# Australian Orthopaedic Association National Joint Replacement Registry

AOA
AUSTRALIAN
ORTHOPAEDIC
ASSOCIATION

## Hip, Knee & Shoulder Arthroplasty

# ANNUAL REPORT 2021

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Australian Orthopaedic Association
National Joint Replacement Registry

# 2021 Annual Report

**Hip, Knee & Shoulder Arthroplasty**

September 1999 – December 2020

# Preface

It is my great pleasure to present the Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR) Annual Report for 2021. This is the 22nd Annual Report produced by the AOANJRR. The Registry has information on joint replacement that goes back many years and during this time there have been significant changes in both the practice and outcomes of joint replacement surgery. To ensure ongoing relevance for surgeons, patients and other stakeholders this year's report has focused on providing information on currently used prostheses.

I hope that the two new chapters are found to be both helpful and informative. They reflect the increasingly important role of the Registry. The first new chapter is a brief overview of the impact of COVID-19 on the delivery of joint replacement surgery in Australia during 2020. The AOANJRR is the only organisation that can provide an accurate national perspective on this. COVID-19 has significantly impacted the delivery of healthcare, particularly elective surgery in the public system. The AOA remains concerned about the increasing burden of unmet needs which has now been exacerbated by the pandemic, not only in 2020 but likely into the foreseeable future. Strategies to address this going forward will need to be implemented and monitored, which the Registry will be able to do.

The second new chapter reports, for the first time, the initial findings of patient-reported outcomes. The Registry is currently rolling out an ambitious national program to collect these data directly from all patients having elective joint replacement procedures. The Registry team is ensuring that the roll-out is on track with an anticipated completion date in mid-2022. This is being supported by funds from Federal, and all State and Territory Governments. The AOA greatly appreciates their support and ongoing participation in the program.

The Registry continues to work diligently at achieving the goals set by the AOA through the AOANJRR strategic plan. It has made great progress in all areas including the implementation of registry nested trials with 10 active trials currently being managed by the Registry staff. National data linkage projects are also providing additional high-quality new information on the outcomes of joint replacement surgery. The continual enhancement of stakeholder reporting is progressing and will soon incorporate the new area of patient reported outcomes.

The AOA carefully reviews the Annual Report prior to publication through an annual review by an independent group of surgeons with expertise in arthroplasty surgery as well as a separate review by the Board. Both have assessed this report to be of the highest quality.

I would like to take the opportunity to thank all of those who have made this report possible. The committed, quality registry team led by the registry manager, director, and deputy directors. The South Australian Health and Medical Research Institute (SAHMRI) who are responsible for data collection, management, and analysis. The University of South Australia who provides additional statistical expertise and data linkage analysis support. The Federal Government who funds the Registry core activity through the legislated cost recovery program and has maintained and expanded the Registry's coverage under qualified privilege. In addition, the ongoing advice, support and involvement of the Therapeutics Goods Administration and the orthopaedic and healthcare industry.

Lastly, I would like to thank those that provide the high-quality data to the Registry, including patients, surgeons and hospitals. Their involvement is entirely voluntary, but their support and commitment are reflected in the almost 100% participation rates. This has been responsible for greatly enhancing the outcomes of joint replacement, not only in Australia but internationally. Their ongoing commitment is required to ensure the continued success of what I often refer to as the "Jewel in the Crown" of the AOA.

Michael J Gillespie

Michael Gillespie

President of the Australian Orthopaedic Association

AOA AUSTRALIAN ORTHOPAEDIC ASSOCIATION

85th Anniversary ORTHOPAEDICS IN AUSTRALIA

# AOANJRR Data Snapshot 2020

**1,723,466**
Total number of joint replacement procedures reported by the Registry at the end of 2020

**196**
Ad Hoc Reports Produced in 2020

**42**
Conference Presentations

Joint Replacement Procedures Reported in 2020

**49,169** Hips

**62,624** Knees

**7,827** Shoulders

**1,558**
Automated Industry Reporting System (AIRS) Produced

**35**
Hospital Audit Reports Produced

**986**
Individual Surgeon Reports

**32**
Journal Articles Published in 2020

## COVID-19 Impact on Joint Replacement in Australia

Joint replacement declined by **5.7%** in 2020 compared to 2019

**Actual decrease:**
In 2020, there were
**7,086**
less hip, knee, and shoulder joint replacement procedures compared to 2019

| Primary THR | Primary TKR | Primary TSR |
|---|---|---|
| ⬇4.9% | ⬇6.1% | ⬇1.8% |
| compared to 2019 | compared to 2019 | compared to 2019 |

## Update June 2021

### Registry Nested Clinical Trials

**3** Surgeon Initiated RNCTs

**7** Industry Initiated RNCTS

| CRISTAL | RASKAL | DISTINCT |
|---|---|---|
| 12,722 procedures | 10 hospitals | 51 hospitals |

### PROMs National Rollout

Hospitals **143**

Pre-Op PROMs **30,246**

Post-Op PROMs **26,796**

Pre-Op Completion **86.4%**

Post-Op Completion **74.4%**

# Executive Summary

This summary provides a brief overview of some of the major findings from the 2021 Annual Report. Although the design and structure of this report are similar to previous reports, there are important differences in the approach to reporting prosthesis outcomes. In the 2019 Annual Report, the Registry detailed the significant changes in prosthesis use, approach to implantation, and the improving outcomes over time. Many of the prostheses used since the Registry first began collecting data in 1999 are no longer available and it is known that the performance of many of these older designs is inferior compared to many of the currently used prostheses (described as 'modern prostheses'). 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 2020. The impact is that overall outcomes reported for the different device classes have improved and a reduced number of individual prostheses/prosthesis combinations are listed in the report. For those who may be interested, historic data are still available in previous Annual Reports on the AOANJRR website.

As with previous Annual Reports, new information is presented on additional topics in what is referred to as the 'new chapters'. The first new chapter provides an overview of the impact of COVID-19 on joint replacement in Australia during 2020. The second new chapter details for the first time, pre-operative and 6 months post-operative patient reported outcomes.

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-2021 from 1 October 2021. They include a Lay Summary of the main report and 14 additional reports on arthroplasty topics, as well as detailed analyses of all prostheses identified as having a higher than anticipated rate of revision.

**Impact of COVID-19 in 2020**

For the first time since the Registry commenced data collection, the number of joint replacement procedures decreased compared to the previous year. There were 5.7% fewer hip, knee and shoulder joint replacement procedures performed in 2020 compared to 2019. This equates to just over 7,000 fewer procedures. However, this number does not include the anticipated increase in procedures that would have normally occurred. Taking this into account, the likely reduction in during 2020 was over 11,000 procedures.

Most of the reduction nationally occurred during the months of April and May. There was a rebound in the number of procedures after June, but this occurred only in the private system. The number of procedures undertaken in the public system remained below previous years for the remainder of the year. The reduction in joint replacement in Victoria was greater than other states and territories, in part due to a second shutdown occurring later in the year (August-October).

The impact varied depending on the type of joint replacement and the indication. The reduction was greatest for primary elective procedures particularly knee replacement. A proportion of hip and shoulder replacements are undertaken as emergency procedures, most often to treat fractures. There was no reduction in hip and shoulder replacements to treat fractures. The number of revision procedures also declined, particularly during April and May. This reduction was not to the same extent as primary procedures, but the evident rebound in primary procedures after June did not occur for revision procedures.

**Patient Reported Outcome Measures**

The AOANJRR is providing information on patient reported outcome measures (PROMs) for the first time. These are additional joint replacement outcomes that are reported directly by patients through a bespoke electronic data capture system. The system is currently being implemented nationally in all hospitals undertaking joint replacement surgery. Several different instruments are used to collect data on patients' quality of life and joint-specific pain, function, and recovery. This year, PROMs data are reported for primary total hip and primary total knee replacement undertaken for osteoarthritis (OA), and primary reverse total shoulder replacement undertaken for OA and separately for rotator cuff arthropathy. There were insufficient data at this time to include information on stemmed total shoulder replacement. The data are presented overall for each category of joint replacement as well as for the two shoulder diagnoses assessed, and how this varied by age and gender. Individual surgeon and individual hospital (both de-identified) pre-operative quality of life and joint-specific scores are also reported for primary total hip and primary total knee only. There were insufficient data to report this for primary total reverse shoulder replacement.

All groups demonstrated large improvements in quality of life, joint-specific pain and function, 6 months after joint replacement surgery. This varied very little by age and gender. There was also little variation in the pre-operative quality of life and joint-specific scores for individual surgeons. This was true for both hip and knee replacement. Similarly, there was little variation in these scores when individual hospitals (public and private) were compared. Although in general, public patients had lower pre-operative quality of life and joint-specific scores.

**Ten, Fifteen and Twenty Year Outcome Data**

This section of the report provides 10 and 15 year benchmarks for prostheses used in >350 procedures in primary total hip and primary total knee replacement undertaken for OA. For the first time, this chapter reports 20 year outcomes for a small number of prostheses that are still used.

Restricting the analysis to prostheses that were used in 2020 has had a significant impact on the data provided. Fewer hip and knee prosthesis combinations are now listed, and the benchmark standards have changed. In previous years, the 10 year benchmark standard chosen was the commonly used 5% cumulative percent revision for both hip and knee replacement. This benchmark standard is now considered to be an overestimation. Restricting analyses to modern prostheses reduces the 10 year benchmark standard to 4.4% for hips and 4.8% for knees. The calculated 15 year benchmark standard for hips is 6.5% and for knees is also 6.5%.

The AOANJRR uses the benchmark approach recommended by the International Working Group to identify those devices that have superior and non-inferior performance at 10 years. The same approach has been applied to the 15 year benchmarks. The benchmarks reflect proven long-term success. In this chapter, the benchmark approach is described and the prostheses achieving the benchmarks are highlighted. Of those hip and knee prosthesis combinations with a sufficient number of procedures and follow-up, 22.9% of hip and 16.3% of knee prosthesis combinations achieved a 10 year superiority benchmark. At 15 years, 27.8% of hip and 20.8% of knee prostheses combinations still in use achieve a superiority benchmark.

### Hip Replacement Data

In 2020, hip replacement decreased by 4.8% compared to 2019. The revision burden in 2020 is 8.0% which is the lowest burden reported by the Registry. However, the impact of COVID-19 makes the interpretation of this finding uncertain. Only summary data on partial hip replacement are provided in this year's report. A full report on partial hip replacement is available as a supplementary report. The summary information reports that 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.

Primary total hip replacement decreased by 4.8% in 2020. Of the two types of primary total hip replacement, conventional total hip has a lower cumulative percent revision than resurfacing hip replacement. The 20 year cumulative percent revision for currently used devices undertaken for osteoarthritis is 9.0%. Age does not have a major impact on revision risk, particularly in males. 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. With the analysis restricted to modern prostheses, 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 cement fixation is used. Dual mobility has the same revision risk as standard acetabular prostheses when used in the management of OA, but has half the risk of being revised for dislocation. When adjusted for age, gender, ASA score, BMI category, femoral fixation, and head size, there is no difference in the rate of revision related to operative approach. However, there are 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.

### Knee Replacement Data

In 2020, knee replacement decreased by 6.8%. The revision burden decreased to 7.3% which is the lowest reported, but as was the case for hip replacement, the impact of COVID-19 makes the interpretation of this finding uncertain. There has been a small increase in the use of partial knee replacement, but in 2020 it remains a small proportion (6.2%) of all knee replacement procedures. Younger age and female gender are associated with higher rates of revision for unicompartmental knee replacement. Robotic assistance is associated with a reduced revision risk, but its use is restricted to specific prostheses. Mobile bearings increase revision risk. There is no difference between medial and lateral unicompartmental knee replacement.

Primary total knee replacement decreased by 6.1% in 2020. The 20 year cumulative percent revision of knee prostheses still used in 2020 for the management of OA is 8.1%. Despite restricting the analysis to modern prostheses, 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. 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. Medial pivot designs have a higher rate of revision compared to minimally stabilised prostheses. However, there is no difference if the patella is resurfaced. Medial pivot designs have a lower rate of revision compared to posterior stabilised prostheses. There is no difference when minimally stabilised and ultra-congruent inserts are compared.

The effect of fixation varies depending on prosthesis stability. For minimally stabilised prostheses, hybrid fixation has the lowest rate of revision. For posterior stabilised prostheses, cement fixation has the lowest revision rate in the first 1.5 years, but after that time cementless fixation has the lowest rate of revision. For medial pivot prostheses, the use of cementless fixation is associated with a higher rate of revision.

**Shoulder Replacement Data**

In 2020, shoulder replacement decreased by 1.8%. The revision burden decreased to 7.9% which is the lowest reported. As with hip and knee replacement, due to the impact of COVID-19, the interpretation of this result remains uncertain. Less than 300 partial shoulder replacements were undertaken in 2020. Summary data on these procedures are provided in the Annual Report and a full analysis is provided in the Partial Shoulder Arthroplasty Supplementary Report.

There are three main types of total shoulder replacement: reverse, total stemmed shoulder replacement, and total mid head. The proportional use of both the reverse and mid head increased in 2020. However, reverse shoulder replacement is by far the most common type of total shoulder replacement undertaken in Australia and accounts for 66.9% of all total shoulder procedures reported to the Registry. When the outcomes of these three different types of total shoulder are compared, reverse and mid head have lower rates of revision compared to stemmed total shoulders. The outcome of stemmed total shoulders is influenced in a major way by cement fixation of the glenoid and the use of XLPE, each of which are associated with a lower rate of revision in this class of total shoulder replacement.

The rate of revision for reverse total shoulders is the same when used for either osteoarthritis or rotator cuff arthropathy. Younger age and male gender are associated with an increased risk of revision. It is becoming evident that higher ASA scores increase revision risk, but the evidence for BMI categories impacting revision rates remains unclear. The method of fixation is not a risk factor for revision.

The Registry now reports 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.

**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, 1 unicompartmental knee, 1 total stemmed shoulder, 1 reverse total shoulder, and 1 total ankle prosthesis combination have been newly identified.

# Acknowledgements


The Registry continues to receive support and invaluable assistance from the Commonwealth 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 2021 Hip, Knee, and Shoulder Arthroplasty Annual Report is based on the analysis of 1,723,466 (743,899 hip, 911,953 knee and 67,614 shoulder) primary and revision procedures recorded by the Registry with a procedure date up to and including 31 December 2020. Shoulder arthroplasty has been included in this report since 2017.

In addition, there are 15 Supplementary Reports that complete the AOANJRR Annual Report for 2021:

1. Lay Summary – Hip, Knee & Shoulder Replacement
2. Demographics of Hip, Knee & Shoulder Arthroplasty
3. Cement in Hip and Knee Arthroplasty
4. Mortality of Hip and Knee Arthroplasty
5. Revision of Hip and Knee Arthroplasty
6. Metal/Metal Bearing Surface in Total Conventional Hip Arthroplasty
7. Prosthesis Types No Longer Used
8. Demographics and Outcomes of Elbow and Wrist Arthroplasty
9. Demographics and Outcomes of Ankle Arthroplasty
10. Demographics of Spinal Disc Arthroplasty
11. Analysis of State and Territory Health Data – All Arthroplasty 1993/1994 – 2019/2020
12. Partial Hip Arthroplasty
13. Partial Knee Arthroplasty
14. Partial Shoulder Arthroplasty
15. Comparative Prosthesis Performance

In addition to the 15 Supplementary Reports, investigations of prostheses with higher than anticipated rates of revision are published online
https://aoanjrr.sahmri.com/annual-reports-2021

All public and private hospitals 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

Joint replacement is a commonly performed major surgical procedure that has considerable success in alleviating pain and disability.

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 in arthroplasty 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 Commonwealth Department of Health (DoH) funded the AOA to establish the Registry. The Department of Health 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 contributes crucial data management and analysis expertise through the Registry Working Group and a variety of project working groups.

The AOA contracts the University of South Australia to provide 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. 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.

## 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 ad hoc reports (196 in 2020). These ad hoc 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 6 weeks of the procedure date, although there has been some disruption to this timeframe in 2020 due to COVID-19.

The percentage of revision hip procedures has declined from a peak of 12.9% in 2003 to 8.0% in 2020. The percentage of revision knee procedures has declined from a peak of 8.8% in 2004 to 7.3% in 2020. Revision shoulder arthroplasty peaked at 10.9% in 2012 and has declined to 7.9% in 2020.

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) and knees (2013).
- The benefit of computer assisted surgery for knee replacement.
- The identification 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.

The National Board of the AOA established the AOANJRR Committee to develop and manage AOANJRR policies. The Committee reports to the AOA Board. Members include the Chairperson, AOANJRR Director, three AOANJRR Deputy Directors and two Assistant Deputy Directors. 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 AOANJRR Committee is provided in the acknowledgements section of this report.

The Director, Deputy Directors and Assistant Deputy Directors are appointed by the AOA Board and are responsible for providing strategic and clinical guidance. Additionally, the 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 Manager, Project Managers, Project Officers, Administration Officer, and Publications Manager. The AOANJRR team are responsible for the day-to-day operations, implementing new strategies and activities, provision of data reports, research and publications activity, and coordinating the preparation of the Annual Report.

# Data Quality

## 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 AOANJRR website.

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.

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.

In the 2019/20 financial year, the Registry received 3,115 more hip, knee and shoulder procedures than were provided in the various health department data files.

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.

The Registry is able to obtain over 97.3 % of joint replacement procedures undertaken in Australia. On initial submission of forms from participating hospitals, the Registry's capture rate is 94.3%. Following verification against health department data, checking of unmatched data and subsequent retrieval of unreported procedures, the Registry is able to obtain an almost complete dataset relating to hip, knee and shoulder replacement in Australia.

## OUTCOME ASSESSMENT

The Registry describes the time to first revision using the Kaplan-Meier estimates of survivorship. The cumulative percent revision 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.

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 (CPR) 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.

The Registry is currently investigating the introduction of different analytical methods to cope with competing risks. 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

[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.

anticipated rate of revision'. A three-stage approach has been developed and is outlined in detail in the relevant chapter of the report.

## REPORT REVIEW PRIOR TO PUBLICATION

Prior to publication, there are two workshops held to review, comment, and provide advice on all sections of the report. This year, as was the case in 2020, due to COVID-19 restrictions workshops were held online rather than face-to-face. The workshop format was modified to accommodate the online delivery. This enabled a larger than usual number of surgeons to attend.

In addition to AOANJRR and SAHMRI staff, and the AOA Executive, 29 AOA members with expertise in hip and knee arthroplasty attended the workshop. This workshop was online on the weekend of 7 and 8 August 2021.

Members of the AOA with expertise in shoulder surgery were invited to attend a separate workshop to review this section of the report. In addition to AOANJRR and SAHMRI staff, and the AOA Executive, 11 AOA members with expertise in shoulder arthroplasty attended the workshop. This workshop was held online on 14 August 2021.

This year 1 ankle prosthesis was reidentified as having a higher than anticipated rate of revision, this was reviewed separately by a sub-group of ankle arthroplasty surgeons and has been included in this report.

Following these workshops, the report was provided to the AOA Board for consideration and final approval prior to publication.

2021

# Summary of the Impact of COVID-19 on Joint Replacement in Australia in 2020

## INTRODUCTION

COVID-19 had a significant impact on the delivery of health services in Australia during 2020. The AOANJRR is in a unique position to assess this impact with respect to joint replacement surgery nationally and by state and territory. The number of joint replacement procedures performed in 2020 has been compared to the previous three years (2019, 2018, and 2017).

The information is presented for all procedures nationally, by state and territory, as well as by public and private hospitals. The information is also presented by joint replacement type (hip, knee, and shoulder) for primary procedures (overall, elective and trauma) as well as revision procedures.

Since the AOANJRR commenced data collection, the number of procedures undertaken each year has increased. If COVID-19 had not occurred, it could have been anticipated that the number of primary procedures undertaken in 2020 would have increased slightly compared to 2019, and revision procedures would have remained steady or declined.

## ALL JOINT REPLACEMENT NATIONALLY

Joint replacement declined by 5.7% in 2020 compared to 2019 with most of that reduction occurring in the months of April and May (Figure C1). There was a rebound in the number of procedures undertaken in subsequent months. From July through to the end of December, more procedures were performed in 2020 compared to 2019. However, this increase only occurred in the private hospital system. Not only was there no rebound in the public system, the number of public procedures during the latter 6 months of 2020 remained below that of previous years (Figure C2).

In 2020, there were 7,086 fewer hip, knee, and shoulder joint replacement procedures compared to 2019. Calculating the expected number of procedures in 2020 based on the average increase that occurred in the previous 3 years for each procedure type, the likely shortfall in 2020 is estimated to be 11,407 procedures.

**Figure C1** **All Joint Replacement Hip, Knee and Shoulder (Primary and Revision)**

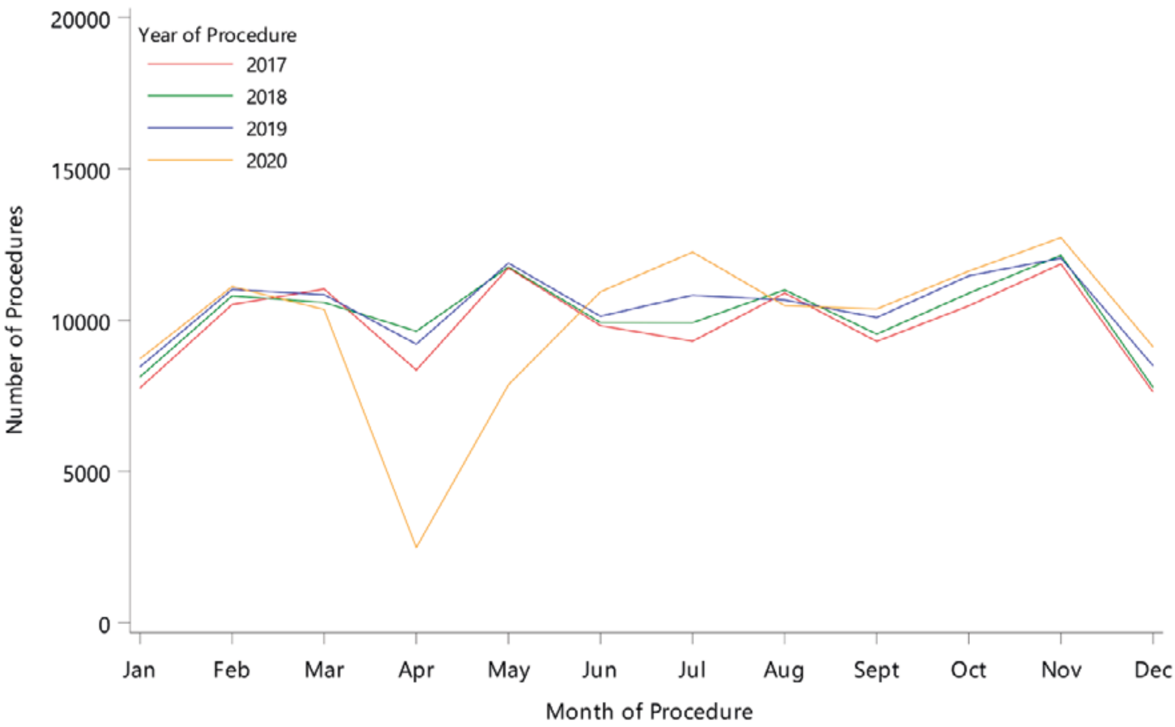
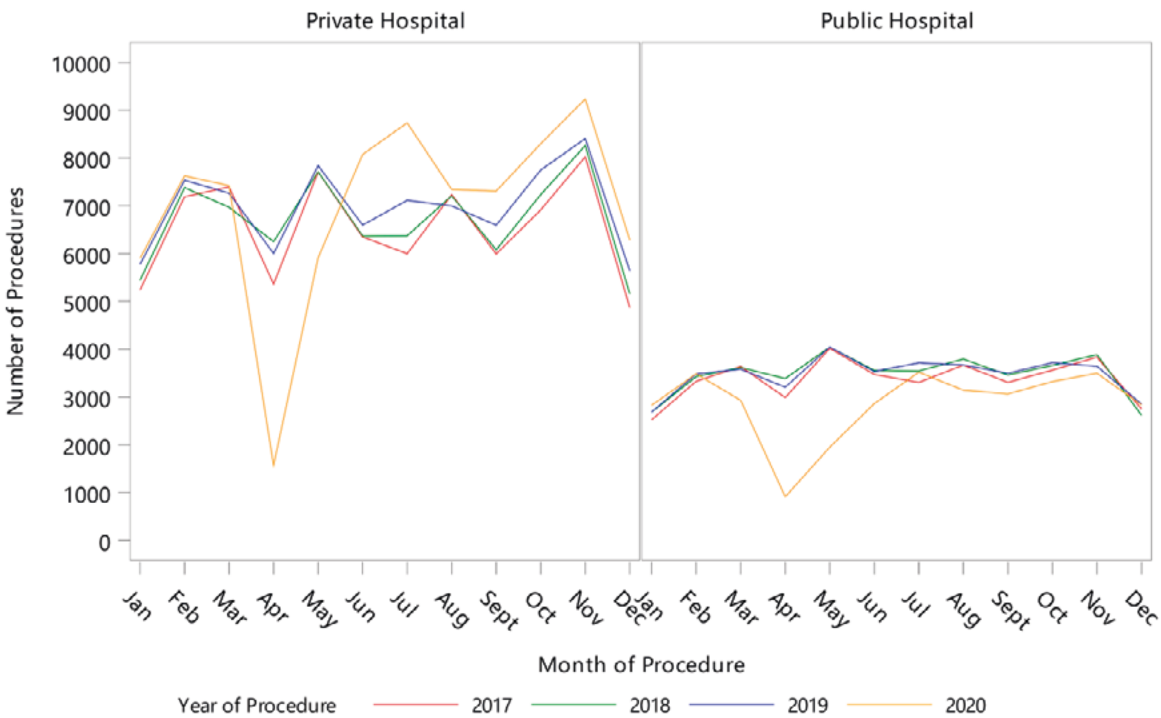



**Figure C2** **Primary Joint Replacement - By Hospital Type**

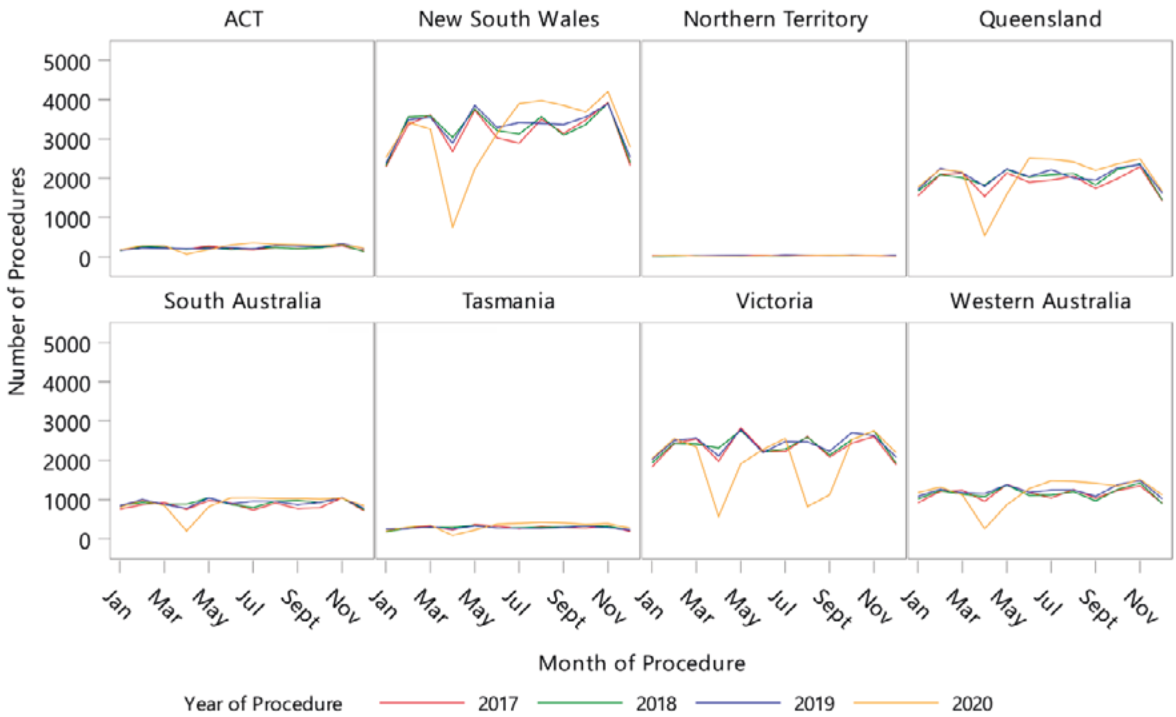


## ALL JOINT REPLACEMENT BY STATE AND TERRITORY

The impact of COVID-19 varied by state and territory. Larger states demonstrated a greater proportional reduction during the April-May period. The only state to have a second period of decline was Victoria (August-October).

The rebound in procedure numbers observed nationally was evident in all states and territories except for Victoria (Figure C3).

**Figure C3** **All Joint Replacement – By State and Territory**



## PROCEDURE TYPE AND INDICATION

Primary knee replacement had a greater reduction compared to primary hip and primary shoulder replacement (Figure C4, Figure C5 and Figure C6). A possible explanation for this is that primary knee replacement is almost entirely an elective procedure, whereas a proportion of primary hip and primary shoulder surgery is undertaken for fracture management, which is usually an emergency procedure.

There was no reduction in hip and shoulder replacement undertaken for the management of fractures during 2020 (Figure C7 and Figure C8).

Revision procedures declined during the April-May period but not to the same extent as occurred with primary procedures. Unlike primary procedures, there was no rebound in the number of revision procedures in later months (Figure C9).

**Figure C4 All Primary Hip Replacement (All Diagnoses)**

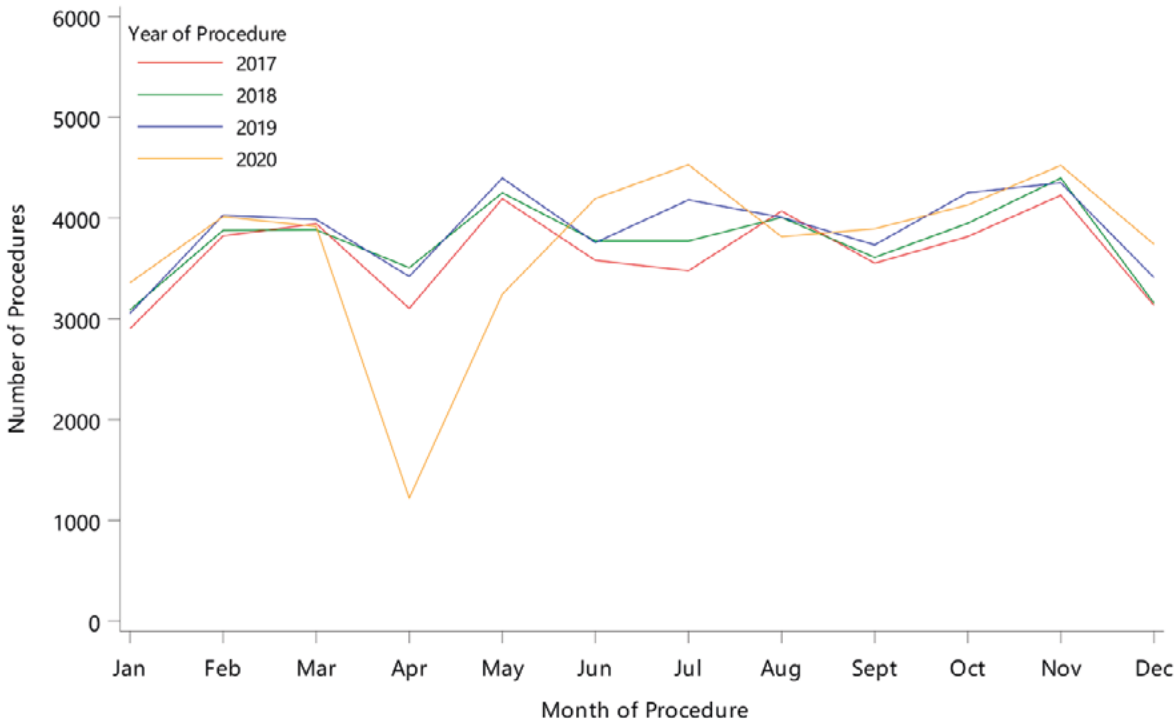


**Figure C5 All Primary Knee Replacement (All Diagnoses)**

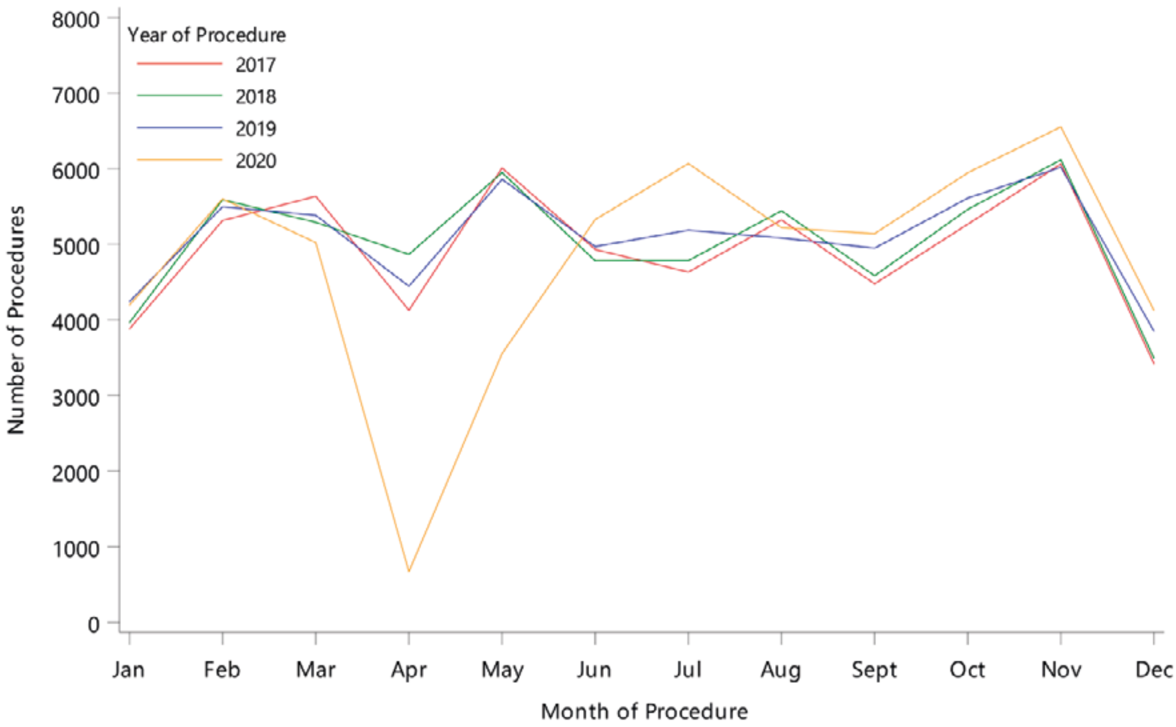



**Figure C6 All Primary Shoulder Replacement (All Diagnoses)**

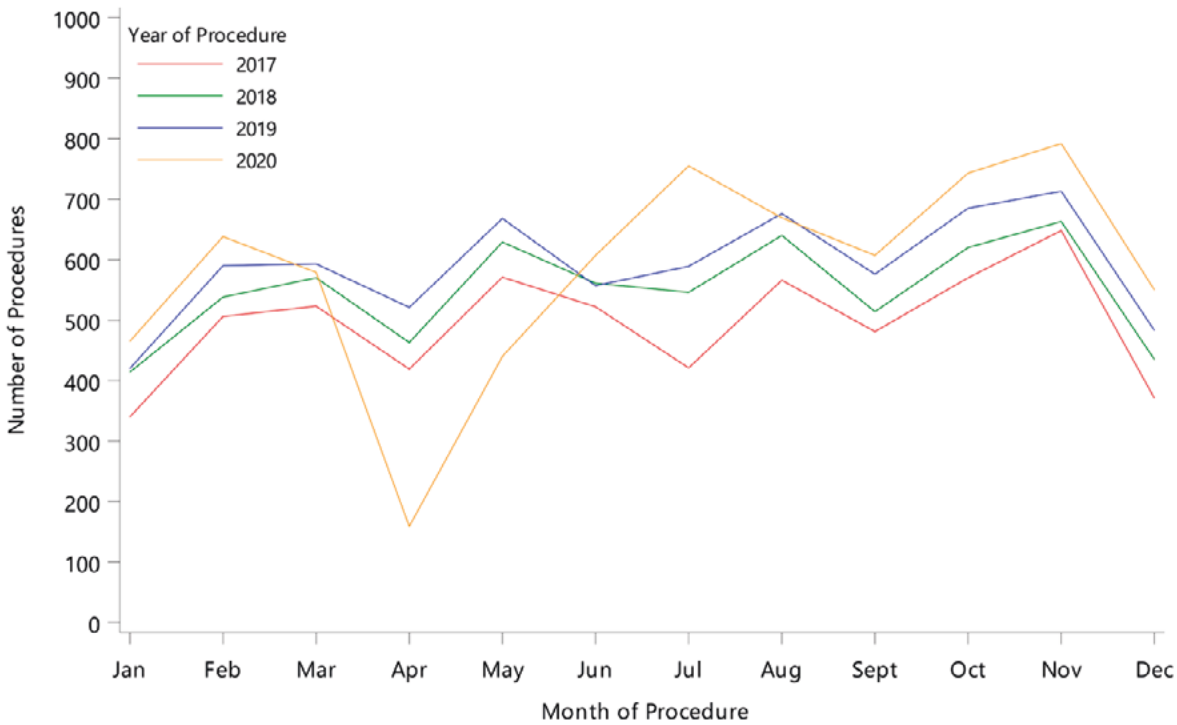


**Figure C7** **Primary Hip Replacement (Primary Diagnosis Fractured Neck of Femur)**

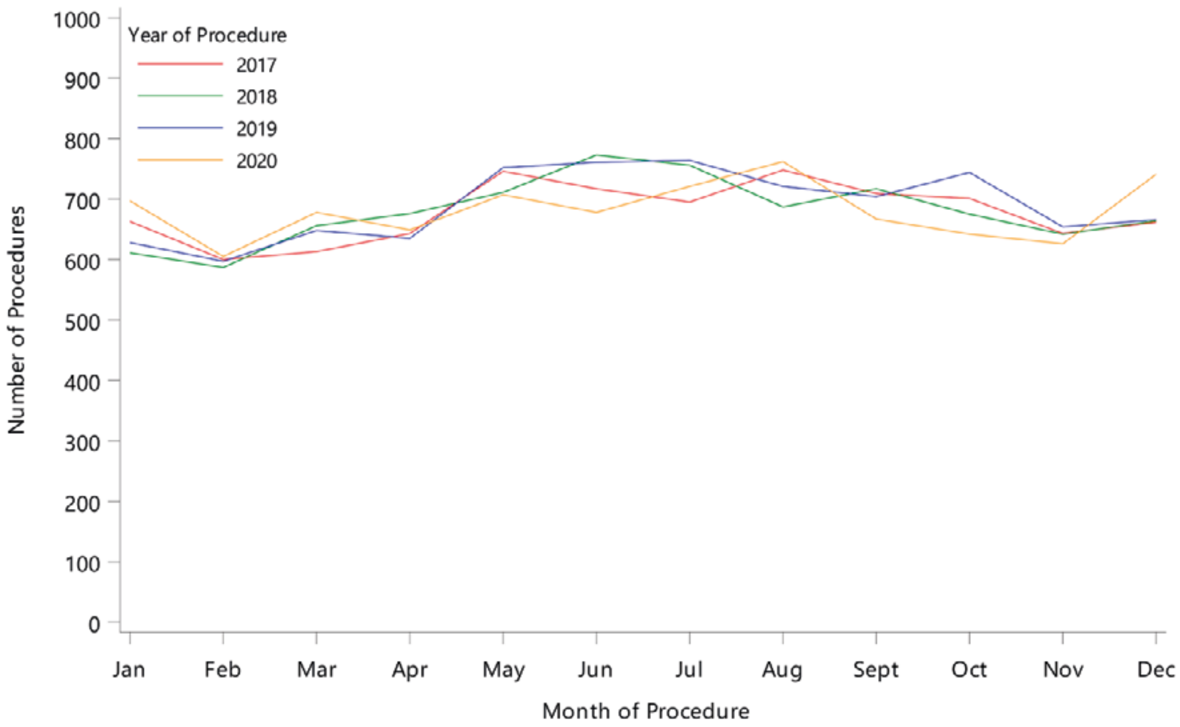



**Figure C8** **Primary Shoulder Replacement (Primary Diagnosis Fracture)**

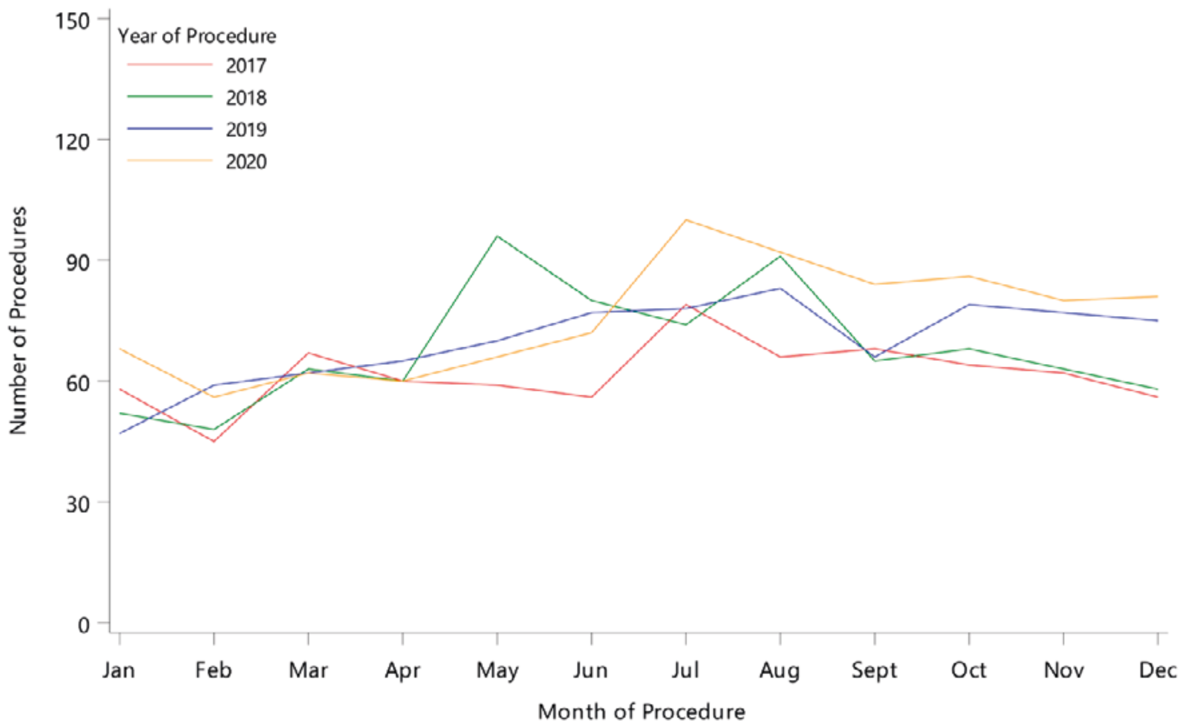
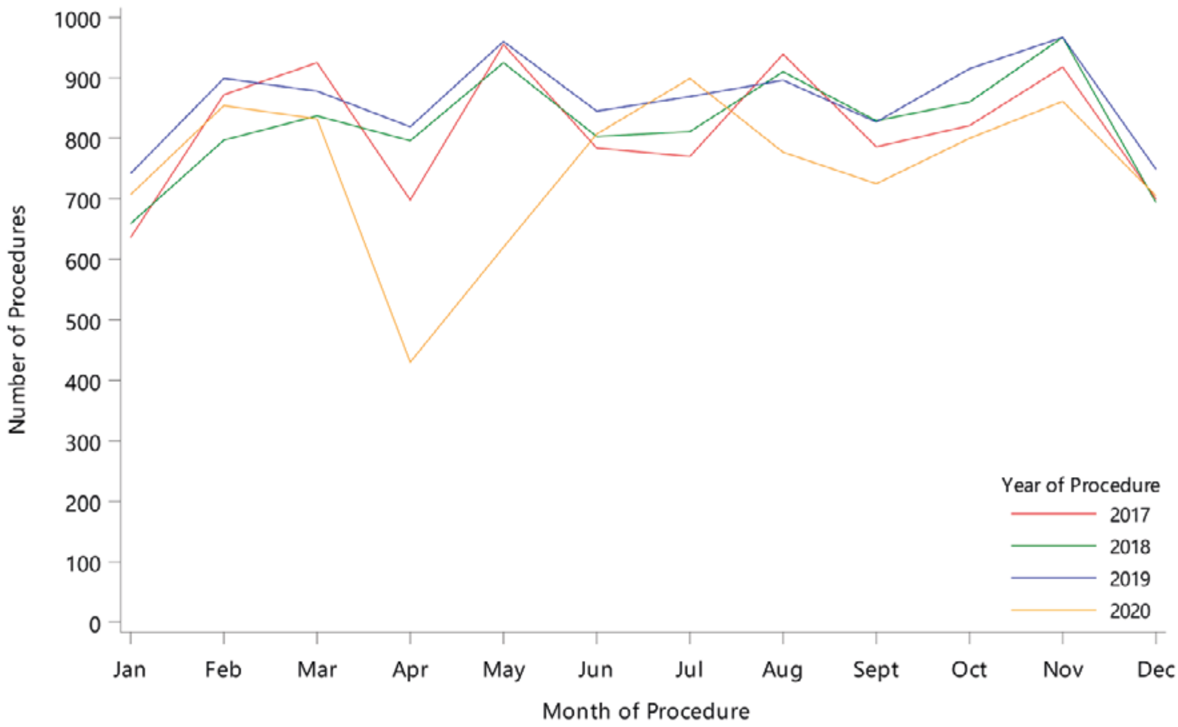
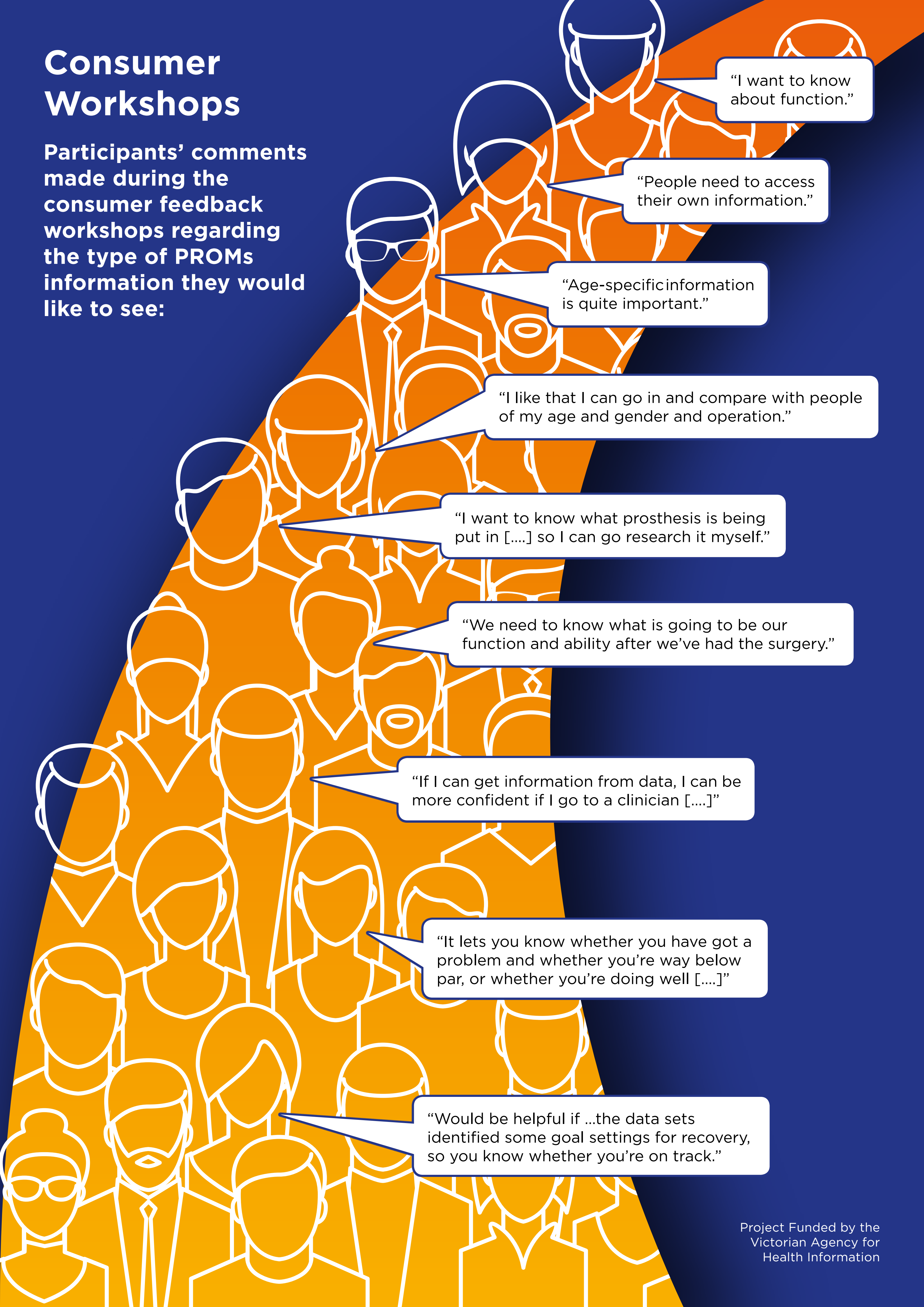


**Figure C9** **Revision Hip, Knee and Shoulder Replacement**



# Consumer Workshops

**Participants' comments made during the consumer feedback workshops regarding the type of PROMs information they would like to see:**




Project Funded by the Victorian Agency for Health Information

# Patient Reported Outcome Measures

## INTRODUCTION

Patient reported outcome measures (PROMs) are surveys that assess dimensions of health and wellbeing from the perspective of the patient. They are commonly used in research to measure the outcomes (effectiveness) of medical interventions, such as surgery. They are also frequently used in clinical practice to measure quality of care and to guide decision-making for patients and surgeons.

## BACKGROUND

In 2017, the AOANJRR began a pilot program involving 44 hospitals to determine the feasibility of collecting PROMs within the Registry, for patients undergoing hip, knee or shoulder arthroplasty. A panel of international and local PROM experts was convened to determine which PROM instruments to use and the timing of collection, acknowledging a balance between the depth of information collected and the burden on patients.

Separately, the PROMs Working Group considered options for data collection, including the use of existing systems. Given the time and resource burden of paper and telephone collection, an electronic system was chosen. A bespoke electronic system for the collection and storage of patient-entered data was designed and built by AOANJRR and SAHMRI. The platform known as *RAPID* (Real-time Automated Platform for Integrated Data capture) is used for the core PROM data collection as well as clinical trials nested within the AOANJRR. Data collection for the AOANJRR PROMs program is now standardised. The *RAPID* platform has been designed to be flexible and accommodate the demands and requirements of individual research studies, specific sites and surgeons. Additional data fields and time points can be added depending on the requirements of the stakeholder.

A report on the PROMs pilot program is available on the AOANJRR website.[2] The report includes recommendations on overcoming barriers, infrastructure requirements, and optimising patient and clinician engagement.

## PROMs INSTRUMENTS

The list of instruments used for AOANJRR PROMs collection are provided in Table P1 and includes measures of quality of life and joint-specific pain, function and recovery.

In reporting the EQ-5D health-related quality of life in this report, the EQ-5D Utility Index is also used; this is a summary score generated from the 5 domains listed in Table P1.

The Oxford Hip Score, Oxford Knee Score and Oxford Shoulder Score are standardised and validated PROM instruments developed to assess function and pain in patients undergoing total joint replacement surgery.

The HOOS-12 and KOOS-12 instruments are joint-specific measures of health and are included as optional surveys. These surveys consist of 12 questions each, reducing the responder burden associated with the full (42-item) HOOS and KOOS surveys. The HOOS and KOOS instruments were completed by 58% of responders. HOOS and KOOS results are not presented in this report.

## PATIENT REGISTRATION AND PARTICIPATION

Inclusion of patients in the AOANJRR PROMs program depends on patients being registered in the system (for example, by pre-admission staff) and invited to participate by email or SMS. Patients then respond to the invitation and enter their responses.

Registration rates (the proportion of all cases for which a patient was registered) varied widely between hospitals, from 4% to 85%. The response rate (the proportion of registered patients who provided data) varied from 51% to 100% for pre-operative collection and 34% to 89% for post-operative collection. Separate analyses performed by the Registry have shown that the representativeness of responders from each hospital is not greatly affected by the response rate.

2 https://aoanjrr.sahmri.com/proms-pilot-report

Currently, PROMs are collected pre-operatively and at 6 months post-operatively. Telephone follow-up of patients was used in the pilot program for patients who did not provide data electronically. However, this method was discontinued in the national roll-out due to the high cost and lack of any significant improvement in representativeness from its use.

### NATIONAL PROM DATA COLLECTION

After the success of the pilot program, the national roll-out of PROM data collection commenced in 2020. Data will progressively become available to all surgeons and hospitals as they become enrolled.

From 2020, PROM data are covered under the same Qualified Privilege legislation as other AOANJRR procedure data, ensuring the highest level of data protection for patients and surgeons.

Surgeons can review their patients' responses via online surgeon portals.

Patients can review their pre-operative and post-operative responses recorded in *RAPID* compared to all other patients undergoing the same procedure.

De-identified reports are provided to hospitals and funders (e.g. state governments and hospital owners).

In 2020, the Registry began a consultation project with consumers to guide the production of patient-facing / publicly available reporting of PROM data.

The AOANJRR is also undertaking research on the validity, reliability and responsiveness of the PROMs used. This research includes detailed psychometric analyses and measurement of minimum clinically important differences, factors affecting the representativeness of PROMs data collection and the feasibility of developing crosswalks between similar PROMs.

In this chapter, a summary of the PROM data collected is provided. Information is also provided on pre-operative health, joint symptoms and surgical expectations, and post-operative outcomes of surgery. Reporting is restricted to total hip, total knee and reverse total shoulder replacement. Numbers for other types of arthroplasty (e.g. revision, unicompartmental, hemiarthoplasty and total stemmed shoulder replacement) were insufficient for graphical representation.

**Table P1 Data Captured in the Minimum Dataset for PROMs Collection**

| Measurement Tool | Scoring | Applied to Hip (H), Knee (K) or Shoulder (S) |
|---|---|---|
| EQ-5D (Quality of Life) | | |
| Usual activities | 5 categories | H, K, S |
| Mobility | 5 categories | H, K, S |
| Pain | 5 categories | H, K, S |
| Depression / Anxiety | 5 categories | H, K, S |
| Quality of life | 5 categories | H, K, S |
| EQ-VAS (general health rating) | 0-100 | H, K, S |
| Oxford Hip Score | 0-48 | H |
| Oxford Knee Score | 0-48 | K |
| Oxford Shoulder Score | 0-48 | S |
| HOOS-12 | | H (optional) |
| KOOS-12 | | K (optional) |
| Joint-specific pain (last 7 days) | 0-10 | H, K, S |
| Low back pain (last 7 days) | 0-10 | H, K |
| Neck pain (last 7 days) | 0-10 | S |
| Expectation for pain, 6 months post-surgery | 0-10 | H, K, S |
| Expectation for mobility, 6 months post-surgery | 5 categories | H, K, S |
| Expectation for health, 6 months post-surgery | 0-100 | H, K, S |
| Pre-operative patient-reported coincidental issues walking | Yes/No | H, K |
| Pre-operative patient-reported problems with the corresponding side | Yes/No | H, K, S |
| Satisfaction with the procedure | 5 categories | H, K, S |
| Improvement (in problems with joint compared to before surgery) | 5 categories | H, K, S |

# OUTCOMES

## EQ-5D QUALITY OF LIFE SCORES

The pre- and post-operative scores for the EQ Visual Analogue Scale (VAS) and EQ-5D Utility Index are provided in Table P2. The EQ VAS (or EQ VAS Health) is a measure of patient-reported health ‘today’ and ranges from 0 (‘worst health imaginable’) to 100 (‘best health imaginable’). The EQ-5D Utility Index is a summary score generated from the 5 domains of the EQ-5D survey, anchored at 1 (‘full health’) and 0 (‘a state as bad as being dead’).

Changes in the EQ VAS from pre-operative to post-operative, overall, and by age and gender for each joint (hip, knee, and shoulder) are provided in Figure P1 to Figure P8. The box plots represent the median and interquartile range (the boxes), 1.5 x inter-quartile range (the lines), and outliers (the circles).

Pre- and post-operative changes in each of the 5 domains in the EQ-5D as well as the EQ VAS and the Oxford Scores are provided in Figure P9 to Figure P12.

**Table P2 PROMs of Primary Joint Replacement by Joint Class**

| Joint | PROMs Outcome | Preoperative N | Preoperative Mean±SD | Postoperative N | Postoperative Mean±SD | Mean Difference (95% CI) |
|---|---|---|---|---|---|---|
| Total Conventional Hip (OA) | EQ VAS Health | 7602 | 66.85±20.09 | 4606 | 80.99±16.12 | 14.13 (13.56, 14.70) |
| | EQ-5D Utility | 7675 | 0.35±0.35 | 4644 | 0.80±0.24 | 0.45 (0.44, 0.46) |
| Total Knee (OA) | EQ VAS Health | 12015 | 69.52±18.62 | 7148 | 79.58±15.94 | 10.06 (9.63, 10.49) |
| | EQ-5D Utility | 12148 | 0.44±0.32 | 7198 | 0.76±0.24 | 0.32 (0.31, 0.32) |
| Total Reverse Shoulder (OA) | EQ VAS Health | 258 | 68.45±18.91 | 146 | 75.55±19.64 | 7.10 (3.70, 10.50) |
| | EQ-5D Utility | 261 | 0.48±0.29 | 146 | 0.73±0.25 | 0.25 (0.21, 0.29) |
| Total Reverse Shoulder (Rotator Cuff) | EQ VAS Health | 227 | 70.62±17.87 | 117 | 76.51±17.11 | 5.90 (2.61, 9.19) |
| | EQ-5D Utility | 229 | 0.52±0.28 | 117 | 0.68±0.30 | 0.16 (0.11, 0.21) |

**Figure P1** EQ VAS Health Pre- and Post-Operative for Primary Total Conventional Hip Replacement (Primary Diagnosis OA)

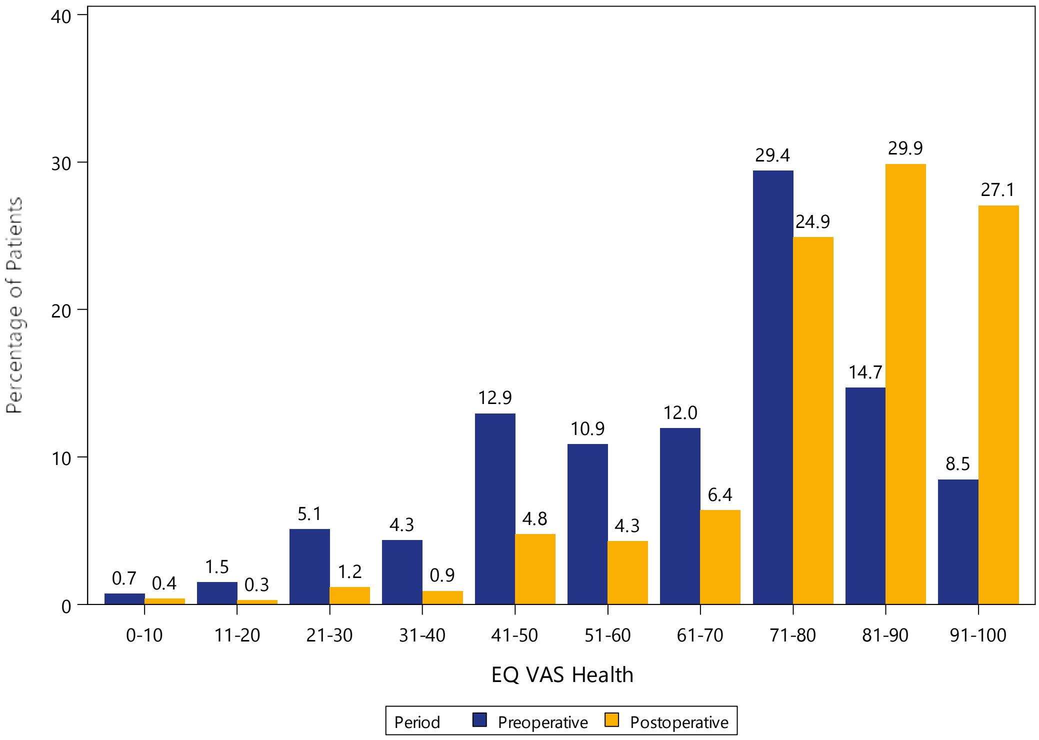



**Figure P2** EQ VAS Health Pre- and Post-Operative for Primary Total Knee Replacement (Primary Diagnosis OA)

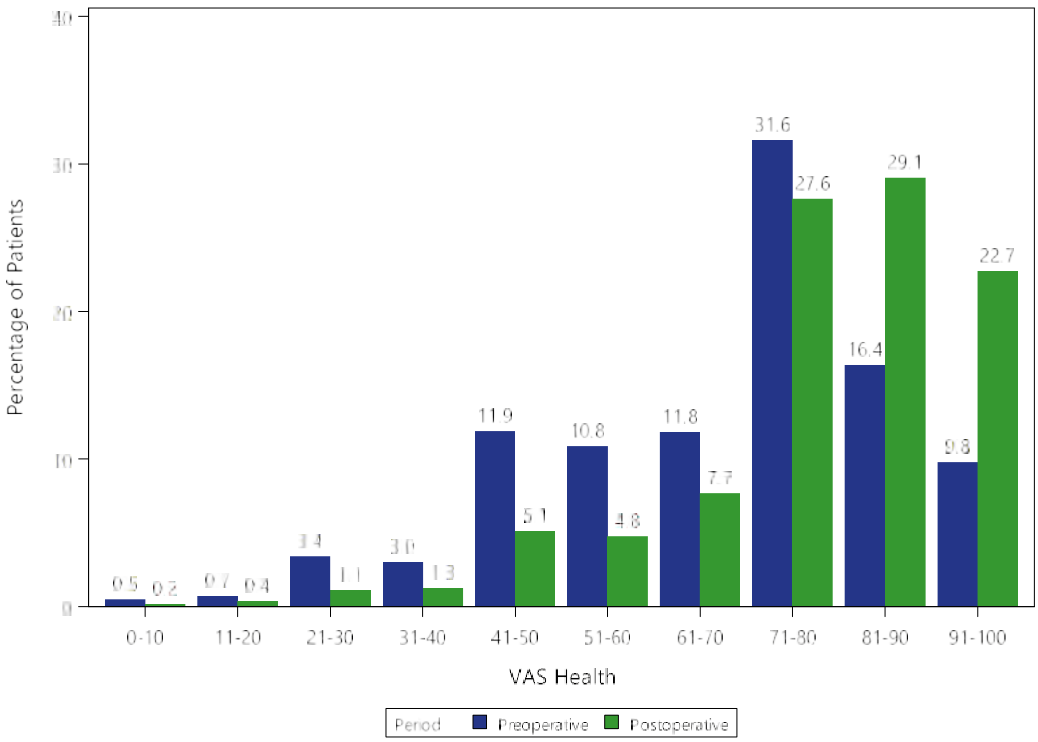


**Figure P3** EQ VAS Health Pre- and Post-Operative for Primary Total Reverse Shoulder Replacement (Primary Diagnosis OA)

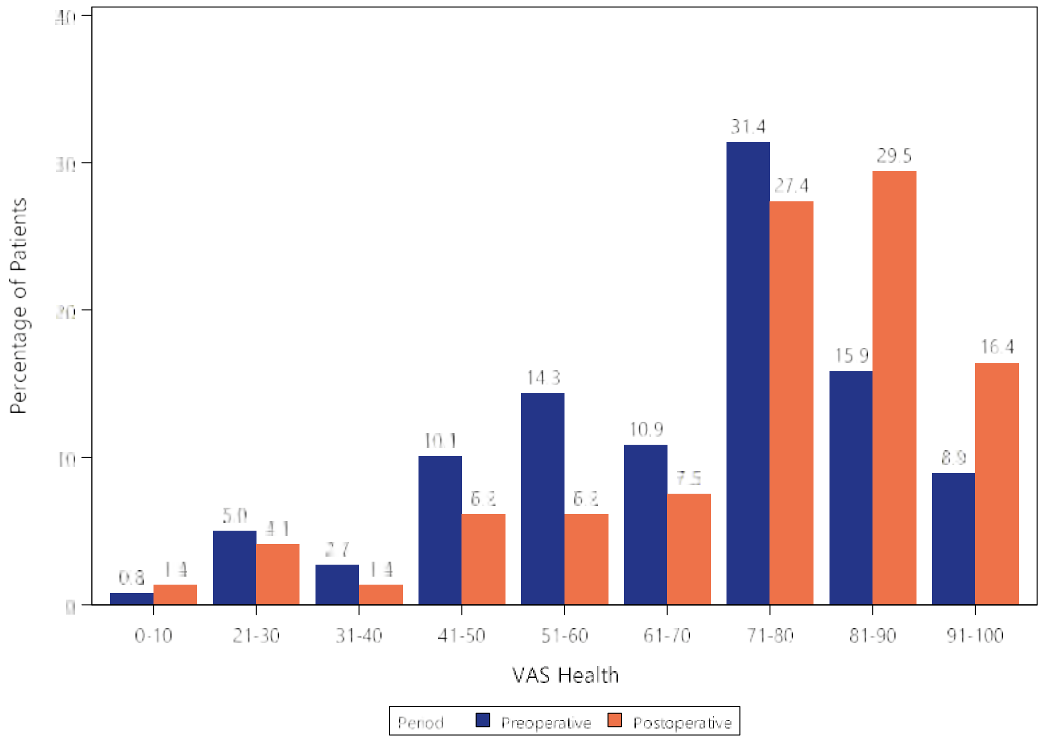



**Figure P4** EQ VAS Health Pre- and Post-Operative for Primary Total Reverse Shoulder Replacement (Primary Diagnosis Rotator Cuff Arthropathy)

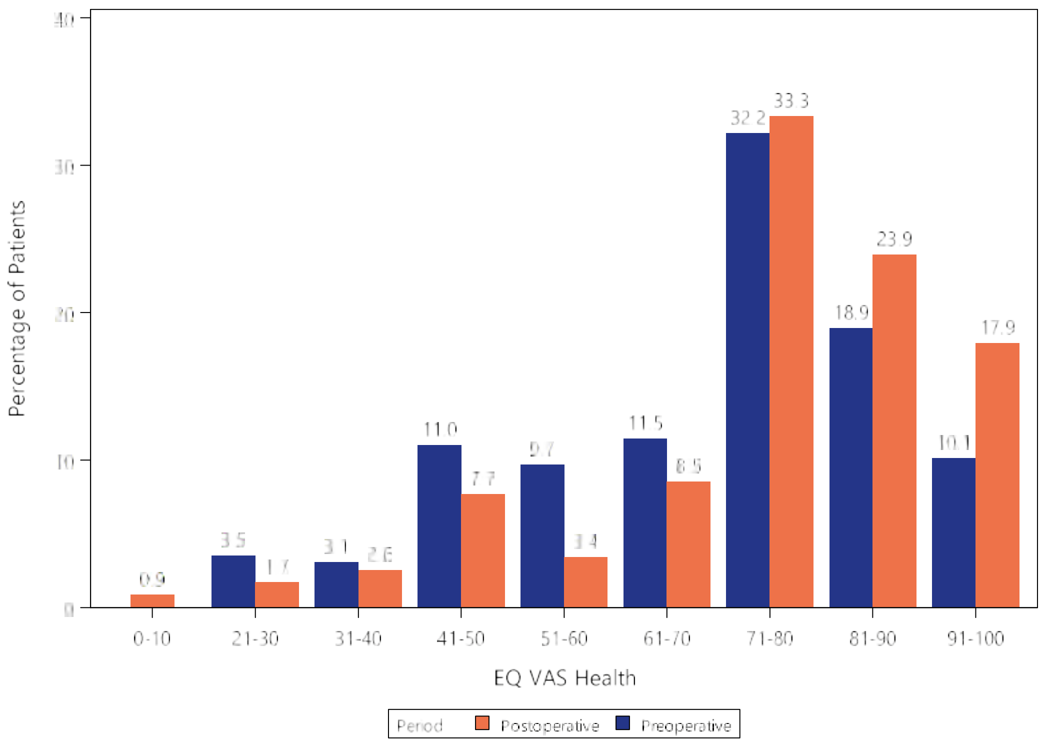


**Figure P5** EQ VAS Health Pre- and Post-Operative for Primary Total Conventional Hip Replacement by Age and Gender (Primary Diagnosis OA)

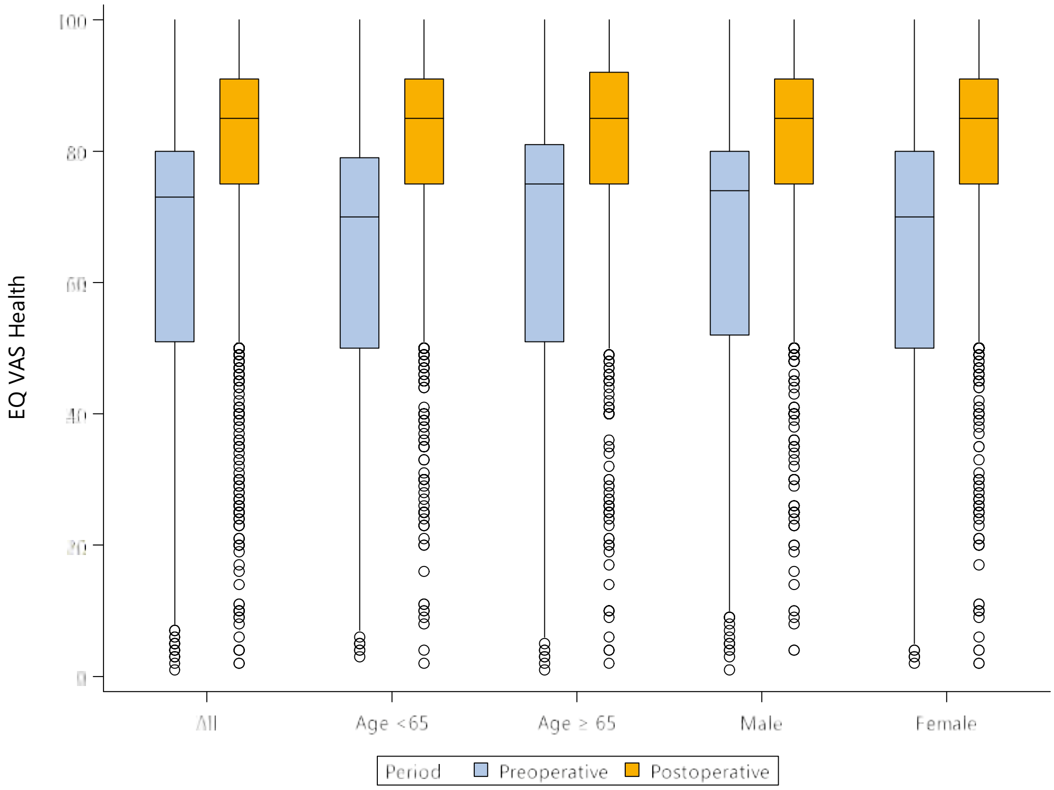



**Figure P6** EQ VAS Health Pre- and Post-Operative for Primary Total Knee Replacement by Age and Gender (Primary Diagnosis OA)

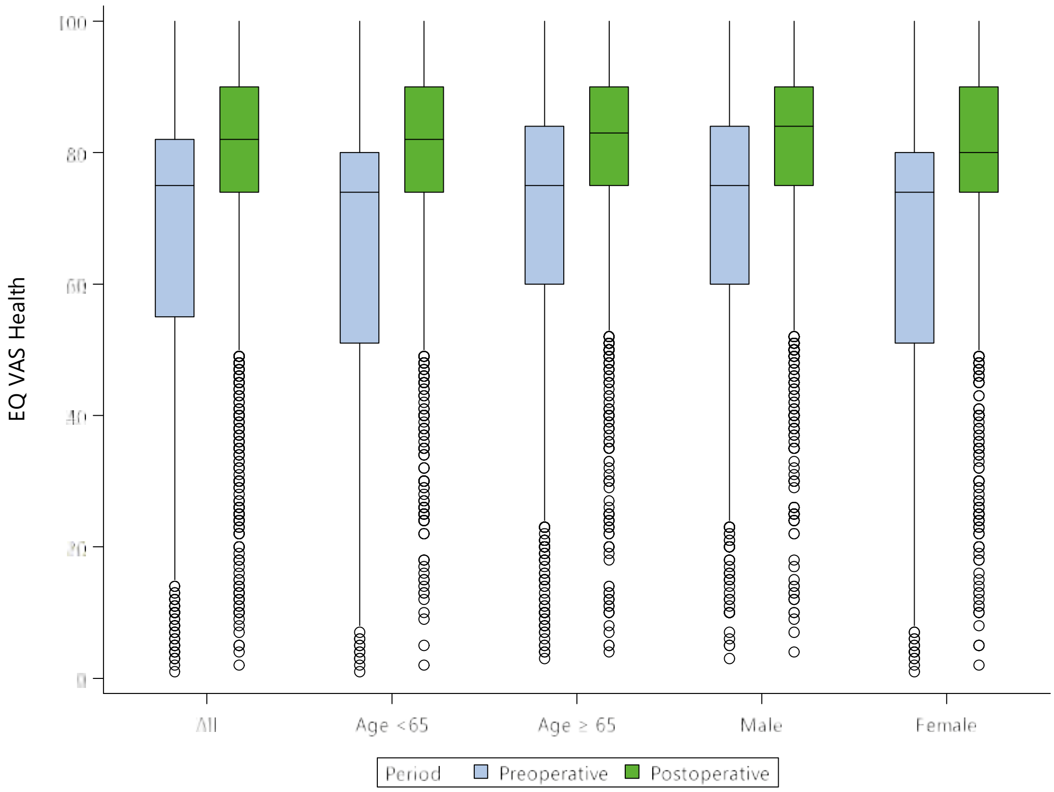


**Figure P7** EQ VAS Health Pre- and Post-Operative for Primary Total Reverse Shoulder Replacement by Age and Gender (Primary Diagnosis OA)

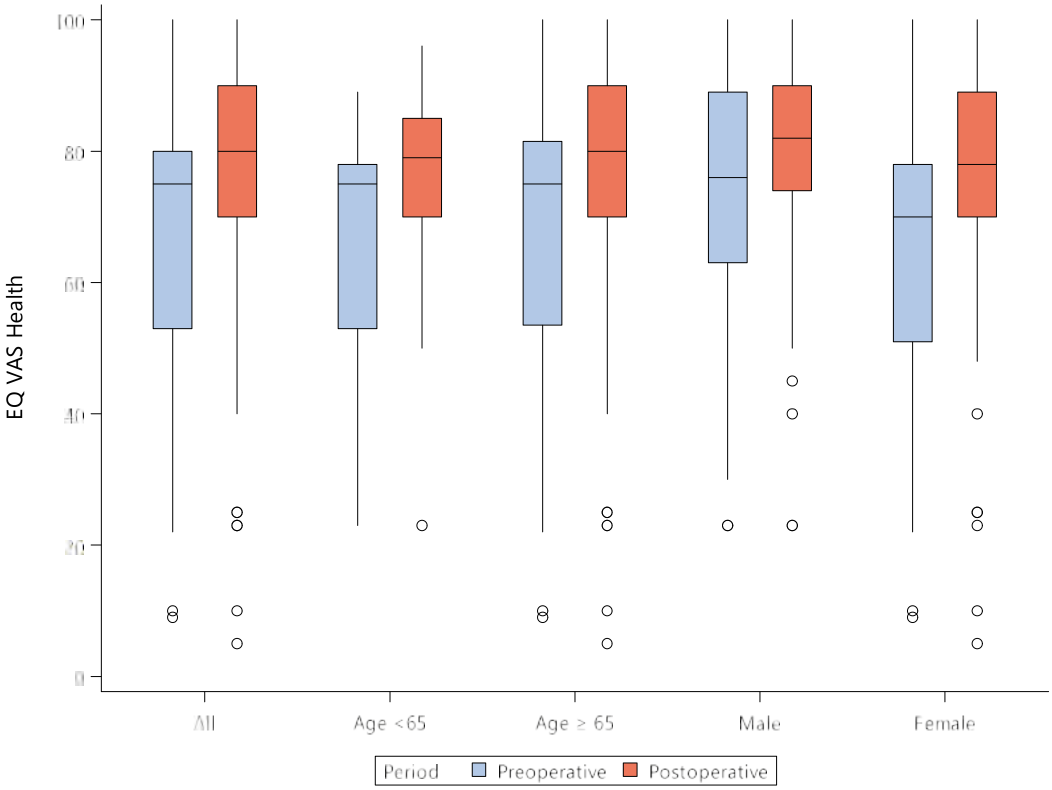



**Figure P8** EQ VAS Health Pre- and Post-Operative for Primary Total Reverse Shoulder Replacement by Age and Gender (Primary Diagnosis Rotator Cuff Arthropathy)

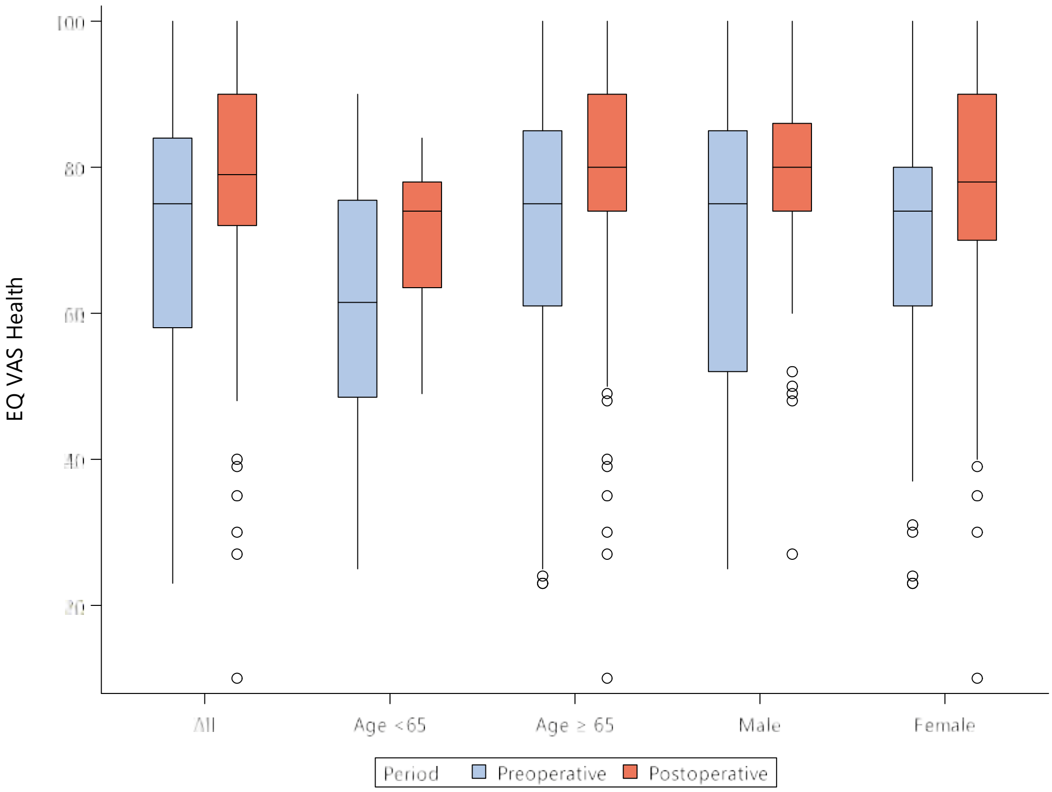


**Figure P9** **Percent Change in PROMs Scores from Pre-Operative to Post-Operative Primary Total Conventional Hip Replacement (Primary Diagnosis OA)**


**Figure P10** **Percent Change in PROMs Scores from Pre-Operative to Post-Operative Primary Total Knee Replacement (Primary Diagnosis OA)**

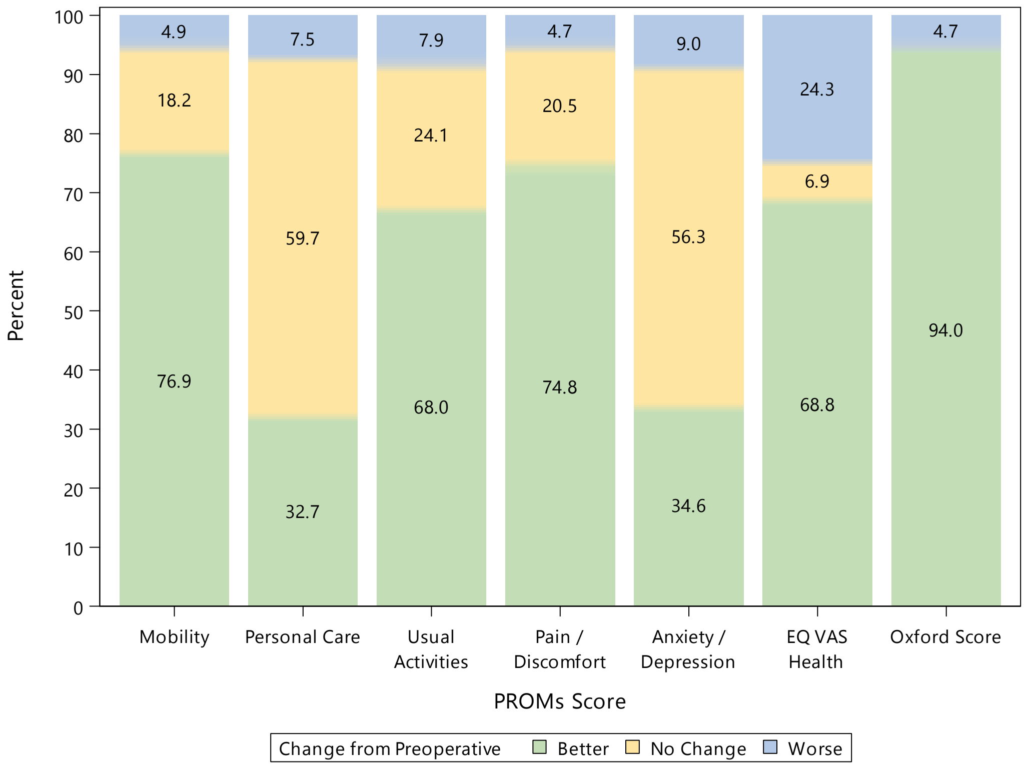


**Figure P11** **Percent Change in PROMs Scores from Pre-Operative to Post-Operative Primary Total Reverse Shoulder Replacement (Primary Diagnosis OA)**

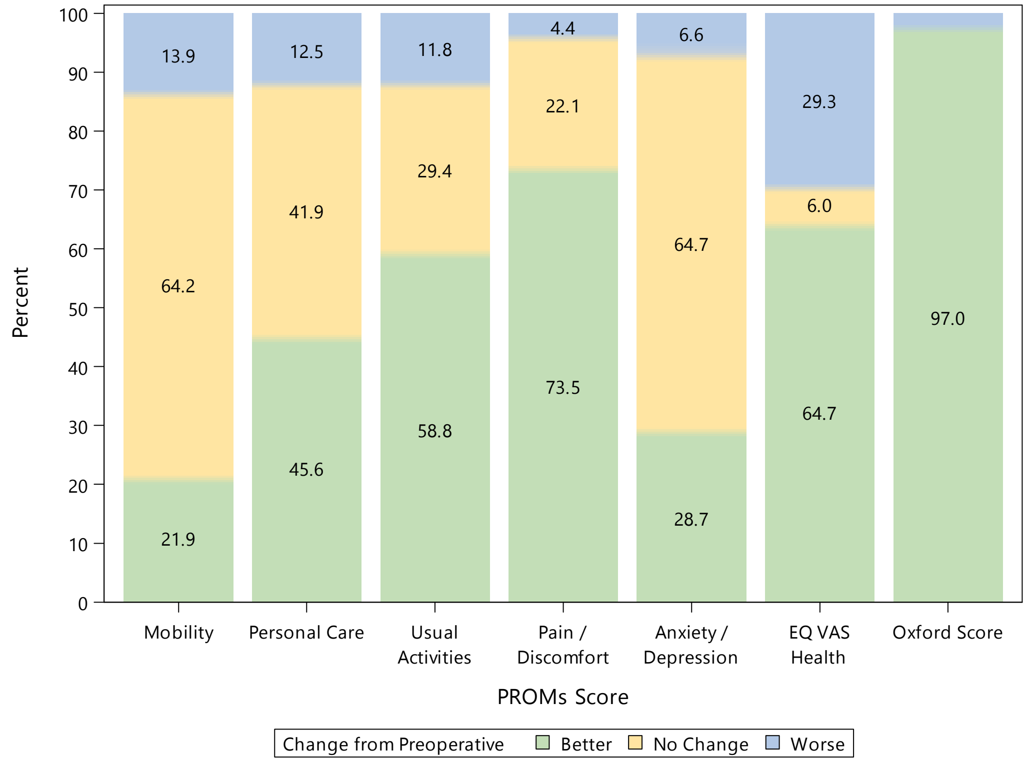
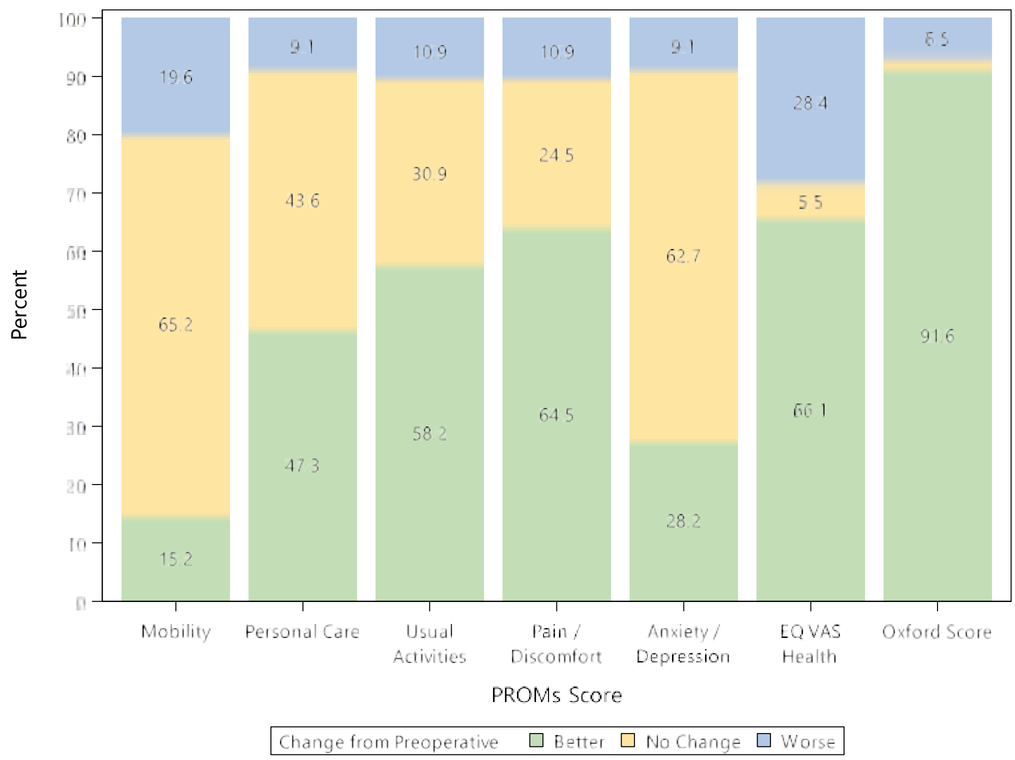


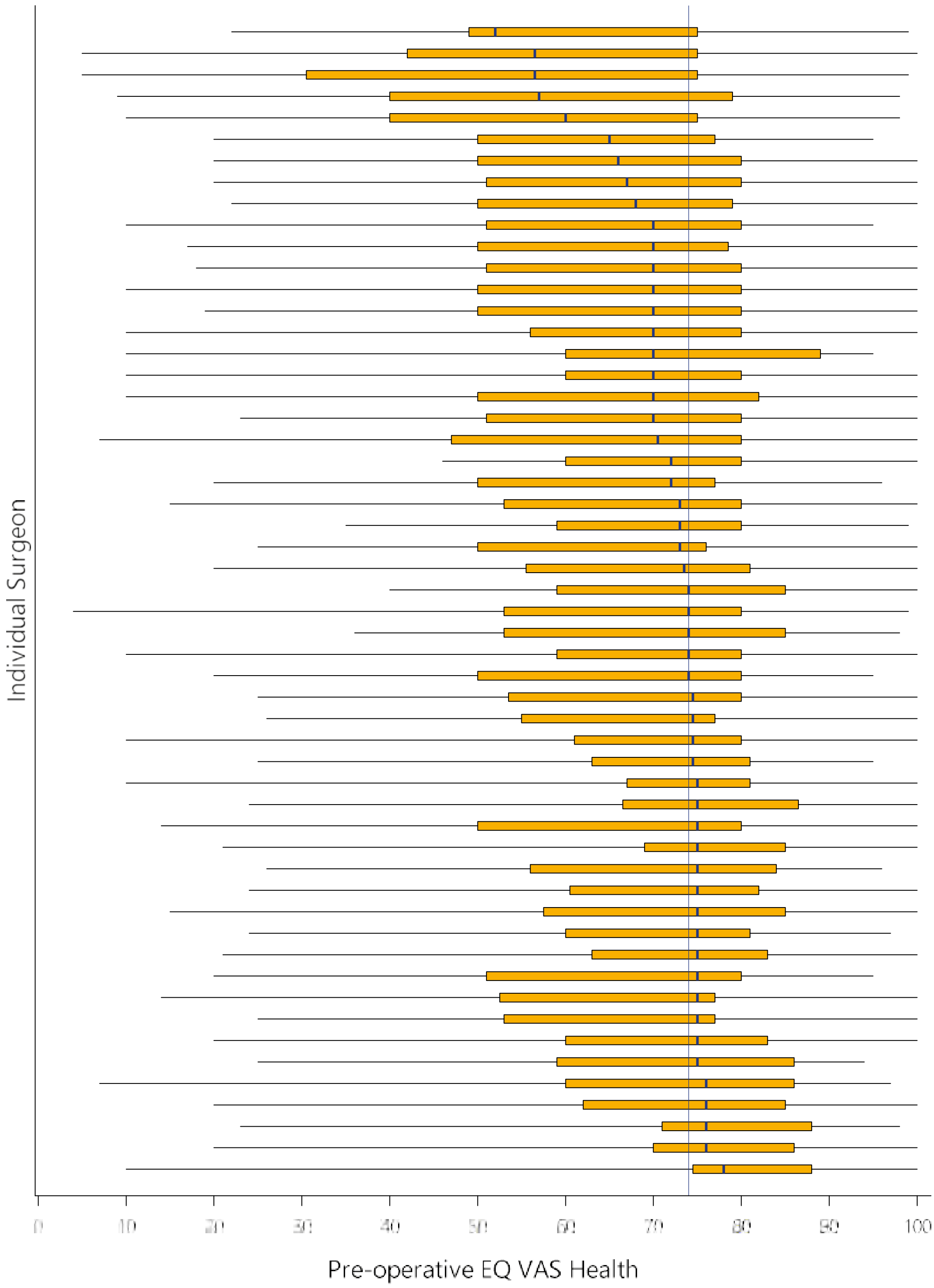

**Figure P12** **Percent Change in PROMs Scores from Pre-Operative to Post-Operative Primary Total Reverse Shoulder Replacement (Primary Diagnosis Rotator Cuff Arthropathy)**



## SURGEON AND HOSPITAL EQ VAS VARIATION

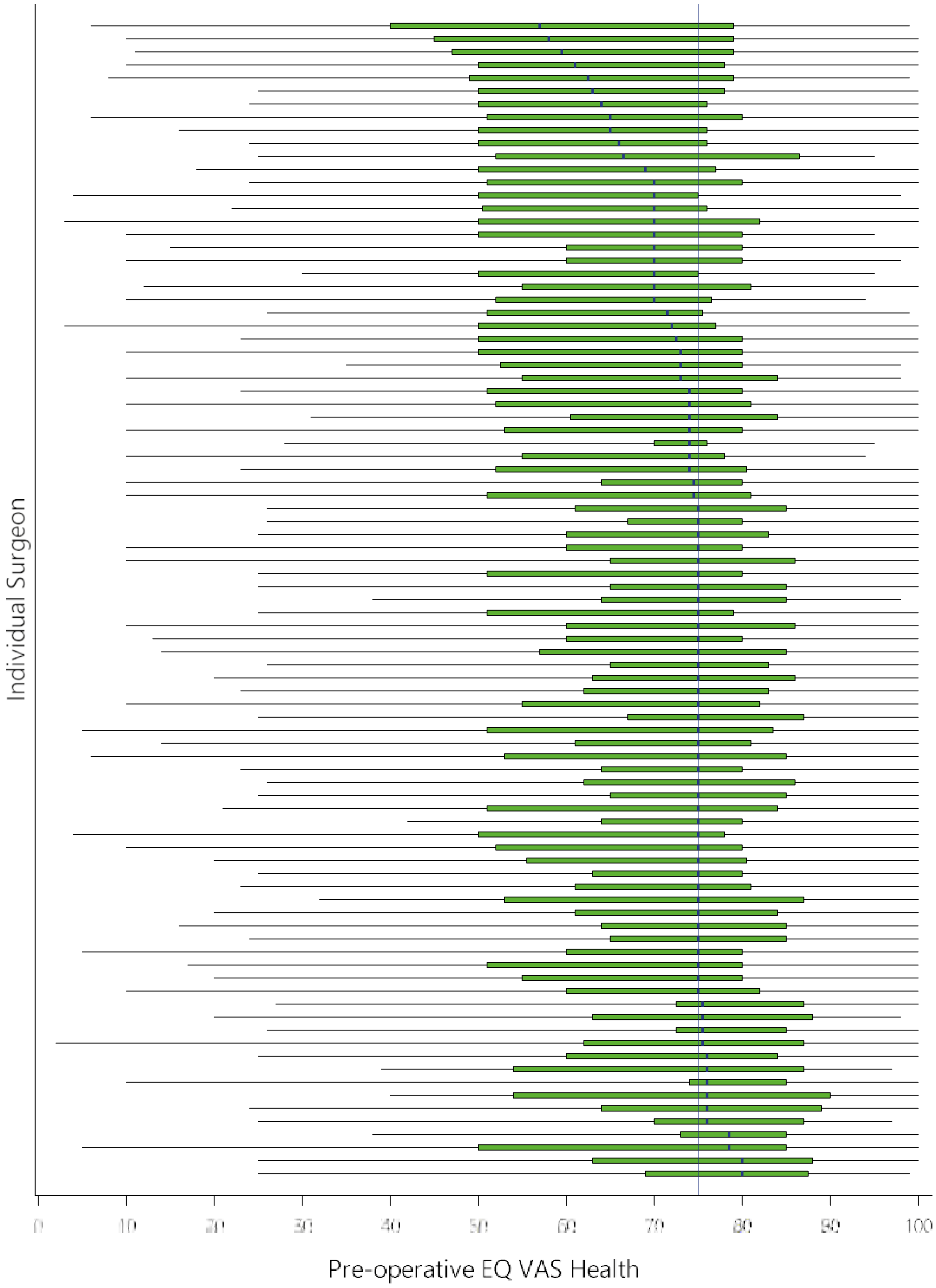
Variation between surgeons and between hospitals in the EQ VAS is displayed as ‘caterpillar plots’ for surgeons and hospitals with at least 50 recorded cases for hip and knee replacement (Figure P13 to Figure P16). There were insufficient data to report variation in shoulder outcomes.

**Figure P13 Pre-Operative EQ VAS Health for Patients Undergoing Primary Total Conventional Hip Replacement by Surgeon (Primary Diagnosis OA)**




Note: The median pre-operative EQ VAS Health is 74

**Figure P14** **Pre-Operative EQ VAS Health for Patients Undergoing Primary Total Knee Replacement by Surgeon (Primary Diagnosis OA)**

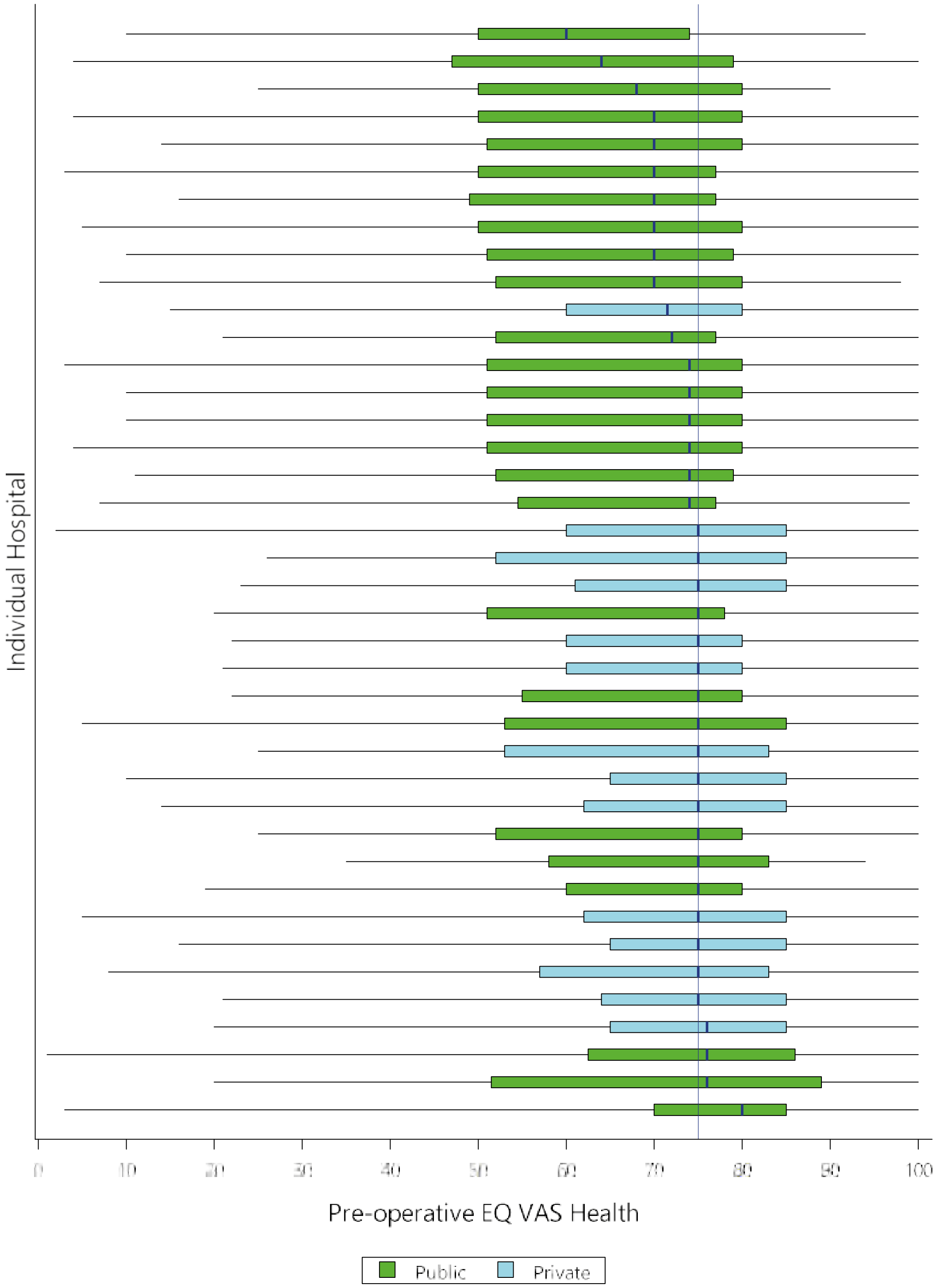



Note: The median pre-operative EQ VAS Health is 75

**Figure P15** **Pre-Operative EQ VAS Health for Patients Undergoing Primary Total Conventional Hip Replacement by Hospital (Primary Diagnosis OA)**


Note: The median pre-operative EQ VAS Health is 73

**Figure P16** **Pre-Operative EQ VAS Health for Patients Undergoing Primary Total Knee Replacement by Hospital (Primary Diagnosis OA)**




Note: The median pre-operative EQ VAS Health is 75

## OXFORD SCORE

The Oxford Score provides joint-specific scores of pain and function. There are separate Oxford Scores for the hip, knee and shoulder. These scores total the responses from 12 questions, each on a 5-level scale of 0 to 4. The worst possible score is 0 and the best possible score is 48.

A comparison of pre- and post-operative Oxford Score is provided in Table P3 and visually represented in Figure P17 and Figure P18 for hip replacement, Figure P19 and Figure P20 for knee replacement and Figure P21 to Figure P24 for shoulder replacement.

Proportions of patients whose Oxford Score were better, the same, or worse after surgery are also provided (Figure P9 to Figure P12).

**Table P3 Pre- and Post-Operative Oxford Score of Primary Joint Replacement by Joint Class**

| Joint | Preoperative N | Preoperative Mean±SD | Postoperative N | Postoperative Mean±SD | Mean Difference (95% CI) |
|---|---|---|---|---|---|
| Total Conventional Hip (OA) | 7585 | 20.42±8.89 | 4621 | 41.52±7.31 | 21.10 (20.84, 21.36) |
| Total Knee (OA) | 11975 | 22.05±8.31 | 7150 | 37.57±7.95 | 15.52 (15.31, 15.73) |
| Total Reverse Shoulder (OA) | 257 | 22.11±8.64 | 146 | 39.22±7.25 | 17.11 (15.73, 18.50) |
| Total Reverse Shoulder (Rotator Cuff) | 224 | 22.17±8.52 | 117 | 36.83±9.34 | 14.65 (12.88, 16.43) |

Figure P17 Pre- and Post-Operative Oxford Score for Primary Total Conventional Hip Replacement (Primary Diagnosis OA)

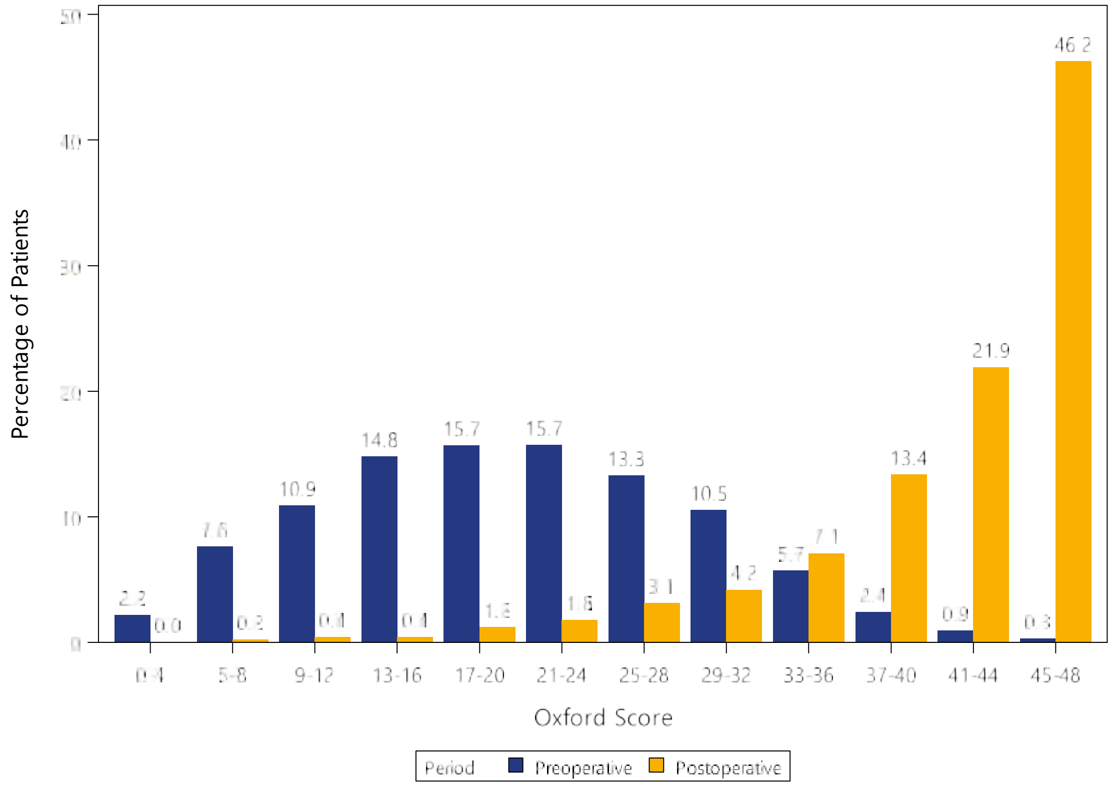



Figure P18 Pre- and Post-Operative Oxford Score for Primary Total Conventional Hip Replacement by Age and Gender (Primary Diagnosis OA)

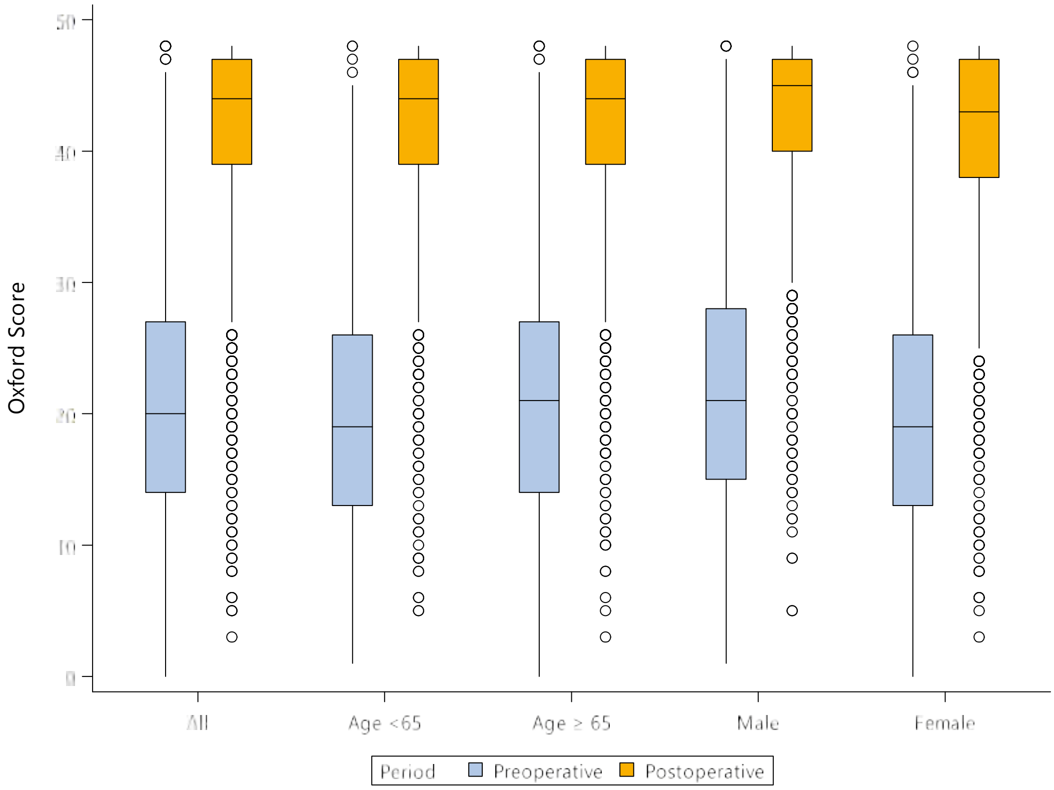


Figure P19 Pre- and Post-Operative Oxford Score for Primary Total Knee Replacement (Primary Diagnosis OA)

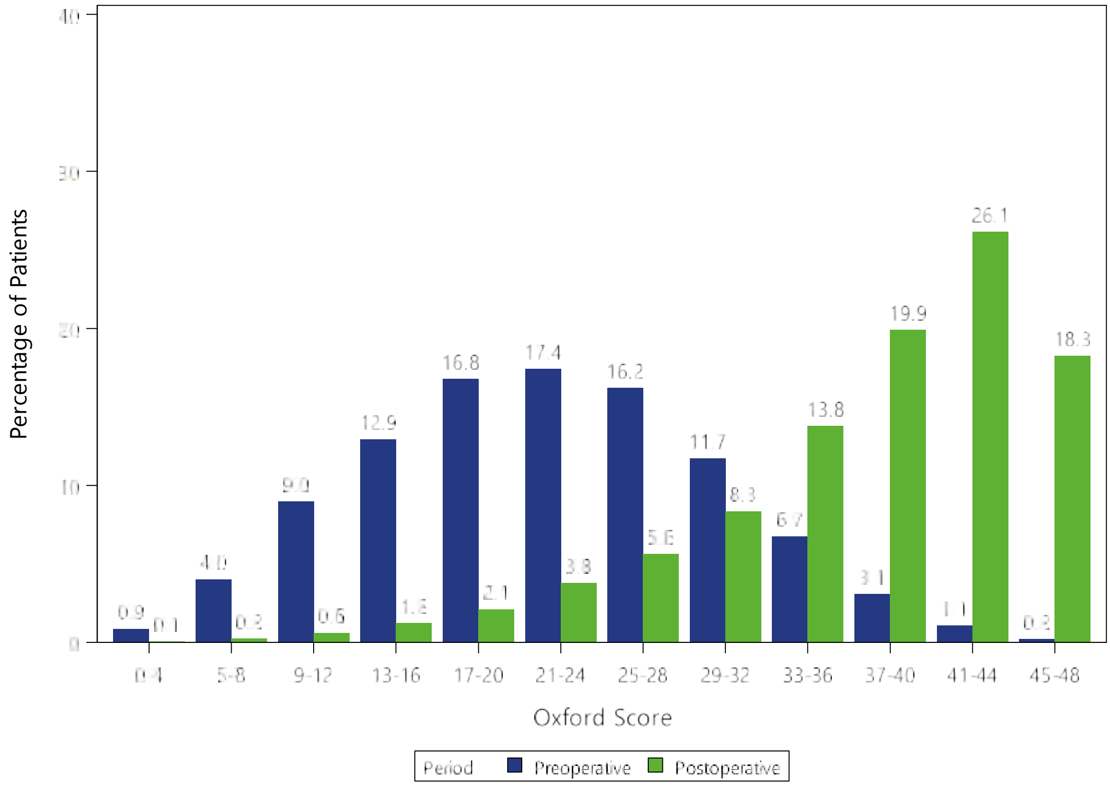



Figure P20 Pre- and Post-Operative Oxford Score for Primary Total Knee Replacement by Age and Gender (Primary Diagnosis OA)

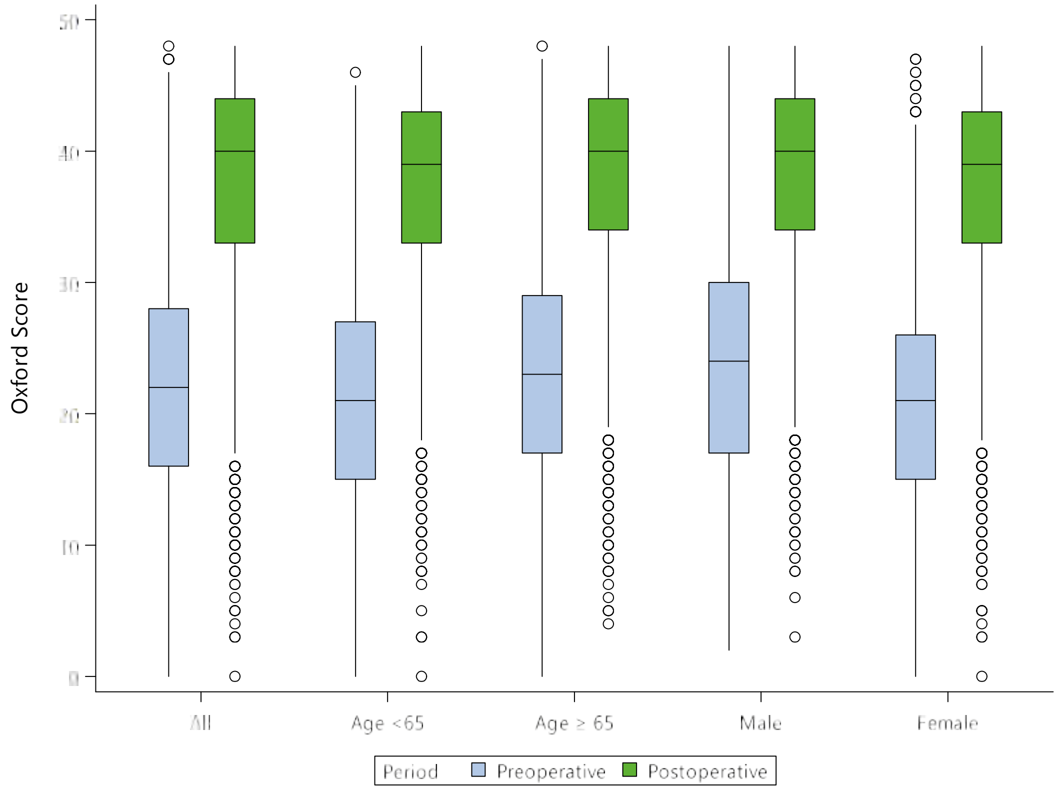


**Figure P21** Pre- and Post-Operative Oxford Score for Primary Total Reverse Shoulder Replacement (Primary Diagnosis OA)

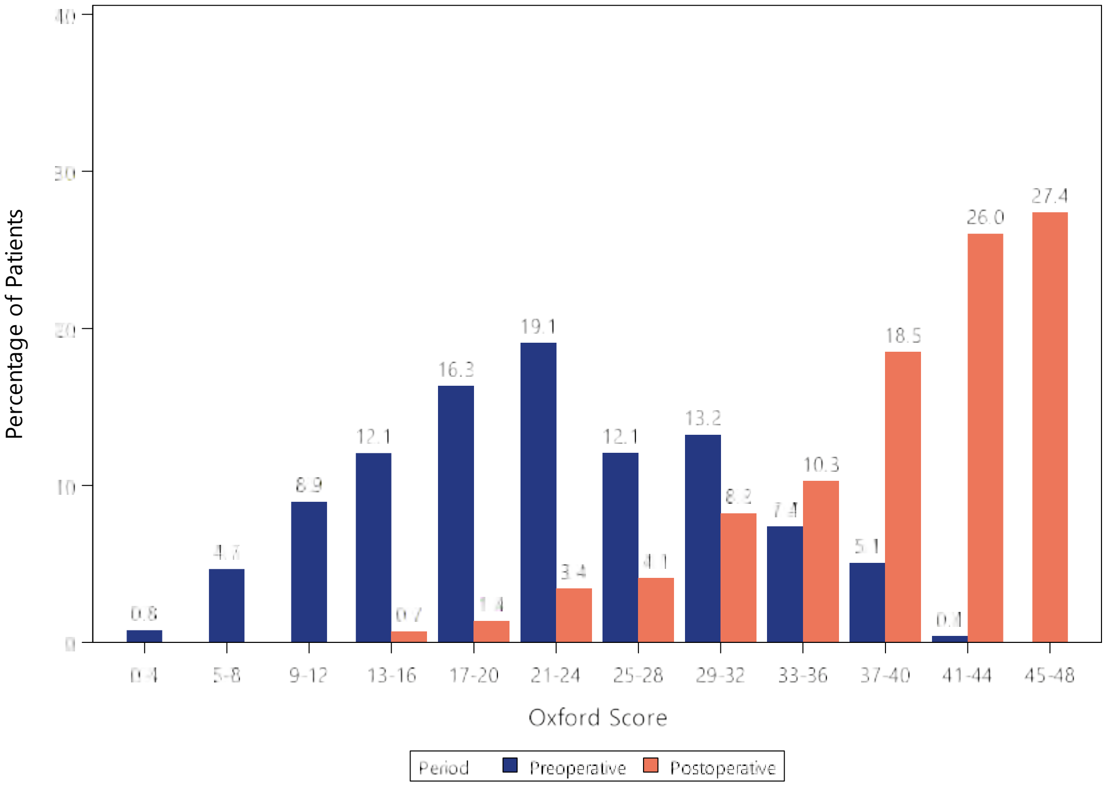



**Figure P22** Pre- and Post-Operative Oxford Score for Primary Total Reverse Shoulder Replacement by Age and Gender (Primary Diagnosis OA)

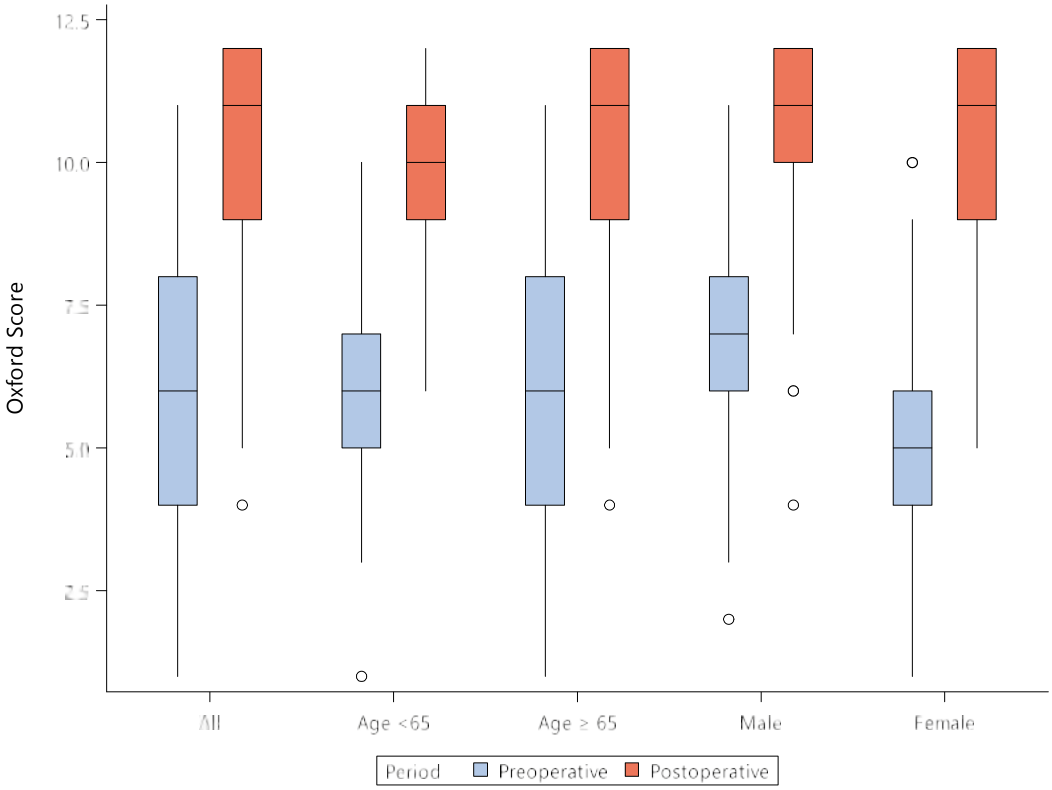


Figure P23 Pre- and Post-Operative Oxford Score for Primary Total Reverse Shoulder Replacement (Primary Diagnosis Rotator Cuff Arthropathy)

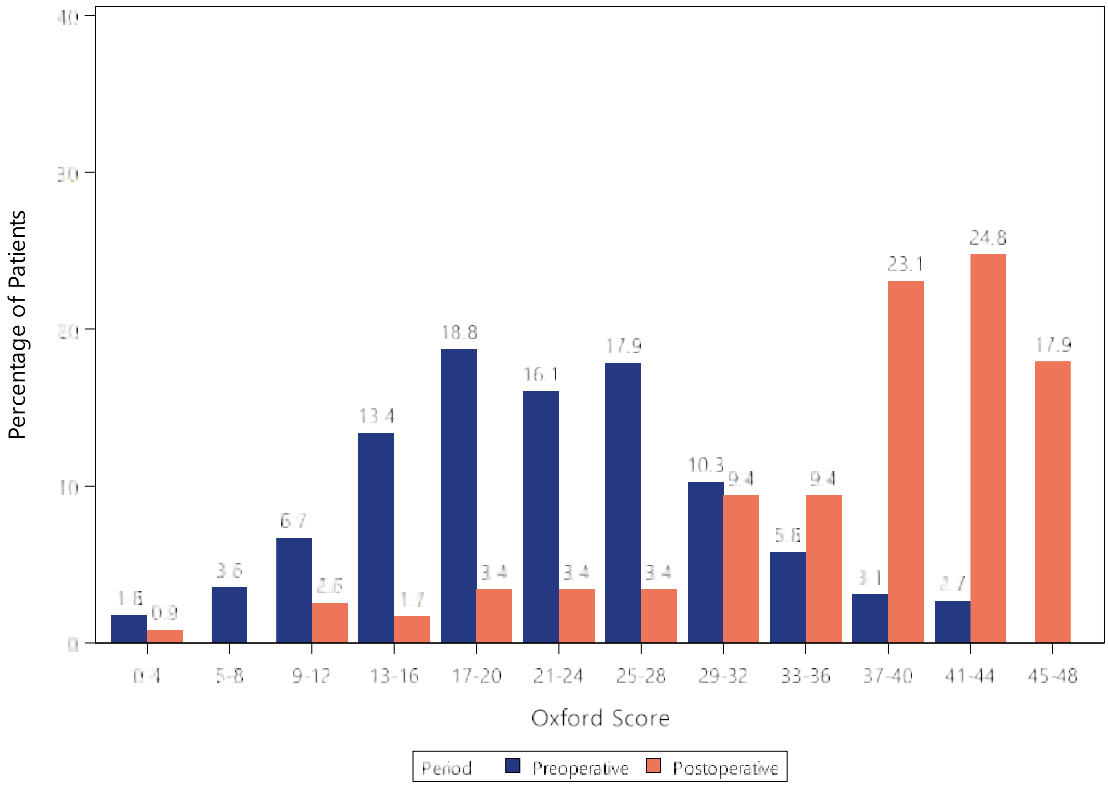
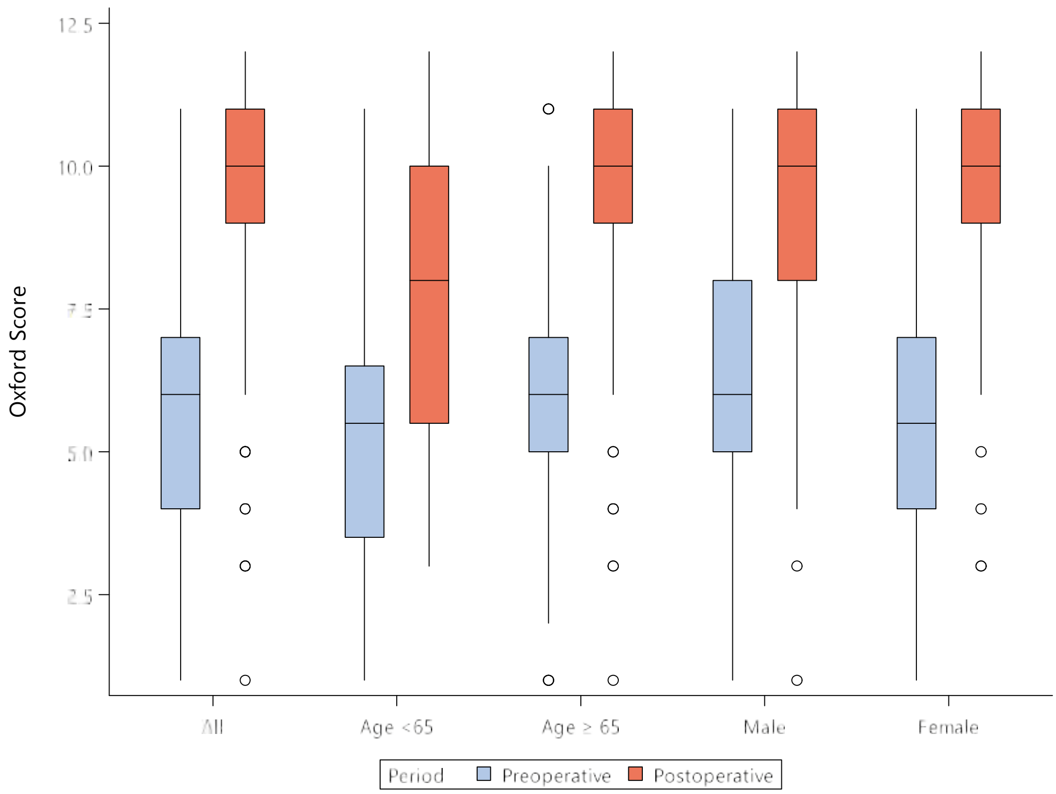


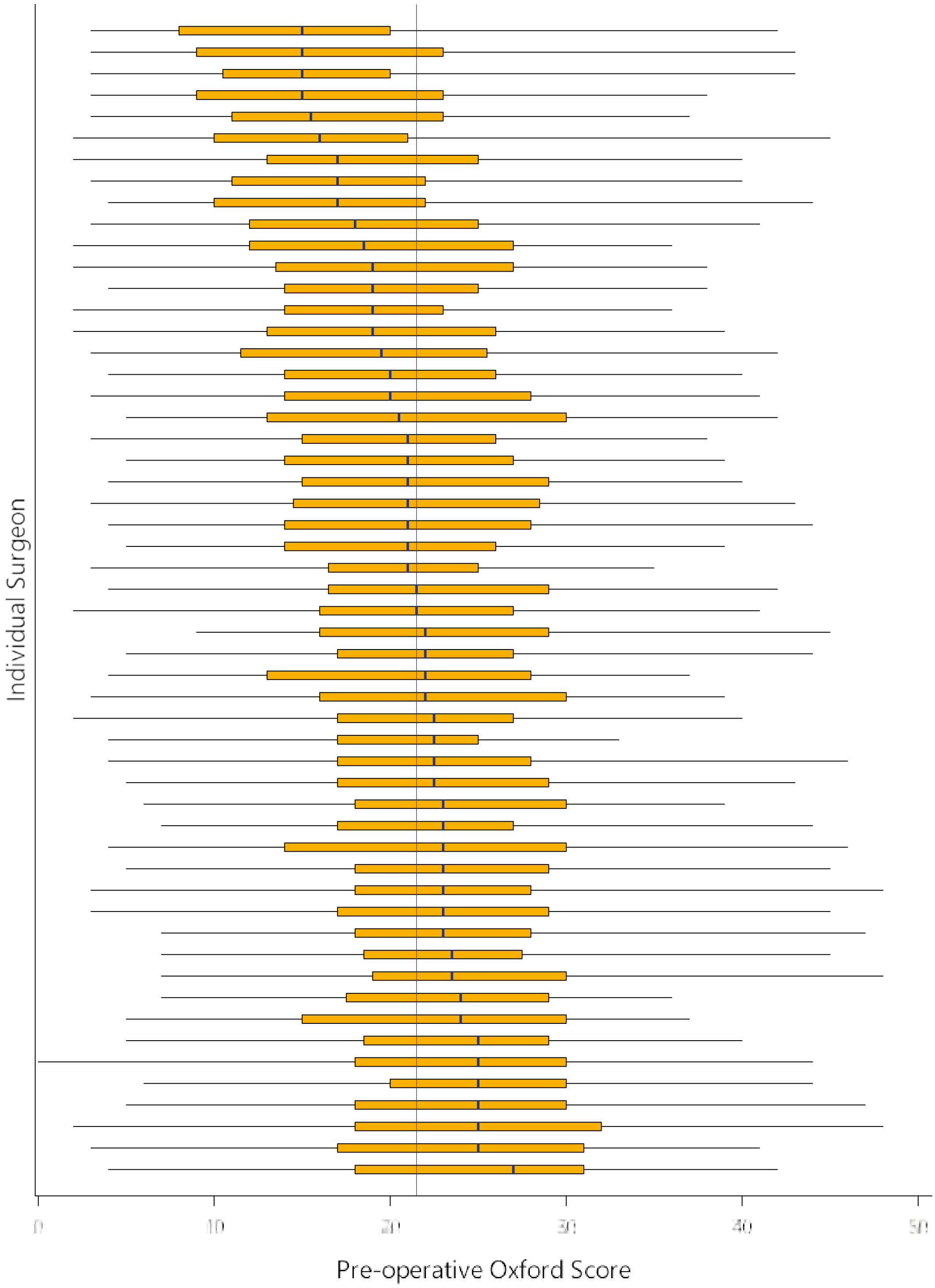

Figure P24 Pre- and Post-Operative Oxford Score for Primary Total Reverse Shoulder Replacement by Age and Gender (Primary Diagnosis Rotator Cuff Arthropathy)



## HOSPITAL AND SURGEON COMPARISONS FOR OXFORD SCORE

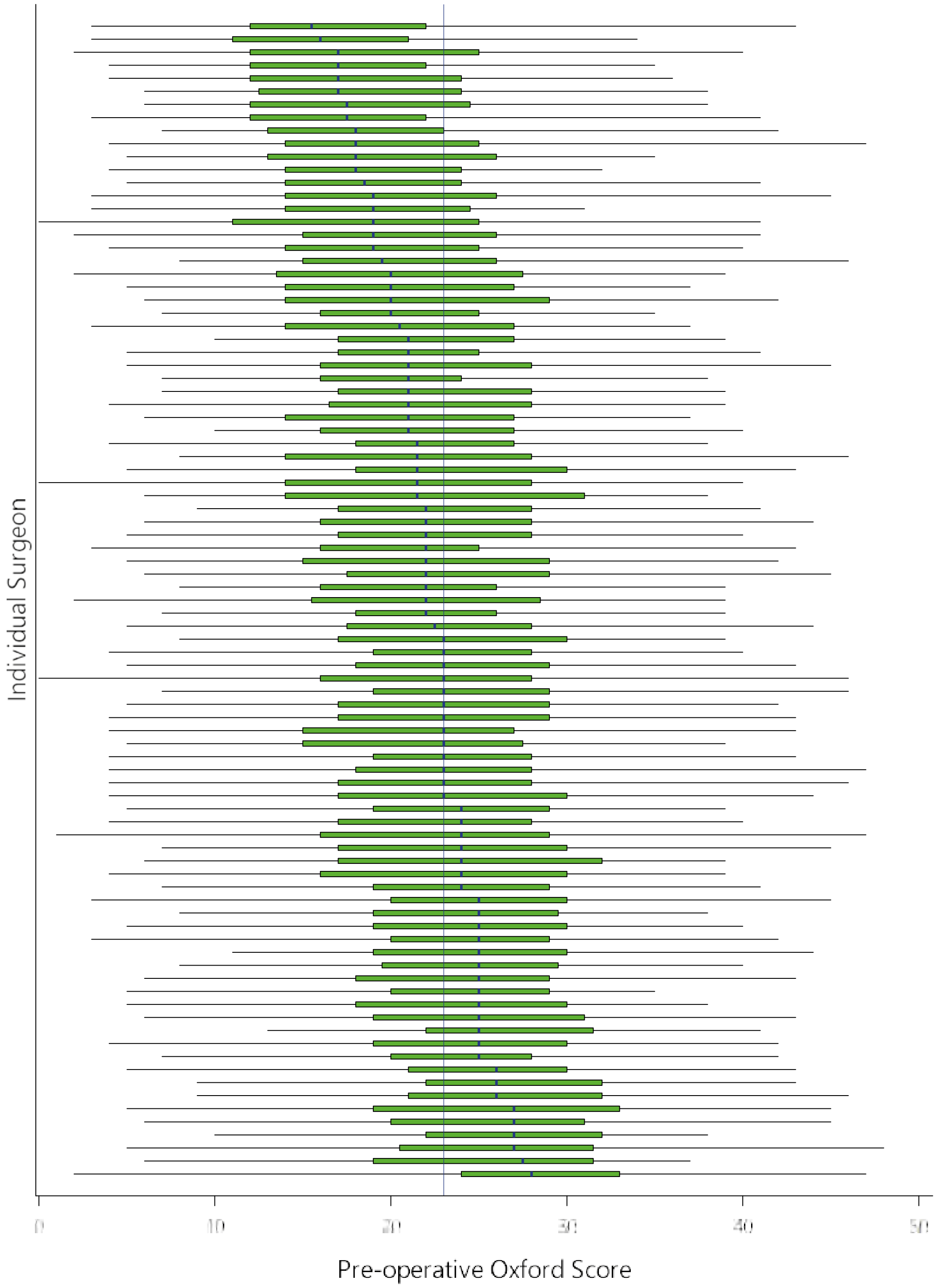
Hospital and surgeon comparisons of Oxford Score for hip and knee replacement are shown in Figure P25 to Figure P28.

**Figure P25 Pre-Operative Oxford Score for Patients Undergoing Primary Total Conventional Hip Replacement by Surgeon (Primary Diagnosis OA)**



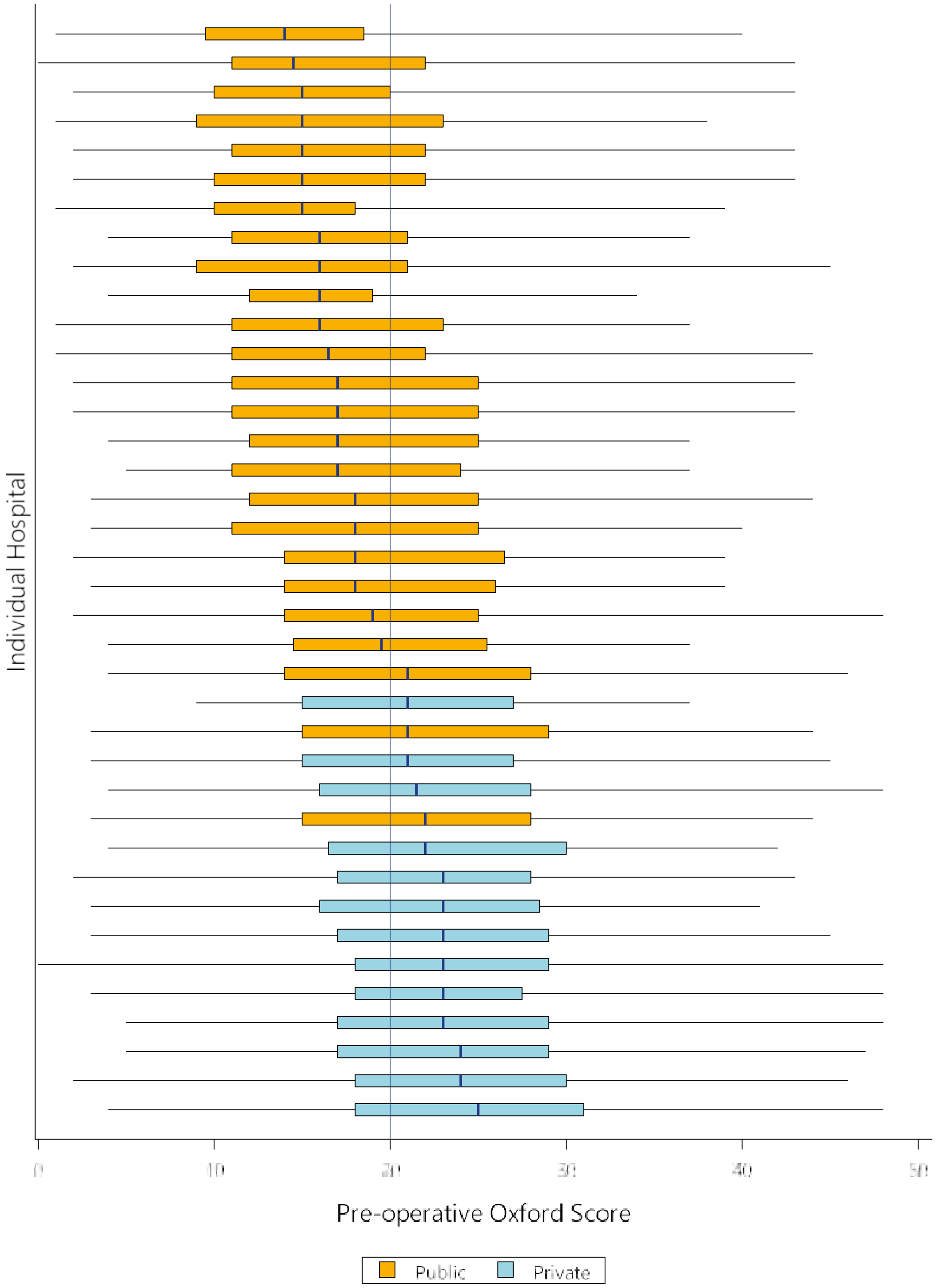

Note: The median pre-operative Oxford Score is 21.5

**Figure P26** **Pre-Operative Oxford Score for Patients Undergoing Primary Total Knee Replacement by Surgeon (Primary Diagnosis OA)**



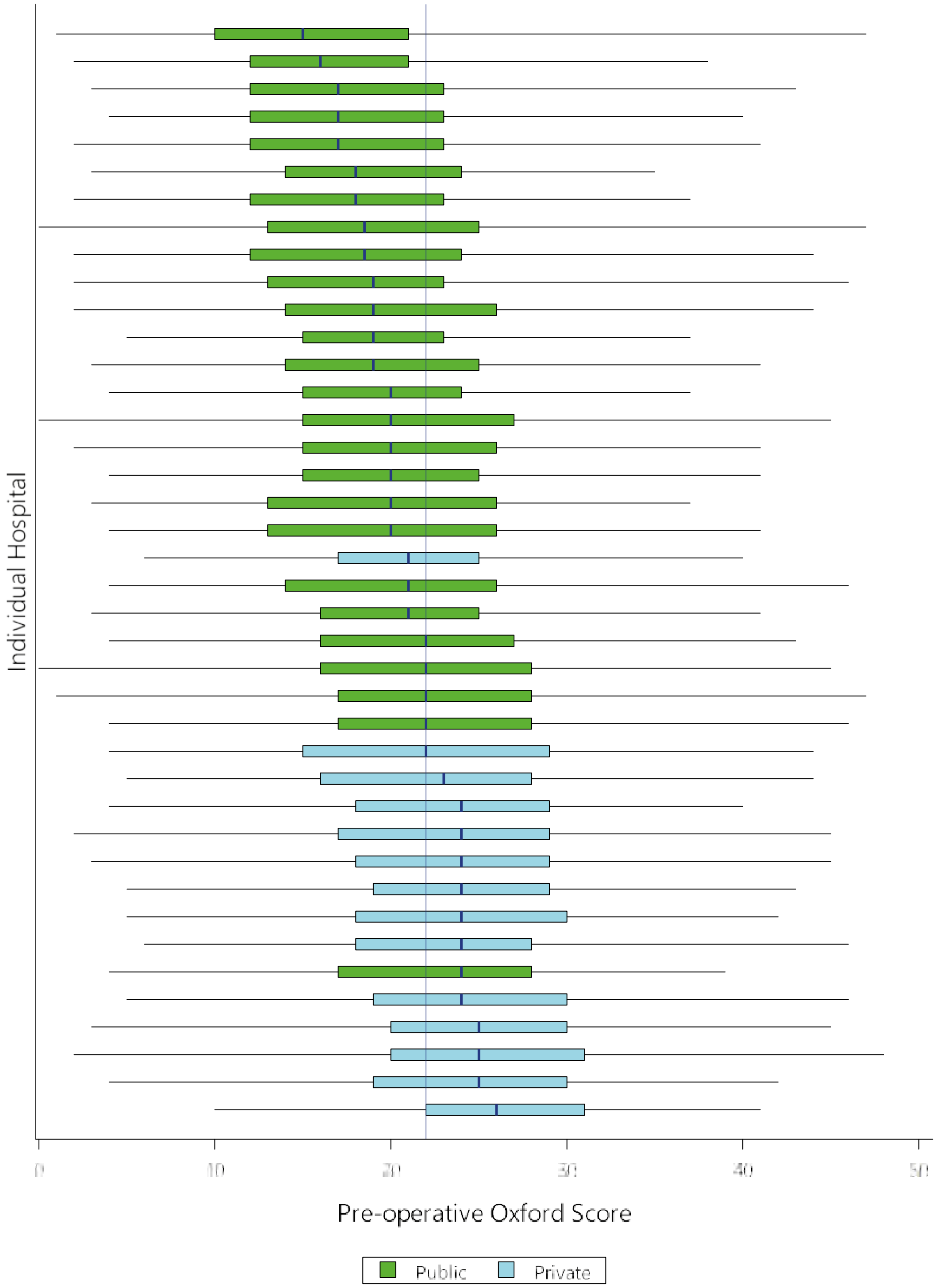

Note: The median pre-operative Oxford Score is 23

**Figure P27** **Pre-Operative Oxford Score for Patients Undergoing Primary Total Conventional Hip Replacement by Hospital (Primary Diagnosis OA)**




Note: The median pre-operative Oxford Score is 20

**Figure P28** Pre-Operative Oxford Score for Patients Undergoing Primary Total Knee Replacement by Hospital (Primary Diagnosis OA)




Note: The median pre-operative Oxford Score is 22

## JOINT PAIN AND PATIENT EXPECTATIONS

In the figures below, patient-reported expectations of joint pain at 6 months post-surgery are plotted against patient-reported joint pain at 6 months post-surgery. Expected and experienced pain at 6 months are similar for hip replacement (Figure P29). However, for knee and reverse shoulder replacement, the pain reported at 6 months post-surgery is higher than the expected pain (provided pre-operatively) (Figure P30 to Figure P32).

**Figure P29** **Expected Joint Pain vs Actual Joint Pain for Patients Undergoing Primary Total Conventional Hip Replacement (Primary Diagnosis OA)**

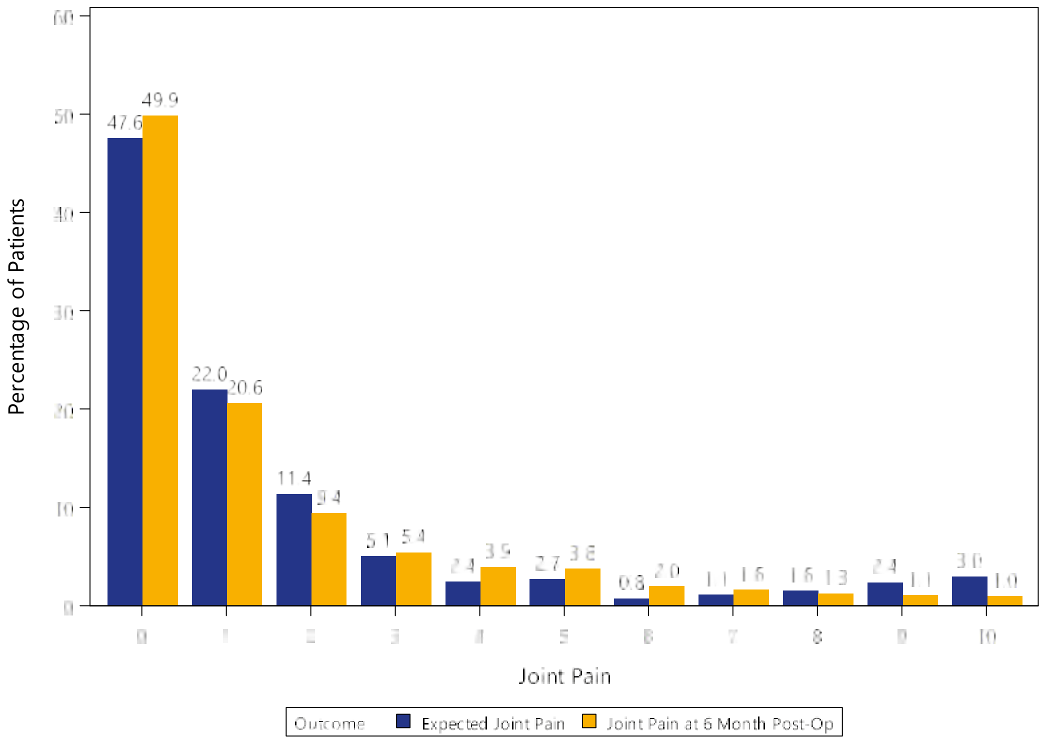


**Figure P30** **Expected Joint Pain vs Actual Joint Pain for Patients Undergoing Primary Total Knee Replacement (Primary Diagnosis OA)**

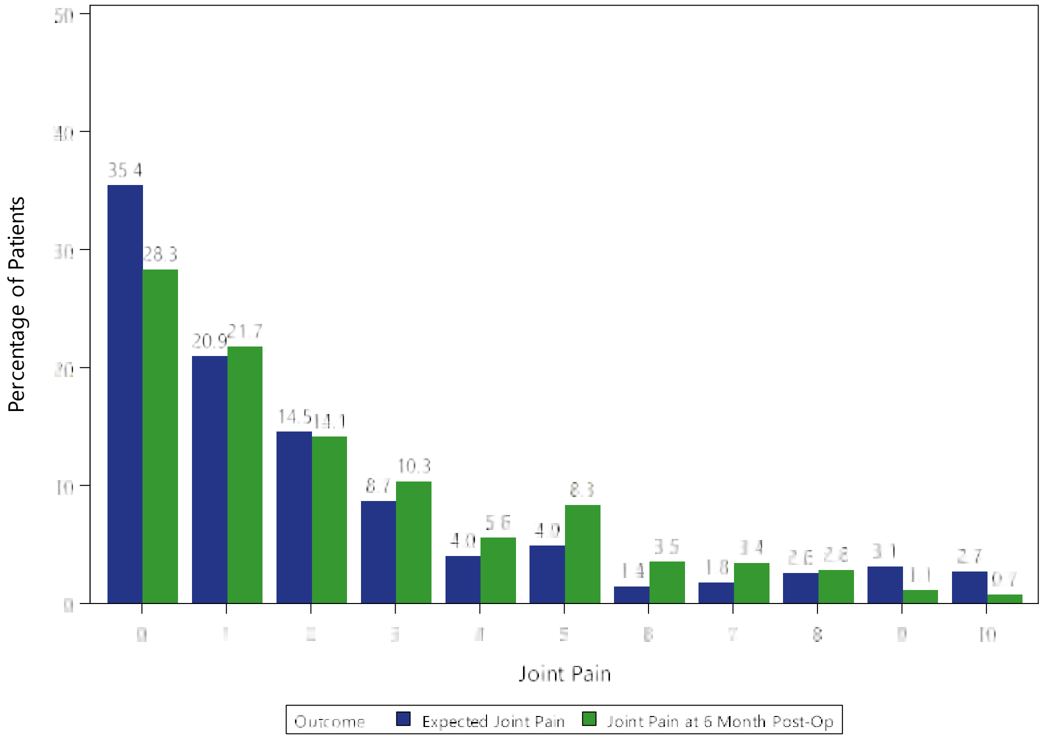



**Figure P31** **Expected Joint Pain vs Actual Joint Pain for Patients Undergoing Primary Total Reverse Shoulder Replacement (Primary Diagnosis OA)**

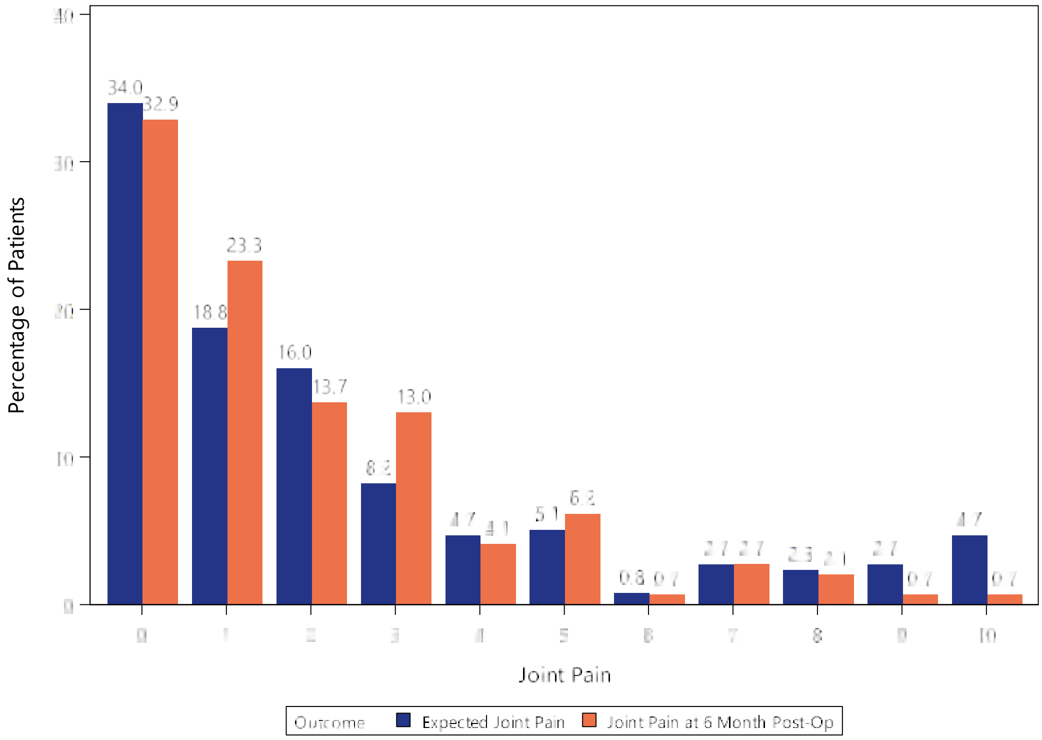
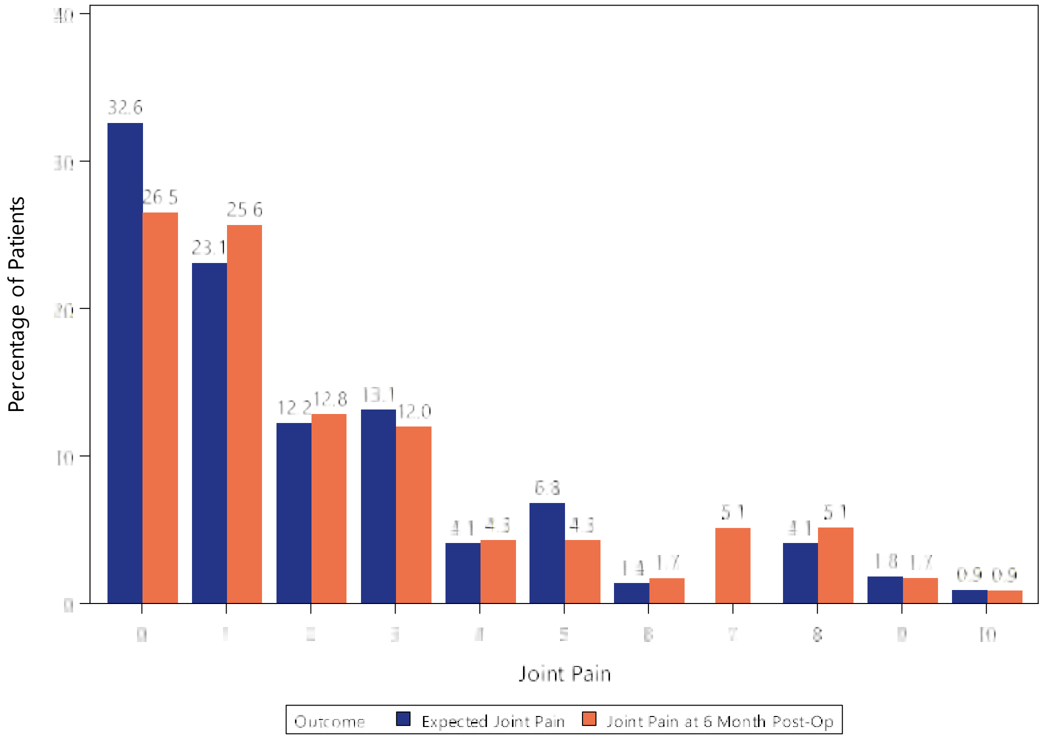


**Figure P32** **Expected Joint Pain vs Actual Joint Pain for Patients Undergoing Primary Total Reverse Shoulder Replacement (Primary Diagnosis Rotator Cuff Arthropathy)**



## SATISFACTION

Patients were asked at 6 months post-surgery to rate their satisfaction with the outcome of the surgery on a 5-level scale: 'very satisfied', 'satisfied', 'neutral', 'dissatisfied', or 'very dissatisfied'. Funnel plots showing surgeon-level and hospital-level variation are provided in Figure P33 to Figure P36. Outcomes for shoulders were not included due to the low number of procedures.

Surgeons who had PROM data for at least 10 primary total conventional hip or knee replacements with a diagnosis of osteoarthritis were included in the funnel plots. For hospitals, data on at least 50 procedures were required for inclusion in the funnel plots.

Each dot on the funnel plot represents an individual surgeon's or hospital's proportion of patients who indicated that they were satisfied ('very satisfied' or 'satisfied') with the outcome of their joint replacement against the number of procedures they have undertaken. The green line represents the average satisfaction rate for all surgeons/hospitals. The orange and red lines represent the 95% and 99.7% confidence limits.

A higher rate means a greater proportion of patients indicated they were satisfied with the outcome of their joint replacement. A satisfaction rating of 1 means that all patients rated their outcome as 'very satisfied' or 'satisfied' at 6 months post-surgery.

For surgeons, the overall rate of satisfaction was higher for total hip replacement (87%) than for total knee replacement (81%). For hospitals, the overall rate of satisfaction was also higher for total hip replacement (87%) than for total knee replacement (81%).

**Figure P33 Funnel Plot of Procedure Satisfaction After Primary Total Conventional Hip Replacement by Surgeon (Primary Diagnosis OA)**

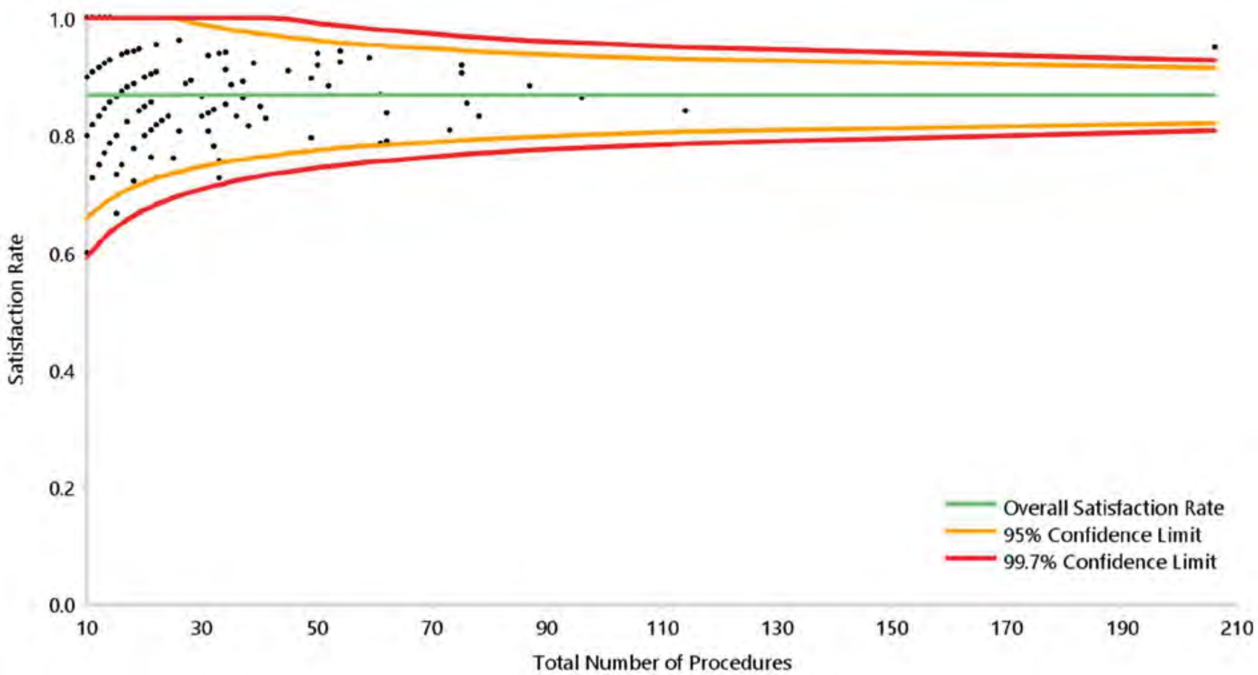


**Figure P34 Funnel Plot of Procedure Satisfaction After Primary Total Knee Replacement by Surgeon (Primary Diagnosis OA)**

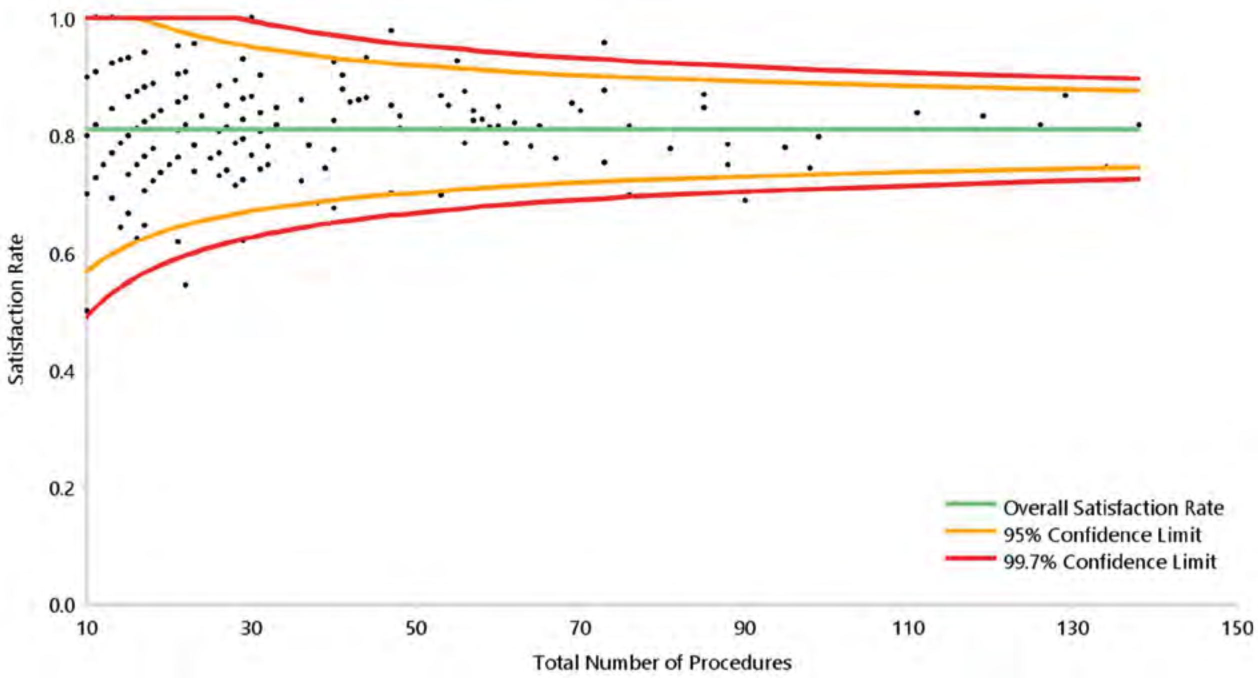



**Figure P35 Funnel Plot of Procedure Satisfaction After Primary Total Conventional Hip Replacement by Hospital (Primary Diagnosis OA)**

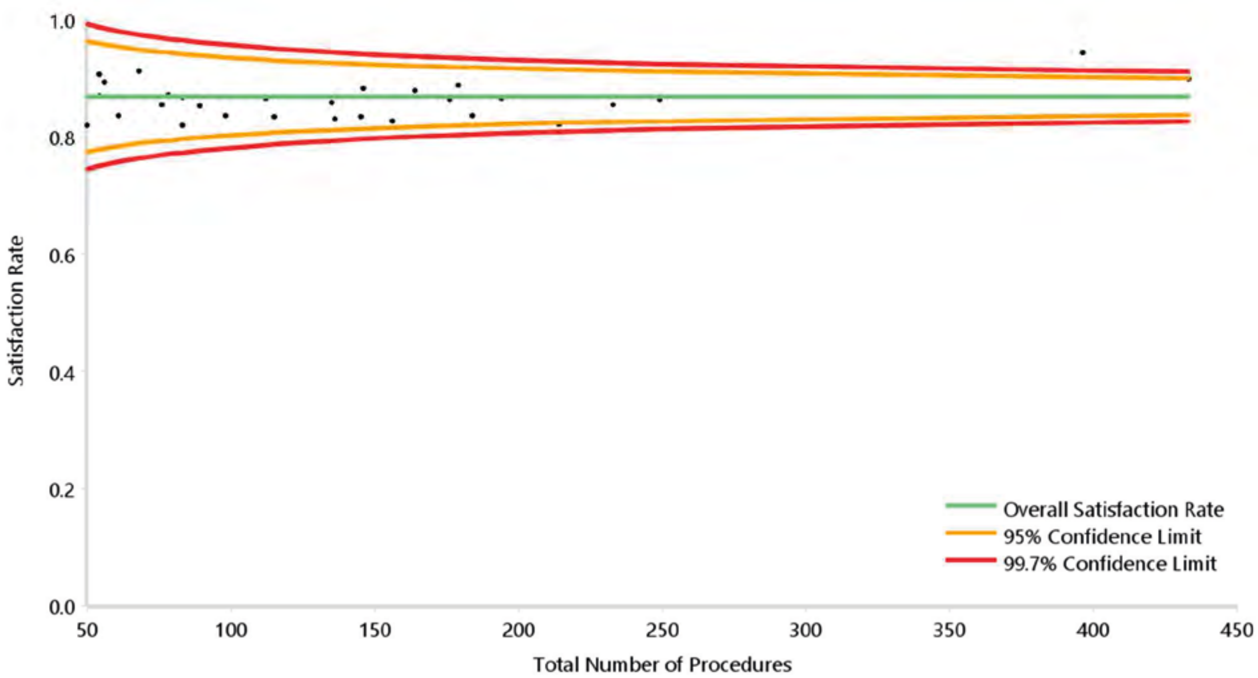
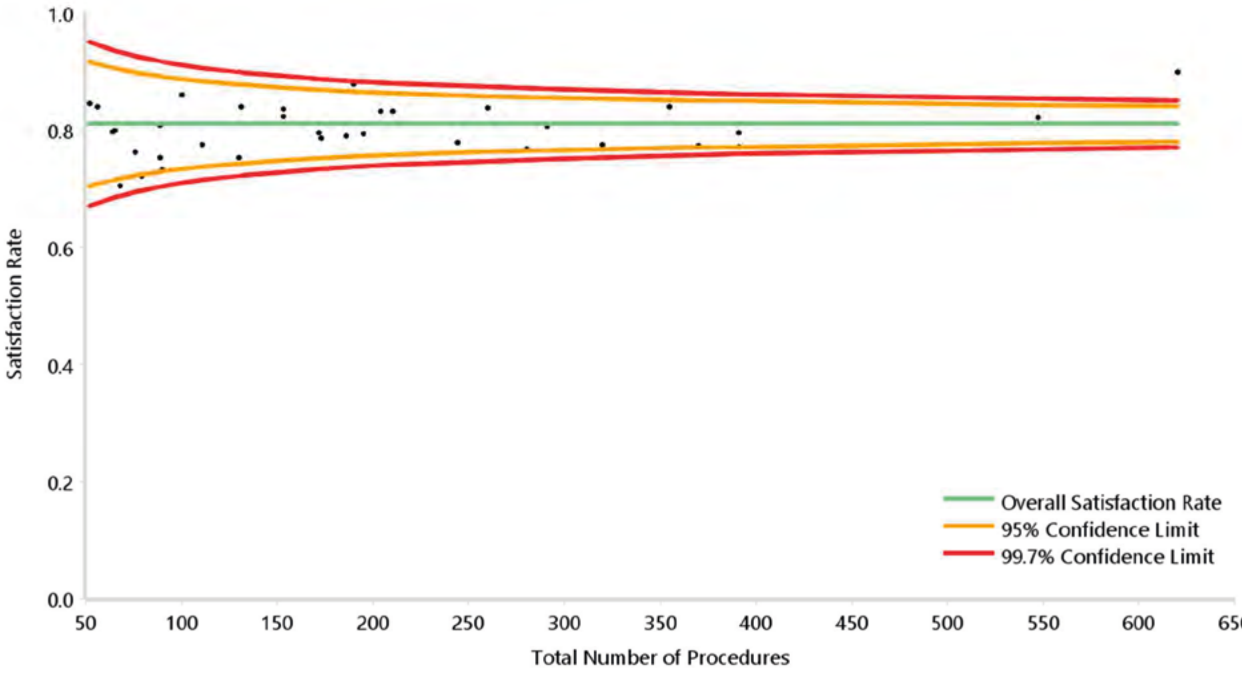


**Figure P36 Funnel Plot of Procedure Satisfaction After Primary Total Knee Replacement by Hospital (Primary Diagnosis OA)**



## IMPROVEMENT

At 6 months post-surgery, patients were asked to rate 'how the problems are now' in the joint that was operated on compared to before their operation on a 5-level scale: 'much better', 'a little better', 'about the same', 'a little worse', and 'much worse'.

Funnel plots showing surgeon-level and hospital-level variation in this outcome are provided in Figure P37 to Figure P40. Outcomes for shoulders were not included in these analyses due to the low number of shoulder procedures.

Surgeons who had PROM data for at least 10 primary total hip or knee replacements with a diagnosis of osteoarthritis were included in the funnel plots. For hospitals, data for at least 50 procedures were required for inclusion in the funnel plots.

Each dot on the funnel plot represents an individual surgeon's or hospital's proportion of patients who indicated they were 'much better' 6 months after their joint replacement out of the number of procedures undertaken. The green line represents the average improvement rate for all surgeons/hospitals. The orange and red lines represent the 95% and 99.7% confidence limits.

A higher rate means a greater proportion of patients indicated they were much better after their joint replacement. An improvement rate of 1 means that all patients were much better 6 months after their joint replacement.

Similar to the satisfaction rating, the proportion of patients reporting their joint problems to be 'much better' is higher for total hip replacement compared to total knee replacement. For surgeons and for hospitals, these proportions were 93% (hips) and 82% (knees).

**Figure P37 Funnel Plot of Patient-Rated Improvement ("Much Better") After Primary Total Conventional Hip Replacement by Surgeon (Primary Diagnosis OA)**

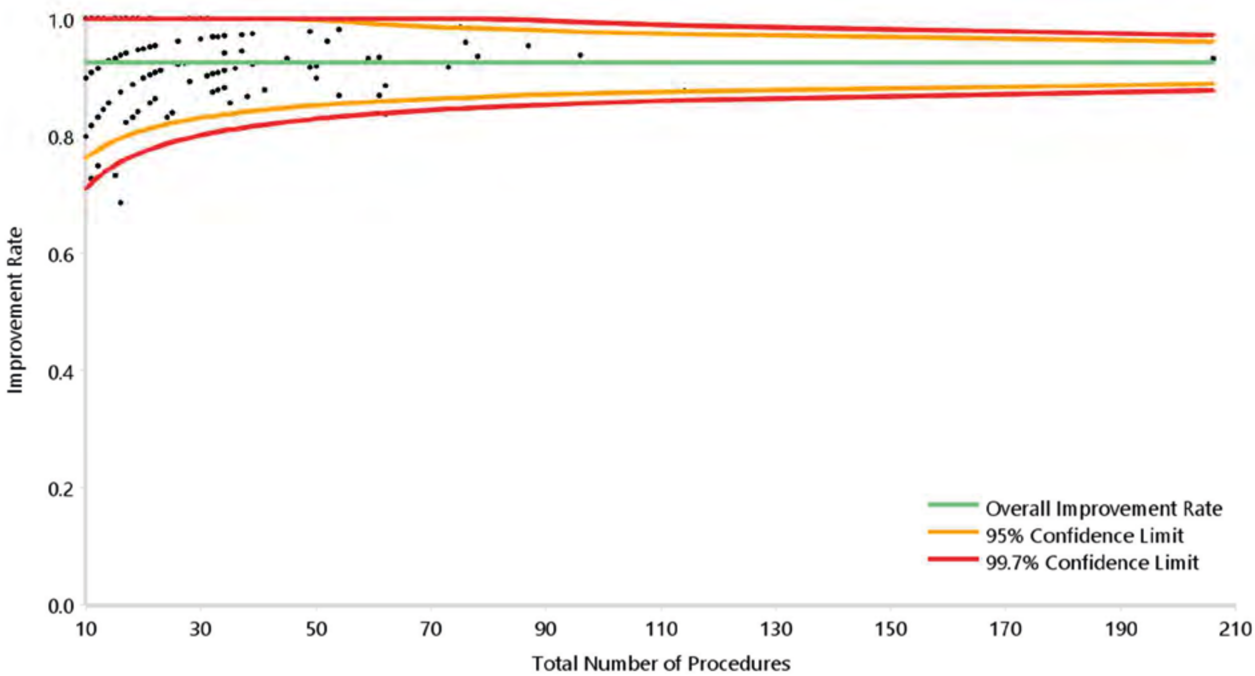


**Figure P38 Funnel Plot of Patient-Rated Improvement ("Much Better") After Primary Total Knee Replacement by Surgeon (Primary Diagnosis OA)**

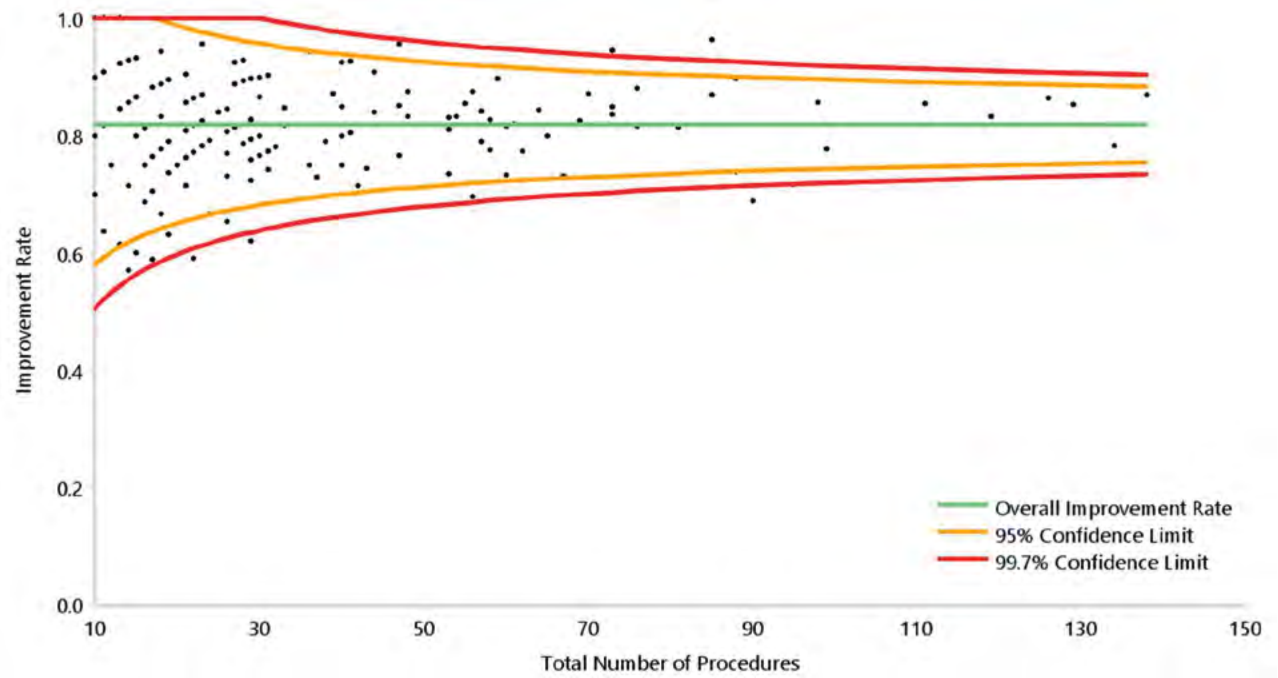



**Figure P39 Funnel Plot of Patient-Rated Improvement ("Much Better") After Primary Total Conventional Hip Replacement by Hospital (Primary Diagnosis OA)**

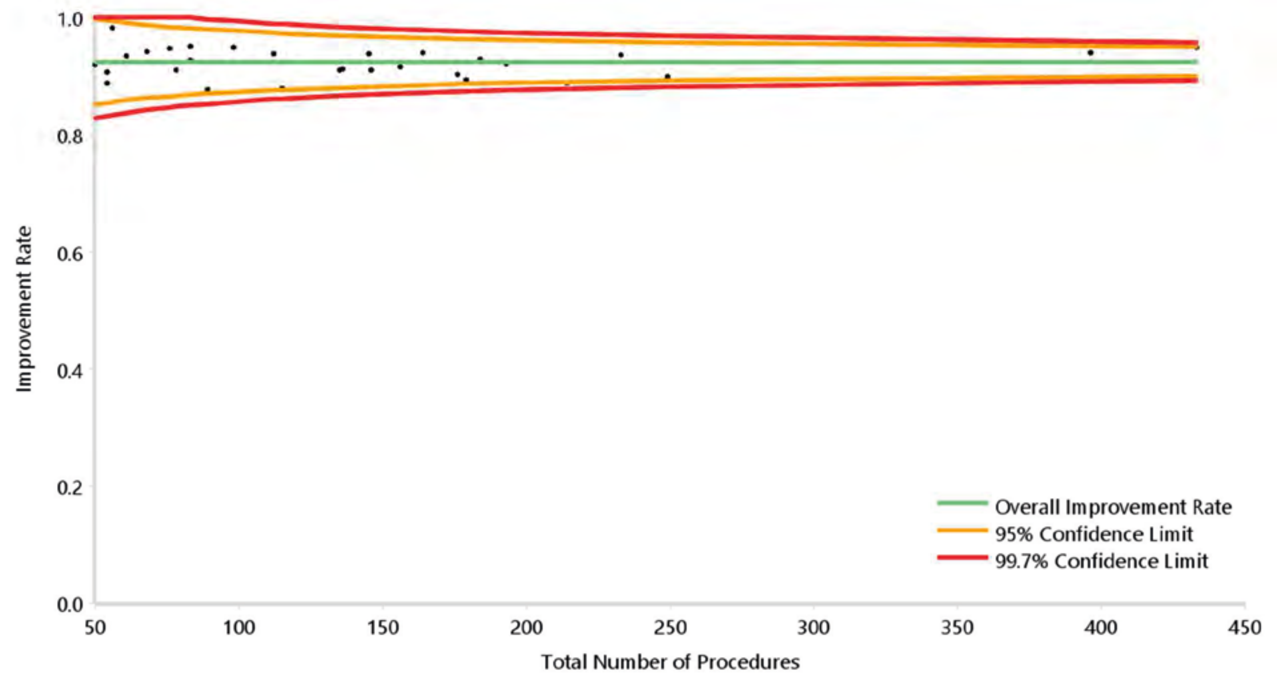
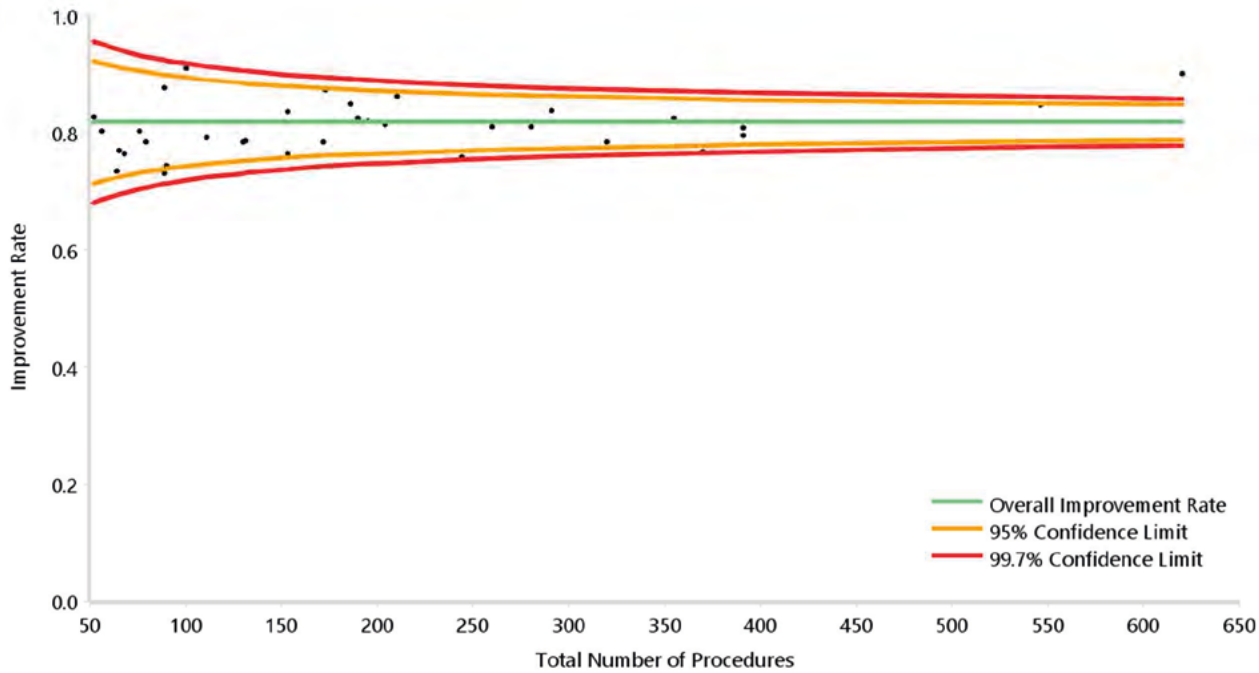


**Figure P40 Funnel Plot of Patient-Rated Improvement ("Much Better") After Primary Total Knee Replacement by Hospital (Primary Diagnosis OA)**




## SUMMARY

The successful pilot program has led to a standardised collection of patient-reported outcomes and has facilitated the Registry's ability to conduct nested clinical trials. This is the first time that the Registry has provided patient-reported outcomes in the Annual Report. The Registry is currently rolling out the PROMs program to hospitals nationally and will continue to refine individual patient, surgeon, and site reports, and provide an annual summary.

# Consumer Workshops

## Participants' comments after participating in the consumer feedback workshops:

"Learning about the Registry."

"It was very pleasing to have the opportunity to have input into the design features."

"It was well run and a good experience to be part of. I would love to see the final product!"

"Finding out that there is a trustworthy and competent organisation that is transparent and gives relevant data on joint replacements."

"Meeting other people who had been through a similar operation, and talking openly to professionals who were respectful, and listened to what we all had to say."

"I would like to see data kept on other medical procedures. When I was searching for detailed and updated info on hip prosthesis. I never found your group."

"Staff attendees were unfailingly patient and respectful to consumer reps. Warm and friendly atmosphere. Obvious intention to ensure that all consumers were encouraged to participate."

Project Funded by the Victorian Agency for Health Information

# 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 2020 (described as modern prostheses) are included in the analyses, unless clearly specified. This approach has been applied to both 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 prosthesis combinations is available in the supplementary report 'Comparative Prosthesis Performance' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2021

### 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 35 femoral and acetabular combinations with 10 year outcome data. These prosthesis combinations have been used in 74% of all primary total conventional hip procedures performed for osteoarthritis reported to the Registry.

The 10 year cumulative percent revision for the individual prosthesis combinations ranges from 2.6% to 8.2%. 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. The new benchmark, based on the cumulative percent revision at 10 years calculated with a restriction to modern prostheses, is now 4.4%. Approaches to benchmarking hip and knee prostheses have been reviewed by an International Working Group. An important recommendation was to use confidence intervals rather than the estimated rate of revision previously used. The reason for this is that data quality is inherently reflected in the confidence interval. To identify better performing prosthesis combinations, the following two approaches were recommended:

**Superiority approach:** the upper confidence interval is less than, or equal to, the benchmark standard. Using the new benchmark of 4.4% at 10 years, then 8 (22.9%) hip prosthesis combinations qualify for the superiority benchmark. These are highlighted in green in Table TY1.

**Non-inferiority approach:** the permitted upper confidence interval level is 20% above the benchmark standard. For the benchmark standard of 4.4% at 10 years, the accepted upper confidence interval is 5.3% or less. Using this approach, an additional 5 prosthesis combinations can be benchmarked, i.e. 13 (37.1%) prosthesis combinations would receive either a superiority or non-inferiority benchmark. The additional 5 prostheses with a non-inferiority benchmark are highlighted in blue in Table TY1.

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 TY1 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: THR | Femoral | Acetabular | Other | 2 Yrs | 5 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|---|---|
| Alloclassic | Allofit | 140 | 3333 | 12 | 78 | 17 | 33 | 1.8 (1.4, 2.3) | 2.6 (2.1, 3.2) | 4.3 (3.6, 5.1) |
| Anthology | R3 | 202 | 7018 | 18 | 61 | 39 | 84 | 2.2 (1.9, 2.6) | 2.7 (2.3, 3.1) | 3.5 (3.0, 4.1) |
| C-Stem AMT | PINNACLE | 98 | 4131 | 8 | 37 | 11 | 42 | 1.6 (1.2, 2.0) | 2.9 (2.3, 3.6) | 4.5 (3.4, 6.0) |
| CLS | Allofit | 29 | 469 | 2 | 16 | 8 | 3 | 2.6 (1.5, 4.5) | 4.4 (2.8, 6.7) | 5.7 (3.9, 8.4) |
| CORAIL | PINNACLE | 1735 | 50561 | 147 | 643 | 273 | 672 | 2.1 (2.0, 2.2) | 3.1 (2.9, 3.3) | 4.9 (4.7, 5.2) |
| CPCS | R3 | 177 | 5662 | 19 | 52 | 35 | 71 | 2.4 (2.0, 2.8) | 3.2 (2.7, 3.7) | 4.8 (3.9, 5.8) |
| CPCS | Reflection (Cup) | 71 | 791 | 24 | 3 | 31 | 13 | 1.5 (0.8, 2.6) | 2.8 (1.8, 4.4) | 8.2 (6.0, 11.0) |
| CPCS | Reflection (Shell) | 98 | 2725 | 13 | 42 | 12 | 31 | 0.9 (0.6, 1.4) | 1.7 (1.2, 2.2) | 3.3 (2.6, 4.2) |
| CPT | Allofit | 41 | 1423 | 3 | 20 | 4 | 14 | 1.2 (0.7, 1.9) | 2.6 (1.8, 3.7) | 4.7 (3.3, 6.6) |
| CPT | Continuum | 124 | 2753 | 8 | 42 | 16 | 58 | 3.2 (2.6, 3.9) | 4.2 (3.4, 5.0) | 6.7 (5.2, 8.5) |
| CPT | Trabecular Metal (Shell) | 92 | 1919 | 7 | 40 | 17 | 28 | 2.8 (2.1, 3.6) | 4.2 (3.3, 5.3) | 6.5 (5.2, 8.2) |
| CPT | Trilogy | 354 | 7621 | 35 | 131 | 38 | 150 | 2.3 (2.0, 2.6) | 3.5 (3.1, 4.0) | 5.2 (4.7, 5.8) |
| CPT | ZCA | 37 | 851 | 13 | 9 | 9 | 6 | 1.0 (0.5, 1.9) | 2.3 (1.4, 3.6) | 4.7 (3.3, 6.8) |
| Exeter V40 | Contemporary | 277 | 4577 | 70 | 46 | 129 | 32 | 2.1 (1.8, 2.6) | 3.2 (2.7, 3.8) | 5.6 (4.9, 6.4) |
| Exeter V40 | Exeter Contemporary | 154 | 2916 | 52 | 33 | 47 | 22 | 1.9 (1.5, 2.5) | 3.0 (2.4, 3.7) | 4.7 (3.9, 5.6) |
| Exeter V40 | PINNACLE | 46 | 1858 | 2 | 18 | 11 | 15 | 1.6 (1.1, 2.2) | 1.9 (1.3, 2.7) | 4.2 (2.9, 6.0) |
| Exeter V40 | Trabecular Metal (Shell) | 20 | 430 | 2 | 2 | 2 | 14 | 3.1 (1.8, 5.3) | 4.3 (2.7, 6.8) | 5.5 (3.5, 8.5) |
| Exeter V40 | Trident (Shell) | 1804 | 64640 | 253 | 557 | 244 | 750 | 1.5 (1.4, 1.6) | 2.3 (2.2, 2.4) | 3.6 (3.5, 3.8) |
| Exeter V40 | Trident/Tritanium (Shell) | 97 | 3955 | 8 | 19 | 23 | 47 | 1.7 (1.3, 2.2) | 2.7 (2.2, 3.3) | 3.9 (2.9, 5.4) |
| Exeter V40 | Trilogy | 18 | 517 | 2 | 5 | 2 | 9 | 2.3 (1.3, 4.1) | 2.5 (1.5, 4.3) | 3.7 (2.3, 5.9) |
| M/L Taper | Allofit | 19 | 689 | 1 | 10 | 3 | 5 | 1.8 (1.0, 3.1) | 2.1 (1.3, 3.6) | 3.8 (2.2, 6.5) |
| MS 30 | Fitmore | 15 | 505 | 0 | 1 | 8 | 6 | 1.5 (0.7, 3.0) | 2.7 (1.5, 4.9) | 4.1 (2.4, 7.0) |
| Omnifit | Trident (Shell) | 155 | 3787 | 12 | 38 | 27 | 78 | 2.2 (1.7, 2.7) | 2.9 (2.4, 3.5) | 3.8 (3.2, 4.5) |
| Polarstem | R3 | 320 | 12232 | 18 | 102 | 42 | 158 | 2.3 (2.0, 2.5) | 3.0 (2.7, 3.4) | 4.1 (3.3, 5.3) |
| Quadra-H | Versafitcup CC | 282 | 8609 | 28 | 120 | 55 | 79 | 2.3 (2.0, 2.6) | 3.3 (2.9, 3.7) | 5.9 (4.8, 7.2) |
| S-Rom | PINNACLE | 138 | 2488 | 14 | 77 | 12 | 35 | 2.8 (2.2, 3.6) | 4.4 (3.6, 5.3) | 5.7 (4.8, 6.7) |
| SL-Plus | EP-Fit Plus | 47 | 1106 | 3 | 20 | 9 | 15 | 2.0 (1.3, 3.0) | 3.0 (2.1, 4.2) | 4.2 (3.1, 5.7) |
| SL-Plus | R3 | 89 | 1641 | 3 | 26 | 21 | 39 | 3.3 (2.5, 4.3) | 4.4 (3.5, 5.6) | 6.3 (5.1, 7.8) |
| Secur-Fit | Trident (Shell) | 427 | 9531 | 24 | 186 | 79 | 138 | 2.3 (2.0, 2.6) | 3.4 (3.1, 3.8) | 4.6 (4.2, 5.1) |
| Secur-Fit Plus | Trident (Shell) | 210 | 5752 | 15 | 54 | 52 | 89 | 1.5 (1.3, 1.9) | 2.2 (1.9, 2.7) | 3.3 (2.8, 3.8) |
| Spectron EF | R3 | 76 | 1992 | 11 | 11 | 16 | 38 | 2.4 (1.8, 3.1) | 3.7 (2.9, 4.7) | 5.1 (4.0, 6.5) |
| Summit | PINNACLE | 149 | 5124 | 10 | 33 | 21 | 85 | 1.8 (1.5, 2.2) | 2.3 (1.9, 2.8) | 3.4 (2.9, 4.1) |
| Synergy | R3 | 139 | 4762 | 3 | 39 | 30 | 67 | 2.0 (1.7, 2.5) | 2.6 (2.2, 3.2) | 3.4 (2.8, 4.0) |
| Synergy | Reflection (Shell) | 365 | 7243 | 32 | 81 | 115 | 137 | 1.9 (1.7, 2.3) | 2.6 (2.2, 3.0) | 3.8 (3.4, 4.3) |
| Tri-Lock | PINNACLE | 20 | 919 | 0 | 8 | 4 | 8 | 1.5 (0.9, 2.5) | 2.4 (1.5, 3.7) | 2.6 (1.7, 4.1) |
| TOTAL | | 8065 | 234530 | 872 | 2660 | 1462 | 3071 | | | |

Note: Only prostheses with over 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 to both 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 prosthesis combinations is available in the supplementary report 'Comparative Prosthesis Performance' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2021

There are 43 total knee replacement combinations with 10 year outcome data. These prosthesis combinations were used in 84.6% of all primary total knee replacement procedures performed for osteoarthritis reported to the Registry.

The 10 year cumulative percent revision ranges from 2.9% to 10.1%. In the past, when assessing superior and non-inferior performance, the benchmark standard used was a cumulative percent revision at 10 years of 5%. The new cumulative percent revision at 10 years, calculated with a restriction to modern prostheses, is now 4.8%.

Applying the recommendations of the International Benchmarking Working Group, and using the new benchmark of 4.8% at 10 years, 7 (16.3%) knee prosthesis combinations qualify for the superiority benchmark. These are highlighted in green in Table TY2.

To assess non-inferiority, the permitted upper confidence interval level is 20% above the new benchmark standard which is 5.8% or less. An additional 13 knee prosthesis combinations can be benchmarked, i.e. 20 (46.5%) prosthesis combinations would receive either a superiority or a non-inferiority benchmark. The additional 13 devices with a non-inferiority benchmark are highlighted in blue (Table TY2).

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 TY2 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: TKR | Femoral | Tibial | Other | 2 Yrs | 5 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|---|---|
| Active Knee | Active Knee | 767 | 9964 | 218 | 29 | 42 | 478 | 2.5 (2.2, 2.8) | 4.7 (4.3, 5.2) | 8.2 (7.6, 8.8) |
| Advance | Advance | 55 | 957 | 21 | 4 | 8 | 22 | 3.8 (2.7, 5.2) | 5.7 (4.3, 7.4) | 6.8 (5.2, 8.9) |
| Advance | Advance II | 112 | 1621 | 45 | 3 | 13 | 51 | 3.6 (2.8, 4.6) | 5.0 (4.0, 6.2) | 6.8 (5.6, 8.2) |
| BalanSys | BalanSys | 92 | 4001 | 24 | 5 | 7 | 56 | 1.3 (1.0, 1.8) | 2.3 (1.8, 2.9) | 4.1 (3.1, 5.3) |
| Columbus | Columbus | 130 | 4097 | 33 | 6 | 7 | 84 | 2.2 (1.7, 2.8) | 4.8 (3.9, 5.8) | 7.7 (6.3, 9.4) |
| E.Motion | E.Motion | 79 | 1344 | 23 | 10 | 4 | 42 | 4.2 (3.2, 5.4) | 6.5 (5.2, 8.1) | 7.2 (5.8, 8.9) |
| GMK Primary | GMK Primary | 89 | 2621 | 30 | 2 | 12 | 45 | 2.5 (1.9, 3.2) | 3.7 (3.0, 4.6) | 4.6 (3.7, 5.9) |
| Genesis II CR | Genesis II | 1092 | 24634 | 225 | 68 | 56 | 743 | 2.0 (1.8, 2.2) | 3.5 (3.3, 3.8) | 5.0 (4.7, 5.4) |
| Genesis II Oxinium CR (ctd) | Genesis II | 513 | 9553 | 100 | 28 | 25 | 360 | 1.9 (1.6, 2.2) | 3.6 (3.2, 4.0) | 6.1 (5.5, 6.7) |
| Genesis II Oxinium PS (ctd) | Genesis II | 1230 | 20507 | 166 | 33 | 162 | 869 | 2.8 (2.6, 3.1) | 5.1 (4.8, 5.4) | 7.5 (7.1, 8.0) |
| Genesis II PS | Genesis II | 856 | 19724 | 151 | 29 | 54 | 622 | 2.1 (1.9, 2.3) | 3.7 (3.4, 4.0) | 5.2 (4.8, 5.5) |
| LCS CR | LCS | 617 | 8323 | 251 | 24 | 89 | 253 | 2.5 (2.1, 2.8) | 4.5 (4.0, 4.9) | 6.4 (5.9, 7.0) |
| LCS CR | MBT | 1280 | 32051 | 427 | 61 | 148 | 644 | 1.9 (1.8, 2.1) | 3.4 (3.2, 3.6) | 4.8 (4.6, 5.1) |
| LCS CR | MBT Duofix | 803 | 15167 | 230 | 34 | 43 | 496 | 2.7 (2.4, 2.9) | 4.1 (3.7, 4.4) | 5.3 (4.9, 5.7) |
| Legion CR | Genesis II | 183 | 6457 | 27 | 15 | 7 | 134 | 2.2 (1.8, 2.6) | 3.6 (3.1, 4.2) | 5.2 (4.0, 6.7) |
| Legion Oxinium CR | Genesis II | 174 | 7231 | 43 | 16 | 3 | 112 | 1.7 (1.4, 2.1) | 3.5 (3.0, 4.2) | 4.6 (3.8, 5.4) |
| Legion Oxinium PS | Genesis II | 574 | 14898 | 78 | 16 | 49 | 431 | 2.2 (2.0, 2.5) | 4.1 (3.8, 4.5) | 5.9 (5.3, 6.5) |
| Legion PS | Genesis II | 169 | 5412 | 43 | 3 | 6 | 117 | 1.9 (1.5, 2.3) | 3.2 (2.7, 3.7) | 4.5 (3.7, 5.4) |
| MRK | MRK | 20 | 675 | 4 | 1 | 0 | 15 | 1.8 (1.0, 3.1) | 2.5 (1.5, 4.1) | 3.7 (2.3, 5.9) |
| Natural Knee Flex | Natural Knee II | 145 | 5962 | 44 | 6 | 7 | 88 | 1.5 (1.2, 1.9) | 2.4 (2.0, 2.8) | 3.3 (2.8, 4.0) |
| Nexgen CR | Nexgen | 424 | 11521 | 136 | 22 | 31 | 235 | 1.2 (1.1, 1.5) | 2.2 (1.9, 2.5) | 3.1 (2.8, 3.5) |
| Nexgen CR | Nexgen TM CR | 55 | 862 | 19 | 4 | 11 | 21 | 2.5 (1.6, 3.8) | 5.6 (4.2, 7.4) | 6.6 (5.1, 8.7) |
| Nexgen CR Flex | Nexgen | 1410 | 58675 | 330 | 100 | 123 | 857 | 1.4 (1.3, 1.5) | 2.3 (2.2, 2.4) | 3.1 (2.9, 3.3) |
| Nexgen CR Flex | Nexgen TM CR | 317 | 11937 | 98 | 21 | 28 | 170 | 1.3 (1.1, 1.5) | 2.3 (2.0, 2.6) | 3.2 (2.8, 3.6) |
| Nexgen LCCK | Nexgen | 46 | 912 | 6 | 3 | 1 | 36 | 3.2 (2.2, 4.6) | 5.2 (3.8, 7.0) | 6.3 (4.6, 8.6) |
| Nexgen LPS | Nexgen | 361 | 7003 | 94 | 20 | 33 | 214 | 2.0 (1.7, 2.3) | 3.3 (2.9, 3.8) | 4.9 (4.4, 5.5) |
| Nexgen LPS | Nexgen TM LPS | 33 | 1436 | 10 | 3 | 6 | 14 | 1.0 (0.6, 1.6) | 2.2 (1.5, 3.2) | 2.9 (2.0, 4.2) |
| Nexgen LPS Flex | Nexgen | 1512 | 37006 | 413 | 65 | 236 | 798 | 1.8 (1.6, 1.9) | 3.2 (3.0, 3.3) | 5.0 (4.8, 5.3) |
| Nexgen LPS Flex | Nexgen TM LPS | 70 | 1565 | 34 | 4 | 6 | 26 | 2.0 (1.4, 2.8) | 3.5 (2.7, 4.6) | 4.7 (3.7, 6.0) |
| Nexgen RH | Nexgen | 29 | 533 | 3 | 4 | 3 | 19 | 3.1 (1.8, 5.0) | 5.3 (3.5, 8.2) | 9.6 (6.4, 14.2) |
| PFC Sigma CR | MBT | 322 | 6255 | 63 | 35 | 45 | 179 | 2.7 (2.3, 3.1) | 4.0 (3.5, 4.5) | 5.1 (4.6, 5.7) |
| PFC Sigma CR | MBT Duofix | 155 | 3314 | 24 | 18 | 6 | 107 | 2.5 (2.0, 3.1) | 3.6 (3.0, 4.4) | 5.0 (4.2, 5.9) |
| PFC Sigma CR | PFC Sigma | 849 | 24584 | 214 | 54 | 64 | 517 | 1.5 (1.4, 1.7) | 2.5 (2.3, 2.7) | 3.6 (3.3, 3.8) |
| PFC Sigma PS | MBT | 343 | 6322 | 115 | 14 | 24 | 190 | 2.2 (1.9, 2.6) | 3.9 (3.4, 4.4) | 5.4 (4.8, 6.0) |
| PFC Sigma PS | MBT Duofix | 173 | 2212 | 38 | 4 | 6 | 125 | 3.5 (2.8, 4.3) | 6.0 (5.1, 7.2) | 8.4 (7.2, 9.7) |
| PFC Sigma PS | PFC Sigma | 361 | 7979 | 123 | 12 | 27 | 199 | 1.9 (1.7, 2.3) | 3.3 (2.9, 3.7) | 4.8 (4.3, 5.3) |
| RBK | RBK | 534 | 10891 | 203 | 14 | 42 | 275 | 2.3 (2.1, 2.6) | 3.9 (3.5, 4.3) | 5.3 (4.9, 5.8) |
| Score | Score | 326 | 5251 | 124 | 20 | 10 | 172 | 3.3 (2.9, 3.9) | 6.3 (5.6, 7.1) | 10.1 (8.9, 11.5) |
| Triathlon CR | Triathlon | 2506 | 109011 | 454 | 106 | 115 | 1831 | 1.5 (1.4, 1.6) | 2.5 (2.4, 2.6) | 3.8 (3.6, 4.0) |
| Triathlon PS | Triathlon | 539 | 12926 | 97 | 28 | 71 | 343 | 2.4 (2.1, 2.7) | 3.9 (3.6, 4.3) | 5.6 (5.1, 6.1) |
| Vanguard CR | Regenerex | 85 | 1706 | 21 | 5 | 10 | 49 | 2.7 (2.0, 3.5) | 4.1 (3.3, 5.2) | 7.3 (5.6, 9.3) |
| Vanguard CR | Vanguard | 906 | 26692 | 200 | 32 | 66 | 608 | 1.7 (1.6, 1.9) | 3.0 (2.8, 3.2) | 4.9 (4.5, 5.3) |
| Vanguard PS | Vanguard | 308 | 5104 | 75 | 7 | 58 | 168 | 3.5 (3.0, 4.0) | 5.3 (4.7, 6.0) | 7.5 (6.6, 8.4) |
| TOTAL | | 20644 | 548896 | 5077 | 988 | 1764 | 12815 | | | |

Note: 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

## FIFTEEN YEAR OUTCOMES

This year, the Registry is reporting 15 year outcomes for 18 hip and 24 knee prosthesis combinations. A combination is included if >350 procedures have been reported to the Registry and the follow-up period is ≥15 years and the prosthesis is still available and still used.

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-2021

### HIP REPLACEMENT

The listed prosthesis combinations were used in 54.7% of all primary total conventional hip replacement procedures performed for osteoarthritis.

The 15 year cumulative percent revision ranges from 4.1% to 19.1%. The benchmark used to assess superiority and non-inferiority performance at 15 years was calculated with a restriction to modern prostheses. The 15 year benchmark is 6.5%. There are 5 (27.8%) hip prosthesis combinations that qualify for a superiority benchmark (highlighted in green). An additional 4 prosthesis combinations qualify for a non-inferiority benchmark, i.e. 9 (50.0%) qualify for either a superiority or non-inferiority benchmark. Those prosthesis combinations that qualify for a non-inferiority benchmark are highlighted in blue (Table TY3).

### KNEE REPLACEMENT

The listed prosthesis combinations were used in 68.3% of all primary total knee replacement procedures performed for osteoarthritis.

The 15 year cumulative percent revision ranges from 4.0% to 11.9%. The benchmark used to assess superiority and non-inferiority at 15 years is 6.5%. There are 5 (20.8%) knee prosthesis combinations that qualify for a superiority benchmark (highlighted in green) (Table TY4). An additional 8 prosthesis combinations qualify for a non-inferiority benchmark, i.e. 13 (54.2%) prosthesis combinations qualify for either a superiority or non-inferiority benchmark. Those prostheses that qualify for a non-inferiority benchmark are highlighted in blue (Table TY4).

**Table TY3 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: THR | Type of Revision: Femoral | Type of Revision: Acetabular | Type of Revision: Other | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|---|---|---|
| Alloclassic | Allofit | 140 | 3333 | 12 | 78 | 17 | 33 | 2.6 (2.1, 3.2) | 4.3 (3.6, 5.1) | 6.4 (5.2, 7.7) |
| CLS | Allofit | 29 | 469 | 2 | 16 | 8 | 3 | 4.4 (2.8, 6.7) | 5.7 (3.9, 8.4) | 8.1 (5.4, 11.9) |
| CORAIL | PINNACLE | 1735 | 50561 | 147 | 643 | 273 | 672 | 3.1 (2.9, 3.3) | 4.9 (4.7, 5.2) | 8.0 (7.0, 9.3) |
| CPCS | Reflection (Cup) | 71 | 791 | 24 | 3 | 31 | 13 | 2.8 (1.8, 4.4) | 8.2 (6.0, 11.0) | 19.1 (15.0, 24.3) |
| CPCS | Reflection (Shell) | 98 | 2725 | 13 | 42 | 12 | 31 | 1.7 (1.2, 2.2) | 3.3 (2.6, 4.2) | 6.6 (5.1, 8.4) |
| CPT | Trilogy | 354 | 7621 | 35 | 131 | 38 | 150 | 3.5 (3.1, 4.0) | 5.2 (4.7, 5.8) | 6.7 (5.9, 7.6) |
| CPT | ZCA | 37 | 851 | 13 | 9 | 9 | 6 | 2.3 (1.4, 3.6) | 4.7 (3.3, 6.8) | 6.5 (4.5, 9.5) |
| Exeter V40 | Contemporary | 277 | 4577 | 70 | 46 | 129 | 32 | 3.2 (2.7, 3.8) | 5.6 (4.9, 6.4) | 9.1 (7.9, 10.4) |
| Exeter V40 | Exeter Contemporary | 154 | 2916 | 52 | 33 | 47 | 22 | 3.0 (2.4, 3.7) | 4.7 (3.9, 5.6) | 8.0 (6.7, 9.7) |
| Exeter V40 | Trident (Shell) | 1804 | 64640 | 253 | 557 | 244 | 750 | 2.3 (2.2, 2.4) | 3.6 (3.5, 3.8) | 5.4 (5.0, 5.7) |
| Exeter V40 | Trilogy | 18 | 517 | 2 | 5 | 2 | 9 | 2.5 (1.5, 4.3) | 3.7 (2.3, 5.9) | 4.1 (2.6, 6.6) |
| MS 30 | Fitmore | 15 | 505 | 0 | 1 | 8 | 6 | 2.7 (1.5, 4.9) | 4.1 (2.4, 7.0) | 5.3 (2.9, 9.7) |
| Omnifit | Trident (Shell) | 155 | 3787 | 12 | 38 | 27 | 78 | 2.9 (2.4, 3.5) | 3.8 (3.2, 4.5) | 5.1 (4.3, 6.1) |
| S-Rom | PINNACLE | 138 | 2488 | 14 | 77 | 12 | 35 | 4.4 (3.6, 5.3) | 5.7 (4.8, 6.7) | 7.3 (6.0, 8.8) |
| Secur-Fit | Trident (Shell) | 427 | 9531 | 24 | 186 | 79 | 138 | 3.4 (3.1, 3.8) | 4.6 (4.2, 5.1) | 6.0 (5.4, 6.7) |
| Secur-Fit Plus | Trident (Shell) | 210 | 5752 | 15 | 54 | 52 | 89 | 2.2 (1.9, 2.7) | 3.3 (2.8, 3.8) | 4.5 (3.9, 5.2) |
| Summit | PINNACLE | 149 | 5124 | 10 | 33 | 21 | 85 | 2.3 (1.9, 2.8) | 3.4 (2.9, 4.1) | 4.7 (3.8, 5.9) |
| Synergy | Reflection (Shell) | 365 | 7243 | 32 | 81 | 115 | 137 | 2.6 (2.2, 3.0) | 3.8 (3.4, 4.3) | 5.7 (5.1, 6.4) |
| TOTAL | | 6176 | 173431 | 730 | 2033 | 1124 | 2289 | | | |

Note: Green: prosthesis combination qualifies for a superiority benchmark
Blue: prosthesis combination qualifies for non-inferiority benchmark
Restricted to modern prostheses

**Table TY4 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 TKR | Femoral | Tibial | Other | 5 Yrs | 10 Yrs | 15 Yrs |
|---|---|---|---|---|---|---|---|---|---|---|
| Active Knee | Active Knee | 767 | 9964 | 218 | 29 | 42 | 478 | 4.7 (4.3, 5.2) | 8.2 (7.6, 8.8) | 11.9 (11.0, 12.9) |
| Advance | Advance II | 112 | 1621 | 45 | 3 | 13 | 51 | 5.0 (4.0, 6.2) | 6.8 (5.6, 8.2) | 7.6 (6.3, 9.3) |
| BalanSys | BalanSys | 92 | 4001 | 24 | 5 | 7 | 56 | 2.3 (1.8, 2.9) | 4.1 (3.1, 5.3) | 6.1 (3.9, 9.4) |
| Genesis II CR | Genesis II | 1092 | 24634 | 225 | 68 | 56 | 743 | 3.5 (3.3, 3.8) | 5.0 (4.7, 5.4) | 6.2 (5.8, 6.7) |
| Genesis II Oxinium CR (ctd) | Genesis II | 513 | 9553 | 100 | 28 | 25 | 360 | 3.6 (3.2, 4.0) | 6.1 (5.5, 6.7) | 8.7 (7.8, 9.6) |
| Genesis II Oxinium PS (ctd) | Genesis II | 1230 | 20507 | 166 | 33 | 162 | 869 | 5.1 (4.8, 5.4) | 7.5 (7.1, 8.0) | 10.2 (9.4, 11.1) |
| Genesis II PS | Genesis II | 856 | 19724 | 151 | 29 | 54 | 622 | 3.7 (3.4, 4.0) | 5.2 (4.8, 5.5) | 6.6 (6.0, 7.2) |
| LCS CR | LCS | 617 | 8323 | 251 | 24 | 89 | 253 | 4.5 (4.0, 4.9) | 6.4 (5.9, 7.0) | 8.1 (7.5, 8.7) |
| LCS CR | MBT | 1280 | 32051 | 427 | 61 | 148 | 644 | 3.4 (3.2, 3.6) | 4.8 (4.6, 5.1) | 6.0 (5.6, 6.4) |
| LCS CR | MBT Duofix | 803 | 15167 | 230 | 34 | 43 | 496 | 4.1 (3.7, 4.4) | 5.3 (4.9, 5.7) | 7.3 (6.7, 7.9) |
| Nexgen CR | Nexgen | 424 | 11521 | 136 | 22 | 31 | 235 | 2.2 (1.9, 2.5) | 3.1 (2.8, 3.5) | 4.5 (4.1, 5.0) |
| Nexgen CR | Nexgen TM CR | 55 | 862 | 19 | 4 | 11 | 21 | 5.6 (4.2, 7.4) | 6.6 (5.1, 8.7) | 8.1 (6.0, 10.8) |
| Nexgen CR Flex | Nexgen | 1410 | 58675 | 330 | 100 | 123 | 857 | 2.3 (2.2, 2.4) | 3.1 (2.9, 3.3) | 4.0 (3.7, 4.4) |
| Nexgen CR Flex | Nexgen TM CR | 317 | 11937 | 98 | 21 | 28 | 170 | 2.3 (2.0, 2.6) | 3.2 (2.8, 3.6) | 4.3 (3.7, 5.0) |
| Nexgen LPS | Nexgen | 361 | 7003 | 94 | 20 | 33 | 214 | 3.3 (2.9, 3.8) | 4.9 (4.4, 5.5) | 6.6 (5.9, 7.4) |
| Nexgen LPS Flex | Nexgen | 1512 | 37006 | 413 | 65 | 236 | 798 | 3.2 (3.0, 3.3) | 5.0 (4.8, 5.3) | 6.9 (6.4, 7.3) |
| PFC Sigma CR | MBT | 322 | 6255 | 63 | 35 | 45 | 179 | 4.0 (3.5, 4.5) | 5.1 (4.6, 5.7) | 6.7 (5.9, 7.6) |
| PFC Sigma CR | MBT Duofix | 155 | 3314 | 24 | 18 | 6 | 107 | 3.6 (3.0, 4.4) | 5.0 (4.2, 5.9) | 7.3 (6.0, 8.9) |
| PFC Sigma CR | PFC Sigma | 849 | 24584 | 214 | 54 | 64 | 517 | 2.5 (2.3, 2.7) | 3.6 (3.3, 3.8) | 5.4 (5.0, 5.9) |
| PFC Sigma PS | MBT | 343 | 6322 | 115 | 14 | 24 | 190 | 3.9 (3.4, 4.4) | 5.4 (4.8, 6.0) | 7.7 (6.7, 8.9) |
| PFC Sigma PS | MBT Duofix | 173 | 2212 | 38 | 4 | 6 | 125 | 6.0 (5.1, 7.2) | 8.4 (7.2, 9.7) | 10.7 (8.9, 12.9) |
| PFC Sigma PS | PFC Sigma | 361 | 7979 | 123 | 12 | 27 | 199 | 3.3 (2.9, 3.7) | 4.8 (4.3, 5.3) | 6.6 (5.8, 7.4) |
| RBK | RBK | 534 | 10891 | 203 | 14 | 42 | 275 | 3.9 (3.5, 4.3) | 5.3 (4.9, 5.8) | 6.8 (6.1, 7.6) |
| Triathlon CR | Triathlon | 2506 | 109011 | 454 | 106 | 115 | 1831 | 2.5 (2.4, 2.6) | 3.8 (3.6, 4.0) | 5.7 (4.8, 6.8) |
| TOTAL | | 16684 | 443117 | 4161 | 803 | 1430 | 10290 | | | |

Note: Green: prosthesis combination qualifies for a superiority benchmark
Blue: prosthesis combination qualifies for non-inferiority benchmark
Restricted to modern prostheses

## TWENTY YEAR OUTCOMES

For the first time, the Registry can report 20 year outcomes for 1 hip and 5 knee combinations of prostheses that are currently being used. A combination is included if >350 procedures have been reported to the Registry and the follow-up period is ≥20 years.

### HIP REPLACEMENT

The listed prosthesis combination has been used in 1.8% of all primary total conventional hip replacement procedures performed for osteoarthritis. The 20 year cumulative percent revision is 5.4% (Table TY5).

### KNEE REPLACEMENT

The listed prosthesis combinations were used in 11.7% of all primary total knee replacement procedures performed for osteoarthritis. All 5 combinations were used in 2020. The 20 year cumulative percent revision ranges from 6.1% to 9.6% (Table TY6).

**Table TY5 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 | | | |
| Secur-Fit Plus | Trident (Shell) | 210 | 5752 | 15 | 54 | 52 | 89 | 3.3 (2.8, 3.8) | 4.5 (3.9, 5.2) | 5.4 (4.6, 6.4) |
| TOTAL | | 210 | 5752 | 15 | 54 | 52 | 89 | | | |

Note: Restricted to modern prostheses

**Table TY6 Cumulative Percent Revision of Primary Total Knee Replacement Prosthesis 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 | | | |
| Genesis II CR | Genesis II | 1092 | 24634 | 225 | 68 | 56 | 743 | 5.0 (4.7, 5.4) | 6.2 (5.8, 6.7) | 7.3 (6.6, 8.2) |
| LCS CR | LCS | 617 | 8323 | 251 | 24 | 89 | 253 | 6.4 (5.9, 7.0) | 8.1 (7.5, 8.7) | 9.6 (8.7, 10.5) |
| Nexgen CR | Nexgen | 424 | 11521 | 136 | 22 | 31 | 235 | 3.1 (2.8, 3.5) | 4.5 (4.1, 5.0) | 6.1 (5.3, 7.0) |
| Nexgen LPS | Nexgen | 361 | 7003 | 94 | 20 | 33 | 214 | 4.9 (4.4, 5.5) | 6.6 (5.9, 7.4) | 7.9 (6.9, 9.0) |
| PFC Sigma CR | PFC Sigma | 849 | 24584 | 214 | 54 | 64 | 517 | 3.6 (3.3, 3.8) | 5.4 (5.0, 5.9) | 6.5 (5.6, 7.6) |
| TOTAL | | 3343 | 76065 | 920 | 188 | 273 | 1962 | | | |

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

# Hip Replacement

# Hip Replacement

## CATEGORIES OF HIP REPLACEMENT

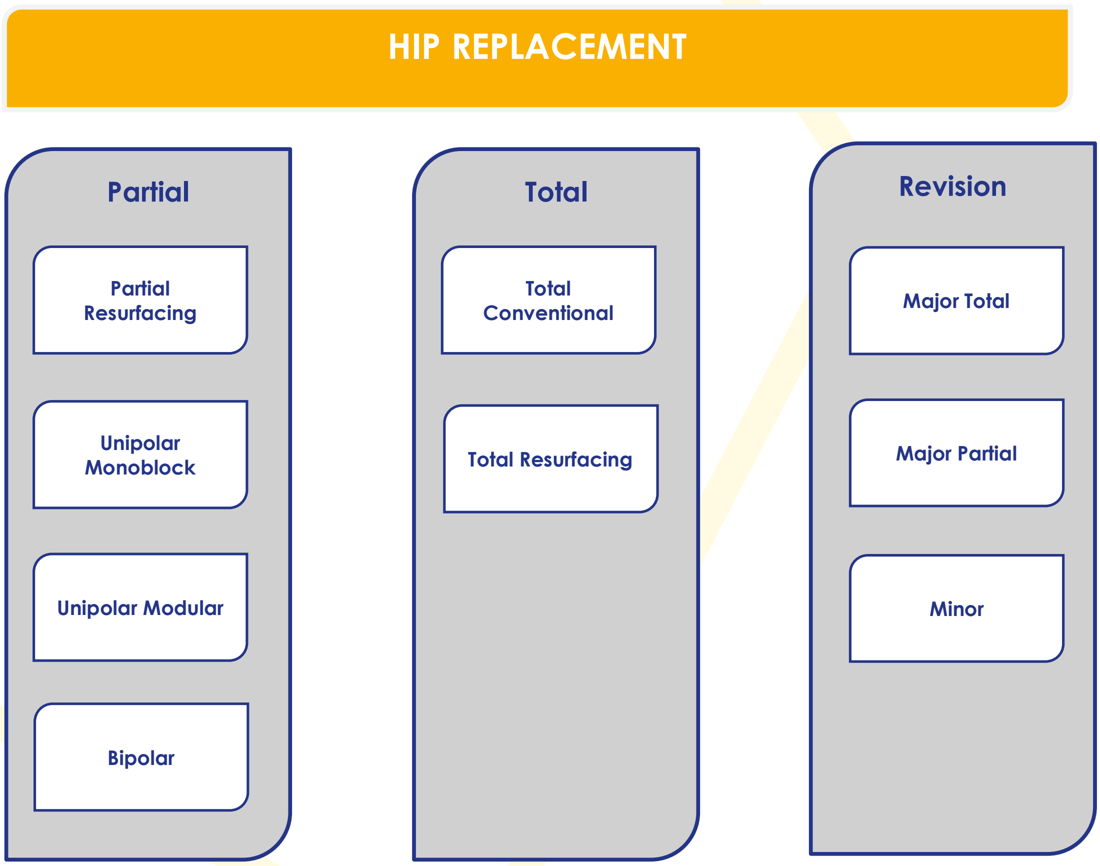
The Registry groups hip replacement into three broad categories: primary partial, primary total and revision hip replacement.

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-2021



## USE OF HIP REPLACEMENT

This report includes 743,899 hip replacements reported to the Registry with a procedure date up to and including 31 December 2020. This is an additional 49,169 hip procedures compared to the number reported last year. The relative frequency of each type of hip procedure is provided in Table H1.

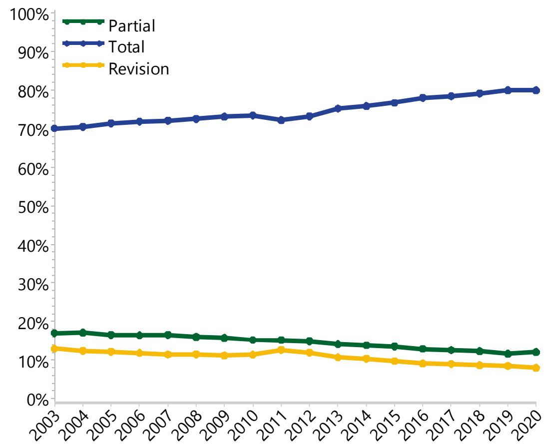
**Table H1 Number of Hip Replacements**

| Hip Category | Number | Percent |
|---|---|---|
| Partial | 107643 | 14.5 |
| Total | 557117 | 74.9 |
| Revision | 79139 | 10.6 |
| **TOTAL** | **743899** | **100.00** |

In 2020, the number of hip replacements undertaken has decreased by 2,432 (4.8%) compared to 2019. During this time, the use of primary total hip replacement decreased by 4.8%, accounting for 79.9% of all hip replacement procedures in 2020. Primary partial hip replacement decreased by 0.9%, accounting for 12.1% of hip procedures in 2020. The proportion of revision hip procedures has declined from a peak of 12.9% in 2003 to 8.0% in 2020 (Figure H1).

This is the first time the Registry has recorded a reduction in the number of hip replacements, and this is due to the cancellation of elective surgery during COVID-19 restrictions.

**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 Anaesthesiologists - Physical Status Classification (ASA score) and Body Mass Index (BMI). The Registry commenced collecting ASA score in 2012 and BMI in 2015.

There are ASA score data on 356,126 and BMI data on 250,277 hip replacement procedures. Since its initial collection, ASA score has been recorded in 95.7% of procedures. BMI has been recorded in 86.6% of procedures since its collection commenced.

In 2020, ASA score is reported in 99.8% and BMI in 91.8% of hip replacement procedures. There is no variation in the reporting of ASA score based on procedure type. However, there is some variation in the reporting of BMI in 2020. The Registry recorded BMI for 61.9% of primary partial hip, 96.8% of primary total hip, and 86.9% of revision hip replacement procedures.

ASA score and BMI are both known to impact the outcome of hip replacement surgery.

### 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 hip replacement. Revision hip replacement procedures also have patients with higher ASA scores (Table H2).

### BMI

BMI for adults is classified by the World Health Organisation into six main categories.[4]

| | |
|---|---|
| Underweight | <18.50 |
| Normal | 18.50 - 24.99 |
| Pre-obese | 25.00 - 29.99 |
| Obese Class 1 | 30.00 - 34.99 |
| Obese Class 2 | 35.00 - 39.99 |
| Obese Class 3 | ≥40.00 |

The majority of hip replacement procedures are undertaken in patients who are normal or pre-obese (Table H3).

[3] https://www.asahq.org/resources/clinical-information/asa-physical-status-classification-system

[4] http://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi

**Table H2 ASA Score for Hip Replacement**

| ASA Score | Partial | | Total | | Revision | | TOTAL | |
|---|---|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% | N | Col% |
| ASA 1 | 156 | 0.3 | 26632 | 9.6 | 1334 | 4.1 | 28122 | 7.9 |
| ASA 2 | 5051 | 11.2 | 147522 | 53.0 | 11390 | 35.1 | 163963 | 46.0 |
| ASA 3 | 27287 | 60.6 | 98847 | 35.5 | 17104 | 52.6 | 143238 | 40.2 |
| ASA 4 | 12366 | 27.4 | 5562 | 2.0 | 2639 | 8.1 | 20567 | 5.8 |
| ASA 5 | 194 | 0.4 | 19 | 0.0 | 23 | 0.1 | 236 | 0.1 |
| TOTAL | 45054 | 100.0 | 278582 | 100.0 | 32490 | 100.0 | 356126 | 100.0 |

**Table H3 BMI Category for Hip Replacement**

| BMI Category | Partial | | Total | | Revision | | TOTAL | |
|---|---|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% | N | Col% |
| Underweight | 1833 | 9.7 | 2198 | 1.0 | 360 | 1.7 | 4391 | 1.8 |
| Normal | 9367 | 49.8 | 46600 | 22.1 | 5035 | 24.0 | 61002 | 24.4 |
| Pre Obese | 5303 | 28.2 | 77555 | 36.8 | 7254 | 34.5 | 90112 | 36.0 |
| Obese Class 1 | 1667 | 8.9 | 51668 | 24.5 | 4950 | 23.6 | 58285 | 23.3 |
| Obese Class 2 | 450 | 2.4 | 21811 | 10.4 | 2165 | 10.3 | 24426 | 9.8 |
| Obese Class 3 | 184 | 1.0 | 10644 | 5.1 | 1233 | 5.9 | 12061 | 4.8 |
| TOTAL | 18804 | 100.0 | 210476 | 100.0 | 20997 | 100.0 | 250277 | 100.0 |

Note: BMI has not been presented for patients aged ≤19 years

# Primary Partial Hip Replacement Summary

## INTRODUCTION

This section provides summary information on partial hip replacement. Previously, detailed information on partial hips was included in the Annual Report. It is now provided as a separate supplementary report. The Partial Hip Arthroplasty Report is one of 15 supplementary reports to complete the AOANJRR Annual Report for 2021 and is available on the AOANJRR website.

## CLASSES OF PARTIAL HIP REPLACEMENT

The Registry identifies 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**

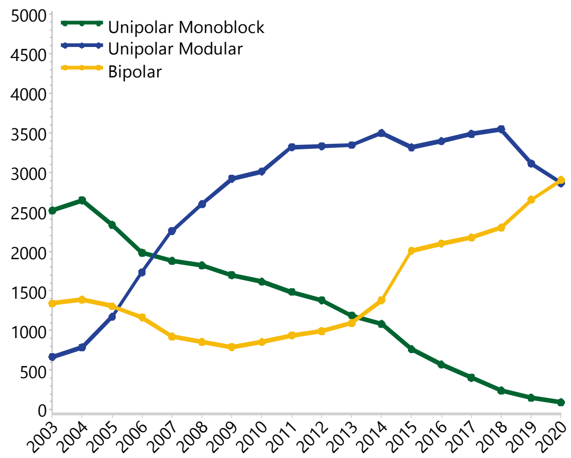
| Hip Class | Number | Percent |
|---|---|---|
| Unipolar Monoblock | 29105 | 27.0 |
| Unipolar Modular | 49246 | 45.8 |
| Bipolar | 29277 | 27.2 |
| TOTAL | 107628 | 100.0 |

Note: Excludes 15 partial resurfacing procedures not used since 2014

In 2020, bipolar hip replacement was more commonly used than unipolar modular. The use of unipolar monoblock continues to decline (Figure HP1). The 10 most used femoral prostheses for partial hip replacement are listed in Table HP2. In 2020, the Exeter V40, CPT and CPCS 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-2021

**Figure HP1 Primary Partial Hip Replacement by Class**




Detailed information on partial resurfacing hip replacement is available in the supplementary report 'Prosthesis Types No Longer Used' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2021

**Table HP2 10 Most Used Femoral Prostheses in Primary Partial Hip Replacement**

| 2003 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 1988 | Austin-Moore Type | 2645 | Exeter V40 | 2851 | Exeter V40 | 2964 | Exeter V40 | 2863 | Exeter V40 |
| 810 | Exeter V40 | 722 | CPT | 812 | CPCS | 722 | CPCS | 827 | CPT |
| 526 | Thompson Type | 712 | CPCS | 623 | CPT | 712 | CPT | 756 | CPCS |
| 186 | Alloclassic | 434 | C-Stem AMT | 459 | C-Stem AMT | 475 | C-Stem AMT | 472 | C-Stem AMT |
| 127 | Elite Plus | 239 | CORAIL | 292 | Absolut | 175 | Absolut | 122 | Short Exeter V40 |
| 105 | CPT | 231 | ETS | 166 | CORAIL | 141 | CORAIL | 106 | CORAIL |
| 95 | Spectron EF | 192 | Absolut | 164 | ETS | 121 | ETS | 84 | ETS |
| 74 | C-Stem | 101 | Austin-Moore Type | 83 | Quadra-C | 96 | Short Exeter V40 | 83 | Taper Fit |
| 65 | CPCS | 96 | Spectron EF | 83 | Short Exeter V40 | 63 | Spectron EF | 77 | twinSys (ctd) |
| 63 | Omnifit | 70 | Thompson Type | 62 | Austin-Moore Type | 56 | Quadra-C | 60 | Quadra-C |
| **10 Most Used** | | | | | | | | | |
| 4039 | (10) 89.3% | 5442 | (10) 89.8% | 5595 | (10) 92.0% | 5525 | (10) 93.5% | 5450 | (10) 93.0% |
| **Remainder** | | | | | | | | | |
| 482 | (52) 10.7% | 620 | (46) 10.2% | 489 | (40) 8.0% | 385 | (36) 6.5% | 409 | (35) 7.0% |
| **TOTAL** | | | | | | | | | |
| 4521 | (62) 100.0% | 6062 | (56) 100.0% | 6084 | (50) 100.0% | 5910 | (46) 100.0% | 5859 | (45) 100.0% |

## OUTCOME FOR FRACTURED NECK OF FEMUR

In order to keep Registry data contemporaneous, only procedures using prostheses that have been available and used in 2020 (described as modern prostheses) are included in the analyses, unless clearly specified.

Fractured neck of femur is the principal diagnosis for the three main classes of primary partial hip replacement: unipolar monoblock (97.6%), unipolar modular (96.0%) and bipolar (93.6%). A comparative analysis of partial hip replacement and total conventional hip replacement was undertaken for fractured neck of femur and is presented in the primary total hip replacement chapter 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 HP3).

At 10 years, bipolar has the lowest cumulative percent revision for fractured neck of femur, followed by unipolar modular, and unipolar monoblock (Table HP4 and Figure HP2). The difference in outcome between classes is most apparent in patients aged <75 years (Table HP5 and Figure HP3).

**Table HP3 Cumulative Percent Mortality of Primary Partial Hip Replacement by Class (Primary Diagnosis Fractured NOF)**

| Hip Class | N Deceased | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Unipolar Monoblock | 25095 | 27698 | 37.0 (36.4, 37.6) | 60.9 (60.3, 61.4) | 76.8 (76.3, 77.4) | 86.2 (85.7, 86.6) | 93.2 (92.9, 93.6) |
| Unipolar Modular | 26336 | 39557 | 26.3 (25.9, 26.8) | 47.4 (46.8, 47.9) | 63.1 (62.6, 63.7) | 74.4 (73.9, 74.9) | 84.5 (83.9, 85.0) |
| Bipolar | 12426 | 21651 | 24.0 (23.4, 24.6) | 43.9 (43.2, 44.7) | 59.2 (58.4, 60.0) | 69.9 (69.1, 70.7) | 81.1 (80.2, 81.9) |
| TOTAL | 63857 | 88906 | | | | | |

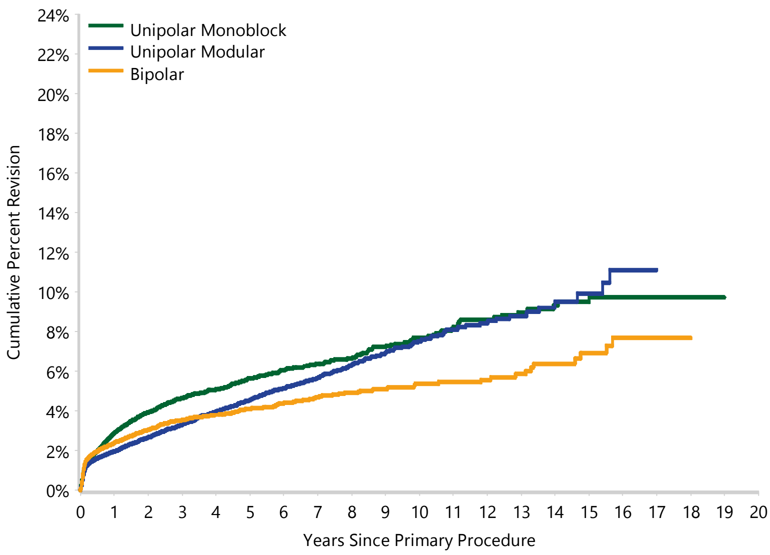
Note: Restricted to modern prostheses

**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 | 1078 | 28419 | 2.9 (2.7, 3.1) | 3.9 (3.7, 4.2) | 4.6 (4.3, 5.0) | 5.6 (5.3, 6.0) | 6.4 (5.9, 6.8) | 7.7 (7.1, 8.4) |
| Unipolar Modular | 1338 | 40895 | 2.0 (1.8, 2.1) | 2.7 (2.5, 2.9) | 3.3 (3.1, 3.5) | 4.5 (4.3, 4.8) | 5.7 (5.3, 6.0) | 7.5 (6.9, 8.1) |
| Bipolar | 675 | 22244 | 2.4 (2.2, 2.6) | 3.0 (2.8, 3.3) | 3.5 (3.3, 3.8) | 4.1 (3.8, 4.5) | 4.7 (4.3, 5.2) | 5.4 (4.8, 6.0) |
| TOTAL | 3091 | 91558 | | | | | | |

Note: Restricted to modern prostheses

**Figure HP2 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=1.37 (1.26, 1.49),p<0.001

Unipolar Monoblock vs Bipolar
0 - 2Wk: HR=1.59 (1.19, 2.12),p=0.001
2Wk - 3Mth: HR=0.92 (0.78, 1.08),p=0.306
3Mth+: HR=1.97 (1.73, 2.25),p<0.001

Bipolar vs Unipolar Modular
0 - 1Mth: HR=1.22 (1.02, 1.45),p=0.026
1Mth - 3Mth: HR=1.28 (1.06, 1.54),p=0.010
3Mth - 2.5Yr: HR=0.84 (0.73, 0.98),p=0.022
2.5Yr+: HR=0.54 (0.43, 0.67),p<0.001

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Unipolar Monoblock | 28419 | 17345 | 13514 | 10436 | 5928 | 3330 | 1404 |
| Unipolar Modular | 40895 | 27549 | 21566 | 16602 | 9484 | 5100 | 1850 |
| Bipolar | 22244 | 14462 | 10778 | 8125 | 4454 | 2486 | 1200 |

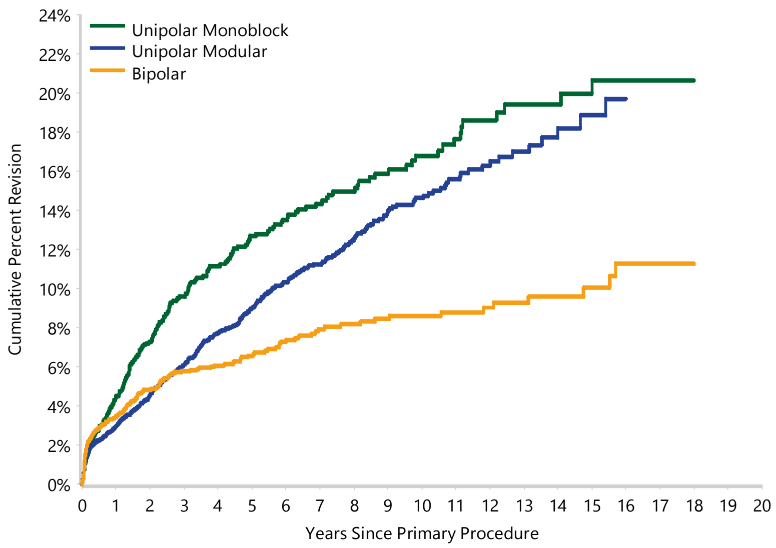
Note: Restricted to modern prostheses

**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 | 240 | 2466 | 4.4 (3.6, 5.4) | 7.3 (6.2, 8.5) | 9.6 (8.3, 11.1) | 12.7 (11.1, 14.5) | 14.3 (12.6, 16.3) | 16.8 (14.7, 19.2) |
| Unipolar Modular | 478 | 6003 | 2.9 (2.5, 3.4) | 4.5 (4.0, 5.1) | 6.1 (5.4, 6.8) | 9.0 (8.1, 10.0) | 11.2 (10.2, 12.4) | 14.6 (13.2, 16.2) |
| Bipolar | 217 | 3906 | 3.5 (2.9, 4.1) | 4.8 (4.1, 5.6) | 5.8 (5.0, 6.7) | 6.6 (5.7, 7.6) | 7.9 (6.8, 9.2) | 8.6 (7.4, 10.0) |
| TOTAL | 935 | 12375 | | | | | | |

Note: Restricted to modern prostheses

**Figure HP3 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 - 3Mth: HR=0.82 (0.56, 1.18),p=0.281
3Mth+: HR=2.41 (1.93, 3.01),p<0.001

Unipolar Monoblock vs Unipolar Modular
Entire Period: HR=1.30 (1.11, 1.52),p<0.001

Unipolar Modular vs Bipolar
0 - 3Mth: HR=0.81 (0.61, 1.08),p=0.147
3Mth - 2.5Yr: HR=1.15 (0.90, 1.47),p=0.266
2.5Yr - 3Yr: HR=1.83 (0.99, 3.39),p=0.054
3Yr+: HR=2.82 (2.15, 3.71),p<0.001

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|
| Unipolar Monoblock | 2466 | 1677 | 1388 | 1160 | 798 | 574 | 332 |
| Unipolar Modular | 6003 | 4511 | 3777 | 3152 | 2151 | 1450 | 725 |
| Bipolar | 3906 | 2770 | 2185 | 1802 | 1196 | 795 | 524 |

Note: Restricted to modern prostheses

More information regarding partial hip procedures is available in the ‘Partial Hip Supplementary Report’ available on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2021

# Primary Total Hip Replacement

## CLASSES OF TOTAL HIP REPLACEMENT

A total hip procedure replaces both the femoral and acetabular articular surfaces. The Registry subcategorises primary total hip replacement 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-2021

## USE OF TOTAL HIP REPLACEMENT

The Registry has recorded 556,859 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 | 538045 | 96.6 |
| Total Resurfacing | 18814 | 3.4 |
| TOTAL | 556859 | 100.0 |

Osteoarthritis is the principal diagnosis for primary total hip replacement (88.4%).

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 | 1946 | 18814 | 1.7 (1.5, 1.9) | 3.1 (2.9, 3.4) | 4.8 (4.5, 5.2) | 9.2 (8.7, 9.6) | 12.5 (12.0, 13.1) | 16.1 (14.7, 17.7) |
| Total Conventional | 25728 | 538045 | 1.8 (1.7, 1.8) | 2.8 (2.7, 2.8) | 3.7 (3.6, 3.7) | 6.1 (6.0, 6.2) | 9.1 (9.0, 9.3) | 12.3 (11.9, 12.7) |
| TOTAL | 27674 | 556859 | | | | | | |

# PRIMARY TOTAL CONVENTIONAL HIP REPLACEMENT

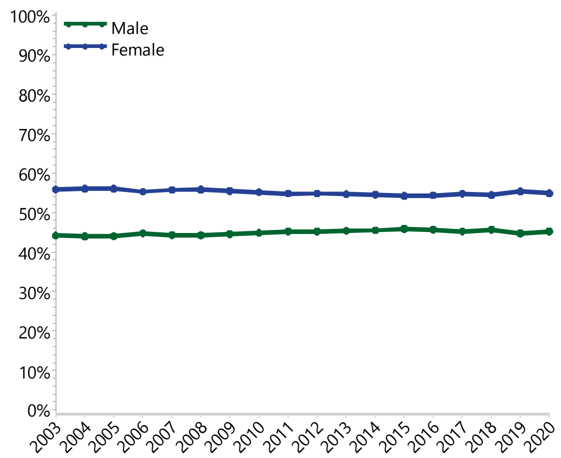
## DEMOGRAPHICS

There have been 538,045 primary total conventional hip replacement procedures reported to the Registry. This is an additional 38,606 procedures compared to the previous report.

Primary total conventional hip replacement procedures decreased by 4.9% in 2020 compared to the previous year. This is the first time the number of hip replacements has decreased and is due to the cancellation of elective surgery during COVID-19 restrictions. There has been a 123.5% increase since 2003.

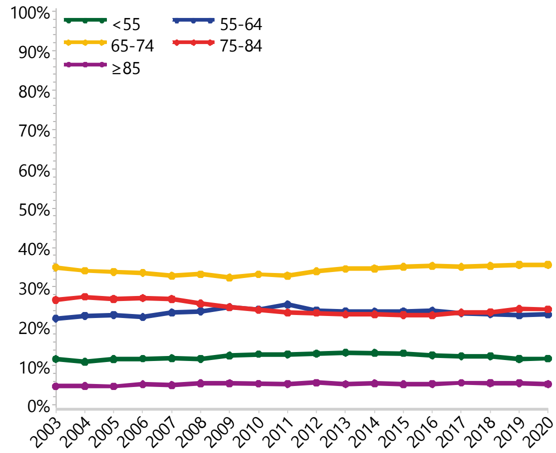
Primary total conventional hip replacement is more common in females. This proportion has remained stable since 2003 (Figure HT1).

**Figure HT1** **Primary Total Conventional Hip Replacement by Gender**




The mean age of patients is 67.8 years (Table HT3). There has been minimal change in the proportion of patients aged 55-64 years (21.9% in 2003 to 23.0% in 2020) and for patients aged <55 years (11.7% in 2003 to 11.8% in 2020) (Figure HT2).

**Figure HT2** **Primary Total Conventional Hip Replacement by Age**




The use of cementless fixation has increased from 51.3% in 2003 to 60.8% in 2020. Hybrid fixation has increased from 34.8% to 36.8% and cemented fixation has declined from 13.9% to 2.4% (Figure HT3).

**Figure HT3** **Primary Total Conventional Hip Replacement by Fixation**

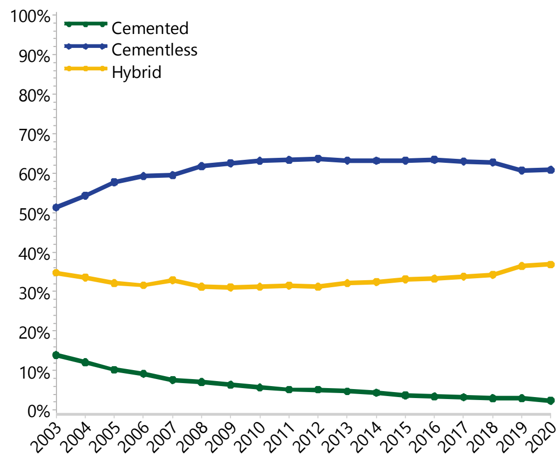



**Table HT3** **Age and Gender of Primary Total Conventional Hip Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 242382 | 45.0% | 12 | 102 | 67 | 66.3 | 11.5 |
| Female | 295663 | 55.0% | 11 | 101 | 70 | 68.9 | 11.3 |
| TOTAL | 538045 | 100.0% | 11 | 102 | 69 | 67.8 | 11.5 |

The Exeter V40, CORAIL, and Accolade II are the most used femoral stems for primary total conventional hip replacement (Table HT4). In 2020, 66.9% of primary total conventional hip replacements used stems in the 10 most used femoral component list. Six of these stems are cementless. The 10 most used cemented and cementless stems are listed in Table HT5 and Table HT6, respectively. In 2020, the 10 most used cemented stems account for 93.2% of cemented stem procedures. The 10 most used cementless stems account for 77.6% of cementless stem procedures.

The Trident (Shell), PINNACLE, and Trinity are the most frequently used acetabular prostheses for primary total conventional hip replacement. In 2020, 86.0% 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.

**Table HT4** **10 Most Used Femoral Components in Primary Total Conventional Hip Replacement**

| 2003 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | N | Model | N | Model | N |
| 3901 | Exeter V40 | 7326 | Exeter V40 | 7368 | Exeter V40 | 7832 | Exeter V40 | 7033 | Exeter V40 |
| 1029 | ABGII | 5376 | CORAIL | 5321 | CORAIL | 4890 | CORAIL | 4502 | CORAIL |
| 1000 | Synergy | 1944 | Quadra-H | 2243 | Polarstem | 2523 | Metafix | 2605 | Accolade II |
| 819 | Alloclassic | 1928 | Polarstem | 2134 | Metafix | 2400 | Accolade II | 2599 | Metafix |
| 809 | VerSys | 1850 | Accolade II | 2072 | Quadra-H | 2330 | Polarstem | 2446 | Polarstem |
| 780 | Spectron EF | 1578 | Metafix | 1995 | Accolade II | 2020 | Quadra-H | 1723 | Quadra-H |
| 713 | Secur-Fit Plus | 1240 | CPT | 1185 | Paragon | 1288 | Paragon | 1310 | CPT |
| 618 | Omnifit | 1028 | Taperloc | 1159 | CPT | 1276 | CPT | 1231 | Paragon |
| 565 | C-Stem | 1022 | AMIStem H | 944 | Taperloc | 1081 | Taperloc | 1114 | Quadra-C |
| 485 | S-Rom | 872 | C-Stem AMT | 905 | CPCS | 1059 | C-Stem AMT | 972 | CPCS |
| 10 Most Used | | | | | | | | | |
| 10719 | (10) 62.8% | 24164 | (10) 64.7% | 25326 | (10) 65.3% | 26699 | (10) 66.5% | 25535 | (10) 66.9% |
| Remainder | | | | | | | | | |
| 6354 | (73) 37.2% | 13201 | (94) 35.3% | 13476 | (88) 34.7% | 13440 | (90) 33.5% | 12624 | (79) 33.1% |
| TOTAL | | | | | | | | | |
| 17073 | (83) 100.0% | 37365 | (104) 100.0% | 38802 | (98) 100.0% | 40139 | (100) 100.0% | 38159 | (89) 100.0% |

**Table HT5 10 Most Used Cemented Femoral Components in Primary Total Conventional Hip Replacement**

| 2003 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 3901 | Exeter V40 | 7326 | Exeter V40 | 7368 | Exeter V40 | 7832 | Exeter V40 | 7033 | Exeter V40 |
| 780 | Spectron EF | 1240 | CPT | 1159 | CPT | 1276 | CPT | 1310 | CPT |
| 565 | C-Stem | 872 | C-Stem AMT | 905 | CPCS | 1059 | C-Stem AMT | 1114 | Quadra-C |
| 477 | CPT | 857 | CPCS | 885 | C-Stem AMT | 988 | CPCS | 972 | CPCS |
| 445 | Elite Plus | 556 | Short Exeter V40 | 727 | Quadra-C | 839 | Quadra-C | 775 | Short Exeter V40 |
| 358 | MS 30 | 550 | Quadra-C | 681 | Short Exeter V40 | 806 | Short Exeter V40 | 775 | Taper Fit |
| 338 | Omnifit | 442 | Evolve | 592 | Taper Fit | 788 | Taper Fit | 727 | C-Stem AMT |
| 321 | Charnley | 394 | MS 30 | 394 | MS 30 | 383 | Absolut | 524 | Evolve |
| 245 | CPCS | 315 | Taper Fit | 387 | Evolve | 358 | Evolve | 360 | MS 30 |
| 123 | Exeter | 235 | Absolut | 343 | Absolut | 324 | MS 30 | 305 | Absolut |
| 10 Most Used | | | | | | | | | |
| 7553 | (10) 91.7% | 12787 | (10) 92.9% | 13441 | (10) 93.3% | 14653 | (10) 93.3% | 13895 | (10) 93.2% |
| Remainder | | | | | | | | | |
| 680 | (26) 8.3% | 977 | (22) 7.1% | 966 | (21) 6.7% | 1057 | (23) 6.7% | 1014 | (17) 6.8% |
| TOTAL | | | | | | | | | |
| 8233 | (36) 100.0% | 13764 | (32) 100.0% | 14407 | (31) 100.0% | 15710 | (33) 100.0% | 14909 | (27) 100.0% |

**Table HT6 10 Most Used Cementless Femoral Components in Primary Total Conventional Hip Replacement**

| 2003 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 1029 | ABGII | 5376 | CORAIL | 5321 | CORAIL | 4890 | CORAIL | 4502 | CORAIL |
| 980 | Synergy | 1944 | Quadra-H | 2243 | Polarstem | 2523 | Metafix | 2605 | Accolade II |
| 819 | Alloclassic | 1928 | Polarstem | 2134 | Metafix | 2400 | Accolade II | 2599 | Metafix |
| 739 | VerSys | 1850 | Accolade II | 2072 | Quadra-H | 2327 | Polarstem | 2350 | Polarstem |
| 713 | Secur-Fit Plus | 1578 | Metafix | 1995 | Accolade II | 2020 | Quadra-H | 1723 | Quadra-H |
| 485 | S-Rom | 1028 | Taperloc | 1185 | Paragon | 1288 | Paragon | 1231 | Paragon |
| 482 | Secur-Fit | 1022 | AMIStem H | 944 | Taperloc | 1081 | Taperloc | 918 | AMIStem H |
| 376 | CORAIL | 797 | Tri-Fit TS | 860 | AMIStem H | 846 | AMIStem H | 873 | Taperloc |
| 334 | Accolade I | 782 | Paragon | 580 | Anthology | 598 | Taperloc Microplasty | 771 | Taperloc Microplasty |
| 334 | Mallory-Head | 687 | Anthology | 549 | Tri-Fit TS | 480 | Anthology | 475 | Optimys |
| 10 Most Used | | | | | | | | | |
| 6291 | (10) 71.2% | 16992 | (10) 72.0% | 17883 | (10) 73.3% | 18453 | (10) 75.5% | 18047 | (10) 77.6% |
| Remainder | | | | | | | | | |
| 2549 | (47) 28.8% | 6609 | (69) 28.0% | 6512 | (64) 26.7% | 5976 | (68) 24.5% | 5203 | (58) 22.4% |
| TOTAL | | | | | | | | | |
| 8840 | (57) 100.0% | 23601 | (79) 100.0% | 24395 | (74) 100.0% | 24429 | (78) 100.0% | 23250 | (68) 100.0% |

**Table HT7 10 Most Used Acetabular Components in Primary Total Conventional Hip Replacement**

| 2003 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 3986 | Trident (Shell) | 8141 | Trident (Shell) | 8563 | Trident (Shell) | 9255 | Trident (Shell) | 8741 | Trident (Shell) |
| 1748 | Reflection (Shell) | 6590 | PINNACLE | 6385 | PINNACLE | 6122 | PINNACLE | 5210 | PINNACLE |
| 1524 | Trilogy | 3816 | R3 | 3873 | R3 | 4383 | Trinity | 4794 | Trinity |
| 955 | Vitalock | 2955 | Trinity | 3688 | Trinity | 3825 | R3 | 3891 | R3 |
| 907 | Duraloc | 2069 | Versafitcup CC | 1914 | Mpact | 2303 | Mpact | 2884 | G7 |
| 827 | ABGII | 1402 | Mpact | 1836 | Versafitcup CC | 2227 | G7 | 2762 | Mpact |
| 793 | Allofit | 1293 | Continuum | 1494 | G7 | 1721 | Versafitcup CC | 1356 | Versafitcup CC |
| 729 | Mallory-Head | 1254 | Logical G | 1444 | Logical G | 1473 | Logical G | 1326 | Logical G |
| 539 | Contemporary | 1145 | Trident/Tritanium (Shell) | 1321 | Acetabular Shell (Global) | 1214 | Acetabular Shell (Global) | 1134 | Trident/Tritanium (Shell) |
| 537 | PINNACLE | 1051 | G7 | 1197 | Continuum | 1112 | Trident/Tritanium (Shell) | 715 | RM Cup |
| **10 Most Used** | | | | | | | | | |
| 12545 | (10) 73.5% | 29716 | (10) 79.5% | 31715 | (10) 81.7% | 33635 | (10) 83.8% | 32813 | (10) 86.0% |
| **Remainder** | | | | | | | | | |
| 4528 | (69) 26.5% | 7649 | (68) 20.5% | 7087 | (62) 18.3% | 6504 | (63) 16.2% | 5346 | (61) 14.0% |
| **TOTAL** | | | | | | | | | |
| 17073 | (79) 100.0% | 37365 | (78) 100.0% | 38802 | (72) 100.0% | 40139 | (73) 100.0% | 38159 | (71) 100.0% |

**Table HT8 10 Most Used Cemented Acetabular Components in Primary Total Conventional Hip Replacement**

| 2003 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 539 | Contemporary | 503 | Exeter X3 Rimfit | 532 | Exeter X3 Rimfit | 571 | Exeter X3 Rimfit | 508 | Exeter X3 Rimfit |
| 256 | Exeter | 110 | Marathon | 105 | Contemporary | 91 | Marathon | 52 | Marathon |
| 251 | Reflection (Cup) | 97 | ZCA | 82 | Marathon | 73 | Contemporary | 49 | Reflection (Cup) |
| 227 | Exeter Contemporary | 94 | Contemporary | 81 | ZCA | 66 | Novae E | 42 | Avantage |
| 199 | Charnley Ogee | 68 | Reflection (Cup) | 53 | Reflection (Cup) | 50 | Reflection (Cup) | 39 | Novae E |
| 149 | Elite Plus LPW | 67 | Exeter Contemporary | 52 | Novae E | 46 | Avantage | 39 | ZCA |
| 130 | Low Profile Cup | 47 | Avantage | 41 | Avantage | 40 | ZCA | 24 | Apricot |
| 110 | Elite Plus Ogee | 45 | Novae E | 34 | Apricot | 35 | Apricot | 24 | Muller |
| 102 | Charnley | 39 | Muller | 32 | Exeter Contemporary | 34 | Low Profile Cup | 22 | Contemporary |
| 90 | ZCA | 26 | Apricot | 24 | Muller | 33 | Exeter Contemporary | 21 | Polarcup |
| **10 Most Used** | | | | | | | | | |
| 2053 (10) 85.4% | | 1096 (10) 90.2% | | 1036 (10) 89.7% | | 1039 (10) 88.7% | | 820 (10) 88.8% | |
| **Remainder** | | | | | | | | | |
| 351 (16) 14.6% | | 119 (19) 9.8% | | 119 (18) 10.3% | | 133 (20) 11.3% | | 103 (19) 11.2% | |
| **TOTAL** | | | | | | | | | |
| 2404 (26) 100.0% | | 1215 (29) 100.0% | | 1155 (28) 100.0% | | 1172 (30) 100.0% | | 923 (29) 100.0% | |

**Table HT9 10 Most Used Cementless Acetabular Components in Primary Total Conventional Hip Replacement**

| 2003 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 3986 | Trident (Shell) | 8141 | Trident (Shell) | 8563 | Trident (Shell) | 9255 | Trident (Shell) | 8741 | Trident (Shell) |
| 1748 | Reflection (Shell) | 6590 | PINNACLE | 6384 | PINNACLE | 6121 | PINNACLE | 5209 | PINNACLE |
| 1524 | Trilogy | 3816 | R3 | 3873 | R3 | 4383 | Trinity | 4794 | Trinity |
| 955 | Vitalock | 2955 | Trinity | 3688 | Trinity | 3824 | R3 | 3890 | R3 |
| 907 | Duraloc | 2069 | Versafitcup CC | 1913 | Mpact | 2303 | Mpact | 2884 | G7 |
| 827 | ABGII | 1402 | Mpact | 1836 | Versafitcup CC | 2227 | G7 | 2762 | Mpact |
| 793 | Allofit | 1292 | Continuum | 1494 | G7 | 1721 | Versafitcup CC | 1356 | Versafitcup CC |
| 729 | Mallory-Head | 1254 | Logical G | 1444 | Logical G | 1473 | Logical G | 1326 | Logical G |
| 537 | PINNACLE | 1145 | Trident/Tritanium (Shell) | 1321 | Acetabular Shell (Global) | 1213 | Acetabular Shell (Global) | 1134 | Trident/Tritanium (Shell) |
| 521 | Fitmore | 1051 | G7 | 1196 | Continuum | 1112 | Trident/Tritanium (Shell) | 715 | RM Cup |
| **10 Most Used** | | | | | | | | | |
| 12527 (10) 85.4% | | 29715 (10) 82.2% | | 31712 (10) 84.2% | | 33632 (10) 86.3% | | 32811 (10) 88.1% | |
| **Remainder** | | | | | | | | | |
| 2142 (43) 14.6% | | 6435 (48) 17.8% | | 5935 (43) 15.8% | | 5335 (44) 13.7% | | 4425 (39) 11.9% | |
| **TOTAL** | | | | | | | | | |
| 14669 (53) 100.0% | | 36150 (58) 100.0% | | 37647 (53) 100.0% | | 38967 (54) 100.0% | | 37236 (49) 100.0% | |

Note: In 2020, 2 shells in the cementless group were inserted with cement

## OUTCOME FOR ALL DIAGNOSES

In 2014, the Registry excluded large head metal/metal bearing surfaces from many comparative analyses of primary total conventional hip replacement outcomes due to several factors: they are no longer used, account for an increasingly small proportion of procedures (currently 3.0%) and have a much higher rate of revision than other bearing surfaces (28.5% at 15 years). In addition, large head metal/metal bearings were preferentially used in younger patients with cementless fixation and with particular femoral stem and acetabular prosthesis combinations.

Consequently, in specific analyses metal/metal bearings have the potential to be a major confounding factor and are almost always excluded from general analyses. In prosthesis-specific analyses, prostheses with large head metal/metal bearings are identified separately. Where large head metal/metal bearings are excluded in any analysis this is clearly identified by the Registry.

Since 2019, the Registry has also excluded small head size (<32mm in diameter) metal/metal bearings from comparative analyses. Small head metal/metal bearings were not used in 2020 and form a small proportion of all primary total conventional hip replacement procedures (1.1%).

The Registry recognises that hip replacement prosthesis use and availability changes with time. In order to keep Registry data contemporaneous, only procedures using prostheses that have been available and used in 2020 (described as modern prostheses) are included in the analyses, unless clearly specified. This has resulted in 95,696 procedures being excluded (18.5%).

**In order to keep Registry data contemporaneous, only procedures using modern prostheses that have been available and used in 2020 are included in the analyses, unless clearly specified.**

Osteoarthritis is the principal diagnosis, followed by fractured neck of femur, osteonecrosis, developmental dysplasia, rheumatoid arthritis, and tumour (Table HT10).

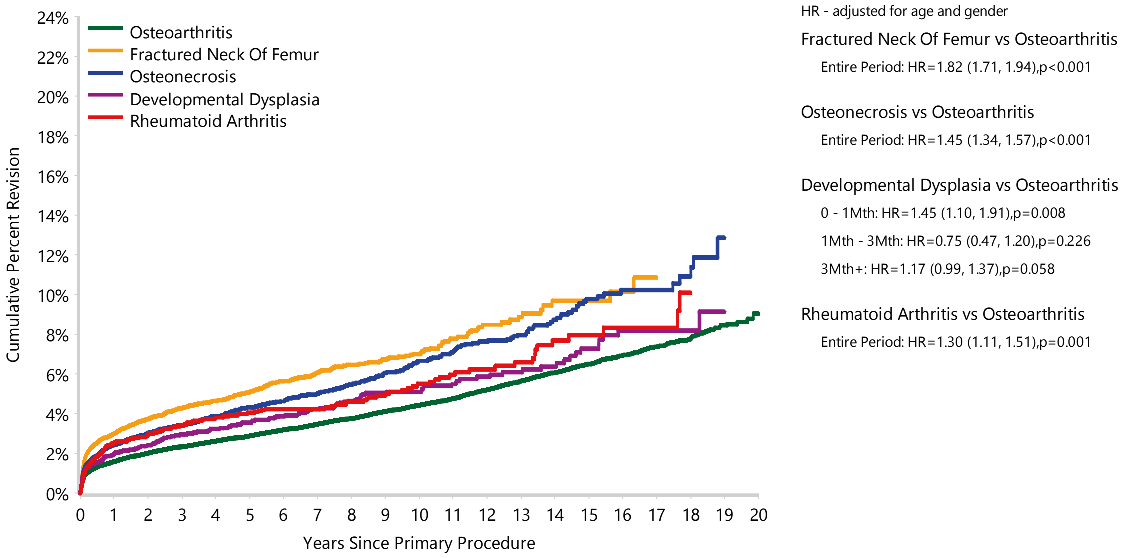
Osteoarthritis has a lower rate of revision compared to fractured neck of femur, osteonecrosis, and rheumatoid arthritis. Osteoarthritis also has a lower rate of revision compared to developmental dysplasia. However, this difference is only evident in the first month (Figure HT4).

**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 | 12028 | 368834 | 1.6 (1.5, 1.6) | 2.3 (2.3, 2.4) | 2.9 (2.8, 3.0) | 4.4 (4.3, 4.5) | 6.5 (6.3, 6.7) | 9.0 (8.3, 9.8) |
| Fractured Neck Of Femur | 1050 | 22439 | 3.0 (2.8, 3.2) | 4.3 (4.0, 4.6) | 5.1 (4.8, 5.4) | 7.0 (6.5, 7.6) | 9.7 (8.5, 11.0) | |
| Osteonecrosis | 644 | 13451 | 2.4 (2.2, 2.7) | 3.4 (3.1, 3.8) | 4.3 (3.9, 4.7) | 6.7 (6.1, 7.3) | 9.8 (8.7, 11.0) | |
| Developmental Dysplasia | 224 | 5468 | 1.9 (1.6, 2.4) | 3.0 (2.5, 3.5) | 3.6 (3.1, 4.1) | 5.1 (4.4, 5.9) | 7.3 (6.1, 8.7) | |
| Rheumatoid Arthritis | 160 | 3424 | 2.6 (2.1, 3.2) | 3.4 (2.8, 4.1) | 4.0 (3.4, 4.8) | 5.5 (4.6, 6.5) | 8.0 (6.5, 9.8) | |
| Tumour | 122 | 2351 | 4.7 (3.8, 5.7) | 6.9 (5.6, 8.5) | 8.1 (6.6, 10.0) | 11.7 (8.8, 15.5) | | |
| Other (5) | 282 | 4275 | 4.0 (3.4, 4.6) | 5.8 (5.1, 6.6) | 6.7 (5.9, 7.6) | 8.9 (7.8, 10.2) | 11.4 (9.6, 13.6) | |
| TOTAL | 14510 | 420242 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses
Only primary diagnoses with over 2,000 procedures have been listed

**Figure HT4 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Primary Diagnosis**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Osteoarthritis | 368834 | 327362 | 251190 | 182981 | 68326 | 17085 | 266 |
| Fractured Neck Of Femur | 22439 | 18018 | 12042 | 7490 | 1859 | 258 | 1 |
| Osteonecrosis | 13451 | 11675 | 8855 | 6374 | 2464 | 747 | 15 |
| Developmental Dysplasia | 5468 | 4854 | 3709 | 2793 | 1285 | 439 | 11 |
| Rheumatoid Arthritis | 3424 | 3070 | 2493 | 1947 | 901 | 286 | 9 |

Note: Only primary diagnoses with over 2,500 procedures have been listed
All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

## PROSTHESIS TYPES

There are 1,490 different stem and acetabular combinations for primary total conventional hip replacement recorded by the Registry. This is a decrease of 1,741 prosthesis combinations since the previous report and is due to the restriction in the analyses to modern prosthesis combinations. Prosthesis combinations using large head metal/metal bearings are listed separately.

The cumulative percent revision of the 100 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 91.5% of all primary total conventional hip replacement procedures. A large number of prosthesis combinations have been used in small numbers and have no recorded use in 2020, hence the considerable reduction in numbers compared to the previous report.

The 'Other' group consists of all prosthesis combinations with ≤500 procedures. This group accounts for 8.5% of all primary total conventional hip replacement procedures.

There are 7 cemented primary total conventional stem and acetabular combinations with >500 procedures. The CPT/ZCA has the lowest 15 year cumulative percent revision of 7.2% (Table HT11).

There are 62 cementless primary total conventional stem and acetabular combinations listed. The Alloclassic/Trilogy has the lowest 15 year cumulative percent revision. At 20 years, the Secur-Fit Plus/Trident has a cumulative percent revision of 5.7% (Table HT12).

There are 31 combinations of primary total hip replacement with hybrid fixation. The Exeter V40 /Trilogy has the lowest cumulative percent revision at 15 years of 3.9% (n=606) followed by the Omnifit/Trident (n=2968) with a cumulative percent revision of 4.5% (Table HT13). The Exeter/Vitalock has previously been reported with the lowest cumulative percent revision for hybrid fixation but this combination is not a modern prosthesis.

**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 | 17 | 581 | 2.0 (1.1, 3.6) | 2.4 (1.4, 4.2) | 3.0 (1.8, 5.1) | | | |
| CPCS | Reflection (Cup) | 87 | 1069 | 1.8 (1.1, 2.8) | 2.9 (2.0, 4.2) | 3.7 (2.6, 5.1) | 8.3 (6.3, 10.8) | 18.8 (14.9, 23.5) | |
| CPT | ZCA | 48 | 1033 | 0.9 (0.5, 1.7) | 2.2 (1.4, 3.3) | 2.8 (1.9, 4.1) | 5.1 (3.6, 7.0) | 7.2 (5.1, 10.2) | |
| Exeter V40 | Contemporary | 356 | 5687 | 1.7 (1.4, 2.1) | 2.9 (2.5, 3.4) | 3.6 (3.1, 4.1) | 6.2 (5.5, 7.0) | 9.9 (8.7, 11.1) | |
| | Exeter Contemporary | 187 | 3420 | 1.4 (1.1, 1.9) | 2.4 (1.9, 2.9) | 3.1 (2.6, 3.8) | 4.9 (4.1, 5.7) | 8.4 (7.1, 9.9) | |
| | Exeter X3 Rimfit | 125 | 4825 | 1.5 (1.2, 1.9) | 2.3 (1.9, 2.8) | 2.8 (2.4, 3.4) | | | |
| Spectron EF | Reflection (Cup)* | 134 | 1663 | 1.1 (0.7, 1.7) | 1.8 (1.2, 2.5) | 2.8 (2.1, 3.8) | 7.1 (5.8, 8.7) | 13.8 (11.4, 16.5) | |
| Other (255) | | 246 | 5198 | 2.7 (2.2, 3.2) | 3.8 (3.3, 4.4) | 4.5 (3.9, 5.2) | 6.7 (5.7, 7.8) | 11.5 (9.4, 14.0) | |
| TOTAL | | 1200 | 23476 | | | | | | |

Note: Some cementless components have been cemented
Procedures using metal/metal prostheses have been included
Restricted to modern prostheses
*denotes prosthesis combination with no reported use in primary total conventional hip procedures in 2020
Only prostheses with over 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 |
|---|---|---|---|---|---|---|---|---|---|
| AMIStem H | Mpact | 39 | 1675 | 2.0 (1.4, 2.9) | 2.8 (2.0, 3.9) | | | | |
| | Versafitcup CC | 58 | 3014 | 1.4 (1.0, 1.9) | 2.0 (1.5, 2.6) | 2.6 (1.9, 3.5) | | | |
| Accolade II | Trident (Shell) | 201 | 9228 | 1.8 (1.5, 2.1) | 2.4 (2.1, 2.8) | 2.8 (2.4, 3.2) | | | |
| | Trident/Tritanium (Shell) | 64 | 2378 | 2.3 (1.7, 3.0) | 3.0 (2.3, 3.8) | 3.6 (2.7, 4.9) | | | |
| Alloclassic | Allofit | 178 | 3928 | 1.6 (1.2, 2.0) | 2.3 (1.9, 2.9) | 2.9 (2.4, 3.5) | 4.8 (4.1, 5.6) | 6.8 (5.7, 8.1) | |
| | Fitmore* | 53 | 727 | 4.4 (3.1, 6.2) | 5.4 (4.0, 7.3) | 5.8 (4.3, 7.8) | 8.0 (6.1, 10.5) | 8.6 (6.4, 11.5) | |
| | Trabecular Metal (Shell)* | 52 | 1060 | 2.3 (1.5, 3.4) | 2.9 (2.0, 4.1) | 4.0 (3.0, 5.4) | 5.1 (3.8, 6.7) | 6.4 (4.6, 8.7) | |
| | Trilogy* | 20 | 946 | 0.6 (0.3, 1.4) | 0.9 (0.4, 1.7) | 1.1 (0.6, 2.0) | 2.5 (1.6, 3.9) | 2.7 (1.7, 4.3) | |
| Anthology | R3 | 228 | 7621 | 2.0 (1.7, 2.3) | 2.5 (2.1, 2.8) | 2.8 (2.4, 3.2) | 3.6 (3.1, 4.1) | | |
| | Reflection (Shell)* | 31 | 907 | 1.9 (1.2, 3.0) | 2.2 (1.4, 3.4) | 2.6 (1.7, 3.8) | 3.5 (2.4, 5.0) | | |
| Apex | Acetabular Shell (Global) | 26 | 545 | 3.1 (2.0, 5.0) | 4.4 (2.9, 6.6) | 5.3 (3.6, 7.8) | | | |
| | Fin II* | 55 | 984 | 1.9 (1.2, 3.0) | 2.6 (1.7, 3.8) | 3.8 (2.7, 5.2) | 6.1 (4.7, 8.0) | | |
| Avenir | Continuum | 56 | 1705 | 2.6 (1.9, 3.4) | 3.0 (2.2, 3.9) | 3.4 (2.6, 4.5) | | | |
| | Trilogy* | 12 | 626 | 1.0 (0.4, 2.1) | 1.1 (0.5, 2.3) | 1.3 (0.6, 2.6) | 2.4 (1.2, 4.5) | | |
| C2 | Delta-TT | 24 | 933 | 1.2 (0.7, 2.2) | 2.1 (1.3, 3.4) | 2.6 (1.7, 4.0) | | | |
| CLS | Fitmore | 19 | 564 | 1.5 (0.7, 2.9) | 2.6 (1.5, 4.4) | 2.9 (1.7, 4.9) | 4.9 (2.8, 8.4) | 4.9 (2.8, 8.4) | |
| CORAIL | Fitmore | 14 | 514 | 2.1 (1.2, 3.8) | 2.4 (1.3, 4.1) | 2.4 (1.3, 4.1) | 3.8 (2.0, 7.1) | | |
| | PINNACLE | 1974 | 55417 | 1.7 (1.6, 1.8) | 2.7 (2.5, 2.8) | 3.3 (3.1, 3.4) | 5.1 (4.8, 5.4) | 8.1 (7.0, 9.2) | |
| | PINNACLE*MoM | 128 | 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) | 17.2 (13.9, 21.2) | |
| | Trinity | 12 | 796 | 1.5 (0.9, 2.8) | 1.8 (1.0, 3.1) | | | | |
| EVOK | C2 | 29 | 780 | 2.7 (1.8, 4.1) | 3.1 (2.1, 4.7) | 3.3 (2.3, 4.9) | | | |
| | Logical G | 10 | 679 | 1.2 (0.6, 2.5) | 1.7 (0.9, 3.3) | | | | |
| H-Max | Delta-TT | 63 | 1628 | 1.9 (1.4, 2.7) | 3.3 (2.5, 4.3) | 3.9 (3.0, 5.1) | | | |
| HACTIV | Logical G | 45 | 1185 | 3.3 (2.4, 4.6) | 4.4 (3.3, 5.9) | | | | |
| M/L Taper | Allofit | 21 | 751 | 1.6 (0.9, 2.8) | 1.9 (1.1, 3.2) | 2.2 (1.4, 3.6) | 3.7 (2.2, 6.1) | | |
| | Continuum | 55 | 1571 | 2.2 (1.6, 3.1) | 3.2 (2.5, 4.3) | 3.5 (2.7, 4.6) | | | |
| | Trilogy | 32 | 888 | 1.2 (0.7, 2.2) | 1.6 (0.9, 2.7) | 2.8 (1.9, 4.2) | 4.1 (2.8, 5.8) | 4.9 (3.4, 7.2) | |
| Metafix | Trinity | 207 | 10703 | 1.5 (1.3, 1.7) | 2.3 (2.0, 2.7) | 2.7 (2.3, 3.2) | | | |
| MiniHip | Trinity | 37 | 1093 | 2.6 (1.8, 3.8) | 3.4 (2.4, 4.7) | 3.5 (2.5, 4.8) | | | |
| Nanos | R3 | 10 | 660 | 0.9 (0.4, 2.0) | 1.2 (0.6, 2.4) | 1.2 (0.6, 2.4) | 1.6 (0.8, 2.9) | | |
| Omnifit | Trident (Shell) | 86 | 1272 | 1.9 (1.3, 2.8) | 3.2 (2.3, 4.3) | 4.1 (3.1, 5.4) | 5.6 (4.4, 7.0) | 7.4 (5.9, 9.2) | |
| Optimys | RM Cup | 22 | 1525 | 1.3 (0.8, 2.0) | 1.5 (1.0, 2.4) | 1.8 (1.1, 2.7) | | | |
| Origin | Logical G | 50 | 1959 | 1.9 (1.4, 2.6) | 2.9 (2.2, 3.8) | 3.4 (2.4, 4.7) | | | |
| Paragon | Acetabular Shell (Global) | 66 | 3796 | 1.5 (1.1, 1.9) | 1.8 (1.4, 2.3) | 2.2 (1.6, 2.9) | | | |
| | Novae | 16 | 835 | 1.0 (0.5, 2.0) | 2.0 (1.2, 3.4) | 2.3 (1.4, 3.8) | | | |
| | Trinity | 20 | 864 | 2.2 (1.4, 3.5) | 2.8 (1.8, 4.6) | | | | |
| Polarstem | EP-Fit Plus | 11 | 2233 | 0.2 (0.1, 0.5) | 0.5 (0.3, 1.0) | 0.6 (0.3, 1.2) | | | |
| | R3 | 347 | 13033 | 2.0 (1.8, 2.3) | 2.6 (2.3, 2.9) | 3.1 (2.7, 3.4) | 4.1 (3.3, 5.2) | | |
| Profemur L | Dynasty | 84 | 1879 | 3.5 (2.7, 4.4) | 4.7 (3.7, 5.8) | 5.3 (4.2, 6.6) | | | |
| | Procotyl L | 19 | 834 | 1.7 (1.0, 2.9) | 2.3 (1.5, 3.7) | 2.7 (1.7, 4.3) | | | |
| Quadra-H | Mpact | 144 | 4495 | 2.1 (1.7, 2.6) | 3.4 (2.8, 4.0) | 5.5 (4.3, 7.0) | | | |
| | Trident (Shell) | 18 | 696 | 1.5 (0.8, 2.7) | 2.6 (1.6, 4.2) | 3.0 (1.8, 5.0) | | | |
| | Versafitcup CC | 298 | 9076 | 1.9 (1.6, 2.2) | 2.7 (2.4, 3.1) | 3.3 (2.9, 3.7) | 5.8 (4.8, 7.2) | | |
| | Versafitcup DM | 37 | 705 | 4.0 (2.8, 5.9) | 6.1 (4.4, 8.4) | 6.7 (4.7, 9.4) | | | |
| S-Rom | PINNACLE | 211 | 3581 | 2.5 (2.0, 3.0) | 3.9 (3.3, 4.6) | 4.7 (4.0, 5.4) | 6.2 (5.4, 7.1) | 8.0 (6.8, 9.4) | |

| Femoral Component | Acetabular Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| SL-Plus | EP-Fit Plus | 48 | 1210 | 1.6 (1.0, 2.5) | 2.1 (1.4, 3.1) | 2.7 (1.9, 3.8) | 3.9 (2.9, 5.2) | | |
| | R3 | 102 | 1796 | 2.6 (2.0, 3.5) | 4.1 (3.3, 5.2) | 4.5 (3.6, 5.6) | 6.7 (5.5, 8.2) | | |
| Secur-Fit | Trident (Shell) | 474 | 10300 | 1.8 (1.6, 2.1) | 2.8 (2.5, 3.2) | 3.5 (3.2, 3.9) | 4.7 (4.3, 5.2) | 6.2 (5.5, 6.8) | |
| Secur-Fit Plus | Trident (Shell) | 241 | 6230 | 1.2 (1.0, 1.6) | 1.9 (1.6, 2.3) | 2.4 (2.0, 2.8) | 3.5 (3.0, 4.0) | 4.8 (4.2, 5.5) | 5.7 (4.9, 6.5) |
| Summit | PINNACLE | 163 | 5492 | 1.5 (1.2, 1.8) | 2.1 (1.8, 2.6) | 2.4 (2.0, 2.9) | 3.4 (2.9, 4.1) | 5.0 (4.0, 6.3) | |
| | PINNACLE*MoM | 81 | 784 | 1.5 (0.9, 2.7) | 2.2 (1.4, 3.5) | 3.5 (2.4, 5.1) | 8.7 (6.8, 11.0) | 11.5 (9.2, 14.2) | |
| Synergy | R3 | 163 | 5192 | 1.8 (1.5, 2.2) | 2.4 (2.0, 2.8) | 2.8 (2.4, 3.3) | 3.7 (3.1, 4.3) | | |
| | Reflection (Shell) | 407 | 7843 | 1.5 (1.3, 1.8) | 2.3 (2.0, 2.7) | 2.7 (2.3, 3.1) | 4.0 (3.6, 4.5) | 5.9 (5.3, 6.6) | |
| Taperloc | Continuum | 16 | 722 | 1.8 (1.1, 3.1) | 2.4 (1.4, 3.8) | | | | |
| | Exceed* | 50 | 1973 | 1.4 (1.0, 2.1) | 2.0 (1.5, 2.7) | 2.2 (1.6, 3.0) | 3.2 (2.3, 4.3) | | |
| | G7 | 75 | 3436 | 1.9 (1.5, 2.5) | 2.4 (1.9, 3.1) | 2.6 (2.0, 3.3) | | | |
| Taperloc Microplasty | Continuum | 16 | 547 | 2.8 (1.7, 4.7) | 3.2 (2.0, 5.3) | | | | |
| | G7 | 25 | 2118 | 1.2 (0.8, 1.8) | 1.3 (0.9, 2.0) | 1.3 (0.9, 2.0) | | | |
| Tri-Fit TS | Trinity | 87 | 4150 | 1.3 (1.0, 1.7) | 2.1 (1.7, 2.6) | 2.3 (1.9, 2.9) | | | |
| Tri-Lock | PINNACLE | 27 | 1027 | 1.5 (0.9, 2.5) | 2.3 (1.5, 3.5) | 2.8 (1.9, 4.1) | 3.2 (2.2, 4.8) | | |
| VerSys | Trilogy* | 256 | 4498 | 2.6 (2.2, 3.1) | 3.4 (2.9, 4.0) | 4.0 (3.5, 4.6) | 5.3 (4.7, 6.0) | 6.3 (5.5, 7.1) | |
| twinSys (cless) | RM Cup | 45 | 1317 | 2.2 (1.5, 3.2) | 3.1 (2.2, 4.2) | 3.3 (2.4, 4.5) | | | |
| Other (616) | | 937 | 21587 | 2.5 (2.3, 2.7) | 3.7 (3.4, 3.9) | 4.3 (4.0, 4.6) | 5.9 (5.5, 6.4) | 7.7 (6.9, 8.6) | |
| **TOTAL** | | **8395** | **241477** | | | | | | |

Note: Procedures using metal/metal prostheses have been included
Restricted to modern prostheses
MoM denotes metal/metal prostheses with head sizes >32mm
*denotes prosthesis combination with no reported use in primary total conventional hip procedures in 2020
Only prostheses with over 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 |
|---|---|---|---|---|---|---|---|---|---|
| Absolut | Acetabular Shell (Global) | 21 | 843 | 1.6 (0.9, 2.7) | 2.5 (1.6, 3.9) | 3.3 (2.0, 5.4) | | | |
| C-Stem AMT | PINNACLE | 141 | 5385 | 1.5 (1.2, 1.8) | 2.4 (2.0, 2.9) | 3.3 (2.7, 3.9) | 4.9 (3.9, 6.3) | | |
| CPCS | R3 | 246 | 7188 | 2.2 (1.9, 2.6) | 3.1 (2.7, 3.5) | 3.5 (3.1, 4.0) | 5.5 (4.6, 6.5) | | |
| | Reflection (Shell) | 120 | 3098 | 0.9 (0.6, 1.3) | 1.3 (0.9, 1.8) | 1.7 (1.3, 2.3) | 3.6 (3.0, 4.5) | 7.1 (5.7, 8.9) | |
| CPT | Allofit | 51 | 1581 | 1.3 (0.8, 2.0) | 1.9 (1.3, 2.7) | 2.9 (2.1, 4.0) | 5.0 (3.7, 6.8) | | |
| | Continuum | 168 | 3334 | 2.9 (2.4, 3.5) | 4.0 (3.4, 4.8) | 4.7 (4.0, 5.5) | 7.3 (5.9, 9.0) | | |
| | G7 | 39 | 1393 | 3.0 (2.2, 4.2) | 3.8 (2.7, 5.3) | | | | |
| | Trabecular Metal (Shell) | 123 | 2372 | 2.6 (2.0, 3.3) | 3.7 (3.0, 4.5) | 4.8 (3.9, 5.9) | 7.0 (5.8, 8.5) | | |
| | Trilogy | 418 | 8655 | 1.9 (1.7, 2.2) | 2.9 (2.5, 3.2) | 3.7 (3.3, 4.1) | 5.5 (5.0, 6.1) | 7.1 (6.3, 8.0) | |
| E2 | C2 | 22 | 753 | 1.5 (0.8, 2.6) | 2.3 (1.5, 3.7) | 3.1 (2.0, 4.8) | | | |
| | Logical G | 11 | 562 | 1.9 (1.0, 3.4) | 2.2 (1.2, 4.0) | | | | |
| Evolve | Logical G | 37 | 1867 | 1.6 (1.1, 2.3) | 2.1 (1.5, 2.9) | 2.4 (1.7, 3.3) | | | |
| Exeter V40 | Fixa | 24 | 772 | 1.8 (1.1, 3.1) | 2.4 (1.5, 3.8) | 2.8 (1.8, 4.3) | | | |
| | PINNACLE | 64 | 2330 | 1.5 (1.0, 2.0) | 2.0 (1.5, 2.7) | 2.3 (1.8, 3.1) | 4.4 (3.2, 6.0) | | |
| | R3 | 84 | 2474 | 1.9 (1.4, 2.5) | 2.8 (2.2, 3.6) | 3.5 (2.8, 4.4) | 4.2 (3.4, 5.3) | | |
| | Trabecular Metal (Shell) | 27 | 547 | 2.8 (1.7, 4.6) | 3.4 (2.2, 5.4) | 4.2 (2.7, 6.4) | 6.1 (4.2, 8.9) | | |
| | Trident (Shell) | 2247 | 75347 | 1.3 (1.2, 1.4) | 2.0 (1.9, 2.1) | 2.5 (2.4, 2.7) | 4.0 (3.8, 4.2) | 5.7 (5.4, 6.1) | |
| | Trident/Tritanium (Shell) | 162 | 5264 | 1.7 (1.4, 2.1) | 2.6 (2.2, 3.1) | 3.4 (2.9, 4.0) | 4.8 (3.8, 6.1) | | |
| | Trilogy | 20 | 606 | 1.7 (0.9, 3.1) | 2.4 (1.4, 4.0) | 2.6 (1.5, 4.2) | 3.6 (2.3, 5.6) | 3.9 (2.5, 6.1) | |
| MS 30 | Allofit* | 51 | 1337 | 1.1 (0.6, 1.8) | 1.6 (1.0, 2.4) | 2.1 (1.4, 3.0) | 3.8 (2.8, 5.2) | 7.1 (5.0, 10.0) | |
| | Continuum | 18 | 878 | 1.6 (1.0, 2.7) | 1.9 (1.2, 3.1) | 2.3 (1.4, 3.9) | | | |
| | Fitmore | 20 | 600 | 1.5 (0.8, 2.9) | 2.1 (1.2, 3.7) | 3.2 (2.0, 5.3) | 4.4 (2.8, 7.1) | 5.5 (3.2, 9.4) | |
| | G7 | 6 | 573 | 1.2 (0.5, 2.7) | 1.2 (0.5, 2.7) | | | | |
| Omnifit | Trident (Shell) | 103 | 2968 | 1.7 (1.3, 2.3) | 2.6 (2.1, 3.3) | 2.9 (2.3, 3.6) | 3.6 (2.9, 4.4) | 4.5 (3.6, 5.6) | |
| Quadra-C | Mpact | 34 | 2496 | 1.2 (0.8, 1.8) | 1.6 (1.1, 2.3) | 2.1 (1.2, 3.6) | | | |
| | Versafitcup CC | 27 | 1409 | 1.7 (1.1, 2.5) | 1.9 (1.3, 2.8) | 2.0 (1.4, 3.0) | | | |
| Short Exeter V40 | Trident (Shell) | 48 | 2666 | 1.4 (1.0, 1.9) | 2.1 (1.5, 2.9) | 2.8 (2.0, 4.0) | | | |
| Spectron EF | R3 | 87 | 2250 | 1.7 (1.3, 2.4) | 2.8 (2.2, 3.6) | 3.6 (2.8, 4.5) | 5.5 (4.3, 7.0) | | |
| | Reflection (Shell)* | 345 | 5210 | 1.1 (0.9, 1.4) | 2.0 (1.6, 2.4) | 2.8 (2.4, 3.3) | 5.5 (4.8, 6.2) | 9.8 (8.7, 11.0) | 14.5 (11.7, 18.0) |
| Taper Fit | Trinity | 61 | 2925 | 1.6 (1.2, 2.1) | 2.6 (2.0, 3.4) | 3.5 (2.6, 4.8) | | | |
| X-Acta | Versafitcup CC | 7 | 588 | 0.9 (0.4, 2.1) | 1.1 (0.5, 2.5) | 1.5 (0.7, 3.1) | | | |
| Other (519) | | 348 | 9307 | 2.2 (1.9, 2.5) | 3.1 (2.7, 3.5) | 4.0 (3.5, 4.5) | 6.2 (5.4, 7.1) | 8.5 (7.2, 10.1) | |
| **TOTAL** | | **5180** | **157578** | | | | | | |

Note: Procedures using metal/metal prostheses have been included
Restricted to modern prostheses
MoM denotes metal/metal prostheses with head sizes >32mm
Only prostheses with over 500 procedures have been listed
*denotes prosthesis combination with no reported use in primary total conventional hip procedures in 2020

## OUTCOME FOR OSTEOARTHRITIS - PATIENT CHARACTERISTICS

The following analyses have been undertaken excluding all procedures using metal/metal bearing surfaces. All other bearing surfaces are included in this analysis. Only procedures using prostheses that have been used in the past year have been included. The 20 year cumulative percent revision of primary total conventional hip replacement undertaken for osteoarthritis is 9.0% (Table HT14 and Figure HT5).

### Reason for Revision

This year, the Registry has decided to combine dislocation and instability together for the analyses as they both reflect a similar reason for revision. The most common reasons for revision of primary total conventional hip replacement are prosthesis dislocation/instability, infection, fracture and loosening (Table HT15).

The most common reason for revision varies with time. In the first 11 years, dislocation and infection are the most frequent reasons for revision. After 11 years, loosening is the predominant reason 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. Overall, patients aged ≥75 years have a lower rate of revision than patients aged <55 years after 3 months, patients 55-64 years after 6 months, and patients 65-74 years after 4 years (Table HT17 and Figure HT7).

Males have a higher rate of revision than females after 6 months. The cumulative percent revision at 20 years is 10.1% for males and 8.2% for females (Table HT18 and Figure HT8). The Registry continues to report a difference in the rate of revision between age groups within gender.

Males aged ≥75 years have a higher rate of revision initially, compared to the younger age groups. However, the rate of revision decreases with increasing age as time progresses (Table HT18 and Figure HT9). For females, the rate of revision decreases with increasing age. After 3 months, females aged <55 years have almost twice the rate of revision compared to females aged ≥75 years (Table HT18 and Figure HT10).

For both males and females <75 years of age, loosening is the most common reason for revision. For patients aged ≥75 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 chapter. The Registry can now report on the outcome of 228,771 primary total conventional hip replacement procedures for osteoarthritis in relation to 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 HT19 and Figure HT13). The difference in revision rate for each ASA score is partially due to an increase in revision for infection with increasing ASA score (Figure HT14).

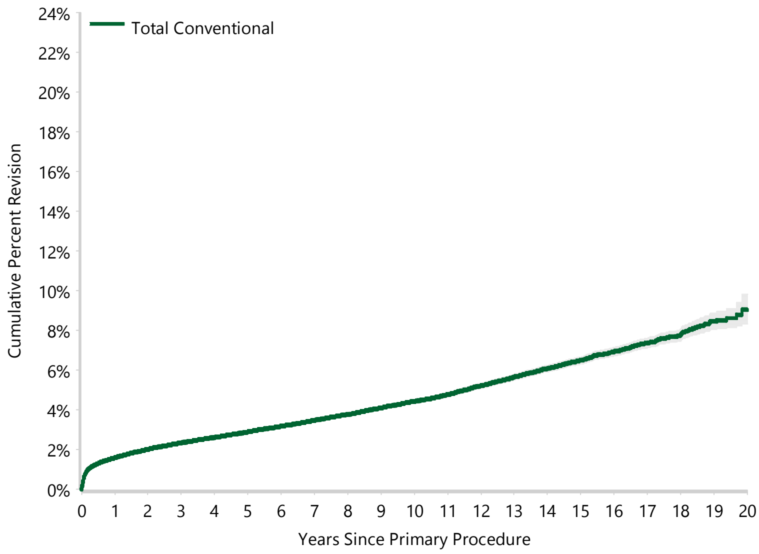
BMI data have been collected since 2015. The revision outcomes are reported for 181,595 primary total conventional hip replacement procedures for osteoarthritis. When compared to patients in the normal BMI class, there is no difference in the rate of revision for patients in the underweight or pre-obese classes. The rate of revision increases for obese class 1, obese class 2, and obese class 3 (Table HT20 and Figure HT15). The most common reasons for revision are shown in Figure HT16. There is an increasing rate of revision for infection with increasing obesity classes. At 3 years, the cumulative incidence of infection is 2.0% for obese class 3 compared to 1.3% for obese class 2 and 0.8% for obese class 1. The revision for infection for patients in obese class 3 is 6-fold compared to patients in the normal BMI class (Figure HT16).

**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 | 12028 | 368834 | 1.6 (1.5, 1.6) | 2.3 (2.3, 2.4) | 2.9 (2.8, 3.0) | 4.4 (4.3, 4.5) | 6.5 (6.3, 6.7) | 9.0 (8.3, 9.8) |
| TOTAL | 12028 | 368834 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**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 | 368834 | 327362 | 251190 | 182981 | 68326 | 17085 | 266 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT15 Primary Total Conventional Hip Replacement by Reason for Revision (Primary Diagnosis OA)**

| Reason for Revision | Number | Percent |
|---|---|---|
| Prosthesis Dislocation/Instability | 2702 | 22.5 |
| Infection | 2687 | 22.3 |
| Fracture | 2589 | 21.5 |
| Loosening | 2535 | 21.1 |
| Pain | 245 | 2.0 |
| Leg Length Discrepancy | 207 | 1.7 |
| Malposition | 181 | 1.5 |
| Lysis | 154 | 1.3 |
| Implant Breakage Stem | 105 | 0.9 |
| Implant Breakage Acetabular Insert | 102 | 0.8 |
| Incorrect Sizing | 81 | 0.7 |
| Wear Acetabular Insert | 72 | 0.6 |
| Metal Related Pathology | 55 | 0.5 |
| Implant Breakage Acetabular | 46 | 0.4 |
| Implant Breakage Head | 23 | 0.2 |
| Other | 244 | 2.0 |
| TOTAL | 12028 | 100.0 |

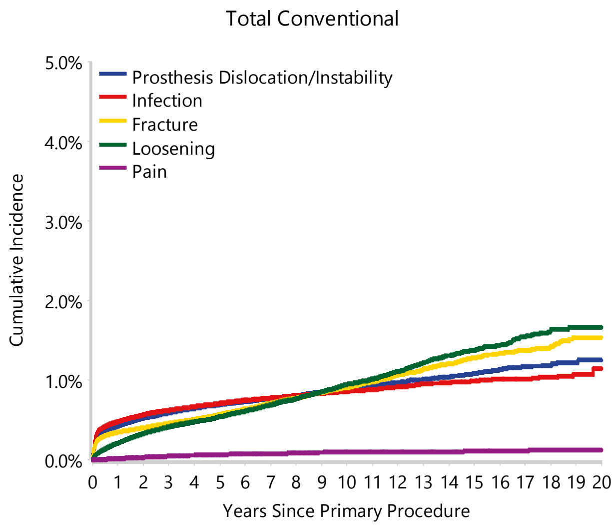
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT16 Primary Total Conventional Hip Replacement by Type of Revision (Primary Diagnosis OA)**

| Type of Revision | Number | Percent |
|---|---|---|
| Femoral Component | 3918 | 32.6 |
| Head/Insert | 2910 | 24.2 |
| Acetabular Component | 2332 | 19.4 |
| THR (Femoral/Acetabular) | 1337 | 11.1 |
| Head Only | 604 | 5.0 |
| Cement Spacer | 484 | 4.0 |
| Minor Components | 217 | 1.8 |
| Insert Only | 121 | 1.0 |
| Removal of Prostheses | 70 | 0.6 |
| Reinsertion of Components | 16 | 0.1 |
| Head/Neck | 6 | 0.0 |
| Head/Neck/Insert | 4 | 0.0 |
| Total Femoral | 2 | 0.0 |
| Bipolar Only | 2 | 0.0 |
| Bipolar Head and Femoral | 2 | 0.0 |
| Saddle | 1 | 0.0 |
| Neck Only | 1 | 0.0 |
| Cement Only | 1 | 0.0 |
| TOTAL | 12028 | 100.0 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses
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)**



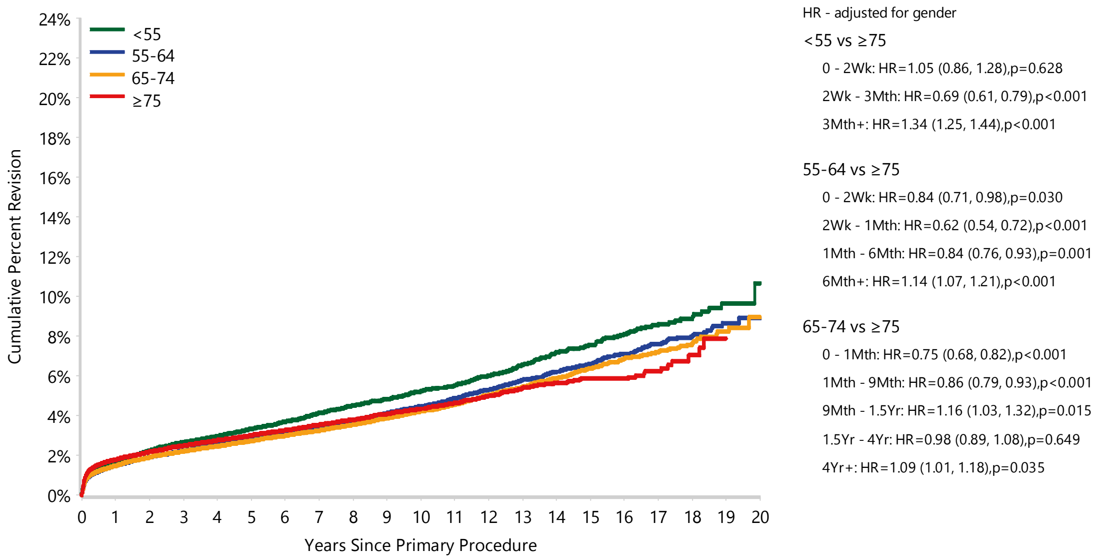

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**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 | 1491 | 38579 | 1.6 (1.5, 1.8) | 2.7 (2.5, 2.8) | 3.3 (3.1, 3.5) | 5.2 (4.9, 5.5) | 7.6 (7.0, 8.1) | 10.7 (8.6, 13.1) |
| 55-64 | 2918 | 86889 | 1.5 (1.4, 1.6) | 2.2 (2.1, 2.3) | 2.8 (2.7, 2.9) | 4.5 (4.3, 4.6) | 6.6 (6.3, 6.9) | 8.9 (8.1, 9.8) |
| 65-74 | 4175 | 132629 | 1.5 (1.4, 1.5) | 2.2 (2.1, 2.3) | 2.7 (2.6, 2.8) | 4.2 (4.1, 4.4) | 6.4 (6.1, 6.7) | 9.0 (7.7, 10.3) |
| ≥75 | 3444 | 110737 | 1.8 (1.7, 1.9) | 2.5 (2.4, 2.6) | 3.0 (2.9, 3.1) | 4.3 (4.2, 4.5) | 5.9 (5.5, 6.2) | |
| TOTAL | 12028 | 368834 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT7 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Age (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| <55 | 38579 | 34376 | 26740 | 19713 | 7713 | 2557 | 64 |
| 55-64 | 86889 | 77574 | 60547 | 44998 | 18557 | 5483 | 104 |
| 65-74 | 132629 | 117936 | 90768 | 66792 | 26456 | 6776 | 85 |
| ≥75 | 110737 | 97476 | 73135 | 51478 | 15600 | 2269 | 13 |

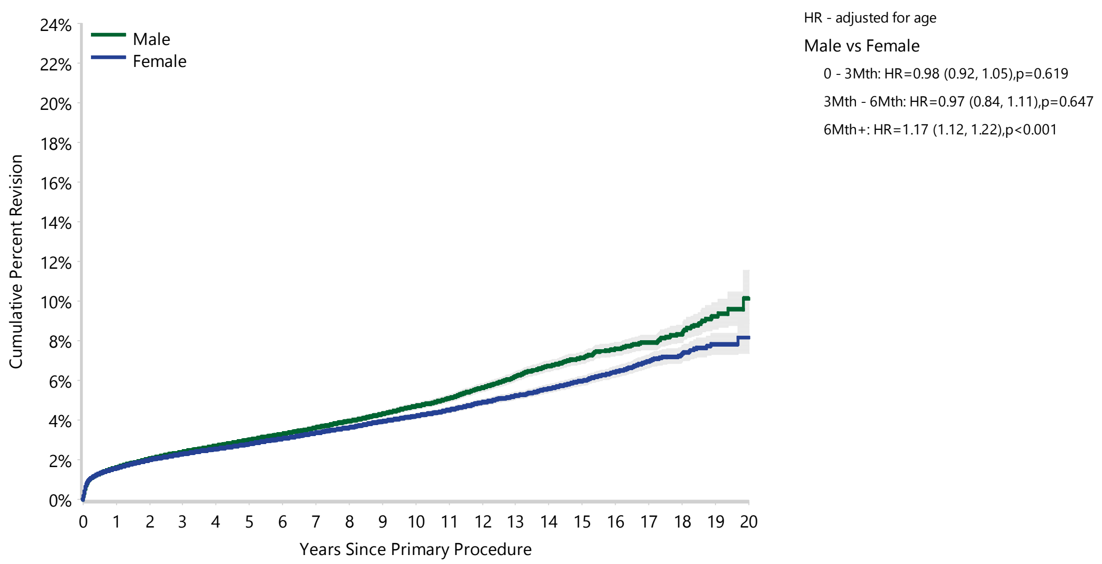
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**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 | | 5694 | 168743 | 1.6 (1.5, 1.7) | 2.4 (2.3, 2.5) | 3.0 (2.9, 3.1) | 4.7 (4.6, 4.9) | 7.1 (6.9, 7.4) | 10.1 (8.9, 11.5) |
| | <55 | 804 | 21690 | 1.6 (1.4, 1.8) | 2.6 (2.3, 2.8) | 3.2 (3.0, 3.5) | 5.1 (4.7, 5.6) | 7.6 (6.9, 8.4) | |
| | 55-64 | 1433 | 43666 | 1.5 (1.4, 1.6) | 2.2 (2.1, 2.3) | 2.8 (2.6, 2.9) | 4.4 (4.1, 4.7) | 6.9 (6.4, 7.5) | 9.4 (8.0, 11.1) |
| | 65-74 | 1938 | 59765 | 1.5 (1.4, 1.6) | 2.2 (2.1, 2.3) | 2.8 (2.6, 2.9) | 4.5 (4.2, 4.7) | 6.9 (6.4, 7.3) | |
| | ≥75 | 1519 | 43622 | 1.9 (1.8, 2.1) | 2.8 (2.7, 3.0) | 3.5 (3.3, 3.7) | 5.1 (4.8, 5.5) | 7.3 (6.7, 8.1) | |
| Female | | 6334 | 200091 | 1.6 (1.5, 1.6) | 2.3 (2.2, 2.4) | 2.8 (2.7, 2.9) | 4.2 (4.1, 4.3) | 6.0 (5.8, 6.2) | 8.2 (7.4, 9.0) |
| | <55 | 687 | 16889 | 1.7 (1.5, 1.9) | 2.8 (2.5, 3.1) | 3.5 (3.2, 3.8) | 5.3 (4.9, 5.8) | 7.5 (6.8, 8.3) | |
| | 55-64 | 1485 | 43223 | 1.5 (1.4, 1.6) | 2.3 (2.1, 2.4) | 2.8 (2.7, 3.0) | 4.5 (4.3, 4.8) | 6.3 (5.9, 6.7) | 8.4 (7.6, 9.4) |
| | 65-74 | 2237 | 72864 | 1.5 (1.4, 1.6) | 2.2 (2.1, 2.3) | 2.7 (2.6, 2.8) | 4.0 (3.8, 4.2) | 6.0 (5.6, 6.4) | 8.4 (6.6, 10.5) |
| | ≥75 | 1925 | 67115 | 1.7 (1.6, 1.8) | 2.3 (2.2, 2.4) | 2.7 (2.6, 2.9) | 3.9 (3.7, 4.1) | 5.1 (4.7, 5.5) | |
| TOTAL | | 12028 | 368834 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

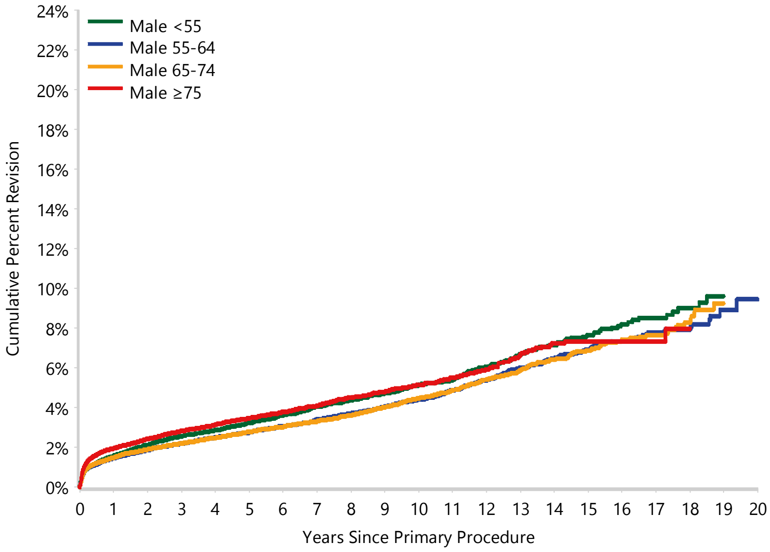
**Figure HT8 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Gender (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Male | 168743 | 149274 | 113338 | 81325 | 29128 | 7470 | 113 |
| Female | 200091 | 178088 | 137852 | 101656 | 39198 | 9615 | 153 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**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=1.12 (0.85, 1.47),p=0.413
2Wk - 3Mth: HR=0.65 (0.54, 0.78),p<0.001
3Mth+: HR=1.05 (0.95, 1.16),p=0.347

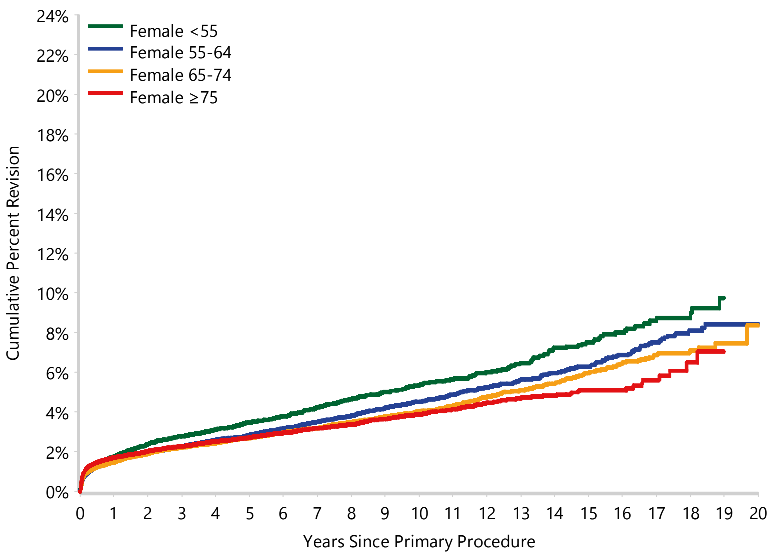
Male 55-64 vs Male ≥75
0 - 3Mth: HR=0.75 (0.66, 0.84),p<0.001
3Mth - 6Mth: HR=0.67 (0.51, 0.86),p=0.002
6Mth+: HR=0.89 (0.82, 0.98),p=0.013

Male 65-74 vs Male ≥75
0 - 1.5Yr: HR=0.80 (0.73, 0.87),p<0.001
1.5Yr - 2Yr: HR=0.71 (0.55, 0.91),p=0.008
2Yr - 3Yr: HR=0.76 (0.61, 0.93),p=0.009
3Yr+: HR=0.92 (0.83, 1.02),p=0.117

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Male | <55 | 21690 | 19336 | 14892 | 10737 | 3917 | 1326 | 36 |
| | 55-64 | 43666 | 38797 | 29982 | 21922 | 8574 | 2610 | 40 |
| | 65-74 | 59765 | 53161 | 40779 | 29902 | 11575 | 2893 | 35 |
| | ≥75 | 43622 | 37980 | 27685 | 18764 | 5062 | 641 | 2 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**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=1.06 (0.80, 1.42),p=0.673
2Wk - 3Mth: HR=0.77 (0.64, 0.94),p=0.009
3Mth+: HR=1.63 (1.47, 1.81),p<0.001

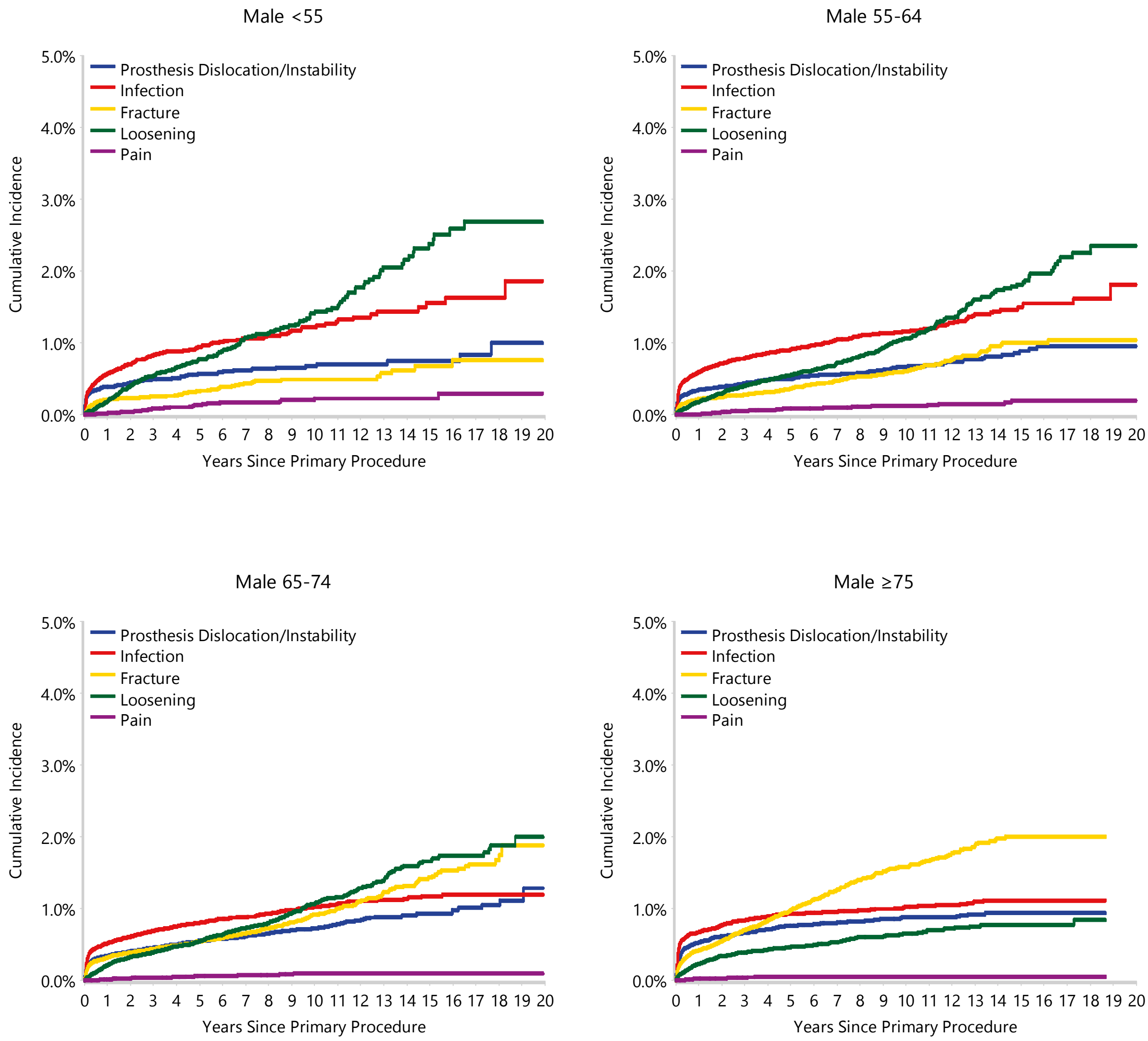
Female 55-64 vs Female ≥75
0 - 2Wk: HR=0.87 (0.70, 1.08),p=0.193
2Wk - 1Mth: HR=0.62 (0.51, 0.75),p<0.001
1Mth - 6Mth: HR=0.94 (0.81, 1.09),p=0.433
6Mth+: HR=1.36 (1.24, 1.48),p<0.001

Female 65-74 vs Female ≥75
0 - 1Mth: HR=0.77 (0.68, 0.88),p<0.001
1Mth - 6Mth: HR=0.90 (0.79, 1.02),p=0.111
6Mth+: HR=1.20 (1.10, 1.30),p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Female | <55 | 16889 | 15040 | 11848 | 8976 | 3796 | 1231 | 28 |
| | 55-64 | 43223 | 38777 | 30565 | 23076 | 9983 | 2873 | 64 |
| | 65-74 | 72864 | 64775 | 49989 | 36890 | 14881 | 3883 | 50 |
| | ≥75 | 67115 | 59496 | 45450 | 32714 | 10538 | 1628 | 11 |

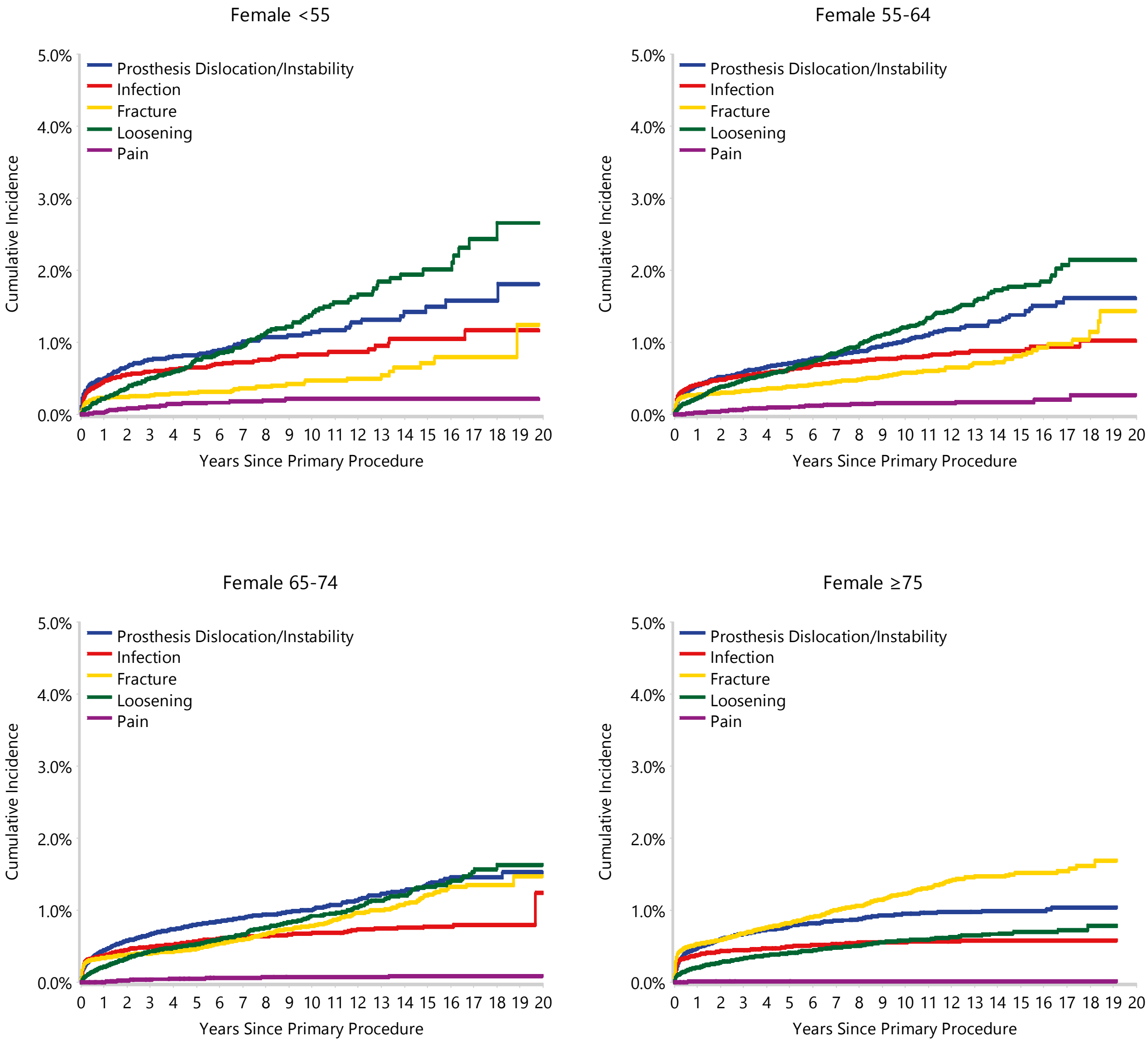
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT11** **Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement in Males by Age (Primary Diagnosis OA)**




Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT12 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement in Females by Age (Primary Diagnosis OA)**



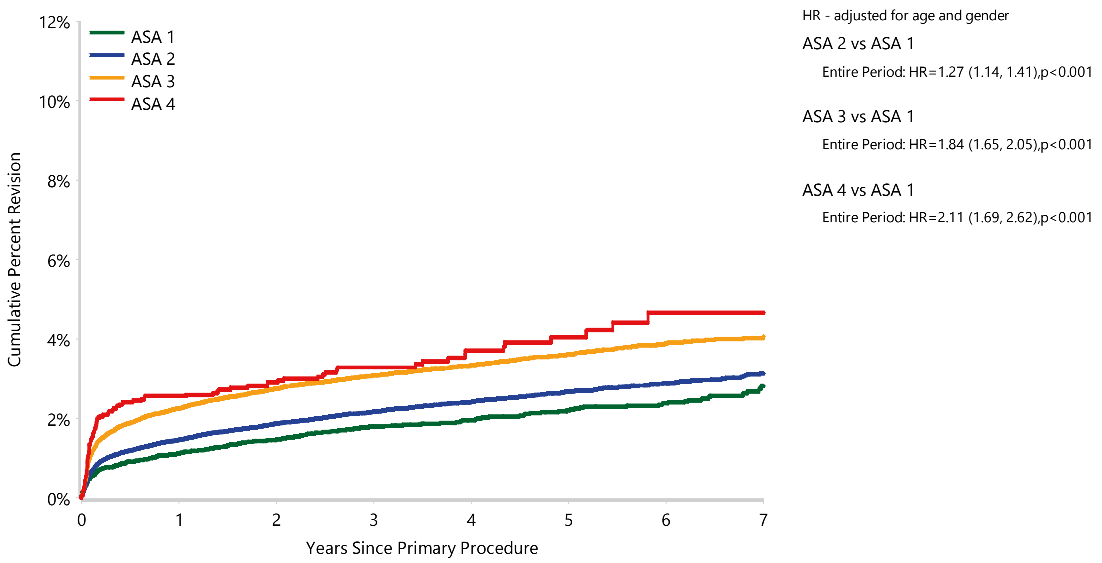

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**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 | 4 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|---|
| ASA 1 | 392 | 21028 | 1.1 (1.0, 1.3) | 1.5 (1.3, 1.7) | 1.8 (1.6, 2.0) | 2.0 (1.8, 2.2) | 2.2 (2.0, 2.5) | 2.8 (2.5, 3.2) |
| ASA 2 | 2765 | 125080 | 1.5 (1.4, 1.5) | 1.9 (1.8, 1.9) | 2.2 (2.1, 2.3) | 2.4 (2.3, 2.5) | 2.7 (2.6, 2.8) | 3.1 (3.0, 3.3) |
| ASA 3 | 2381 | 79421 | 2.3 (2.2, 2.4) | 2.7 (2.6, 2.9) | 3.1 (3.0, 3.2) | 3.3 (3.2, 3.5) | 3.6 (3.5, 3.8) | 4.1 (3.9, 4.3) |
| ASA 4 | 106 | 3233 | 2.6 (2.1, 3.2) | 2.9 (2.4, 3.6) | 3.3 (2.7, 4.0) | 3.7 (3.0, 4.5) | 4.1 (3.3, 5.0) | 4.7 (3.7, 5.9) |
| ASA 5 | 0 | 9 | 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) | |
| TOTAL | 5644 | 228771 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

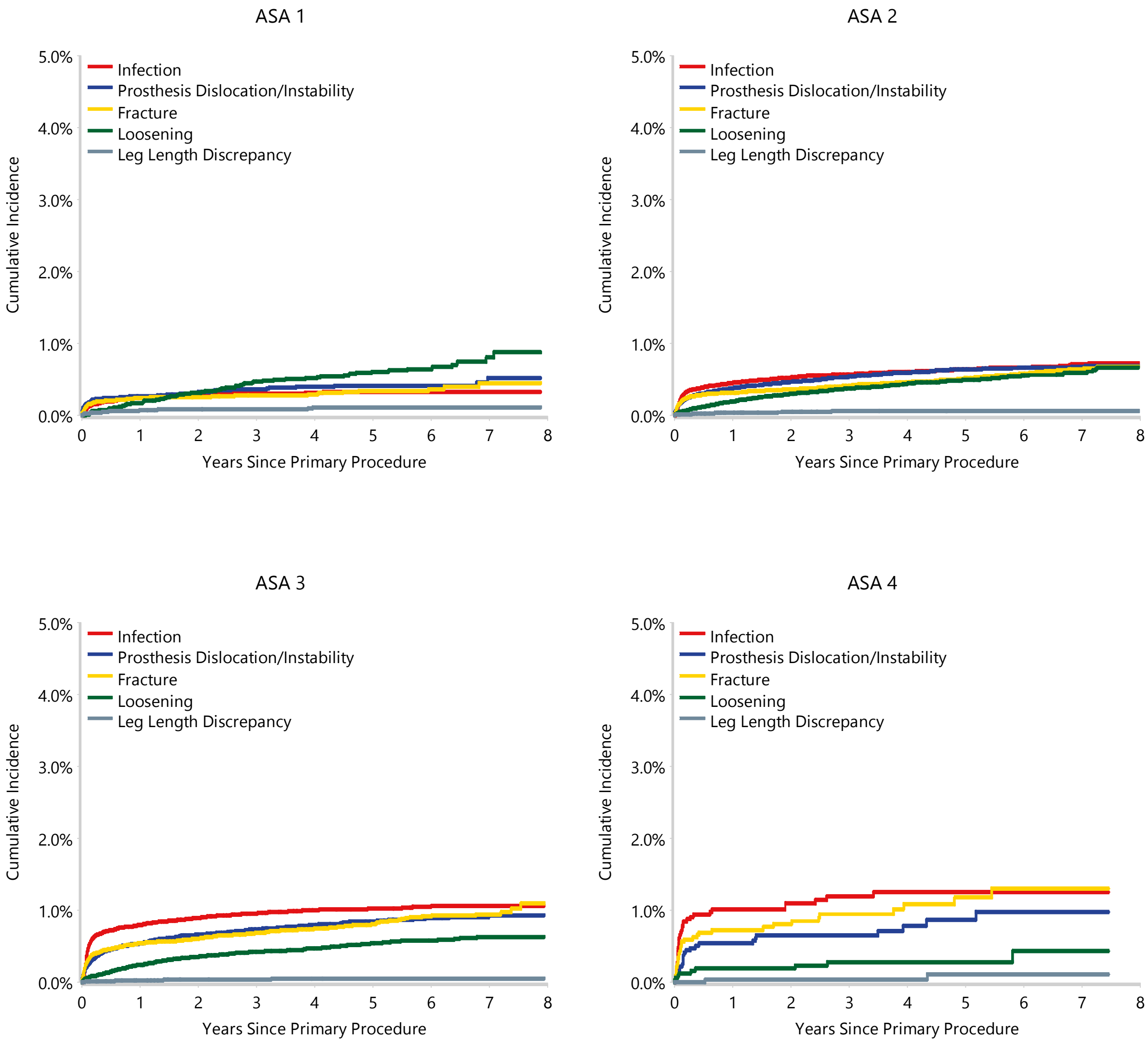
**Figure HT13 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by ASA Score (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|
| ASA 1 | 21028 | 18157 | 15297 | 12280 | 9316 | 6443 | 1475 |
| ASA 2 | 125080 | 105291 | 86148 | 68095 | 50894 | 34350 | 7192 |
| ASA 3 | 79421 | 64807 | 51080 | 38475 | 27409 | 17717 | 3412 |
| ASA 4 | 3233 | 2583 | 2024 | 1460 | 1035 | 641 | 120 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT14** **Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement by ASA Score (Primary Diagnosis OA)**



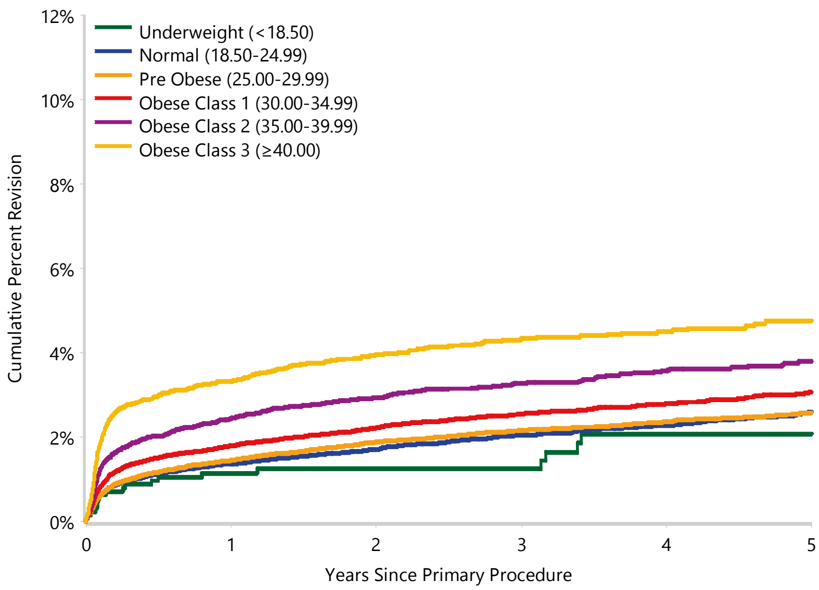

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT20** **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 |
|---|---|---|---|---|---|---|---|
| Underweight (<18.50) | 20 | 1273 | 1.2 (0.7, 1.9) | 1.3 (0.8, 2.1) | 1.3 (0.8, 2.1) | 2.1 (1.3, 3.4) | 2.1 (1.3, 3.4) |
| Normal (18.50-24.99) | 711 | 37592 | 1.4 (1.2, 1.5) | 1.7 (1.6, 1.9) | 2.1 (1.9, 2.2) | 2.3 (2.1, 2.5) | 2.6 (2.4, 2.8) |
| Pre Obese (25.00-29.99) | 1323 | 67184 | 1.5 (1.4, 1.5) | 1.9 (1.8, 2.0) | 2.2 (2.0, 2.3) | 2.4 (2.2, 2.5) | 2.6 (2.4, 2.7) |
| Obese Class 1 (30.00-34.99) | 1086 | 46185 | 1.8 (1.7, 1.9) | 2.2 (2.1, 2.4) | 2.6 (2.4, 2.7) | 2.8 (2.6, 3.0) | 3.1 (2.9, 3.3) |
| Obese Class 2 (35.00-39.99) | 597 | 19740 | 2.4 (2.2, 2.7) | 2.9 (2.7, 3.2) | 3.3 (3.0, 3.6) | 3.6 (3.3, 3.9) | 3.8 (3.5, 4.1) |
| Obese Class 3 (≥40.00) | 386 | 9621 | 3.3 (3.0, 3.7) | 4.0 (3.6, 4.4) | 4.3 (3.9, 4.8) | 4.5 (4.1, 5.0) | 4.8 (4.3, 5.3) |
| **TOTAL** | **4123** | **181595** | | | | | |

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 HT15** **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=0.84 (0.54, 1.31),p=0.444

Pre Obese (25.00-29.99) vs Normal (18.50-24.99)
Entire Period: HR=1.03 (0.94, 1.13),p=0.473

Obese Class 1 (30.00-34.99) vs Normal (18.50-24.99)
Entire Period: HR=1.25 (1.13, 1.37),p<0.001

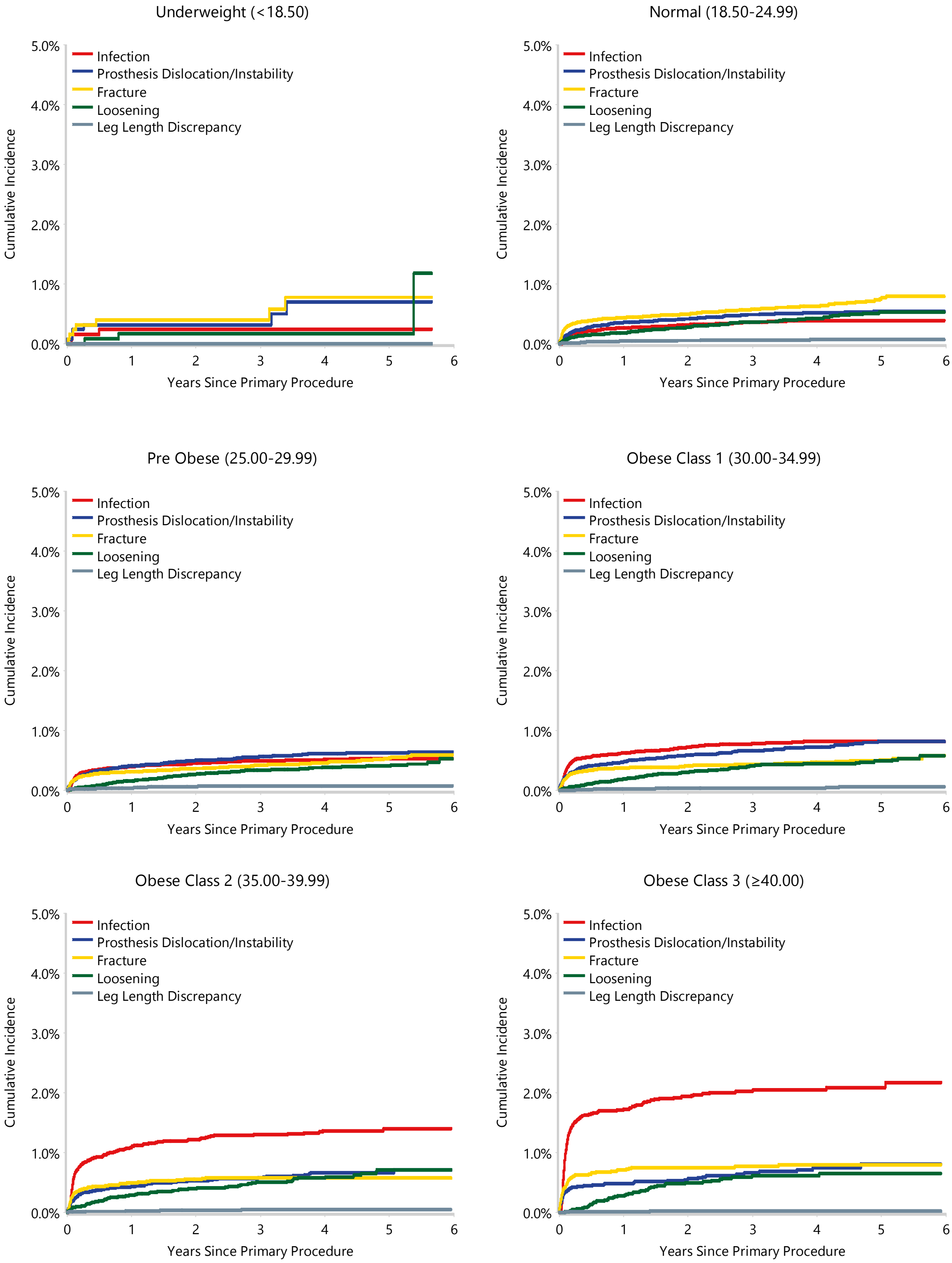
Obese Class 2 (35.00-39.99) vs Normal (18.50-24.99)
0 - 2Wk: HR=1.60 (1.23, 2.08),p<0.001
2Wk - 1Mth: HR=2.16 (1.78, 2.63),p<0.001
1Mth - 3Mth: HR=1.74 (1.43, 2.13),p<0.001
3Mth+: HR=1.41 (1.22, 1.63),p<0.001

Obese Class 3 (≥40.00) vs Normal (18.50-24.99)
0 - 3Mth: HR=2.92 (2.52, 3.39),p<0.001
3Mth+: HR=1.48 (1.22, 1.79),p<0.001

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|
| Underweight (<18.50) | 1273 | 1019 | 753 | 534 | 325 | 146 |
| Normal (18.50-24.99) | 37592 | 30132 | 22925 | 16229 | 10141 | 4615 |
| Pre Obese (25.00-29.99) | 67184 | 53982 | 41049 | 29018 | 18146 | 8184 |
| Obese Class 1 (30.00-34.99) | 46185 | 36900 | 28049 | 19731 | 12135 | 5418 |
| Obese Class 2 (35.00-39.99) | 19740 | 15624 | 11748 | 8276 | 5080 | 2223 |
| Obese Class 3 (≥40.00) | 9621 | 7613 | 5724 | 4019 | 2542 | 1143 |

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 HT16** **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

## OUTCOME FOR OSTEOARTHRITIS - PROSTHESIS CHARACTERISTICS

The analysis of prosthesis fixation was performed for prosthesis combinations using only modern bearing surfaces with recorded use in 2020. These bearing surfaces include mixed ceramic/mixed ceramic and all femoral head materials used in conjunction with cross-linked polyethylene (XLPE).

### Fixation

Modern bearing surfaces account for 96.8% of all primary total conventional hip procedures performed in 2020.

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 in the first 3 years and after this time there is no difference. Cementless fixation has a higher rate of revision than cemented fixation for the first month and after this time there is no difference (Table HT21 and Figure HT17).

**The outcome with respect to fixation varies with age.**

For patients aged <55 years, there is no difference in the rate of revision when comparing fixation methods. 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 in the first 1.5 years for patients aged 65-74 years when compared to hybrid fixation. 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 (Table HT22 and Figure HT18 to Figure HT21).

### Mini Stems

The Registry defines a mini stem as a short cementless femoral stem where fixation is designed to be entirely metaphyseal. These stems may enable femoral neck sparing.

There have been 6,737 procedures using a mini stem prosthesis undertaken for osteoarthritis. This represents prosthesis. <1.9% of all primary conventional hip procedures. There were 1,347 procedures recorded in 2020 using a mini stem prosthesis. This is an increase of 9.9% compared to 2019. The 10 year cumulative percent revision for primary total conventional hip replacement using a mini stem is 3.0% compared to 4.4% for other femoral stems. Mini stems have a reduced rate of revision after 6 months (Table HT23 and Figure HT22). There is an increased cumulative incidence of fracture and loosening for procedures using a mini stem compared to other femoral stems at 1 year (0.6% compared to 0.3%, and 0.4% compared to 0.2%, respectively) (Figure HT23). The types of revision are presented in Table HT24. The Registry has information on 7 different mini stem prostheses. Rates of revision vary depending on the type of prosthesis (Table HT25).

### Femoral Stems with Exchangeable Necks

A femoral stem with an exchangeable neck has a separate neck that connects proximally to the stem. Femoral stems with exchangeable necks were introduced to enable surgeons to have increased choice with respect to determining femoral neck version, offset and length during primary total conventional hip replacement.

The Registry has recorded 1,875 primary procedures using femoral stems with exchangeable necks undertaken for osteoarthritis. There were only 34 procedures reported in 2020 which comprised 0.1% of all primary total conventional hip procedures. This is a 22.7% decrease compared to 2019. The proportion of procedures using exchangeable necks continues to decline and peaked in 2008 at 1.3% of all primary total conventional hip procedures.

The cumulative percent revision at 10 years is 6.7% for stems with exchangeable necks compared to 4.4% for fixed neck stems. Femoral stems with exchangeable necks have almost 1.5 times the rate of revision compared to fixed neck stems (Table HT26 and Figure HT24). The increase in the rate of revision is due to a higher cumulative incidence of prosthesis dislocation/instability (1.6% compared to 0.9%, respectively) (Figure HT25).

Of the reasons for revision of femoral stems with exchangeable necks, 2.0% are for implant breakage of the femoral component compared to 0.9% for fixed neck stems (Table HT27). The higher rate of revision when using stems with exchangeable necks is evident for all bearing surfaces.

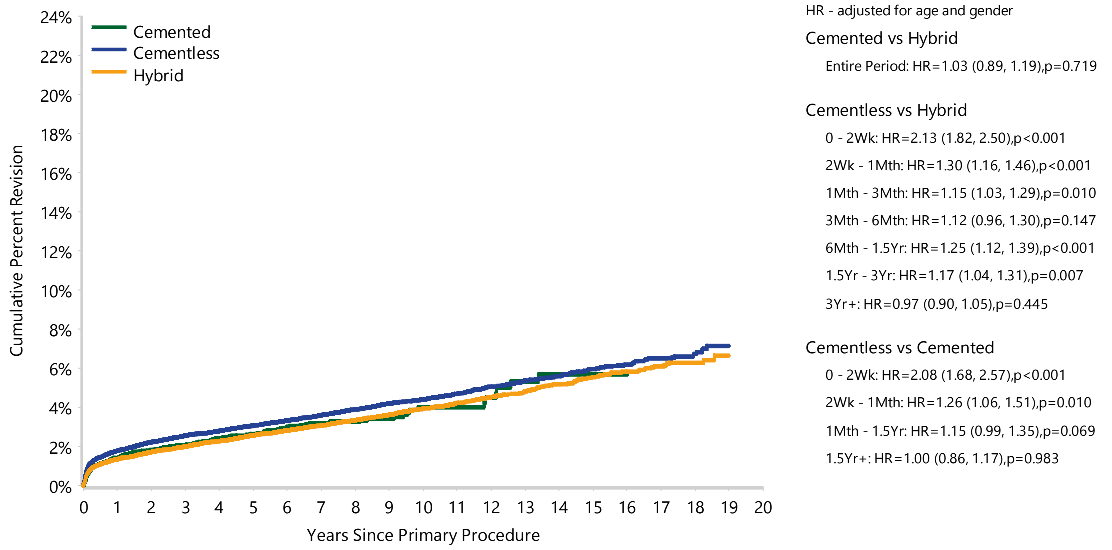
The Registry has information on 3 different exchangeable femoral neck prostheses that continue to be implanted and have been used in >30 procedures. The outcomes of each of these stems are detailed in Table HT28.

**Table HT21 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 | 191 | 6913 | 1.4 (1.2, 1.8) | 2.1 (1.8, 2.5) | 2.6 (2.3, 3.1) | 4.0 (3.3, 4.8) | 5.7 (4.3, 7.4) | |
| Cementless | 6393 | 203677 | 1.8 (1.7, 1.8) | 2.6 (2.5, 2.6) | 3.1 (3.0, 3.2) | 4.4 (4.3, 4.5) | 6.0 (5.7, 6.2) | |
| Hybrid | 3429 | 122724 | 1.3 (1.3, 1.4) | 2.0 (1.9, 2.1) | 2.6 (2.5, 2.7) | 4.0 (3.8, 4.1) | 5.5 (5.3, 5.8) | |
| TOTAL | 10013 | 333314 | | | | | | |

Note: Includes mixed ceramic/mixed ceramic and cross-linked polyethylene (XLPE) bearing surfaces
Restricted to modern prostheses

**Figure HT17 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Cemented | 6913 | 6268 | 4885 | 3602 | 644 | 136 | 0 |
| Cementless | 203677 | 178603 | 132762 | 91648 | 28365 | 5333 | 22 |
| Hybrid | 122724 | 108808 | 83275 | 60942 | 21785 | 4649 | 33 |

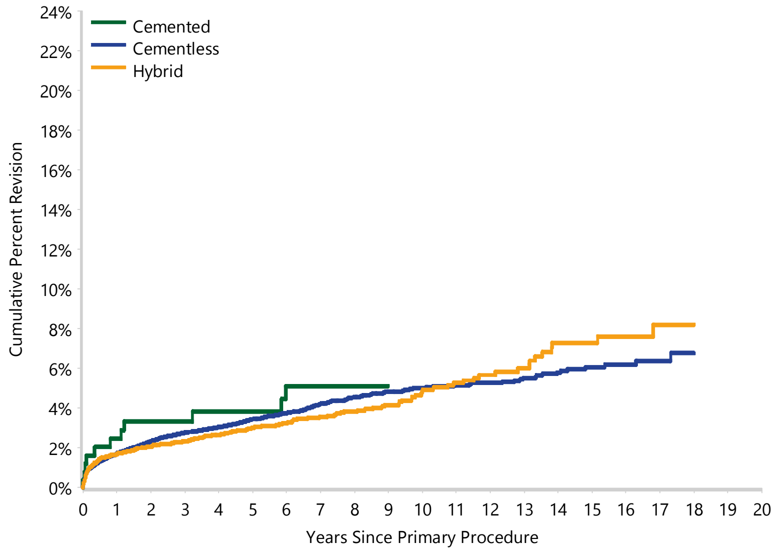
Note: Includes mixed ceramic/mixed ceramic and cross-linked polyethylene (XLPE) bearing surfaces
Restricted to modern prostheses

**Table HT22 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** | | **1169** | **33961** | **1.7 (1.6, 1.9)** | **2.7 (2.5, 2.9)** | **3.4 (3.2, 3.6)** | **5.0 (4.7, 5.3)** | **6.4 (5.9, 7.1)** | |
| | Cemented | 14 | 249 | 2.5 (1.1, 5.4) | 3.3 (1.7, 6.5) | 3.8 (2.0, 7.2) | | | |
| | Cementless | 942 | 27348 | 1.7 (1.6, 1.9) | 2.8 (2.6, 3.0) | 3.4 (3.2, 3.7) | 5.0 (4.6, 5.4) | 6.1 (5.5, 6.7) | |
| | Hybrid | 213 | 6364 | 1.7 (1.4, 2.0) | 2.3 (2.0, 2.8) | 3.0 (2.6, 3.5) | 4.8 (4.1, 5.7) | 7.3 (5.9, 8.9) | |
| **55-64** | | **2351** | **77493** | **1.5 (1.4, 1.6)** | **2.3 (2.2, 2.4)** | **2.8 (2.7, 2.9)** | **4.3 (4.1, 4.5)** | **6.0 (5.6, 6.4)** | |
| | Cemented | 26 | 744 | 1.9 (1.1, 3.2) | 2.7 (1.7, 4.1) | 2.8 (1.8, 4.4) | 4.0 (2.6, 6.0) | | |
| | Cementless | 1702 | 57503 | 1.6 (1.5, 1.7) | 2.3 (2.2, 2.4) | 2.8 (2.7, 3.0) | 4.2 (4.0, 4.5) | 5.7 (5.3, 6.2) | |
| | Hybrid | 623 | 19246 | 1.4 (1.2, 1.6) | 2.1 (1.9, 2.3) | 2.7 (2.5, 3.0) | 4.5 (4.1, 4.9) | 6.5 (5.8, 7.2) | |
| **65-74** | | **3445** | **120945** | **1.5 (1.4, 1.5)** | **2.2 (2.1, 2.3)** | **2.7 (2.6, 2.8)** | **4.0 (3.8, 4.1)** | **5.5 (5.2, 5.8)** | |
| | Cemented | 61 | 2127 | 1.2 (0.8, 1.8) | 1.9 (1.4, 2.6) | 2.5 (1.9, 3.3) | 4.2 (3.1, 5.8) | 6.3 (4.1, 9.6) | |
| | Cementless | 2173 | 75046 | 1.6 (1.6, 1.7) | 2.4 (2.2, 2.5) | 2.8 (2.7, 3.0) | 4.0 (3.8, 4.3) | 5.5 (5.1, 6.0) | |
| | Hybrid | 1211 | 43772 | 1.2 (1.1, 1.3) | 1.9 (1.7, 2.0) | 2.4 (2.3, 2.6) | 3.8 (3.6, 4.1) | 5.3 (4.9, 5.8) | |
| **≥75** | | **3048** | **100915** | **1.8 (1.7, 1.9)** | **2.5 (2.4, 2.6)** | **3.0 (2.9, 3.1)** | **4.3 (4.1, 4.4)** | **5.8 (5.4, 6.2)** | |
| | Cemented | 90 | 3793 | 1.4 (1.1, 1.8) | 2.0 (1.6, 2.5) | 2.6 (2.1, 3.3) | 3.1 (2.5, 3.9) | | |
| | Cementless | 1576 | 43780 | 2.3 (2.2, 2.5) | 3.1 (2.9, 3.2) | 3.6 (3.4, 3.8) | 5.0 (4.7, 5.3) | 7.2 (6.5, 8.0) | |
| | Hybrid | 1382 | 53342 | 1.4 (1.3, 1.5) | 2.0 (1.9, 2.2) | 2.6 (2.4, 2.7) | 3.7 (3.5, 4.0) | 4.9 (4.5, 5.4) | |
| TOTAL | | 10013 | 333314 | | | | | | |

Note: Includes mixed ceramic/mixed ceramic and cross-linked polyethylene (XLPE) bearing surfaces
Restricted to modern prostheses

**Figure HT18 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years by Fixation (Primary Diagnosis OA)**




HR - adjusted for age and gender

Cemented vs Hybrid
Entire Period: HR=1.51 (0.88, 2.59),p=0.136

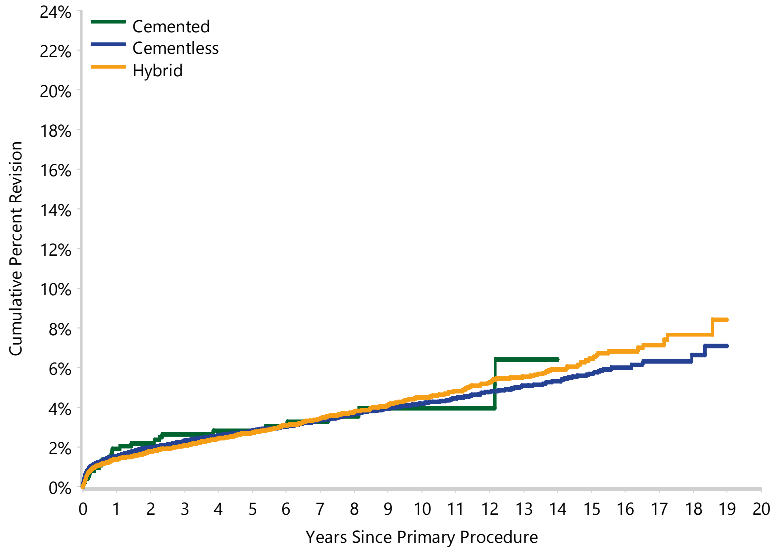
Cemented vs Cementless
Entire Period: HR=1.43 (0.85, 2.43),p=0.180

Cementless vs Hybrid
Entire Period: HR=1.05 (0.91, 1.22),p=0.505

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Cemented | 249 | 230 | 193 | 163 | 29 | 9 | 0 |
| Cementless | 27348 | 24091 | 18159 | 12687 | 4007 | 882 | 2 |
| Hybrid | 6364 | 5634 | 4311 | 3129 | 1019 | 293 | 3 |

Note: Includes mixed ceramic/mixed ceramic and cross-linked polyethylene (XLPE) bearing surfaces
Restricted to modern prostheses

**Figure HT19 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 Hybrid
Entire Period: HR=1.01 (0.68, 1.50),p=0.944

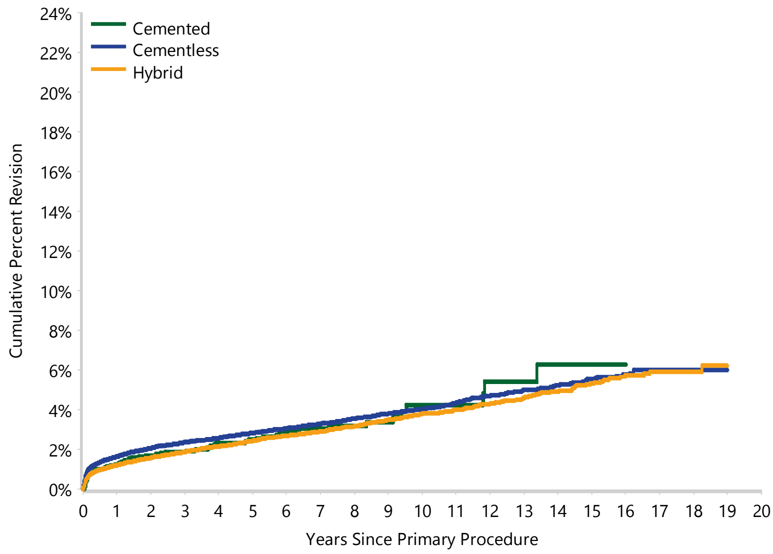
Cemented vs Cementless
Entire Period: HR=1.04 (0.71, 1.53),p=0.847

Cementless vs Hybrid
0 - 1Mth: HR=1.81 (1.40, 2.33),p<0.001
1Mth+: HR=0.88 (0.80, 0.97),p=0.010

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Cemented | 744 | 702 | 600 | 492 | 106 | 36 | 0 |
| Cementless | 57503 | 50691 | 38191 | 26831 | 8851 | 1855 | 10 |
| Hybrid | 19246 | 17144 | 13389 | 10006 | 3969 | 1076 | 9 |

Note: Includes mixed ceramic/mixed ceramic and cross-linked polyethylene (XLPE) bearing surfaces
Restricted to modern prostheses

**Figure HT20 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=1.06 (0.82, 1.38),p=0.635

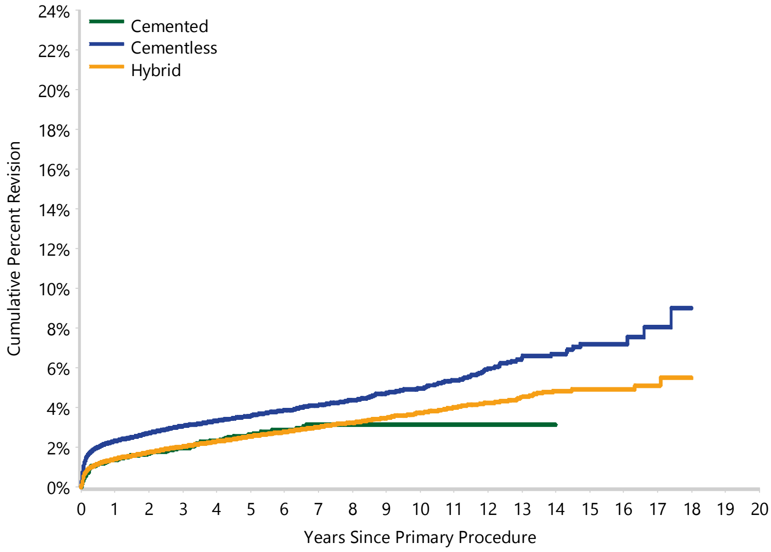
Cementless vs Hybrid
0 - 2Wk: HR=2.16 (1.62, 2.88),p<0.001
2Wk - 3Mth: HR=1.31 (1.14, 1.50),p<0.001
3Mth - 1.5Yr: HR=1.20 (1.03, 1.39),p=0.016
1.5Yr+: HR=0.94 (0.85, 1.05),p=0.259

Cementless vs Cemented
0 - 1Mth: HR=1.49 (1.11, 1.99),p=0.008
1Mth+: HR=1.00 (0.77, 1.29),p=0.996

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Cemented | 2127 | 1964 | 1617 | 1232 | 247 | 63 | 0 |
| Cementless | 75046 | 65798 | 48706 | 33645 | 10715 | 2030 | 10 |
| Hybrid | 43772 | 39071 | 30412 | 22977 | 9400 | 2285 | 18 |

Note: Includes mixed ceramic/mixed ceramic and cross-linked polyethylene (XLPE) bearing surfaces
Restricted to modern prostheses

**Figure HT21** **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=0.96 (0.77, 1.19),p=0.695

Cementless vs Hybrid

0 - 2Wk: HR=2.65 (2.07, 3.40),p<0.001

2Wk - 3Mth: HR=1.61 (1.42, 1.83),p<0.001

3Mth+: HR=1.22 (1.10, 1.34),p<0.001

Cementless vs Cemented

0 - 2Wk: HR=2.78 (2.02, 3.81),p<0.001

2Wk+: HR=1.41 (1.13, 1.74),p=0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Cemented | 3793 | 3372 | 2475 | 1715 | 262 | 28 | 0 |
| Cementless | 43780 | 38023 | 27706 | 18485 | 4792 | 566 | 0 |
| Hybrid | 53342 | 46959 | 35163 | 24830 | 7397 | 995 | 3 |

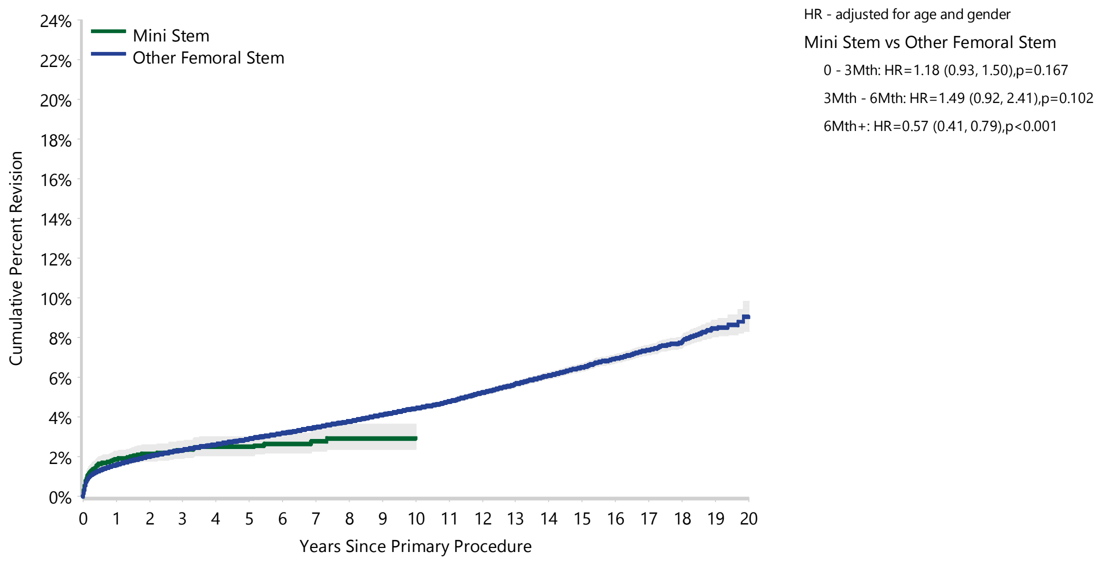
Note: Includes mixed ceramic/mixed ceramic and cross-linked polyethylene (XLPE) bearing surfaces
Restricted to modern prostheses

**Table HT23 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Stem Type (Primary Diagnosis OA)**

| Stem Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Mini Stem | 121 | 5442 | 1.9 (1.5, 2.3) | 2.3 (1.9, 2.8) | 2.5 (2.1, 3.0) | 2.9 (2.4, 3.6) | | |
| Other Femoral Stem | 11907 | 363392 | 1.6 (1.5, 1.6) | 2.3 (2.3, 2.4) | 2.9 (2.8, 3.0) | 4.4 (4.3, 4.5) | 6.5 (6.3, 6.7) | 9.0 (8.3, 9.8) |
| **TOTAL** | **12028** | **368834** | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

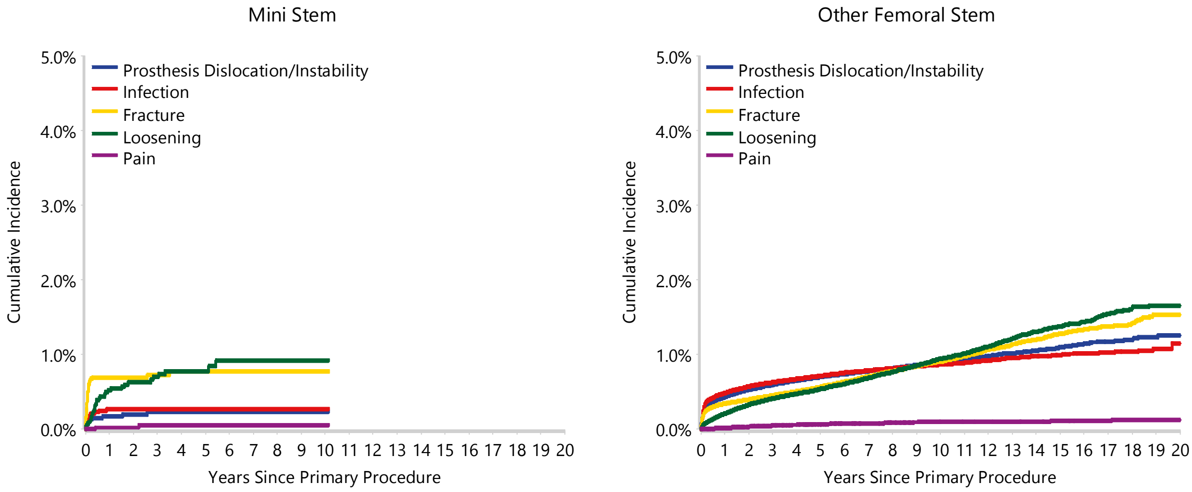
**Figure HT22 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Stem Type (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Mini Stem | 5442 | 4296 | 2496 | 1430 | 64 | 0 | 0 |
| Other Femoral Stem | 363392 | 323066 | 248694 | 181551 | 68262 | 17085 | 266 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT23** **Cumulative Incidence Revision Diagnosis of 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 HT24** **Primary Total Conventional Hip Replacement by Type of Revision and Stem Type (Primary Diagnosis OA)**

| Type of Revision | Mini Stem | | | Other Femoral Stem | | |
|---|---|---|---|---|---|---|
| | Number | % Primaries Revised | % Revisions | Number | % Primaries Revised | % Revisions |
| Femoral Component | 59 | 1.1 | 48.8 | 3859 | 1.1 | 32.4 |
| Head/Insert | 17 | 0.3 | 14.0 | 2893 | 0.8 | 24.3 |
| Acetabular Component | 22 | 0.4 | 18.2 | 2310 | 0.6 | 19.4 |
| THR (Femoral/Acetabular) | 8 | 0.1 | 6.6 | 1329 | 0.4 | 11.2 |
| Head Only | 9 | 0.2 | 7.4 | 595 | 0.2 | 5.0 |
| Cement Spacer | 3 | 0.1 | 2.5 | 481 | 0.1 | 4.0 |
| Minor Components | 1 | 0.0 | 0.8 | 216 | 0.1 | 1.8 |
| Other | 2 | 0.0 | 1.7 | 224 | 0.1 | 1.9 |
| N Revision | 121 | 2.2 | 100.0 | 11907 | 3.3 | 100.0 |
| N Primary | 5442 | | | 363392 | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT25** **Cumulative Percent Revision of Primary Total Conventional Hip Replacement using a Mini Stem by Femoral Component (Primary Diagnosis OA)**

| Femoral Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Collo-MIS | 0 | 12 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | |
| Metha | 2 | 32 | 3.1 (0.4, 20.2) | 6.4 (1.6, 23.1) | 6.4 (1.6, 23.1) | | | |
| MiniHip | 41 | 1202 | 2.5 (1.7, 3.5) | 3.2 (2.3, 4.4) | 3.6 (2.6, 5.0) | | | |
| MiniMax | 19 | 361 | 4.5 (2.8, 7.3) | | | | | |
| Nanos | 10 | 671 | 0.9 (0.4, 2.0) | 1.2 (0.6, 2.4) | 1.2 (0.6, 2.4) | 1.6 (0.8, 2.9) | | |
| Optimys | 8 | 630 | 1.0 (0.4, 2.2) | 1.2 (0.6, 2.5) | 1.6 (0.8, 3.2) | | | |
| Taperloc Microplasty | 41 | 2534 | 1.6 (1.2, 2.2) | 1.9 (1.4, 2.6) | 1.9 (1.4, 2.6) | | | |
| TOTAL | 121 | 5442 | | | | | | |

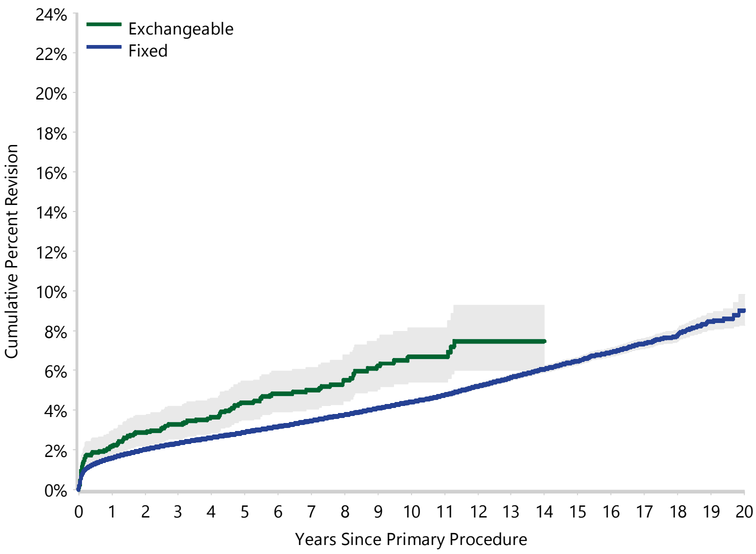
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT26** **Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Type of Femoral Neck (Primary Diagnosis OA)**

| Femoral Neck | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Exchangeable | 102 | 1875 | 2.2 (1.6, 3.0) | 3.3 (2.5, 4.2) | 4.4 (3.5, 5.4) | 6.7 (5.4, 8.2) | | |
| Fixed | 11926 | 366959 | 1.6 (1.5, 1.6) | 2.3 (2.3, 2.4) | 2.9 (2.8, 2.9) | 4.4 (4.3, 4.5) | 6.5 (6.3, 6.7) | 9.0 (8.3, 9.8) |
| TOTAL | 12028 | 368834 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT24** **Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Type of Femoral Neck (Primary Diagnosis OA)**

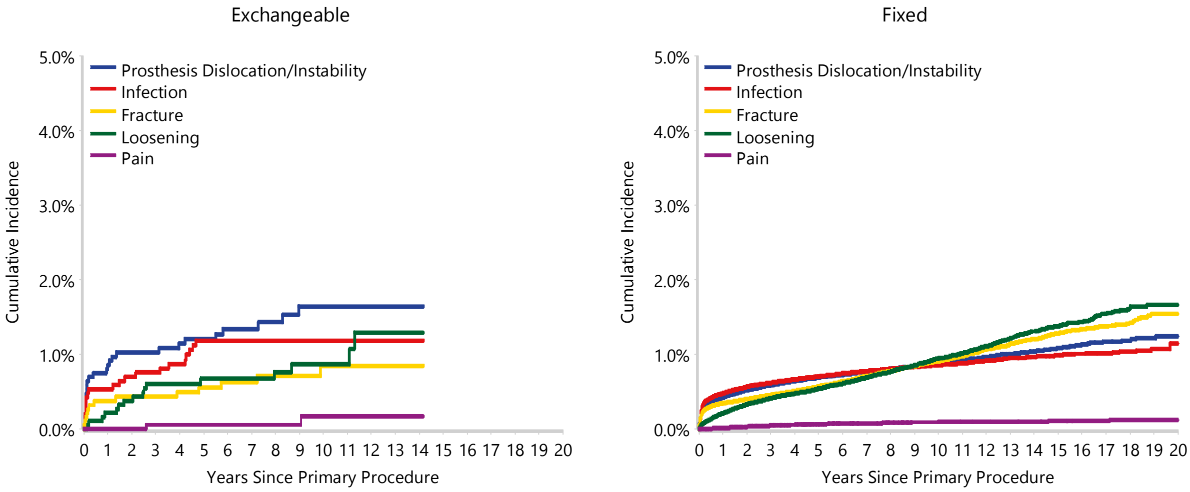



HR - adjusted for age and gender
Exchangeable vs Fixed
Entire Period: HR=1.44 (1.19, 1.75),p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Exchangeable | 1875 | 1791 | 1629 | 1350 | 544 | 2 | 0 |
| Fixed | 366959 | 325571 | 249561 | 181631 | 67782 | 17083 | 266 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT25** **Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement by Type of Femoral Neck (Primary Diagnosis OA)**




Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT27** **Primary Total Conventional Hip Replacement by Reason for Revision and Type of Femoral Neck (Primary Diagnosis OA)**

| Revision Diagnosis | Exchangeable Number | Exchangeable % Primaries Revised | Exchangeable % Revisions | Fixed Number | Fixed % Primaries Revised | Fixed % Revisions |
|---|---|---|---|---|---|---|
| Prosthesis Dislocation/Instability | 27 | 1.4 | 26.5 | 2675 | 0.7 | 22.4 |
| Infection | 21 | 1.1 | 20.6 | 2666 | 0.7 | 22.4 |
| Fracture | 13 | 0.7 | 12.7 | 2576 | 0.7 | 21.6 |
| Loosening | 16 | 0.9 | 15.7 | 2519 | 0.7 | 21.1 |
| Pain | 2 | 0.1 | 2.0 | 243 | 0.1 | 2.0 |
| Leg Length Discrepancy | 4 | 0.2 | 3.9 | 203 | 0.1 | 1.7 |
| Malposition | 4 | 0.2 | 3.9 | 177 | 0.0 | 1.5 |
| Lysis | 2 | 0.1 | 2.0 | 152 | 0.0 | 1.3 |
| Implant Breakage Stem | 2 | 0.1 | 2.0 | 103 | 0.0 | 0.9 |
| Implant Breakage Acetabular Insert | 3 | 0.2 | 2.9 | 99 | 0.0 | 0.8 |
| Incorrect Sizing | 1 | 0.1 | 1.0 | 80 | 0.0 | 0.7 |
| Wear Acetabular Insert | | | | 72 | 0.0 | 0.6 |
| Metal Related Pathology | 2 | 0.1 | 2.0 | 53 | 0.0 | 0.4 |
| Implant Breakage Acetabular | 3 | 0.2 | 2.9 | 43 | 0.0 | 0.4 |
| Wear Head | 2 | 0.1 | 2.0 | 39 | 0.0 | 0.3 |
| Implant Breakage Head | | | | 23 | 0.0 | 0.2 |
| Heterotopic Bone | | | | 20 | 0.0 | 0.2 |
| Tumour | | | | 13 | 0.0 | 0.1 |
| Wear Acetabulum | | | | 7 | 0.0 | 0.1 |
| Synovitis | | | | 1 | 0.0 | 0.0 |
| Other | | | | 162 | 0.0 | 1.4 |
| N Revision | 102 | 5.4 | 100.0 | 11926 | 3.2 | 100.0 |
| N Primary | 1875 | | | 366959 | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT28** **Cumulative Percent Revision of Primary Total Conventional Hip Replacement Using an Exchangeable Femoral Neck by Prosthesis Type (Primary Diagnosis OA)**

| Prosthesis Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Apex | 98 | 1789 | 2.2 (1.6, 3.0) | 3.3 (2.6, 4.2) | 4.4 (3.5, 5.5) | 6.6 (5.4, 8.1) | | |
| Modula | 1 | 36 | 0.0 (0.0, 0.0) | 4.8 (0.7, 29.3) | | | | |
| Profemur | 3 | 49 | 2.1 (0.3, 14.2) | 2.1 (0.3, 14.2) | 4.7 (1.2, 17.6) | 7.8 (2.5, 22.5) | | |
| Other (1) | 0 | 1 | | | | | | |
| TOTAL | 102 | 1875 | | | | | | |

Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded
Only prostheses with over 30 procedures have been listed

### Bearing Surface

Bearing surface is a combination of the material used for the femoral head and acetabular insert or cup. For this analysis, the Registry has identified 3 types of femoral head (metal, ceramic, and ceramicised metal) and 4 types of acetabular articular surface (XLPE, non XLPE, ceramic, and metal). Metal/metal bearing surface includes large head sizes >32mm and head sizes ≤32mm. The following analyses comprises all prosthesis combinations including those with no recorded use in 2020.

XLPE is classified as ultra high molecular weight polyethylene that has been irradiated by high dose (≥50kGy) gamma or electron beam radiation.

### Comparison of Bearing Surfaces

This year, the Registry is reporting on 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 10 years. As in previous years, the Registry urges caution in the interpretation of this result. 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 on the outcome, 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/XLPE has a lower rate of revision compared to metal/XLPE after 2 weeks (Table HT29 and Figure HT26). The Registry acknowledges that there may be prosthesis-specific factors that are confounders in the analysis of bearing surface.

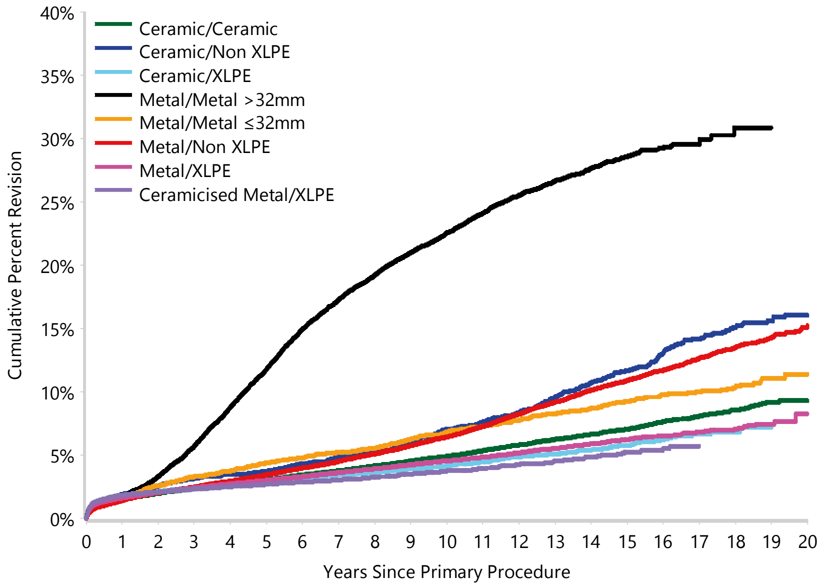
Detailed information on the analysis of metal/metal and metal/ceramic bearing surfaces are available in the supplementary reports 'Metal/Metal Bearing Surface in Total Conventional Hip Arthroplasty' and 'Prosthesis Types No Longer Used' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2021

**Table HT29 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 | 4243 | 98889 | 1.5 (1.4, 1.6) | 2.4 (2.3, 2.5) | 3.1 (3.0, 3.2) | 4.9 (4.8, 5.1) | 7.0 (6.8, 7.3) | 9.3 (8.8, 9.9) |
| Ceramic/Non XLPE | 622 | 8641 | 1.9 (1.6, 2.2) | 3.2 (2.8, 3.6) | 3.8 (3.3, 4.2) | 7.1 (6.4, 7.8) | 11.7 (10.7, 12.7) | 16.1 (14.6, 17.6) |
| Ceramic/XLPE | 2903 | 106764 | 1.7 (1.6, 1.7) | 2.5 (2.4, 2.6) | 3.0 (2.8, 3.1) | 4.2 (4.0, 4.4) | 5.8 (5.3, 6.2) | |
| Ceramic/Metal | 28 | 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) | | |
| Metal/Metal >32mm | 3546 | 14422 | 1.7 (1.5, 1.9) | 5.7 (5.3, 6.1) | 11.8 (11.3, 12.3) | 22.6 (21.9, 23.3) | 28.6 (27.7, 29.5) | |
| Metal/Metal ≤32mm | 436 | 5143 | 1.6 (1.3, 2.0) | 3.3 (2.9, 3.8) | 4.4 (3.9, 5.0) | 6.8 (6.1, 7.6) | 9.3 (8.4, 10.2) | 11.4 (10.1, 12.8) |
| Metal/Non XLPE | 2926 | 35389 | 1.4 (1.3, 1.6) | 2.5 (2.3, 2.7) | 3.5 (3.3, 3.7) | 6.4 (6.2, 6.7) | 10.9 (10.5, 11.3) | 15.2 (14.4, 16.1) |
| Metal/XLPE | 6317 | 175872 | 1.6 (1.6, 1.7) | 2.4 (2.3, 2.5) | 3.0 (2.9, 3.1) | 4.6 (4.4, 4.7) | 6.2 (6.0, 6.5) | 8.3 (7.0, 9.7) |
| Ceramicised Metal/Non XLPE | 55 | 302 | 1.7 (0.7, 4.0) | 3.7 (2.1, 6.6) | 4.1 (2.3, 7.1) | 12.7 (9.1, 17.5) | 22.3 (17.2, 28.7) | |
| Ceramicised Metal/XLPE | 829 | 28180 | 1.8 (1.7, 2.0) | 2.3 (2.2, 2.5) | 2.7 (2.5, 2.9) | 3.8 (3.5, 4.1) | 5.3 (4.7, 5.9) | |
| **TOTAL** | **21905** | **473901** | | | | | | |

Note: Excludes 225 procedures with unknown bearing surfaces, 1 procedure with ceramicised metal/ceramic bearing surface, 8 procedures with metal/ceramic bearing surface

**Figure HT26** **Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Bearing Surface (Primary Diagnosis OA)**




HR adjusted for Age and Gender

| | | | |
|---|---|---|---|
| Ceramic/Ceramic vs Metal/XLPE | Entire Period: HR=1.01 (0.97, 1.05),p=0.613 | Metal/Metal ≤32mm vs Metal/XLPE | Entire Period: HR=1.36 (1.23, 1.50),p<0.001 |
| Ceramic/XLPE vs Metal/XLPE | 0 - 2Wk: HR=1.08 (0.95, 1.23),p=0.238<br>2Wk+: HR=0.93 (0.89, 0.98),p=0.003 | Ceramicised Metal/XLPE vs Metal/XLPE | 0 - 3Mth: HR=1.20 (1.07, 1.33),p=0.001<br>3Mth+: HR=0.69 (0.63, 0.76),p<0.001 |
| Metal/Metal >32mm vs Metal/XLPE | 0 - 2Wk: HR=1.29 (0.97, 1.71),p=0.080<br>2Wk - 1Mth: HR=0.46 (0.31, 0.67),p<0.001<br>1Mth - 3Mth: HR=0.79 (0.60, 1.05),p=0.104<br>3Mth - 9Mth: HR=1.10 (0.86, 1.40),p=0.471<br>9Mth - 1.5Yr: HR=2.64 (2.23, 3.12),p<0.001<br>1.5Yr - 2Yr: HR=4.23 (3.51, 5.09),p<0.001<br>2Yr - 3Yr: HR=6.53 (5.78, 7.39),p<0.001<br>3Yr - 6Yr: HR=10.77 (10.03, 11.56),p<0.001<br>6Yr - 9.5Yr: HR=6.68 (6.15, 7.26),p<0.001<br>9.5Yr - 11.5Yr: HR=5.35 (4.72, 6.06),p<0.001<br>11.5Yr+: HR=3.24 (2.81, 3.73),p<0.001 | Metal/Non XLPE vs Metal/XLPE | 0 - 1Mth: HR=0.73 (0.62, 0.86),p<0.001<br>1Mth - 6Mth: HR=0.88 (0.76, 1.02),p=0.086<br>6Mth - 1.5Yr: HR=1.41 (1.24, 1.61),p<0.001<br>1.5Yr - 3Yr: HR=1.24 (1.08, 1.42),p=0.002<br>3Yr - 10Yr: HR=1.83 (1.70, 1.96),p<0.001<br>10Yr+: HR=2.44 (2.24, 2.66),p<0.001 |
| | | Ceramic/Non XLPE vs Metal/XLPE | 0 - 3Mth: HR=1.03 (0.84, 1.26),p=0.771<br>3Mth - 2Yr: HR=1.42 (1.18, 1.72),p<0.001<br>2Yr - 2.5Yr: HR=2.05 (1.40, 3.02),p<0.001<br>2.5Yr+: HR=2.00 (1.80, 2.22),p<0.001 |

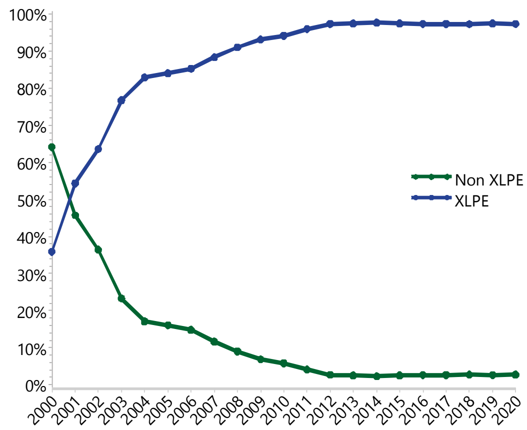
| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Ceramic/Ceramic | 98889 | 92925 | 80939 | 67064 | 30413 | 9999 | 216 |
| Ceramic/Non XLPE | 8641 | 7761 | 6343 | 5193 | 3281 | 1915 | 243 |
| Ceramic/XLPE | 106764 | 89324 | 58797 | 36094 | 9528 | 1771 | 14 |
| Metal/Metal >32mm | 14422 | 14061 | 13215 | 11979 | 9079 | 1676 | 16 |
| Metal/Metal ≤32mm | 5143 | 5021 | 4840 | 4654 | 3845 | 2110 | 73 |
| Metal/Non XLPE | 35389 | 34103 | 31670 | 28889 | 20320 | 10086 | 615 |
| Metal/XLPE | 175872 | 161073 | 132622 | 103437 | 41261 | 9766 | 60 |
| Ceramicised Metal/XLPE | 28180 | 24746 | 19367 | 14785 | 5277 | 1090 | 0 |

Note: Only bearing surfaces with over 5,000 procedures have been listed

### Cross-linked Polyethylene (XLPE)

XLPE has been used in 280,745 procedures reported to the Registry. This includes 25,126 procedures that have XLPE with the addition of an antioxidant. In 2020, when polyethylene was used as a bearing surface in primary total conventional hip procedures, the proportion of XLPE was 97.3% (Figure HT27).

**Figure HT27** **Primary Total Conventional Hip Replacement by Polyethylene Type (Primary Diagnosis OA)**




XLPE has a lower rate of revision compared to non XLPE after 9 months (Table HT30 and Figure HT28). The difference increases with time and at 20 years the cumulative percent revision is 7.8% and 18.2%, respectively. The cumulative incidence of loosening and prosthesis dislocation/instability at 20 years is 1.1% and 1.3% for XLPE, compared to 4.8% and 1.5% for non XLPE bearings, respectively (Figure HT29).

For non XLPE, there is no difference in the rate of revision between head sizes <32mm, 32mm and >32mm (Figure HT30 and Figure HT31).

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 82.5% of XLPE procedures and in only 21.2% of non XLPE procedures. The Registry has previously shown that this increased use of larger head sizes with XLPE is the reason for a reduction in revision for dislocation (Figure HT32).

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 HT33).

**At 20 years, the cumulative percent revision of total conventional hip replacement with XLPE is 7.8%.**

### Prosthesis Specific

Further analysis has been undertaken for specific acetabular prostheses that have both XLPE and non XLPE bearing options and ≥500 procedures in each group. Two prostheses fulfil these criteria. Both have a reduced rate of revision when XLPE is used.

The Reflection (Cup) has a 16 year follow-up for both types of polyethylene. XLPE has been used in 55.0% of Reflection (Cup) primary total conventional hip procedures. After 2 years, XLPE has a lower rate of revision than non XLPE (Table HT31 and Figure HT34).

The Reflection (Shell) has a 19 year follow-up with an insert using both types of polyethylene. XLPE is used in 84.3% of Reflection (Shell) primary total conventional hip procedures. XLPE has a lower rate of revision after 3 months compared to non XLPE (Table HT31 and Figure HT35).

### Prosthesis Specific (Antioxidant)

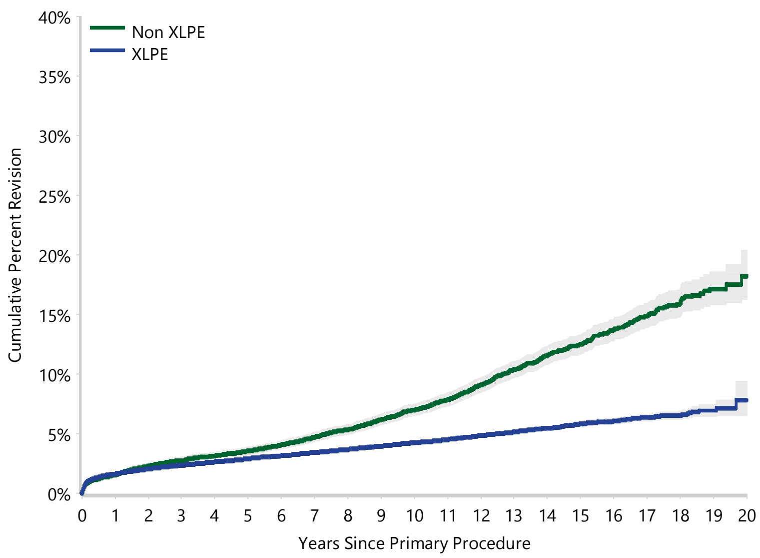
The Registry has performed a separate analysis of acetabular components that have both XLPE and XLPE with antioxidant. There has been a 19.2% increase in procedures using antioxidant compared to 2019. There were 2 components that had both types of polyethylene: Ringloc and Trinity inserts. There was no difference when comparing the rate of revision between XLPE and XLPE with antioxidant within these prostheses (Table HT32).

**Table HT30 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 | | 1194 | 16935 | 1.6 (1.4, 1.8) | 2.8 (2.5, 3.0) | 3.6 (3.3, 3.9) | 7.0 (6.5, 7.5) | 12.5 (11.7, 13.3) | 18.2 (16.3, 20.4) |
| | <32mm | 1013 | 13338 | 1.5 (1.3, 1.8) | 2.7 (2.5, 3.1) | 3.6 (3.2, 3.9) | 7.1 (6.6, 7.6) | 12.6 (11.8, 13.5) | 18.4 (16.4, 20.5) |
| | 32mm | 178 | 3532 | 1.7 (1.3, 2.1) | 2.8 (2.3, 3.4) | 3.5 (2.9, 4.2) | 6.4 (5.4, 7.6) | 10.7 (8.7, 13.1) | |
| | >32mm | 3 | 65 | 3.6 (0.9, 13.8) | 5.7 (1.9, 16.8) | 5.7 (1.9, 16.8) | | | |
| XLPE | | 8495 | 280745 | 1.6 (1.6, 1.7) | 2.4 (2.3, 2.4) | 2.9 (2.8, 3.0) | 4.3 (4.2, 4.4) | 5.8 (5.6, 6.0) | 7.8 (6.5, 9.4) |
| | <32mm | 1981 | 49091 | 1.6 (1.5, 1.7) | 2.4 (2.3, 2.6) | 3.0 (2.8, 3.2) | 4.4 (4.2, 4.7) | 6.0 (5.7, 6.3) | 8.1 (6.8, 9.7) |
| | 32mm | 3339 | 118623 | 1.6 (1.5, 1.7) | 2.3 (2.2, 2.4) | 2.8 (2.7, 2.9) | 4.0 (3.8, 4.2) | 5.3 (4.9, 5.7) | |
| | >32mm | 3175 | 113031 | 1.7 (1.6, 1.8) | 2.4 (2.3, 2.5) | 3.0 (2.9, 3.1) | 4.4 (4.2, 4.6) | 6.2 (5.6, 6.8) | |
| TOTAL | | 9689 | 297680 | | | | | | |

Note: Restricted to modern prostheses

**Figure HT28 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=0.93 (0.80, 1.08),p=0.340

3Mth - 6Mth: HR=0.80 (0.55, 1.15),p=0.225

6Mth - 9Mth: HR=1.15 (0.80, 1.65),p=0.458

9Mth - 1.5Yr: HR=1.85 (1.49, 2.28),p<0.001

1.5Yr - 2Yr: HR=1.45 (1.05, 1.99),p=0.023

2Yr - 5.5Yr: HR=1.57 (1.35, 1.82),p<0.001

5.5Yr - 7.5Yr: HR=2.61 (2.16, 3.16),p<0.001

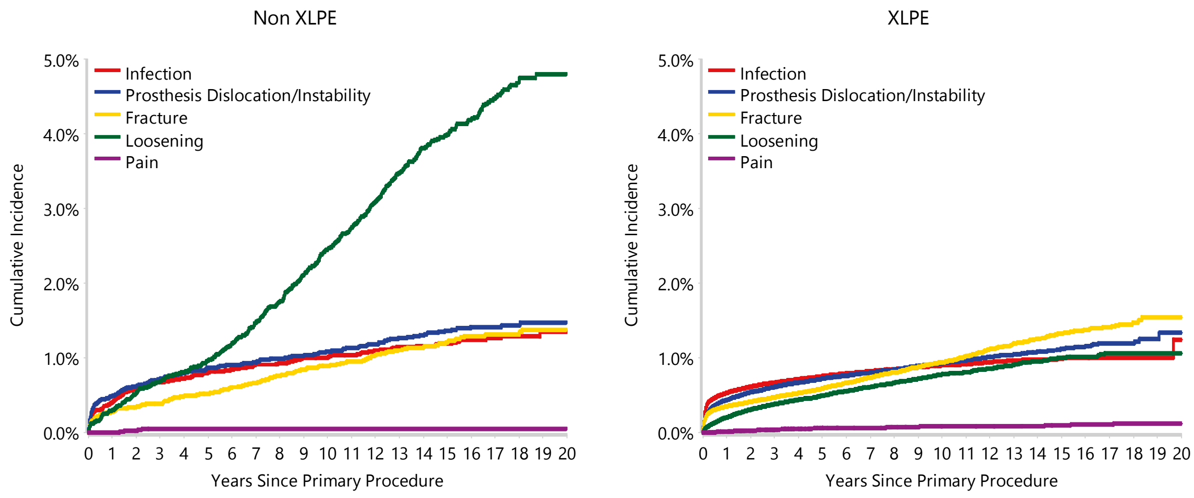
7.5Yr - 8.5Yr: HR=2.36 (1.74, 3.19),p<0.001

8.5Yr+: HR=3.70 (3.27, 4.17),p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Non XLPE | 16935 | 15599 | 13209 | 11070 | 6628 | 2484 | 95 |
| XLPE | 280745 | 245964 | 183218 | 129601 | 44113 | 9776 | 55 |

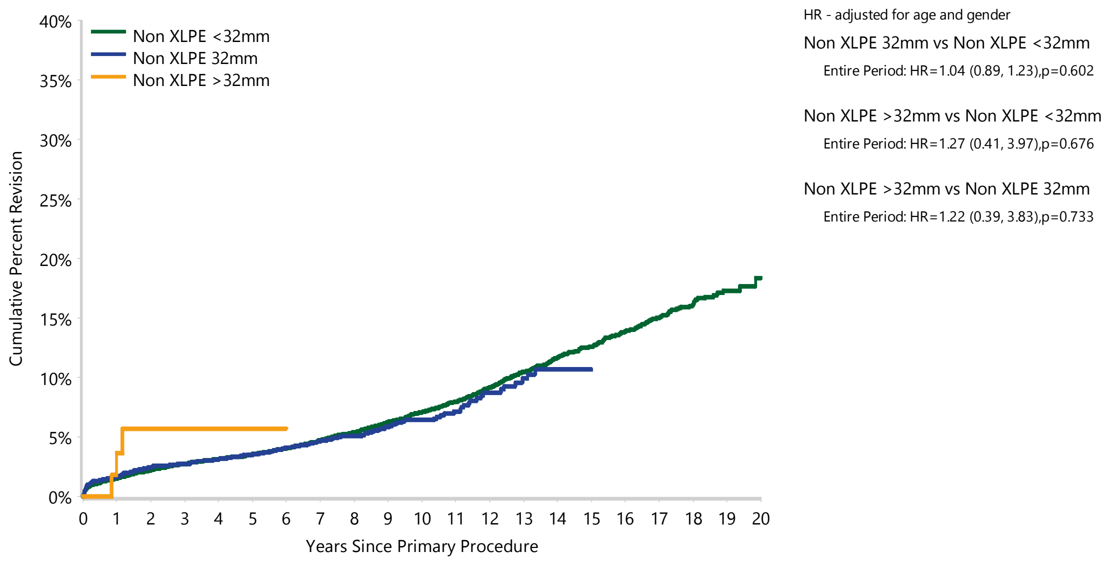
Note: Restricted to modern prostheses

**Figure HT29 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement by Polyethylene Type (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

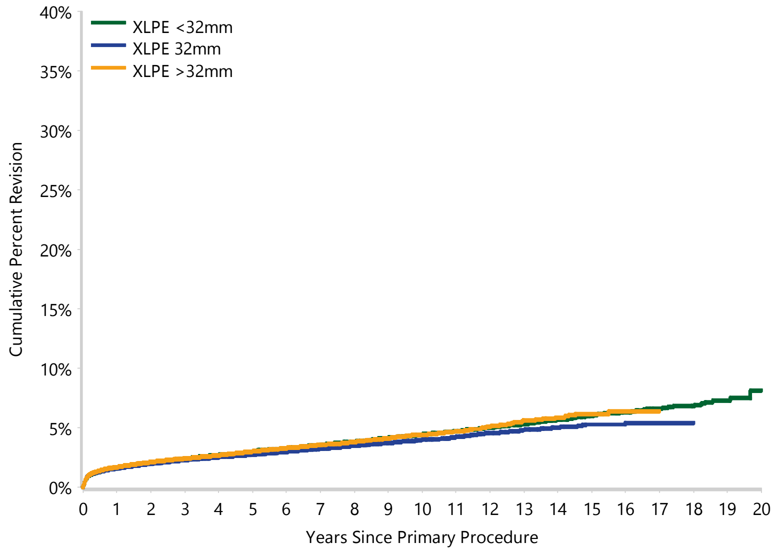
**Figure HT30 Cumulative Percent Revision of Primary Total Conventional Hip Replacement using Non XLPE by Head Size (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Non XLPE | <32mm | 13338 | 12237 | 10429 | 8842 | 5831 | 2407 | 95 |
| | 32mm | 3532 | 3309 | 2757 | 2209 | 796 | 77 | 0 |
| | >32mm | 65 | 53 | 23 | 19 | 1 | 0 | 0 |

Note: Restricted to modern prostheses

**Figure HT31** **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 - 3Mth: HR=1.01 (0.92, 1.12),p=0.782

3Mth+: HR=1.14 (1.07, 1.22),p<0.001

XLPE >32mm vs XLPE 32mm

Entire Period: HR=1.07 (1.02, 1.13),p=0.005

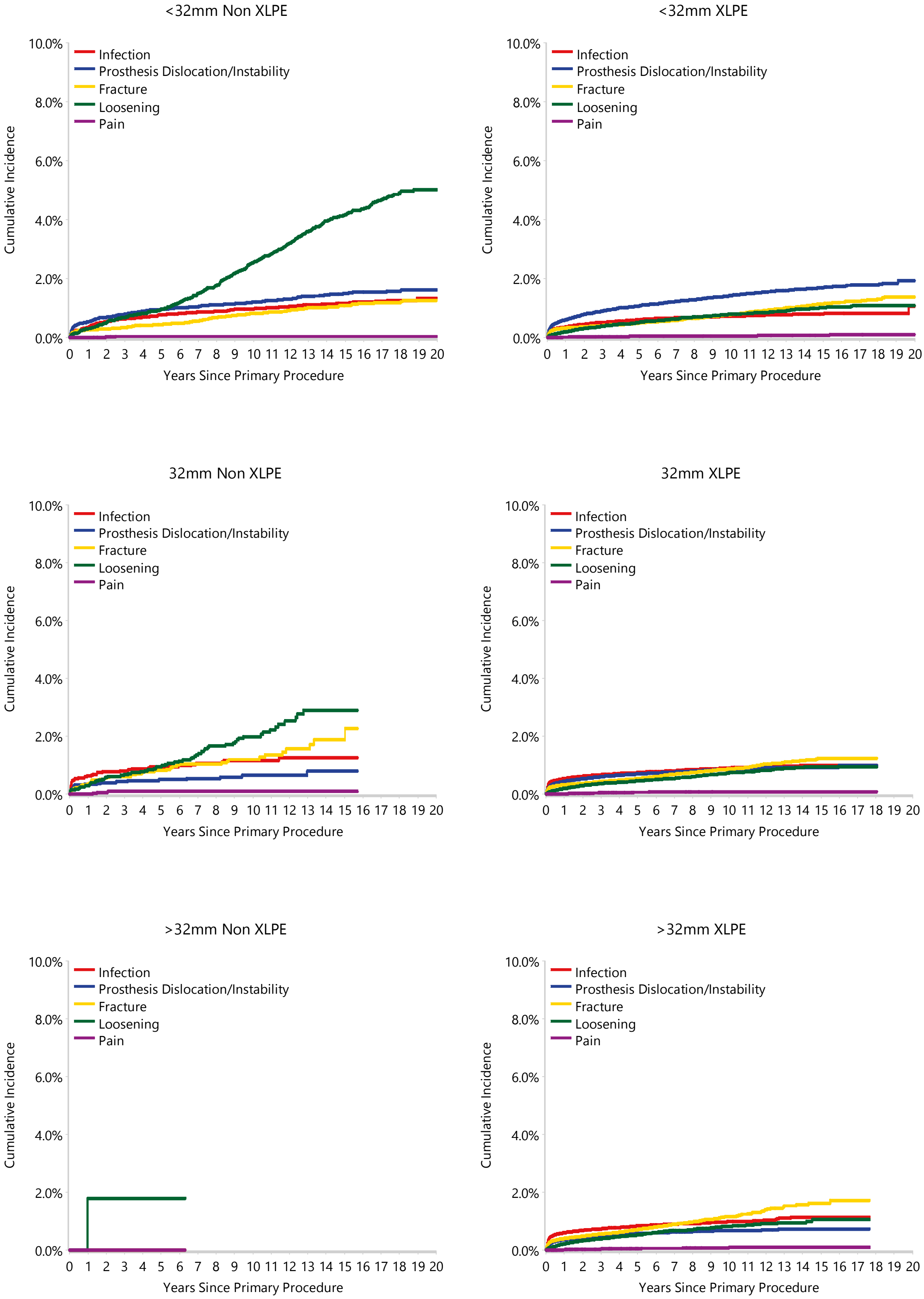
XLPE >32mm vs XLPE <32mm

Entire Period: HR=0.98 (0.93, 1.04),p=0.572

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| XLPE | <32mm | 49091 | 44505 | 37881 | 32760 | 19245 | 7642 | 54 |
| | 32mm | 118623 | 106065 | 80235 | 55249 | 14659 | 1493 | 1 |
| | >32mm | 113031 | 95394 | 65102 | 41592 | 10209 | 641 | 0 |

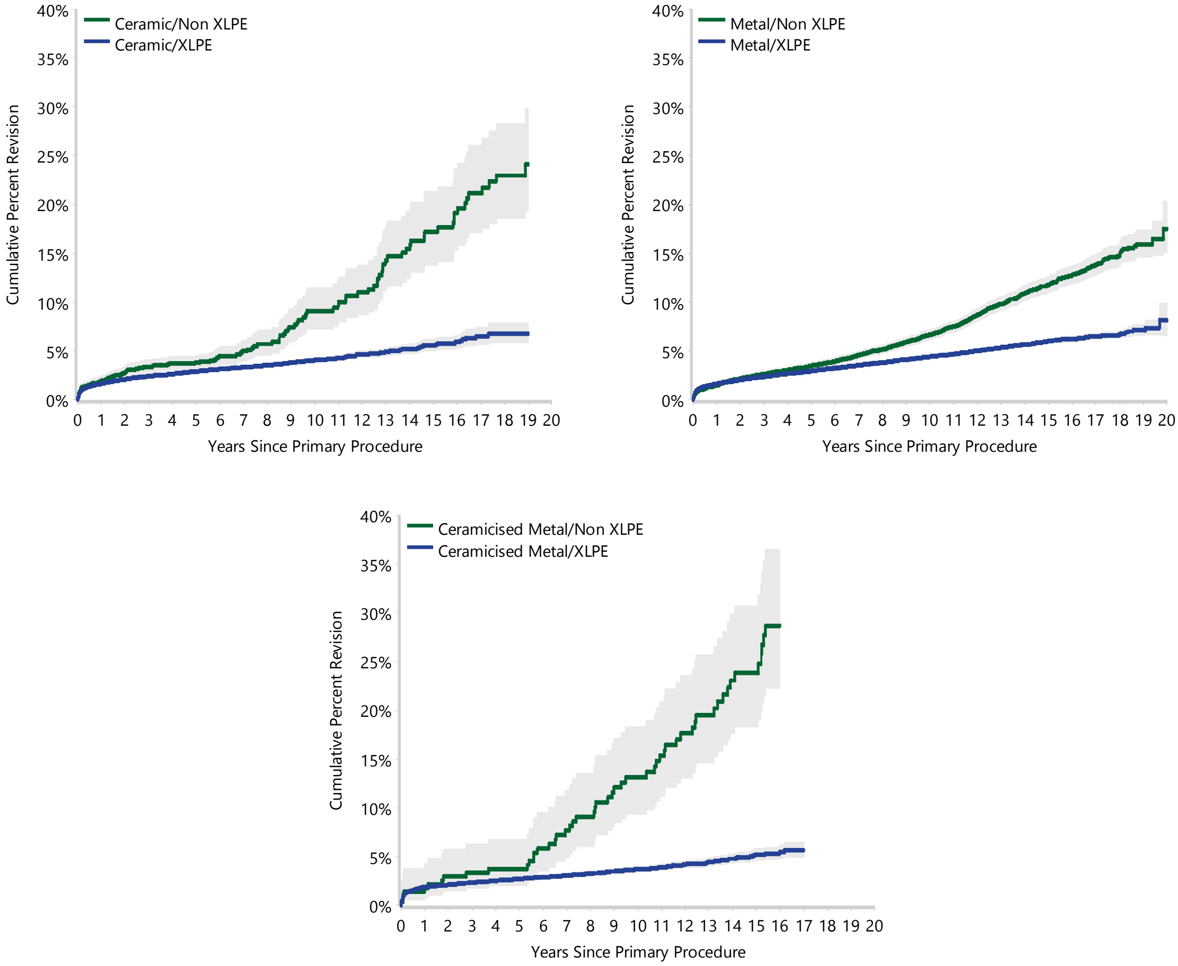
Note: Restricted to modern prostheses

**Figure HT32** **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 HT33** **Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Head Surface and Polyethylene Type (Primary Diagnosis OA)**



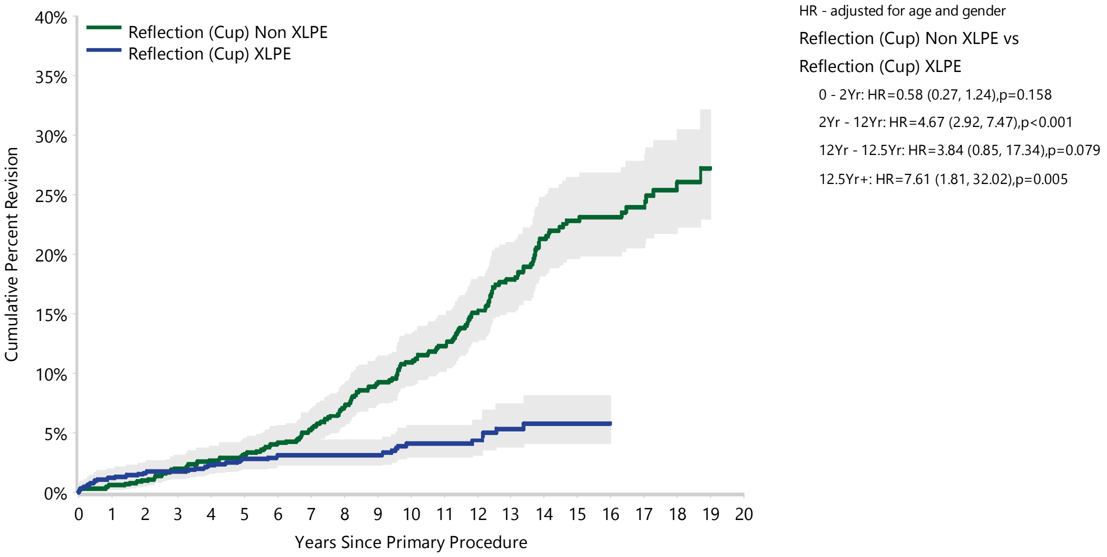

Note: Restricted to modern prostheses

**Table HT31** **Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Prosthesis Type and Polyethylene Type (Primary Diagnosis OA)**

| Prosthesis Type | Polyethylene Type | N Revised | N Total | 5 Yrs | 10 Yrs | 12 Yrs | 15 Yrs | 16 Yrs |
|---|---|---|---|---|---|---|---|---|
| Reflection (Cup) | | 202 | 2284 | 3.0 (2.4, 3.8) | 7.6 (6.4, 9.0) | 10.2 (8.7, 12.0) | 16.0 (13.8, 18.4) | 16.2 (14.0, 18.7) |
| | Non XLPE | 157 | 1027 | 3.2 (2.3, 4.6) | 10.9 (8.9, 13.3) | 15.1 (12.7, 17.9) | 22.8 (19.6, 26.5) | 23.1 (19.9, 26.8) |
| | XLPE | 45 | 1257 | 2.8 (2.0, 4.0) | 4.1 (3.0, 5.6) | 4.4 (3.2, 6.0) | 5.8 (4.1, 8.1) | 5.8 (4.1, 8.1) |
| Reflection (Shell) | | 738 | 14203 | 2.4 (2.2, 2.7) | 4.3 (3.9, 4.7) | 5.3 (4.9, 5.8) | 7.1 (6.6, 7.7) | 7.9 (7.3, 8.6) |
| | Non XLPE | 328 | 2225 | 4.4 (3.6, 5.4) | 9.8 (8.6, 11.3) | 13.2 (11.7, 14.9) | 17.4 (15.6, 19.4) | 19.3 (17.4, 21.5) |
| | XLPE | 410 | 11978 | 2.1 (1.8, 2.3) | 3.2 (2.9, 3.5) | 3.6 (3.3, 4.0) | 4.7 (4.2, 5.3) | 4.9 (4.4, 5.5) |
| TOTAL | | 940 | 16487 | | | | | |

Note: Restricted to modern prostheses

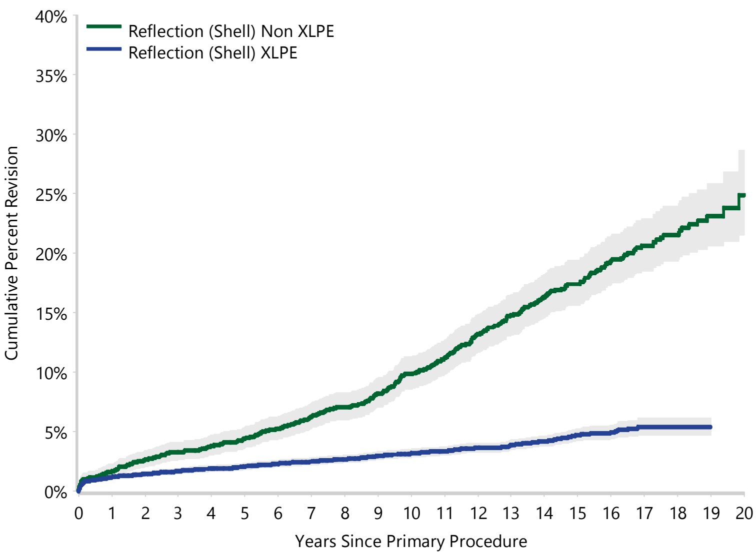
**Figure HT34** **Cumulative Percent Revision of Reflection (Cup) Primary Total Conventional Hip Replacement by Polyethylene Type (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Reflection (Cup) | Non XLPE | 1027 | 1001 | 929 | 856 | 585 | 257 | 16 |
| | XLPE | 1257 | 1186 | 1073 | 927 | 477 | 114 | 0 |

Note: Restricted to modern prostheses

**Figure HT35** **Cumulative Percent Revision of Reflection (Shell) Primary Total Conventional Hip Replacement by Polyethylene Type (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Reflection (Shell) Non XLPE | 2225 | 2147 | 2028 | 1881 | 1408 | 801 | 56 |
| XLPE | 11978 | 11619 | 10946 | 10151 | 6692 | 2112 | 5 |

Note: Restricted to modern prostheses

**Table HT32** **Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Prosthesis Type and XLPE Type (Primary Diagnosis OA)**

| Prosthesis Type | Polyethylene Type | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Ringloc | | 49 | 1952 | 1.4 (1.0, 2.0) | 1.7 (1.3, 2.4) | 2.0 (1.5, 2.7) | 2.2 (1.7, 3.0) | 2.4 (1.8, 3.2) | 3.1 (2.2, 4.2) |
| | XLPE | 29 | 1164 | 1.3 (0.8, 2.1) | 1.7 (1.1, 2.7) | 1.8 (1.2, 2.8) | 2.1 (1.4, 3.1) | 2.2 (1.5, 3.2) | 3.0 (2.1, 4.5) |
| | XLPE + Antioxidant | 20 | 788 | 1.5 (0.9, 2.7) | 1.8 (1.1, 3.0) | 2.3 (1.5, 3.6) | 2.5 (1.6, 3.9) | 2.8 (1.8, 4.3) | 2.8 (1.8, 4.3) |
| Trinity | | 270 | 14207 | 1.5 (1.3, 1.7) | 1.9 (1.7, 2.2) | 2.3 (2.1, 2.7) | 2.6 (2.2, 3.0) | 3.0 (2.5, 3.6) | |
| | XLPE | 36 | 1587 | 1.3 (0.8, 2.0) | 1.9 (1.3, 2.7) | 2.3 (1.7, 3.2) | 2.4 (1.7, 3.4) | 2.8 (1.9, 4.0) | |
| | XLPE + Antioxidant | 234 | 12620 | 1.6 (1.3, 1.8) | 1.9 (1.7, 2.2) | 2.3 (2.0, 2.7) | 2.6 (2.2, 3.1) | 3.0 (2.5, 3.7) | |
| TOTAL | | 319 | 16159 | | | | | | |

Note: Restricted to modern prostheses

### Ceramic/Ceramic Bearings

Ceramic/ceramic bearings have been used in 70,697 primary total conventional hip replacement procedures undertaken for osteoarthritis. This is the second most common bearing reported to the Registry.

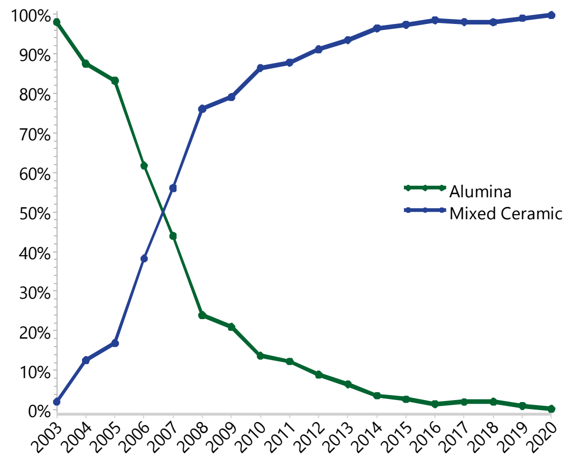
This analysis has been restricted to procedures with mixed ceramic femoral head and mixed ceramic acetabular bearing surfaces. In 2020, mixed ceramic accounted for 99.7% of all procedures with a ceramic/ceramic bearing surface (Figure HT36).

### 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. Mixed ceramic heads with head sizes ≤28mm have a higher rate of revision than 32mm heads in the first 3 months. When compared to 32mm head sizes, there is no difference in the rate of revision for 36-38mm and ≥40mm head sizes over the entire period. There is no difference in the rate of revision between 36-38mm and ≥40mm head sizes (Table HT33 and Figure HT37).

At 1 year, the cumulative incidence of prosthesis dislocation/instability is 1.7% for head sizes ≤28mm compared to 0.4% for 32mm, 0.3% for 36-38mm, and 0.2% for head sizes ≥40mm (Figure HT38).

**Figure HT36 Primary Total Conventional Hip Replacement with Ceramic Femoral Heads by Ceramic Type (Primary Diagnosis OA)**



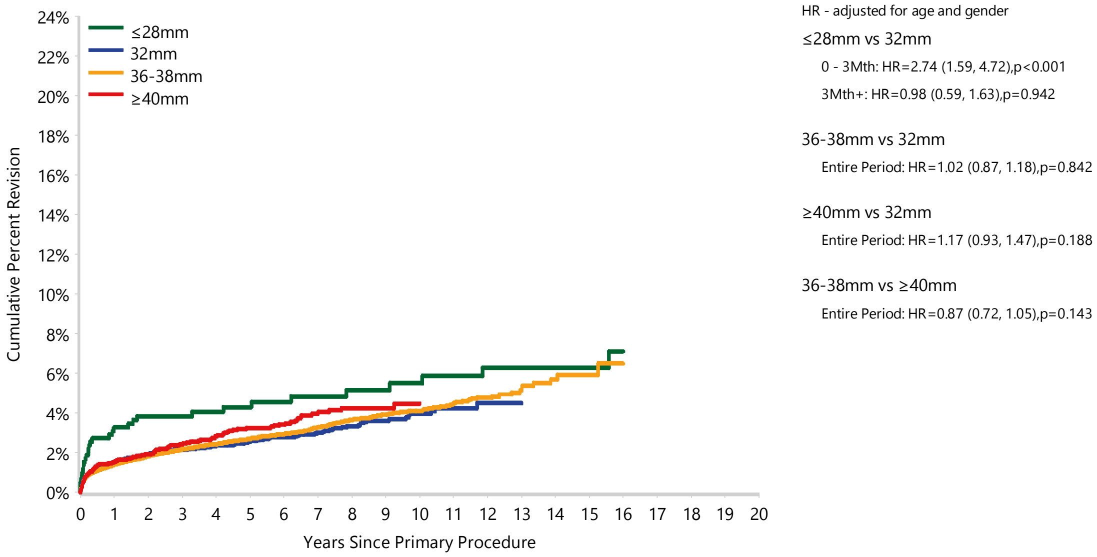

Note: Restricted to modern prostheses

**Table HT33** **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 | 31 | 594 | 3.3 (2.1, 5.1) | 3.8 (2.5, 5.8) | 4.3 (2.9, 6.4) | 5.5 (3.8, 8.0) | 6.3 (4.3, 9.0) | |
| 32mm | 240 | 9193 | 1.5 (1.3, 1.8) | 2.2 (1.9, 2.5) | 2.6 (2.2, 2.9) | 4.0 (3.4, 4.6) | | |
| 36-38mm | 1124 | 38812 | 1.4 (1.3, 1.5) | 2.2 (2.0, 2.3) | 2.7 (2.5, 2.9) | 4.1 (3.8, 4.4) | 5.9 (5.1, 6.8) | |
| ≥40mm | 123 | 3970 | 1.5 (1.2, 2.0) | 2.4 (2.0, 3.0) | 3.3 (2.7, 3.9) | 4.5 (3.6, 5.5) | | |
| **TOTAL** | **1518** | **52569** | | | | | | |

Note: Restricted to modern prostheses

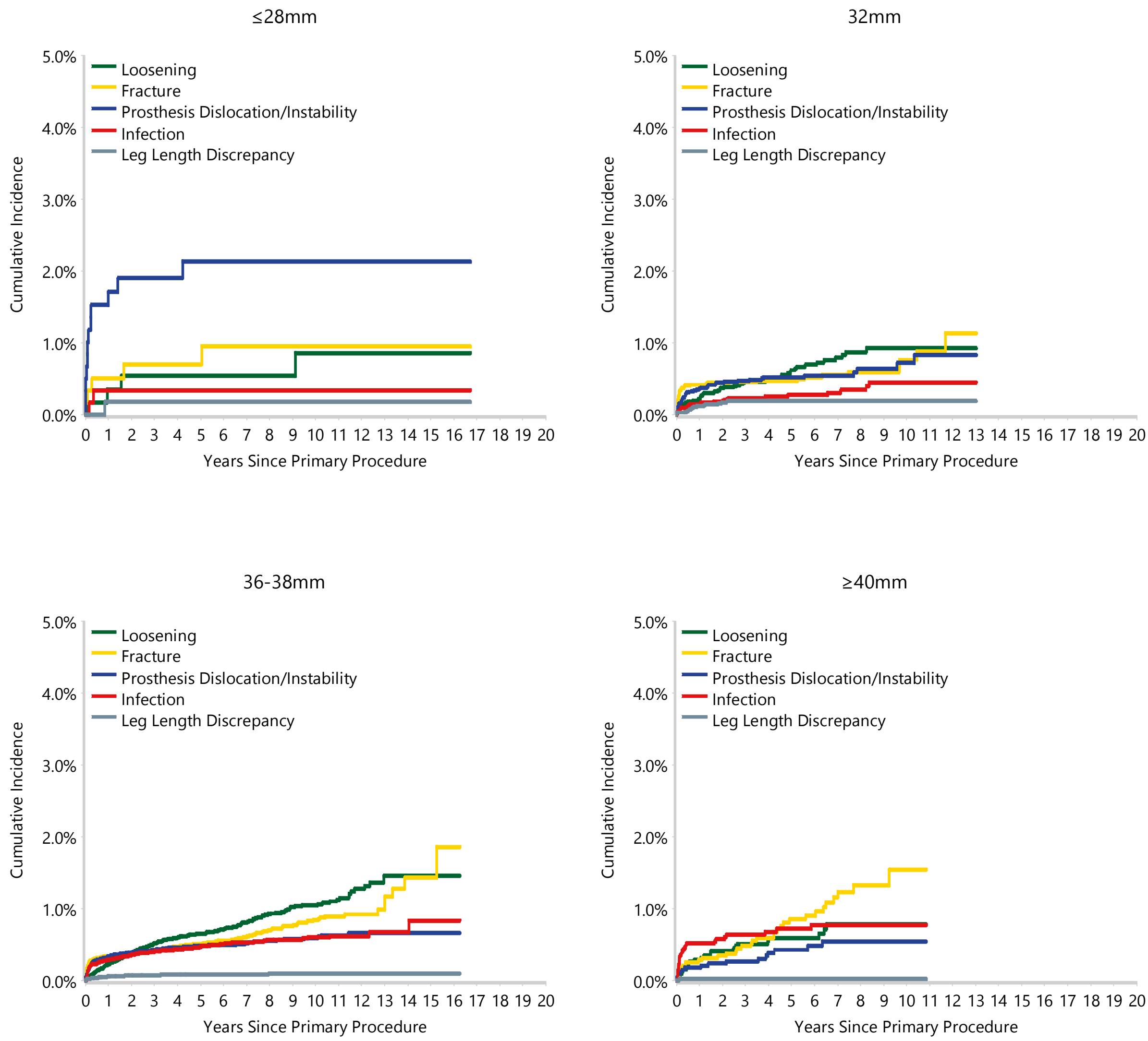
**Figure HT37** **Cumulative Percent Revision of Mixed Ceramic/Mixed Ceramic Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| ≤28mm | 594 | 531 | 442 | 384 | 256 | 129 | 0 |
| 32mm | 9193 | 8193 | 6318 | 4227 | 904 | 0 | 0 |
| 36-38mm | 38812 | 35590 | 28294 | 19980 | 5307 | 213 | 0 |
| ≥40mm | 3970 | 3401 | 2650 | 2000 | 214 | 0 | 0 |

Note: Restricted to modern prostheses

**Figure HT38** **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

### 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 803 procedures using constrained acetabular prostheses for primary total conventional hip replacement. Of these, 649 procedures were constrained acetabular inserts and 154 procedures were constrained cups. There were 92 procedures reported in 2020. This is an increase of 12.2% compared to 2019. The commonly used constrained prostheses are presented in Table HT34.

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 HT35).

When all diagnoses are included, and when used only for osteoarthritis, constrained acetabular prostheses have a higher rate of revision compared to other acetabular prostheses (Table HT36, Figure HT39, Table HT37, and Figure HT40). Gender and age <70 years and ≥70 years are not risk factors for revision (Table HT38, Figure HT41, Table HT39 and Figure HT42). 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 fixation (Table HT40 and Table HT41).

**Table HT34 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 | 3 | 77 | 4.8 (1.6, 14.2) | 4.8 (1.6, 14.2) | | | | |
| PINNACLE/PINNACLE | 6 | 122 | 2.6 (0.9, 7.9) | 4.6 (1.9, 10.8) | | | | |
| Trabecular Metal (Shell)/Longevity | 7 | 101 | 2.1 (0.5, 8.1) | 5.7 (2.4, 13.3) | 7.5 (3.4, 16.3) | | | |
| Trident (Cup) | 7 | 130 | 5.3 (2.4, 11.5) | | | | | |
| Trident (Shell)/Trident | 14 | 204 | 4.3 (2.2, 8.4) | 5.0 (2.6, 9.5) | 6.8 (3.8, 12.1) | | | |
| Other Constrained Prosthesis | 11 | 169 | 6.8 (3.7, 12.2) | 6.8 (3.7, 12.2) | 8.1 (4.5, 14.6) | | | |
| TOTAL | 48 | 803 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT35 Primary Total Conventional Hip Replacement by Primary Diagnosis and Acetabular Type**

| Primary Diagnosis | Constrained Prosthesis N | Constrained Prosthesis Col% | Other Acetabular Prosthesis N | Other Acetabular Prosthesis Col% |
|---|---|---|---|---|
| Osteoarthritis | 311 | 38.7 | 368523 | 87.9 |
| Fractured Neck Of Femur | 223 | 27.8 | 22216 | 5.3 |
| Osteonecrosis | 29 | 3.6 | 13422 | 3.2 |
| Developmental Dysplasia | 21 | 2.6 | 5447 | 1.3 |
| Rheumatoid Arthritis | 6 | 0.7 | 3418 | 0.8 |
| Tumour | 89 | 11.1 | 2262 | 0.5 |
| Failed Internal Fixation | 90 | 11.2 | 1729 | 0.4 |
| Other Inflammatory Arthritis | 6 | 0.7 | 1713 | 0.4 |
| Fracture/Dislocation | 20 | 2.5 | 542 | 0.1 |
| Arthrodesis Takedown | 4 | 0.5 | 88 | 0.0 |
| Other | 4 | 0.5 | 79 | 0.0 |
| TOTAL | 803 | 100.0 | 419439 | 100.0 |

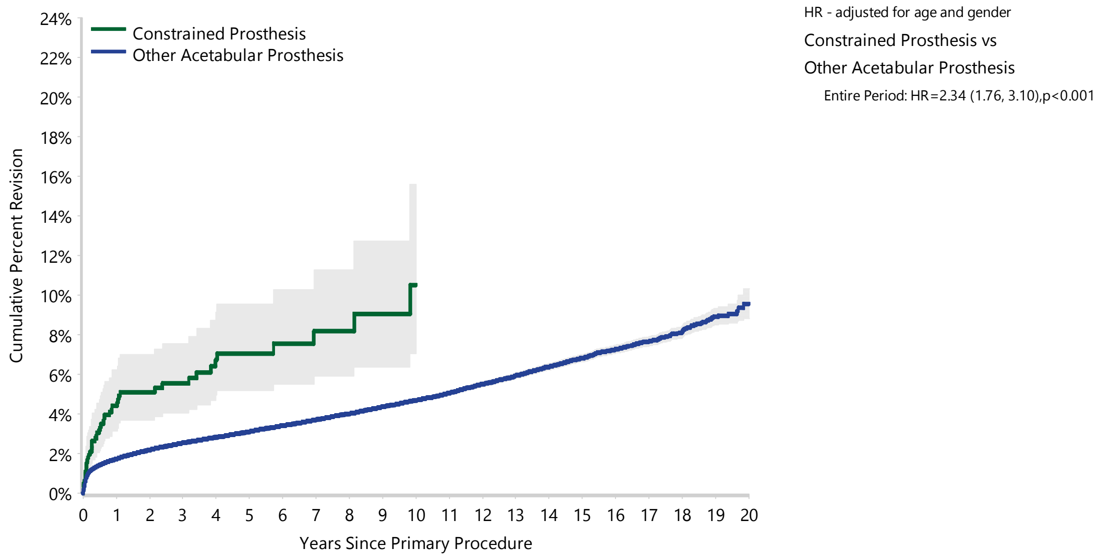
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT36 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 | 48 | 803 | 4.4 (3.2, 6.2) | 5.5 (4.0, 7.6) | 7.1 (5.2, 9.6) | 10.5 (7.0, 15.6) | | |
| Other Acetabular Prosthesis | 14462 | 419439 | 1.7 (1.7, 1.8) | 2.5 (2.5, 2.6) | 3.1 (3.1, 3.2) | 4.7 (4.6, 4.8) | 6.8 (6.7, 7.0) | 9.6 (8.8, 10.3) |
| TOTAL | 14510 | 420242 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT39 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 | 803 | 578 | 363 | 228 | 57 | 12 | 0 |
| Other Acetabular Prosthesis | 419439 | 369136 | 281029 | 203427 | 75504 | 19000 | 307 |

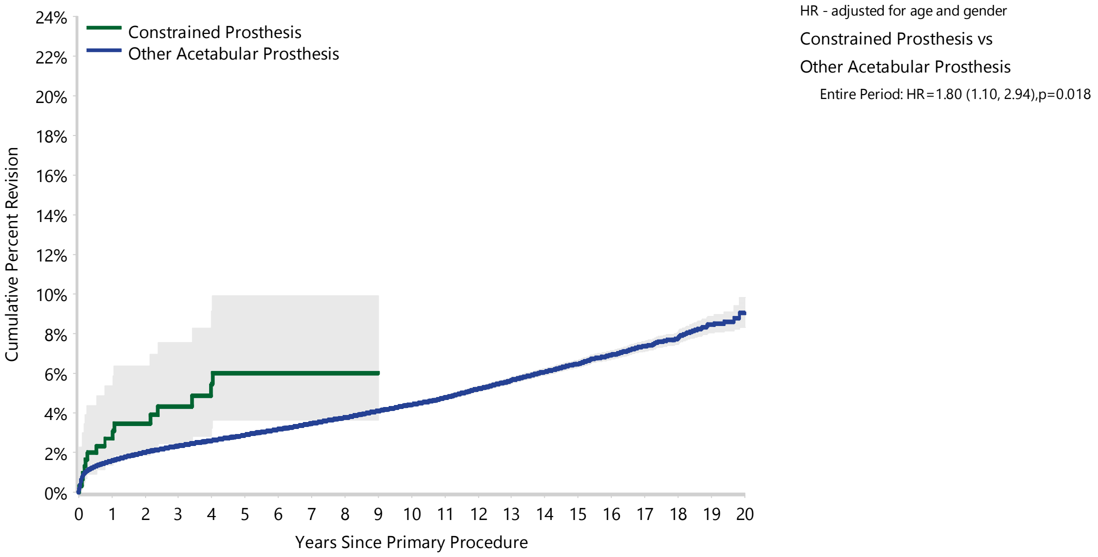
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT37 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 | 16 | 311 | 2.7 (1.4, 5.4) | 4.3 (2.5, 7.6) | 6.0 (3.6, 9.9) | | | |
| Other Acetabular Prosthesis | 12012 | 368523 | 1.6 (1.5, 1.6) | 2.3 (2.3, 2.4) | 2.9 (2.8, 3.0) | 4.4 (4.3, 4.5) | 6.5 (6.3, 6.7) | 9.0 (8.3, 9.8) |
| TOTAL | 12028 | 368834 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT40 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Type (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Constrained Prosthesis | 311 | 259 | 194 | 135 | 38 | 9 | 0 |
| Other Acetabular Prosthesis | 368523 | 327103 | 250996 | 182846 | 68288 | 17076 | 266 |

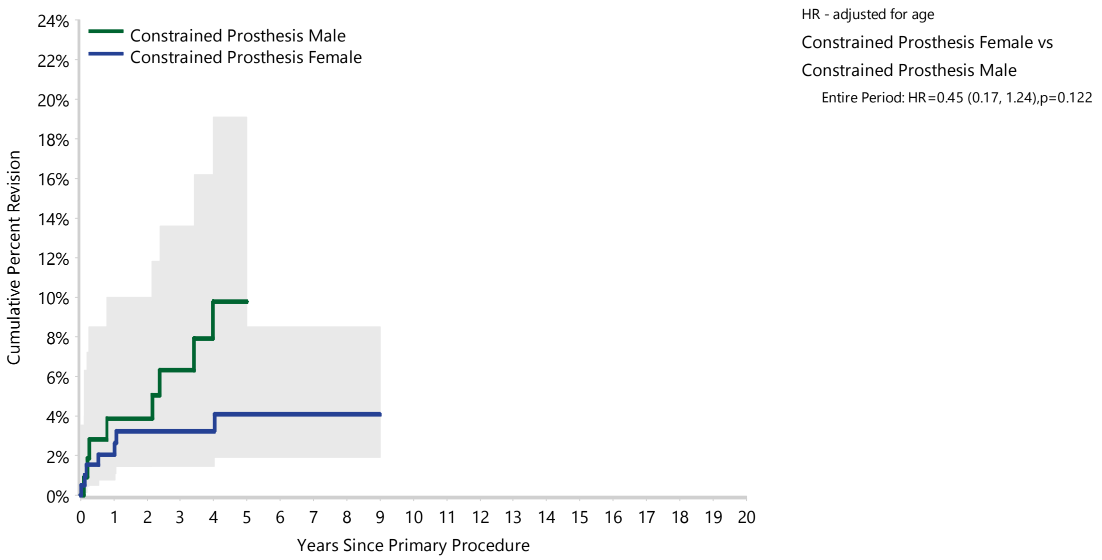
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT38 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 | 8 | 112 | 3.9 (1.5, 10.0) | 6.3 (2.9, 13.6) | 9.8 (4.9, 19.1) | | | |
| | Female | 8 | 199 | 2.1 (0.8, 5.4) | 3.2 (1.5, 7.1) | 4.1 (1.9, 8.5) | | | |
| TOTAL | | 16 | 311 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT41 Cumulative Percent Revision of Constrained 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 |
|---|---|---|---|---|---|---|---|---|
| Constrained Prosthesis | Male | 112 | 90 | 64 | 41 | 7 | 1 | 0 |
| | Female | 199 | 169 | 130 | 94 | 31 | 8 | 0 |

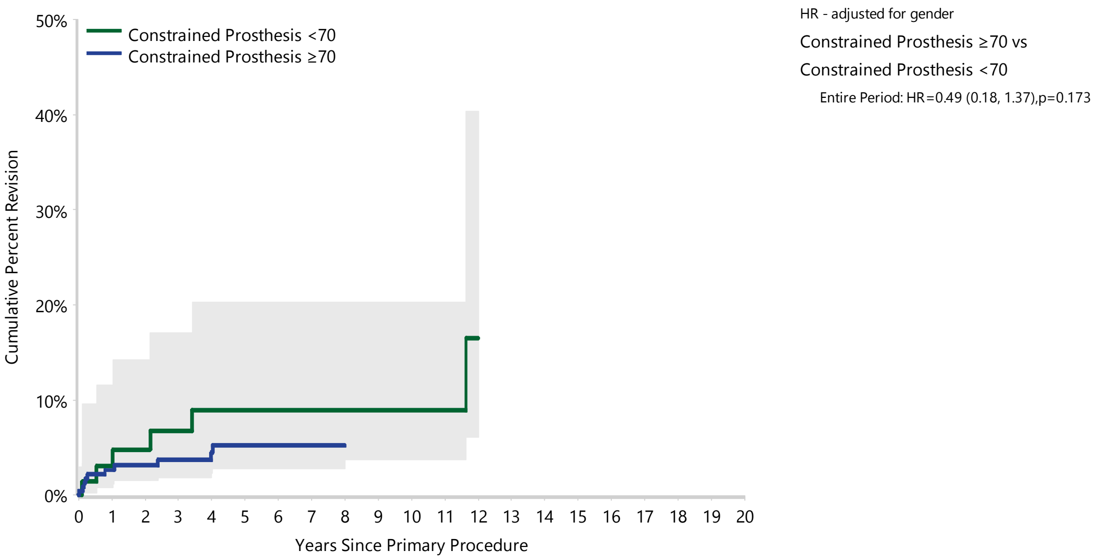
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT39 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 | 6 | 71 | 3.0 (0.8, 11.6) | 6.7 (2.6, 17.1) | 8.9 (3.8, 20.3) | 8.9 (3.8, 20.3) | | |
| | ≥70 | 10 | 240 | 2.6 (1.2, 5.8) | 3.7 (1.9, 7.3) | 5.2 (2.8, 9.7) | | | |
| TOTAL | | 16 | 311 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT42 Cumulative Percent Revision of Constrained Primary Total Conventional Hip Replacement by Age (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Constrained Prosthesis | <70 | 71 | 55 | 45 | 35 | 16 | 6 | 0 |
| | ≥70 | 240 | 204 | 149 | 100 | 22 | 3 | 0 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT40 Cumulative Percent Revision of Constrained Primary Total Conventional Hip Replacement by Acetabular Fixation (Primary Diagnosis OA)**

| Acetabular Type | Acetabular Fixation | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Constrained Prosthesis | Cementless | 16 | 279 | 3.0 (1.5, 6.0) | 4.8 (2.8, 8.4) | 6.6 (4.0, 10.8) | | | |
| | Cemented | 0 | 32 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | |
| TOTAL | | 16 | 311 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT41 Cumulative Percent Revision of Constrained Primary Total Conventional Hip Replacement with Cemented Femoral Fixation by Acetabular Fixation (Primary Diagnosis OA)**

| Acetabular Type | Acetabular Fixation | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Constrained Prosthesis | Cementless | 4 | 183 | 1.2 (0.3, 4.5) | 1.8 (0.6, 5.4) | 2.6 (1.0, 6.9) | | | |
| | Cemented | 0 | 28 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | |
| TOTAL | | 4 | 211 | | | | | | |

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.

The commonly used dual mobility prostheses are presented in Table HT42.

There has been an increasing use of these prostheses for primary hip replacement. The Registry has recorded 15,777 primary total conventional hip replacement procedures using dual mobility prostheses; an increase of 19.6% since 2019. 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 HT43).

When all diagnoses are included, dual mobility prostheses have a higher rate of revision compared to other acetabular prostheses (Table HT44 and Figure HT43).

For the diagnosis of osteoarthritis, there is no difference in the overall rate of revision when dual mobility prostheses are used (Table HT45 and Figure HT44). Dual mobility prostheses have a lower rate of revision for dislocation compared to all other acetabular prostheses (Table HT46 and Figure HT45).

Males have a higher risk of revision than females when used for a diagnosis of osteoarthritis, but age is not a risk factor for revision (Table HT47, Figure HT46, Table HT48 and Figure HT47).

The majority of dual mobility prostheses are inserted with cementless acetabular fixation. However, there is no difference in the rate of revision when acetabular fixation is compared (Table HT49 and Figure HT48). There are not enough dual mobility prostheses recorded with a cemented acetabular component to perform a comparative analysis with regards to the type of femoral fixation.

**Table HT42 Cumulative Percent Revision of Dual Mobility Primary Total Conventional Hip Replacement by Component (All Diagnoses)**

| Acetabular Component | Dual Mobility Insert | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Avantage | Avantage | 10 | 277 | 3.2 (1.6, 6.2) | 3.8 (2.0, 7.3) | | | | |
| Delta-TT | 2M | 10 | 311 | 2.4 (1.2, 5.1) | 3.3 (1.6, 6.7) | 4.8 (2.2, 10.4) | | | |
| G7 | Active Articulation | 63 | 2755 | 2.4 (1.9, 3.1) | 3.3 (2.4, 4.6) | | | | |
| Novae | Novae E | 19 | 1184 | 0.8 (0.4, 1.5) | 1.8 (1.1, 2.9) | 2.0 (1.2, 3.2) | | | |
| Novae E | Novae E | 8 | 265 | 1.9 (0.8, 4.6) | 3.5 (1.6, 7.8) | 3.5 (1.6, 7.8) | | | |
| Polarcup | Polarcup | 41 | 865 | 2.6 (1.7, 4.0) | 4.5 (3.2, 6.3) | 5.7 (4.1, 8.1) | 8.3 (5.6, 12.2) | | |
| Restoration | Restoration | 4 | 247 | 0.8 (0.2, 3.2) | 1.4 (0.4, 4.2) | 1.4 (0.4, 4.2) | | | |
| Saturne | Saturne | 19 | 832 | 1.7 (1.0, 2.8) | 2.7 (1.7, 4.4) | 3.2 (1.9, 5.1) | | | |
| Trident (Shell) | MDM (Dual Mobility) | 27 | 1093 | 1.8 (1.1, 2.8) | 3.0 (2.0, 4.4) | 3.7 (2.4, 5.7) | | | |
| | Restoration | 69 | 2763 | 1.9 (1.5, 2.5) | 2.7 (2.0, 3.4) | 3.7 (2.8, 5.0) | | | |
| Trident/Tritanium (Shell) | MDM (Dual Mobility) | 17 | 898 | 1.4 (0.8, 2.5) | 2.1 (1.3, 3.4) | 2.1 (1.3, 3.4) | | | |
| | Restoration | 39 | 917 | 3.5 (2.5, 5.0) | 4.9 (3.6, 6.8) | 5.4 (3.9, 7.6) | | | |
| Trinity | Trinity | 22 | 1858 | 1.2 (0.8, 1.8) | | | | | |
| Versafitcup DM | Versafit | 48 | 1126 | 3.4 (2.5, 4.7) | 4.9 (3.7, 6.6) | 5.5 (4.0, 7.5) | | | |
| Other (25) | | 16 | 386 | 2.5 (1.3, 4.7) | 4.1 (2.3, 7.0) | 5.9 (3.3, 10.5) | | | |
| TOTAL | | 412 | 15777 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Only prostheses with over 100 procedures have been listed.
Restricted to modern prostheses

**Table HT43 Primary Total Conventional Hip Replacement by Primary Diagnosis and Acetabular Mobility**

| Primary Diagnosis | Dual Mobility Prosthesis | | Other Acetabular Prosthesis | |
|---|---|---|---|---|
| | N | Col% | N | Col% |
| Osteoarthritis | 10763 | 68.2 | 358071 | 88.5 |
| Fractured Neck Of Femur | 3139 | 19.9 | 19300 | 4.8 |
| Osteonecrosis | 615 | 3.9 | 12836 | 3.2 |
| Developmental Dysplasia | 298 | 1.9 | 5170 | 1.3 |
| Rheumatoid Arthritis | 94 | 0.6 | 3330 | 0.8 |
| Tumour | 412 | 2.6 | 1939 | 0.5 |
| Failed Internal Fixation | 259 | 1.6 | 1560 | 0.4 |
| Other Inflammatory Arthritis | 78 | 0.5 | 1641 | 0.4 |
| Fracture/Dislocation | 97 | 0.6 | 465 | 0.1 |
| Arthrodesis Takedown | 12 | 0.1 | 80 | 0.0 |
| Other | 10 | 0.1 | 73 | 0.0 |
| TOTAL | 15777 | 100.0 | 404465 | 100.0 |

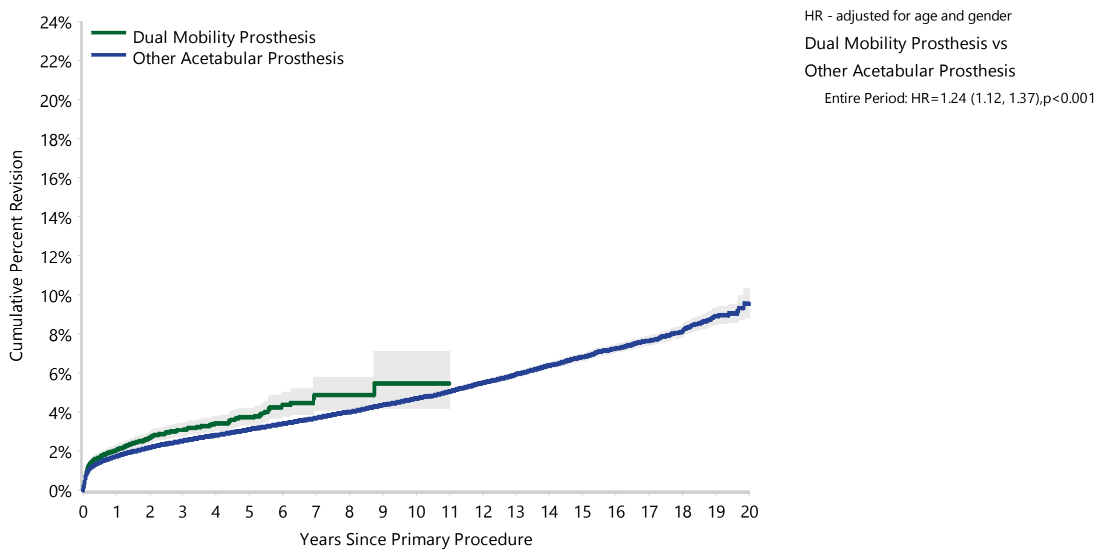
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT44 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 | 412 | 15777 | 2.1 (1.8, 2.3) | 3.1 (2.8, 3.4) | 3.7 (3.3, 4.2) | 5.5 (4.2, 7.1) | | |
| Other Acetabular Prosthesis | 14098 | 404465 | 1.7 (1.7, 1.8) | 2.5 (2.5, 2.6) | 3.1 (3.0, 3.2) | 4.7 (4.6, 4.8) | 6.8 (6.6, 7.0) | 9.5 (8.8, 10.3) |
| TOTAL | 14510 | 420242 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT43 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 | 15777 | 10724 | 4487 | 1671 | 69 | 0 | 0 |
| Other Acetabular Prosthesis | 404465 | 358990 | 276905 | 201984 | 75492 | 19012 | 307 |

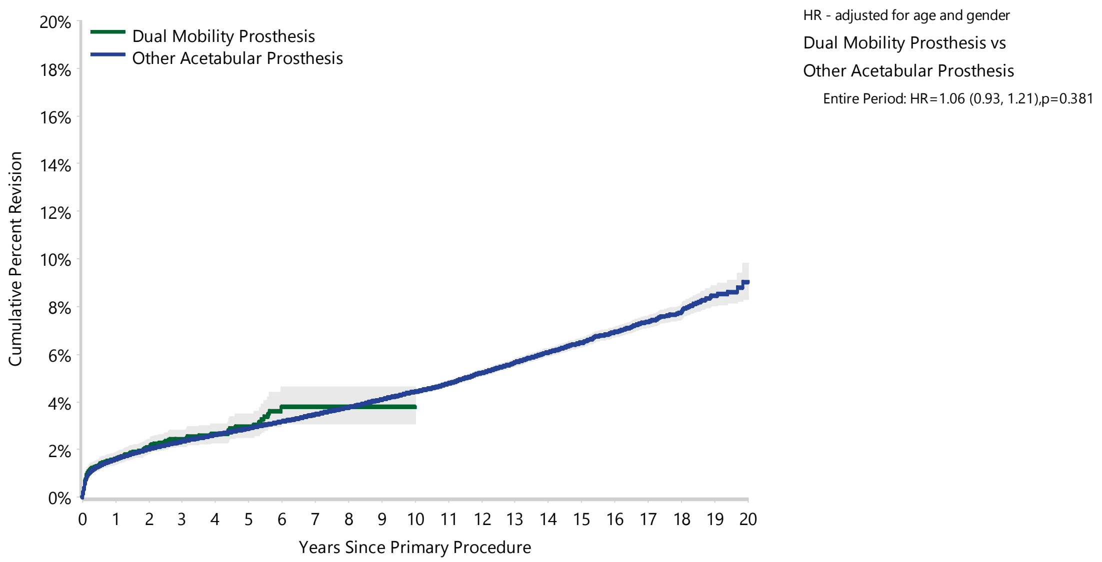
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT45 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 | 223 | 10763 | 1.6 (1.4, 1.9) | 2.5 (2.1, 2.8) | 3.0 (2.5, 3.5) | 3.8 (3.1, 4.6) | | |
| Other Acetabular Prosthesis | 11805 | 358071 | 1.6 (1.5, 1.6) | 2.3 (2.3, 2.4) | 2.9 (2.8, 3.0) | 4.4 (4.3, 4.5) | 6.5 (6.3, 6.7) | 9.0 (8.3, 9.8) |
| TOTAL | 12028 | 368834 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT44 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Mobility (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Dual Mobility Prosthesis | 10763 | 7379 | 3036 | 1116 | 40 | 0 | 0 |
| Other Acetabular Prosthesis | 358071 | 319983 | 248154 | 181865 | 68286 | 17085 | 266 |

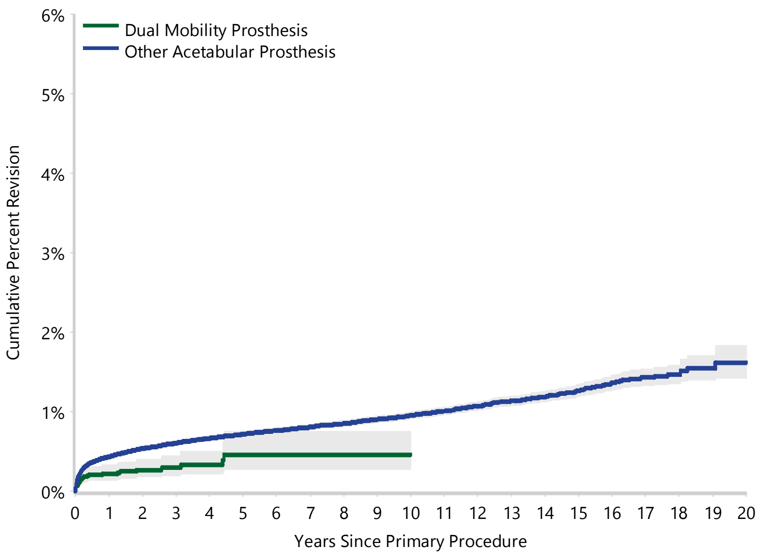
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT46** **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 | 29 | 10763 | 0.2 (0.1, 0.3) | 0.3 (0.2, 0.4) | 0.5 (0.3, 0.7) | 0.5 (0.3, 0.7) | | |
| Other Acetabular Prosthesis | 2673 | 358071 | 0.4 (0.4, 0.5) | 0.6 (0.6, 0.6) | 0.7 (0.7, 0.7) | 1.0 (0.9, 1.0) | 1.3 (1.2, 1.3) | 1.6 (1.4, 1.8) |
| TOTAL | 2702 | 368834 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT45** **Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Mobility (Primary Diagnosis OA, Revision for Prosthesis Dislocation/Instability)**




HR - adjusted for age and gender
Dual Mobility Prosthesis vs
Other Acetabular Prosthesis
Entire Period: HR=0.51 (0.35, 0.74),p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Dual Mobility Prosthesis | 10763 | 7379 | 3036 | 1116 | 40 | 0 | 0 |
| Other Acetabular Prosthesis | 358071 | 319983 | 248154 | 181865 | 68286 | 17085 | 266 |

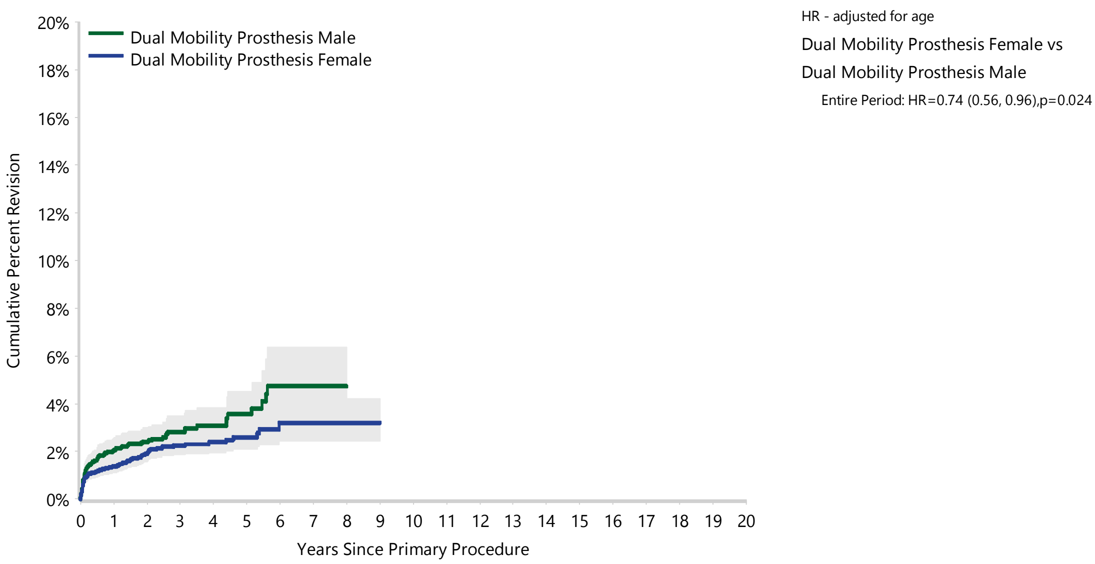
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT47** **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 | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Dual Mobility Prosthesis | Male | 100 | 4005 | 2.0 (1.6, 2.5) | 2.8 (2.3, 3.5) | 3.6 (2.8, 4.5) | | | |
| | Female | 123 | 6758 | 1.4 (1.1, 1.7) | 2.2 (1.9, 2.7) | 2.6 (2.1, 3.2) | | | |
| TOTAL | | 223 | 10763 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT46** **Cumulative Percent Revision of Dual Mobility 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 |
|---|---|---|---|---|---|---|---|---|
| Dual Mobility Prosthesis | Male | 4005 | 2745 | 1162 | 434 | 8 | 0 | 0 |
| | Female | 6758 | 4634 | 1874 | 682 | 32 | 0 | 0 |

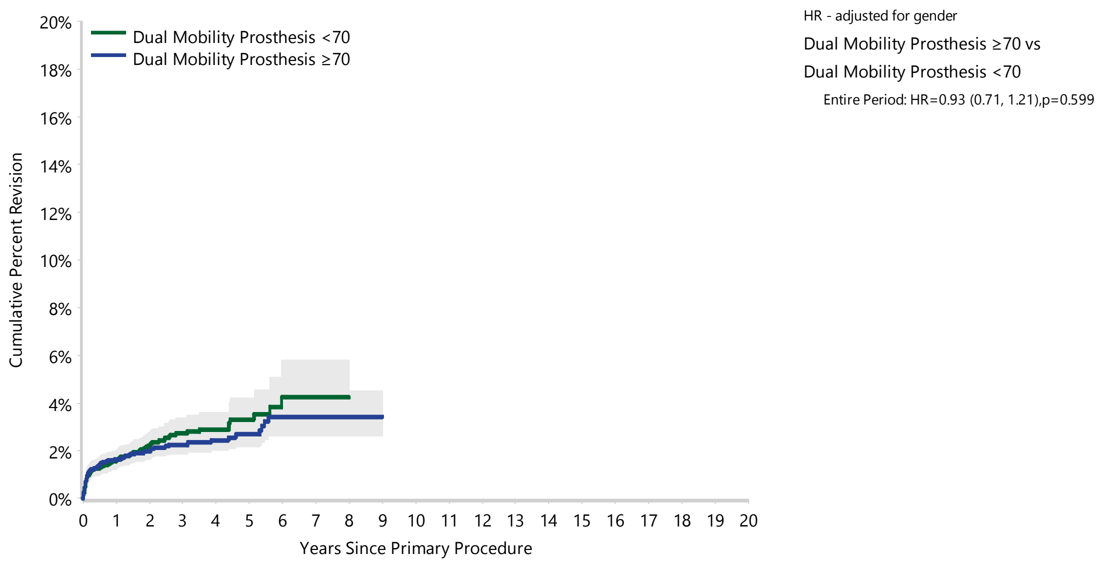
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT48** **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 | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Dual Mobility Prosthesis | <70 | 100 | 4507 | 1.6 (1.2, 2.0) | 2.7 (2.2, 3.4) | 3.3 (2.6, 4.2) | | | |
| | ≥70 | 123 | 6256 | 1.6 (1.3, 2.0) | 2.2 (1.8, 2.7) | 2.7 (2.2, 3.3) | | | |
| TOTAL | | 223 | 10763 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT47** **Cumulative Percent Revision of Dual Mobility Primary Total Conventional Hip Replacement by Age (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Dual Mobility Prosthesis | <70 | 4507 | 3140 | 1341 | 471 | 15 | 0 | 0 |
| | ≥70 | 6256 | 4239 | 1695 | 645 | 25 | 0 | 0 |

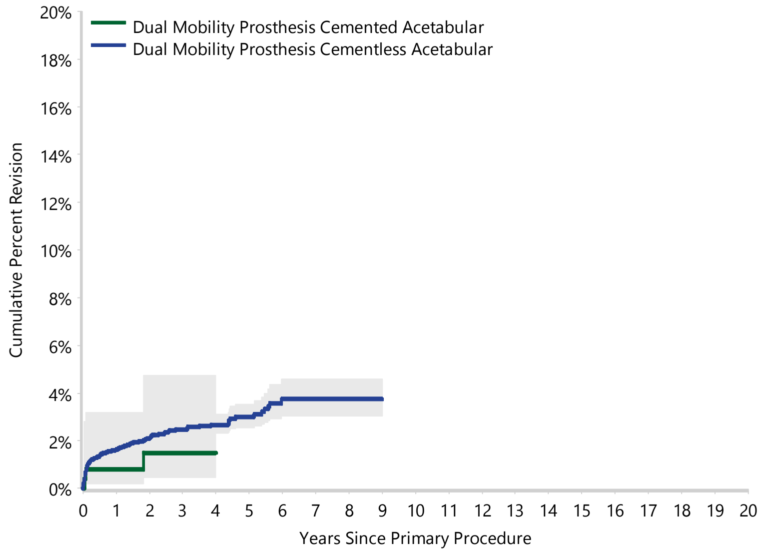
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT49** **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 | 219 | 10513 | 1.6 (1.4, 1.9) | 2.5 (2.1, 2.9) | 3.0 (2.6, 3.5) | | | |
| | Cemented | 4 | 250 | 0.8 (0.2, 3.2) | 1.5 (0.5, 4.7) | | | | |
| TOTAL | | 223 | 10763 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT48** **Cumulative Percent Revision of Dual Mobility Primary Total Conventional Hip Replacement by Acetabular Fixation (Primary Diagnosis OA)**




HR - adjusted for age and gender
Dual Mobility Prosthesis Cemented Acetabular vs
Dual Mobility Prosthesis Cementless Acetabular
Entire Period: HR=0.72 (0.27, 1.95),p=0.523

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Dual Mobility Prosthesis | Cemented Acetabular | 250 | 190 | 102 | 32 | 4 | 0 | 0 |
| | Cementless Acetabular | 10513 | 7189 | 2934 | 1084 | 36 | 0 | 0 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

## SURGICAL APPROACH

The Registry commenced collection of surgical approach in 2015 and can now report on the outcome of 51,226 anterior, 31,468 lateral, and 103,353 posterior total conventional hip replacement procedures for osteoarthritis.

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 HT50 to Table HT52).

The following analyses were performed with hazard ratios adjusted for age, gender, ASA score, BMI category, femoral fixation, and head size. There is no difference in the overall rate of revision when surgical approach is compared (Table HT53 and Figure HT49). However, there are differences in the types of revision and reasons for revision between the approaches.

There is a higher rate of major revisions with the anterior approach compared to other approaches. There is no difference between the posterior and lateral approaches (Table HT54 and Figure HT50). The most common reasons for revision of primary total hip replacement in the first 6 years include loosening, fracture, infection, and dislocation (Figure HT51).

There is a higher rate of revision for loosening with the anterior approach compared to both the posterior and lateral approaches (Table HT55 and Figure HT52).

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 and after this time a lower rate of revision for fracture (Table HT56 and Figure HT53). There is no difference when the posterior approach is compared to the lateral approach.

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 HT57 and Figure HT54).

The anterior approach has a lower rate of revision for dislocation compared to both the posterior approach and the lateral approach. There is no difference when the posterior is compared to the lateral approach (Table HT58 and Figure HT55).

**Table HT50 Primary Total Conventional Hip Replacement by Age and Surgical Approach (Primary Diagnosis OA)**

| Age | Anterior | | Lateral | | Posterior | |
|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% |
| <55 | 6445 | 12.6 | 3211 | 10.2 | 10916 | 10.6 |
| 55-64 | 13373 | 26.1 | 7278 | 23.1 | 24161 | 23.4 |
| 65-74 | 18749 | 36.6 | 11519 | 36.6 | 37619 | 36.4 |
| ≥75 | 12659 | 24.7 | 9460 | 30.1 | 30657 | 29.7 |
| **TOTAL** | **51226** | **100.0** | **31468** | **100.0** | **103353** | **100.0** |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT51 Primary Total Conventional Hip Replacement by BMI Category and Surgical Approach (Primary Diagnosis OA)**

| BMI Category | Anterior | | Lateral | | Posterior | |
|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% |
| Underweight (<18.50) | 383 | 0.8 | 214 | 0.7 | 663 | 0.7 |
| Normal (18.50-24.99) | 11971 | 24.0 | 5821 | 19.5 | 19267 | 19.5 |
| Pre Obese (25.00-29.99) | 19918 | 39.9 | 10669 | 35.7 | 35554 | 35.9 |
| Obese Class 1 (30.00-34.99) | 11780 | 23.6 | 7964 | 26.6 | 25716 | 26.0 |
| Obese Class 2 (35.00-39.99) | 4173 | 8.4 | 3522 | 11.8 | 11730 | 11.8 |
| Obese Class 3 (≥40.00) | 1649 | 3.3 | 1711 | 5.7 | 6127 | 6.2 |
| TOTAL | 49874 | 100.0 | 29901 | 100.0 | 99057 | 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 HT52 Primary Total Conventional Hip Replacement by ASA Score and Surgical Approach (Primary Diagnosis OA)**

| ASA Score | Anterior | | Lateral | | Posterior | |
|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% |
| ASA 1 | 6150 | 12.0 | 2525 | 8.0 | 8072 | 7.8 |
| ASA 2 | 28898 | 56.5 | 16654 | 53.1 | 55303 | 53.6 |
| ASA 3 | 15587 | 30.5 | 11749 | 37.4 | 38179 | 37.0 |
| ASA 4 | 511 | 1.0 | 453 | 1.4 | 1612 | 1.6 |
| ASA 5 | . | . | 1 | 0.0 | 3 | 0.0 |
| TOTAL | 51146 | 100.0 | 31382 | 100.0 | 103169 | 100.0 |

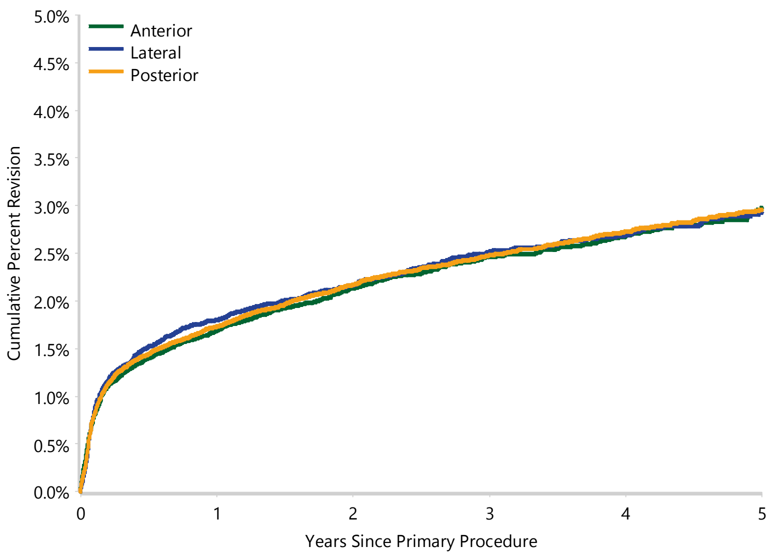
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT53** **Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Surgical Approach (Primary Diagnosis OA)**

| Surgical Approach | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|---|
| Anterior | 1106 | 49818 | 1.7 (1.6, 1.8) | 2.1 (2.0, 2.3) | 2.5 (2.3, 2.6) | 2.7 (2.5, 2.9) | 3.0 (2.8, 3.2) | |
| Lateral | 719 | 29835 | 1.8 (1.7, 2.0) | 2.2 (2.0, 2.3) | 2.5 (2.3, 2.7) | 2.7 (2.5, 2.9) | 2.9 (2.7, 3.2) | |
| Posterior | 2219 | 98932 | 1.7 (1.7, 1.8) | 2.2 (2.1, 2.3) | 2.5 (2.4, 2.6) | 2.7 (2.6, 2.8) | 3.0 (2.8, 3.1) | |
| TOTAL | 4044 | 178585 | | | | | | |

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 HT49** **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=0.99 (0.90, 1.09),p=0.777

Posterior vs Anterior
Entire Period: HR=0.99 (0.92, 1.07),p=0.761

Posterior vs Lateral
Entire Period: HR=1.00 (0.92, 1.09),p=0.957

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|
| Anterior | 49818 | 39112 | 29098 | 19843 | 11868 | 5075 | 15 |
| Lateral | 29835 | 25254 | 20590 | 15544 | 10308 | 4811 | 14 |
| Posterior | 98932 | 78021 | 57859 | 39888 | 23873 | 10348 | 24 |

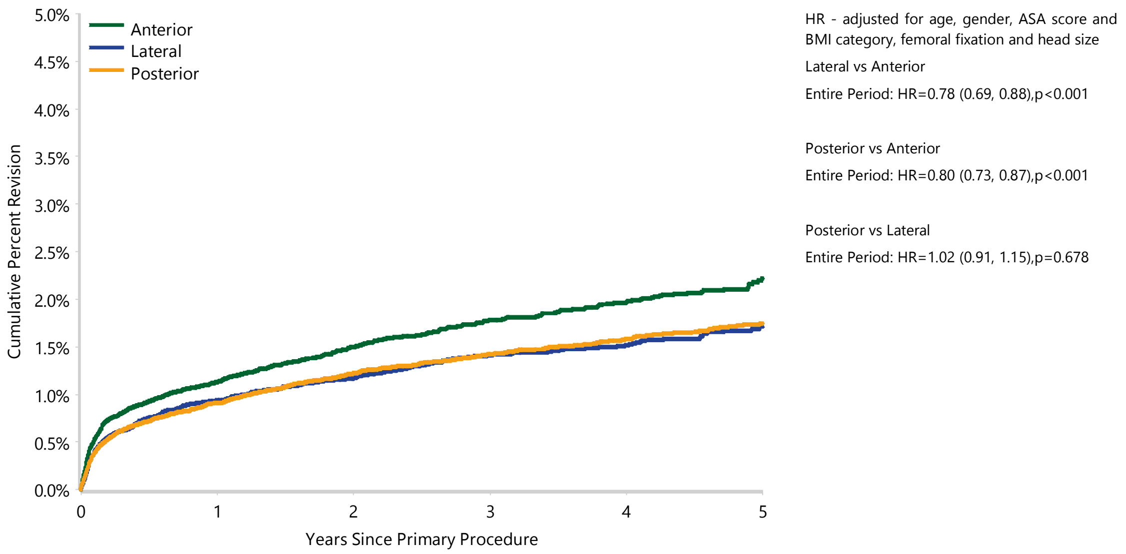
Note: All procedures using metal/metal prostheses have been excluded
Excludes procedures with unknown ASA score, BMI category or head size
Due to low numbers, ASA score 1-2 and 3-5 were combined
Due to low numbers BMI categories underweight and normal were combined
Restricted to modern prostheses

**Table HT54** **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 | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|---|
| Anterior | 791 | 49818 | 1.1 (1.0, 1.2) | 1.5 (1.4, 1.6) | 1.8 (1.7, 1.9) | 2.0 (1.8, 2.1) | 2.2 (2.0, 2.4) | |
| Lateral | 401 | 29835 | 0.9 (0.8, 1.1) | 1.2 (1.1, 1.3) | 1.4 (1.3, 1.6) | 1.5 (1.4, 1.7) | 1.7 (1.5, 1.9) | |
| Posterior | 1246 | 98932 | 0.9 (0.9, 1.0) | 1.2 (1.2, 1.3) | 1.4 (1.3, 1.5) | 1.6 (1.5, 1.7) | 1.7 (1.6, 1.9) | |
| TOTAL | 2438 | 178585 | | | | | | |

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

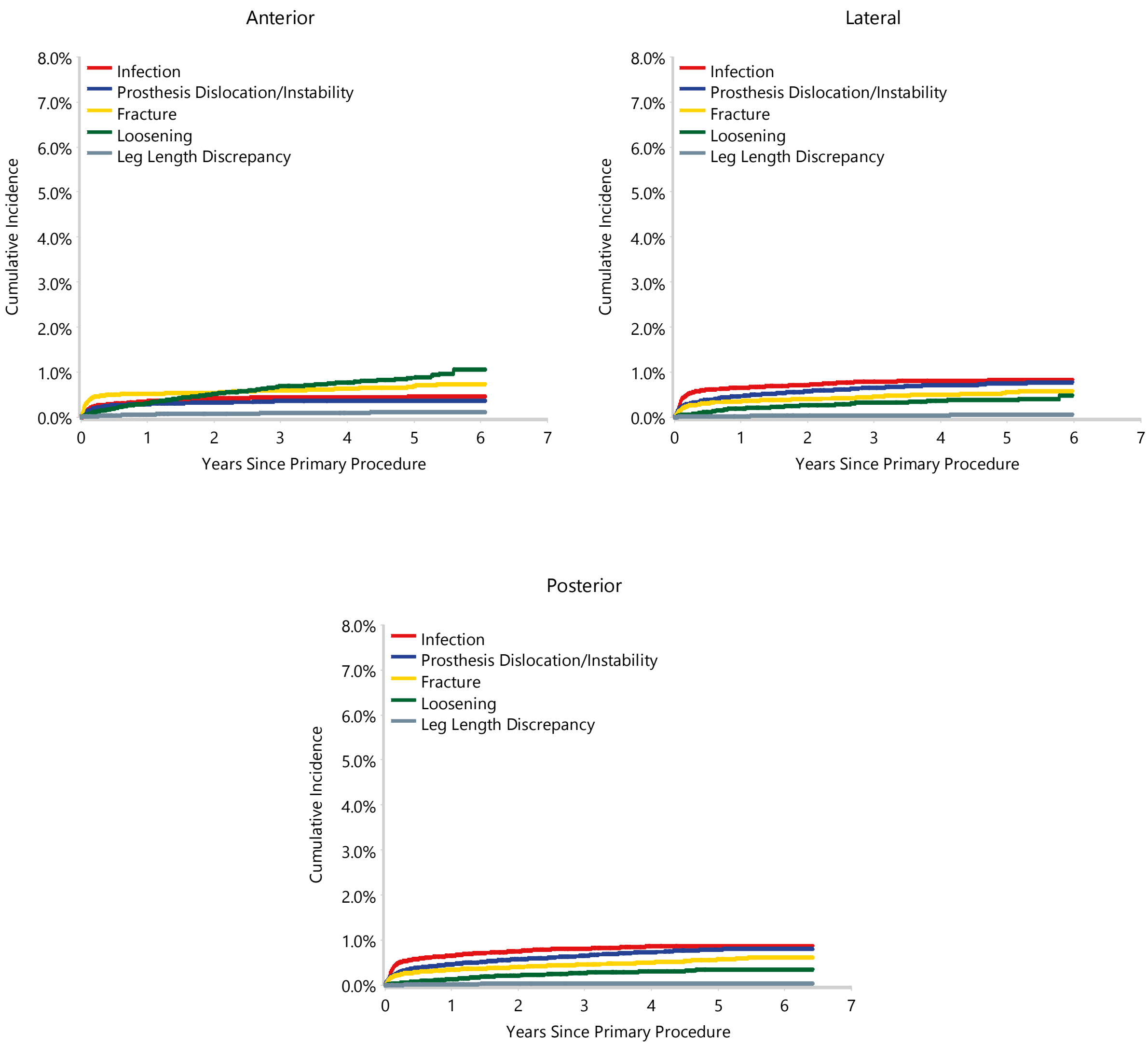
**Figure HT50** **Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Surgical Approach (Primary Diagnosis OA, Major Revisions)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|
| Anterior | 49818 | 39112 | 29098 | 19843 | 11868 | 5075 | 15 |
| Lateral | 29835 | 25254 | 20590 | 15544 | 10308 | 4811 | 14 |
| Posterior | 98932 | 78021 | 57859 | 39888 | 23873 | 10348 | 24 |

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 were combined
Due to low numbers BMI categories underweight and normal were combined

**Figure HT51 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement by Surgical Approach (Primary Diagnosis OA)**



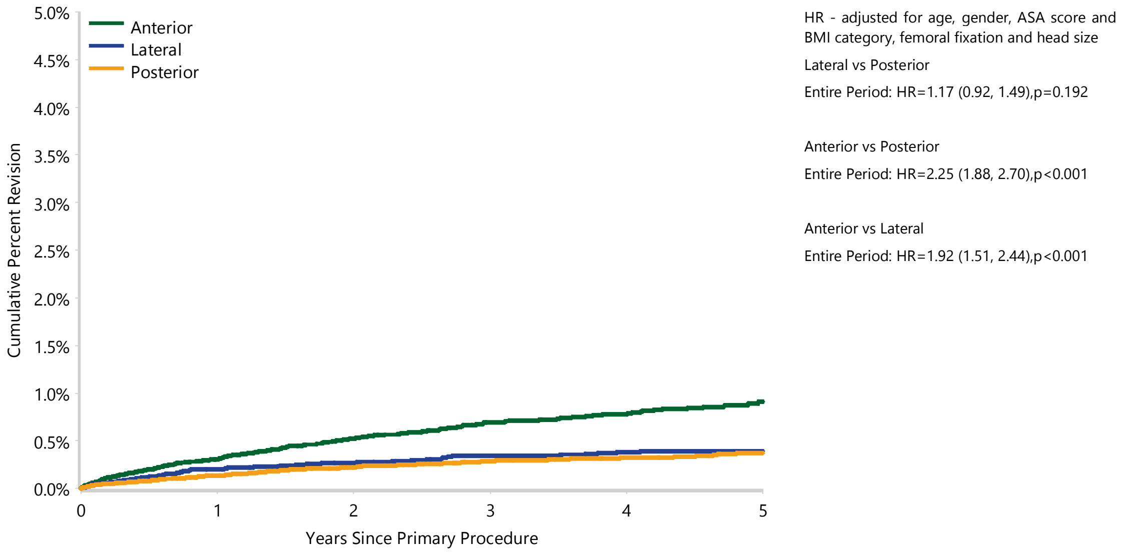

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT55** **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 | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|---|
| Anterior | 286 | 49818 | 0.3 (0.3, 0.4) | 0.5 (0.5, 0.6) | 0.7 (0.6, 0.8) | 0.8 (0.7, 0.9) | 0.9 (0.8, 1.0) | |
| Lateral | 93 | 29835 | 0.2 (0.2, 0.3) | 0.3 (0.2, 0.3) | 0.3 (0.3, 0.4) | 0.4 (0.3, 0.5) | 0.4 (0.3, 0.5) | |
| Posterior | 233 | 98932 | 0.1 (0.1, 0.2) | 0.2 (0.2, 0.3) | 0.3 (0.3, 0.3) | 0.3 (0.3, 0.4) | 0.4 (0.3, 0.4) | |
| TOTAL | 612 | 178585 | | | | | | |

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 HT52** **Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Surgical Approach (Primary Diagnosis OA, Revision for Loosening)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|
| Anterior | 49818 | 39112 | 29098 | 19843 | 11868 | 5075 | 15 |
| Lateral | 29835 | 25254 | 20590 | 15544 | 10308 | 4811 | 14 |
| Posterior | 98932 | 78021 | 57859 | 39888 | 23873 | 10348 | 24 |

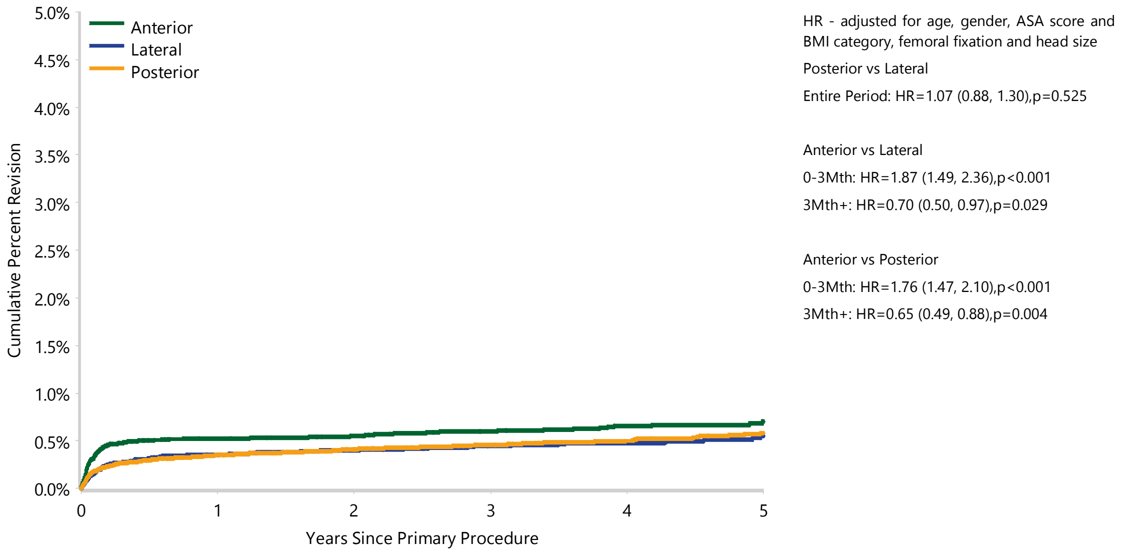
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses
Excludes procedures with unknown ASA score, BMI category or head size
Due to low numbers, ASA scores 1-2 and 3-5 were combined
Due to low numbers, BMI categories underweight and normal were combined

**Table HT56** **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 | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|---|
| Anterior | 289 | 49818 | 0.5 (0.5, 0.6) | 0.5 (0.5, 0.6) | 0.6 (0.5, 0.7) | 0.7 (0.6, 0.7) | 0.7 (0.6, 0.8) | |
| Lateral | 131 | 29835 | 0.4 (0.3, 0.4) | 0.4 (0.3, 0.5) | 0.5 (0.4, 0.5) | 0.5 (0.4, 0.6) | 0.5 (0.5, 0.7) | |
| Posterior | 424 | 98932 | 0.3 (0.3, 0.4) | 0.4 (0.4, 0.5) | 0.5 (0.4, 0.5) | 0.5 (0.5, 0.6) | 0.6 (0.5, 0.7) | |
| TOTAL | 844 | 178585 | | | | | | |

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 HT53** **Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Surgical Approach (Primary Diagnosis OA, Revision for Fracture)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|
| Anterior | 49818 | 39112 | 29098 | 19843 | 11868 | 5075 | 15 |
| Lateral | 29835 | 25254 | 20590 | 15544 | 10308 | 4811 | 14 |
| Posterior | 98932 | 78021 | 57859 | 39888 | 23873 | 10348 | 24 |

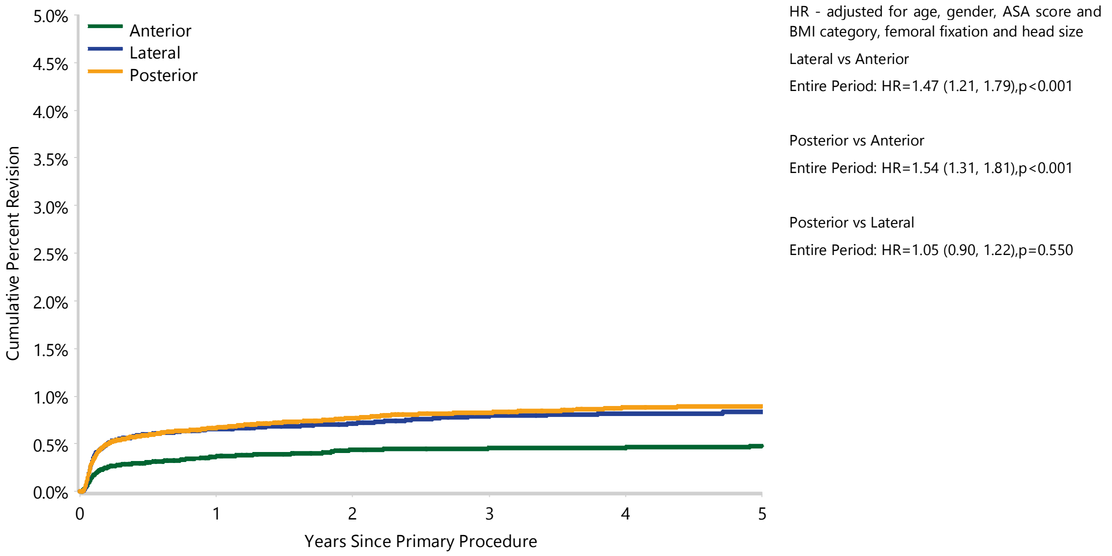
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses
Excludes procedures with unknown ASA score, BMI category or head size
Due to low numbers, ASA scores 1-2, and 3-5 were combined
Due to low numbers, BMI categories underweight and normal were combined

**Table HT57 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 | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|---|
| Anterior | 202 | 49818 | 0.4 (0.3, 0.4) | 0.4 (0.4, 0.5) | 0.5 (0.4, 0.5) | 0.5 (0.4, 0.5) | 0.5 (0.4, 0.6) | |
| Lateral | 222 | 29835 | 0.7 (0.6, 0.8) | 0.7 (0.6, 0.8) | 0.8 (0.7, 0.9) | 0.8 (0.7, 0.9) | 0.8 (0.7, 1.0) | |
| Posterior | 751 | 98932 | 0.7 (0.6, 0.7) | 0.8 (0.7, 0.8) | 0.8 (0.8, 0.9) | 0.9 (0.8, 1.0) | 0.9 (0.8, 1.0) | |
| TOTAL | 1175 | 178585 | | | | | | |

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 HT54 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Surgical Approach (Primary Diagnosis OA, Revision for Infection)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|
| Anterior | 49818 | 39112 | 29098 | 19843 | 11868 | 5075 | 15 |
| Lateral | 29835 | 25254 | 20590 | 15544 | 10308 | 4811 | 14 |
| Posterior | 98932 | 78021 | 57859 | 39888 | 23873 | 10348 | 24 |

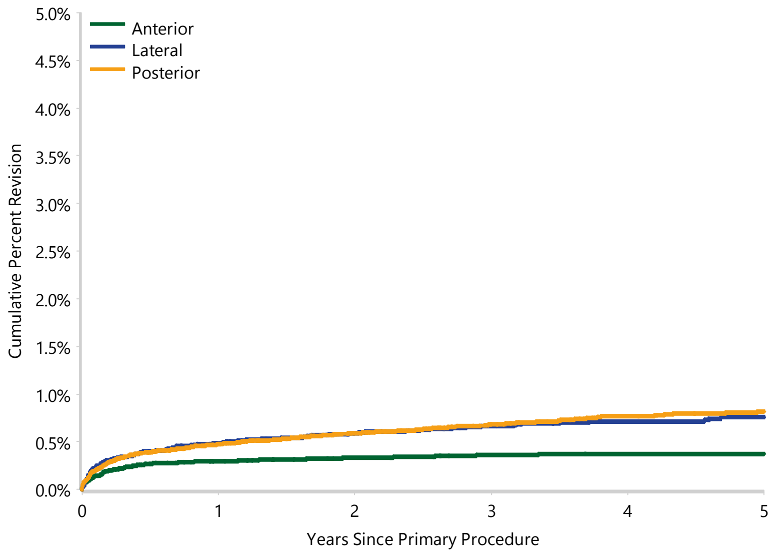
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses
Excludes procedures with unknown ASA score, BMI category or head size
Due to low numbers, ASA scores 1-2 and 3-5 were combined
Due to low numbers, BMI categories underweight and normal were combined

**Table HT58 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 | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|---|
| Anterior | 162 | 49818 | 0.3 (0.3, 0.4) | 0.3 (0.3, 0.4) | 0.4 (0.3, 0.4) | 0.4 (0.3, 0.4) | 0.4 (0.3, 0.4) | |
| Lateral | 188 | 29835 | 0.5 (0.4, 0.6) | 0.6 (0.5, 0.7) | 0.7 (0.6, 0.8) | 0.7 (0.6, 0.8) | 0.8 (0.6, 0.9) | |
| Posterior | 604 | 98932 | 0.5 (0.4, 0.5) | 0.6 (0.5, 0.6) | 0.7 (0.6, 0.7) | 0.8 (0.7, 0.8) | 0.8 (0.7, 0.9) | |
| TOTAL | 954 | 178585 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT55 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=1.48 (0.97, 2.25),p=0.066
2wk-1Mth: HR=1.96 (1.28, 2.99),p=0.001
1Mth-6Mth: HR=1.31 (0.93, 1.82),p=0.118
6Mth+: HR=2.77 (1.90, 4.04),p<0.001

Posterior vs Anterior
0-3Mth: HR=1.49 (1.19, 1.85),p<0.001
3Mth-9Mth: HR=1.54 (1.10, 2.16),p=0.011
9Mth+: HR=3.67 (2.55, 5.29),p<0.001

Posterior vs Lateral
Entire Period: HR=1.05 (0.89, 1.24),p=0.551

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|
| Anterior | 49818 | 39112 | 29098 | 19843 | 11868 | 5075 | 15 |
| Lateral | 29835 | 25254 | 20590 | 15544 | 10308 | 4811 | 14 |
| Posterior | 98932 | 78021 | 57859 | 39888 | 23873 | 10348 | 24 |

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 scores 1-2 and 3-5 were combined
Due to low numbers, BMI categories underweight and normal were combined

## OUTCOME FOR FRACTURED NECK OF FEMUR

There have been 22,439 primary total conventional hip replacement procedures recorded by the Registry with a diagnosis of fractured neck of femur.

The cumulative percent revision of primary total conventional hip replacement for fractured neck of femur is 9.7% at 15 years (Table HT59 and Figure HT56).

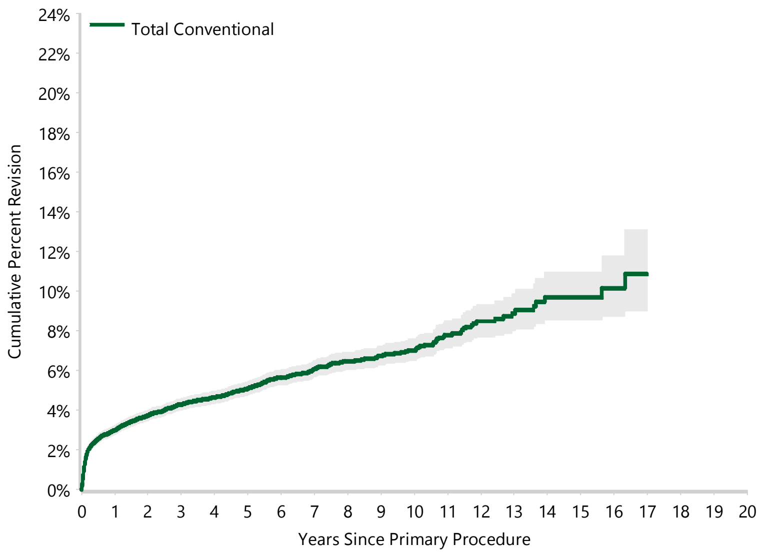
At 15 years, the cumulative percent survival of patients is 29.5% (Table HT60 and Figure HT57).

**Table HT59 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 | 1050 | 22439 | 3.0 (2.8, 3.2) | 4.3 (4.0, 4.6) | 5.1 (4.8, 5.4) | 7.0 (6.5, 7.6) | 9.7 (8.5, 11.0) | |
| TOTAL | 1050 | 22439 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT56 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 | 22439 | 18018 | 12042 | 7490 | 1859 | 258 | 1 |

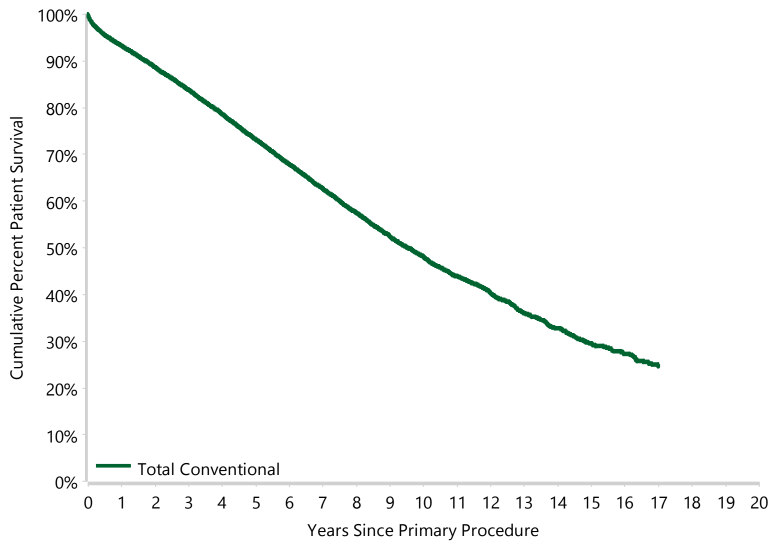
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT60** **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 | 6427 | 22439 | 93.2 (92.9, 93.6) | 83.8 (83.3, 84.4) | 73.2 (72.4, 73.9) | 48.0 (46.9, 49.1) | 29.5 (27.7, 31.3) | |
| TOTAL | 6427 | 22439 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT57** **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 | 22439 | 18018 | 12042 | 7490 | 1859 | 258 | 1 |

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 HT61 and Figure HT58).

### Type of Revision

Replacement of the femoral component only is the most common type of revision, followed by head and insert, acetabular only, and total hip replacement (femoral/acetabular) (Table HT62).

**Table HT61 Primary Total Conventional Hip Replacement by Reason for Revision (Primary Diagnosis Fractured NOF)**

| Reason for Revision | Number | Percent |
|---|---|---|
| Prosthesis Dislocation/Instability | 353 | 33.6 |
| Fracture | 294 | 28.0 |
| Infection | 188 | 17.9 |
| Loosening | 147 | 14.0 |
| Leg Length Discrepancy | 9 | 0.9 |
| Pain | 9 | 0.9 |
| Implant Breakage Stem | 7 | 0.7 |
| Malposition | 7 | 0.7 |
| Lysis | 7 | 0.7 |
| Implant Breakage Acetabular Insert | 6 | 0.6 |
| Implant Breakage Acetabular | 5 | 0.5 |
| Tumour | 3 | 0.3 |
| Heterotopic Bone | 2 | 0.2 |
| Metal Related Pathology | 2 | 0.2 |
| Incorrect Sizing | 1 | 0.1 |
| Progression Of Disease | 1 | 0.1 |
| Other | 9 | 0.9 |
| TOTAL | 1050 | 100.0 |

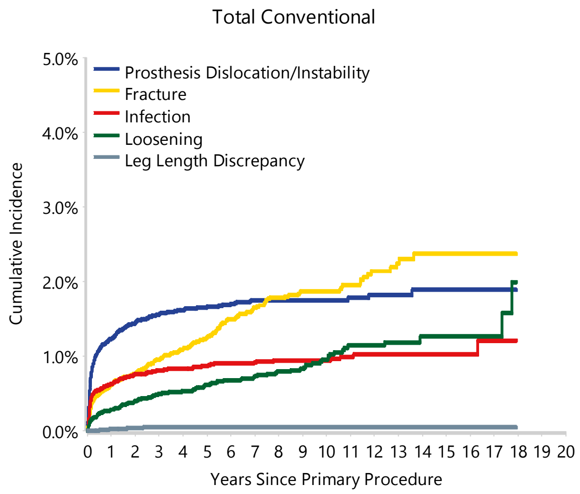
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT62 Primary Total Conventional Hip Replacement by Type of Revision (Primary Diagnosis Fractured NOF)**

| Type of Revision | Number | Percent |
|---|---|---|
| Femoral Component | 368 | 35.0 |
| Head/Insert | 263 | 25.0 |
| Acetabular Component | 184 | 17.5 |
| THR (Femoral/Acetabular) | 106 | 10.1 |
| Head Only | 47 | 4.5 |
| Cement Spacer | 34 | 3.2 |
| Minor Components | 22 | 2.1 |
| Insert Only | 15 | 1.4 |
| Removal of Prostheses | 6 | 0.6 |
| Total Femoral | 2 | 0.2 |
| Neck Only | 1 | 0.1 |
| Head/Neck | 1 | 0.1 |
| Reinsertion of Components | 1 | 0.1 |
| TOTAL | 1050 | 100.0 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses
Femoral heads are usually replaced when the acetabular component or femoral stem is revised

**Figure HT58 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

### 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 chapter. The Registry can now report on the early outcome of 15,106 primary total conventional hip replacement procedures for fractured neck of femur in relation to these scores.

When compared to patients with an ASA score of 1, there is no difference in the rate of revision for patients with an ASA score of 2, whereas patients with ASA scores of 3 and 4 have a higher rate of revision (Table HT63 and Figure HT59). The most common reasons for revision for each ASA score are shown in Figure HT60. The difference in the rate of revision is partially due to an increase in revision for dislocation and infection with increasing ASA score.

There is a larger proportion of fractured neck of femur patients with an ASA score of 3 or above than patients with osteoarthritis (Table HT64).

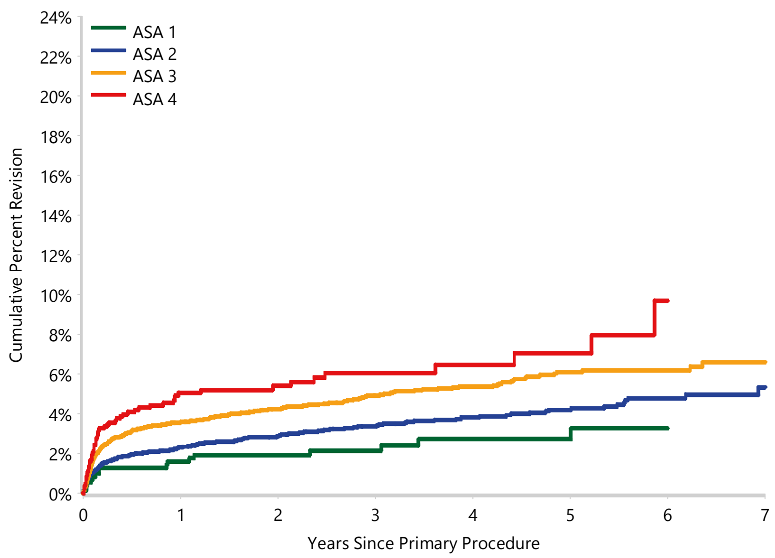
BMI data have been collected since 2015. The early revision outcomes are reported for 8,575 primary total conventional hip replacement procedures for fractured neck of femur. Patients in obese class 2 and obese class 3 have a higher rate of revision compared to patients in the normal BMI class (Table HT65 and Figure HT61). The most common reasons for revision are shown in Figure HT62.

**Table HT63 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 |
|---|---|---|---|---|---|---|---|---|
| ASA 1 | 18 | 717 | 1.6 (0.9, 2.9) | 1.9 (1.1, 3.3) | 2.2 (1.3, 3.6) | 2.7 (1.6, 4.5) | 2.7 (1.6, 4.5) | |
| ASA 2 | 192 | 5626 | 2.3 (1.9, 2.7) | 2.9 (2.5, 3.4) | 3.4 (2.9, 3.9) | 3.8 (3.3, 4.5) | 4.2 (3.6, 4.9) | 5.3 (4.3, 6.6) |
| ASA 3 | 338 | 7542 | 3.6 (3.2, 4.0) | 4.2 (3.8, 4.8) | 4.9 (4.4, 5.5) | 5.4 (4.8, 6.0) | 6.1 (5.4, 6.9) | 6.6 (5.7, 7.6) |
| ASA 4 | 62 | 1213 | 5.1 (3.9, 6.6) | 5.4 (4.1, 7.0) | 6.1 (4.7, 7.9) | 6.5 (4.9, 8.5) | 7.1 (5.2, 9.5) | |
| ASA 5 | 0 | 8 | 0.0 (0.0, 0.0) | | | | | |
| TOTAL | 610 | 15106 | | | | | | |

Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded

**Figure HT59 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=1.54 (0.95, 2.51),p=0.080

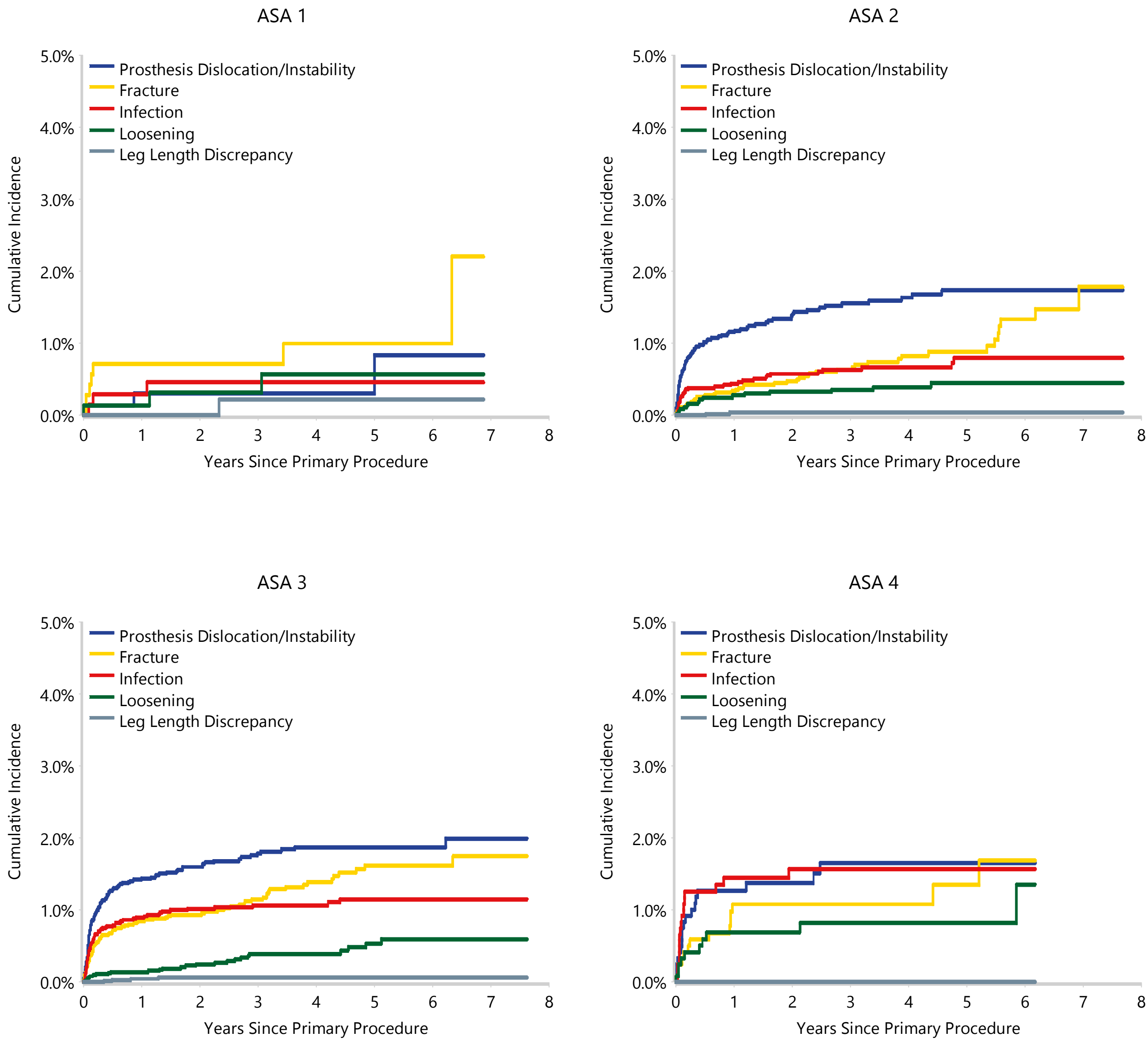
ASA 3 vs ASA 1
Entire Period: HR=2.27 (1.40, 3.66),p<0.001

ASA 4 vs ASA 1
Entire Period: HR=3.01 (1.76, 5.13),p<0.001

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|
| ASA 1 | 717 | 594 | 470 | 378 | 276 | 178 | 34 |
| ASA 2 | 5626 | 4627 | 3684 | 2769 | 1930 | 1235 | 223 |
| ASA 3 | 7542 | 5560 | 4105 | 2916 | 1892 | 1161 | 177 |
| ASA 4 | 1213 | 726 | 488 | 332 | 198 | 109 | 11 |

Note: Restricted to modern prostheses
All procedures using metal/metal prostheses have been excluded

**Figure HT60** **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 HT64** **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 | 717 | 4.7 | 21028 | 9.2 | 21745 | 8.9 |
| ASA 2 | 5626 | 37.2 | 125080 | 54.7 | 130706 | 53.6 |
| ASA 3 | 7542 | 49.9 | 79421 | 34.7 | 86963 | 35.7 |
| ASA 4 | 1213 | 8.0 | 3233 | 1.4 | 4446 | 1.8 |
| ASA 5 | 8 | 0.1 | 9 | 0.0 | 17 | 0.0 |
| TOTAL | 15106 | 100.0 | 228771 | 100.0 | 243877 | 100.0 |

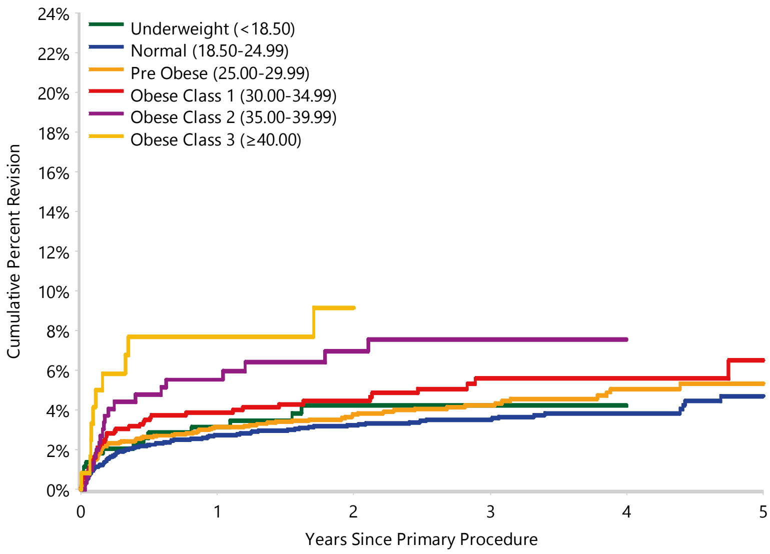
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT65 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 | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|---|
| Underweight (<18.50) | 16 | 449 | 3.1 (1.8, 5.4) | 4.2 (2.6, 6.9) | 4.2 (2.6, 6.9) | 4.2 (2.6, 6.9) | | |
| Normal (18.50-24.99) | 122 | 3758 | 2.7 (2.2, 3.3) | 3.2 (2.7, 3.9) | 3.5 (2.9, 4.2) | 3.8 (3.2, 4.7) | 4.7 (3.7, 6.0) | |
| Pre Obese (25.00-29.99) | 110 | 2929 | 3.2 (2.6, 3.9) | 3.8 (3.1, 4.6) | 4.2 (3.5, 5.2) | 5.1 (4.1, 6.2) | 5.3 (4.3, 6.6) | |
| Obese Class 1 (30.00-34.99) | 47 | 1012 | 3.9 (2.8, 5.3) | 4.5 (3.3, 6.0) | 5.6 (4.1, 7.5) | 5.6 (4.1, 7.5) | 6.5 (4.5, 9.4) | |
| Obese Class 2 (35.00-39.99) | 21 | 305 | 5.5 (3.4, 8.9) | 7.0 (4.5, 10.7) | 7.6 (4.9, 11.6) | 7.6 (4.9, 11.6) | | |
| Obese Class 3 (≥40.00) | 10 | 122 | 7.7 (4.1, 14.3) | 9.1 (5.0, 16.6) | | | | |
| TOTAL | 326 | 8575 | | | | | | |

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 HT61 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=1.18 (0.70, 1.98),p=0.544

Pre Obese (25.00-29.99) vs Normal (18.50-24.99)
Entire Period: HR=1.13 (0.88, 1.47),p=0.342

Obese Class 1 (30.00-34.99) vs Normal (18.50-24.99)
Entire Period: HR=1.38 (0.98, 1.93),p=0.063

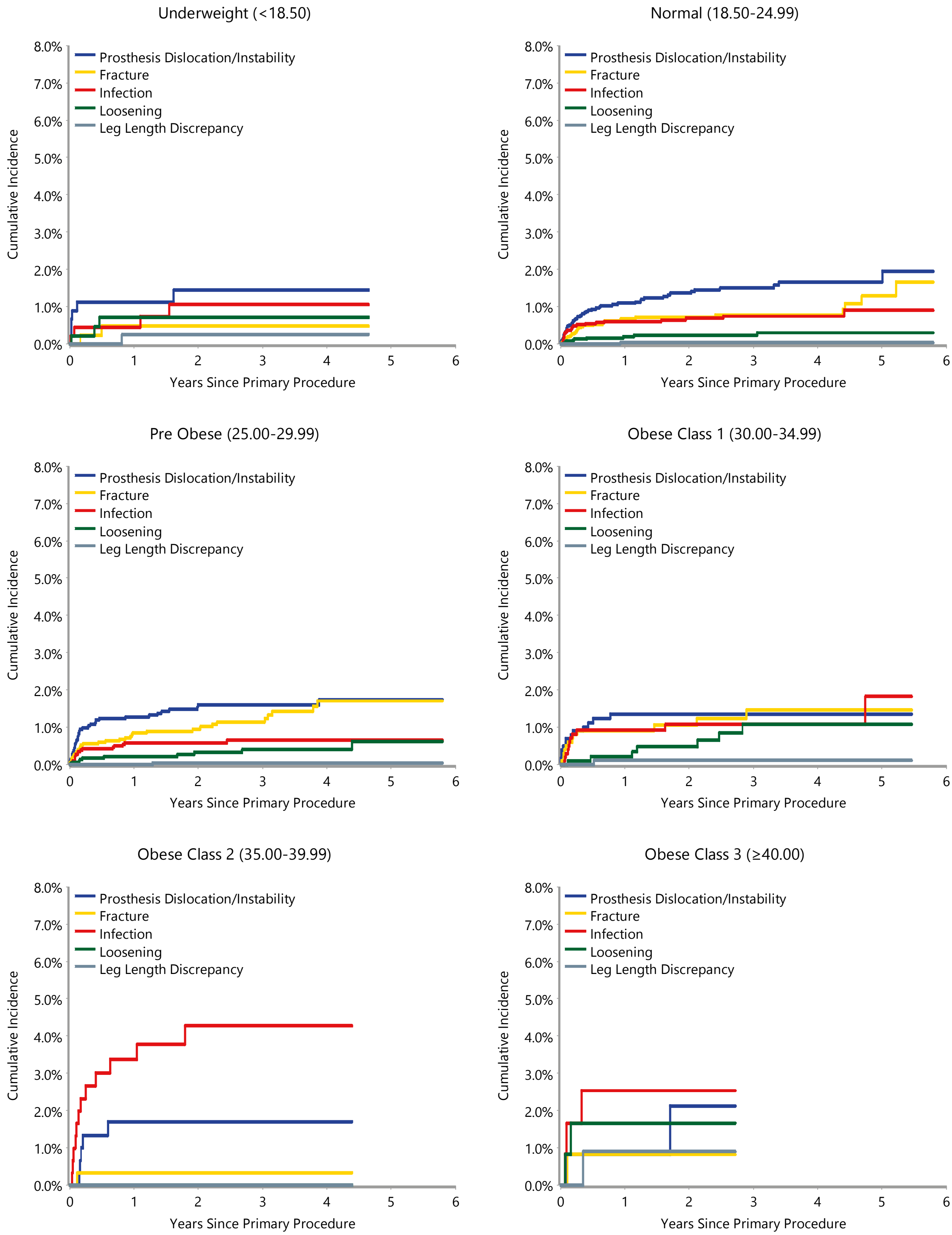
Obese Class 2 (35.00-39.99) vs Normal (18.50-24.99)
Entire Period: HR=2.03 (1.28, 3.24),p=0.002

Obese Class 3 (≥40.00) vs Normal (18.50-24.99)
Entire Period: HR=2.59 (1.36, 4.95),p=0.004

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|
| Underweight (<18.50) | 449 | 317 | 220 | 158 | 73 | 23 | 0 |
| Normal (18.50-24.99) | 3758 | 2725 | 1929 | 1255 | 692 | 258 | 3 |
| Pre Obese (25.00-29.99) | 2929 | 2096 | 1465 | 949 | 507 | 207 | 4 |
| Obese Class 1 (30.00-34.99) | 1012 | 726 | 513 | 355 | 197 | 83 | 0 |
| Obese Class 2 (35.00-39.99) | 305 | 226 | 162 | 103 | 56 | 26 | 0 |
| Obese Class 3 (≥40.00) | 122 | 80 | 57 | 32 | 12 | 4 | 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 HT62** **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.

The Registry has recorded 1,344 procedures with cemented fixation, 5,718 with cementless fixation and 13,252 with hybrid fixation. Cemented fixation has a lower rate of revision compared to cementless fixation, but there is no difference compared to hybrid 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 HT66 and Figure HT63).

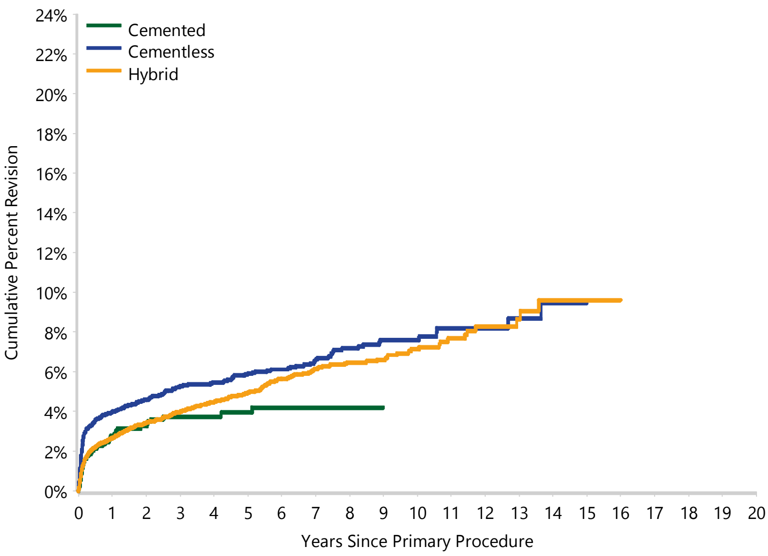
There are differences in outcome with respect to fixation and age. For patients aged <70 years, there is no difference in the rate of revision between cemented and cementless fixation. For the first month only, cementless fixation has a higher rate of revision than hybrid fixation for this age group (Table HT67 and Figure HT64). 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 HT67 and Figure HT65).

**Table HT66** **Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis Fractured NOF)**

| Fixation | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cemented | 45 | 1344 | 2.8 (2.0, 3.8) | 3.7 (2.8, 5.0) | 3.9 (2.9, 5.3) | | | |
| Cementless | 320 | 5718 | 4.0 (3.5, 4.5) | 5.3 (4.7, 5.9) | 5.9 (5.2, 6.6) | 7.6 (6.7, 8.6) | 9.5 (7.5, 11.9) | |
| Hybrid | 573 | 13252 | 2.7 (2.4, 3.0) | 4.0 (3.6, 4.4) | 4.9 (4.5, 5.4) | 7.1 (6.4, 8.0) | 9.6 (7.9, 11.7) | |
| TOTAL | 938 | 20314 | | | | | | |

Note: Includes mixed ceramic/mixed ceramic and cross-linked polyethylene (XLPE) bearing surfaces.
Restricted to modern prostheses

**Figure HT63** **Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis Fractured NOF)**




HR - adjusted for age and gender

Cementless vs Cemented
Entire Period: HR=1.39 (1.01, 1.90),p=0.040

Cementless vs Hybrid
0 - 3Mth: HR=1.74 (1.43, 2.12),p<0.001
3Mth+: HR=0.83 (0.68, 1.01),p=0.062

Hybrid vs Cemented
Entire Period: HR=1.18 (0.87, 1.60),p=0.283

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Cemented | 1344 | 1030 | 672 | 379 | 25 | 1 | 0 |
| Cementless | 5718 | 4694 | 3328 | 2188 | 551 | 66 | 1 |
| Hybrid | 13252 | 10568 | 6789 | 4002 | 850 | 79 | 0 |

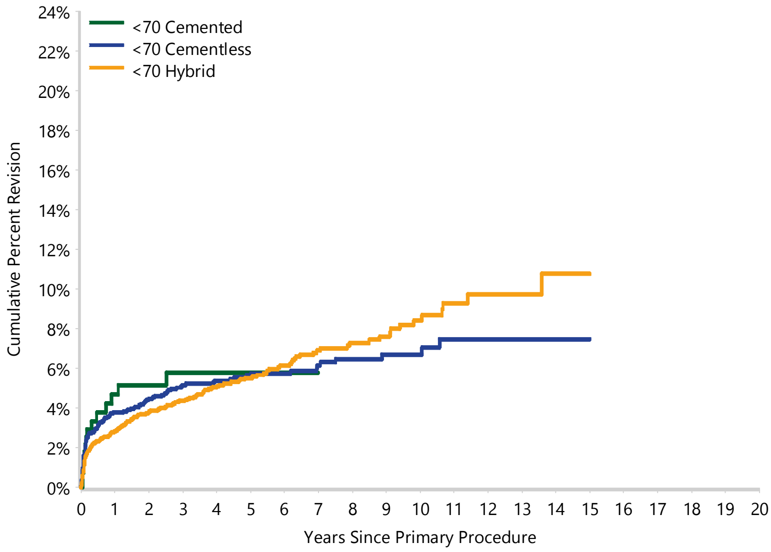
Note: Includes mixed ceramic/mixed ceramic and XLPE bearing surfaces
Restricted to modern prostheses

**Table HT67 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 | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| <70 | | 346 | 6631 | 3.2 (2.8, 3.7) | 4.7 (4.2, 5.3) | 5.6 (5.0, 6.2) | 7.6 (6.7, 8.7) | 9.2 (7.7, 11.1) | |
| | Cemented | 14 | 287 | 4.7 (2.7, 8.1) | 5.8 (3.4, 9.7) | 5.8 (3.4, 9.7) | | | |
| | Cementless | 123 | 2293 | 3.8 (3.1, 4.6) | 5.2 (4.3, 6.2) | 5.7 (4.7, 6.8) | 6.7 (5.5, 8.1) | 7.5 (6.0, 9.3) | |
| | Hybrid | 209 | 4051 | 2.8 (2.3, 3.4) | 4.4 (3.8, 5.1) | 5.5 (4.8, 6.4) | 8.4 (7.1, 10.0) | 10.8 (8.3, 13.9) | |
| ≥70 | | 592 | 13683 | 3.0 (2.7, 3.3) | 4.1 (3.8, 4.5) | 4.9 (4.5, 5.4) | 6.8 (6.1, 7.5) | 9.7 (7.6, 12.5) | |
| | Cemented | 31 | 1057 | 2.3 (1.5, 3.4) | 3.2 (2.2, 4.6) | 3.5 (2.4, 5.0) | | | |
| | Cementless | 197 | 3425 | 4.1 (3.5, 4.9) | 5.3 (4.6, 6.2) | 6.1 (5.2, 7.0) | 8.3 (7.0, 9.9) | | |
| | Hybrid | 364 | 9201 | 2.6 (2.3, 2.9) | 3.8 (3.4, 4.2) | 4.7 (4.2, 5.2) | 6.4 (5.6, 7.3) | | |
| TOTAL | | 938 | 20314 | | | | | | |

Note: Includes mixed ceramic/mixed ceramic and XLPE bearing surfaces
Restricted to modern prostheses

**Figure HT64 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 Hybrid
Entire Period: HR=1.11 (0.64, 1.90),p=0.716

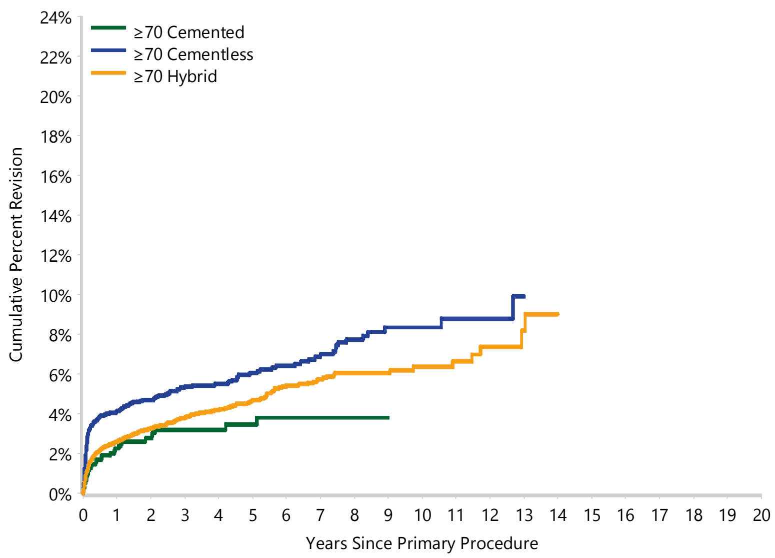
<70 Cemented vs <70 Cementless
Entire Period: HR=1.11 (0.64, 1.93),p=0.718

<70 Cementless vs <70 Hybrid
0 - 1Mth: HR=1.73 (1.11, 2.72),p=0.016
1Mth+: HR=0.80 (0.62, 1.04),p=0.097

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| <70 | Cemented | 287 | 204 | 139 | 83 | 7 | 1 | 0 |
| | Cementless | 2293 | 1946 | 1426 | 982 | 275 | 42 | 1 |
| | Hybrid | 4051 | 3325 | 2227 | 1393 | 382 | 43 | 0 |

Note: Includes mixed ceramic/mixed ceramic and XLPE bearing surfaces
Restricted to modern prostheses

**Figure HT65** **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=1.73 (1.19, 2.53),p=0.004

≥70 Cementless vs ≥70 Hybrid
0 - 3Mth: HR=2.00 (1.57, 2.55),p<0.001
3Mth+: HR=0.92 (0.71, 1.18),p=0.519

≥70 Hybrid vs ≥70 Cemented
Entire Period: HR=1.29 (0.89, 1.86),p=0.179

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| ≥70 | Cemented | 1057 | 826 | 533 | 296 | 18 | 0 | 0 |
| | Cementless | 3425 | 2748 | 1902 | 1206 | 276 | 24 | 0 |
| | Hybrid | 9201 | 7243 | 4562 | 2609 | 468 | 36 | 0 |

Note: Includes mixed ceramic/mixed ceramic and XLPE bearing surfaces
Restricted to modern prostheses

### Head Size

When used for fractured neck of femur, there is no difference in the rate of revision between head sizes 32mm, <32mm, and >32mm (Table HT68 and Figure HT66).

There is high rate of revision for prosthesis dislocation/instability for <32mm and 32mm when compared to >32mm. Head size 32mm have a lower rate of revision for prosthesis dislocation/instability compared to <32mm after 6 months (Table HT69 and Figure HT67).

### 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 HT70 and Figure HT68).

### Dual Mobility

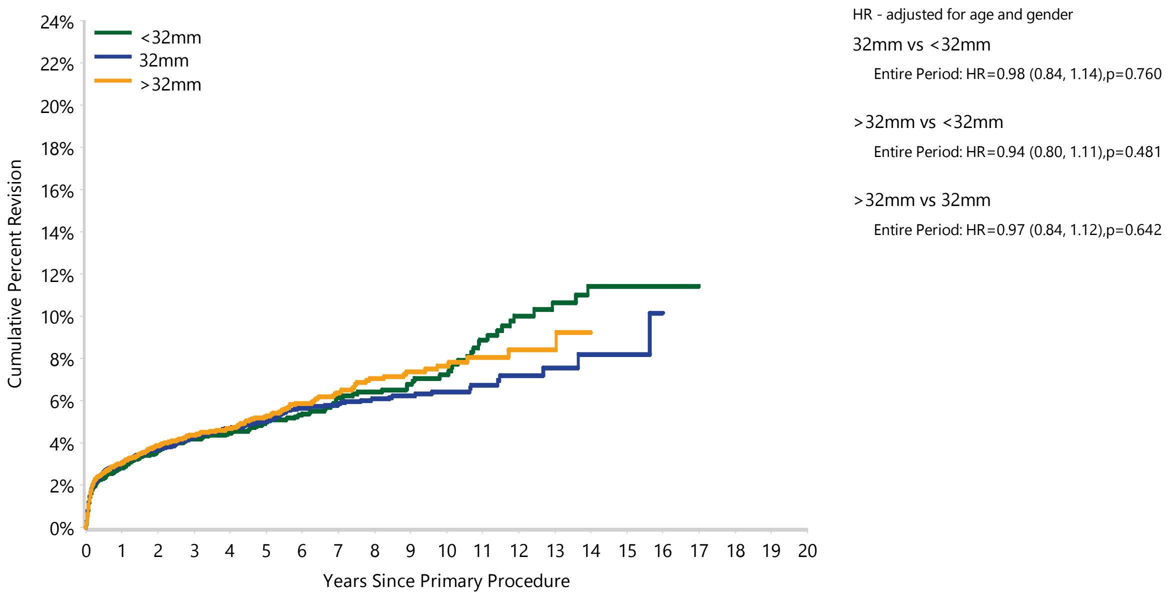
There is no difference in the rate of revision when dual mobility prostheses are used (Table HT71 and Figure HT69).

**Table HT68 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis Fractured NOF)**

| Head Size | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| <32mm | 261 | 5655 | 2.8 (2.4, 3.3) | 4.2 (3.7, 4.8) | 5.0 (4.3, 5.7) | 7.2 (6.2, 8.5) | 11.4 (9.4, 13.9) | |
| 32mm | 426 | 9118 | 3.1 (2.7, 3.4) | 4.3 (3.9, 4.8) | 5.0 (4.5, 5.6) | 6.4 (5.7, 7.2) | 8.2 (6.6, 10.2) | |
| >32mm | 362 | 7640 | 3.0 (2.7, 3.5) | 4.4 (3.9, 4.9) | 5.2 (4.7, 5.9) | 7.6 (6.7, 8.7) | | |
| TOTAL | 1049 | 22413 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses
Excludes 26 procedures with unknown head sizes

**Figure HT66 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis Fractured NOF)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| <32mm | 5655 | 4317 | 2684 | 1677 | 551 | 157 | 1 |
| 32mm | 9118 | 7616 | 5379 | 3368 | 757 | 70 | 0 |
| >32mm | 7640 | 6065 | 3963 | 2432 | 549 | 31 | 0 |

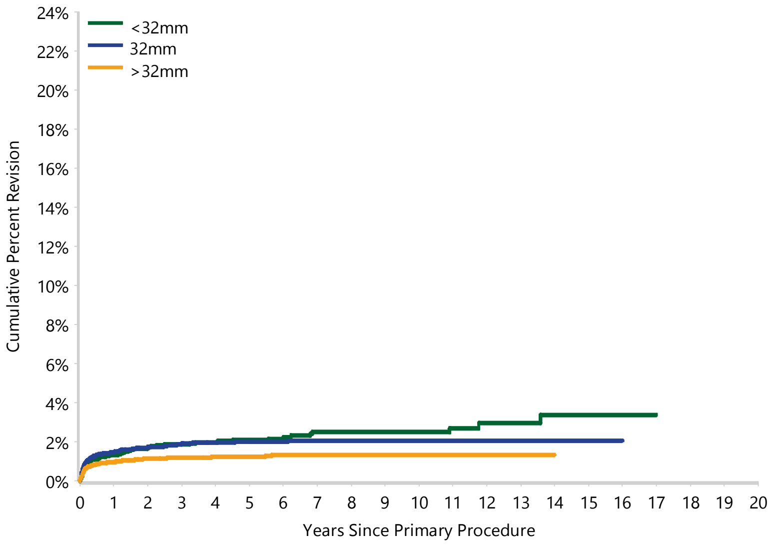
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT69 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis Fractured NOF, Revision for Prosthesis Dislocation/Instability)**

| Head Size | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| <32mm | 103 | 5655 | 1.3 (1.1, 1.7) | 1.9 (1.5, 2.3) | 2.1 (1.7, 2.6) | 2.5 (2.0, 3.1) | 3.4 (2.4, 4.8) | |
| 32mm | 164 | 9118 | 1.5 (1.2, 1.8) | 1.9 (1.6, 2.2) | 2.0 (1.7, 2.3) | 2.1 (1.8, 2.4) | 2.1 (1.8, 2.4) | |
| >32mm | 85 | 7640 | 1.0 (0.8, 1.2) | 1.2 (0.9, 1.5) | 1.2 (1.0, 1.5) | 1.3 (1.1, 1.7) | | |
| TOTAL | 352 | 22413 | | | | | | |

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 by Head Size (Primary Diagnosis Fractured NOF, Revision for Prosthesis Dislocation/Instability)**




HR - adjusted for age and gender

<32mm vs >32mm
0 - 3Mth: HR=1.31 (0.90, 1.89),p=0.157
3Mth - 2Yr: HR=1.90 (1.22, 2.94),p=0.004
2Yr+: HR=3.59 (1.89, 6.81),p<0.001

32mm vs >32mm
Entire Period: HR=1.60 (1.22, 2.09),p<0.001

32mm vs <32mm
0 - 3Mth: HR=1.18 (0.83, 1.67),p=0.348
3Mth - 6Mth: HR=1.24 (0.66, 2.33),p=0.502
6Mth+: HR=0.60 (0.40, 0.91),p=0.015

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| <32mm | 5655 | 4317 | 2684 | 1677 | 551 | 157 | 1 |
| 32mm | 9118 | 7616 | 5379 | 3368 | 757 | 70 | 0 |
| >32mm | 7640 | 6065 | 3963 | 2432 | 549 | 31 | 0 |

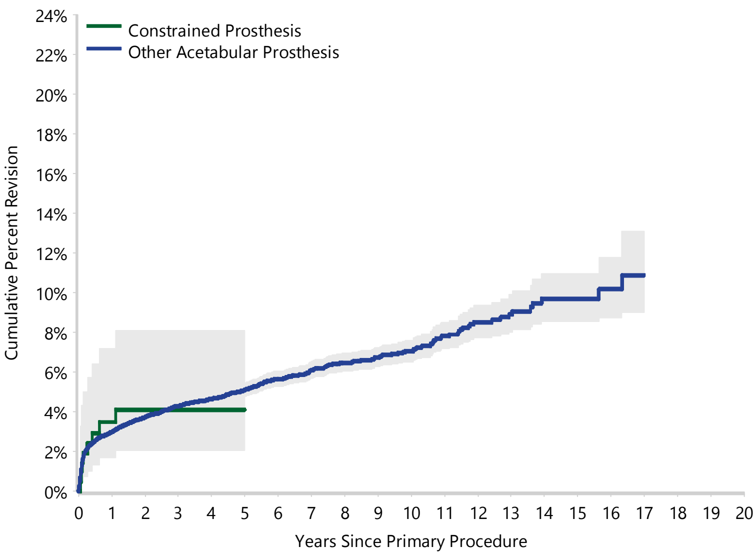
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT70 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Type (Primary Diagnosis Fractured NOF)**

| Acetabular Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Constrained Prosthesis | 8 | 223 | 3.5 (1.7, 7.2) | 4.1 (2.1, 8.1) | 4.1 (2.1, 8.1) | | | |
| Other Acetabular Prosthesis | 1042 | 22216 | 3.0 (2.8, 3.2) | 4.3 (4.0, 4.6) | 5.1 (4.8, 5.4) | 7.0 (6.5, 7.6) | 9.7 (8.6, 11.0) | |
| TOTAL | 1050 | 22439 | | | | | | |

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 by Acetabular Type (Primary Diagnosis Fractured NOF)**




HR - adjusted for age and gender
Constrained Prosthesis vs
Other Acetabular Prosthesis
Entire Period: HR=0.95 (0.48, 1.91),p=0.894

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Constrained Prosthesis | 223 | 155 | 75 | 45 | 8 | 0 | 0 |
| Other Acetabular Prosthesis | 22216 | 17863 | 11967 | 7445 | 1851 | 258 | 1 |

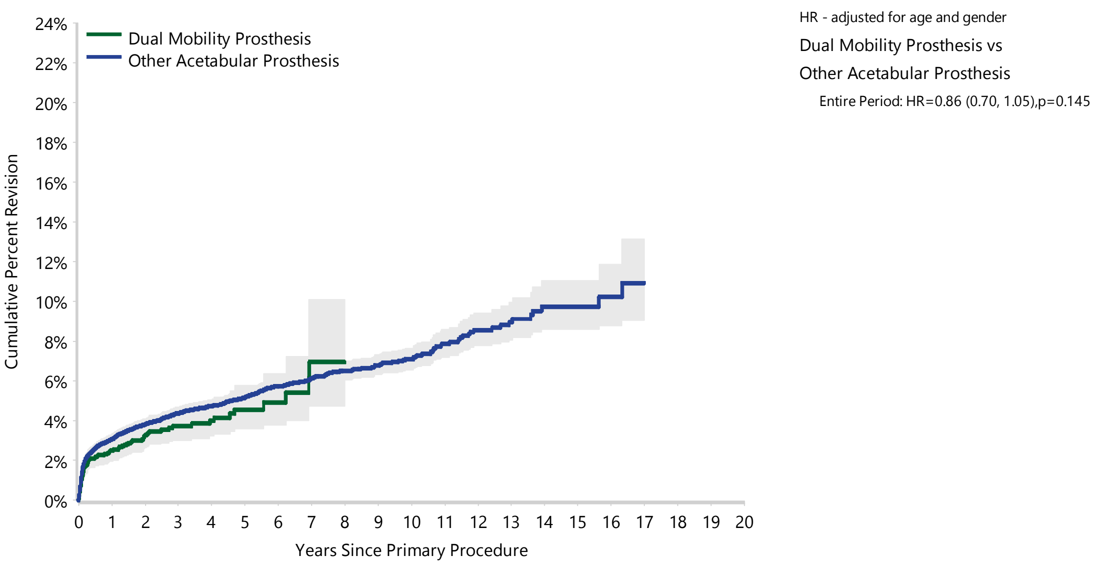
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT71** **Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Mobility (Primary Diagnosis Fractured NOF)**

| Acetabular Mobility | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Dual Mobility Prosthesis | 101 | 3139 | 2.5 (2.0, 3.1) | 3.7 (3.0, 4.6) | 4.6 (3.6, 5.8) | | | |
| Other Acetabular Prosthesis | 949 | 19300 | 3.1 (2.8, 3.3) | 4.4 (4.1, 4.7) | 5.2 (4.8, 5.5) | 7.1 (6.6, 7.7) | 9.7 (8.6, 11.0) | |
| TOTAL | 1050 | 22439 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT69** **Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Mobility (Primary Diagnosis Fractured NOF)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Dual Mobility Prosthesis | 3139 | 2164 | 954 | 368 | 18 | 0 | 0 |
| Other Acetabular Prosthesis | 19300 | 15854 | 11088 | 7122 | 1841 | 258 | 1 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

## OUTCOME OF TOTAL CONVENTIONAL COMPARED TO PARTIAL HIP REPLACEMENT

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 hip replacement procedures were compared.

Unipolar monoblock hip replacement has a higher rate of revision than total conventional hip replacement after 3 months. Unipolar modular hip replacement has a lower rate of revision than total conventional hip replacement for the first month. From 1 month to 1.5 years there is no difference, but after this time unipolar modular has a higher rate of revision. There is no difference in the rate of revision when comparing bipolar to total conventional hip replacement (Table HT72 and Figure HT70).

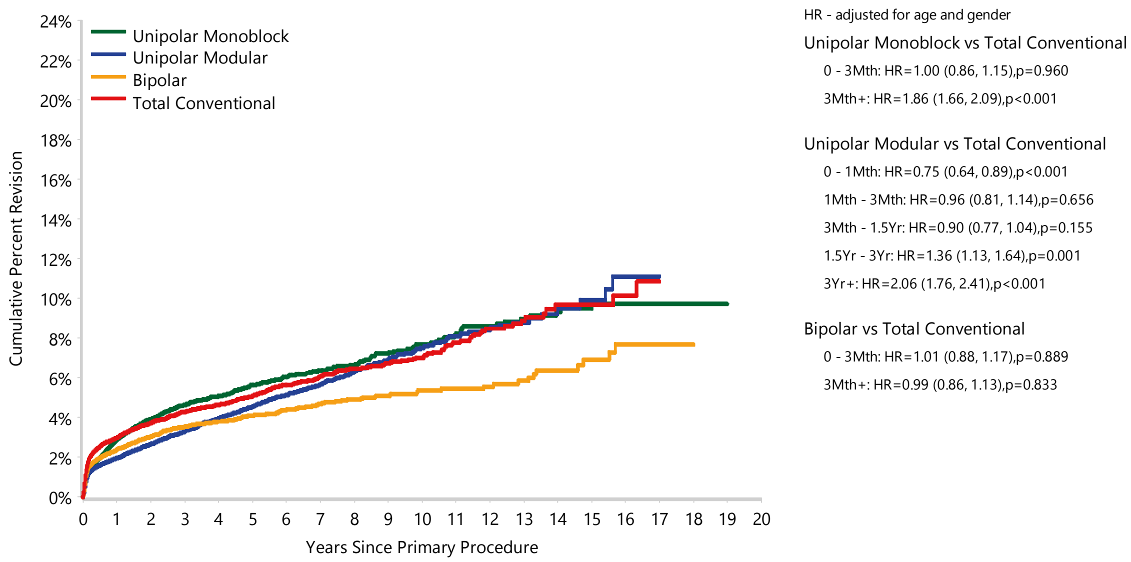
The rates of revision for each type of hip replacement for patients aged <70 years and ≥70 years are provided in Table HT73, Figure HT71 and Figure HT72.

**Table HT72 Cumulative Percent Revision of Primary Hip Replacement by Class (Primary Diagnosis Fractured NOF)**

| Hip Class | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Unipolar Monoblock | 1078 | 28419 | 2.9 (2.7, 3.1) | 4.6 (4.3, 5.0) | 5.6 (5.3, 6.0) | 7.7 (7.1, 8.4) | 9.5 (8.5, 10.6) | |
| Unipolar Modular | 1338 | 40895 | 2.0 (1.8, 2.1) | 3.3 (3.1, 3.5) | 4.5 (4.3, 4.8) | 7.5 (6.9, 8.1) | 9.9 (8.6, 11.5) | |
| Bipolar | 675 | 22244 | 2.4 (2.2, 2.6) | 3.5 (3.3, 3.8) | 4.1 (3.8, 4.5) | 5.4 (4.8, 6.0) | 6.9 (5.8, 8.2) | |
| Total Conventional | 1050 | 22439 | 3.0 (2.8, 3.2) | 4.3 (4.0, 4.6) | 5.1 (4.8, 5.4) | 7.0 (6.5, 7.6) | 9.7 (8.5, 11.0) | |
| TOTAL | 4141 | 113997 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT70 Cumulative Percent Revision of Primary Hip Replacement by Class (Primary Diagnosis Fractured NOF)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Unipolar Monoblock | 28419 | 17345 | 10436 | 5928 | 1404 | 396 | 19 |
| Unipolar Modular | 40895 | 27549 | 16602 | 9484 | 1850 | 188 | 2 |
| Bipolar | 22244 | 14462 | 8125 | 4454 | 1200 | 310 | 5 |
| Total Conventional | 22439 | 18018 | 12042 | 7490 | 1859 | 258 | 1 |

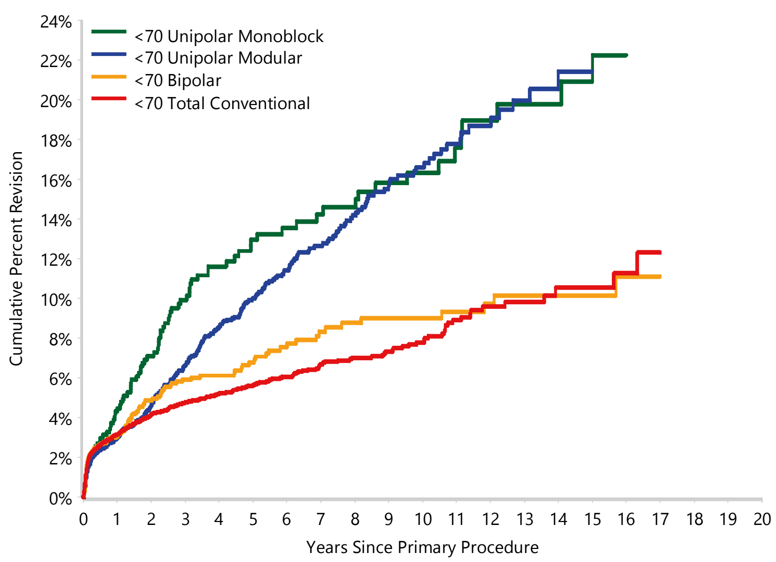
Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Table HT73 Cumulative Percent Revision of Primary Hip Replacement by Age and Class (Primary Diagnosis Fractured NOF)**

| Age | Hip Class | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| **<70** | | **878** | **13094** | **3.2 (2.9, 3.5)** | **5.6 (5.2, 6.1)** | **7.2 (6.7, 7.8)** | **10.6 (9.8, 11.4)** | **13.7 (12.4, 15.0)** | |
| | Unipolar Monoblock | 94 | 922 | 4.3 (3.1, 6.0) | 9.9 (7.8, 12.5) | 12.9 (10.4, 16.0) | 16.3 (13.2, 20.1) | 20.9 (16.5, 26.4) | |
| | Unipolar Modular | 269 | 2930 | 3.0 (2.4, 3.7) | 6.6 (5.6, 7.7) | 10.0 (8.7, 11.5) | 16.6 (14.6, 18.9) | 21.4 (18.2, 25.2) | |
| | Bipolar | 119 | 2065 | 3.1 (2.4, 3.9) | 5.9 (4.8, 7.2) | 6.8 (5.6, 8.3) | 9.0 (7.4, 11.0) | 10.1 (8.2, 12.6) | |
| | Total Conventional | 396 | 7177 | 3.2 (2.8, 3.6) | 4.8 (4.3, 5.3) | 5.6 (5.0, 6.3) | 7.8 (6.9, 8.8) | 10.5 (8.9, 12.4) | |
| **≥70** | | **3263** | **100903** | **2.4 (2.3, 2.5)** | **3.6 (3.4, 3.7)** | **4.4 (4.3, 4.6)** | **6.3 (6.0, 6.6)** | **8.0 (7.3, 8.7)** | |
| | Unipolar Monoblock | 984 | 27497 | 2.8 (2.6, 3.1) | 4.4 (4.1, 4.7) | 5.3 (5.0, 5.7) | 7.2 (6.6, 7.9) | 8.6 (7.6, 9.7) | |
| | Unipolar Modular | 1069 | 37965 | 1.9 (1.7, 2.0) | 3.0 (2.8, 3.2) | 4.0 (3.7, 4.2) | 6.2 (5.6, 6.8) | 7.7 (6.3, 9.4) | |
| | Bipolar | 556 | 20179 | 2.3 (2.1, 2.6) | 3.3 (3.0, 3.6) | 3.8 (3.4, 4.1) | 4.9 (4.3, 5.5) | 6.7 (5.2, 8.5) | |
| | Total Conventional | 654 | 15262 | 2.9 (2.7, 3.2) | 4.0 (3.7, 4.4) | 4.8 (4.4, 5.2) | 6.6 (6.0, 7.2) | 9.2 (7.6, 11.2) | |
| TOTAL | | 4141 | 113997 | | | | | | |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT71 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
0 - 3Mth: HR=0.95 (0.58, 1.56),p=0.848
3Mth+: HR=2.59 (2.01, 3.34),p<0.001

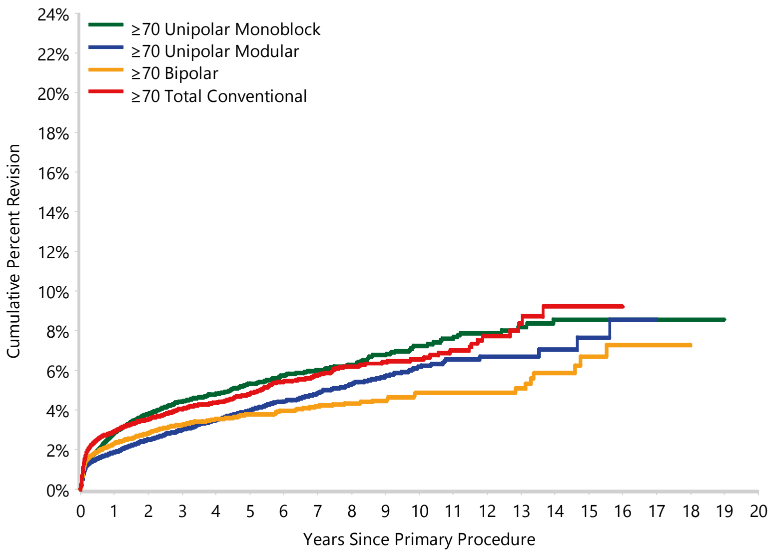
<70 Unipolar Modular vs <70 Total Conventional
0 - 2Yr: HR=1.07 (0.86, 1.32),p=0.564
2Yr - 3Yr: HR=2.65 (1.75, 4.03),p<0.001
3Yr+: HR=3.41 (2.65, 4.40),p<0.001

<70 Bipolar vs <70 Total Conventional
Entire Period: HR=1.13 (0.92, 1.38),p=0.253

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| <70 | Unipolar Monoblock | 922 | 622 | 445 | 310 | 153 | 60 | 3 |
| | Unipolar Modular | 2930 | 2197 | 1575 | 1104 | 396 | 59 | 1 |
| | Bipolar | 2065 | 1476 | 986 | 655 | 299 | 110 | 3 |
| | Total Conventional | 7177 | 5940 | 4178 | 2781 | 864 | 157 | 1 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT72** **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
- 0 - 2Wk: HR=1.06 (0.81, 1.38),p=0.671
- 2Wk - 1Mth: HR=0.69 (0.55, 0.85),p<0.001
- 1Mth - 3Mth: HR=0.60 (0.49, 0.74),p<0.001
- 3Mth+: HR=1.36 (1.20, 1.53),p<0.001

≥70 Unipolar Modular vs ≥70 Total Conventional
- 0 - 3Mth: HR=0.62 (0.54, 0.71),p<0.001
- 3Mth - 1.5Yr: HR=0.67 (0.57, 0.79),p<0.001
- 1.5Yr - 3.5Yr: HR=1.02 (0.84, 1.24),p=0.825
- 3.5Yr+: HR=1.35 (1.11, 1.66),p=0.003

≥70 Bipolar vs ≥70 Total Conventional
- Entire Period: HR=0.76 (0.68, 0.85),p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| ≥70 | Unipolar Monoblock | 27497 | 16723 | 9991 | 5618 | 1251 | 336 | 16 |
| | Unipolar Modular | 37965 | 25352 | 15027 | 8380 | 1454 | 129 | 1 |
| | Bipolar | 20179 | 12986 | 7139 | 3799 | 901 | 200 | 2 |
| | Total Conventional | 15262 | 12078 | 7864 | 4709 | 995 | 101 | 0 |

Note: All procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

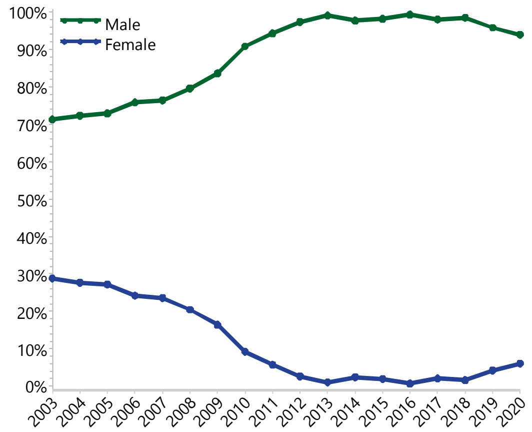
# PRIMARY TOTAL RESURFACING HIP REPLACEMENT

## DEMOGRAPHICS

There have been 18,814 primary total resurfacing hip replacement procedures reported to the Registry. This is an additional 564 procedures compared to the last report.

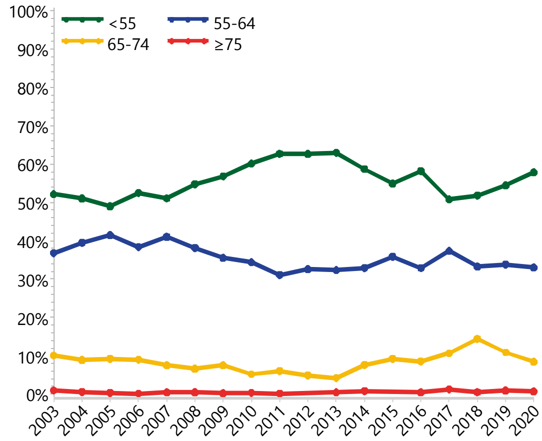
In 2020, the number of primary total resurfacing procedures is 6.9% more than in 2019, and 69.5% less than in 2005. Primary total resurfacing hip replacement represents 1.2% of all hip replacements performed in 2020.
In 2020, 93.9% of primary total resurfacing hip replacements were undertaken in males (Table HT74 and Figure HT73).

**Figure HT73 Primary Total Resurfacing Hip Replacement by Gender**




The changes in usage of primary total resurfacing hip replacement for each age group in 2020 are provided in Figure HT74.

**Figure HT74 Primary Total Resurfacing Hip Replacement by Age**




There were only three types of resurfacing prostheses used in 2020, with the Adept the most commonly used. The ReCerf resurfacing head was used for the first time in 2018 (Table HT75).

**Table HT74 Age and Gender of Primary Total Resurfacing Hip Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 15170 | 80.6% | 13 | 82 | 54 | 53.4 | 9.1 |
| Female | 3644 | 19.4% | 14 | 81 | 53 | 51.6 | 8.6 |
| TOTAL | 18814 | 100.0% | 13 | 82 | 54 | 53.0 | 9.0 |

**Table HT75 Most Used Resurfacing Heads in Primary Total Resurfacing Hip Replacement**

| 2003 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 1359 | BHR | 268 | Adept | 247 | Adept | 297 | Adept | 316 | Adept |
| 58 | Durom | 126 | BHR | 132 | BHR | 145 | BHR | 152 | BHR |
| 43 | ASR | | | 3 | ReCerf | 82 | ReCerf | 92 | ReCerf |
| 42 | Cormet | | | | | | | | |
| 38 | Cormet 2000 HAP | | | | | | | | |
| 7 | Conserve Plus | | | | | | | | |
| Most Used | | | | | | | | | |
| 1547 | (6) 100.0% | 394 | (2) 100.0% | 382 | (3) 100.0% | 524 | (3) 100.0% | 560 | (3) 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 (95.5%), followed by developmental dysplasia (2.0%), and osteonecrosis (1.7%).

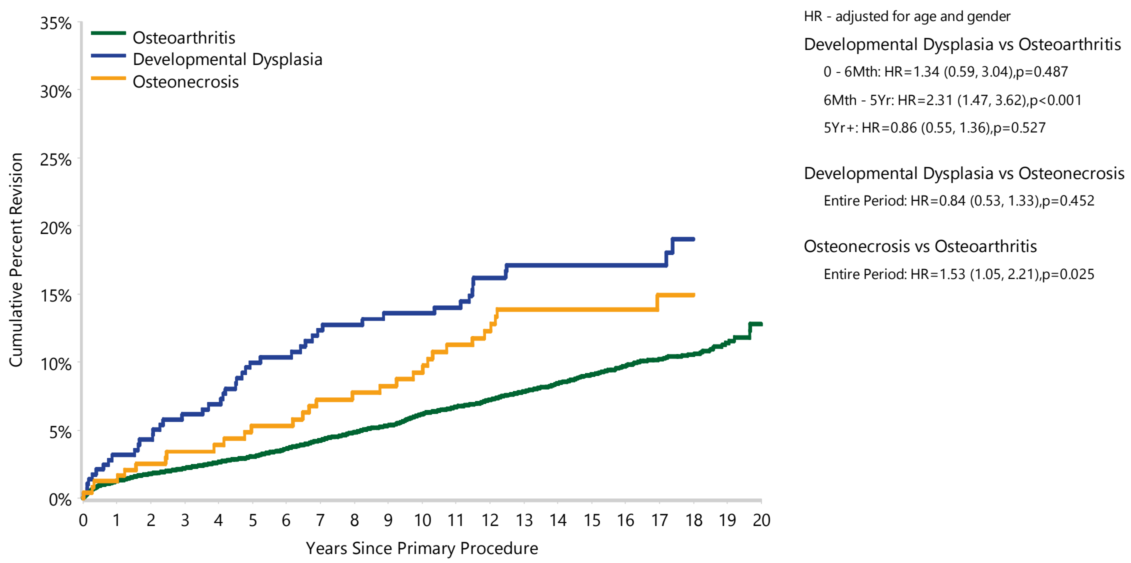
Primary total resurfacing hip replacement for osteoarthritis has a lower rate of revision compared to developmental dysplasia from 6 months up to 5 years. There is a higher rate of revision for osteonecrosis compared to osteoarthritis (Table HT76 and Figure HT75).

**Table HT76 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 | 989 | 13804 | 1.3 (1.1, 1.5) | 2.2 (2.0, 2.5) | 3.1 (2.8, 3.4) | 6.2 (5.7, 6.6) | 9.1 (8.5, 9.7) | 12.8 (11.2, 14.6) |
| Developmental Dysplasia | 47 | 287 | 3.2 (1.7, 6.0) | 6.2 (3.9, 9.7) | 10.0 (7.0, 14.2) | 13.6 (10.0, 18.3) | 17.1 (13.0, 22.4) | |
| Osteonecrosis | 30 | 243 | 1.2 (0.4, 3.8) | 3.4 (1.7, 6.7) | 5.3 (3.1, 9.2) | 9.2 (6.0, 14.0) | 13.9 (9.8, 19.4) | |
| Other (6) | 16 | 115 | 2.6 (0.8, 7.9) | 3.6 (1.3, 9.2) | 6.6 (3.2, 13.3) | 13.5 (8.0, 22.3) | 16.3 (10.1, 25.8) | |
| TOTAL | 1082 | 14449 | | | | | | |

Note: Only primary diagnoses with >100 procedures have been listed
Restricted to modern prostheses

**Figure HT75 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Primary Diagnosis**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Osteoarthritis | 13804 | 13079 | 12037 | 11084 | 8625 | 4483 | 71 |
| Developmental Dysplasia | 287 | 267 | 249 | 233 | 203 | 130 | 4 |
| Osteonecrosis | 243 | 233 | 212 | 198 | 181 | 128 | 6 |

Note: Only primary diagnoses with >100 procedures have been listed
Restricted to modern prostheses

## Prosthesis Types

The cumulative percent revision of different primary total resurfacing hip prosthesis combinations with >100 procedures is listed in Table HT77.

**Table HT77 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 | 63 | 2334 | 0.9 (0.6, 1.4) | 1.6 (1.2, 2.3) | 2.3 (1.7, 3.1) | 5.7 (4.2, 7.7) | | |
| BHR | BHR | 1018 | 11936 | 1.4 (1.2, 1.6) | 2.5 (2.2, 2.8) | 3.4 (3.1, 3.8) | 6.6 (6.1, 7.1) | 9.6 (9.0, 10.2) | 13.2 (11.7, 14.9) |
| ReCerf | ReCerf | 1 | 177 | 0.6 (0.1, 4.2) | | | | | |
| Other (2) | | 0 | 2 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | | |
| TOTAL | | 1082 | 14449 | | | | | | |

Note: Only combinations with over 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 12.8% (Table HT78 and Figure HT76).

### Reasons for Revision

The main reasons for revision of primary total resurfacing hip replacement are loosening, metal related pathology, and fracture (Table HT79).

**Loosening is the most common reason for revision after 7 years.**

The five most common reasons for revision are shown in Figure HT77. 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 continues to increase and becomes the most common reason for revision after 7 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 HT80).

### 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 patients aged 55-64 years. After 6 months there is no difference in the rate of revision for patients aged ≥65 years compared to 55-64 years (Table HT81 and Figure HT78).

Females have a higher rate of revision compared to males (Table HT82 and Figure HT79). Males aged ≥65 years have a higher rate of revision compared to males aged <55 years and 55-64 years, for the first 6 months only. After this time, there is no difference (Figure HT80). There is no difference in the rate of revision for females aged ≥65 years compared to ≤55 years (Figure HT81).

### Head Size

The rate of revision decreases as the femoral component head size increases. Femoral head sizes ≤44mm and 45-49mm, have over twice the rate of revision compared to head sizes ≥55mm. There is no difference for head sizes 50-54mm compared to ≥55mm (Table HT83 and Figure HT82).

The reason for revision varies with head size. Head sizes <50mm have a higher cumulative incidence of metal related pathology, loosening, fracture, pain, and lysis compared to head sizes ≥50mm (Figure HT83).

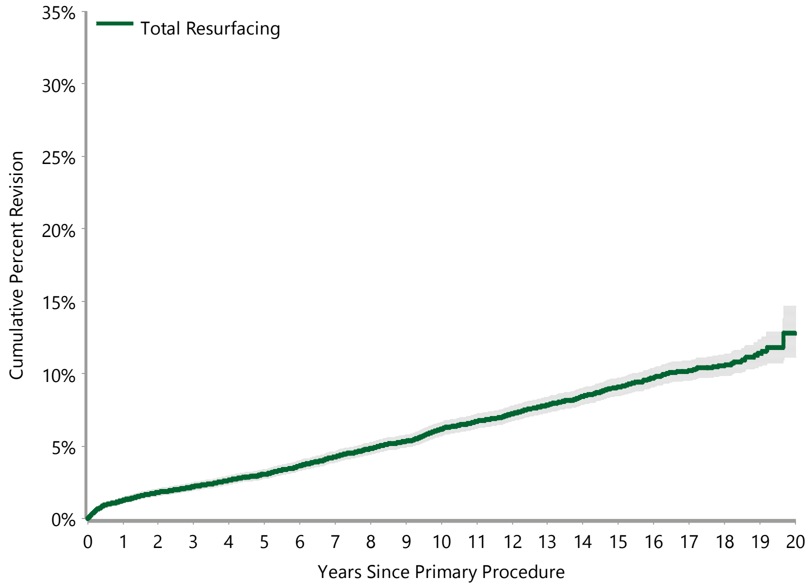
This effect of femoral component head size is evident in both males and females (Table HT84 and Figure HT84).

**Table HT78 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 | 989 | 13804 | 1.3 (1.1, 1.5) | 2.2 (2.0, 2.5) | 3.1 (2.8, 3.4) | 6.2 (5.7, 6.6) | 9.1 (8.5, 9.7) | 12.8 (11.2, 14.6) |
| TOTAL | 989 | 13804 | | | | | | |

Note: Restricted to modern prostheses

**Figure HT76 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 | 13804 | 13079 | 12037 | 11084 | 8625 | 4483 | 71 |

Note: Restricted to modern prostheses

**Table HT79 Primary Total Resurfacing Hip Replacement by Reason for Revision (Primary Diagnosis OA)**

| Reason for Revision | Number | Percent |
|---|---|---|
| Loosening | 256 | 25.9 |
| Metal Related Pathology | 217 | 21.9 |
| Fracture | 197 | 19.9 |
| Lysis | 100 | 10.1 |
| Infection | 63 | 6.4 |
| Pain | 59 | 6.0 |
| Osteonecrosis | 25 | 2.5 |
| Prosthesis Dislocation/Instability | 23 | 2.3 |
| Other (10) | 49 | 5.0 |
| TOTAL | 989 | 100.0 |

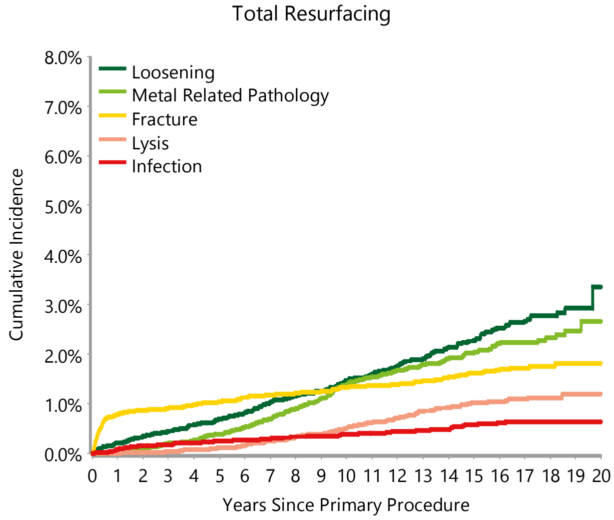
Note: Restricted to modern prostheses

**Table HT80 Primary Total Resurfacing Hip Replacement by Type of Revision (Primary Diagnosis OA)**

| Type of Revision | Number | Percent |
|---|---|---|
| THR (Femoral/Acetabular) | 687 | 69.5 |
| Femoral Component | 241 | 24.4 |
| Acetabular Component | 30 | 3.0 |
| Cement Spacer | 25 | 2.5 |
| Removal of Prostheses | 6 | 0.6 |
| TOTAL | 989 | 100.0 |

Note: Restricted to modern prostheses

**Figure HT77 Cumulative Incidence Revision Diagnosis of Primary Total Resurfacing Hip Replacement (Primary Diagnosis OA)**



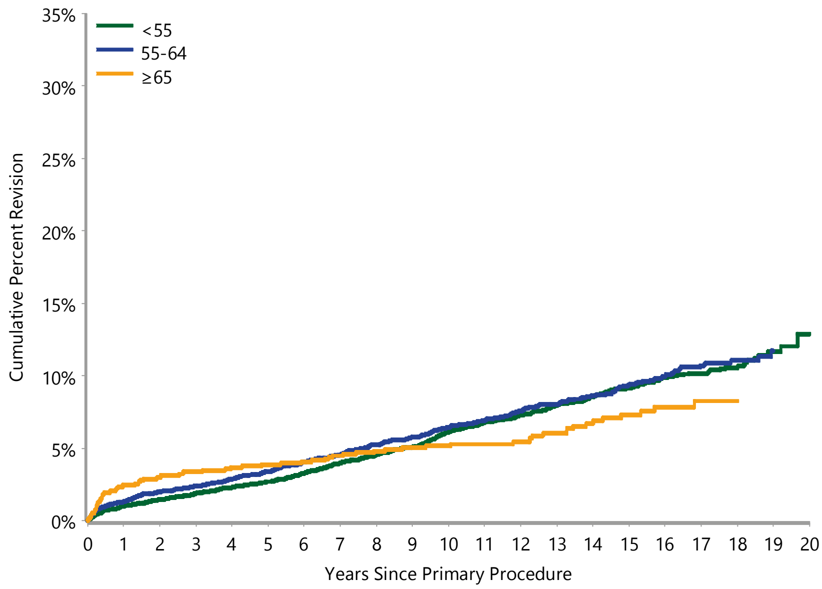

Note: Restricted to modern prostheses

**Table HT81 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 | 517 | 7287 | 1.0 (0.8, 1.3) | 1.9 (1.6, 2.2) | 2.7 (2.3, 3.1) | 6.1 (5.5, 6.8) | 9.2 (8.4, 10.0) | 12.9 (10.9, 15.3) |
| 55-64 | 396 | 5205 | 1.3 (1.0, 1.7) | 2.4 (2.0, 2.8) | 3.4 (2.9, 4.0) | 6.4 (5.8, 7.2) | 9.4 (8.5, 10.4) | |
| ≥65 | 76 | 1312 | 2.5 (1.8, 3.5) | 3.4 (2.5, 4.6) | 3.9 (2.9, 5.1) | 5.2 (4.0, 6.6) | 7.3 (5.8, 9.2) | |
| TOTAL | 989 | 13804 | | | | | | |

Note: Restricted to modern prostheses

**Figure HT78 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Age (Primary Diagnosis OA)**




HR - adjusted for gender

55-64 vs <55

0 - 1.5Yr: HR=1.50 (1.12, 2.02),p=0.006

1.5Yr+: HR=0.98 (0.85, 1.14),p=0.832

≥65 vs <55

0 - 6Mth: HR=3.28 (2.06, 5.20),p<0.001

6Mth - 1.5Yr: HR=2.12 (1.11, 4.08),p=0.023

1.5Yr - 13Yr: HR=0.60 (0.41, 0.87),p=0.007

13Yr+: HR=1.01 (0.53, 1.94),p=0.967

≥65 vs 55-64

0 - 3Mth: HR=1.53 (0.82, 2.86),p=0.184

3Mth - 6Mth: HR=4.07 (2.09, 7.94),p<0.001

6Mth+: HR=0.77 (0.57, 1.03),p=0.078

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| <55 | 7287 | 6908 | 6374 | 5873 | 4473 | 2327 | 48 |
| 55-64 | 5205 | 4946 | 4576 | 4224 | 3378 | 1760 | 20 |
| ≥65 | 1312 | 1225 | 1087 | 987 | 774 | 396 | 3 |

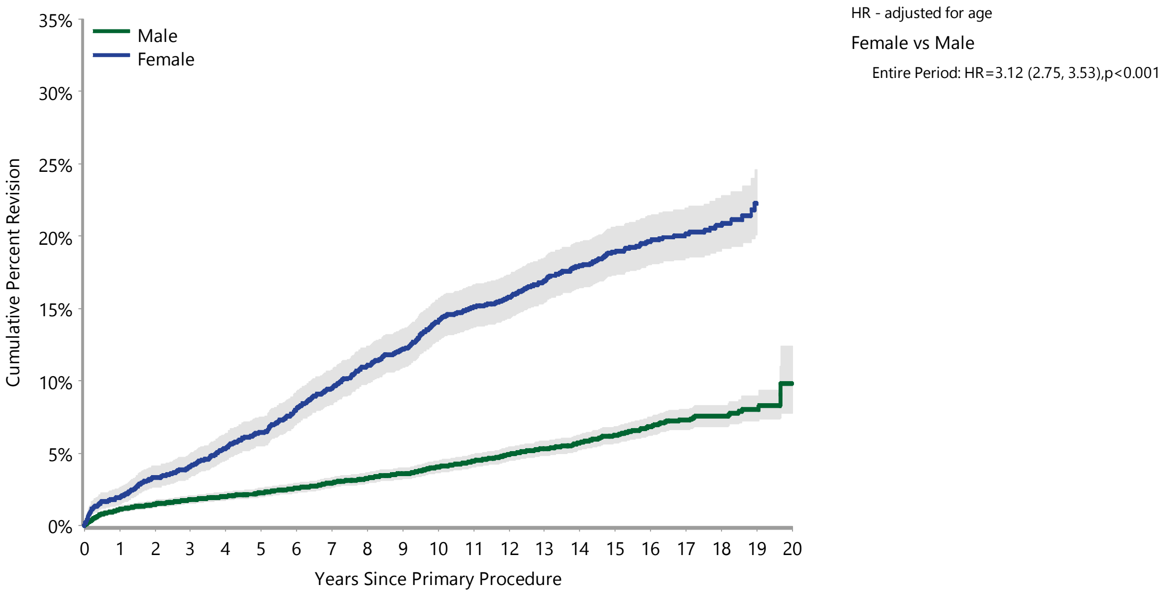
Note: Restricted to modern prostheses

**Table HT82 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 | | 541 | 11383 | 1.1 (0.9, 1.3) | 1.8 (1.6, 2.1) | 2.3 (2.0, 2.6) | 4.1 (3.7, 4.5) | 6.2 (5.7, 6.8) | 9.8 (7.7, 12.4) |
| | <55 | 264 | 5911 | 0.9 (0.7, 1.2) | 1.5 (1.2, 1.8) | 1.9 (1.6, 2.3) | 3.7 (3.2, 4.3) | 6.1 (5.3, 6.9) | |
| | 55-64 | 214 | 4264 | 1.1 (0.8, 1.4) | 1.8 (1.4, 2.3) | 2.5 (2.0, 3.0) | 4.3 (3.7, 5.1) | 6.4 (5.6, 7.4) | |
| | ≥65 | 63 | 1208 | 2.4 (1.7, 3.5) | 3.3 (2.4, 4.5) | 3.7 (2.7, 5.0) | 4.8 (3.6, 6.2) | 6.5 (5.0, 8.4) | |
| Female | | 448 | 2421 | 1.9 (1.5, 2.6) | 4.1 (3.4, 5.0) | 6.4 (5.5, 7.5) | 14.1 (12.7, 15.6) | 18.9 (17.3, 20.6) | |
| | <55 | 253 | 1376 | 1.5 (1.0, 2.3) | 3.6 (2.7, 4.7) | 5.8 (4.7, 7.2) | 14.3 (12.5, 16.3) | 18.9 (16.8, 21.2) | |
| | 55-64 | 182 | 941 | 2.4 (1.6, 3.7) | 4.8 (3.6, 6.4) | 7.4 (5.9, 9.3) | 14.4 (12.3, 16.8) | 19.4 (16.9, 22.2) | |
| | ≥65 | 13 | 104 | 2.9 (0.9, 8.7) | 4.8 (2.0, 11.2) | 5.8 (2.6, 12.4) | 8.8 (4.7, 16.3) | 14.2 (8.4, 23.4) | |
| TOTAL | | 989 | 13804 | | | | | | |

Note: Restricted to modern prostheses

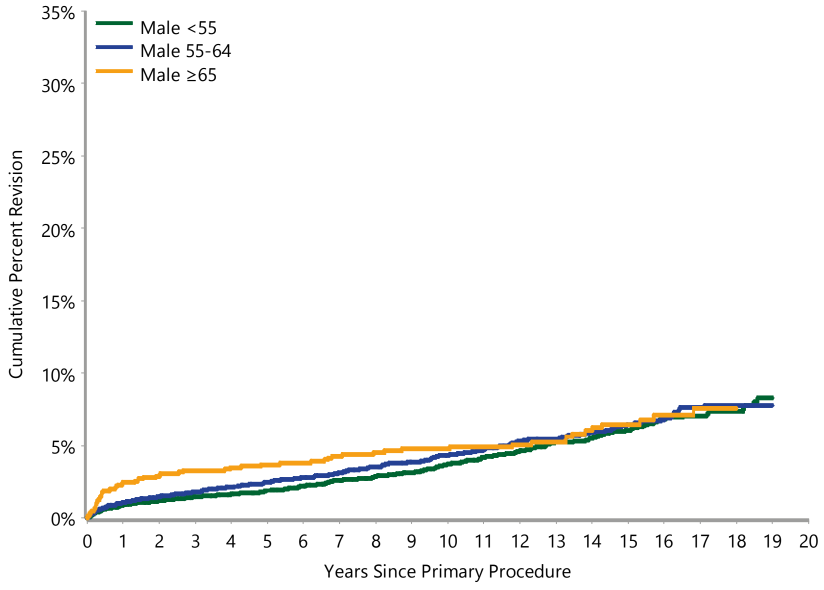
**Figure HT79 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Male | 11383 | 10737 | 9775 | 8895 | 6695 | 3280 | 50 |
| Female | 2421 | 2342 | 2262 | 2189 | 1930 | 1203 | 21 |

Note: Restricted to modern prostheses

**Figure HT80** **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=1.09 (0.91, 1.31),p=0.342

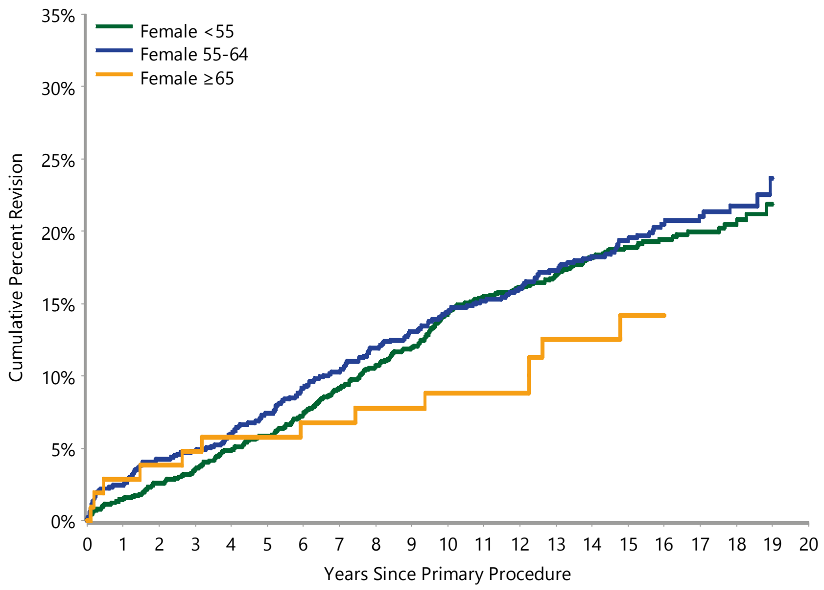
Male ≥65 vs Male <55
0 - 6Mth: HR=2.84 (1.75, 4.63),p<0.001
6Mth - 1Yr: HR=2.13 (0.93, 4.88),p=0.074
1Yr - 13.5Yr: HR=0.81 (0.55, 1.20),p=0.298
13.5Yr+: HR=0.83 (0.36, 1.92),p=0.659

Male ≥65 vs Male 55-64
0 - 6Mth: HR=2.61 (1.59, 4.26),p<0.001
6Mth - 1Yr: HR=1.95 (0.85, 4.48),p=0.115
1Yr+: HR=0.75 (0.52, 1.07),p=0.114

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Male | <55 | 5911 | 5579 | 5089 | 4631 | 3380 | 1658 | 32 |
| | 55-64 | 4264 | 4034 | 3696 | 3373 | 2625 | 1276 | 15 |
| | ≥65 | 1208 | 1124 | 990 | 891 | 690 | 346 | 3 |

Note: Restricted to modern prostheses

**Figure HT81** **Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement in Females by Age (Primary Diagnosis OA)**




Female 55-64 vs Female <55
0 - 1.5Yr: HR=1.91 (1.17, 3.13),p=0.009
1.5Yr+: HR=0.94 (0.77, 1.16),p=0.578

Female 55-64 vs Female ≥65
Entire Period: HR=1.56 (0.89, 2.73),p=0.122

Female ≥65 vs Female <55
Entire Period: HR=0.67 (0.39, 1.18),p=0.163

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Female | <55 | 1376 | 1329 | 1285 | 1242 | 1093 | 669 | 16 |
| | 55-64 | 941 | 912 | 880 | 851 | 753 | 484 | 5 |
| | ≥65 | 104 | 101 | 97 | 96 | 84 | 50 | 0 |

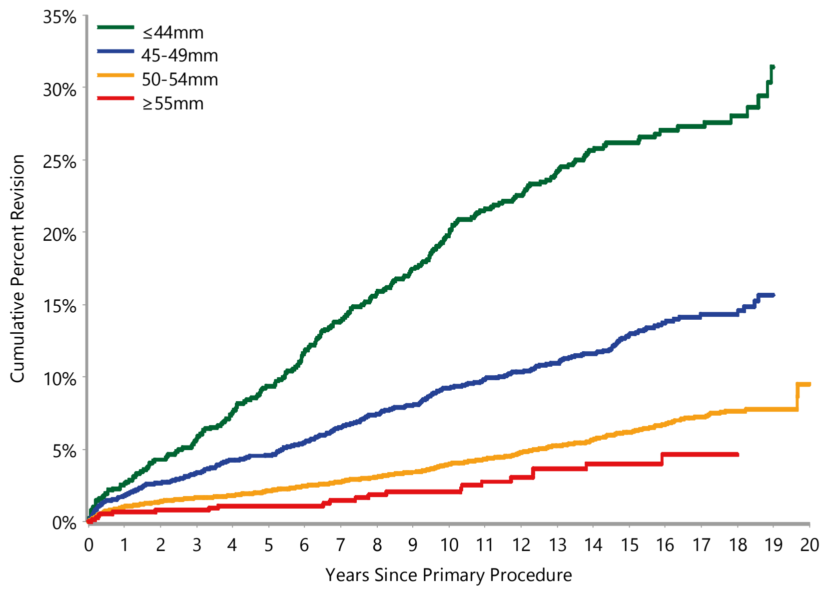
Note: Restricted to modern prostheses

**Table HT83 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 | 225 | 873 | 2.6 (1.8, 4.0) | 5.7 (4.3, 7.5) | 9.4 (7.6, 11.5) | 19.8 (17.2, 22.6) | 26.2 (23.3, 29.4) | |
| 45-49mm | 294 | 2783 | 1.8 (1.3, 2.3) | 3.4 (2.8, 4.1) | 4.6 (3.9, 5.5) | 9.3 (8.2, 10.5) | 12.9 (11.5, 14.4) | |
| 50-54mm | 448 | 9373 | 1.0 (0.9, 1.3) | 1.6 (1.4, 1.9) | 2.1 (1.9, 2.5) | 4.0 (3.5, 4.4) | 6.2 (5.6, 6.8) | 9.5 (7.3, 12.4) |
| ≥55mm | 22 | 775 | 0.7 (0.3, 1.6) | 0.8 (0.4, 1.8) | 1.1 (0.6, 2.2) | 2.0 (1.2, 3.5) | 4.0 (2.5, 6.3) | |
| TOTAL | 989 | 13804 | | | | | | |

Note: Restricted to modern prostheses

**Figure HT82 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Head Size (Primary Diagnosis OA)**




HR - adjusted for age and gender

≤44mm vs ≥55mm

Entire Period: HR=4.40 (2.74, 7.07),p<0.001

45-49mm vs ≥55mm

Entire Period: HR=2.47 (1.57, 3.87),p<0.001

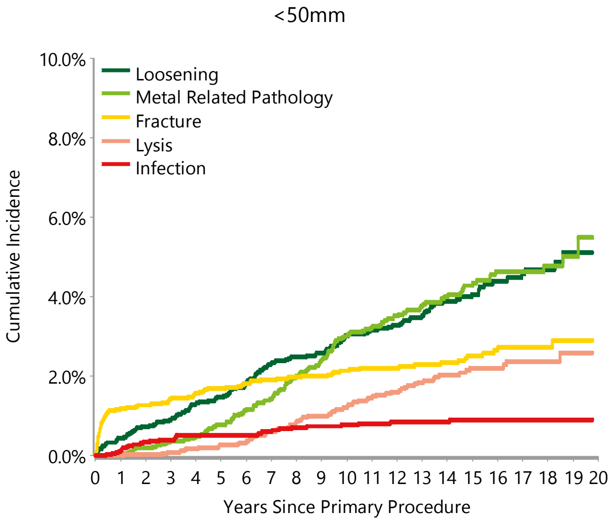
50-54mm vs ≥55mm

Entire Period: HR=1.53 (1.00, 2.35),p=0.050

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| ≤44mm | 873 | 836 | 799 | 765 | 655 | 379 | 7 |
| 45-49mm | 2783 | 2640 | 2452 | 2297 | 1814 | 908 | 12 |
| 50-54mm | 9373 | 8867 | 8115 | 7410 | 5724 | 2997 | 47 |
| ≥55mm | 775 | 736 | 671 | 612 | 432 | 199 | 5 |

Note: Restricted to modern prostheses

**Figure HT83** **Cumulative Incidence Revision Diagnosis of Primary Total Resurfacing Hip Replacement by Head Size (Primary Diagnosis OA)**



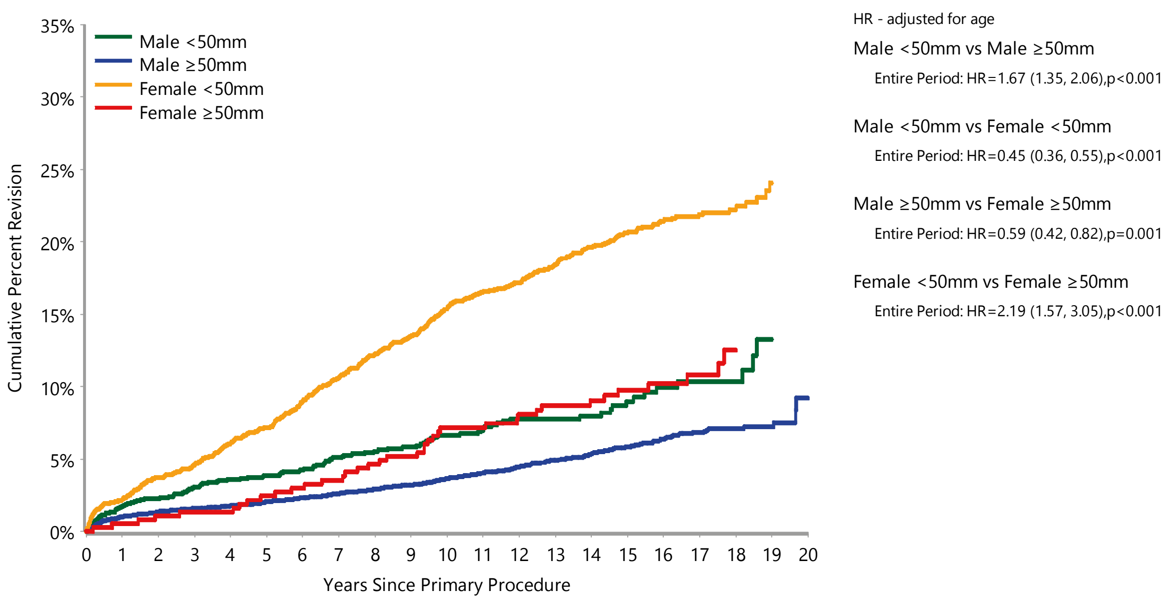

Note: Restricted to modern prostheses

**Table HT84 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 | | 541 | 11383 | 1.1 (0.9, 1.3) | 1.8 (1.6, 2.1) | 2.3 (2.0, 2.6) | 4.1 (3.7, 4.5) | 6.2 (5.7, 6.8) | 9.8 (7.7, 12.4) |
| | <50mm | 109 | 1607 | 1.7 (1.2, 2.5) | 3.1 (2.3, 4.1) | 3.8 (3.0, 4.9) | 6.6 (5.4, 8.2) | 9.0 (7.3, 11.0) | |
| | ≥50mm | 432 | 9776 | 1.0 (0.8, 1.3) | 1.6 (1.4, 1.9) | 2.0 (1.8, 2.4) | 3.6 (3.3, 4.1) | 5.8 (5.3, 6.4) | 9.2 (7.0, 12.1) |
| Female | | 448 | 2421 | 1.9 (1.5, 2.6) | 4.1 (3.4, 5.0) | 6.4 (5.5, 7.5) | 14.1 (12.7, 15.6) | 18.9 (17.3, 20.6) | |
| | <50mm | 410 | 2049 | 2.2 (1.7, 2.9) | 4.6 (3.8, 5.6) | 7.2 (6.1, 8.4) | 15.4 (13.8, 17.0) | 20.6 (18.8, 22.5) | |
| | ≥50mm | 38 | 372 | 0.5 (0.1, 2.1) | 1.3 (0.6, 3.2) | 2.4 (1.3, 4.6) | 7.2 (4.9, 10.4) | 9.8 (7.1, 13.4) | |
| TOTAL | | 989 | 13804 | | | | | | |

Note: Restricted to modern prostheses

**Figure HT84 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender and Femoral Head Size (Primary Diagnosis OA)**




| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Male | <50mm | 1607 | 1504 | 1350 | 1230 | 864 | 320 | 2 |
| | ≥50mm | 9776 | 9233 | 8425 | 7665 | 5831 | 2960 | 48 |
| Female | <50mm | 2049 | 1972 | 1901 | 1832 | 1605 | 967 | 17 |
| | ≥50mm | 372 | 370 | 361 | 357 | 325 | 236 | 4 |

Note: Restricted to modern prostheses

## OUTCOME OF PRIMARY TOTAL RESURFACING COMPARED TO PRIMARY TOTAL CONVENTIONAL HIP REPLACEMENT

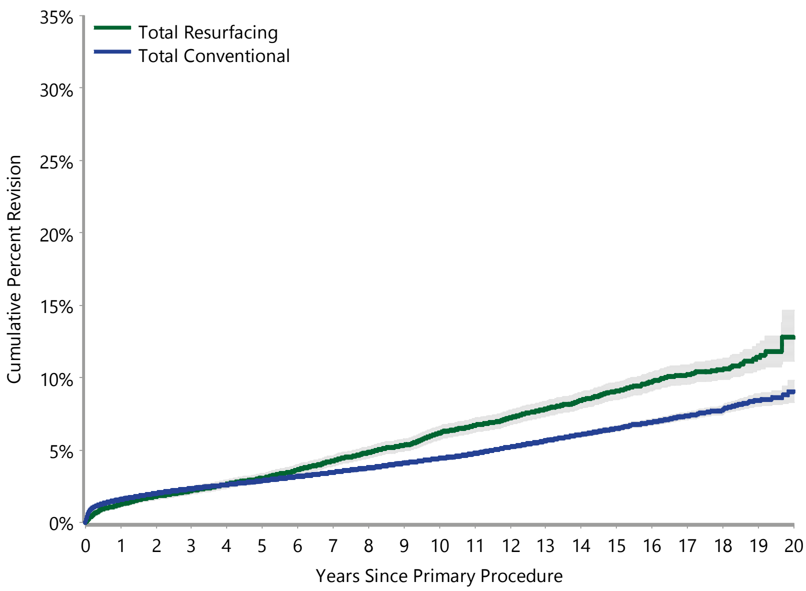
The rate of revision for osteoarthritis in primary total resurfacing and primary total conventional hip replacement was compared using only modern prostheses. Primary total resurfacing has a lower rate of revision than primary total conventional hip replacement in the first month. After 3 months, primary total resurfacing has a higher rate of revision (Table HT85 and Figure HT85).

**Table HT85 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 | 989 | 13804 | 1.3 (1.1, 1.5) | 2.2 (2.0, 2.5) | 3.1 (2.8, 3.4) | 6.2 (5.7, 6.6) | 9.1 (8.5, 9.7) | 12.8 (11.2, 14.6) |
| Total Conventional | 12028 | 368834 | 1.6 (1.5, 1.6) | 2.3 (2.3, 2.4) | 2.9 (2.8, 3.0) | 4.4 (4.3, 4.5) | 6.5 (6.3, 6.7) | 9.0 (8.3, 9.8) |
| TOTAL | 13017 | 382638 | | | | | | |

Note: All primary total conventional procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

**Figure HT85 Cumulative Percent Revision of Primary Total Hip Replacement by Class (Primary Diagnosis OA)**




HR - adjusted for age and gender
Total Resurfacing vs Total Conventional
0 - 1Mth: HR=0.32 (0.22, 0.46),p<0.001
1Mth - 3Mth: HR=0.89 (0.68, 1.16),p=0.393
3Mth+: HR=1.48 (1.37, 1.60),p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Total Resurfacing | 13804 | 13079 | 12037 | 11084 | 8625 | 4483 | 71 |
| Total Conventional | 368834 | 327362 | 251190 | 182981 | 68326 | 17085 | 266 |

Note: All primary total conventional procedures using metal/metal prostheses have been excluded
Restricted to modern prostheses

# Knee Replacement

# Knee Replacement

## CATEGORIES OF KNEE REPLACEMENT

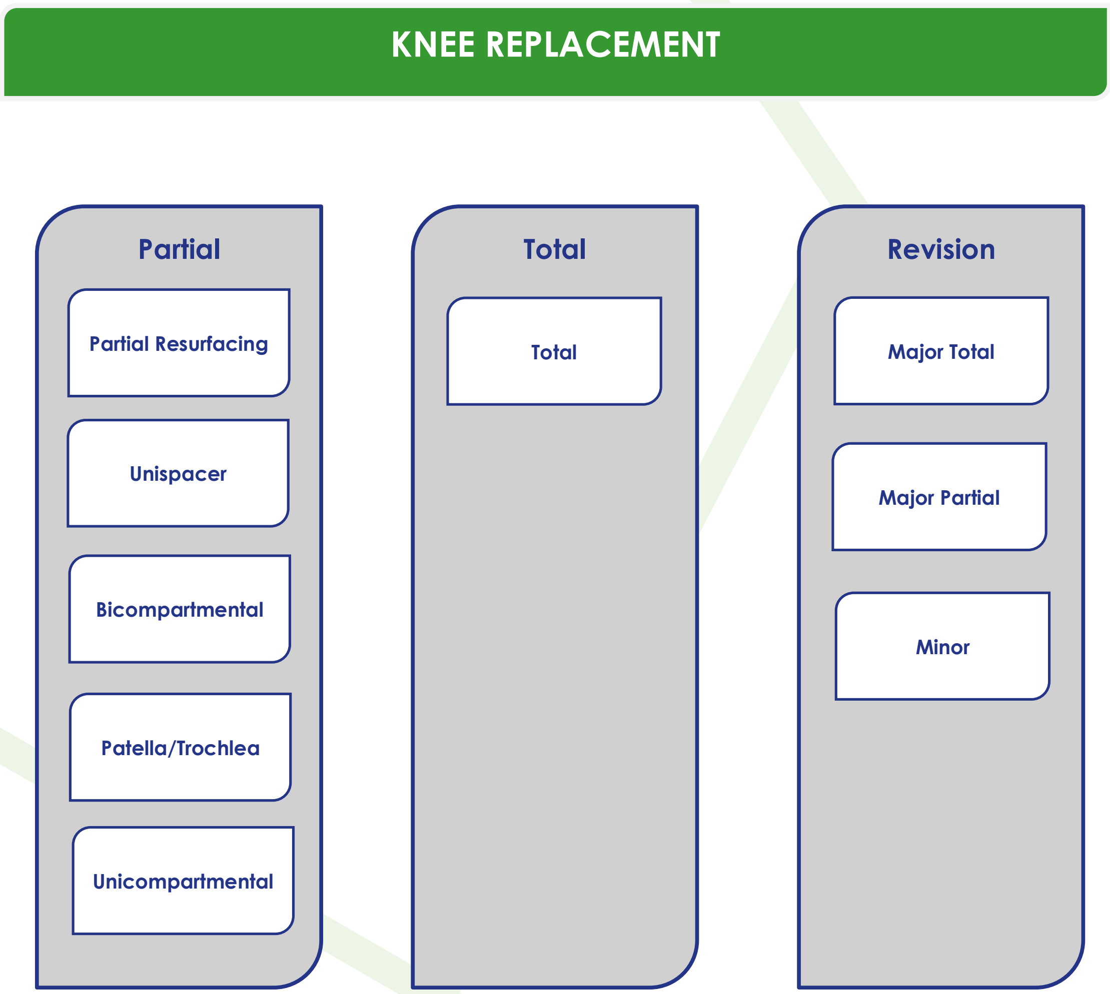
The Registry groups knee replacement into three broad categories: primary partial, primary total and revision knee replacement.

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.

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-2021



## USE OF KNEE REPLACEMENT

This report analyses 911,953 knee replacements with a procedure date up to and including 31 December 2020. This is an additional 62,624 knee procedures compared to the number reported last year. The relative frequency of each type of knee replacement procedure is provided in Table K1.

**Table K1 Number of Knee Replacements**

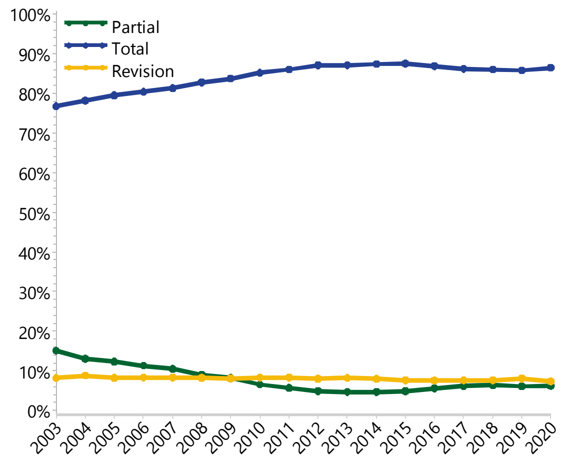
| Knee Category | Number | Percent |
|---|---|---|
| Partial | 68956 | 7.6 |
| Total | 769798 | 84.4 |
| Revision | 73199 | 8.0 |
| TOTAL | 911953 | 100.0 |

In 2020, the number of knee replacements undertaken has decreased by 4,527 (6.8%) compared to 2019. During the last year, primary partial knee replacement decreased by 5.2% and primary total knee replacement decreased by 6.1%. Revision knee replacement decreased by 15.8%.

This is the first time the number of knee replacements has decreased since the Registry began and this is due to the cancellation of elective surgery during COVID-19 restrictions.

In 2020, primary total knee replacement accounts for 86.5% of all knee replacement procedures. Primary partial knee replacement increased to 6.2%, and the proportion of revision knee procedures has declined to 7.3%. This equates to 915 fewer revision procedures in 2020 than would have been expected if the proportion of revision procedures had remained at the level reported in 2003 (Figure K1).

**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 Anaesthesiologists Physical Status Classification (ASA score) and Body Mass Index (BMI). The Registry commenced collecting ASA score in 2012 and BMI data in 2015.

ASA score and BMI are both known to impact the outcome of knee replacement surgery.

There are ASA score data on 463,968 and BMI data on 354,660 knee replacement procedures. Since its initial collection, ASA score has been recorded for 96.3% of procedures. BMI has been recorded for 94.2% of procedures since collection commenced.

In 2020, ASA score is reported in 99.8% of knee replacement procedures and BMI data are reported in 98.6% of procedures.

BMI data are reported for 99.2% of primary partial knees, 99.0% of primary total knees and 93.7% of revision knee replacement procedures.

### 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

Overall, in 92.7% of procedures, patients have an ASA score of 2 or 3, 6.1% 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 a lower proportion with ASA scores of 1 or 2 (Table K2).

### BMI

BMI for adults is classified by the World Health Organisation into six main categories.[6]

| | | |
|---|---|---|
| 1. | Underweight | <18.50 |
| 2. | Normal | 18.50 - 24.99 |
| 3. | Pre-obese | 25.00 - 29.99 |
| 4. | Obese Class 1 | 30.00 - 34.99 |
| 5. | Obese Class 2 | 35.00 - 39.99 |
| 6. | Obese Class 3 | ≥40.00 |

For all knee replacements, the majority of procedures are undertaken in patients that are either pre-obese or obese class 1. There is almost no 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 K3).

[5] https://www.asahq.org/resources/clinical-information/asa-physical-status-classification-system

[6] http://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi

**Table K2 ASA Score for Knee Replacement**

| ASA Score | Partial | | Total | | Revision | | TOTAL | |
|---|---|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% | N | Col% |
| ASA 1 | 3342 | 12.7 | 23426 | 5.8 | 1320 | 3.7 | 28088 | 6.1 |
| ASA 2 | 16121 | 61.2 | 220244 | 54.8 | 15240 | 42.7 | 251605 | 54.2 |
| ASA 3 | 6739 | 25.6 | 153887 | 38.3 | 17651 | 49.5 | 178277 | 38.4 |
| ASA 4 | 126 | 0.5 | 4378 | 1.1 | 1470 | 4.1 | 5974 | 1.3 |
| ASA 5 | . | . | 11 | 0.0 | 13 | 0.0 | 24 | 0.0 |
| TOTAL | 26328 | 100.0 | 401946 | 100.0 | 35694 | 100.0 | 463968 | 100.0 |

**Table K3 BMI Category for Knee Replacement**

| BMI Category | Partial | | Total | | Revision | | TOTAL | |
|---|---|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% | N | Col% |
| Underweight | 39 | 0.2 | 611 | 0.2 | 91 | 0.4 | 741 | 0.2 |
| Normal | 3116 | 14.7 | 32188 | 10.5 | 2836 | 11.0 | 38140 | 10.8 |
| Pre Obese | 8606 | 40.5 | 95909 | 31.2 | 7779 | 30.2 | 112294 | 31.7 |
| Obese Class 1 | 6492 | 30.5 | 94707 | 30.8 | 7815 | 30.3 | 109014 | 30.7 |
| Obese Class 2 | 2212 | 10.4 | 52168 | 17.0 | 4424 | 17.2 | 58804 | 16.6 |
| Obese Class 3 | 804 | 3.8 | 32051 | 10.4 | 2812 | 10.9 | 35667 | 10.1 |
| TOTAL | 21269 | 100.0 | 307634 | 100.0 | 25757 | 100.0 | 354660 | 100.0 |

Note: BMI has not been presented for patients aged ≤19 years

# Primary Partial Knee Replacement Summary

## INTRODUCTION

This section provides summary information on partial knee replacement. Previously, detailed information on partial knees was included in the Annual Report. Since 2019, it has been provided as a separate supplementary report with the aim of streamlining the Annual Report. The Partial Knee Arthroplasty Supplementary Report is one of 15 supplementary reports that complete the AOANJRR Annual Report for 2021 and is available on the AOANJRR website.

## CLASSES OF PARTIAL KNEE REPLACEMENT

The Registry subcategorises partial knee replacement 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.

## USE OF PARTIAL KNEE REPLACEMENT

Unicompartmental knee replacement remains the most common class of primary partial knee replacement, accounting for 92.8% of all partial knee replacement procedures. The second most common class is patella/trochlear replacement (6.6%). 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 | 245 | 0.4 |
| Unispacer | 40 | 0.1 |
| Bicompartmental | 165 | 0.2 |
| Patella/Trochlea | 4529 | 6.6 |
| Unicompartmental | 63977 | 92.8 |
| TOTAL | 68956 | 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. Partial resurfacing has not been recorded in 2020. These classes of partial knee replacement are not presented in detail in this report.

Detailed information on unispacer, bicompartmental and partial resurfacing knee replacement is available in the supplementary report 'Prosthesis Types No Longer Used' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2021

## PATELLA/TROCHLEA

There have been 4,529 patella/trochlear knee replacement procedures undertaken for all diagnoses. This is an additional 302 procedures compared to the previous report. The principal diagnosis for patella/trochlea procedures is osteoarthritis. The mean age of patients is 58.5 years, with this procedure undertaken more frequently in females.

In order to keep Registry data contemporaneous, only procedures using prostheses that have been available and used in 2020 (described as modern prostheses) are included in the analyses, unless clearly specified.

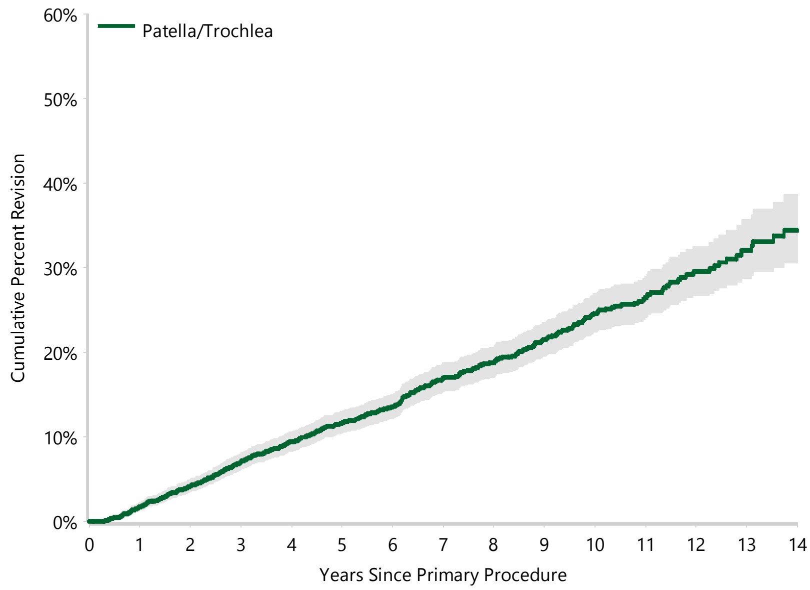
The Registry has recorded 480 revisions of primary patella/trochlear knee replacement for osteoarthritis. The cumulative percent revision of patella/ trochlear replacement at 14 years is 34.4% (Table KP2 and Figure KP1). The most common reason for revision is progression of disease, with most revised to a total knee replacement. Both age and gender are risk factors for revision with patients aged <65 years and males having a higher rate of revision.

**Table KP2 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 | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Patella/Trochlea | 480 | 3324 | 1.8 (1.4, 2.3) | 7.0 (6.1, 8.1) | 11.7 (10.4, 13.0) | 17.0 (15.4, 18.7) | 24.5 (22.4, 26.9) | 34.4 (30.5, 38.7) |
| TOTAL | 480 | 3324 | | | | | | |

Note: Restricted to modern prostheses

**Figure KP1 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 | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Patella/Trochlea | 3324 | 2977 | 2201 | 1564 | 1074 | 519 | 83 |

Note: Restricted to modern prostheses

More information regarding patella/trochlea procedures is available in the 'Partial Knee Arthroplasty Supplementary Report' on the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2021

## UNICOMPARTMENTAL

### DEMOGRAPHICS

This year, the Registry is reporting on 63,977 primary unicompartmental knee procedures. This is an additional 3,590 procedures compared to the last report.

The use of unicompartmental knee replacement increased from 5.6% in 2019 to 5.7% of all knee procedures in 2020. Although the proportion of unicompartmental knee replacements has increased over the last 5 years (from 4.2% in 2014), it is still considerably less than in 2003 (14.5%). Osteoarthritis is the principal diagnosis.

This procedure is undertaken more often in males (54.0%) (Table KP3). The proportion of males has increased to 58.7% in 2020 (Figure KP2).

Unicompartmental knee replacement is most frequently undertaken in patients aged 55-74 years. The age distribution has remained relatively stable since 2003 (Figure KP3). The mean age of patients is 65.4 years (Table KP3).

**Figure KP2** **Primary Unicompartmental Knee Replacement by Gender**

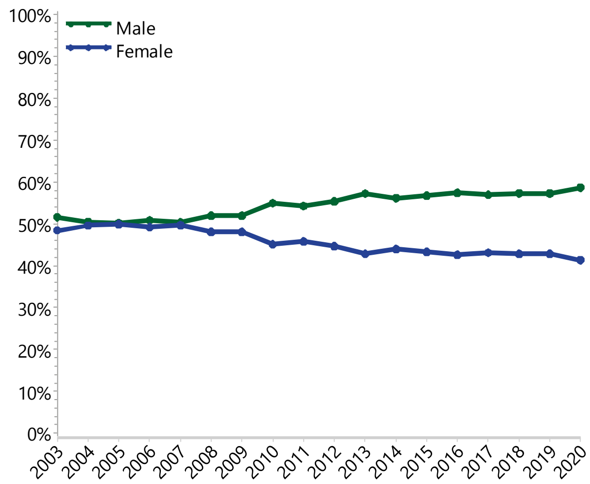
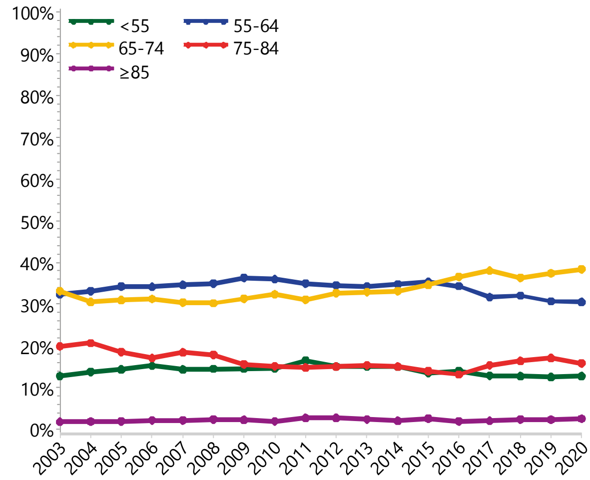



**Figure KP3** **Primary Unicompartmental Knee Replacement by Age**




The proportion of unicompartmental knee replacements using robotic assistance continues to increase in 2020 to 34.2% despite a small decrease in 2019 (Figure KP4).

In 2020, the 10 most used tibial prostheses account for 98.7% of all unicompartmental procedures. The Restoris MCK, Oxford (cementless) and ZUK are the most used prostheses in 2020 (Table KP4).

The outcomes of unicompartmental knee prosthesis combinations with more than 200 procedures are presented in Table KP5.

**Figure KP4** **Primary Unicompartmental Knee Replacement by Robotic Assistance (Primary Diagnosis OA)**

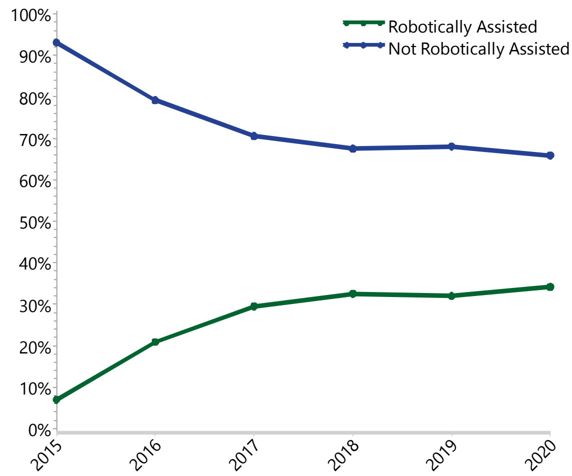


**Table KP3 Age and Gender of Primary Unicompartmental Knee Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 34534 | 54.0% | 24 | 98 | 66 | 65.8 | 9.6 |
| Female | 29443 | 46.0% | 13 | 98 | 65 | 64.9 | 10.2 |
| TOTAL | 63977 | 100.0% | 13 | 98 | 65 | 65.4 | 9.9 |

**Table KP4 10 Most Used Tibial Prostheses in Primary Unicompartmental Knee Replacement**

| 2003 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 1366 | Oxford (ctd) | 1026 | Restoris MCK | 1148 | Restoris MCK | 1094 | Restoris MCK | 1139 | Restoris MCK |
| 444 | Repicci II | 915 | ZUK | 985 | ZUK | 897 | ZUK | 807 | Oxford (cless) |
| 373 | Preservation Fixed | 912 | Oxford (cless) | 804 | Oxford (cless) | 830 | Oxford (cless) | 709 | ZUK |
| 353 | M/G | 262 | Oxford (ctd) | 202 | Journey Uni (v2) | 208 | BalanSys Uni Fixed | 176 | BalanSys Uni Fixed |
| 336 | Allegretto Uni | 175 | Journey Uni (v2) | 196 | Oxford (ctd) | 196 | Journey Uni (v2) | 168 | Sigma HP |
| 321 | GRU | 136 | Sigma HP | 146 | Sigma HP | 168 | Oxford (ctd) | 151 | Journey Uni (v2) |
| 275 | Genesis | 62 | Triathlon PKR | 139 | BalanSys Uni Fixed | 162 | Sigma HP | 139 | Oxford (ctd) |
| 260 | Unix | 43 | Endo-Model Sled | 46 | Triathlon PKR | 118 | Genus | 128 | Genus |
| 121 | Preservation Mobile | 27 | Journey Uni All | 36 | Genus | 24 | Journey Uni All | 68 | Persona |
| 101 | Endo-Model Sled | 25 | Repicci II | 29 | GMK-UNI | 17 | Endo-Model Sled | 20 | Endo-Model Sled |
| 10 Most Used | | | | | | | | | |
| 3950 | (10) 96.1% | 3583 | (10) 98.0% | 3731 | (10) 98.0% | 3714 | (10) 98.9% | 3505 | (10) 98.7% |
| Remainder | | | | | | | | | |
| 159 | (7) 3.9% | 74 | (8) 2.0% | 76 | (7) 2.0% | 40 | (6) 1.1% | 46 | (6) 1.3% |
| TOTAL | | | | | | | | | |
| 4109 | (17) 100.0% | 3657 | (18) 100.0% | 3807 | (17) 100.0% | 3754 | (16) 100.0% | 3551 | (16) 100.0% |

**Table KP5 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 |
|---|---|---|---|---|---|---|---|---|---|
| Allegretto Uni | ZUK | 20 | 281 | 0.8 (0.2, 3.0) | 5.0 (2.9, 8.7) | 8.4 (5.2, 13.4) | | | |
| BalanSys Uni | BalanSys Uni Fixed | 46 | 923 | 2.1 (1.3, 3.3) | 3.9 (2.7, 5.6) | 4.7 (3.3, 6.7) | 8.1 (5.8, 11.3) | | |
| Endo-Model Sled | Endo-Model Sled | 209 | 1328 | 1.3 (0.8, 2.1) | 5.2 (4.1, 6.6) | 7.9 (6.6, 9.6) | 14.8 (12.8, 17.1) | 22.2 (19.4, 25.3) | |
| Genus | Genus | 7 | 287 | 1.8 (0.7, 4.8) | | | | | |
| Journey Uni | Journey Uni (v2) | 46 | 1049 | 2.5 (1.7, 3.6) | 4.7 (3.5, 6.5) | 6.0 (4.4, 8.1) | | | |
| | Journey Uni All Poly | 37 | 330 | 1.6 (0.7, 3.7) | 7.0 (4.6, 10.5) | 9.0 (6.2, 13.0) | 15.3 (10.9, 21.2) | | |
| Oxford (cless) | Oxford (cless) | 492 | 7507 | 2.7 (2.3, 3.1) | 4.7 (4.2, 5.2) | 6.0 (5.4, 6.7) | 11.2 (10.0, 12.5) | | |
| | Oxford (ctd) | 44 | 459 | 3.3 (2.0, 5.4) | 6.4 (4.4, 9.1) | 9.2 (6.7, 12.6) | | | |
| Oxford (ctd) | Oxford (ctd) | 2423 | 13432 | 2.2 (1.9, 2.4) | 5.7 (5.4, 6.2) | 8.2 (7.7, 8.7) | 14.6 (14.0, 15.3) | 22.5 (21.6, 23.4) | 31.5 (29.5, 33.7) |
| Repicci II | Repicci II | 591 | 2237 | 1.5 (1.1, 2.1) | 4.6 (3.8, 5.6) | 7.6 (6.5, 8.8) | 18.8 (17.1, 20.6) | 30.8 (28.6, 33.1) | |
| Restoris MCK | Restoris MCK | 132 | 5162 | 1.5 (1.1, 1.8) | 3.2 (2.7, 3.9) | 4.2 (3.4, 5.0) | | | |
| Sigma HP | Sigma HP | 60 | 1470 | 0.9 (0.6, 1.6) | 2.8 (2.0, 3.9) | 4.7 (3.6, 6.2) | 7.5 (5.5, 10.1) | | |
| Triathlon PKR | Triathlon PKR | 29 | 366 | 3.1 (1.7, 5.5) | 6.5 (4.3, 9.7) | 7.8 (5.3, 11.4) | | | |
| ZUK | ZUK | 509 | 9303 | 1.5 (1.2, 1.7) | 3.5 (3.1, 3.9) | 4.7 (4.2, 5.2) | 8.1 (7.3, 8.9) | 12.4 (10.5, 14.6) | |
| Other (10) | | 93 | 623 | 4.3 (2.9, 6.3) | 11.0 (8.6, 14.0) | 14.5 (11.7, 18.0) | 20.5 (16.7, 24.9) | | |
| TOTAL | | 4738 | 44757 | | | | | | |

Note: Restricted to modern prostheses
Only prostheses with over 200 procedures have been listed

## OUTCOME FOR OSTEOARTHRITIS

The Registry has recorded 4,690 revisions of primary unicompartmental knee replacements with an initial diagnosis of osteoarthritis.

In order to keep Registry data contemporaneous, only procedures using prostheses that have been available and used in 2020 (described as modern prostheses) are included in the analyses, unless clearly specified.

The cumulative percent revision for primary unicompartmental knee replacement undertaken for osteoarthritis is 13.0% at 10 years and 30.7% at 20 years (Table KP6 and Figure KP5).

The main reasons for revision are progression of disease, loosening and pain (Table KP7 and Figure KP6). The main type of revision is to a total knee replacement (Table KP8).

### Patient Characteristics

Age is a major factor affecting the outcome of primary unicompartmental knee replacement, with the rate of revision decreasing with increasing age (Table KP9 and Figure KP7).

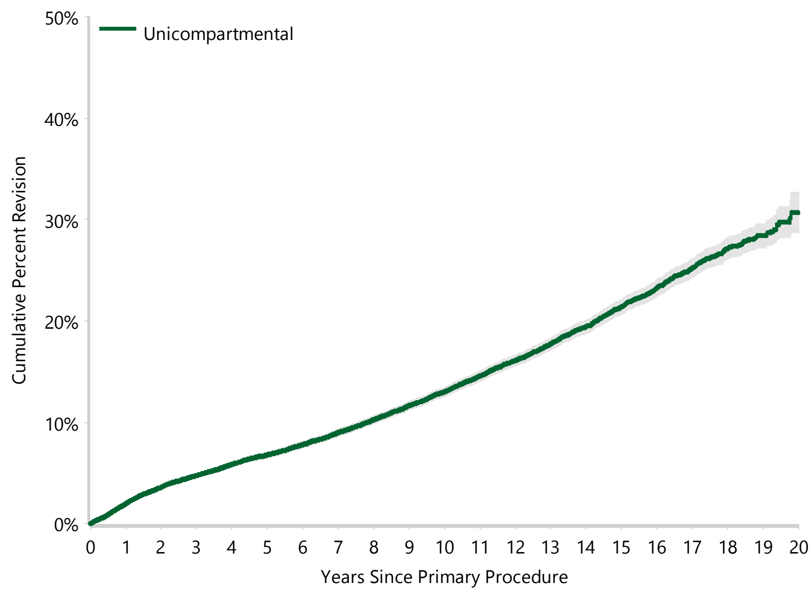
Females have a higher rate of revision. The effect of age on the rate of revision is evident in both males and females (Table KP10 and Figure KP8).

**Table KP6 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement (Primary Diagnosis OA)**

| Knee Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Unicompartmental | 4690 | 44380 | 2.0 (1.8, 2.1) | 4.8 (4.5, 5.0) | 6.8 (6.5, 7.0) | 13.0 (12.6, 13.4) | 21.4 (20.7, 22.1) | 30.7 (28.7, 32.7) |
| TOTAL | 4690 | 44380 | | | | | | |

Note: Restricted to modern prostheses

**Figure KP5 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Unicompartmental | 44380 | 39889 | 31090 | 23763 | 12503 | 4384 | 103 |

Note: Restricted to modern prostheses

**Table KP7** **Primary Unicompartmental Knee Replacement by Reason for Revision (Primary Diagnosis OA)**

| Reason for Revision | Number | Percent |
|---|---|---|
| Progression Of Disease | 1691 | 36.1 |
| Loosening | 1567 | 33.4 |
| Pain | 364 | 7.8 |
| Infection | 224 | 4.8 |
| Bearing Dislocation | 153 | 3.3 |
| Fracture | 129 | 2.8 |
| Lysis | 110 | 2.3 |
| Instability | 71 | 1.5 |
| Wear Tibial Insert | 71 | 1.5 |
| Malalignment | 59 | 1.3 |
| Other (14) | 251 | 5.4 |
| TOTAL | 4690 | 100.0 |

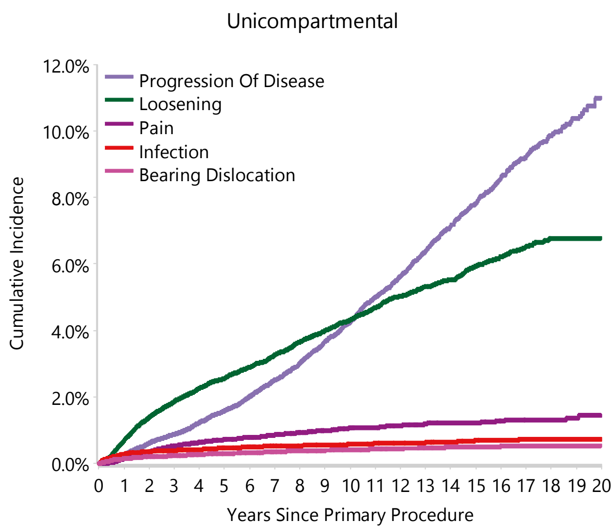
Note: Restricted to modern prostheses

**Table KP8** **Primary Unicompartmental Knee Replacement by Type of Revision (Primary Diagnosis OA)**

| Type of Revision | Number | Percent |
|---|---|---|
| TKR (Tibial/Femoral) | 4008 | 85.5 |
| Uni Insert Only | 417 | 8.9 |
| Uni Tibial Component | 113 | 2.4 |
| Uni Femoral Component | 48 | 1.0 |
| Cement Spacer | 39 | 0.8 |
| UKR (Uni Tibial/Uni Femoral) | 37 | 0.8 |
| Patella/Trochlear Resurfacing | 13 | 0.3 |
| Removal of Prostheses | 5 | 0.1 |
| Reinsertion of Components | 4 | 0.1 |
| Femoral Component* | 3 | 0.1 |
| Tibial Component | 2 | 0.0 |
| Patella Only | 1 | 0.0 |
| TOTAL | 4690 | 100.0 |

Note: *Bicompartmental component
Restricted to modern prostheses

**Figure KP6** **Cumulative Incidence Revision Diagnosis of Primary Unicompartmental Knee Replacement (Primary Diagnosis OA)**



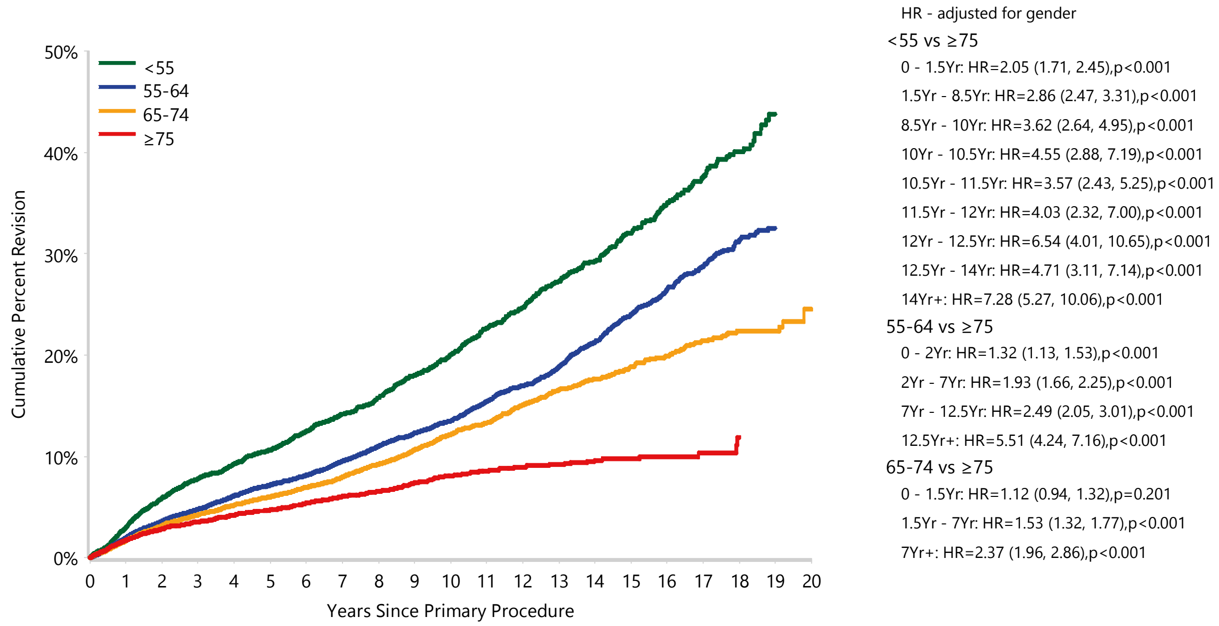

Note: Restricted to modern prostheses

**Table KP9 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 | 1017 | 5842 | 3.0 (2.6, 3.5) | 7.8 (7.1, 8.5) | 10.6 (9.8, 11.5) | 20.0 (18.7, 21.4) | 32.1 (30.1, 34.2) | |
| 55-64 | 1797 | 14601 | 2.0 (1.8, 2.2) | 4.8 (4.4, 5.2) | 7.2 (6.7, 7.7) | 13.5 (12.8, 14.2) | 24.0 (22.8, 25.2) | |
| 65-74 | 1408 | 15455 | 1.7 (1.5, 1.9) | 4.2 (3.9, 4.6) | 6.0 (5.6, 6.4) | 12.1 (11.4, 12.9) | 18.8 (17.7, 20.0) | 24.5 (21.6, 27.7) |
| ≥75 | 468 | 8482 | 1.7 (1.5, 2.0) | 3.5 (3.1, 4.0) | 4.7 (4.2, 5.3) | 8.1 (7.3, 8.9) | 9.8 (8.7, 10.9) | |
| TOTAL | 4690 | 44380 | | | | | | |

Note: Restricted to modern prostheses

**Figure KP7 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 | 5842 | 5227 | 4058 | 3139 | 1676 | 619 | 11 |
| 55-64 | 14601 | 13237 | 10546 | 8228 | 4581 | 1710 | 38 |
| 65-74 | 15455 | 13819 | 10682 | 8028 | 4248 | 1546 | 45 |
| ≥75 | 8482 | 7606 | 5804 | 4368 | 1998 | 509 | 9 |

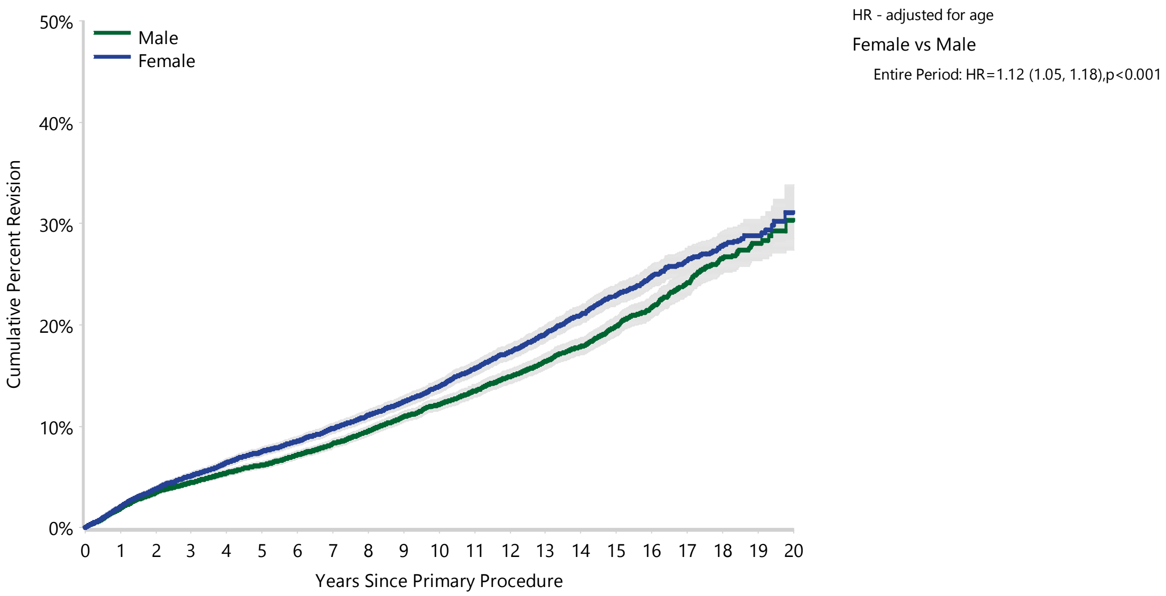
Note: Restricted to modern prostheses

**Table KP10 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** | | **2275** | **24222** | **1.9 (1.7, 2.1)** | **4.5 (4.2, 4.7)** | **6.1 (5.8, 6.5)** | **12.1 (11.6, 12.7)** | **19.8 (18.9, 20.8)** | **30.3 (27.4, 33.5)** |
| | <55 | 446 | 2694 | 3.0 (2.4, 3.7) | 7.3 (6.4, 8.5) | 9.6 (8.5, 10.9) | 19.9 (17.9, 22.0) | 33.0 (29.8, 36.4) | |
| | 55-64 | 908 | 8044 | 2.0 (1.7, 2.4) | 4.7 (4.2, 5.2) | 6.8 (6.2, 7.4) | 13.0 (12.1, 14.1) | 22.3 (20.7, 24.0) | |
| | 65-74 | 703 | 8801 | 1.6 (1.3, 1.9) | 4.0 (3.6, 4.5) | 5.5 (5.0, 6.1) | 11.1 (10.2, 12.0) | 16.9 (15.5, 18.4) | |
| | ≥75 | 218 | 4683 | 1.6 (1.2, 2.0) | 3.2 (2.7, 3.7) | 4.0 (3.4, 4.7) | 7.4 (6.4, 8.5) | 9.0 (7.6, 10.7) | |
| **Female** | | **2415** | **20158** | **2.1 (1.9, 2.3)** | **5.1 (4.8, 5.4)** | **7.5 (7.1, 7.9)** | **13.9 (13.3, 14.6)** | **22.9 (21.9, 23.9)** | **31.1 (28.6, 33.8)** |
| | <55 | 571 | 3148 | 3.0 (2.4, 3.7) | 8.1 (7.2, 9.2) | 11.4 (10.3, 12.7) | 20.2 (18.5, 22.1) | 31.4 (28.9, 34.1) | |
| | 55-64 | 889 | 6557 | 1.9 (1.6, 2.3) | 4.9 (4.4, 5.5) | 7.6 (6.9, 8.3) | 14.0 (13.0, 15.1) | 25.7 (24.0, 27.6) | |
| | 65-74 | 705 | 6654 | 1.8 (1.5, 2.2) | 4.5 (4.0, 5.1) | 6.6 (5.9, 7.3) | 13.5 (12.4, 14.6) | 21.0 (19.4, 22.8) | |
| | ≥75 | 250 | 3799 | 1.9 (1.5, 2.4) | 3.9 (3.3, 4.7) | 5.5 (4.8, 6.4) | 8.9 (7.8, 10.2) | 10.6 (9.2, 12.2) | |
| **TOTAL** | | **4690** | **44380** | | | | | | |

Note: Restricted to modern prostheses

**Figure KP8 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 | 24222 | 21611 | 16620 | 12478 | 6198 | 2142 | 47 |
| Female | 20158 | 18278 | 14470 | 11285 | 6305 | 2242 | 56 |

Note: Restricted to modern prostheses

## OUTCOME BY PROSTHESIS CHARACTERISTICS

### Bearing Mobility

Fixed bearings are used in 51.8% of unicompartmental knee replacements, while in the remainder the bearing insert is mobile. Three different prostheses have a mobile bearing. Fixed bearing prostheses have a lower rate of revision compared to mobile bearing prostheses in the first 2 years and between 2.5 and 7.5 years (Table KP11 and Figure KP9).

### Robotic Assistance

There have been 5,476 robotically assisted unicompartmental knee replacement procedures recorded since 2015. In 2020, 34.2% of unicompartmental knee procedures used robotic assistance. There are only 4 unicompartmental combinations that can be used with robotic assistance.

Unicompartmental knee procedures using robotic assistance have a lower rate of revision compared to unicompartmental procedures without robotic assistance (Table KP12 and Figure KP10). When using robotic assistance, there are fewer revisions for loosening, progression of disease and pain, but more revisions for infection (Table KP13 and Figure KP11).

### Position

The Registry has recorded 1,285 lateral unicompartmental knee procedures undertaken for osteoarthritis. There is no difference in the rate of revision when lateral unicompartmental knee replacement is compared to medial unicompartmental knee replacement (Table KP14 and Figure KP12). The most common reasons for revision of both lateral and medial unicompartmental knees are progression of disease and loosening (Table KP15 and Figure KP13).

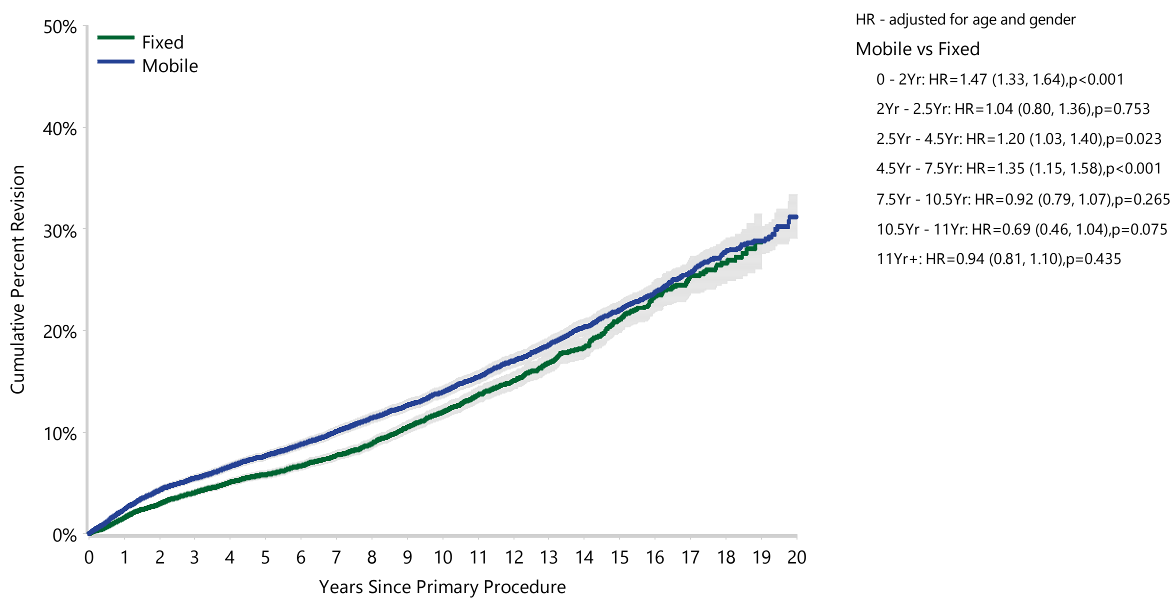
The outcome of prosthesis combinations with >50 procedures used in lateral unicompartmental knee replacement is presented in Table KP16.

**Table KP11 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 | 1743 | 22977 | 1.6 (1.4, 1.7) | 4.0 (3.8, 4.3) | 5.8 (5.5, 6.2) | 11.9 (11.3, 12.6) | 21.0 (19.8, 22.4) | |
| Mobile | 2946 | 21334 | 2.4 (2.2, 2.6) | 5.5 (5.2, 5.8) | 7.7 (7.3, 8.1) | 13.9 (13.4, 14.5) | 22.0 (21.2, 22.9) | 31.2 (29.1, 33.4) |
| TOTAL | 4689 | 44311 | | | | | | |

Note: Excludes 69 primary unicompartmental knee procedures with unknown/missing mobility
Restricted to modern prostheses

**Figure KP9 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 | 22977 | 20068 | 14061 | 9641 | 4341 | 1077 | 2 |
| Mobile | 21334 | 19820 | 17029 | 14122 | 8162 | 3307 | 101 |

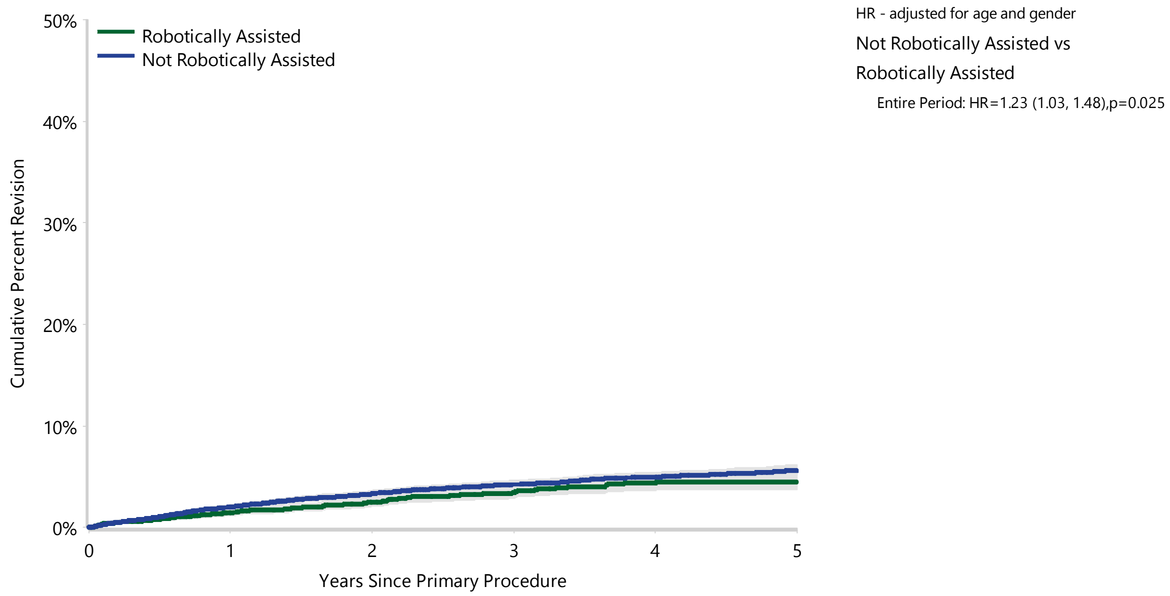
Note: Restricted to modern prostheses

**Table KP12 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement since 2015 by Robotic Assistance (Primary Diagnosis OA)**

| Robotic Assistance | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|
| Robotically Assisted | 147 | 5476 | 1.5 (1.2, 1.8) | 2.5 (2.1, 3.0) | 3.4 (2.9, 4.1) | 4.3 (3.6, 5.2) | 4.5 (3.7, 5.4) |
| Not Robotically Assisted | 549 | 14341 | 2.0 (1.8, 2.3) | 3.3 (3.0, 3.6) | 4.2 (3.9, 4.6) | 4.9 (4.5, 5.4) | 5.6 (5.1, 6.1) |
| TOTAL | 696 | 19817 | | | | | |

Note: Restricted to modern prostheses

**Figure KP10 Cumulative Percent Revision of 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 | 5 Yrs |
|---|---|---|---|---|---|---|
| Robotically Assisted | 5476 | 4193 | 2980 | 1776 | 738 | 141 |
| Not Robotically Assisted | 14341 | 11750 | 9094 | 6557 | 4114 | 1958 |

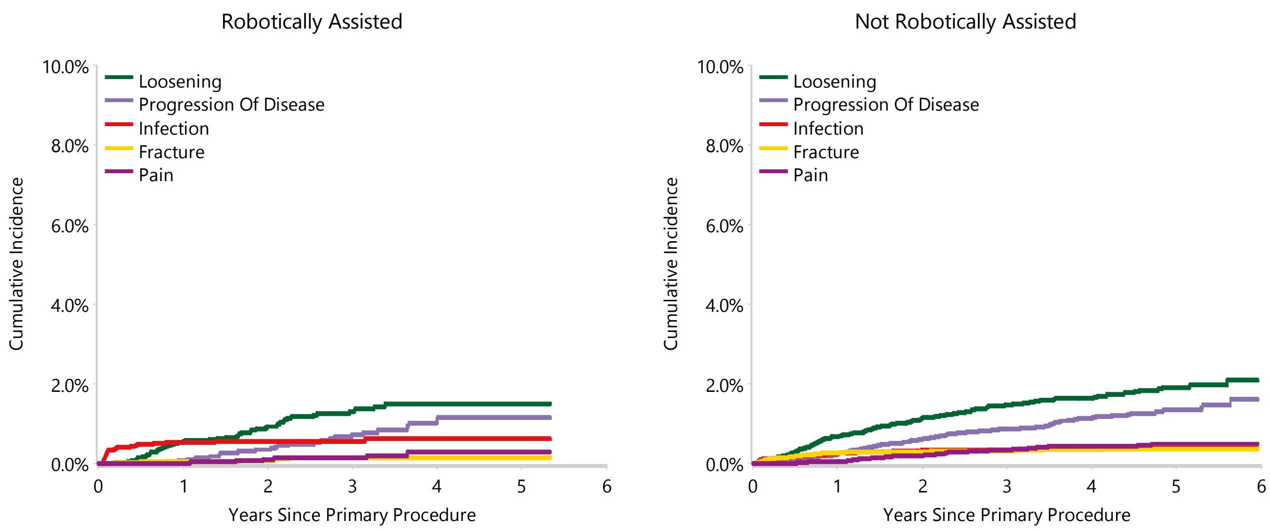
Note: Restricted to modern prostheses

**Table KP13** **Revision Diagnosis of Primary Unicompartmental Knee Replacement Since 2015 by Robotic Assistance (Primary Diagnosis OA)**

| Revision Diagnosis | Robotically Assisted | | | Not Robotically Assisted | | |
|---|---|---|---|---|---|---|
| | Number | % Primaries Revised | % Revisions | Number | % Primaries Revised | % Revisions |
| Loosening | 52 | 0.9 | 35.4 | 187 | 1.3 | 34.1 |
| Progression Of Disease | 28 | 0.5 | 19.0 | 118 | 0.8 | 21.5 |
| Infection | 30 | 0.5 | 20.4 | 46 | 0.3 | 8.4 |
| Bearing Dislocation | | | | 45 | 0.3 | 8.2 |
| Fracture | 6 | 0.1 | 4.1 | 45 | 0.3 | 8.2 |
| Pain | 7 | 0.1 | 4.8 | 43 | 0.3 | 7.8 |
| Instability | 5 | 0.1 | 3.4 | 17 | 0.1 | 3.1 |
| Malalignment | 4 | 0.1 | 2.7 | 13 | 0.1 | 2.4 |
| Prosthesis Dislocation | | | | 6 | 0.0 | 1.1 |
| Incorrect Sizing | | | | 5 | 0.0 | 0.9 |
| Lysis | 3 | 0.1 | 2.0 | 5 | 0.0 | 0.9 |
| Arthrofibrosis | | | | 2 | 0.0 | 0.4 |
| Implant Breakage Tibial | | | | 2 | 0.0 | 0.4 |
| Osteonecrosis | 2 | 0.0 | 1.4 | 2 | 0.0 | 0.4 |
| Patellofemoral Pain | 1 | 0.0 | 0.7 | 2 | 0.0 | 0.4 |
| Wear Tibial Insert | 1 | 0.0 | 0.7 | 2 | 0.0 | 0.4 |
| Metal Related Pathology | 1 | 0.0 | 0.7 | 1 | 0.0 | 0.2 |
| Patella Erosion | | | | 1 | 0.0 | 0.2 |
| Synovitis | 1 | 0.0 | 0.7 | 1 | 0.0 | 0.2 |
| Other | 6 | 0.1 | 4.1 | 6 | 0.0 | 1.1 |
| **N Revision** | **147** | **2.7** | **100.0** | **549** | **3.8** | **100.0** |
| **N Primary** | **5476** | | | **14341** | | |

Note: Restricted to modern prostheses

**Figure KP11** **Cumulative Incidence Revision Diagnosis of Primary Unicompartmental Knee Replacement Since 2015 by Robotic Assistance (Primary Diagnosis OA)**



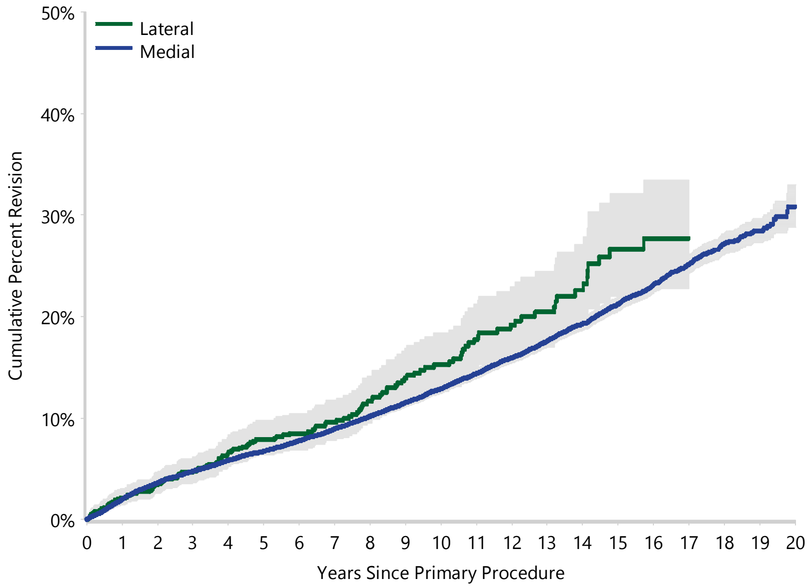

Note: Restricted to modern prostheses

**Table KP14 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 | 140 | 1285 | 2.1 (1.4, 3.1) | 4.7 (3.6, 6.1) | 7.9 (6.3, 9.8) | 15.2 (12.6, 18.4) | 26.6 (22.0, 32.1) | |
| Medial | 4478 | 42639 | 2.0 (1.8, 2.1) | 4.7 (4.5, 5.0) | 6.7 (6.5, 7.0) | 12.9 (12.4, 13.3) | 21.2 (20.5, 21.9) | 30.8 (28.8, 32.9) |
| TOTAL | 4618 | 43924 | | | | | | |

Note: Excludes 456 primary unicompartmental knee procedures with unknown/missing position
Restricted to modern prostheses

**Figure KP12 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Position (Primary Diagnosis OA)**




HR - adjusted for age and gender

Lateral vs Medial

Entire Period: HR=1.05 (0.88, 1.24),p=0.597

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Lateral | 1285 | 1168 | 883 | 632 | 292 | 94 | 6 |
| Medial | 42639 | 38318 | 29881 | 22847 | 12015 | 4202 | 97 |

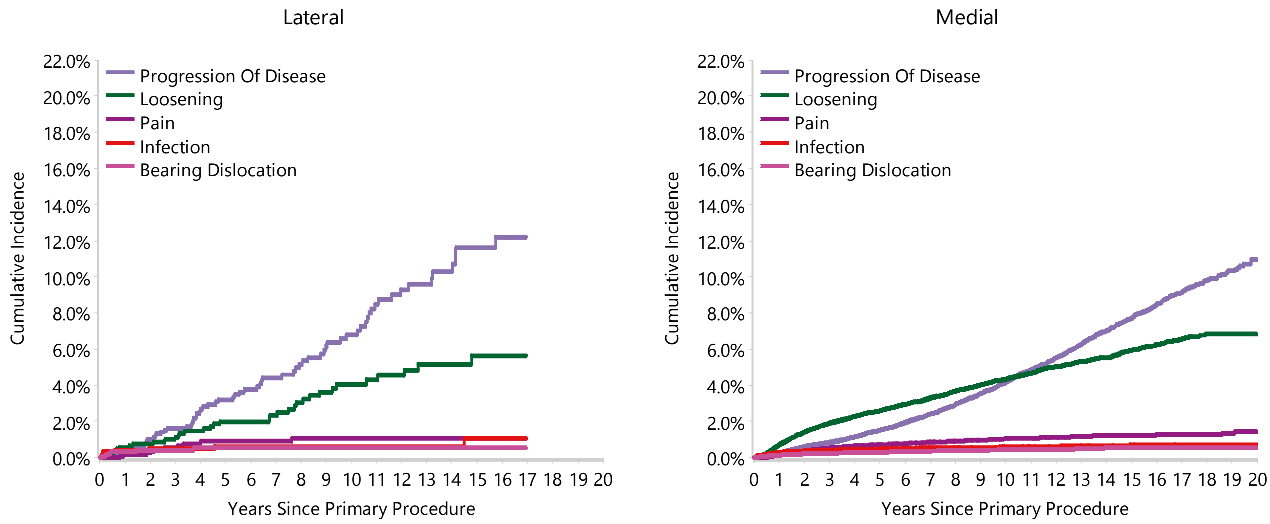
Note: Restricted to modern prostheses

**Table KP15 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 | 68 | 5.3 | 48.6 | 1591 | 3.7 | 35.5 |
| Loosening | 36 | 2.8 | 25.7 | 1513 | 3.5 | 33.8 |
| Pain | 10 | 0.8 | 7.1 | 345 | 0.8 | 7.7 |
| Infection | 8 | 0.6 | 5.7 | 216 | 0.5 | 4.8 |
| Bearing Dislocation | 6 | 0.5 | 4.3 | 147 | 0.3 | 3.3 |
| Fracture | 3 | 0.2 | 2.1 | 124 | 0.3 | 2.8 |
| Lysis | 1 | 0.1 | 0.7 | 107 | 0.3 | 2.4 |
| Instability | 2 | 0.2 | 1.4 | 68 | 0.2 | 1.5 |
| Wear Tibial Insert | 2 | 0.2 | 1.4 | 66 | 0.2 | 1.5 |
| Malalignment | 1 | 0.1 | 0.7 | 57 | 0.1 | 1.3 |
| Other | 3 | 0.2 | 2.1 | 244 | 0.6 | 5.4 |
| **N Revision** | **140** | **10.9** | **100.0** | **4478** | **10.5** | **100.0** |
| **N Primary** | **1285** | | | **42639** | | |

Note: Restricted to modern prostheses

**Figure KP13 Cumulative Incidence Revision Diagnosis of Primary Unicompartmental Knee Replacement by Position (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

**Table KP16 Cumulative Percent Revision of Lateral Primary Unicompartmental Knee Replacement by Prosthesis Combination (Primary Diagnosis OA)**

| 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 | 1 | 52 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 3.8 (0.6, 24.3) | | |
| Endo-Model Sled | Endo-Model Sled | 22 | 156 | 0.0 (0.0, 0.0) | 4.0 (1.8, 8.8) | 7.1 (3.9, 12.8) | 13.6 (8.4, 21.6) | | |
| Oxford (cless) | Oxford (ctd) | 7 | 81 | 3.8 (1.2, 11.2) | 5.3 (2.0, 13.5) | 5.3 (2.0, 13.5) | 15.4 (7.0, 32.1) | | |
| Oxford (ctd) | Oxford (ctd) | 37 | 171 | 5.9 (3.2, 10.7) | 9.0 (5.5, 14.5) | 13.0 (8.6, 19.2) | 22.0 (15.9, 30.1) | | |
| Repicci II | Repicci II | 41 | 105 | 1.9 (0.5, 7.5) | 8.7 (4.6, 16.0) | 17.7 (11.5, 26.6) | 27.8 (19.9, 37.9) | | |
| Restoris MCK | Restoris MCK | 2 | 192 | 0.6 (0.1, 4.0) | 1.2 (0.3, 4.9) | | | | |
| Sigma HP | Sigma HP | 3 | 52 | 2.2 (0.3, 14.4) | 2.2 (0.3, 14.4) | 8.3 (2.7, 23.9) | 8.3 (2.7, 23.9) | | |
| ZUK | ZUK | 17 | 299 | 1.0 (0.3, 3.1) | 2.9 (1.5, 5.8) | 5.3 (3.0, 9.2) | | | |
| Other (15) | | 10 | 177 | 3.5 (1.6, 7.7) | 5.6 (2.9, 10.4) | 5.6 (2.9, 10.4) | | | |
| TOTAL | | 140 | 1285 | | | | | | |

Note: Only prostheses with over 50 procedures have been listed
Restricted to modern prostheses

# Primary Total Knee Replacement

## CLASS OF TOTAL KNEE REPLACEMENT

The Registry defines a total knee replacement 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 Registry details the outcome of total knee replacement based on specific patient and prosthesis characteristics. 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, the Registry subdivides these systems into the specific prosthesis types. The initial characteristic used is fixation. Further subdivision is based on mobility, stability and flexion capacity. However, this further system subdivision is not uniformly applied to all knee systems at this time.

High use prosthesis systems are subdivided. This enables the identification of differences or potential differences in outcome between prostheses with different characteristics within each of these systems.

Low use systems are unlikely to be subdivided. This is because of small numbers or insufficient follow-up. The exception is if the entire system is identified as having a higher than anticipated rate of revision. The Registry then undertakes a catalogue range-specific analysis to determine if the higher than anticipated rate of revision is associated with specific prosthesis attributes within that system.

To enable the Registry to undertake range-specific analyses uniformly across all knee systems, it is necessary to link the different catalogue ranges to the specific prosthesis characteristics for every prosthesis within the system. This is an ongoing process with increasing numbers of systems being subdivided.

## DEMOGRAPHICS

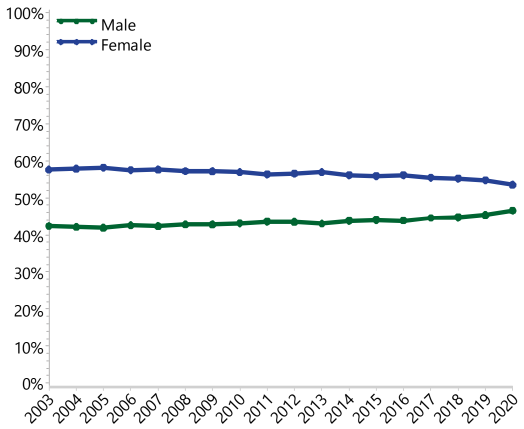
There have been 769,798 primary total knee replacement procedures reported to the Registry. This is an additional 54,013 procedures compared to the last report.

In 2020, there was a decrease of 6.1% in primary total knee replacement procedures when compared to 2019. This is the first time the number of knee replacements has decreased since the Registry began and this is due to the cancellation of elective surgery during COVID-19 restrictions. As a proportion of all knee replacement procedures, primary total knee replacement increased to 86.5% in 2020.

Osteoarthritis is the most common diagnosis for primary total knee replacement.

Primary total knee replacement remains more common in females (56.2%). This proportion has shown little change from 2003. The mean age of patients is 68.5 years (Table KT1 and Figure KT1).

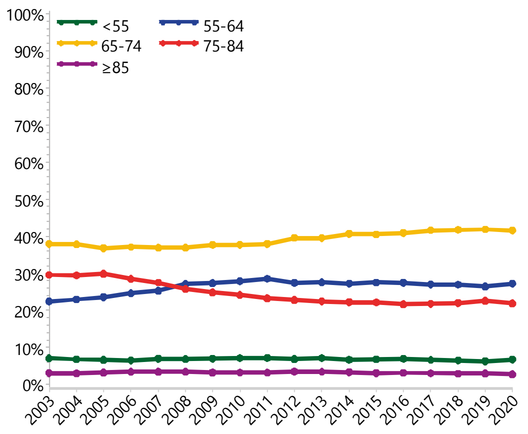
**Figure KT1 Primary Total Knee Replacement by Gender**




**There have been 769,798 primary total knee replacement procedures reported to the Registry. This is an additional 54,013 procedures compared to the last report.**

There has been a decrease in the proportion of patients aged 75-84 years. The proportion of patients aged <55 years remains small and there has been little change in that proportion (Figure KT2).

**Figure KT2 Primary Total Knee Replacement by Age**



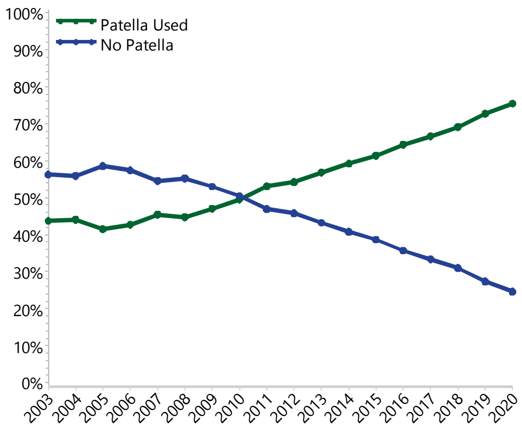

Detailed demographic information on primary total knee replacement is available in the supplementary report 'Demographics of Hip, Knee and Shoulder Arthroplasty' on the AOANJRR website:
https://aoanjrr.sahmri.com/annual-reports-2021

**Table KT1 Age and Gender of Primary Total Knee Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 337110 | 43.8% | 8 | 101 | 68 | 68.1 | 9.1 |
| Female | 432688 | 56.2% | 8 | 103 | 69 | 68.7 | 9.4 |
| TOTAL | 769798 | 100.0% | 8 | 103 | 69 | 68.5 | 9.2 |

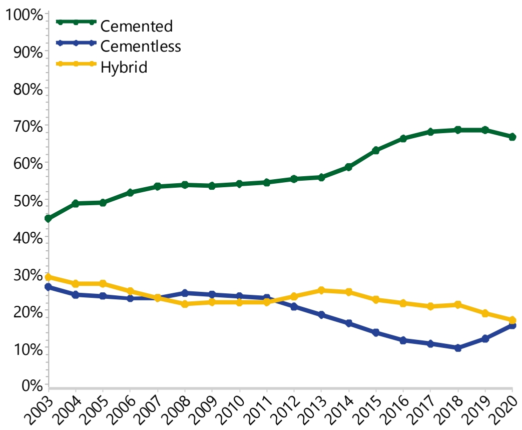
Patella resurfacing at the time of the primary total knee replacement has increased to 75.4% in 2020 (Figure KT3).

**Figure KT3** **Primary Total Knee Replacement by Patella Usage**



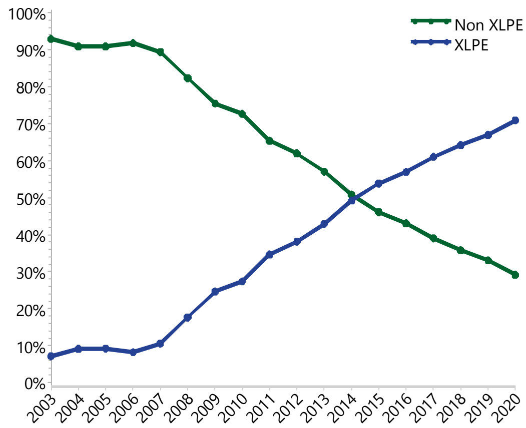

The most common method of fixation is cementing both femoral and tibial components. This accounts for 66.7% of procedures in 2020. The use of cementless fixation decreased to 9.8% in 2018 but has increased to 15.9% in 2020 (Figure KT4).

**Figure KT4** **Primary Total Knee Replacement by Fixation**




The use of cross-linked polyethylene (XLPE) in primary total knee replacement increased to 70.9% in 2020 (Figure KT5).

**Figure KT5** **Primary Total Knee Replacement by Polyethylene Type**




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 2020, the most commonly used femoral prostheses were the Triathlon CR, Persona CR and GMK Sphere Primary (Table KT2). The most used prostheses are also reported based on fixation (cemented, cementless and hybrid) (Table KT3 to Table KT5).

**Table KT2 10 Most Used Femoral Prostheses in Primary Total Knee Replacement**

| 2003 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 3184 | LCS CR | 10502 | Triathlon CR | 12327 | Triathlon CR | 13391 | Triathlon CR | 13707 | Triathlon CR |
| 2846 | Duracon | 6644 | Nexgen CR Flex | 5796 | Nexgen CR Flex | 5663 | Persona CR | 8283 | Persona CR |
| 2150 | Nexgen CR | 3195 | Attune CR | 3586 | Persona CR | 4303 | Nexgen CR Flex | 3220 | GMK Sphere Primary |
| 1419 | PFC Sigma CR | 2649 | LCS CR | 3246 | Attune CR | 3402 | Attune CR | 3130 | Attune CR |
| 1354 | Scorpio CR | 2645 | Nexgen LPS Flex | 2190 | Nexgen LPS Flex | 2744 | GMK Sphere Primary | 2380 | Nexgen CR Flex |
| 1059 | Genesis II CR | 2388 | Vanguard CR | 2147 | GMK Sphere Primary | 1842 | LCS CR | 1774 | Attune PS |
| 1002 | Natural Knee II | 1754 | Evolution | 2089 | LCS CR | 1795 | Attune PS | 1597 | Apex Knee CR |
| 902 | Nexgen LPS | 1583 | Legion Oxinium PS | 1956 | Vanguard CR | 1568 | Vanguard CR | 1394 | LCS CR |
| 883 | Profix | 1537 | GMK Sphere Primary | 1660 | Evolution | 1536 | Evolution | 1353 | Legion Oxinium CR |
| 751 | Scorpio PS | 1484 | Persona CR | 1409 | Apex Knee CR | 1475 | Apex Knee CR | 1199 | Evolution |
| 10 Most Used | | | | | | | | | |
| 15550 | (10) 71.5% | 34381 | (10) 62.4% | 36406 | (10) 64.8% | 37719 | (10) 66.1% | 38037 | (10) 71.0% |
| Remainder | | | | | | | | | |
| 6185 | (47) 28.5% | 20738 | (70) 37.6% | 19774 | (73) 35.2% | 19326 | (66) 33.9% | 15543 | (64) 29.0% |
| TOTAL | | | | | | | | | |
| 21735 | (57) 100.0% | 55119 | (80) 100.0% | 56180 | (83) 100.0% | 57045 | (76) 100.0% | 53580 | (74) 100.0% |

**Table KT3 10 Most Used Femoral Prostheses in Cemented Primary Total Knee Replacement**

| 2003 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 1213 | Duracon | 6018 | Triathlon CR | 6689 | Triathlon CR | 6632 | Triathlon CR | 6149 | Triathlon CR |
| 948 | LCS CR | 3420 | Nexgen CR Flex | 3158 | Attune CR | 3423 | Persona CR | 4748 | Persona CR |
| 824 | Nexgen LPS | 3175 | Attune CR | 2953 | Nexgen CR Flex | 3280 | Attune CR | 3220 | GMK Sphere Primary |
| 761 | Nexgen CR | 2327 | Nexgen LPS Flex | 2392 | Persona CR | 2743 | GMK Sphere Primary | 2858 | Attune CR |
| 690 | Nexgen LPS Flex | 1747 | Evolution | 2147 | GMK Sphere Primary | 2312 | Nexgen CR Flex | 1650 | Attune PS |
| 642 | Genesis II CR | 1582 | Legion Oxinium PS | 1918 | Nexgen LPS Flex | 1776 | Attune PS | 1337 | Legion Oxinium CR |
| 495 | Profix | 1537 | GMK Sphere Primary | 1620 | Evolution | 1510 | Evolution | 1216 | Nexgen CR Flex |
| 471 | Genesis II Oxinium CR | 1431 | Genesis II Oxinium PS | 1392 | Legion Oxinium PS | 1377 | Legion Oxinium CR | 1126 | Evolution |
| 471 | PFC Sigma PS | 1353 | Attune PS | 1365 | Attune PS | 1269 | Legion Oxinium PS | 1102 | Columbus |
| 419 | Genesis II PS | 1187 | Persona CR | 1343 | Genesis II Oxinium PS | 1267 | Genesis II Oxinium PS | 1068 | Genesis II Oxinium PS |
| 10 Most Used | | | | | | | | | |
| 6934 | (10) 71.3% | 23777 | (10) 63.4% | 24977 | (10) 64.8% | 25589 | (10) 65.4% | 24474 | (10) 68.4% |
| Remainder | | | | | | | | | |
| 2795 | (41) 28.7% | 13752 | (69) 36.6% | 13587 | (70) 35.2% | 13542 | (65) 34.6% | 11286 | (62) 31.6% |
| TOTAL | | | | | | | | | |
| 9729 | (51) 100.0% | 37529 | (79) 100.0% | 38564 | (80) 100.0% | 39131 | (75) 100.0% | 35760 | (72) 100.0% |

**Table KT4 10 Most Used Femoral Prostheses in Cementless Primary Total Knee Replacement**

| 2003 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 1470 | LCS CR | 1357 | Nexgen CR Flex | 1619 | Triathlon CR | 3362 | Triathlon CR | 4871 | Triathlon CR |
| 793 | Nexgen CR | 1288 | Triathlon CR | 1177 | Nexgen CR Flex | 894 | Nexgen CR Flex | 1283 | Persona CR |
| 500 | Natural Knee II | 1177 | LCS CR | 851 | LCS CR | 754 | LCS CR | 567 | LCS CR |
| 487 | Active Knee | 272 | Scorpio NRG CR | 219 | PFC Sigma CR | 458 | Persona CR | 533 | Nexgen CR Flex |
| 476 | Duracon | 229 | PFC Sigma CR | 209 | Score | 194 | PFC Sigma CR | 246 | Score |
| 320 | Scorpio CR | 219 | Nexgen LPS Flex | 200 | Nexgen LPS Flex | 192 | ACS | 175 | Attune CR |
| 314 | PFC Sigma CR | 205 | Vanguard CR | 167 | GMK Primary | 146 | Nexgen LPS Flex | 137 | PFC Sigma CR |
| 303 | RBK | 200 | RBK | 144 | RBK | 146 | Score | 104 | GMK Primary |
| 187 | Profix | 158 | Score | 143 | Vanguard CR | 137 | GMK Primary | 99 | RBK |
| 181 | Scorpio PS | 157 | Natural Knee Flex | 119 | Natural Knee Flex | 92 | Triathlon PS | 79 | Attune PS |
| **10 Most Used** | | | | | | | | | |
| 5031 | (10) 88.1% | 5262 | (10) 87.6% | 4848 | (10) 87.7% | 6375 | (10) 91.0% | 8094 | (10) 94.8% |
| **Remainder** | | | | | | | | | |
| 681 | (14) 11.9% | 745 | (15) 12.4% | 680 | (18) 12.3% | 627 | (16) 9.0% | 447 | (13) 5.2% |
| **TOTAL** | | | | | | | | | |
| 5712 | (24) 100.0% | 6007 | (25) 100.0% | 5528 | (28) 100.0% | 7002 | (26) 100.0% | 8541 | (23) 100.0% |

**Table KT5 10 Most Used Femoral Prostheses in Hybrid Primary Total Knee Replacement**

| 2003 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 1157 | Duracon | 3196 | Triathlon CR | 4019 | Triathlon CR | 3397 | Triathlon CR | 2687 | Triathlon CR |
| 766 | LCS CR | 1867 | Nexgen CR Flex | 1666 | Nexgen CR Flex | 1782 | Persona CR | 2252 | Persona CR |
| 764 | PFC Sigma CR | 1201 | Vanguard CR | 1158 | Persona CR | 1097 | Nexgen CR Flex | 756 | Apex Knee CR |
| 737 | Scorpio CR | 752 | LCS CR | 899 | Vanguard CR | 757 | Vanguard CR | 631 | Nexgen CR Flex |
| 596 | Nexgen CR | 552 | Apex Knee CR | 618 | Apex Knee CR | 607 | Apex Knee CR | 437 | LCS CR |
| 364 | Genesis II CR | 407 | Legion CR | 599 | LCS CR | 570 | LCS CR | 404 | Legion CR |
| 255 | Maxim | 388 | Genesis II CR | 549 | Legion CR | 490 | Legion CR | 374 | Vanguard CR |
| 247 | Natural Knee II | 318 | BalanSys | 366 | BalanSys | 389 | BalanSys | 304 | PFC Sigma CR |
| 204 | AGC | 299 | PFC Sigma CR | 310 | PFC Sigma CR | 353 | PFC Sigma CR | 223 | BalanSys |
| 203 | Scorpio PS | 299 | Scorpio CR | 300 | Genesis II CR | 255 | Genesis II CR | 207 | Genesis II CR |
| **10 Most Used** | | | | | | | | | |
| 5293 | (10) 84.1% | 9279 | (10) 80.1% | 10484 | (10) 86.7% | 9697 | (10) 88.9% | 8275 | (10) 89.2% |
| **Remainder** | | | | | | | | | |
| 1001 | (27) 15.9% | 2304 | (29) 19.9% | 1604 | (27) 13.3% | 1215 | (26) 11.1% | 1004 | (27) 10.8% |
| **TOTAL** | | | | | | | | | |
| 6294 | (37) 100.0% | 11583 | (39) 100.0% | 12088 | (37) 100.0% | 10912 | (36) 100.0% | 9279 | (37) 100.0% |

## OUTCOME FOR ALL DIAGNOSES

### Primary Diagnosis

The Registry recognises that the usage and availability of knee prostheses changes with time. In order to keep Registry data contemporaneous, only procedures using prostheses that have been available and used in 2020 (described as modern prostheses) are included in the analyses, unless clearly specified.

The most common diagnosis for primary total knee replacement is osteoarthritis. Comparisons of revision rates of other primary diagnoses compared to osteoarthritis are shown in Table KT6 and Figure KT6.

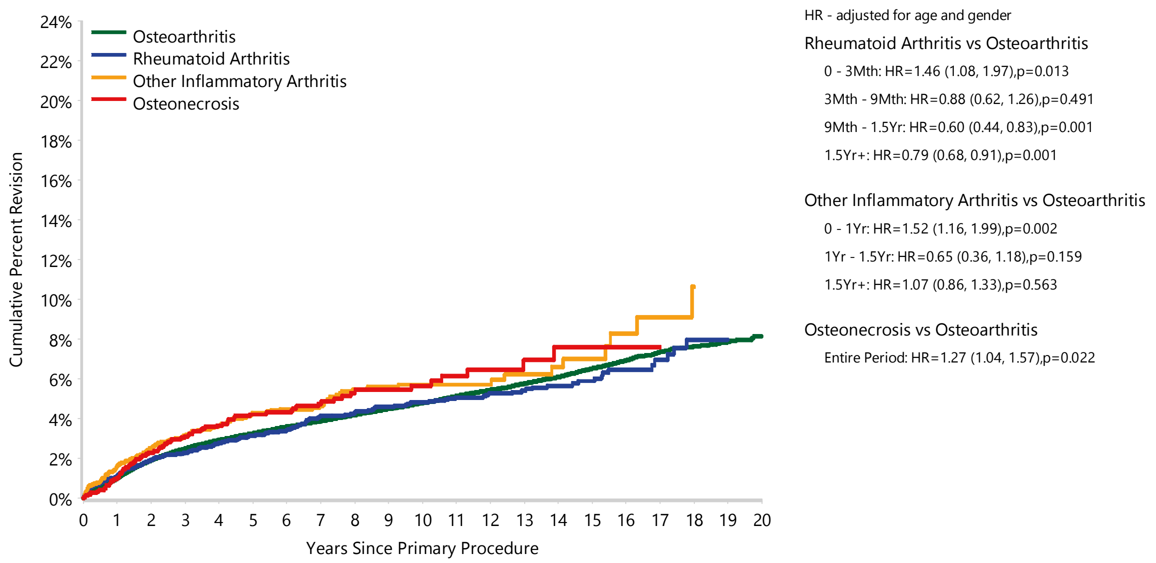
**Rheumatoid arthritis has a lower rate of revision compared to osteoarthritis after 9 months.**

**Table KT6 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 | 22899 | 654260 | 1.0 (1.0, 1.0) | 2.5 (2.5, 2.5) | 3.3 (3.2, 3.3) | 4.8 (4.7, 4.9) | 6.5 (6.4, 6.6) | 8.1 (7.8, 8.5) |
| Rheumatoid Arthritis | 296 | 7672 | 1.1 (0.9, 1.4) | 2.3 (2.0, 2.7) | 3.1 (2.7, 3.6) | 4.8 (4.3, 5.5) | 5.9 (5.1, 6.8) | |
| Other Inflammatory Arthritis | 145 | 3385 | 1.6 (1.2, 2.1) | 3.1 (2.6, 3.8) | 4.3 (3.6, 5.1) | 5.7 (4.8, 6.8) | 7.0 (5.5, 8.9) | |
| Osteonecrosis | 89 | 2036 | 1.0 (0.7, 1.6) | 3.1 (2.4, 4.0) | 4.2 (3.3, 5.3) | 5.7 (4.5, 7.1) | 7.6 (5.7, 10.1) | |
| Other (4) | 173 | 1499 | 4.4 (3.4, 5.6) | 9.4 (7.9, 11.3) | 12.8 (10.9, 15.1) | 20.6 (17.4, 24.3) | | |
| TOTAL | 23602 | 668852 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT6 Cumulative Percent Revision of Primary Total Knee Replacement by Primary Diagnosis**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Osteoarthritis | 654260 | 591609 | 464003 | 349144 | 132336 | 31023 | 645 |
| Rheumatoid Arthritis | 7672 | 7122 | 5877 | 4707 | 2148 | 709 | 24 |
| Other Inflammatory Arthritis | 3385 | 3059 | 2313 | 1701 | 618 | 178 | 6 |
| Osteonecrosis | 2036 | 1858 | 1467 | 1106 | 424 | 106 | 0 |

Note: Only primary diagnoses with over 1,000 procedures have been listed
Restricted to modern prostheses

## PROSTHESIS TYPES

Overall, there have been 260 femoral and tibial prosthesis combinations that meet the definition of a modern prosthesis in primary total knee replacement. Of these, only172 were used in 2020.

The cumulative percent revision of the 113 combinations with >400 procedures by fixation are listed in Table KT7 to Table KT9. Although the listed combinations are a small proportion of all possible combinations, they represent 98.5% of all primary total knee replacement procedures. The 'other' group is the combined outcome of the remaining 147 prosthesis combinations with <400 procedures per combination.

There are 54 cemented femoral and tibial prosthesis combinations with >400 procedures. Of those combinations with a 20 year cumulative percent revision, the Nexgen CR/Nexgen has the lowest rate of revision (Table KT7).

There are 28 cementless femoral and tibial prosthesis combinations with >400 procedures. Of those combinations with a 20 year cumulative percent revision, the Nexgen CR/Nexgen has the lowest rate of revision (Table KT8).

There are 31 combinations of primary total knee replacement using hybrid fixation with >400 procedures. The PFC Sigma CR/PFC Sigma has the lowest 20 year cumulative percent revision (Table KT9).

**There have been 172 different femoral and tibial prosthesis combinations reported to the Registry in 2020. Outcomes at 20 years are being reported for the first time.**

**Table KT7 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 | 22 | 694 | 1.5 (0.8, 2.7) | 2.9 (1.8, 4.5) | 3.9 (2.5, 6.0) | | | |
| | ACS Mobile | 25 | 1137 | 0.6 (0.3, 1.3) | 1.8 (1.1, 2.9) | 3.4 (2.2, 5.2) | | | |
| Active Knee | Active Knee | 105 | 2972 | 1.0 (0.7, 1.4) | 2.8 (2.2, 3.5) | 3.6 (2.9, 4.4) | 5.3 (4.3, 6.5) | 8.5 (5.5, 13.3) | |
| Advance | Advance II | 67 | 918 | 1.5 (0.9, 2.6) | 4.4 (3.3, 6.0) | 5.1 (3.9, 6.8) | 7.1 (5.5, 9.0) | 8.1 (6.3, 10.5) | |
| Anatomic | Anatomic | 16 | 1072 | 0.7 (0.3, 1.4) | 1.8 (1.1, 3.0) | | | | |
| Apex Knee CR | Apex Knee | 37 | 4089 | 0.5 (0.3, 0.8) | 1.0 (0.7, 1.5) | 1.8 (1.2, 2.7) | | | |
| Apex Knee PS | Apex Knee | 104 | 4830 | 0.9 (0.6, 1.2) | 2.2 (1.8, 2.7) | 3.0 (2.4, 3.7) | | | |
| Attune CR | Attune | 392 | 18176 | 1.0 (0.8, 1.1) | 2.4 (2.2, 2.7) | 3.1 (2.8, 3.5) | | | |
| Attune PS | Attune | 159 | 8840 | 0.9 (0.7, 1.1) | 2.0 (1.7, 2.4) | 2.7 (2.3, 3.2) | | | |
| BalanSys | BalanSys | 57 | 2079 | 0.4 (0.2, 0.8) | 1.6 (1.1, 2.3) | 2.0 (1.5, 2.8) | 4.0 (3.0, 5.4) | 5.8 (3.8, 8.7) | |
| Columbus | Columbus | 38 | 3360 | 0.7 (0.4, 1.0) | 1.9 (1.3, 2.7) | 2.0 (1.4, 2.9) | 2.4 (1.6, 3.8) | | |
| E.Motion | E.Motion | 37 | 852 | 1.8 (1.1, 3.0) | 3.9 (2.7, 5.5) | 4.4 (3.1, 6.2) | | | |
| Evolis | Evolis | 21 | 1069 | 0.3 (0.1, 0.9) | 1.0 (0.6, 1.9) | 1.6 (0.9, 2.7) | 3.0 (1.9, 4.8) | | |
| Evolution | Evolution | 213 | 9099 | 0.9 (0.7, 1.1) | 2.5 (2.1, 2.8) | 3.4 (2.9, 3.9) | | | |
| GMK Primary | GMK Primary | 25 | 693 | 1.0 (0.5, 2.1) | 2.6 (1.7, 4.2) | 3.4 (2.2, 5.1) | 4.9 (3.2, 7.6) | | |
| GMK Sphere Primary | GMK Primary | 247 | 11134 | 1.3 (1.1, 1.6) | 2.9 (2.5, 3.3) | 3.3 (2.9, 3.7) | | | |
| | GMK Sphere Primary | 50 | 1910 | 0.9 (0.5, 1.5) | 3.1 (2.3, 4.2) | 4.6 (3.4, 6.2) | | | |
| Genesis II CR | Genesis II | 638 | 16068 | 0.9 (0.8, 1.1) | 2.4 (2.2, 2.6) | 3.0 (2.8, 3.3) | 4.5 (4.1, 4.9) | 5.7 (5.2, 6.3) | 6.9 (5.9, 8.1) |
| Genesis II Oxinium CR | Genesis II | 505 | 9621 | 1.1 (0.9, 1.3) | 2.7 (2.4, 3.0) | 3.5 (3.1, 3.9) | 6.0 (5.4, 6.6) | 8.5 (7.7, 9.4) | |
| Genesis II Oxinium PS | Genesis II | 1240 | 20938 | 1.4 (1.3, 1.6) | 3.7 (3.4, 3.9) | 5.0 (4.7, 5.4) | 7.4 (7.0, 7.9) | 10.2 (9.4, 11.1) | |
| Genesis II PS | Genesis II | 783 | 19152 | 1.1 (1.0, 1.3) | 2.7 (2.5, 2.9) | 3.6 (3.3, 3.9) | 4.9 (4.6, 5.3) | 6.2 (5.6, 6.8) | |
| LCS CR | LCS | 334 | 3939 | 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) | 11.1 (9.7, 12.7) |
| | MBT | 532 | 12912 | 0.8 (0.7, 1.0) | 2.5 (2.3, 2.8) | 3.5 (3.1, 3.8) | 5.2 (4.7, 5.7) | 6.0 (5.4, 6.7) | |
| Legion CR | Genesis II | 70 | 3207 | 1.1 (0.8, 1.5) | 2.2 (1.7, 2.8) | 3.0 (2.3, 3.8) | 4.2 (2.8, 6.4) | | |
| Legion Oxinium CR | Genesis II | 177 | 7313 | 0.7 (0.6, 1.0) | 2.4 (2.1, 2.9) | 3.6 (3.0, 4.2) | 4.6 (3.8, 5.4) | | |

| Femoral Component | Tibial Component | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Legion Oxinium PS | Genesis II | 577 | 15094 | 1.1 (0.9, 1.2) | 3.0 (2.8, 3.3) | 4.1 (3.8, 4.5) | 5.8 (5.2, 6.5) | | |
| Legion PS | Genesis II | 172 | 5538 | 1.2 (1.0, 1.6) | 2.4 (2.0, 2.9) | 3.2 (2.7, 3.7) | 4.5 (3.7, 5.4) | | |
| MRK | MRK | 15 | 592 | 0.7 (0.3, 1.9) | 1.9 (1.0, 3.5) | 2.1 (1.2, 3.8) | 3.3 (1.9, 5.7) | | |
| Natural Knee Flex | Natural Knee II | 72 | 2497 | 1.2 (0.8, 1.7) | 2.5 (2.0, 3.3) | 2.9 (2.3, 3.8) | 4.3 (3.3, 5.6) | | |
| Nexgen CR | Nexgen | 152 | 4147 | 0.7 (0.5, 1.0) | 1.6 (1.2, 2.0) | 2.1 (1.7, 2.6) | 3.1 (2.6, 3.7) | 4.9 (4.1, 5.8) | 5.7 (4.8, 6.9) |
| Nexgen CR Flex | Natural Knee II* | 15 | 806 | 0.2 (0.1, 1.0) | 0.9 (0.4, 1.8) | 1.1 (0.6, 2.2) | 2.2 (1.3, 3.8) | | |
| | Nexgen | 618 | 29406 | 0.7 (0.6, 0.8) | 1.5 (1.4, 1.7) | 2.0 (1.9, 2.2) | 2.9 (2.6, 3.2) | 4.1 (3.5, 4.9) | |
| Nexgen LCCK | Nexgen | 53 | 1040 | 2.1 (1.4, 3.2) | 3.8 (2.8, 5.2) | 5.4 (4.0, 7.1) | 6.4 (4.8, 8.5) | | |
| Nexgen LPS | Nexgen | 309 | 6158 | 1.1 (0.9, 1.4) | 2.4 (2.1, 2.8) | 3.1 (2.7, 3.5) | 4.7 (4.2, 5.3) | 6.5 (5.8, 7.3) | 8.5 (7.1, 10.3) |
| Nexgen LPS Flex | Nexgen | 1460 | 35887 | 0.9 (0.8, 1.0) | 2.3 (2.1, 2.4) | 3.1 (2.9, 3.3) | 5.0 (4.7, 5.3) | 6.8 (6.3, 7.2) | |
| Nexgen RH | Nexgen | 34 | 619 | 2.2 (1.3, 3.8) | 4.3 (2.9, 6.4) | 5.6 (3.8, 8.1) | 9.0 (6.3, 12.9) | | |
| Optetrak Logic CR | Optetrak Logic | 11 | 621 | 0.9 (0.4, 2.1) | 2.0 (1.1, 3.8) | 2.4 (1.3, 4.3) | | | |
| Optetrak Logic PS | Optetrak Logic | 21 | 611 | 2.1 (1.2, 3.6) | 3.9 (2.5, 6.0) | 4.2 (2.7, 6.5) | | | |
| | Optetrak Logic RBK | 16 | 769 | 1.5 (0.8, 2.8) | 2.5 (1.5, 4.3) | 3.7 (2.1, 6.6) | | | |
| PFC Sigma CR | MBT | 40 | 1190 | 0.8 (0.5, 1.6) | 1.9 (1.2, 2.8) | 2.3 (1.6, 3.4) | 3.3 (2.4, 4.6) | 3.9 (2.7, 5.7) | |
| | PFC Sigma | 474 | 13414 | 0.8 (0.7, 1.0) | 2.1 (1.8, 2.3) | 2.6 (2.4, 2.9) | 3.7 (3.3, 4.1) | 5.5 (4.9, 6.2) | |
| PFC Sigma PS | MBT | 331 | 6142 | 1.0 (0.8, 1.3) | 2.9 (2.5, 3.4) | 3.8 (3.4, 4.3) | 5.4 (4.8, 6.0) | 7.6 (6.6, 8.7) | |
| | PFC Sigma | 374 | 8289 | 1.2 (0.9, 1.4) | 2.5 (2.2, 2.9) | 3.3 (2.9, 3.7) | 4.8 (4.3, 5.3) | 6.6 (5.8, 7.4) | |
| Persona CR | Nexgen | 5 | 481 | 0.6 (0.2, 2.0) | 1.2 (0.5, 2.9) | | | | |
| | Persona | 123 | 11681 | 0.8 (0.6, 1.0) | 1.9 (1.5, 2.3) | 2.6 (1.9, 3.6) | | | |
| Persona PS | Persona | 47 | 3435 | 0.9 (0.6, 1.2) | 1.9 (1.4, 2.5) | 1.9 (1.4, 2.5) | | | |
| RBK | RBK | 112 | 2646 | 1.0 (0.7, 1.4) | 2.4 (1.9, 3.1) | 3.2 (2.6, 4.0) | 4.8 (4.0, 5.9) | 6.1 (4.8, 7.8) | |
| SAIPH | SAIPH | 61 | 4128 | 0.5 (0.3, 0.8) | 1.8 (1.4, 2.3) | 2.2 (1.7, 2.9) | | | |
| Score | Score | 36 | 970 | 1.5 (0.9, 2.5) | 2.9 (1.9, 4.2) | 4.0 (2.8, 5.6) | 5.1 (3.6, 7.2) | | |
| Triathlon CR | Triathlon | 1306 | 56580 | 0.8 (0.7, 0.9) | 1.9 (1.8, 2.1) | 2.4 (2.3, 2.6) | 3.8 (3.6, 4.1) | 5.4 (4.5, 6.4) | |
| Triathlon PS | Triathlon | 386 | 9343 | 1.4 (1.2, 1.7) | 3.0 (2.7, 3.4) | 3.9 (3.5, 4.3) | 5.8 (5.2, 6.5) | | |
| Unity Knee | Unity Knee | 1 | 455 | 0.2 (0.0, 1.5) | | | | | |
| Vanguard CR | Vanguard | 382 | 12079 | 0.7 (0.6, 0.9) | 2.1 (1.9, 2.4) | 2.7 (2.4, 3.1) | 4.6 (4.1, 5.2) | | |
| Vanguard PS | Vanguard | 287 | 4525 | 2.0 (1.6, 2.4) | 4.5 (3.9, 5.2) | 5.6 (4.9, 6.3) | 7.9 (7.0, 8.9) | | |
| Other (65) | | 333 | 4264 | 3.5 (3.0, 4.1) | 6.7 (5.9, 7.5) | 8.7 (7.7, 9.8) | 13.3 (11.7, 15.1) | 20.1 (15.8, 25.5) | |
| TOTAL | | 13717 | 409481 | | | | | | |

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 2020

**Table KT8 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 | 50 | 1027 | 1.6 (1.0, 2.6) | 4.2 (3.1, 5.7) | 5.3 (3.9, 7.0) | | | |
| Active Knee | Active Knee | 540 | 4899 | 1.3 (1.1, 1.7) | 4.0 (3.4, 4.5) | 5.6 (5.0, 6.3) | 9.7 (8.9, 10.6) | 13.5 (12.4, 14.7) | |
| Advance | Advance | 57 | 908 | 1.8 (1.1, 2.9) | 5.4 (4.1, 7.1) | 6.3 (4.8, 8.1) | 7.5 (5.7, 9.7) | | |
| Apex Knee CR | Apex Knee | 27 | 446 | 2.5 (1.4, 4.4) | 5.7 (3.9, 8.5) | 6.0 (4.1, 8.8) | | | |
| Columbus | Columbus | 65 | 500 | 3.2 (2.0, 5.2) | 7.7 (5.6, 10.4) | 9.7 (7.4, 12.7) | 13.2 (10.4, 16.6) | | |
| GMK Primary | GMK Primary | 40 | 1294 | 1.2 (0.7, 1.9) | 2.9 (2.1, 4.0) | 3.6 (2.6, 5.0) | | | |
| Genesis II CR | Genesis II | 38 | 744 | 1.5 (0.8, 2.7) | 3.9 (2.7, 5.6) | 4.6 (3.3, 6.5) | 6.6 (4.8, 9.1) | | |
| Genesis II PS | Genesis II | 26 | 420 | 1.7 (0.8, 3.5) | 3.3 (2.0, 5.6) | 4.1 (2.5, 6.5) | 6.1 (4.1, 9.1) | | |
| LCS CR | LCS | 169 | 2369 | 1.4 (1.0, 2.0) | 3.4 (2.7, 4.2) | 4.3 (3.6, 5.2) | 6.1 (5.2, 7.2) | 7.3 (6.3, 8.5) | 8.8 (7.5, 10.2) |
| | MBT | 440 | 9244 | 1.1 (0.9, 1.3) | 3.3 (3.0, 3.7) | 4.0 (3.6, 4.5) | 5.4 (4.9, 6.0) | 7.5 (6.6, 8.5) | |
| | MBT Duofix | 785 | 14487 | 1.3 (1.1, 1.5) | 3.3 (3.0, 3.6) | 4.1 (3.8, 4.4) | 5.4 (5.0, 5.8) | 7.4 (6.8, 8.0) | |
| Natural Knee Flex | Natural Knee II | 37 | 1635 | 0.7 (0.4, 1.2) | 1.6 (1.1, 2.4) | 2.1 (1.4, 2.9) | 3.0 (2.2, 4.3) | | |
| Nexgen CR | Nexgen | 126 | 3442 | 0.6 (0.4, 0.9) | 1.7 (1.3, 2.2) | 2.1 (1.7, 2.7) | 3.0 (2.5, 3.7) | 4.0 (3.3, 4.8) | 5.9 (4.5, 7.6) |
| | Nexgen TM CR | 50 | 741 | 1.4 (0.7, 2.5) | 4.4 (3.1, 6.2) | 6.3 (4.7, 8.3) | 7.1 (5.3, 9.3) | 8.5 (6.2, 11.5) | |
| Nexgen CR Flex | Nexgen | 311 | 8567 | 1.1 (0.9, 1.4) | 2.7 (2.4, 3.1) | 3.3 (2.9, 3.7) | 4.3 (3.8, 4.8) | 4.9 (4.3, 5.7) | |
| | Nexgen TM CR | 299 | 11163 | 0.5 (0.4, 0.7) | 1.8 (1.6, 2.1) | 2.3 (2.0, 2.6) | 3.3 (2.9, 3.8) | 4.4 (3.7, 5.2) | |
| Nexgen LPS | Nexgen TM LPS | 32 | 1408 | 0.7 (0.3, 1.3) | 1.1 (0.7, 1.9) | 2.1 (1.4, 3.1) | 2.8 (1.9, 4.1) | | |
| Nexgen LPS Flex | Nexgen | 47 | 1188 | 2.7 (1.9, 3.8) | 4.1 (3.0, 5.4) | 4.2 (3.1, 5.6) | | | |
| | Nexgen TM LPS | 50 | 1056 | 1.3 (0.8, 2.2) | 3.1 (2.2, 4.4) | 4.3 (3.2, 5.8) | 5.7 (4.2, 7.8) | | |
| PFC Sigma CR | MBT | 69 | 995 | 2.3 (1.5, 3.5) | 4.9 (3.7, 6.4) | 5.6 (4.3, 7.2) | 6.6 (5.2, 8.4) | 8.5 (6.5, 11.0) | |
| | MBT Duofix | 154 | 3327 | 1.1 (0.8, 1.5) | 2.8 (2.3, 3.4) | 3.5 (2.9, 4.3) | 4.9 (4.2, 5.9) | 7.3 (5.9, 8.8) | |
| Persona CR | Persona | 12 | 1666 | 1.1 (0.6, 1.9) | | | | | |
| RBK | RBK | 355 | 6825 | 1.3 (1.1, 1.6) | 3.2 (2.8, 3.6) | 4.2 (3.7, 4.7) | 5.5 (5.0, 6.2) | 6.8 (6.0, 7.7) | |
| Score | Score | 208 | 2638 | 1.7 (1.2, 2.2) | 5.3 (4.5, 6.3) | 7.3 (6.3, 8.5) | 11.8 (10.2, 13.7) | | |
| Triathlon CR | Triathlon | 658 | 24405 | 1.1 (1.0, 1.2) | 2.3 (2.1, 2.6) | 3.0 (2.8, 3.3) | 4.4 (4.0, 4.8) | | |
| Triathlon PS | Triathlon | 62 | 1246 | 1.9 (1.3, 2.8) | 3.6 (2.7, 4.9) | 4.6 (3.6, 6.1) | 5.7 (4.5, 7.3) | | |
| Vanguard CR | Regenerex | 85 | 1695 | 1.2 (0.8, 1.8) | 3.4 (2.6, 4.3) | 4.1 (3.2, 5.2) | 7.4 (5.7, 9.5) | | |
| | Vanguard | 101 | 1695 | 1.4 (1.0, 2.1) | 4.1 (3.3, 5.2) | 4.8 (3.9, 6.0) | 6.7 (5.4, 8.2) | | |
| Other (28) | | 176 | 2649 | 2.7 (2.1, 3.4) | 6.1 (5.2, 7.2) | 7.3 (6.3, 8.5) | 8.9 (7.6, 10.3) | 9.6 (8.0, 11.5) | |
| TOTAL | | 5069 | 112679 | | | | | | |

Note: Only combinations with >400 procedures have been listed
Restricted to modern prostheses

**Table KT9 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 | 60 | 1377 | 1.4 (0.9, 2.2) | 4.4 (3.4, 5.8) | 5.2 (4.0, 6.7) | | | |
| Active Knee | Active Knee | 142 | 2306 | 0.6 (0.4, 1.0) | 2.7 (2.1, 3.5) | 3.8 (3.0, 4.6) | 6.7 (5.6, 8.0) | 9.7 (8.1, 11.6) | |
| Advance | Advance II | 25 | 478 | 1.1 (0.4, 2.5) | 2.8 (1.6, 4.7) | 3.7 (2.3, 5.9) | 5.6 (3.7, 8.4) | 6.8 (4.5, 10.3) | |
| Apex Knee CR | Apex Knee | 49 | 3454 | 1.0 (0.7, 1.4) | 1.6 (1.2, 2.1) | 2.1 (1.6, 2.9) | | | |
| BalanSys | BalanSys | 39 | 2004 | 1.0 (0.6, 1.5) | 2.1 (1.5, 2.9) | 2.7 (1.9, 3.8) | | | |
| GMK Primary | GMK Primary | 26 | 695 | 0.8 (0.3, 1.8) | 3.6 (2.4, 5.4) | 4.0 (2.7, 5.9) | | | |
| Genesis II CR | Genesis II | 442 | 8424 | 1.0 (0.8, 1.2) | 3.2 (2.8, 3.6) | 4.3 (3.9, 4.8) | 5.9 (5.3, 6.5) | 7.1 (6.3, 7.8) | |
| Genesis II PS | Genesis II | 67 | 707 | 1.7 (1.0, 3.0) | 4.4 (3.1, 6.2) | 5.6 (4.1, 7.6) | 8.7 (6.8, 11.2) | 11.0 (8.7, 14.0) | |
| LCS CR | LCS | 146 | 2364 | 1.0 (0.7, 1.5) | 2.7 (2.1, 3.5) | 3.8 (3.1, 4.7) | 5.5 (4.6, 6.5) | 6.7 (5.7, 7.9) | 8.8 (6.5, 11.9) |
| | MBT | 341 | 10693 | 0.7 (0.6, 0.9) | 2.1 (1.9, 2.4) | 2.8 (2.5, 3.2) | 4.0 (3.5, 4.4) | 4.5 (4.0, 5.1) | |
| | MBT Duofix | 36 | 987 | 1.3 (0.8, 2.3) | 3.3 (2.3, 4.6) | 3.4 (2.4, 4.8) | 4.2 (3.0, 5.9) | | |
| Legion CR | Genesis II | 117 | 3324 | 1.4 (1.0, 1.9) | 3.5 (2.9, 4.3) | 4.3 (3.6, 5.2) | 5.7 (4.5, 7.1) | | |
| Natural Knee Flex | Natural Knee II | 40 | 1934 | 0.4 (0.2, 0.8) | 1.3 (0.9, 1.9) | 1.9 (1.3, 2.6) | 2.6 (1.9, 3.6) | | |
| Nexgen CR | Nexgen | 159 | 4345 | 0.6 (0.4, 0.9) | 1.7 (1.4, 2.2) | 2.2 (1.8, 2.7) | 3.2 (2.7, 3.8) | 4.5 (3.8, 5.4) | |
| Nexgen CR Flex | Nexgen | 515 | 21655 | 0.7 (0.6, 0.9) | 1.8 (1.6, 2.0) | 2.2 (2.0, 2.5) | 3.0 (2.7, 3.3) | 3.8 (3.2, 4.5) | |
| | Nexgen TM CR | 23 | 847 | 0.7 (0.3, 1.6) | 1.6 (0.9, 2.7) | 1.7 (1.0, 2.9) | 2.4 (1.6, 3.8) | 3.6 (2.3, 5.5) | |
| Nexgen LPS | Nexgen | 56 | 1028 | 0.5 (0.2, 1.2) | 2.7 (1.9, 3.9) | 4.1 (3.1, 5.6) | 5.4 (4.1, 7.1) | 6.4 (4.9, 8.4) | |
| Nexgen LPS Flex | Nexgen | 58 | 1060 | 2.1 (1.4, 3.2) | 4.5 (3.4, 6.0) | 5.7 (4.4, 7.4) | 6.6 (5.0, 8.6) | | |
| | Nexgen TM LPS | 20 | 508 | 0.6 (0.2, 1.8) | 1.8 (0.9, 3.4) | 2.0 (1.1, 3.7) | 3.1 (1.9, 5.1) | | |
| Optetrak Logic CR | Optetrak Logic | 21 | 921 | 1.3 (0.7, 2.3) | 2.7 (1.7, 4.2) | 3.4 (2.1, 5.4) | | | |
| PFC Sigma CR | MBT | 217 | 4153 | 1.3 (1.0, 1.7) | 3.1 (2.6, 3.7) | 4.1 (3.5, 4.8) | 5.3 (4.6, 6.0) | 7.1 (6.0, 8.2) | |
| | PFC Sigma | 392 | 11649 | 0.6 (0.5, 0.8) | 1.9 (1.7, 2.2) | 2.4 (2.2, 2.8) | 3.5 (3.1, 3.9) | 5.2 (4.6, 5.9) | 5.9 (5.1, 6.9) |
| PFC Sigma PS | MBT Duofix | 173 | 2252 | 1.8 (1.3, 2.5) | 4.5 (3.7, 5.4) | 6.0 (5.1, 7.1) | 8.2 (7.0, 9.5) | 10.5 (8.7, 12.5) | |
| Persona CR | Persona | 67 | 5609 | 1.1 (0.8, 1.4) | 2.0 (1.5, 2.6) | 2.5 (1.6, 3.9) | | | |
| RBK | RBK | 73 | 1604 | 1.1 (0.7, 1.7) | 2.9 (2.2, 3.9) | 3.7 (2.8, 4.8) | 4.9 (3.8, 6.2) | 8.0 (5.7, 11.2) | |
| Score | Score | 84 | 1670 | 1.6 (1.1, 2.3) | 4.0 (3.1, 5.2) | 6.1 (4.9, 7.6) | | | |
| Trekking | Trekking | 15 | 545 | 1.1 (0.5, 2.5) | 2.6 (1.5, 4.5) | 3.3 (1.8, 5.8) | | | |
| Triathlon CR | Triathlon | 591 | 29974 | 0.7 (0.6, 0.8) | 1.6 (1.4, 1.7) | 2.1 (1.9, 2.3) | 3.2 (2.9, 3.6) | | |
| Triathlon PS | Triathlon | 109 | 2872 | 1.7 (1.3, 2.2) | 2.7 (2.1, 3.3) | 3.6 (2.9, 4.4) | 5.0 (4.0, 6.1) | | |
| Vanguard CR | Vanguard | 437 | 13289 | 0.8 (0.7, 1.0) | 2.2 (2.0, 2.5) | 3.0 (2.7, 3.3) | 4.9 (4.4, 5.5) | | |
| Vanguard PS | Vanguard | 32 | 693 | 1.2 (0.6, 2.4) | 3.0 (2.0, 4.7) | 4.1 (2.8, 6.0) | 6.0 (4.2, 8.7) | | |
| Other (54) | | 244 | 3271 | 3.0 (2.4, 3.6) | 6.2 (5.4, 7.2) | 7.5 (6.6, 8.6) | 9.6 (8.4, 10.9) | 11.7 (9.8, 13.8) | |
| TOTAL | | 4816 | 146692 | | | | | | |

Note: Only combinations with >400 procedures have been listed
Restricted to modern prostheses

## 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 8.1% (Table KT10 and Figure KT7).

### Reasons for Revision

Infection is the most common reason for revision followed by loosening, instability patellofemoral pain, and pain (Table KT11 and Figure KT8).

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 bone resorption.

### Types of Revision

The most common types of revision are insert only, both femoral and tibial components, and patella only (Table KT12).

### Age and Gender

The rate of revision decreases with increasing age. This difference becomes more evident with time. Patients aged <55 years have almost 3 times the rate of revision after 6 months and this increases to more than 5 times after 7 years, compared to patients aged ≥75 years (Table KT13 and Figure KT9).

Males have a higher rate of revision compared to females (Table KT14 and Figure KT10). Loosening is the most common reason for revision in females. Males have a higher incidence of revision for infection (Figure KT11).

**Males have a higher rate of revision which is largely due to an increased incidence of infection.**

Age-related differences in the rate of revision are evident for both males and females (Table KT14, Figure KT12 and Figure KT13).

### 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 part of this chapter. The Registry reports on the outcome of 386,408 primary total knee replacement procedures for osteoarthritis in relation to 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 KT15 and Figure KT14). 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 KT15).

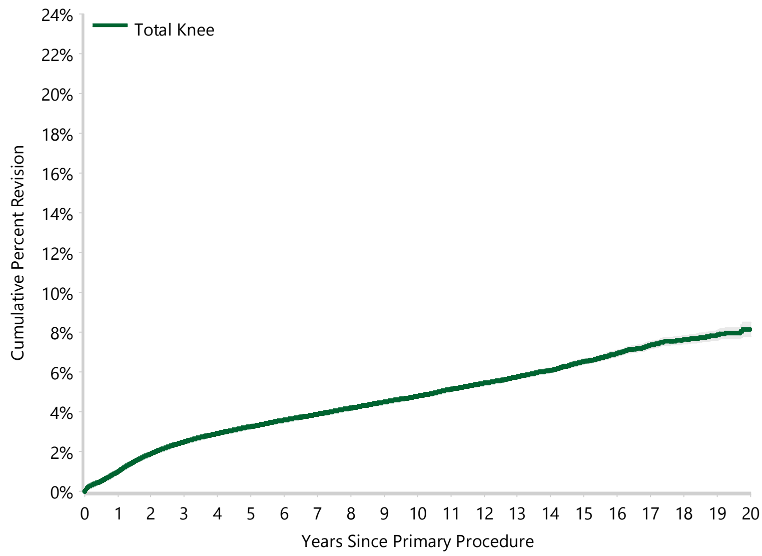
BMI data have been collected since 2015. The early revision outcomes are reported for 298,203 primary total knee replacement procedures for osteoarthritis in relation to BMI category. When compared to patients with normal BMI, there is no difference in the rate of revision for patients who are pre-obese 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 KT16 and Figure KT16). The most common reasons for revision are shown in Figure KT17. There is an increased rate of revision for infection for patients in obese classes 2 and 3 when compared to patients with a normal BMI (Table KT17 and Figure KT18).

**Table KT10 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 | 22899 | 654260 | 1.0 (1.0, 1.0) | 2.5 (2.5, 2.5) | 3.3 (3.2, 3.3) | 4.8 (4.7, 4.9) | 6.5 (6.4, 6.6) | 8.1 (7.8, 8.5) |
| TOTAL | 22899 | 654260 | | | | | | |

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 | 654260 | 591609 | 464003 | 349144 | 132336 | 31023 | 645 |

Note: Restricted to modern prostheses

**Table KT11 Primary Total Knee Replacement by Reason for Revision (Primary Diagnosis OA)**

| Reason for Revision | Number | Percent |
|---|---|---|
| Infection | 6055 | 26.4 |
| Loosening | 5194 | 22.7 |
| Instability | 2170 | 9.5 |
| Patellofemoral Pain | 1931 | 8.4 |
| Pain | 1846 | 8.1 |
| Patella Erosion | 1451 | 6.3 |
| Arthrofibrosis | 879 | 3.8 |
| Fracture | 789 | 3.4 |
| Malalignment | 532 | 2.3 |
| Lysis | 304 | 1.3 |
| Wear Tibial Insert | 294 | 1.3 |
| Incorrect Sizing | 244 | 1.1 |
| Metal Related Pathology | 109 | 0.5 |
| Other | 1101 | 4.8 |
| TOTAL | 22899 | 100.0 |

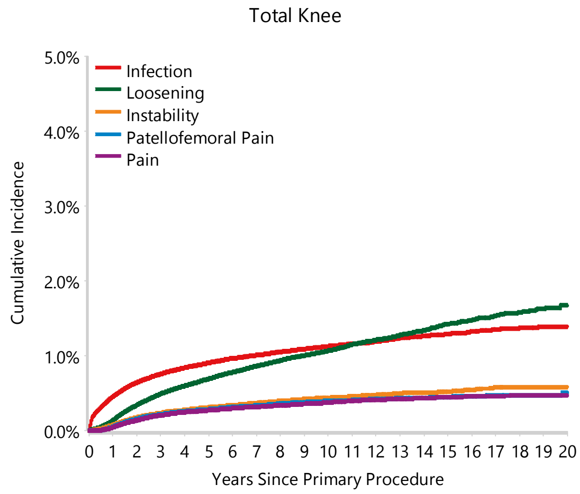
Note: Restricted to modern prostheses

**Table KT12 Primary Total Knee Replacement by Type of Revision (Primary Diagnosis OA)**

| Type of Revision | Number | Percent |
|---|---|---|
| Insert Only | 6150 | 26.9 |
| TKR (Tibial/Femoral) | 5582 | 24.4 |
| Patella Only | 4309 | 18.8 |
| Insert/Patella | 2386 | 10.4 |
| Tibial Component | 1916 | 8.4 |
| Cement Spacer | 1208 | 5.3 |
| Femoral Component | 1140 | 5.0 |
| Removal of Prostheses | 129 | 0.6 |
| Minor Components | 47 | 0.2 |
| Cement Only | 11 | 0.0 |
| Total Femoral | 11 | 0.0 |
| Reinsertion of Components | 10 | 0.0 |
| TOTAL | 22899 | 100.0 |

Note: Restricted to modern prostheses

**Figure KT8 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement (Primary Diagnosis OA)**



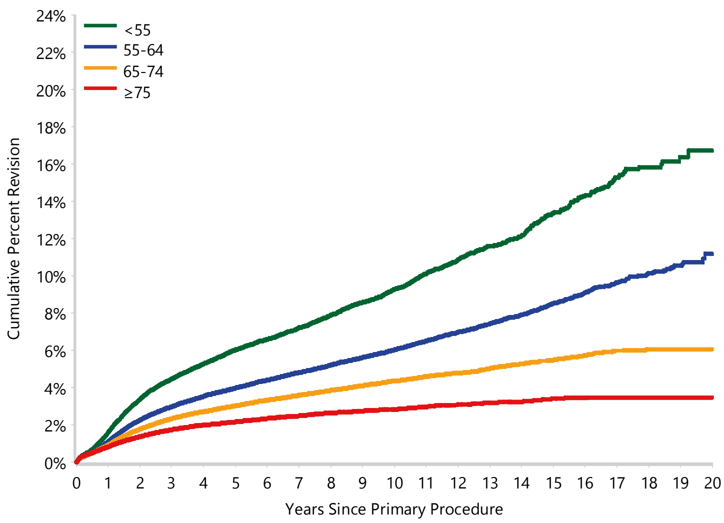

Note: Restricted to modern prostheses

**Table KT13 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 | 3048 | 43036 | 1.6 (1.5, 1.7) | 4.5 (4.3, 4.7) | 6.0 (5.8, 6.3) | 9.3 (8.9, 9.6) | 13.4 (12.8, 14.0) | 16.7 (15.5, 18.1) |
| 55-64 | 7921 | 175435 | 1.1 (1.1, 1.2) | 3.0 (2.9, 3.1) | 4.0 (3.9, 4.1) | 6.0 (5.9, 6.2) | 8.5 (8.3, 8.8) | 11.2 (10.4, 12.1) |
| 65-74 | 8242 | 261499 | 0.9 (0.9, 1.0) | 2.3 (2.3, 2.4) | 3.0 (3.0, 3.1) | 4.4 (4.3, 4.5) | 5.5 (5.3, 5.6) | 6.1 (5.8, 6.3) |
| ≥75 | 3688 | 174290 | 0.8 (0.8, 0.9) | 1.7 (1.7, 1.8) | 2.2 (2.1, 2.2) | 2.8 (2.7, 2.9) | 3.4 (3.2, 3.6) | 3.5 (3.3, 3.7) |
| TOTAL | 22899 | 654260 | | | | | | |

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 - 6Mth: HR=1.40 (1.23, 1.60),p<0.001
6Mth - 1.5Yr: HR=2.92 (2.66, 3.20),p<0.001
1.5Yr - 2Yr: HR=3.47 (2.96, 4.06),p<0.001
2Yr - 3.5Yr: HR=3.26 (2.93, 3.62),p<0.001
3.5Yr - 4Yr: HR=3.82 (3.12, 4.66),p<0.001
4Yr - 6.5Yr: HR=3.80 (3.38, 4.28),p<0.001
6.5Yr - 7Yr: HR=4.58 (3.45, 6.09),p<0.001
7Yr+: HR=5.69 (5.12, 6.33),p<0.001

55-64 vs ≥75
0 - 3Mth: HR=0.96 (0.86, 1.07),p=0.425
3Mth - 9Mth: HR=1.49 (1.36, 1.64),p<0.001
9Mth - 1.5Yr: HR=1.93 (1.78, 2.09),p<0.001
1.5Yr - 2Yr: HR=2.21 (1.94, 2.51),p<0.001
2Yr - 2.5Yr: HR=2.06 (1.84, 2.30),p<0.001
2.5Yr - 4Yr: HR=2.26 (2.07, 2.47),p<0.001
4Yr - 4.5Yr: HR=2.48 (2.11, 2.92),p<0.001
4.5Yr - 6.5Yr: HR=2.47 (2.24, 2.73),p<0.001
6.5Yr - 7Yr: HR=2.59 (2.08, 3.23),p<0.001
7Yr - 13Yr: HR=3.15 (2.87, 3.46),p<0.001
13Yr+: HR=4.08 (3.43, 4.86),p<0.001

65-74 vs ≥75
0 - 6Mth: HR=1.02 (0.94, 1.11),p=0.625
6Mth - 1.5Yr: HR=1.37 (1.28, 1.48),p<0.001
1.5Yr - 2Yr: HR=1.60 (1.41, 1.81),p<0.001
2Yr+: HR=1.68 (1.58, 1.78),p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| <55 | 43036 | 38817 | 30945 | 23878 | 10173 | 2956 | 80 |
| 55-64 | 175435 | 158877 | 126049 | 96622 | 39566 | 10403 | 240 |
| 65-74 | 261499 | 236236 | 184397 | 138529 | 53432 | 13052 | 269 |
| ≥75 | 174290 | 157679 | 122612 | 90115 | 29165 | 4612 | 56 |

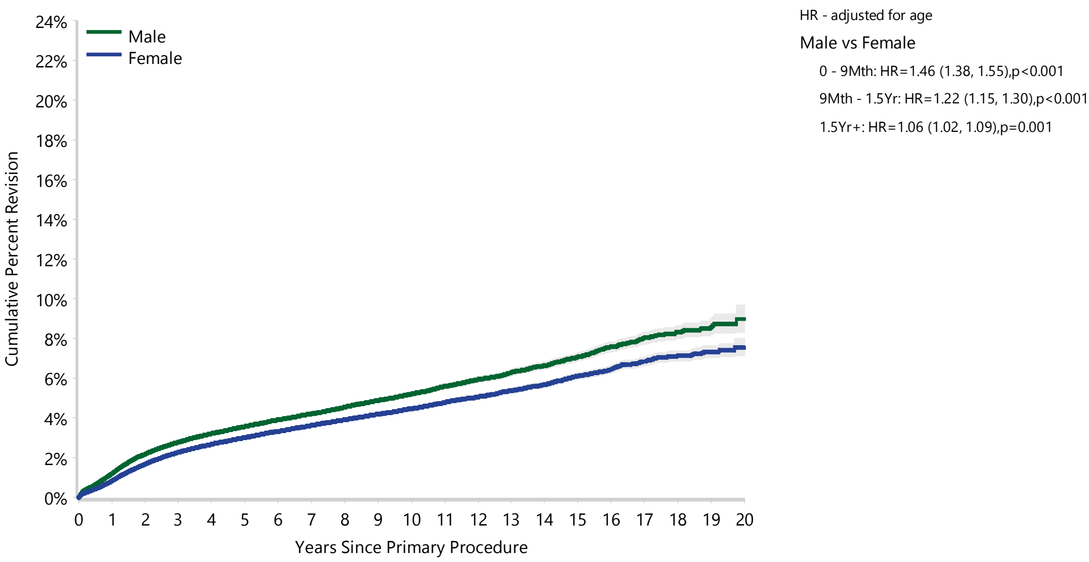
Note: Restricted to modern prostheses

**Table KT14 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 | | 10888 | 289361 | 1.2 (1.2, 1.2) | 2.8 (2.7, 2.8) | 3.6 (3.5, 3.7) | 5.2 (5.1, 5.3) | 7.1 (6.9, 7.3) | 9.0 (8.3, 9.7) |
| | <55 | 1366 | 18531 | 1.9 (1.7, 2.1) | 4.9 (4.5, 5.2) | 6.3 (6.0, 6.7) | 9.5 (9.0, 10.1) | 13.8 (12.9, 14.8) | 17.0 (15.4, 18.9) |
| | 55-64 | 3848 | 81699 | 1.3 (1.2, 1.4) | 3.3 (3.1, 3.4) | 4.3 (4.1, 4.4) | 6.4 (6.2, 6.6) | 8.9 (8.5, 9.3) | 11.7 (10.3, 13.2) |
| | 65-74 | 4022 | 117951 | 1.1 (1.1, 1.2) | 2.6 (2.5, 2.7) | 3.3 (3.2, 3.4) | 4.8 (4.6, 4.9) | 6.0 (5.7, 6.3) | 6.9 (6.4, 7.3) |
| | ≥75 | 1652 | 71180 | 1.0 (0.9, 1.1) | 2.0 (1.9, 2.1) | 2.4 (2.3, 2.6) | 3.1 (3.0, 3.3) | 3.7 (3.4, 4.0) | |
| Female | | 12011 | 364899 | 0.8 (0.8, 0.9) | 2.3 (2.2, 2.3) | 3.0 (3.0, 3.1) | 4.5 (4.4, 4.6) | 6.1 (6.0, 6.3) | 7.5 (7.1, 8.0) |
| | <55 | 1682 | 24505 | 1.4 (1.2, 1.5) | 4.2 (3.9, 4.4) | 5.8 (5.5, 6.1) | 9.1 (8.6, 9.6) | 13.0 (12.2, 13.9) | |
| | 55-64 | 4073 | 93736 | 0.9 (0.9, 1.0) | 2.7 (2.6, 2.9) | 3.7 (3.6, 3.9) | 5.7 (5.5, 5.9) | 8.2 (7.9, 8.6) | 10.8 (9.8, 11.9) |
| | 65-74 | 4220 | 143548 | 0.8 (0.7, 0.8) | 2.1 (2.1, 2.2) | 2.8 (2.7, 2.9) | 4.0 (3.9, 4.2) | 5.1 (4.9, 5.3) | 5.5 (5.2, 5.8) |
| | ≥75 | 2036 | 103110 | 0.7 (0.7, 0.8) | 1.6 (1.5, 1.6) | 2.0 (1.9, 2.1) | 2.6 (2.5, 2.8) | 3.2 (3.0, 3.4) | |
| TOTAL | | 22899 | 654260 | | | | | | |

Note: Restricted to modern prostheses

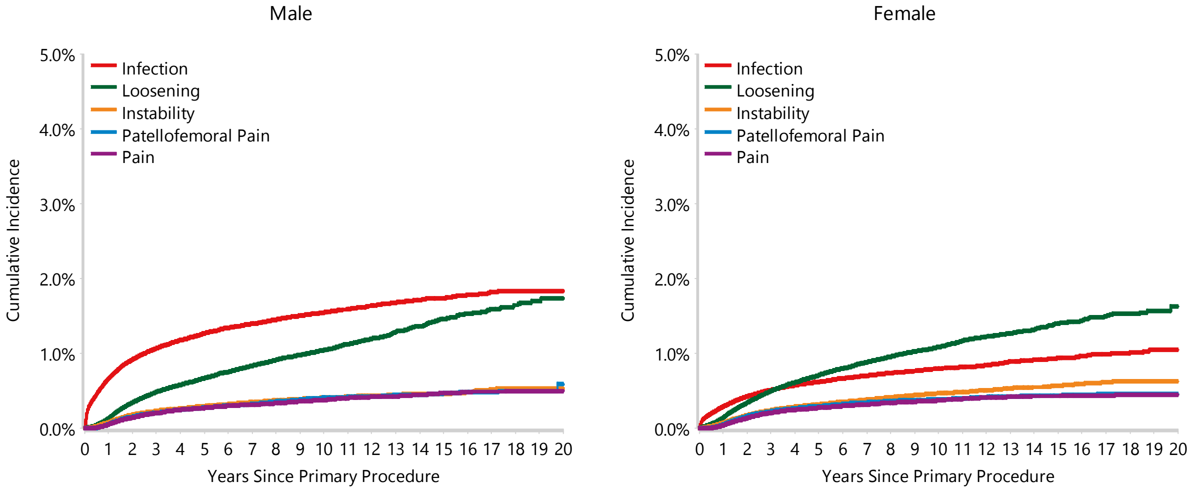
**Figure KT10 Cumulative Percent Revision of Primary Total Knee Replacement by Gender (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Male | 289361 | 259351 | 200789 | 149220 | 54589 | 12277 | 253 |
| Female | 364899 | 332258 | 263214 | 199924 | 77747 | 18746 | 392 |

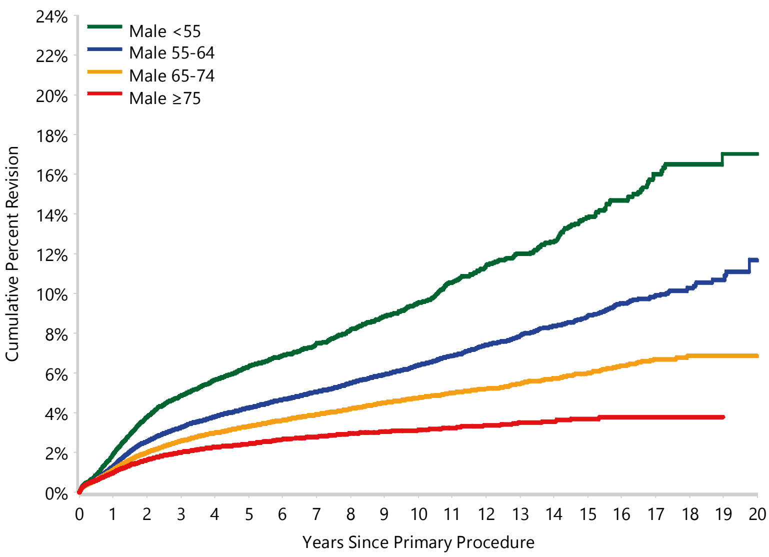
Note: Restricted to modern prostheses

**Figure KT11 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by Gender (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

**Figure KT12 Cumulative Percent Revision of Primary Total Knee Replacement in Males by Age (Primary Diagnosis OA)**




Male <55 vs Male ≥75
- 0 - 6Mth: HR=1.54 (1.29, 1.84),p<0.001
- 6Mth - 9Mth: HR=2.61 (2.07, 3.28),p<0.001
- 9Mth - 3.5Yr: HR=2.93 (2.65, 3.23),p<0.001
- 3.5Yr - 7.5Yr: HR=3.53 (3.05, 4.08),p<0.001
- 7.5Yr+: HR=5.58 (4.74, 6.57),p<0.001

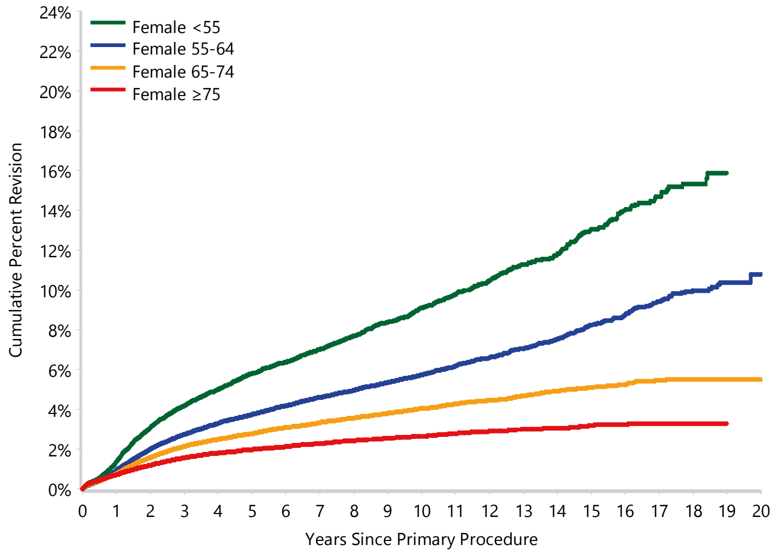
Male 55-64 vs Male ≥75
- 0 - 3Mth: HR=1.06 (0.92, 1.23),p=0.423
- 3Mth - 1Yr: HR=1.58 (1.42, 1.75),p<0.001
- 1Yr - 5.5Yr: HR=2.04 (1.89, 2.19),p<0.001
- 5.5Yr - 8.5Yr: HR=2.53 (2.20, 2.91),p<0.001
- 8.5Yr+: HR=3.41 (2.93, 3.96),p<0.001

Male 65-74 vs Male ≥75
- 0 - 6Mth: HR=1.08 (0.96, 1.21),p=0.203
- 6Mth - 2.5Yr: HR=1.37 (1.27, 1.48),p<0.001
- 2.5Yr+: HR=1.71 (1.57, 1.86),p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Male | <55 | 18531 | 16602 | 13122 | 10103 | 4349 | 1285 | 43 |
| | 55-64 | 81699 | 73332 | 57356 | 43632 | 17630 | 4476 | 105 |
| | 65-74 | 117951 | 105715 | 81825 | 60910 | 22481 | 5116 | 88 |
| | ≥75 | 71180 | 63702 | 48486 | 34575 | 10129 | 1400 | 17 |

Note: Restricted to modern prostheses

**Figure KT13 Cumulative Percent Revision of Primary Total Knee Replacement in Females by Age (Primary Diagnosis OA)**




Female <55 vs Female ≥75
- 0 - 6Mth: HR=1.21 (1.00, 1.47),p=0.051
- 6Mth - 3Yr: HR=3.35 (3.06, 3.66),p<0.001
- 3Yr - 7Yr: HR=4.03 (3.59, 4.52),p<0.001
- 7Yr - 14Yr: HR=5.82 (4.98, 6.80),p<0.001
- 14Yr+: HR=10.63 (7.46, 15.14),p<0.001

Female 55-64 vs Female ≥75
- 0 - 3Mth: HR=0.80 (0.68, 0.94),p=0.008
- 3Mth - 6Mth: HR=1.16 (0.95, 1.42),p=0.134
- 6Mth - 3.5Yr: HR=2.13 (1.99, 2.29),p<0.001
- 3.5Yr - 8Yr: HR=2.68 (2.43, 2.94),p<0.001
- 8Yr - 12Yr: HR=3.34 (2.85, 3.91),p<0.001
- 12Yr - 15Yr: HR=4.50 (3.54, 5.71),p<0.001
- 15Yr+: HR=7.40 (4.94, 11.08),p<0.001

Female 65-74 vs Female ≥75
- 0 - 6Mth: HR=0.91 (0.81, 1.03),p=0.149
- 6Mth - 5Yr: HR=1.57 (1.48, 1.68),p<0.001
- 5Yr+: HR=1.78 (1.59, 1.98),p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Female | <55 | 24505 | 22215 | 17823 | 13775 | 5824 | 1671 | 37 |
| | 55-64 | 93736 | 85545 | 68693 | 52990 | 21936 | 5927 | 135 |
| | 65-74 | 143548 | 130521 | 102572 | 77619 | 30951 | 7936 | 181 |
| | ≥75 | 103110 | 93977 | 74126 | 55540 | 19036 | 3212 | 39 |

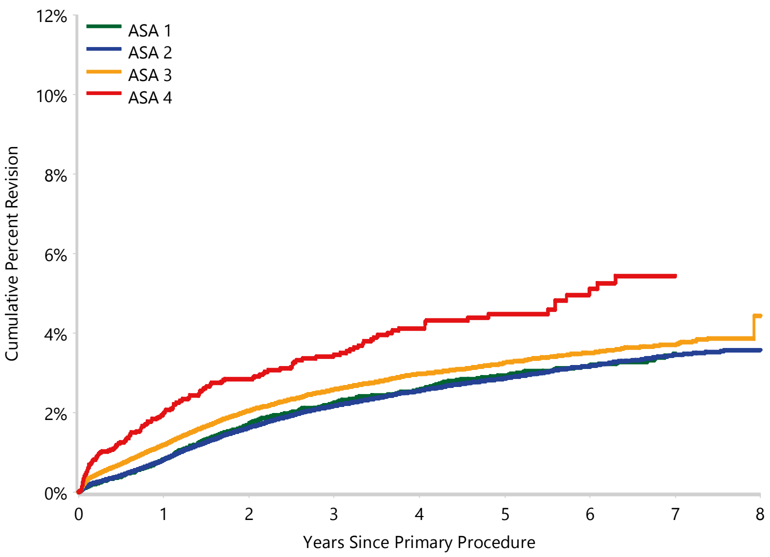
Note: Restricted to modern prostheses

**Table KT15 Cumulative Percent Revision of Primary Total Knee Replacement by ASA Score (Primary Diagnosis OA)**

| ASA Score | N Revised | N Total | 1 Yr | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| ASA 1 | 523 | 22609 | 0.8 (0.7, 1.0) | 2.3 (2.0, 2.5) | 2.6 (2.3, 2.8) | 2.9 (2.7, 3.2) | 3.2 (2.9, 3.5) | 3.5 (3.2, 3.9) | |
| ASA 2 | 4685 | 212441 | 0.8 (0.8, 0.9) | 2.2 (2.1, 2.2) | 2.6 (2.5, 2.6) | 2.9 (2.8, 3.0) | 3.2 (3.1, 3.3) | 3.5 (3.3, 3.6) | 3.6 (3.4, 3.7) |
| ASA 3 | 3621 | 147280 | 1.2 (1.1, 1.3) | 2.6 (2.5, 2.7) | 3.0 (2.9, 3.1) | 3.3 (3.2, 3.4) | 3.5 (3.4, 3.6) | 3.7 (3.6, 3.9) | 4.4 (3.4, 5.7) |
| ASA 4 | 145 | 4067 | 2.0 (1.6, 2.5) | 3.4 (2.9, 4.1) | 4.1 (3.5, 4.9) | 4.5 (3.8, 5.3) | 5.1 (4.2, 6.1) | 5.4 (4.5, 6.6) | |
| ASA 5 | 0 | 11 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | |
| TOTAL | 8974 | 386408 | | | | | | | |

Note: Restricted to modern prostheses

**Figure KT14 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=1.17 (1.07, 1.28),p<0.001

ASA 3 vs ASA 1

0 - 6Mth: HR=2.11 (1.87, 2.38),p<0.001

6Mth - 1.5Yr: HR=1.44 (1.29, 1.61),p<0.001

1.5Yr+: HR=1.24 (1.12, 1.38),p<0.001

ASA 4 vs ASA 1

0 - 1.5Yr: HR=2.89 (2.33, 3.60),p<0.001

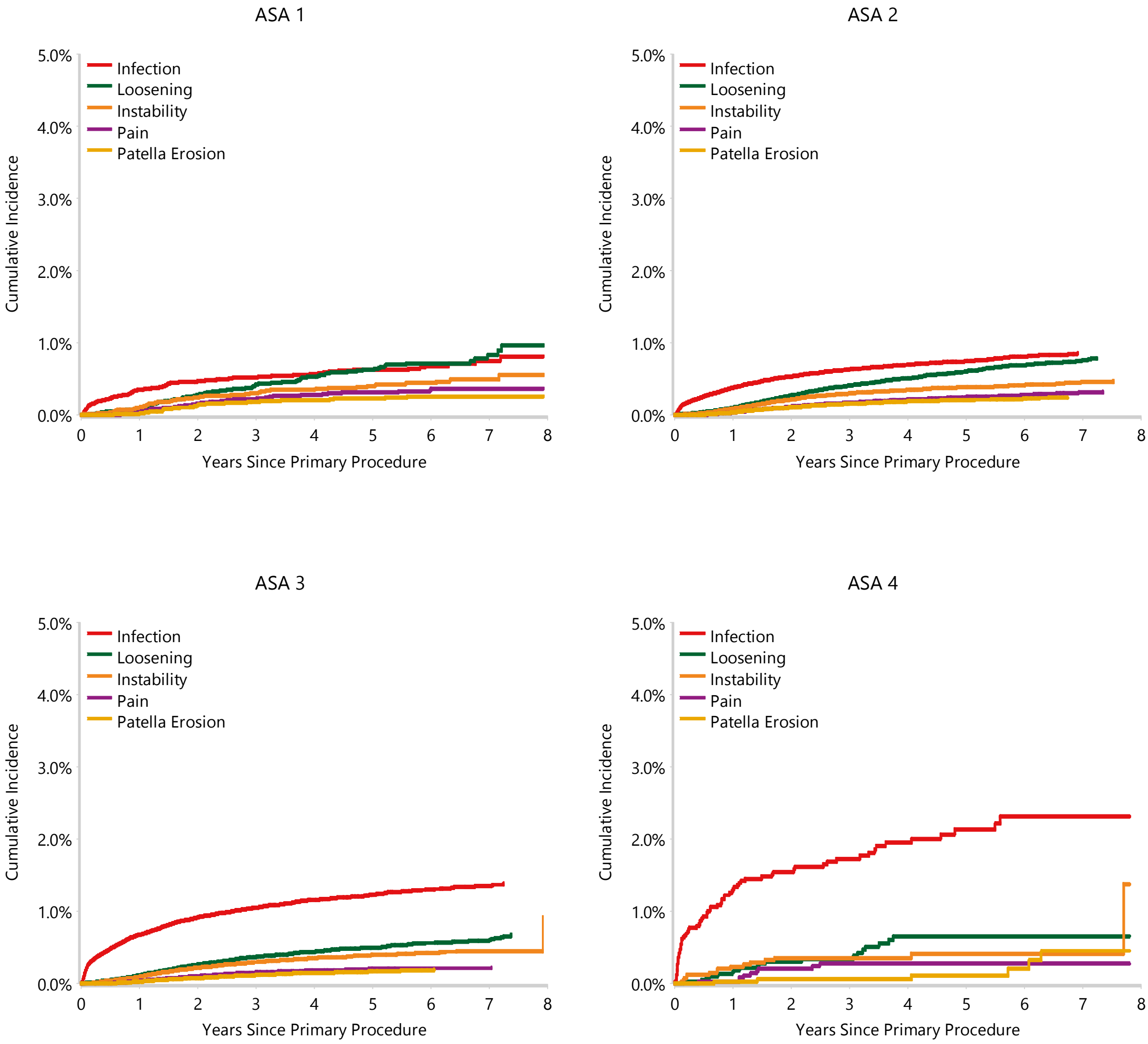
1.5Yr - 2Yr: HR=0.72 (0.32, 1.62),p=0.433

2Yr+: HR=1.89 (1.37, 2.60),p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|
| ASA 1 | 22609 | 19584 | 13358 | 10273 | 7401 | 4511 | 1892 | 19 |
| ASA 2 | 212441 | 182219 | 120584 | 91447 | 64244 | 38265 | 15096 | 133 |
| ASA 3 | 147280 | 123540 | 76235 | 55538 | 37023 | 21183 | 7910 | 59 |
| ASA 4 | 4067 | 3390 | 2064 | 1522 | 1053 | 631 | 256 | 5 |

Note: Restricted to modern prostheses

**Figure KT15** **Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by ASA Score (Primary Diagnosis OA)**



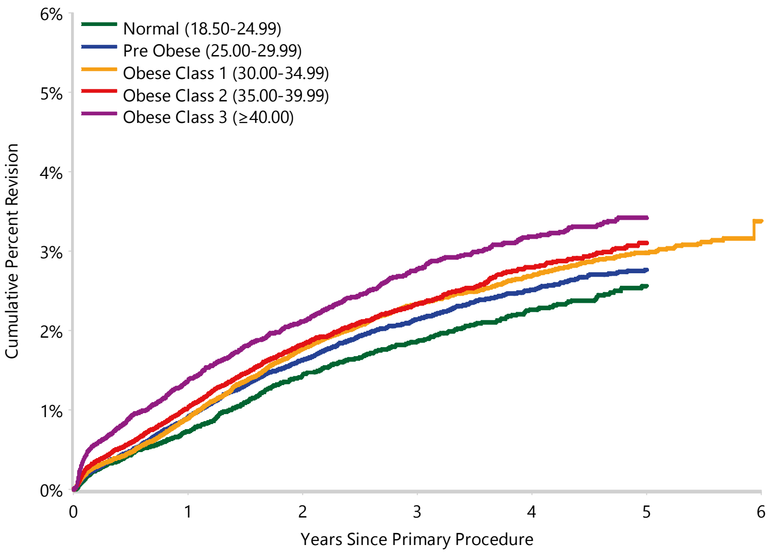

Note: Restricted to modern prostheses

**Table KT16 Cumulative Percent Revision of Primary Total Knee 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 (<18.50) | 7 | 531 | 0.8 (0.3, 2.1) | 1.1 (0.4, 2.6) | 1.4 (0.6, 3.2) | 1.4 (0.6, 3.2) | 2.3 (0.9, 5.6) | |
| Normal (18.50-24.99) | 504 | 30704 | 0.7 (0.6, 0.8) | 1.4 (1.3, 1.6) | 1.9 (1.7, 2.1) | 2.3 (2.1, 2.5) | 2.6 (2.3, 2.8) | |
| Pre Obese (25.00-29.99) | 1715 | 92848 | 0.9 (0.9, 1.0) | 1.6 (1.5, 1.7) | 2.1 (2.0, 2.3) | 2.5 (2.4, 2.6) | 2.8 (2.6, 2.9) | |
| Obese Class 1 (30.00-34.99) | 1815 | 92082 | 0.9 (0.8, 1.0) | 1.8 (1.7, 1.9) | 2.3 (2.2, 2.5) | 2.7 (2.6, 2.8) | 3.0 (2.8, 3.1) | 3.4 (2.9, 3.9) |
| Obese Class 2 (35.00-39.99) | 1043 | 50787 | 1.0 (0.9, 1.1) | 1.8 (1.7, 2.0) | 2.3 (2.2, 2.5) | 2.8 (2.6, 3.0) | 3.1 (2.9, 3.3) | |
| Obese Class 3 (≥40.00) | 757 | 31251 | 1.4 (1.3, 1.5) | 2.1 (1.9, 2.3) | 2.8 (2.6, 3.0) | 3.2 (2.9, 3.4) | 3.4 (3.2, 3.7) | |
| TOTAL | 5841 | 298203 | | | | | | |

Note: BMI has not been presented for patients aged ≤19 years
Restricted to modern prostheses

**Figure KT16 Cumulative Percent Revision of Primary Total 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=1.03 (0.94, 1.14),p=0.518

Obese Class 1 (30.00-34.99) vs Normal (18.50-24.99)
Entire Period: HR=1.06 (0.96, 1.17),p=0.235

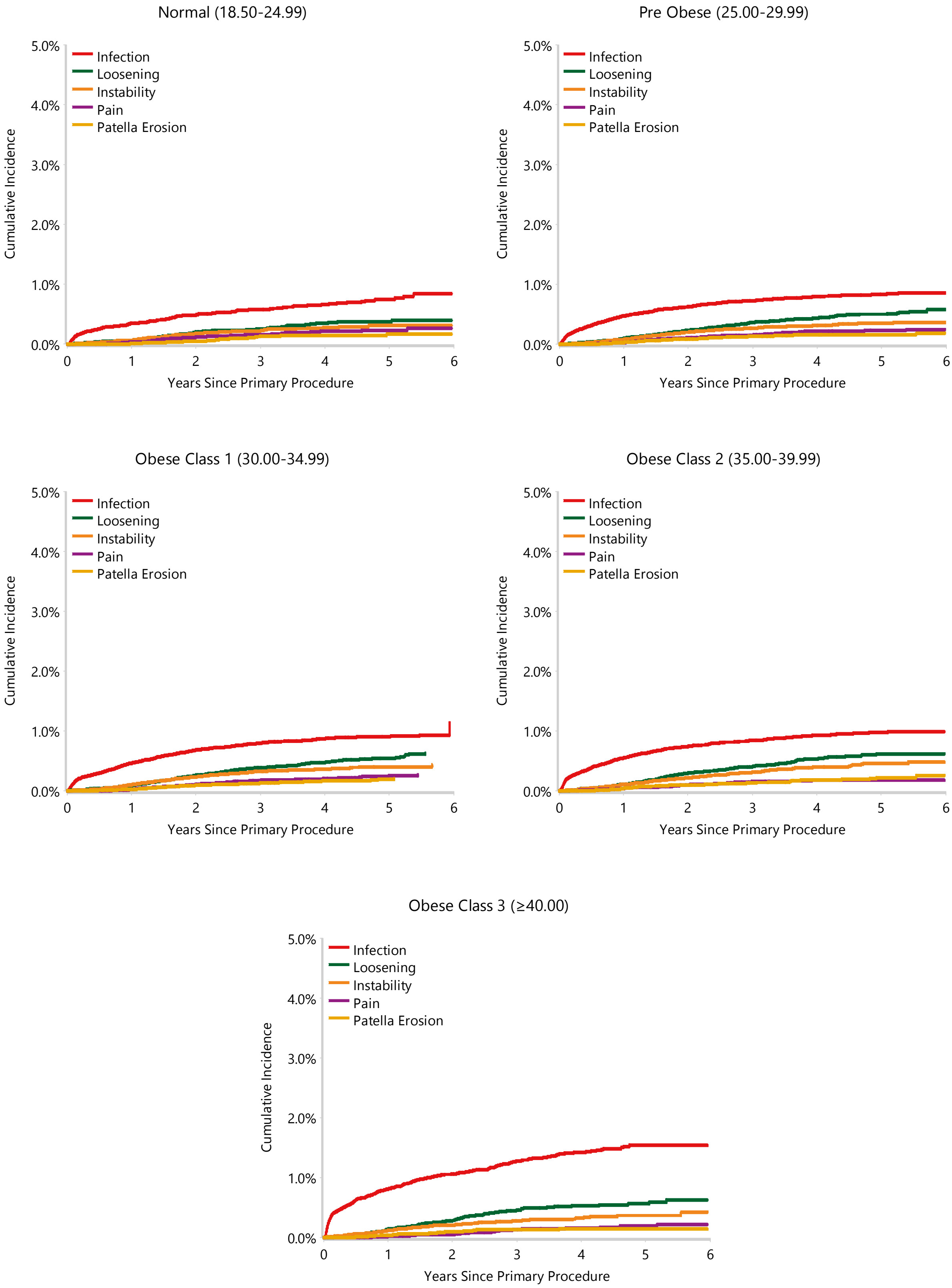
Obese Class 2 (35.00-39.99) vs Normal (18.50-24.99)
0 - 1Mth: HR=1.38 (1.09, 1.75),p=0.007
1Mth - 3Mth: HR=1.16 (0.91, 1.48),p=0.231
3Mth - 1.5Yr: HR=1.07 (0.94, 1.22),p=0.316
1.5Yr+: HR=1.01 (0.88, 1.17),p=0.839

Obese Class 3 (≥40.00) vs Normal (18.50-24.99)
0 - 1Mth: HR=2.42 (1.92, 3.04),p<0.001
1Mth - 6Mth: HR=1.62 (1.34, 1.95),p<0.001
6Mth - 1.5Yr: HR=1.03 (0.88, 1.21),p=0.706
1.5Yr - 2Yr: HR=0.83 (0.64, 1.08),p=0.169
2Yr+: HR=1.12 (0.94, 1.34),p=0.207

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|
| Normal (18.50-24.99) | 30704 | 24826 | 18865 | 13357 | 8372 | 3864 | 9 |
| Pre Obese (25.00-29.99) | 92848 | 75213 | 57461 | 40800 | 25276 | 11466 | 38 |
| Obese Class 1 (30.00-34.99) | 92082 | 74832 | 56963 | 40386 | 24971 | 11359 | 41 |
| Obese Class 2 (35.00-39.99) | 50787 | 41394 | 31733 | 22254 | 13703 | 6182 | 22 |
| Obese Class 3 (≥40.00) | 31251 | 25687 | 19687 | 13926 | 8577 | 3766 | 9 |

Note: BMI has not been presented for patients aged ≤19 years
Restricted to modern prostheses

**Figure KT17** **Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by BMI Category (Primary Diagnosis OA)**



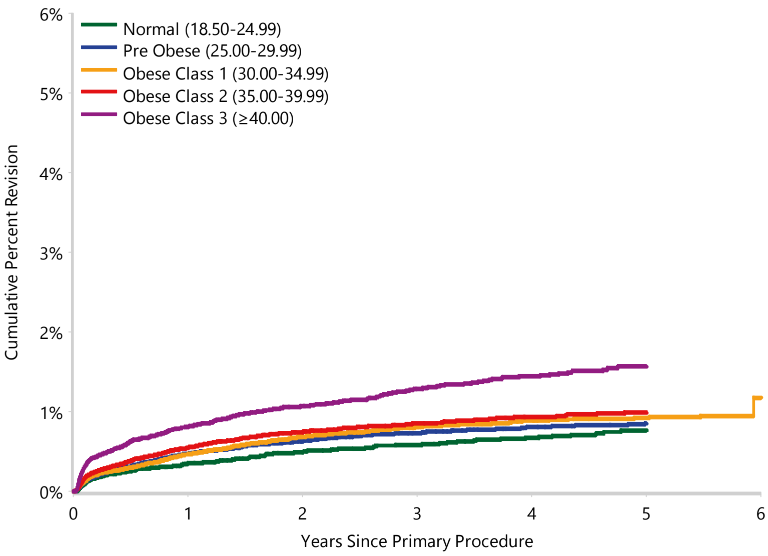

Note: BMI has not been presented for patients aged ≤19 years
Restricted to modern prostheses

**Table KT17 Cumulative Percent Revision of Primary Total Knee Replacement by BMI Category (Primary Diagnosis OA, Revision for Infection)**

| BMI Category | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|---|
| Underweight (<18.50) | 4 | 531 | 0.6 (0.2, 1.8) | 0.6 (0.2, 1.8) | 0.9 (0.3, 2.5) | 0.9 (0.3, 2.5) | 0.9 (0.3, 2.5) | |
| Normal (18.50-24.99) | 166 | 30704 | 0.4 (0.3, 0.4) | 0.5 (0.4, 0.6) | 0.6 (0.5, 0.7) | 0.7 (0.6, 0.8) | 0.8 (0.6, 0.9) | |
| Pre Obese (25.00-29.99) | 602 | 92848 | 0.5 (0.4, 0.5) | 0.6 (0.6, 0.7) | 0.7 (0.7, 0.8) | 0.8 (0.7, 0.9) | 0.9 (0.8, 0.9) | |
| Obese Class 1 (30.00-34.99) | 641 | 92082 | 0.5 (0.4, 0.5) | 0.7 (0.6, 0.7) | 0.8 (0.7, 0.9) | 0.9 (0.8, 1.0) | 0.9 (0.8, 1.0) | 1.2 (0.8, 1.7) |
| Obese Class 2 (35.00-39.99) | 386 | 50787 | 0.5 (0.5, 0.6) | 0.7 (0.7, 0.8) | 0.9 (0.8, 0.9) | 0.9 (0.8, 1.0) | 1.0 (0.9, 1.1) | |
| Obese Class 3 (≥40.00) | 363 | 31251 | 0.8 (0.7, 0.9) | 1.1 (1.0, 1.2) | 1.3 (1.2, 1.4) | 1.4 (1.3, 1.6) | 1.6 (1.4, 1.8) | |
| TOTAL | 2162 | 298203 | | | | | | |

Note: BMI has not been presented for patients aged ≤19 years
Restricted to modern prostheses

**Figure KT18 Cumulative Percent Revision of Primary Total Knee Replacement by BMI Category (Primary Diagnosis OA, Revision for Infection)**




HR - adjusted for age and gender

Pre Obese (25.00-29.99) vs Normal (18.50-24.99)
Entire Period: HR=1.07 (0.90, 1.27),p=0.442

Obese Class 1 (30.00-34.99) vs Normal (18.50-24.99)
Entire Period: HR=1.18 (1.00, 1.41),p=0.053

Obese Class 2 (35.00-39.99) vs Normal (18.50-24.99)
Entire Period: HR=1.39 (1.16, 1.68),p<0.001

Obese Class 3 (≥40.00) vs Normal (18.50-24.99)
0 - 1Mth: HR=3.44 (2.59, 4.57),p<0.001
1Mth+: HR=2.10 (1.73, 2.56),p<0.001

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|
| Normal (18.50-24.99) | 30704 | 24826 | 18865 | 13357 | 8372 | 3864 | 9 |
| Pre Obese (25.00-29.99) | 92848 | 75213 | 57461 | 40800 | 25276 | 11466 | 38 |
| Obese Class 1 (30.00-34.99) | 92082 | 74832 | 56963 | 40386 | 24971 | 11359 | 41 |
| Obese Class 2 (35.00-39.99) | 50787 | 41394 | 31733 | 22254 | 13703 | 6182 | 22 |
| Obese Class 3 (≥40.00) | 31251 | 25687 | 19687 | 13926 | 8577 | 3766 | 9 |

Note: BMI has not been presented for patients aged ≤19 years
Restricted to modern prostheses

## 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.

Fixed bearings include non-modular tibial prostheses, as well as those with fixed inserts that do not move relative to the baseplate.

Fixed bearing prostheses have a lower rate of revision compared to mobile bearings in the first 7 years (Table KT18 and Figure KT19).

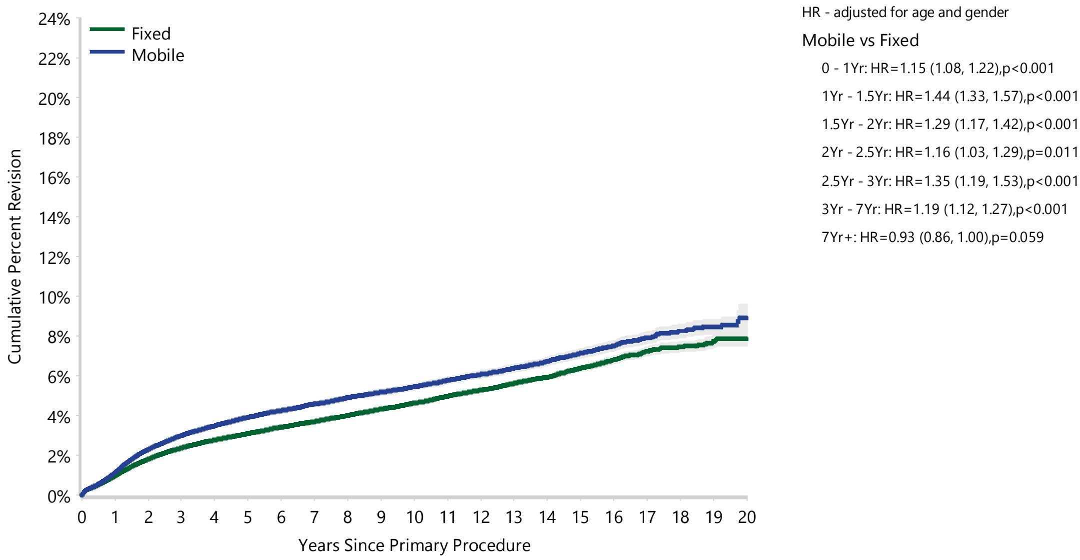
When types of fixed bearings are compared, moulded non-modular tibial prostheses have a lower rate of revision compared to fixed modular components. There is no difference when comparing all-polyethylene to fixed modular or fixed non-modular tibial prostheses. However, the moulded non-modular and the all-polyethylene groups only have a limited number of prosthesis types (Table KT19 and Figure KT20).

**Table KT18 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 | 17224 | 531654 | 1.0 (0.9, 1.0) | 2.4 (2.3, 2.4) | 3.1 (3.0, 3.1) | 4.6 (4.6, 4.7) | 6.4 (6.2, 6.5) | 7.9 (7.5, 8.2) |
| Mobile | 5669 | 122448 | 1.1 (1.1, 1.2) | 3.0 (2.9, 3.1) | 3.9 (3.8, 4.0) | 5.4 (5.3, 5.6) | 7.1 (6.9, 7.4) | 8.9 (8.3, 9.6) |
| TOTAL | 22893 | 654102 | | | | | | |

Note: Excludes 158 procedures with unknown bearing mobility
Restricted to modern prostheses

**Figure KT19 Cumulative Percent Revision of Primary Total Knee Replacement by Bearing Mobility (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Fixed | 531654 | 477465 | 367604 | 270282 | 93784 | 18668 | 305 |
| Mobile | 122448 | 113992 | 96267 | 78744 | 38491 | 12337 | 339 |

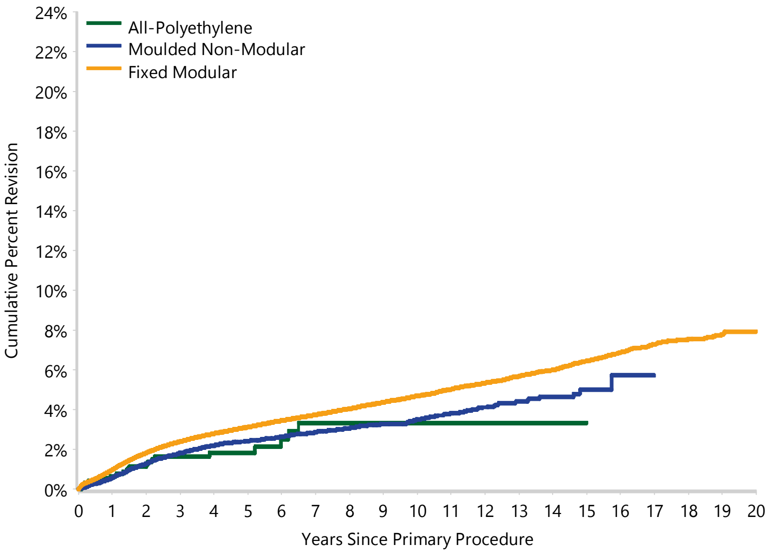
Note: Restricted to modern prostheses

Table KT19 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 | 19 | 950 | 0.7 (0.3, 1.4) | 1.6 (1.0, 2.8) | 1.8 (1.1, 3.1) | 3.3 (2.0, 5.6) | 3.3 (2.0, 5.6) | |
| Moulded Non-Modular | 544 | 18308 | 0.6 (0.5, 0.7) | 1.8 (1.6, 2.0) | 2.4 (2.2, 2.7) | 3.5 (3.2, 3.9) | 5.0 (4.3, 5.8) | |
| Fixed Modular | 16661 | 512396 | 1.0 (1.0, 1.0) | 2.4 (2.4, 2.4) | 3.1 (3.1, 3.2) | 4.7 (4.6, 4.8) | 6.5 (6.3, 6.6) | 7.9 (7.6, 8.3) |
| TOTAL | 17224 | 531654 | | | | | | |

Note: Restricted to modern prostheses

Figure KT20 Cumulative Percent Revision of Primary Total Knee Replacement by Fixed Bearing Type (Primary Diagnosis OA)




HR - adjusted for age and gender

All-Polyethylene vs Fixed Modular

Entire Period: HR=0.79 (0.50, 1.24),p=0.305

Moulded Non-Modular vs Fixed Modular

Entire Period: HR=0.73 (0.67, 0.79),p<0.001

Moulded Non-Modular vs All-Polyethylene

Entire Period: HR=0.92 (0.58, 1.45),p=0.717

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| All-Polyethylene | 950 | 868 | 638 | 345 | 143 | 44 | 1 |
| Moulded Non-Modular | 18308 | 17605 | 15499 | 13230 | 5240 | 375 | 0 |
| Fixed Modular | 512396 | 458992 | 351467 | 256707 | 88401 | 18249 | 304 |

Note: Restricted to modern prostheses

## Stability

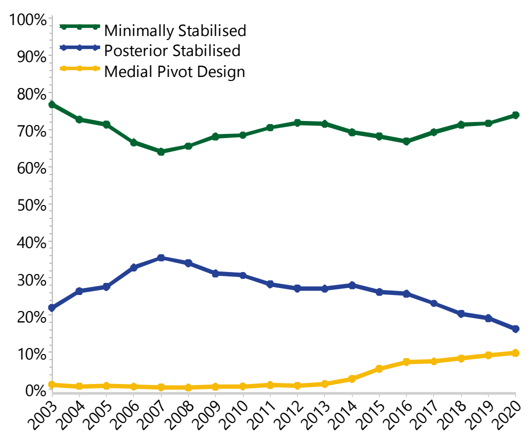
Stability refers to particular prosthetic features intended to substitute for the intrinsic stability of knee ligaments. In 2018, the Registry expanded the classification to include the medial pivot designs separately. The five categories are: minimally stabilised, medial pivot design, posterior stabilised, fully stabilised, and hinged prostheses.

**The five major categories for stability are: minimally stabilised, medial pivot design, posterior stabilised, fully stabilised, and hinged prostheses.**

The Registry defines minimally stabilised prostheses 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, or less frequently, a cam and groove.

The use of minimally stabilised prostheses has remained relatively constant over the last 10 years. In 2020, these accounted for 73.9% of primary procedures. The use of posterior stabilised prostheses has declined to 16.3% in 2020. Medial pivot design prostheses have been used in small numbers since the Registry began collecting data. In 2020, medial pivot design prostheses accounted for 9.8% of primary procedures (Figure KT21).

**Figure KT21 Primary Total Knee Replacement by Stability (Primary Diagnosis OA)**




Posterior stabilised and medial pivot design prostheses have higher rates of revision compared to minimally stabilised prostheses (Table KT20 and Figure KT22). The cumulative incidence for the different reasons for revision varies depending on stability. Posterior stabilised prostheses have a higher cumulative incidence of infection compared to minimally stabilised and medial pivot design prostheses. Posterior stabilised also have a higher cumulative incidence of loosening compared to minimally stabilised prostheses. Medial pivot design prostheses have a higher cumulative incidence of revision for pain and instability compared to minimally stabilised prostheses (Figure KT23).

As with minimally stabilised and posterior stabilised prostheses, there is variation in the rate of revision when different prostheses are compared within the medial pivot design group. This group only contains 6 prosthesis designs (Table KT21). The Advance/Advance is identified as a prosthesis combination with a higher than anticipated rate of revision. When this combination is excluded from the analysis, medial pivot designs have a higher rate of revision than minimally stabilised but a lower rate compared to posterior stabilised prostheses (Table KT22 and Figure KT24).

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’ or ‘anterior stabilised’ designs which are intended to provide additional anterior stability.

There are two knee prostheses with >500 procedures in each conformity category using a fixed bearing XLPE insert, with a follow-up of >3 years. The Triathlon prosthesis with the cruciate retaining polyethylene insert shows no difference when compared to the condylar stabilising polyethylene (Table KT23 and Figure KT25).

The PFC Sigma knee shows no difference in revision rates when the cruciate retaining (curved) and curved plus inserts are compared (Table KT24 and Figure KT26).

An alternative approach is the ultra-congruent or 'deep dish' polyethylene shape that can add additional sagittal stability without the need for a peg and box design. There are two prostheses with >500 procedures in each category using a fixed bearing XLPE insert with a follow-up of >3 years. The Natural Knee and Persona have both cruciate retaining and ultra-congruent components. There is no difference in the rate of revision between the polyethylene insert styles for either design (Table KT25, Figure KT27, Table KT26, and Figure KT28).

**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 0.4% 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 and fracture. Hinged prostheses are used proportionally more for tumour, fracture and rheumatoid arthritis (Table KT27).

Fully stabilised prostheses have been used in 2,934 primary procedures and hinged prostheses in 2,234 primary procedures. For these two knee designs, the cumulative percent revision for all diagnoses are shown in Table KT28 and Figure KT29.

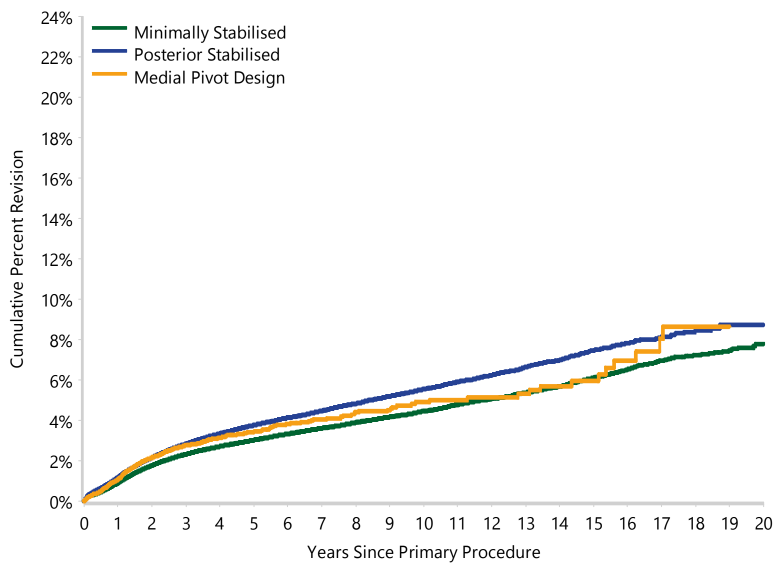
When the outcome for osteoarthritis alone is considered, fully stabilised and hinged knee prostheses both have higher rates of revision compared to minimally stabilised prostheses (Figure KT30). For both of these designs, infection is the most common reason for revision, followed by loosening for fully stabilised and fracture for hinged prostheses (Table KT29 and Figure KT31).

**Table KT20 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 | 14876 | 456782 | 0.9 (0.9, 0.9) | 2.3 (2.3, 2.4) | 3.0 (3.0, 3.1) | 4.5 (4.4, 4.5) | 6.1 (6.0, 6.3) | 7.8 (7.4, 8.2) |
| Posterior Stabilised | 7032 | 164228 | 1.2 (1.1, 1.2) | 2.8 (2.8, 2.9) | 3.8 (3.7, 3.9) | 5.6 (5.4, 5.7) | 7.5 (7.2, 7.7) | 8.7 (8.2, 9.4) |
| Medial Pivot Design | 743 | 29189 | 1.1 (1.0, 1.2) | 2.8 (2.6, 3.0) | 3.4 (3.2, 3.7) | 4.9 (4.4, 5.5) | 6.0 (5.0, 7.1) | |
| Fully Stabilised | 153 | 2664 | 2.7 (2.1, 3.4) | 5.0 (4.2, 6.0) | 6.3 (5.4, 7.5) | 9.0 (7.4, 10.9) | | |
| Hinged | 89 | 1240 | 3.3 (2.4, 4.5) | 6.3 (4.9, 8.0) | 8.6 (6.8, 10.8) | 13.0 (10.1, 16.5) | | |
| TOTAL | 22893 | 654103 | | | | | | |

Note: Excludes 157 procedures with unknown stability
Restricted to modern prostheses

**Figure KT22 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=1.42 (1.32, 1.53),p<0.001
6Mth - 1Yr: HR=1.21 (1.12, 1.31),p<0.001
1Yr - 2Yr: HR=1.11 (1.04, 1.18),p=0.001
2Yr+: HR=1.26 (1.21, 1.31),p<0.001

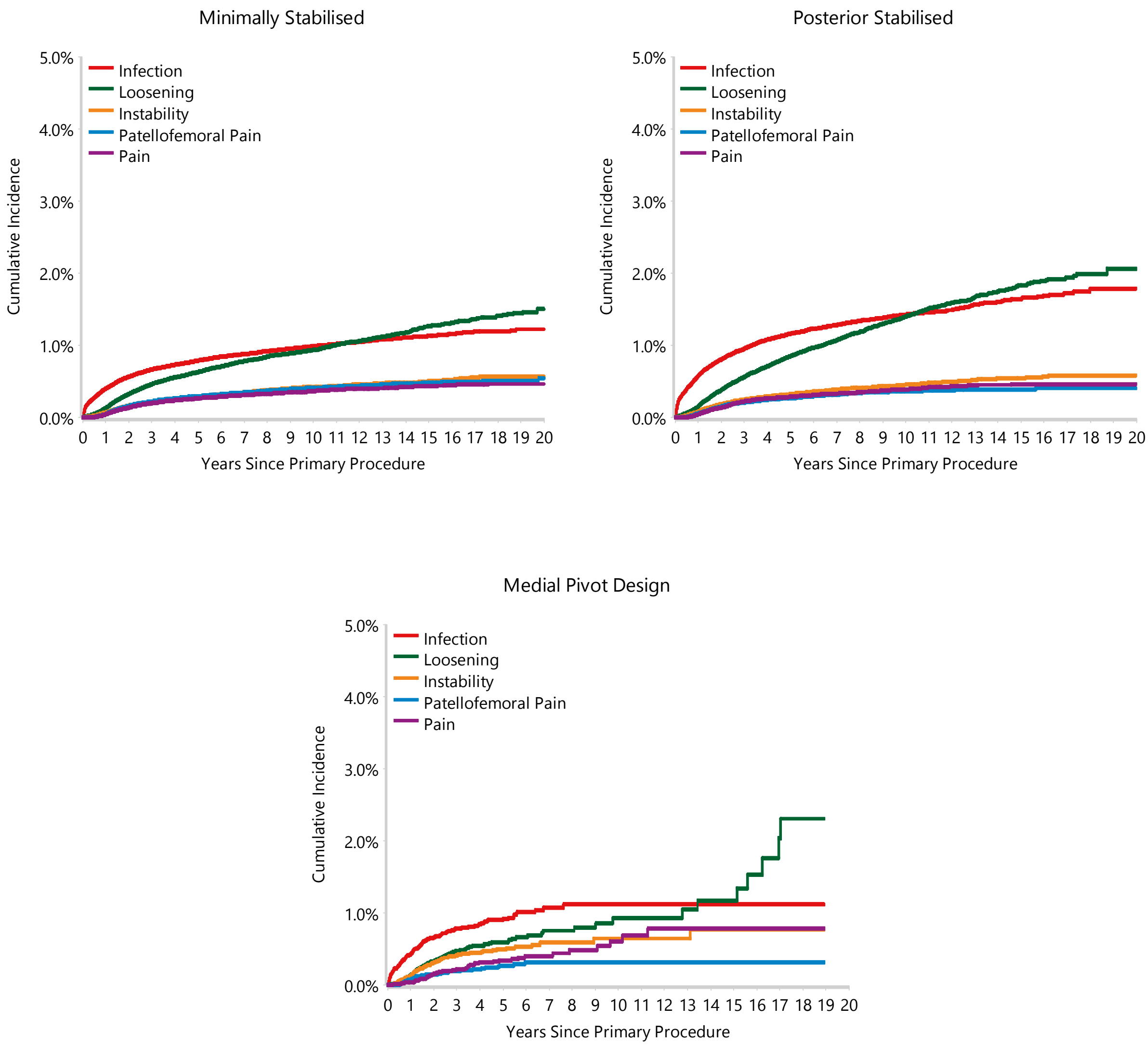
Posterior Stabilised vs Medial Pivot Design
Entire Period: HR=1.08 (1.00, 1.16),p=0.050

Medial Pivot Design vs Minimally Stabilised
Entire Period: HR=1.15 (1.07, 1.24),p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Minimally Stabilised | 456782 | 411706 | 321752 | 243874 | 92437 | 23709 | 579 |
| Posterior Stabilised | 164228 | 152769 | 126222 | 97672 | 38475 | 6948 | 64 |
| Medial Pivot Design | 29189 | 23712 | 13697 | 6123 | 1040 | 319 | 0 |

Note: Restricted to modern prostheses

**Figure KT23 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by Stability (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

**Table KT21 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 | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| GMK Sphere Primary | 291 | 12844 | 1.3 (1.1, 1.5) | 2.9 (2.6, 3.3) | 3.4 (3.0, 3.9) | | | |
| Evolution | 210 | 9168 | 0.9 (0.7, 1.1) | 2.4 (2.1, 2.8) | 3.3 (2.8, 3.8) | | | |
| SAIPH | 60 | 4073 | 0.5 (0.3, 0.8) | 1.8 (1.4, 2.4) | 2.2 (1.7, 2.9) | | | |
| Advance II | 123 | 1696 | 1.8 (1.3, 2.5) | 4.5 (3.6, 5.6) | 5.5 (4.5, 6.7) | 7.3 (6.1, 8.7) | 8.2 (6.8, 9.9) | |
| Advance | 39 | 733 | 1.5 (0.8, 2.7) | 4.6 (3.3, 6.4) | 5.3 (3.8, 7.2) | 6.2 (4.5, 8.4) | | |
| MRK | 20 | 675 | 0.8 (0.3, 1.8) | 2.3 (1.4, 3.8) | 2.5 (1.5, 4.1) | 3.7 (2.3, 5.9) | | |
| TOTAL | 743 | 29189 | | | | | | |

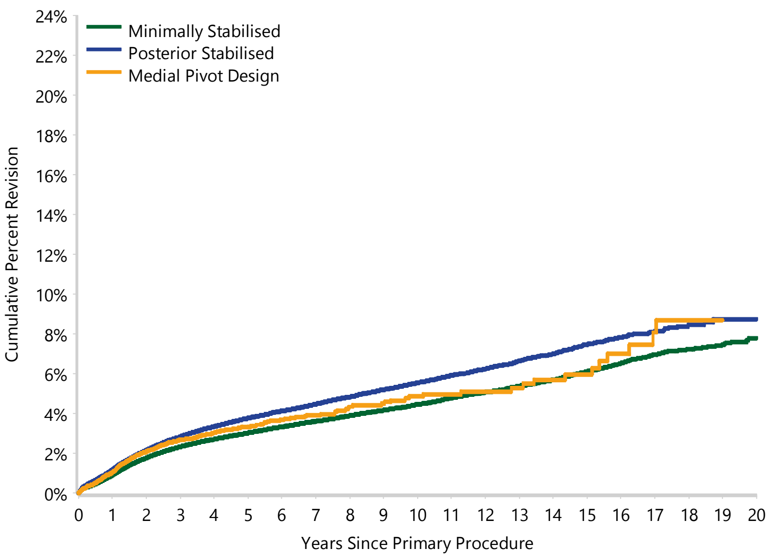
Note: Restricted to modern prostheses

**Table KT22 Cumulative Percent Revision of Primary Total Knee Replacement by Stability (Primary Diagnosis OA, Excluding Advance/Advance)**

| Stability | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Minimally Stabilised | 14876 | 456782 | 0.9 (0.9, 0.9) | 2.3 (2.3, 2.4) | 3.0 (3.0, 3.1) | 4.5 (4.4, 4.5) | 6.1 (6.0, 6.3) | 7.8 (7.4, 8.2) |
| Posterior Stabilised | 7031 | 164195 | 1.2 (1.1, 1.2) | 2.8 (2.8, 2.9) | 3.8 (3.7, 3.9) | 5.6 (5.4, 5.7) | 7.5 (7.2, 7.7) | 8.8 (8.2, 9.4) |
| Medial Pivot Design | 689 | 28268 | 1.0 (0.9, 1.2) | 2.7 (2.5, 2.9) | 3.3 (3.1, 3.6) | 4.9 (4.3, 5.5) | 6.0 (5.0, 7.2) | |
| Fully Stabilised | 153 | 2664 | 2.7 (2.1, 3.4) | 5.0 (4.2, 6.0) | 6.3 (5.4, 7.5) | 9.0 (7.4, 10.9) | | |
| Hinged | 89 | 1240 | 3.3 (2.4, 4.5) | 6.3 (4.9, 8.0) | 8.6 (6.8, 10.8) | 13.0 (10.1, 16.5) | | |
| TOTAL | 22838 | 653149 | | | | | | |

Note: Excludes 157 procedures with unknown stability
Restricted to modern prostheses

**Figure KT24 Cumulative Percent Revision of Primary Total Knee Replacement by Stability (Primary Diagnosis OA, Excluding Advance/Advance)**




HR - adjusted for age and gender

Posterior Stabilised vs Minimally Stabilised
0 - 6Mth: HR=1.42 (1.32, 1.52),p<0.001
6Mth - 1Yr: HR=1.21 (1.12, 1.32),p<0.001
1Yr - 2Yr: HR=1.11 (1.04, 1.18),p=0.001
2Yr+: HR=1.26 (1.21, 1.31),p<0.001

Posterior Stabilised vs Medial Pivot Design
Entire Period: HR=1.10 (1.02, 1.20),p=0.012

Medial Pivot Design vs Minimally Stabilised
Entire Period: HR=1.12 (1.04, 1.21),p=0.003

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Minimally Stabilised | 456782 | 411706 | 321752 | 243874 | 92437 | 23709 | 579 |
| Posterior Stabilised | 164195 | 152739 | 126194 | 97646 | 38451 | 6927 | 64 |
| Medial Pivot Design | 28268 | 22836 | 12980 | 5591 | 895 | 314 | 0 |

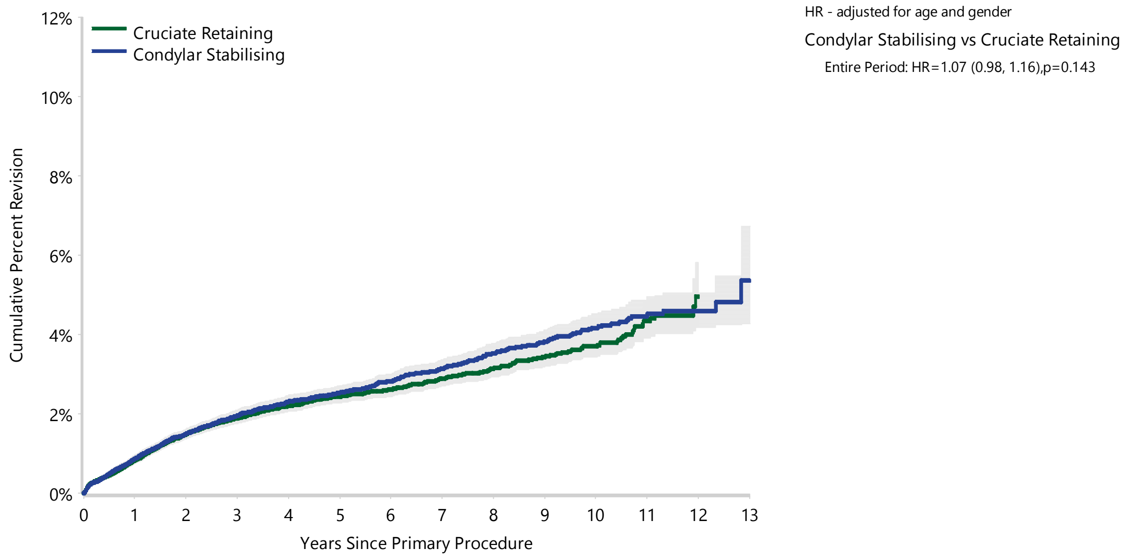
Note: Restricted to modern prostheses

**Table KT23 Cumulative Percent Revision of Triathlon/Triathlon Primary Total Knee Replacement with XLPE by Polyethylene Insert Shape (Primary Diagnosis OA)**

| Polyethylene Insert Shape | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 13 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cruciate Retaining | 1038 | 47784 | 0.8 (0.7, 0.9) | 1.9 (1.8, 2.0) | 2.4 (2.3, 2.6) | 2.9 (2.7, 3.1) | 3.7 (3.4, 4.0) | |
| Condylar Stabilising | 1118 | 49983 | 0.9 (0.8, 1.0) | 2.0 (1.8, 2.1) | 2.5 (2.4, 2.7) | 3.1 (2.9, 3.4) | 4.2 (3.9, 4.5) | 5.4 (4.3, 6.7) |
| TOTAL | 2156 | 97767 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT25 Cumulative Percent Revision of Triathlon/Triathlon Primary Total Knee Replacement with XLPE by Polyethylene Insert Shape (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 13 Yrs |
|---|---|---|---|---|---|---|---|
| Cruciate Retaining | 47784 | 40776 | 28396 | 19639 | 12068 | 3213 | 30 |
| Condylar Stabilising | 49983 | 42629 | 28979 | 18326 | 10411 | 2942 | 105 |

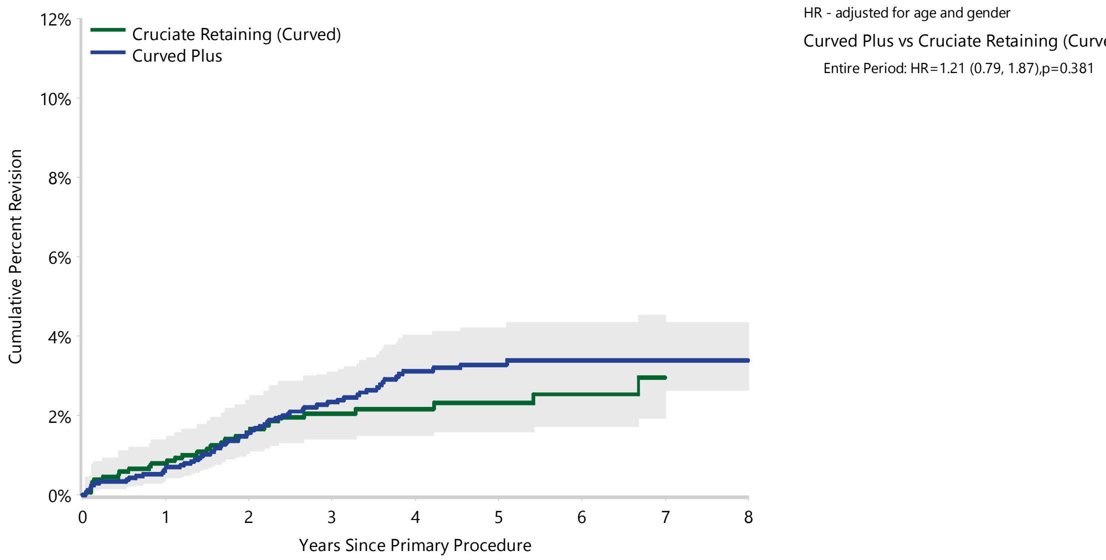
Note: Restricted to modern prostheses

**Table KT24 Cumulative Percent Revision of PFC Sigma/PFC Sigma Primary Total Knee Replacement with XLPE by Polyethylene Insert Shape (Primary Diagnosis OA)**

| Polyethylene Insert Shape | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cruciate Retaining (Curved) | 31 | 1579 | 0.8 (0.5, 1.4) | 1.6 (1.0, 2.4) | 2.1 (1.4, 3.0) | 2.3 (1.6, 3.3) | 3.0 (1.9, 4.5) | |
| Curved Plus | 64 | 2361 | 0.7 (0.4, 1.1) | 1.6 (1.1, 2.2) | 2.3 (1.8, 3.1) | 3.3 (2.6, 4.2) | 3.4 (2.6, 4.3) | 3.4 (2.6, 4.3) |
| TOTAL | 95 | 3940 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT26 Cumulative Percent Revision of PFC Sigma/PFC Sigma Primary Total Knee Replacement with XLPE by Polyethylene Insert Shape (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 5 Yrs | 7 Yrs | 8 Yrs |
|---|---|---|---|---|---|---|---|
| Cruciate Retaining (Curved) | 1579 | 1384 | 1102 | 897 | 514 | 133 | 4 |
| Curved Plus | 2361 | 2159 | 1938 | 1637 | 950 | 282 | 120 |

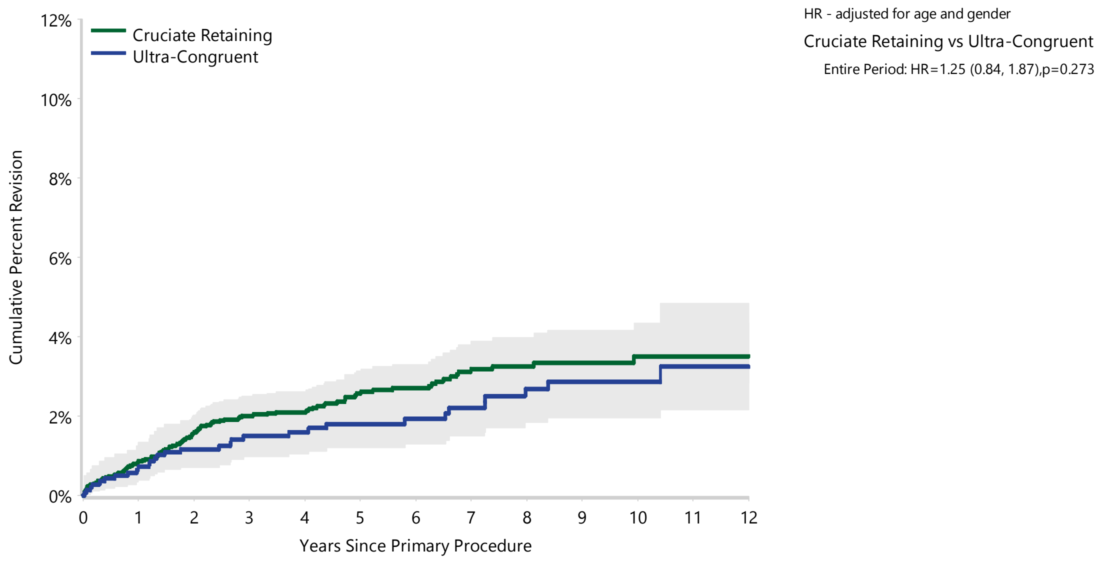
Note: Restricted to modern prostheses

**Table KT25 Cumulative Percent Revision of Natural/Natural Primary Total Knee Replacement with XLPE by Polyethylene Insert Shape (Primary Diagnosis OA)**

| Polyethylene Insert Shape | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 11 Yrs | 12 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cruciate Retaining | 107 | 4252 | 0.8 (0.6, 1.2) | 2.0 (1.6, 2.5) | 2.6 (2.1, 3.1) | 3.2 (2.6, 3.9) | 3.5 (2.8, 4.3) | 3.5 (2.8, 4.3) |
| Ultra-Congruent | 31 | 1395 | 0.7 (0.4, 1.3) | 1.5 (1.0, 2.3) | 1.8 (1.2, 2.7) | 2.2 (1.5, 3.3) | 3.2 (2.2, 4.8) | 3.2 (2.2, 4.8) |
| TOTAL | 138 | 5647 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT27 Cumulative Percent Revision of Natural/Natural Primary Total Knee Replacement with XLPE by Polyethylene Insert Shape (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 11 Yrs | 12 Yrs |
|---|---|---|---|---|---|---|---|
| Cruciate Retaining | 4252 | 3935 | 3212 | 2276 | 1448 | 322 | 110 |
| Ultra-Congruent | 1395 | 1361 | 1118 | 856 | 665 | 181 | 71 |

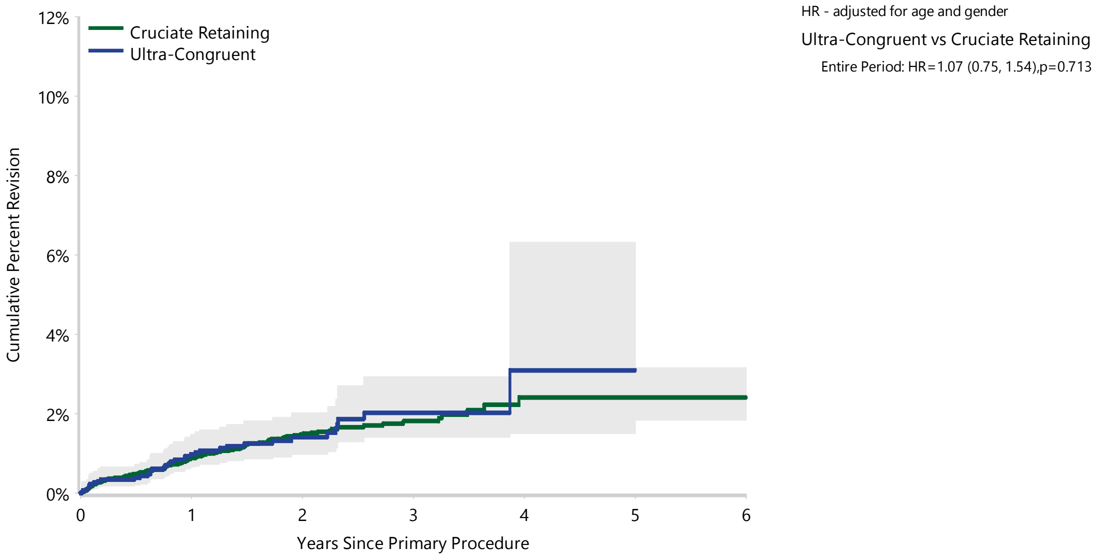
Note: Restricted to modern prostheses

**Table KT26 Cumulative Percent Revision of Persona Primary Total Knee Replacement with XLPE by Polyethylene Insert Shape (Primary Diagnosis OA)**

| Polyethylene Insert Shape | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cruciate Retaining | 167 | 16553 | 0.9 (0.7, 1.1) | 1.5 (1.3, 1.8) | 1.8 (1.5, 2.2) | 2.4 (1.8, 3.2) | 2.4 (1.8, 3.2) | 2.4 (1.8, 3.2) |
| Ultra-Congruent | 36 | 2653 | 1.0 (0.7, 1.5) | 1.4 (1.0, 2.0) | 2.0 (1.4, 2.9) | 3.1 (1.5, 6.3) | 3.1 (1.5, 6.3) | |
| TOTAL | 203 | 19206 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT28 Cumulative Percent Revision of Persona Primary Total Knee Replacement with XLPE by Polyethylene Insert Shape (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 6 Yrs |
|---|---|---|---|---|---|---|---|
| Cruciate Retaining | 16553 | 8888 | 4282 | 1592 | 513 | 260 | 102 |
| Ultra-Congruent | 2653 | 2016 | 1112 | 390 | 78 | 40 | 12 |

Note: Restricted to modern prostheses

**Table KT27 Primary Total Knee Replacement by Primary Diagnosis and Stability**

| Primary Diagnosis | Fully Stabilised | | Hinged | | TOTAL | |
|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% |
| Osteoarthritis | 2664 | 90.8 | 1240 | 55.5 | 3904 | 75.5 |
| Tumour | 8 | 0.3 | 593 | 26.5 | 601 | 11.6 |
| Fracture | 47 | 1.6 | 225 | 10.1 | 272 | 5.3 |
| Rheumatoid Arthritis | 134 | 4.6 | 67 | 3.0 | 201 | 3.9 |
| Osteonecrosis | 34 | 1.2 | 30 | 1.3 | 64 | 1.2 |
| Other Inflammatory Arthritis | 27 | 0.9 | 27 | 1.2 | 54 | 1.0 |
| Other | 20 | 0.7 | 52 | 2.3 | 72 | 1.4 |
| TOTAL | 2934 | 100.0 | 2234 | 100.0 | 5168 | 100.0 |

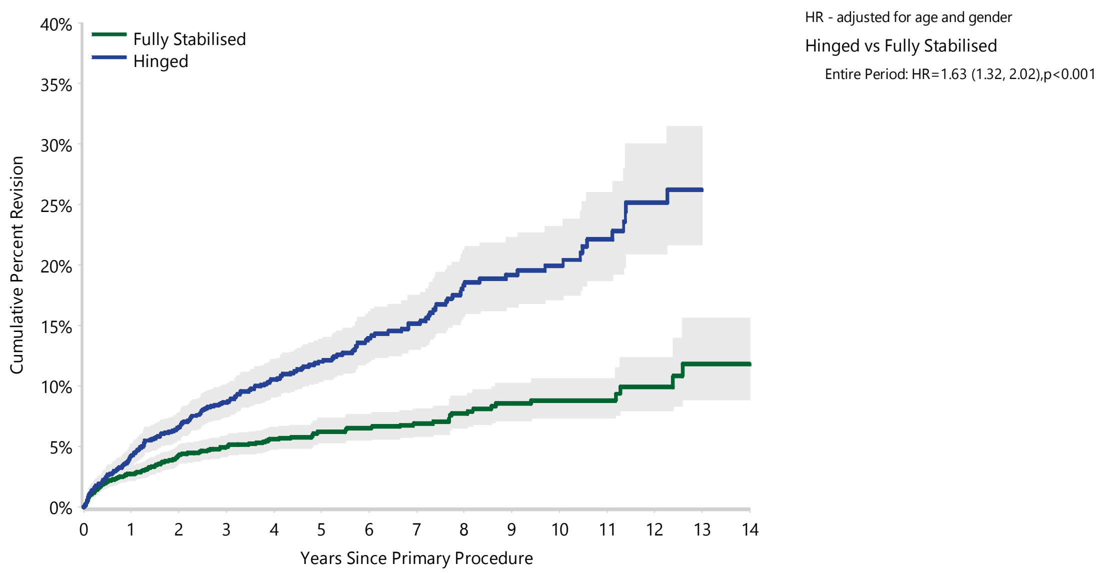
Note: Restricted to modern prostheses

**Table KT28 Cumulative Percent Revision of Primary Total Knee Replacement by Stability (All Diagnoses)**

| Stability | N Revised | N Total | 1 Yr | 3 Yrs | 6 Yrs | 9 Yrs | 12 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Fully Stabilised | 167 | 2934 | 2.8 (2.2, 3.5) | 5.0 (4.2, 5.9) | 6.5 (5.6, 7.7) | 8.6 (7.1, 10.3) | 9.9 (7.9, 12.4) | 11.8 (8.9, 15.6) |
| Hinged | 230 | 2234 | 4.2 (3.4, 5.2) | 8.7 (7.4, 10.1) | 14.0 (12.1, 16.1) | 19.2 (16.5, 22.3) | 25.1 (20.9, 30.0) | |
| TOTAL | 397 | 5168 | | | | | | |

Note: Restricted to modern prostheses

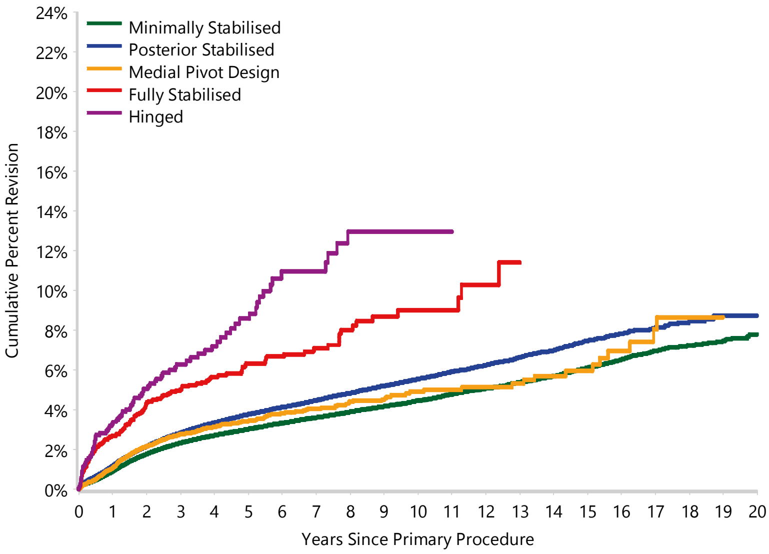
**Figure KT29 Cumulative Percent Revision of Primary Total Knee Replacement by Stability (All Diagnoses)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 6 Yrs | 9 Yrs | 12 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Fully Stabilised | 2934 | 2505 | 1764 | 867 | 366 | 116 | 44 |
| Hinged | 2234 | 1727 | 1047 | 476 | 235 | 76 | 38 |

Note: Restricted to modern prostheses

**Figure KT30 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=1.41 (1.31, 1.52),p<0.001
6Mth - 9Mth: HR=1.09 (0.96, 1.22),p=0.173
9Mth - 1Yr: HR=1.34 (1.20, 1.50),p<0.001
1Yr - 2Yr: HR=1.11 (1.04, 1.18),p=0.001
2Yr+: HR=1.26 (1.21, 1.31),p<0.001

Medial Pivot Design vs Minimally Stabilised
Entire Period: HR=1.15 (1.07, 1.24),p<0.001

Fully Stabilised vs Minimally Stabilised
0 - 6Mth: HR=4.49 (3.42, 5.89),p<0.001
6Mth - 1.5Yr: HR=1.41 (0.99, 2.02),p=0.060
1.5Yr+: HR=1.87 (1.48, 2.37),p<0.001

Hinged vs Minimally Stabilised
Entire Period: HR=3.12 (2.54, 3.85),p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Minimally Stabilised | 456782 | 411706 | 321752 | 243874 | 92437 | 23709 | 579 |
| Posterior Stabilised | 164228 | 152769 | 126222 | 97672 | 38475 | 6948 | 64 |
| Medial Pivot Design | 29189 | 23712 | 13697 | 6123 | 1040 | 319 | 0 |
| Fully Stabilised | 2664 | 2287 | 1607 | 1010 | 244 | 21 | 1 |
| Hinged | 1240 | 983 | 593 | 347 | 79 | 8 | 0 |

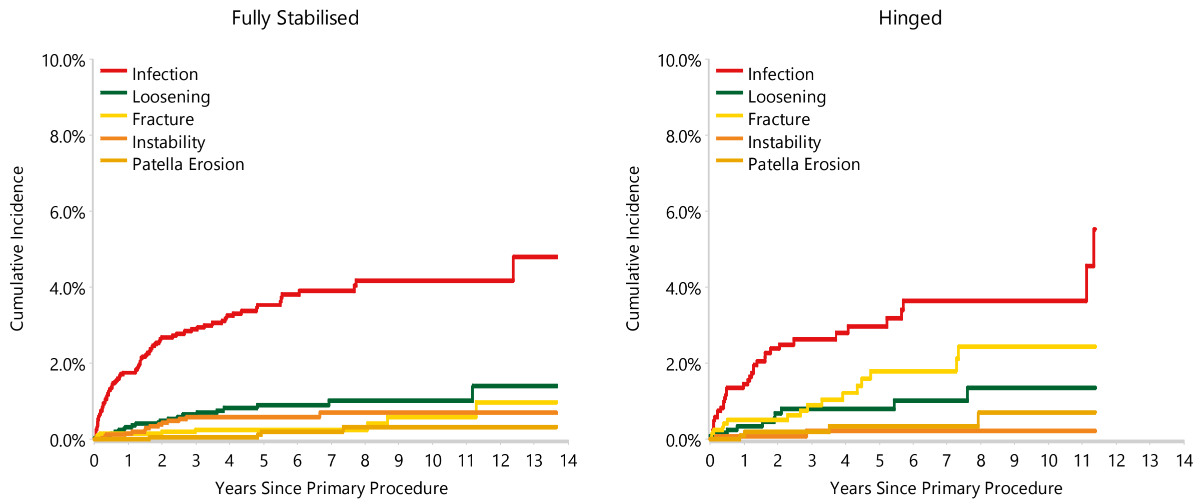
Note: Restricted to modern prostheses

**Table KT29 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 | 87 | 3.3 | 56.9 | 35 | 2.8 | 39.3 |
| Loosening | 21 | 0.8 | 13.7 | 10 | 0.8 | 11.2 |
| Fracture | 9 | 0.3 | 5.9 | 16 | 1.3 | 18.0 |
| Instability | 14 | 0.5 | 9.2 | 2 | 0.2 | 2.2 |
| Bearing Dislocation | 4 | 0.2 | 2.6 | 3 | 0.2 | 3.4 |
| Patella Erosion | 4 | 0.2 | 2.6 | 4 | 0.3 | 4.5 |
| Other | 14 | 0.5 | 9.2 | 19 | 1.5 | 21.3 |
| N Revision | 153 | 5.7 | 100.0 | 89 | 7.2 | 100.0 |
| N Primary | 2664 | | | 1240 | | |

Note: Restricted to modern prostheses

**Figure KT31 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by Stability (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

### Patellar Resurfacing

Primary total knee replacement procedures with patellar resurfacing have a lower rate of revision compared to procedures without patellar resurfacing. This is both overall and for each of the three common stability types (Table KT30 and Figure KT32).

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 KT31 and Figure KT33).

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 (Figure KT34).

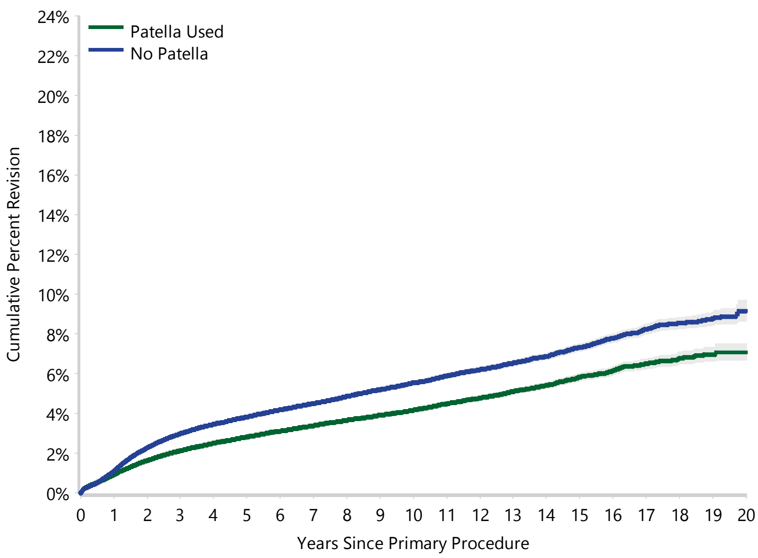
Outcomes related to the use of patellar resurfacing vary depending on the type of prosthesis used.

**Table KT30 Cumulative Percent Revision of Primary Total Knee Replacement by Patella Usage (Primary Diagnosis OA)**

| Patella Usage | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Patella Used | 10913 | 386174 | 0.9 (0.9, 0.9) | 2.1 (2.1, 2.2) | 2.8 (2.8, 2.9) | 4.2 (4.1, 4.3) | 5.8 (5.7, 6.0) | 7.1 (6.7, 7.5) |
| No Patella | 11986 | 268086 | 1.1 (1.1, 1.1) | 3.0 (2.9, 3.1) | 3.8 (3.8, 3.9) | 5.5 (5.4, 5.6) | 7.3 (7.1, 7.5) | 9.2 (8.6, 9.7) |
| TOTAL | 22899 | 654260 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT32 Cumulative Percent Revision of Primary Total Knee Replacement by Patella Usage (Primary Diagnosis OA)**




HR - adjusted for age and gender

No Patella vs Patella Used

0 - 6Mth: HR=0.96 (0.90, 1.03),p=0.248

6Mth - 1Yr: HR=1.47 (1.36, 1.58),p<0.001

1Yr - 1.5Yr: HR=1.69 (1.58, 1.82),p<0.001

1.5Yr - 2Yr: HR=1.51 (1.39, 1.65),p<0.001

2Yr - 3.5Yr: HR=1.40 (1.32, 1.49),p<0.001

3.5Yr+: HR=1.19 (1.13, 1.24),p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Patella Used | 386174 | 341166 | 254783 | 182151 | 61829 | 13369 | 208 |
| No Patella | 268086 | 250443 | 209220 | 166993 | 70507 | 17654 | 437 |

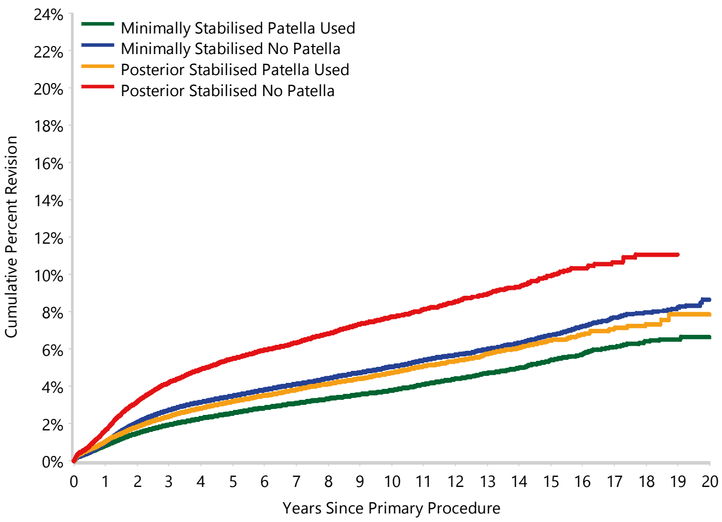
Note: Restricted to modern prostheses

**Table KT31** **Cumulative Percent Revision of Primary Total Knee Replacement by Stability and Patella 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 | 6057 | 239359 | 0.8 (0.8, 0.9) | 1.9 (1.9, 2.0) | 2.6 (2.5, 2.6) | 3.8 (3.7, 3.9) | 5.4 (5.2, 5.6) | 6.6 (6.2, 7.1) |
| | No Patella | 8856 | 217586 | 1.0 (0.9, 1.0) | 2.7 (2.7, 2.8) | 3.5 (3.4, 3.6) | 5.1 (4.9, 5.2) | 6.8 (6.6, 6.9) | 8.6 (8.1, 9.2) |
| Posterior Stabilised | Patella Used | 4371 | 125899 | 1.0 (1.0, 1.1) | 2.4 (2.3, 2.5) | 3.2 (3.1, 3.3) | 4.7 (4.6, 4.9) | 6.5 (6.2, 6.8) | 7.9 (7.0, 8.8) |
| | No Patella | 2661 | 38329 | 1.6 (1.5, 1.8) | 4.2 (4.0, 4.4) | 5.5 (5.3, 5.7) | 7.7 (7.4, 8.0) | 9.9 (9.4, 10.4) | |
| Medial Pivot Design | Patella Used | 328 | 18078 | 0.9 (0.8, 1.1) | 2.2 (1.9, 2.4) | 2.6 (2.3, 3.0) | 3.3 (2.8, 4.0) | 5.2 (3.1, 8.7) | |
| | No Patella | 415 | 11111 | 1.3 (1.1, 1.5) | 3.6 (3.2, 4.0) | 4.4 (4.0, 4.9) | 6.4 (5.6, 7.4) | 7.2 (6.1, 8.5) | |
| TOTAL | | 22688 | 650362 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT33** **Cumulative Percent Revision of Primary Total Knee Replacement by Stability and Patella Usage (Primary Diagnosis OA)**




HR - adjusted for age and gender
Minimally Stabilised Patella Used vs
Minimally Stabilised No Patella
0 - 3Mth: HR=1.09 (0.99, 1.20),p=0.077
3Mth - 6Mth: HR=0.91 (0.80, 1.04),p=0.163
6Mth - 1.5Yr: HR=0.64 (0.60, 0.69),p<0.001
1.5Yr - 3.5Yr: HR=0.70 (0.66, 0.75),p<0.001
3.5Yr+: HR=0.84 (0.80, 0.89),p<0.001

Minimally Stabilised Patella Used vs
Posterior Stabilised Patella Used
Entire Period: HR=0.82 (0.78, 0.85),p<0.001

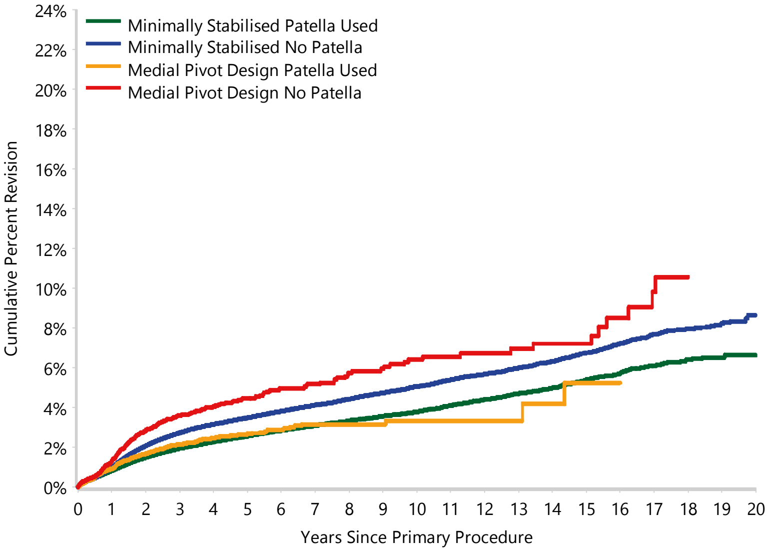
Minimally Stabilised No Patella vs
Posterior Stabilised No Patella
0 - 1Yr: HR=0.61 (0.56, 0.66),p<0.001
1Yr - 2Yr: HR=0.68 (0.62, 0.75),p<0.001
2Yr - 3.5Yr: HR=0.62 (0.56, 0.68),p<0.001
3.5Yr - 5Yr: HR=0.58 (0.51, 0.66),p<0.001
5Yr+: HR=0.71 (0.66, 0.78),p<0.001

Posterior Stabilised Patella Used vs Posterior
Stabilised No Patella
Entire Period: HR=0.61 (0.58, 0.64),p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Minimally Stabilised | Patella Used | 239359 | 208783 | 152585 | 108767 | 36985 | 8924 | 163 |
| | No Patella | 217586 | 203069 | 169265 | 135179 | 55461 | 14785 | 416 |
| Posterior Stabilised | Patella Used | 125899 | 115979 | 93348 | 69563 | 24339 | 4359 | 44 |
| | No Patella | 38329 | 36790 | 32874 | 28109 | 14136 | 2589 | 20 |

Note: Restricted to modern prostheses

**Figure KT34 Cumulative Percent Revision of Primary Total Knee Replacement by Stability and Patella Usage (Primary Diagnosis OA)**




HR - adjusted for age and gender

Minimally Stabilised Patella Used vs
Minimally Stabilised No Patella
0 - 3Mth: HR=1.13 (1.02, 1.25),p=0.020
3Mth - 6Mth: HR=0.90 (0.78, 1.04),p=0.163
6Mth - 1.5Yr: HR=0.63 (0.59, 0.67),p<0.001
1.5Yr - 3.5Yr: HR=0.69 (0.65, 0.73),p<0.001
3.5Yr+: HR=0.86 (0.81, 0.91),p<0.001

Minimally Stabilised Patella Used vs
Medial Pivot Design Patella Used
Entire Period: HR=0.95 (0.85, 1.07),p=0.403

Minimally Stabilised No Patella vs
Medial Pivot Design No Patella
Entire Period: HR=0.78 (0.71, 0.86),p<0.001

Medial Pivot Design Patella Used vs
Medial Pivot Design No Patella
Entire Period: HR=0.62 (0.54, 0.72),p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Minimally Stabilised | Patella Used | 239359 | 208783 | 152585 | 108767 | 36985 | 8924 | 163 |
| | No Patella | 217586 | 203069 | 169265 | 135179 | 55461 | 14785 | 416 |
| Medial Pivot Design | Patella Used | 18078 | 14074 | 7360 | 2939 | 316 | 70 | 0 |
| | No Patella | 11111 | 9638 | 6337 | 3184 | 724 | 249 | 0 |

Note: Restricted to modern prostheses

**FIXATION**

The effect of fixation varies depending on prosthesis stability.

For minimally stabilised prostheses, hybrid fixation has a lower rate of revision compared to when both components are cemented, and to when both components use cementless fixation. Cementless fixation has a higher rate of revision compared to cemented fixation after 3 months (Table KT32 and Figure KT35).

When a posterior stabilised knee is used, cemented fixation has a lower rate of revision compared to both hybrid and cementless fixation for the first 1.5 years. After 1.5 years, cementless fixation has a lower rate of revision than cemented fixation. Cementless fixation has a lower rate of revision than hybrid fixation (Table KT33 and Figure KT36).

**Cementing the tibial component gives the best outcome for minimally stabilised knee replacement.**

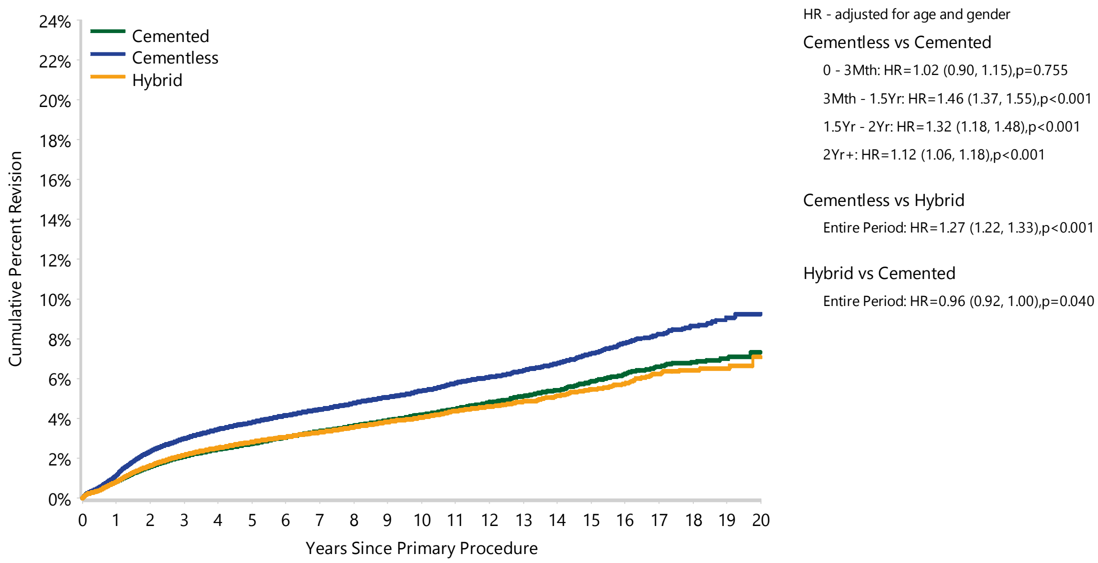
When a medial pivot design prosthesis is used, cemented fixation has a lower rate of revision compared to cementless fixation. However, there is no difference when hybrid fixation is compared to cemented fixation (Table KT34 and Figure KT37).

**Table KT32** **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 | 6160 | 219514 | 0.8 (0.8, 0.9) | 2.1 (2.0, 2.2) | 2.7 (2.7, 2.8) | 4.2 (4.1, 4.3) | 5.9 (5.6, 6.1) | 7.3 (6.7, 8.0) |
| Cementless | 4619 | 103736 | 1.1 (1.1, 1.2) | 3.0 (2.9, 3.1) | 3.8 (3.7, 3.9) | 5.4 (5.2, 5.6) | 7.3 (7.0, 7.5) | 9.2 (8.6, 9.9) |
| Hybrid | 4051 | 133426 | 0.8 (0.8, 0.9) | 2.2 (2.1, 2.2) | 2.8 (2.7, 2.9) | 4.1 (3.9, 4.2) | 5.5 (5.2, 5.7) | 7.1 (6.2, 8.1) |
| TOTAL | 14830 | 456676 | | | | | | |

Note: Excluding cementless Genesis Oxinium femoral prostheses
Restricted to modern prostheses

**Figure KT35** **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 | 219514 | 194977 | 144517 | 102444 | 36194 | 8639 | 239 |
| Cementless | 103736 | 93899 | 79423 | 66802 | 29659 | 8477 | 192 |
| Hybrid | 133426 | 122738 | 97751 | 74568 | 26537 | 6559 | 148 |

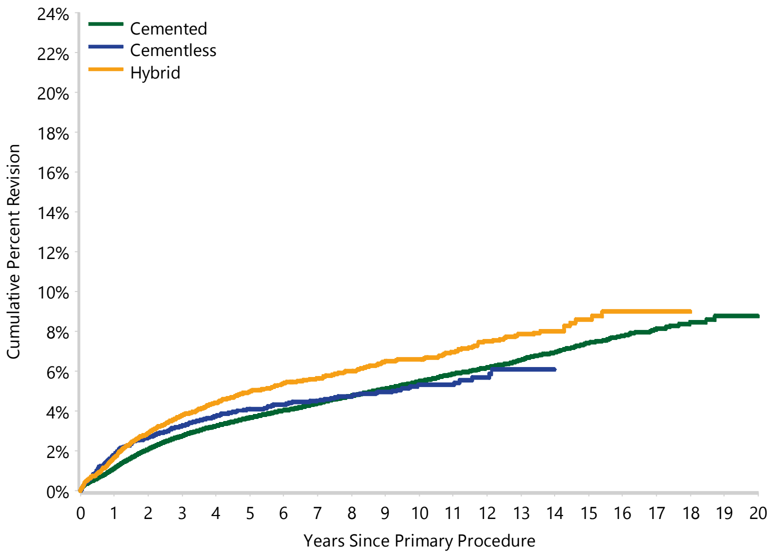
Note: Restricted to modern prostheses

**Table KT33 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 | 6194 | 148297 | 1.1 (1.1, 1.2) | 2.8 (2.7, 2.8) | 3.7 (3.6, 3.8) | 5.5 (5.3, 5.6) | 7.4 (7.1, 7.7) | 8.8 (8.1, 9.4) |
| Cementless | 259 | 5983 | 1.8 (1.5, 2.2) | 3.3 (2.8, 3.8) | 4.1 (3.6, 4.7) | 5.3 (4.7, 6.0) | | |
| Hybrid | 579 | 9948 | 1.7 (1.4, 1.9) | 3.8 (3.4, 4.2) | 5.0 (4.5, 5.4) | 6.6 (6.0, 7.2) | 8.6 (7.7, 9.6) | |
| TOTAL | 7032 | 164228 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT36 Cumulative Percent Revision of Posterior Stabilised Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)**




HR - adjusted for age and gender

Cementless vs Cemented
0 - 1.5Yr: HR=1.33 (1.12, 1.57),p=0.001
1.5Yr+: HR=0.70 (0.58, 0.84),p<0.001

Hybrid vs Cemented
0 - 1.5Yr: HR=1.40 (1.23, 1.61),p<0.001
1.5Yr+: HR=1.09 (0.97, 1.21),p=0.140

Hybrid vs Cementless
0 - 5Yr: HR=1.24 (1.06, 1.46),p=0.007
5Yr+: HR=1.62 (1.13, 2.33),p=0.009

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Cemented | 148297 | 137676 | 113260 | 87101 | 33892 | 6432 | 62 |
| Cementless | 5983 | 5564 | 4686 | 3829 | 1478 | 27 | 0 |
| Hybrid | 9948 | 9529 | 8276 | 6742 | 3105 | 489 | 2 |

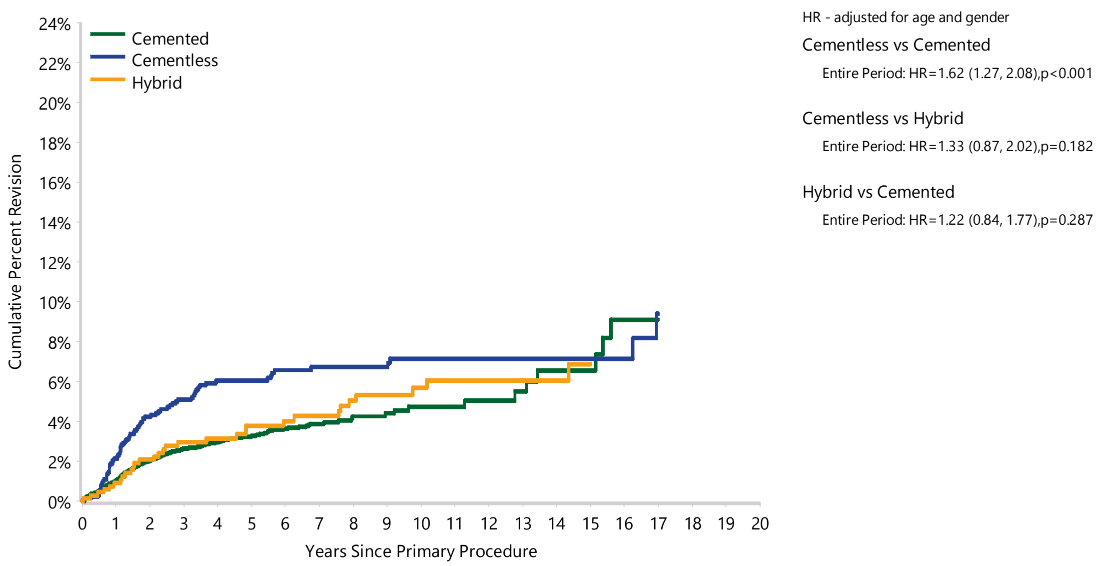
Note: Restricted to modern prostheses

**Table KT34 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 | 636 | 27302 | 1.0 (0.9, 1.2) | 2.6 (2.4, 2.9) | 3.3 (3.0, 3.5) | 4.7 (4.0, 5.6) | 6.6 (4.9, 8.8) | |
| Cementless | 76 | 1189 | 2.1 (1.5, 3.2) | 5.1 (4.0, 6.5) | 6.0 (4.8, 7.6) | 7.1 (5.7, 8.9) | 7.1 (5.7, 8.9) | |
| Hybrid | 31 | 698 | 0.9 (0.4, 2.0) | 3.0 (1.9, 4.7) | 3.8 (2.5, 5.7) | 5.7 (3.9, 8.2) | 6.9 (4.6, 10.2) | |
| TOTAL | 743 | 29189 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT37 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 | 27302 | 21966 | 12236 | 4927 | 448 | 123 | 0 |
| Cementless | 1189 | 1131 | 954 | 750 | 338 | 113 | 0 |
| Hybrid | 698 | 615 | 507 | 446 | 254 | 83 | 0 |

Note: Restricted to modern prostheses

## 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.

There are 294,169 primary total knee procedures that have used XLPE. After 3 months, the XLPE group has a lower rate of revision compared to the non XLPE group (Table KT35 and Figure KT38). The major reason for this difference is a reduced cumulative incidence for loosening (Figure KT39).

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 10.3%. For patients aged ≥65 years, the 15 year cumulative percent revision for XLPE is 3.8% and for non XLPE is 5.1% (Table KT36 and Figure KT40).

There are prosthesis specific differences when XLPE is used.

When considering the XLPE sub-types there is no difference when XLPE is compared to XLPE with antioxidant. There are only 13 prostheses using XLPE with antioxidant (Table KT37, Figure KT41 and Figure KT42).

### 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' or 'ceramic surface components'. These can be made of a ceramacised metal or have a zirconia or titanium nitride coating. They are suggested for use in patients who have a metal allergy.

There are 61,659 procedures with an alternate surface femoral component. Procedures using an alternate surface femoral component have a higher rate of revision after 9 months, compared to when these are not used (Table KT38 and Figure KT43). There are more revisions for loosening and for patella causes where an alternate surface femoral component are used (Figure KT44).

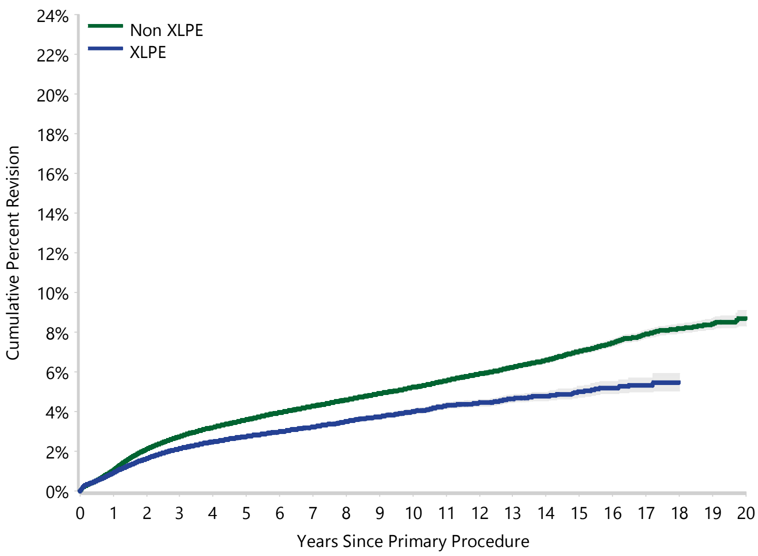
There is variation in the revision rate depending on the type of material used in the alternate surface. Zirconia based alternate surface femoral components have a lower rate of revision compared to those with a titanium nitrate surface or those made of ceramicised metal. Ceramicised metal components have a lower rate of revision compared to those with a titanium nitrate coating (Table KT39 and Figure KT45).

**Table KT35 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 | 15856 | 359758 | 1.0 (1.0, 1.1) | 2.8 (2.7, 2.8) | 3.6 (3.5, 3.7) | 5.2 (5.1, 5.3) | 7.0 (6.9, 7.2) | 8.7 (8.3, 9.1) |
| XLPE | 7036 | 294169 | 0.9 (0.9, 1.0) | 2.1 (2.1, 2.2) | 2.8 (2.7, 2.8) | 4.0 (3.9, 4.1) | 5.0 (4.8, 5.3) | |
| TOTAL | 22892 | 653927 | | | | | | |

Note: Includes 51,330 procedures using XLPE with antioxidant
Excludes 333 procedures with unknown polyethylene
Restricted to modern prostheses

**Figure KT38 Cumulative Percent Revision of Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA)**

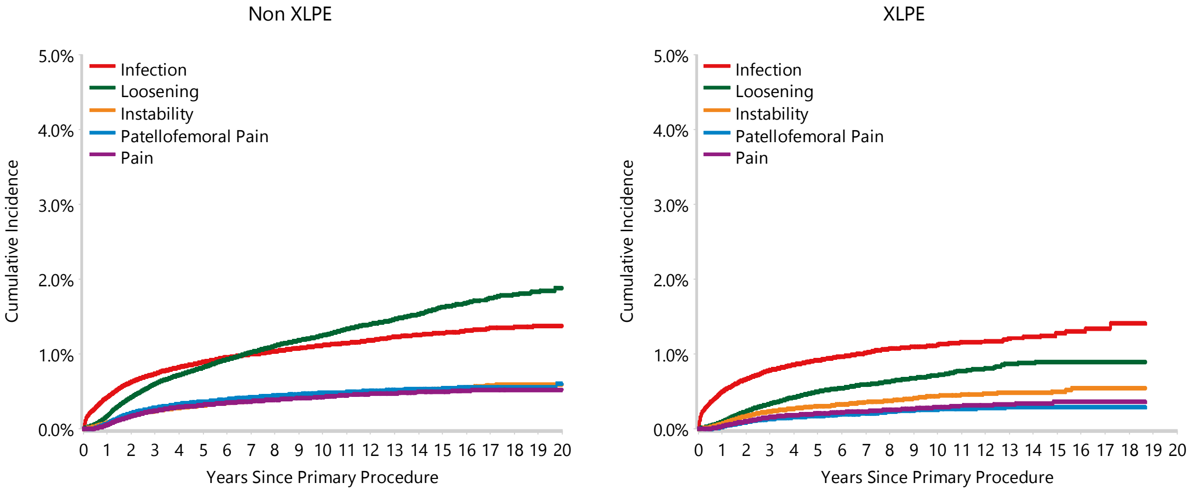



HR - adjusted for age and gender
Non XLPE vs XLPE
0 - 3Mth: HR=0.95 (0.87, 1.03),p=0.189
3Mth - 6Mth: HR=1.18 (1.05, 1.33),p=0.006
6Mth - 9Mth: HR=1.42 (1.27, 1.59),p<0.001
9Mth - 1Yr: HR=1.23 (1.10, 1.36),p<0.001
1Yr - 1.5Yr: HR=1.57 (1.45, 1.70),p<0.001
1.5Yr+: HR=1.38 (1.32, 1.43),p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Non XLPE | 359758 | 338410 | 288646 | 236833 | 109474 | 28071 | 644 |
| XLPE | 294169 | 252939 | 175224 | 112193 | 22801 | 2934 | 0 |

Note: Restricted to modern prostheses

**Figure KT39 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA)**



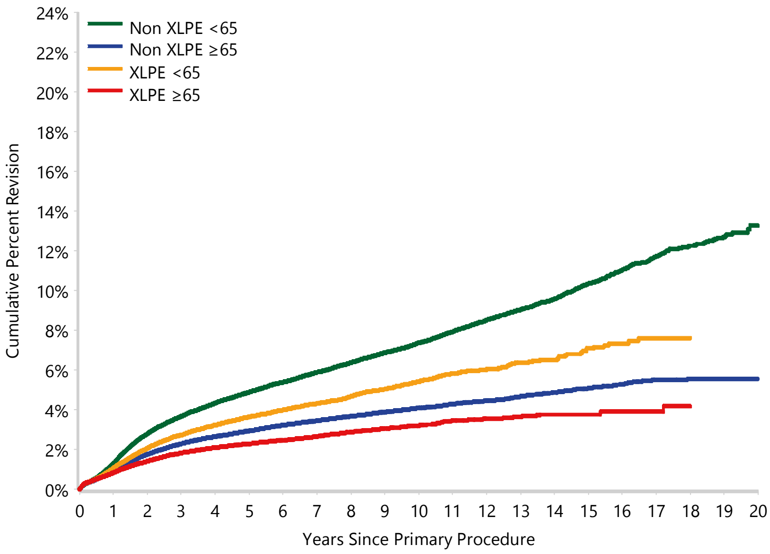

Note: Restricted to modern prostheses

**Table KT36 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 | | 15856 | 359758 | 1.0 (1.0, 1.1) | 2.8 (2.7, 2.8) | 3.6 (3.5, 3.7) | 5.2 (5.1, 5.3) | 7.0 (6.9, 7.2) | 8.7 (8.3, 9.1) |
| | <65 | 7774 | 119103 | 1.3 (1.2, 1.4) | 3.7 (3.6, 3.8) | 4.9 (4.8, 5.0) | 7.4 (7.2, 7.5) | 10.3 (10.1, 10.6) | 13.3 (12.6, 14.0) |
| | ≥65 | 8082 | 240655 | 0.9 (0.9, 1.0) | 2.3 (2.2, 2.4) | 2.9 (2.9, 3.0) | 4.1 (4.0, 4.2) | 5.1 (4.9, 5.2) | 5.6 (5.4, 5.8) |
| XLPE | | 7036 | 294169 | 0.9 (0.9, 1.0) | 2.1 (2.1, 2.2) | 2.8 (2.7, 2.8) | 4.0 (3.9, 4.1) | 5.0 (4.8, 5.3) | |
| | <65 | 3190 | 99231 | 1.1 (1.0, 1.1) | 2.7 (2.6, 2.8) | 3.6 (3.5, 3.8) | 5.4 (5.2, 5.6) | 7.1 (6.6, 7.6) | |
| | ≥65 | 3846 | 194938 | 0.8 (0.8, 0.9) | 1.8 (1.8, 1.9) | 2.3 (2.2, 2.4) | 3.2 (3.1, 3.3) | 3.8 (3.5, 4.0) | |
| TOTAL | | 22892 | 653927 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT40 Cumulative Percent Revision of Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)**




HR - adjusted for gender

Non XLPE <65 vs Non XLPE ≥65
0 - 3Mth: HR=1.00 (0.89, 1.12),p=0.958
3Mth - 9Mth: HR=1.53 (1.39, 1.68),p<0.001
9Mth - 3.5Yr: HR=1.74 (1.67, 1.82),p<0.001
3.5Yr - 6Yr: HR=2.01 (1.86, 2.16),p<0.001
6Yr - 8.5Yr: HR=2.19 (2.00, 2.40),p<0.001
8.5Yr - 10Yr: HR=2.37 (2.05, 2.73),p<0.001
10Yr - 11.5Yr: HR=2.79 (2.36, 3.29),p<0.001
11.5Yr+: HR=3.42 (2.99, 3.92),p<0.001

Non XLPE <65 vs XLPE <65
0 - 3Mth: HR=0.90 (0.80, 1.02),p=0.094
3Mth - 6Mth: HR=1.26 (1.09, 1.46),p=0.002
6Mth - 1Yr: HR=1.45 (1.32, 1.60),p<0.001
1Yr - 1.5Yr: HR=1.61 (1.47, 1.76),p<0.001
1.5Yr - 2Yr: HR=1.36 (1.23, 1.51),p<0.001
2Yr - 2.5Yr: HR=1.21 (1.08, 1.36),p=0.001
2.5Yr - 3.5Yr: HR=1.28 (1.15, 1.42),p<0.001
3.5Yr+: HR=1.54 (1.44, 1.65),p<0.001

Non XLPE ≥65 vs XLPE ≥65
0 - 6Mth: HR=0.96 (0.89, 1.04),p=0.376
6Mth - 9Mth: HR=1.45 (1.26, 1.66),p<0.001
9Mth - 1Yr: HR=1.25 (1.10, 1.41),p<0.001
1Yr - 2Yr: HR=1.47 (1.37, 1.59),p<0.001
2Yr+: HR=1.31 (1.24, 1.39),p<0.001

XLPE <65 vs XLPE ≥65
0 - 3Mth: HR=1.02 (0.92, 1.14),p=0.652
3Mth - 6Mth: HR=1.27 (1.10, 1.48),p=0.001
6Mth - 1.5Yr: HR=1.59 (1.46, 1.72),p<0.001
1.5Yr+: HR=1.83 (1.71, 1.95),p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Non XLPE | <65 | 119103 | 112100 | 96661 | 80961 | 40983 | 12071 | 319 |
| | ≥65 | 240655 | 226310 | 191985 | 155872 | 68491 | 16000 | 325 |
| XLPE | <65 | 99231 | 85488 | 60292 | 39502 | 8735 | 1280 | 0 |
| | ≥65 | 194938 | 167451 | 114932 | 72691 | 14066 | 1654 | 0 |

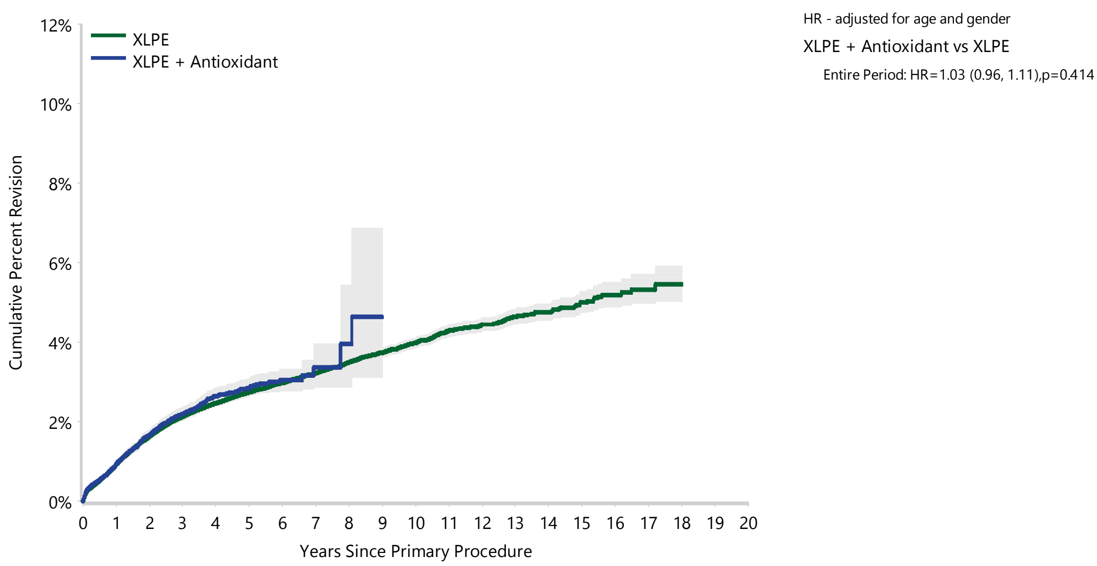
Note: Restricted to modern prostheses

**Table KT37 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 | 6192 | 242839 | 0.9 (0.9, 1.0) | 2.1 (2.1, 2.2) | 2.7 (2.7, 2.8) | 4.0 (3.9, 4.1) | 5.0 (4.7, 5.3) | |
| XLPE + Antioxidant | 844 | 51330 | 0.9 (0.8, 1.0) | 2.2 (2.0, 2.4) | 2.8 (2.6, 3.1) | | | |
| TOTAL | 7036 | 294169 | | | | | | |

Note: Restricted to modern prostheses

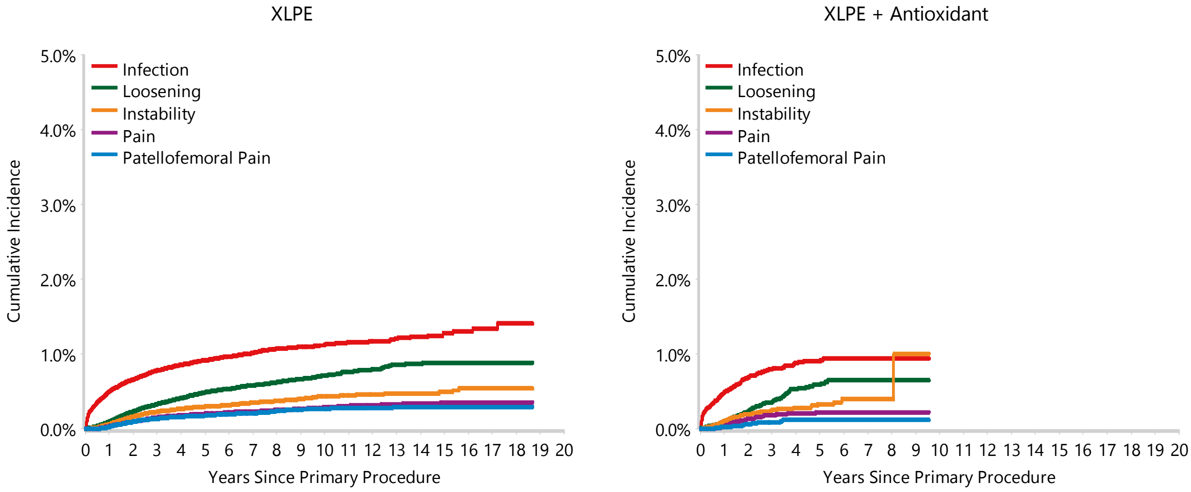
**Figure KT41 Cumulative Percent Revision of XLPE Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| XLPE | 242839 | 216144 | 159138 | 106888 | 22778 | 2934 | 0 |
| XLPE + Antioxidant | 51330 | 36795 | 16086 | 5305 | 23 | 0 | 0 |

Note: Restricted to modern prostheses

**Figure KT42 Cumulative Incidence Revision Diagnosis of XLPE Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA)**



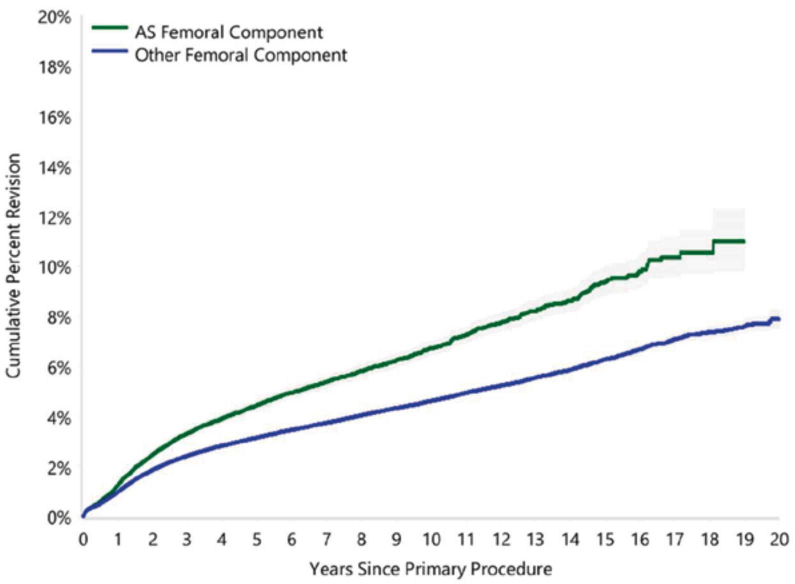

Note: Restricted to modern prostheses

**Table KT38** **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 | 2856 | 61659 | 1.2 (1.1, 1.3) | 3.3 (3.2, 3.5) | 4.4 (4.3, 4.6) | 6.7 (6.4, 7.0) | 9.4 (8.8, 9.9) | |
| Other Femoral Component | 20043 | 592601 | 1.0 (0.9, 1.0) | 2.4 (2.4, 2.5) | 3.1 (3.1, 3.2) | 4.6 (4.5, 4.7) | 6.3 (6.1, 6.4) | 7.9 (7.5, 8.3) |
| TOTAL | 22899 | 654260 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT43** **Cumulative Percent Revision of Primary Total Knee Replacement by Femoral Component Type (Primary Diagnosis OA)**




HR - adjusted for age and gender

AS Femoral Component vs Other Femoral Component

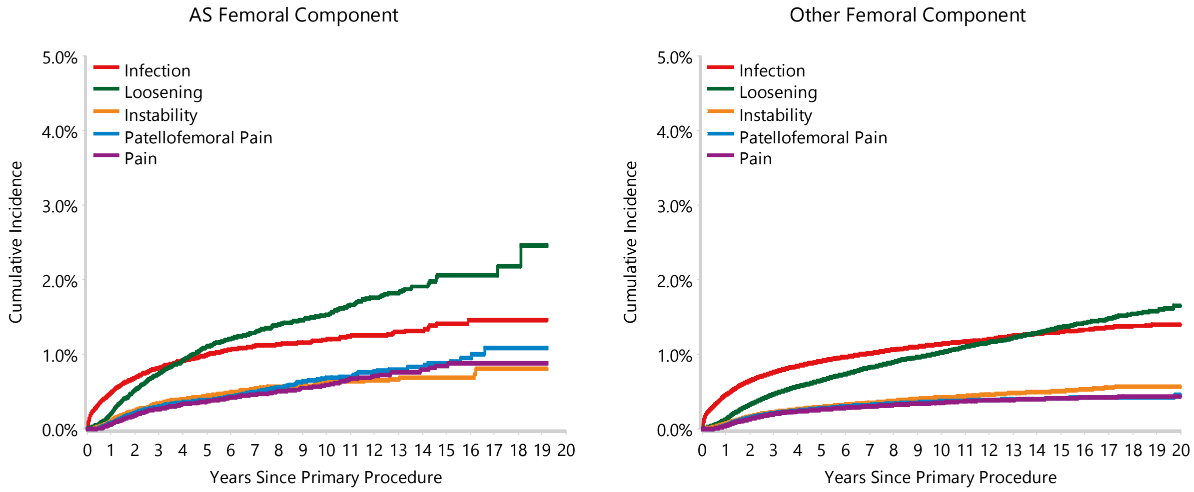
0 – 9Mth: HR=1.08 (0.98, 1.18),p=0.115

9Mth+: HR=1.36 (1.30, 1.42),p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| AS Femoral Component | 61659 | 55283 | 42448 | 31257 | 10150 | 2006 | 1 |
| Other Femoral Component | 592601 | 536326 | 421555 | 317887 | 122186 | 29017 | 644 |

Note: Restricted to modern prostheses

**Figure KT44 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by Femoral Component Type (All Diagnoses)**



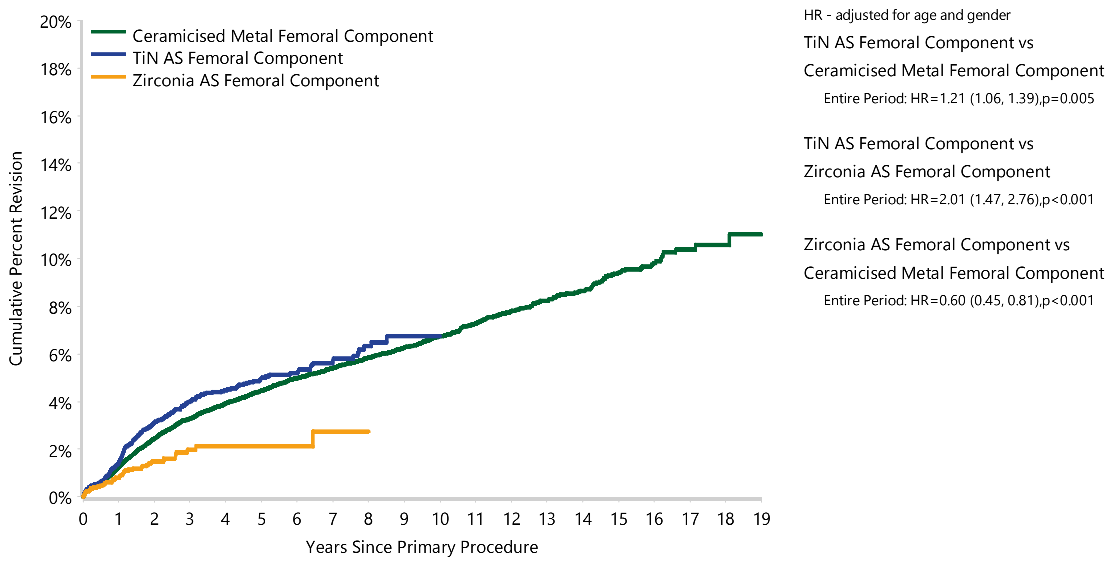

Note: Restricted to modern prostheses

**Table KT39 Cumulative Percent Revision of AS Primary Total Knee Replacement by AS Femoral Material (Primary Diagnosis OA)**

| AS Femoral Material | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Ceramicised Metal Femoral Component | 2581 | 52878 | 1.2 (1.1, 1.3) | 3.3 (3.1, 3.5) | 4.5 (4.3, 4.7) | 6.8 (6.5, 7.0) | 9.4 (8.9, 10.0) | |
| TiN AS Femoral Component | 228 | 5172 | 1.4 (1.1, 1.8) | 4.0 (3.5, 4.6) | 5.0 (4.4, 5.7) | 6.7 (5.7, 7.9) | | |
| Zirconia AS Femoral Component | 47 | 3609 | 0.8 (0.5, 1.2) | 2.0 (1.4, 2.7) | 2.1 (1.5, 2.9) | | | |
| TOTAL | 2856 | 61659 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT45 Cumulative Percent Revision of AS Primary Total Knee Replacement by AS Femoral Material (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Ceramicised Metal Femoral Component | 52878 | 48203 | 38244 | 28727 | 10071 | 2006 | 1 |
| TiN AS Femoral Component | 5172 | 4635 | 3354 | 2253 | 68 | 0 | 0 |
| Zirconia AS Femoral Component | 3609 | 2445 | 850 | 277 | 11 | 0 | 0 |

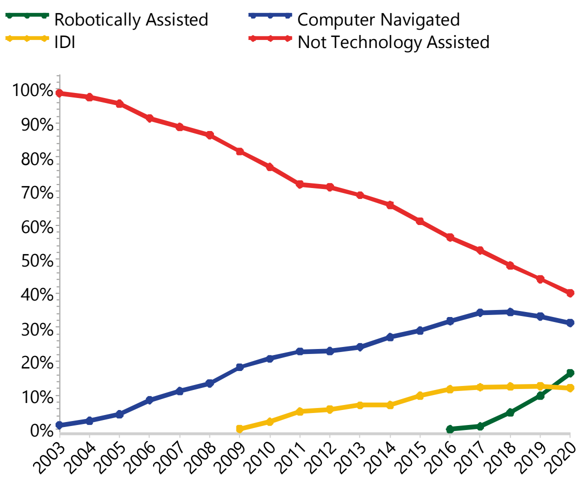
Note: Restricted to modern prostheses

## TECHNOLOGY ASSISTANCE

Computer navigation, image derived instrumentation (IDI) and robotic assistance to aid implantation of knee replacements have been grouped as 'technology assisted' methods. Procedures not using these methods have decreased to 40% of primary knee procedures in 2020. The increase in use of individual technology assisted methods is shown in Figure KT46.

Results of each category of technology assistance are shown, but outcomes related to technology assistance vary with the prostheses used.

**Figure KT46 Primary Total Knee Replacement by Technology Assistance (Primary Diagnosis OA)**




### Computer Navigation

There have been 160,724 primary total knee replacement procedures using computer navigation. In 2020, computer navigation was used in 31.3% of all primary total knee replacement procedures.

After 6 months, procedures using computer navigation have a lower rate of revision compared to non navigated procedures (Table KT40, Figure KT47 and Figure KT48).

Patients aged <65 years have a lower rate of revision when computer navigation is used compared to when it is not used. This effect is less consistent for patients aged ≥65 years (Table KT41 and Figure KT49).

### 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 them specifically for each patient.

There have been 49,779 primary total knee replacement procedures undertaken using IDI since 2009. In 2020, IDI was used in 12.1% of all primary total knee replacement procedures.

IDI usage has a higher rate of revision compared to when IDI is not used (Table KT42 and Figure KT50). There is an increased proportion of revision for loosening when IDI is used (Figure KT51).

The effect of IDI on revision varies with age. In patients aged ≥65 years where IDI is used, there is a higher rate of revision after 3 months compared to when it is not used. There is no difference with IDI use for patients aged <65 years (Table KT43 and Figure KT52).

### Robotic Assistance

Robotic assistance has been recorded for 17,353 total knee replacements since 2017, and in 2020 was used for 16.6% of procedures. There are 4 types of robotic assistance that are used with a small number of prostheses. The use of robotic assistance is associated with a lower rate of revision compared to when it is not used (Table KT44 and Figure KT53). There are fewer revisions for loosening and instability using robotic assistance (Figure KT54).

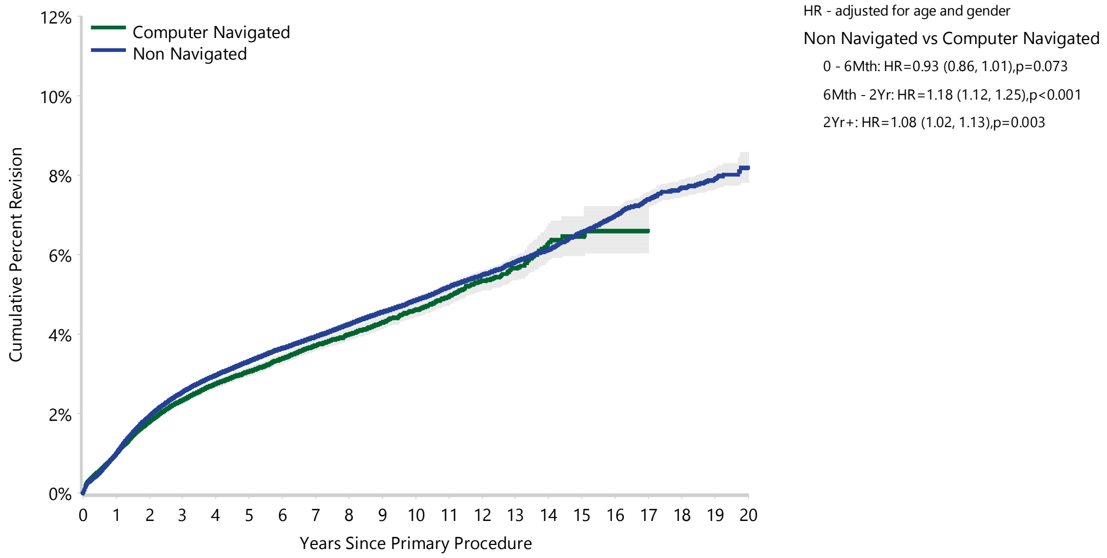
For patients aged ≥65 years, the use of robotic assistance leads to a lower rate of revision compared to when it is not used, but there is no difference for patients aged <65 years (Table KT45 and Figure KT55).

**Table KT40 Cumulative Percent Revision of Primary Total Knee Replacement by Computer Navigation (Primary Diagnosis OA)**

| Navigation | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Computer Navigated | 4551 | 160724 | 1.0 (0.9, 1.0) | 2.3 (2.3, 2.4) | 3.1 (3.0, 3.2) | 4.6 (4.4, 4.8) | 6.5 (6.0, 7.0) | |
| Non Navigated | 18348 | 493536 | 1.0 (1.0, 1.0) | 2.5 (2.5, 2.6) | 3.3 (3.3, 3.4) | 4.8 (4.8, 4.9) | 6.6 (6.4, 6.7) | 8.2 (7.8, 8.6) |
| TOTAL | 22899 | 654260 | | | | | | |

Note: Restricted to modern prostheses

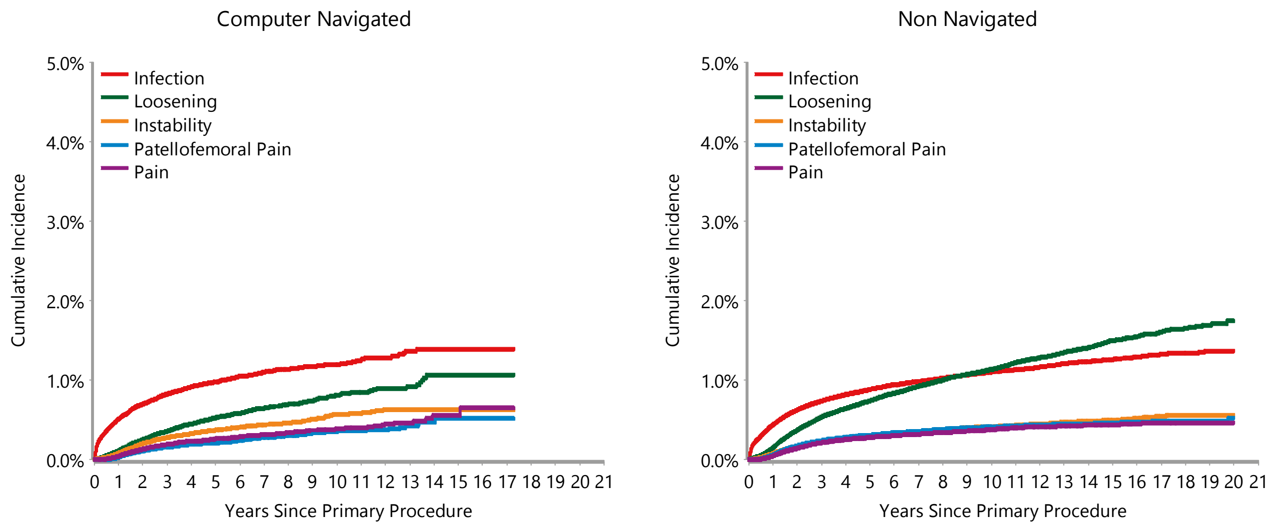
**Figure KT47 Cumulative Percent Revision of Primary Total Knee Replacement by Navigation (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|
| Computer Navigated | 160724 | 141982 | 101442 | 66083 | 14993 | 664 | 0 |
| Non Navigated | 493536 | 449627 | 362561 | 283061 | 117343 | 30359 | 645 |

Note: Restricted to modern prostheses

**Figure KT48 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by Navigation (Primary Diagnosis OA)**



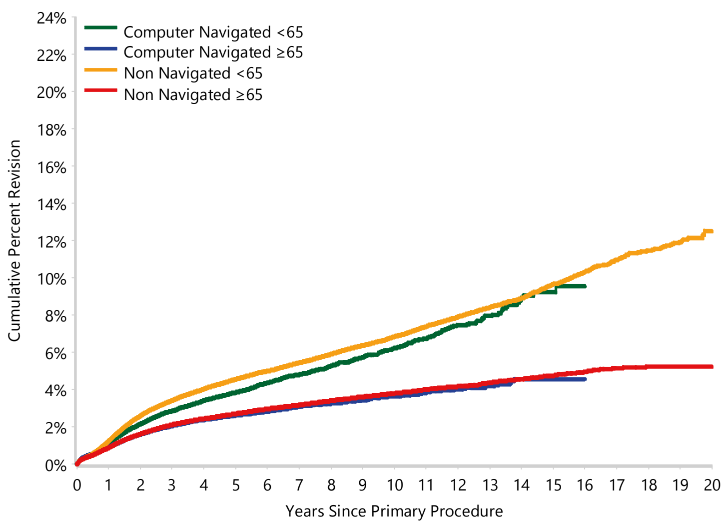

Note: Restricted to modern prostheses

**Table KT41 Cumulative Percent Revision of Primary Total Knee Replacement by Computer Navigation and Age (Primary Diagnosis OA)**

| Navigation | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| Computer Navigated | | 4551 | 160724 | 1.0 (0.9, 1.0) | 2.3 (2.3, 2.4) | 3.1 (3.0, 3.2) | 4.6 (4.4, 4.8) | 6.5 (6.0, 7.0) | |
| | <65 | 2114 | 56234 | 1.1 (1.0, 1.2) | 2.9 (2.7, 3.0) | 3.8 (3.7, 4.0) | 6.2 (5.9, 6.6) | 9.2 (8.3, 10.2) | |
| | ≥65 | 2437 | 104490 | 0.9 (0.8, 1.0) | 2.1 (2.0, 2.2) | 2.6 (2.5, 2.7) | 3.6 (3.5, 3.8) | 4.6 (4.1, 5.0) | |
| Non Navigated | | 18348 | 493536 | 1.0 (1.0, 1.0) | 2.5 (2.5, 2.6) | 3.3 (3.3, 3.4) | 4.8 (4.8, 4.9) | 6.6 (6.4, 6.7) | 8.2 (7.8, 8.6) |
| | <65 | 8855 | 162237 | 1.2 (1.2, 1.3) | 3.4 (3.3, 3.5) | 4.6 (4.4, 4.7) | 6.8 (6.7, 7.0) | 9.7 (9.4, 9.9) | 12.5 (11.8, 13.2) |
| | ≥65 | 9493 | 331299 | 0.9 (0.8, 0.9) | 2.1 (2.1, 2.2) | 2.7 (2.6, 2.8) | 3.8 (3.7, 3.9) | 4.8 (4.6, 4.9) | 5.2 (5.0, 5.4) |
| TOTAL | | 22899 | 654260 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT49 Cumulative Percent Revision of Primary Total Knee Replacement by Computer Navigation and Age (Primary Diagnosis OA)**




HR - adjusted for gender

Computer Navigated <65 vs Computer Navigated ≥65
0 - 6Mth: HR=0.95 (0.83, 1.09),p=0.494
6Mth - 2.5Yr: HR=1.55 (1.43, 1.68),p<0.001
2.5Yr - 3.5Yr: HR=1.57 (1.36, 1.82),p<0.001
3.5Yr - 5Yr: HR=1.84 (1.58, 2.13),p<0.001
5Yr - 7.5Yr: HR=2.19 (1.90, 2.53),p<0.001
7.5Yr - 8Yr: HR=2.41 (1.66, 3.51),p<0.001
8Yr+: HR=2.91 (2.45, 3.46),p<0.001

Computer Navigated <65 vs Non Navigated <65
Entire Period: HR=0.88 (0.84, 0.92),p<0.001

Computer Navigated ≥65 vs Non Navigated ≥65
0 - 6Mth: HR=1.17 (1.06, 1.29),p=0.001
6Mth+: HR=0.92 (0.88, 0.97),p=0.002

Non Navigated <65 vs Non Navigated ≥65
0 - 3Mth: HR=1.10 (1.01, 1.21),p=0.033
3Mth - 9Mth: HR=1.47 (1.36, 1.59),p<0.001
9Mth - 1.5Yr: HR=1.78 (1.67, 1.89),p<0.001
1.5Yr - 2Yr: HR=1.84 (1.68, 2.02),p<0.001
2Yr - 3Yr: HR=1.65 (1.53, 1.78),p<0.001
3Yr - 3.5Yr: HR=1.79 (1.57, 2.03),p<0.001
3.5Yr - 5Yr: HR=2.06 (1.89, 2.25),p<0.001
5Yr - 6Yr: HR=1.77 (1.57, 1.99),p<0.001
6Yr - 8Yr: HR=2.17 (1.96, 2.41),p<0.001
8Yr - 8.5Yr: HR=2.53 (2.01, 3.20),p<0.001
8.5Yr - 9Yr: HR=2.04 (1.60, 2.60),p<0.001
9Yr - 12.5Yr: HR=2.90 (2.58, 3.26),p<0.001
12.5Yr - 13Yr: HR=1.93 (1.36, 2.73),p<0.001
13Yr - 15Yr: HR=3.33 (2.64, 4.20),p<0.001
15Yr - 15.5Yr: HR=2.53 (1.46, 4.39),p<0.001
15.5Yr+: HR=4.61 (3.18, 6.67),p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 15 Yrs | 20 Yrs |
|---|---|---|---|---|---|---|---|---|
| Computer Navigated | <65 | 56234 | 49954 | 36351 | 24170 | 6096 | 309 | 0 |
| | ≥65 | 104490 | 92028 | 65091 | 41913 | 8897 | 355 | 0 |
| Non Navigated | <65 | 162237 | 147740 | 120643 | 96330 | 43643 | 13050 | 320 |
| | ≥65 | 331299 | 301887 | 241918 | 186731 | 73700 | 17309 | 325 |

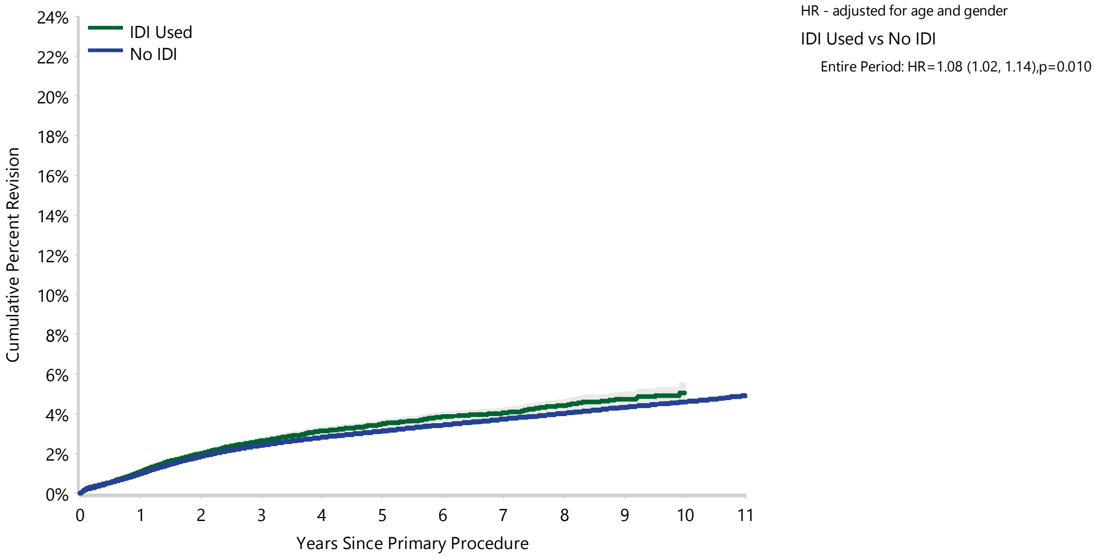
Note: Restricted to modern prostheses

**Table KT42 Cumulative Percent Revision of Primary Total Knee Replacement Since 2009 by IDI Usage (Primary Diagnosis OA)**

| IDI Usage | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|---|
| IDI Used | 1359 | 49779 | 1.1 (1.0, 1.2) | 2.6 (2.5, 2.8) | 3.5 (3.3, 3.7) | 4.0 (3.8, 4.3) | 5.1 (4.6, 5.6) | |
| No IDI | 14316 | 484178 | 1.0 (1.0, 1.0) | 2.4 (2.4, 2.5) | 3.1 (3.1, 3.2) | 3.7 (3.7, 3.8) | 4.6 (4.5, 4.7) | 4.9 (4.8, 5.0) |
| TOTAL | 15675 | 533957 | | | | | | |

Note: Restricted to modern prostheses

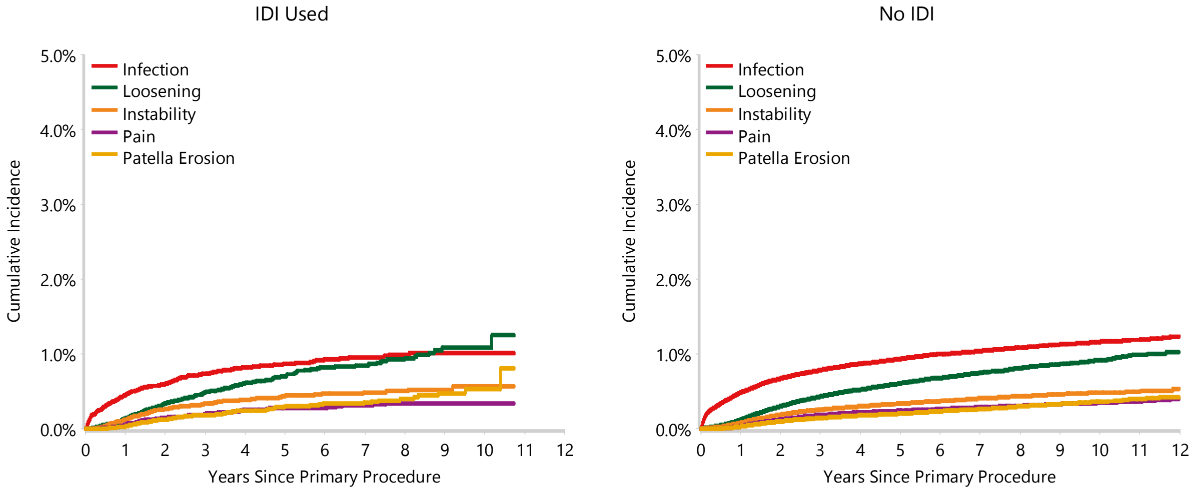
**Figure KT50 Cumulative Percent Revision of Primary Total Knee Replacement Since 2009 by IDI Usage (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|
| IDI Used | 49779 | 42532 | 27357 | 14676 | 7016 | 646 | 21 |
| No IDI | 484178 | 431132 | 324014 | 227694 | 142266 | 44426 | 19444 |

Note: Restricted to modern prostheses

**Figure KT51 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement Since 2009 by IDI Usage (Primary Diagnosis OA)**



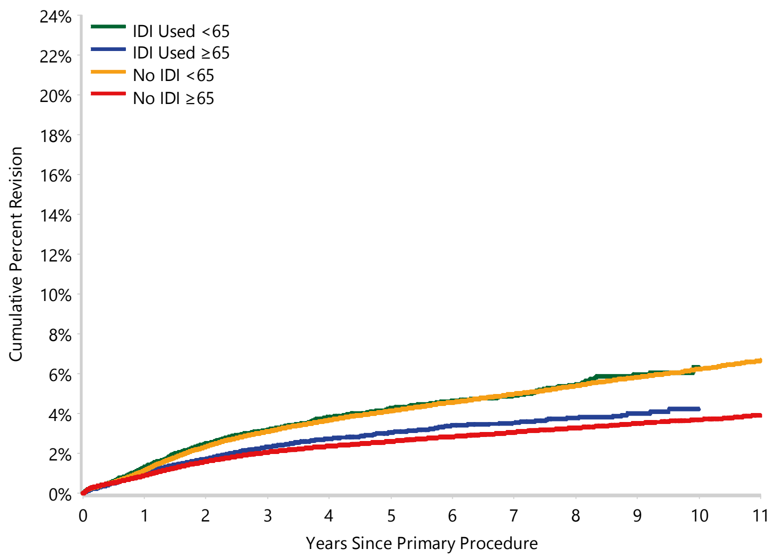

Note: Restricted to modern prostheses

**Table KT43 Cumulative Percent Revision of Primary Total Knee Replacement Since 2009 by IDI Usage and Age (Primary Diagnosis OA)**

| IDI Usage | Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|---|---|
| IDI Used | | 1359 | 49779 | 1.1 (1.0, 1.2) | 2.6 (2.5, 2.8) | 3.5 (3.3, 3.7) | 4.0 (3.8, 4.3) | 5.1 (4.6, 5.6) | |
| | <65 | 609 | 17740 | 1.3 (1.2, 1.5) | 3.2 (2.9, 3.5) | 4.3 (3.9, 4.6) | 4.9 (4.5, 5.4) | 6.3 (5.5, 7.3) | |
| | ≥65 | 750 | 32039 | 1.0 (0.9, 1.1) | 2.3 (2.2, 2.5) | 3.1 (2.8, 3.3) | 3.5 (3.3, 3.8) | 4.2 (3.7, 4.8) | |
| No IDI | | 14316 | 484178 | 1.0 (1.0, 1.0) | 2.4 (2.4, 2.5) | 3.1 (3.1, 3.2) | 3.7 (3.7, 3.8) | 4.6 (4.5, 4.7) | 4.9 (4.8, 5.0) |
| | <65 | 6565 | 163520 | 1.2 (1.1, 1.2) | 3.1 (3.0, 3.2) | 4.1 (4.0, 4.2) | 5.0 (4.9, 5.1) | 6.2 (6.1, 6.4) | 6.7 (6.5, 6.9) |
| | ≥65 | 7751 | 320658 | 0.9 (0.9, 0.9) | 2.1 (2.0, 2.1) | 2.6 (2.5, 2.7) | 3.1 (3.0, 3.1) | 3.7 (3.6, 3.8) | 3.9 (3.8, 4.0) |
| TOTAL | | 15675 | 533957 | | | | | | |

Note: Restricted to modern prostheses

**Figure KT52 Cumulative Percent Revision of Primary Total Knee Replacement Since 2009 by IDI Usage and Age (Primary Diagnosis OA)**




HR - adjusted for gender

IDI Used <65 vs IDI Used ≥65
Entire Period: HR=1.41 (1.27, 1.57),p<0.001

IDI Used <65 vs No IDI <65
Entire Period: HR=1.03 (0.95, 1.12),p=0.521

IDI Used ≥65 vs No IDI ≥65
0 - 3Mth: HR=0.74 (0.65, 0.83),p<0.001
3Mth - 1.5Yr: HR=1.26 (1.14, 1.39),p<0.001
1.5Yr+: HR=1.20 (1.09, 1.33),p<0.001

No IDI <65 vs No IDI ≥65
0 - 3Mth: HR=0.94 (0.85, 1.03),p=0.189
3Mth - 6Mth: HR=1.39 (1.22, 1.58),p<0.001
6Mth - 3Yr: HR=1.66 (1.59, 1.73),p<0.001
3Yr+: HR=1.92 (1.81, 2.03),p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 11 Yrs |
|---|---|---|---|---|---|---|---|---|
| IDI Used | <65 | 17740 | 15210 | 10071 | 5728 | 2899 | 305 | 11 |
| | ≥65 | 32039 | 27322 | 17286 | 8948 | 4117 | 341 | 10 |
| No IDI | <65 | 163520 | 145920 | 111623 | 80414 | 52344 | 17642 | 7871 |
| | ≥65 | 320658 | 285212 | 212391 | 147280 | 89922 | 26784 | 11573 |

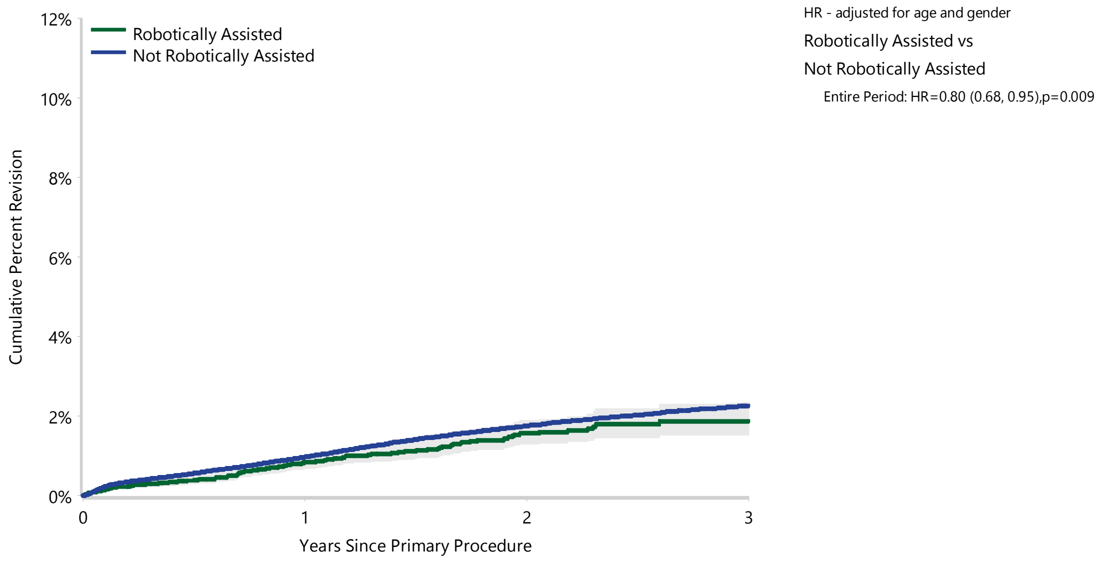
Note: Restricted to modern prostheses

**Table KT44 Cumulative Percent Revision of Primary Total Knee Replacement Since 2017 by Robotic Assistance (Primary Diagnosis OA)**

| Robotic Assistance | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs |
|---|---|---|---|---|---|
| Robotically Assisted | 150 | 17353 | 0.8 (0.7, 1.0) | 1.6 (1.3, 1.9) | 1.9 (1.5, 2.3) |
| Not Robotically Assisted | 3261 | 199261 | 1.0 (0.9, 1.0) | 1.8 (1.7, 1.8) | 2.3 (2.2, 2.3) |
| TOTAL | 3411 | 216614 | | | |

Note: Restricted to modern prostheses

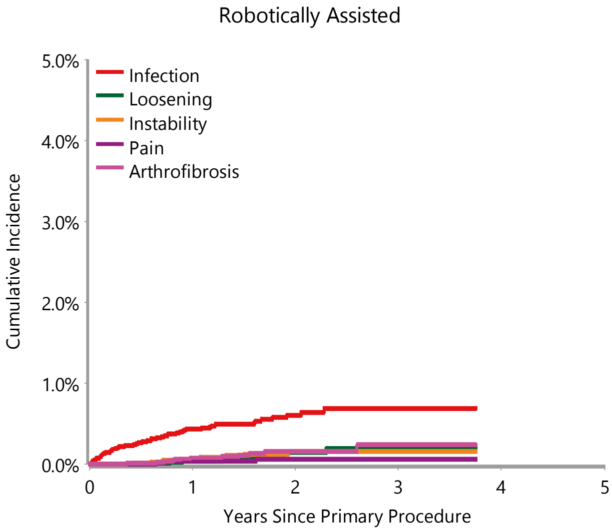
**Figure KT53 Cumulative Percent Revision of Primary Total Knee Replacement Since 2017 by Robotic Assistance (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs |
|---|---|---|---|---|
| Robotically Assisted | 17353 | 8531 | 3037 | 408 |
| Not Robotically Assisted | 199261 | 152940 | 101581 | 50168 |

Note: Restricted to modern prostheses

**Figure KT54 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement Since 2017 by Robotic Assistance (Primary Diagnosis OA)**



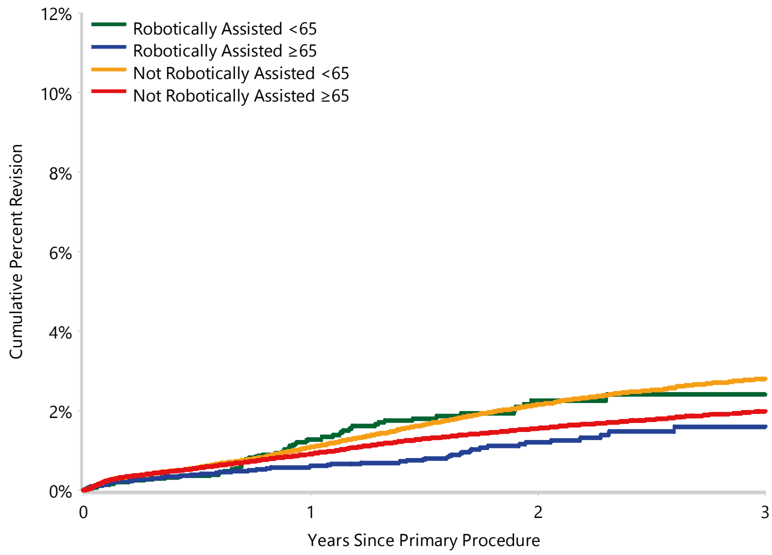

Note: Restricted to modern prostheses

**Table KT45** Cumulative Percent Revision of Primary Total Knee Replacement Since 2017 by Robotic Assistance and Age (Primary Diagnosis OA)

| Robotic Assistance | Age | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs |
|---|---|---|---|---|---|---|---|
| **Robotically Assisted** | | **150** | **17353** | **0.8 (0.7, 1.0)** | **1.6 (1.3, 1.9)** | **1.9 (1.5, 2.3)** | |
| | <65 | 71 | 6106 | 1.3 (1.0, 1.7) | 2.3 (1.7, 2.9) | 2.4 (1.8, 3.1) | |
| | ≥65 | 79 | 11247 | 0.6 (0.5, 0.8) | 1.2 (0.9, 1.6) | 1.6 (1.2, 2.2) | |
| **Not Robotically Assisted** | | **3261** | **199261** | **1.0 (0.9, 1.0)** | **1.8 (1.7, 1.8)** | **2.3 (2.2, 2.3)** | |
| | <65 | 1326 | 65932 | 1.1 (1.0, 1.2) | 2.2 (2.0, 2.3) | 2.8 (2.6, 3.0) | |
| | ≥65 | 1935 | 133329 | 0.9 (0.9, 1.0) | 1.6 (1.5, 1.6) | 2.0 (1.9, 2.1) | |
| **TOTAL** | | **3411** | **216614** | | | | |

Note: Restricted to modern prostheses

**Figure KT55** Cumulative Percent Revision of Primary Total Knee Replacement Since 2017 by Robotic Assistance and Age (Primary Diagnosis OA)




HR - adjusted for gender

Robotically Assisted <65 vs
Robotically Assisted ≥65
0 - 6Mth: HR=1.00 (0.61, 1.63),p=0.995
6Mth - 1.5Yr: HR=2.69 (1.86, 3.90),p<0.001
1.5Yr+: HR=1.27 (0.59, 2.77),p=0.541

Robotically Assisted <65 vs
Not Robotically Assisted <65
Entire Period: HR=0.96 (0.75, 1.21),p=0.713

Robotically Assisted ≥65 vs
Not Robotically Assisted ≥65
Entire Period: HR=0.74 (0.59, 0.92),p=0.007

Not Robotically Assisted <65 vs
Not Robotically Assisted ≥65
0 - 9Mth: HR=1.07 (0.96, 1.19),p=0.215
9Mth - 1.5Yr: HR=1.51 (1.33, 1.71),p<0.001
1.5Yr+: HR=1.79 (1.57, 2.04),p<0.001

| Number at Risk | | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs |
|---|---|---|---|---|---|---|
| Robotically Assisted | <65 | 6106 | 2902 | 1089 | 152 | 0 |
| | ≥65 | 11247 | 5629 | 1948 | 256 | 0 |
| Not Robotically Assisted | <65 | 65932 | 50587 | 33980 | 16949 | 0 |
| | ≥65 | 133329 | 102353 | 67601 | 33219 | 0 |

Note: Restricted to modern prostheses

# Shoulder Replacement

# Shoulder Replacement

## CATEGORIES OF SHOULDER REPLACEMENT

The Registry groups shoulder replacement into three broad categories: primary partial, primary total, and revision shoulder replacement.

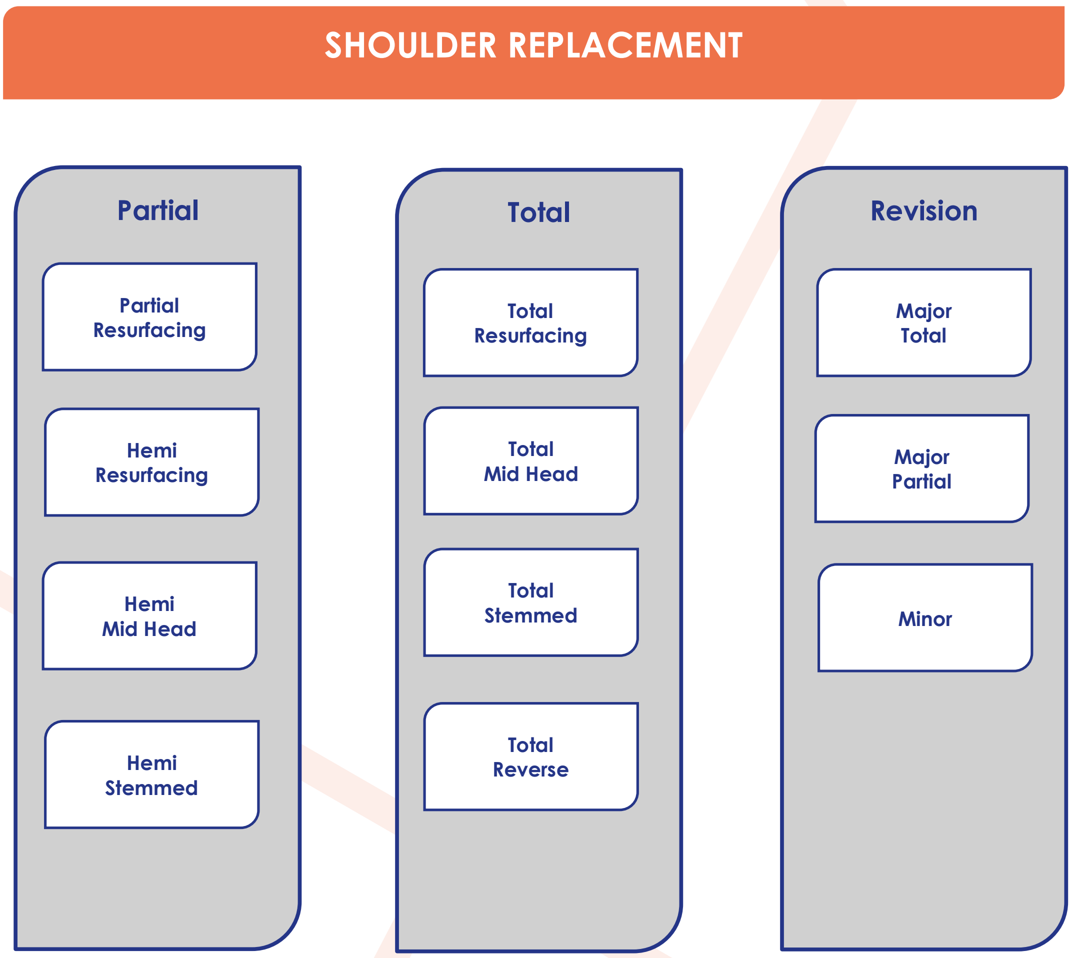
A primary replacement is an initial procedure undertaken on a joint and involves replacing either part (partial) or all (total) of the articular surface.

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, hemi resurfacing, hemi mid head and hemi stemmed replacement.

Total shoulder subclasses include total resurfacing, total mid head, total stemmed and total reverse shoulder replacement. 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-2021



## USE OF SHOULDER REPLACEMENT

This report includes 67,614 shoulder replacements reported to the Registry with a procedure date up to and including 31 December 2020. This is an additional 7,827 shoulder procedures since the last 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 2020 decreased by 137 (1.8%) compared to the previous year and has increased by 188.5% since 2008.

This is the first time the number of shoulder replacements has decreased, and this is due to the cancellation of elective surgery during COVID-19 restrictions.

**The proportion of total shoulder replacements has increased from 57.6% in 2008 to 88.4% in 2020.**

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 S1).

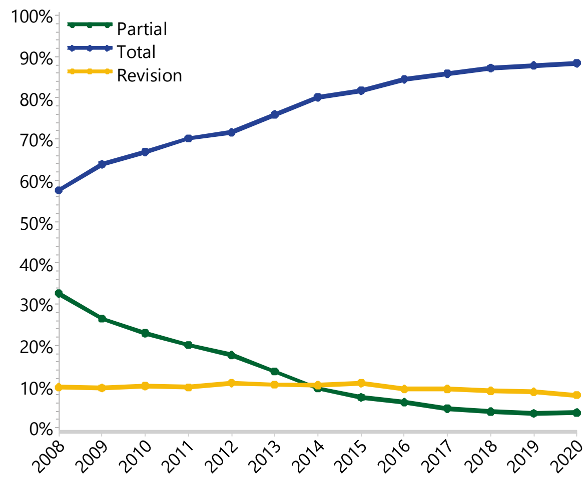
**Table S1 Number of Shoulder Replacements**

| Shoulder Category | Number | Percent |
|---|---|---|
| Partial | 7346 | 10.9 |
| Total | 53815 | 79.6 |
| Revision | 6453 | 9.5 |
| TOTAL | 67614 | 100.0 |

Since 2008, there has been a proportional increase in the use of total shoulder replacement, a major decline in the use of partial shoulder replacement and a small decrease in the proportion of revision procedures (Figure S1).

**In 2020, the proportion of revision procedures has declined to 7.9%, this equates to 224 less revisions compared to the peak of 10.9% in 2012.**

**Figure S1 Proportion of Shoulder Replacements**



## ASA SCORE AND BMI

Data are reported on shoulder replacement procedures for both the American Society of Anaesthesiologists Physical Status Classification (ASA score) and Body Mass Index (BMI). The Registry commenced collecting ASA score in 2012 and BMI data in 2015.

There are ASA score data on 46,245 procedures and BMI data on 35,643 shoulder replacement procedures. Since its initial collection, ASA score has been recorded in 94.0% of procedures. BMI data have been recorded in 88.7% of procedures since collection commenced.

In 2020, ASA score is reported in 99.8% of shoulder replacement procedures and BMI is reported in 96.1% of procedures.

In 2020, the percentage of procedures with ASA score reported for primary partial shoulder is 99.6%, primary total shoulder 99.8%, and revision shoulder replacement 99.7%. BMI data are reported for 94.2% of primary partial shoulder, 96.4% of primary total shoulder, and 94.0% of revision shoulder replacements.

ASA score and BMI are both known to impact the outcome of shoulder replacement surgery.

### ASA SCORE

There are five ASA score classifications:[7]

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

Differences in ASA scores by procedure category are presented in Table S2.

### BMI

BMI for adults is classified by the World Health Organisation into six main categories:[8]

| | | |
|---|---|---|
| 1. | Underweight | <18.50 |
| 2. | Normal | 18.50 - 24.99 |
| 3. | Pre-obese | 25.00 - 29.99 |
| 4. | Obese Class 1 | 30.00 - 34.99 |
| 5. | Obese Class 2 | 35.00 - 39.99 |
| 6. | Obese Class 3 | ≥40.00 |

For all shoulder replacements, the majority of procedures are undertaken in patients who are pre-obese or obese class 1 (61.5%). There is a slightly higher proportion of primary total shoulder replacement procedures where the patients are pre-obese or obese class 1 (61.8%), compared to partial shoulder replacement (59.3%), and revision shoulder replacement (60.4%) (Table S3).

[7] https://www.asahq.org/resources/clinical-information/asa-physical-status-classification-system

[8] http://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi

**Table S2 ASA Score for Shoulder Replacement**

| ASA Score | Partial | | Total | | Revision | | TOTAL | |
|---|---|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% | N | Col% |
| ASA 1 | 291 | 11.4 | 1619 | 4.1 | 146 | 3.4 | 2056 | 4.4 |
| ASA 2 | 1115 | 43.6 | 17717 | 44.9 | 1601 | 37.5 | 20433 | 44.2 |
| ASA 3 | 1057 | 41.4 | 18997 | 48.2 | 2350 | 55.0 | 22404 | 48.4 |
| ASA 4 | 92 | 3.6 | 1079 | 2.7 | 175 | 4.1 | 1346 | 2.9 |
| ASA 5 | . | . | 6 | 0.0 | . | . | 6 | 0.0 |
| TOTAL | 2555 | 100.0 | 39418 | 100.0 | 4272 | 100.0 | 46245 | 100.0 |

Note: A further 21,369 procedures did not have ASA score recorded

**Table S3 BMI Category for Shoulder Replacement**

| BMI Category | Partial | | Total | | Revision | | TOTAL | |
|---|---|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% | N | Col% |
| Underweight | 19 | 1.2 | 235 | 0.8 | 33 | 1.0 | 287 | 0.8 |
| Normal | 291 | 19.0 | 5127 | 16.6 | 564 | 17.9 | 5982 | 16.8 |
| Pre Obese | 526 | 34.4 | 10558 | 34.1 | 1029 | 32.6 | 12113 | 34.0 |
| Obese Class 1 | 382 | 25.0 | 8567 | 27.7 | 874 | 27.7 | 9823 | 27.6 |
| Obese Class 2 | 196 | 12.8 | 4131 | 13.3 | 409 | 13.0 | 4736 | 13.3 |
| Obese Class 3 | 117 | 7.6 | 2341 | 7.6 | 244 | 7.7 | 2702 | 7.6 |
| TOTAL | 1531 | 100.0 | 30959 | 100.0 | 3153 | 100.0 | 35643 | 100.0 |

Note: BMI has not been presented for patients aged ≤19 years
A further 31,971 procedures did not have BMI recorded or the patient is aged ≤19 years

## 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.

The number of procedures with CT scan usage data and glenoid morphology data by shoulder procedure category are listed in Table S4 and Table S5.

**Overall, a CT scan was undertaken in 65.9% of shoulder replacements.**

### 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.

### GLENOID MORPHOLOGY

There are 5 glenoid morphology categories based on the Walch classification:[9]

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 and B2 for partial shoulder replacement (Table S5).

**Table S4 Usage of CT Scan for Shoulder Replacement**

| CT Scan Usage | Partial | | Total | | Revision | | TOTAL | |
|---|---|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% | N | Col% |
| Yes | 434 | 43.2 | 16143 | 69.9 | 825 | 35.9 | 17402 | 65.9 |
| No | 539 | 53.6 | 6587 | 28.5 | 1324 | 57.6 | 8450 | 32.0 |
| Unknown | 32 | 3.2 | 360 | 1.6 | 150 | 6.5 | 542 | 2.1 |
| TOTAL | 1005 | 100.0 | 23090 | 100.0 | 2299 | 100.0 | 26394 | 100.0 |

Note: A further 41,220 procedures did not have CT scan usage recorded

**Table S5 Glenoid Morphology for Shoulder Replacement**

| Glenoid Morphology | Partial | | Total | | Revision | | TOTAL | |
|---|---|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% | N | Col% |
| A1 | 261 | 41.8 | 8704 | 45.0 | 287 | 37.4 | 9252 | 44.6 |
| A2 | 105 | 16.8 | 4337 | 22.4 | 247 | 32.2 | 4689 | 22.6 |
| B1 | 69 | 11.0 | 2911 | 15.0 | 76 | 9.9 | 3056 | 14.7 |
| B2 | 136 | 21.8 | 2583 | 13.3 | 86 | 11.2 | 2805 | 13.5 |
| C | 54 | 8.6 | 826 | 4.3 | 71 | 9.3 | 951 | 4.6 |
| TOTAL | 625 | 100.0 | 19361 | 100.0 | 767 | 100.0 | 20753 | 100.0 |

Note: 63 procedures have been excluded where a glenoid morphology of B3 was recorded
A further 46,798 procedures did not have glenoid morphology recorded

[9] 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. Previously, detailed information on partial shoulders was included in the Annual Report. Commencing this year, it is now provided as a separate supplementary report with the aim of streamlining the Annual Report. The Partial Shoulder Arthroplasty Supplementary Report is one of 15 supplementary reports that complete the AOANJRR Annual Report for 2021 and is available on the AOANJRR website.

## CLASSES OF PARTIAL SHOULDER REPLACEMENT

The Registry subcategorises primary partial shoulder replacement into four main classes. 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 shoulder joint.

**Hemi resurfacing** involves the use of a humeral prosthesis that replaces the humeral articular surface only, without resecting the head.

**Hemi mid head** involves resection of part of the humeral head and replacement with a humeral head and an epiphyseal fixation prosthesis.

**Hemi stemmed** 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 have been 7,346 primary partial shoulder replacements reported to the Registry up to 31 December 2020. This is an additional 284 procedures compared to the number reported last year.

The most common class of primary partial shoulder replacement is hemi stemmed. This accounts for 72.6% of all partial shoulder replacements, followed by hemi resurfacing (23.7%), partial resurfacing (2.7%), and hemi mid head (1.1%) (Table SP1).

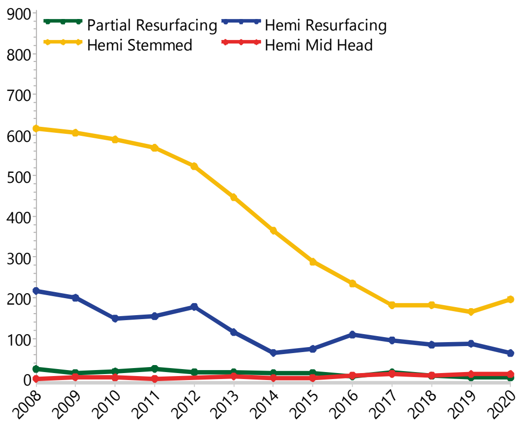
**Table SP1 Primary Partial Shoulder Replacement by Class**

| Shoulder Class | Number | Percent |
|---|---|---|
| Partial Resurfacing | 196 | 2.7 |
| Hemi Resurfacing | 1739 | 23.7 |
| Hemi Stemmed | 5332 | 72.6 |
| Hemi Mid Head | 79 | 1.1 |
| **TOTAL** | **7346** | **100.0** |

The use of the two main classes of primary partial shoulder replacement has declined over the last 8 years. The number of hemi resurfacing procedures decreased from 178 in 2012 to 64 in 2020. The number of hemi stemmed procedures decreased from 616 in 2008 to 196 in 2020 (Figure SP1).

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-2021

**Figure SP1** **Primary Partial Shoulder Replacement by Class**

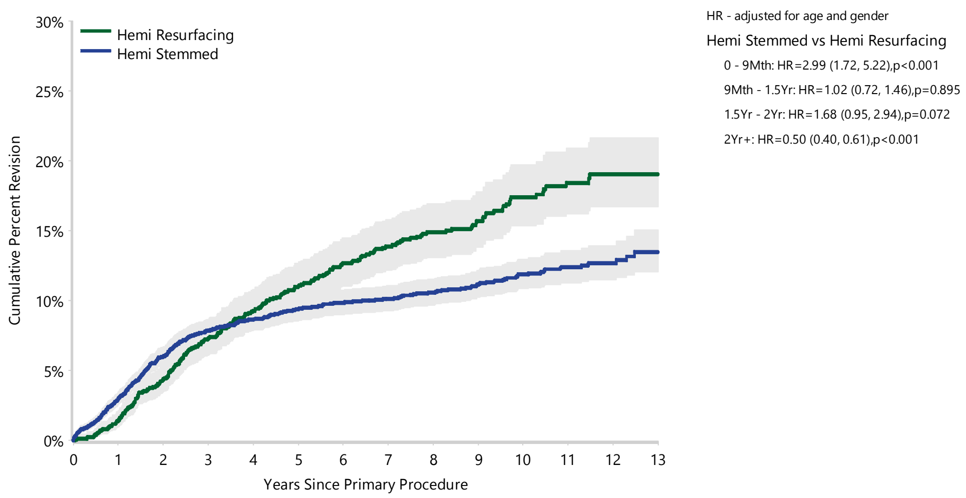



The cumulative percent revision varies depending on the shoulder class. Partial resurfacing and hemi mid head have only been used in small numbers (196 and 79 procedures, respectively). This makes the assessment of comparative performance difficult. However, there is a clear difference between the two more commonly used classes. Devices in these classes have a longer follow-up and the cumulative percent revision at 10 years for hemi resurfacing is higher than for hemi stemmed (17.4% compared to 11.9%, respectively) (Table SP2 and Figure SP2).

**Table SP2** **Cumulative Percent Revision of Primary Partial Shoulder Replacement by Class (All Diagnoses)**

| Shoulder Class | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Partial Resurfacing | 12 | 196 | 0.5 (0.1, 3.7) | 1.6 (0.5, 4.8) | 2.9 (1.2, 6.8) | 5.0 (2.5, 9.8) | 6.0 (3.1, 11.5) | |
| Hemi Resurfacing | 232 | 1739 | 1.4 (1.0, 2.1) | 7.3 (6.1, 8.7) | 11.0 (9.5, 12.7) | 13.9 (12.2, 15.8) | 17.4 (15.3, 19.7) | |
| Hemi Stemmed | 501 | 5332 | 3.0 (2.6, 3.5) | 7.9 (7.1, 8.6) | 9.4 (8.6, 10.3) | 10.1 (9.3, 11.1) | 11.9 (10.8, 13.0) | |
| Hemi Mid Head | 9 | 79 | 2.8 (0.7, 10.9) | 12.2 (5.9, 24.2) | 18.3 (9.5, 33.6) | 18.3 (9.5, 33.6) | | |
| TOTAL | 754 | 7346 | | | | | | |

**Figure SP2** **Cumulative Percent Revision of Primary Partial Shoulder Replacement by Class (All Diagnoses)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Hemi Resurfacing | 1739 | 1643 | 1358 | 1063 | 879 | 465 | 13 |
| Hemi Stemmed | 5332 | 4773 | 3862 | 3118 | 2319 | 1050 | 19 |

## PRIMARY PARTIAL RESURFACING SHOULDER REPLACEMENT

The Registry has recorded 196 partial resurfacing shoulder replacement procedures. This is an additional 5 procedures compared to the number reported last year. The principal diagnosis for partial resurfacing shoulder procedures is instability for males (55.3%) and osteoarthritis for females (45.7%). This procedure is undertaken more commonly in males (76.5%). The mean age for males is 38.8 years compared to 55.1 years for females.

The Registry has recorded 12 revisions of primary partial resurfacing shoulder replacement. The cumulative percent revision at 10 years is 6.0% (Table SP2). The most common reason for revision is glenoid erosion. All were revised to a total shoulder replacement (8 of which were total stemmed).

## PRIMARY HEMI RESURFACING SHOULDER REPLACEMENT

There have been 1,739 primary hemi resurfacing shoulder replacement procedures reported to the Registry. This is an additional 64 procedures compared to the previous report. The use of primary hemi resurfacing has declined by 55.8% since 2008. The procedure is more common in males (58.8%). The mean age is 60.2 years for males and 67.9 years for females. The principal diagnosis for primary hemi resurfacing shoulder replacement is osteoarthritis (88.3%).

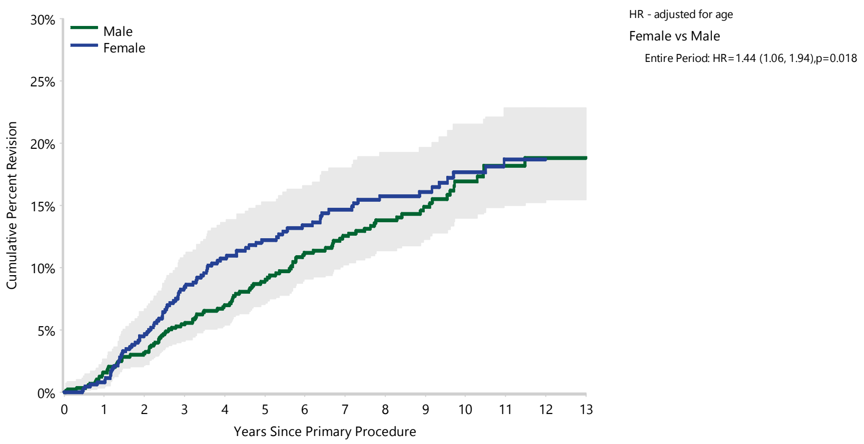
The Registry has recorded 232 revisions of primary hemi resurfacing shoulder replacement. The cumulative percent revision at 10 years is 17.4% (Table SP2 and Figure SP2). The most common reasons for revision are glenoid erosion, pain, rotator cuff insufficiency, and instability/dislocation. The most common type of revision is to a total shoulder replacement, the majority of which were total reverse.

Females have a higher rate of revision than males (Table SP3 and Figure SP3).

**Table SP3 Cumulative Percent Revision of Primary Hemi Resurfacing Shoulder Replacement by Gender (Primary Diagnosis OA)**

| Gender | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Male | 108 | 910 | 1.6 (0.9, 2.7) | 5.5 (4.1, 7.2) | 8.9 (7.0, 11.1) | 12.5 (10.3, 15.3) | 16.9 (14.0, 20.4) | |
| Female | 89 | 625 | 0.8 (0.3, 1.9) | 8.5 (6.5, 11.0) | 12.2 (9.8, 15.3) | 14.7 (11.9, 18.0) | 17.7 (14.4, 21.5) | |
| TOTAL | 197 | 1535 | | | | | | |

**Figure SP3 Cumulative Percent Revision of Primary Hemi Resurfacing 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 | 910 | 855 | 700 | 533 | 444 | 220 | 5 |
| Female | 625 | 601 | 494 | 396 | 320 | 183 | 5 |

## PRIMARY HEMI MID HEAD SHOULDER REPLACEMENT

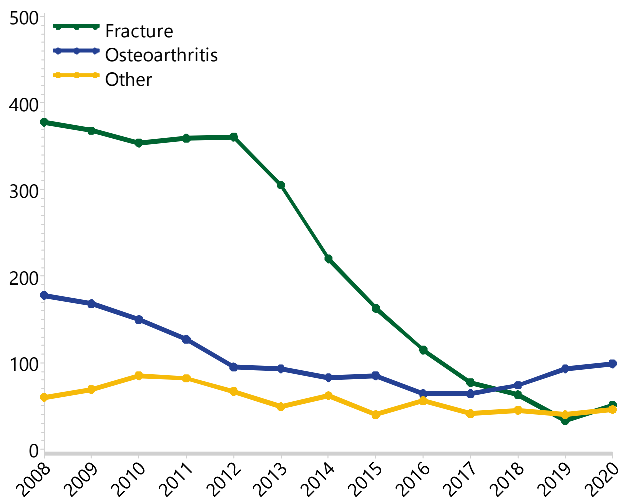
The Registry has recorded 79 primary hemi mid head shoulder replacement procedures. This is an additional 12 procedures compared to the number reported last year. The principal diagnosis is osteoarthritis (58.2%). This procedure is undertaken more commonly in males (62.0%). The mean age for males is 49.8 years and 64.7 years for females.

The Registry has recorded 9 revisions of primary hemi mid head shoulder replacement. The cumulative percent revision at 7 years is 18.3% (Table SP2). The most common reason for revision is glenoid erosion. The most common type of revision involves replacement of the humeral and glenoid components.

## PRIMARY HEMI STEMMED SHOULDER REPLACEMENT

This year, the Registry is reporting on 5,332 primary hemi stemmed shoulder replacement procedures. This is an additional 203 procedures compared to the last report. This procedure is more commonly undertaken in females (69.5%). The mean age is 72.0 years for females and 63.5 years for males. The most common primary diagnosis is fracture (57.1%), followed by osteoarthritis (28.0%). In 2020, the number of primary hemi stemmed shoulder replacements undertaken for fracture decreased by 86.5% compared to 2008. In 2020, the number of primary hemi stemmed shoulder replacements undertaken for osteoarthritis decreased by 44.4% compared to 2008 (Figure SP4).

**Figure SP4** **Primary Hemi Stemmed Shoulder Replacement by Primary Diagnosis**




The cumulative percent revision at 10 years for primary hemi stemmed shoulder replacement procedures undertaken for fracture is 12.0% compared to 11.2% if undertaken for osteoarthritis. There is a higher rate of revision in the first 6 months when primary hemi stemmed shoulder replacement is performed for fracture compared to osteoarthritis. After this time, there is no difference (Table SP4 and Figure SP5).

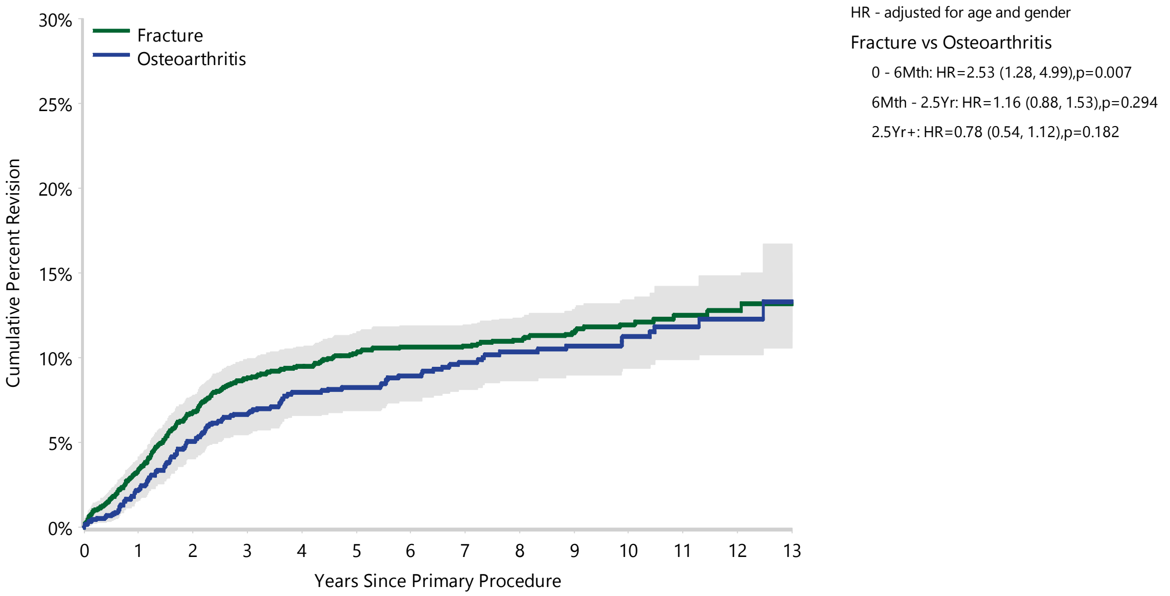
The Registry has recorded 501 revisions of primary hemi stemmed shoulder replacement. Reasons for revision vary depending on the primary diagnosis. Rotator cuff insufficiency occurs more frequently in primary hemi stemmed shoulder replacement undertaken for fracture (26.8%), whereas glenoid erosion occurs more frequently in procedures undertaken for osteoarthritis (29.5%). The most common type of revision is to a total shoulder replacement for both primary diagnoses (71.9% for fracture and 57.4% for osteoarthritis). Most were revised to a total reverse shoulder replacement (97.8% when used for fracture and 86.5% for osteoarthritis). Glenoid component only revision occurs more frequently in procedures undertaken for osteoarthritis (26.4% compared to 4.5% for fracture).

**Table SP4** **Cumulative Percent Revision of Primary Hemi Stemmed Shoulder Replacement by Primary Diagnosis**

| Primary Diagnosis | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Fracture | 310 | 3046 | 3.4 (2.8, 4.1) | 8.8 (7.8, 9.9) | 10.3 (9.2, 11.5) | 10.7 (9.6, 11.9) | 12.0 (10.7, 13.4) | |
| Osteoarthritis | 129 | 1492 | 2.3 (1.6, 3.2) | 6.7 (5.4, 8.2) | 8.3 (6.9, 9.9) | 9.7 (8.1, 11.6) | 11.2 (9.4, 13.4) | |
| Rotator Cuff Arthropathy | 18 | 240 | 2.1 (0.9, 5.0) | 5.5 (3.1, 9.5) | 7.2 (4.4, 11.8) | 7.2 (4.4, 11.8) | | |
| Osteonecrosis | 16 | 193 | 2.1 (0.8, 5.6) | 5.2 (2.7, 9.8) | 7.8 (4.4, 13.5) | 9.9 (5.8, 16.4) | 13.0 (7.8, 21.2) | |
| Tumour | 15 | 173 | 3.6 (1.5, 8.5) | 11.5 (6.0, 21.2) | | | | |
| Other (4) | 13 | 188 | 3.3 (1.5, 7.1) | 5.6 (3.0, 10.1) | 5.6 (3.0, 10.1) | 5.6 (3.0, 10.1) | 10.6 (5.7, 19.2) | |
| TOTAL | 501 | 5332 | | | | | | |

Note: Only primary diagnoses with over 100 procedures have been listed

**Figure SP5** **Cumulative Percent Revision of Primary Hemi Stemmed Shoulder Replacement by Primary Diagnosis**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Fracture | 3046 | 2771 | 2303 | 1869 | 1398 | 595 | 8 |
| Osteoarthritis | 1492 | 1337 | 1060 | 866 | 639 | 336 | 5 |

Note: Only primary diagnoses with over 1,000 procedures have been listed

# Primary Total Shoulder Replacement

## CLASSES OF TOTAL SHOULDER REPLACEMENT

The Registry subcategorises primary total shoulder replacement into four classes. These are defined by the type of prosthesis used.

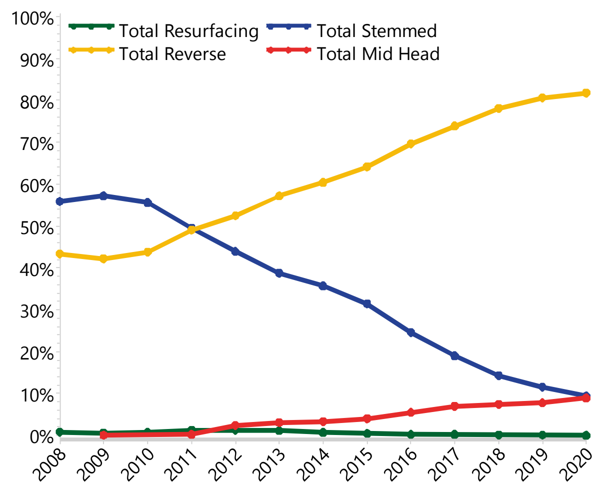
**Total resurfacing** involves glenoid replacement and the use of a humeral prosthesis that replaces the humeral articular surface without resecting the head.
**Total mid head** involves glenoid replacement combined with resection of part of the humeral head and replacement with a humeral head and an epiphyseal fixation prosthesis.
**Total stemmed** 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 reverse** involves glenoid replacement with a glenosphere prosthesis combined with resection of the humeral head and replacement with humeral cup and humeral stem prostheses. A humeral stem prosthesis may have metaphyseal or diaphyseal fixation.

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-2021

There is variation in the primary total shoulder replacement class used according to gender. Total reverse, total stemmed and total mid head are used more often in females but total resurfacing is used more often in males (Table ST2).

The mean age for females is higher than for males (Table ST3).

**Figure ST1 Primary Total Shoulder Replacement by Class**




## USE OF TOTAL SHOULDER REPLACEMENT

The Registry has recorded 53,815 primary total shoulder replacement procedures. Of these, total reverse is the most common, followed by total stemmed. Total mid head and total resurfacing shoulder replacements are used infrequently (Table ST1).

The use of different prosthesis classes has changed over time with a major increase in the use of total reverse shoulder and a corresponding decline in the use of total stemmed shoulder replacement (Figure ST1).

**Table ST1 Primary Total Shoulder Replacement by Class**

| Shoulder Class | Number | Percent |
|---|---|---|
| Total Resurfacing | 235 | 0.4 |
| Total Stemmed | 14872 | 27.6 |
| Total Reverse | 35980 | 66.9 |
| Total Mid Head | 2728 | 5.1 |
| **TOTAL** | **53815** | **100.0** |

Most patients are aged ≥65 years but the proportion in this age group varies depending on the class of shoulder replacement, with total reverse shoulders having the highest proportion (Table ST4).

Osteoarthritis is the most common primary diagnosis followed by rotator cuff arthropathy and fracture (Table ST5).

In order to keep Registry data contemporaneous, only procedures using prostheses that have been available and used in 2020 (described as modern prostheses) are included in the analyses, unless clearly specified.

The cumulative percent revision varies by class with total reverse and total mid head having a lower cumulative percent revision than total stemmed shoulder replacement (Table ST6 and Figure ST2).

**Table ST2 Primary Total Shoulder Replacement by Class and Gender**

| Shoulder Class | Male | | Female | | TOTAL | |
|---|---|---|---|---|---|---|
| | N | Row% | N | Row% | N | Row% |
| Total Resurfacing | 140 | 59.6 | 95 | 40.4 | 235 | 100.0 |
| Total Stemmed | 6347 | 42.7 | 8525 | 57.3 | 14872 | 100.0 |
| Total Reverse | 13216 | 36.7 | 22764 | 63.3 | 35980 | 100.0 |
| Total Mid Head | 1311 | 48.1 | 1417 | 51.9 | 2728 | 100.0 |
| **TOTAL** | **21014** | **39.0** | **32801** | **61.0** | **53815** | **100.0** |

**Table ST3 Age and Gender of Primary Total Shoulder Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 21014 | 39.0% | 14 | 96 | 71 | 70.2 | 9.0 |
| Female | 32801 | 61.0% | 13 | 102 | 74 | 73.4 | 8.4 |
| **TOTAL** | **53815** | **100.0%** | **13** | **102** | **73** | **72.2** | **8.8** |

**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 Resurfacing | 33 | 14.0 | 77 | 32.8 | 106 | 45.1 | 19 | 8.1 | 235 | 100.0 |
| Total Stemmed | 824 | 5.5 | 3461 | 23.3 | 6596 | 44.4 | 3991 | 26.8 | 14872 | 100.0 |
| Total Reverse | 558 | 1.6 | 3638 | 10.1 | 13911 | 38.7 | 17873 | 49.7 | 35980 | 100.0 |
| Total Mid Head | 245 | 9.0 | 748 | 27.4 | 1221 | 44.8 | 514 | 18.8 | 2728 | 100.0 |
| **TOTAL** | **1660** | **3.1** | **7924** | **14.7** | **21834** | **40.6** | **22397** | **41.6** | **53815** | **100.0** |

**Table ST5 Primary Total Shoulder Replacement by Primary Diagnosis and Gender**

| Primary Diagnosis | Male | | Female | | TOTAL | |
|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% |
| Osteoarthritis | 13579 | 64.6 | 19061 | 58.1 | 32640 | 60.7 |
| Rotator Cuff Arthropathy | 5811 | 27.7 | 7201 | 22.0 | 13012 | 24.2 |
| Fracture | 907 | 4.3 | 4706 | 14.3 | 5613 | 10.4 |
| Rheumatoid Arthritis | 212 | 1.0 | 717 | 2.2 | 929 | 1.7 |
| Osteonecrosis | 157 | 0.7 | 557 | 1.7 | 714 | 1.3 |
| Instability | 158 | 0.8 | 270 | 0.8 | 428 | 0.8 |
| Other Inflammatory Arthritis | 76 | 0.4 | 177 | 0.5 | 253 | 0.5 |
| Tumour | 107 | 0.5 | 105 | 0.3 | 212 | 0.4 |
| Other | 7 | 0.0 | 7 | 0.0 | 14 | 0.0 |
| **TOTAL** | **21014** | **100.0** | **32801** | **100.0** | **53815** | **100.0** |

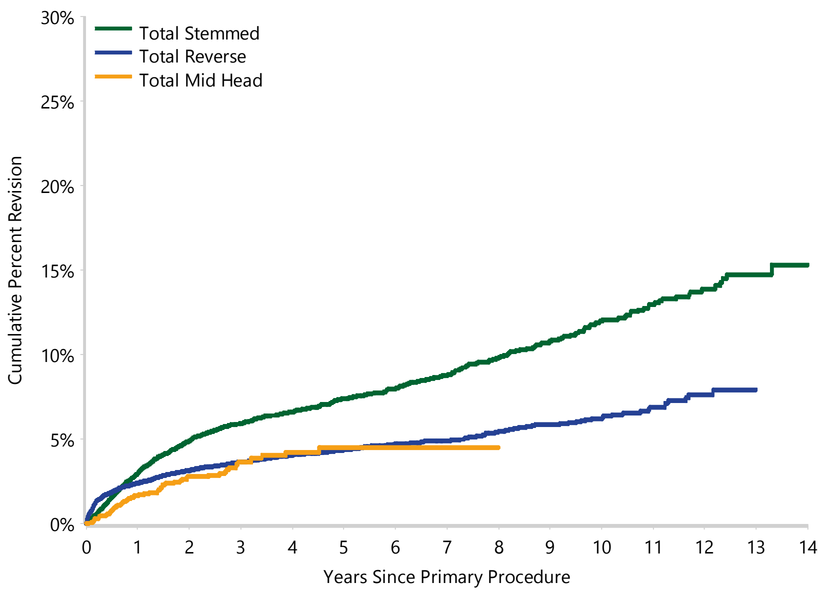
Note: Instability includes instability and dislocation

**Table ST6** **Cumulative Percent Revision of Primary Total Shoulder Replacement by Class**

| Shoulder Class | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Total Stemmed | 640 | 8324 | 3.0 (2.6, 3.4) | 5.9 (5.4, 6.5) | 7.4 (6.8, 8.0) | 8.8 (8.1, 9.6) | 12.0 (10.9, 13.1) | 15.3 (13.4, 17.4) |
| Total Reverse | 1238 | 34017 | 2.4 (2.2, 2.6) | 3.6 (3.4, 3.9) | 4.3 (4.1, 4.6) | 4.9 (4.6, 5.2) | 6.2 (5.7, 6.8) | |
| Total Mid Head | 64 | 2406 | 1.6 (1.2, 2.3) | 3.6 (2.8, 4.7) | 4.5 (3.4, 5.9) | 4.5 (3.4, 5.9) | | |
| TOTAL | 1942 | 44747 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST2** **Cumulative Percent Revision of Primary Total Shoulder Replacement by Class**




HR - adjusted for age and gender

Total Stemmed vs Total Reverse
0 - 3Mth: HR=0.42 (0.32, 0.55),p<0.001
3Mth+: HR=1.95 (1.74, 2.18),p<0.001

Total Stemmed vs Total Mid Head
Entire Period: HR=1.88 (1.45, 2.43),p<0.001

Total Mid Head vs Total Reverse
0 - 3Mth: HR=0.21 (0.11, 0.41),p<0.001
3Mth+: HR=1.05 (0.80, 1.39),p=0.713

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Total Stemmed | 8324 | 7408 | 5533 | 3858 | 2269 | 1058 | 40 |
| Total Reverse | 34017 | 27344 | 16229 | 8746 | 4352 | 1213 | 16 |
| Total Mid Head | 2406 | 1773 | 802 | 240 | 98 | 0 | 0 |

Note: Restricted to modern prostheses

## PRIMARY TOTAL RESURFACING SHOULDER REPLACEMENT

### DEMOGRAPHICS AND OUTCOME

There have been 235 primary total resurfacing shoulder replacements reported to the Registry. This is an additional 1 procedure compared to the previous report.

Primary total resurfacing shoulder replacement is undertaken more often in males and the mean age for males is younger than for females (Table ST7).

Osteoarthritis is the most common primary diagnosis (Table ST8).

The total resurfacing prostheses used are listed in Table ST9 and Table ST10.

The most common reason for revision is loosening (Table ST11). The most common type of revision is to a total shoulder replacement (Table ST12).

**Table ST7 Age and Gender of Primary Total Resurfacing Shoulder Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 140 | 59.6% | 35 | 83 | 63 | 62.2 | 9.8 |
| Female | 95 | 40.4% | 46 | 86 | 67 | 67.0 | 6.7 |
| TOTAL | 235 | 100.0% | 35 | 86 | 65 | 64.1 | 9.0 |

**Table ST8 Primary Total Resurfacing Shoulder Replacement by Primary Diagnosis and Gender**

| Primary Diagnosis | Male | | Female | | TOTAL | |
|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% |
| Osteoarthritis | 136 | 97.1 | 90 | 94.7 | 226 | 96.2 |
| Rheumatoid Arthritis | 1 | 0.7 | 2 | 2.1 | 3 | 1.3 |
| Fracture | 1 | 0.7 | 1 | 1.1 | 2 | 0.9 |
| Osteonecrosis | 1 | 0.7 | . | . | 1 | 0.4 |
| Rotator Cuff Arthropathy | . | . | 1 | 1.1 | 1 | 0.4 |
| Instability | 1 | 0.7 | . | . | 1 | 0.4 |
| Other Inflammatory Arthritis | . | . | 1 | 1.1 | 1 | 0.4 |
| TOTAL | 140 | 100.0 | 95 | 100.0 | 235 | 100.0 |

Note: Instability includes instability and dislocation

**Table ST9 Most Used Humeral Head Prostheses in Primary Total Resurfacing Shoulder Replacement**

| 2008 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 5 | SMR | 8 | Global CAP | 9 | Global CAP | 4 | Global CAP | 1 | Global CAP |
| 4 | Aequalis | 2 | Epoca RH | | | | | | |
| 2 | Copeland | | | | | | | | |
| 1 | Global CAP | | | | | | | | |
| Most Used | | | | | | | | | |
| 12 | (4) 100.0% | 10 | (2) 100.0% | 9 | (1) 100.0% | 4 | (1) 100.0% | 1 | (1) 100.0% |

**Table ST10 Most Used Glenoid Prostheses in Primary Total Resurfacing Shoulder Replacement**

| 2008 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 4 | Aequalis | 8 | Global | 9 | Global | 4 | Global | 1 | Global |
| 3 | SMR L1 | 2 | Epoca | | | | | | |
| 2 | Copeland | | | | | | | | |
| 2 | SMR | | | | | | | | |
| 1 | Global | | | | | | | | |
| Most Used | | | | | | | | | |
| 12 | (5) 100.0% | 10 | (2) 100.0% | 9 | (1) 100.0% | 4 | (1) 100.0% | 1 | (1) 100.0% |

**Table ST11 Primary Total Resurfacing Shoulder Replacement by Reason for Revision**

| Reason for Revision | Number | Percent |
|---|---|---|
| Loosening | 9 | 40.9 |
| Instability/Dislocation | 3 | 13.6 |
| Implant Breakage Glenoid Insert | 3 | 13.6 |
| Infection | 2 | 9.1 |
| Rotator Cuff Insufficiency | 2 | 9.1 |
| Fracture | 1 | 4.5 |
| Implant Breakage Glenoid | 1 | 4.5 |
| Wear Glenoid Insert | 1 | 4.5 |
| TOTAL | 22 | 100.0 |

**Table ST12 Primary Total Resurfacing Shoulder Replacement by Type of Revision**

| Type of Revision | Number | Percent |
|---|---|---|
| Humeral/Glenoid | 11 | 50.0 |
| Humeral Component | 6 | 27.3 |
| Insert Only | 2 | 9.1 |
| Head Only | 1 | 4.5 |
| Cement Spacer | 1 | 4.5 |
| Reoperation | 1 | 4.5 |
| TOTAL | 22 | 100.0 |

Note: Humeral heads are replaced when the humeral component is revised

## PRIMARY TOTAL MID HEAD SHOULDER REPLACEMENT

### DEMOGRAPHICS AND OUTCOME

There have been 2,728 primary total mid head shoulder replacements reported to the Registry. This is an additional 604 procedures compared to the previous report.

**The use of primary mid head shoulder replacement has increased by 740.9% since its first full year of use in 2012.**

Primary total mid head shoulder replacement is undertaken more often in females who have an older mean age than males (Table ST13).

Osteoarthritis is the most common primary diagnosis (Table ST14). The most used total mid head prostheses are listed in Table ST15 and Table ST16.

In order to keep Registry data contemporaneous, only procedures using prostheses that have been available and used in 2020 (described as modern prostheses) are included in the analyses, unless clearly specified.

The main reasons for revision are instability/dislocation, rotator cuff insufficiency, loosening, and infection (Table ST17).

The most common types of revision involve replacement of both the humeral and glenoid components with most being revised to a total reverse shoulder replacement (Table ST18).

The outcomes of the most commonly used prosthesis combinations are listed in Table ST19.

**Table ST13 Age and Gender of Primary Total Mid Head Shoulder Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 1311 | 48.1% | 32 | 95 | 65 | 64.7 | 9.1 |
| Female | 1417 | 51.9% | 32 | 94 | 69 | 68.9 | 8.2 |
| TOTAL | 2728 | 100.0% | 32 | 95 | 68 | 66.9 | 8.9 |

**Table ST14 Primary Total Mid Head Shoulder Replacement by Primary Diagnosis and Gender**

| Primary Diagnosis | Male | | Female | | TOTAL | |
|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% |
| Osteoarthritis | 1263 | 96.3 | 1329 | 93.8 | 2592 | 95.0 |
| Osteonecrosis | 12 | 0.9 | 38 | 2.7 | 50 | 1.8 |
| Rotator Cuff Arthropathy | 18 | 1.4 | 12 | 0.8 | 30 | 1.1 |
| Rheumatoid Arthritis | 4 | 0.3 | 18 | 1.3 | 22 | 0.8 |
| Instability | 11 | 0.8 | 5 | 0.4 | 16 | 0.6 |
| Other Inflammatory Arthritis | 2 | 0.2 | 11 | 0.8 | 13 | 0.5 |
| Fracture | 1 | 0.1 | 4 | 0.3 | 5 | 0.2 |
| TOTAL | 1311 | 100.0 | 1417 | 100.0 | 2728 | 100.0 |

**Table ST15 Most Used Humeral Stem Prostheses in Primary Total Mid Head Shoulder Replacement**

| 2011 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 2 | Simpliciti | 266 | Affinis | 270 | Affinis | 310 | Affinis | 367 | Affinis |
| 2 | TESS | 68 | Simpliciti | 108 | Simpliciti | 119 | Simpliciti | 162 | Simpliciti |
| 1 | Affinis | 27 | SMR | 39 | Comprehensive | 50 | Comprehensive | 32 | Comprehensive |
| | | 22 | Comprehensive | 29 | SMR | 34 | SMR | 22 | SMR |
| | | 8 | Sidus | 13 | Global Icon | 17 | Global Icon | 11 | Global Icon |
| | | | | 10 | Sidus | | | 2 | Equinoxe |
| | | | | | | | | 1 | Sidus |
| Most Used | | | | | | | | | |
| 5 | (3) 100.0% | 391 | (5) 100.0% | 469 | (6) 100.0% | 530 | (5) 100.0% | 597 | (7) 100.0% |

**Table ST16 Most Used Glenoid Prostheses in Primary Total Mid Head Shoulder Replacement**

| 2011 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 2 | Aequalis | 266 | Affinis | 257 | Affinis | 297 | Affinis | 343 | Affinis |
| 1 | Affinis | 53 | Aequalis | 81 | Perform | 120 | Perform | 162 | Perform |
| 1 | Comprehensive | 20 | Comprehensive | 38 | Comprehensive | 50 | Comprehensive | 35 | Global |
| 1 | TESS | 15 | Perform | 27 | Aequalis | 29 | Global | 33 | Comprehensive |
| | | 14 | SMR L1 | 27 | Global | 26 | SMR L1 | 12 | SMR L1 |
| | | 13 | SMR | 15 | SMR | 8 | SMR | 9 | SMR |
| | | 7 | Anatomical Shoulder | 14 | SMR L1 | | | 2 | Equinoxe |
| | | 2 | Custom Made (Comprehensive) | 7 | Anatomical Shoulder | | | 1 | Custom Made (Lima) |
| | | 1 | Bigliani/Flatow TM | 1 | Bigliani/Flatow | | | | |
| | | | | 1 | Bigliani/Flatow TM | | | | |
| Most Used | | | | | | | | | |
| 5 | (4) 100.0% | 391 | (9) 100.0% | 468 | (10) 99.8% | 530 | (6) 100.0% | 597 | (8) 100.0% |

**Table ST17 Primary Total Mid Head Shoulder Replacement by Reason for Revision**

| Reason for Revision | Number | Percent |
|---|---|---|
| Instability/Dislocation | 25 | 39.1 |
| Rotator Cuff Insufficiency | 14 | 21.9 |
| Loosening | 8 | 12.5 |
| Infection | 8 | 12.5 |
| Pain | 4 | 6.3 |
| Malposition | 1 | 1.6 |
| Incorrect Sizing | 1 | 1.6 |
| Lysis | 1 | 1.6 |
| Other | 2 | 3.1 |
| TOTAL | 64 | 100.0 |

Note: Restricted to modern prostheses

**Table ST18 Primary Total Mid Head Shoulder Replacement by Type of Revision**

| Type of Revision | Number | Percent |
|---|---|---|
| Humeral/Glenoid | 44 | 68.8 |
| Humeral Component | 7 | 10.9 |
| Head Only | 5 | 7.8 |
| Cement Spacer | 4 | 6.3 |
| Removal of Prostheses | 2 | 3.1 |
| Glenoid Component | 1 | 1.6 |
| Reoperation | 1 | 1.6 |
| TOTAL | 64 | 100.0 |

Note: Restricted to modern prostheses

**Table ST19 Cumulative Percent Revision of Primary Total Mid Head 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 | 47 | 1649 | 1.5 (1.0, 2.3) | 3.5 (2.6, 4.8) | 4.5 (3.3, 6.1) | 4.5 (3.3, 6.1) | | |
| | Global | 0 | 49 | 0.0 (0.0, 0.0) | | | | | |
| Comprehensive | Comprehensive | 7 | 150 | 3.6 (1.5, 8.6) | | | | | |
| Global Icon | Global | 0 | 41 | 0.0 (0.0, 0.0) | | | | | |
| SMR | SMR | 3 | 49 | 4.6 (1.2, 17.0) | 7.3 (2.4, 21.0) | | | | |
| | SMR L1 | 4 | 75 | 3.0 (0.8, 11.6) | 9.5 (3.2, 26.4) | | | | |
| Simpliciti | Perform | 2 | 379 | 0.7 (0.2, 3.0) | | | | | |
| Other (6) | | 1 | 14 | 7.7 (1.1, 43.4) | 7.7 (1.1, 43.4) | | | | |
| TOTAL | | 64 | 2406 | | | | | | |

Note: Only prostheses with >10 procedures have been listed
Restricted to modern prostheses

## PRIMARY TOTAL STEMMED SHOULDER REPLACEMENT

### DEMOGRAPHICS

There have been 14,872 total stemmed shoulder replacements reported to the Registry. This is an additional 641 procedures compared to the previous report.

Although the proportional use in males has increased since 2008, the majority of procedures are undertaken in females. The mean age of females is older than males (Figure ST3 and Table ST20).

Almost 50% of procedures are undertaken in the 65-74 year age group (Figure ST4).

Osteoarthritis is the most common primary diagnosis (Table ST21).

**The use of total stemmed shoulder replacement has, as in previous years, continued to decline.**

**Figure ST3 Primary Total Stemmed Shoulder Replacement by Gender**

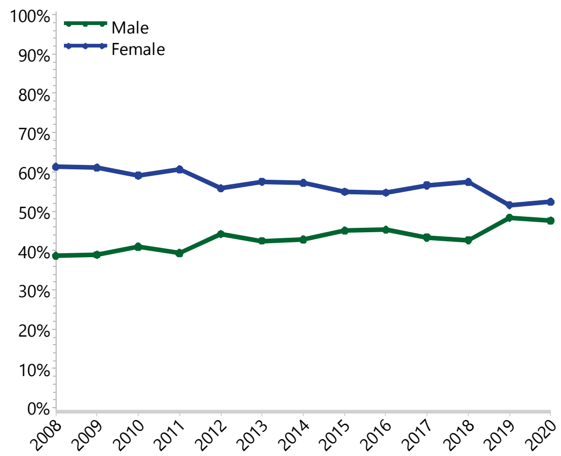



**Figure ST4 Primary Total Stemmed Shoulder Replacement by Age**

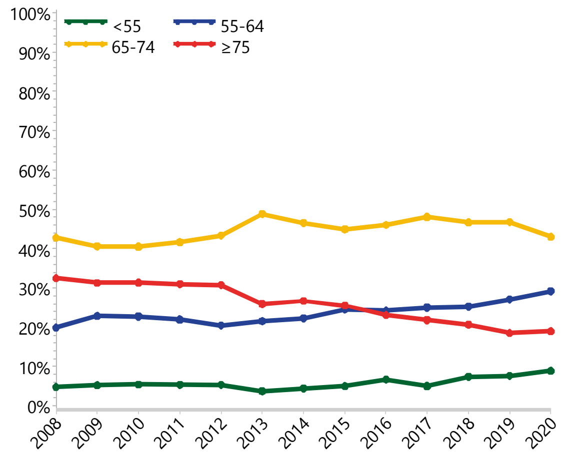



**Table ST20 Age and Gender of Primary Total Stemmed Shoulder Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 6347 | 42.7% | 21 | 93 | 67 | 66.9 | 9.0 |
| Female | 8525 | 57.3% | 19 | 96 | 71 | 70.4 | 8.5 |
| **TOTAL** | **14872** | **100.0%** | **19** | **96** | **69** | **68.9** | **8.9** |

**Table ST21 Primary Total Stemmed Shoulder Replacement by Primary Diagnosis and Gender**

| Primary Diagnosis | Male | | Female | | TOTAL | |
|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% |
| Osteoarthritis | 6077 | 95.7 | 7937 | 93.1 | 14014 | 94.2 |
| Rheumatoid Arthritis | 64 | 1.0 | 191 | 2.2 | 255 | 1.7 |
| Osteonecrosis | 66 | 1.0 | 180 | 2.1 | 246 | 1.7 |
| Fracture | 34 | 0.5 | 93 | 1.1 | 127 | 0.9 |
| Other Inflammatory Arthritis | 29 | 0.5 | 58 | 0.7 | 87 | 0.6 |
| Rotator Cuff Arthropathy | 41 | 0.6 | 41 | 0.5 | 82 | 0.6 |
| Instability | 29 | 0.5 | 16 | 0.2 | 45 | 0.3 |
| Tumour | 4 | 0.1 | 6 | 0.1 | 10 | 0.1 |
| Other | 3 | 0.0 | 3 | 0.0 | 6 | 0.0 |
| TOTAL | 6347 | 100.0 | 8525 | 100.0 | 14872 | 100.0 |

Note: Instability includes dislocation

The most common type of fixation, which continues to increase in use, is hybrid fixation (cementless humerus and cemented glenoid) (Figure ST5).

**Hybrid fixation with a cemented glenoid has increased from 55.8% in 2010 to 79.9% in 2020.**

The 10 most used humeral stem and glenoid prostheses are listed in Table ST22 and Table ST23.

**Figure ST5 Primary Total Stemmed Shoulder Replacement by Fixation**

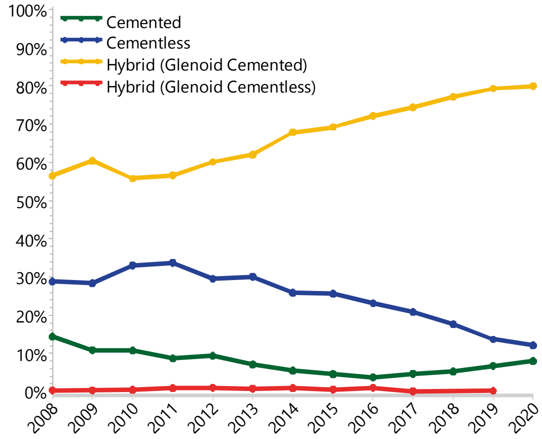


Table ST22 10 Most Used Humeral Stem Prostheses in Primary Total Stemmed Shoulder Replacement

| 2008 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 298 | SMR | 199 | SMR | 176 | Ascend Flex | 175 | Ascend Flex | 137 | Ascend Flex |
| 167 | Aequalis | 179 | Global AP | 146 | Comprehensive | 128 | Global Unite | 110 | Global Unite |
| 117 | Global Advantage | 178 | Global Unite | 146 | SMR | 119 | Comprehensive | 92 | Comprehensive |
| 91 | Global AP | 135 | Comprehensive | 137 | Global Unite | 119 | SMR | 89 | Equinoxe |
| 40 | Bigliani/Flatow | 122 | Ascend Flex | 134 | Global AP | 105 | Equinoxe | 89 | SMR |
| 37 | Bigliani/Flatow TM | 71 | Equinoxe | 80 | Equinoxe | 81 | Global AP | 75 | Global AP |
| 32 | Solar | 69 | Bigliani/Flatow TM | 36 | Bigliani/Flatow TM | 29 | Bigliani/Flatow TM | 19 | Global Advantage |
| 27 | Affinis | 49 | Aequalis | 16 | Global Advantage | 10 | Global Advantage | 9 | Bigliani/Flatow TM |
| 11 | Univers 3D | 25 | Global Advantage | 14 | Turon | 6 | MSS | 5 | Turon |
| 10 | Cofield 2 | 20 | Turon | 11 | Aequalis | 5 | Turon | 2 | Affinis |
| 10 Most Used | | | | | | | | | |
| 830 | (10) 97.9% | 1047 | (10) 97.9% | 896 | (10) 99.4% | 777 | (10) 99.2% | 627 | (10) 99.8% |
| Remainder | | | | | | | | | |
| 18 | (7) 2.1% | 23 | (5) 2.1% | 5 | (3) 0.6% | 6 | (2) 0.8% | 1 | (1) 0.2% |
| TOTAL | | | | | | | | | |
| 848 | (17) 100.0% | 1070 | (15) 100.0% | 901 | (13) 100.0% | 783 | (12) 100.0% | 628 | (11) 100.0% |

Table ST23 10 Most Used Glenoid Prostheses in Primary Total Stemmed Shoulder Replacement

| 2008 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 237 | SMR L1 | 381 | Global | 287 | Global | 221 | Global | 204 | Global |
| 209 | Global | 172 | SMR L1 | 153 | Perform | 179 | Perform | 137 | Perform |
| 167 | Aequalis | 131 | Comprehensive | 139 | Comprehensive | 114 | Comprehensive | 89 | Comprehensive |
| 79 | Bigliani/Flatow | 97 | Aequalis | 129 | SMR L1 | 105 | Equinoxe | 89 | Equinoxe |
| 57 | SMR | 86 | Perform | 80 | Equinoxe | 98 | SMR L1 | 73 | SMR L1 |
| 32 | Solar | 71 | Equinoxe | 34 | Aequalis | 23 | Bigliani/Flatow | 15 | SMR |
| 27 | Affinis | 37 | Bigliani/Flatow TM | 21 | Bigliani/Flatow | 18 | SMR | 8 | Bigliani/Flatow |
| 11 | Univers 3D | 32 | Bigliani/Flatow | 16 | Bigliani/Flatow TM | 6 | Bigliani/Flatow TM | 5 | Turon |
| 10 | Cofield 2 | 23 | SMR | 14 | SMR | 6 | MSS | 2 | Affinis |
| 7 | Promos | 20 | Turon | 14 | Turon | 5 | Custom Made (Comprehensive) | 2 | Alliance |
| 10 Most Used | | | | | | | | | |
| 836 | (10) 98.6% | 1050 | (10) 98.1% | 887 | (10) 98.4% | 775 | (10) 99.0% | 624 | (10) 99.4% |
| Remainder | | | | | | | | | |
| 12 | (6) 1.4% | 20 | (8) 1.9% | 14 | (5) 1.6% | 8 | (3) 1.0% | 4 | (4) 0.6% |
| TOTAL | | | | | | | | | |
| 848 | (16) 100.0% | 1070 | (18) 100.0% | 901 | (15) 100.0% | 783 | (13) 100.0% | 628 | (14) 100.0% |

## OUTCOME FOR ALL DIAGNOSES

### Primary Diagnosis

The Registry recognises that the usage and availability of prostheses change with time. In order to keep Registry data contemporaneous, only procedures using prostheses that have been available and used in 2020 (described as modern prostheses) are included in the analyses, unless clearly specified. This change to the assessment of the overall cumulative percent revision has been made to ensure that it reflects the use of currently available prostheses.

At 10 years, the cumulative percent revision for primary total stemmed shoulder replacement undertaken for osteoarthritis is 11.7%. There is no difference in the rate of revision when osteoarthritis is compared to other reasons for revision. However, the number of procedures undertaken for other diagnoses is small (Table ST24 and Figure ST6).

### Reason for Revision

The most common reason for revision is rotator cuff insufficiency followed by instability/ dislocation, and loosening (Table ST25 and Figure ST7).

### Type of Revision

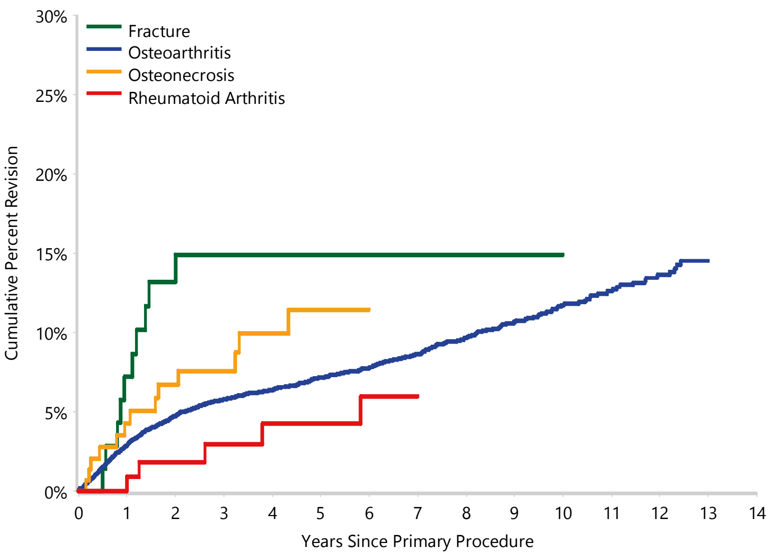
The most common type of revision is of the humeral component only. This may include the revision of a humeral component (epiphysis and/or humeral stem) and additional minor components, such as the humeral head/glenosphere and/or removal of the glenoid component (Table ST26). Almost all are revised to a total reverse shoulder replacement with retention of the original humeral stem on most occasions (87.5%).

**Table ST24 Cumulative Percent Revision of Primary Total Stemmed Shoulder Replacement by Primary Diagnosis**

| Primary Diagnosis | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Osteoarthritis | 591 | 7850 | 2.9 (2.5, 3.3) | 5.8 (5.3, 6.4) | 7.2 (6.6, 7.8) | 8.6 (7.9, 9.4) | 11.7 (10.7, 12.9) | |
| Osteonecrosis | 13 | 150 | 4.3 (1.9, 9.3) | 7.6 (4.1, 13.7) | 11.4 (6.7, 19.3) | | | |
| Rheumatoid Arthritis | 8 | 116 | 0.9 (0.1, 6.3) | 3.0 (1.0, 9.0) | 4.3 (1.6, 11.1) | 6.0 (2.5, 14.2) | | |
| Fracture | 10 | 72 | 7.2 (3.1, 16.5) | 14.9 (8.3, 26.0) | 14.9 (8.3, 26.0) | 14.9 (8.3, 26.0) | 14.9 (8.3, 26.0) | |
| Rotator Cuff Arthropathy | 9 | 57 | 7.4 (2.8, 18.4) | 14.1 (7.0, 27.6) | 17.3 (8.9, 32.2) | 17.3 (8.9, 32.2) | | |
| Other Inflammatory Arthritis | 4 | 45 | 4.7 (1.2, 17.3) | 4.7 (1.2, 17.3) | 7.7 (2.5, 22.3) | 7.7 (2.5, 22.3) | 16.1 (5.2, 43.7) | |
| Other (3) | 5 | 34 | 6.3 (1.6, 23.0) | 15.1 (5.8, 36.0) | 21.1 (9.0, 45.0) | | | |
| TOTAL | 640 | 8324 | | | | | | |

Note: Only primary diagnoses with over 30 procedures have been listed
Restricted to modern prostheses

**Figure ST6 Cumulative Percent Revision of Primary Total Stemmed Shoulder Replacement by Primary Diagnosis**




HR - adjusted for age and gender

Fracture vs Osteoarthritis
Entire Period: HR=1.71 (0.92, 3.20),p=0.092

Osteonecrosis vs Osteoarthritis
Entire Period: HR=1.06 (0.60, 1.84),p=0.850

Rheumatoid Arthritis vs Osteoarthritis
Entire Period: HR=0.63 (0.31, 1.29),p=0.206

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Fracture | 72 | 64 | 47 | 39 | 21 | 9 | 0 |
| Osteoarthritis | 7850 | 7001 | 5241 | 3655 | 2151 | 996 | 36 |
| Osteonecrosis | 150 | 124 | 84 | 50 | 25 | 14 | 1 |
| Rheumatoid Arthritis | 116 | 108 | 84 | 62 | 42 | 24 | 2 |

Note: Only primary diagnoses with over 70 procedures have been listed
Restricted to modern prostheses

**Table ST25 Primary Total Stemmed Shoulder Replacement by Reason for Revision**

| Reason for Revision | Number | Percent |
|---|---|---|
| Rotator Cuff Insufficiency | 216 | 33.8 |
| Instability/Dislocation | 172 | 26.9 |
| Loosening | 100 | 15.6 |
| Infection | 39 | 6.1 |
| Fracture | 21 | 3.3 |
| Arthrofibrosis | 13 | 2.0 |
| Pain | 13 | 2.0 |
| Malposition | 9 | 1.4 |
| Incorrect Sizing | 9 | 1.4 |
| Wear Glenoid Insert | 9 | 1.4 |
| Lysis | 7 | 1.1 |
| Implant Breakage Glenoid | 7 | 1.1 |
| Dissociation | 6 | 0.9 |
| Implant Breakage Glenoid Insert | 5 | 0.8 |
| Metal Related Pathology | 5 | 0.8 |
| Progression Of Disease | 2 | 0.3 |
| Other | 7 | 1.1 |
| TOTAL | 640 | 100.0 |

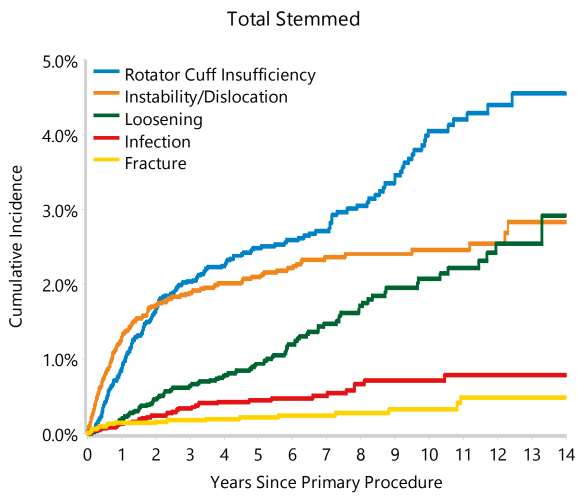
Note: Restricted to modern prostheses

**Table ST26 Primary Total Stemmed Shoulder Replacement by Type of Revision**

| Type of Revision | Number | Percent |
|---|---|---|
| Humeral Component | 358 | 55.9 |
| Humeral/Glenoid | 164 | 25.6 |
| Head Only | 54 | 8.4 |
| Glenoid Component | 28 | 4.4 |
| Cement Spacer | 20 | 3.1 |
| Reoperation | 5 | 0.8 |
| Removal of Prostheses | 5 | 0.8 |
| Minor Components | 3 | 0.5 |
| Head/Insert | 2 | 0.3 |
| Reinsertion of Components | 1 | 0.2 |
| TOTAL | 640 | 100.0 |

Note: Humeral heads are replaced when the humeral component is revised
Restricted to modern prostheses

**Figure ST7 Cumulative Incidence Revision Diagnosis of Primary Total Stemmed Shoulder Replacement**




Note: Restricted to modern prostheses

## OUTCOME FOR OSTEOARTHRITIS - PATIENT CHARACTERISTICS

### Age and Gender

Patients aged ≥65 years have a lower rate of revision compared to patients aged <55 years (Table ST27 and Figure ST8).

There is no difference in the rate of revision between males and females (Table ST28 and Figure ST9).

**There is no difference in the rate of revision between males and females.**

### ASA and BMI

Most patients have an ASA score of 2 or 3, and fewer patients have an ASA score of 1. ASA score does not affect the rate of revision (Table ST29 and Figure ST10). The most common reasons for revision by ASA score are presented in Figure ST11.

The most common BMI categories are pre-obese and obese class 1. BMI is not a risk factor for revision (Table ST30 and Figure ST12). The most common reasons for revision by BMI category are shown in Figure ST13.

### Glenoid Morphology

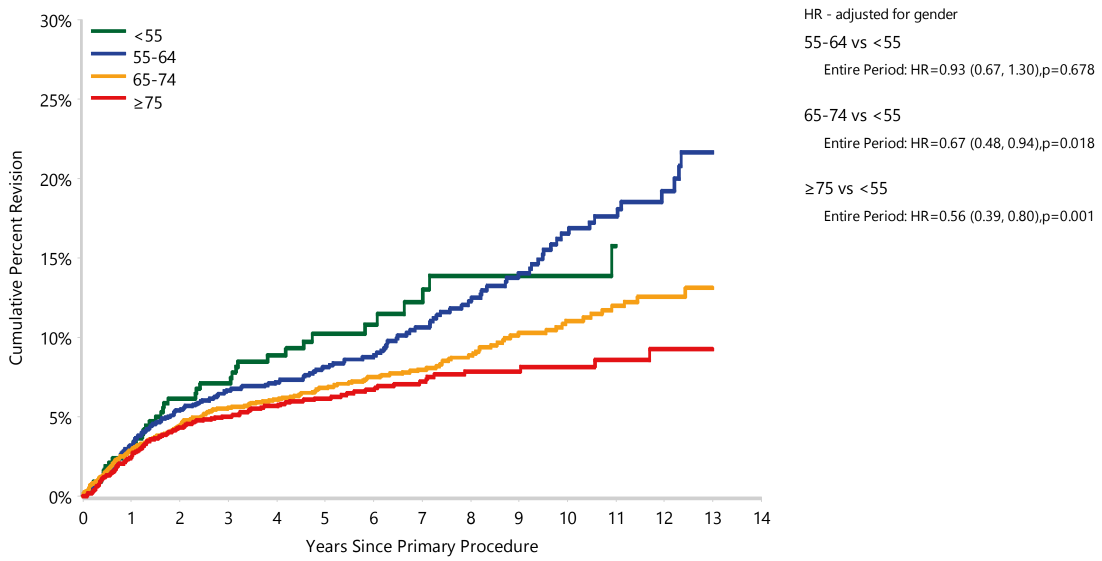
The Registry can now report on the early outcome of 2,221 primary total stemmed shoulder replacement procedures for osteoarthritis by glenoid morphology category. The distribution of the different morphology categories is presented in Table ST31. The category of glenoid morphology is not a risk factor for revision (Figure ST14).

**Table ST27** **Cumulative Percent Revision of Primary Total Stemmed Shoulder Replacement by Age (Primary Diagnosis OA)**

| Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| <55 | 42 | 438 | 3.1 (1.8, 5.4) | 7.1 (4.9, 10.2) | 10.2 (7.4, 14.1) | 12.2 (8.8, 16.8) | 13.9 (10.0, 19.1) | |
| 55-64 | 179 | 1915 | 3.2 (2.5, 4.1) | 6.7 (5.6, 8.0) | 8.2 (6.9, 9.7) | 10.6 (9.0, 12.6) | 16.5 (13.8, 19.7) | |
| 65-74 | 248 | 3525 | 2.9 (2.4, 3.5) | 5.6 (4.8, 6.4) | 6.8 (6.0, 7.8) | 8.0 (7.0, 9.1) | 11.0 (9.5, 12.8) | |
| ≥75 | 122 | 1972 | 2.5 (1.9, 3.3) | 5.0 (4.1, 6.1) | 6.2 (5.1, 7.4) | 7.2 (6.0, 8.7) | 8.1 (6.7, 9.8) | |
| TOTAL | 591 | 7850 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST8** **Cumulative Percent Revision of Primary Total Stemmed Shoulder Replacement by Age (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| <55 | 438 | 377 | 266 | 178 | 108 | 55 | 2 |
| 55-64 | 1915 | 1682 | 1237 | 860 | 487 | 244 | 9 |
| 65-74 | 3525 | 3157 | 2341 | 1622 | 951 | 441 | 19 |
| ≥75 | 1972 | 1785 | 1397 | 995 | 605 | 256 | 6 |

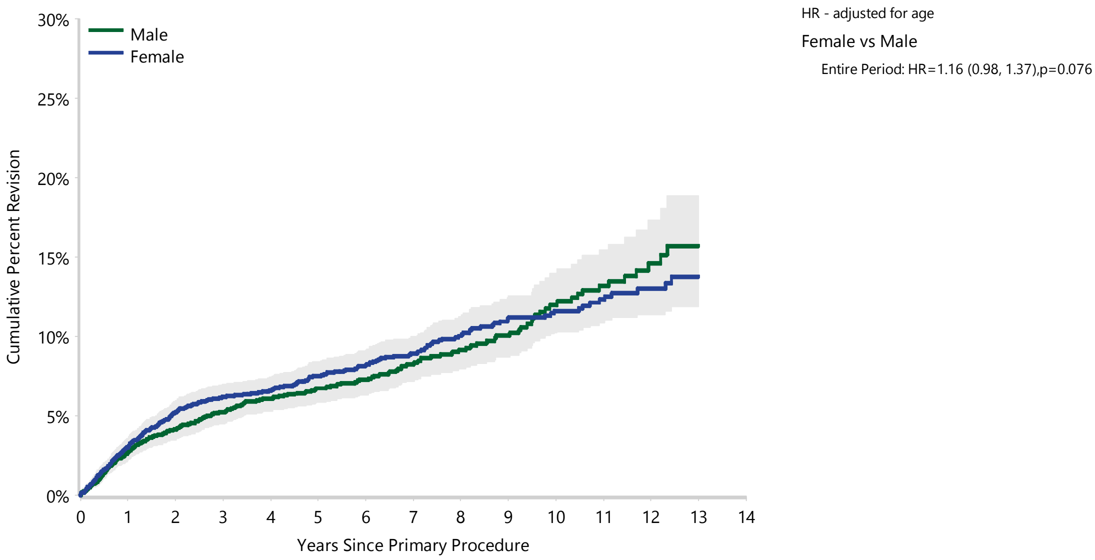
Note: Restricted to modern prostheses

**Table ST28** **Cumulative Percent Revision of Primary Total Stemmed Shoulder Replacement by Gender (Primary Diagnosis OA)**

| Gender | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Male | 249 | 3506 | 2.7 (2.2, 3.3) | 5.2 (4.5, 6.1) | 6.7 (5.9, 7.7) | 8.2 (7.2, 9.5) | 12.0 (10.2, 14.0) | |
| Female | 342 | 4344 | 3.0 (2.5, 3.6) | 6.2 (5.5, 7.0) | 7.5 (6.7, 8.4) | 8.9 (8.0, 10.0) | 11.6 (10.3, 13.1) | |
| TOTAL | 591 | 7850 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST9** **Cumulative Percent Revision of Primary Total Stemmed 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 | 3506 | 3103 | 2307 | 1572 | 900 | 407 | 16 |
| Female | 4344 | 3898 | 2934 | 2083 | 1251 | 589 | 20 |

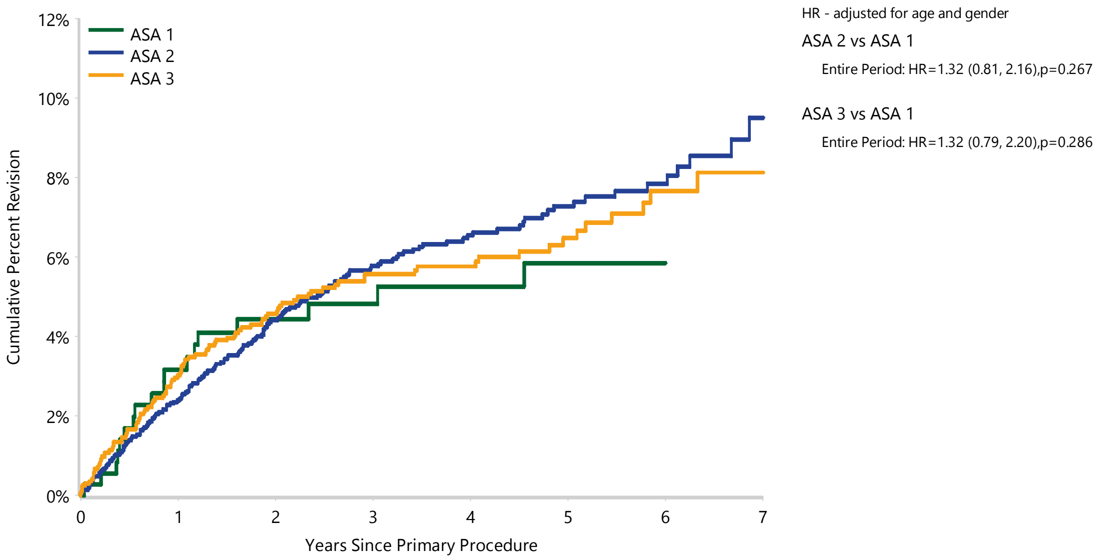
Note: Restricted to modern prostheses

**Table ST29** **Cumulative Percent Revision of Primary Total Stemmed Shoulder Replacement by ASA Score (Primary Diagnosis OA)**

| ASA Score | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|---|
| ASA 1 | 18 | 365 | 3.2 (1.8, 5.7) | 4.4 (2.7, 7.3) | 4.8 (3.0, 7.8) | 5.3 (3.3, 8.4) | 5.9 (3.7, 9.3) | |
| ASA 2 | 171 | 2917 | 2.4 (1.9, 3.0) | 4.4 (3.7, 5.3) | 5.8 (4.9, 6.8) | 6.5 (5.6, 7.7) | 7.3 (6.2, 8.5) | 9.5 (7.7, 11.7) |
| ASA 3 | 107 | 1966 | 3.0 (2.3, 3.9) | 4.6 (3.7, 5.7) | 5.6 (4.6, 6.8) | 5.8 (4.7, 7.0) | 6.5 (5.3, 7.9) | 8.1 (6.4, 10.2) |
| ASA 4 | 1 | 57 | 2.0 (0.3, 13.1) | 2.0 (0.3, 13.1) | 2.0 (0.3, 13.1) | 2.0 (0.3, 13.1) | 2.0 (0.3, 13.1) | |
| ASA 5 | 0 | 1 | | | | | | |
| TOTAL | 297 | 5306 | | | | | | |

Note: Restricted to modern prostheses

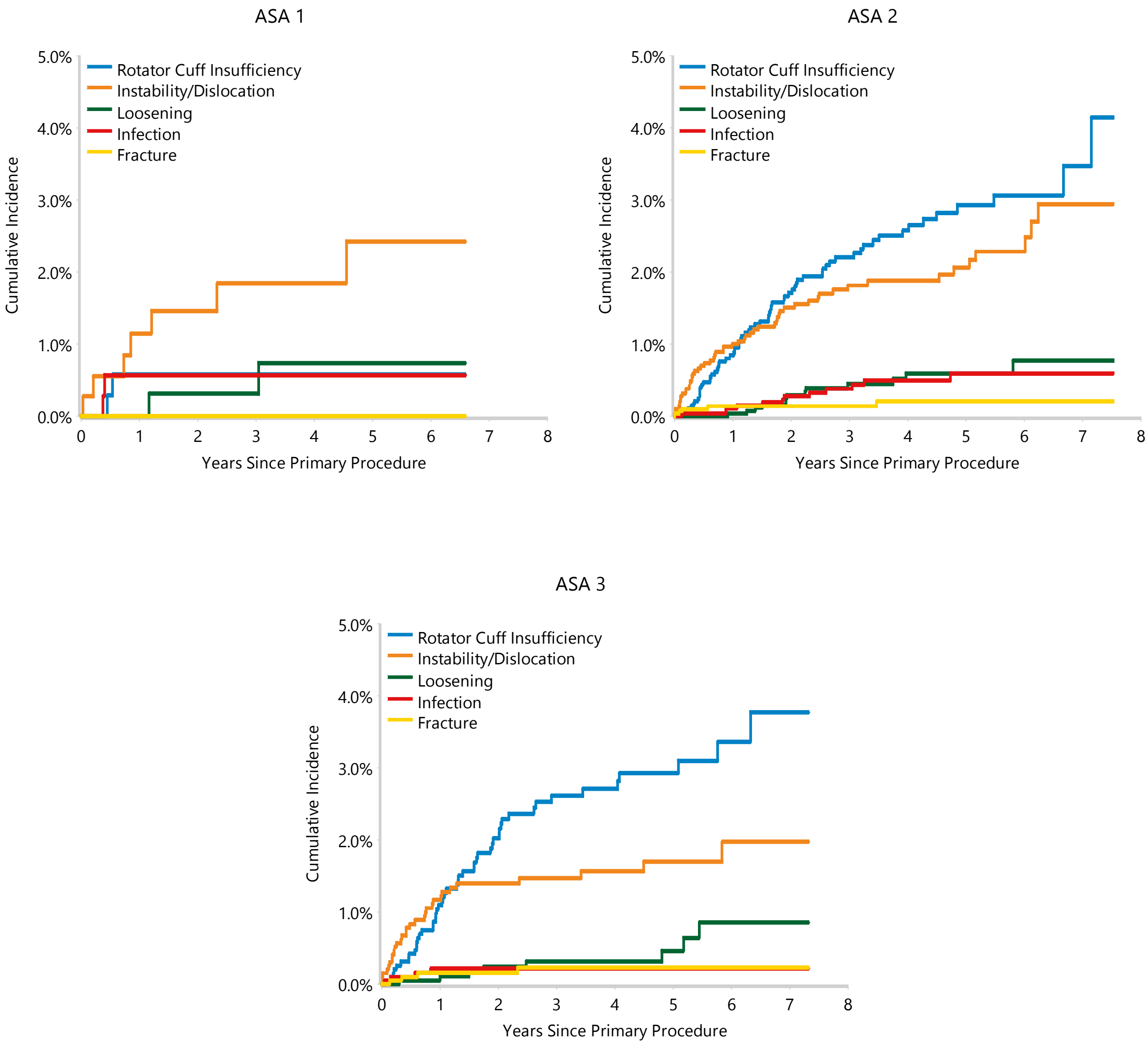
**Figure ST10** **Cumulative Percent Revision of Primary Total Stemmed Shoulder Replacement by ASA Score (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|
| ASA 1 | 365 | 314 | 271 | 219 | 181 | 128 | 16 |
| ASA 2 | 2917 | 2518 | 2074 | 1645 | 1218 | 840 | 145 |
| ASA 3 | 1966 | 1682 | 1366 | 1053 | 806 | 521 | 84 |

Note: Restricted to modern prostheses

**Figure ST11 Cumulative Incidence Revision Diagnosis of Primary Total Stemmed Shoulder Replacement by ASA Score (Primary Diagnosis OA)**



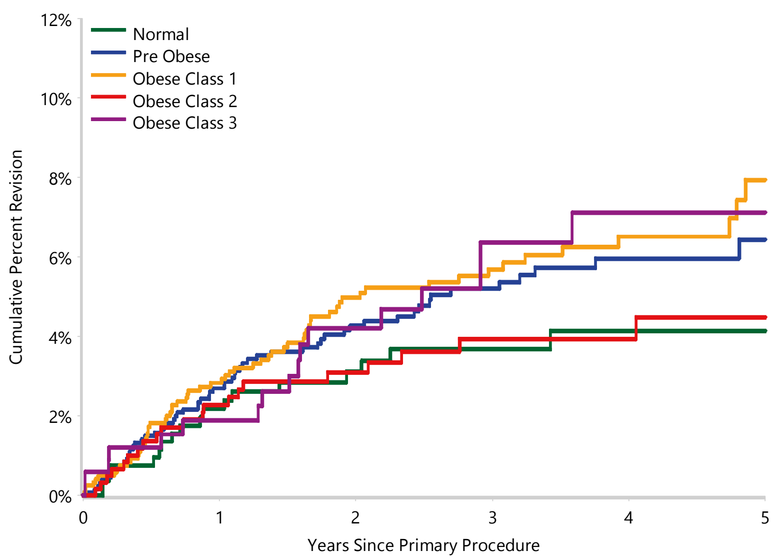

Note: Restricted to modern prostheses

**Table ST30** **Cumulative Percent Revision of Primary Total Stemmed Shoulder Replacement by BMI Category (Primary Diagnosis OA)**

| BMI Category | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|
| Underweight | 0 | 8 | 0.0 (0.0, 0.0) | | | | |
| Normal | 18 | 535 | 2.2 (1.2, 3.9) | 3.1 (1.9, 5.1) | 3.7 (2.3, 5.9) | 4.1 (2.6, 6.6) | 4.1 (2.6, 6.6) |
| Pre Obese | 61 | 1318 | 2.7 (1.9, 3.8) | 4.3 (3.2, 5.6) | 5.2 (4.0, 6.7) | 6.0 (4.6, 7.7) | 6.4 (4.9, 8.5) |
| Obese Class 1 | 65 | 1226 | 2.8 (2.0, 4.0) | 5.0 (3.8, 6.5) | 5.7 (4.4, 7.3) | 6.5 (5.0, 8.4) | 7.9 (5.9, 10.6) |
| Obese Class 2 | 21 | 612 | 2.3 (1.3, 3.9) | 3.1 (1.9, 5.0) | 3.9 (2.5, 6.1) | 3.9 (2.5, 6.1) | 4.5 (2.8, 7.0) |
| Obese Class 3 | 17 | 338 | 1.9 (0.8, 4.1) | 4.2 (2.4, 7.3) | 6.4 (3.9, 10.3) | 7.1 (4.4, 11.4) | 7.1 (4.4, 11.4) |
| TOTAL | 182 | 4037 | | | | | |

Note: BMI has not been presented for patients aged ≤19 years
Restricted to modern prostheses

**Figure ST12** **Cumulative Percent Revision of Primary Total Stemmed Shoulder Replacement by BMI Category (Primary Diagnosis OA)**




HR - adjusted for age and gender

Pre Obese vs Normal
Entire Period: HR=1.47 (0.87, 2.50),p=0.150

Obese Class 1 vs Normal
Entire Period: HR=1.66 (0.98, 2.81),p=0.057

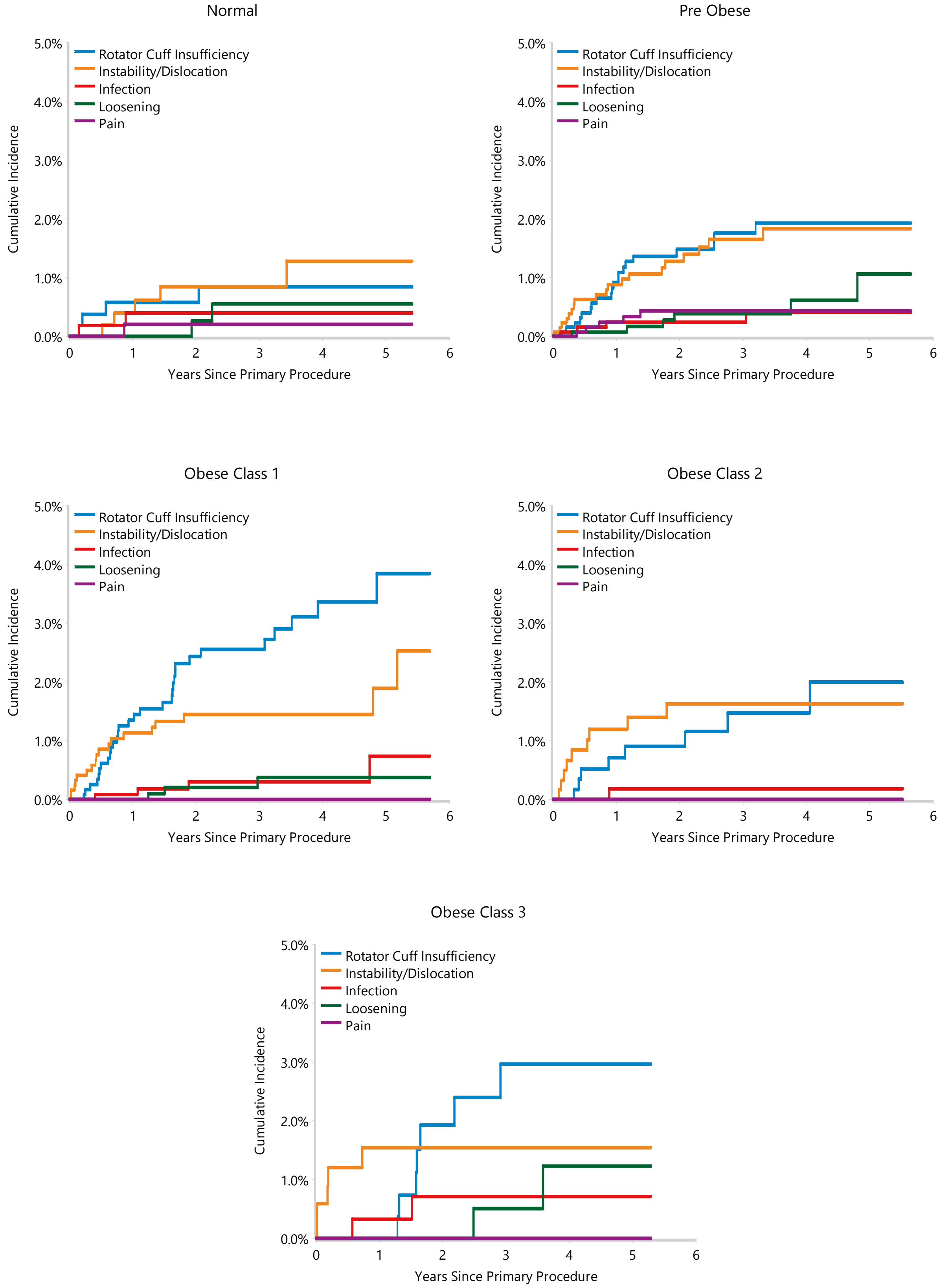
Obese Class 2 vs Normal
Entire Period: HR=1.02 (0.55, 1.93),p=0.940

Obese Class 3 vs Normal
Entire Period: HR=1.43 (0.74, 2.79),p=0.288

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|
| Normal | 535 | 454 | 359 | 254 | 162 | 85 |
| Pre Obese | 1318 | 1093 | 830 | 580 | 361 | 163 |
| Obese Class 1 | 1226 | 1012 | 782 | 557 | 346 | 163 |
| Obese Class 2 | 612 | 507 | 393 | 277 | 180 | 77 |
| Obese Class 3 | 338 | 275 | 218 | 154 | 106 | 50 |

Note: BMI has not been presented for patients aged ≤19 years
Restricted to modern prostheses

**Figure ST13 Cumulative Incidence Revision Diagnosis of Primary Total Stemmed Shoulder Replacement by BMI Category (Primary Diagnosis OA)**



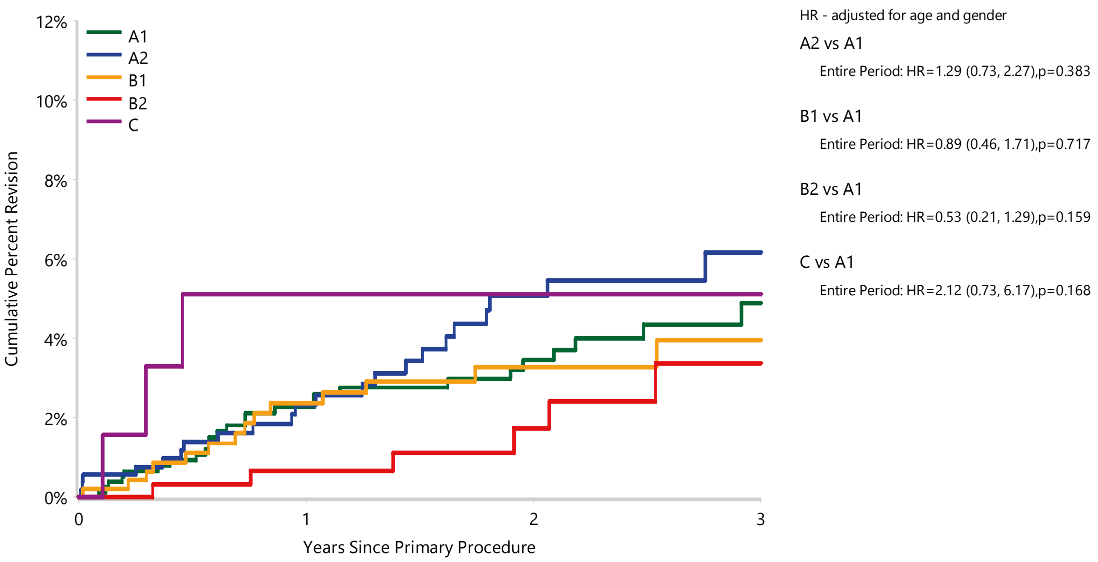

Note: BMI has not been presented for patients aged ≤19 years
Restricted to modern prostheses

**Table ST31** **Cumulative Percent Revision of Primary Total Stemmed Shoulder Replacement by Glenoid Morphology (Primary Diagnosis OA)**

| Glenoid Morphology | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs |
|---|---|---|---|---|---|
| A1 | 26 | 794 | 2.3 (1.4, 3.7) | 3.5 (2.3, 5.2) | 4.9 (3.2, 7.4) |
| A2 | 22 | 534 | 2.3 (1.3, 4.2) | 5.1 (3.3, 7.8) | 6.2 (4.0, 9.5) |
| B1 | 14 | 478 | 2.4 (1.3, 4.4) | 3.3 (1.9, 5.6) | 4.0 (2.3, 6.9) |
| B2 | 6 | 350 | 0.7 (0.2, 2.7) | 1.7 (0.6, 4.7) | 3.4 (1.4, 7.8) |
| C | 4 | 65 | 5.1 (1.7, 15.1) | 5.1 (1.7, 15.1) | 5.1 (1.7, 15.1) |
| TOTAL | 72 | 2221 | | | |

Note: Restricted to modern prostheses
3 procedures have been excluded where a glenoid morphology of B3 was recorded

**Figure ST14** **Cumulative Percent Revision of Primary Total Stemmed Shoulder Replacement by Glenoid Morphology (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs |
|---|---|---|---|---|
| A1 | 794 | 600 | 389 | 168 |
| A2 | 534 | 398 | 250 | 97 |
| B1 | 478 | 365 | 227 | 88 |
| B2 | 350 | 262 | 154 | 62 |
| C | 65 | 42 | 20 | 9 |

Note: Restricted to modern prostheses

## OUTCOME FOR OSTEOARTHRITIS - PROSTHESIS CHARACTERISTICS

### Fixation

Cementless fixation has a higher rate of revision compared to both cemented and hybrid (glenoid cemented) fixation. There is no difference between cemented and hybrid (glenoid cemented) fixation (Table ST32 and Figure ST15).

**The revision rate is increased if the glenoid is cementless.**

### Glenoid Type and Design

An analysis was undertaken to determine the impact of glenoid type. There are three broad glenoid types: modular metal backed, non modular metal backed and all-polyethylene. Cemented all-polyethylene glenoids are the most common type of glenoid used. These prostheses have a lower rate of revision compared to modular metal backed glenoids over the entire period and when compared to non modular metal backed glenoid prostheses in the first 1.5 years. Modular metal backed glenoids have a higher rate of revision compared to non modular metal backed glenoids (Table ST33 and Figure ST16).

When a modular metal backed glenoid was revised, most retained the metal glenoid component (base plate) and replaced the modular insert with a glenosphere. The humeral stem was also revised in only a small number of revisions.

Pegged and keeled all-polyethylene glenoid prostheses were also compared. The majority of all-polyethylene glenoid prostheses are pegged. There is no difference in the rate of revision between these prostheses (Table ST34 and Figure ST17).

The most common type of polyethylene used is non XLPE. XLPE increased in use up to 2015 but has remained relatively constant since that time (Figure ST18).

Glenoid prostheses using XLPE have a lower rate of revision compared to non XLPE (Table ST35 and Figure ST19).

**XLPE glenoids have a lower rate of revision than non XLPE glenoids.**

This is also the case when only cemented all-polyethylene glenoids using non XLPE and XLPE are compared (Table ST36 and Figure ST20). However, it remains uncertain if these differences are due to the XLPE or the prosthesis with which it is used. Prosthesis combinations with both XLPE and non XLPE are provided in Table ST37.

### Humeral Heads

Humeral head sizes <44mm have the highest rate of revision. This rate of revision decreases with increasing humeral head size. Humeral heads >50mm have the lowest rate of revision (Table ST38 and Figure ST21). The cumulative incidence for the most common reasons for revision of the different head sizes is shown in Figure ST22.

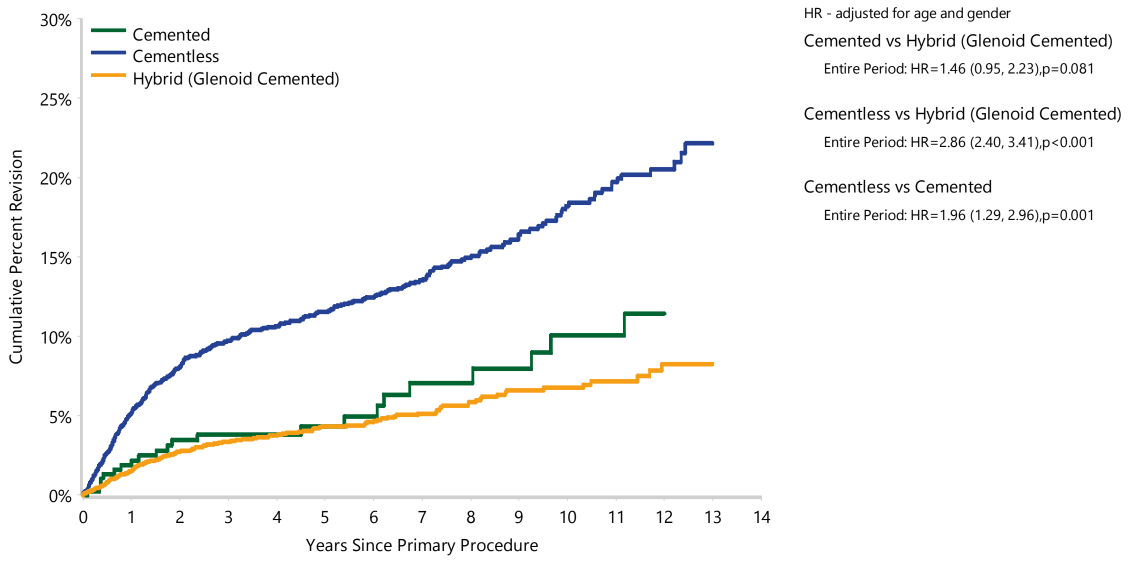
The outcomes of the most commonly used prosthesis combinations are listed in Table ST39. The most commonly used cementless prosthesis combinations are listed in Table ST40. The most commonly used prosthesis combinations with hybrid (glenoid cemented) fixation are listed in Table ST41.

**Table ST32** **Cumulative Percent Revision of Primary Total Stemmed 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 | 24 | 393 | 1.9 (0.9, 3.9) | 3.8 (2.2, 6.5) | 4.3 (2.6, 7.3) | 7.1 (4.3, 11.4) | 10.1 (6.3, 16.0) | |
| Cementless | 371 | 2730 | 5.2 (4.4, 6.1) | 9.7 (8.7, 11.0) | 11.5 (10.4, 12.9) | 13.5 (12.2, 15.0) | 18.2 (16.2, 20.4) | |
| Hybrid (Glenoid Cemented) | 189 | 4675 | 1.5 (1.2, 1.9) | 3.4 (2.9, 4.0) | 4.3 (3.7, 5.1) | 5.1 (4.4, 6.0) | 6.8 (5.7, 8.0) | |
| Hybrid (Glenoid Cementless) | 7 | 52 | 5.8 (1.9, 16.9) | 7.9 (3.0, 19.7) | 15.6 (7.7, 30.4) | 15.6 (7.7, 30.4) | | |
| TOTAL | 591 | 7850 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST15** **Cumulative Percent Revision of Primary Total Stemmed 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 | 393 | 336 | 235 | 168 | 116 | 79 | 4 |
| Cementless | 2730 | 2503 | 2110 | 1634 | 1005 | 424 | 10 |
| Hybrid (Glenoid Cemented) | 4675 | 4114 | 2852 | 1824 | 1012 | 487 | 22 |

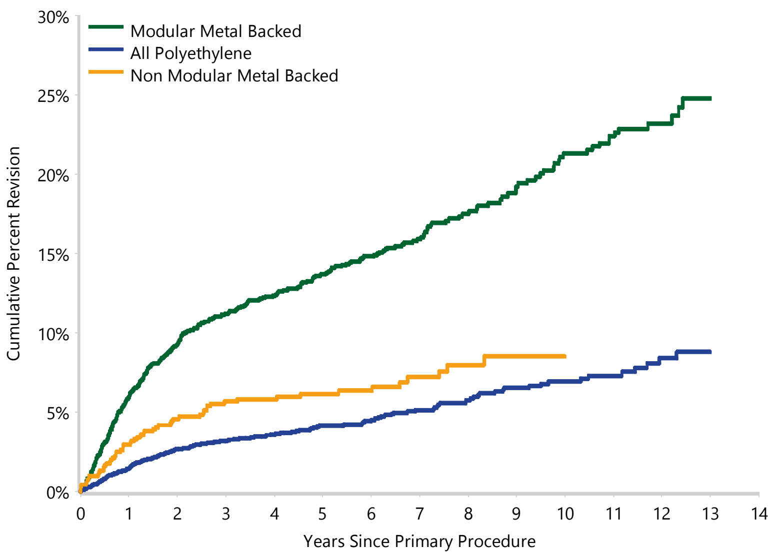
Note: Only fixations with over 100 procedures have been listed
Restricted to modern prostheses

**Table ST33** **Cumulative Percent Revision of Primary Total Stemmed 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 |
|---|---|---|---|---|---|---|---|---|
| Modular Metal Backed | 334 | 2121 | 6.0 (5.0, 7.1) | 11.2 (9.9, 12.7) | 13.7 (12.2, 15.3) | 15.9 (14.2, 17.7) | 21.3 (19.0, 23.9) | |
| All Polyethylene | 198 | 4817 | 1.5 (1.2, 1.9) | 3.2 (2.7, 3.8) | 4.1 (3.5, 4.8) | 5.1 (4.4, 6.0) | 6.9 (5.9, 8.2) | |
| Non Modular Metal Backed | 59 | 912 | 3.0 (2.0, 4.3) | 5.7 (4.3, 7.5) | 6.1 (4.7, 8.0) | 7.2 (5.5, 9.4) | 8.5 (6.4, 11.3) | |
| TOTAL | 591 | 7850 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST16** **Cumulative Percent Revision of Primary Total Stemmed Shoulder Replacement by Glenoid Type (Primary Diagnosis OA)**




HR - adjusted for age and gender

Modular Metal Backed vs All Polyethylene
Entire Period: HR=3.34 (2.80, 3.98),p<0.001

Modular Metal Backed vs Non Modular Metal Backed
Entire Period: HR=2.24 (1.70, 2.96),p<0.001

Non Modular Metal Backed vs All Polyethylene
0 - 1.5Yr: HR=1.71 (1.18, 2.48),p=0.004
1.5Yr - 2.5Yr: HR=1.07 (0.49, 2.34),p=0.855
2.5Yr+: HR=1.37 (0.83, 2.26),p=0.219

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Modular Metal Backed | 2121 | 1915 | 1572 | 1214 | 749 | 371 | 10 |
| All Polyethylene | 4817 | 4273 | 3003 | 1950 | 1124 | 565 | 26 |
| Non Modular Metal Backed | 912 | 813 | 666 | 491 | 278 | 60 | 0 |

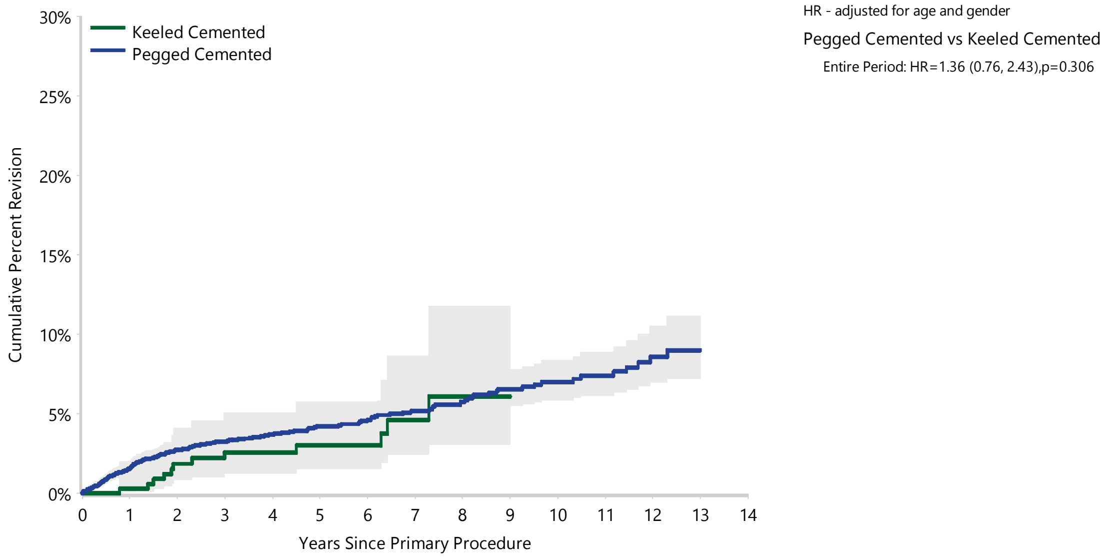
Note: Restricted to modern prostheses

**Table ST34 Cumulative Percent Revision of All-Polyethylene Cemented Primary Total Stemmed Shoulder Replacement by Glenoid Design (Primary Diagnosis OA)**

| Glenoid Design | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Keeled Cemented | 12 | 382 | 0.3 (0.0, 2.0) | 2.6 (1.3, 5.1) | 3.0 (1.6, 5.7) | 4.6 (2.4, 8.7) | | |
| Pegged Cemented | 186 | 4428 | 1.6 (1.2, 2.0) | 3.3 (2.7, 3.9) | 4.2 (3.6, 5.0) | 5.2 (4.4, 6.1) | 7.0 (5.9, 8.3) | |
| TOTAL | 198 | 4810 | | | | | | |

Note: Restricted to modern prostheses

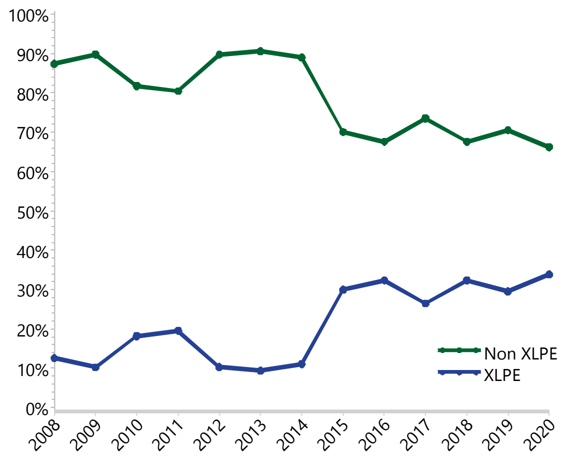
**Figure ST17 Cumulative Percent Revision of All-Polyethylene Cemented Primary Total Stemmed Shoulder Replacement by Glenoid Design (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Keeled Cemented | 382 | 338 | 268 | 194 | 73 | 33 | 6 |
| Pegged Cemented | 4428 | 3931 | 2733 | 1755 | 1050 | 532 | 20 |

Note: Restricted to modern prostheses

**Figure ST18 Primary Total Stemmed Shoulder Replacement by Polyethylene Type (All Diagnoses)**



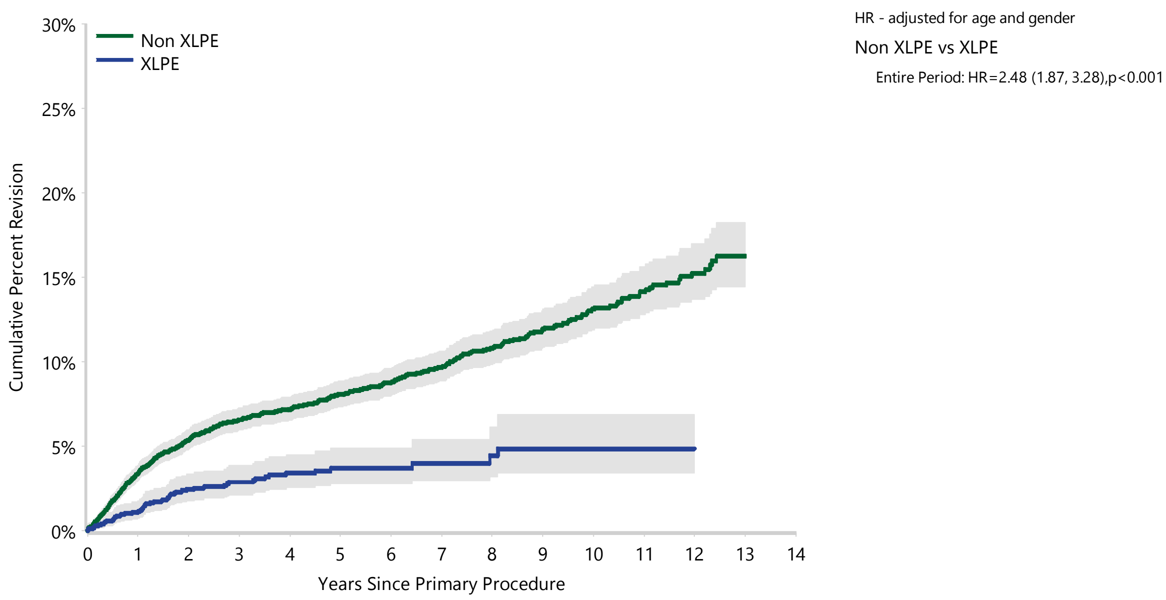

Note: Restricted to modern prostheses

**Table ST35 Cumulative Percent Revision of Primary Total Stemmed Shoulder Replacement using All Types of Glenoids by Polyethylene Type (Primary Diagnosis OA)**

| Polyethylene Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Non XLPE | 537 | 6076 | 3.4 (2.9, 3.9) | 6.6 (5.9, 7.3) | 8.1 (7.3, 8.9) | 9.7 (8.8, 10.6) | 13.1 (11.9, 14.4) | |
| XLPE | 53 | 1754 | 1.1 (0.7, 1.8) | 2.9 (2.1, 3.9) | 3.7 (2.8, 4.9) | 4.0 (3.0, 5.4) | 4.9 (3.4, 6.9) | |
| TOTAL | 590 | 7830 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST19 Cumulative Percent Revision of Primary Total Stemmed Shoulder Replacement using All Types of Glenoids by Polyethylene Type (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Non XLPE | 6076 | 5457 | 4199 | 3067 | 1876 | 866 | 31 |
| XLPE | 1754 | 1527 | 1030 | 578 | 275 | 130 | 5 |

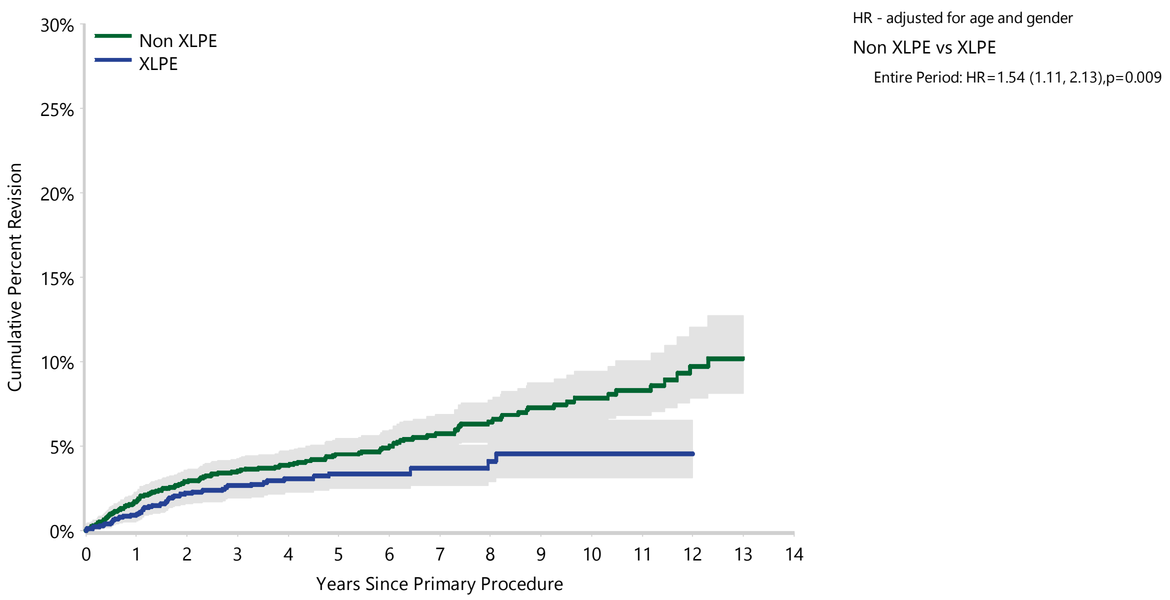
Note: Restricted to modern prostheses

**Table ST36** **Cumulative Percent Revision of Primary Total Stemmed Shoulder Replacement using All-Polyethylene Glenoids by Polyethylene Type (Primary Diagnosis OA)**

| Polyethylene Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Non XLPE | 150 | 3073 | 1.7 (1.3, 2.3) | 3.5 (2.9, 4.3) | 4.5 (3.8, 5.4) | 5.7 (4.8, 6.9) | 7.8 (6.5, 9.5) | |
| XLPE | 48 | 1742 | 1.0 (0.6, 1.6) | 2.7 (1.9, 3.6) | 3.4 (2.5, 4.6) | 3.7 (2.7, 5.0) | 4.6 (3.2, 6.6) | |
| TOTAL | 198 | 4815 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST20** **Cumulative Percent Revision of Primary Total Stemmed Shoulder Replacement using All-Polyethylene Glenoids by Polyethylene Type (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Non XLPE | 3073 | 2755 | 1975 | 1372 | 849 | 435 | 21 |
| XLPE | 1742 | 1518 | 1028 | 578 | 275 | 130 | 5 |

Note: Restricted to modern prostheses

**Table ST37** **Primary Total Stemmed Shoulder Replacement using All-Polyethylene Glenoids by Polyethylene Type and Prosthesis Combination (All Diagnoses)**

| | Non XLPE | | | XLPE | | | TOTAL | | |
|---|---|---|---|---|---|---|---|---|---|
| Prosthesis Combination | N | Row% | Col% | N | Row% | Col% | N | Row% | Col% |
| Global Unite/Global | 24 | 2.7 | 3.0 | 881 | 97.3 | 50.7 | 905 | 100.0 | 35.5 |
| Global Advantage/Global | 560 | 77.5 | 69.1 | 163 | 22.5 | 9.4 | 723 | 100.0 | 28.4 |
| SMR/SMR | 30 | 6.4 | 3.7 | 440 | 93.6 | 25.3 | 470 | 100.0 | 18.4 |
| Global AP/Global | 20 | 7.4 | 2.5 | 250 | 92.6 | 14.4 | 270 | 100.0 | 10.6 |
| Affinis/Affinis | 177 | 97.3 | 21.8 | 5 | 2.7 | 0.3 | 182 | 100.0 | 7.1 |
| TOTAL | 811 | 31.8 | 100.0 | 1739 | 68.2 | 100.0 | 2550 | 100.0 | 100.0 |

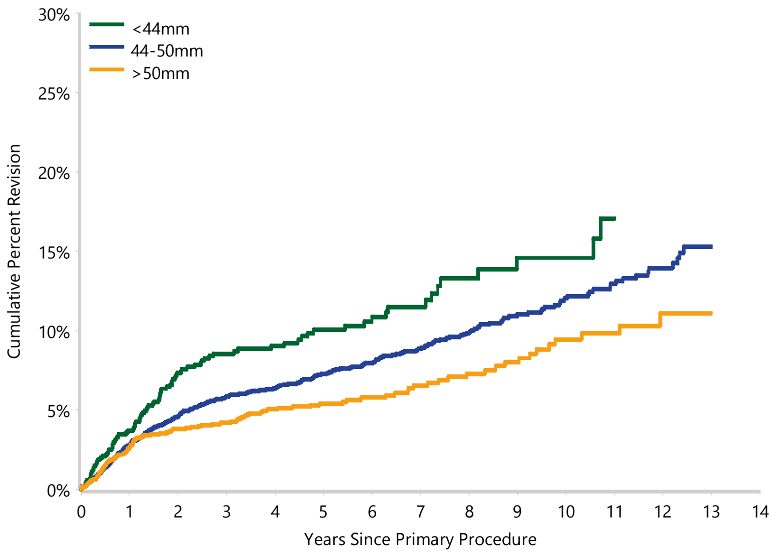
Note: Restricted to modern prostheses

**Table ST38 Cumulative Percent Revision of Primary Total Stemmed 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 | 97 | 1014 | 3.7 (2.7, 5.1) | 8.6 (6.9, 10.6) | 10.1 (8.2, 12.4) | 11.5 (9.3, 14.2) | 14.6 (11.5, 18.4) | |
| 44-50mm | 380 | 4845 | 2.8 (2.4, 3.3) | 5.9 (5.2, 6.6) | 7.3 (6.5, 8.1) | 8.9 (7.9, 9.9) | 12.0 (10.7, 13.5) | |
| >50mm | 114 | 1990 | 2.6 (2.0, 3.4) | 4.2 (3.4, 5.2) | 5.4 (4.4, 6.6) | 6.6 (5.3, 8.0) | 9.5 (7.6, 11.8) | |
| TOTAL | 591 | 7849 | | | | | | |

Note: Excludes 1 procedure with unknown head size
Restricted to modern prostheses

**Figure ST21 Cumulative Percent Revision of Primary Total Stemmed Shoulder Replacement by Humeral Head Size (Primary Diagnosis OA)**




HR - adjusted for age and gender

<44mm vs >50mm

Entire Period: HR=2.05 (1.49, 2.83),p<0.001

<44mm vs 44-50mm

Entire Period: HR=1.41 (1.12, 1.78),p=0.003

44-50mm vs >50mm

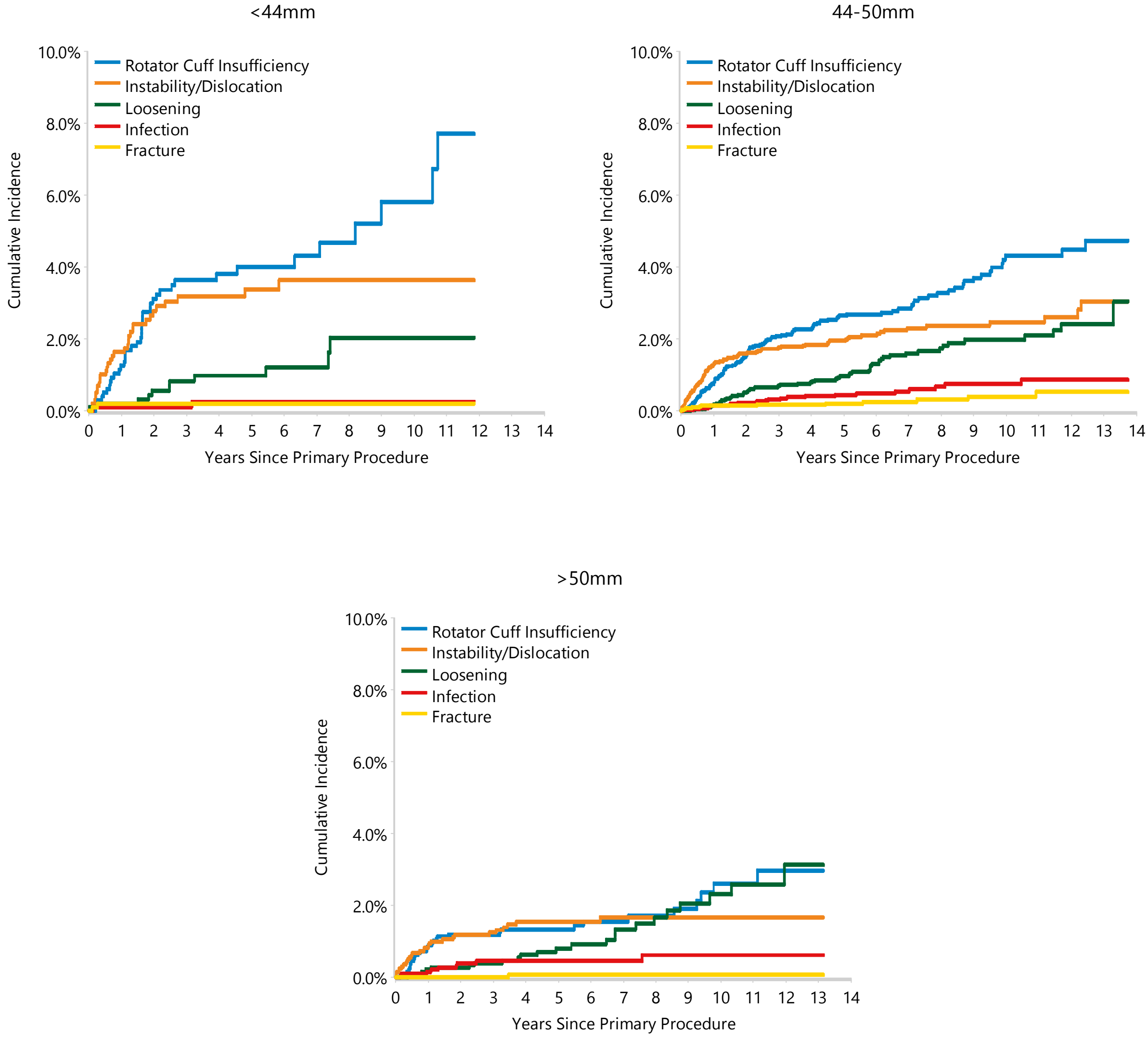
0 - 1.5Yr: HR=1.29 (0.97, 1.72),p=0.077

1.5Yr+: HR=1.67 (1.25, 2.24),p<0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| <44mm | 1014 | 878 | 609 | 403 | 214 | 84 | 3 |
| 44-50mm | 4845 | 4370 | 3308 | 2355 | 1391 | 647 | 23 |
| >50mm | 1990 | 1753 | 1324 | 897 | 546 | 265 | 10 |

Note: Excludes 1 procedure with unknown head size
Restricted to modern prostheses

**Figure ST22** **Cumulative Incidence Revision Diagnosis of Primary Total Stemmed Shoulder Replacement by Humeral Head Size (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

**Table ST39 Cumulative Percent Revision of Primary Total Stemmed 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 | 14 | 182 | 0.0 (0.0, 0.0) | 1.7 (0.6, 5.2) | 4.7 (2.4, 9.3) | 5.4 (2.8, 10.1) | 8.2 (4.8, 13.8) | |
| Ascend Flex | Perform | 9 | 772 | 0.6 (0.2, 1.5) | 1.3 (0.6, 2.5) | 1.6 (0.8, 3.1) | | | |
| Bigliani/Flatow TM | Bigliani/Flatow | 27 | 449 | 1.8 (0.9, 3.6) | 4.2 (2.7, 6.6) | 5.0 (3.3, 7.6) | 6.1 (4.1, 9.1) | 7.8 (5.3, 11.4) | |
| | Bigliani/Flatow TM | 40 | 642 | 2.3 (1.4, 3.9) | 4.7 (3.3, 6.7) | 5.1 (3.6, 7.1) | 6.2 (4.5, 8.6) | 7.2 (5.1, 10.0) | |
| Comprehensive | Comprehensive | 32 | 688 | 3.6 (2.4, 5.3) | 4.6 (3.2, 6.6) | 5.3 (3.7, 7.5) | 5.3 (3.7, 7.5) | | |
| Equinoxe | Equinoxe | 32 | 483 | 3.2 (1.9, 5.3) | 7.0 (4.8, 10.2) | 9.3 (6.3, 13.8) | | | |
| Global AP | Global | 5 | 270 | 0.8 (0.2, 3.2) | | | | | |
| Global Advantage | Global | 47 | 723 | 1.3 (0.7, 2.4) | 3.5 (2.3, 5.1) | 4.0 (2.7, 5.8) | 5.4 (3.9, 7.5) | 7.2 (5.3, 9.9) | |
| Global Unite | Global | 16 | 905 | 0.6 (0.2, 1.4) | 1.6 (0.9, 2.9) | 2.7 (1.6, 4.7) | | | |
| SMR | SMR | 24 | 470 | 1.9 (1.0, 3.7) | 4.4 (2.9, 6.8) | 4.7 (3.1, 7.1) | 5.0 (3.3, 7.5) | 5.9 (3.9, 8.7) | |
| | SMR L1 | 327 | 2088 | 5.9 (4.9, 7.0) | 11.1 (9.8, 12.6) | 13.5 (12.0, 15.1) | 15.7 (14.1, 17.6) | 21.2 (18.8, 23.8) | |
| Turon | Turon | 6 | 112 | 2.7 (0.9, 8.1) | 4.7 (2.0, 10.9) | 4.7 (2.0, 10.9) | | | |
| Other (8) | | 12 | 66 | 7.9 (3.4, 18.0) | 13.0 (6.7, 24.3) | 20.1 (11.5, 33.8) | 20.1 (11.5, 33.8) | 24.3 (13.9, 40.5) | |
| TOTAL | | 591 | 7850 | | | | | | |

Note: Only combinations with over 50 procedures have been listed
Restricted to modern prostheses

**Table ST40 Cumulative Percent Revision of Cementless Primary Total Stemmed 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 |
|---|---|---|---|---|---|---|---|---|---|
| Bigliani/Flatow TM | Bigliani/Flatow TM | 38 | 615 | 2.1 (1.2, 3.6) | 4.6 (3.2, 6.6) | 5.0 (3.5, 7.1) | 6.2 (4.4, 8.6) | 7.2 (5.1, 10.1) | |
| Comprehensive | Custom Made (Comprehensive) | 5 | 12 | 25.0 (8.8, 59.2) | | | | | |
| Equinoxe | Equinoxe | 5 | 36 | 11.1 (4.3, 26.9) | 14.0 (6.1, 30.4) | 14.0 (6.1, 30.4) | | | |
| SMR | SMR L1 | 321 | 2057 | 5.9 (4.9, 7.0) | 11.1 (9.8, 12.6) | 13.4 (11.9, 15.0) | 15.6 (14.0, 17.5) | 21.1 (18.7, 23.7) | |
| Other (5) | | 2 | 10 | 10.0 (1.5, 52.7) | 10.0 (1.5, 52.7) | 10.0 (1.5, 52.7) | 10.0 (1.5, 52.7) | 32.5 (8.1, 83.8) | |
| TOTAL | | 371 | 2730 | | | | | | |

Note: Only prostheses with over 10 procedures have been listed
Restricted to modern prostheses

**Table ST41 Cumulative Percent Revision of Hybrid (Glenoid Cemented) Primary Total Stemmed 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 | 14 | 177 | 0.0 (0.0, 0.0) | 1.7 (0.6, 5.3) | 4.8 (2.4, 9.4) | 5.5 (2.9, 10.3) | 8.3 (4.9, 13.9) | |
| Ascend Flex | Perform | 9 | 692 | 0.6 (0.2, 1.7) | 1.4 (0.7, 2.8) | 1.7 (0.9, 3.4) | | | |
| Bigliani/Flatow TM | Bigliani/Flatow | 20 | 418 | 1.2 (0.5, 2.9) | 3.3 (1.9, 5.6) | 4.2 (2.6, 6.7) | 5.0 (3.1, 7.9) | 6.2 (3.9, 9.6) | |
| Comprehensive | Comprehensive | 32 | 680 | 3.6 (2.4, 5.4) | 4.7 (3.3, 6.7) | 5.4 (3.8, 7.7) | 5.4 (3.8, 7.7) | | |
| Equinoxe | Equinoxe | 27 | 424 | 2.6 (1.4, 4.8) | 6.8 (4.4, 10.3) | 9.6 (6.2, 14.9) | | | |
| Global AP | Global | 5 | 260 | 0.8 (0.2, 3.3) | | | | | |
| Global Advantage | Global | 35 | 599 | 1.2 (0.6, 2.5) | 3.7 (2.4, 5.6) | 4.1 (2.7, 6.1) | 5.1 (3.5, 7.5) | 6.7 (4.6, 9.5) | |
| Global Unite | Global | 15 | 820 | 0.6 (0.3, 1.5) | 1.6 (0.9, 2.9) | 2.8 (1.6, 4.8) | | | |
| SMR | SMR | 22 | 453 | 2.0 (1.1, 3.8) | 4.2 (2.6, 6.5) | 4.4 (2.8, 6.8) | 4.7 (3.1, 7.3) | 5.6 (3.7, 8.6) | |
| Turon | Turon | 5 | 105 | 1.9 (0.5, 7.5) | 4.1 (1.5, 10.5) | 4.1 (1.5, 10.5) | | | |
| Other (8) | | 5 | 47 | 2.3 (0.3, 15.1) | 6.9 (2.3, 20.0) | 12.7 (5.4, 28.0) | 12.7 (5.4, 28.0) | 12.7 (5.4, 28.0) | |
| TOTAL | | 189 | 4675 | | | | | | |

Note: Only combinations with over 50 procedures have been listed
Restricted to modern prostheses

## PRIMARY TOTAL REVERSE SHOULDER REPLACEMENT

### DEMOGRAPHICS

There have been 35,980 primary total reverse shoulder replacement procedures reported to the Registry. This is an increase of 5,650 procedures compared to the previous report.

Osteoarthritis is the most common diagnosis for primary total reverse shoulder replacement followed by rotator cuff arthropathy, and fracture. There has been little change in the proportion of these three diagnoses during the last 8 years (Table ST42 and Figure ST23).

Primary total reverse shoulder replacement is more commonly undertaken in females and there has been minimal change in gender distribution since 2008 (Figure ST24).

**Figure ST24** **Primary Total Reverse Shoulder Replacement by Gender**

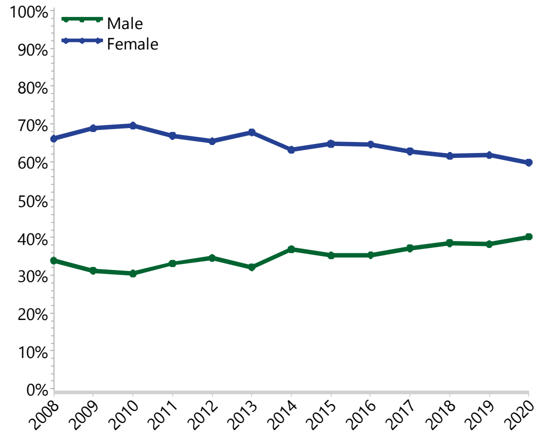
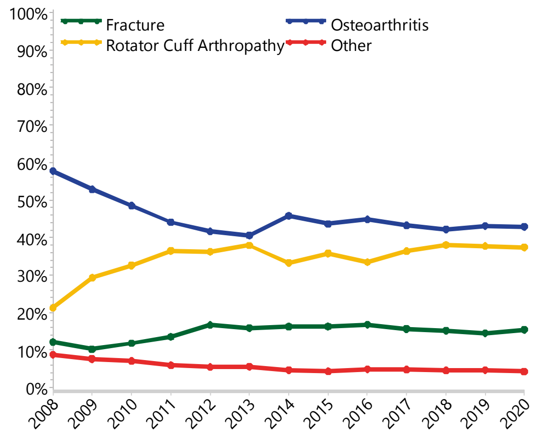



**Figure ST23** **Primary Total Reverse Shoulder Replacement by Primary Diagnosis**




Females have a higher mean age (Table ST43). The proportional use in patients aged ≥75 years has declined in recent years and is now very similar to the proportional use in the 65-74 year age group (Figure ST25).

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 ST26).

**The most common primary diagnoses are osteoarthritis, rotator cuff arthropathy, and fracture.**

The most commonly used humeral stems are listed in Table ST44. The most used glenoid prostheses are listed in Table ST45.

**Table ST42 Primary Total Reverse Shoulder Replacement by Primary Diagnosis and Gender**

| Primary Diagnosis | Male | | Female | | TOTAL | |
|---|---|---|---|---|---|---|
| | N | Col% | N | Col% | N | Col% |
| Osteoarthritis | 6103 | 46.2 | 9705 | 42.6 | 15808 | 43.9 |
| Rotator Cuff Arthropathy | 5752 | 43.5 | 7147 | 31.4 | 12899 | 35.9 |
| Fracture | 871 | 6.6 | 4608 | 20.2 | 5479 | 15.2 |
| Rheumatoid Arthritis | 143 | 1.1 | 506 | 2.2 | 649 | 1.8 |
| Osteonecrosis | 78 | 0.6 | 339 | 1.5 | 417 | 1.2 |
| Instability | 117 | 0.9 | 249 | 1.1 | 366 | 1.0 |
| Tumour | 103 | 0.8 | 99 | 0.4 | 202 | 0.6 |
| Other Inflammatory Arthritis | 45 | 0.3 | 107 | 0.5 | 152 | 0.4 |
| Other | 4 | 0.0 | 4 | 0.0 | 8 | 0.0 |
| TOTAL | 13216 | 100.0 | 22764 | 100.0 | 35980 | 100.0 |

**Table ST43 Age and Gender of Primary Total Reverse Shoulder Replacement**

| Gender | Number | Percent | Minimum | Maximum | Median | Mean | Std Dev |
|---|---|---|---|---|---|---|---|
| Male | 13216 | 36.7% | 14 | 96 | 73 | 72.4 | 8.2 |
| Female | 22764 | 63.3% | 13 | 102 | 75 | 74.9 | 8.0 |
| TOTAL | 35980 | 100.0% | 13 | 102 | 74 | 74.0 | 8.1 |

**Figure ST25 Primary Total Reverse Shoulder Replacement by Age**

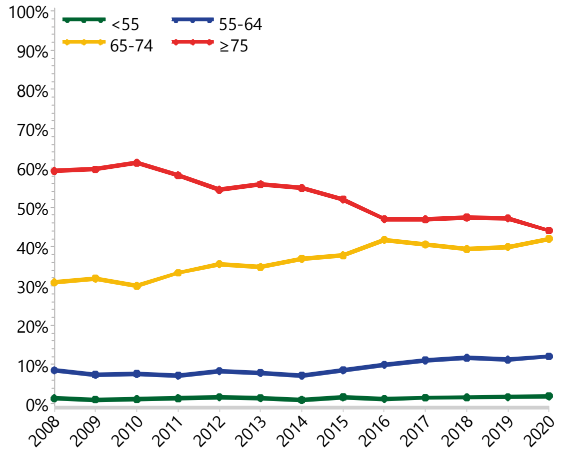


**Figure ST26** **Primary Total Reverse Shoulder Replacement by Fixation**

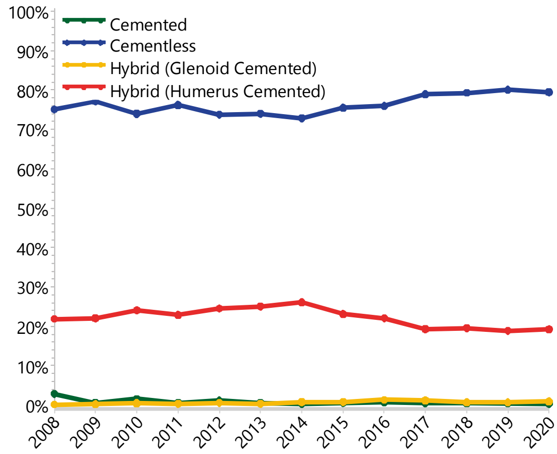



**Table ST44** **10 Most Used Humeral Stem Prostheses in Primary Total Reverse Shoulder Replacement**

| 2008 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 263 | SMR | 1026 | Delta Xtend | 1074 | SMR | 1103 | SMR | 1018 | SMR |
| 252 | Delta Xtend | 936 | SMR | 1064 | Delta Xtend | 976 | Delta Xtend | 828 | Equinoxe |
| 76 | Aequalis | 371 | Aequalis | 496 | Comprehensive | 676 | Equinoxe | 767 | Comprehensive |
| 42 | Trabecular Metal | 364 | Comprehensive | 495 | Equinoxe | 645 | Comprehensive | 755 | Delta Xtend |
| 21 | Delta CTA | 350 | RSP | 420 | RSP | 482 | Ascend Flex | 559 | Ascend Flex |
| 2 | Custom Made (Lima) | 332 | Equinoxe | 375 | Ascend Flex | 403 | RSP | 345 | Aequalis |
| 1 | Generic Humeral Stem | 262 | Affinis | 357 | Aequalis | 382 | Aequalis | 323 | Affinis |
| 1 | Promos | 203 | Trabecular Metal | 324 | Affinis | 341 | Affinis | 275 | RSP |
| | | 161 | Ascend Flex | 183 | Trabecular Metal | 180 | Trabecular Metal | 243 | AltiVate Reverse |
| | | 125 | Global Unite | 95 | Global Unite | 159 | Global Unite | 177 | Global Unite |
| 10 Most Used | | | | | | | | | |
| 658 | (8) 100.0% | 4130 | (10) 99.3% | 4883 | (10) 99.1% | 5347 | (10) 97.5% | 5290 | (10) 96.2% |
| Remainder | | | | | | | | | |
| 0 | (0) 0% | 30 | (4) 0.7% | 44 | (6) 0.9% | 137 | (5) 2.5% | 210 | (6) 3.8% |
| TOTAL | | | | | | | | | |
| 658 | (8) 100.0% | 4160 | (14) 100.0% | 4927 | (16) 100.0% | 5484 | (15) 100.0% | 5500 | (16) 100.0% |

**Table ST45 10 Most Used Glenoid Prostheses in Primary Total Reverse Shoulder Replacement**

| 2008 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|
| N | Model | N | Model | N | Model | N | Model | N | Model |
| 264 | SMR L1 | 1151 | Delta Xtend | 1157 | Delta Xtend | 1134 | Delta Xtend | 971 | SMR L1 |
| 252 | Delta Xtend | 930 | SMR L1 | 1046 | SMR L1 | 1051 | SMR L1 | 930 | Delta Xtend |
| 76 | Aequalis | 532 | Aequalis | 701 | Aequalis | 763 | Aequalis | 828 | Equinoxe |
| 42 | Trabecular Metal | 373 | Comprehensive Reverse | 519 | Comprehensive Reverse | 688 | Comprehensive Reverse | 783 | Comprehensive Reverse |
| 21 | Delta CTA | 351 | RSP | 495 | Equinoxe | 676 | Equinoxe | 770 | Aequalis |
| 1 | Generic Metaglene | 332 | Equinoxe | 431 | RSP | 482 | RSP | 518 | RSP |
| 1 | Promos | 262 | Affinis | 323 | Affinis | 341 | Affinis | 323 | Affinis |
| 1 | SMR | 191 | Trabecular Metal | 154 | Trabecular Metal | 136 | Trabecular Metal | 138 | Trabecular Metal |
| | | 12 | Custom Made (Comprehensive) | 31 | Perform Reversed | 101 | Perform Reversed | 136 | Perform Reversed |
| | | 11 | Mets | 19 | Custom Made (Comprehensive) | 34 | SMR Axioma | 37 | MSS |
| 10 Most Used | | | | | | | | | |
| 658 | (8) 100.0% | 4145 | (10) 99.6% | 4876 | (10) 99.0% | 5406 | (10) 98.6% | 5434 | (10) 98.8% |
| Remainder | | | | | | | | | |
| 0 | (0) 0% | 15 | (4) 0.4% | 51 | (7) 1.0% | 78 | (6) 1.4% | 66 | (7) 1.2% |
| TOTAL | | | | | | | | | |
| 658 | (8) 100.0% | 4160 | (14) 100.0% | 4927 | (17) 100.0% | 5484 | (16) 100.0% | 5500 | (17) 100.0% |

## OUTCOME FOR ALL DIAGNOSES

In order to keep Registry data contemporaneous, only procedures using prostheses that have been available and used in 2020 (described as modern prostheses) are included in the analyses, unless clearly specified. As with primary stemmed total shoulder replacement, all outcomes analyses have been confined to total reverse shoulder prostheses used in 2020, irrespective of primary diagnoses.

### Primary Diagnosis

Procedures undertaken for instability and rheumatoid arthritis 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 ST46 and Figure ST27).

### Reason for Revision

Instability/dislocation is the most common reason for revision followed by infection, loosening, and fracture (Table ST47 and Figure ST28).

### Type of Revision

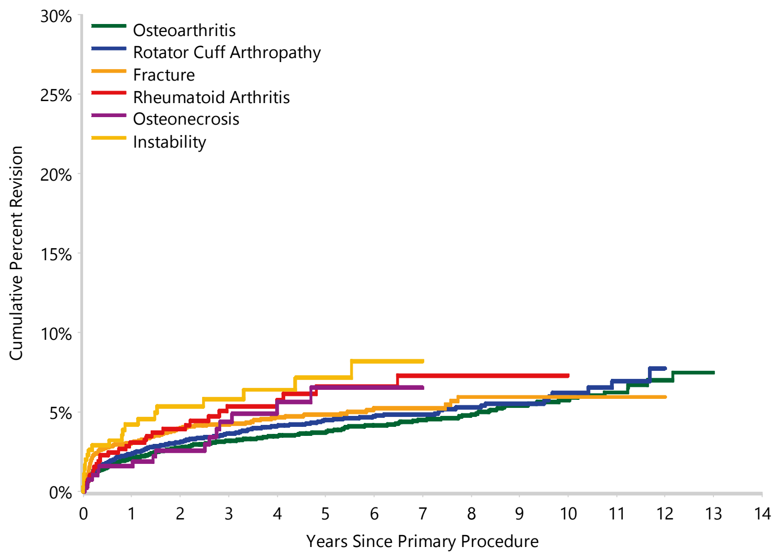
The most common types of revision are humeral component only, replacement of both cup (liner) and glenosphere, and cup only revisions (Table ST48). When only the humeral component is revised, this may be associated with exchange of the epiphysis and/or humeral stem and additional minor components such as the liner.

**Table ST46 Cumulative Percent Revision of Primary Total 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 | 488 | 14926 | 2.1 (1.9, 2.3) | 3.2 (2.9, 3.5) | 3.7 (3.4, 4.1) | 4.5 (4.0, 5.0) | 5.8 (5.0, 6.6) | |
| Rotator Cuff Arthropathy | 438 | 12239 | 2.4 (2.1, 2.7) | 3.6 (3.3, 4.0) | 4.5 (4.0, 5.0) | 4.8 (4.3, 5.4) | 6.2 (5.2, 7.3) | |
| Fracture | 212 | 5171 | 3.1 (2.6, 3.6) | 4.2 (3.7, 4.8) | 4.8 (4.2, 5.6) | 5.2 (4.5, 6.1) | 5.9 (4.9, 7.2) | |
| Rheumatoid Arthritis | 31 | 591 | 3.1 (1.9, 4.9) | 5.4 (3.6, 7.8) | 6.6 (4.5, 9.6) | 7.3 (5.0, 10.7) | 7.3 (5.0, 10.7) | |
| Osteonecrosis | 16 | 392 | 1.6 (0.7, 3.5) | 4.4 (2.5, 7.6) | 6.5 (3.9, 10.9) | 6.5 (3.9, 10.9) | | |
| Instability | 23 | 348 | 4.2 (2.5, 7.0) | 5.8 (3.7, 9.1) | 7.1 (4.6, 11.1) | 8.2 (5.2, 12.9) | | |
| Other (3) | 30 | 350 | 4.2 (2.5, 7.1) | 10.0 (6.6, 15.0) | 11.9 (7.9, 17.7) | | | |
| TOTAL | 1238 | 34017 | | | | | | |

Note: Only primary diagnoses with over 300 procedures have been listed
Restricted to modern prostheses

**Figure ST27 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Primary Diagnosis**




HR - adjusted for age and gender

Rotator Cuff Arthropathy vs Osteoarthritis
Entire Period: HR=1.11 (0.97, 1.26),p=0.127

Fracture vs Osteoarthritis
0 - 3Mth: HR=2.41 (1.94, 3.00),p<0.001
3Mth+: HR=1.08 (0.86, 1.36),p=0.520

Rheumatoid Arthritis vs Osteoarthritis
Entire Period: HR=1.47 (1.02, 2.12),p=0.040

Osteonecrosis vs Osteoarthritis
Entire Period: HR=1.27 (0.77, 2.10),p=0.344

Instability vs Osteoarthritis
Entire Period: HR=1.95 (1.28, 2.96),p=0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Osteoarthritis | 14926 | 12156 | 7445 | 4100 | 2070 | 664 | 8 |
| Rotator Cuff Arthropathy | 12239 | 9814 | 5650 | 3012 | 1491 | 337 | 6 |
| Fracture | 5171 | 4054 | 2357 | 1198 | 534 | 121 | 1 |
| Rheumatoid Arthritis | 591 | 481 | 293 | 189 | 121 | 43 | 1 |
| Osteonecrosis | 392 | 328 | 192 | 87 | 43 | 16 | 0 |
| Instability | 348 | 275 | 174 | 100 | 54 | 21 | 0 |

Note: Only primary diagnoses with over 300 procedures have been listed
Restricted to modern prostheses

**Table ST47** **Primary Total Reverse Shoulder Replacement by Reason for Revision**

| Reason for Revision | Number | Percent |
|---|---|---|
| Instability/Dislocation | 421 | 34.0 |
| Infection | 290 | 23.4 |
| Loosening | 206 | 16.6 |
| Fracture | 144 | 11.6 |
| Dissociation | 41 | 3.3 |
| Pain | 23 | 1.9 |
| Malposition | 16 | 1.3 |
| Lysis | 14 | 1.1 |
| Incorrect Sizing | 11 | 0.9 |
| Arthrofibrosis | 11 | 0.9 |
| Metal Related Pathology | 10 | 0.8 |
| Implant Breakage Glenoid | 7 | 0.6 |
| Rotator Cuff Insufficiency | 6 | 0.5 |
| Wear Humeral Cup | 4 | 0.3 |
| Tumour | 3 | 0.2 |
| Heterotopic Bone | 3 | 0.2 |
| Implant Breakage Humeral | 2 | 0.2 |
| Wear Glenoid Insert | 1 | 0.1 |
| Implant Breakage Glenoid Insert | 1 | 0.1 |
| Other | 24 | 1.9 |
| TOTAL | 1238 | 100.0 |

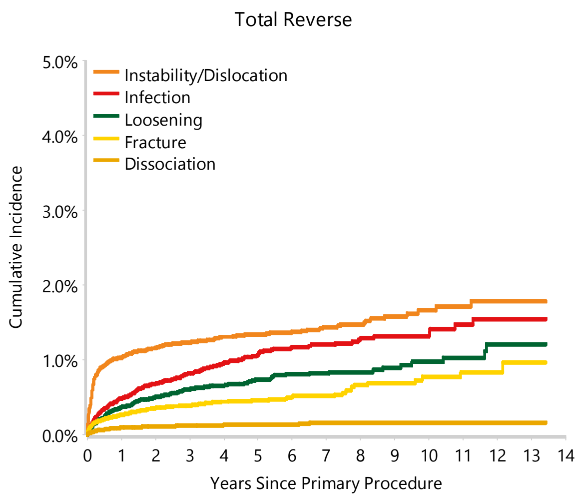
Note: Restricted to modern prostheses

**Table ST48** **Primary Total Reverse Shoulder Replacement by Type of Revision**

| Type of Revision | Number | Percent |
|---|---|---|
| Humeral Component | 270 | 21.8 |
| Cup/Head | 263 | 21.2 |
| Cup Only | 237 | 19.1 |
| Humeral Head Only | 131 | 10.6 |
| Cement Spacer | 102 | 8.2 |
| Glenoid Component | 89 | 7.2 |
| Humeral/Glenoid | 87 | 7.0 |
| Removal of Prostheses | 24 | 1.9 |
| Reoperation | 10 | 0.8 |
| Minor Components | 10 | 0.8 |
| Glenosphere Only | 8 | 0.6 |
| Cement Only | 3 | 0.2 |
| Head/Insert | 2 | 0.2 |
| Reinsertion of Components | 2 | 0.2 |
| TOTAL | 1238 | 100.0 |

Note: Restricted to modern prostheses

**Figure ST28** **Cumulative Incidence Revision Diagnosis of Primary Total Reverse Shoulder Replacement**




Note: Restricted to modern prostheses

## OUTCOME FOR OSTEOARTHRITIS – PATIENT CHARACTERISTICS

### Age and Gender

Primary total reverse shoulder replacement, when used for the management of osteoarthritis, is most commonly used in patients aged ≥75 years. Older patients have a lower rate of revision (Table ST49 and Figure ST29).

Males have a higher rate of revision compared to females in the first 9 months (Table ST50 and Figure ST30). The increase in the rate of revision is due to a higher cumulative incidence of instability/dislocation and infection (Figure ST31).

**Males have a higher rate of revision compared to females. The increase in the rate of revision is due to a higher cumulative incidence of instability/dislocation and infection.**

### ASA and BMI

Patients with ASA scores 3 and 4 have higher rates of revision compared to patients with an ASA 2 score (Table ST51 and Figure ST32). The most common reasons for revision for the different ASA scores are presented in Figure ST33. The rate of revision for instability/dislocation increases with increasing ASA score.

There is no difference in the rate of revision when pre-obese and obese classes 1, 2, and 3 patients are compared to patients with a normal BMI (Table ST52 and Figure ST34). The most common reasons for revision for the different BMI categories are shown in Figure ST35.

### Glenoid Morphology

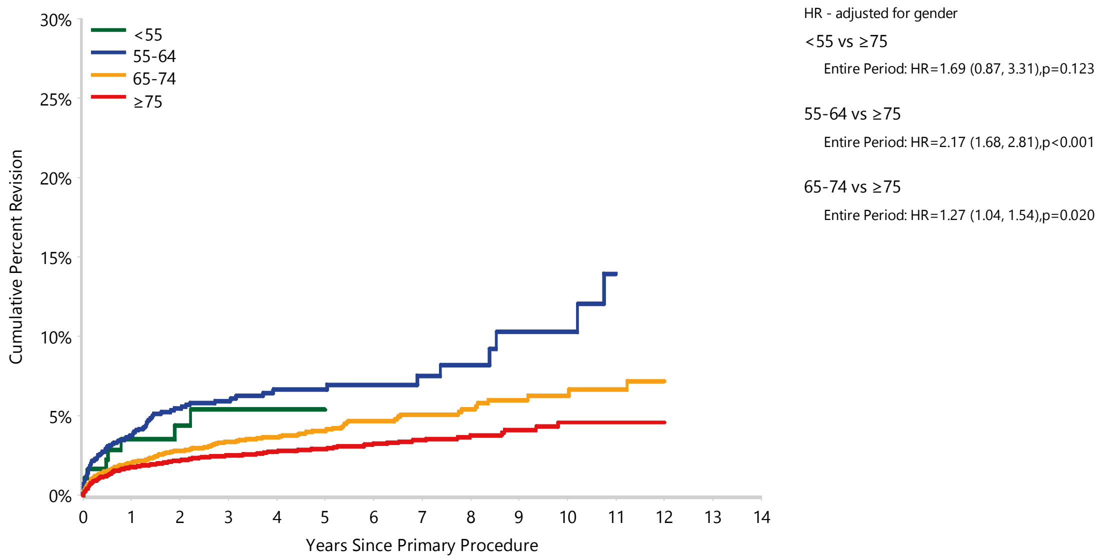
The Registry has glenoid morphology data on 6,077 primary total reverse shoulder replacements undertaken for osteoarthritis. The distribution of the different morphology categories is presented in Table ST53. The category of glenoid morphology is not a risk factor for revision (Figure ST36).

**Table ST49** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Age (Primary Diagnosis OA)**

| Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| <55 | 9 | 185 | 3.5 (1.6, 7.7) | 5.4 (2.7, 10.7) | 5.4 (2.7, 10.7) | | | |
| 55-64 | 85 | 1419 | 3.7 (2.8, 4.9) | 5.9 (4.7, 7.5) | 6.7 (5.3, 8.3) | 7.5 (5.8, 9.7) | 10.3 (7.2, 14.6) | |
| 65-74 | 200 | 5825 | 2.0 (1.7, 2.4) | 3.4 (2.9, 3.9) | 4.0 (3.5, 4.7) | 5.1 (4.3, 6.0) | 6.3 (5.1, 7.7) | |
| ≥75 | 194 | 7497 | 1.8 (1.5, 2.1) | 2.5 (2.1, 2.9) | 2.9 (2.5, 3.4) | 3.5 (2.9, 4.1) | 4.6 (3.7, 5.8) | |
| TOTAL | 488 | 14926 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST29** **Cumulative Percent Revision of Primary Total 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 |
|---|---|---|---|---|---|---|---|
| <55 | 185 | 140 | 82 | 43 | 25 | 8 | 1 |
| 55-64 | 1419 | 1103 | 611 | 314 | 159 | 59 | 0 |
| 65-74 | 5825 | 4706 | 2870 | 1514 | 751 | 251 | 2 |
| ≥75 | 7497 | 6207 | 3882 | 2229 | 1135 | 346 | 5 |

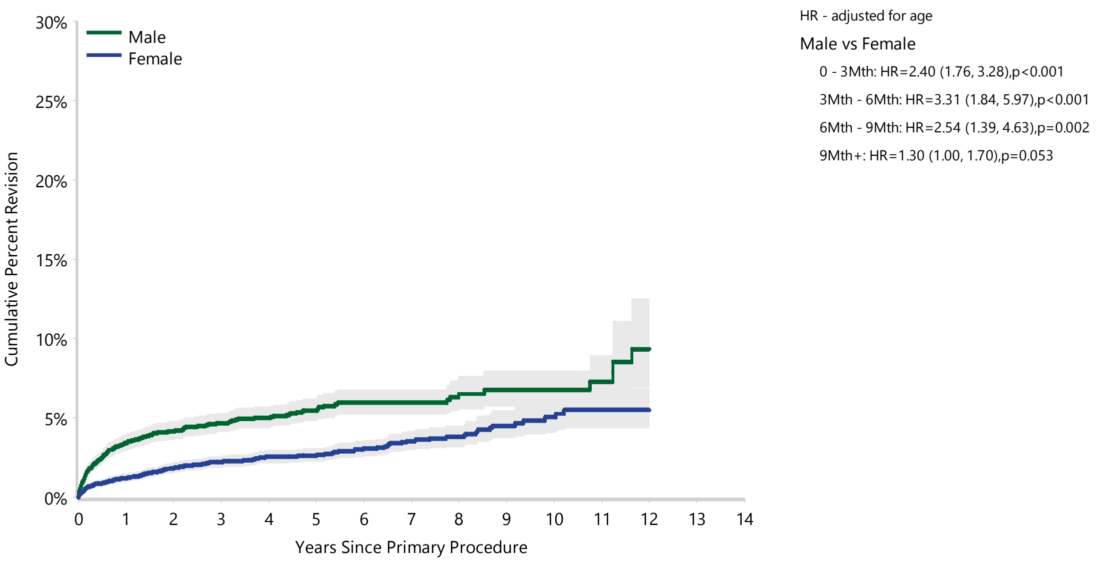
Note: Restricted to modern prostheses

**Table ST50 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Gender (Primary Diagnosis OA)**

| Gender | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Male | 270 | 5808 | 3.4 (3.0, 4.0) | 4.7 (4.1, 5.3) | 5.5 (4.8, 6.2) | 6.0 (5.2, 6.8) | 6.8 (5.7, 8.0) | |
| Female | 218 | 9118 | 1.2 (1.0, 1.5) | 2.2 (1.9, 2.6) | 2.6 (2.3, 3.1) | 3.6 (3.0, 4.2) | 5.0 (4.1, 6.2) | |
| TOTAL | 488 | 14926 | | | | | | |

Note: Restricted to modern prostheses

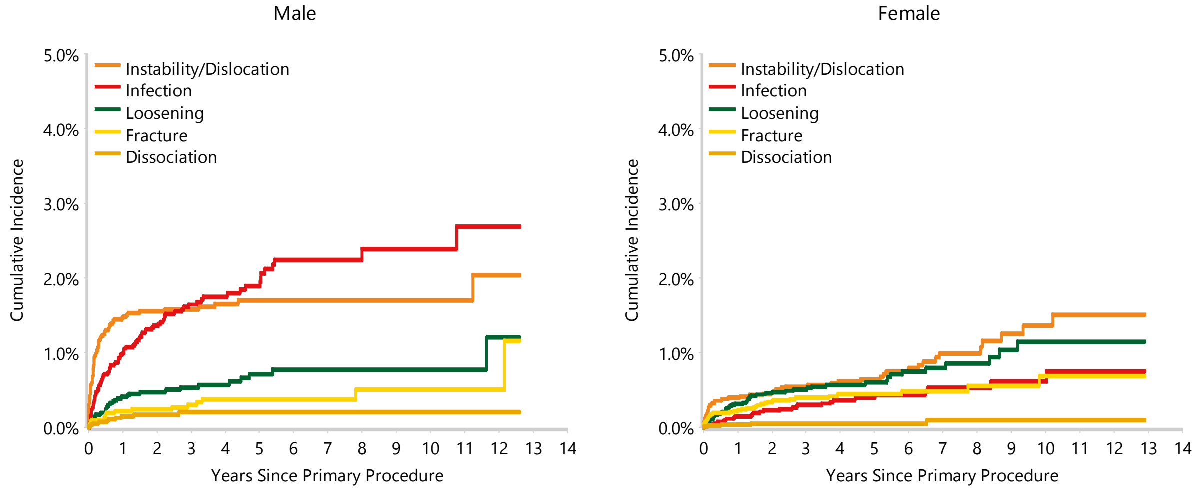
**Figure ST30 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Gender (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Male | 5808 | 4590 | 2724 | 1462 | 699 | 222 | 2 |
| Female | 9118 | 7566 | 4721 | 2638 | 1371 | 442 | 6 |

Note: Restricted to modern prostheses

**Figure ST31** **Cumulative Incidence Revision Diagnosis of Primary Total Reverse Shoulder Replacement by Gender (Primary Diagnosis OA)**



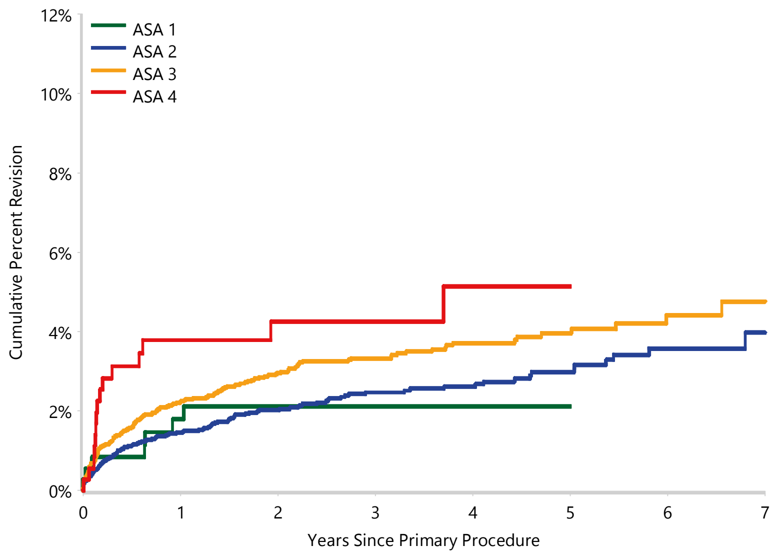

Note: Restricted to modern prostheses

**Table ST51** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by ASA Score (Primary Diagnosis OA)**

| ASA Score | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|---|
| ASA 1 | 7 | 359 | 1.8 (0.8, 3.9) | 2.1 (1.0, 4.4) | 2.1 (1.0, 4.4) | 2.1 (1.0, 4.4) | 2.1 (1.0, 4.4) | |
| ASA 2 | 122 | 5317 | 1.5 (1.2, 1.8) | 2.0 (1.7, 2.5) | 2.5 (2.0, 3.0) | 2.6 (2.2, 3.2) | 3.0 (2.4, 3.6) | 4.0 (3.0, 5.2) |
| ASA 3 | 188 | 6235 | 2.2 (1.9, 2.6) | 3.0 (2.5, 3.5) | 3.3 (2.9, 3.9) | 3.7 (3.2, 4.3) | 4.0 (3.4, 4.6) | 4.8 (3.8, 5.9) |
| ASA 4 | 15 | 366 | 3.8 (2.2, 6.4) | 4.3 (2.5, 7.1) | 4.3 (2.5, 7.1) | 5.1 (3.0, 8.8) | 5.1 (3.0, 8.8) | |
| ASA 5 | 0 | 1 | | | | | | |
| TOTAL | 332 | 12278 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST32** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by ASA Score (Primary Diagnosis OA)**




HR - adjusted for age and gender

ASA 1 vs ASA 2

Entire Period: HR=0.66 (0.31, 1.42),p=0.287

ASA 3 vs ASA 2

Entire Period: HR=1.49 (1.19, 1.88),p<0.001

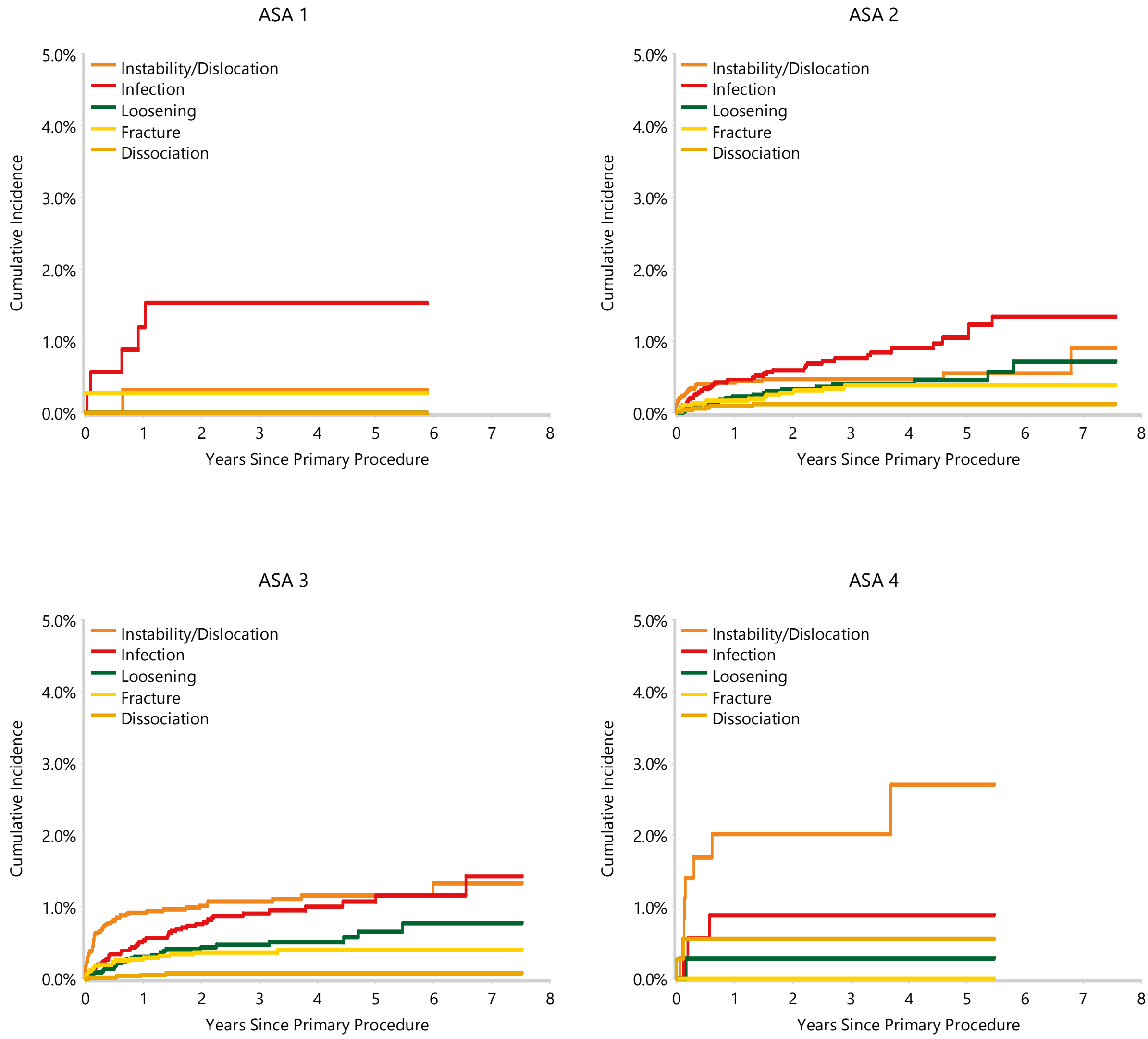
ASA 4 vs ASA 2

Entire Period: HR=2.13 (1.24, 3.64),p=0.005

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|
| ASA 1 | 359 | 301 | 240 | 166 | 118 | 69 | 13 |
| ASA 2 | 5317 | 4271 | 3276 | 2407 | 1599 | 985 | 183 |
| ASA 3 | 6235 | 4790 | 3485 | 2390 | 1564 | 906 | 144 |
| ASA 4 | 366 | 270 | 205 | 143 | 96 | 54 | 14 |

Note: Restricted to modern prostheses

**Figure ST33** **Cumulative Incidence Revision Diagnosis of Primary Total Reverse Shoulder Replacement by ASA Score (Primary Diagnosis OA)**



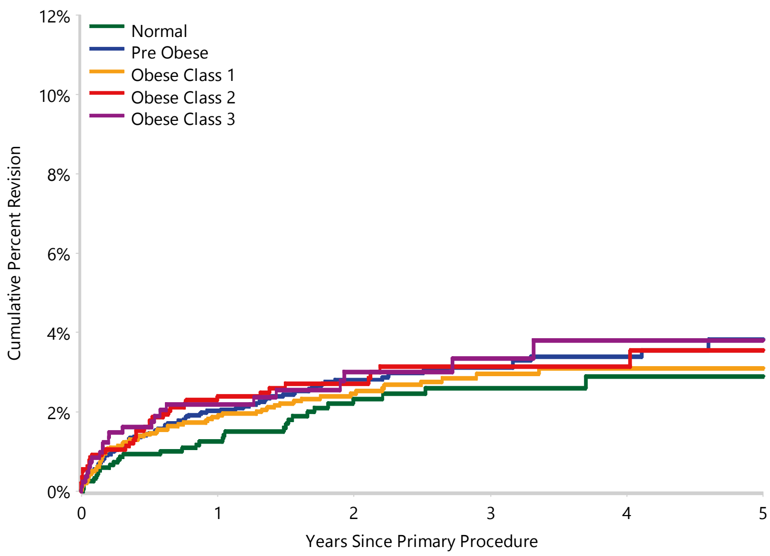

Note: Restricted to modern prostheses

**Table ST52 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by BMI Category (Primary Diagnosis OA)**

| BMI Category | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|---|
| Underweight | 3 | 59 | 3.5 (0.9, 13.3) | 5.9 (1.9, 17.5) | 5.9 (1.9, 17.5) | 5.9 (1.9, 17.5) | |
| Normal | 32 | 1548 | 1.2 (0.8, 2.0) | 2.3 (1.6, 3.4) | 2.6 (1.8, 3.7) | 2.9 (2.0, 4.2) | 2.9 (2.0, 4.2) |
| Pre Obese | 94 | 3497 | 2.0 (1.6, 2.6) | 2.8 (2.3, 3.5) | 3.1 (2.5, 3.9) | 3.4 (2.7, 4.2) | 3.8 (3.0, 4.9) |
| Obese Class 1 | 67 | 2776 | 1.9 (1.4, 2.5) | 2.5 (1.9, 3.2) | 3.0 (2.3, 3.8) | 3.1 (2.4, 4.0) | 3.1 (2.4, 4.0) |
| Obese Class 2 | 38 | 1429 | 2.4 (1.7, 3.4) | 2.7 (1.9, 3.8) | 3.1 (2.3, 4.4) | 3.1 (2.3, 4.4) | 3.5 (2.5, 5.1) |
| Obese Class 3 | 23 | 830 | 2.2 (1.4, 3.5) | 3.0 (1.9, 4.6) | 3.3 (2.2, 5.2) | 3.8 (2.4, 5.9) | 3.8 (2.4, 5.9) |
| TOTAL | 257 | 10139 | | | | | |

Note: Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years

**Figure ST34 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by BMI Category (Primary Diagnosis OA)**




HR - adjusted for age and gender
Pre Obese vs Normal
Entire Period: HR=1.12 (0.75, 1.67),p=0.587

Obese Class 1 vs Normal
Entire Period: HR=1.00 (0.66, 1.53),p=0.990

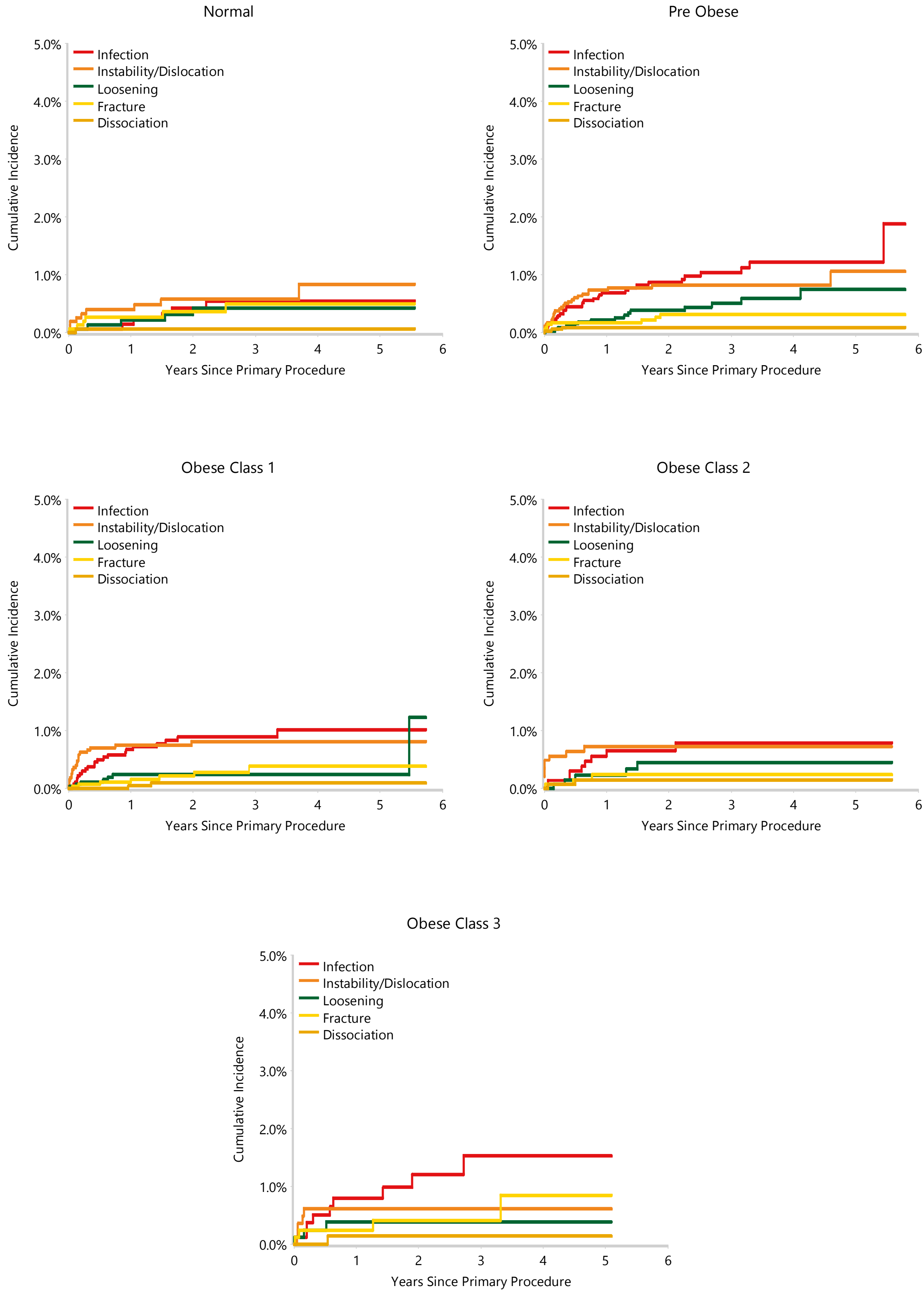
Obese Class 2 vs Normal
Entire Period: HR=1.22 (0.76, 1.96),p=0.411

Obese Class 3 vs Normal
Entire Period: HR=1.30 (0.76, 2.24),p=0.338

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs |
|---|---|---|---|---|---|---|
| Normal | 1548 | 1171 | 843 | 554 | 275 | 107 |
| Pre Obese | 3497 | 2636 | 1845 | 1182 | 621 | 242 |
| Obese Class 1 | 2776 | 2117 | 1450 | 869 | 489 | 185 |
| Obese Class 2 | 1429 | 1024 | 705 | 447 | 243 | 93 |
| Obese Class 3 | 830 | 602 | 411 | 250 | 129 | 48 |

Note: Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years

**Figure ST35** **Cumulative Incidence Revision Diagnosis of Primary Total Reverse Shoulder Replacement by BMI Category (Primary Diagnosis OA)**



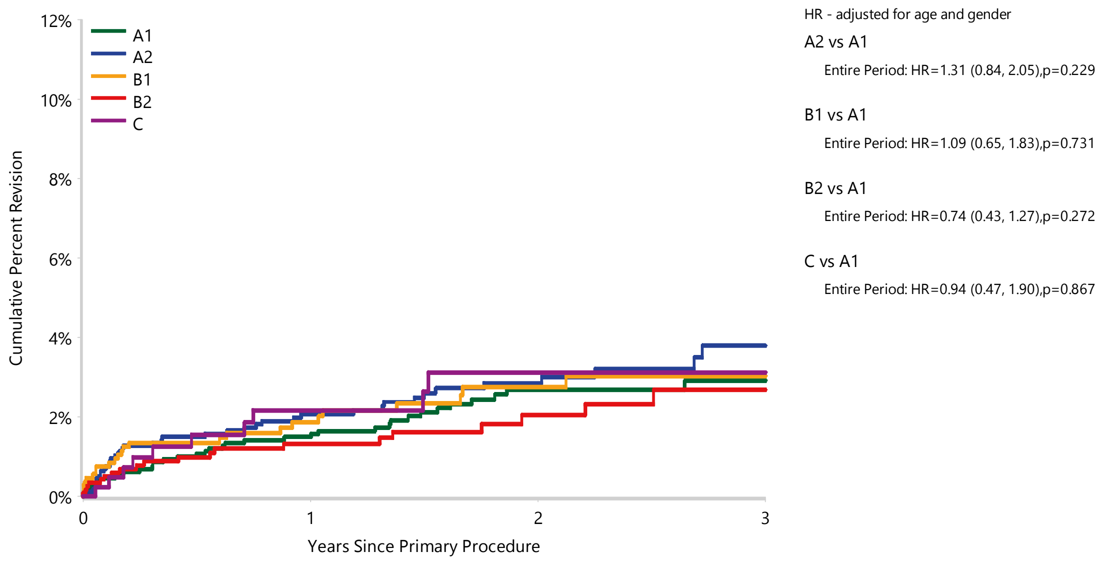

Note: Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years

**Table ST53 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Glenoid Morphology (Primary Diagnosis OA)**

| Glenoid Morphology | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs |
|---|---|---|---|---|---|
| A1 | 37 | 1798 | 1.5 (1.0, 2.2) | 2.7 (1.9, 3.7) | 2.9 (2.1, 4.1) |
| A2 | 41 | 1605 | 2.1 (1.5, 3.0) | 2.9 (2.1, 4.0) | 3.8 (2.7, 5.4) |
| B1 | 24 | 1065 | 1.9 (1.2, 3.0) | 2.7 (1.8, 4.2) | 3.0 (2.0, 4.6) |
| B2 | 21 | 1174 | 1.3 (0.8, 2.2) | 2.0 (1.3, 3.3) | 2.7 (1.6, 4.4) |
| C | 10 | 435 | 2.2 (1.1, 4.3) | 3.1 (1.6, 5.8) | 3.1 (1.6, 5.8) |
| TOTAL | 133 | 6077 | | | |

Note: Restricted to modern prostheses
35 procedures have been excluded where a glenoid morphology of B3 was recorded

**Figure ST36 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Glenoid Morphology (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs |
|---|---|---|---|---|
| A1 | 1798 | 1257 | 726 | 294 |
| A2 | 1605 | 1095 | 613 | 240 |
| B1 | 1065 | 679 | 379 | 156 |
| B2 | 1174 | 789 | 428 | 150 |
| C | 435 | 280 | 158 | 60 |

Note: Restricted to modern prostheses

## OUTCOME FOR OSTEOARTHRITIS – PROSTHESIS CHARACTERISTICS

### Fixation

Fixation is not a risk factor for revision of primary total reverse shoulder replacement. There is no difference between hybrid (humerus cemented) and cementless humeral stems (Table ST54 and Figure ST37).

### Type of Polyethylene

Non XLPE is the most common type of polyethylene used in primary total reverse shoulder replacement for the management of osteoarthritis. There is no difference in the cumulative percent revision when the different types of polyethylene are compared (Table ST55 and Figure ST38). The reasons for revision for the different polyethylene types are presented in Figure ST39.

### Glenosphere Size

Glenosphere sizes <38mm have a higher rate of revision compared to 38-40mm and >40mm sizes (Table ST57 and Figure ST40). The cumulative incidence for the most common reasons for revision of the three different glenosphere sizes is presented in Figure ST41.

**Glenosphere sizes <38mm have a higher rate of revision.**

The outcomes of the most commonly used primary total reverse shoulder prostheses are listed in Table ST58.

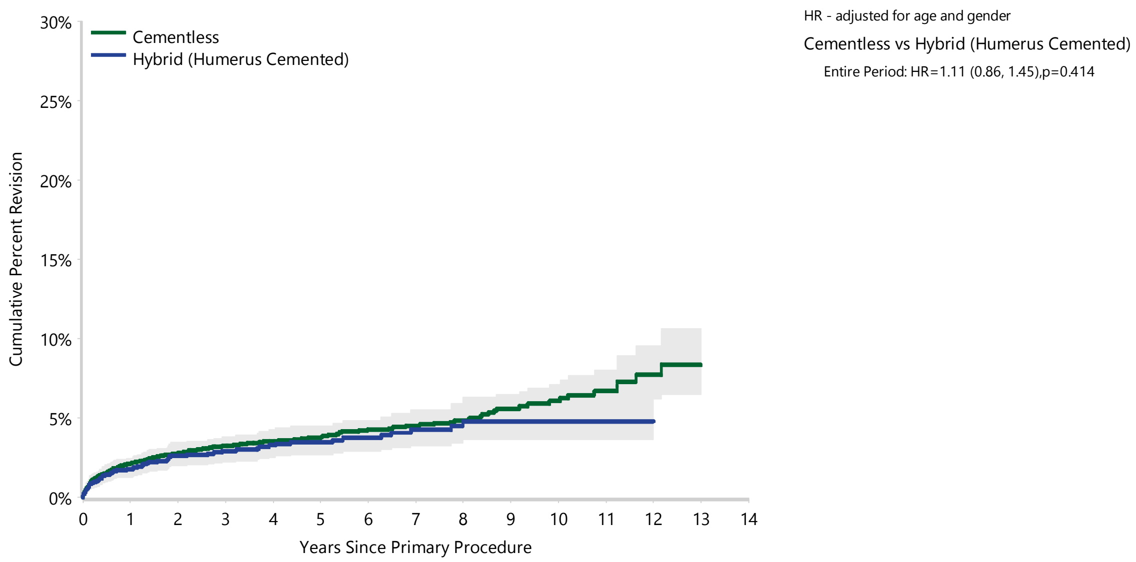
The outcomes for the most used prosthesis combinations using cementless fixation are listed in Table ST59. The most commonly used prosthesis combinations using hybrid (humerus cemented) fixation are listed in Table ST60.

**Table ST54** **Cumulative Percent Revision of Primary Total Reverse 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 | 2 | 87 | 0.0 (0.0, 0.0) | 1.3 (0.2, 9.1) | 3.3 (0.8, 12.9) | 3.3 (0.8, 12.9) | 3.3 (0.8, 12.9) | |
| Cementless | 418 | 12739 | 2.1 (1.9, 2.4) | 3.2 (2.9, 3.6) | 3.8 (3.4, 4.2) | 4.5 (4.0, 5.1) | 6.1 (5.2, 7.1) | |
| Hybrid (Glenoid Cemented) | 2 | 64 | 1.6 (0.2, 10.6) | 3.7 (0.9, 14.5) | 3.7 (0.9, 14.5) | | | |
| Hybrid (Humerus Cemented) | 66 | 2036 | 1.8 (1.3, 2.5) | 2.9 (2.2, 3.8) | 3.5 (2.7, 4.5) | 4.3 (3.3, 5.5) | 4.8 (3.6, 6.3) | |
| TOTAL | 488 | 14926 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST37** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Fixation (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Cementless | 12739 | 10264 | 6118 | 3251 | 1546 | 503 | 8 |
| Hybrid (Humerus Cemented) | 2036 | 1758 | 1230 | 794 | 482 | 140 | 0 |

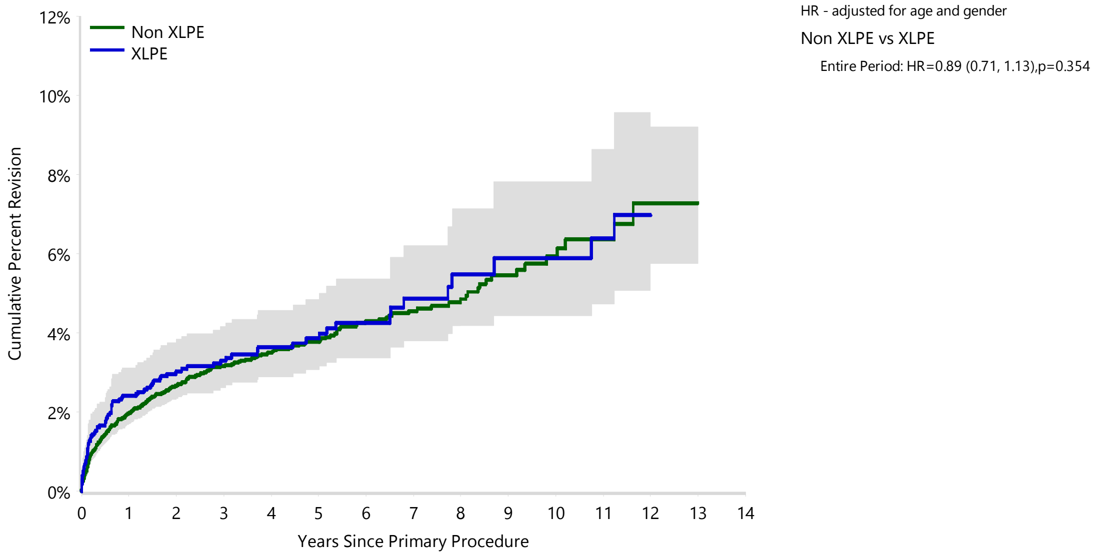
Note: Only fixations with over 100 procedures have been listed
Restricted to modern prostheses

**Table ST55 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Polyethylene Type (Primary Diagnosis OA)**

| Polyethylene Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Non XLPE | 317 | 9470 | 2.0 (1.7, 2.3) | 3.2 (2.8, 3.6) | 3.8 (3.3, 4.2) | 4.6 (4.0, 5.2) | 5.9 (5.0, 7.0) | |
| XLPE | 89 | 2481 | 2.4 (1.9, 3.1) | 3.3 (2.6, 4.2) | 3.9 (3.1, 4.9) | 4.9 (3.8, 6.2) | 5.9 (4.4, 7.8) | |
| TOTAL | 406 | 11951 | | | | | | |

Note: Restricted to modern prostheses

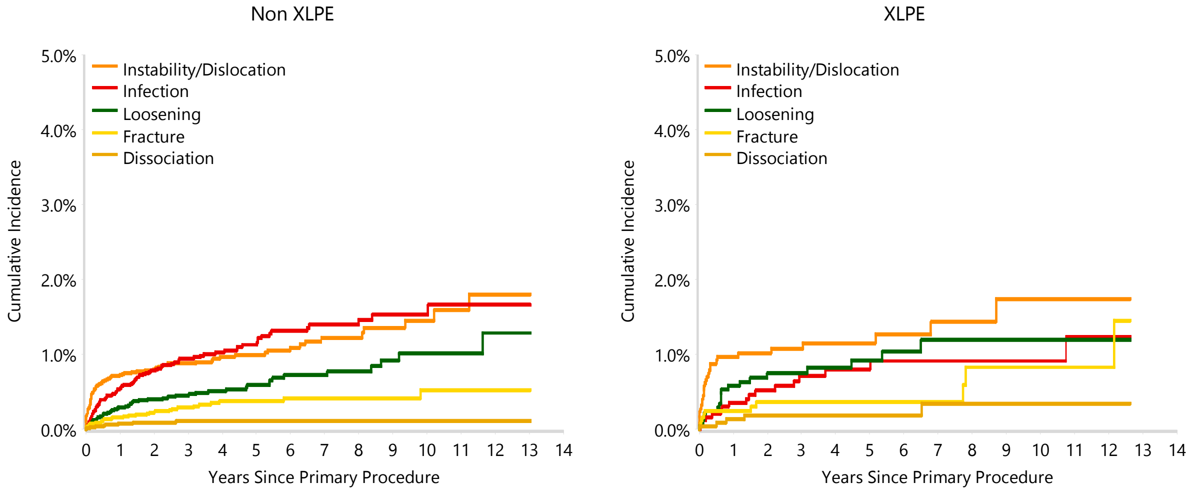
**Figure ST38 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Polyethylene Type (Primary Diagnosis OA)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Non XLPE | 9470 | 7826 | 4950 | 2876 | 1546 | 463 | 4 |
| XLPE | 2481 | 1960 | 1279 | 766 | 407 | 195 | 4 |

Note: Restricted to modern prostheses

**Figure ST39** **Cumulative Incidence Revision Diagnosis of Primary Total Reverse Shoulder Replacement by Polyethylene Type (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

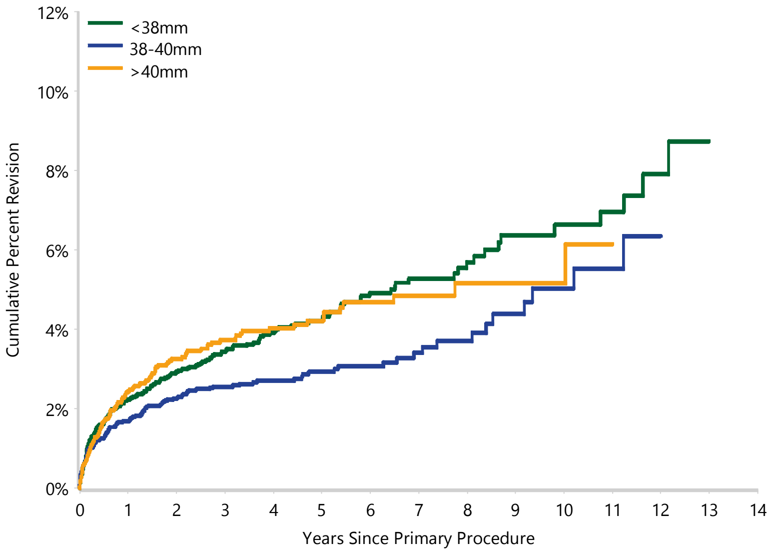
**Table ST56** **Table no longer provided**

**Table ST57** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Glenosphere Size (Primary Diagnosis OA)**

| Glenosphere Size | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| <38mm | 198 | 5166 | 2.2 (1.8, 2.7) | 3.4 (2.9, 4.0) | 4.2 (3.6, 4.9) | 5.3 (4.5, 6.2) | 6.6 (5.5, 8.0) | |
| 38-40mm | 153 | 5870 | 1.7 (1.4, 2.0) | 2.6 (2.2, 3.0) | 2.9 (2.5, 3.5) | 3.4 (2.8, 4.1) | 5.0 (3.8, 6.6) | |
| >40mm | 130 | 3668 | 2.4 (2.0, 3.0) | 3.7 (3.1, 4.5) | 4.2 (3.5, 5.1) | 4.9 (4.0, 5.9) | 5.2 (4.1, 6.4) | |
| TOTAL | 481 | 14704 | | | | | | |

Note: Excludes 222 procedures with unknown glenosphere size
Restricted to modern prostheses

**Figure ST40** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Glenosphere Size (Primary Diagnosis OA)**




HR - adjusted for age and gender
<38mm vs 38-40mm
Entire Period: HR=1.40 (1.13, 1.73),p=0.001

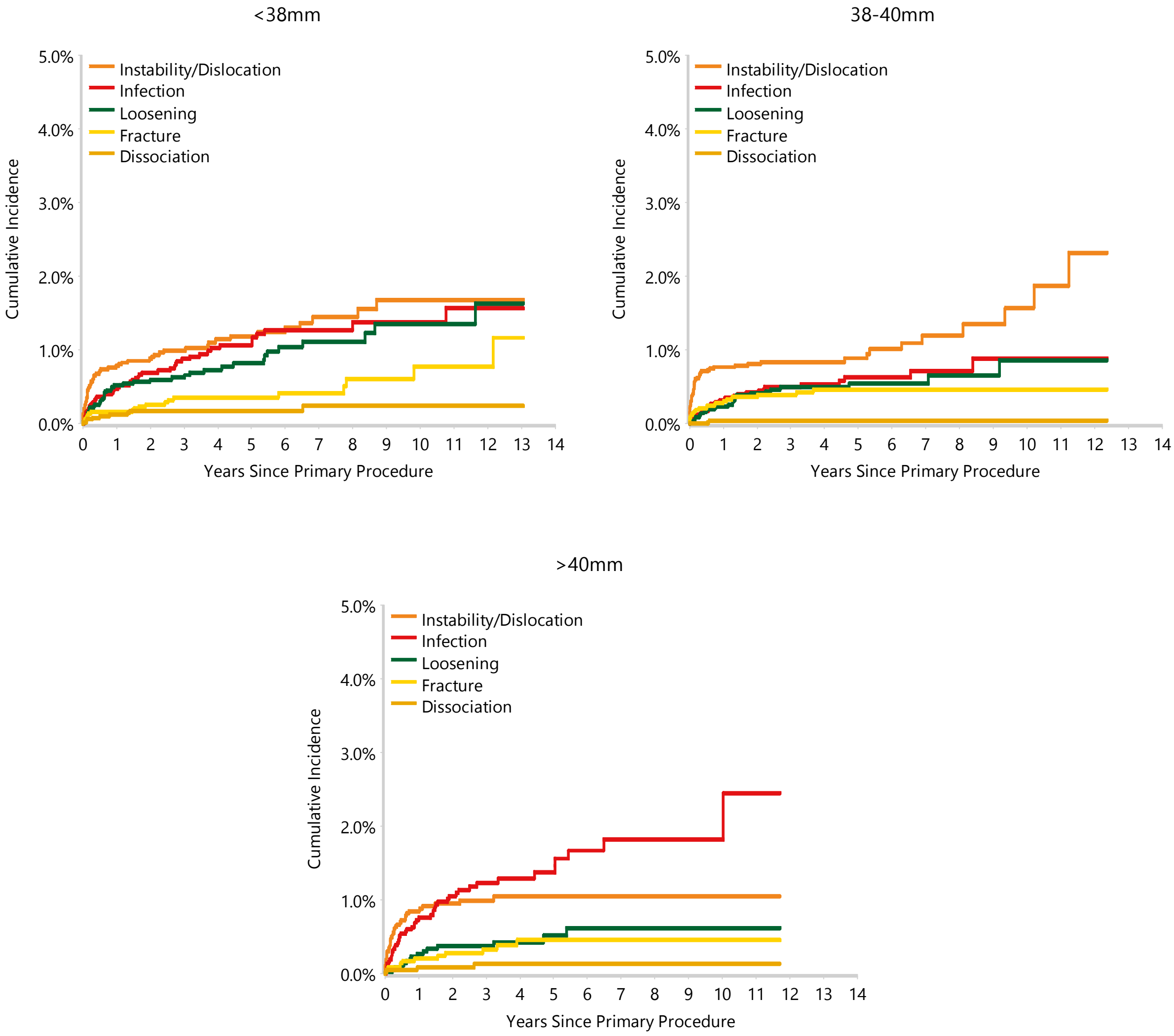
>40mm vs 38-40mm
0 - 3Mth: HR=0.77 (0.52, 1.13),p=0.180
3Mth - 9Mth: HR=1.19 (0.76, 1.86),p=0.450
9Mth+: HR=0.98 (0.70, 1.37),p=0.914

>40mm vs <38mm
Entire Period: HR=0.68 (0.53, 0.86),p=0.001

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| <38mm | 5166 | 4242 | 2782 | 1668 | 914 | 349 | 8 |
| 38-40mm | 5870 | 4805 | 2919 | 1535 | 719 | 218 | 0 |
| >40mm | 3668 | 2993 | 1743 | 897 | 437 | 97 | 0 |

Note: Excludes 222 procedures with unknown glenosphere size
Restricted to modern prostheses

**Figure ST41** **Cumulative Incidence Revision Diagnosis of Primary Total Reverse Shoulder Replacement by Glenosphere Size (Primary Diagnosis OA)**




Note: Restricted to modern prostheses

**Table ST58 Cumulative Percent Revision of Primary Total 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 | 64 | 1338 | 2.0 (1.4, 2.9) | 3.4 (2.5, 4.6) | 4.1 (3.1, 5.5) | 5.8 (4.5, 7.6) | 7.7 (5.6, 10.6) | |
| | Perform Reversed | 0 | 40 | 0.0 (0.0, 0.0) | | | | | |
| Affinis | Affinis | 13 | 547 | 1.6 (0.8, 3.2) | 2.8 (1.6, 4.9) | | | | |
| AltiVate Reverse | RSP | 1 | 122 | | | | | | |
| Ascend Flex | Aequalis | 22 | 787 | 2.0 (1.2, 3.3) | 3.9 (2.5, 6.0) | 4.6 (2.8, 7.5) | | | |
| | Perform Reversed | 1 | 82 | 2.2 (0.3, 14.4) | | | | | |
| Comprehensive | Comprehensive Reverse | 19 | 1208 | 1.2 (0.7, 2.0) | 1.8 (1.1, 2.9) | 2.6 (1.5, 4.5) | | | |
| | Custom Made (Comprehensive) | 0 | 34 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | | |
| Delta Xtend | Delta Xtend | 134 | 4171 | 1.8 (1.5, 2.3) | 2.7 (2.3, 3.3) | 3.1 (2.6, 3.8) | 3.8 (3.1, 4.6) | 5.0 (4.0, 6.3) | |
| Equinoxe | Equinoxe | 34 | 1396 | 2.0 (1.4, 3.0) | 3.2 (2.3, 4.6) | 3.7 (2.5, 5.4) | | | |
| Global Unite | Delta Xtend | 8 | 264 | 0.9 (0.2, 3.4) | 4.3 (2.1, 8.5) | 4.3 (2.1, 8.5) | | | |
| MSS | MSS | 0 | 40 | 0.0 (0.0, 0.0) | | | | | |
| RSP | RSP | 21 | 588 | 2.9 (1.8, 4.7) | 3.8 (2.5, 5.9) | | | | |
| SMR | Custom Made (Lima) | 3 | 25 | 13.1 (4.4, 35.7) | | | | | |
| | SMR Axioma | 4 | 67 | 3.5 (0.9, 13.3) | 10.2 (3.7, 26.2) | | | | |
| | SMR L1 | 130 | 3459 | 2.7 (2.2, 3.3) | 3.6 (3.0, 4.3) | 3.9 (3.2, 4.7) | 4.7 (3.8, 5.8) | 5.7 (4.4, 7.4) | |
| Trabecular Metal | Comprehensive Reverse | 2 | 68 | 1.5 (0.2, 10.3) | 8.1 (1.6, 35.3) | | | | |
| | Trabecular Metal | 24 | 646 | 1.8 (1.0, 3.2) | 2.9 (1.8, 4.7) | 4.4 (2.9, 6.6) | 4.4 (2.9, 6.6) | 5.4 (3.3, 8.7) | |
| Other (10) | | 8 | 44 | 19.1 (9.4, 36.5) | 19.1 (9.4, 36.5) | | | | |
| TOTAL | | 488 | 14926 | | | | | | |

Note: Only combinations with over 25 procedures have been listed
Restricted to modern prostheses

**Table ST59 Cumulative Percent Revision of Cementless Primary Total 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 | 54 | 1028 | 2.1 (1.4, 3.2) | 3.8 (2.7, 5.2) | 4.5 (3.3, 6.0) | 6.5 (4.9, 8.6) | 8.5 (5.9, 12.1) | |
| | Perform Reversed | 0 | 35 | 0.0 (0.0, 0.0) | | | | | |
| Affinis | Affinis | 8 | 322 | 1.4 (0.5, 3.7) | 2.8 (1.3, 5.9) | | | | |
| AltiVate Reverse | RSP | 1 | 113 | | | | | | |
| Ascend Flex | Aequalis | 21 | 724 | 2.0 (1.2, 3.4) | 4.1 (2.6, 6.4) | 4.9 (2.9, 8.1) | | | |
| | Perform Reversed | 1 | 73 | 2.5 (0.4, 16.5) | | | | | |
| Comprehensive | Comprehensive Reverse | 18 | 1161 | 1.2 (0.7, 2.1) | 1.9 (1.1, 3.1) | 2.3 (1.3, 3.9) | | | |
| | Custom Made (Comprehensive) | 0 | 33 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | | |
| Delta Xtend | Delta Xtend | 102 | 3000 | 2.0 (1.6, 2.6) | 3.0 (2.4, 3.7) | 3.4 (2.7, 4.1) | 3.9 (3.1, 4.8) | 5.8 (4.3, 7.7) | |
| Equinoxe | Equinoxe | 31 | 1333 | 2.0 (1.3, 3.0) | 3.1 (2.1, 4.5) | 3.5 (2.3, 5.4) | | | |
| Global Unite | Delta Xtend | 6 | 233 | 1.0 (0.2, 3.8) | 3.5 (1.6, 7.8) | 3.5 (1.6, 7.8) | | | |
| MSS | MSS | 0 | 40 | 0.0 (0.0, 0.0) | | | | | |
| RSP | RSP | 18 | 499 | 3.0 (1.8, 5.0) | 3.9 (2.4, 6.2) | | | | |
| SMR | Custom Made (Lima) | 3 | 25 | 13.1 (4.4, 35.7) | | | | | |
| | SMR Axioma | 3 | 65 | 3.5 (0.9, 13.6) | 6.8 (2.1, 20.6) | | | | |
| | SMR L1 | 124 | 3367 | 2.6 (2.1, 3.2) | 3.5 (2.9, 4.2) | 3.8 (3.2, 4.6) | 4.6 (3.7, 5.7) | 5.7 (4.3, 7.4) | |
| Trabecular Metal | Comprehensive Reverse | 2 | 65 | 1.6 (0.2, 10.7) | 8.1 (1.6, 35.3) | | | | |
| | Trabecular Metal | 20 | 586 | 1.8 (1.0, 3.3) | 2.6 (1.6, 4.4) | 4.0 (2.5, 6.2) | 4.0 (2.5, 6.2) | 5.1 (2.9, 8.9) | |
| Other (8) | | 6 | 37 | 15.8 (6.8, 34.4) | 15.8 (6.8, 34.4) | | | | |
| TOTAL | | 418 | 12739 | | | | | | |

Note: Only combinations with over 25 procedures have been listed
Restricted to modern prostheses

**Table ST60 Cumulative Percent Revision of Hybrid (Humerus Cemented) Primary Total 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 | 10 | 289 | 1.8 (0.7, 4.2) | 2.2 (1.0, 5.0) | 3.3 (1.7, 6.7) | 4.0 (2.1, 7.8) | | |
| Affinis | Affinis | 4 | 207 | 2.0 (0.8, 5.2) | 2.0 (0.8, 5.2) | | | | |
| Ascend Flex | Aequalis | 1 | 59 | 1.8 (0.2, 11.8) | 1.8 (0.2, 11.8) | 1.8 (0.2, 11.8) | | | |
| Comprehensive | Comprehensive Reverse | 1 | 41 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 7.1 (1.0, 40.9) | | | |
| Delta Xtend | Delta Xtend | 31 | 1112 | 1.4 (0.8, 2.3) | 2.3 (1.5, 3.4) | 2.6 (1.7, 3.7) | 3.5 (2.4, 5.1) | 3.8 (2.6, 5.6) | |
| Equinoxe | Equinoxe | 3 | 61 | 3.9 (1.0, 14.6) | 6.7 (2.2, 19.8) | | | | |
| Global Unite | Delta Xtend | 2 | 29 | 0.0 (0.0, 0.0) | 10.9 (2.8, 37.8) | 10.9 (2.8, 37.8) | | | |
| RSP | RSP | 3 | 85 | 2.4 (0.6, 9.4) | 3.9 (1.3, 11.5) | 3.9 (1.3, 11.5) | | | |
| SMR | SMR L1 | 5 | 67 | 4.6 (1.5, 13.6) | 8.3 (3.5, 18.9) | 8.3 (3.5, 18.9) | 8.3 (3.5, 18.9) | | |
| Trabecular Metal | Trabecular Metal | 4 | 51 | 2.0 (0.3, 13.1) | 6.7 (2.2, 19.6) | 9.9 (3.8, 24.6) | 9.9 (3.8, 24.6) | 9.9 (3.8, 24.6) | |
| Other (11) | | 2 | 35 | 8.3 (2.0, 31.1) | | | | | |
| TOTAL | | 66 | 2036 | | | | | | |

Note: Only combinations with over 25 procedures have been listed
Restricted to modern prostheses

## OUTCOME FOR ROTATOR CUFF ARTHROPATHY – PATIENT CHARACTERISTICS

### Age and Gender

For the diagnosis of rotator cuff arthropathy, age is not a risk factor for revision (Table ST61 and Figure ST42).

Males have a higher rate of revision compared to females (Table ST62 and Figure ST43).

The increase in the rate of revision is due to a higher cumulative incidence of instability/ dislocation and infection (Figure ST44).

### ASA and BMI

There is no difference in the rate of revision when patients with ASA scores 2 and 3 are compared to patients with an ASA score of 1. Patients with an ASA score of 4 have a higher risk of revision than those with an ASA score of 1 (Table ST63 and Figure ST45). The most common reasons for revision for the different ASA scores are presented in Figure ST46.

Pre-obese patients have a lower risk of revision compared to patients with a normal BMI. There is no difference in the rate of revision when patients in obese class 1, 2, and 3 are compared to patients with a normal BMI (Table ST64 and Figure ST47).

The most common reasons for revision for the different BMI categories are shown in Figure ST48. The rate of revision for instability/ dislocation increases with increasing BMI class.

### Glenoid Morphology

**The rate of instability/dislocation increases with increasing BMI class.**

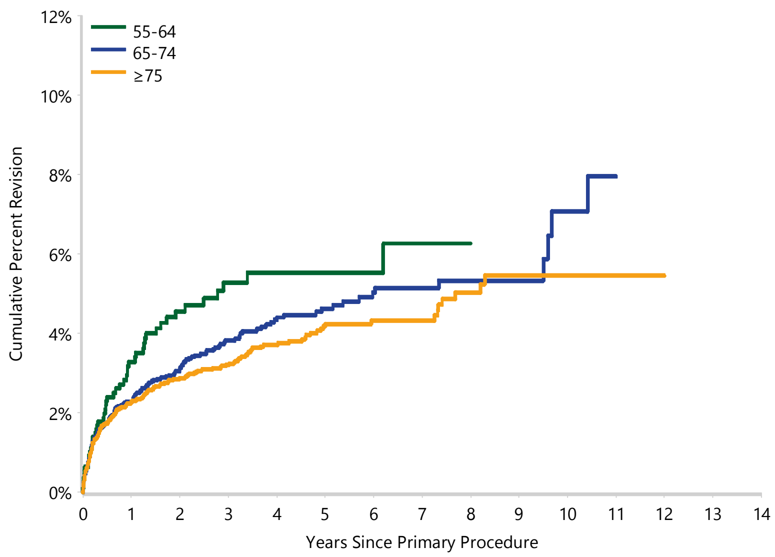
The Registry has glenoid morphology data on 6,123 primary total reverse shoulder replacements undertaken for rotator cuff arthropathy. The distribution of the different morphology categories is presented in Table ST65. The category of glenoid morphology is not a risk factor for revision (Figure ST49).

**Table ST61** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Age (Primary Diagnosis Rotator Cuff Arthropathy)**

| Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| <55 | 5 | 116 | 3.5 (1.3, 9.1) | | | | | |
| 55-64 | 50 | 1102 | 3.3 (2.3, 4.6) | 5.3 (4.0, 7.0) | 5.5 (4.1, 7.4) | 6.3 (4.4, 8.8) | | |
| 65-74 | 178 | 4880 | 2.3 (1.9, 2.8) | 3.8 (3.2, 4.5) | 4.6 (3.9, 5.4) | 5.1 (4.3, 6.1) | 7.1 (5.2, 9.6) | |
| ≥75 | 205 | 6141 | 2.3 (1.9, 2.7) | 3.2 (2.8, 3.7) | 4.2 (3.6, 4.8) | 4.3 (3.7, 5.0) | 5.5 (4.5, 6.6) | |
| TOTAL | 438 | 12239 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST42** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Age (Primary Diagnosis Rotator Cuff Arthropathy)**




HR - adjusted for gender

55-64 vs ≥75

Entire Period: HR=1.30 (0.95, 1.77),p=0.102

55-64 vs 65-74

Entire Period: HR=1.21 (0.88, 1.66),p=0.232

65-74 vs ≥75

Entire Period: HR=1.07 (0.87, 1.31),p=0.508

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| 55-64 | 1102 | 843 | 451 | 202 | 94 | 24 | 0 |
| 65-74 | 4880 | 3835 | 2167 | 1142 | 587 | 130 | 5 |
| ≥75 | 6141 | 5051 | 2994 | 1650 | 802 | 181 | 1 |

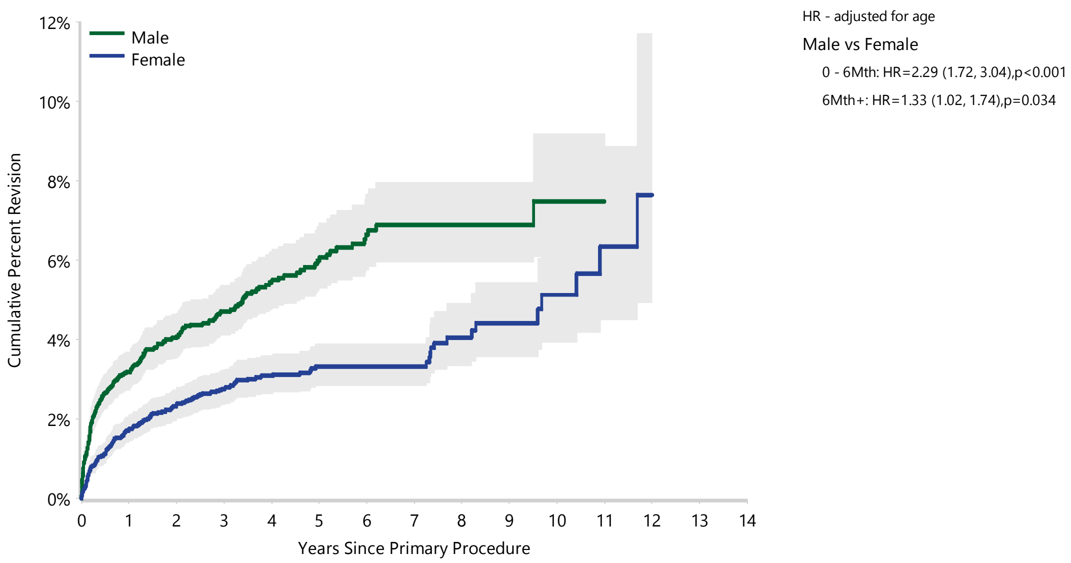
Note: Restricted to modern prostheses

**Table ST62** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Gender (Primary Diagnosis Rotator Cuff Arthropathy)**

| Gender | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Male | 253 | 5488 | 3.2 (2.7, 3.7) | 4.7 (4.1, 5.4) | 6.0 (5.2, 6.8) | 6.9 (6.0, 7.9) | 7.5 (6.1, 9.2) | |
| Female | 185 | 6751 | 1.7 (1.4, 2.1) | 2.8 (2.4, 3.2) | 3.3 (2.8, 3.9) | 3.3 (2.8, 3.9) | 5.1 (3.9, 6.7) | |
| TOTAL | 438 | 12239 | | | | | | |

Note: Restricted to modern prostheses

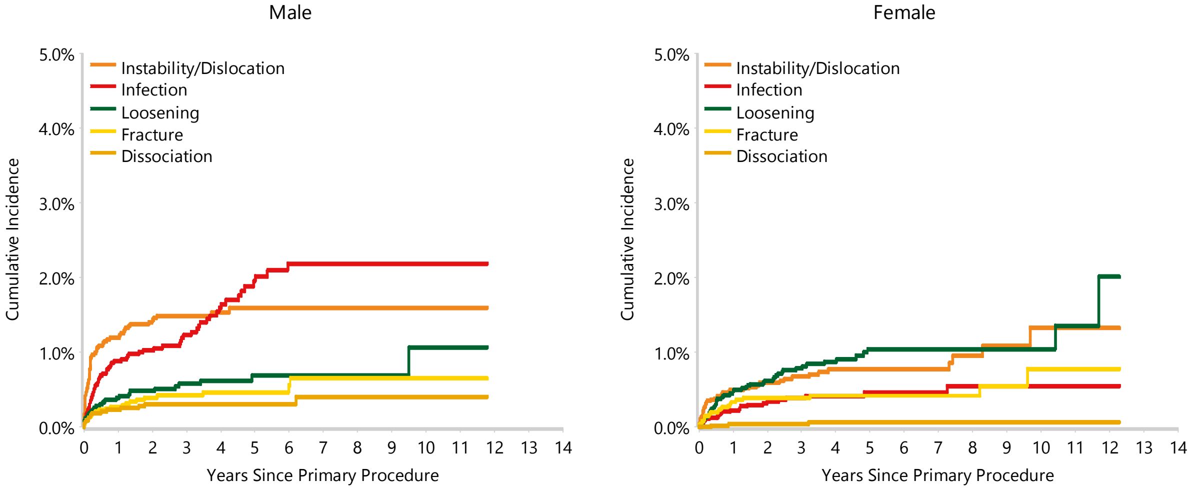
**Figure ST43** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Gender (Primary Diagnosis Rotator Cuff Arthropathy)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Male | 5488 | 4277 | 2338 | 1180 | 551 | 124 | 5 |
| Female | 6751 | 5537 | 3312 | 1832 | 940 | 213 | 1 |

Note: Restricted to modern prostheses

**Figure ST44 Cumulative Incidence Revision Diagnosis of Primary Total Reverse Shoulder Replacement by Gender (Primary Diagnosis Rotator Cuff Arthropathy)**



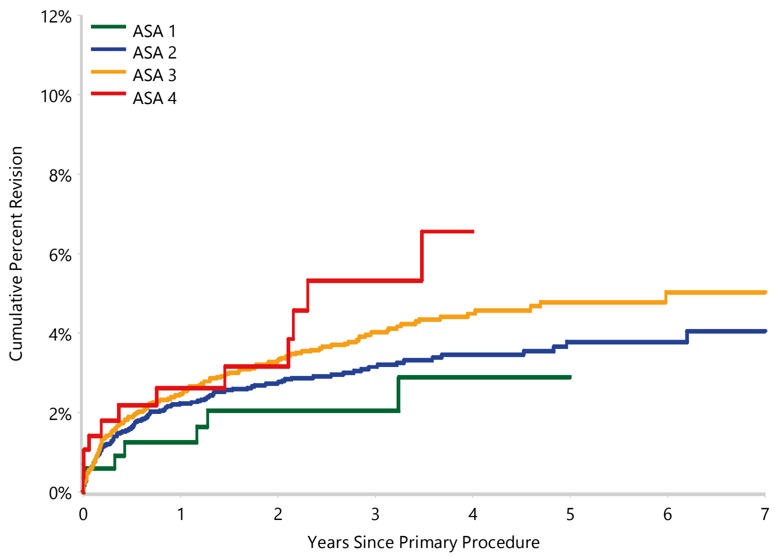

Note: Restricted to modern prostheses

**Table ST63** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by ASA Score (Primary Diagnosis Rotator Cuff Arthropathy)**

| ASA Score | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|---|
| ASA 1 | 7 | 334 | 1.3 (0.5, 3.3) | 2.0 (0.9, 4.5) | 2.0 (0.9, 4.5) | 2.9 (1.3, 6.4) | 2.9 (1.3, 6.4) | |
| ASA 2 | 130 | 4529 | 2.2 (1.8, 2.7) | 2.8 (2.3, 3.3) | 3.2 (2.6, 3.8) | 3.4 (2.9, 4.1) | 3.8 (3.1, 4.6) | 4.1 (3.2, 5.1) |
| ASA 3 | 183 | 5328 | 2.5 (2.1, 2.9) | 3.3 (2.8, 3.9) | 4.0 (3.4, 4.7) | 4.5 (3.8, 5.2) | 4.8 (4.1, 5.6) | 5.0 (4.2, 6.0) |
| ASA 4 | 13 | 282 | 2.6 (1.3, 5.4) | 3.2 (1.6, 6.3) | 5.3 (2.9, 9.7) | 6.6 (3.6, 12.0) | | |
| ASA 5 | 0 | 1 | | | | | | |
| TOTAL | 333 | 10474 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST45** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by ASA Score (Primary Diagnosis Rotator Cuff Arthropathy)**




HR - adjusted for age and gender

ASA 2 vs ASA 1

Entire Period: HR=1.56 (0.73, 3.35),p=0.251

ASA 3 vs ASA 1

Entire Period: HR=2.02 (0.95, 4.32),p=0.069

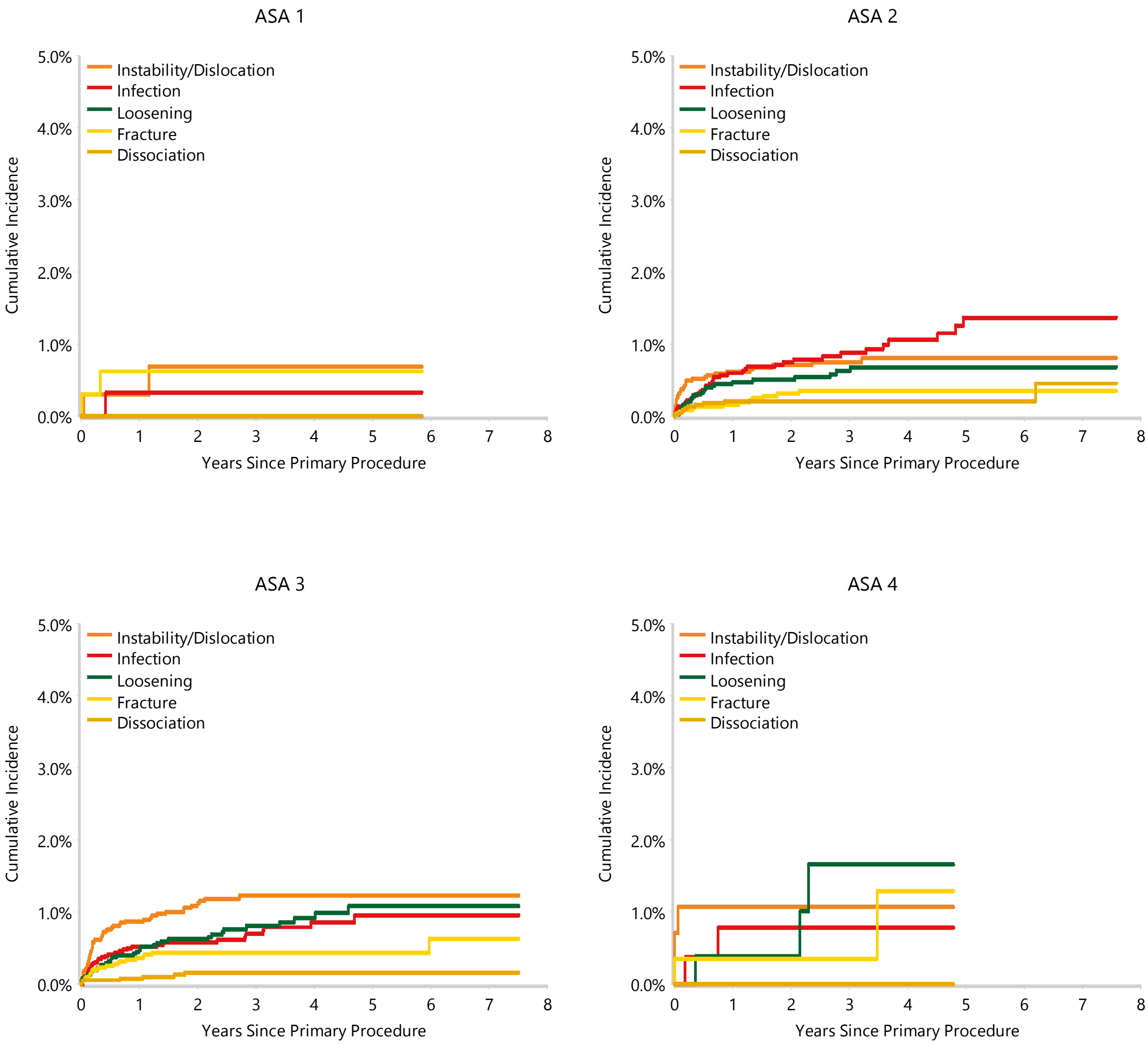
ASA 4 vs ASA 1

Entire Period: HR=2.77 (1.10, 6.97),p=0.030

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|
| ASA 1 | 334 | 263 | 205 | 135 | 85 | 64 | 17 |
| ASA 2 | 4529 | 3557 | 2695 | 1893 | 1240 | 789 | 165 |
| ASA 3 | 5328 | 4088 | 2948 | 1964 | 1229 | 729 | 144 |
| ASA 4 | 282 | 215 | 141 | 91 | 60 | 36 | 7 |

Note: Restricted to modern prostheses

**Figure ST46** **Cumulative Incidence Revision Diagnosis of Primary Total Reverse Shoulder Replacement by ASA Score (Primary Diagnosis Rotator Cuff Arthropathy)**



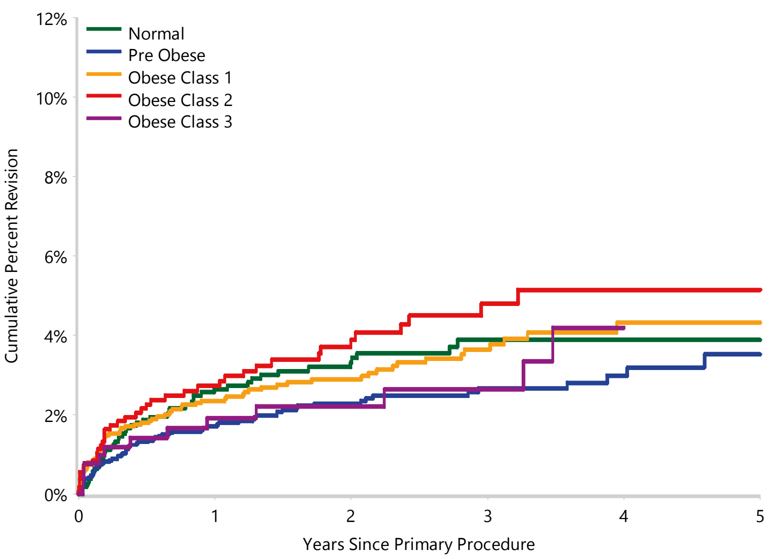

Note: Restricted to modern prostheses

**Table ST64** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by BMI Category (Primary Diagnosis Rotator Cuff Arthropathy)**

| BMI Category | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs |
|---|---|---|---|---|---|---|
| Underweight | 1 | 60 | 1.7 (0.2, 11.6) | 1.7 (0.2, 11.6) | 1.7 (0.2, 11.6) | 1.7 (0.2, 11.6) |
| Normal | 49 | 1567 | 2.6 (1.9, 3.6) | 3.3 (2.5, 4.4) | 3.9 (2.9, 5.2) | 3.9 (2.9, 5.2) |
| Pre Obese | 70 | 3107 | 1.7 (1.3, 2.3) | 2.3 (1.8, 2.9) | 2.7 (2.1, 3.4) | 3.0 (2.3, 3.9) |
| Obese Class 1 | 75 | 2475 | 2.4 (1.8, 3.1) | 2.9 (2.3, 3.7) | 3.6 (2.9, 4.6) | 4.3 (3.3, 5.6) |
| Obese Class 2 | 40 | 1076 | 2.7 (1.9, 3.9) | 3.9 (2.8, 5.4) | 4.8 (3.5, 6.6) | 5.1 (3.7, 7.2) |
| Obese Class 3 | 13 | 514 | 1.9 (1.0, 3.7) | 2.2 (1.2, 4.1) | 2.6 (1.4, 4.8) | 4.2 (2.2, 7.9) |
| TOTAL | 248 | 8799 | | | | |

Note: Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years

**Figure ST47** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by BMI Category (Primary Diagnosis Rotator Cuff Arthropathy)**




HR - adjusted for age and gender

Pre Obese vs Normal
Entire Period: HR=0.68 (0.47, 0.98),p=0.037

Obese Class 1 vs Normal
Entire Period: HR=0.92 (0.64, 1.32),p=0.638

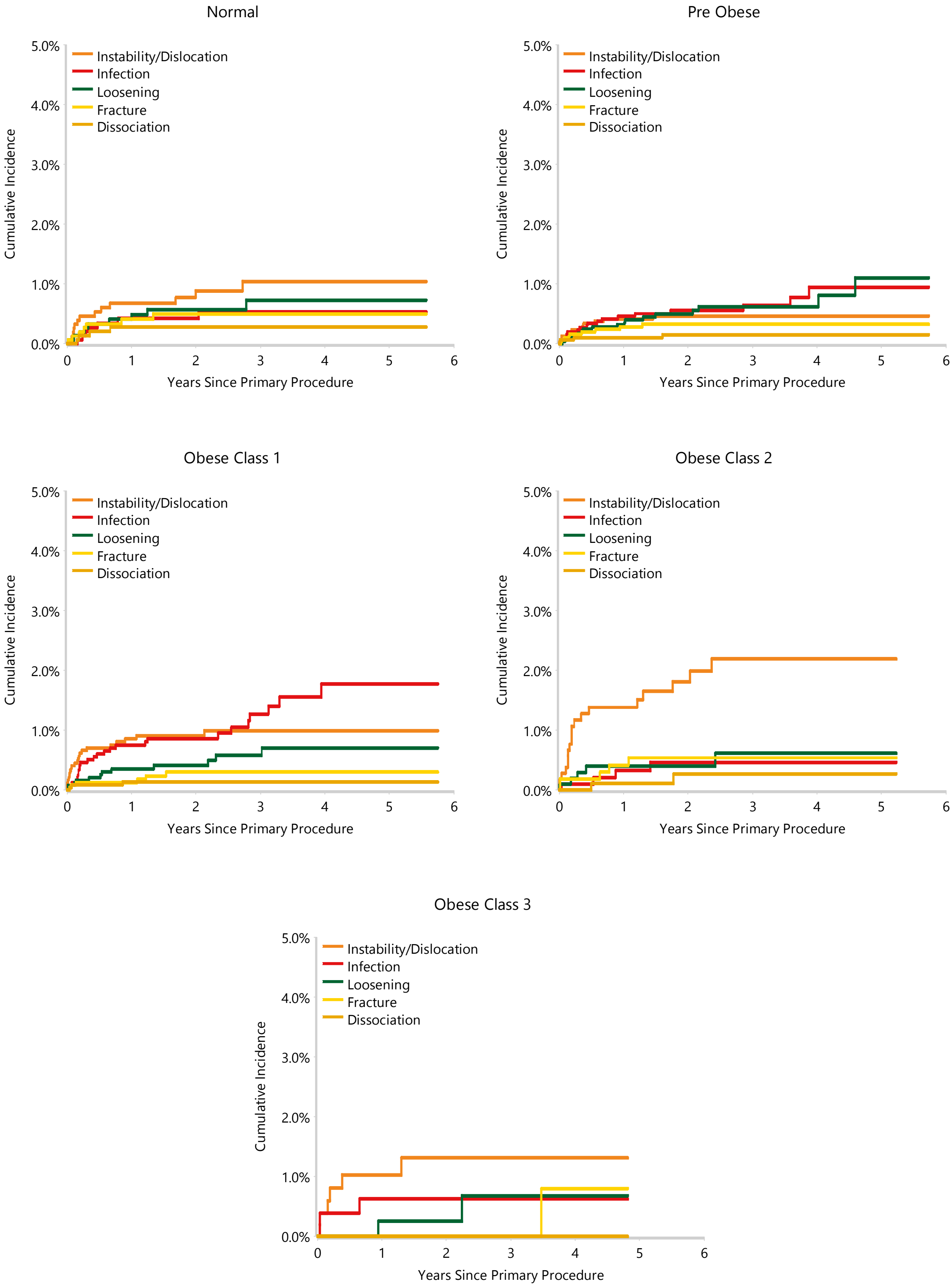
Obese Class 2 vs Normal
Entire Period: HR=1.16 (0.76, 1.77),p=0.497

Obese Class 3 vs Normal
Entire Period: HR=0.83 (0.45, 1.54),p=0.551

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs |
|---|---|---|---|---|---|
| Normal | 1567 | 1194 | 834 | 493 | 261 |
| Pre Obese | 3107 | 2333 | 1598 | 990 | 477 |
| Obese Class 1 | 2475 | 1814 | 1254 | 753 | 390 |
| Obese Class 2 | 1076 | 786 | 537 | 314 | 149 |
| Obese Class 3 | 514 | 379 | 248 | 154 | 80 |

Note: Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years

**Figure ST48 Cumulative Incidence Revision Diagnosis of Primary Total Reverse Shoulder Replacement by BMI Category (Primary Diagnosis Rotator Cuff Arthropathy)**



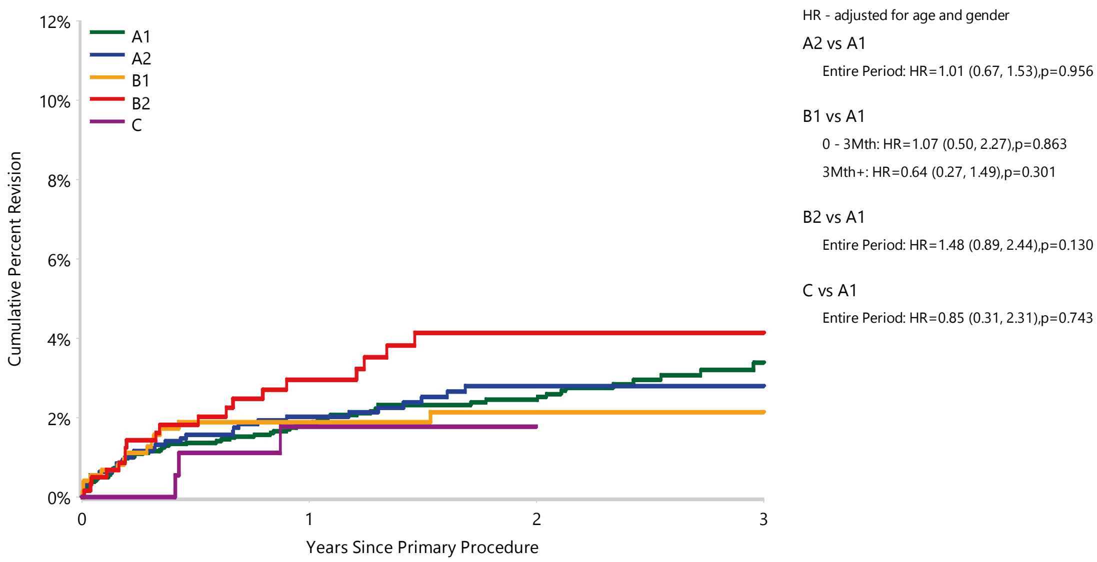

Note: Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years

**Table ST65 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Glenoid Morphology (Primary Diagnosis Rotator Cuff Arthropathy)**

| Glenoid Morphology | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs |
|---|---|---|---|---|---|
| A1 | 75 | 3157 | 1.8 (1.4, 2.4) | 2.5 (1.9, 3.1) | 3.4 (2.6, 4.4) |
| A2 | 32 | 1425 | 2.0 (1.4, 3.0) | 2.8 (2.0, 4.0) | 2.8 (2.0, 4.0) |
| B1 | 14 | 738 | 1.9 (1.1, 3.2) | 2.2 (1.3, 3.6) | 2.2 (1.3, 3.6) |
| B2 | 19 | 590 | 3.0 (1.8, 4.9) | 4.1 (2.6, 6.5) | 4.1 (2.6, 6.5) |
| C | 4 | 213 | 1.8 (0.6, 5.4) | 1.8 (0.6, 5.4) | |
| TOTAL | 144 | 6123 | | | |

Note: Restricted to modern prostheses
11 procedures have been excluded where a glenoid morphology of B3 was recorded

**Figure ST49 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Glenoid Morphology (Primary Diagnosis Rotator Cuff Arthropathy)**




| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs |
|---|---|---|---|---|
| A1 | 3157 | 2174 | 1312 | 491 |
| A2 | 1425 | 970 | 548 | 217 |
| B1 | 738 | 484 | 283 | 120 |
| B2 | 590 | 385 | 205 | 75 |
| C | 213 | 140 | 77 | 33 |

Note: Restricted to modern prostheses

## OUTCOME FOR ROTATOR CUFF ARTHROPATHY – PROSTHESIS CHARACTERISTICS

### Fixation

Fixation is not a risk factor for revision (Table ST66 and Figure ST50).

### Type of Polyethylene

Non XLPE is the most common type of polyethylene used in primary total reverse shoulder replacement for the management of rotator cuff arthropathy. There is no difference in the cumulative percent revision when the different types of polyethylene are compared (Table ST67 and Figure ST51). The reasons for revision of the different polyethylene types are presented in Figure ST52.

### Glenosphere Size

Glenosphere size does not affect the risk of revision when total reverse shoulder replacement is used for the management of rotator cuff arthropathy (Table ST69 and Figure ST53). The cumulative incidence of the most common reasons for revision for the different glenosphere sizes is presented in Figure ST54.

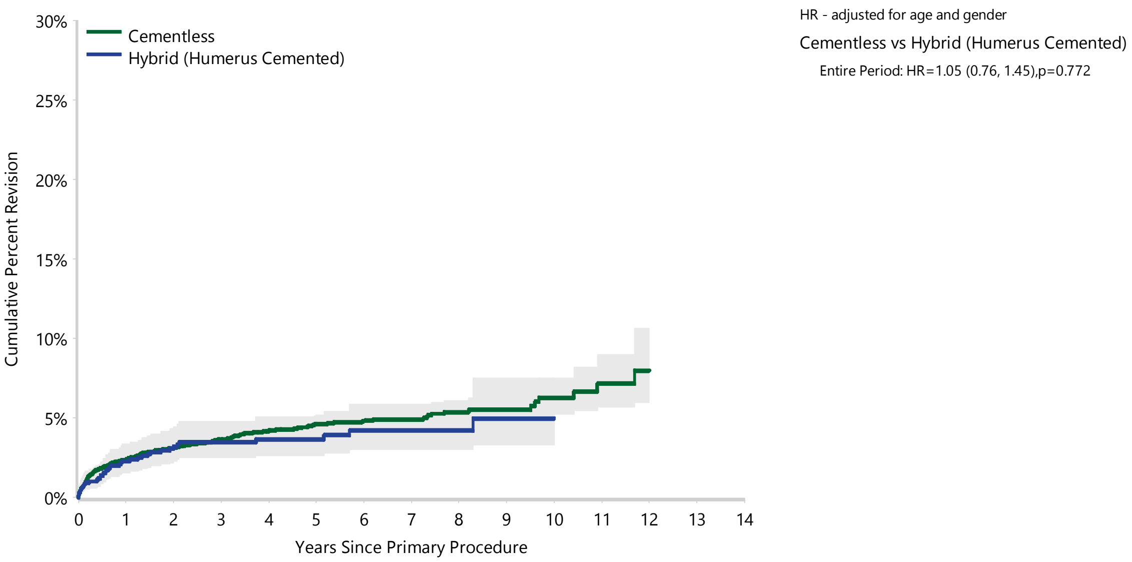
The outcomes of the most commonly used prosthesis combinations are listed in Table ST70. The most commonly used prosthesis combinations using cementless fixation for rotator cuff arthropathy are listed in Table ST71. The most commonly used prosthesis combinations using hybrid (humerus cemented) fixation for rotator cuff arthropathy are listed in Table ST72.

**Table ST66** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Fixation (Primary Diagnosis Rotator Cuff Arthropathy)**

| Fixation | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cemented | 1 | 22 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | |
| Cementless | 394 | 10924 | 2.4 (2.1, 2.7) | 3.6 (3.3, 4.1) | 4.6 (4.1, 5.1) | 4.9 (4.4, 5.5) | 6.3 (5.2, 7.5) | |
| Hybrid (Glenoid Cemented) | 3 | 83 | 3.8 (1.2, 11.4) | 3.8 (1.2, 11.4) | | | | |
| Hybrid (Humerus Cemented) | 40 | 1210 | 2.3 (1.6, 3.4) | 3.5 (2.5, 4.8) | 3.7 (2.6, 5.0) | 4.2 (3.0, 5.8) | 5.0 (3.3, 7.5) | |
| TOTAL | 438 | 12239 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST50** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Fixation (Primary Diagnosis Rotator Cuff Arthropathy)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Cementless | 10924 | 8744 | 5024 | 2605 | 1267 | 293 | 6 |
| Hybrid (Humerus Cemented) | 1210 | 993 | 582 | 391 | 216 | 42 | 0 |

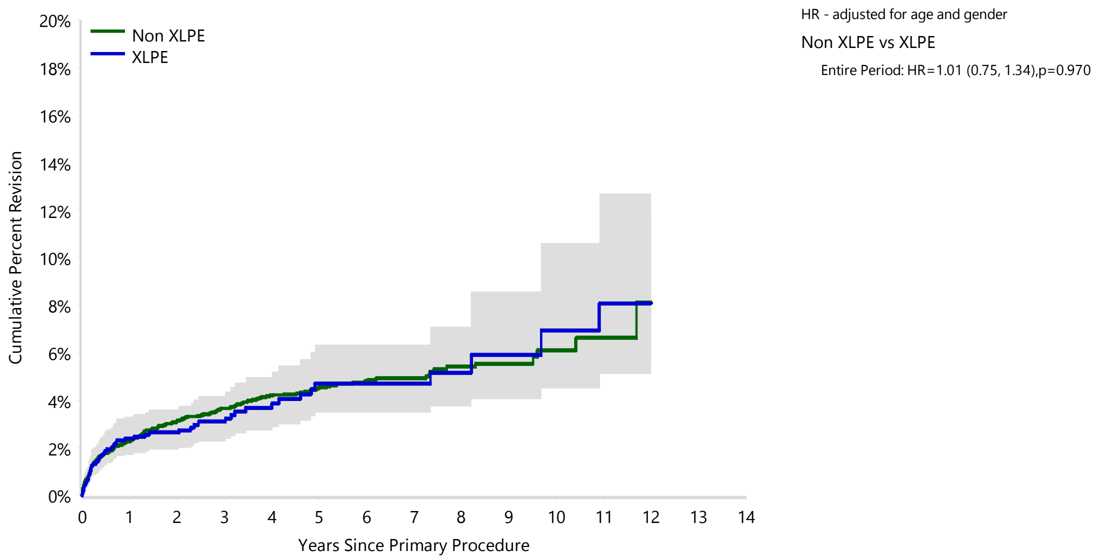
Note: Only fixations with over 100 procedures have been listed
Restricted to modern prostheses

**Table ST67** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Polyethylene Type (Primary Diagnosis Rotator Cuff Arthropathy)**

| Polyethylene Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Non XLPE | 296 | 8027 | 2.3 (2.0, 2.7) | 3.7 (3.2, 4.1) | 4.5 (4.0, 5.1) | 4.9 (4.3, 5.6) | 6.1 (5.1, 7.3) | |
| XLPE | 56 | 1641 | 2.4 (1.7, 3.3) | 3.1 (2.3, 4.2) | 4.7 (3.5, 6.3) | 4.7 (3.5, 6.3) | 7.0 (4.5, 10.6) | |
| TOTAL | 352 | 9668 | | | | | | |

Note: Restricted to modern prostheses

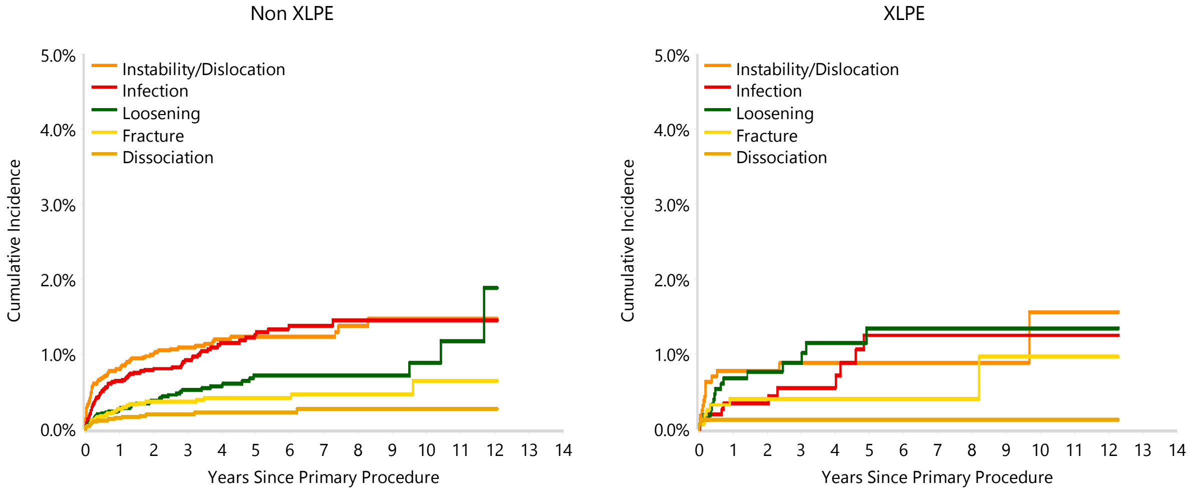
**Figure ST51** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Polyethylene Type (Primary Diagnosis Rotator Cuff Arthropathy)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Non XLPE | 8027 | 6579 | 3934 | 2211 | 1145 | 247 | 2 |
| XLPE | 1641 | 1232 | 693 | 421 | 236 | 86 | 4 |

Note: Restricted to modern prostheses

**Figure ST52** **Cumulative Incidence Revision Diagnosis of Primary Total Reverse Shoulder Replacement by Polyethylene Type (Primary Diagnosis Rotator Cuff Arthropathy)**




Note: Restricted to modern prostheses

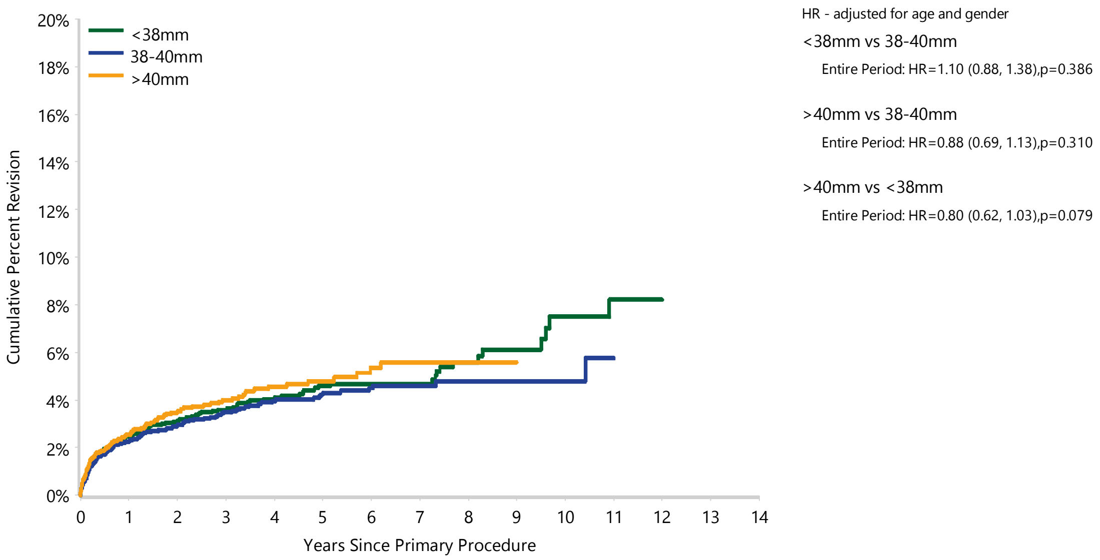
**Table ST68** **Table no longer provided**

**Table ST69** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Glenosphere Size (Primary Diagnosis Rotator Cuff Arthropathy)**

| Glenosphere Size | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| <38mm | 152 | 4032 | 2.5 (2.0, 3.1) | 3.6 (3.0, 4.3) | 4.6 (3.8, 5.5) | 4.7 (3.9, 5.6) | 7.5 (5.7, 9.8) | |
| 38-40mm | 164 | 4794 | 2.3 (1.9, 2.7) | 3.5 (3.0, 4.1) | 4.2 (3.6, 5.0) | 4.6 (3.9, 5.5) | 4.8 (4.0, 5.7) | |
| >40mm | 121 | 3234 | 2.5 (2.0, 3.2) | 4.0 (3.3, 4.8) | 4.8 (4.0, 5.8) | 5.6 (4.5, 6.9) | | |
| TOTAL | 437 | 12060 | | | | | | |

Note: Excludes 179 procedures with unknown glenosphere size
Restricted to modern prostheses

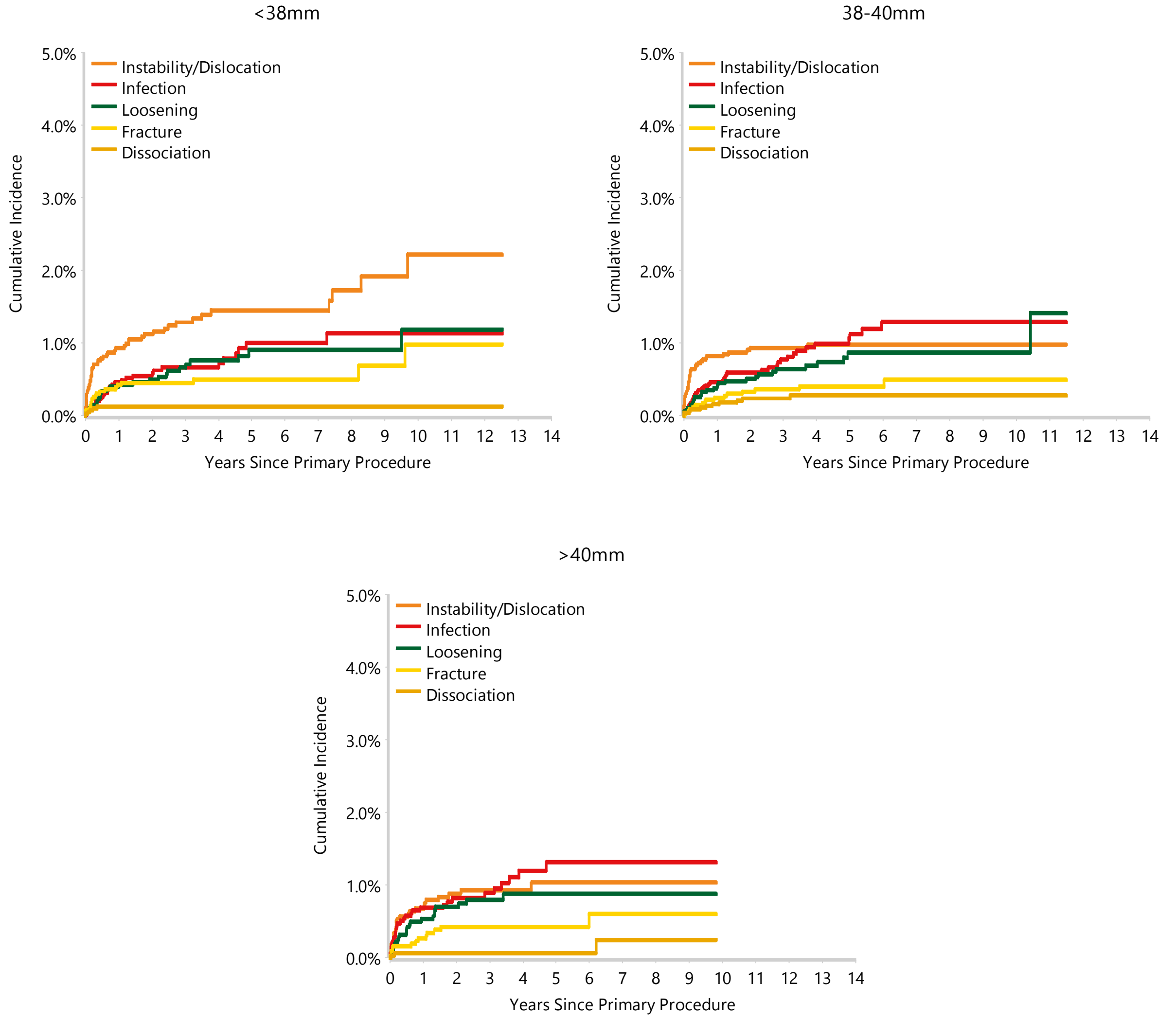
**Figure ST53** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Glenosphere Size (Primary Diagnosis Rotator Cuff Arthropathy)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| <38mm | 4032 | 3266 | 1903 | 1078 | 610 | 170 | 6 |
| 38-40mm | 4794 | 3917 | 2377 | 1276 | 601 | 132 | 0 |
| >40mm | 3234 | 2537 | 1370 | 658 | 280 | 35 | 0 |

Note: Restricted to modern prostheses

**Figure ST54** **Cumulative Incidence Revision Diagnosis of Primary Total Reverse Shoulder Replacement by Glenosphere Size (Primary Diagnosis Rotator Cuff Arthropathy)**




Note: Restricted to modern prostheses

**Table ST70 Cumulative Percent Revision of Primary Total 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 | 48 | 1058 | 2.4 (1.6, 3.5) | 3.7 (2.6, 5.1) | 4.8 (3.5, 6.5) | 5.0 (3.7, 6.8) | 7.8 (5.3, 11.4) | |
| | Perform Reversed | 0 | 43 | 0.0 (0.0, 0.0) | | | | | |
| Affinis | Affinis | 13 | 532 | 2.2 (1.2, 4.0) | 3.3 (1.9, 5.7) | | | | |
| AltiVate Reverse | RSP | 5 | 159 | 4.1 (1.4, 11.9) | | | | | |
| Ascend Flex | Aequalis | 21 | 723 | 2.3 (1.3, 3.8) | 3.9 (2.5, 6.0) | 3.9 (2.5, 6.0) | | | |
| | Perform Reversed | 2 | 81 | 2.7 (0.7, 10.6) | | | | | |
| Comprehensive | Comprehensive Reverse | 13 | 883 | 1.1 (0.6, 2.1) | 1.5 (0.8, 2.8) | 3.8 (1.5, 9.7) | | | |
| | Trabecular Metal | 1 | 27 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | | |
| Delta Xtend | Delta Xtend | 124 | 3517 | 2.0 (1.6, 2.5) | 3.2 (2.6, 3.9) | 3.9 (3.3, 4.7) | 4.5 (3.7, 5.4) | 4.6 (3.8, 5.6) | |
| Equinoxe | Equinoxe | 23 | 937 | 1.8 (1.1, 3.0) | 2.9 (1.8, 4.5) | | | | |
| Global Unite | Delta Xtend | 11 | 236 | 2.3 (1.0, 5.5) | 4.7 (2.4, 8.8) | | | | |
| RSP | RSP | 20 | 614 | 2.8 (1.7, 4.5) | 3.7 (2.4, 5.7) | | | | |
| SMR | SMR L1 | 112 | 2648 | 3.1 (2.5, 3.8) | 4.2 (3.4, 5.1) | 4.9 (4.0, 5.9) | 5.1 (4.2, 6.2) | 7.1 (4.9, 10.3) | |
| Trabecular Metal | Comprehensive Reverse | 4 | 71 | 3.1 (0.8, 11.7) | 13.3 (3.9, 40.1) | | | | |
| | Trabecular Metal | 38 | 638 | 4.0 (2.7, 5.8) | 5.4 (3.9, 7.5) | 5.9 (4.3, 8.2) | 6.3 (4.5, 8.7) | | |
| Other (9) | | 3 | 72 | 4.5 (1.5, 13.4) | 4.5 (1.5, 13.4) | | | | |
| TOTAL | | 438 | 12239 | | | | | | |

Note: Only combinations with over 25 procedures have been listed
Restricted to modern prostheses

**Table ST71 Cumulative Percent Revision of Cementless Primary Total 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 | 37 | 871 | 2.2 (1.4, 3.4) | 3.4 (2.3, 4.9) | 4.8 (3.4, 6.7) | 4.8 (3.4, 6.7) | 7.6 (4.8, 11.7) | |
| | Perform Reversed | 0 | 32 | 0.0 (0.0, 0.0) | | | | | |
| Affinis | Affinis | 9 | 311 | 2.1 (0.9, 4.5) | 3.8 (1.9, 7.4) | | | | |
| AltiVate Reverse | RSP | 5 | 146 | | | | | | |
| Ascend Flex | Aequalis | 20 | 652 | 2.3 (1.4, 4.0) | 4.1 (2.7, 6.4) | | | | |
| | Perform Reversed | 2 | 76 | 3.0 (0.7, 11.4) | | | | | |
| Comprehensive | Comprehensive Reverse | 13 | 872 | 1.1 (0.6, 2.1) | 1.5 (0.8, 2.8) | 3.9 (1.5, 9.7) | | | |
| | Trabecular Metal | 1 | 27 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | | |
| Delta Xtend | Delta Xtend | 108 | 2962 | 2.1 (1.6, 2.7) | 3.3 (2.7, 4.1) | 4.1 (3.4, 5.0) | 4.7 (3.8, 5.7) | 4.7 (3.8, 5.7) | |
| Equinoxe | Equinoxe | 23 | 907 | 1.9 (1.1, 3.1) | 3.0 (1.9, 4.7) | | | | |
| Global Unite | Delta Xtend | 10 | 218 | 2.5 (1.0, 5.9) | 4.4 (2.2, 8.7) | | | | |
| RSP | RSP | 17 | 561 | 2.5 (1.4, 4.2) | 3.5 (2.2, 5.5) | | | | |
| SMR | SMR L1 | 106 | 2553 | 3.0 (2.4, 3.7) | 4.1 (3.3, 5.0) | 4.8 (3.9, 5.9) | 5.0 (4.1, 6.2) | 7.1 (4.8, 10.5) | |
| Trabecular Metal | Comprehensive Reverse | 4 | 70 | 3.1 (0.8, 11.9) | 13.4 (4.0, 40.1) | | | | |
| | Trabecular Metal | 37 | 598 | 4.1 (2.7, 6.0) | 5.6 (4.0, 7.8) | 6.2 (4.4, 8.6) | 6.6 (4.7, 9.1) | | |
| Other (8) | | 2 | 68 | 3.0 (0.7, 11.3) | 3.0 (0.7, 11.3) | | | | |
| TOTAL | | 394 | 10924 | | | | | | |

Note: Only combinations with over 25 procedures have been listed
Restricted to modern prostheses

**Table ST72 Cumulative Percent Revision of Hybrid (Humerus Cemented) Primary Total 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 | 183 | 3.3 (1.5, 7.3) | 5.2 (2.7, 9.7) | 5.2 (2.7, 9.7) | 6.3 (3.4, 11.6) | | |
| Affinis | Affinis | 4 | 203 | 2.5 (0.9, 6.5) | | | | | |
| Ascend Flex | Aequalis | 0 | 69 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | | |
| Delta Xtend | Delta Xtend | 15 | 539 | 1.5 (0.8, 3.0) | 2.7 (1.6, 4.7) | 3.1 (1.8, 5.2) | 3.5 (2.1, 5.9) | | |
| Equinoxe | Equinoxe | 0 | 28 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | | | | |
| RSP | RSP | 3 | 50 | 6.4 (2.1, 18.6) | 6.4 (2.1, 18.6) | | | | |
| SMR | SMR L1 | 4 | 39 | 7.8 (2.6, 22.2) | 10.6 (4.1, 26.0) | 10.6 (4.1, 26.0) | 10.6 (4.1, 26.0) | | |
| Trabecular Metal | Trabecular Metal | 1 | 36 | 2.8 (0.4, 18.1) | 2.8 (0.4, 18.1) | 2.8 (0.4, 18.1) | 2.8 (0.4, 18.1) | | |
| Other (9) | | 2 | 63 | 2.1 (0.3, 14.2) | 5.3 (1.3, 20.0) | | | | |
| TOTAL | | 40 | 1210 | | | | | | |

Note: Only combinations with over 25 procedures have been listed
Restricted to modern prostheses

## OUTCOME FOR FRACTURE – PATIENT CHARACTERISTICS

### Age and Gender

For the diagnosis of fracture, patients aged 55-64 and 65-74 years have a higher risk of revision than patients aged ≥75 years (Table ST73 and Figure ST55).

Males have a higher rate of revision than females in the first 3 months (Table ST74 and Figure ST56). The higher rate of revision for males is due to an increased incidence of revision for instability/dislocation (Figure ST57).

### ASA and BMI

There is no difference in revision rates when comparing patients with ASA scores 3 and 4 to patients with an ASA score of 2 (Table ST75 and Figure ST58). The most common reasons for revision for the different ASA scores are presented in Figure ST59.

There is no difference in the rate of revision when pre-obese and obese classes 1, 2, and 3 patients are compared to patients with a normal BMI (Table ST76 and Figure ST60). The most common reasons for revision for the different BMI categories are shown in Figure ST61.

### Glenoid Morphology

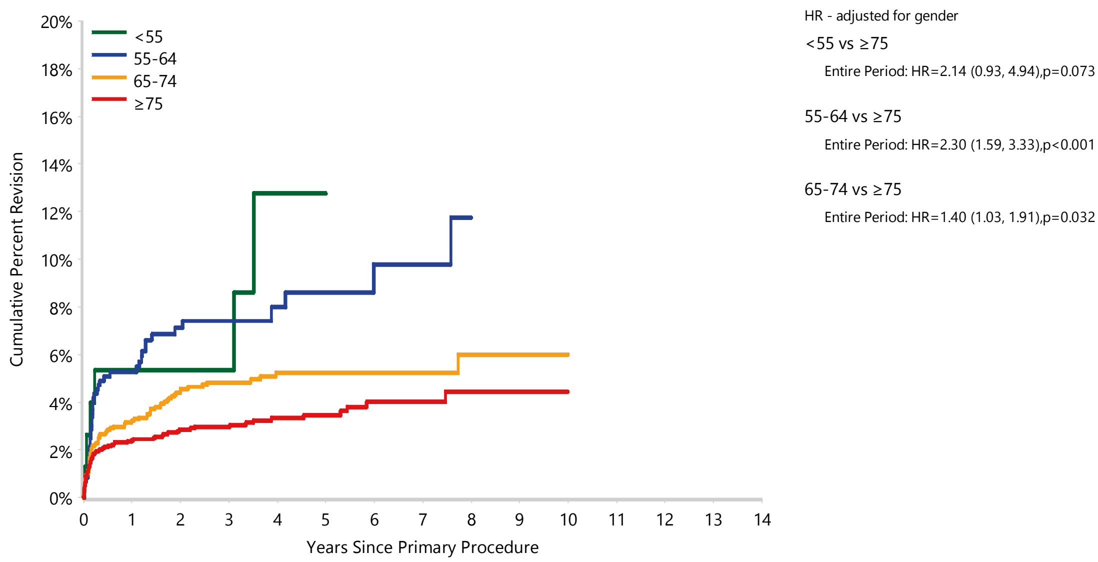
The Registry has glenoid morphology data on 2,094 primary total reverse shoulder replacements undertaken for fracture. The distribution of the different morphology categories is presented in Table ST77. Almost all are in the A1 category, so it is not possible at this time to make a meaningful comparison of outcomes based on the different types of glenoid morphology.

**Table ST73** Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Age (Primary Diagnosis Fracture)

| Age | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| <55 | 6 | 77 | 5.3 (2.0, 13.6) | 5.3 (2.0, 13.6) | 12.8 (5.3, 29.1) | | | |
| 55-64 | 44 | 616 | 5.3 (3.7, 7.4) | 7.4 (5.5, 10.0) | 8.6 (6.2, 11.8) | 9.8 (6.8, 14.0) | | |
| 65-74 | 83 | 1877 | 3.2 (2.5, 4.2) | 4.8 (3.9, 6.0) | 5.2 (4.2, 6.5) | 5.2 (4.2, 6.5) | 6.0 (4.4, 8.2) | |
| ≥75 | 79 | 2601 | 2.4 (1.9, 3.1) | 3.0 (2.4, 3.8) | 3.5 (2.7, 4.4) | 4.0 (3.1, 5.2) | 4.4 (3.3, 6.0) | |
| TOTAL | 212 | 5171 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST55** Cumulative Percent Revision of Primary Total 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 |
|---|---|---|---|---|---|---|---|
| <55 | 77 | 54 | 29 | 12 | 4 | 2 | 0 |
| 55-64 | 616 | 450 | 232 | 105 | 53 | 19 | 0 |
| 65-74 | 1877 | 1490 | 881 | 440 | 184 | 43 | 0 |
| ≥75 | 2601 | 2060 | 1215 | 641 | 293 | 57 | 1 |

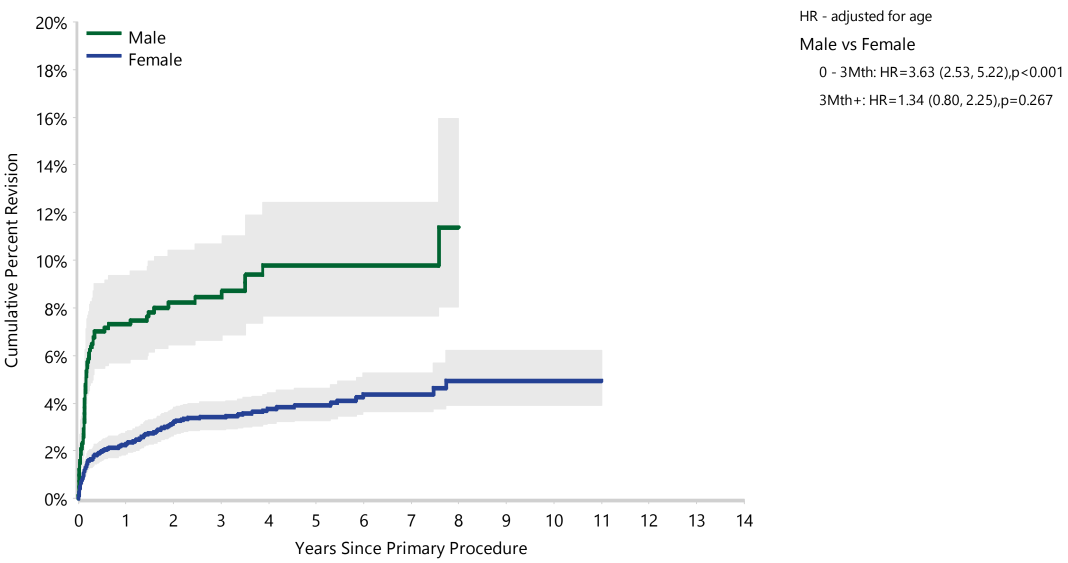
Note: Restricted to modern prostheses

**Table ST74** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Gender (Primary Diagnosis Fracture)**

| Gender | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Male | 69 | 826 | 7.3 (5.7, 9.3) | 8.4 (6.6, 10.7) | 9.8 (7.7, 12.4) | 9.8 (7.7, 12.4) | | |
| Female | 143 | 4345 | 2.3 (1.9, 2.8) | 3.4 (2.9, 4.1) | 3.9 (3.3, 4.6) | 4.4 (3.6, 5.3) | 4.9 (3.9, 6.2) | |
| TOTAL | 212 | 5171 | | | | | | |

Note: Restricted to modern prostheses

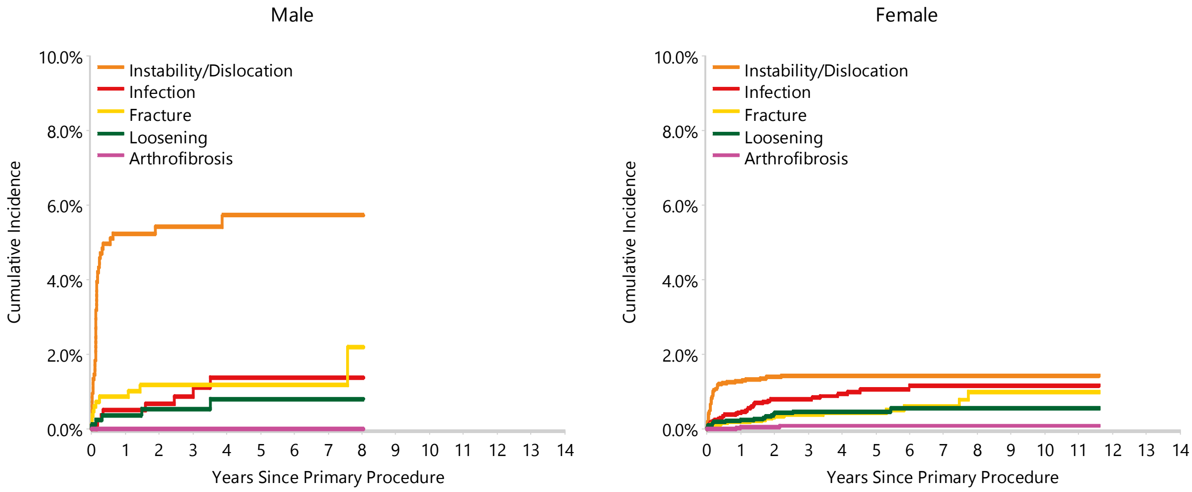
**Figure ST56** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Gender (Primary Diagnosis Fracture)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Male | 826 | 589 | 334 | 154 | 67 | 15 | 0 |
| Female | 4345 | 3465 | 2023 | 1044 | 467 | 106 | 1 |

Note: Restricted to modern prostheses

**Figure ST57** **Cumulative Incidence Revision Diagnosis of Primary Total Reverse Shoulder Replacement by Gender (Primary Diagnosis Fracture)**



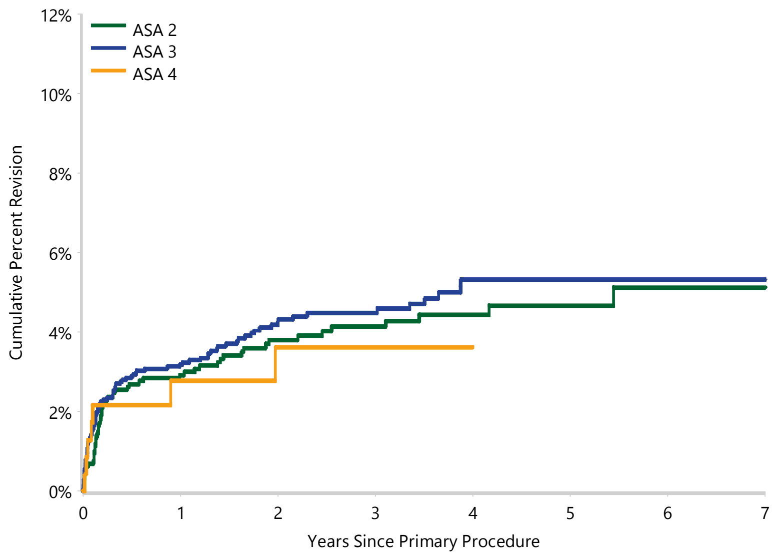

Note: Restricted to modern prostheses

**Table ST75** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by ASA Score (Primary Diagnosis Fracture)**

| ASA Score | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|---|
| ASA 1 | 4 | 104 | 3.9 (1.5, 10.1) | 3.9 (1.5, 10.1) | 3.9 (1.5, 10.1) | | | |
| ASA 2 | 62 | 1607 | 2.9 (2.2, 3.9) | 3.8 (2.9, 4.9) | 4.1 (3.2, 5.3) | 4.4 (3.4, 5.7) | 4.7 (3.6, 6.1) | 5.1 (3.8, 6.9) |
| ASA 3 | 99 | 2406 | 3.2 (2.5, 4.0) | 4.3 (3.5, 5.2) | 4.5 (3.7, 5.5) | 5.3 (4.3, 6.6) | 5.3 (4.3, 6.6) | 5.3 (4.3, 6.6) |
| ASA 4 | 7 | 237 | 2.8 (1.2, 6.1) | 3.6 (1.7, 7.7) | 3.6 (1.7, 7.7) | 3.6 (1.7, 7.7) | | |
| TOTAL | 172 | 4354 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST58** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by ASA Score (Primary Diagnosis Fracture)**




HR - adjusted for age and gender
ASA 3 vs ASA 2
Entire Period: HR=1.17 (0.85, 1.62),p=0.327

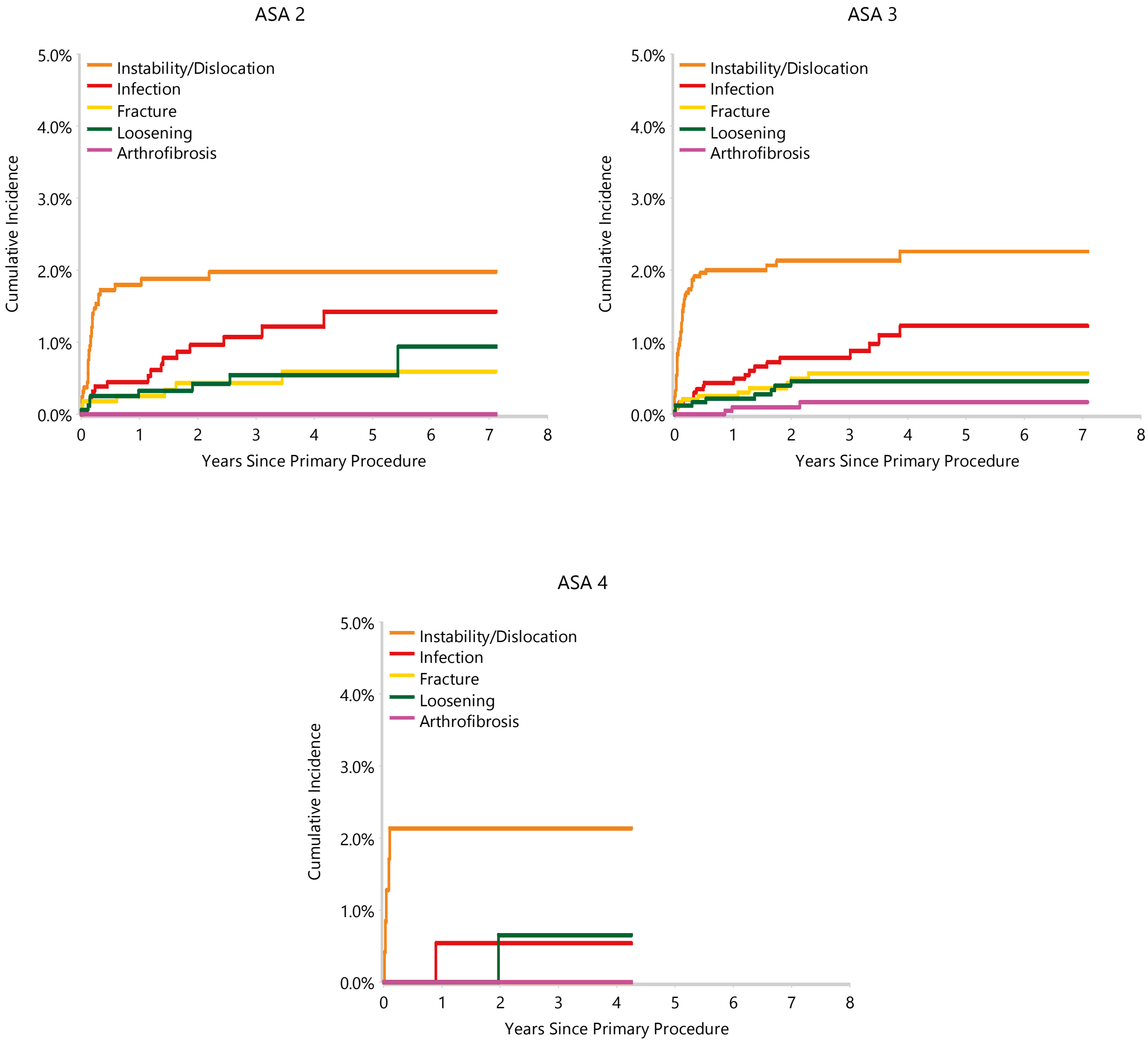
ASA 3 vs ASA 4
Entire Period: HR=1.23 (0.57, 2.66),p=0.593

ASA 4 vs ASA 2
Entire Period: HR=0.95 (0.43, 2.09),p=0.903

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs | 5 Yrs | 7 Yrs |
|---|---|---|---|---|---|---|---|
| ASA 2 | 1607 | 1248 | 959 | 705 | 451 | 269 | 50 |
| ASA 3 | 2406 | 1817 | 1318 | 868 | 569 | 320 | 48 |
| ASA 4 | 237 | 155 | 115 | 70 | 45 | 28 | 2 |

Note: Restricted to modern prostheses

**Figure ST59** **Cumulative Incidence Revision Diagnosis of Primary Total Reverse Shoulder Replacement by ASA Score (Primary Diagnosis Fracture)**



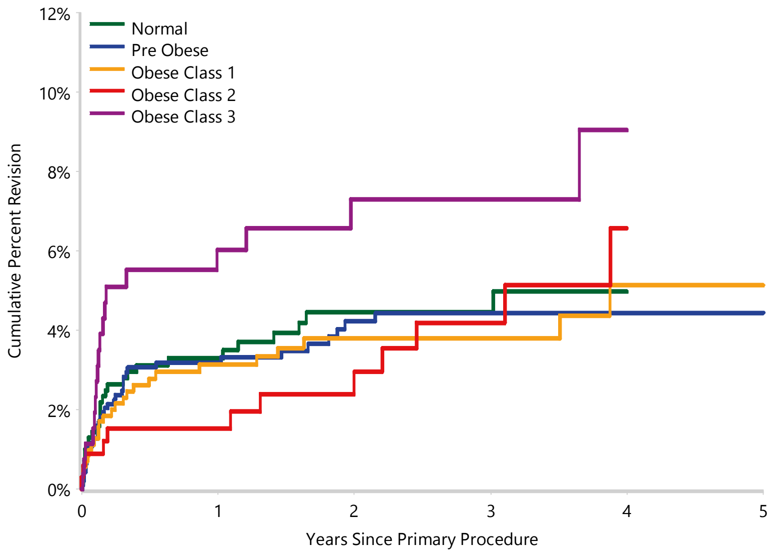

Note: Restricted to modern prostheses

**Table ST76** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by BMI Category (Primary Diagnosis Fracture)**

| BMI Category | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs |
|---|---|---|---|---|---|---|
| Underweight | 1 | 64 | 1.6 (0.2, 10.7) | 1.6 (0.2, 10.7) | 1.6 (0.2, 10.7) | 1.6 (0.2, 10.7) |
| Normal | 28 | 698 | 3.3 (2.2, 5.0) | 4.5 (3.0, 6.5) | 4.5 (3.0, 6.5) | 5.0 (3.3, 7.4) |
| Pre Obese | 36 | 947 | 3.2 (2.2, 4.6) | 4.2 (3.0, 5.9) | 4.4 (3.2, 6.2) | 4.4 (3.2, 6.2) |
| Obese Class 1 | 26 | 717 | 3.1 (2.1, 4.8) | 3.8 (2.5, 5.6) | 3.8 (2.5, 5.6) | 5.1 (3.2, 8.1) |
| Obese Class 2 | 12 | 336 | 1.5 (0.6, 3.6) | 3.0 (1.5, 5.9) | 4.2 (2.2, 7.9) | 6.6 (3.4, 12.4) |
| Obese Class 3 | 18 | 262 | 6.0 (3.7, 9.8) | 7.3 (4.5, 11.6) | 7.3 (4.5, 11.6) | 9.0 (5.3, 15.2) |
| TOTAL | 121 | 3024 | | | | |

Note: BMI has not been presented for patients aged ≤19 years
Restricted to modern prostheses

**Figure ST60** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by BMI Category (Primary Diagnosis Fracture)**




HR - adjusted for age and gender

Pre Obese vs Normal
Entire Period: HR=0.87 (0.53, 1.43),p=0.580

Obese Class 1 vs Normal
Entire Period: HR=0.81 (0.47, 1.39),p=0.447

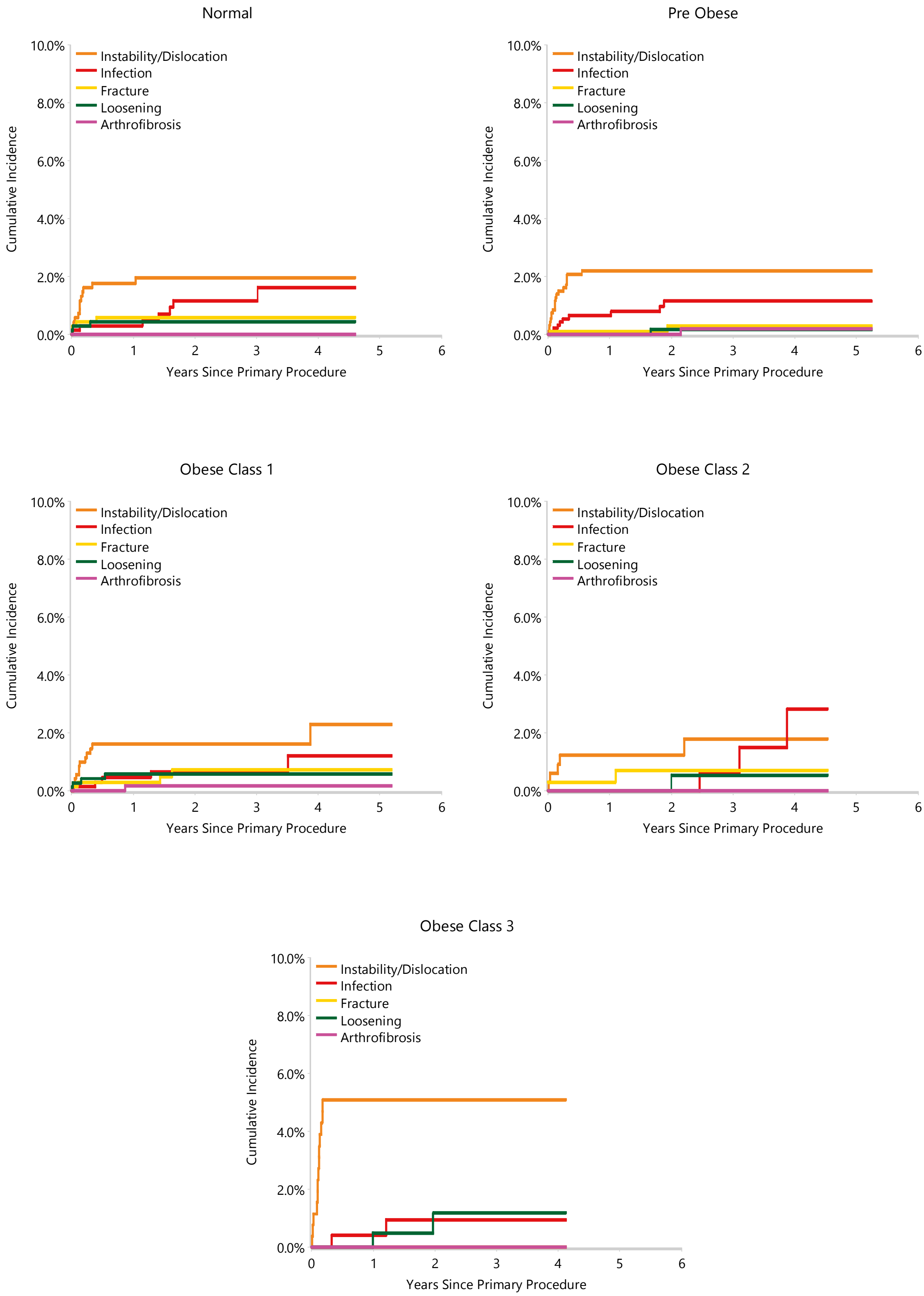
Obese Class 2 vs Normal
Entire Period: HR=0.80 (0.40, 1.58),p=0.511

Obese Class 3 vs Normal
Entire Period: HR=1.47 (0.80, 2.72),p=0.216

| Number at Risk | 0 Yr | 1 Yr | 2 Yrs | 3 Yrs | 4 Yrs |
|---|---|---|---|---|---|
| Normal | 698 | 487 | 328 | 185 | 85 |
| Pre Obese | 947 | 707 | 480 | 316 | 155 |
| Obese Class 1 | 717 | 514 | 372 | 231 | 121 |
| Obese Class 2 | 336 | 240 | 175 | 108 | 61 |
| Obese Class 3 | 262 | 187 | 126 | 75 | 45 |

Note: Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years

**Figure ST61 Cumulative Incidence Revision Diagnosis of Primary Total Reverse Shoulder Replacement by BMI Category (Primary Diagnosis Fracture)**




Note: Restricted to modern prostheses
BMI has not been presented for patients aged ≤19 years

**Table ST77 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Glenoid Morphology (Primary Diagnosis Fracture)**

| Glenoid Morphology | N Revised | N Total | 1 Yr | 2 Yrs | 3 Yrs |
|---|---|---|---|---|---|
| A1 | 60 | 1773 | 2.9 (2.2, 3.8) | 3.8 (2.9, 5.0) | 4.1 (3.2, 5.4) |
| A2 | 9 | 169 | 4.3 (2.1, 8.8) | 7.0 (3.5, 13.7) | |
| B1 | 2 | 80 | 1.4 (0.2, 9.2) | 4.4 (1.0, 18.3) | |
| B2 | 1 | 51 | 0.0 (0.0, 0.0) | 3.7 (0.5, 23.5) | 3.7 (0.5, 23.5) |
| C | 0 | 21 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | |
| TOTAL | 72 | 2094 | | | |

Note: Restricted to modern prostheses

## OUTCOME FOR FRACTURE – PROSTHESIS CHARACTERISTICS

### Fixation

When cementless fixation is compared to hybrid fixation (humerus cemented) there is no difference in the cumulative percent revision when total reverse shoulder replacement is used for the management of fracture (Table ST78 and Figure ST62

**There is no difference in the rate of revision when cementless and hybrid fixation are compared.**

### Type of Polyethylene

Non XLPE is the most common type of polyethylene used in primary total reverse shoulder replacement for the management of fracture. There is no difference in the cumulative percent revision when the different types of polyethylene are compared (Table ST79 and Figure ST63).

The reasons for revision for the different polyethylene types are presented in Figure ST64.

### Glenosphere Size

Glenosphere sizes >40mm have a higher risk of revision compared to <38mm sizes (Table ST81 and Figure ST65). The reasons for revision of the different glenosphere sizes are presented in Figure ST66.

**Glenosphere sizes >40mm have a higher risk of revision compared to <38mm sizes.**

### Prosthesis Types

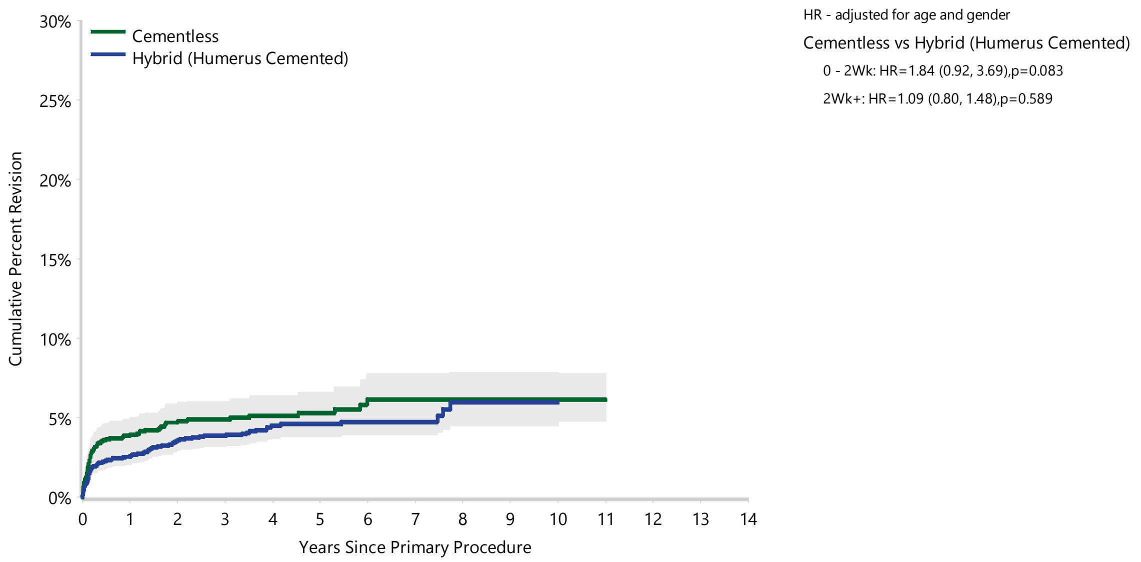
The outcomes of the most commonly used prosthesis combinations in total reverse shoulder replacement for fracture are listed in Table ST82. The cementless prosthesis combinations are listed in Table ST83. The hybrid (humerus cemented) prosthesis combinations are listed in Table ST84.

**Table ST78** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Fixation (Primary Diagnosis Fracture)**

| Fixation | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Cemented | 3 | 71 | 4.4 (1.4, 13.0) | 4.4 (1.4, 13.0) | 4.4 (1.4, 13.0) | 4.4 (1.4, 13.0) | | |
| Cementless | 83 | 1709 | 3.9 (3.1, 5.0) | 4.9 (3.9, 6.1) | 5.3 (4.2, 6.6) | 6.1 (4.8, 7.8) | 6.1 (4.8, 7.8) | |
| Hybrid (Glenoid Cemented) | 3 | 61 | 5.3 (1.7, 15.8) | 5.3 (1.7, 15.8) | 5.3 (1.7, 15.8) | | | |
| Hybrid (Humerus Cemented) | 123 | 3330 | 2.6 (2.1, 3.2) | 3.9 (3.2, 4.6) | 4.6 (3.8, 5.5) | 4.7 (3.9, 5.8) | 6.0 (4.5, 7.8) | |
| TOTAL | 212 | 5171 | | | | | | |

Note: Restricted to modern prostheses

**Figure ST62** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Fixation (Primary Diagnosis Fracture)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Cementless | 1709 | 1400 | 850 | 436 | 202 | 50 | 0 |
| Hybrid (Humerus Cemented) | 3330 | 2560 | 1450 | 736 | 317 | 67 | 1 |

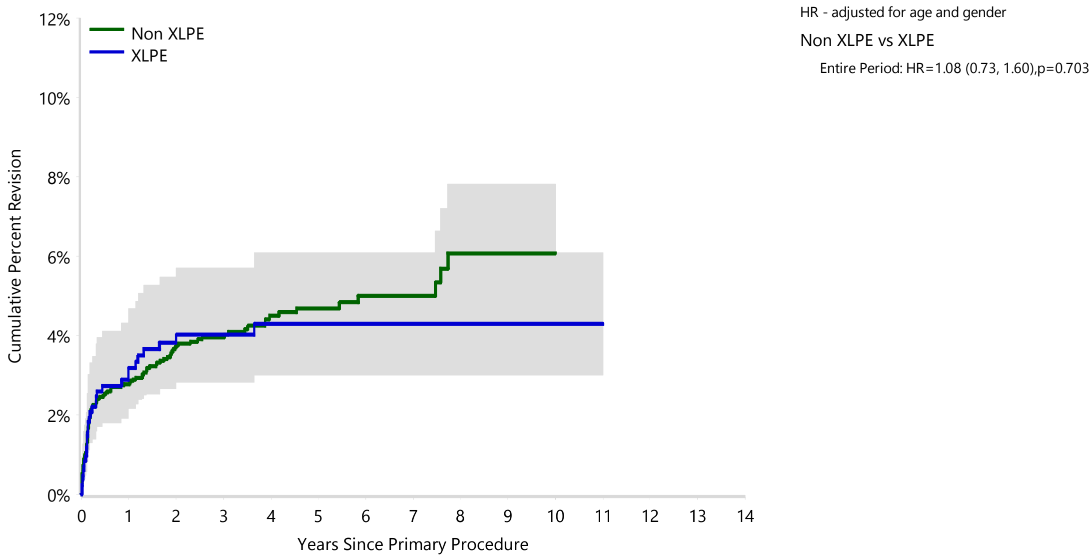
Note: Restricted to modern prostheses

**Table ST79 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Polyethylene Type (Primary Diagnosis Fracture)**

| Polyethylene Type | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| Non XLPE | 125 | 3162 | 2.8 (2.3, 3.4) | 4.0 (3.3, 4.8) | 4.7 (3.9, 5.6) | 5.0 (4.1, 6.1) | 6.1 (4.7, 7.8) | |
| XLPE | 31 | 840 | 3.2 (2.2, 4.7) | 4.0 (2.8, 5.7) | 4.3 (3.0, 6.1) | 4.3 (3.0, 6.1) | 4.3 (3.0, 6.1) | |
| **TOTAL** | **156** | **4002** | | | | | | |

Note: Restricted to modern prostheses

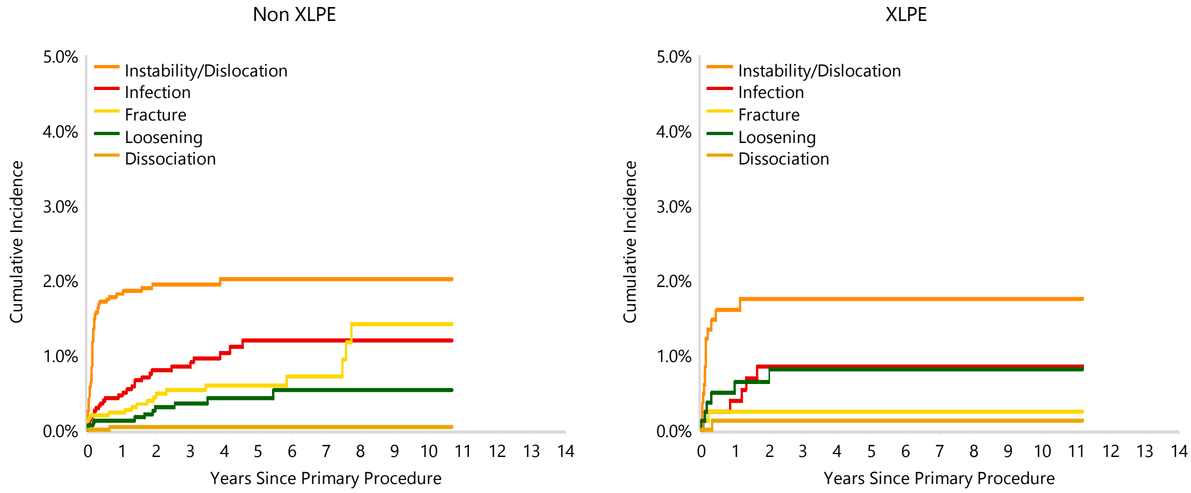
**Figure ST63 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Polyethylene Type (Primary Diagnosis Fracture)**




| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| Non XLPE | 3162 | 2512 | 1496 | 800 | 357 | 69 | 1 |
| XLPE | 840 | 640 | 409 | 242 | 142 | 51 | 0 |

Note: Restricted to modern prostheses

**Figure ST64** **Cumulative Incidence Revision Diagnosis of Primary Total Reverse Shoulder Replacement by Polyethylene Type (Primary Diagnosis Fracture)**




Note: Restricted to modern prostheses

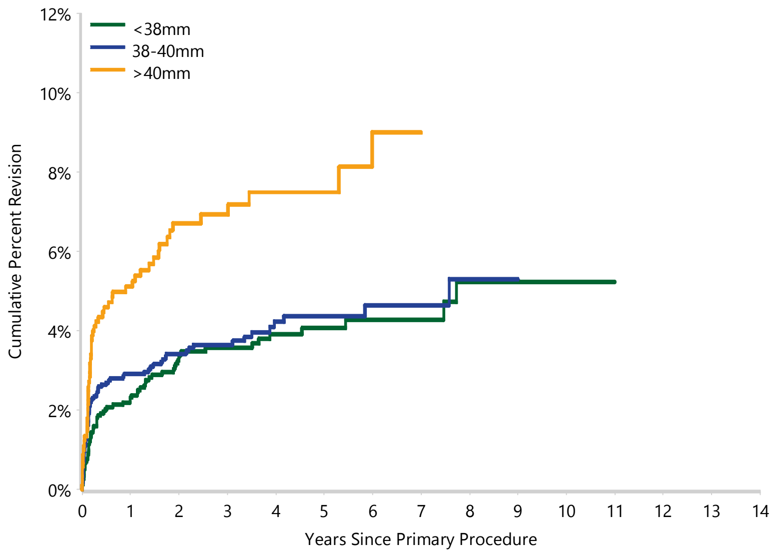
**Table ST80** **Table no longer provided**

**Table ST81** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Glenosphere Size (Primary Diagnosis Fracture)**

| Glenosphere Size | N Revised | N Total | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|---|
| <38mm | 70 | 2047 | 2.3 (1.7, 3.1) | 3.6 (2.8, 4.6) | 4.1 (3.2, 5.2) | 4.3 (3.3, 5.5) | 5.2 (3.8, 7.2) | |
| 38-40mm | 81 | 2206 | 2.9 (2.3, 3.7) | 3.6 (2.9, 4.6) | 4.4 (3.5, 5.5) | 4.6 (3.6, 5.9) | | |
| >40mm | 59 | 903 | 5.1 (3.8, 6.8) | 6.9 (5.3, 9.0) | 7.5 (5.8, 9.7) | 9.0 (6.5, 12.3) | | |
| TOTAL | 210 | 5156 | | | | | | |

Note: Excludes 15 procedures with unknown glenosphere size
Restricted to modern prostheses

**Figure ST65** **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Glenosphere Size (Primary Diagnosis Fracture)**




HR - adjusted for age and gender

38-40mm vs <38mm
0 - 3Mth: HR=1.35 (0.91, 2.01),p=0.140
3Mth+: HR=0.87 (0.55, 1.38),p=0.559

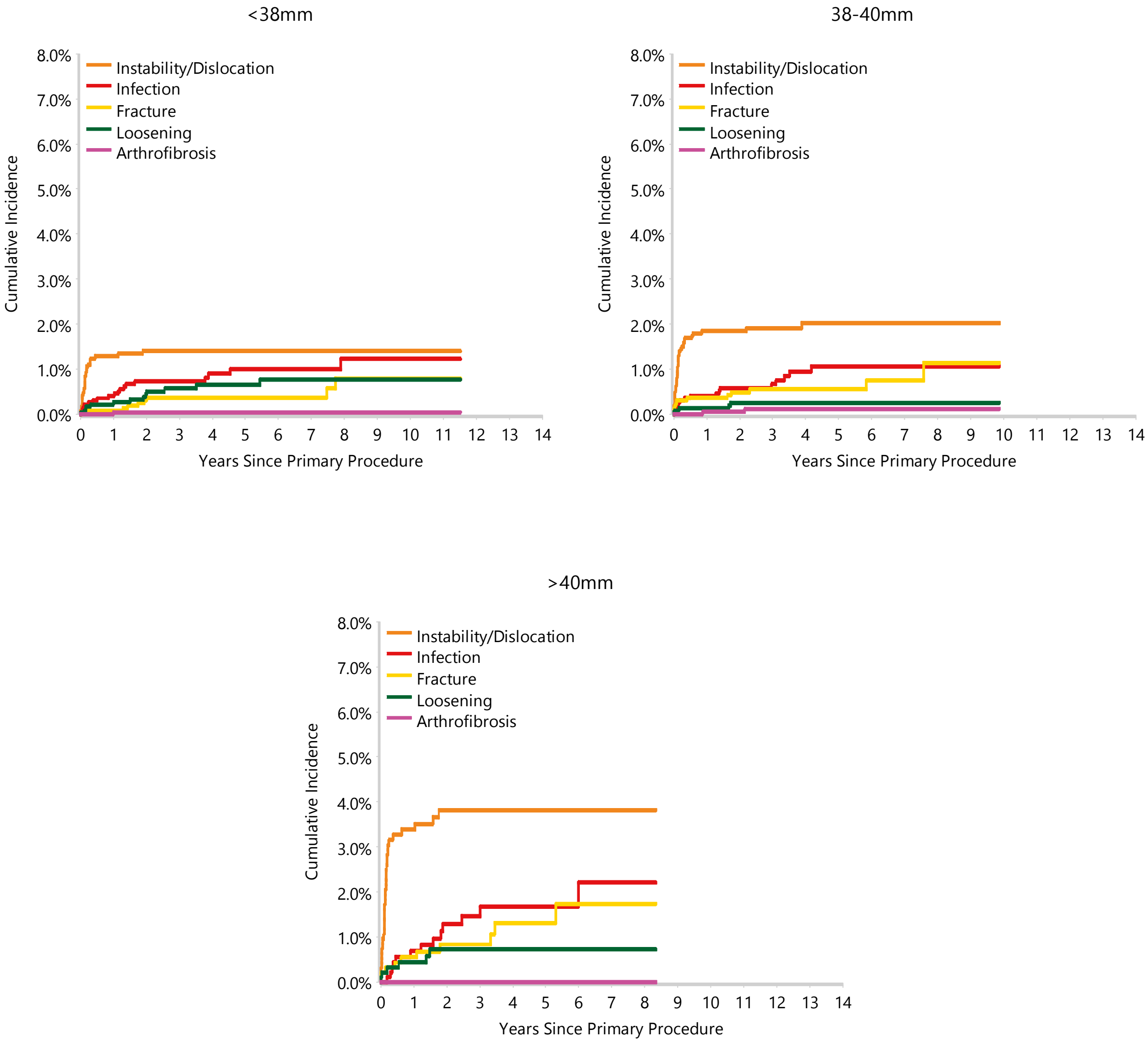
>40mm vs <38mm
Entire Period: HR=1.45 (1.01, 2.10),p=0.044

>40mm vs 38-40mm
Entire Period: HR=1.29 (0.90, 1.85),p=0.167

| Number at Risk | 0 Yr | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 10 Yrs | 14 Yrs |
|---|---|---|---|---|---|---|---|
| <38mm | 2047 | 1618 | 991 | 544 | 279 | 78 | 1 |
| 38-40mm | 2206 | 1741 | 997 | 495 | 191 | 37 | 0 |
| >40mm | 903 | 688 | 367 | 158 | 63 | 6 | 0 |

Note: Excludes 15 procedures with unknown glenosphere size
Restricted to modern prostheses

**Figure ST66** **Cumulative Incidence Revision Diagnosis of Primary Total Reverse Shoulder Replacement by Glenosphere Size (Primary Diagnosis Fracture)**




Note: Restricted to modern prostheses

**Table ST82** **Cumulative Percent Revision of Primary Total 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 | 31 | 898 | 1.8 (1.1, 3.0) | 3.1 (2.1, 4.6) | 4.2 (2.8, 6.2) | 4.7 (3.1, 7.0) | | |
| Affinis | Affinis | 9 | 282 | 2.3 (1.0, 5.0) | 3.4 (1.7, 6.8) | | | | |
| Comprehensive | Comprehensive Reverse | 8 | 394 | 1.7 (0.8, 3.9) | 2.3 (1.1, 4.9) | | | | |
| Delta Xtend | Delta Xtend | 60 | 1242 | 3.6 (2.7, 4.8) | 4.5 (3.5, 5.9) | 5.3 (4.1, 6.8) | 5.6 (4.3, 7.2) | 6.2 (4.5, 8.3) | |
| Equinoxe | Equinoxe | 8 | 239 | 2.1 (0.9, 5.0) | 4.8 (2.3, 9.9) | | | | |
| Global Unite | Delta Xtend | 6 | 253 | 2.1 (0.9, 5.0) | 2.7 (1.2, 5.9) | | | | |
| RSP | RSP | 10 | 176 | 3.6 (1.7, 8.0) | | | | | |
| SMR | SMR L1 | 70 | 1299 | 4.5 (3.5, 5.8) | 5.6 (4.4, 7.1) | 5.8 (4.6, 7.3) | 6.4 (5.0, 8.2) | 6.4 (5.0, 8.2) | |
| Trabecular Metal | Trabecular Metal | 7 | 244 | 2.5 (1.2, 5.6) | 3.0 (1.5, 6.3) | 3.0 (1.5, 6.3) | 3.0 (1.5, 6.3) | | |
| Other (11) | | 3 | 144 | 2.3 (0.8, 7.1) | | | | | |
| TOTAL | | 212 | 5171 | | | | | | |

Note: Only combinations with over 50 procedures have been listed
Restricted to modern prostheses

**Table ST83** **Cumulative Percent Revision of Cementless Primary Total 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 | 3 | 56 | 3.6 (0.9, 13.5) | 3.6 (0.9, 13.5) | 8.2 (2.4, 26.1) | 8.2 (2.4, 26.1) | | |
| Comprehensive | Comprehensive Reverse | 2 | 82 | 1.4 (0.2, 9.5) | 4.0 (0.9, 15.9) | | | | |
| Delta Xtend | Delta Xtend | 7 | 191 | 1.6 (0.5, 4.9) | 2.8 (1.2, 6.6) | 3.5 (1.6, 7.8) | | | |
| Equinoxe | Equinoxe | 2 | 51 | 3.9 (1.0, 14.8) | 3.9 (1.0, 14.8) | | | | |
| Global Unite | Delta Xtend | 2 | 70 | 2.9 (0.7, 11.3) | 2.9 (0.7, 11.3) | 2.9 (0.7, 11.3) | | | |
| SMR | SMR L1 | 63 | 1129 | 4.7 (3.6, 6.1) | 5.7 (4.5, 7.3) | 5.9 (4.6, 7.6) | 6.7 (5.1, 8.8) | | |
| Trabecular Metal | Trabecular Metal | 2 | 58 | 3.5 (0.9, 13.2) | 3.5 (0.9, 13.2) | 3.5 (0.9, 13.2) | 3.5 (0.9, 13.2) | | |
| Other (9) | | 2 | 72 | 2.9 (0.7, 11.2) | 2.9 (0.7, 11.2) | | | | |
| TOTAL | | 83 | 1709 | | | | | | |

Note: Only combinations with over 50 procedures have been listed
Restricted to modern prostheses

**Table ST84** **Cumulative Percent Revision of Hybrid (Humerus Cemented) Primary Total 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 | 28 | 829 | 1.7 (1.0, 2.9) | 3.1 (2.0, 4.7) | 3.9 (2.6, 5.9) | 4.5 (2.9, 6.9) | | |
| Affinis | Affinis | 8 | 267 | 2.0 (0.8, 4.7) | 3.2 (1.5, 6.7) | | | | |
| Comprehensive | Comprehensive Reverse | 6 | 290 | 2.0 (0.8, 4.8) | 2.0 (0.8, 4.8) | | | | |
| Delta Xtend | Delta Xtend | 50 | 1029 | 3.8 (2.8, 5.1) | 4.6 (3.5, 6.2) | 5.4 (4.1, 7.2) | 5.4 (4.1, 7.2) | | |
| Equinoxe | Equinoxe | 5 | 175 | 1.2 (0.3, 4.6) | | | | | |
| Global Unite | Delta Xtend | 4 | 171 | 1.9 (0.6, 5.8) | | | | | |
| RSP | RSP | 10 | 147 | 4.4 (2.0, 9.4) | | | | | |
| SMR | SMR L1 | 5 | 160 | 2.0 (0.6, 6.0) | 3.8 (1.6, 9.0) | 3.8 (1.6, 9.0) | | | |
| Trabecular Metal | Trabecular Metal | 5 | 172 | 2.4 (0.9, 6.4) | 3.1 (1.3, 7.4) | 3.1 (1.3, 7.4) | | | |
| Other (7) | | 2 | 90 | 2.5 (0.6, 9.5) | 2.5 (0.6, 9.5) | | | | |
| TOTAL | | 123 | 3330 | | | | | | |

Note: Only combinations with over 50 procedures have been listed
Restricted to modern prostheses

# 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 are able to 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. The comparator group includes all other prostheses within the same class regardless of their rate of revision. 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 prostheses in the same class. It is an automated analysis that identifies prostheses based on set criteria. These include:

1. The revision rate (per 100 component years) exceeds twice that for the group, and
2. The Poisson probability of observing that number of revisions, given the rate of the group is significant ($p<0.05$), and
3. There are at least 10 primary procedures for that component,
4. 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.

### Stage 2

In Stage 2, the AOANJRR Director and Deputy 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 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 Arthroplasty Society. The panel meets with Registry staff at a joint specific workshop 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 which 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, there are two workshops held to review, comment, and provide advice on all sections of the report. This year, due to COVID-19 restrictions, workshops were held online rather than face-to-face. The workshop format was modified to accommodate the online delivery. This enabled a larger than usual number of surgeons to attend.

In addition to AOANJRR and SAHMRI staff, and the AOA Executive, 29 AOA members with expertise in hip and knee arthroplasty attended the Hip and Knee Surgeon Review Workshop.

Members of the AOA with expertise in shoulder surgery were invited to attend a separate workshop to review this section of the report. In addition to AOANJRR and SAHMRI staff, and the AOA Executive, 11 AOA members with expertise in shoulder arthroplasty attended the Shoulder Surgeon Review Workshop.

This year, one ankle prosthesis was re-identified as having a higher than anticipated rate of revision. This was reviewed separately by a subgroup of ankle arthroplasty surgeons and has been included in this report.

Only prostheses identified for the first time or prostheses that are not re-identified are discussed in the following text.

Investigations of prostheses identified as having a higher than anticipated rate of revision are available on the Registry website: https://www.aoanjrr.sahmri.com/annual-reports-2021

# 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 |
|---|---|---|---|---|---|
| Identified and no longer used | . | . | . | . | |
| Unipolar Head (JRI)/Furlong LOL | 11 | 132 | 494 | 2.23 | Entire Period: HR=2.12 (1.17, 3.84),p=0.012 |

Note: Components have been compared to all other modern unipolar modular hip components

**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 | 19 Yrs |
|---|---|---|---|---|---|
| Identified and no longer used | | | | | |
| Unipolar Head (JRI)/Furlong LOL | 6.4 (3.1, 13.0) | 9.7 (5.3, 17.4) | 11.1 (6.3, 19.4) | | |

**Table IP3 Yearly Usage of Unipolar Modular Hip Prostheses identified as having a Higher than Anticipated Rate of Revision**

| Year of Implant | ≤2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Identified and no longer used | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Unipolar Head (JRI)/Furlong LOL | . | . | . | . | 12 | 18 | 10 | 13 | 10 | 8 | 7 | 34 | 16 | 4 | . | . | . | . |

## 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 | 83 | 189 | 3.70 | Entire Period: HR=3.34 (1.59, 7.04),p=0.001 |
| Identified and no longer used | . | . | . | . | |
| UHR/ABGII | 22 | 177 | 986 | 2.23 | 0 - 2Wk: HR=4.63 (1.13, 18.99),p=0.033 |
| | . | . | . | . | 2Wk - 3.5Yr: HR=1.26 (0.60, 2.64),p=0.550 |
| | . | . | . | . | 3.5Yr+: HR=8.43 (4.68, 15.21),p<0.001 |
| UHR/Omnifit (cless) | 8 | 40 | 262 | 3.05 | Entire Period: HR=3.81 (1.90, 7.67),p<0.001 |
| **Basis | 18 | 156 | 785 | 2.29 | 0 - 1Yr: HR=0.49 (0.12, 1.95),p=0.308 |
| | . | . | . | . | 1Yr+: HR=5.23 (3.15, 8.70),p<0.001 |
| **Synergy | 9 | 55 | 420 | 2.14 | Entire Period: HR=2.67 (1.38, 5.18),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 | 19 Yrs |
|---|---|---|---|---|---|
| Re-Identified and Still Used | | | | | |
| **Quadra-H | 6.7 (2.5, 17.0) | 11.9 (5.4, 25.1) | 16.3 (7.5, 33.1) | | |
| 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 (cless) | 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

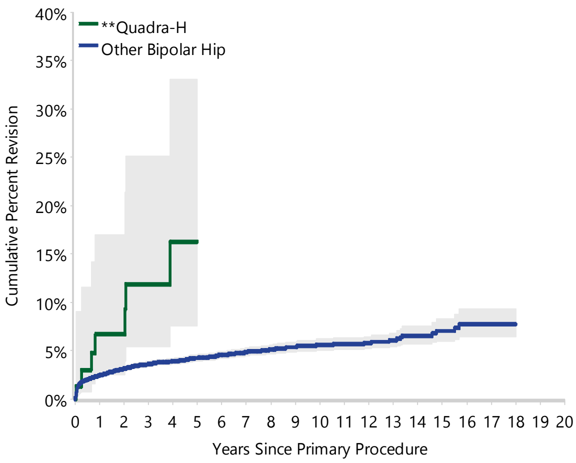
**Table IP6 Yearly Usage of Bipolar Hip Prostheses Identified as having a Higher than Anticipated Rate of Revision**

| Year of Implant | ≤2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Re-Identified and Still Used | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **Quadra-H | . | . | . | . | . | . | 11 | 7 | 5 | 6 | 4 | 11 | 9 | 7 | 4 | 7 | 5 | 7 |
| Identified and no longer used | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| UHR/ABGII | 50 | 36 | 34 | 10 | 15 | 20 | 7 | 5 | . | . | . | . | . | . | . | . | . | . |
| UHR/Omnifit (cless) | 21 | 7 | 5 | 4 | 1 | 2 | . | . | . | . | . | . | . | . | . | . | . | . |
| **Basis | 42 | . | 10 | 13 | 9 | 11 | 4 | 7 | 8 | 21 | 24 | 6 | 1 | . | . | . | . | . |
| **Synergy | 25 | 9 | 10 | 3 | 2 | 1 | 1 | . | 1 | . | 2 | . | . | . | 1 | . | . | . |

Note: **Femoral Stem Component

**Figure IP1 Cumulative Percent Revision of Re-Identified and Still Used Bipolar Hip Prostheses**

Re-identified and Still Used



## PRIMARY TOTAL HIP REPLACEMENT

### TOTAL CONVENTIONAL

Large head (>32mm) metal/metal bearings have been removed from the comparator group for all primary total conventional hip investigations.

There is one newly identified total conventional hip prosthesis.

The Atlas (Shell) acetabular component has been used in 464 procedures, 49 of which have been revised. The cumulative percent revision at 15 years is 18.7%. Of the 19 revisions, 41 were major revision, 22 of which involved the acetabulum. There were 14 revisions for loosening, 10 for fracture, 6 for infection, and 2 acetabular shell implant breakages.

The Taperloc/Versafitcup CC combination is no longer identified as it no longer has a significantly higher rate of revision.

**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 | . | . | . | . | |
| **Atlas (Shell) | 49 | 464 | 3760 | 1.30 | Entire Period: HR=2.19 (1.66, 2.90),p<0.001 |
| Re-Identified and Still Used | . | . | . | . | |
| Accolade II/Trident Tritanium (Shell) | 64 | 2382 | 5478 | 1.17 | 0 - 1Mth: HR=1.79 (1.25, 2.56),p=0.001 |
| | . | . | . | . | 1Mth+: HR=0.94 (0.67, 1.32),p=0.714 |
| Avenir/Fitmore | 15 | 242 | 597 | 2.51 | Entire Period: HR=2.76 (1.67, 4.58),p<0.001 |
| CORAIL/Trabecular Metal (Shell) | 11 | 98 | 659 | 1.67 | Entire Period: HR=3.02 (1.67, 5.45),p<0.001 |
| CPT/Fitmore | 20 | 285 | 1543 | 1.30 | Entire Period: HR=2.20 (1.42, 3.41),p<0.001 |
| CPT/Low Profile Cup | 15 | 196 | 998 | 1.50 | Entire Period: HR=2.52 (1.52, 4.18),p<0.001 |
| HACTIV/Logical G | 45 | 1185 | 2142 | 2.10 | Entire Period: HR=1.86 (1.39, 2.49),p<0.001 |
| Taperloc/G7 | 75 | 3442 | 8831 | 0.85 | 0 - 2Wk: HR=2.00 (1.27, 3.14),p=0.002 |
| | . | . | . | . | 2Wk+: HR=0.80 (0.62, 1.04),p=0.096 |
| *Apex | 173 | 2591 | 20931 | 0.83 | 0 - 2Wk: HR=0.69 (0.29, 1.65),p=0.400 |
| | . | . | . | . | 2Wk+: HR=1.62 (1.39, 1.88),p<0.001 |
| *Furlong Evolution | 32 | 442 | 1150 | 2.78 | Entire Period: HR=3.13 (2.22, 4.43),p<0.001 |
| *Linear | 18 | 289 | 1440 | 1.25 | Entire Period: HR=1.97 (1.24, 3.13),p=0.004 |
| *MiniMax | 19 | 391 | 767 | 2.48 | Entire Period: HR=2.26 (1.44, 3.55),p<0.001 |
| *Novation | 77 | 1382 | 6903 | 1.12 | 0 - 2Wk: HR=3.14 (1.78, 5.55),p<0.001 |
| | . | . | . | . | 2Wk+: HR=1.65 (1.29, 2.10),p<0.001 |
| *Profemur L | 104 | 2784 | 9008 | 1.15 | 0 - 3Mth: HR=1.78 (1.38, 2.31),p<0.001 |
| | . | . | . | . | 3Mth+: HR=1.19 (0.89, 1.59),p=0.239 |
| *Taper Fit | 116 | 3388 | 10288 | 1.13 | 0 - 2Yr: HR=0.96 (0.74, 1.23),p=0.726 |
| | . | . | . | . | 2Yr+: HR=3.08 (2.36, 4.02),p<0.001 |
| **Continuum | 550 | 13390 | 72818 | 0.76 | 0 - 1Mth: HR=1.79 (1.53, 2.10),p<0.001 |
| | . | . | . | . | 1Mth - 3Mth: HR=1.51 (1.23, 1.86),p<0.001 |
| | . | . | . | . | 3Mth - 1.5Yr: HR=1.14 (0.95, 1.37),p=0.154 |
| | . | . | . | . | 1.5Yr+: HR=0.95 (0.81, 1.10),p=0.487 |
| **Delta-One-TT | 10 | 161 | 653 | 1.53 | Entire Period: HR=2.20 (1.19, 4.09),p=0.012 |
| **Dynasty | 97 | 2039 | 7065 | 1.37 | Entire Period: HR=1.81 (1.48, 2.21),p<0.001 |
| **Fin II | 148 | 2204 | 18021 | 0.82 | Entire Period: HR=1.58 (1.34, 1.85),p<0.001 |
| **Furlong | 60 | 871 | 5048 | 1.19 | Entire Period: HR=2.01 (1.56, 2.59),p<0.001 |
| **Versafitcup DM | 51 | 1157 | 3202 | 1.59 | Entire Period: HR=1.88 (1.42, 2.47),p<0.001 |
| Identified and no longer used | . | . | . | . | |
| Anatomic II/Duraloc Option | 10 | 60 | 658 | 1.52 | Entire Period: HR=3.04 (1.64, 5.65),p<0.001 |
| Anca-Fit/PINNACLE | 16 | 101 | 981 | 1.63 | Entire Period: HR=3.27 (2.00, 5.33),p<0.001 |
| F2L/Delta-PF | 19 | 107 | 1193 | 1.59 | Entire Period: HR=3.19 (2.04, 5.01),p<0.001 |
| Friendly Hip/Cup (Exactech) | 14 | 97 | 1032 | 1.36 | Entire Period: HR=2.76 (1.63, 4.65),p<0.001 |
| Friendly Hip/Delta-TT | 6 | 74 | 400 | 1.50 | Entire Period: HR=2.59 (1.17, 5.75),p=0.019 |
| MBA (exch neck)/PINNACLE | 27 | 225 | 1832 | 1.47 | 0 - 1Mth: HR=2.54 (0.95, 6.78),p=0.062 |
| | . | . | . | . | 1Mth - 4Yr: HR=1.29 (0.58, 2.88),p=0.527 |
| | . | . | . | . | 4Yr+: HR=5.21 (3.24, 8.38),p<0.001 |
| Secur-Fit Plus/PINNACLE | 13 | 246 | 1164 | 1.12 | Entire Period: HR=1.74 (1.01, 3.00),p=0.045 |
| Secur-Fit Plus/Secur-Fit | 30 | 197 | 2512 | 1.19 | Entire Period: HR=2.40 (1.68, 3.44),p<0.001 |
| Taperloc/M2a$^{MoM}$ | 72 | 515 | 6195 | 1.16 | Entire Period: HR=2.35 (1.87, 2.97),p<0.001 |

| Femoral Stem/Acetabular | N Revised | N Total | Obs. Years | Revisions/ 100 Obs. Yrs | Hazard Ratio, P Value |
|---|---|---|---|---|---|
| *ABGII (exch neck) | 90 | 246 | 1909 | 4.72 | 0 - 1Mth: HR=4.11 (1.96, 8.62),p<0.001 |
| | . | . | . | . | 1Mth - 1.5Yr: HR=2.63 (1.31, 5.25),p=0.006 |
| | . | . | . | . | 1.5Yr - 2.5Yr: HR=7.79 (3.71, 16.36),p<0.001 |
| | . | . | . | . | 2.5Yr - 4Yr: HR=13.53 (7.84, 23.37),p<0.001 |
| | . | . | . | . | 4Yr - 4.5Yr: HR=38.82 (21.29, 70.76),p<0.001 |
| | . | . | . | . | 4.5Yr+: HR=14.22 (10.56, 19.15),p<0.001 |
| *Adapter (cless) | 151 | 744 | 6670 | 2.26 | 0 - 2Wk: HR=3.88 (1.94, 7.78),p<0.001 |
| | . | . | . | . | 2Wk - 1Mth: HR=1.59 (0.66, 3.83),p=0.299 |
| | . | . | . | . | 1Mth - 6Mth: HR=0.75 (0.28, 2.00),p=0.566 |
| | . | . | . | . | 6Mth+: HR=5.67 (4.78, 6.72),p<0.001 |
| *Adapter (ctd) | 31 | 148 | 1206 | 2.57 | 0 - 6Mth: HR=1.94 (0.73, 5.16),p=0.185 |
| | . | . | . | . | 6Mth+: HR=6.47 (4.43, 9.44),p<0.001 |
| *BMHR VST | 32 | 260 | 2380 | 1.34 | Entire Period: HR=2.51 (1.77, 3.56),p<0.001 |
| *CBH Stem | 40 | 274 | 2343 | 1.71 | Entire Period: HR=3.32 (2.43, 4.52),p<0.001 |
| *Edinburgh | 19 | 138 | 1031 | 1.84 | Entire Period: HR=3.56 (2.27, 5.58),p<0.001 |
| *Elite Plus | 266 | 2841 | 31415 | 0.85 | 0 - 1Mth: HR=0.26 (0.11, 0.62),p=0.002 |
| | . | . | . | . | 1Mth - 9Mth: HR=0.96 (0.64, 1.43),p=0.832 |
| | . | . | . | . | 9Mth+: HR=2.15 (1.88, 2.45),p<0.001 |
| *Emperion | 51 | 507 | 4035 | 1.26 | Entire Period: HR=2.34 (1.78, 3.09),p<0.001 |
| *Excia (cless) | 27 | 426 | 2400 | 1.13 | Entire Period: HR=1.88 (1.29, 2.75),p=0.001 |
| *GHE | 11 | 114 | 780 | 1.41 | Entire Period: HR=2.63 (1.46, 4.73),p=0.001 |
| *K2 | 82 | 601 | 5375 | 1.53 | Entire Period: HR=3.02 (2.43, 3.75),p<0.001 |
| *LYDERIC II | 15 | 164 | 1444 | 1.04 | Entire Period: HR=2.05 (1.23, 3.39),p=0.005 |
| *ML Taper Kinectiv | 183 | 3532 | 26192 | 0.70 | Entire Period: HR=1.30 (1.13, 1.51),p<0.001 |
| *MSA | 38 | 224 | 1787 | 2.13 | Entire Period: HR=3.93 (2.85, 5.40),p<0.001 |
| *Margron | 120 | 688 | 8492 | 1.41 | Entire Period: HR=2.83 (2.36, 3.38),p<0.001 |
| *Mayo | 17 | 168 | 1851 | 0.92 | Entire Period: HR=1.86 (1.16, 2.99),p=0.010 |
| *Metha (exch neck) | 14 | 88 | 780 | 1.79 | Entire Period: HR=3.51 (2.08, 5.92),p<0.001 |
| *Profemur Z | 28 | 186 | 1990 | 1.41 | Entire Period: HR=2.79 (1.93, 4.05),p<0.001 |
| *Trabecular Metal | 120 | 1904 | 14969 | 0.80 | 0 - 1Mth: HR=2.58 (1.85, 3.61),p<0.001 |
| | . | . | . | . | 1Mth - 3Mth: HR=1.88 (1.16, 3.03),p=0.009 |
| | . | . | . | . | 3Mth - 1.5Yr: HR=1.56 (1.05, 2.34),p=0.028 |
| | . | . | . | . | 1.5Yr+: HR=1.06 (0.78, 1.42),p=0.720 |
| *UniSyn | 58 | 466 | 4348 | 1.33 | Entire Period: HR=2.58 (1.99, 3.34),p<0.001 |
| **2000 Plus | 19 | 135 | 1235 | 1.54 | Entire Period: HR=3.02 (1.93, 4.74),p<0.001 |
| **ASR | 2013 | 4421 | 37903 | 5.31 | 0 - 2Wk: HR=1.27 (0.78, 2.09),p=0.335 |
| | . | . | . | . | 2Wk - 1Mth: HR=0.21 (0.08, 0.55),p=0.001 |
| | . | . | . | . | 1Mth - 9Mth: HR=1.03 (0.76, 1.39),p=0.858 |
| | . | . | . | . | 9Mth - 1.5Yr: HR=4.04 (3.17, 5.14),p<0.001 |
| | . | . | . | . | 1.5Yr - 2Yr: HR=7.06 (5.46, 9.11),p<0.001 |
| | . | . | . | . | 2Yr - 2.5Yr: HR=12.74 (10.33, 15.72),p<0.001 |
| | . | . | . | . | 2.5Yr - 3Yr: HR=18.02 (14.74, 22.02),p<0.001 |
| | . | . | . | . | 3Yr - 5Yr: HR=29.57 (26.92, 32.49),p<0.001 |
| | . | . | . | . | 5Yr - 6Yr: HR=34.84 (30.36, 39.99),p<0.001 |
| | . | . | . | . | 6Yr - 7Yr: HR=22.02 (18.58, 26.10),p<0.001 |
| | . | . | . | . | 7Yr - 8Yr: HR=17.54 (14.46, 21.28),p<0.001 |
| | . | . | . | . | 8Yr - 8.5Yr: HR=13.98 (10.38, 18.81),p<0.001 |
| | . | . | . | . | 8.5Yr - 10Yr: HR=10.48 (8.57, 12.82),p<0.001 |
| | . | . | . | . | 10Yr - 10.5Yr: HR=8.59 (5.60, 13.16),p<0.001 |
| | . | . | . | . | 10.5Yr+: HR=5.40 (4.51, 6.48),p<0.001 |

| Femoral Stem/Acetabular | N Revised | N Total | Obs. Years | Revisions/ 100 Obs. Yrs | Hazard Ratio, P Value |
|---|---|---|---|---|---|
| **Adept | 20 | 121 | 1183 | 1.69 | Entire Period: HR=3.25 (2.10, 5.04),p<0.001 |
| **Artek | 69 | 179 | 2315 | 2.98 | 0 - 1Yr: HR=1.56 (0.65, 3.75),p=0.320 |
| | . | . | . | . | 1Yr - 1.5Yr: HR=4.45 (1.11, 17.83),p=0.034 |
| | . | . | . | . | 1.5Yr - 2.5Yr: HR=5.79 (2.17, 15.44),p<0.001 |
| | . | . | . | . | 2.5Yr - 4Yr: HR=14.60 (8.06, 26.43),p<0.001 |
| | . | . | . | . | 4Yr - 4.5Yr: HR=4.37 (0.61, 31.11),p=0.140 |
| | . | . | . | . | 4.5Yr - 6Yr: HR=18.14 (10.26, 32.07),p<0.001 |
| | . | . | . | . | 6Yr+: HR=5.71 (4.05, 8.04),p<0.001 |
| **BHR | 498 | 2988 | 31727 | 1.57 | 0 - 2Wk: HR=0.82 (0.39, 1.73),p=0.608 |
| | . | . | . | . | 2Wk - 1Mth: HR=0.15 (0.04, 0.62),p=0.008 |
| | . | . | . | . | 1Mth - 3Mth: HR=1.10 (0.67, 1.80),p=0.702 |
| | . | . | . | . | 3Mth - 1Yr: HR=0.52 (0.27, 1.01),p=0.053 |
| | . | . | . | . | 1Yr - 1.5Yr: HR=1.58 (0.89, 2.79),p=0.116 |
| | . | . | . | . | 1.5Yr+: HR=4.53 (4.12, 4.99),p<0.001 |
| **Bionik | 149 | 608 | 5471 | 2.72 | 0 - 2Wk: HR=2.98 (1.24, 7.16),p=0.014 |
| | . | . | . | . | 2Wk - 3Mth: HR=1.10 (0.50, 2.46),p=0.809 |
| | . | . | . | . | 3Mth+: HR=6.59 (5.57, 7.79),p<0.001 |
| **Conserve Plus | 20 | 135 | 1551 | 1.29 | 0 - 1Yr: HR=0.83 (0.21, 3.33),p=0.796 |
| | . | . | . | . | 1Yr+: HR=3.38 (2.13, 5.36),p<0.001 |
| **Cormet | 138 | 803 | 8587 | 1.61 | 0 - 1.5Yr: HR=1.10 (0.69, 1.75),p=0.679 |
| | . | . | . | . | 1.5Yr - 2Yr: HR=0.60 (0.08, 4.24),p=0.604 |
| | . | . | . | . | 2Yr+: HR=4.72 (3.94, 5.67),p<0.001 |
| **DeltaLox | 27 | 222 | 1607 | 1.68 | Entire Period: HR=3.19 (2.19, 4.65),p<0.001 |
| **Duraloc | 619 | 5354 | 61629 | 1.00 | 0 - 3Mth: HR=0.79 (0.59, 1.04),p=0.094 |
| | . | . | . | . | 3Mth - 9Mth: HR=1.33 (0.93, 1.91),p=0.121 |
| | . | . | . | . | 9Mth - 2Yr: HR=1.80 (1.38, 2.36),p<0.001 |
| | . | . | . | . | 2Yr - 2.5Yr: HR=0.84 (0.42, 1.69),p=0.632 |
| | . | . | . | . | 2.5Yr - 3Yr: HR=2.14 (1.32, 3.47),p=0.002 |
| | . | . | . | . | 3Yr - 5.5Yr: HR=1.79 (1.39, 2.31),p<0.001 |
| | . | . | . | . | 5.5Yr+: HR=2.91 (2.62, 3.24),p<0.001 |
| **Durom | 196 | 1245 | 14157 | 1.38 | 0 - 1.5Yr: HR=0.74 (0.47, 1.17),p=0.198 |
| | . | . | . | . | 1.5Yr+: HR=3.86 (3.32, 4.48),p<0.001 |
| **ExpanSys | 13 | 71 | 784 | 1.66 | Entire Period: HR=3.36 (1.95, 5.78),p<0.001 |
| **Hedrocel | 12 | 46 | 573 | 2.09 | Entire Period: HR=4.10 (2.32, 7.22),p<0.001 |
| **Icon | 100 | 401 | 3845 | 2.60 | 0 - 2.5Yr: HR=2.53 (1.70, 3.78),p<0.001 |
| | . | . | . | . | 2.5Yr+: HR=7.30 (5.82, 9.15),p<0.001 |
| **Inter-Op | 9 | 33 | 364 | 2.47 | Entire Period: HR=4.90 (2.55, 9.41),p<0.001 |
| **MBA | 18 | 124 | 1097 | 1.64 | Entire Period: HR=3.23 (2.03, 5.13),p<0.001 |
| **Mitch TRH | 141 | 731 | 7445 | 1.89 | 0 - 3Mth: HR=0.57 (0.24, 1.37),p=0.209 |
| | . | . | . | . | 3Mth - 2Yr: HR=2.40 (1.51, 3.81),p<0.001 |
| | . | . | . | . | 2Yr+: HR=5.55 (4.63, 6.67),p<0.001 |
| **Mueller | 12 | 58 | 504 | 2.38 | Entire Period: HR=4.47 (2.54, 7.87),p<0.001 |
| **Plasmacup | 34 | 482 | 3827 | 0.89 | Entire Period: HR=1.69 (1.20, 2.36),p=0.002 |
| **SPH-Blind | 126 | 952 | 12296 | 1.02 | Entire Period: HR=2.07 (1.73, 2.47),p<0.001 |
| **seleXys (excluding seleXys PC) | 51 | 391 | 3167 | 1.61 | Entire Period: HR=3.07 (2.34, 4.05),p<0.001 |

Note: Components have been compared to all other modern total conventional hip components
*Femoral Stem Component
**Acetabular Component

**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 | 19 Yrs |
|---|---|---|---|---|---|
| Newly Identified | | | | | |
| **Atlas (Shell) | 3.3 (2.0, 5.4) | 4.3 (2.7, 6.6) | 5.2 (3.4, 7.8) | 10.4 (7.5, 14.5) | |
| Re-Identified and Still Used | | | | | |
| Accolade II/Trident Tritanium (Shell) | 2.3 (1.7, 3.0) | 3.0 (2.3, 3.8) | 3.6 (2.7, 4.9) | | |
| Avenir/Fitmore | 5.6 (3.3, 9.4) | 6.1 (3.7, 10.2) | | | |
| CORAIL/Trabecular Metal (Shell) | 6.2 (2.8, 13.2) | 9.6 (5.1, 17.7) | 12.1 (6.9, 20.9) | 12.1 (6.9, 20.9) | |
| CPT/Fitmore | 3.9 (2.2, 6.9) | 6.1 (3.8, 9.8) | 6.8 (4.2, 10.8) | | |
| CPT/Low Profile Cup | 5.2 (2.8, 9.4) | 6.5 (3.7, 11.2) | 9.2 (5.5, 15.1) | | |
| HACTIV/Logical G | 3.3 (2.4, 4.6) | 4.4 (3.3, 5.9) | | | |
| Taperloc/G7 | 1.9 (1.5, 2.4) | 2.4 (1.9, 3.1) | 2.6 (2.0, 3.3) | | |
| *Apex | 2.2 (1.7, 2.9) | 3.3 (2.6, 4.0) | 4.7 (3.9, 5.6) | 7.6 (6.5, 8.9) | |
| *Furlong Evolution | 6.0 (4.1, 8.7) | 8.0 (5.6, 11.2) | 9.1 (6.2, 13.2) | | |
| *Linear | 2.4 (1.2, 5.0) | 5.6 (3.5, 9.0) | 6.5 (4.1, 10.1) | | |
| *MiniMax | 4.2 (2.6, 6.7) | 5.3 (3.4, 8.2) | | | |
| *Novation | 3.8 (2.9, 4.9) | 4.6 (3.6, 5.9) | 5.5 (4.3, 6.9) | | |
| *Profemur L | 2.9 (2.4, 3.6) | 3.9 (3.2, 4.8) | 4.4 (3.6, 5.4) | | |
| *Taper Fit | 1.6 (1.2, 2.1) | 2.9 (2.2, 3.6) | 4.8 (3.8, 6.1) | 10.0 (7.5, 13.3) | |
| **Continuum | 2.6 (2.4, 2.9) | 3.5 (3.2, 3.8) | 3.9 (3.6, 4.3) | 5.4 (4.9, 6.0) | |
| **Delta-One-TT | 3.2 (1.3, 7.5) | 5.5 (2.8, 10.8) | 6.7 (3.5, 12.7) | | |
| **Dynasty | 3.4 (2.7, 4.3) | 4.7 (3.8, 5.7) | 5.4 (4.4, 6.7) | | |
| **Fin II | 2.6 (2.0, 3.4) | 3.5 (2.8, 4.4) | 4.6 (3.8, 5.6) | 7.7 (6.5, 9.0) | |
| **Furlong | 4.5 (3.3, 6.1) | 6.2 (4.8, 8.1) | 6.6 (5.1, 8.6) | 7.8 (6.0, 10.2) | |
| **Versafitcup DM | 3.4 (2.5, 4.7) | 5.0 (3.8, 6.6) | 5.9 (4.3, 8.1) | | |
| Identified and no longer used | | | | | |
| 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, 15.3) | 11.0 (6.3, 19.1) | 16.2 (10.0, 25.6) | |
| 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) | |
| Friendly Hip/Delta-TT | 5.5 (2.1, 14.0) | 8.3 (3.8, 17.6) | 8.3 (3.8, 17.6) | | |
| MBA (exch neck)/PINNACLE | 2.2 (0.9, 5.3) | 3.6 (1.8, 7.1) | 7.6 (4.7, 12.1) | 14.4 (9.8, 20.8) | |
| Secur-Fit Plus/PINNACLE | 3.3 (1.6, 6.4) | 4.6 (2.6, 8.1) | 5.1 (2.9, 8.8) | | |
| Secur-Fit Plus/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) | |
| 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, 15.7) | |
| *ABGII (exch neck) | 4.5 (2.5, 8.0) | 11.1 (7.8, 15.8) | 20.5 (15.9, 26.2) | 35.3 (29.5, 42.0) | |
| *Adapter (cless) | 3.2 (2.2, 4.8) | 6.9 (5.2, 8.9) | 11.7 (9.5, 14.3) | 20.1 (17.2, 23.4) | |
| *Adapter (ctd) | 4.1 (1.9, 8.9) | 9.1 (5.4, 15.2) | 17.0 (11.6, 24.5) | 23.6 (17.0, 32.2) | |
| *BMHR VST | 1.9 (0.8, 4.6) | 4.6 (2.7, 8.0) | 7.0 (4.5, 10.8) | 13.1 (9.3, 18.2) | |
| *CBH Stem | 4.0 (2.3, 7.2) | 7.4 (4.9, 11.3) | 9.8 (6.8, 14.1) | 15.4 (11.4, 20.6) | |
| *Edinburgh | 6.0 (3.1, 11.7) | 9.6 (5.6, 16.4) | 12.5 (7.7, 20.0) | 16.8 (10.7, 25.7) | |
| *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) | 14.4 (12.7, 16.4) |
| *Emperion | 4.8 (3.2, 7.0) | 6.0 (4.2, 8.4) | 7.0 (5.1, 9.7) | 12.4 (9.4, 16.2) | |
| *Excia (cless) | 4.2 (2.7, 6.6) | 5.2 (3.5, 7.8) | 5.9 (4.0, 8.7) | 7.3 (4.8, 11.2) | |
| *GHE | 2.6 (0.9, 8.0) | 5.3 (2.4, 11.5) | 8.2 (4.3, 15.2) | | |
| *K2 | 5.2 (3.7, 7.3) | 7.5 (5.7, 10.0) | 9.8 (7.7, 12.6) | 13.9 (11.3, 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) | |
| *ML Taper Kinectiv | 2.4 (2.0, 3.0) | 3.5 (3.0, 4.2) | 4.3 (3.7, 5.0) | 5.9 (5.1, 6.9) | |
| *MSA | 5.8 (3.4, 9.8) | 9.5 (6.3, 14.1) | 11.3 (7.8, 16.3) | 19.1 (14.0, 25.8) | |
| *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) | |
| *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) | |

| CPR | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 19 Yrs |
|---|---|---|---|---|---|
| *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) | |
| *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) | |
| *Trabecular Metal | 3.5 (2.7, 4.4) | 4.8 (3.9, 5.8) | 5.4 (4.5, 6.6) | 6.9 (5.8, 8.2) | |
| *UniSyn | 3.2 (2.0, 5.3) | 5.9 (4.1, 8.5) | 6.6 (4.7, 9.3) | 12.3 (9.4, 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 (23.2, 25.8) | 45.1 (43.5, 46.6) | |
| **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, 22.4) | 26.3 (20.3, 33.6) | 42.4 (35.2, 50.6) |
| **BHR | 1.1 (0.8, 1.6) | 3.2 (2.6, 3.9) | 6.1 (5.3, 7.0) | 14.3 (13.1, 15.7) | |
| **Bionik | 3.6 (2.4, 5.5) | 7.7 (5.8, 10.2) | 14.5 (11.9, 17.6) | 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) | |
| **DeltaLox | 5.9 (3.5, 9.9) | 8.7 (5.6, 13.2) | 10.1 (6.8, 15.0) | | |
| **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) | 18.3 (16.8, 20.0) |
| **Durom | 1.1 (0.7, 1.9) | 3.6 (2.7, 4.8) | 5.5 (4.3, 6.9) | 13.5 (11.7, 15.7) | |
| **ExpanSys | 2.8 (0.7, 10.8) | 5.7 (2.2, 14.4) | 10.2 (5.0, 20.2) | 16.6 (9.6, 28.1) | |
| **Hedrocel | 4.3 (1.1, 16.3) | 6.6 (2.2, 19.2) | 6.6 (2.2, 19.2) | 20.4 (10.7, 37.0) | |
| **Icon | 3.0 (1.7, 5.3) | 7.8 (5.5, 10.9) | 12.7 (9.7, 16.4) | 24.2 (20.1, 29.0) | |
| **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) | 15.3 (12.8, 18.2) | |
| **Mueller | 1.8 (0.2, 11.8) | 12.5 (5.8, 25.9) | 14.8 (7.3, 28.7) | 23.9 (13.4, 40.5) | |
| **Plasmacup | 4.4 (2.9, 6.6) | 5.6 (3.9, 8.1) | 5.8 (4.1, 8.3) | 7.3 (5.2, 10.2) | |
| **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) | 16.5 (13.4, 20.2) |
| **seleXys (excluding seleXys PC) | 4.6 (2.9, 7.2) | 7.8 (5.5, 11.0) | 10.6 (7.9, 14.1) | 13.8 (10.5, 17.9) | |

Note: *Femoral Stem Component
**Acetabular Component

**Table IP9 Yearly Usage of Total Conventional Hip Prostheses Identified as having a Higher than Anticipated Rate of Revision**

| Year of Implant | ≤2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Newly Identified** | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **Atlas (Shell) | 8 | 56 | 45 | 79 | 46 | 16 | 13 | 6 | 7 | 4 | 8 | 28 | 23 | 13 | 27 | 26 | 26 | 33 |
| **Re-Identified and Still Used** | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Accolade II/Trident Tritanium (Shell) | . | . | . | . | . | . | . | . | . | 1 | 1 | 30 | 119 | 258 | 484 | 401 | 509 | 579 |
| Avenir/Fitmore | . | . | . | . | . | . | . | . | . | . | 2 | 7 | 5 | 46 | 44 | 42 | 56 | 40 |
| CORAIL/Trabecular Metal (Shell) | . | . | . | . | 5 | 10 | 17 | 21 | 8 | 8 | 8 | 6 | 1 | 6 | 2 | 4 | 1 | 1 |
| CPT/Fitmore | . | 19 | 6 | 6 | 4 | 16 | 12 | 15 | 24 | 14 | 30 | 30 | 22 | 18 | 16 | 20 | 25 | 8 |
| CPT/Low Profile Cup | . | 15 | 9 | 8 | 7 | 7 | 6 | 9 | 16 | 26 | 20 | 6 | 5 | 2 | 3 | 15 | 31 | 11 |
| HACTIV/Logical G | . | . | . | . | . | . | . | . | 1 | . | . | . | . | 18 | 169 | 395 | 310 | 292 |
| Taperloc/G7 | . | . | . | . | . | . | . | . | . | . | 19 | 147 | 334 | 415 | 482 | 506 | 801 | 738 |
| *Apex | . | . | 75 | 247 | 223 | 265 | 197 | 169 | 190 | 219 | 246 | 188 | 193 | 168 | 88 | 61 | 44 | 18 |
| *Furlong Evolution | . | . | . | . | . | . | . | . | . | . | 29 | 25 | 32 | 11 | 54 | 102 | 106 | 83 |
| *Linear | . | . | . | . | . | . | . | . | . | 23 | 31 | 31 | 88 | 70 | 27 | 12 | 5 | 2 |
| *MiniMax | . | . | . | . | . | . | . | . | . | . | . | . | . | 4 | 43 | 170 | 133 | 41 |
| *Novation | . | . | . | . | . | . | 4 | 32 | 53 | 130 | 137 | 226 | 266 | 148 | 90 | 101 | 145 | 50 |
| *Profemur L | . | . | . | . | . | . | . | . | . | 2 | 47 | 288 | 383 | 406 | 405 | 439 | 426 | 388 |
| *Taper Fit | 64 | 65 | 50 | 66 | 26 | 18 | 6 | 8 | 17 | 55 | 45 | 110 | 161 | 227 | 315 | 592 | 788 | 775 |
| **Continuum | . | . | . | . | . | . | 175 | 1117 | 1245 | 1333 | 1502 | 1492 | 1359 | 1327 | 1293 | 1197 | 848 | 502 |
| **Delta-One-TT | . | . | . | . | . | . | . | 4 | 7 | 7 | 15 | 37 | 13 | 12 | 14 | 14 | 23 | 15 |
| **Dynasty | . | . | . | . | . | . | . | . | 40 | 31 | 49 | 178 | 298 | 317 | 306 | 307 | 272 | 241 |
| **Fin II | . | . | 39 | 128 | 175 | 251 | 269 | 318 | 286 | 205 | 247 | 101 | 6 | . | . | 9 | 76 | 94 |
| **Furlong | 31 | . | . | . | 4 | 7 | 61 | 90 | 85 | 73 | 76 | 64 | 66 | 12 | 55 | 100 | 82 | 65 |
| **Versafitcup DM | . | . | . | . | . | . | . | . | 10 | 12 | 4 | 19 | 139 | 184 | 196 | 182 | 185 | 226 |
| **Identified and no longer used** | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Anatomic II/Duraloc Option | . | . | 4 | 33 | 23 | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Anca-Fit/PINNACLE | . | . | . | 30 | 55 | 16 | . | . | . | . | . | . | . | . | . | . | . | . |
| F2L/Delta-PF | . | 7 | 62 | 28 | 10 | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Friendly Hip/Cup (Exactech) | 24 | 18 | 16 | 19 | 12 | 2 | 6 | . | . | . | . | . | . | . | . | . | . | . |
| Friendly Hip/Delta-TT | . | . | . | . | . | . | . | . | 14 | 12 | 13 | 13 | 9 | 6 | 4 | 2 | 1 | . |
| MBA (exch neck)/PINNACLE | . | . | . | . | 24 | 45 | 9 | 43 | 46 | 14 | 44 | . | . | . | . | . | . | . |
| Secur-Fit Plus/PINNACLE | . | 1 | 3 | . | . | . | . | . | . | . | 42 | 42 | 53 | 25 | 33 | 31 | 16 | . |
| Secur-Fit Plus/Secur-Fit | 128 | 21 | 26 | 22 | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Taperloc/M2a$^{MoM}$ | 97 | 113 | 74 | 38 | 43 | 76 | 49 | 23 | 2 | . | . | . | . | . | . | . | . | . |
| *ABGII (exch neck) | . | . | . | . | 10 | 39 | 69 | 58 | 63 | 7 | . | . | . | . | . | . | . | . |
| *Adapter (cless) | . | . | 19 | 140 | 131 | 122 | 158 | 113 | 60 | . | 1 | . | . | . | . | . | . | . |
| *Adapter (ctd) | . | . | 7 | 41 | 52 | 33 | 8 | 7 | . | . | . | . | . | . | . | . | . | . |
| *BMHR VST | . | . | . | . | . | 2 | 65 | 81 | 71 | 22 | 13 | 5 | 1 | . | . | . | . | . |
| *CBH Stem | . | 12 | 7 | 14 | 37 | 28 | 27 | 45 | 53 | 43 | 7 | . | 1 | . | . | . | . | . |
| *Edinburgh | . | . | 20 | 37 | 29 | 18 | 23 | 10 | 1 | . | . | . | . | . | . | . | . | . |
| *Elite Plus | 2054 | 353 | 249 | 112 | 46 | 26 | . | . | 1 | . | . | . | . | . | . | . | . | . |
| *Emperion | . | . | 1 | 13 | 21 | 26 | 65 | 87 | 72 | 44 | 53 | 38 | 41 | 34 | 12 | . | . | . |
| *Excia (cless) | . | . | . | . | . | 6 | 34 | 8 | 47 | 58 | 38 | 17 | 42 | 35 | 65 | 66 | 10 | . |
| *GHE | . | . | . | . | . | . | . | 9 | 4 | 47 | 28 | 14 | 12 | . | . | . | . | . |
| *K2 | . | . | . | 1 | 22 | 80 | 172 | 204 | 122 | . | . | . | . | . | . | . | . | . |
| *LYDERIC II | 49 | 64 | 23 | 12 | 8 | 8 | . | . | . | . | . | . | . | . | . | . | . | . |
| *ML Taper Kinectiv | . | . | . | . | . | 36 | 341 | 647 | 576 | 515 | 384 | 345 | 256 | 199 | 159 | 74 | . | . |

| Year of Implant | ≤2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *MSA | . | . | . | . | 2 | 3 | 11 | 58 | 76 | 46 | 21 | 7 | . | . | . | . | . | . |
| *Margron | 337 | 140 | 96 | 85 | 28 | 2 | . | . | . | . | . | . | . | . | . | . | . | . |
| *Mayo | 21 | 14 | 23 | 24 | 25 | 29 | 30 | 2 | . | . | . | . | . | . | . | . | . | . |
| *Metha (exch neck) | . | . | . | . | . | . | 20 | 53 | 15 | . | . | . | . | . | . | . | . | . |
| *Profemur Z | . | 41 | 79 | 56 | 6 | 1 | 2 | 1 | . | . | . | . | . | . | . | . | . | . |
| *Trabecular Metal | . | . | . | 6 | 101 | 148 | 198 | 242 | 272 | 276 | 186 | 220 | 112 | 106 | 32 | 5 | . | . |
| *UniSyn | 15 | 41 | 74 | 33 | 37 | 46 | 48 | 36 | 22 | 19 | 23 | 27 | 23 | 17 | 5 | . | . | . |
| **2000 Plus | . | . | 11 | 23 | 42 | 14 | 18 | 25 | 2 | . | . | . | . | . | . | . | . | . |
| **ASR | . | 84 | 584 | 958 | 1185 | 1180 | 430 | . | . | . | . | . | . | . | . | . | . | . |
| **Adept | . | . | . | 19 | 20 | 29 | 30 | 11 | 12 | . | . | . | . | . | . | . | . | . |
| **Artek | 179 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **BHR | 105 | 127 | 288 | 550 | 581 | 477 | 404 | 276 | 134 | 27 | 13 | 5 | 1 | . | . | . | . | . |
| **Bionik | . | . | 11 | 147 | 136 | 138 | 134 | 38 | 4 | . | . | . | . | . | . | . | . | . |
| **Conserve Plus | . | 19 | 16 | 46 | 24 | 15 | 14 | 1 | . | . | . | . | . | . | . | . | . | . |
| **Cormet | 62 | 74 | 103 | 114 | 73 | 129 | 124 | 93 | 26 | 4 | 1 | . | . | . | . | . | . | . |
| **DeltaLox | . | . | . | . | . | . | . | 32 | 86 | 72 | 24 | 8 | . | . | . | . | . | . |
| **Duraloc | 3054 | 631 | 448 | 301 | 253 | 293 | 187 | 82 | 84 | 18 | 3 | . | . | . | . | . | . | . |
| **Durom | 5 | 79 | 265 | 322 | 257 | 218 | 85 | 13 | 1 | . | . | . | . | . | . | . | . | . |
| **ExpanSys | 1 | 7 | 24 | 30 | 8 | 1 | . | . | . | . | . | . | . | . | . | . | . | . |
| **Hedrocel | 46 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **Icon | . | 3 | 40 | 80 | 84 | 68 | 78 | 37 | 11 | . | . | . | . | . | . | . | . | . |
| **Inter-Op | 33 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **MBA | 78 | 19 | 11 | 9 | 5 | 2 | . | . | . | . | . | . | . | . | . | . | . | . |
| **Mitch TRH | . | . | . | 45 | 273 | 164 | 130 | 82 | 37 | . | . | . | . | . | . | . | . | . |
| **Mueller | 40 | 4 | 3 | . | 1 | 2 | . | . | . | 1 | . | 1 | 1 | . | 1 | 1 | 3 | . |
| **Plasmacup | . | . | 10 | 16 | 13 | 7 | 54 | 60 | 59 | 77 | 70 | 44 | 51 | 21 | . | . | . | . |
| **SPH-Blind | 638 | 205 | 41 | 49 | 19 | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **seleXys (excluding seleXys PC) | . | . | . | 35 | 33 | 20 | 21 | 53 | 70 | 89 | 57 | 13 | . | . | . | . | . | . |

Note: *Femoral Stem Component
**Acetabular Component

**Figure IP2** Cumulative Percent Revision of Newly Identified Total Conventional Hip Prostheses

## Newly Identified

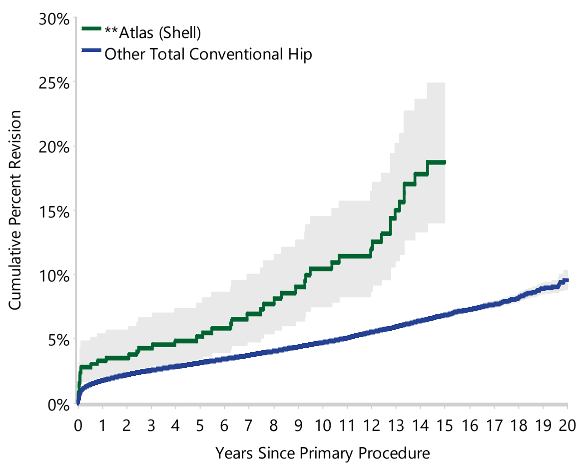
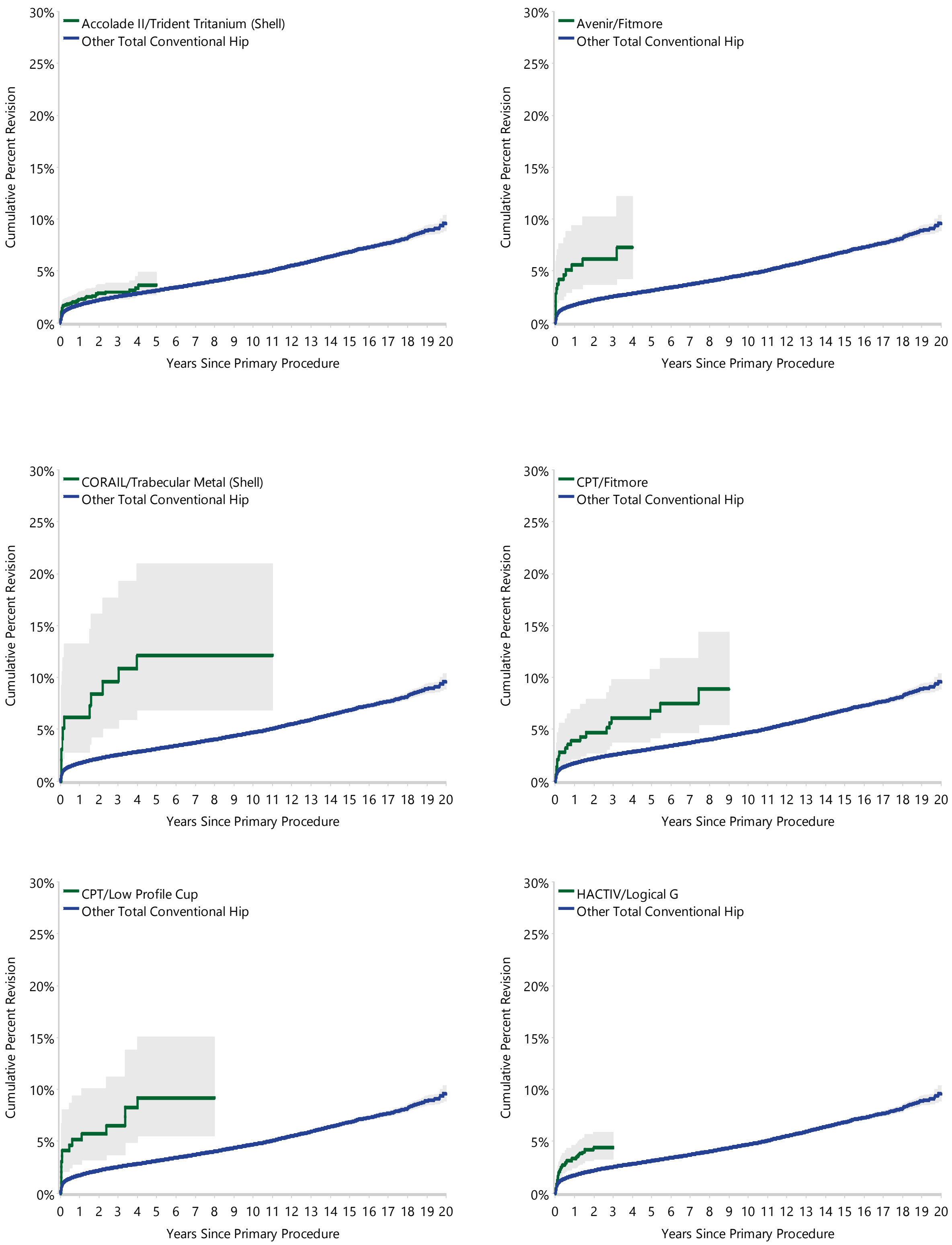
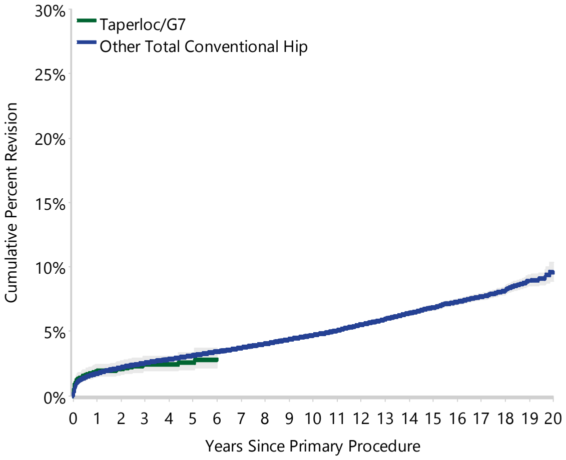
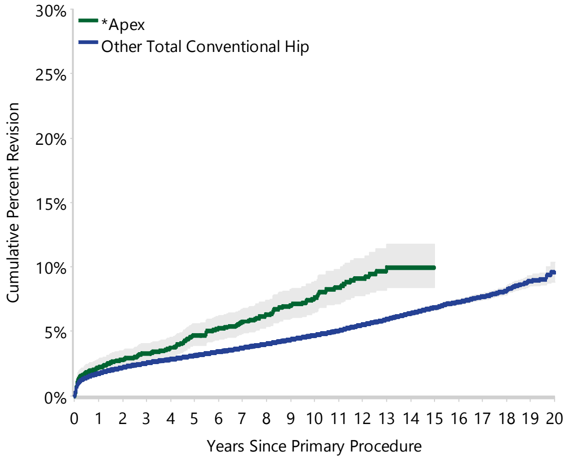


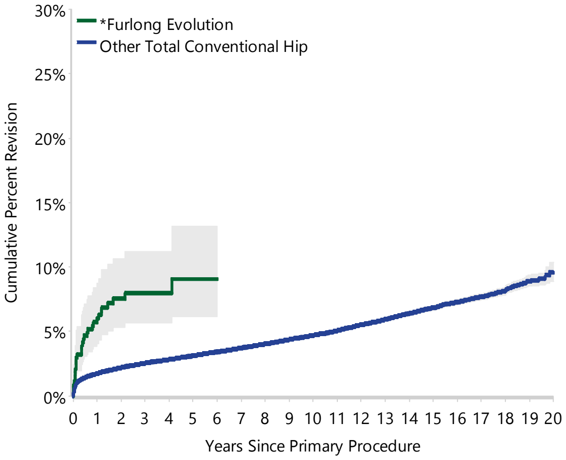
**Figure IP3** **Cumulative Percent Revision of Re-Identified and Still Used Total Conventional Hip Prostheses**

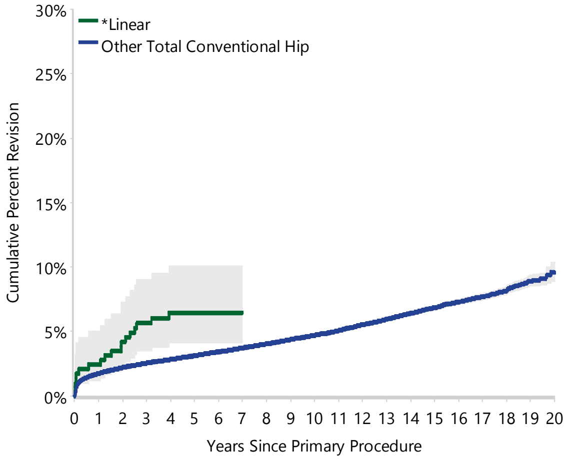
## Re-identified and Still Used

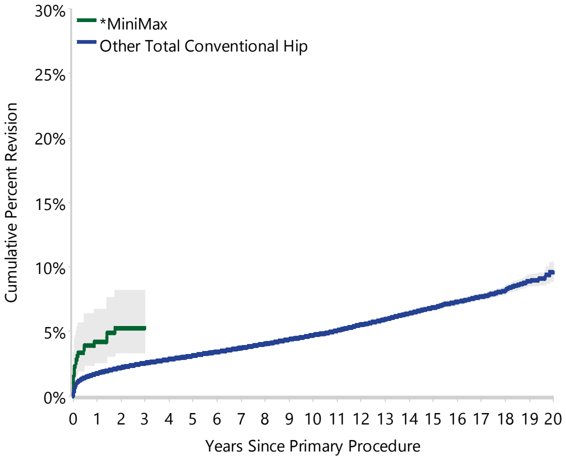


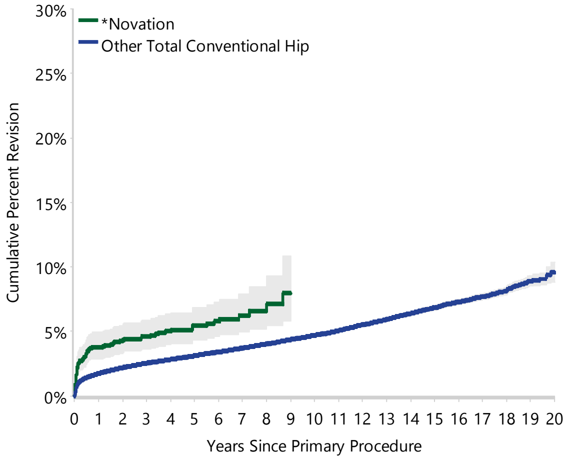

Taperloc/G7
Other Total Conventional Hip
Cumulative Percent Revision
0% 5% 10% 15% 20% 25% 30%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years Since Primary Procedure

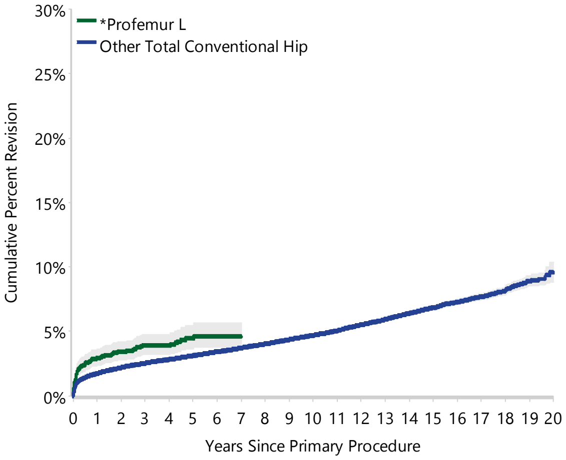

*Apex
Other Total Conventional Hip
Cumulative Percent Revision
0% 5% 10% 15% 20% 25% 30%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years Since Primary Procedure

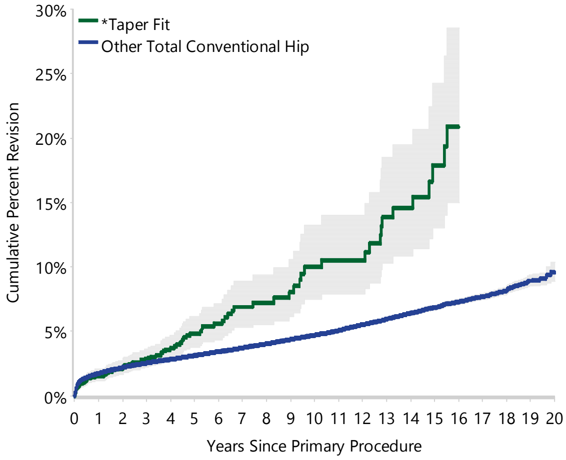

*Furlong Evolution
Other Total Conventional Hip
Cumulative Percent Revision
0% 5% 10% 15% 20% 25% 30%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years Since Primary Procedure

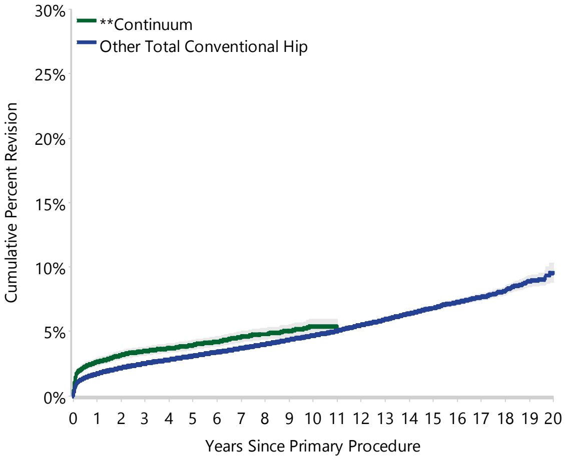

*Linear
Other Total Conventional Hip
Cumulative Percent Revision
0% 5% 10% 15% 20% 25% 30%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years Since Primary Procedure

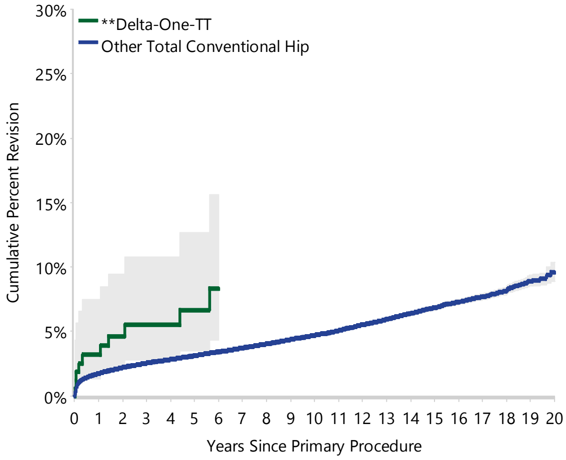

*MiniMax
Other Total Conventional Hip
Cumulative Percent Revision
0% 5% 10% 15% 20% 25% 30%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years Since Primary Procedure

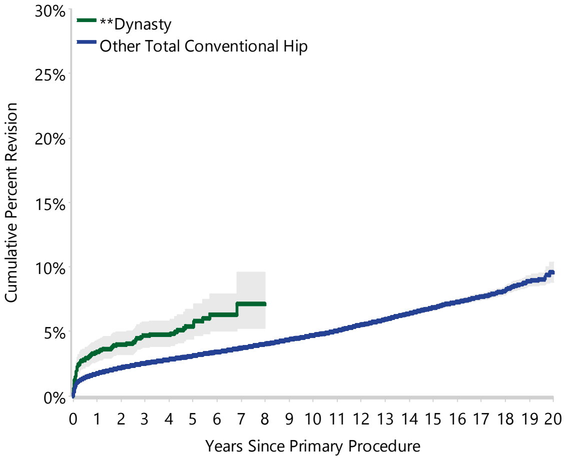

*Novation
Other Total Conventional Hip
Cumulative Percent Revision
0% 5% 10% 15% 20% 25% 30%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years Since Primary Procedure

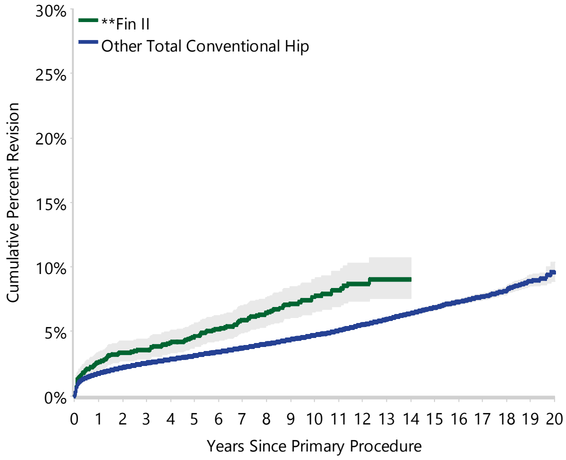

*Profemur L
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years Since Primary Procedure

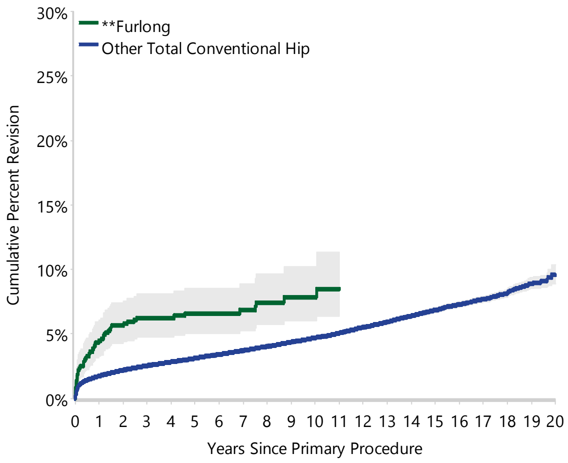

*Taper Fit
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years Since Primary Procedure

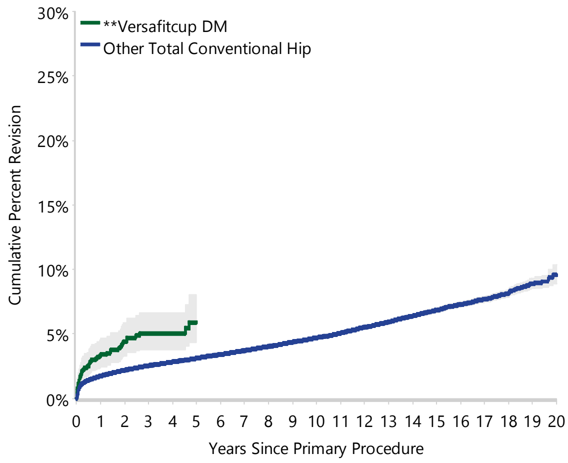

**Continuum
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years Since Primary Procedure


**Delta-One-TT
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years Since Primary Procedure


**Dynasty
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years Since Primary Procedure


**Fin II
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years Since Primary Procedure


**Furlong
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years Since Primary Procedure


**Versafitcup DM
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years Since Primary Procedure

## 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 | 399 | 1168 | 13101 | 3.05 | 0 - 3Yr: HR=2.74 (2.16, 3.49),p<0.001 |
| | . | . | . | . | 3Yr - 4.5Yr: HR=7.64 (5.54, 10.54),p<0.001 |
| | . | . | . | . | 4.5Yr - 5Yr: HR=11.14 (6.79, 18.25),p<0.001 |
| | . | . | . | . | 5Yr - 6Yr: HR=7.87 (5.40, 11.48),p<0.001 |
| | . | . | . | . | 6Yr - 7.5Yr: HR=6.81 (4.98, 9.33),p<0.001 |
| | . | . | . | . | 7.5Yr - 8.5Yr: HR=4.58 (2.92, 7.20),p<0.001 |
| | . | . | . | . | 8.5Yr - 10.5Yr: HR=3.85 (2.73, 5.42),p<0.001 |
| | . | . | . | . | 10.5Yr - 12.5Yr: HR=2.91 (1.89, 4.46),p<0.001 |
| | . | . | . | . | 12.5Yr - 14Yr: HR=3.40 (1.92, 6.00),p<0.001 |
| | . | . | . | . | 14Yr+: HR=0.24 (0.03, 1.69),p=0.150 |
| Bionik/Bionik | 60 | 200 | 2021 | 2.97 | Entire Period: HR=4.71 (3.63, 6.12),p<0.001 |
| Conserve Plus/Conserve Plus | 16 | 63 | 846 | 1.89 | Entire Period: HR=2.38 (1.45, 3.90),p<0.001 |
| Cormet/Cormet | 133 | 626 | 7430 | 1.79 | Entire Period: HR=2.53 (2.12, 3.03),p<0.001 |
| Durom/Durom | 111 | 847 | 10987 | 1.01 | 0 - 4.5Yr: HR=2.52 (1.93, 3.28),p<0.001 |
| | . | . | . | . | 4.5Yr+: HR=1.07 (0.80, 1.43),p=0.666 |
| Recap/Recap | 30 | 196 | 2225 | 1.35 | 0 - 6Mth: HR=3.03 (1.34, 6.85),p=0.007 |
| | . | . | . | . | 6Mth - 1.5Yr: HR=6.60 (3.20, 13.62),p<0.001 |
| | . | . | . | . | 1.5Yr+: HR=1.42 (0.87, 2.33),p=0.164 |
| *Cormet 2000 HAP | 27 | 95 | 1309 | 2.06 | Entire Period: HR=3.42 (2.34, 5.01),p<0.001 |

Note: Components have been compared to all other modern 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 | 19 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) | |
| Bionik/Bionik | 3.5 (1.7, 7.2) | 12.5 (8.7, 18.0) | 18.6 (13.8, 24.7) | 27.2 (21.6, 34.0) | |
| 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) | |
| Cormet/Cormet | 2.1 (1.2, 3.6) | 5.6 (4.1, 7.7) | 9.7 (7.6, 12.3) | 17.2 (14.4, 20.4) | |
| 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) | |
| 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) | 22.1 (15.0, 31.9) | |

Note: *Head Component

**Table IP12 Yearly Usage of Total Resurfacing Hip Prostheses Identified as having a Higher than Anticipated Rate of Revision**

| Year of Implant | ≤2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Identified and no longer used | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| ASR/ASR | 43 | 165 | 302 | 258 | 176 | 133 | 91 | . | . | . | . | . | . | . | . | . | . | . |
| Bionik/Bionik | . | . | 12 | 33 | 33 | 46 | 54 | 20 | 2 | . | . | . | . | . | . | . | . | . |
| Conserve Plus/Conserve Plus | 15 | 18 | 15 | 11 | 3 | . | 1 | . | . | . | . | . | . | . | . | . | . | . |
| Cormet/Cormet | 104 | 50 | 85 | 74 | 76 | 94 | 75 | 50 | 10 | 4 | 4 | . | . | . | . | . | . | . |
| Durom/Durom | 58 | 166 | 207 | 143 | 105 | 88 | 46 | 24 | 10 | . | . | . | . | . | . | . | . | . |
| Recap/Recap | . | 27 | 14 | 10 | 42 | 46 | 38 | 16 | 3 | . | . | . | . | . | . | . | . | . |
| *Cormet 2000 HAP | 56 | 39 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |

Note: *Head Component

# PRIMARY PARTIAL KNEE REPLACEMENT

## PATELLA/TROCHLEA

There are no newly identified patella/trochlear knee 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 | . | . | . | . | |
| **LCS | 208 | 413 | 3971 | 5.24 | Entire Period: HR=1.86 (1.57, 2.20),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 | 19 Yrs |
|---|---|---|---|---|---|
| Identified and no longer used | | | | | |
| **LCS | 3.9 (2.4, 6.2) | 11.9 (9.1, 15.4) | 20.7 (17.1, 25.0) | 40.9 (36.1, 45.9) | |

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 | ≤2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Identified and no longer used | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| **LCS | 82 | 68 | 47 | 65 | 64 | 60 | 27 | . | . | . | . | . | . | . | . | . | . | . |

Note: **Trochlear Component

## UNICOMPARTMENTAL

The Freedom PKR Active/Freedom PKR Active combination is identified for the first time and is no longer used.

**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 |
|---|---|---|---|---|---|
| Re-Identified and Still Used | . | . | . | . | |
| GMK-UNI/GMK-UNI | 37 | 164 | 766 | 4.83 | Entire Period: HR=2.97 (2.15, 4.10),p<0.001 |
| Uniglide/Uniglide | 175 | 756 | 7852 | 2.23 | 0 - 1.5Yr: HR=2.23 (1.69, 2.94),p<0.001 |
| | . | . | . | . | 1.5Yr - 2Yr: HR=1.51 (0.75, 3.06),p=0.248 |
| | . | . | . | . | 2Yr - 3Yr: HR=2.30 (1.47, 3.61),p<0.001 |
| | . | . | . | . | 3Yr+: HR=1.02 (0.83, 1.25),p=0.854 |
| Identified and no longer used | . | . | . | . | |
| +Freedom PKR Active/Freedom PKR Active | 442 | 1505 | 14353 | 3.08 | 0 - 1Yr: HR=0.75 (0.50, 1.11),p=0.148 |
| | . | . | . | . | 1Yr - 1.5Yr: HR=2.08 (1.47, 2.93),p<0.001 |
| | . | . | . | . | 1.5Yr+: HR=2.22 (2.00, 2.46),p<0.001 |
| Advance/Advance | 16 | 37 | 322 | 4.97 | Entire Period: HR=3.35 (2.05, 5.47),p<0.001 |
| BalanSys Uni/BalanSys Uni Mobile | 54 | 199 | 2228 | 2.42 | 0 - 6Mth: HR=4.17 (2.07, 8.39),p<0.001 |
| | . | . | . | . | 6Mth - 2Yr: HR=2.57 (1.52, 4.35),p<0.001 |
| | . | . | . | . | 2Yr+: HR=1.08 (0.76, 1.53),p=0.668 |
| **Preservation Mobile | 149 | 400 | 4838 | 3.08 | 0 - 1.5Yr: HR=2.55 (1.82, 3.57),p<0.001 |
| | . | . | . | . | 1.5Yr - 3Yr: HR=3.35 (2.28, 4.93),p<0.001 |
| | . | . | . | . | 3Yr+: HR=1.23 (1.00, 1.53),p=0.055 |

Note: Components have been compared to all other modern unicompartmental knee components
**Tibial Component
+ Newly identified and no longer used

**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 | 19 Yrs |
|---|---|---|---|---|---|
| Re-Identified and Still Used | | | | | |
| GMK-UNI/GMK-UNI | 6.8 (3.8, 12.0) | 18.8 (13.4, 25.9) | 24.2 (17.9, 32.2) | | |
| Uniglide/Uniglide | 4.8 (3.5, 6.6) | 10.7 (8.7, 13.2) | 12.9 (10.7, 15.5) | 19.8 (17.0, 22.9) | |
| Identified and no longer used | | | | | |
| +Freedom PKR Active/Freedom PKR Active | 1.7 (1.1, 2.5) | 7.9 (6.6, 9.4) | 13.7 (12.1, 15.6) | 27.7 (25.4, 30.2) | |
| Advance/Advance | 10.8 (4.2, 26.3) | 27.0 (15.6, 44.4) | 32.9 (20.2, 50.6) | 41.6 (27.5, 59.4) | |
| 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) | |
| **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) | |

Note: **Tibial Component
+ Newly identified and no longer used

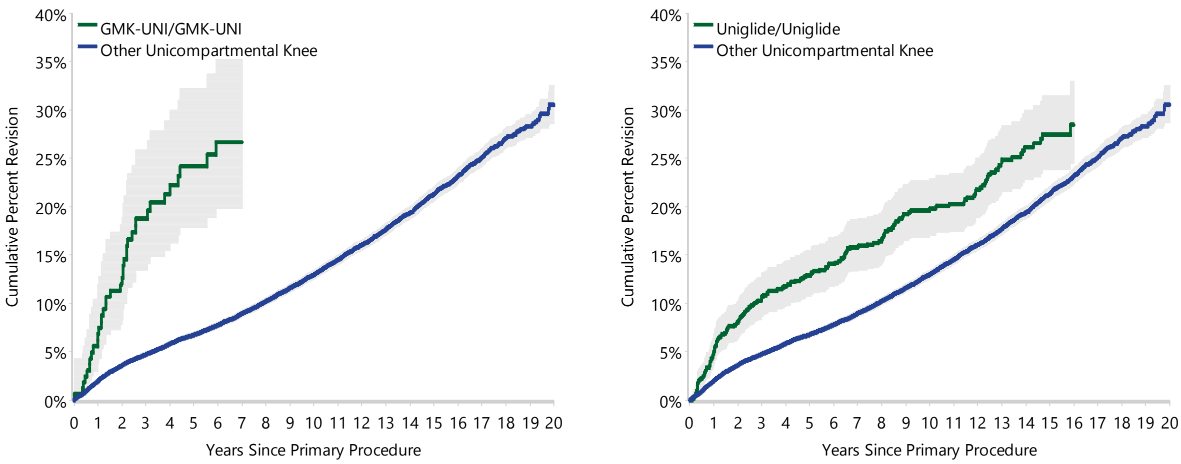
**Table IP18** **Yearly Usage of Unicompartmental Knee Prostheses Identified as having a Higher than Anticipated Rate of Revision**

| Year of Implant | ≤2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Re-Identified and Still Used | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| GMK-UNI/GMK-UNI | . | . | . | . | . | 5 | 10 | 2 | . | 21 | 22 | 16 | 19 | 17 | 12 | 29 | 3 | 8 |
| Uniglide/Uniglide | 80 | 66 | 123 | 84 | 107 | 93 | 61 | 30 | 38 | 25 | 22 | 9 | 5 | 8 | 3 | . | 1 | 1 |
| Identified and no longer used | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| +Freedom PKR Active/Freedom PKR Active | . | 19 | 223 | 281 | 264 | 162 | 149 | 102 | 75 | 68 | 63 | 51 | 31 | 12 | 5 | . | . | . |
| Advance/Advance | 13 | 11 | 7 | 2 | 3 | 1 | . | . | . | . | . | . | . | . | . | . | . | . |
| BalanSys Uni/BalanSys Uni Mobile | . | 37 | 51 | 63 | 33 | 9 | 2 | 4 | . | . | . | . | . | . | . | . | . | . |
| **Preservation Mobile | 285 | 59 | 26 | 17 | 13 | . | . | . | . | . | . | . | . | . | . | . | . | . |

Note: **Tibial Component
+ Newly identified and no longer used

**Figure IP4** **Cumulative Percent Revision of Re-Identified and Still Used Unicompartmental Knee Prostheses**

**Re-identified and Still Used**



## PRIMARY TOTAL KNEE REPLACEMENT

There are no newly identified total knee prostheses.

**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 |
|---|---|---|---|---|---|
| Re-Identified and Still Used | . | . | . | . | |
| ACS (cless)/ACS Fixed | 110 | 2400 | 10045 | 1.10 | Entire Period: HR=1.57 (1.30, 1.89),p<0.001 |
| Active Knee (cless)/Active Knee | 679 | 7197 | 72764 | 0.93 | 0 - 1Yr: HR=1.03 (0.83, 1.29),p=0.773 |
| | . | . | . | . | 1Yr - 2.5Yr: HR=1.60 (1.36, 1.89),p<0.001 |
| | . | . | . | . | 2.5Yr - 3Yr: HR=1.13 (0.74, 1.72),p=0.564 |
| | . | . | . | . | 3Yr+: HR=2.23 (2.02, 2.46),p<0.001 |
| Advance/Advance | 65 | 991 | 6442 | 1.01 | Entire Period: HR=1.67 (1.31, 2.14),p<0.001 |
| Apex Knee CR (cless)/Apex Knee (cless) | 27 | 449 | 2419 | 1.12 | Entire Period: HR=1.78 (1.22, 2.60),p=0.002 |
| Columbus/Columbus | 132 | 4151 | 14624 | 0.90 | 0 - 2Yr: HR=1.10 (0.87, 1.40),p=0.429 |
| | . | . | . | . | 2Yr+: HR=1.87 (1.46, 2.39),p<0.001 |
| E.Motion/E.Motion | 79 | 1360 | 7003 | 1.13 | 0 - 1.5Yr: HR=2.41 (1.81, 3.20),p<0.001 |
| | . | . | . | . | 1.5Yr+: HR=1.31 (0.93, 1.86),p=0.122 |
| Nexgen LPS Flex (cless)/Nexgen | 102 | 2098 | 10144 | 1.01 | 0 - 1.5Yr: HR=1.96 (1.52, 2.52),p<0.001 |
| | . | . | . | . | 1.5Yr - 3.5Yr: HR=1.59 (1.13, 2.23),p=0.008 |
| | . | . | . | . | 3.5Yr+: HR=0.64 (0.33, 1.23),p=0.183 |
| Score (cless)/Score (cless) | 211 | 2666 | 15357 | 1.37 | 0 - 9Mth: HR=1.26 (0.86, 1.84),p=0.230 |
| | . | . | . | . | 9Mth - 1.5Yr: HR=2.28 (1.70, 3.06),p<0.001 |
| | . | . | . | . | 1.5Yr+: HR=2.39 (2.02, 2.83),p<0.001 |
| Score (cless)/Score (ctd) | 81 | 1635 | 6509 | 1.24 | Entire Period: HR=1.72 (1.38, 2.13),p<0.001 |
| Trekking/Trekking | 57 | 1243 | 5989 | 0.95 | 0 - 9Mth: HR=2.53 (1.70, 3.79),p<0.001 |
| | . | . | . | . | 9Mth - 2.5Yr: HR=1.06 (0.67, 1.68),p=0.811 |
| | . | . | . | . | 2.5Yr+: HR=1.13 (0.68, 1.87),p=0.644 |
| Vanguard PS/Vanguard | 320 | 5231 | 35973 | 0.89 | 0 - 1.5Yr: HR=1.94 (1.65, 2.27),p<0.001 |
| | . | . | . | . | 1.5Yr+: HR=1.35 (1.16, 1.58),p<0.001 |
| **Legion Revision Tibial Baseplate | 58 | 847 | 4017 | 1.44 | 0 - 1Mth: HR=7.26 (4.13, 12.76),p<0.001 |
| | . | . | . | . | 1Mth - 6Mth: HR=4.10 (2.38, 7.08),p<0.001 |
| | . | . | . | . | 6Mth - 1.5Yr: HR=0.90 (0.43, 1.90),p=0.790 |
| | . | . | . | . | 1.5Yr+: HR=1.69 (1.15, 2.48),p=0.007 |
| Identified and no longer used | . | . | . | . | |
| ACS/ACS Mobile PC (cless) | 29 | 131 | 818 | 3.55 | Entire Period: HR=5.75 (3.99, 8.27),p<0.001 |
| AMK/AMK | 26 | 203 | 2476 | 1.05 | Entire Period: HR=2.33 (1.58, 3.42),p<0.001 |
| Buechel-Pappas/Buechel-Pappas | 51 | 479 | 4692 | 1.09 | Entire Period: HR=2.08 (1.58, 2.74),p<0.001 |
| Eska RP/Eska RP | 9 | 40 | 354 | 2.54 | Entire Period: HR=5.45 (2.84, 10.47),p<0.001 |
| Evolis (cless)/Evolis (cless) | 9 | 87 | 718 | 1.25 | Entire Period: HR=2.19 (1.14, 4.20),p=0.018 |
| Gemini MK II/Gemini MK II | 8 | 21 | 214 | 3.74 | Entire Period: HR=7.25 (3.63, 14.50),p<0.001 |
| Genesis (ctd)/Genesis (ctd) | 11 | 62 | 682 | 1.61 | Entire Period: HR=3.70 (2.05, 6.67),p<0.001 |
| Genesis II CR (cless)/Profix Mobile (ctd) | 35 | 241 | 2760 | 1.27 | Entire Period: HR=2.76 (1.98, 3.85),p<0.001 |
| Genesis II Oxinium CR (cless)/Genesis II | 47 | 110 | 974 | 4.83 | 0 - 1.5Yr: HR=13.64 (9.15, 20.35),p<0.001 |
| | . | . | . | . | 1.5Yr - 2.5Yr: HR=23.72 (14.28, 39.38),p<0.001 |
| | . | . | . | . | 2.5Yr+: HR=2.69 (1.35, 5.37),p=0.005 |

| Femoral/Tibial | N Revised | N Total | Obs. Years | Revisions/ 100 Obs. Yrs | Hazard Ratio, P Value |
|---|---|---|---|---|---|
| Genesis II Oxinium CR (cless)/Profix Mobile | 56 | 88 | 608 | 9.21 | 0 - 6Mth: HR=7.26 (2.72, 19.36),p<0.001 |
| | . | . | . | . | 6Mth - 9Mth: HR=51.53 (28.47, 93.25),p<0.001 |
| | . | . | . | . | 9Mth - 1.5Yr: HR=37.38 (24.34, 57.38),p<0.001 |
| | . | . | . | . | 1.5Yr - 2Yr: HR=30.90 (14.71, 64.88),p<0.001 |
| | . | . | . | . | 2Yr - 4Yr: HR=10.16 (4.23, 24.43),p<0.001 |
| | . | . | . | . | 4Yr+: HR=5.06 (2.53, 10.13),p<0.001 |
| Genesis II Oxinium PS (ctd)/Genesis II (cless) | 17 | 56 | 433 | 3.93 | 0 - 1Yr: HR=16.90 (9.35, 30.53),p<0.001 |
| | . | . | . | . | 1Yr+: HR=3.03 (1.36, 6.74),p=0.006 |
| Genesis II Oxinium PS (ctd)/Genesis II (keel) | 68 | 269 | 2790 | 2.44 | Entire Period: HR=4.89 (3.86, 6.21),p<0.001 |
| HLS Noetos/HLS Noetos | 42 | 294 | 2757 | 1.52 | Entire Period: HR=2.96 (2.19, 4.01),p<0.001 |
| IB II/IB II | 39 | 199 | 2518 | 1.55 | 0 - 2Yr: HR=0.88 (0.28, 2.72),p=0.818 |
| | . | . | . | . | 2Yr - 2.5Yr: HR=5.20 (1.68, 16.09),p=0.004 |
| | . | . | . | . | 2.5Yr+: HR=5.24 (3.73, 7.38),p<0.001 |
| Interax/Interax | 11 | 52 | 517 | 2.13 | 0 - 3Yr: HR=0.85 (0.12, 6.04),p=0.872 |
| | . | . | . | . | 3Yr+: HR=8.93 (4.80, 16.61),p<0.001 |
| Journey Oxinium/Journey | 336 | 3033 | 28142 | 1.19 | 0 - 3Mth: HR=0.27 (0.09, 0.85),p=0.025 |
| | . | . | . | . | 3Mth - 1.5Yr: HR=2.14 (1.71, 2.68),p<0.001 |
| | . | . | . | . | 1.5Yr - 2Yr: HR=1.73 (1.12, 2.65),p=0.012 |
| | . | . | . | . | 2Yr - 2.5Yr: HR=2.30 (1.53, 3.48),p<0.001 |
| | . | . | . | . | 2.5Yr - 3Yr: HR=1.53 (0.87, 2.70),p=0.142 |
| | . | . | . | . | 3Yr+: HR=2.88 (2.50, 3.31),p<0.001 |
| Maxim (cless)/Vanguard (ctd) | 64 | 413 | 5156 | 1.24 | 0 - 2Yr: HR=1.49 (0.85, 2.63),p=0.165 |
| | . | . | . | . | 2Yr - 3Yr: HR=1.24 (0.40, 3.83),p=0.714 |
| | . | . | . | . | 3Yr+: HR=3.37 (2.54, 4.46),p<0.001 |
| Optetrak-CR (ctd)/Optetrak (ctd) | 11 | 92 | 806 | 1.36 | Entire Period: HR=2.84 (1.58, 5.11),p<0.001 |
| Optetrak-PS/Optetrak | 263 | 2410 | 23958 | 1.10 | 0 - 1Yr: HR=1.44 (1.03, 2.01),p=0.030 |
| | . | . | . | . | 1Yr - 1.5Yr: HR=1.88 (1.25, 2.84),p=0.002 |
| | . | . | . | . | 1.5Yr+: HR=2.47 (2.15, 2.84),p<0.001 |
| Optetrak-PS/Optetrak RBK | 86 | 1127 | 8888 | 0.97 | Entire Period: HR=1.84 (1.49, 2.27),p<0.001 |
| Optetrak-PS/Optetrak-PS | 14 | 55 | 528 | 2.65 | Entire Period: HR=5.85 (3.47, 9.88),p<0.001 |
| PFC Sigma PS (ctd)/MBT (cless) | 24 | 316 | 2472 | 0.97 | Entire Period: HR=1.65 (1.11, 2.47),p=0.013 |
| Profix Oxinium (cless)/Profix | 33 | 75 | 702 | 4.70 | 0 - 9Mth: HR=5.94 (2.23, 15.83),p<0.001 |
| | . | . | . | . | 9Mth - 2Yr: HR=25.94 (16.90, 39.82),p<0.001 |
| | . | . | . | . | 2Yr+: HR=3.34 (1.67, 6.68),p<0.001 |
| Profix Oxinium (cless)/Profix Mobile | 71 | 158 | 1326 | 5.35 | 0 - 9Mth: HR=3.14 (1.18, 8.33),p=0.021 |
| | . | . | . | . | 9Mth - 1.5Yr: HR=25.72 (17.86, 37.06),p<0.001 |
| | . | . | . | . | 1.5Yr - 2Yr: HR=17.62 (9.16, 33.91),p<0.001 |
| | . | . | . | . | 2Yr - 2.5Yr: HR=37.08 (21.99, 62.53),p<0.001 |
| | . | . | . | . | 2.5Yr - 3Yr: HR=22.75 (10.20, 50.74),p<0.001 |
| | . | . | . | . | 3Yr+: HR=2.60 (1.35, 5.00),p=0.004 |
| Profix Oxinium (ctd)/Profix (cless) | 14 | 100 | 1188 | 1.18 | Entire Period: HR=2.12 (1.26, 3.57),p=0.004 |
| Profix Oxinium (ctd)/Profix Mobile | 28 | 228 | 2981 | 0.94 | Entire Period: HR=1.74 (1.20, 2.53),p=0.003 |
| Profix/Profix Mobile | 113 | 1005 | 12048 | 0.94 | 0 - 1.5Yr: HR=2.68 (1.97, 3.66),p<0.001 |
| | . | . | . | . | 1.5Yr - 2.5Yr: HR=3.06 (1.99, 4.69),p<0.001 |
| | . | . | . | . | 2.5Yr+: HR=1.47 (1.12, 1.93),p=0.006 |

| Femoral/Tibial | N Revised | N Total | Obs. Years | Revisions/ 100 Obs. Yrs | Hazard Ratio, P Value |
|---|---|---|---|---|---|
| Rotaglide Plus/Rotaglide Plus | 82 | 631 | 7499 | 1.09 | 0 - 1.5Yr: HR=1.29 (0.73, 2.27),p=0.379 |
| | . | . | . | . | 1.5Yr - 2Yr: HR=3.36 (1.68, 6.72),p<0.001 |
| | . | . | . | . | 2Yr+: HR=2.60 (2.02, 3.34),p<0.001 |
| SAL/SAL | 14 | 56 | 724 | 1.93 | 0 - 8.5Yr: HR=1.59 (0.60, 4.25),p=0.351 |
| | . | . | . | . | 8.5Yr+: HR=9.96 (5.37, 18.48),p<0.001 |
| Scorpio NRG PS (cless)/Series 7000 (cless) | 79 | 1172 | 9542 | 0.83 | Entire Period: HR=1.33 (1.06, 1.66),p=0.012 |
| TC-Plus (cless)/TC-Plus (ctd) | 8 | 63 | 680 | 1.18 | Entire Period: HR=2.68 (1.34, 5.34),p=0.005 |
| Trac/Trac | 27 | 138 | 1640 | 1.65 | Entire Period: HR=3.36 (2.31, 4.90),p<0.001 |
| Vanguard PS/Regenerex | 34 | 465 | 2822 | 1.20 | 0 - 1.5Yr: HR=2.40 (1.51, 3.81),p<0.001 |
| | . | . | . | . | 1.5Yr - 2Yr: HR=2.59 (1.08, 6.23),p=0.033 |
| | . | . | . | . | 2Yr - 3Yr: HR=3.10 (1.55, 6.19),p=0.001 |
| | . | . | . | . | 3Yr+: HR=0.50 (0.16, 1.56),p=0.233 |
| *LCS Duofix | 652 | 4866 | 50759 | 1.28 | 0 - 1.5Yr: HR=1.74 (1.46, 2.07),p<0.001 |
| | . | . | . | . | 1.5Yr - 2Yr: HR=2.49 (1.87, 3.31),p<0.001 |
| | . | . | . | . | 2Yr - 3Yr: HR=3.78 (3.12, 4.59),p<0.001 |
| | . | . | . | . | 3Yr - 3.5Yr: HR=4.77 (3.59, 6.34),p<0.001 |
| | . | . | . | . | 3.5Yr - 4Yr: HR=5.71 (4.31, 7.58),p<0.001 |
| | . | . | . | . | 4Yr - 4.5Yr: HR=4.44 (3.17, 6.24),p<0.001 |
| | . | . | . | . | 4.5Yr - 5Yr: HR=5.66 (4.14, 7.73),p<0.001 |
| | . | . | . | . | 5Yr - 5.5Yr: HR=4.55 (3.19, 6.49),p<0.001 |
| | . | . | . | . | 5.5Yr - 7Yr: HR=2.89 (2.21, 3.78),p<0.001 |
| | . | . | . | . | 7Yr+: HR=1.49 (1.22, 1.82),p<0.001 |
| *LCS PS | 69 | 638 | 5278 | 1.31 | Entire Period: HR=2.54 (2.00, 3.22),p<0.001 |
| *Renasys | 17 | 121 | 1394 | 1.22 | Entire Period: HR=2.65 (1.65, 4.25),p<0.001 |

Note: Components have been compared to all other modern total knee components
*Femoral Component
**Tibial Component

**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 | 19 Yrs |
|---|---|---|---|---|---|
| Re-Identified and Still Used | | | | | |
| ACS (cless)/ACS Fixed | 1.5 (1.1, 2.1) | 4.4 (3.6, 5.3) | 5.2 (4.3, 6.4) | | |
| Active Knee (cless)/Active Knee | 1.1 (0.9, 1.4) | 3.6 (3.1, 4.0) | 5.0 (4.5, 5.6) | 8.8 (8.1, 9.6) | |
| Advance/Advance | 2.0 (1.3, 3.1) | 5.3 (4.1, 7.0) | 6.3 (4.9, 8.1) | 8.0 (6.3, 10.3) | |
| Apex Knee CR (cless)/Apex Knee (cless) | 2.5 (1.4, 4.4) | 5.7 (3.9, 8.4) | 6.0 (4.1, 8.8) | | |
| Columbus/Columbus | 1.1 (0.8, 1.4) | 3.5 (2.8, 4.3) | 4.8 (3.9, 5.9) | 7.7 (6.3, 9.4) | |
| E.Motion/E.Motion | 2.4 (1.7, 3.4) | 5.4 (4.3, 6.8) | 6.4 (5.1, 8.0) | 7.1 (5.7, 8.8) | |
| Nexgen LPS Flex (cless)/Nexgen | 2.5 (1.9, 3.2) | 4.5 (3.7, 5.6) | 5.3 (4.3, 6.4) | 6.2 (4.9, 7.9) | |
| Score (cless)/Score (cless) | 1.6 (1.2, 2.2) | 5.3 (4.5, 6.3) | 7.4 (6.3, 8.6) | 11.9 (10.3, 13.8) | |
| Score (cless)/Score (ctd) | 1.6 (1.1, 2.3) | 4.0 (3.1, 5.1) | 6.0 (4.8, 7.6) | | |
| Trekking/Trekking | 2.3 (1.6, 3.3) | 3.7 (2.7, 4.9) | 4.8 (3.6, 6.3) | | |
| Vanguard PS/Vanguard | 1.9 (1.5, 2.3) | 4.3 (3.8, 4.9) | 5.4 (4.8, 6.1) | 7.6 (6.8, 8.5) | |
| **Legion Revision Tibial Baseplate | 3.6 (2.5, 5.1) | 5.7 (4.2, 7.6) | 6.9 (5.2, 9.2) | 10.6 (8.0, 14.2) | |
| Identified and no longer used | | | | | |
| ACS/ACS Mobile PC (cless) | 7.7 (4.2, 13.8) | 19.3 (13.5, 27.2) | 20.1 (14.2, 28.2) | | |
| AMK/AMK | 1.0 (0.2, 3.9) | 5.0 (2.7, 9.1) | 6.6 (3.9, 11.1) | 11.3 (7.5, 16.9) | 14.6 (9.8, 21.5) |
| 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 (cless)/Evolis (cless) | 2.3 (0.6, 8.9) | 8.0 (3.9, 16.1) | 10.3 (5.5, 18.9) | 10.3 (5.5, 18.9) | |
| 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) | |
| Genesis II CR (cless)/Profix Mobile (ctd) | 2.9 (1.4, 6.1) | 7.7 (4.9, 11.9) | 9.4 (6.3, 14.0) | 14.6 (10.5, 20.1) | |
| Genesis II Oxinium CR (cless)/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 (cless)/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) | |
| Genesis II Oxinium PS (ctd)/Genesis II (cless) | 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) | 13.6 (10.1, 18.3) | |
| IB II/IB II | 0.0 (0.0, 0.0) | 3.5 (1.7, 7.3) | 7.8 (4.8, 12.6) | 15.8 (11.3, 22.0) | |
| 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) | 11.0 (9.9, 12.3) | |
| Maxim (cless)/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) | |
| Optetrak-CR (ctd)/Optetrak (ctd) | 0.0 (0.0, 0.0) | 6.6 (3.0, 14.0) | 10.1 (5.4, 18.5) | 11.4 (6.3, 20.2) | |
| Optetrak-PS/Optetrak | 1.5 (1.1, 2.0) | 4.8 (4.0, 5.7) | 6.4 (5.4, 7.4) | 11.0 (9.7, 12.4) | |
| Optetrak-PS/Optetrak RBK | 1.8 (1.2, 2.7) | 4.6 (3.5, 6.1) | 5.9 (4.7, 7.6) | 8.6 (6.9, 10.7) | |
| 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 (cless) | 2.2 (1.1, 4.6) | 5.4 (3.4, 8.6) | 7.1 (4.7, 10.5) | | |
| Profix Oxinium (cless)/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) | |
| Profix Oxinium (cless)/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 (cless) | 4.0 (1.5, 10.3) | 8.0 (4.1, 15.4) | 9.0 (4.8, 16.6) | 11.2 (6.4, 19.4) | |
| Profix Oxinium (ctd)/Profix Mobile | 2.2 (0.9, 5.2) | 6.7 (4.1, 10.9) | 9.0 (5.9, 13.6) | 11.3 (7.8, 16.3) | |
| 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) | |
| 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) | |
| 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) | 33.3 (21.1, 50.1) |
| Scorpio NRG PS (cless)/Series 7000 (cless) | 1.2 (0.7, 2.0) | 4.9 (3.8, 6.3) | 6.1 (4.8, 7.7) | 7.3 (5.8, 9.1) | |
| TC-Plus (cless)/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) | |

| CPR | 1 Yr | 3 Yrs | 5 Yrs | 10 Yrs | 19 Yrs |
|---|---|---|---|---|---|
| Trac/Trac | 2.2 (0.7, 6.6) | 5.9 (3.0, 11.4) | 9.0 (5.2, 15.2) | 15.1 (9.9, 22.7) | |
| Vanguard PS/Regenerex | 3.2 (2.0, 5.3) | 6.9 (4.9, 9.7) | 7.2 (5.1, 10.0) | 8.2 (5.8, 11.5) | |
| *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) | 11.8 (9.4, 14.7) | |
| *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**

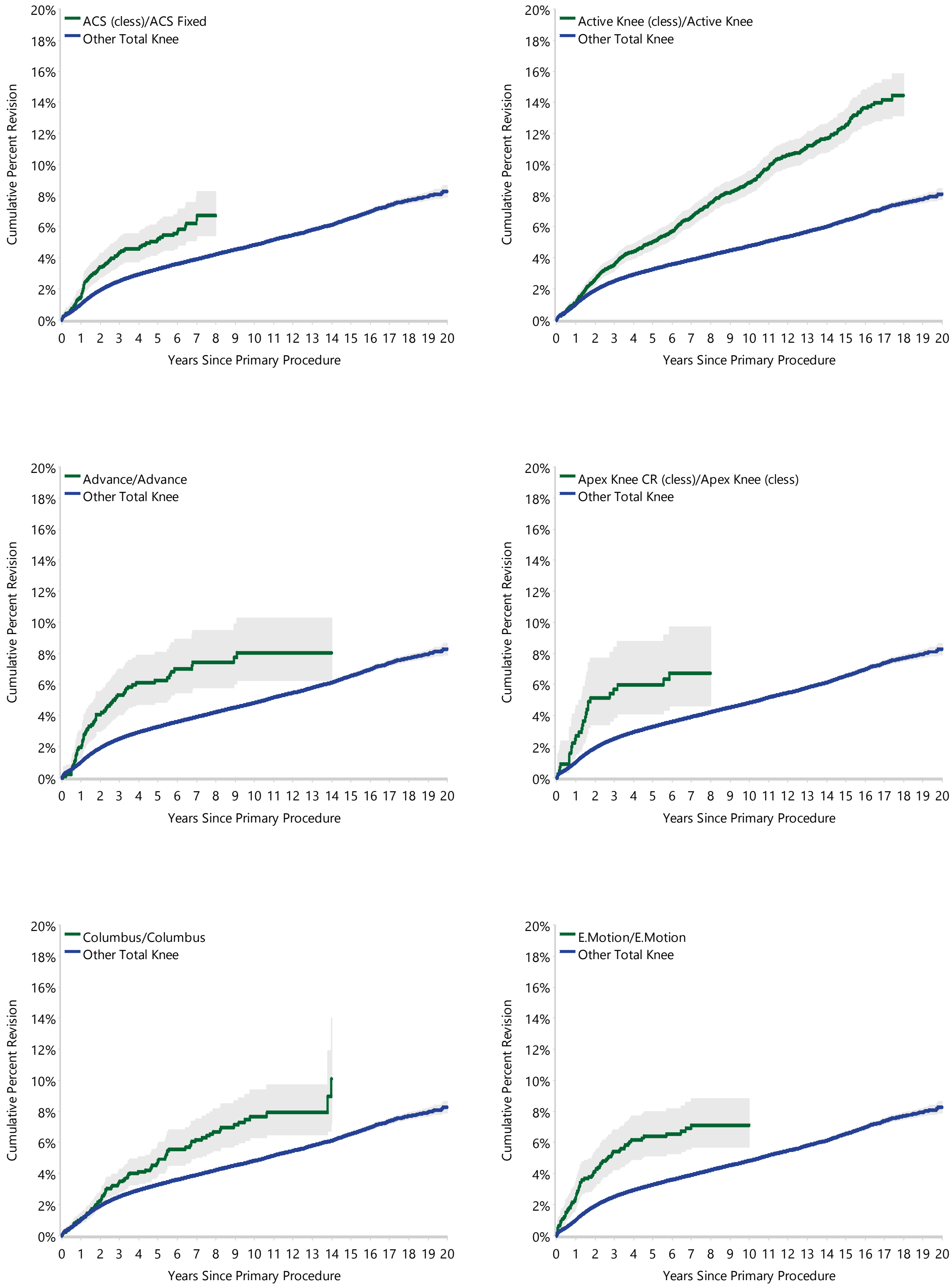
| Year of Implant | ≤2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Re-Identified and Still Used | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| ACS (cless)/ACS Fixed | . | . | . | . | . | . | . | . | 41 | 119 | 283 | 337 | 331 | 238 | 266 | 259 | 319 | 207 |
| Active Knee (cless)/Active Knee | 834 | 790 | 693 | 466 | 510 | 483 | 412 | 479 | 601 | 500 | 427 | 319 | 336 | 176 | 91 | 35 | 21 | 24 |
| Advance/Advance | 53 | 8 | 12 | 16 | 2 | 5 | 43 | 115 | 138 | 74 | 7 | 92 | 92 | 100 | 90 | 69 | 58 | 17 |
| Apex Knee CR (cless)/Apex Knee (cless) | . | . | . | . | . | . | . | . | . | 69 | 83 | 118 | 78 | 11 | 3 | 29 | 52 | 6 |
| Columbus/Columbus | . | . | 49 | 91 | 90 | 148 | 156 | 134 | 136 | 108 | 69 | 36 | 60 | 118 | 358 | 670 | 826 | 1102 |
| E.Motion/E.Motion | . | . | . | . | . | . | 12 | 87 | 114 | 129 | 236 | 106 | 113 | 125 | 140 | 99 | 94 | 105 |
| Nexgen LPS Flex (cless)/Nexgen | . | . | . | . | . | . | . | 73 | 78 | 149 | 312 | 238 | 280 | 225 | 252 | 221 | 188 | 82 |
| Score (cless)/Score (cless) | . | . | 1 | . | 11 | 135 | 212 | 187 | 204 | 196 | 238 | 273 | 263 | 171 | 160 | 214 | 150 | 251 |
| Score (cless)/Score (ctd) | . | 3 | . | . | 3 | 3 | 3 | . | 5 | 15 | 90 | 181 | 324 | 300 | 267 | 122 | 205 | 114 |
| Trekking/Trekking | . | . | . | . | . | . | . | 35 | 102 | 133 | 107 | 108 | 106 | 129 | 216 | 144 | 98 | 65 |
| Vanguard PS/Vanguard | . | . | 22 | 81 | 145 | 321 | 430 | 478 | 607 | 561 | 451 | 523 | 445 | 331 | 310 | 205 | 186 | 135 |
| **Legion Revision Tibial Baseplate | . | . | . | 16 | 33 | 48 | 40 | 56 | 47 | 63 | 54 | 47 | 38 | 50 | 50 | 87 | 93 | 125 |
| Identified and no longer used | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| ACS/ACS Mobile PC (cless) | . | . | . | . | . | . | . | . | 20 | 37 | 57 | 17 | . | . | . | . | . | . |
| AMK/AMK | 202 | 1 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Buechel-Pappas/Buechel-Pappas | . | . | 1 | 39 | 51 | 84 | 100 | 148 | 44 | 4 | . | 7 | 1 | . | . | . | . | . |
| Eska RP/Eska RP | . | . | 9 | 24 | 5 | . | 2 | . | . | . | . | . | . | . | . | . | . | . |
| Evolis (cless)/Evolis (cless) | . | . | . | . | . | 17 | 5 | 11 | 9 | 20 | 7 | 11 | 7 | . | . | . | . | . |
| Gemini MK II/Gemini MK II | 21 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Genesis (ctd)/Genesis (ctd) | 51 | 3 | 8 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Genesis II CR (cless)/Profix Mobile (ctd) | 152 | 10 | 4 | 2 | 5 | 12 | 6 | 9 | 17 | 2 | 22 | . | . | . | . | . | . | . |
| Genesis II Oxinium CR (cless)/Genesis II | 110 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Genesis II Oxinium CR (cless)/Profix Mobile | 88 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Genesis II Oxinium PS (ctd)/Genesis II (cless) | . | . | . | . | 4 | 4 | 11 | 35 | 1 | 1 | . | . | . | . | . | . | . | . |
| Genesis II Oxinium PS (ctd)/Genesis II (keel) | . | . | 19 | 123 | 127 | . | . | . | . | . | . | . | . | . | . | . | . | . |
| HLS Noetos/HLS Noetos | . | 2 | 2 | 47 | 45 | 45 | 56 | 48 | 28 | 20 | 1 | . | . | . | . | . | . | . |
| IB II/IB II | 199 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Interax/Interax | 52 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Journey Oxinium/Journey | . | . | . | 134 | 337 | 541 | 555 | 464 | 334 | 343 | 325 | . | . | . | . | . | . | . |
| Maxim (cless)/Vanguard (ctd) | 180 | 106 | 64 | 23 | 30 | 10 | . | . | . | . | . | . | . | . | . | . | . | . |
| Optetrak-CR (ctd)/Optetrak (ctd) | 14 | 6 | 2 | 9 | 7 | 7 | 4 | . | 5 | 6 | 8 | 24 | . | . | . | . | . | . |
| Optetrak-PS/Optetrak | 256 | 155 | 252 | 253 | 216 | 168 | 202 | 198 | 202 | 200 | 151 | 115 | 30 | 3 | 5 | 3 | 1 | . |
| Optetrak-PS/Optetrak RBK | . | . | 1 | 81 | 173 | 166 | 119 | 82 | 40 | 37 | 50 | 100 | 56 | 46 | 88 | 75 | 13 | . |
| Optetrak-PS/Optetrak-PS | . | 8 | 14 | 18 | 15 | . | . | . | . | . | . | . | . | . | . | . | . | . |
| PFC Sigma PS (ctd)/MBT (cless) | . | . | 47 | 2 | . | . | . | . | 25 | 89 | 110 | 42 | . | 1 | . | . | . | . |
| Profix Oxinium (cless)/Profix | 75 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Profix Oxinium (cless)/Profix Mobile | 158 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Profix Oxinium (ctd)/Profix (cless) | 10 | 29 | 17 | 15 | 8 | 10 | 8 | 2 | . | 1 | . | . | . | . | . | . | . | . |

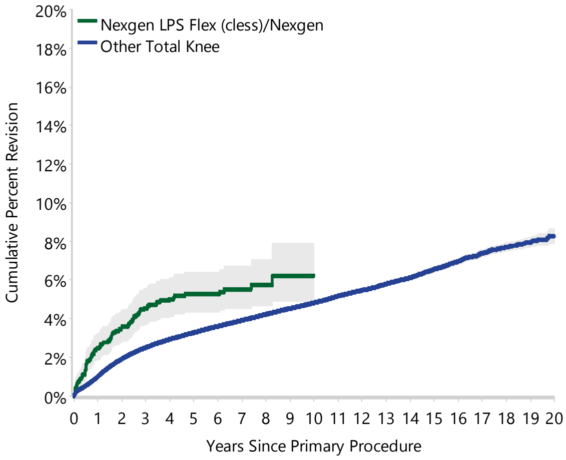
| Year of Implant | ≤2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Profix Oxinium (ctd)/Profix Mobile | 103 | 91 | 24 | 3 | 4 | 1 | 2 | . | . | . | . | . | . | . | . | . | . | . |
| Profix/Profix Mobile | 370 | 258 | 245 | 51 | 56 | 11 | 12 | 2 | . | . | . | . | . | . | . | . | . | . |
| Rotaglide Plus/Rotaglide Plus | 332 | 110 | 101 | 43 | 30 | 15 | . | . | . | . | . | . | . | . | . | . | . | . |
| SAL/SAL | 56 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Scorpio NRG PS (cless)/Series 7000 (cless) | . | . | . | . | 76 | 185 | 171 | 166 | 114 | 67 | 71 | 76 | 72 | 77 | 69 | 28 | . | . |
| TC-Plus (cless)/TC-Plus (ctd) | 1 | 27 | 27 | 5 | 3 | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Trac/Trac | 137 | 1 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Vanguard PS/Regenerex | . | . | . | . | . | . | 4 | 121 | 54 | 27 | 15 | 21 | 18 | 76 | 59 | 56 | 14 | . |
| *LCS Duofix | . | . | . | 844 | 1636 | 1532 | 854 | . | . | . | . | . | . | . | . | . | . | . |
| *LCS PS | . | . | . | . | . | 8 | 157 | 203 | 109 | 51 | 69 | 39 | 2 | . | . | . | . | . |
| *Renasys | . | . | 51 | 53 | 3 | 14 | . | . | . | . | . | . | . | . | . | . | . | . |

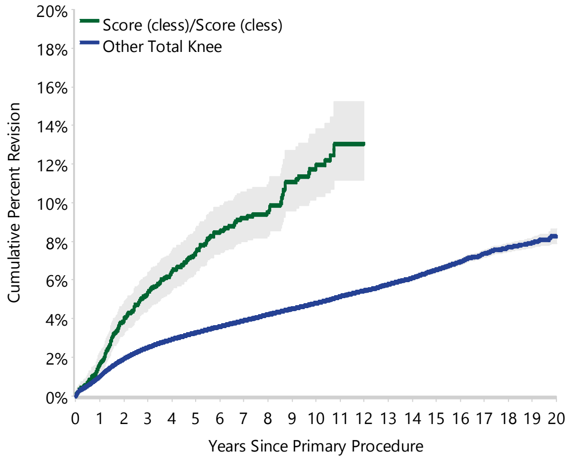
Note: *Femoral Component
**Tibial Component

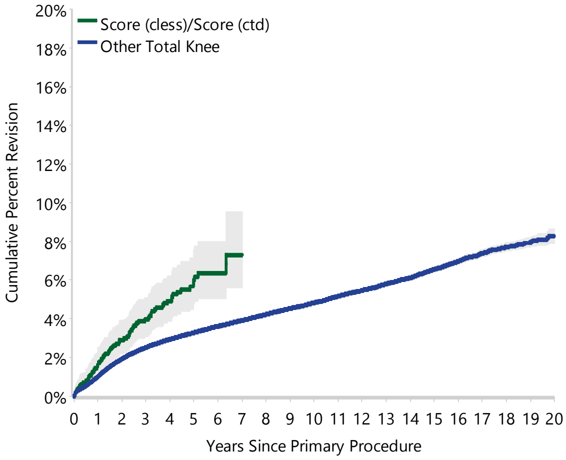
**Figure IP5** **Cumulative Percent Revision of Re-identified and Still Used Total Knee Prostheses**

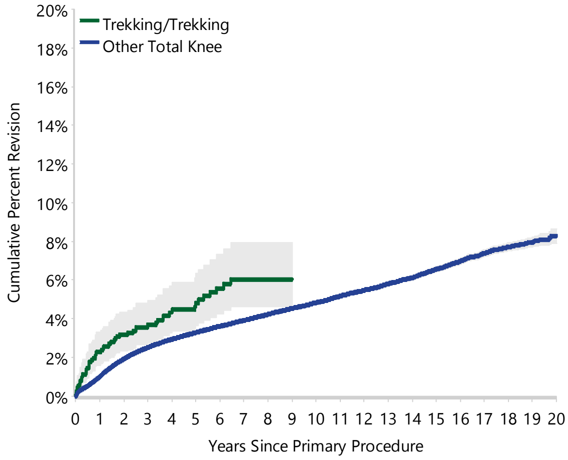
**Re-identified and Still Used**

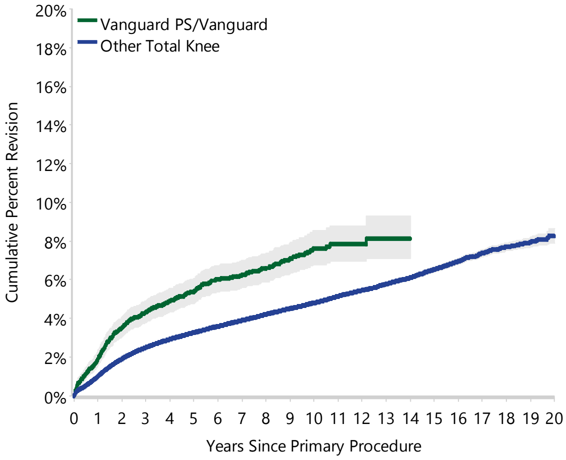


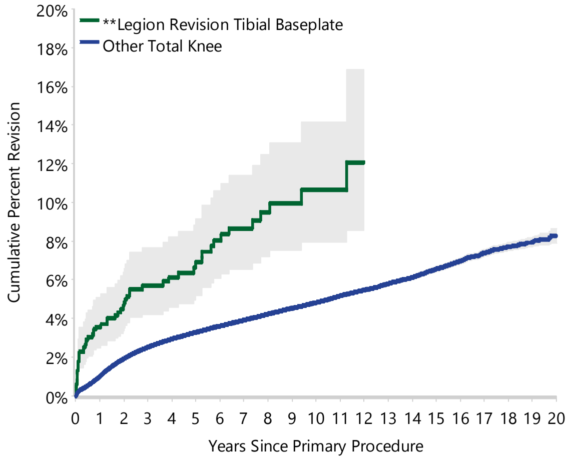

Nexgen LPS Flex (cless)/Nexgen
Other Total Knee
Cumulative Percent Revision
Years Since Primary Procedure


Score (cless)/Score (cless)
Other Total Knee
Cumulative Percent Revision
Years Since Primary Procedure


Score (cless)/Score (ctd)
Other Total Knee
Cumulative Percent Revision
Years Since Primary Procedure


Trekking/Trekking
Other Total Knee
Cumulative Percent Revision
Years Since Primary Procedure


Vanguard PS/Vanguard
Other Total Knee
Cumulative Percent Revision
Years Since Primary Procedure


**Legion Revision Tibial Baseplate
Other Total Knee
Cumulative Percent Revision
Years Since Primary Procedure

# PRIMARY PARTIAL SHOULDER REPLACEMENT

## HEMI STEMMED

There are no newly identified hemi stemmed shoulder prostheses.

**Table IP22 Revision Rate of Hemi Stemmed 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 | 75 | 396 | 3.53 | Entire Period: HR=2.47 (1.45, 4.21),p<0.001 |
| Global Unite/Global Unite | 36 | 201 | 824 | 4.37 | Entire Period: HR=2.02 (1.43, 2.84),p<0.001 |

Note: Components have been compared to all other hemi stemmed shoulder components

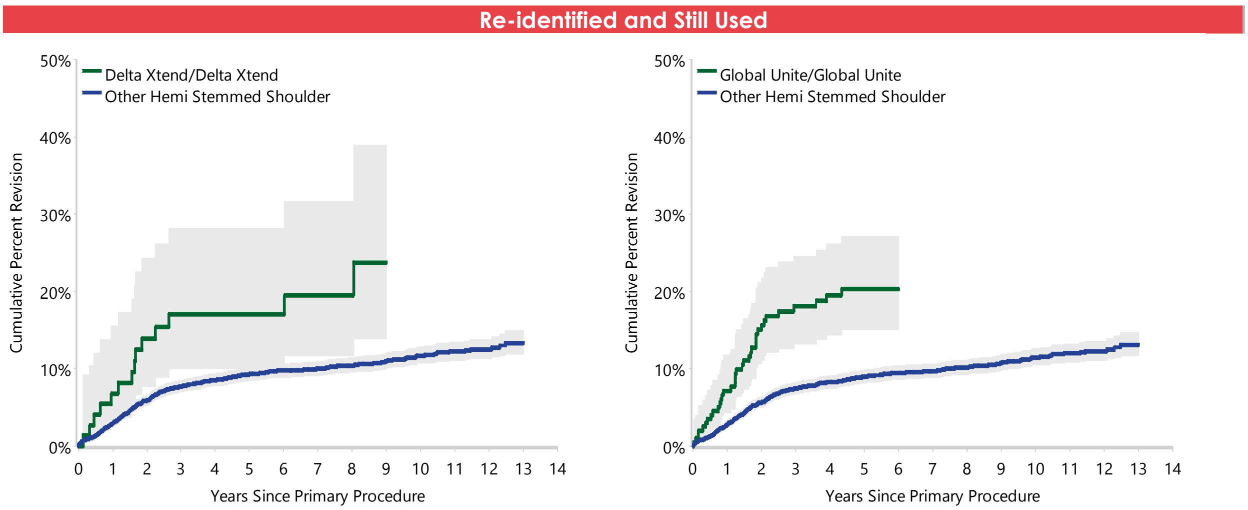
**Table IP23 Cumulative Percent Revision of Hemi Stemmed Shoulder Prostheses Identified as having a Higher than Anticipated Rate of Revision**

| CPR | 1 Yr | 3 Yrs | 5 Yrs | 7 Yrs | 13 Yrs |
|---|---|---|---|---|---|
| Re-Identified and Still Used | | | | | |
| Delta Xtend/Delta Xtend | 6.8 (2.9, 15.6) | 17.1 (10.1, 28.2) | 17.1 (10.1, 28.2) | 19.5 (11.7, 31.6) | |
| Global Unite/Global Unite | 7.1 (4.3, 11.8) | 18.1 (13.2, 24.5) | 20.3 (15.0, 27.0) | | |

**Table IP24 Yearly Usage of Hemi Stemmed Shoulder 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Re-Identified and Still Used | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Delta Xtend/Delta Xtend | 2 | 5 | 9 | 9 | 5 | 10 | 7 | 6 | 5 | 4 | 3 | 6 | 3 | 1 |
| Global Unite/Global Unite | . | . | . | . | . | 15 | 37 | 25 | 38 | 37 | 14 | 12 | 11 | 12 |

**Figure IP6 Cumulative Percent Revision of Re-Identified and Still Used Hemi Stemmed Shoulder Prostheses**



# PRIMARY TOTAL SHOULDER REPLACEMENT

## TOTAL STEMMED

There is one newly identified total stemmed shoulder prosthesis combination.

The Comprehensive/Custom Made (Comprehensive) combination has been used in 18 procedures since 2016. The 2 year cumulative percent revision is 30.2%. Of the 6 revisions, 5 were major revisions including 4 humeral components and 1 humeral/glenoid component. All of the total stemmed shoulder replacements that were revised used cementless fixation. There were 4 revisions for instability/dislocation, 1 for arthrofibrosis, and 1 for rotator cuff insufficiency.

**Table IP25 Revision Rate of Total Stemmed 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 | . | . | . | . | |
| Comprehensive/Custom Made (Comprehensive) | 6 | 18 | 31 | 19.4 | Entire Period: HR=7.67 (3.42, 17.20),p<0.001 |
| Re-Identified and Still Used | . | . | . | . | |
| SMR/SMR L1 | 357 | 2241 | 13171 | 2.71 | Entire Period: HR=3.02 (2.58, 3.53),p<0.001 |
| Identified and no longer used | . | . | . | . | |
| SMR/SMR L2 | 310 | 856 | 5730 | 5.41 | Entire Period: HR=4.15 (3.62, 4.76),p<0.001 |
| Univers 3D/Univers 3D | 16 | 34 | 281 | 5.69 | Entire Period: HR=4.56 (2.77, 7.51),p<0.001 |
| Vaios/Vaios | 19 | 36 | 194 | 9.77 | Entire Period: HR=6.83 (4.32, 10.78),p<0.001 |

Note: Components have been compared to all other modern total stemmed shoulder components

**Table IP26 Cumulative Percent Revision of Total Stemmed 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 | | | | | |
| Comprehensive/Custom Made (Comprehensive) | 17.4 (5.9, 44.8) | | | | |
| Re-Identified and Still Used | | | | | |
| SMR/SMR L1 | 6.1 (5.2, 7.2) | 11.5 (10.2, 13.0) | 13.9 (12.5, 15.5) | 16.1 (14.5, 17.9) | 24.8 (21.8, 28.1) |
| Identified and no longer used | | | | | |
| SMR/SMR L2 | 9.5 (7.7, 11.7) | 22.2 (19.6, 25.2) | 29.7 (26.8, 33.0) | 34.0 (30.8, 37.3) | |
| 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) | |

**Table IP27 Yearly Usage of Total Stemmed Shoulder 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Newly Identified | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| Comprehensive/Custom Made (Comprehensive) | . | . | . | . | . | . | . | . | . | 1 | 4 | 7 | 5 | 1 |
| Re-Identified and Still Used | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| SMR/SMR L1 | 135 | 237 | 247 | . | . | 157 | 301 | 255 | 242 | 195 | 172 | 129 | 98 | 73 |
| Identified and no longer used | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| SMR/SMR L2 | . | . | 43 | 343 | 336 | 134 | . | . | . | . | . | . | . | . |
| Univers 3D/Univers 3D | 23 | 11 | . | . | . | . | . | . | . | . | . | . | . | . |
| Vaios/Vaios | . | . | . | . | 16 | 17 | 2 | 1 | . | . | . | . | . | . |

**Figure IP7** **Cumulative Percent Revision of Newly Identified Total Stemmed Shoulder Prostheses**

**Newly Identified**

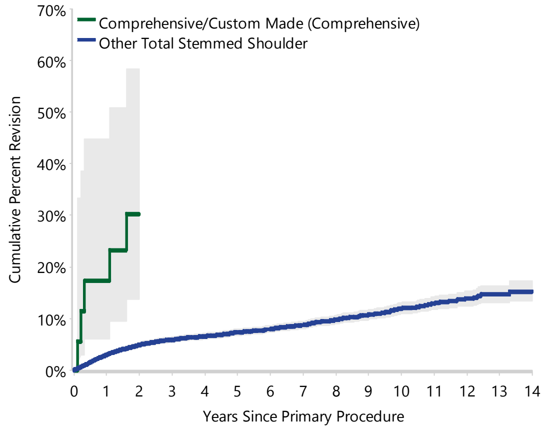
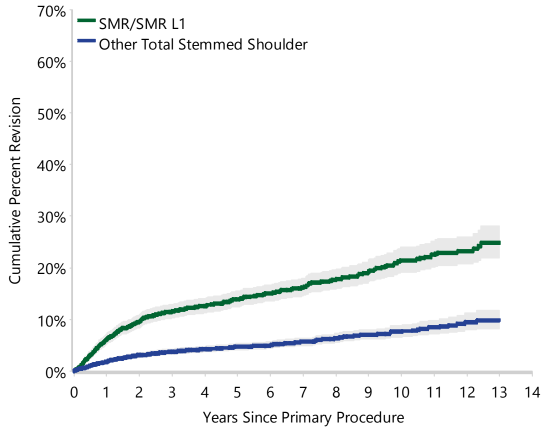



**Figure IP8** **Cumulative Percent Revision of Re-Identified and Still Used Total Stemmed Shoulder Prostheses**

**Re-identified and Still Used**



## TOTAL REVERSE

There is one newly identified total reverse shoulder prosthesis combination.

The SMR/SMR Axioma combination has been used in 105 procedures since 2014. The 1 year cumulative percent revision is 5.2%. Of the 7 revisions, 4 were minor revisions including replacement of the cup/head, the cup only and 2 head only replacements. There were 3 major revisions, including 2 humeral components and 1 cement spacer. Six of the revised total reverse shoulder replacements used cementless fixation. There were 2 revisions for instability/dislocation, 2 for infection, 2 for fracture and 1 for loosening.

**Table IP28 Revision Rate of Total Reverse Shoulder 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 |
|---|---|---|---|---|---|
| Newly Identified | . | . | . | . | |
| SMR/SMR Axioma | 7 | 105 | 164 | 4.26 | Entire Period: HR=2.21 (1.05, 4.65),p=0.036 |
| Re-Identified and Still Used | . | . | . | . | |
| SMR/SMR L1 | 331 | 7765 | 29761 | 1.11 | 0 - 3Mth: HR=1.52 (1.26, 1.84),p<0.001 |
| | . | . | . | . | 3Mth - 1.5Yr: HR=1.14 (0.91, 1.42),p=0.261 |
| | . | . | . | . | 1.5Yr+: HR=0.77 (0.60, 1.00),p=0.048 |

Note: Components have been compared to all other modern total reverse shoulder components

**Table IP29 Cumulative Percent Revision of Total 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 | | | | | |
| SMR/SMR Axioma | 5.2 (2.2, 12.2) | | | | |
| Re-Identified and Still Used | | | | | |
| SMR/SMR L1 | 3.1 (2.7, 3.5) | 4.2 (3.7, 4.7) | 4.7 (4.2, 5.2) | 5.2 (4.6, 5.9) | 7.9 (6.2, 9.9) |

**Table IP30 Yearly Usage of Total Reverse Shoulder 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Newly Identified | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| SMR/SMR Axioma | . | . | . | . | . | . | . | 3 | 2 | 7 | 5 | 19 | 34 | 35 |
| Re-Identified and Still Used | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| SMR/SMR L1 | 145 | 262 | 271 | . | . | 249 | 562 | 632 | 732 | 914 | 930 | 1046 | 1051 | 971 |

Figure IP9 Cumulative Percent Revision of Newly Identified Total Reverse Shoulder Prostheses

Newly Identified

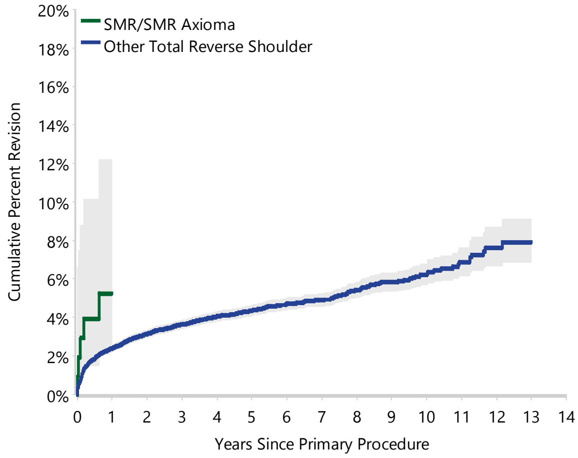
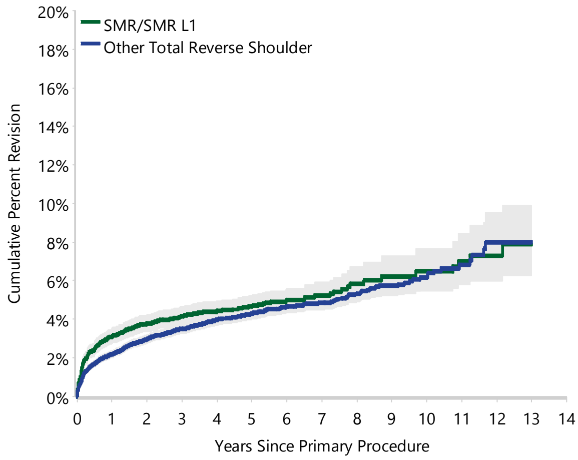



Figure IP10 Cumulative Percent Revision of Re-Identified and Still Used Total Reverse Shoulder Prostheses

Re-identified and Still Used



## PRIMARY TOTAL ANKLE REPLACEMENT

The S.T.A.R/S.T.A.R combination is newly identified and no longer used.

**Table IP31 Revision Rate of Total Ankle 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 |
|---|---|---|---|---|---|
| Identified and no longer used | . | . | . | . | |
| +S.T.A.R/S.T.A.R | 10 | 49 | 290 | 3.45 | Entire Period: HR=1.97 (1.05, 3.71),p=0.034 |

Note: Components have been compared to all other total ankle components
+ Newly identified and no longer used

**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 |
|---|---|---|---|---|---|
| Identified and no longer used | | | | | |
| +S.T.A.R/S.T.A.R | 4.1 (1.0, 15.5) | 12.6 (5.9, 26.0) | 14.8 (7.3, 28.6) | 24.5 (13.6, 41.6) | |

Note: + Newly identified and no longer used

**Table IP33 Yearly Usage of Total Ankle 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Identified and no longer used | . | . | . | . | . | . | . | . | . | . | . | . | . | . |
| +S.T.A.R/S.T.A.R | 1 | . | 3 | 3 | 4 | 2 | 15 | 12 | 4 | 4 | . | 1 | . | . |

Note: + Newly identified and no longer used

# Appendices

# Appendices

## APPENDIX 1 - PARTICIPATING HOSPITALS & COORDINATORS

### VICTORIA

| PUBLIC HOSPITALS | | PRIVATE HOSPITALS | |
|---|---|---|---|
| Austin Health | R Kentish/B Murray | Ballarat Day Procedure Centre | Amy Ingram |
| Bairnsdale Regional Health Service | Sian Guns | Beleura Private Hospital | Jean Leyland |
| Ballarat Health Service | M Nicholson/B Anderson | Bellbird Private Hospital | Belinda Van Denberg |
| Bass Coast Regional Health | Fanella King | Cabrini Private Hospital, Brighton | T Colliver/ M Speak |
| Bendigo Health Care Group | S Sharp/C Jensen | Cabrini Private Hospital, Malvern | T Colliver/ M Speak |
| Box Hill Hospital | Lisa Bingham | Epping Private Hospital | Jooly Jose |
| Broadmeadows Hospital | B Wilson/R Paul | Epworth Eastern Hospital | Linda Dennehy |
| Central Gippsland Health | Mandy Pusmucans | Epworth Freemasons | Claudia Nozzolillo |
| Cohuna District Hospital | Karyn Storm | Epworth Geelong | Christian King |
| Colac Area Health | Amanda Tout | Epworth Richmond | Lynne Moyes |
| Dandenong Hospital | K Ferguson/M Murray | Essendon Private Hospital | Elaine Jordan |
| Djerriwarrh Health Services Bacchus Marsh Campus | J Dehnert/C Clifford | Frankston Private Hospital | Tracy McIndoe-Norton |
| East Grampians Health Service | K Carr/J Sargent | Glenferrie Private Hospital | Marianne Westley |
| Echuca Regional Health | K Giorgianni/H Lias | Holmesglen Private Hospital | Nicole Groves |
| Footscray Hospital | A Dijak/V Mahaljcek | John Fawkner Hospital | Belinda Emmett |
| Frankston Hospital | Donna Anderson | Knox Private Hospital | J Assauw/H McCarty/E George |
| Goulburn Valley Health | Andrea Stevens | Linacre Private Hospital | D Tyler/M Dillon |
| Hamilton Base Hospital | Rosalie Broadfoot | Maryvale Private Hospital | Glenda Chambers |
| Kyabram District Health Service | L Walker/L Fleming | Masada Private Hospital | A Bonato/J Walsh |
| Latrobe Regional Hospital | Simone Lovison | Melbourne Private Hospital | Tracey Perkins |
| Maroondah Hospital | Benjamin Connelly | Mildura Private Hospital | Sue Malcolm |
| Mildura Base Hospital | Kaylene Mailes | Mitcham Private Hospital | J Nankivell/J Lonthyil |
| Monash Medical Centre Clayton Campus | Jessica Cranston | Mulgrave Private Hospital | Anthony Puzon |
| Moorabbin Hospital | C Jackson/L Mason | Northpark Private Hospital | Kath Morris |
| Northeast Health Wangaratta | Debbie Reidy | Peninsula Private Hospital | Ruth Honan |
| Portland Hospital | Donna Eichler | Ringwood Private Hospital | Carol Burns |
| Sandringham Hospital | L Scopel/G Jack | Shepparton Private Hospital | Niki Miller |
| Seymour District Memorial Hospital | Karen Lamaro | St John of God Ballarat Hospital | Gitty Mathachan |
| South West Health Care Warrnambool Campus | Tony Kelly | St John of God Bendigo Hospital | Alanna Sheehan |
| St Vincents Public Hospital | S Osman/A Lynskey | St John of God Berwick Hospital | Rebecca Jamieson |
| Stawell Regional Health | C Ellen/S Campigli | St John of God Geelong Hospital | Colin Hay |
| Sunshine Hospital | Cassandra Mules | St John of God Warrnambool Hospital | G Wheaton/L McPherson |
| Swan Hill District Health | Donna Hartland | St Vincent's Private East Melbourne | Brandi Lyon |
| The Alfred | Caroline McMurray | St Vincent's Private Fitzroy | D Dellevirgini/N Carter |
| The Northern Hospital | Siew Perry | St Vincent's Private Kew | J Miller/H Xing |
| The Royal Children's Hospital | Sonia Mouat | St Vincent's Private Werribee | D Sanchez/C Ipio |
| The Royal Melbourne Hospital | Brycelyn Bennett | The Avenue Hospital | John Davidson |
| University Hospital Geelong Barwon Health | D Barber/M Quinn | The Bays Hospital | L Kerr/S Burton |
| West Gippsland Healthcare Group | B Norman/S Backman | The Melbourne Eastern Private Hospital | Jay Phillpotts |
| West Wimmera Health Service | Michelle Borain | Vermont Private Hospital | Dionne Smithwick |
| Williamstown Hospital | M Clark/A Chircop | Wangaratta Private Hospital | Janet Mckie |
| Wimmera Health Care Group | M Markby/ S de Rome | Warringal Private Hospital | Marilyn Dey |
| | | Waverley Private Hospital | Alfred Monleon |
| | | Werribee Mercy Hospital | Jamil Anwar |
| | | Western Private Hospital | Sharryn McKinley |

## NEW SOUTH WALES

| PUBLIC HOSPITALS | | PRIVATE HOSPITALS | |
|---|---|---|---|
| Albury Base Hospital | Laurel Rhodes | Albury Wodonga Private Hospital | Dom Mahaffrey |
| Armidale Hospital | Tanya Scott | Armidale Private Hospital | Katherine Latter |
| Auburn Health Service | Sarah Sisson | Baringa Private Hospital | E Ford / K Henderson / F Howson |
| Bankstown/Lidcombe Hospital | Karen Och | Bathurst Private Hospital | Diane Carter |
| Bathurst Base Hospital | Kylie Peers | Brisbane Waters Private Hospital | Adele Ryan |
| Belmont Hospital | Jenny Jones | Bathurst Private Hospital | Diane Carter |
| Blacktown Hospital | June Tsang | Brisbane Waters Private Hospital | Adele Ryan |
| Bowral and District Hospital | B Allan / J Elsing | Dalcross Adventist Hospital | K Legg / A Carroll |
| Broken Hill Health Service | Sue Beahl | Delmar Private Hospital | Cathy Byrne |
| Campbelltown Hospital | Susan Birch | Dubbo Private Hospital | K Troth / S Cross |
| Canterbury Hospital | Jenny Cubitt | Dudley Private Hospital | Pam Fullgrabe |
| Chris O'Brien Lifehouse | Fiona Strachan | East Sydney Private Hospital | Thea Woodgate |
| Coffs Harbour Health Campus | Robbie Bentley | Forster Private Hospital | Deb Conway |
| Concord Repatriation Hospital | David Debello | Gosford Private Hospital | Amy Maguire |
| Dubbo Base Hospital | Kathy Chapman | Hawkesbury District Health Service | E Jones / S Garden |
| Fairfield Hospital | Caroline Youkhana | Holroyd Private Hospital | Mynard Brosas |
| Gosford Hospital | M Farthing / T Hoad / K Brown | Hunter Valley Private Hospital | Renae Pridue |
| Goulburn Base Hospital | D Hay / K Goode | Hurstville Private Hospital | Simelibuhle (Simmy) Masuku |
| Grafton Base Hospital | Anthony Corkett | Insight Clinic Private Hospital | Debbie van de Stadt |
| Hornsby Ku-Ring-Gai Hospital | J Colville / B Chu | Kareena Private Hospital | Anita Burazer |
| Institute of Rheumatology and Orthopaedic Surgery | Maria Hatziandreou | Kogarah Private Hospital | E Naidoo / K Gardner |
| John Hunter Hospital | Felicia Bristow | Lake Macquarie Private Hospital | Vanessa Jones |
| Lismore Base Hospital | Glen Nettle | Lakeview Private Hospital | Hailey MacAllister |
| Liverpool Health Service | John Murphy | Lingard Private Hospital | A Flaherty / A Dagg |
| Maitland Hospital | Karen Cheers | Macquarie University Hospital | Julie Guthrie |
| Manning Rural Referral Hospital | Grahame Cooke | Maitland Private Hospital | J Chalmers / M Mead |
| Mount Druitt Hospital | Charmaine Boyd | Mayo Private Hospital | Hannah Evenden |
| Murwillumbah District Hospital | Glenda Jacklin | Nepean Private Hospital | Jacintha Vimalraj |
| Nepean Hospital | Debbie Dobbs | Newcastle Private Hospital | J Kelly/D Fogarty |
| Orange Health Service | D Campbell / A Woods | North Shore Private Hospital | Satheesh Jose |
| Port Macquarie Base Hospital | F Cheney / J Atkins | Northern Beaches Hospital | Jojo Sebastian |
| Royal Newcastle Centre | Graham Cutler | Norwest Private Hospital | J Woodward / R Shepherd |
| Royal North Shore Hospital | Kathy Chung | Nowra Private Hospital | Linda Wright |
| Royal Prince Alfred Hospital | Jennifer Wilkie | Port Macquarie Private Hospital | Tresna Bell |
| Ryde Hospital | L Landers / KJones | Shellharbour Private Hospital | Cassie Lee Cormick |
| Shoalhaven District Memorial Hospital | Luke Royston | Southern Highlands Hospital | Lynne Byrne |
| South East Regional Hospital | Leanne Williams | St George Private Hospital | L Mayo / S Tanevska |
| St George Hospital | David Gray | St Lukes Care | Celeste Gaspar |
| St Vincents Public Hospital | M Ellis / A Baker / T Butler | St Vincents Private Community Hospital Griffith | Margaret Blackman |
| Sutherland Hospital | Claire Kirgan | St Vincents Private Hospital Darlinghurst | Hannah George |
| Tamworth Base Hospital | Molly Lebrocq | St Vincents Private Hospital Lismore | Janelle Hospers |
| The Children's Hospital Westmead | Ariella Galstaun | Strathfield Private Hospital | J Mati / M Ng |
| The Prince of Wales Hospital | Elena Katz | Sydney Adventist Private Hospital | Jill Parker |
| Tweed Hospital | N Prestage / A Budd | Sydney Private Hospital | Margaret Haughton |
| Wagga Wagga Base Hospital | M O'Reilly / A Giese | Sydney South West Private Hospital | Hong Tran |
| Westmead Public Hospital | Dee Martic | Tamara Private Hospital | Kris Wall |
| Wollongong Hospital | Carol Jackson | The Mater Hospital | N Guerrero / R Gengania |
| Wyong Hospital | T Clancy / M Randall | The Prince of Wales Private Hospital | Ellaine Perez |
| | | Toronto Private Hospital | Stephanie Keys |

## NEW SOUTH WALES continued

| PUBLIC HOSPITALS | | PRIVATE HOSPITALS | |
|---|---|---|---|
| | | Tuggerah Lakes Private Hospital | Jane Hanneghan |
| | | Waratah Private Hospital | Kim Graham |
| | | Warners Bay Private Hospital | Annette Harrison |
| | | Westmead Private Hospital | Katarina Teren |
| | | Wollongong Private Hospital | C Gillespie / K Jankulovski |

## QUEENSLAND

| PUBLIC HOSPITALS | | PRIVATE HOSPITALS | |
|---|---|---|---|
| Bundaberg Base Hospital | J Anderson/J Larsen/D Norman | Brisbane Private Hospital | L Drabble/J Oddy |
| Cairns Base Hospital | L Van Nieker/ H Campbell/ E Walker | Buderim Private Hospital | Phil Hall |
| Gold Coast Hospital, Robina Campus | A Brooks/R Kapera | Caboolture Private Hospital | Rachel Condon |
| Gold Coast University Hospital | Karen Morton | Cairns Private Hospital | Louisa Smit |
| Hervey Bay Hospital | Sarah Dane Smith | Friendly Societys Hospital Bundaberg | K Smith/M Alcorn |
| Ipswich Hospital | Jannah O'Sullivan | Gold Coast Private Hospital | Kathryn Schott |
| Logan Hospital | Janelle Lindsay | Greenslopes Private Hospital | K Williams/R Griffin |
| Mackay Base Hospital | Chantal Ruthenberg | Hervey Bay Surgical Centre | M Christensen/S Costello |
| Maryborough Hospital | Y Howlett/ D Carroll | Hillcrest Private Hospital, Rockhampton | Lyn Martin |
| Mater Hospital Brisbane | C Steains/L Evans | John Flynn Hospital, Tugun | Lynda Wise |
| Nambour General Hospital | Renee Hutchison | Mater Health Services North Queensland | Saroj Saini |
| Prince Charles Hospital | L Tuppin/R Seddon | Mater Misericordiae Hospital, Bundaberg | J Zillmann/L Zunker/M Mooney |
| Princess Alexandra Hospital | Jo-Anne de Plater | Mater Misericordiae Hospital, Gladstone | Saroj Saini |
| Queen Elizabeth II Jubilee Hospital | Donna Cal | Mater Misericordiae Hospital, Mackay | Hazel Douglas |
| Queensland Children's Hospital | M Cullen/F Wright | Mater Misericordiae Hospital, Rockhampton | T Harkin/M Havik |
| Redcliffe Hospital | G van Fleet/R Kitchin/E Nugent | Mater Private Hospital Brisbane | J Windsor/M Baltais/S Pfeffer |
| Redland Public Hospital | Sara Mackenzie | Mater Private Hospital Redland | J Golding/J Garnsey |
| Rockhampton Base Hospital | Simone Platzke | Mater Private Hospital Springfield | C James/K Lording |
| Royal Brisbane and Women's Hospital | G McPhee/B Ballantyne/A Dowe | Mater Private Hospital, Townsville | Joanne Humphreys |
| Sunshine Coast University Hospital | C Jones/F Tognolini | Nambour Selangor Private Hospital | T Dempsey/S Pfeiffer |
| Toowoomba Hospital | F Chadwick/A Lostroh | Noosa Hospital | Judy Anderson |
| Townsville Hospital | Tara Cudmore | North West Private Hospital | D Campbell/T Auckland |
| | | Peninsula Private Hospital | Anne Moutrey |
| | | Pindara Private Hospital | Esther* Moire |
| | | St Andrews Hospital, Toowoomba | Anna Nell |
| | | St Andrews Private Hospital, Ipswich | Mel Grant |
| | | St Andrews War Memorial Hospital, Spring Hill | Stephanie Flood |
| | | St Stephen's Private Hospital | Karen McLaughlan |
| | | St Vincent's Private Hospital Northside | D Ryan/L Shannon |
| | | St Vincents Hospital | Amanda Fitzgerald |
| | | Sunnybank Private Hospital | Francina Robinston |
| | | Sunshine Coast University Private Hospital | Tanya Prothero |
| | | Wesley Hospital | K Patel/C Gregory |
| | | Westside Private Hospital | Mark Esdale |

## WESTERN AUSTRALIA

| PUBLIC HOSPITALS | | PRIVATE HOSPITALS | |
|---|---|---|---|
| Albany Regional Hospital | Paula Karra | Bethesda Hospital | H Hanekom/ H Collis/ J Fitzroy |
| Armadale Health Service | E Griffiths/D Carkeek | Hollywood Private Hospital | Michelle Connor |
| Bunbury Regional Hospital | Anthea Amonini | Joondalup Health Campus | J Holmes/D Crowley |
| Busselton Health Campus | Gemma Moyes | Mount Private Hospital | M Gontran/M Huyser |
| Fiona Stanley Hospital | Jarrod Duncan | Peel Health Campus | Geraldine Keogh |
| Fremantle Hospital | Elsy Jiji | South Perth Hospital | Deb Waters |
| Geraldton Hospital | Vicki Richards | St John of God Bunbury Hospital | Corne Habig |
| Kalgoorlie Health Campus | Nicole Hintz | St John of God Geraldton Hospital | Kristie Hutton |
| Osborne Park Hospital | Jenny Misiewicz | St John of God Midland Hospital | Stuart Blinman |
| Rockingham General Hospital | Carol Beaney | St John of God Mt Lawley Hospital | S Meek/F Campos |
| Royal Perth Hospital | Kerry Hodgkinson | St John of God Murdoch Hospital | Christopher Sheen |
| Sir Charles Gairdner Hospital | A Bibb/ T Lemmey | St John of God Subiaco Hospital | Philip Emrose |
| | | Waikiki Private Hospital | Bill Muir |

## SOUTH AUSTRALIA

| PUBLIC HOSPITALS | | PRIVATE HOSPITALS | |
|---|---|---|---|
| Clare Hospital and Health Services | J Knappstein/M Bradley | Ashford Community Hospital | Lisa Kowalik |
| Flinders Medical Centre | J Platten/A Ware | Burnside War Memorial Hospital | Laura Johnson |
| Gawler Health Services | Sharon Mewett | Calvary Adelaide Hospital | I Snowball/T Heinrich |
| Lyell McEwin Hospital | Lisa Wills | Calvary Central Districts Hospital | Linda Keech |
| Modbury Public Hospital | Brenda Foster | Calvary North Adelaide Hospital | Arlene Somido |
| Mount Barker District Soldiers Memorial Hospital | Emma Crowder | Flinders Private Hospital | Marcus Ender |
| Mount Gambier Hospital | Kylie Duncan | Glenelg Community Hospital | N Russell-Higgins/V Lawrence/R English |
| Murray Bridge Soldiers Memorial Hospital | Janine Colwell | North Eastern Community Hospital | Laura Shaw |
| Naracoorte Health Service | Trina Berry | Parkwynd Private Hospital | M Andersen/S English |
| Noarlunga Hospital | Kylie Thomson | Sportsmed SA | S Smith/K Stapleton/ V Lawal/ M Odgaard |
| Port Augusta Hospital | P Williams/J Haynes | St Andrews Private Hospital | C McAllister/ L White |
| Port Lincoln Hospital | Christine Weber | Stirling District Hospital | Kylie Buck |
| Port Pirie Regional Health Service | Sarah Zanker | The Memorial Hospital | J Emery/J Ohlson |
| Queen Elizabeth Hospital | Kasey Irwin | Western Hospital | Sharon Till |
| Riverland General Hospital | Michiela Gardner | | |
| Royal Adelaide Hospital | L Davies/R Woodfine | | |
| South Coast District Hospital | A Price/J Hunt | | |
| Whyalla Hospital and Health Service | M Prunty/E Windhouwer | | |
| Women's and Children's Hospital | Margaret Betterman | | |

## TASMANIA

| PUBLIC HOSPITALS | | PRIVATE HOSPITALS | |
|---|---|---|---|
| Launceston General Hospital | M Postmus/E Davidson | Calvary Health Care St Lukes | G Stratton/T Morice |
| North West Regional Hospital, Burnie Campus | B Kerr/R Dicker | Calvary Health Care, St Johns | Cate Farrell |
| Royal Hobart Hospital | Stuart Kirkham | Calvary Hospital | E Hey/K Harrex/ B Stephensen/A Copping |
| | | Hobart Private Hospital | Janine Dohnt |
| | | North-West Private Hospital | Danielle Jenner |

## AUSTRALIAN CAPITAL TERRITORY

| PUBLIC HOSPITALS | | PRIVATE HOSPITALS | |
|---|---|---|---|
| The Canberra Hospital | H Boyd/T Schild | Calvary Bruce Private Hospital | Carlene Morris |
| Calvary Public Hospital | Jennifer Cain | Calvary John James Memorial Hospital | Samjith Sreesan |
| | | Canberra Private Hospital | M Gower/S Phillips/M Rogina/L Tuohy |
| | | The National Capital Private | R Barancewicz/G Palada |

## NORTHERN TERRITORY

| PUBLIC HOSPITALS | | PRIVATE HOSPITALS | |
|---|---|---|---|
| Alice Springs Hospital | Debra Mullan | Darwin Private Hospital | B Hinchcliffe/V Frewin |
| Royal Darwin Hospital | Wendy Rogers | | |

## APPENDIX 2 -GLOSSARY

# 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 Test ($\chi$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.

**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 set of values for a summary measure, such as a rate or rate ratio, constructed so the set has a specified probability of including the true value of the measure. The specified probability is called the confidence interval, the end points are called lower and upper confidence limits; 95% confidence intervals are most common.

**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 (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

### 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 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 joint |
| 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 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 | Malposition | |
| 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 | Implant Breakage Glenoid Insert | |
| 13 | Implant Breakage Glenoid | |
| 14 | Implant Breakage Humeral | |
| 15 | Implant Breakage Head | |
| 16 | Instability/ Dislocation | Stability of prosthesis |
| 17 | Rotator Cuff Insufficiency | |
| 18 | Dissociation | |
| 19 | Fracture (Glenoid/Humeral/Periprosthetic) | Fracture of bone |
| 20 | Progression of Disease | Progression of disease on non-operated part of joint |
| 21 | Glenoid Erosion | |
| 22 | Synovitis | New diseases occurring in association with joint replacement |
| 23 | Arthrofibrosis | |
| 24 | Osteonecrosis/AVN | |
| 25 | Heterotopic Bone | |
| 26 | Pain | Pain |
| 27 | Other | Remaining diagnoses |

# 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 off or discuss any issues, a freecall number is available to contact the Registry.

## PATIENT CONFIDENTIALITY

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 & CONFIDENTIALITY

The South Australian Health and Medical Research Institute (SAHMRI) undertakes data entry, validation and analysis and provides secure data storage.

The list of personnel with access to identified Registry information is as follows:

Director, Professor Stephen Graves
Deputy Director, Professor Richard de Steiger
Deputy Director, Mr Peter Lewis
Deputy Director, Professor Ian Harris
Assistant Deputy Director, Mr James Stoney
Manager, Ms Cindy Turner
Publications Manager, Dr Sophia Rainbird
SAHMRI staff including the project manager, data managers, data assistants, statisticians, and programmers.

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 and for a further five years in August 2018. An amendment was approved in 2018 to add collection of Knee Osteotomy procedures and a further amendment in November 2020 to add the collection of Patient Reported Outcome Measure data. 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 numberof 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 relevantto 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 Ms Cindy Turner.

*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*

# APPENDIX 6 – IMPLEMENTATION TIMELINE

**Implementation of National Joint Replacement Registry for Hip, Knee & Shoulder Arthroplasty**

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. Patient Reported Outcome Measure data collection commenced in 2017.

| 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 – V11 (2019 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 & femur

49346-00 Revision of partial arthroplasty hip replacement

## 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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