | Revisions/ 100 Obs. Yrs | Hazard Ratio, P Value |
|---|---|---|---|---|---|
| Re-Identified and Still Used | . | . | . | . | |
| Hintermann Series H3/Hintermann Series H3 | 108 | 573 | 4725 | 2.29 | Entire Period: HR=1.93 (95% CI 1.55, 2.40), p<0.001 |
| Identified and no longer used | . | . | . | . | |
| S.T.A.R/S.T.A.R | 14 | 49 | 411 | 3.40 | Entire Period: HR=2.45 (95% CI 1.44, 4.18), p<0.001 |

Note: Components have been compared to all other total ankle components

**Table IP32 Cumulative Percent Revision of Total Ankle Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| CPR | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 13 Yrs |
|---|---|---|---|---|---|
| Re-Identified and Still Used | | | | | |
| Hintermann Series H3/Hintermann Series H3 | 4.1 (2.7, 6.0) | 8.4 (6.4, 11.1) | 11.4 (8.9, 14.4) | 15.7 (12.7, 19.2) | 24.9 (20.8, 29.7) |
| Identified and no longer used | | | | | |
| S.T.A.R/S.T.A.R | 4.1 (1.0, 15.5) | 12.6 (5.8, 25.8) | 14.7 (7.3, 28.4) | 21.3 (12.0, 35.9) | |

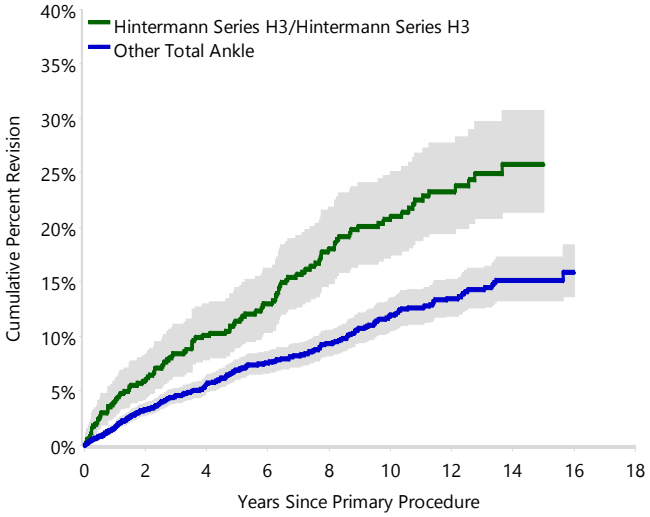
**Table IP33 Yearly Usage of Total Ankle Prostheses Identified as Having a Higher than Anticipated Rate of Revision**

| Year of Implant | ≤2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Re-Identified and Still Used | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Hintermann Series H3/Hintermann Series H3 | 40 | 45 | 63 | 56 | 67 | 48 | 40 | 34 | 12 | 25 | 30 | 13 | 20 | 24 | 21 | 20 | 15 |
| Identified and no longer used | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| S.T.A.R/S.T.A.R | 1 | 3 | 3 | 4 | 2 | 15 | 12 | 4 | 4 | . | 1 | . | . | . | . | . | . |

# Prostheses with Higher than Anticipated Rates of Revision

**Figure IP11 Cumulative Percent Revision of Re-Identified and Still Used Total Ankle Prostheses**

**Re-Identified and Still Used**



# Appendices

# Appendices

## APPENDIX 1 – Participating Hospitals and Coordinators

| VICTORIA | | | |
|---|---|---|---|
| **Public Hospitals** | | **Private Hospitals** | |
| Austin Health | R Kentish / B Murray | Ballarat Day Procedure Centre | A Ingram |
| Bacchus Marsh Hospital | C Clifford / J Dehnert | Beleura Private Hospital | J Leyland |
| Bairnsdale Regional Health Service | S Guns | Bellbird Private Hospital | B Van Denberg |
| Bass Coast Health | L Mckenzie / P Dewar | Cabrini Brighton | D Heng |
| Bendigo Health | E Smith / S Sharp / C Jensen | Cabrini Malvern | D Heng |
| Broadmeadows Hospital | R Paul / B Wilson | Epping Private Hospital | J Jose |
| Central Gippsland Health | M Pusmucans / J Hunt | Epworth Eastern | K Longley |
| Cohuna District Hospital | K Storm | Epworth Freemasons | C Nozzolillo |
| Colac Area Health | A Tout | Epworth Geelong | N Cuttiford |
| Dandenong Hospital | K Ferguson / M Murray | Epworth Richmond | A Condon |
| East Grampians Health Service | K Carr / J Debney / J Sargent | Essendon Private Hospital | E Jordan |
| Eastern Health Box Hill | L Bingham / D Wickramasinghe | Glenferrie Private Hospital | L Banbury / S Srisawat / S Jones / M |
| Eastern Health Maroondah | B Connelly / G Whitemore | Holmesglen Private Hospital | N Malovic |
| Echuca Regional Health | H Lias / K Giorgianni | John Fawkner Private Hospital | B Emmett |
| Footscray Hospital | L Carbone / A Dijak | Knox Private Hospital | J Assauw / E George / H McCarty |
| Frankston Hospital | J Harry | La Trobe Private Hospital | J Flestado / J Telfer |
| Frankston Public Surgical Centre | N Larner / S Reeves | Linacre Private Hospital | M Krotwaar / R Carliesh / B Prentice / D |
| Goulburn Valley Health | A Stevens | Maryvale Private Hospital | F Van Dyke / K Collier |
| Grampians Health Ballarat | M Nicholson / B Anderson | Masada Private Hospital | D MacKenzie / S Howell |
| Grampians Health Horsham | M Markby / A Ampt | Melbourne Private Hospital | T Perkins |
| Grampians Health Stawell | S Hamilton / C Ellen | Mildura Health Private Hospital | S Malcolm |
| Hamilton Base Hospital | C Raymond / R Broadfoot | Mitcham Private Hospital | J Lonthyil / J Nankivell |
| Kyabram District Health Service | B Harrison / L Walker | Mulgrave Private Hospital | B Gurung / A Chandrakumar |
| Latrobe Regional Hospital | S Lovison | Northern Private Hospital | L Macpherson |
| Mildura Base Public Hospital | K Mailes | Northpark Private Hospital | J Flestado / M Muganiwa / K Morris |
| Monash Medical Centre | J Cranston | Peninsula Private Hospital | K Jones |
| Moorabbin Hospital | C Jackson / L Mason | Ringwood Private Hospital | C Burns |
| Northeast Health Wangaratta | D Reidy | Shepparton Private Hospital | V Cabatu / A Lam |
| Northern Hospital Epping | S Perry | St John of God Ballarat Hospital | G Mathachan |
| Portland District Health | M Ashby | St John of God Bendigo Hospital | A Sheehan |
| Sandringham Hospital | G Jack / L Scopel / S Kurup | St John of God Berwick Hospital | R Jamieson |
| St Vincent's Hospital Melbourne | A Lynskey / D Thangavel | St John of God Geelong Hospital | C Hay |
| Sunshine Hospital | A Dijak | St John of God Warrnambool Hospital | G Wheaton / L McPherson |
| Swan Hill District Health | D Hartland | St Vincent's Private Hospital East | E Valenton / S Francis |
| The Alfred | T Krohman | St Vincent's Private Hospital Fitzroy | D Dellevirgini / N Carter |
| The Royal Children's Hospital | S Lauletta | St Vincent's Private Hospital Kew | S Vohra / H Xing |
| The Royal Melbourne Hospital | H Eggleston | St Vincent's Private Hospital Werribee | D Adanza / D Sanchez / M Ipio / L Fifis |
| University Hospital Geelong | M Quinn / D Barber | Sunshine Private Hospital | C Alagao |
| Warrnambool Base Hospital | W Marsh / T Kelly | The Avenue Hospital | K Seng / R Crompton / T Kilpi |
| West Gippsland Healthcare Group | B Norman / S Backman | The Bays Hospital | L Charenko / L Kerr / S Burton |
| West Wimmera Health Service | T Heinrich | The Melbourne Eastern Private Hospital | J Phillpotts |
| Williamstown Hospital | J Bonganay / A Chircop | Vermont Private Hospital | V Howell / D Cooper |
| | | Wangaratta Private Hospital | J McKie |
| | | Warringal Private Hospital | M Dey / M Bhagat |

| VICTORIA | | | |
|---|---|---|---|
| **Public Hospitals** | | **Private Hospitals** | |
| | | Waverley Private Hospital | E Fernandez / N Smith / N Dator |
| | | Werribee Mercy Hospital | J Anwar |
| | | Western Private Hospital | M Samson / D Cringasu |

| NEW SOUTH WALES | | | |
|---|---|---|---|
| **Public Hospitals** | | **Private Hospitals** | |
| Albury Base Hospital | L Rhodes | Albury Wodonga Private Hospital | R Daggett |
| Armidale Hospital | J Waters / A Sutherland / A Prater | Armidale Private Hospital | K Latter |
| Auburn Health Service | A Balangue / M Malonzo | Baringa Private Hospital | E Ford / K Henderson / F Howson |
| Bankstown-Lidcombe Hospital | W Liaw / N Bassett* / K Och | Bathurst Private Hospital | K Quinton / D Carter |
| Bathurst Hospital | B Hodges | Brisbane Waters Private Hospital | A Ryan |
| Belmont Hospital | J Jones / J Osland | Calvary Riverina Hospital | F Oxley / L Pennier |
| Blacktown Hospital | J Tsang | Campbelltown Private Hospital | J Blanch / C Macdonald |
| Bowral and District Hospital | R Roberts / B Allan | Delmar Private Hospital | C Byrne |
| Broken Hill Base Hospital | T Kerle / S Beahl | Dubbo Private Hospital | A Wright / K Troth / S Cross |
| Campbelltown Hospital | K Hanger / S Paudel / S Birch | Dudley Private Hospital | P Fullgrabe |
| Canterbury Hospital | J Cubitt | East Sydney Private Hospital | T Woodgate |
| Chris O'Brien Lifehouse | S Harnedy | Forster Private Hospital | S Jose / D Conway / S Daczko |
| Coffs Harbour Health Campus | J Bellenger | Gosford Private Hospital | A Maguire |
| Concord Repatriation General Hospital | D Debello | Hawkesbury District Health Service | E Jones / S Garden |
| Dubbo Hospital | K Chapman / R Willis | Holroyd Private Hospital | M Brosas |
| Fairfield Hospital | C Youkhana | Hunter Valley Private Hospital | R Pridue |
| Gosford Hospital | K Mizzi / T Hoad / K Brown / M Farthing | Hurstville Private Hospital | J Mati / T Ross |
| Goulburn Base Hospital | K Goode / L Phelan | Insight Private Hospital | J Furness |
| Grafton Base Hospital | K Shaw / G Snook | Kareena Private Hospital | A Burazer / B Mitchell |
| Hornsby Ku-Ring-Gai Hospital | J Colville / B Chu | Kogarah Private Hospital | R Duag |
| Institute of Rheumatology and | M Hatziandreou | Lake Macquarie Private Hospital | V Jones / C Wright |
| John Hunter Hospital | J Gilbert / F Bristow | Lakeview Private Hospital | S Mitchell / H MacAllister |
| Lismore Base Hospital | G Nettle | Lingard Private Hospital | A Flaherty / K Bailey / A Dagg |
| Liverpool Hospital | S Seap | Macquarie University Hospital | J Guthrie |
| Maitland Hospital | B Game | Maitland Private Hospital | J Hayward / M Mead |
| Manning Hospital | G Cooke | Mater Hospital North Sydney | N Guerrero |
| Mount Druitt Hospital | C Boyd | Mayo Private Hospital | K Boucher |
| Murwillumbah District Hospital | S Smith / G Jacklin | Nepean Private Hospital | J Vimalraj |
| Nepean Hospital | D Dobbs / R Steward | Newcastle Private Hospital | D Fogarty / J Kelly |
| Orange Health Service | J Allenby | North Shore Private Hospital | A Bloxham |
| Port Macquarie Base Hospital | J Atkins / A Bartlett | Northern Beaches Hospital | S Maristela |
| Prince of Wales Hospital | E Katz | Norwest Private Hospital | J Woodward / R Shepherd |
| Royal Newcastle Centre | D Sommer / G Cutler | Nowra Private Hospital | D Maslen / G Hutton |
| Royal North Shore Hospital | H Celep | Orange Private Hospital | A McClelland |
| Royal Prince Alfred Hospital | J Wilkie | Port Macquarie Private Hospital | T Bell |
| Ryde Hospital | K Jones / H Nowlan | Prince of Wales Private Hospital | F Sarmiento |
| Shoalhaven Memorial Hospital | L Royston | Shellharbour Private Hospital | M Stevens / J Wilkinson |

# Appendices

| NEW SOUTH WALES | | | |
|---|---|---|---|
| **Public Hospitals** | | **Private Hospitals** | |
| South East Regional Hospital | K Wild-Edwards / L Williams | Somerset Private Hospital | F Strachan |
| St George Hospital | D Gray / D Elliott | Southern Highlands Private Hospital | L Byrne |
| St Vincent's Hospital Sydney | A Baker / L Hatton | St George Private Hospital | L Mayo |
| Sutherland Hospital | P Beattie / C Kirgan | St Luke's Care | D Papadopoulos |
| Tamworth Hospital | M Lebrocq | St Vincent's Private Community Hospital | M Blackman |
| The Children's Hospital at Westmead | A Galstaun | St Vincent's Private Hospital Sydney | H George / M McGlynn / M Bancroft |
| Tweed Valley Hospital | A Budd / N Prestage | St Vincent's Private Hospital Lismore | J Hospers |
| Wagga Wagga Base Hospital | M O'Reilly / J Bowden / A Meek | Strathfield Private Hospital | F Abood / J Mati |
| Westmead Hospital | D Martic | Sydney Adventist Hospital | A Hickey |
| Wollongong Hospital | C Jackson | Sydney South West Private Hospital | H Tran |
| Wyong Hospital | T Clancy / M Randall | Tamara Private Hospital | R Moody |
| | | The George Centre | S Calubaquib |
| | | The Sydney Private Hospital | P Gyawali / R Cabading / S David / M |
| | | Toronto Private Hospital | S Keys |
| | | Tuggerah Lakes Private Hospital | J Hanneghan |
| | | Waratah Private Hospital | K Graham |
| | | Warners Bay Private Hospital | A Harrison |
| | | Westmead Private Hospital | K Teren / L Yogathasar |
| | | Wollongong Private Hospital | R Chapple / J Burns |

| QUEENSLAND | | | |
|---|---|---|---|
| **Public Hospitals** | | **Private Hospitals** | |
| Bundaberg Hospital | J Anderson / D Norman / J Larsen | Brisbane Private Hospital | L Drabble |
| Cairns Hospital | H Campbell / E Walker / C McCall / L Borzi | Buderim Private Hospital | S Newbury |
| Gold Coast University Hospital | M Armstrong | Caboolture Private Hospital | B Altona / L King |
| Hervey Bay Hospital | M Elsworth | Cairns Private Hospital | L Rush |
| Ipswich Hospital | S Wilkinson | Friendly Society Private Hospital | K Smith / M Alcorn |
| Logan Hospital | M Harrison / S Childs | Gold Coast Private Hospital | V French |
| Mackay Base Hospital | B Daley / C Ruthenberg | Greenslopes Private Hospital | K Williams / R Griffin |
| Maryborough Hospital | Y Howlett / S Hose | Hervey Bay Surgical Hospital | M Pracy |
| Mater Hospital Brisbane | M Colbeck / C Steains / A Roeun | Hillcrest Rockhampton Private Hospital | J Smith |
| Nambour General Hospital | B Rajan / T Graham / R Hutchison | John Flynn Private Hospital | L Sarquis |
| Princess Alexandra Hospital | S Reed | Mater Private Hospital Brisbane | N Herden / A Williams / M Baltais / S Pfeffer / J Windsor |
| Queen Elizabeth II Jubilee Hospital | D Cal | Mater Private Hospital Bundaberg | J Zillmann / L Zunker / M Mooney |
| Queensland Children's Hospital | F Wright / M Cullen | Mater Private Hospital Mackay | H Douglas |
| Redcliffe Hospital | S Ovchinnikoff / G van Fleet | Mater Private Hospital Redland | D Chambers / T Hinder / T Diab / J Golding / J Garnsey |
| Redland Hospital | M McGahey | Mater Private Hospital Rockhampton | T Harkin / M Havik |
| Robina Hospital | R Kapera / L Thompson | Mater Private Hospital Springfield | C Cullen / C James |
| Rockhampton Hospital | M Todd / S Platzke | Mater Private Hospital Townsville | M Allan / J Humphreys |
| Royal Brisbane and Women's Hospital | G McPhee / B Ballantyne / A Dowe | Nambour Selangor Private Hospital | L Shanahan / S Pfeiffer / T Dempsey |
| Sunshine Coast University Hospital | F Tognolini / C Jones | Noosa Hospital | M Hale / J Andersson |

| QUEENSLAND | | | |
|---|---|---|---|
| **Public Hospitals** | | **Private Hospitals** | |
| Surgical, Treatment & Rehabilitation Service | E Daniels | North West Private Hospital | D Campbell / T Auckland |
| The Prince Charles Hospital | L Tuppin / R Seddon / S Butler | Pacific Private Hospital | A Keen |
| Toowoomba Hospital | F Chadwick / A Lostroh | Peninsula Private Hospital | A Moutrey |
| Townsville Hospital & Health Service | T Cudmore | Pindara Private Hospital | M Pederson / E Moire |
| | | St Andrew's Ipswich Private Hospital | M Grant |
| | | St Andrew's Toowoomba Hospital | A Shannon |
| | | St Andrew's War Memorial Hospital | S Flood |
| | | St Stephen's Hospital | S Costello / K McLaughlan |
| | | St Vincent's Private Hospital Northside | D Ravn / L Shannon |
| | | St Vincent's Private Hospital Toowoomba | R Butler / A Fitzgerald |
| | | Sunnybank Private Hospital | F Robinston |
| | | Sunshine Coast University Private Hospital | T Prothero |
| | | The Wesley Hospital | C Gregory / K Patel |
| | | Westside Private Hospital | M Esdale / B Owen |

| WESTERN AUSTRALIA | | | |
|---|---|---|---|
| **Public Hospitals** | | **Private Hospitals** | |
| Albany Health Campus | P Karra | Bethesda Health Care | H Hanekom / J Fitzroy |
| Armadale Health Service | L Bennett / E Griffiths | Hollywood Private Hospital | L Godfrey / M Connor |
| Bunbury Regional Hospital | C Wicksteed / L Watterson-Stutley | Joondalup Health Campus | D Crowley / D Jenkins / T Rankin / J Holmes |
| Busselton Health Campus | G Moyes | Mount Private Hospital | M Gontran / M Huyser |
| Fiona Stanley Hospital | J Duncan | Peel Health Campus | G Keogh |
| Fremantle Hospital | E Jiji | South Perth Hospital | D Waters |
| Geraldton Hospital | J Joseph | St John of God Bunbury Hospital | C Habig / I Du Plessis |
| Kalgoorlie Health Campus | N Hintz | St John of God Geraldton Hospital | L Culallad / K Hutton / R Caporn |
| Osborne Park Hospital | T Hughes / K Zhang | St John of God Midland Hospital | S Blinman |
| Perth Children's Hospital | K Theedom | St John of God Mt Lawley Hospital | F Campos |
| Rockingham General Hospital | C Beaney | St John of God Murdoch Hospital | C Sheen / A Kapiteyn |
| Royal Perth Hospital | L Daly | St John of God Subiaco Hospital | P Emrose |
| Sir Charles Gairdner Hospital | T Lemmey / M Requilme | Waikiki Private Hospital | B Muir |

| SOUTH AUSTRALIA | | | |
|---|---|---|---|
| **Public Hospitals** | | **Private Hospitals** | |
| Clare Hospital | M Green | Ashford Hospital | E Moore / L Kowalik |
| Flinders Medical Centre | A Olson / S McAndrew | Burnside Hospital, Stepney | S Williams / K Stapleton / S Chong / F Penning |
| Gawler Health Service | T Sayce | Burnside Hospital, Toorak Gardens | L Johnson / T Behrendt |
| Lyell McEwin Hospital | L Wills | Calvary Adelaide Hospital | D Jocey-Prior / T Heinrich |
| Modbury Hospital | J Harris / B Foster | Calvary Central Districts Hospital | L Keech / M Ireland |
| Mount Barker District Soldiers Memorial | K Schultz / E Crowder | Calvary North Adelaide Hospital | A Labang |
| Mount Gambier and Districts Health | K Duncan | Flinders Private Hospital | M Ender |
| Murray Bridge Soldiers Memorial | J Colwell | Glenelg Community Hospital | N Russell-Higgins / V Lawrence / R English |
| Naracoorte Health Service | T Berry | North Eastern Community Hospital | L Shaw |
| Noarlunga Hospital | C Roper / K Thomson | St Andrew's Hospital | C McAllister / L White |

# Appendices

| SOUTH AUSTRALIA | | | |
|---|---|---|---|
| **Public Hospitals** | | **Private Hospitals** | |
| Port Augusta Hospital | J Haynes / L Turner | Stirling Hospital | S Kemp |
| Port Lincoln Hospital | C Weber | The Memorial Hospital | J Ohlson / J Emery |
| Port Pirie Regional Health Service | N Dolphin / A Murray / L Cutler | Western Hospital | A Scheepers / R Dalziell |
| Riverland General Hospital | M Gardner / N Romeo | | |
| Royal Adelaide Hospital | L Davies / A Wilson / R Woodfine | | |
| South Coast District Hospital | J Hunt / A Price | | |
| The Queen Elizabeth Hospital | A Hunter | | |
| Whyalla Hospital and Health Service | K Sibanda / E Windhouwer / M Prunty | | |
| Women's and Children's Hospital | M Betterman | | |

| TASMANIA | | | |
|---|---|---|---|
| **Public Hospitals** | | **Private Hospitals** | |
| Launceston General Hospital | M Postmus / E Davidson | Calvary Lenah Valley Hospital | B Stephensen / K Harrex / E Hey / A Copping |
| North West Regional Hospital | T Gorrie | Calvary St John's Hospital | C Farrell |
| Royal Hobart Hospital | M Chandler / S Kirkham | Calvary St Luke's Hospital | T Morice / G Stratton |
| | | Hobart Private Hospital | J Dohnt |
| | | North-West Private Hospital | P Purva |

| NORTHERN TERRITORY | | | |
|---|---|---|---|
| **Public Hospitals** | | **Private Hospitals** | |
| Alice Springs Hospital | C Wooding / L Mathieson / M Bibal | Darwin Private Hospital | Y Wing / A Thomas / S Delaney |
| Royal Darwin Hospital | D Shih / W Rogers | | |

| AUSTRALIAN CAPITAL TERRITORY | | | |
|---|---|---|---|
| **Public Hospitals** | | **Private Hospitals** | |
| Canberra Hospital | T Schild / H Boyd | Calvary Bruce Private Hospital | C Morris |
| North Canberra Hospital | R Kathage / T Pula / J Cain | Calvary John James Hospital | S Sreesan / J Lynch |
| | | Canberra Private Hospital | A John / S Phillips / L Tuohy / M Rogina |
| | | The National Capital Private Hospital | G Palada / R Barancewicz / I Coronado |

## Appendix 2 - Glossary

**STATISTICAL TERMS**

**Adjustment**: The process of re-estimating a crude measure, such as a rate or rate ratio, to minimise the effects of a difference in the distribution of a characteristic, such as age, between groups being compared on that measure. Adjustment may be carried out in the context of a modelling procedure, for example, linear or proportional hazards regression models, or by standardising the data set against a reference population with a known age distribution, for example, the World Standard Population or the Australian population defined by the Australian Bureau of Statistics Census in a specified year.

**Censoring:** When the outcome of interest is the time to a defined event, for example, revision of a prosthesis, the event may not occur during the available period of observation. For example, the Registry analyses its data on prosthesis revision for the period ending 31 December each year, and many prostheses will not have been revised by that time. Unless the prosthesis was revised prior to 31 December the outcome is unknown. For the majority, we only know that up until 31 December they had not yet been revised. The times to revision for these prostheses are said to have been censored at 31 December. Statistical methods exist to ensure that censored data are not ignored in analysis, rather information on survival up until the time of censoring is used to give the best possible estimates of survival or revision probabilities.

**Chi-Square ($X^2$) Test**: Any test whose statistic has a chi-square distribution under the null hypothesis is called a chi-square test. A common example is a test for association between two categorical variables whose data are arrayed in a cross-classification table of counts (Pearson's chi-square test). This can be generalised to many situations where the distribution of observed data is being compared to an expected theoretical distribution.

**Closure of the Database**: Closure of the database occurs in April of the report year for procedures up to 31 December of the preceding year. Due to delays in receipt of the procedure form, some procedures are not included until the following annual report.

**Competing Risk**: Any event that changes the probability of occurrence of another event is known as a competing risk for the other event. For example, death is a competing risk for revision because the probability of revision after death cannot be assumed to be the same as the probability of revision before death. Another example is that if interest centres on specific causes of revision, then each cause (infection, loosening etc) is a competing risk for each other cause. Treating a competing risk event as a right censoring will bias the estimation of the risk of the event of interest.

**Confidence Interval**: A range of values, produced to capture the true value of a measure (like a rate or ratio) a certain percentage of the time — usually 95%. This means that if we repeated the study many times, about 95% of the confidence intervals we calculate would include the true value. The range has two ends, called the lower and upper confidence limits.

**Cox Model or Proportional Hazards Model**: A statistical model that relates the hazard for an individual at any time *t* to an (unspecified) baseline hazard and a set of predictor variables, such as treatment type, age, gender etc. The Cox model produces hazard ratios that allow comparisons between groups of the rate of the event of interest. The main assumption of a Cox model is that the ratio of hazards between groups that we wish to compare does not vary over time. If the hazard for prosthesis Model A is twice that of prosthesis Model B at three years, it will also be twice at four years, and so on. This is referred to as the 'proportional hazards assumption'. If the hazard ratio is not proportional over the entire time of observation, then a time varying model is used, which estimates a separate hazard ratio within each pre-defined time period. Within each time period, the hazards are proportional. The Registry uses a set algorithm which iteratively chooses time points until the assumption of proportional hazards is met for each time period. The time points are selected based on where the greatest change in hazard occurs between the two comparison groups, weighted by the number of events in that time period.

**Cumulative Incidence Function**: An estimator of the actual probability of revision in the presence of a competing risk. In these circumstances, the Kaplan-Meier estimate, which treats competing risks as censored, overestimates the true probability. In the competing risks paradigm, patients who have already had a revision or who have died are excluded from the set at risk of being revised. Under Kaplan-Meier, only patients who have already been revised are excluded from the risk set; dead patients are analysed as though they are still at risk of revision.

**Cumulative Percent Revision**: Otherwise known as the 'cumulative failure rate'. This is defined as 100 x [1- S(t)] where S(t) is the survivorship probability estimated by the Kaplan-Meier method (see survival curve, below). The cumulative percent revision gives the percent of procedures revised up until time t, and allows for right censoring due to death (but see Cumulative Incidence Function above) or closure of the database for analysis.

**Hazard Ratio**: A hazard is an estimate of the instantaneous risk of occurrence of an event, for example revision, at a point in time, t. A hazard ratio results from dividing one group's hazard by another's to give a comparative measure of the instantaneous risk of experiencing the event of interest. In this report, hazard ratios are adjusted for age and gender as appropriate. Hazard ratios are either for the entire survivorship period (if proportional; see 'Cox Model or Proportional Hazards Model' section above) or for specific time periods (if the hazard for the entire survivorship period is not proportional).

For example, a comparison of Primary Total Conventional Hip Replacement for a Primary Diagnosis of Avascular Necrosis

# Appendices

(AVN), Developmental Dysplasia of the Hip (DDH) and Osteoarthritis (OA):

Avascular Necrosis vs Osteoarthritis.

Entire Period: HR=1.34 (1.16, 1.54), p<0.001

The hazard ratio for this comparison is proportional over the entire time of observation. AVN has a significantly higher rate of event (in this case, revision) compared to OA over the entire time of observation (p<0.001). The hazard is 1.34 times higher for AVN compared to OA and, with 95% confidence, the true hazard for AVN will lie between 1.16 times higher and 1.54 times higher than the hazard for OA.

Developmental Dysplasia vs Osteoarthritis

0-3Mth: HR=1.75 (1.21, 2.52), p=0.002

3Mth+: HR=1.07 (0.78, 1.45), p=0.683

The hazard ratio is not proportional over the entire time of observation, so the hazard ratio has been divided into two periods; the time from primary arthroplasty to three months following the primary and three months following the primary to the end of observation. DDH has a significantly higher revision rate compared to OA in the first three months following the primary (p=0.002). The hazard for revision in the first three months is 1.75 times higher for DDH than for OA and with 95% confidence, the true hazard for DDH will lie between 1.21 and 2.52 times higher. From three months following the primary to the end of observation, there is no significant difference in the revision rate between DDH and OA (p=0.683).

**Incidence Rate**: The number of new occurrences of an event divided by a measure of the population at risk of that event over a specified time period. The population at risk is often given in terms of person-time: for example, if 6 persons are each at risk over 4 months, they contribute 6 x 1/3 = 2 person-years to the denominator of the incidence rate. The incidence rate ratio (IRR) is commonly used to compare the incidence rates of two groups. If the two groups' incidence rates are the same, the result is an IRR of 1.

**Log Rank Test**: A family of statistical tests that compares the survival experience of two or more groups over the entire time of observation (contrast with comparison of survival at a defined time, e.g. five-year survival).

**Observed Component Years**: For each procedure, component time is the time during which it is at risk of being revised. This is calculated as the number of days from the date of the primary procedure until either the date of revision, date of death or end of study (31/12/2019) whichever happens first. This is then divided by 365.25 to obtain the number of component years. Each primary procedure then contributes this calculated number of component years to the overall total component years for a particular category of prosthesis.

For example: A primary total hip procedure performed on 1/1/2019 was revised on 1/7/2019. Therefore, the number of days that this procedure is at risk of being revised is 183 days. This prosthesis then contributes 0.5 (183/365.25) component years to the overall number of observed component years for the total hip procedure category.

A patient with a primary procedure on 1/1/2019 died without being revised on 1/4/2019. This procedure contributes 0.25 component years.

A primary procedure occurs on 1/1/2019 and has not been revised. This procedure contributes 1 component year (as observation time is censored at 31/12/2019).

**Survival Curve**: A plot of the proportion of subjects who have not yet experienced a defined event (for example, death or revision of prosthesis) versus time. The Kaplan-Meier method is the one most commonly used. The curve takes account of subjects whose ultimate survival time is not known, a phenomenon called 'censoring'. The survival estimate at each time is accompanied by a confidence interval based on the method of Greenwood. An interval is interpretable only at the time for which it was estimated and the sequence of intervals (depicted as shading on the Kaplan-Meier curve) cannot be used to judge the significance of any perceived difference over the entire time of observation. Often, for convenience, the curve is presented to show the proportion revised by a certain time, rather than the proportion not being revised ('surviving'). In the Registry, we call this cumulative percent revision (CPR). The Kaplan-Meier method is biassed in the presence of a competing risk and will overestimate the risk of revision. In such circumstances, use of the cumulative incidence function for all competing risks, rather than the Kaplan-Meier estimate, is advised. The cumulative incidence of all competing risks must be assessed simultaneously to avoid bias in interpretation.

## Appendix 3 – Diagnosis Hierarchy

### DIAGNOSIS HIERARCHY FOR PRIMARY PARTIAL HIP REPLACEMENT

| Rank | Diagnosis |
|---|---|
| 1 | Tumour |
| 2 | Failed Internal Fixation |
| 3 | Fractured Neck of Femur |
| 4 | Osteonecrosis/AVN |
| 5 | Rheumatoid Arthritis |
| 6 | Osteoarthritis (including Post Traumatic OA) |
| 7 | Developmental Dysplasia |
| 8 | Osteochondritis Dissecans |
| 9 | Other |

### DIAGNOSIS HIERARCHY FOR PRIMARY TOTAL RESURFACING HIP REPLACEMENT

| Rank | Diagnosis |
|---|---|
| 1 | Tumour |
| 2 | Arthrodesis Takedown |
| 3 | Osteonecrosis/AVN |
| 4 | Rheumatoid Arthritis |
| 5 | Developmental Dysplasia |
| 6 | Other Inflammatory Arthritis |
| 7 | Osteoarthritis (including Post Traumatic OA) |
| 8 | Fracture/Dislocation (acetabulum) |
| 9 | Other |

### DIAGNOSIS HIERARCHY FOR PRIMARY TOTAL HIP REPLACEMENT (EXCLUDING TOTAL RESURFACING)

| Rank | Diagnosis |
|---|---|
| 1 | Tumour |
| 2 | Arthrodesis Takedown |
| 3 | Failed Internal Fixation |
| 4 | Fractured Neck of Femur |
| 5 | Osteonecrosis/AVN |
| 6 | Rheumatoid Arthritis |
| 7 | Developmental Dysplasia |
| 8 | Other Inflammatory Arthritis |
| 9 | Osteoarthritis (including Post Traumatic OA) |
| 10 | Fracture/Dislocation (acetabulum) |
| 11 | Other |

# Appendices

### DIAGNOSIS HIERARCHY FOR REVISION HIP REPLACEMENT

| Rank | Diagnosis | Category |
|---|---|---|
| 1 | Tumour | Dominant diagnosis independent of prosthesis/surgery |
| 2 | Infection | |
| 3 | Leg Length Discrepancy | Surgical procedure |
| 4 | Incorrect Sizing | |
| 5 | Malposition | |
| 6 | Metal Related Pathology | Reaction to prosthesis |
| 7 | Loosening | |
| 8 | Lysis | |
| 9 | Wear Hip Insert | Wear and implant breakage |
| 10 | Wear Acetabular Cup/Shell | |
| 11 | Wear Head | |
| 12 | Implant Breakage Head | |
| 13 | Implant Breakage Stem | |
| 14 | Implant Breakage Hip Insert | |
| 15 | Implant Breakage Acetabular Cup/Shell | |
| 16 | Prosthesis Dislocation | Stability of prosthesis |
| 17 | Instability | |
| 18 | Fracture (Femur/Acetabular/Neck/Periprosthetic) | Fracture of bone |
| 19 | Chondrolysis/Acetabular Erosion | Progression of disease on non-operated part of joint |
| 20 | Progression of Disease | |
| 21 | Synovitis | New diseases occurring in association with joint replacement |
| 22 | Osteonecrosis/AVN | |
| 23 | Heterotopic Bone | |
| 24 | Pain | Pain |
| 25 | Other | Remaining diagnoses |

## DIAGNOSIS HIERARCHY FOR PRIMARY KNEE REPLACEMENT

| Rank | Diagnosis |
|---|---|
| 1 | Tumour |
| 2 | Osteonecrosis/AVN |
| 3 | Rheumatoid Arthritis |
| 4 | Other Inflammatory Arthritis |
| 5 | Osteoarthritis (including Post Traumatic OA) |
| 6 | Chondrocalcinosis |
| 7 | Osteochondritis Dissecans |

## DIAGNOSIS HIERARCHY FOR REVISION KNEE REPLACEMENT

| Rank | Diagnosis | Category |
|---|---|---|
| 1 | Tumour | Dominant diagnosis independent of prosthesis/surgery |
| 2 | Infection | |
| 3 | Incorrect Side | Surgical procedure |
| 4 | Incorrect Sizing | |
| 5 | Malalignment | |
| 6 | Metal Related Pathology | Reaction to prosthesis |
| 7 | Loosening | |
| 8 | Lysis | |
| 9 | Wear Knee Insert | Wear and implant breakage |
| 10 | Wear Tibial Tray | |
| 11 | Wear Femoral | |
| 12 | Wear Patella | |
| 13 | Implant Breakage Femoral | |
| 14 | Implant Breakage Knee Insert | |
| 15 | Implant Breakage Tibial Tray | |
| 16 | Implant Breakage Patella | |
| 17 | Bearing Dislocation | Stability of prosthesis/knee |
| 18 | Patellar Dislocation | |
| 19 | Prosthesis Dislocation | |
| 20 | Instability | |
| 21 | Patellar Maltracking | |
| 22 | Fracture (Femur/Tibia/Patella/Periprosthetic) | Fracture of bone |
| 23 | Progression of Disease | Progression of disease on non-operated part of join |

# Appendices

| | | |
|---|---|---|
| 24 | Patellar Erosion | |
| 25 | Synovitis | New diseases occurring in association with joint replacement |
| 26 | Arthrofibrosis | |
| 27 | Osteonecrosis/AVN | |
| 28 | Heterotopic Bone | |
| 29 | Patellofemoral Pain | Pain |
| 30 | Pain | |
| 31 | Other | Remaining diagnoses |

### DIAGNOSIS HIERARCHY FOR PRIMARY SHOULDER REPLACEMENT

| Rank | Diagnosis |
|---|---|
| 1 | Tumour |
| 2 | Fracture (including Failed Internal Fixation) |
| 3 | Instability |
| 4 | Dislocation |
| 5 | Osteonecrosis/AVN |
| 6 | Rheumatoid Arthritis |
| 7 | Other Inflammatory Arthritis |
| 8 | Rotator Cuff Arthropathy |
| 9 | Hill-Sachs Defect |
| 10 | Osteoarthritis (including Post Traumatic OA) |
| 11 | Osteochondritis Dissecans |
| 12 | Other |

### DIAGNOSIS HIERARCHY FOR REVISION SHOULDER REPLACEMENT

| Rank | Diagnosis | Category |
|---|---|---|
| 1 | Tumour | Dominant diagnosis independent of prosthesis/surgery |
| 2 | Infection | |
| 3 | Incorrect Side | Surgical procedure |
| 4 | Incorrect Sizing | |
| 5 | Malalignment | |
| 6 | Metal Related Pathology | Reaction to prosthesis |
| 7 | Loosening | |
| 8 | Lysis | |
| 9 | Wear Glenoid Insert | Wear and implant breakage |

| | | |
|---|---|---|
| 10 | Wear Glenoid | |
| 11 | Wear Humeral | |
| 12 | Wear Humeral Cup | |
| 13 | Implant Breakage Glenoid Insert | |
| 14 | Implant Breakage Glenoid | |
| 15 | Implant Breakage Humeral | |
| 16 | Implant Breakage Head | |
| 17 | Instability/ Dislocation | |
| 18 | Rotator Cuff Insufficiency | Stability of prosthesis |
| 19 | Dissociation | |
| 20 | Fracture (Glenoid/Humeral/Periprosthetic) | Fracture of bone |
| 21 | Progression of Disease | Progression of disease on non-operated part of join |
| 22 | Glenoid Erosion | |
| 23 | Synovitis | |
| 24 | Arthrofibrosis | New diseases occurring in association with joint replacement |
| 25 | Osteonecrosis/AVN | |
| 26 | Heterotopic Bone | |
| 27 | Pain | Pain |
| 28 | Other | Remaining diagnoses |

# Appendices

## APPENDIX 4 – Patient Consent and Confidentiality Guidelines

### PATIENT CONSENT

The Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR) obtains consent to include information from individuals undergoing joint replacement by using the 'opt off' approach. The implementation of the new Commonwealth Legislation at the end of 2001 resulted in the Registry meeting with the Privacy Commission to ensure that the system used for patient consent is within the privacy guidelines.

Using this approach, patients are provided with a Patient Information Sheet. This explains what information is required, how it is collected and the avenues to take should an individual not want their information included in the Registry. The information is provided to patients by surgeons and hospitals prior to surgery. To accommodate patients that may have questions, wish to opt out or discuss any issues, a freecall number is available to contact the Registry.

### PATIENT CONFIDENTIALITY

Joint replacement patients will not be contacted directly by the Registry. No individual patient will be identified during analysis or in reports and publications produced by the Registry. Patient operative and prostheses data is managed in accordance with the Guidelines for the Protection of Privacy in the Conduct of Medical Research. Personal data collected are for use by the AOA National Joint Replacement Registry only. The Registry has been listed as a Federal Quality Assurance Activity and all information is protected (refer to section below).

### DATA MANAGEMENT AND CONFIDENTIALITY

The South Australian Health and Medical Research Institute (SAHMRI) undertakes data entry, validation and analysis and provides secure data storage. Only a small number of identified positions have access to patient information.

Declaration of the project as a Quality Assurance Activity ensures that Registry and SAHMRI staff are bound to maintain confidentiality. Confidentiality not only applies to individual patients but also includes surgeons and hospitals.

SAHMRI has security systems to restrict access to SAHMRI and Registry staff only. There are policies and procedures in place as well as software barriers to protect personal information. These include the use of codes, passwords, and encryption.

The proforma used for data collection are stored in a secure locked room at SAHMRI. Forms are scanned and electronically stored. After data entry and data cleaning, all data are securely stored and retained in accordance with good scientific practice.

### SURGEON CONFIDENTIALITY

Surgeon confidentiality is assured. The purpose of the Registry is to provide demographic and outcome information relevant to joint replacement surgery. Surgeon name is not recorded in the Registry database.

It is an important Registry function to provide a service to surgeons that allows them to monitor and audit their own performance. For this reason, surgeons have a choice to identify themselves by code, which can be linked to their procedures. This is optional and there is no requirement to provide the surgeon code. These codes are provided to surgeons by AOA.

Surgeons are provided with access to their own information through a secure online facility. It is important to emphasise that surgeons have the choice of using their code and that surgeon name is not recorded in the database.

### FEDERAL QUALITY ASSURANCE ACTIVITY

The AOANJRR was initially declared a Federal Quality Assurance Activity in March 1999, by the then Federal Minister for Health and Aged Care, Dr Wooldridge. This was renewed in 2001, 2006, 2011, 2016 and for a further five years in July 2022. An amendment was approved in 2018 to add collection of Knee Osteotomy procedures. This declaration ensures freedom from subpoena and absolute confidentiality of information held by the Registry.

The Quality Assurance legislation is part of the Health Insurance Act of 1973. This act was amended in 1992 to include quality assurance confidentiality. The Act operates on the underlying assumption that quality assurance activities are in the public interest.

A declaration as a Quality Assurance Activity by the Commonwealth Minister of Health prohibits the disclosure of information, which identifies individual patients or health care providers that is known solely as a result of the declared quality assurance activity. It is not possible to provide identifying information to any individual or organisation including the government.

The protection provided by the declaration assures surgeons, hospitals and government that information supplied to the Registry remains confidential and secure. The act also protects persons engaging in those activities in good faith from civil liability in respect of those activities.

## APPENDIX 5 - Patient Information Sheet

### INTRODUCTION – ABOUT THE REGISTRY

You are about to have an operation on one of your joints. More than 100,000 people have a joint replacement or knee osteotomy operation each year in Australia. Most of these operations are very successful. However, a number of people who have a joint operation may at some time require another operation on that joint. This may occur due to a variety of reasons. For instance, if you have had a joint replacement the most common cause is that the joint replacement has worn out. How quickly this occurs depends on which of the many different types of artificial joints have been used. For those patients having a knee osteotomy the aim is to delay or prevent the need for having a joint replacement.

In order to improve the success of these operations, the Australian Orthopaedic Association set up the National Joint Replacement Registry in 1999. The purpose is to monitor and report on the results of these operations. This information helps everyone working in the health system to ensure patients get the best treatment possible both now and in the future. Another important Registry role is that it assists hospitals and doctors to locate people in the uncommon event a problem with any medical device used is identified.

To do this it is important for the Registry to record a small amount of information on as many people having these operations as possible. It is also important to record if any subsequent operations have occurred. By analysing this information, it is possible to identify which of the medical devices are working best and the best type of operation for each patient. We are asking you to participate in the Registry, by allowing us to document information relevant to your operation.

### YOUR INVOLVEMENT – THE INFORMATION WE NEED

The information we require includes your name, date of birth, address, Medicare number, hospital identity number, the name of the hospital and the reason you are having a joint replacement or knee osteotomy. This information is necessary to accurately link you to the medical device inserted as well as linking any following joint surgery you may have, to your previous records. We will also record the day of the operation, which joint was operated on and the type of medical device used. No other personal information is recorded. Government Departments also provide information so that the Registry can check the accuracy of the data and update records to reflect if someone has died.

### INFORMATION – HOW WE WILL KEEP YOUR INFORMATION CONFIDENTIAL

Your personal information is confidential and safety measures are in place to protect this information. Your personal information is protected by an Act of Parliament. This means you cannot be identified in any reports produced by the Registry. On occasion, your data may be linked to other government health datasets to further enhance the Registry's ability to improve patient outcomes. Your de-identified data may be used for other research projects and may be shared with national and international collaborators.

### HOW WE WILL COLLECT THE INFORMATION

Although we are asking to record your operation details in the Registry you are not required to do anything. Your surgeon and/or theatre staff will complete the form that contains your personal details at the time of your operation and send it to us. The information will be entered into the secure Registry database which is stored in the South Australian Health & Medical Research Institute, Adelaide, South Australia.

### RISKS AND BENEFITS – TO YOU

There are no risks to you by having your details in the Registry. The Registry produces general reports on a variety of factors that influence the success of joint operations. The results of joint operations have greatly improved because of this information.

### WHAT TO DO IF YOU DON'T WANT TO BE IN THE REGISTRY

We understand that not everyone is comfortable about having his or her personal details documented in a registry. If you feel this way and do not want your details recorded, please contact the Manager on 1800 068 419 (freecall) as well as making your decision known to hospital staff. A decision on whether or not you wish to be involved in the Registry does not affect your treatment in any way. If you have any questions, concerns, or require further information on the National Joint Replacement Registry please do not hesitate to contact the Registry.

Concerns or complaints related to the data collection process may be directed to the AOANJRR on 1800 068 419 (freecall) or alternatively the Australian Government, Office of the Privacy Commissioner on 1300 363 992

# Appendices

## APPENDIX 6 - Implementation Timeline

**IMPLEMENTATION OF NATIONAL JOINT REPLACEMENT REGISTRY FOR HIP, KNEE AND SHOULDER REPLACEMENT**

The Registry was implemented in a staged manner on a state-by-state basis. The table below shows the commencement date for each state or territory. Implementation was completed nationally by mid 2002, therefore 2003 was the first year of complete national data.

National data collection on shoulder replacement commenced in November 2007. Knee osteotomy data collection commenced in early 2018.

| State/Territory | Commencement Date |
|---|---|
| South Australia | September 1999 |
| Queensland | April 2000 |
| Western Australia | April 2000 |
| Victoria | July 2000 |
| Tasmania | September 2000 |
| Northern Territory | October 2000 |
| Australian Capital Territory | May 2001 |
| New South Wales | June 2001 |

## APPENDIX 7 - ICD - 10-AM Codes

| ICD-10-AM CODES – v12 (2022 Edition) State Health Department Separation Data | |
|---|---|
| **HIP** | |
| **Partial Hip Replacement** | |
| 49315-00 | Partial arthroplasty (excludes Austin Moore) |
| 47522-00 | Hemiarthroplasty of femur (Austin Moore) |
| **Primary Total Hip Replacement** | |
| 49318-00 | Total arthroplasty of hip unilateral |
| 49319-00 | Total arthroplasty of hip bilateral |
| 90607-00 [1489] | Resurfacing of hip, unilateral |
| 90607-01 [1489] | Resurfacing of hip, bilateral |
| **Revision Hip Replacement** | |
| 49312-00 | Excision arthroplasty of hip (removal of prosthesis without replacement) |
| 49324-00 | Revision of total arthroplasty of hip |
| 49327-00 | Revision of total arthroplasty with bone graft to acetabulum |
| 49330-00 | Revision of total arthroplasty with bone graft to femur |
| 49333-00 | Revision of total arthroplasty with bone graft to acetabulum and femur |
| 49339-00 | Revision of total arthroplasty with anatomic specific allograft to acetabulum |
| 49342-00 | Revision of total arthroplasty of hip with anatomic specific allograft to femur |
| 49345-00 | Revision of total arthroplasty with anatomic specific allograft to acetabulum and femur |
| 49346-00 | Revision of partial arthroplasty hip replacement |

| ICD-10-AM CODES – v12 (2022 Edition) State Health Department Separation Data | |
|---|---|
| **KNEE** | |
| **Partial Knee Replacement** | |
| **Patellofemoral Knee Replacement** | |
| 49534-01 | Total replacement arthroplasty of patellofemoral joint of knee |
| **Unicompartmental Knee Replacement** | |
| 49517-00 | Hemi arthroplasty of knee |
| **Primary Total Knee Replacement** | |
| 49518-00 | Total arthroplasty of knee unilateral |
| 49519-00 | Total arthroplasty of knee bilateral |
| 49521-00 | Total arthroplasty of knee with bone graft to femur unilateral |
| 49521-01 | Total arthroplasty of knee with bone graft to femur bilateral |
| 49521-02 | Total arthroplasty of knee with bone graft to tibia unilateral |
| 49521-03 | Total arthroplasty of knee with bone graft to tibia bilateral |
| 49524-00 | Total arthroplasty of knee with bone graft to femur and tibia unilateral |
| 49524-01 | Total arthroplasty of knee with bone graft to femur and tibia bilateral |
| **Revision Knee Replacement** | |
| 49512-00 | Arthrodesis with removal of prosthesis |
| 49515-00 | Removal-prostheses from knee |
| 49527-00 | Revision of total arthroplasty of knee excluding patella resurfacing |
| 49530-00 | Revision of total arthroplasty of knee with bone graft to femur |
| 49530-01 | Revision of total arthroplasty of knee with bone graft to tibia |
| 49533-00 | Revision of total arthroplasty of knee with bone graft to femur and tibia |
| 49554-00 | Revision of total arthroplasty of knee with anatomic specific allograft |
| 90562-00 | Patella resurfacing |

| SHOULDER | |
|---|---|
| **Partial Shoulder Replacement** | |
| 48915-00 | Hemiarthroplasty of shoulder |
| **Total Shoulder Replacement** | |
| 48918-00 | Total arthroplasty of shoulder |
| **Revision Shoulder Replacement** | |
| 48921-00 | Revision of total joint replacement of shoulder |
| 48924-00 | Revision of total joint replacement of shoulder with bone graft |
| 48927-00 | Removal of shoulder prosthesis |
| 48942-00 | Arthrodesis and removal of shoulder prosthesis |




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