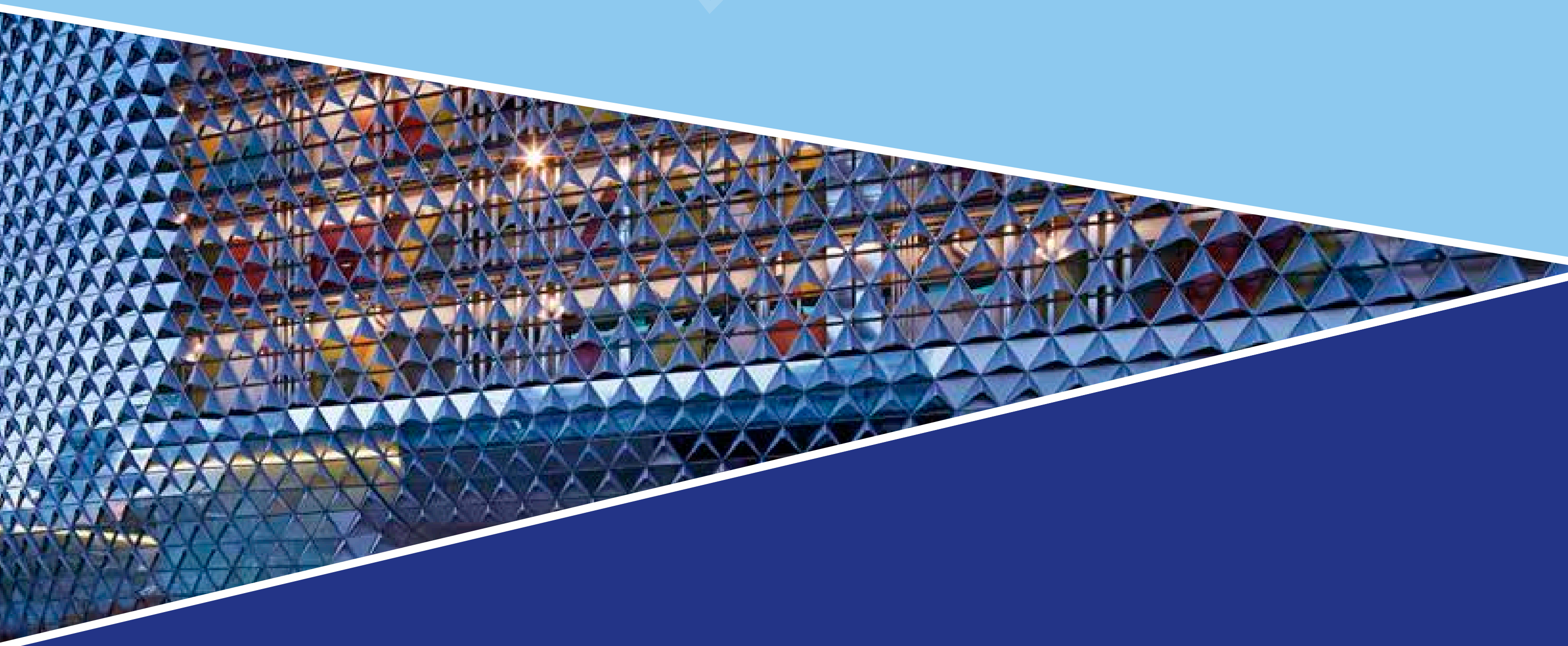
NATIONAL JOINT REPLACEMENT REGISTRY

AUSTRALIAN ORTHOPAEDIC ASSOCIATION

Hip, Knee & Shoulder Arthroplasty

ANNUAL REPORT 2016

CELEBRATING 15 YEARS OF DATA



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2016 ANNUAL REPORT

HIP, KNEE & SHOULDER ARTHROPLASTY

September 1999 to December 2015

Preface

Preface

It is a pleasure to present the Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR) 2016 Annual Report. This year the format of the Annual Report has been modernised as we celebrate the milestone of 15 year outcome data for hip and knee replacement. The 2016 Annual Report has also been expanded to include shoulder arthroplasty. This reflects the quality and availability of shoulder data and acknowledges the increasing importance of shoulder arthroplasty today.

Each year the Registry provides information on new and important themes within the main report. The focus for 2016 is on the outcome of hip and knee replacement in younger patients (those aged less than 55 years). As younger patients are known to have higher rates of revision, this analysis identifies factors important to optimise patient outcomes. The Annual Report also includes a series of accompanying reports on a variety of arthroplasty topics all of which are publicly available from the AOANJRR website: https://aoanjrr.sahmri.com/annual-reports-2016.

This year has seen a number of major changes for the AOANJRR. The most important being the new partnerships with the South Australian Health and Medical Research Institute (SAHMRI) and the University of South Australia. The Australian Orthopaedic Association (AOA) commenced implementation of the Registry in 1999 in partnership with the Data Management & Analysis Centre (DMAC), University of Adelaide. This was a long and very beneficial relationship which saw the AOANJRR develop into a quality national registry that is regarded very highly, not only within Australia, but also internationally. The AOA is grateful to DMAC and the University of Adelaide for their support and strenuous efforts over so many years.

In late 2015, the AOA contracted SAHMRI to manage and analyse AOANJRR data. The AOA wishes to express its thanks to SAHMRI for overseeing the smooth transition of the Registry. The AOA is looking forward to an ongoing fruitful relationship well into the future with this innovative, quality organisation. In addition, the AOA also contracted the University of South Australia to assist in the development of new approaches to Registry analysis. The AOA identified the University's knowledge base and special expertise in managing large data sets and data linkage projects, as necessary for the ongoing development of the Registry. Important areas of development have already been identified and are being progressed.

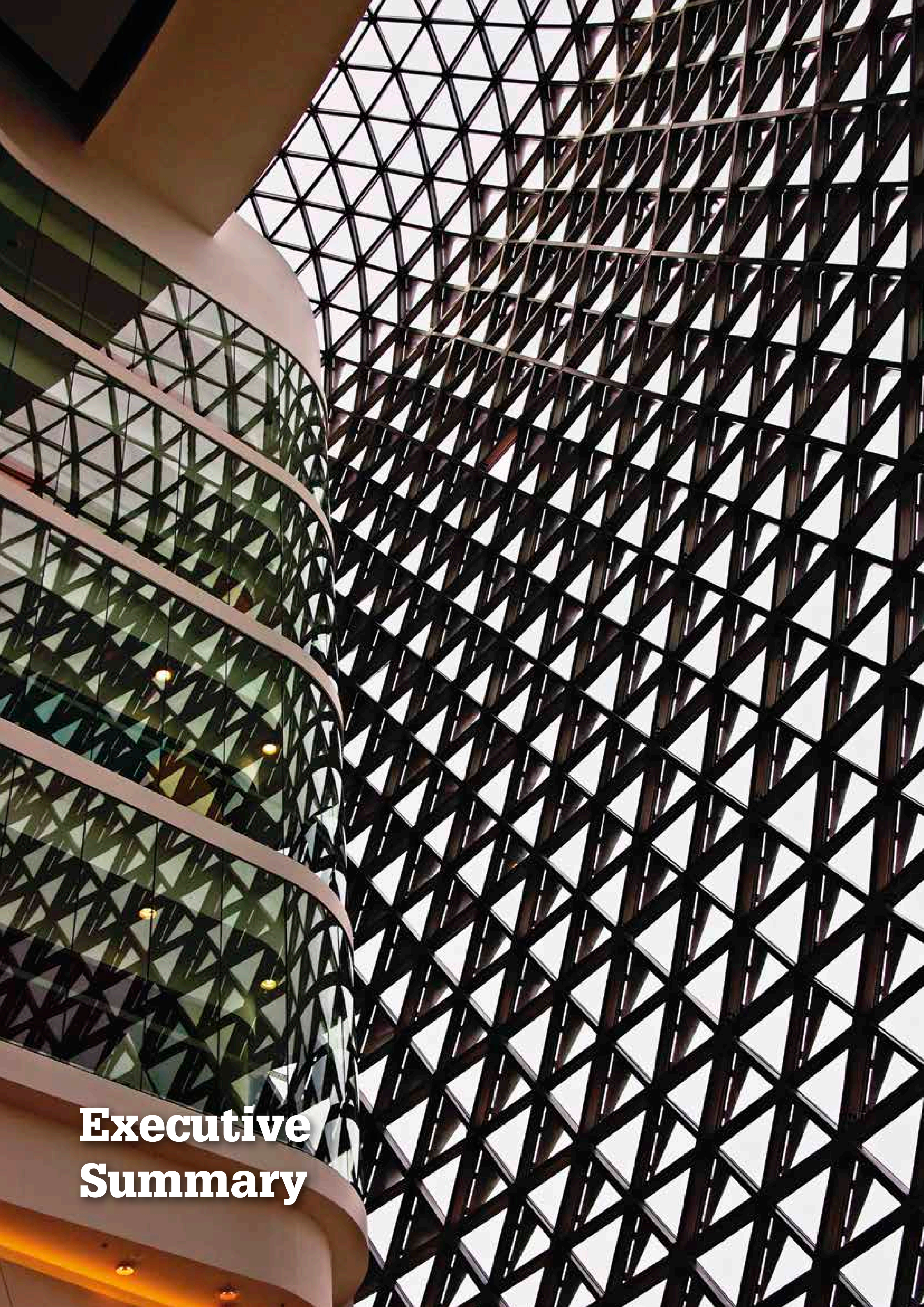
The purpose of the Registry is to benefit patients by enhancing the outcome of joint replacement surgery through the provision of comprehensive, quality, validated information. Since its inception, there has been a continual decline in the number of individuals requiring revision hip and knee replacement procedures. It is heartening to see this decrease continue in this year's results. The proportion of revisions for these procedures is at the lowest level seen since the registry began data collection.

The AOA is grateful for the continued support of the Commonwealth Government. The AOA receives funding for the core activities of the Registry from the Australian Federal Government through a legislated cost recovery program. The Department of Health also chairs and convenes a stakeholder oversight committee that provides important feedback to the AOA. The Registry works closely and receives support from many other stakeholders. These include, State and Territory Governments, the Therapeutic Goods Administration, Industry and particularly orthopaedic manufacturers, hospitals, surgeons, patients and other international arthroplasty registries. Many are not aware that the Registry is entirely voluntary, yet it receives data from all hospitals, surgeons and patients to such an extent that it has information on nearly every joint replacement procedure since its full national implementation in 2002. This cooperation is essential for the ongoing development and success of the AOANJRR. The AOA is very appreciative of this support.

Finally, I would like to take the opportunity to thank the AOANJRR staff, including the directors, deputy directors, administrative staff and the team at SAHMRI for their tireless efforts in producing another quality Annual Report.

Andreas Loefler

President of the Australian Orthopaedic Association



Executive Summary

Executive Summary

This Summary provides a brief overview of some of the major findings from this year's Annual Report. In addition to the standard hip and knee arthroplasty analysis, shoulder arthroplasty has been included for the first time. The 2016 Annual Report presents 15 year outcome data and provides detailed analysis on the outcome of joint replacement procedures in younger patients (those aged less than 55 years). This year, the Registry is reporting demographic data on both the American Society of Anaesthesiologists - Physical Status Classification (ASA score) and Body Mass Index (BMI) for hip, knee and shoulder procedures for the first time.

2016 Outcomes of Joint Replacement Procedures

The report includes detailed information on all primary and revision hip, knee, and shoulder procedures undertaken up to the end of 2015. This includes 498,660 hip, 592,577 knee and 32,406 shoulder procedures, which amount to 1,123,643 joint replacement procedures.

The number of arthroplasty procedures undertaken each year in Australia continues to increase. In 2015, hip procedures increased by 2.6%, knee procedures by 5.9% and shoulder procedures by 7.3%. The outcome of hip and knee arthroplasty continues to improve. The proportion of revision hip procedures reported to the Registry declined from 12.9% of all hip procedures in 2003 to 9.6% in 2015. Revision knee procedures declined from a peak of 8.8% in 2004 to 7.4% in 2015. These are the lowest proportions ever reported to the Registry.

The Registry commenced data collection on shoulder arthroplasty later than hip and knee arthroplasty. The first year of full national data collection for shoulder procedures was 2008. In that year the proportion of revision shoulder replacements was 9.9%. This peaked at 10.8% in 2012 and in 2015 it remains at this level.

Outcomes for Younger Patients

The outcome of hip and knee arthroplasty in younger patients is a major focus of this year's report. This is because younger patients are reported to have higher rates of revision. The purpose of the analysis is to provide information on how best to optimise the outcome of these procedures in this patient group. An important misconception is that the large increase in both hip and knee arthroplasty over the last decade is partly due to the increased use of these procedures in younger patients. This is certainly not the case. The proportion of patients in this age group having total conventional hip replacement has only marginally increased from 11.7% in 2003 to 13.1% in 2015. The proportion of total knee replacement has declined slightly from 7.0% in 2003 to 6.8% in 2015.

The cumulative percent revision for primary total conventional hip replacement in this age group, undertaken for osteoarthritis is 8.4% at 10 years and 12.7% at 15 years. This reduces to 5.8% and 9.9% when large head metal/metal prostheses which are no longer used are excluded. For the diagnosis of developmental dysplasia, which from a surgical perspective is generally a more technically difficult procedure, the cumulative percent revision at 10 years is 7.7% reducing to 5.7% when large head metal/metal prostheses are excluded. In those patients with a primary diagnosis of osteoarthritis, the outcome is better for males. There is no gender difference, however, for the diagnosis of developmental dysplasia.

The impact of prosthesis specific factors was also examined. For patients with osteoarthritis there is no difference in outcome based on prosthesis fixation once non cross-linked polyethylene (non XLPE), preferentially used with cemented fixation, is excluded. The follow up for cemented fixation using cross-linked polyethylene (XLPE), however, is short (five years). There is little difference in outcome when other bearing surfaces (excluding non XLPE and large head metal/metal) are compared. Prosthesis choice is important. Nine prosthesis combinations have a 10 year cumulative percent revision ranging from 2.8% to 7.1%. Five of those combinations have a cumulative percent revision of less than 5% at 10 years.

For primary total resurfacing hip replacement in this age group, there is a higher risk of revision for females and if the resurfacing femoral head size is less than 50mm. There is considerable prosthesis specific variation in outcomes with some prostheses performing much better than others. Only two resurfacing prostheses are currently used in Australia. They are the Adept and the BHR. The combined 10 year cumulative percent revision for these two prostheses for males in this age group is 3.7%.

The cumulative percent revision for primary total knee replacement in the younger age group undertaken for osteoarthritis is 10.9% at 10 years, increasing to 15.7% at 15 years. There is very little gender difference. Males have a slightly higher rate of revision but only in the first year. This is due to a higher rate of revision for infection. There is little difference in outcome based on fixation. The rate of revision is generally reduced if fixed bearing prostheses, patellar resurfacing, XLPE and computer assisted surgery are used. As with hip replacement, prosthesis choice is important. For frequently used prostheses there is an almost three-fold variation in the 10 year cumulative percent revision depending on the type of prosthesis used (5.1% to 14.0%).

10 and 15 Year Outcome Data

The Registry continues to highlight 10 year revision rates of prosthesis combinations used in primary total conventional hip and primary total knee replacement. This has now been extended to include 15 year outcomes. These two important milestones are useful time periods to benchmark comparative prosthesis performance. To be included in the analysis, a prosthesis combination must have at least 350 procedures reported to the Registry and have a minimum follow up of 10 or 15 years.

There are 71 femoral stem and acetabular component combinations with a 10 year cumulative percent revision ranging from 1.9% to 45.8%. The 10 year cumulative percent revision (for any reason) is less than 5.0% for 50.7% of the combinations. There are seven femoral and acetabular component combinations with 15 year data. The cumulative percent revision ranges from 4.3% to 12.4%. Four of the combinations have a cumulative percent revision of less than 6.5%, and one less than 5%.

There are 46 total knee combinations with a 10 year cumulative percent revision ranging from 2.9% to 11.0%. The 10 year cumulative percent revision (for any reason) is less than 5% for 32.6% of the combinations. There are 14 total knee combinations with 15 year data. The cumulative percent revision ranges from 4.5% to 11.5%. Seven of the combinations have a cumulative percent revision of less than 6.5% and one less than 5%.

New ASA Score and BMI Data

For the first time, the Registry is reporting demographic information for ASA score and BMI. The Registry commenced collecting ASA score in 2012 and BMI in 2015. ASA score and BMI are known to impact the outcome of arthroplasty and will provide further information to guide surgeons in relation to patient selection. So far, this data has not been collected for a sufficient length of time to enable outcome analyses to be undertaken. It is anticipated that reporting the effect of ASA score and BMI as well as using these measures to risk adjust will be undertaken in subsequent reports.

Shoulder Arthroplasty

Shoulder arthroplasty has been included in the main report for the first time. Important findings include the declining usage of primary partial shoulder replacement and the increased rate of revision of this class of prostheses (with the exception of partial resurfacing) compared to primary total shoulder replacement. The two main classes of primary total shoulder replacement are total reverse (53.2%) and total conventional (44.0%). Although indications for use may differ, the overall outcome for these two classes appears similar. Early findings of an increased rate of revision associated with the use of cementless glenoid components and significant variation in the outcome of different prosthesis types are likely to be important.

Prostheses with Higher than Anticipated Rates of Revision

Each year, the AOANJRR identifies prostheses with higher than anticipated rates of revision. This year five new prostheses have been identified (one bipolar hip, three total conventional hips and one total knee). Detailed analyses of all identified prostheses and prosthesis combinations including those newly identified prostheses are available as a supplementary report on the AOANJRR website.

This year, as in previous years, the Registry is publishing additional supplementary reports covering a number of different arthroplasty topics. These 12 separate complementary reports are available from the AOANJRR website https://aoanjrr.sahmri.com/annual-reports-2016.

Acknowledgements

The Registry continues to receive support and invaluable assistance from the Commonwealth Government, State and Territory Health Departments and Orthopaedic Companies. The Registry could not function without the cooperation of a large number of organisations and individuals.

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 would also like to acknowledge 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 this report (Appendix 1).

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

DEPUTY DIRECTORS

Professor Richard de Steiger
Mr Peter Lewis
Professor Ian Harris

Assistant Deputy Directors

Mr James Stoney
Dr Bill Donnelly

DIRECTOR

Professor Stephen Graves

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Ms Andrea Peng
Ms Janey Barrow
Mr Robert Armitage
Many thanks to the Data Entry Team

The AOANJRR would like to acknowledge and thank the staff of the Data Management & Analysis Centre, University of Adelaide (DMAC) for their contribution to the Registry and the compilation of the Annual Report from 1999 – 2015.

AOANJRR COMMITTEE

David Hale	Chairperson
Stephen Graves	Director
Richard de Steiger	Deputy Director (Victoria)
Peter Lewis	Deputy Director (South Australia)
Ian Harris	Deputy Director (New South Wales)
Roger Brighton	New South Wales
John Radovanovic	Queensland
Alexander Burns	Australian Capital Territory
Sean Williams	Western Australia
Russell Furzer	Tasmania
Michael O'Sullivan	President, Arthroplasty Society of Australia
Neil Bergman	AOA Representative - AOANJRR Consultative Committee
Peter Myers	Australian Knee Society
Richard Page	Shoulder & Elbow Society Representative
Andrew Beischer	Foot & Ankle Society Representative
Matthew Scott-Young	Spine Society of Australia Representative
James Stoney	Assistant Deputy Director (observer status)
Bill Donnelly	Assistant Deputy Director (observer status)

Contents

Introduction

The 2016 Hip, Knee and Shoulder Arthroplasty Report is based on the analysis of 1,123,643 primary and revision procedures (498,660 hip, 592,577 knee and 32,406 shoulder) recorded by the Registry with a procedure date up to and including 31 December 2015. Shoulder arthroplasty has been included with hip and knee arthroplasty for the first time.

In addition, there are 12 supplementary reports that complete the AOANJRR Annual Report for 2016.

1. Lay Summary – Hip & Knee 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. Metal and Ceramic Bearing Surface in Total Conventional Hip Arthroplasty
8. The Outcome of Classes of Hip and Knee Prostheses No Longer Used
9. Demographics and Outcome of Elbow and Wrist Arthroplasty
10. Demographics and Outcome of Ankle Arthroplasty
11. Demographics of Spinal Disc Arthroplasty
12. Analysis of State and Territory Health Data – All Arthroplasty 1993/1994 – 2014/2015

In addition to the 12 supplementary reports, Investigations of Prostheses with Higher than Anticipated Rates of Revision are published on https://aoanjrr.sahmri.com/annual-reports-2016.

All hospitals, public and private, undertaking joint replacement submit their data to the Registry. Currently there are 309 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 to implant them were unknown.

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

In 1998, the 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.

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 SAHMRI to provide data management and independent data analysis services for the Registry.

PURPOSE

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

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

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 (300 in 2015). These ad hoc reports are specific analyses requested by surgeons, hospitals, academic institutions, government and government agencies as well as orthopaedic companies.

In addition, the Registry provides surgeons with access to their individual data through an online facility. A separate online facility is available for orthopaedic companies to monitor their own prostheses, as well as Australian and regulatory bodies in other countries to monitor the outcome of prostheses used in Australia. The data obtained through the online facilities are updated daily and are over 90% complete within six weeks of the procedure date.

The percentage of revision hip procedures has declined from a peak of 12.9% in 2003 to 9.6% in 2015, equating to 1,487 fewer hip revisions in 2015. The percentage of revision knee procedures has declined from a peak of 8.8% in 2004 to 7.4% in 2015, equating to 795 fewer knee revisions in 2015. Revision shoulder arthroplasty has remained unchanged at 10.8% for the last three years.

The reduction in revision hip and knee surgery has been brought about due to increased use of the type and class of prostheses shown to have better outcomes and a decline in use of prostheses when less satisfactory outcomes are identified.

GOVERNANCE

The AOANJRR is an initiative of the AOA funded by the Commonwealth. In 2009, the Commonwealth established the AOANJRR Consultative Committee, which is administered and chaired by the Department of Health. The purpose is to provide advice on the overall strategic direction of the Registry.

Committee Members

1. Chair, Department of Health
2. AOANJRR Director
3. A representative of
   a. Department of Health
   b. Australian Orthopaedic Association
   c. Consumer's Health Forum
   d. Therapeutic Goods Administration
   e. Prostheses List Advisory Committee
   f. Private Healthcare Australia
   g. Australian Private Hospitals Association
   h. Orthopaedic Industry (2)
      i. Medical Technology Association of Australia
      ii. Non Medical Technology Association of Australia

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 Board and are responsible for providing strategic and clinical guidance. Additionally, the Directors are responsible for maintaining the cooperation of hospitals, surgeons and government, maintaining the profile and reputation of the Registry, international collaboration with other registries, and maintaining the current level of excellence.

The AOANJRR staff include the Registry Manager, Administration Officer, Research Coordinator and Prosthesis Library Coordinator. The AOANJRR team are responsible for the day-to-day operations, implementing new strategies, provision of data reports, research and publications activity, and coordinating the preparation of the annual report.

Data Quality

DATA COLLECTION

Hospitals provide data on specific Registry forms, which are completed in theatre at the time of surgery and submitted to the Registry each month. Examples of Registry data forms are available on the website aoanjrr.sahmri.com/data-collection.

The Registry uses a paper-based system, however, it has established mechanisms to collect data electronically when it becomes feasible for contributing hospitals. 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 number 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 of primary or revision codes or admission period.

In the 2014/15 financial year, the Registry received 1,061 more 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 98% of joint replacement procedures undertaken in Australia. On initial submission of forms from participating hospitals, the Registry's capture rate is 95.9%. 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 five 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). Access to the data required approval of a formal ethics application to AIHW.

Prior to 2013, the Registry reported the revisions per 100 observed component years. This statistic provides a good estimate of the overall 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 revisions are 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 analytic 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.

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

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

REPORT REVIEW PRIOR TO PUBLICATION

Members of the AOA and Arthroplasty Society were invited to attend a two-day workshop to review, comment and provide advice on all sections of the report. The workshop was held in Adelaide on the weekend of 6 and 7 August 2016. The shoulder surgeon review workshop was held in Darwin on 10 August 2016. Following these workshops, the report was provided to the AOA Board for consideration and final approval prior to publication.

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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.

2016

Primary Total Hip Replacement in Younger Patients

This year, the Registry has performed a more detailed analysis of patients aged less than 55 years who had a primary total conventional hip, or total resurfacing hip replacement. The purpose is to provide additional insight into the outcomes of these procedures in younger patients.

In addition, it is hoped that this information will assist counselling, and enable optimisation of surgical and prosthesis choice for this group of patients.

Analysis for all diagnoses is presented, as well as specific analysis for osteoarthritis and developmental dysplasia. The effects of gender, fixation and bearing surface are reported, as well as the outcomes for individual prostheses. Procedures using large head metal/metal bearings have been excluded from the analyses on osteoarthritis and developmental dysplasia.

PRIMARY TOTAL CONVENTIONAL HIP REPLACEMENT

The Registry has recorded 43,380 primary total conventional hip replacements in this age group, up to and including 31 December 2015.

Although the number of primary total conventional hip replacements has increased by 96.2% since 2003, the proportion performed in patients aged less than 55 years has remained relatively unchanged. During this period, it has increased marginally from 11.7% to 13.1%.

The cumulative percent revision of patients aged less than 55 years undergoing total conventional hip replacement for all diagnoses and all bearing surfaces is 12.7% at 15 years (Table YH1 and Figure YH1). Although this is higher than in older age groups, the age related difference is not as marked as with total knee replacement.

“Although the number of primary total conventional hip replacements has increased by 96.2% since 2003, the proportion performed in patients age less than 55 years has remained relatively unchanged.”

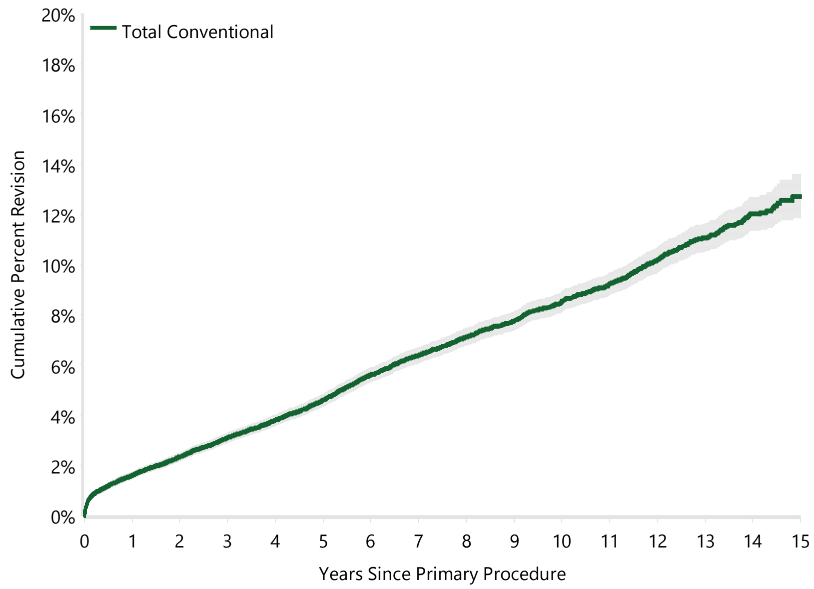
There is a difference with respect to primary diagnosis in patients aged less than 55 years compared to older age groups. The proportion of procedures undertaken for osteoarthritis is 78.0% compared to 90.0% for those aged 55 years and older. In the younger age group, there is an increased proportion of patients with the diagnoses of developmental dysplasia, osteonecrosis, rheumatoid arthritis, ‘other inflammatory arthritis’ and tumour. The proportion of patients with a diagnosis of fractured neck of femur and failed internal fixation is lower (Table YH2).

Compared to osteoarthritis, procedures undertaken for the diagnosis of ‘other inflammatory arthritis’ have a lower cumulative percent revision at 10 years. Patients with surgery for fractured neck of femur and tumour have a higher rate of revision (Table YH3 and Figure YH2).

Table YH1 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years (All Diagnoses and All Bearing Surfaces)

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Total Conventional	2403	43380	1.6 (1.5, 1.7)	3.1 (2.9, 3.3)	4.6 (4.4, 4.8)	6.4 (6.1, 6.7)	8.5 (8.2, 8.9)	12.7 (11.9, 13.6)
TOTAL	2403	43380						

Figure YH1 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years (All Diagnoses and All Bearing Surfaces)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Total Conventional	43380	38039	29231	21863	15515	8765	428

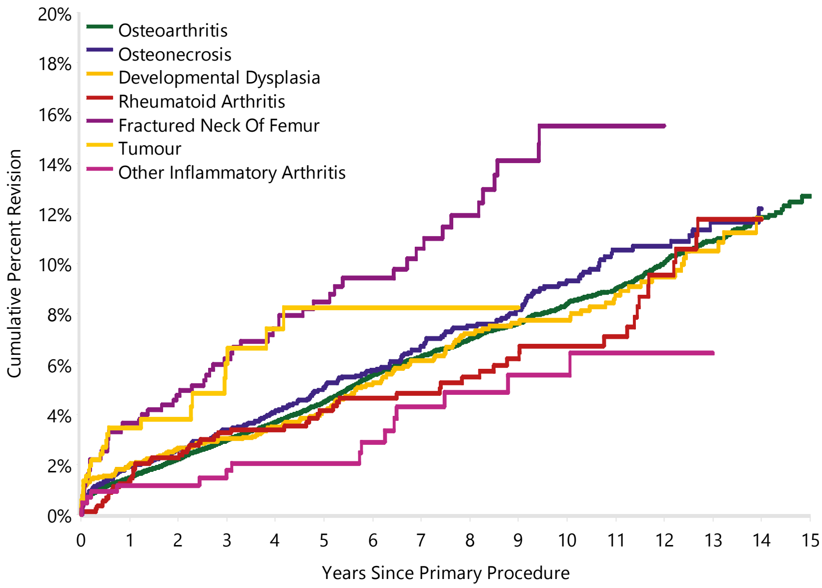
Table YH2 Primary Diagnosis of Primary Total Conventional Hip Replacement by Age (All Bearing Surfaces)

	<55		≥55		TOTAL	
Primary Diagnosis	N	Col%	N	Col%	N	Col%
Osteoarthritis	33854	78.0	273130	90.0	306984	88.5
Fractured Neck Of Femur	696	1.6	13793	4.5	14489	4.2
Osteonecrosis	3779	8.7	7867	2.6	11646	3.4
Developmental Dysplasia	2782	6.4	1583	0.5	4365	1.3
Rheumatoid Arthritis	928	2.1	2687	0.9	3615	1.0
Tumour	531	1.2	1356	0.4	1887	0.5
Other Inflammatory Arthritis	438	1.0	1123	0.4	1561	0.5
Failed Internal Fixation	149	0.3	1410	0.5	1559	0.4
Fracture/Dislocation	76	0.2	321	0.1	397	0.1
Arthrodesis Takedown	62	0.1	68	0.0	130	0.0
Other	85	0.2	64	0.0	149	0.0
TOTAL	43380	100.0	303402	100.0	346782	100.0

Table YH3 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years by Primary Diagnosis (All Bearing Surfaces)

Primary Diagnosis	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Osteoarthritis	1807	33854	1.5 (1.3, 1.6)	3.0 (2.8, 3.2)	4.5 (4.2, 4.7)	6.3 (6.0, 6.6)	8.4 (8.0, 8.8)	12.7 (11.7, 13.7)
Osteonecrosis	234	3779	1.9 (1.5, 2.4)	3.4 (2.8, 4.1)	5.1 (4.3, 5.9)	6.7 (5.8, 7.7)	9.3 (8.1, 10.7)	
Developmental Dysplasia	161	2782	2.0 (1.5, 2.6)	3.0 (2.4, 3.8)	4.1 (3.4, 5.0)	6.1 (5.1, 7.3)	7.7 (6.5, 9.1)	
Rheumatoid Arthritis	57	928	1.3 (0.8, 2.3)	3.3 (2.3, 4.7)	4.1 (3.0, 5.8)	4.8 (3.5, 6.6)	6.7 (5.0, 9.0)	
Fractured Neck Of Femur	61	696	3.6 (2.4, 5.4)	6.2 (4.5, 8.5)	8.5 (6.4, 11.3)	10.6 (8.0, 13.9)	15.5 (11.8, 20.2)	
Tumour	29	531	3.5 (2.1, 5.6)	6.0 (3.8, 9.5)	8.2 (5.2, 12.8)	8.2 (5.2, 12.8)		
Other Inflammatory Arthritis	17	438	1.2 (0.5, 2.8)	1.7 (0.8, 3.6)	2.0 (1.0, 4.1)	4.3 (2.5, 7.5)	5.5 (3.3, 9.3)	
Failed Internal Fixation	12	149	2.0 (0.7, 6.2)	5.2 (2.5, 10.6)	7.4 (3.9, 13.9)	10.0 (5.5, 17.7)		
Fracture/Dislocation	7	76	1.4 (0.2, 9.7)	9.0 (3.8, 20.4)	13.5 (6.6, 26.5)	13.5 (6.6, 26.5)	13.5 (6.6, 26.5)	
Arthrodesis Takedown	11	62	9.7 (4.5, 20.3)	11.5 (5.6, 22.6)	11.5 (5.6, 22.6)	15.5 (8.3, 27.8)	20.4 (11.7, 34.3)	
Other	7	85	3.8 (1.2, 11.3)	5.1 (2.0, 13.1)	7.2 (3.0, 16.8)	10.2 (4.4, 22.5)	16.6 (6.8, 37.5)	
TOTAL	2403	43380						

Figure YH2 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years by Primary Diagnosis (All Bearing Surfaces)



HR - adjusted for age and gender

Osteonecrosis vs Osteoarthritis
Entire Period: HR=1.08 (0.94, 1.24),p=0.300

Developmental Dysplasia vs Osteoarthritis
0 - 2Wk: HR=2.29 (1.44, 3.65),p<0.001
2Wk+: HR=0.86 (0.72, 1.03),p=0.092

Rheumatoid Arthritis vs Osteoarthritis
Entire Period: HR=0.86 (0.66, 1.12),p=0.264

Fractured Neck Of Femur vs Osteoarthritis
Entire Period: HR=1.80 (1.39, 2.32),p<0.001

Tumour vs Osteoarthritis
Entire Period: HR=1.82 (1.26, 2.63),p=0.001

Other Inflammatory Arthritis vs Osteoarthritis
Entire Period: HR=0.62 (0.38, 1.00),p=0.049

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Osteoarthritis	33854	29779	22697	16806	11797	6570	306
Osteonecrosis	3779	3362	2663	2041	1472	854	38
Developmental Dysplasia	2782	2432	1974	1560	1155	706	36
Rheumatoid Arthritis	928	866	735	603	485	303	32
Fractured Neck Of Femur	696	572	417	309	218	107	2
Tumour	531	305	155	97	65	35	1
Other Inflammatory Arthritis	438	397	331	256	186	107	7

OUTCOME FOR OSTEOARTHRITIS

There were 30,956 primary total conventional hip replacement procedures recorded for this diagnosis. The cumulative percent revision at 15 years was 9.9% (Table YH4 and Figure YH3).

GENDER

Primary total conventional hip replacement for osteoarthritis in this age group is more common in males (54.4%) compared to males in the 55 years and older group (44.6%) (Table YH5). Females have a higher rate of revision than males over the entire period (Table YH6 and Figure YH4).

Females aged less than 55 years have a higher rate of revision compared to all other age groups. The age difference is not so apparent in males. The only difference is evident in males aged 75 years and older, for the first six months only (Table YH7, Figures YH5 and YH6).

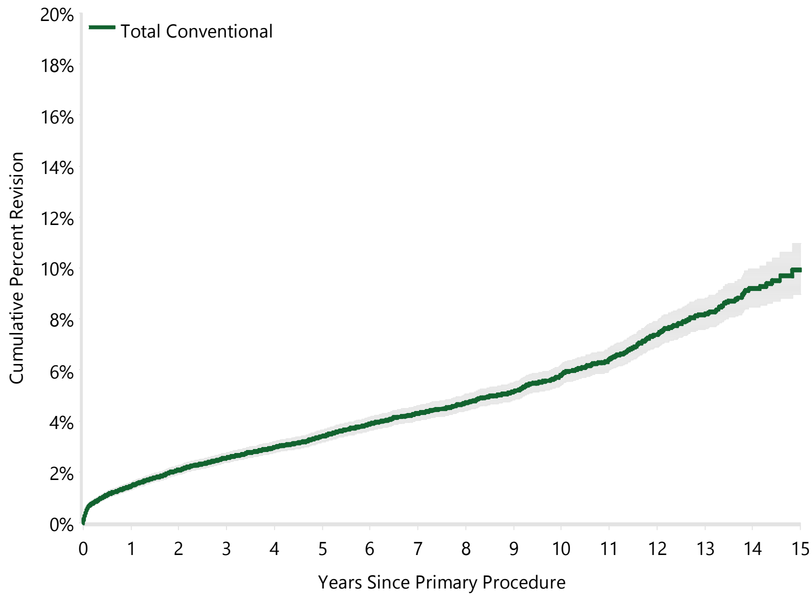
"Females aged less than 55 years have a higher rate of revision compared to all other age groups. The age difference is not so apparent in males."

Table YH4 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years (Primary Diagnosis OA)

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Total Conventional	1210	30956	1.4 (1.3, 1.6)	2.5 (2.4, 2.7)	3.4 (3.2, 3.6)	4.3 (4.0, 4.6)	5.8 (5.4, 6.2)	9.9 (9.0, 11.0)
TOTAL	1210	30956						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure YH3 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Total Conventional	30956	26933	20014	14400	10044	6079	300

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table YH5 Primary Total Conventional Hip Replacement by Gender and Age (Primary Diagnosis OA)

Gender	<55 N	<55 Col%	≥55 N	≥55 Col%	TOTAL N	TOTAL Col%
Male	16838	54.4	116599	44.6	133437	45.6
Female	14118	45.6	145010	55.4	159128	54.4
TOTAL	**30956**	**100.0**	**261609**	**100.0**	**292565**	**100.0**

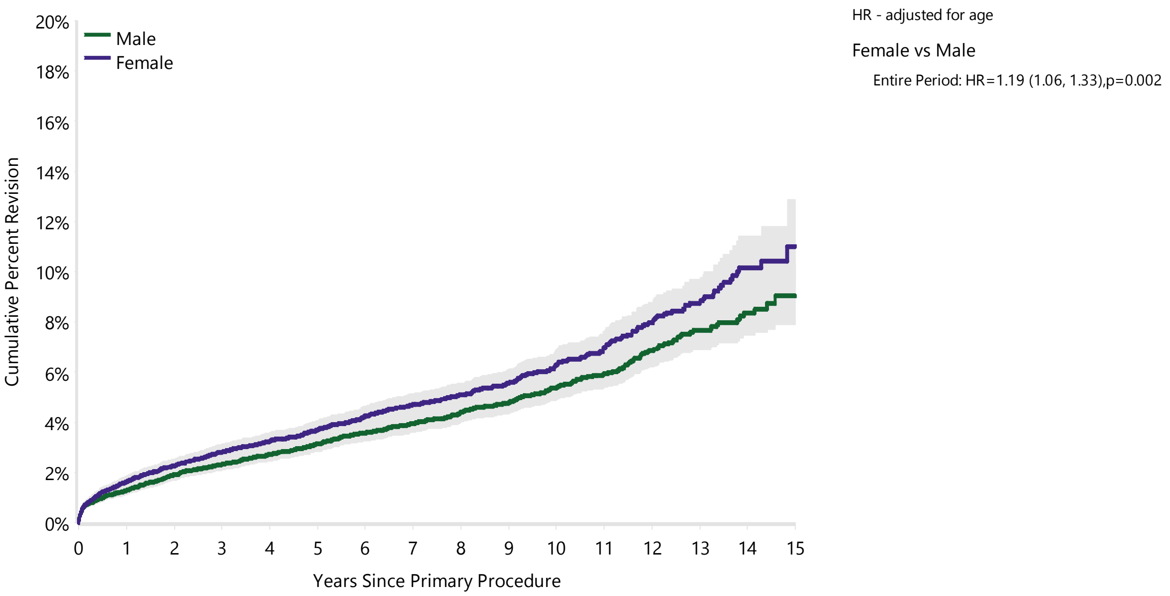
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table YH6 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years by Gender (Primary Diagnosis OA)

Gender	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	596	16838	1.3 (1.1, 1.5)	2.3 (2.1, 2.6)	3.1 (2.8, 3.5)	3.9 (3.6, 4.3)	5.4 (4.9, 5.9)	9.0 (7.9, 10.3)
Female	614	14118	1.6 (1.4, 1.9)	2.8 (2.5, 3.1)	3.7 (3.4, 4.1)	4.7 (4.3, 5.1)	6.3 (5.7, 6.9)	11.0 (9.4, 12.9)
TOTAL	1210	30956						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure YH4 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years by Gender (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	16838	14551	10643	7460	5197	3237	182
Female	14118	12382	9371	6940	4847	2842	118

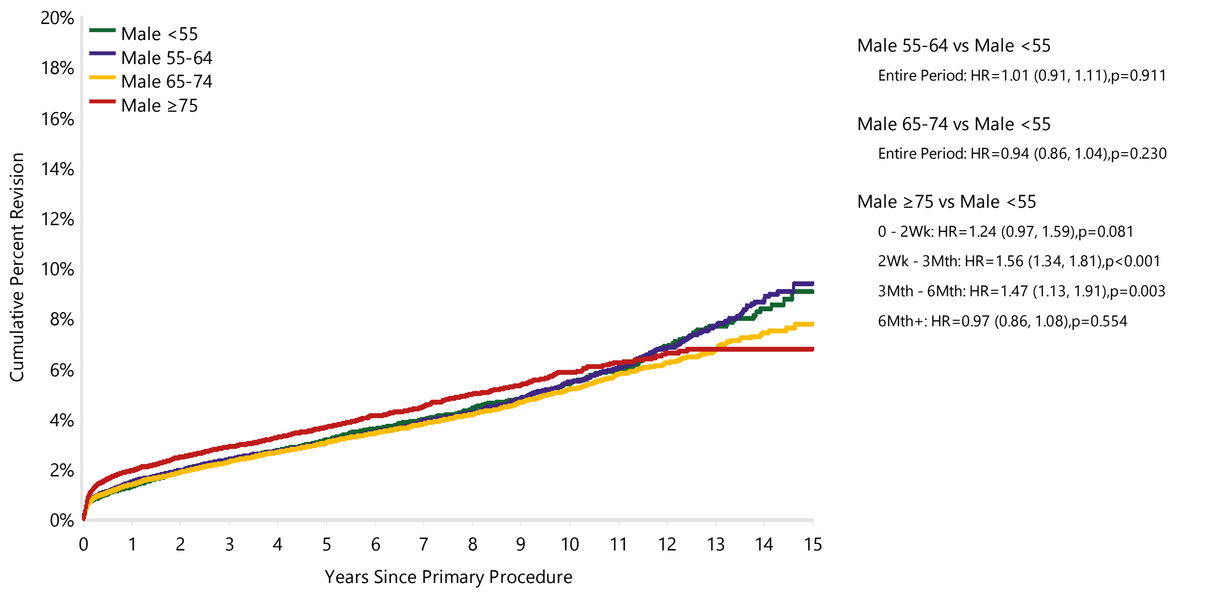
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table YH7 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	7 Yrs	10 Yrs	15 Yrs
Male		**4725**	**133437**	**1.5 (1.5, 1.6)**	**2.4 (2.4, 2.5)**	**3.2 (3.1, 3.3)**	**4.0 (3.9, 4.1)**	**5.4 (5.2, 5.6)**	**8.5 (8.0, 9.0)**
	<55	596	16838	1.3 (1.1, 1.5)	2.3 (2.1, 2.6)	3.1 (2.8, 3.5)	3.9 (3.6, 4.3)	5.4 (4.9, 5.9)	9.0 (7.9, 10.3)
	55-64	1250	34191	1.5 (1.3, 1.6)	2.4 (2.2, 2.5)	3.0 (2.8, 3.2)	3.9 (3.6, 4.2)	5.4 (5.1, 5.8)	9.3 (8.5, 10.3)
	65-74	1640	48028	1.4 (1.3, 1.5)	2.3 (2.1, 2.4)	3.0 (2.9, 3.2)	3.8 (3.6, 4.0)	5.1 (4.9, 5.4)	7.8 (7.1, 8.5)
	≥75	1239	34380	1.9 (1.8, 2.1)	2.9 (2.7, 3.1)	3.6 (3.4, 3.9)	4.5 (4.2, 4.7)	5.8 (5.4, 6.2)	6.8 (6.2, 7.3)
Female		**5307**	**159128**	**1.5 (1.4, 1.6)**	**2.3 (2.3, 2.4)**	**3.0 (2.9, 3.1)**	**3.7 (3.6, 3.8)**	**4.8 (4.7, 5.0)**	**7.6 (7.1, 8.0)**
	<55	614	14118	1.6 (1.4, 1.9)	2.8 (2.5, 3.1)	3.7 (3.4, 4.1)	4.7 (4.3, 5.1)	6.3 (5.7, 6.9)	11.0 (9.4, 12.9)
	55-64	1255	35242	1.4 (1.3, 1.5)	2.3 (2.2, 2.5)	3.0 (2.8, 3.2)	3.8 (3.6, 4.1)	5.4 (5.0, 5.7)	7.8 (7.1, 8.6)
	65-74	1867	55948	1.5 (1.4, 1.6)	2.3 (2.2, 2.4)	3.0 (2.8, 3.1)	3.6 (3.4, 3.8)	4.7 (4.4, 4.9)	7.5 (6.8, 8.2)
	≥75	1571	53820	1.5 (1.4, 1.7)	2.2 (2.1, 2.4)	2.8 (2.6, 2.9)	3.3 (3.2, 3.5)	4.2 (4.0, 4.5)	6.0 (5.3, 6.8)
TOTAL		10032	292565						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

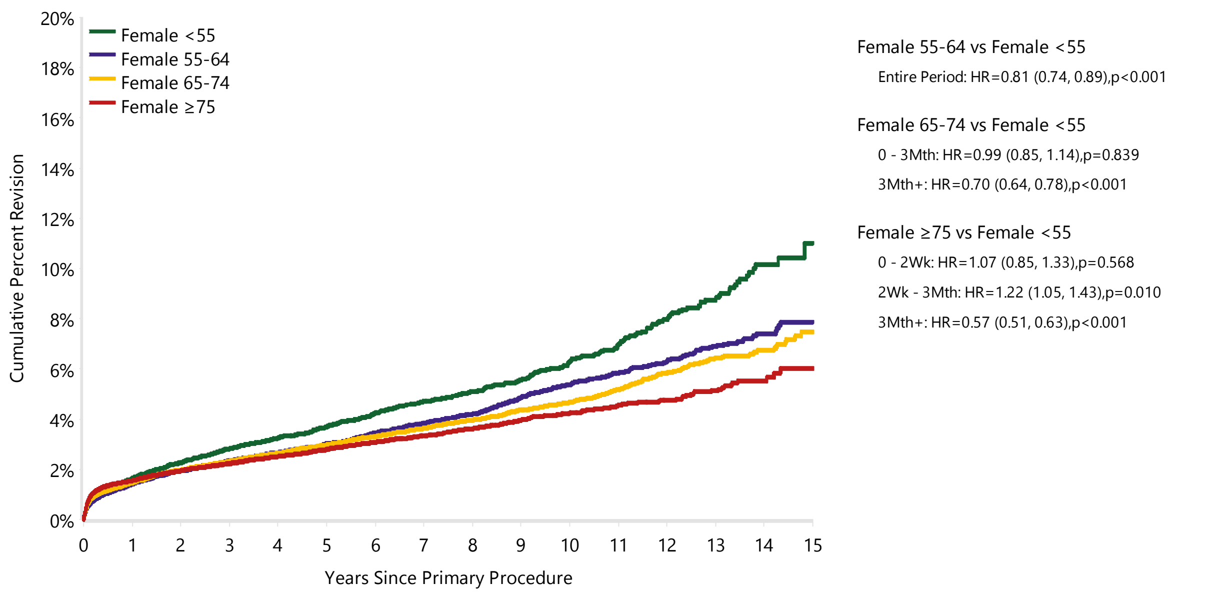
Figure YH5 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Males by Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	<55	16838	14551	10643	7460	5197	3237	182
	55-64	34191	29867	22632	16368	11551	6756	291
	65-74	48028	42173	32125	23700	16656	8894	296
	≥75	34380	29511	21456	14677	9056	3550	49

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure YH6 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Females by Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Female	<55	14118	12382	9371	6940	4847	2842	118
	55-64	35242	31165	24149	17917	12550	6950	315
	65-74	55948	49072	37600	27994	19969	10898	382
	≥75	53820	47397	36232	26083	17239	7692	150

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

FIXATION

In the less than 55 years age group, most total conventional hip replacements are cementless (80.4%). Hybrid and cemented total conventional hip replacements are performed less frequently (16.9% and 2.7% respectively).

The cumulative percent revision at 10 years was 5.5% for cementless, 6.3% for hybrid and 8.2% for cemented (Table YH8 and Figure YH7).

The introduction of cross-linked polyethylene (XLPE) occurred preferentially in association with cementless acetabular fixation and as a consequence non XLPE has been used in a higher proportion of cemented hips. In order to address this potential confounder, a separate analysis excluding non XLPE was undertaken. This showed no difference in the rate of revision for the different types of fixation. The follow up period for cemented procedures with XLPE, however, was much shorter compared to cementless and hybrid fixation (Table YH9 and Figure YH8).

"When non XLPE is excluded from the analysis there is no difference in the rate of revision with different types of fixation."

When non XLPE was excluded there was a reduction in revisions for loosening/lysis and dislocation (Tables YH10 and YH11).

BEARING SURFACE

This analysis was limited to cementless fixation as it accounted for the majority of procedures undertaken in this age group. There were 24,885 procedures included in this analysis.

Ceramic/ceramic, metal/XLPE, ceramic/XLPE, and ceramicised metal/XLPE were the most commonly used bearing surfaces. There was no difference in the cumulative percent revision when these four bearing surfaces were compared. There was a higher rate of revision when non XLPE was used (Table YH12 and Figure YH9).

PROSTHESES

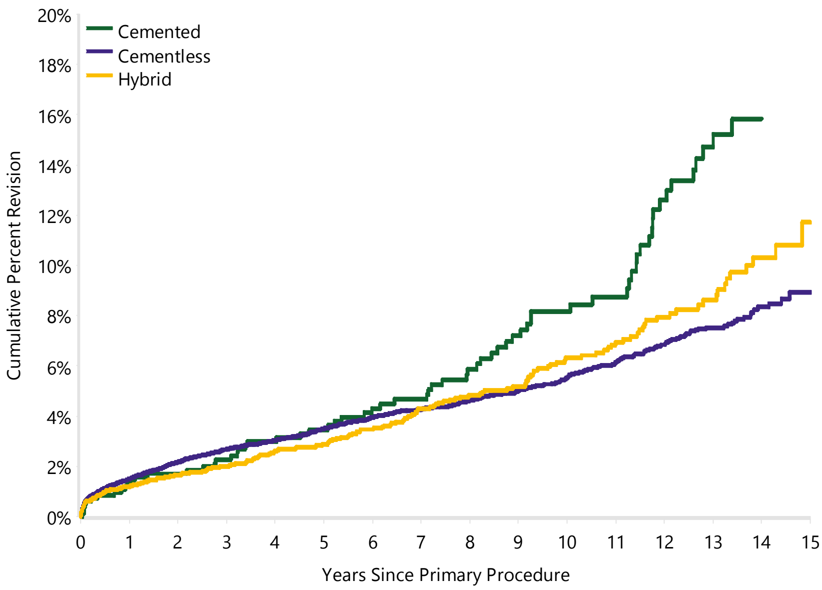
There are 12 prosthesis combinations performed in patients less than 55 years of age, with more than 500 procedures and a minimum of five year follow up. Nine prosthesis combinations have a 10 year cumulative percent revision, ranging from 2.8% to 7.1%. There are five prosthesis combinations with a cumulative percent revision less than 5% at 10 years (Table YH13).

Table YH8 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years by Fixation (Primary Diagnosis OA)

Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	69	845	1.3 (0.7, 2.4)	2.3 (1.4, 3.6)	3.5 (2.4, 5.0)	4.7 (3.3, 6.5)	8.2 (6.2, 10.8)	
Cementless	938	24885	1.5 (1.3, 1.7)	2.7 (2.5, 2.9)	3.5 (3.2, 3.8)	4.3 (4.0, 4.6)	5.5 (5.1, 5.9)	8.9 (7.9, 10.0)
Hybrid	203	5226	1.2 (0.9, 1.5)	2.0 (1.6, 2.4)	2.9 (2.4, 3.4)	4.3 (3.6, 5.1)	6.3 (5.4, 7.4)	11.7 (9.2, 14.8)
TOTAL	1210	30956						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure YH7 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=1.43 (1.08, 1.88),p=0.011

Cementless vs Hybrid

0 - 6Mth: HR=1.25 (0.94, 1.67),p=0.130

6Mth - 2.5Yr: HR=1.67 (1.20, 2.31),p=0.002

2.5Yr+: HR=0.71 (0.58, 0.86),p<0.001

Cementless vs Cemented

0 - 3Mth: HR=0.90 (0.61, 1.34),p=0.603

3Mth - 2.5Yr: HR=1.08 (0.76, 1.54),p=0.665

2.5Yr+: HR=0.50 (0.38, 0.65),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	845	796	686	587	501	333	28
Cementless	24885	21646	16019	11398	7800	4708	192
Hybrid	5226	4491	3309	2415	1743	1038	80

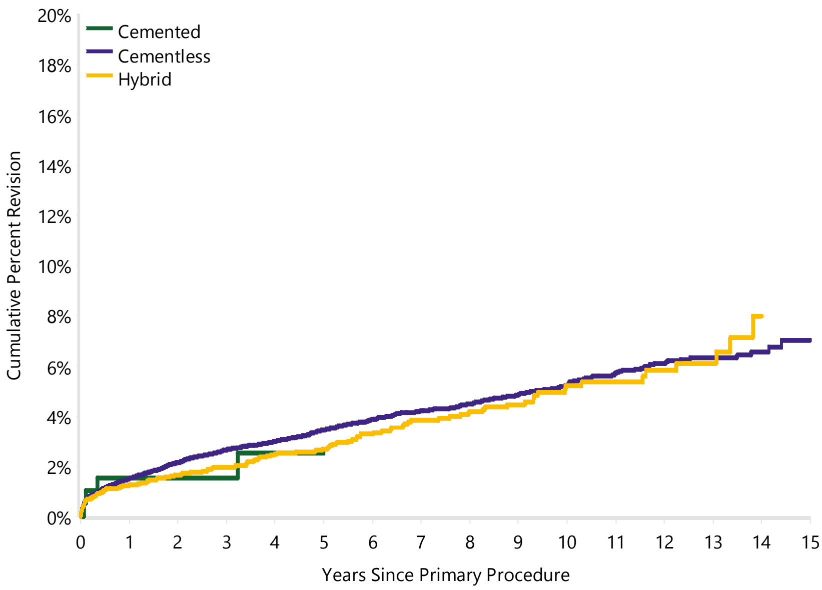
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table YH9 **Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years by Fixation (Primary Diagnosis OA, Excluding Non XLPE)**

Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	4	199	1.5 (0.5, 4.7)	1.5 (0.5, 4.7)	2.5 (0.9, 6.9)			
Cementless	821	23795	1.5 (1.4, 1.7)	2.6 (2.4, 2.9)	3.4 (3.2, 3.7)	4.2 (3.9, 4.5)	5.2 (4.8, 5.6)	7.0 (6.2, 8.0)
Hybrid	137	4662	1.2 (1.0, 1.6)	1.9 (1.6, 2.4)	2.7 (2.2, 3.3)	3.8 (3.1, 4.6)	5.2 (4.2, 6.4)	
TOTAL	962	28656						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure YH8 **Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years by Fixation (Primary Diagnosis OA, Excluding Non XLPE)**



HR - adjusted for age and gender

Cemented vs Hybrid
Entire Period: HR=0.78 (0.29, 2.10),p=0.617

Cementless vs Hybrid
Entire Period: HR=1.13 (0.94, 1.35),p=0.189

Cementless vs Cemented
Entire Period: HR=1.45 (0.54, 3.88),p=0.454

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	199	174	108	43	29	15	1
Cementless	23795	20641	15124	10552	6991	4007	125
Hybrid	4662	3939	2787	1924	1297	681	8

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table YH10 **Revision Diagnosis of Primary Total Conventional Hip Replacement in Patients Aged <55 Years by Fixation (Primary Diagnosis OA)**

Revision Diagnosis	Cemented			Cementless			Hybrid		
	Number	% Primaries Revised	% Revisions	Number	% Primaries Revised	% Revisions	Number	% Primaries Revised	% Revisions
Loosening/Lysis	40	4.7	58.0	285	1.1	30.4	59	1.1	29.1
Prosthesis Dislocation	7	0.8	10.1	171	0.7	18.2	43	0.8	21.2
Infection	12	1.4	17.4	141	0.6	15.0	41	0.8	20.2
Fracture	5	0.6	7.2	78	0.3	8.3	20	0.4	9.9
Pain	1	0.1	1.4	39	0.2	4.2	5	0.1	2.5
Leg Length Discrepancy				28	0.1	3.0	6	0.1	3.0
Malposition				26	0.1	2.8	2	0.0	1.0
Implant Breakage Acetabular				23	0.1	2.5			
Implant Breakage Acetabular Insert				21	0.1	2.2	1	0.0	0.5
Metal Related Pathology				20	0.1	2.1	1	0.0	0.5
Instability				17	0.1	1.8	3	0.1	1.5
Implant Breakage Stem	3	0.4	4.3	13	0.1	1.4	9	0.2	4.4
Incorrect Sizing				13	0.1	1.4	1	0.0	0.5
Implant Breakage Head				11	0.0	1.2			
Wear Acetabular Insert				10	0.0	1.1	7	0.1	3.4
Wear Head				4	0.0	0.4	2	0.0	1.0
Wear Acetabulum	1	0.1	1.4	3	0.0	0.3			
Heterotopic Bone				2	0.0	0.2			
Other				33	0.1	3.5	3	0.1	1.5
N Revision	69	8.2	100.0	938	3.8	100.0	203	3.9	100.0
N Primary	845			24885			5226		

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table YH11 Revision Diagnosis of Primary Total Conventional Hip Replacement in Patients Aged <55 Years by Fixation (Primary Diagnosis OA, Excluding Non XLPE)

Revision Diagnosis	Cemented			Cementless			Hybrid		
	Number	% Primaries Revised	% Revisions	Number	% Primaries Revised	% Revisions	Number	% Primaries Revised	% Revisions
Loosening/Lysis	2	1.0	50.0	223	0.9	27.2	29	0.6	21.2
Prosthesis Dislocation				154	0.6	18.8	31	0.7	22.6
Infection	1	0.5	25.0	129	0.5	15.7	31	0.7	22.6
Fracture	1	0.5	25.0	73	0.3	8.9	18	0.4	13.1
Pain				36	0.2	4.4	4	0.1	2.9
Leg Length Discrepancy				28	0.1	3.4	6	0.1	4.4
Malposition				25	0.1	3.0	2	0.0	1.5
Implant Breakage Acetabular				22	0.1	2.7			
Implant Breakage Acetabular Insert				21	0.1	2.6	1	0.0	0.7
Metal Related Pathology				19	0.1	2.3			
Instability				16	0.1	1.9	2	0.0	1.5
Incorrect Sizing				12	0.1	1.5			
Implant Breakage Head				11	0.0	1.3			
Implant Breakage Stem				11	0.0	1.3	6	0.1	4.4
Wear Acetabular Insert				5	0.0	0.6	2	0.0	1.5
Wear Head				4	0.0	0.5	2	0.0	1.5
Heterotopic Bone				2	0.0	0.2			
Other				30	0.1	3.7	3	0.1	2.2
N Revision	4	2.0	100.0	821	3.5	100.0	137	2.9	100.0
N Primary	199			23795			4662		

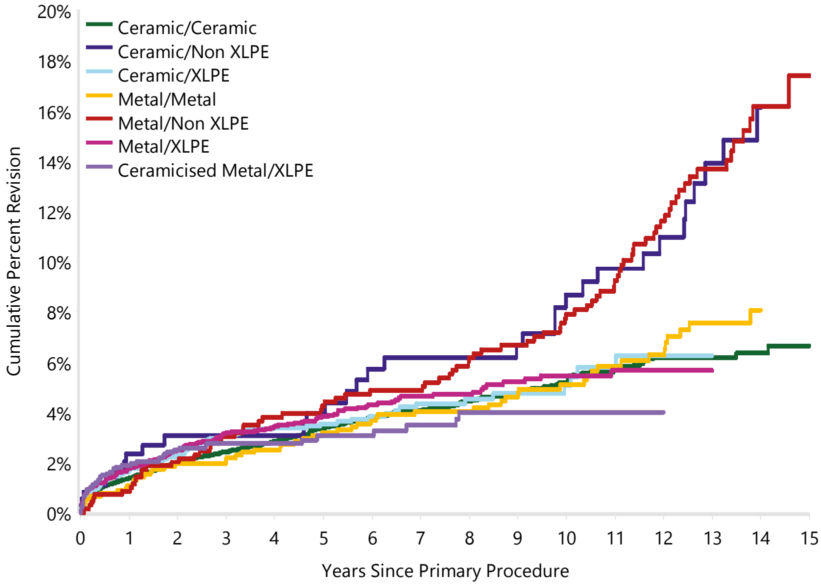
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table YH12 Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Cementless Fixation in Patients Aged <55 Years by Bearing Surface (Primary Diagnosis OA)

Bearing Surface	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Ceramic/Ceramic	434	12726	1.4 (1.2, 1.6)	2.4 (2.1, 2.7)	3.4 (3.0, 3.7)	4.1 (3.6, 4.5)	5.2 (4.7, 5.8)	6.6 (5.7, 7.7)
Ceramic/Non XLPE	32	372	2.4 (1.2, 4.7)	3.0 (1.6, 5.6)	3.9 (2.2, 6.9)	6.2 (3.8, 9.8)	8.7 (5.7, 13.0)	
Ceramic/XLPE	121	4127	1.7 (1.3, 2.1)	3.1 (2.5, 3.7)	3.5 (2.9, 4.3)	4.3 (3.5, 5.3)	5.1 (4.0, 6.5)	
Ceramic/Metal	3	56	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	10.7 (3.2, 32.3)		
Metal/Metal	56	929	1.1 (0.6, 2.0)	2.2 (1.4, 3.3)	3.2 (2.2, 4.6)	4.0 (2.9, 5.5)	5.1 (3.8, 6.8)	
Metal/Non XLPE	84	703	0.9 (0.4, 1.9)	3.0 (2.0, 4.6)	4.2 (3.0, 6.1)	4.9 (3.5, 6.8)	7.9 (6.0, 10.3)	17.4 (13.7, 22.0)
Metal/XLPE	159	4207	1.8 (1.4, 2.2)	3.2 (2.7, 3.8)	3.8 (3.2, 4.5)	4.6 (3.9, 5.4)	5.4 (4.6, 6.5)	
Metal/Ceramic	0	3	0.0 (0.0, 0.0)					
Ceramicised Metal/Non XLPE	1	15	0.0 (0.0, 0.0)	6.7 (1.0, 38.7)	6.7 (1.0, 38.7)	6.7 (1.0, 38.7)	6.7 (1.0, 38.7)	
Ceramicised Metal/XLPE	48	1735	1.9 (1.3, 2.7)	2.7 (2.0, 3.7)	3.0 (2.2, 4.1)	3.5 (2.5, 4.7)	4.0 (2.9, 5.5)	
TOTAL	938	24873						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded
12 procedures with unknown bearing surface have been excluded

Figure YH9 Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Cementless Fixation in Patients Aged <55 Years by Bearing Surface (Primary Diagnosis OA)



HR - adjusted for age and gender

Ceramic/Ceramic vs Metal/XLPE	Entire Period: HR=0.89 (0.75, 1.07),p=0.228
Ceramic/Non XLPE vs Metal/XLPE	Entire Period: HR=1.84 (1.25, 2.69),p=0.001
Ceramic/XLPE vs Metal/XLPE	Entire Period: HR=0.99 (0.78, 1.25),p=0.920
Metal/Metal vs Metal/XLPE	0 - 3Yr: HR=0.76 (0.47, 1.21),p=0.242
	3Yr+: HR=1.25 (0.85, 1.82),p=0.252
Metal/Non XLPE vs Metal/XLPE	0 - 3Mth: HR=0.45 (0.14, 1.42),p=0.174
	3Mth - 1.5Yr: HR=1.37 (0.72, 2.63),p=0.339
	1.5Yr - 3Yr: HR=1.31 (0.63, 2.71),p=0.464
	3Yr - 5.5Yr: HR=1.59 (0.85, 2.99),p=0.149
	5.5Yr - 7Yr: HR=0.29 (0.04, 2.11),p=0.221
	7Yr - 9Yr: HR=2.86 (1.44, 5.66),p=0.002
	9Yr+: HR=4.00 (2.62, 6.10),p<0.001
Ceramicised Metal/XLPE vs Metal/XLPE	Entire Period: HR=0.84 (0.61, 1.17),p=0.301
Ceramic/XLPE vs Ceramic/Ceramic	Entire Period: HR=1.11 (0.91, 1.36),p=0.311
Ceramicised Metal/XLPE vs Ceramic/Ceramic	Entire Period: HR=0.95 (0.70, 1.27),p=0.710
Ceramicised Metal/XLPE vs Ceramic/XLPE	Entire Period: HR=0.85 (0.61, 1.19),p=0.346

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Ceramic/Ceramic	12726	11245	8332	5785	3855	2347	86
Ceramic/Non XLPE	372	298	230	216	205	178	26
Ceramic/XLPE	4127	3228	1969	1177	667	284	2
Metal/Metal	929	914	881	841	751	539	35
Metal/Non XLPE	703	692	654	619	594	517	41
Metal/XLPE	4207	3754	2888	2091	1271	618	2
Ceramicised Metal/XLPE	1735	1431	986	594	423	216	0

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded
Only bearing surfaces with more than 100 procedures are included in the analysis

Table YH13 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years by Prosthesis Combination (Primary Diagnosis OA)

Femoral Component	Acetabular Component	N Revised	N Total	1 Yr	5 Yrs	7 Yrs	10 Yrs	12 Yrs	14 Yrs
Accolade I	Trident (Shell)	71	1260	1.8 (1.2, 2.7)	4.8 (3.7, 6.2)	5.6 (4.4, 7.1)	7.1 (5.5, 9.1)	7.5 (5.8, 9.7)	
Alloclassic	Allofit	24	524	0.6 (0.2, 1.8)	2.3 (1.3, 4.1)	3.0 (1.8, 5.0)	4.3 (2.7, 6.7)	7.2 (4.6, 11.1)	
Anthology	R3	16	655	1.7 (1.0, 3.1)	2.5 (1.5, 4.2)	3.9 (1.8, 8.2)			
Corail	Pinnacle	107	3668	1.5 (1.2, 2.0)	3.7 (3.0, 4.6)	5.4 (4.2, 7.0)	6.0 (4.5, 7.9)		
Exeter V40	Trident (Shell)	75	2814	1.0 (0.7, 1.4)	2.3 (1.8, 3.1)	3.6 (2.8, 4.7)	5.0 (3.8, 6.6)	5.5 (4.1, 7.4)	
Quadra-H	Versafitcup CC	37	1655	1.4 (1.0, 2.2)	3.1 (2.2, 4.4)				
S-Rom	Pinnacle	18	710	1.3 (0.7, 2.5)	2.9 (1.9, 4.7)	2.9 (1.9, 4.7)	2.9 (1.9, 4.7)		
Secur-Fit	Trident (Shell)	41	1239	1.5 (0.9, 2.3)	3.2 (2.3, 4.4)	3.6 (2.6, 5.0)	4.1 (3.0, 5.6)	4.5 (3.2, 6.2)	4.5 (3.2, 6.2)
Secur-Fit Plus	Trident (Shell)	25	744	0.7 (0.3, 1.6)	2.7 (1.7, 4.2)	3.2 (2.1, 5.0)	3.9 (2.6, 5.9)	4.2 (2.8, 6.2)	4.2 (2.8, 6.2)
Summit	Pinnacle	13	576	0.9 (0.4, 2.1)	2.4 (1.4, 4.3)	2.8 (1.6, 4.8)	2.8 (1.6, 4.8)		
Synergy	R3	11	544	1.3 (0.6, 2.7)	2.4 (1.3, 4.4)	2.4 (1.3, 4.4)			
Synergy	Reflection (Shell)	55	1014	1.4 (0.8, 2.3)	3.5 (2.5, 4.8)	3.9 (2.9, 5.3)	5.0 (3.7, 6.6)	6.0 (4.5, 7.9)	8.5 (6.1, 11.7)
Other (780)		717	15553	1.6 (1.4, 1.8)	3.6 (3.3, 3.9)	4.6 (4.2, 5.0)	6.5 (5.9, 7.0)	8.4 (7.7, 9.2)	10.5 (9.6, 11.6)
TOTAL		**1210**	**30956**						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded
Only combinations with over 500 procedures have been listed

OUTCOME FOR DEVELOPMENTAL DYSPLASIA

The Registry has consistently reported no long term differences in rates of revision between patients undergoing total conventional hip replacement for osteoarthritis, compared to developmental dysplasia (DDH). This is despite the more technically challenging surgery in the latter group.

The Registry has recorded 2,579 procedures performed for DDH in those aged less than 55 years. As expected, the majority of total conventional hip replacements for this diagnosis have been performed in females (78.8%).

"The Registry has recorded 2,579 procedures performed for developmental dysplasia in those aged less than 55 years."

The cumulative percent revision at 14 years for total conventional hip replacement performed for DDH was 9.9% (Table YH14 and Figure YH10). Cementless fixation was used in 78.8%, cemented 5.6% and hybrid 15.6%. There was no difference in the rate of revision when stratified by gender or fixation (Table YH15 and Figure YH11; Table YH16 and Figure YH12).

Ceramic/XLPE had the lowest rate of revision at seven years (Table YH17 and Figure YH13).

Surgeons choose different prostheses for dealing with this more complex surgery. There were nine prosthesis combinations used in 50 or more procedures. The cumulative percent revision of these nine combinations is shown in Table YH18.

SUMMARY

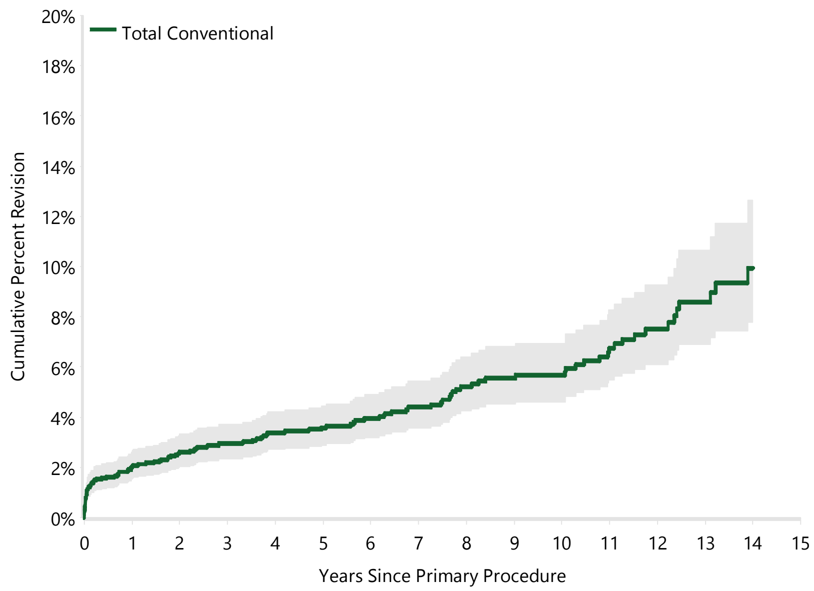
There has been a marginal increase in patients aged less than 55 years undergoing total hip replacement over the past 12 years. The proportion of procedures undertaken for osteoarthritis is less than for older age groups. The cumulative percent revision at 15 years is 9.9% for patients with osteoarthritis and 9.9% at 14 years for patients with developmental dysplasia. Females have a higher rate of revision than males for osteoarthritis but there is no difference for developmental dysplasia. There is no difference in the rate of revision for the four most commonly used bearing surfaces for osteoarthritis but ceramic XLPE has a lower rate of revision for developmental dysplasia. There is prosthesis specific variation in outcomes in the younger age group.

Table YH14 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years (Primary Diagnosis DDH)

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Total Conventional	120	2579	2.0 (1.5, 2.6)	3.0 (2.3, 3.7)	3.6 (2.9, 4.4)	4.4 (3.6, 5.4)	5.7 (4.6, 6.9)	9.9 (7.8, 12.7)
TOTAL	120	2579						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure YH10 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years (Primary Diagnosis DDH)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Total Conventional	2579	2232	1778	1378	1019	672	136

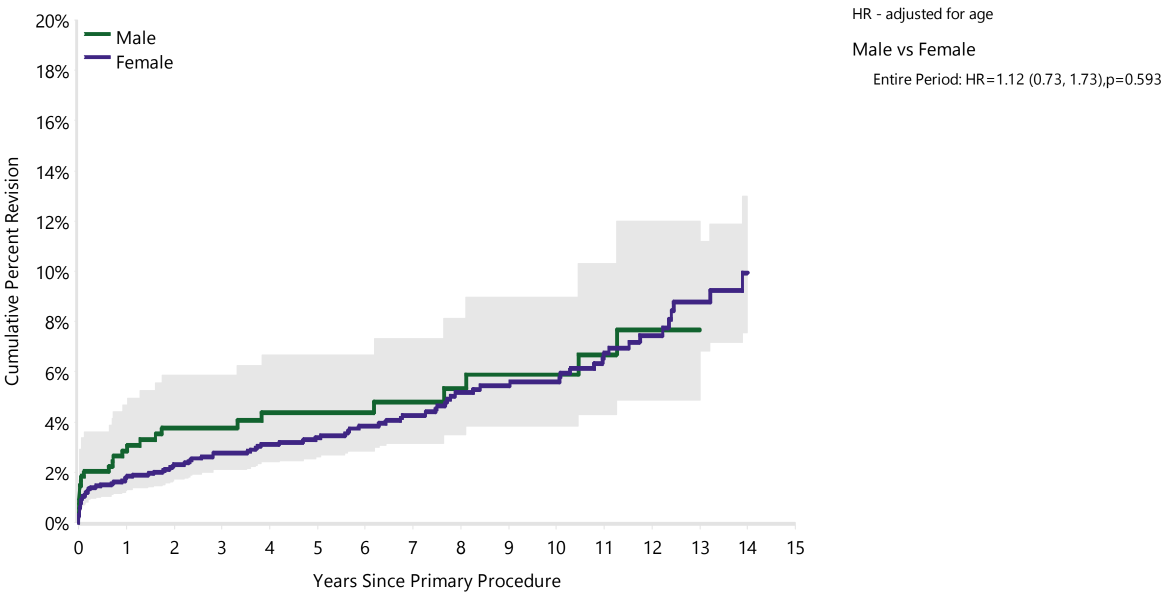
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table YH15 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years by Gender (Primary Diagnosis DDH)

Gender	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Male	27	547	2.8 (1.7, 4.7)	3.8 (2.4, 5.8)	4.4 (2.8, 6.7)	4.8 (3.1, 7.3)	5.9 (3.8, 9.0)	
Female	93	2032	1.8 (1.3, 2.4)	2.7 (2.1, 3.6)	3.4 (2.6, 4.3)	4.3 (3.3, 5.4)	5.6 (4.4, 7.1)	9.9 (7.6, 13.0)
TOTAL	120	2579						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure YH11 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years by Gender (Primary Diagnosis DDH)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Male	547	454	338	261	192	124	23
Female	2032	1778	1440	1117	827	548	113

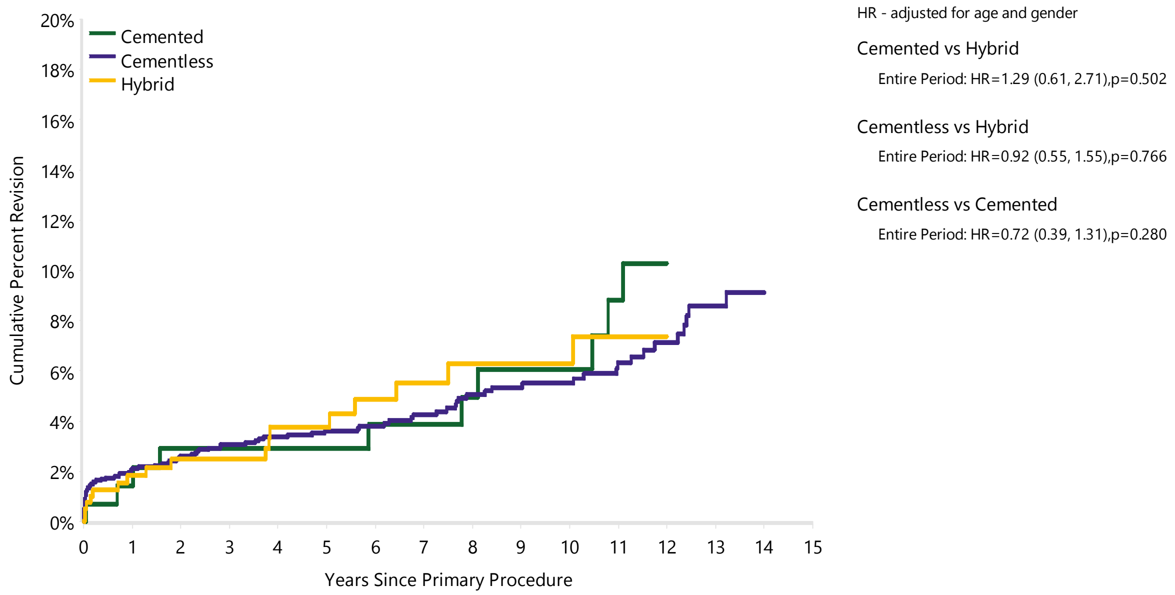
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table YH16 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years by Fixation (Primary Diagnosis DDH)

Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cemented	12	144	1.4 (0.4, 5.6)	2.9 (1.1, 7.6)	2.9 (1.1, 7.6)	3.9 (1.6, 9.1)	6.1 (2.9, 12.5)	
Cementless	91	2033	2.1 (1.5, 2.8)	3.1 (2.4, 3.9)	3.6 (2.8, 4.6)	4.3 (3.3, 5.4)	5.5 (4.3, 6.9)	9.1 (7.0, 11.9)
Hybrid	17	402	1.8 (0.9, 3.8)	2.5 (1.3, 4.7)	3.8 (2.1, 6.6)	5.5 (3.3, 9.3)	6.3 (3.7, 10.5)	
TOTAL	120	2579						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure YH12 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years by Fixation (Primary Diagnosis DDH)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cemented	144	134	122	107	90	71	20
Cementless	2033	1768	1403	1085	792	513	92
Hybrid	402	330	253	186	137	88	24

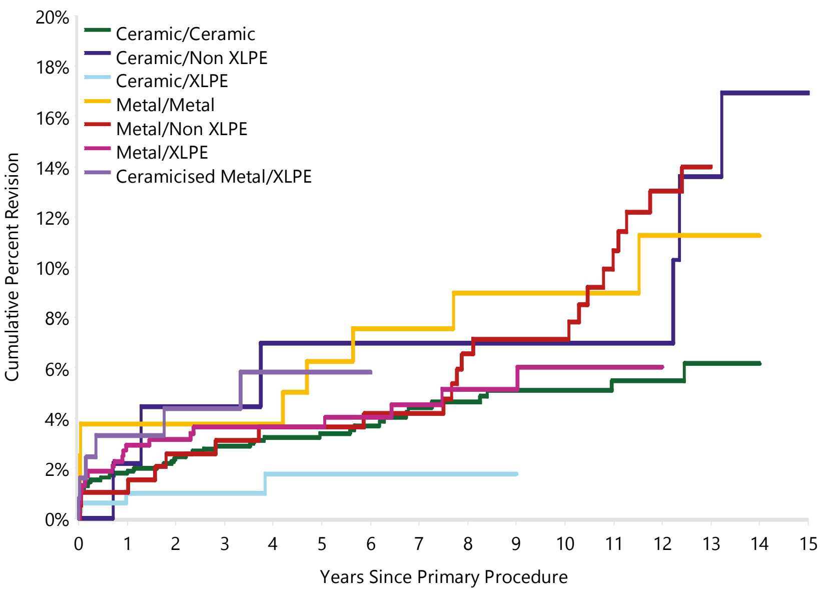
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table YH17 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years by Bearing Surface (Primary Diagnosis DDH)

Bearing Surface	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Ceramic/Ceramic	48	1241	1.8 (1.2, 2.7)	2.9 (2.0, 4.0)	3.4 (2.4, 4.6)	4.4 (3.2, 6.0)	5.1 (3.8, 6.9)	6.2 (4.3, 8.7)
Ceramic/Non XLPE	6	48	2.2 (0.3, 14.4)	4.4 (1.1, 16.6)	7.0 (2.3, 20.1)	7.0 (2.3, 20.1)	7.0 (2.3, 20.1)	16.9 (7.8, 34.4)
Ceramic/XLPE	4	341	1.0 (0.3, 3.1)	1.0 (0.3, 3.1)	1.8 (0.6, 5.1)	1.8 (0.6, 5.1)		
Ceramic/Metal	0	2	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)				
Metal/Metal	8	80	3.7 (1.2, 11.2)	3.7 (1.2, 11.2)	6.2 (2.7, 14.4)	7.6 (3.5, 16.0)	9.0 (4.4, 17.9)	11.2 (5.7, 21.7)
Metal/Non XLPE	24	197	1.0 (0.3, 4.0)	3.1 (1.4, 6.7)	3.6 (1.7, 7.4)	4.2 (2.1, 8.1)	7.1 (4.2, 12.0)	
Metal/XLPE	22	540	2.9 (1.8, 4.8)	3.6 (2.3, 5.7)	3.6 (2.3, 5.7)	4.5 (2.9, 7.1)	6.0 (3.7, 9.7)	
Ceramicised Metal/Non XLPE	0	2	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)				
Ceramicised Metal/XLPE	8	125	3.3 (1.3, 8.6)	4.4 (1.8, 10.2)	5.8 (2.6, 12.8)			
TOTAL	120	2576						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded
3 procedures with unknown bearing surface have been excluded

Figure YH13 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years by Bearing Surface (Primary Diagnosis DDH)



HR - adjusted for age and gender

Ceramic/Ceramic vs Metal/XLPE
Entire Period: HR=0.82 (0.50, 1.36),p=0.445

Ceramic/Non XLPE vs Metal/XLPE
Entire Period: HR=1.96 (0.79, 4.90),p=0.147

Ceramic/XLPE vs Metal/XLPE
Entire Period: HR=0.34 (0.12, 1.00),p=0.049

Metal/Metal vs Metal/XLPE
Entire Period: HR=1.50 (0.66, 3.41),p=0.327

Metal/Non XLPE vs Metal/XLPE
0 - 7Yr: HR=0.92 (0.41, 2.07),p=0.835
7Yr+: HR=4.59 (2.00, 10.53),p<0.001

Ceramicised Metal/XLPE vs Metal/XLPE
Entire Period: HR=1.75 (0.78, 3.94),p=0.174

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Ceramic/Ceramic	1241	1109	893	682	483	306	48
Ceramic/Non XLPE	48	45	39	36	35	33	21
Ceramic/XLPE	341	247	147	98	61	30	4
Metal/Metal	80	77	77	73	68	56	17
Metal/Non XLPE	197	192	184	181	164	139	39
Metal/XLPE	540	454	360	254	170	90	7
Ceramicised Metal/XLPE	125	101	71	50	34	15	0

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded
Only bearing surfaces with more than 10 procedures are included in this analysis

Table YH18 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients Aged <55 Years by Prosthesis Combination (Primary Diagnosis DDH)

Femoral Component	Acetabular Component	N Revised	N Total	1 Yr	5 Yrs	7 Yrs	10 Yrs	12 Yrs	14 Yrs
Accolade I	Trident (Shell)	2	56	1.8 (0.3, 12.0)	3.6 (0.9, 13.8)	3.6 (0.9, 13.8)	3.6 (0.9, 13.8)		
Corail	Pinnacle	8	167	3.1 (1.3, 7.3)	5.7 (2.8, 11.3)				
Exeter V40	Trident (Shell)	6	187	1.1 (0.3, 4.3)	3.1 (1.1, 8.3)	6.0 (2.6, 13.5)			
Quadra-H	Versafitcup CC	1	54	1.9 (0.3, 12.4)					
S-Rom	Pinnacle	12	390	2.1 (1.1, 4.1)	2.8 (1.5, 5.1)	2.8 (1.5, 5.1)	5.5 (2.6, 11.4)		
S-Rom	Trident (Shell)	3	50	0.0 (0.0, 0.0)	4.3 (1.1, 16.1)	4.3 (1.1, 16.1)	8.0 (2.5, 23.7)	8.0 (2.5, 23.7)	8.0 (2.5, 23.7)
Secur-Fit	Trident (Shell)	2	82	1.2 (0.2, 8.3)	2.5 (0.6, 9.6)	2.5 (0.6, 9.6)	2.5 (0.6, 9.6)	2.5 (0.6, 9.6)	2.5 (0.6, 9.6)
Synergy	Reflection (Shell)	4	54	0.0 (0.0, 0.0)	4.0 (1.0, 15.1)	4.0 (1.0, 15.1)	6.3 (2.1, 18.5)	10.4 (3.8, 26.8)	
Wagner	Allofit	1	52	0.0 (0.0, 0.0)	2.5 (0.4, 16.5)	2.5 (0.4, 16.5)	2.5 (0.4, 16.5)	2.5 (0.4, 16.5)	
Other (322)		81	1487	2.2 (1.6, 3.1)	3.7 (2.8, 4.9)	4.7 (3.6, 6.2)	6.0 (4.6, 7.7)	8.2 (6.4, 10.5)	11.2 (8.6, 14.6)
TOTAL		**120**	**2579**						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded
Only combinations with over 50 procedures have been listed

PRIMARY TOTAL RESURFACING HIP REPLACEMENT

The Registry has recorded 8,895 total resurfacing hip replacement procedures in patients less than 55 years of age. In this age group, the use of primary total hip resurfacing as a proportion of primary total hip procedures, has declined from a peak of 30.2% in 2004 to 4.3% in 2015.

There were 93.1% of patients who had a total resurfacing hip replacement performed for osteoarthritis, compared to 97.8 % for the older age groups. The most common diagnoses are shown in Table YH19.

The cumulative percent revision at 15 years for total resurfacing hip replacement for patients less than 55 years of age with a primary diagnosis of osteoarthritis was 13.2% (Table YH20 and Figure YH14). There was a higher rate of revision for females and for head sizes less than 50mm in this younger age group (Table YH21 and Figure YH15; Table YH22 and Figure YH16).

There were 11 primary total resurfacing hip replacement prosthesis combinations recorded by the Registry in patients less than 55 years of age, used with 10 or more procedures (Table YH23).

"There was a higher rate of revision for females and for head sizes less than 50mm in this younger age group."

As the BHR and the Adept are the only resurfacing devices used in 2015, we have performed a separate analysis combining these two prostheses. The cumulative percent revision at 15 years for the BHR and Adept combined is 9.5% (Table YH24 and Figure YH17). Females had a higher rate of revision. At 10 years the cumulative percent revision for females is 14.5% compared to 3.7% for males (Table YH25 and Figure YH18).

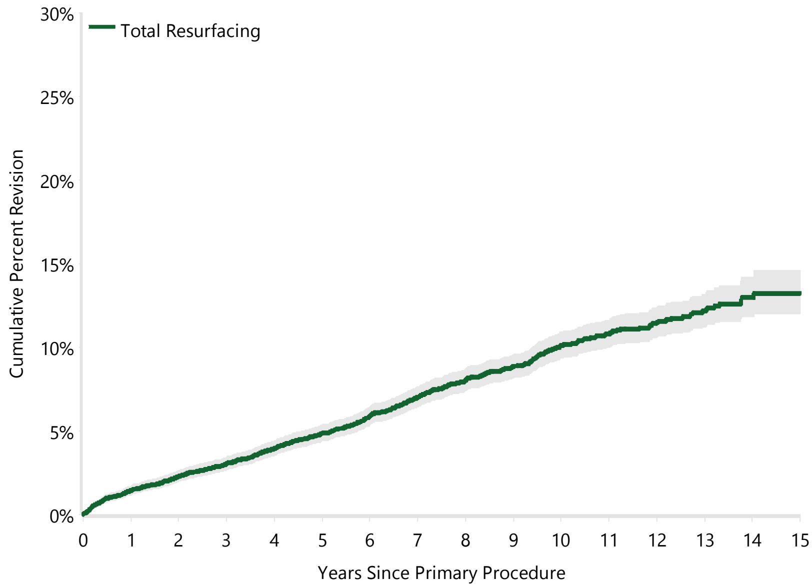
Table YH19 Primary Diagnosis of Primary Total Resurfacing Hip Replacement by Age

	<55		≥55		TOTAL	
Primary Diagnosis	N	Col%	N	Col%	N	Col%
Osteoarthritis	8277	93.1	7462	97.8	15739	95.3
Developmental Dysplasia	313	3.5	77	1.0	390	2.4
Osteonecrosis	216	2.4	49	0.6	265	1.6
Other Inflammatory Arthritis	41	0.5	20	0.3	61	0.4
Rheumatoid Arthritis	37	0.4	18	0.2	55	0.3
Other	11	0.1	.	.	11	0.1
TOTAL	**8895**	**100.0**	**7626**	**100.0**	**16521**	**100.0**

Table YH20 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement in Patients Aged <55 Years (Primary Diagnosis OA)

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Total Resurfacing	700	8277	1.4 (1.2, 1.7)	3.0 (2.7, 3.4)	4.9 (4.4, 5.4)	7.0 (6.4, 7.6)	10.1 (9.4, 10.9)	13.2 (12.0, 14.6)
TOTAL	700	8277						

Figure YH14 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement in Patients Aged <55 Years (Primary Diagnosis OA)

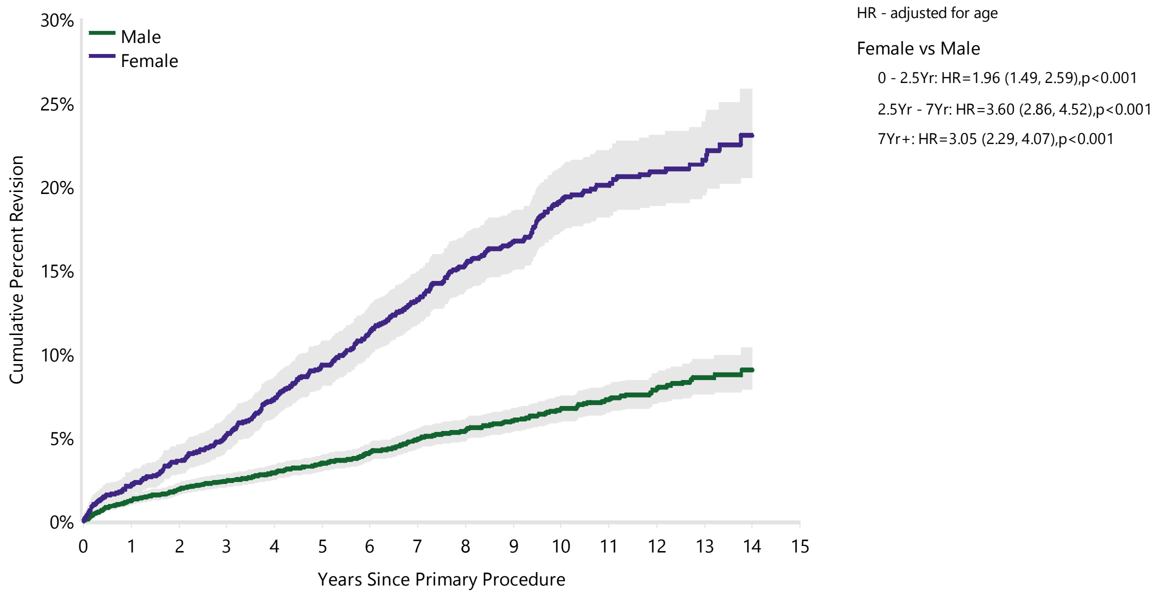


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Total Resurfacing	8277	7964	7366	6578	5268	2989	52

Table YH21 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement in Patients Aged <55 Years by Gender (Primary Diagnosis OA)

Gender	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	354	6404	1.2 (1.0, 1.5)	2.4 (2.0, 2.8)	3.4 (3.0, 3.9)	4.9 (4.3, 5.5)	6.7 (6.0, 7.5)	
Female	346	1873	2.1 (1.6, 2.9)	5.1 (4.2, 6.2)	9.3 (8.1, 10.7)	13.2 (11.8, 14.9)	19.1 (17.3, 21.1)	
TOTAL	700	8277						

Figure YH15 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement in Patients Aged <55 Years by Gender (Primary Diagnosis OA)



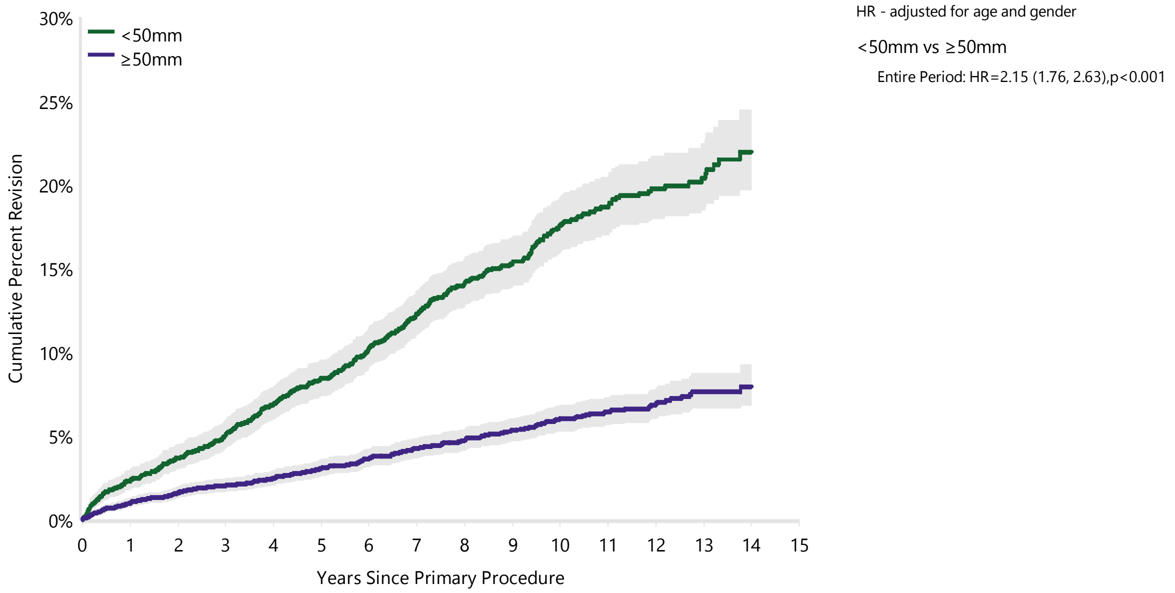
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	6404	6136	5602	4923	3827	2127	36
Female	1873	1828	1764	1655	1441	862	16

Table YH22 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement in Patients Aged <55 Years by Head Size (Primary Diagnosis OA)

Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
<50mm	423	2685	2.3 (1.8, 3.0)	5.1 (4.3, 6.0)	8.4 (7.4, 9.6)	12.3 (11.1, 13.7)	17.6 (16.0, 19.3)	
≥50mm	277	5591	1.0 (0.8, 1.3)	2.0 (1.7, 2.4)	3.1 (2.6, 3.6)	4.2 (3.7, 4.8)	6.0 (5.3, 6.8)	
TOTAL	700	8276						

Note : Excludes 1 procedure with unknown head size

Figure YH16 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement in Patients Aged <55 Years by Head Size (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
<50mm	2685	2582	2439	2233	1841	1007	16
≥50mm	5591	5381	4926	4344	3427	1982	36

Table YH23 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement in Patients Aged <55 Years by Prosthesis Combination (Primary Diagnosis OA)

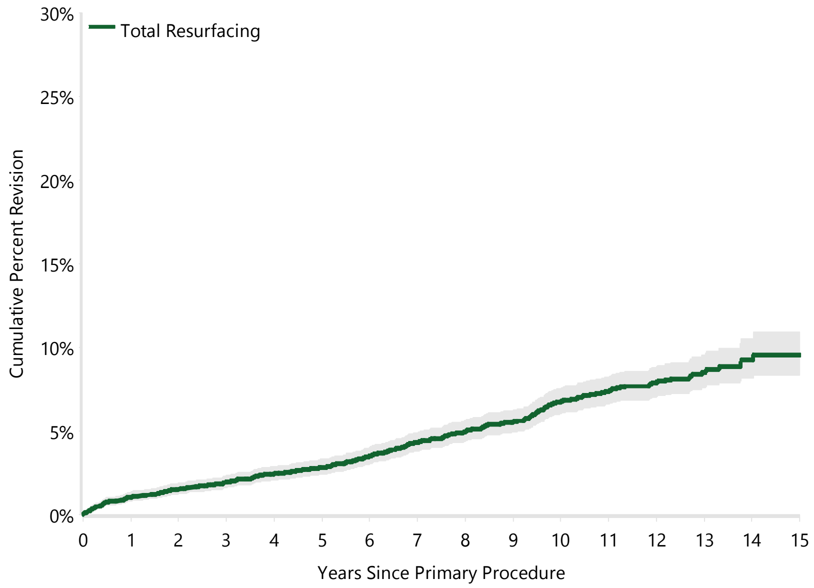
Head Component	Acetabular Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
ASR	ASR	168	558	2.5 (1.5, 4.2)	7.2 (5.3, 9.7)	16.5 (13.7, 19.9)	24.8 (21.4, 28.7)	31.7 (27.7, 36.1)	
Adept	Adept	10	497	0.7 (0.2, 2.0)	1.2 (0.5, 2.9)	1.2 (0.5, 2.9)	2.4 (1.1, 5.3)		
BHR	BHR	333	5579	1.1 (0.8, 1.4)	2.0 (1.7, 2.4)	2.9 (2.5, 3.4)	4.4 (3.9, 5.0)	6.8 (6.1, 7.6)	9.6 (8.3, 11.0)
Bionik	Bionik	30	115	4.3 (1.8, 10.1)	15.7 (10.2, 23.7)	19.1 (13.0, 27.6)	21.0 (14.6, 29.7)		
Conserve Plus	Conserve Plus	6	27	11.1 (3.7, 30.6)	11.1 (3.7, 30.6)	18.5 (8.2, 38.9)	18.5 (8.2, 38.9)	18.5 (8.2, 38.9)	
Cormet	Cormet	53	328	2.4 (1.2, 4.8)	6.1 (4.0, 9.3)	10.2 (7.4, 14.0)	13.9 (10.5, 18.3)	17.2 (13.1, 22.4)	
Cormet 2000 HAP	Cormet	13	50	4.0 (1.0, 15.1)	6.0 (2.0, 17.5)	8.0 (3.1, 19.9)	12.0 (5.6, 24.8)	20.0 (11.3, 34.0)	
Durom	Durom	41	409	2.2 (1.2, 4.2)	4.4 (2.8, 6.9)	6.6 (4.6, 9.5)	7.9 (5.7, 11.0)	10.6 (7.9, 14.3)	
Icon	Icon	6	61	1.6 (0.2, 11.1)	4.9 (1.6, 14.5)	6.6 (2.5, 16.7)	8.3 (3.5, 18.8)	12.7 (5.4, 28.4)	
Mitch TRH	Mitch TRH	26	546	1.3 (0.6, 2.7)	2.4 (1.4, 4.1)	3.1 (2.0, 5.0)	4.3 (2.8, 6.6)		
Recap	Recap	14	93	5.4 (2.3, 12.4)	11.8 (6.7, 20.3)	14.0 (8.4, 22.9)	15.3 (9.3, 24.5)	15.3 (9.3, 24.5)	
Other (4)		0	14	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		700	8277						

Note: Only combinations with over 10 procedures have been listed

Table YH24 Cumulative Percent Revision of BHR and Adept Primary Total Resurfacing Hip Replacement in Patients Aged <55 Years (Primary Diagnosis OA)

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Total Resurfacing	343	6076	1.1 (0.8, 1.3)	2.0 (1.6, 2.3)	2.8 (2.4, 3.3)	4.3 (3.8, 4.9)	6.7 (6.0, 7.5)	9.5 (8.3, 10.9)
TOTAL	343	6076						

Figure YH17 Cumulative Percent Revision of BHR and Adept Primary Total Resurfacing Hip Replacement in Patients Aged <55 Years (Primary Diagnosis OA)

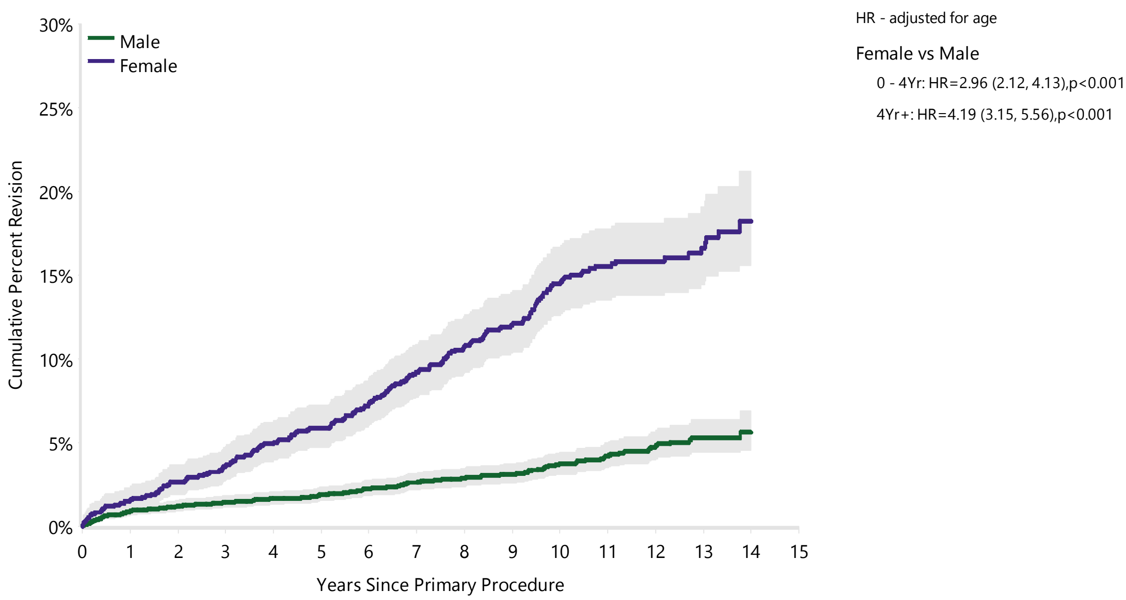


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Total Resurfacing	6076	5818	5306	4698	3885	2458	51

Table YH25 Cumulative Percent Revision of BHR and Adept Primary Total Resurfacing Hip Replacement in Patients Aged <55 Years by Gender (Primary Diagnosis OA)

Gender	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	151	4744	0.9 (0.7, 1.2)	1.5 (1.1, 1.9)	1.9 (1.5, 2.3)	2.6 (2.2, 3.2)	3.7 (3.1, 4.4)	
Female	192	1332	1.6 (1.0, 2.4)	3.6 (2.7, 4.8)	5.8 (4.7, 7.2)	9.2 (7.7, 10.9)	14.5 (12.6, 16.7)	
TOTAL	343	6076						

Figure YH18 Cumulative Percent Revision of BHR and Adept Primary Total Resurfacing Hip Replacement in Patients Aged <55 Years by Gender (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	4744	4512	4033	3481	2782	1730	35
Female	1332	1306	1273	1217	1103	728	16

Primary Total Knee Replacement in Younger Patients

This year, the Registry has performed a more detailed analysis of patients aged less than 55 years who have undergone a primary total knee replacement. The purpose is to provide additional insight into the outcomes of this procedure in this group of patients.

It is known that younger patients have higher rates of revision (Table YK1, Figure YK1 and YK2). This may in part relate to increased physical activity and higher demands placed on prostheses by this age group.

As well as a better understanding of the outcomes, it is hoped that this information will assist counselling and enable optimisation of surgical and prosthesis choice for this group of patients.

Analyses for all diagnoses is presented as well as specific analyses for osteoarthritis. The effects of gender, different prostheses characteristics such as fixation, stability, mobility, use of non XLPE and XLPE, and resurfacing of the patella are reported, as well as the outcomes for individual prostheses.

The Registry has recorded 33,897 primary total knee replacements in patients younger than 55 years of age.

Overall, primary total knee replacement has increased by 130.4% since 2003. This increase, however, is not due to a greater use of this procedure in younger patients, as the proportion of patients aged less than 55 years has changed very little during this time (7.0% in 2003 to 6.8% in 2015).

The most common primary diagnosis in this age group is osteoarthritis (93.7%). This is slightly less than for older patients (97.8%). Total knee replacement was used more often for rheumatoid arthritis, 'other inflammatory arthritis' and tumour in younger patients (Table YK2).

"The Registry has recorded 33,897 primary total knee replacements in patients younger than 55 years of age."

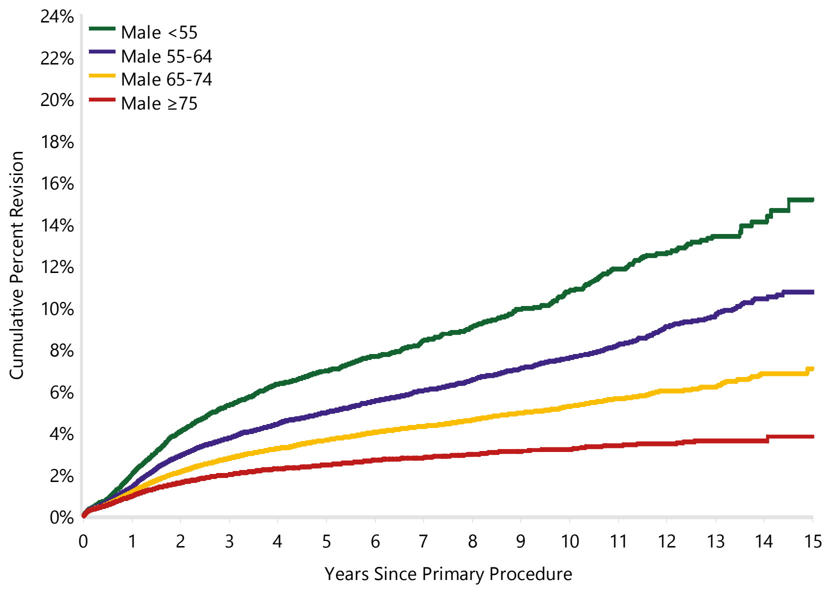
The cumulative percent revision for the four most common primary diagnoses are shown in Table YK3. Compared to patients with osteoarthritis, those with rheumatoid arthritis have a lower rate of revision, while there is no difference for the diagnoses of 'other inflammatory arthritis' and tumour (Figure YK3).

The variation in outcome by primary diagnosis is similar to the outcomes reported in the main knee chapter. Further analysis on outcome has been limited to those with the most common diagnosis (osteoarthritis) in an attempt to minimise confounding factors.

Table YK1 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	7 Yrs	10 Yrs	15 Yrs
Male		**7983**	**209495**	**1.2 (1.2, 1.3)**	**3.0 (2.9, 3.1)**	**3.9 (3.8, 4.0)**	**4.6 (4.5, 4.8)**	**5.8 (5.6, 5.9)**	**8.1 (7.7, 8.5)**
	<55	995	13630	2.0 (1.8, 2.3)	5.3 (4.9, 5.7)	6.9 (6.5, 7.4)	8.4 (7.8, 9.0)	10.8 (10.0, 11.5)	15.1 (13.5, 17.0)
	55-64	2863	57444	1.4 (1.3, 1.5)	3.7 (3.5, 3.9)	4.9 (4.7, 5.1)	6.0 (5.8, 6.2)	7.6 (7.2, 7.9)	10.7 (10.0, 11.4)
	65-74	2890	83068	1.1 (1.1, 1.2)	2.8 (2.6, 2.9)	3.6 (3.5, 3.8)	4.3 (4.1, 4.5)	5.2 (5.0, 5.5)	7.0 (6.5, 7.7)
	≥75	1235	55353	0.9 (0.9, 1.0)	2.0 (1.8, 2.1)	2.4 (2.3, 2.6)	2.8 (2.6, 2.9)	3.2 (3.0, 3.4)	3.8 (3.3, 4.3)
Female		**9230**	**272878**	**0.9 (0.8, 0.9)**	**2.5 (2.5, 2.6)**	**3.5 (3.4, 3.5)**	**4.1 (4.1, 4.2)**	**5.0 (4.9, 5.1)**	**6.8 (6.5, 7.1)**
	<55	1305	18144	1.5 (1.3, 1.7)	4.9 (4.6, 5.3)	7.0 (6.6, 7.5)	8.6 (8.1, 9.1)	11.1 (10.4, 11.7)	16.1 (13.9, 18.7)
	55-64	3020	68600	1.1 (1.0, 1.1)	3.2 (3.0, 3.3)	4.5 (4.3, 4.6)	5.4 (5.2, 5.6)	6.7 (6.4, 6.9)	9.3 (8.7, 9.9)
	65-74	3280	103472	0.8 (0.7, 0.9)	2.4 (2.3, 2.5)	3.3 (3.1, 3.4)	3.9 (3.8, 4.0)	4.7 (4.5, 4.8)	6.1 (5.7, 6.5)
	≥75	1625	82662	0.7 (0.6, 0.8)	1.7 (1.6, 1.8)	2.1 (2.0, 2.2)	2.4 (2.3, 2.6)	2.7 (2.6, 2.8)	2.9 (2.8, 3.1)
TOTAL		17213	482373						

Figure YK1 Cumulative Percent Revision of Primary Total Knee Replacement in Males by Age (Primary Diagnosis OA)



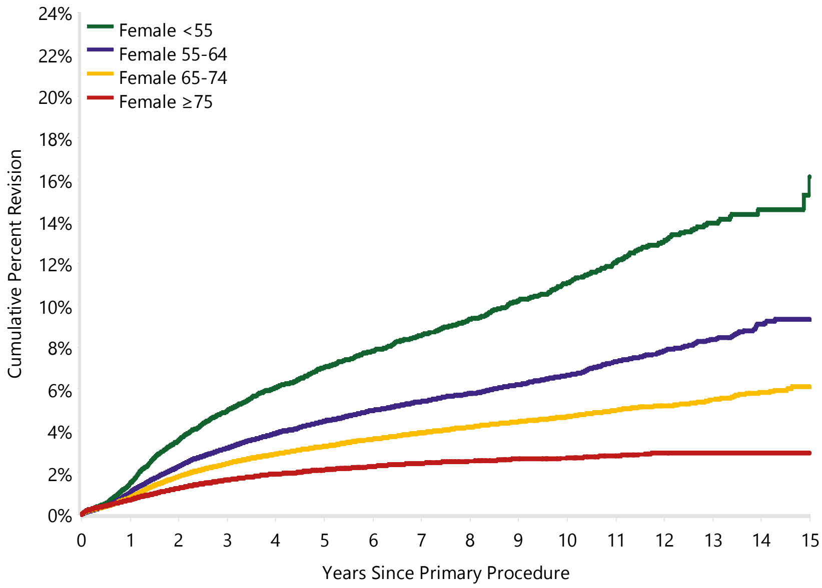
Male 55-64 vs Male <55
- Entire Period: HR=0.70 (0.65, 0.76),p<0.001

Male 65 – 74 vs Male <55
- 0 - 9Mth: HR=0.56 (0.50, 0.63),p<0.001
- 9Mth - 1.5Yr: HR=0.51 (0.45, 0.57),p<0.001
- 1.5Yr - 2Yr: HR=0.45 (0.39, 0.53),p<0.001
- 2Yr - 4Yr: HR=0.50 (0.45, 0.56),p<0.001
- 4Yr - 4.5Yr: HR=0.58 (0.45, 0.76),p<0.001
- 4.5Yr+: HR=0.42 (0.38, 0.47),p<0.001

Male ≥75 vs Male <55
- 0 - 1Mth: HR=0.68 (0.54, 0.85),p<0.001
- 1Mth - 1.5Yr: HR=0.39 (0.35, 0.44),p<0.001
- 1.5Yr - 2Yr: HR=0.28 (0.22, 0.34),p<0.001
- 2Yr - 2.5Yr: HR=0.32 (0.25, 0.40),p<0.001
- 2.5Yr - 3Yr: HR=0.28 (0.21, 0.37),p<0.001
- 3Yr - 3.5Yr: HR=0.32 (0.24, 0.43),p<0.001
- 3.5Yr - 7Yr: HR=0.24 (0.20, 0.29),p<0.001
- 7Yr - 9Yr: HR=0.21 (0.15, 0.29),p<0.001
- 9Yr+: HR=0.14 (0.09, 0.21),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	<55	13630	11974	9145	6719	4685	2425	85
	55-64	57444	50285	37900	27229	18351	8780	281
	65-74	83068	72707	54326	38989	26567	12628	346
	≥75	55353	48587	36259	25233	16037	6226	94

Figure YK2 Cumulative Percent Revision of Primary Total Knee Replacement in Females by Age (Primary Diagnosis OA)



Female 55-64 vs Female <55	0 - 1Yr: HR=0.71 (0.61, 0.82),p<0.001
	1Yr+: HR=0.59 (0.55, 0.63),p<0.001
Female 65-74 vs Female <55	0 - 2Wk: HR=1.01 (0.68, 1.50),p=0.945
	2Wk - 1Mth: HR=0.92 (0.65, 1.28),p=0.604
	1Mth - 3Mth: HR=0.76 (0.58, 1.00),p=0.053
	3Mth - 6Mth: HR=0.50 (0.39, 0.64),p<0.001
	6Mth - 9Mth: HR=0.49 (0.39, 0.61),p<0.001
	9Mth - 1Yr: HR=0.41 (0.33, 0.50),p<0.001
	1Yr - 3Yr: HR=0.46 (0.42, 0.50),p<0.001
	3Yr - 5Yr: HR=0.38 (0.34, 0.43),p<0.001
	5Yr - 7Yr: HR=0.40 (0.34, 0.46),p<0.001
	7Yr - 9Yr: HR=0.36 (0.30, 0.45),p<0.001
	9Yr+: HR=0.28 (0.23, 0.34),p<0.001
Female 75 vs Female <55	0 - 1Mth: HR=1.16 (0.87, 1.54),p=0.322
	1Mth - 3Mth: HR=0.78 (0.59, 1.04),p=0.091
	3Mth - 6Mth: HR=0.43 (0.32, 0.56),p<0.001
	6Mth - 9Mth: HR=0.39 (0.31, 0.50),p<0.001
	9Mth - 1Yr: HR=0.25 (0.20, 0.33),p<0.001
	1Yr - 1.5Yr: HR=0.25 (0.21, 0.29),p<0.001
	1.5Yr - 2Yr: HR=0.27 (0.23, 0.33),p<0.001
	2Yr - 3Yr: HR=0.28 (0.24, 0.33),p<0.001
	3Yr - 5Yr: HR=0.22 (0.19, 0.25),p<0.001
	5Yr - 7Yr: HR=0.19 (0.16, 0.24),p<0.001
	7Yr - 9Yr: HR=0.13 (0.09, 0.18),p<0.001
	9Yr+: HR=0.07 (0.05, 0.11),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Female	<55	18144	16004	12021	8762	6073	3025	97
	55-64	68600	60549	45832	33127	22617	10999	330
	65-74	103472	91399	69434	51073	35662	17977	591
	≥75	82662	73826	57142	41716	28076	11924	216

Table YK2 Primary Diagnosis of Primary Total Knee Replacement by Age

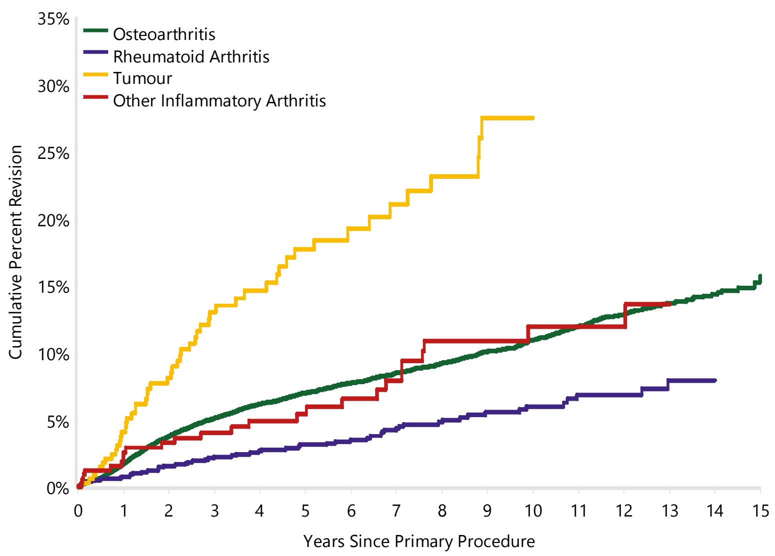
	<55		≥55		TOTAL	
Primary Diagnosis	N	Col%	N	Col%	N	Col%
Osteoarthritis	31774	93.7	450599	97.8	482373	97.5
Rheumatoid Arthritis	1228	3.6	5846	1.3	7074	1.4
Other Inflammatory Arthritis	331	1.0	2102	0.5	2433	0.5
Osteonecrosis	121	0.4	1500	0.3	1621	0.3
Tumour	358	1.1	249	0.1	607	0.1
Fracture	30	0.1	253	0.1	283	0.1
Chondrocalcinosis	1	0.0	19	0.0	20	0.0
Other	54	0.2	106	0.0	160	0.0
TOTAL	33897	100.0	460674	100.0	494571	100.0

Table YK3 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Primary Diagnosis

Primary Diagnosis	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Osteoarthritis	2300	31774	1.7 (1.6, 1.9)	5.1 (4.8, 5.4)	7.0 (6.7, 7.3)	8.5 (8.1, 8.9)	10.9 (10.4, 11.4)	15.7 (14.2, 17.3)
Rheumatoid Arthritis	56	1228	0.7 (0.4, 1.4)	2.2 (1.5, 3.3)	3.1 (2.2, 4.4)	4.4 (3.2, 5.9)	6.0 (4.5, 7.9)	
Tumour	54	358	4.1 (2.4, 6.9)	13.0 (9.5, 17.7)	17.7 (13.3, 23.4)	21.1 (15.9, 27.6)	27.5 (20.7, 36.0)	
Other Inflammatory Arthritis	25	331	2.6 (1.3, 5.1)	4.0 (2.3, 7.0)	5.4 (3.3, 8.9)	7.9 (5.0, 12.4)	11.9 (7.9, 17.9)	
Other (5)	24	206	1.5 (0.5, 4.7)	9.1 (5.7, 14.4)	11.6 (7.5, 17.7)	12.6 (8.2, 19.0)		
TOTAL	2459	33897						

Note: Only primary diagnoses with over 60 procedures have been listed

Figure YK3 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Primary Diagnosis



HR - adjusted for age and gender

Rheumatoid Arthritis vs Osteoarthritis
Entire Period: HR=0.42 (0.32, 0.55),p<0.001

Tumour vs Osteoarthritis
Entire Period: HR=1.36 (0.98, 1.89),p=0.061

Other Inflammatory Arthritis vs Osteoarthritis
Entire Period: HR=0.85 (0.57, 1.26),p=0.405

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Osteoarthritis	31774	27978	21166	15481	10758	5450	182
Rheumatoid Arthritis	1228	1153	976	796	651	394	26
Tumour	358	280	176	125	81	41	3
Other Inflammatory Arthritis	331	287	237	181	131	82	3

OUTCOME FOR OSTEOARTHRITIS

There have been 31,774 primary total knee replacement procedures recorded by the Registry for patients aged less than 55 years with osteoarthritis. At 10 years the cumulative percent revision for this group is 10.9%. At 15 years this has increased to 15.7% (Table YK4 and Figure YK4).

"At 10 years the cumulative percent revision for osteoarthritis is 10.9%. At 15 years this has increased to 15.7%."

GENDER

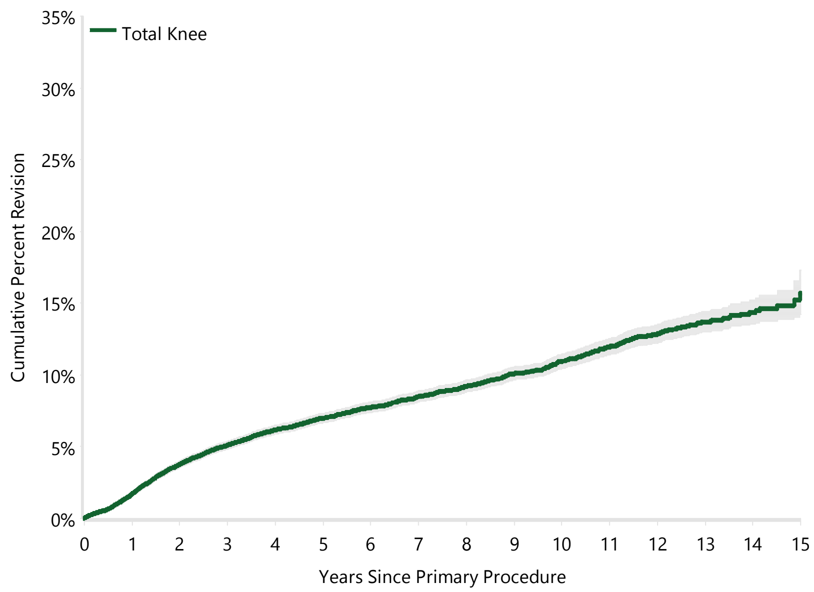
The majority of patients in this age group are female (57.1%). This is similar to the proportion of females in the 55 years and older group (56.5%) (Table YK5).

Young males have a higher rate of revision compared to young females, but this is only evident in the first year (Table YK6 and Figure YK5). This is due to a higher rate of revision for infection (Table YK7, Figures YK6 and YK7).

Table YK4 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years (Primary Diagnosis OA)

Type of Primary	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Total Knee	2300	31774	1.7 (1.6, 1.9)	5.1 (4.8, 5.4)	7.0 (6.7, 7.3)	8.5 (8.1, 8.9)	10.9 (10.4, 11.4)	15.7 (14.2, 17.3)
TOTAL	2300	31774						

Figure YK4 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Total Knee	31774	27978	21166	15481	10758	5450	182

Table YK5 Primary Total Knee Replacement by Gender and Age (Primary Diagnosis OA)

Gender	<55 N	<55 Col%	≥55 N	≥55 Col%	TOTAL N	TOTAL Col%
Male	13630	42.9	195865	43.5	209495	43.4
Female	18144	57.1	254734	56.5	272878	56.6
TOTAL	**31774**	**100.0**	**450599**	**100.0**	**482373**	**100.0**

Table YK6 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Gender (Primary Diagnosis OA)

Gender	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	995	13630	2.0 (1.8, 2.3)	5.3 (4.9, 5.7)	6.9 (6.5, 7.4)	8.4 (7.8, 9.0)	10.8 (10.0, 11.5)	15.1 (13.5, 17.0)
Female	1305	18144	1.5 (1.3, 1.7)	4.9 (4.6, 5.3)	7.0 (6.6, 7.5)	8.6 (8.1, 9.1)	11.1 (10.4, 11.7)	16.1 (13.9, 18.7)
TOTAL	**2300**	**31774**						

Figure YK5 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Gender (Primary Diagnosis OA)

HR - adjusted for age

Male vs Female

0 - 1Yr: HR=1.33 (1.12, 1.58),p=0.001

1Yr - 1.5Yr: HR=0.88 (0.70, 1.10),p=0.259

1.5Yr+: HR=0.91 (0.82, 1.01),p=0.091

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	13630	11974	9145	6719	4685	2425	85
Female	18144	16004	12021	8762	6073	3025	97

Figure YK6 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement in Patients Aged <55 Years by Gender (Primary Diagnosis OA)

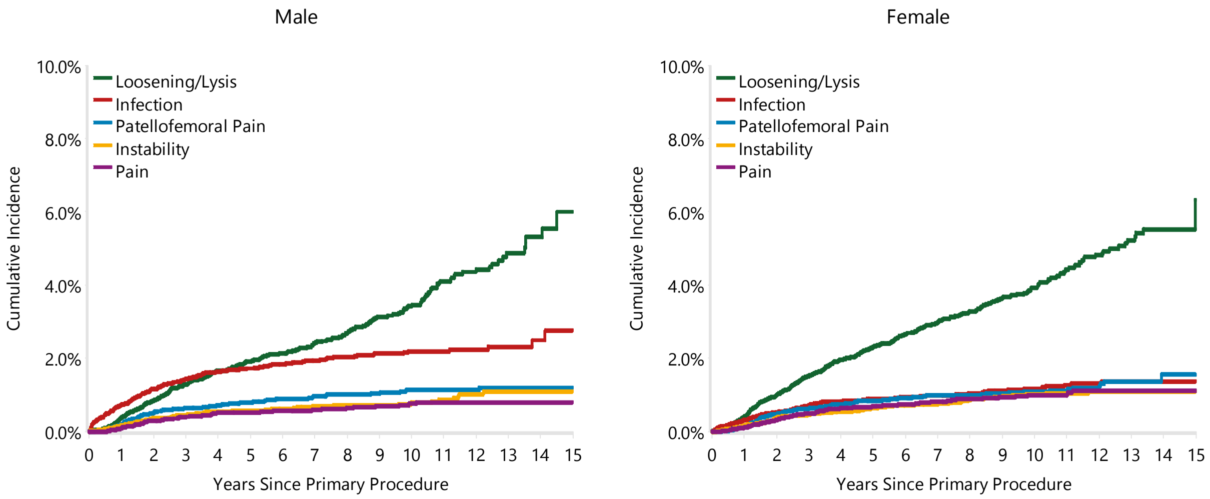
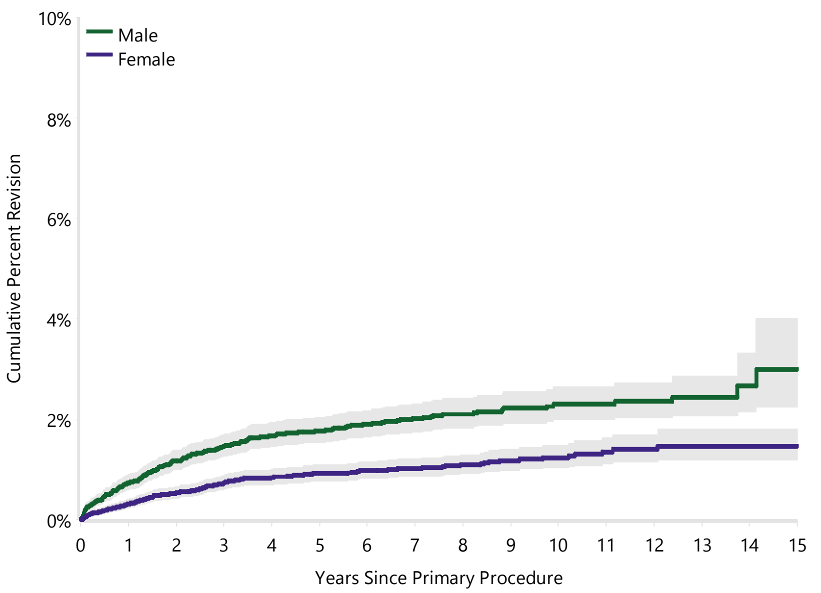


Table YK7 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 years by Gender (Primary Diagnosis OA, Revision for Infection)

Gender	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	228	13630	0.7 (0.6, 0.9)	1.5 (1.3, 1.7)	1.8 (1.5, 2.0)	2.0 (1.7, 2.3)	2.3 (2.0, 2.6)	3.0 (2.2, 4.0)
Female	154	18144	0.3 (0.2, 0.4)	0.7 (0.6, 0.9)	0.9 (0.8, 1.1)	1.0 (0.9, 1.2)	1.2 (1.0, 1.5)	1.5 (1.2, 1.8)
TOTAL	382	31774						

Figure YK7 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Gender (Primary Diagnosis OA, Revision for Infection)



HR - adjusted for age

Male vs Female

Entire Period: HR=1.94 (1.58, 2.38),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	13630	11974	9145	6719	4685	2425	85
Female	18144	16004	12021	8762	6073	3025	97

PROSTHESIS CHARACTERISTICS

Fixation

In those aged 55 years or less, cemented fixation was used more often than cementless and hybrid fixation (47.9%, 27.9% and 24.2% respectively). The percentage of use in the 55 years and over age group was 54.1% (cemented), 21.1% (cementless) and 24.8% (hybrid fixation). Compared to older patients, cemented fixation was used less frequently and there was increased use of cementless fixation. There was a similar use of hybrid fixation (Table YK8).

The approach to fixation makes little difference to revision rates in younger patients. Cementless fixation has a higher rate of revision compared to cemented fixation, but this is only evident in the first 1.5 years. There was no difference between hybrid and other methods of fixation (Table YK9 and Figure YK8). In males, there was no difference in revision rates based on fixation (Table YK10 and Figure YK9). Females had a lower rate of revision for cemented fixation compared to cementless fixation. There was no difference between hybrid and either cemented or cementless fixation in females (Table YK10 and Figure YK10).

The cumulative incidence of the most common revision diagnoses are presented for the three fixation methods. All forms of fixation had similar proportions of revisions for loosening/lysis (Figure YK11).

Revision for infection was higher in those with cemented compared to cementless fixation (Table YK11 and Figure YK12). The difference in rate of revision for infection was seen in both males and females, but is more apparent in males (Table YK12, Figures YK13 and YK14). The reason for the increase in revision for infection when cement is used is unclear.

Stability

Minimally stabilised prostheses (71.8%) were used more often than posterior stabilised prostheses (27.2%) in younger patients. Fully constrained and hinged prostheses are usually reserved for difficult or complex primary cases and were rarely used. The proportions of usage are similar to the patients in the 55 years and over group (Table YK13).

Minimally stabilised prostheses have a lower rate of revision compared to posterior stabilised prostheses (Table YK14 and Figure YK15). The five most common reasons for revision for minimally and posterior stabilised prostheses are shown in Figure YK16.

Bearing Mobility

The Registry approach to bearing classification is described in the primary total knee chapter. Fixed bearing prostheses were used in 75.3% of procedures undertaken in the younger group and rotating bearings were used in 23.2%. Other forms of mobility were rarely used. Compared to the older age group, there were fewer fixed and more rotating bearing prostheses used in the younger age group (Table YK15).

In younger patients, rotating bearing prostheses had a higher rate of revision compared to fixed bearing prostheses, but only for the first three years. After five years, rotating bearing prostheses had a lower rate of revision. There was no difference in the rate of revision between fixed bearing prostheses and those with other forms of bearing mobility (Table YK16 and Figure YK17).

Bearing Surface

Non XLPE was used in 71.4% of primary total knee replacements in the younger patients. The proportion of non XLPE used is similar to the 55 years and over primary total knee group (72.4%) (Table YK17).

XLPE had a lower rate of revision in younger patients compared to non XLPE (Table YK18 and Figure YK18). The five most common reasons for revision are shown in Figure YK19. The rate of revision for loosening/lysis in the XLPE group is lower (Table YK19 and Figure YK20).

"The approach to fixation makes little difference to revision rates in younger patients."

PATELLAR RESURFACING

Patellar components were used in 48.0% of primary total knee replacements in younger patients. This is a little less than the percentage used in those 55 years and over (50.4%) (Table YK20).

Patellar resurfacing was associated with a lower rate of revision in the first two years (Table YK21 and Figure YK21).

COMPUTER NAVIGATION

Computer navigation was used in 17.8% of procedures in the young patient group. This is similar to its use in older patients (16.6%) (Table YK22).

The use of computer navigation is associated with a lower rate of revision (Table YK23 and Figure YK22). There was a lower rate of revision for loosening/lysis in the navigated group (Table YK24, Figures YK23 and YK24).

IMAGE DERIVED INSTRUMENTATION

Image derived instrumentation (IDI) for primary total knee replacement has been used in only 3.5% of procedures in those aged less than 55 years. There is no difference in the rate of revision when this method is used (Table YK25 and Figure YK25).

PROSTHESIS TYPES

In this younger age group, there are 22 total knee replacement prosthesis combinations that have been used in more than 400 procedures with at least five years follow up. There is a considerable range of outcomes for these prostheses. The 10 year cumulative percent revision varies from 5.1% to 14.0% (Table YK26).

The better performing prostheses in this age group are also among the better performing prostheses for all age groups.

> **"Prosthesis choice is also an important factor with an almost three-fold variation in the 10 year cumulative percent revision rates depending on the type of prosthesis used."**

SUMMARY

Osteoarthritis was the most common diagnosis for patients less than 55 years of age undergoing primary total knee replacement. These patients had a 10 year cumulative percent revision of 10.9% and a 15 year cumulative percent revision of 15.7%. In this age group, the use of minimally stabilised prostheses, XLPE, patellar resurfacing and computer navigation were associated with lower rates of revision. Prosthesis choice is also an important factor with an almost three-fold variation in the 10 year cumulative percent revision rates depending on the type of prosthesis used.

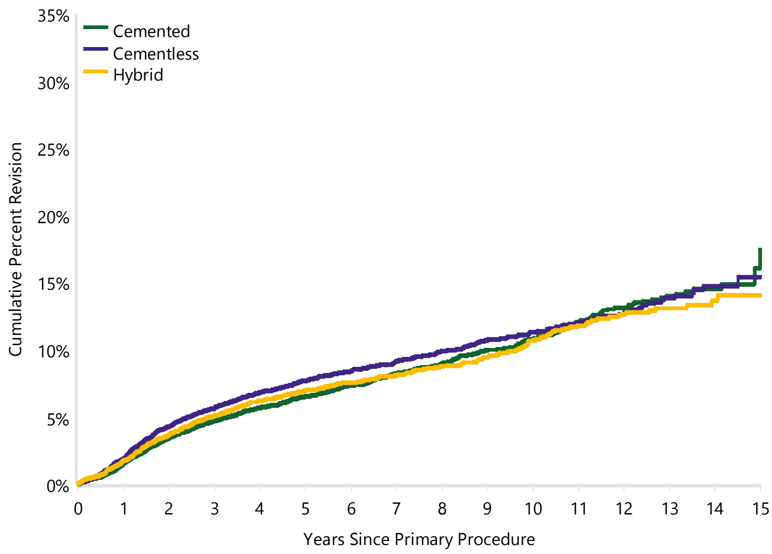
Table YK8 Primary Total Knee Replacement by Fixation and Age (Primary Diagnosis OA)

	<55		≥55		TOTAL	
Fixation	N	Col%	N	Col%	N	Col%
Cemented	15210	47.9	243579	54.1	258789	53.6
Cementless	8871	27.9	95281	21.1	104152	21.6
Hybrid	7693	24.2	111739	24.8	119432	24.8
TOTAL	**31774**	**100.0**	**450599**	**100.0**	**482373**	**100.0**

Table YK9 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Fixation (Primary Diagnosis OA)

Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	1008	15210	1.6 (1.4, 1.8)	4.7 (4.4, 5.1)	6.5 (6.1, 7.0)	8.2 (7.7, 8.8)	10.8 (10.1, 11.6)	17.5 (14.0, 21.6)
Cementless	746	8871	1.9 (1.7, 2.2)	5.7 (5.2, 6.2)	7.7 (7.1, 8.3)	9.2 (8.5, 9.9)	11.3 (10.5, 12.2)	15.4 (13.5, 17.6)
Hybrid	546	7693	1.8 (1.5, 2.1)	5.1 (4.6, 5.7)	7.0 (6.4, 7.7)	8.1 (7.4, 8.9)	10.8 (9.8, 11.8)	14.1 (12.4, 15.9)
TOTAL	2300	31774						

Figure YK8 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Fixation (Primary Diagnosis OA)



HR - adjusted for age and gender

Cementless vs Cemented

0 - 1.5Yr: HR=1.33 (1.13, 1.55),p<0.001

1.5Yr - 2.5Yr: HR=1.08 (0.87, 1.33),p=0.498

2.5Yr+: HR=0.96 (0.84, 1.11),p=0.595

Hybrid vs Cemented

0 - 1.5Yr: HR=1.14 (0.96, 1.36),p=0.132

1.5Yr+: HR=0.93 (0.82, 1.06),p=0.298

Cementless vs Hybrid

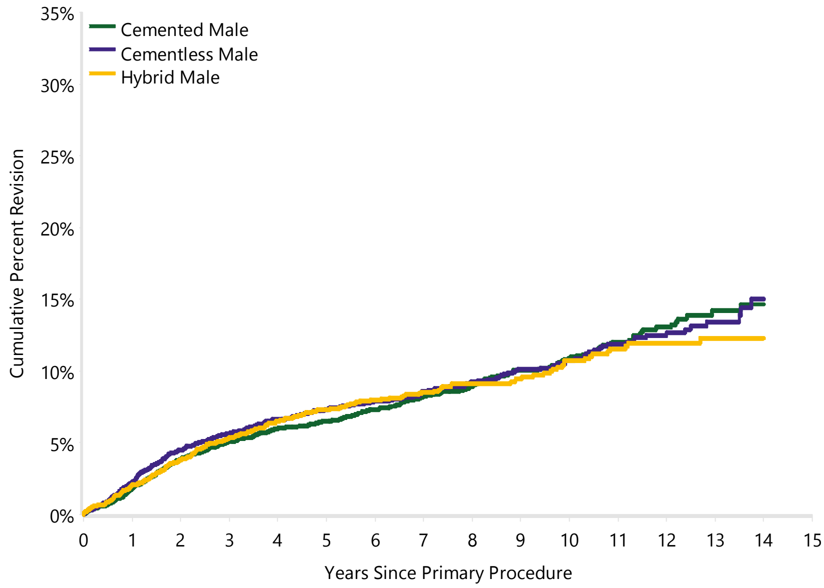
Entire Period: HR=1.10 (0.98, 1.23),p=0.091

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	15210	13077	9617	6849	4666	2276	59
Cementless	8871	8134	6562	4901	3436	1769	71
Hybrid	7693	6767	4987	3731	2656	1405	52

Table YK10 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Fixation and Gender (Primary Diagnosis OA)

Fixation	Gender	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	Male	432	6335	1.8 (1.5, 2.2)	5.1 (4.5, 5.7)	6.5 (5.8, 7.2)	8.2 (7.4, 9.1)	10.9 (9.8, 12.1)	
	Female	576	8875	1.4 (1.2, 1.7)	4.5 (4.0, 5.0)	6.6 (6.0, 7.2)	8.3 (7.6, 9.1)	10.8 (9.8, 11.8)	
Cementless	Male	332	4080	2.3 (1.8, 2.8)	5.6 (4.9, 6.4)	7.3 (6.5, 8.2)	8.6 (7.7, 9.6)	10.7 (9.5, 12.1)	
	Female	414	4791	1.7 (1.3, 2.1)	5.7 (5.0, 6.4)	8.1 (7.2, 9.0)	9.6 (8.7, 10.6)	11.8 (10.7, 13.0)	14.6 (12.8, 16.5)
Hybrid	Male	231	3215	2.0 (1.6, 2.6)	5.3 (4.6, 6.3)	7.3 (6.3, 8.4)	8.5 (7.4, 9.7)	10.7 (9.3, 12.3)	
	Female	315	4478	1.6 (1.2, 2.0)	5.0 (4.3, 5.7)	6.7 (6.0, 7.6)	7.9 (7.0, 8.9)	10.8 (9.5, 12.2)	
TOTAL		2300	31774						

Figure YK9 Cumulative Percent Revision of Primary Total Knee Replacement in Males Aged <55 Years by Fixation (Primary Diagnosis OA)



HR - adjusted for age

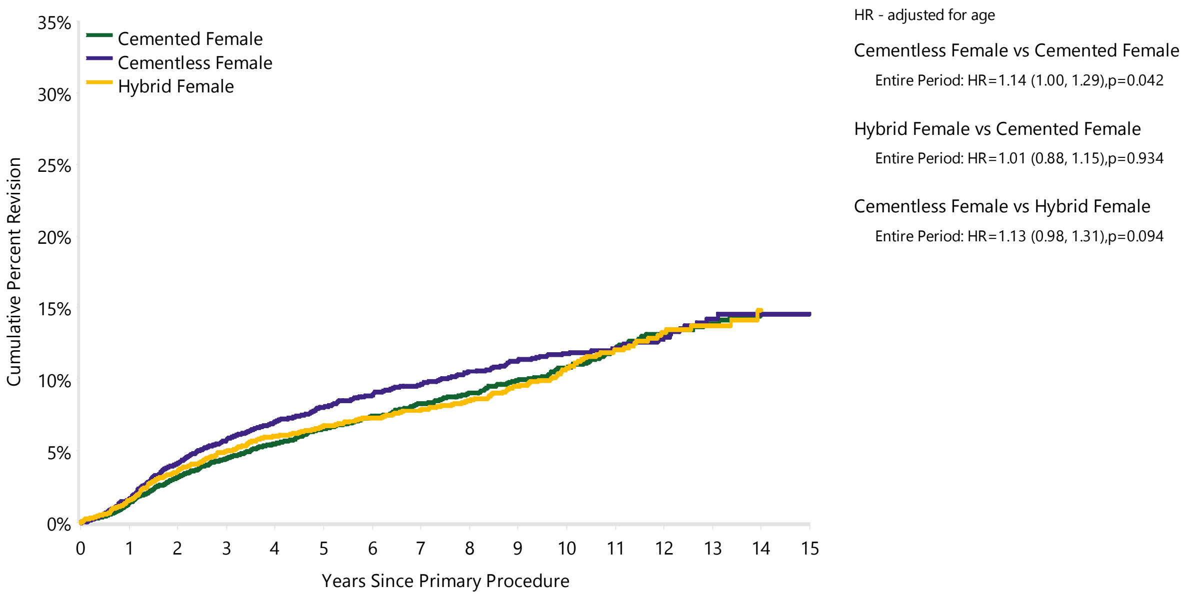
Cementless Male vs Cemented Male
Entire Period: HR=1.06 (0.91, 1.22),p=0.457

Hybrid Male vs Cemented Male
Entire Period: HR=1.00 (0.85, 1.17),p=0.975

Cementless Male vs Hybrid Male
Entire Period: HR=1.06 (0.89, 1.25),p=0.507

Number at Risk	Gender	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	Male	6335	5435	4030	2866	1948	1007	24
Cementless	Male	4080	3731	3021	2268	1597	819	30
Hybrid	Male	3215	2808	2094	1585	1140	599	31

Figure YK10 Cumulative Percent Revision of Primary Total Knee Replacement in Females Aged <55 Years by Fixation (Primary Diagnosis OA)



Number at Risk	Gender	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	Female	8875	7642	5587	3983	2718	1269	35
Cementless	Female	4791	4403	3541	2633	1839	950	41
Hybrid	Female	4478	3959	2893	2146	1516	806	21

Figure YK11 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement in Patients Aged <55 Years by Fixation (Primary Diagnosis OA)

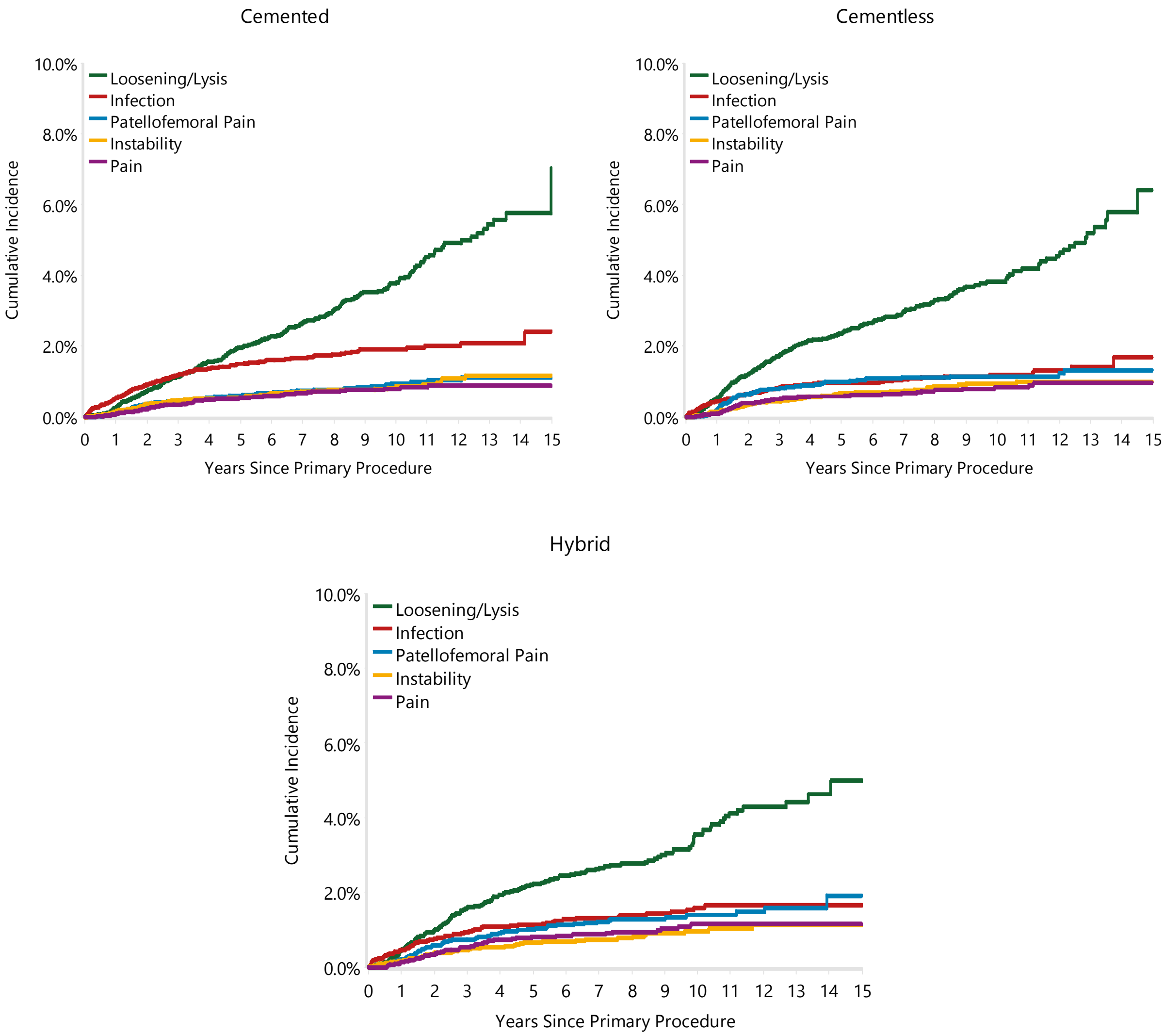
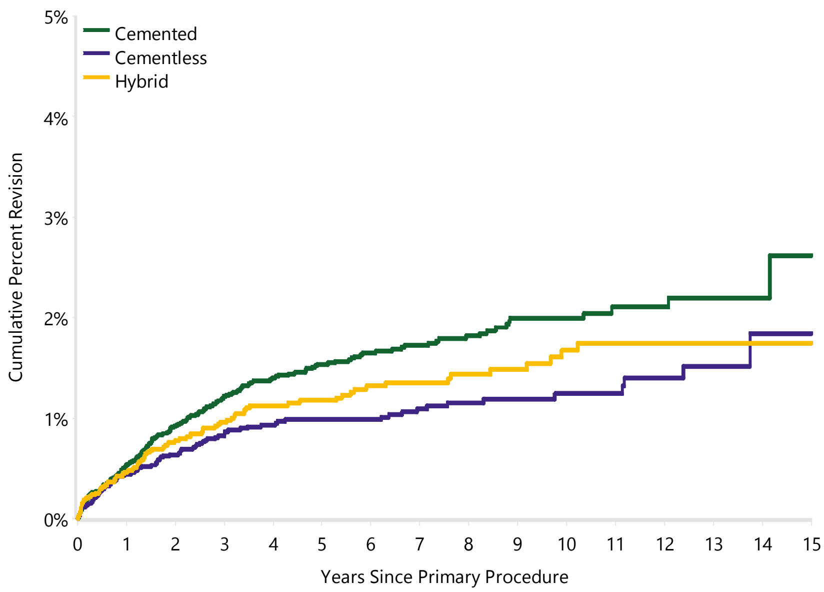


Table YK11 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Fixation (Primary Diagnosis OA, Revision for Infection)

Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	207	15210	0.5 (0.4, 0.7)	1.2 (1.0, 1.4)	1.5 (1.3, 1.8)	1.7 (1.5, 2.0)	2.0 (1.7, 2.3)	2.6 (1.8, 3.7)
Cementless	88	8871	0.4 (0.3, 0.6)	0.8 (0.6, 1.0)	1.0 (0.8, 1.2)	1.1 (0.9, 1.4)	1.2 (1.0, 1.6)	1.8 (1.2, 2.8)
Hybrid	87	7693	0.5 (0.3, 0.6)	1.0 (0.7, 1.2)	1.2 (0.9, 1.5)	1.4 (1.1, 1.7)	1.7 (1.3, 2.1)	1.7 (1.4, 2.2)
TOTAL	382	31774						

Figure YK12 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Fixation (Primary Diagnosis OA, Revision for Infection)



HR - adjusted for age and gender

Cemented vs Cementless

Entire Period: HR=1.57 (1.22, 2.01),p<0.001

Hybrid vs Cementless

Entire Period: HR=1.25 (0.93, 1.68),p=0.141

Cemented vs Hybrid

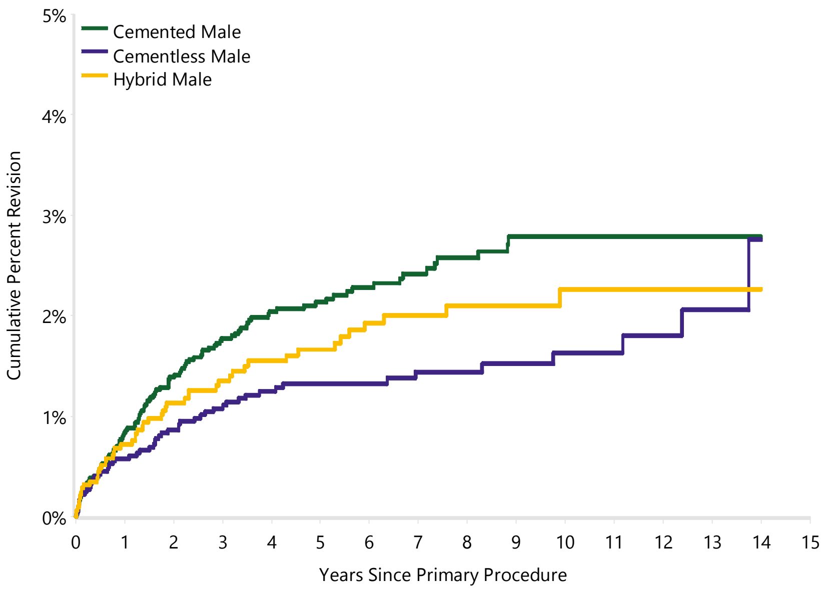
Entire Period: HR=1.26 (0.98, 1.61),p=0.074

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	15210	13077	9617	6849	4666	2276	59
Cementless	8871	8134	6562	4901	3436	1769	71
Hybrid	7693	6767	4987	3731	2656	1405	52

Table YK12 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Fixation and Gender (Primary Diagnosis OA, Revision for Infection)

Fixation	Gender	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	Male	123	6335	0.8 (0.6, 1.1)	1.8 (1.5, 2.2)	2.1 (1.8, 2.6)	2.4 (2.0, 2.9)	2.8 (2.3, 3.4)	
	Female	84	8875	0.3 (0.2, 0.5)	0.8 (0.6, 1.0)	1.1 (0.9, 1.4)	1.2 (1.0, 1.5)	1.4 (1.1, 1.8)	
Cementless	Male	54	4080	0.6 (0.4, 0.9)	1.1 (0.8, 1.5)	1.3 (1.0, 1.8)	1.4 (1.1, 1.9)	1.6 (1.2, 2.2)	
	Female	34	4791	0.3 (0.2, 0.5)	0.6 (0.4, 0.9)	0.7 (0.5, 1.0)	0.8 (0.5, 1.1)	0.9 (0.6, 1.3)	1.0 (0.7, 1.6)
Hybrid	Male	51	3215	0.7 (0.5, 1.1)	1.4 (1.0, 1.9)	1.7 (1.2, 2.2)	2.0 (1.5, 2.7)	2.3 (1.7, 3.1)	
	Female	36	4478	0.3 (0.2, 0.5)	0.7 (0.5, 1.0)	0.8 (0.6, 1.2)	0.9 (0.6, 1.2)	1.2 (0.8, 1.8)	
TOTAL		382	31774						

Figure YK13 Cumulative Percent Revision of Primary Total Knee Replacement in Males Aged <55 Years by Fixation (Primary Diagnosis OA, Revision for Infection)



HR - adjusted for age

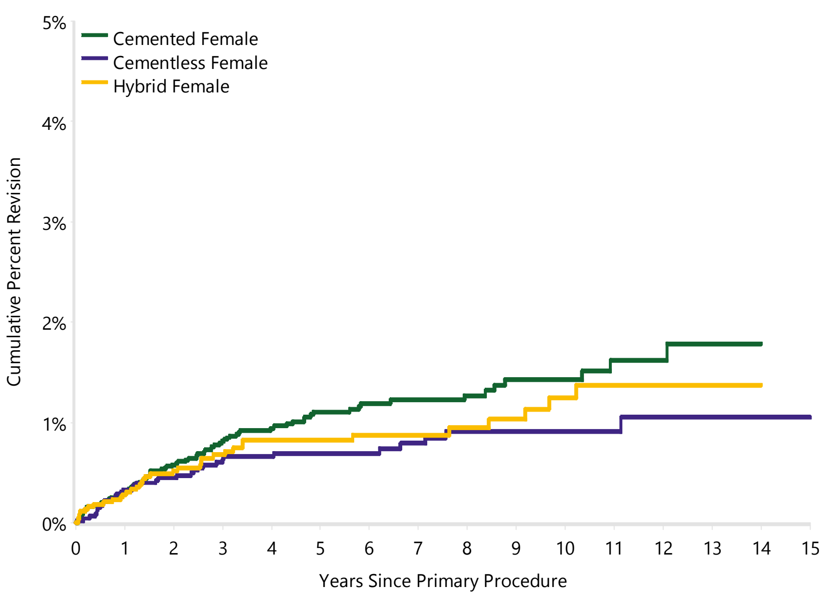
Cemented Male vs Cementless Male
Entire Period: HR=1.62 (1.17, 2.22),p=0.003

Hybrid Male vs Cementless Male
Entire Period: HR=1.27 (0.86, 1.86),p=0.228

Cemented Male vs Hybrid Male
Entire Period: HR=1.28 (0.92, 1.77),p=0.143

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	Male	6335	5435	4030	2866	1948	1007	24
Cementless	Male	4080	3731	3021	2268	1597	819	30
Hybrid	Male	3215	2808	2094	1585	1140	599	31

Figure YK14 Cumulative Percent Revision of Primary Total Knee Replacement in Females Aged <55 Years by Fixation (Primary Diagnosis OA, Revision for Infection)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	Female	8875	7642	5587	3983	2718	1269	35
Cementless	Female	4791	4403	3541	2633	1839	950	41
Hybrid	Female	4478	3959	2893	2146	1516	806	21

Table YK13 Primary Total Knee Replacement by Stability and Age (Primary Diagnosis OA)

	<55		≥55		TOTAL	
Stability	N	Col%	N	Col%	N	Col%
Minimally Stabilised	22817	71.8	325199	72.2	348016	72.2
Posterior Stabilised	8631	27.2	121697	27.0	130328	27.0
Fully Stabilised	242	0.8	3092	0.7	3334	0.7
Hinged	73	0.2	469	0.1	542	0.1
TOTAL	**31763**	**100.0**	**450457**	**100.0**	**482220**	**100.0**

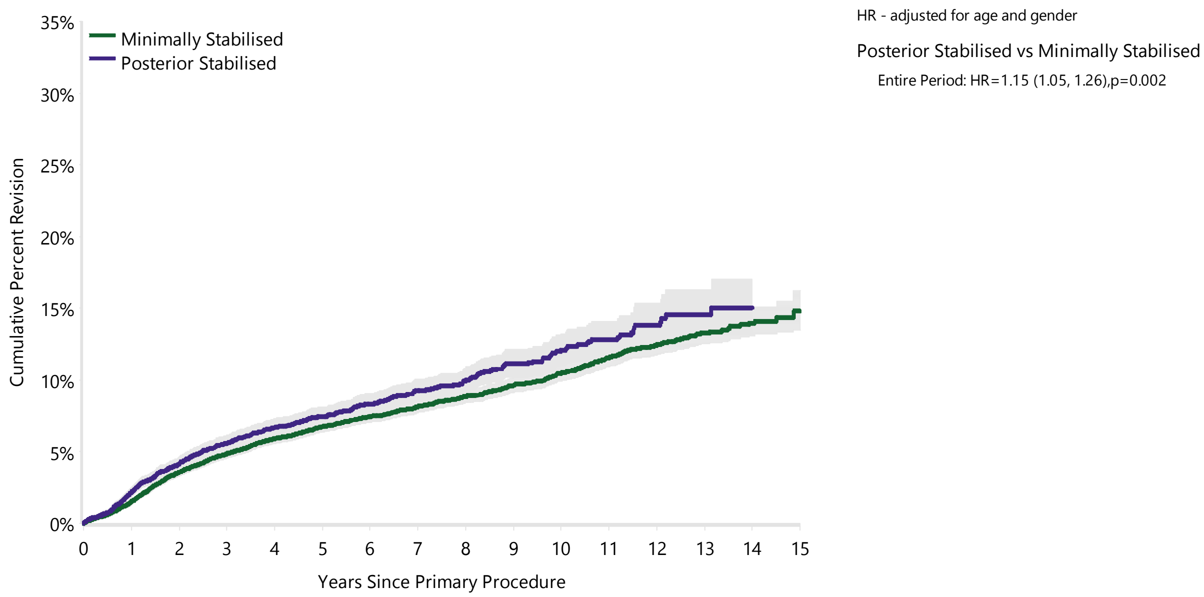
Note: Excluding 153 procedures with unknown stability

Table YK14 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Stability (Primary Diagnosis OA)

Stability	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Fully Stabilised	17	242	3.1 (1.4, 6.9)	9.3 (5.4, 15.8)				
Hinged	13	73	4.2 (1.4, 12.4)	15.8 (8.8, 27.6)	15.8 (8.8, 27.6)	19.2 (10.7, 33.0)		
Minimally Stabilised	1630	22817	1.5 (1.4, 1.7)	4.8 (4.5, 5.1)	6.7 (6.4, 7.1)	8.1 (7.7, 8.6)	10.5 (9.9, 11.0)	14.8 (13.5, 16.2)
Posterior Stabilised	638	8631	2.2 (1.9, 2.5)	5.6 (5.1, 6.1)	7.4 (6.8, 8.1)	9.2 (8.5, 10.0)	12.1 (11.0, 13.2)	
TOTAL	2298	31763						

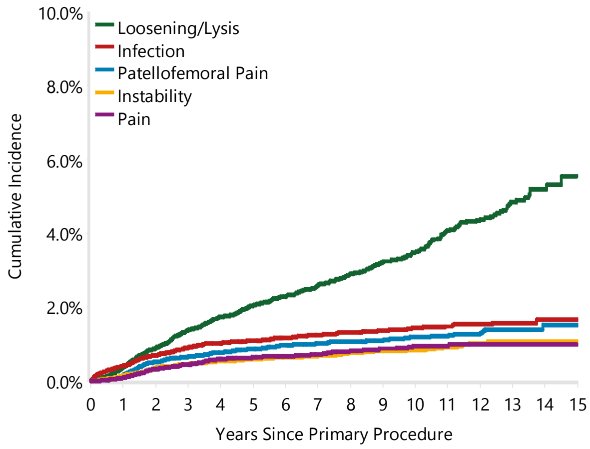
Note: Excluding 11 procedures with unknown stability

Figure YK15 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Stability (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Minimally Stabilised	22817	20198	15462	11481	8257	4489	168
Posterior Stabilised	8631	7555	5586	3930	2461	943	14

Figure YK16 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement in Patients Aged <55 Years by Stability (Primary Diagnosis OA)



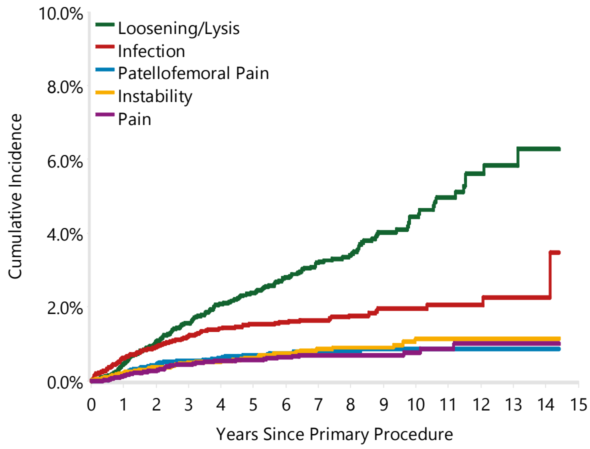


Table YK15 Primary Total Knee Replacement by Bearing Mobility and Age (Primary Diagnosis OA)

	<55		≥55		TOTAL	
Bearing Mobility	N	Col%	N	Col%	N	Col%
Fixed	23903	75.3	352391	78.2	376294	78.0
Rotating	7375	23.2	92736	20.6	100111	20.8
Rotating - Sliding	386	1.2	4463	1.0	4849	1.0
Sliding	99	0.3	849	0.2	948	0.2
TOTAL	31763	100.0	450439	100.0	482202	100.0

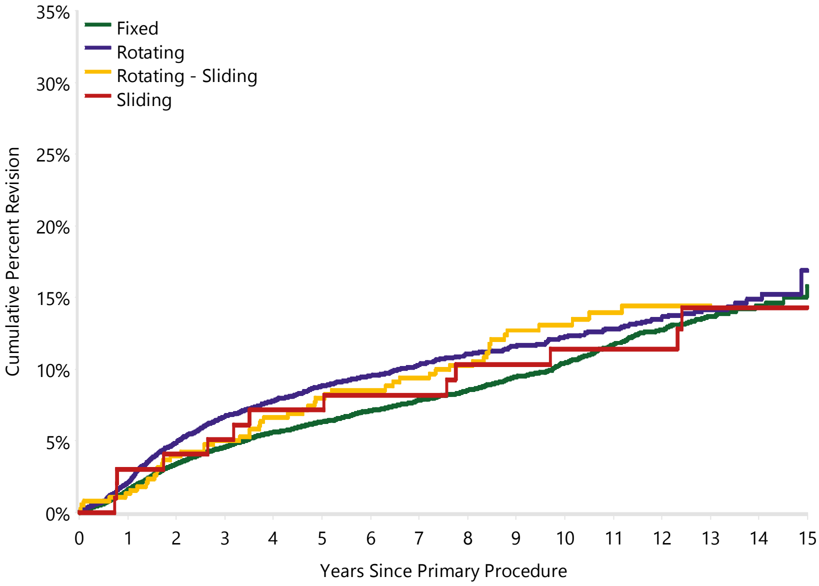
Note: Excluding 171 procedures with unknown bearing mobility

Table YK16 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Bearing Mobility (Primary Diagnosis OA)

Bearing Mobility	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Fixed	1540	23903	1.6 (1.4, 1.8)	4.6 (4.3, 4.9)	6.3 (6.0, 6.7)	7.8 (7.4, 8.3)	10.4 (9.8, 11.0)	15.8 (13.9, 17.9)
Rotating	695	7375	2.1 (1.8, 2.5)	6.7 (6.1, 7.3)	8.8 (8.2, 9.6)	10.3 (9.5, 11.1)	12.3 (11.3, 13.2)	16.9 (13.6, 20.8)
Rotating - Sliding	50	386	1.3 (0.5, 3.1)	5.0 (3.2, 7.7)	8.0 (5.7, 11.2)	9.4 (6.8, 12.8)	13.1 (10.0, 17.0)	
Sliding	13	99	3.0 (1.0, 9.1)	5.1 (2.2, 11.8)	7.2 (3.5, 14.4)	8.2 (4.2, 15.7)	11.4 (6.5, 19.7)	14.3 (8.5, 23.5)
TOTAL	2298	31763						

Note: Excluding 11 procedures with unknown bearing mobility

Figure YK17 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Bearing Mobility (Primary Diagnosis OA)



HR - adjusted for age and gender

Rotating vs Fixed

0 - 1.5Yr: HR=1.47 (1.27, 1.70),p<0.001

1.5Yr - 3Yr: HR=1.46 (1.22, 1.75),p<0.001

3Yr - 5Yr: HR=1.21 (0.97, 1.51),p=0.094

5Yr+: HR=0.82 (0.68, 1.00),p=0.046

Rotating - Sliding vs Fixed

Entire Period: HR=1.19 (0.90, 1.58),p=0.230

Sliding vs Fixed

Entire Period: HR=0.97 (0.56, 1.68),p=0.906

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Fixed	23903	20778	15316	10787	7171	3534	112
Rotating	7375	6717	5396	4265	3181	1620	43
Rotating - Sliding	386	378	355	335	316	213	0
Sliding	99	96	92	89	87	81	27

Table YK17 Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

Polyethylene Type	<55 N	<55 Col%	≥55 N	≥55 Col%	TOTAL N	TOTAL Col%
Non XLPE	22673	71.4	326063	72.4	348736	72.3
XLPE	9092	28.6	124395	27.6	133487	27.7
TOTAL	**31765**	**100.0**	**450458**	**100.0**	**482223**	**100.0**

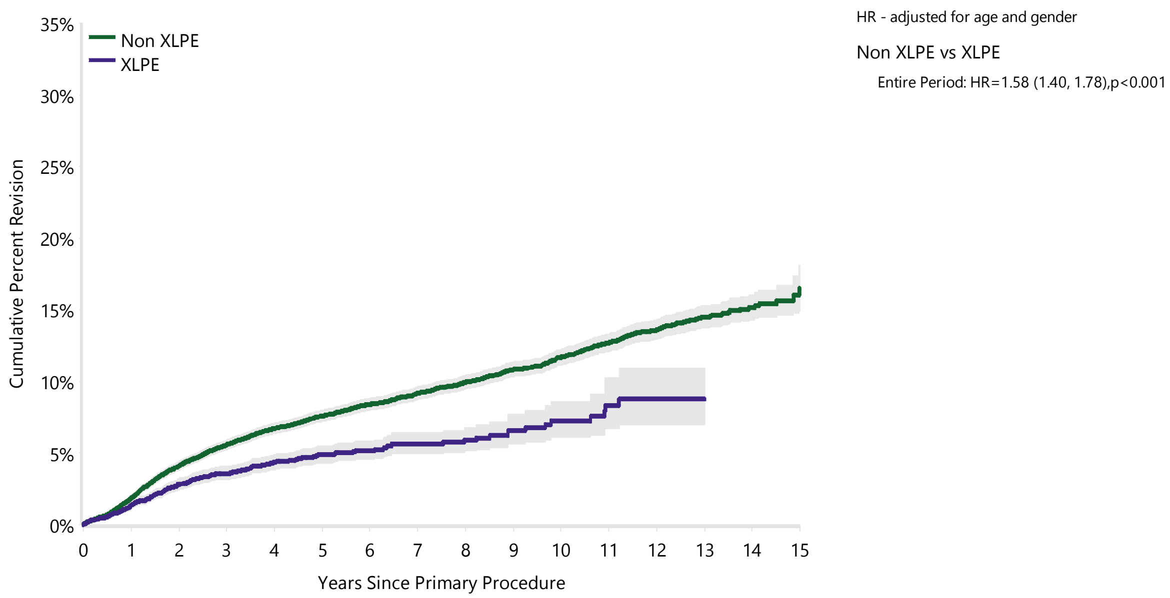
Note: Excluding 150 procedures with unknown bearing surface

Table YK18 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Polyethylene Type (Primary Diagnosis OA)

Polyethylene Type	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Non XLPE	1985	22673	1.8 (1.7, 2.0)	5.6 (5.3, 5.9)	7.6 (7.2, 8.0)	9.2 (8.7, 9.6)	11.7 (11.1, 12.2)	16.5 (15.0, 18.1)
XLPE	314	9092	1.4 (1.1, 1.6)	3.6 (3.2, 4.1)	4.9 (4.3, 5.5)	5.6 (5.0, 6.4)	7.2 (6.1, 8.6)	
TOTAL	**2299**	**31765**						

Note: Excluding 9 procedures with unknown bearing surface

Figure YK18 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Polyethylene Type (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Non XLPE	22673	20763	16879	13205	9713	5078	182
XLPE	9092	7206	4280	2271	1042	370	0

Figure YK19 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement in Patients Aged <55 Years by Polyethylene Type (Primary Diagnosis OA)

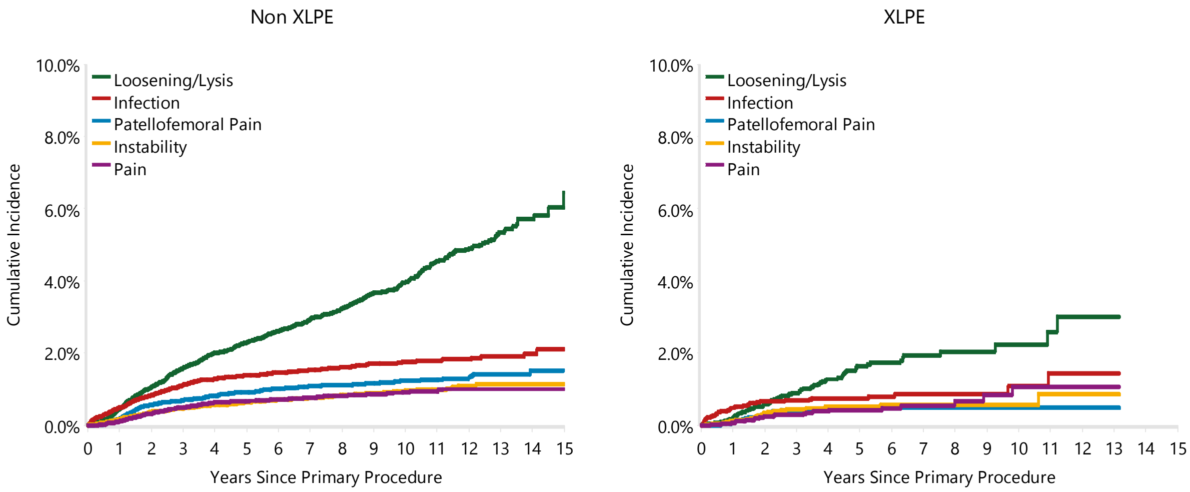
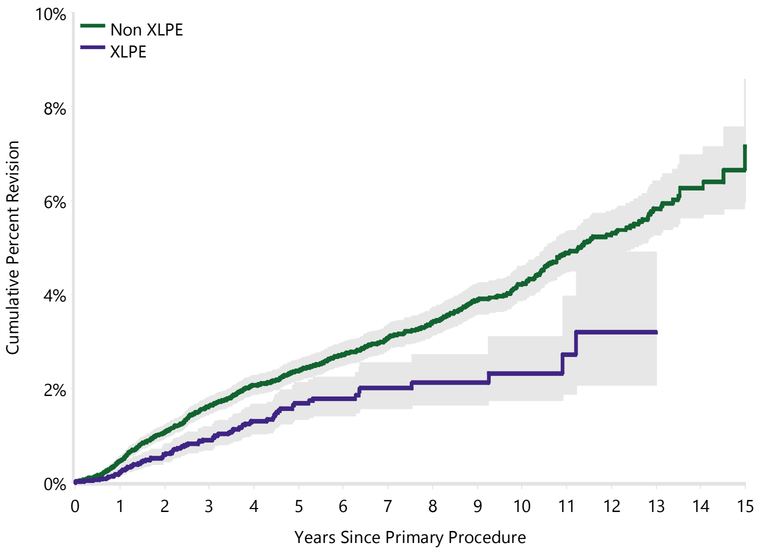


Table YK19 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 years by Type of Polyethylene (Primary Diagnosis OA, Revision for Loosening/Lysis)

Polyethylene Type	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Non XLPE	669	22673	0.5 (0.4, 0.6)	1.6 (1.4, 1.8)	2.4 (2.2, 2.6)	3.1 (2.8, 3.3)	4.2 (3.9, 4.6)	7.1 (5.9, 8.6)
XLPE	91	9092	0.2 (0.1, 0.3)	0.9 (0.7, 1.2)	1.7 (1.3, 2.1)	2.0 (1.6, 2.5)	2.3 (1.7, 3.1)	
TOTAL	760	31765						

Figure YK20 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Polyethylene Type (Primary Diagnosis OA, Revision for Loosening/Lysis)



HR - adjusted for age and gender

Non XLPE vs XLPE

Entire Period: HR=1.65 (1.32, 2.06),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Non XLPE	22673	20763	16879	13205	9713	5078	182
XLPE	9092	7206	4280	2271	1042	370	0

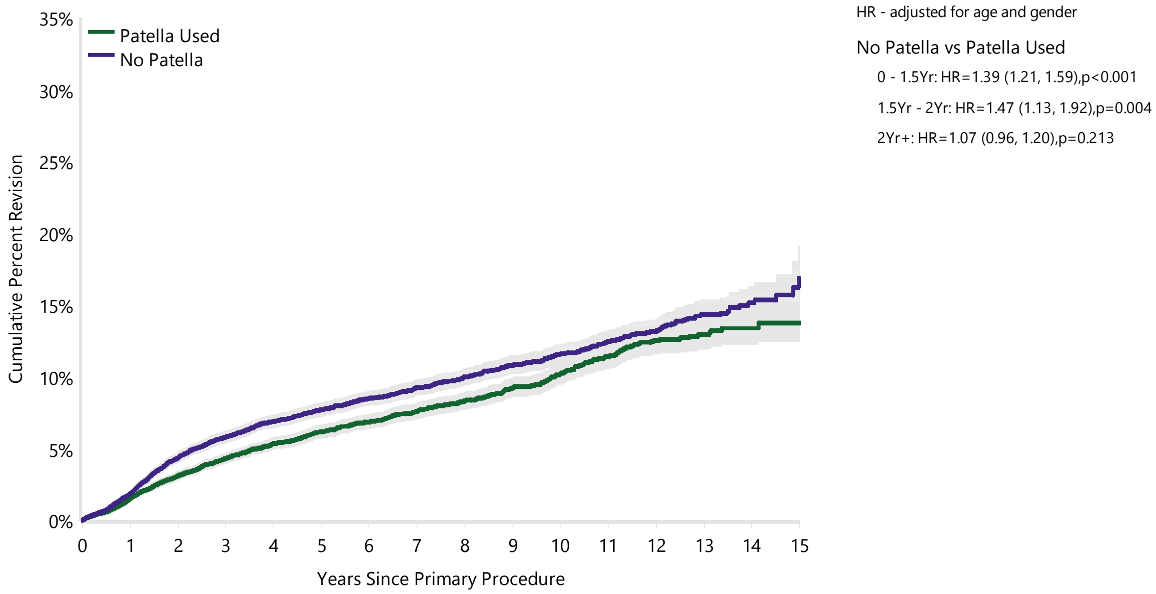
Table YK20 Primary Total Knee Replacement by Patella Usage and Age (Primary Diagnosis OA)

Patella Usage	<55		≥55		TOTAL	
	N	Col%	N	Col%	N	Col%
Patella Used	15245	48.0	226954	50.4	242199	50.2
No Patella	16529	52.0	223645	49.6	240174	49.8
TOTAL	31774	100.0	450599	100.0	482373	100.0

Table YK21 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Patella Usage (Primary Diagnosis OA)

Patella Usage	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Patella Used	940	15245	1.5 (1.3, 1.7)	4.3 (4.0, 4.7)	6.2 (5.7, 6.7)	7.6 (7.1, 8.1)	10.2 (9.5, 11.0)	13.7 (12.4, 15.1)
No Patella	1360	16529	1.9 (1.7, 2.1)	5.8 (5.4, 6.2)	7.7 (7.2, 8.2)	9.3 (8.7, 9.8)	11.6 (10.9, 12.3)	16.8 (14.8, 19.1)
TOTAL	2300	31774						

Figure YK21 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Patella Usage (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Patella Used	15245	13144	9586	6786	4682	2362	51
No Patella	16529	14834	11580	8695	6076	3088	131

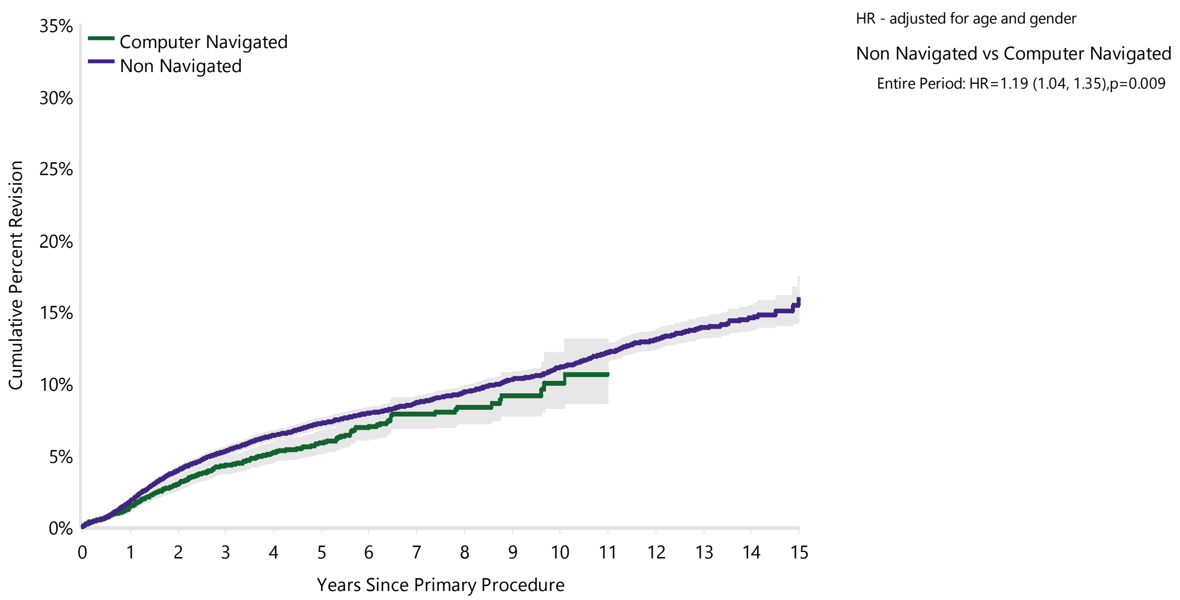
Table YK22 Primary Total Knee Replacement by Computer Navigation and Age (Primary Diagnosis OA)

	<55		≥55		TOTAL	
Computer Navigation	N	Col%	N	Col%	N	Col%
Non Navigated	26113	82.2	375788	83.4	401901	83.3
Computer Navigated	5661	17.8	74811	16.6	80472	16.7
TOTAL	31774	100.0	450599	100.0	482373	100.0

Table YK23 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Computer Navigation (Primary Diagnosis OA)

Computer Navigation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Computer Navigated	261	5661	1.4 (1.1, 1.7)	4.3 (3.7, 4.9)	5.8 (5.1, 6.7)	7.8 (6.8, 9.0)	10.0 (8.2, 12.1)	
Non Navigated	2039	26113	1.8 (1.6, 2.0)	5.2 (5.0, 5.5)	7.2 (6.9, 7.6)	8.6 (8.2, 9.0)	11.1 (10.6, 11.6)	15.8 (14.4, 17.5)
TOTAL	2300	31774						

Figure YK22 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Computer Navigation (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Computer Navigated	5661	4636	3041	1703	745	170	0
Non Navigated	26113	23342	18125	13778	10013	5280	182

Figure YK23 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement in Patients Aged <55 Years by Computer Navigation (Primary Diagnosis OA)

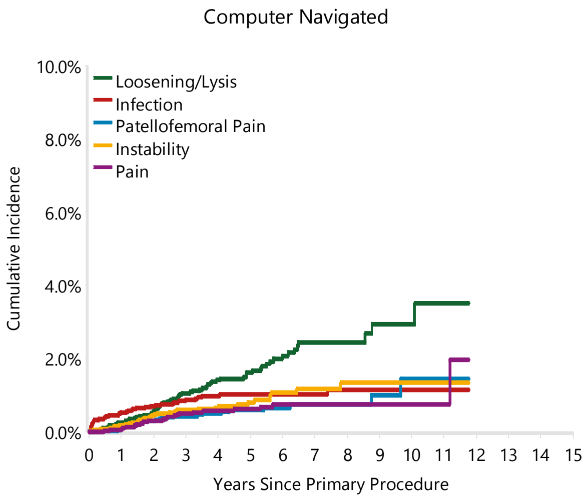
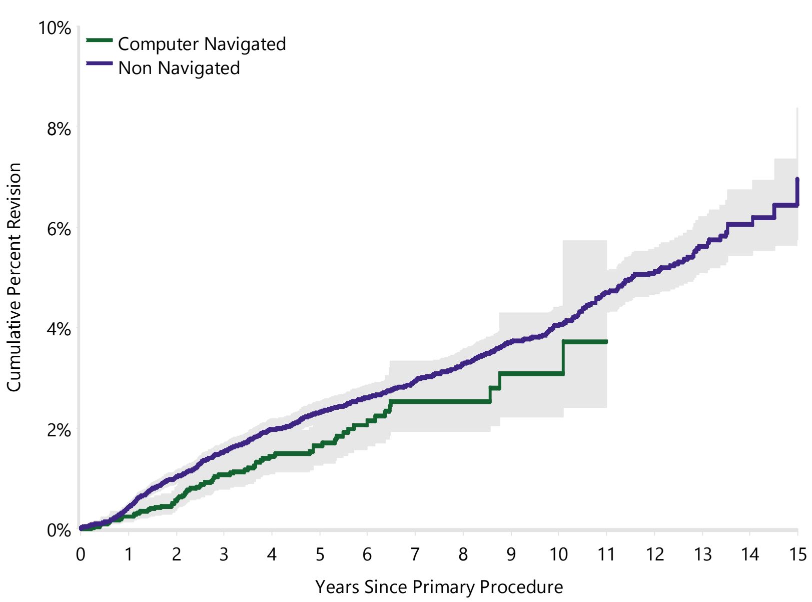


Table YK24 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Computer Navigation (Primary Diagnosis OA, Revision for Loosening/Lysis)

Computer Navigation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Computer Navigated	71	5661	0.2 (0.1, 0.4)	1.1 (0.8, 1.4)	1.7 (1.3, 2.2)	2.5 (1.9, 3.3)	3.1 (2.2, 4.3)	
Non Navigated	690	26113	0.4 (0.4, 0.5)	1.5 (1.4, 1.7)	2.3 (2.1, 2.5)	2.9 (2.7, 3.2)	4.0 (3.7, 4.4)	6.9 (5.8, 8.4)
TOTAL	761	31774						

Figure YK24 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Computer Navigation (Primary Diagnosis OA, Revision for Loosening/Lysis)



HR - adjusted for age and gender

Non Navigated vs Computer Navigated

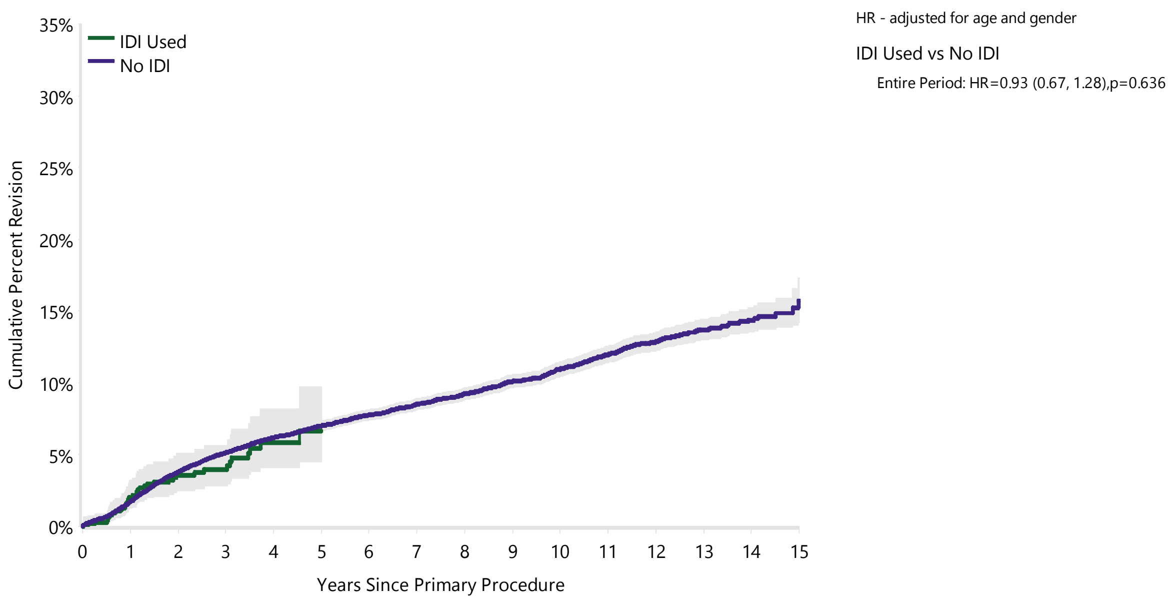
Entire Period: HR=1.34 (1.05, 1.72),p=0.019

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Computer Navigated	5661	4636	3041	1703	745	170	0
Non Navigated	26113	23342	18125	13778	10013	5280	182

Table YK25 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by IDI Usage (Primary Diagnosis OA)

IDI Usage	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
IDI Used	38	1101	2.0 (1.3, 3.2)	4.0 (2.8, 5.6)	6.6 (4.5, 9.7)			
No IDI	2262	30673	1.7 (1.6, 1.9)	5.1 (4.9, 5.4)	7.0 (6.7, 7.3)	8.5 (8.1, 8.9)	10.9 (10.5, 11.4)	15.7 (14.2, 17.3)
TOTAL	2300	31774						

Figure YK25 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by IDI Usage (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
IDI Used	1101	792	370	61	0	0	0
No IDI	30673	27186	20796	15420	10758	5450	182

Table YK26 Cumulative Percent Revision of Primary Total Knee Replacement in Patients Aged <55 Years by Prosthesis Combination (Primary Diagnosis OA)

Femoral Component	Tibial Component	N Revised	N Total	1 Yr	5 Yrs	7 Yrs	10 Yrs	12 Yrs	14 Yrs
Active Knee	Active Knee	55	678	1.2 (0.6, 2.4)	6.4 (4.7, 8.8)	7.7 (5.7, 10.4)	11.2 (8.4, 14.8)	14.6 (10.7, 19.8)	
Duracon	Duracon	125	1030	1.5 (0.9, 2.4)	7.1 (5.6, 8.8)	8.9 (7.3, 10.8)	10.9 (9.1, 13.1)	13.6 (11.5, 16.2)	15.5 (12.7, 18.9)
Genesis II CR	Genesis II	65	863	1.4 (0.8, 2.5)	7.7 (5.9, 10.0)	9.4 (7.3, 12.1)	11.2 (8.6, 14.4)	11.2 (8.6, 14.4)	
Genesis II Oxinium CR	Genesis II	88	777	2.2 (1.4, 3.6)	8.7 (6.9, 11.1)	10.3 (8.2, 12.9)	14.0 (11.3, 17.4)	16.7 (13.3, 20.9)	
Genesis II Oxinium PS	Genesis II	107	1370	2.7 (1.9, 3.7)	8.3 (6.8, 10.1)	9.7 (8.0, 11.8)	11.3 (9.2, 13.9)		
Genesis II PS	Genesis II	42	579	2.2 (1.2, 3.8)	7.1 (5.1, 9.9)	9.0 (6.4, 12.5)	11.4 (7.7, 16.8)		
LCS CR	LCS	72	499	2.0 (1.1, 3.7)	9.3 (7.0, 12.2)	10.3 (7.9, 13.3)	12.8 (10.2, 16.1)	14.0 (11.2, 17.4)	15.3 (12.3, 19.0)
LCS CR	MBT	102	1531	1.5 (0.9, 2.2)	7.1 (5.8, 8.8)	8.8 (7.2, 10.8)	10.0 (8.1, 12.3)	11.1 (8.9, 13.9)	
LCS CR	MBT Duofix	87	1005	2.4 (1.6, 3.5)	7.1 (5.6, 9.0)	8.8 (7.0, 10.9)	10.7 (8.7, 13.2)	11.6 (9.3, 14.5)	
Legion Oxinium PS	Genesis II	23	740	1.7 (0.9, 3.0)	5.5 (3.3, 9.0)				
Nexgen CR	Nexgen	47	504	1.2 (0.5, 2.7)	4.7 (3.1, 7.0)	6.4 (4.5, 9.1)	8.7 (6.4, 11.8)	10.3 (7.7, 13.7)	11.8 (8.8, 15.6)
Nexgen CR Flex	Nexgen	87	2377	1.3 (0.9, 1.8)	4.9 (3.9, 6.1)	5.0 (4.0, 6.3)	6.5 (4.9, 8.5)		
Nexgen CR Flex	Nexgen TM CR	29	760	0.4 (0.1, 1.2)	4.2 (2.8, 6.1)	5.1 (3.5, 7.4)			
Nexgen LPS Flex	Nexgen	105	1631	1.5 (1.0, 2.3)	6.3 (5.1, 7.8)	7.8 (6.3, 9.6)	11.5 (9.2, 14.2)	12.0 (9.6, 15.0)	
PFC Sigma CR	MBT	39	432	1.2 (0.5, 2.8)	8.5 (6.1, 11.8)	9.3 (6.8, 12.8)	10.7 (7.8, 14.6)	12.5 (8.5, 18.3)	
PFC Sigma CR	PFC Sigma	67	1153	1.2 (0.7, 2.0)	5.8 (4.4, 7.5)	7.0 (5.4, 9.1)	9.7 (7.4, 12.8)	10.5 (7.8, 14.0)	
PFC Sigma PS	MBT	23	514	0.8 (0.3, 2.1)	4.1 (2.7, 6.4)	4.6 (2.9, 7.1)	5.1 (3.3, 8.0)		
RBK	RBK	55	672	1.5 (0.8, 2.8)	8.0 (6.0, 10.4)	8.5 (6.5, 11.1)	10.2 (7.7, 13.3)	11.1 (8.2, 14.8)	
Scorpio CR	Series 7000	51	545	1.5 (0.8, 3.0)	7.0 (5.0, 9.6)	8.3 (6.1, 11.1)	10.3 (7.7, 13.6)	12.8 (9.7, 17.0)	
Triathlon CR	Triathlon	87	3179	1.1 (0.7, 1.5)	3.6 (2.8, 4.5)	5.3 (4.0, 6.9)			
Triathlon PS	Triathlon	24	663	1.5 (0.8, 2.8)	4.4 (2.9, 6.7)	4.9 (3.2, 7.3)			
Vanguard CR	Maxim	45	917	1.0 (0.5, 1.9)	6.8 (4.9, 9.2)	9.0 (6.4, 12.7)			
Other (164)		875	9355	2.3 (2.0, 2.7)	8.8 (8.1, 9.4)	10.6 (9.9, 11.4)	13.6 (12.7, 14.6)	16.0 (14.8, 17.3)	17.9 (16.4, 19.4)
TOTAL		2300	31774						

Note: Only combinations with over 400 procedures have been listed

Ten and Fifteen 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.

This year the number of individual combinations of femoral and acetabular hip prostheses with 10 year outcomes has increased by 20.3% and the number of individual combinations of femoral and tibial knee prostheses has increased by 7.0%.

HIP REPLACEMENT

Individual femoral and acetabular prosthesis combinations are reported. A combination is included if more than 350 procedures have been reported to the Registry and the follow up is 10 or more years.

When combinations include a variety of bearing surfaces, large head metal/metal surfaces have been reported separately.

There are 71 femoral and acetabular combinations with 10 year outcome data. This is 12 more than last year. These prosthesis combinations account for 62.3% of all primary total conventional hip procedures. Of these 71 combinations, 32 were not used in 2015, accounting for 8.1% of all primary total conventional hip procedures.

The 10 year cumulative percent revision for the prosthesis combinations range from 1.9% to 45.8%. There are 36 (50.7%) hip prosthesis combinations with a 10 year cumulative percent revision (for any reason) of less than 5.0%. These are indicated in bold text in Table TY1.

Table TY1 **Cumulative Percent Revision of Primary Total Conventional Hip Replacement Combinations with 10 Year Data (Primary Diagnosis OA)**

Femoral Stem	Acetabular Component	N Revised	N Total	Type of Revision: THR	Femoral	Acetabular	Other	1 Yr	5 Yrs	10 Yrs
ABGII	ABGII	217	2746	29	102	56	30	1.8 (1.3, 2.3)	4.1 (3.5, 5.0)	6.9 (6.0, 8.0)
ABGII	ABGII (Shell/Insert)	54	834	10	30	10	4	1.4 (0.8, 2.5)	2.8 (1.9, 4.3)	6.8 (5.1, 9.1)
ABGII	Trident (Shell)	160	2341	8	93	22	37	2.5 (1.9, 3.2)	4.8 (4.0, 5.8)	8.2 (6.9, 9.7)
Accolade I	Trident (Shell)	369	8432	40	145	75	109	1.6 (1.4, 1.9)	3.8 (3.4, 4.2)	5.7 (5.1, 6.4)
Alloclassic	**Allofit**	**189**	**4814**	**24**	**68**	**36**	**61**	**1.2 (0.9, 1.5)**	**2.7 (2.2, 3.2)**	**4.8 (4.1, 5.6)**
Alloclassic	Durom^{MoM}*	67	547	17	10	31	9	1.3 (0.6, 2.7)	7.2 (5.3, 9.8)	14.9 (11.7, 18.9)
Alloclassic	Fitmore	105	1676	12	51	12	30	3.1 (2.4, 4.1)	5.5 (4.5, 6.8)	7.2 (5.9, 8.7)
Alloclassic	**Metasul***	**19**	**371**	**3**	**2**	**9**	**5**	**0.8 (0.3, 2.5)**	**3.6 (2.1, 6.1)**	**4.8 (3.0, 7.7)**
Alloclassic	**Trabecular Metal (Shell)**	**32**	**955**	**2**	**8**	**4**	**18**	**2.3 (1.5, 3.5)**	**3.7 (2.6, 5.2)**	**3.7 (2.6, 5.2)**
Alloclassic	**Trilogy**	**7**	**808**	**.**	**5**	**.**	**2**	**0.4 (0.1, 1.2)**	**0.4 (0.1, 1.2)**	**1.9 (0.8, 4.7)**
C-Stem	Duraloc*	68	894	8	16	11	33	2.0 (1.3, 3.2)	3.8 (2.7, 5.3)	7.1 (5.5, 9.2)
C-Stem	Elite Plus LPW*	17	367	7	4	6	.	0.6 (0.1, 2.2)	2.7 (1.4, 5.0)	5.1 (3.1, 8.5)
C-Stem	**Pinnacle**	**22**	**725**	**1**	**9**	**4**	**8**	**1.8 (1.1, 3.1)**	**2.7 (1.7, 4.3)**	**4.3 (2.7, 6.7)**
CLS	Allofit	46	786	5	26	10	5	1.4 (0.8, 2.6)	3.9 (2.7, 5.5)	6.6 (4.8, 8.9)
CLS	Fitmore	39	668	3	19	6	11	1.7 (0.9, 3.0)	4.3 (3.0, 6.3)	5.8 (4.1, 8.2)
CPCS	Reflection (Cup)	42	691	13	2	17	10	0.6 (0.2, 1.6)	2.6 (1.6, 4.4)	8.4 (5.9, 12.0)
CPCS	**Reflection (Shell)**	**62**	**2554**	**5**	**24**	**10**	**23**	**0.8 (0.5, 1.2)**	**1.6 (1.1, 2.2)**	**3.8 (2.8, 5.1)**
CPT	**Trilogy**	**218**	**6607**	**20**	**64**	**32**	**102**	**1.5 (1.3, 1.9)**	**3.1 (2.7, 3.6)**	**4.6 (4.0, 5.4)**

Femoral Stem	Acetabular Component	N Revised	N Total	Type of Revision				1 Yr	5 Yrs	10 Yrs
				THR	Femoral	Acetabular	Other			
CPT	ZCA	26	756	9	5	6	6	0.5 (0.2, 1.4)	2.3 (1.4, 3.8)	4.9 (3.2, 7.5)
Charnley	Charnley Ogee*	50	630	28	7	3	12	1.1 (0.5, 2.3)	4.9 (3.5, 7.0)	8.2 (6.2, 11.0)
Charnley	Charnley*	37	563	28	6	3	.	0.5 (0.2, 1.7)	2.2 (1.3, 3.9)	6.7 (4.6, 9.7)
Charnley	Vitalock*	32	370	4	15	2	11	1.9 (0.9, 3.9)	4.4 (2.7, 7.1)	7.9 (5.5, 11.4)
Citation	Trident (Shell)*	40	1035	3	8	10	19	1.7 (1.1, 2.8)	3.2 (2.3, 4.5)	4.0 (2.9, 5.4)
Citation	Vitalock*	31	508	2	4	10	15	0.4 (0.1, 1.6)	2.0 (1.1, 3.7)	5.0 (3.4, 7.5)
Corail	ASR MoM*	1064	2652	185	34	804	41	2.0 (1.6, 2.7)	27.2 (25.5, 29.0)	45.8 (43.5, 48.1)
Corail	Duraloc*	55	1267	4	25	10	16	1.0 (0.6, 1.8)	2.5 (1.8, 3.6)	4.9 (3.7, 6.6)
Corail	Pinnacle	740	29292	70	234	117	319	1.6 (1.5, 1.8)	3.0 (2.8, 3.2)	4.9 (4.3, 5.7)
Corail	Pinnacle MoM*	82	880	10	27	17	28	2.3 (1.5, 3.5)	6.2 (4.7, 8.0)	11.7 (9.3, 14.9)
Elite Plus	Duraloc*	92	953	14	54	6	18	1.6 (1.0, 2.6)	5.1 (3.9, 6.8)	8.8 (7.0, 10.9)
Epoch	Trilogy*	40	990	.	9	7	24	2.4 (1.6, 3.6)	3.5 (2.5, 4.8)	4.4 (3.2, 6.1)
Exeter	Contemporary*	35	427	8	6	13	8	1.9 (1.0, 3.8)	4.2 (2.6, 6.6)	6.0 (4.0, 8.9)
Exeter	Vitalock*	54	1076	6	10	22	16	1.4 (0.8, 2.3)	2.3 (1.5, 3.4)	4.6 (3.4, 6.1)
Exeter V40	ABGII	33	963	8	11	8	6	0.8 (0.4, 1.7)	1.6 (1.0, 2.7)	3.3 (2.3, 4.8)
Exeter V40	Contemporary	198	4309	43	36	91	28	1.4 (1.1, 1.8)	3.3 (2.7, 3.9)	5.8 (5.0, 6.7)
Exeter V40	Exeter Contemporary	103	2735	28	27	29	19	1.4 (1.0, 1.9)	2.9 (2.3, 3.7)	4.6 (3.7, 5.6)
Exeter V40	Exeter*	64	1526	11	13	25	15	0.9 (0.5, 1.5)	2.9 (2.1, 3.9)	4.3 (3.3, 5.6)
Exeter V40	Hemispherical	21	644	4	5	.	12	1.9 (1.1, 3.3)	3.0 (2.0, 4.7)	4.5 (2.6, 7.6)
Exeter V40	Mallory-Head	30	1296	3	18	2	7	0.5 (0.2, 1.1)	1.0 (0.5, 1.7)	2.9 (1.9, 4.4)
Exeter V40	Trident (Shell)	924	41320	118	274	142	390	1.0 (0.9, 1.1)	2.2 (2.1, 2.4)	3.7 (3.4, 4.0)
Exeter V40	Trilogy	17	517	2	5	2	8	1.9 (1.0, 3.6)	2.5 (1.5, 4.3)	4.6 (2.7, 7.7)
Exeter V40	Vitalock*	65	1795	14	19	18	14	0.8 (0.5, 1.4)	2.3 (1.7, 3.1)	3.2 (2.5, 4.2)
F2L	SPH-Blind*	49	571	5	17	14	13	2.8 (1.7, 4.5)	6.1 (4.4, 8.4)	7.6 (5.7, 10.2)
M/L Taper	Trilogy	15	625	.	3	4	8	1.3 (0.6, 2.6)	2.0 (1.1, 3.6)	3.6 (2.1, 6.2)
MS 30	Allofit	44	1413	6	14	13	11	1.2 (0.8, 2.0)	2.1 (1.4, 3.1)	3.5 (2.5, 4.9)
MS 30	Fitmore	14	524	.	2	6	6	0.2 (0.0, 1.4)	1.4 (0.6, 3.2)	2.5 (1.3, 4.8)
MS 30	Low Profile Cup	12	582	4	2	5	1	0.4 (0.1, 1.4)	1.0 (0.4, 2.4)	2.4 (1.3, 4.6)
Mallory-Head	Mallory-Head	141	2812	13	12	45	71	1.8 (1.3, 2.3)	3.0 (2.4, 3.7)	5.0 (4.1, 6.0)
Mallory-Head	Recap MoM*	20	395	4	.	14	2	1.0 (0.4, 2.7)	2.6 (1.4, 4.8)	5.7 (3.7, 8.8)
Meridian	Vitalock*	24	354	2	2	10	10	0.9 (0.3, 2.6)	3.5 (2.0, 6.1)	6.0 (3.9, 9.2)
Natural Hip	Allofit*	10	529	.	3	3	4	0.8 (0.3, 2.0)	1.1 (0.5, 2.5)	1.9 (1.0, 3.7)
Natural Hip	Fitmore*	30	882	2	4	9	15	0.5 (0.2, 1.2)	2.0 (1.3, 3.2)	4.0 (2.8, 5.7)
Omnifit	Secur-Fit*	74	716	7	20	17	30	2.4 (1.5, 3.8)	6.2 (4.6, 8.2)	10.0 (7.9, 12.6)
Omnifit	Trident (Shell)	121	3497	12	28	20	61	1.7 (1.3, 2.2)	3.1 (2.5, 3.7)	3.9 (3.2, 4.7)
S-Rom	Duraloc Option*	24	523	4	9	4	7	1.7 (0.9, 3.3)	3.3 (2.1, 5.2)	4.6 (3.1, 6.8)
S-Rom	Pinnacle	80	2152	8	47	7	18	2.2 (1.7, 2.9)	3.7 (3.0, 4.7)	4.4 (3.5, 5.5)
SL-Plus	EP-Fit Plus	95	2053	5	42	18	30	1.6 (1.1, 2.2)	3.5 (2.8, 4.4)	5.7 (4.6, 7.1)
Secur-Fit	Trident (Shell)	261	8082	21	107	50	83	1.5 (1.3, 1.8)	3.1 (2.7, 3.6)	4.2 (3.6, 4.7)
Secur-Fit Plus	Trident (Shell)	146	5182	11	38	35	62	1.1 (0.8, 1.4)	2.2 (1.8, 2.6)	3.2 (2.7, 3.8)
Spectron EF	Reflection (Cup)	94	1394	31	10	44	9	1.0 (0.6, 1.7)	2.9 (2.1, 3.9)	7.6 (6.0, 9.6)
Spectron EF	Reflection (Shell)	225	4564	46	72	35	72	1.0 (0.7, 1.3)	2.7 (2.2, 3.2)	5.7 (4.9, 6.6)
Stability	Duraloc*	43	374	1	9	13	20	0.5 (0.1, 2.1)	2.2 (1.1, 4.3)	8.9 (6.3, 12.5)
Summit	ASR MoM*	396	1041	14	5	356	21	1.1 (0.6, 1.9)	19.6 (17.3, 22.2)	42.8 (39.4, 46.4)
Summit	Pinnacle	73	3807	4	15	14	40	1.1 (0.8, 1.5)	1.9 (1.5, 2.4)	2.8 (2.1, 3.7)
Summit	Pinnacle MoM*	51	730	2	5	9	35	1.4 (0.7, 2.5)	3.4 (2.3, 5.0)	8.3 (6.3, 10.9)
Synergy	BHR MoM*	62	698	4	5	39	14	1.4 (0.8, 2.6)	4.8 (3.4, 6.7)	11.7 (8.9, 15.2)
Synergy	Reflection (Shell)	271	7238	23	52	92	104	1.5 (1.2, 1.8)	2.5 (2.2, 2.9)	3.9 (3.4, 4.4)

Femoral Stem	Acetabular Component	N Revised	N Total	Type of Revision				1 Yr	5 Yrs	10 Yrs
				THR	Femoral	Acetabular	Other			
Synergy	**Trident (Shell)***	**10**	**438**	**.**	**2**	**2**	**6**	**0.9 (0.3, 2.4)**	**1.9 (0.9, 3.7)**	**3.0 (1.5, 5.9)**
Taperloc	M2a MoM*	53	471	11	2	37	3	1.5 (0.7, 3.1)	6.9 (4.9, 9.6)	12.5 (9.6, 16.2)
Taperloc	Mallory-Head	62	1484	6	13	21	22	1.9 (1.3, 2.7)	3.3 (2.4, 4.4)	5.7 (4.3, 7.5)
Taperloc	Recap MoM*	37	456	8	5	19	5	2.0 (1.0, 3.8)	5.6 (3.8, 8.2)	9.4 (6.7, 13.0)
VerSys	**Trilogy**	**194**	**4307**	**13**	**68**	**34**	**79**	**2.5 (2.0, 3.0)**	**3.7 (3.2, 4.3)**	**4.8 (4.2, 5.5)**
TOTAL		8297	191214	1076	2143	2687	2391			

Note: Only combinations with over 350 procedures have been listed
MoM denotes metal/metal prosthesis combinations used with head size larger than 32mm
* denotes prosthesis combinations that have not had any reported use in primary total conventional hip replacement in 2015

KNEE REPLACEMENT

Individual femoral and tibial prosthesis combinations are reported. A combination is included if more than 350 procedures have been reported to the Registry and the follow up is 10 or more 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. However, prosthesis types are separated as to whether they are minimally or posteriorly stabilised.

There are 46 total knee replacement combinations with 10 year outcome data. This is three more than last year. These prosthesis combinations account for 78.9% of all primary total knee replacement procedures. Of these 46 prosthesis combinations, 15 were not used in 2015, accounting for 8.9% of all primary total knee procedures.

The 10 year cumulative percent revision ranges from 2.9% to 11.0%. There are 15 knee prosthesis combinations (32.6%) with a 10 year cumulative percent revision (for any reason) of less than 5.0%. These are indicated in bold text in Table TY2.

Table TY2 Cumulative Percent Revision of Primary Total Knee Replacement Combinations with 10 Year Data (Primary Diagnosis OA)

Femoral Component	Tibial Component	N Revised	N Total	Type of Revision				1 Yr	5 Yrs	10 Yrs
				TKR	Femoral	Tibial	Other			
AGC	**AGC**	**222**	**5020**	**79**	**4**	**24**	**115**	**0.5 (0.4, 0.8)**	**3.1 (2.6, 3.6)**	**4.8 (4.2, 5.6)**
Active Knee	Active Knee	463	8095	133	24	32	274	1.1 (0.9, 1.4)	4.8 (4.3, 5.3)	7.9 (7.2, 8.7)
Advance	Advance	29	646	9	1	8	11	2.2 (1.3, 3.8)	4.8 (3.2, 7.1)	9.2 (5.4, 15.5)
Advance	Advance II	94	1575	30	2	13	49	1.6 (1.1, 2.4)	4.9 (3.9, 6.2)	7.1 (5.8, 8.7)
Advantim	**Advantim***	**54**	**1454**	**22**	**3**	**3**	**26**	**0.7 (0.4, 1.3)**	**3.1 (2.3, 4.2)**	**4.7 (3.5, 6.2)**
BalanSys	**BalanSys**	**22**	**1694**	**7**	**2**	**2**	**11**	**0.2 (0.1, 0.6)**	**2.1 (1.3, 3.4)**	**4.1 (2.3, 7.0)**
Duracon	**Duracon***	**977**	**19830**	**227**	**29**	**65**	**656**	**1.1 (1.0, 1.3)**	**3.4 (3.2, 3.7)**	**4.9 (4.6, 5.3)**
Genesis II CR	**Genesis II**	**678**	**19727**	**133**	**46**	**42**	**457**	**0.9 (0.8, 1.1)**	**3.4 (3.1, 3.7)**	**4.6 (4.2, 5.0)**
Genesis II CR	Profix Mobile*	89	1209	33	9	7	40	1.9 (1.3, 2.9)	5.3 (4.2, 6.8)	7.4 (5.9, 9.2)
Genesis II Oxinium CR (ctd)	Genesis II	315	6925	51	23	22	219	1.0 (0.8, 1.3)	3.7 (3.3, 4.2)	6.3 (5.5, 7.1)
Genesis II Oxinium PS (ctd)	Genesis II	688	14081	78	24	119	467	1.5 (1.4, 1.8)	5.4 (4.9, 5.8)	7.8 (7.1, 8.5)
Genesis II PS	Genesis II	571	15460	86	26	39	420	1.3 (1.1, 1.5)	3.8 (3.5, 4.2)	5.3 (4.9, 5.9)
Kinemax Plus	**Kinemax Plus***	**102**	**1815**	**55**	**3**	**5**	**39**	**0.9 (0.6, 1.5)**	**3.2 (2.4, 4.1)**	**4.6 (3.7, 5.7)**
LCS CR	LCS	540	8290	215	23	83	219	1.1 (0.9, 1.3)	4.4 (4.0, 4.9)	6.2 (5.7, 6.8)

Femoral Component	Tibial Component	N Revised	N Total	Type of Revision TKR	Femoral	Tibial	Other	1 Yr	5 Yrs	10 Yrs
LCS CR	MBT	753	24023	232	33	109	379	0.8 (0.7, 0.9)	3.5 (3.2, 3.7)	4.9 (4.5, 5.3)
LCS CR	MBT Duofix	564	12658	157	24	38	345	1.3 (1.2, 1.6)	4.2 (3.8, 4.6)	5.5 (5.1, 6.0)
MBK (Zimmer)	Nexgen*	29	448	15	1	1	12	0.9 (0.3, 2.4)	4.1 (2.6, 6.5)	5.9 (4.0, 8.6)
Maxim	Maxim*	158	2447	42	14	12	90	1.1 (0.7, 1.6)	4.0 (3.3, 4.8)	6.1 (5.1, 7.2)
Natural Knee II	Natural Knee II	334	6443	124	8	58	144	0.9 (0.7, 1.2)	2.8 (2.4, 3.3)	5.5 (4.9, 6.2)
Nexgen CR	Nexgen	308	10726	94	12	30	172	0.5 (0.4, 0.6)	2.0 (1.7, 2.3)	3.0 (2.7, 3.4)
Nexgen CR	Nexgen TM CR	42	774	14	3	8	17	1.3 (0.7, 2.4)	5.6 (4.1, 7.6)	6.4 (4.7, 8.7)
Nexgen CR Flex	Nexgen	636	36419	121	50	74	391	0.8 (0.7, 0.9)	2.2 (2.0, 2.4)	2.9 (2.6, 3.3)
Nexgen CR Flex	Nexgen TM CR	175	8845	47	15	20	93	0.5 (0.4, 0.7)	2.3 (1.9, 2.6)	3.1 (2.5, 3.8)
Nexgen LPS	Nexgen	266	6416	62	17	30	157	0.9 (0.7, 1.2)	3.2 (2.8, 3.7)	5.0 (4.4, 5.7)
Nexgen LPS Flex	Nexgen	848	27431	199	46	158	445	0.9 (0.8, 1.1)	3.2 (3.0, 3.5)	5.1 (4.7, 5.5)
Optetrak-CR	Optetrak	32	730	8	5	3	16	1.6 (0.9, 3.0)	5.6 (3.8, 8.1)	6.9 (4.8, 9.8)
Optetrak-PS	Optetrak	171	2523	55	4	25	87	1.5 (1.1, 2.0)	6.6 (5.6, 7.7)	9.7 (8.2, 11.3)
PFC Sigma CR	AMK Duofix*	51	1890	16	.	1	34	0.7 (0.4, 1.2)	2.4 (1.7, 3.2)	3.2 (2.4, 4.3)
PFC Sigma CR	MBT	244	5573	32	27	42	143	1.4 (1.1, 1.7)	4.2 (3.7, 4.8)	5.2 (4.6, 5.9)
PFC Sigma CR	MBT Duofix	108	2411	13	16	3	76	1.3 (0.9, 1.9)	4.4 (3.6, 5.4)	5.8 (4.6, 7.2)
PFC Sigma CR	PFC Sigma	532	21660	111	41	45	335	0.7 (0.6, 0.8)	2.4 (2.2, 2.6)	3.5 (3.1, 3.8)
PFC Sigma PS	MBT	211	6024	55	10	18	128	0.9 (0.7, 1.1)	3.6 (3.1, 4.1)	4.6 (4.0, 5.3)
PFC Sigma PS	MBT Duofix	121	1754	19	3	4	95	1.8 (1.3, 2.6)	7.1 (5.9, 8.5)	8.9 (7.4, 10.8)
PFC Sigma PS	PFC Sigma	232	6896	70	7	20	135	1.2 (1.0, 1.5)	3.2 (2.8, 3.7)	4.6 (3.9, 5.3)
Profix	Profix Mobile*	98	986	28	6	5	59	2.3 (1.6, 3.5)	8.2 (6.6, 10.1)	9.8 (8.1, 11.9)
Profix	Profix*	252	5370	52	13	18	169	1.0 (0.8, 1.4)	3.7 (3.2, 4.3)	5.1 (4.5, 5.8)
Profix Oxinium (ctd)	Profix*	88	1049	18	4	14	52	2.1 (1.4, 3.2)	6.9 (5.5, 8.7)	8.6 (7.0, 10.5)
RBK	RBK	362	9302	127	11	34	190	1.2 (1.0, 1.5)	4.0 (3.5, 4.4)	5.5 (4.9, 6.2)
Rocc	Rocc*	35	575	11	1	2	21	1.7 (0.9, 3.2)	5.2 (3.6, 7.3)	6.6 (4.7, 9.1)
Rotaglide Plus	Rotaglide Plus*	64	616	25	1	5	33	0.8 (0.3, 2.0)	5.8 (4.1, 8.0)	11.0 (8.6, 13.9)
Scorpio CR	Scorpio+*	150	2448	35	10	21	84	0.9 (0.6, 1.4)	4.2 (3.4, 5.0)	6.5 (5.5, 7.7)
Scorpio CR	Series 7000	462	10880	112	22	39	289	0.9 (0.8, 1.1)	3.4 (3.1, 3.8)	5.2 (4.7, 5.7)
Scorpio PS	Scorpio*	30	524	8	.	8	14	1.2 (0.5, 2.6)	4.5 (3.0, 6.7)	6.3 (4.4, 8.9)
Scorpio PS	Scorpio+*	128	2036	33	12	8	75	1.4 (1.0, 2.1)	5.0 (4.1, 6.0)	6.6 (5.5, 7.8)
Scorpio PS	Series 7000	285	4659	92	7	58	128	1.3 (1.0, 1.7)	4.7 (4.1, 5.4)	7.0 (6.2, 7.9)
Triathlon CR	Triathlon	929	50363	140	46	47	696	0.8 (0.7, 0.9)	2.5 (2.3, 2.6)	3.4 (3.0, 3.9)
TOTAL		13542	380720	3325	688	1422	8107			

Note: Only combinations with over 350 procedures have been listed
* denotes prosthesis combinations that have not had any reported use in primary total knee procedures in 2015

FIFTEEN YEAR OUTCOMES

For the first time, the Registry is able to report the 15 year outcomes for combinations of hip and knee prostheses (7 hip and 14 knee). A combination is included if more than 350 procedures have been reported to the Registry and the follow up is 15 or more years.

HIP REPLACEMENT

The listed prosthesis combinations were used in 8.2% of all primary total conventional hip replacement procedures for osteoarthritis. Of the seven combinations, two had no reported use in 2015.

The 15 year cumulative percent revision ranges from 4.3% to 12.4%. Four of the combinations have a cumulative percent revision of less than 6.5%, and one less than 5% (Table FY1).

KNEE REPLACEMENT

The listed prosthesis combinations were used in 25.6% of all primary total knee replacement procedures for osteoarthritis. Of the 14 combinations, nine are still in use.

The 15 year cumulative percent revision ranges from 4.5% to 11.5%. Seven of the combinations have a cumulative percent revision of less than 6.5% and one less than 5% at 15 years (Table FY2).

Table FY1 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Combinations with 15 Year Data (Primary Diagnosis OA)

Femoral Stem	Acetabular Component	N Revised	N Total	Type of Revision THR	Femoral	Acetabular	Other	5 Yrs	10 Yrs	15 Yrs
Exeter	Vitalock*	54	1076	6	10	22	16	2.3 (1.5, 3.4)	4.6 (3.4, 6.1)	6.3 (4.8, 8.3)
Mallory-Head	Mallory-Head	141	2812	13	12	45	71	3.0 (2.4, 3.7)	5.0 (4.1, 6.0)	9.8 (7.9, 12.2)
Omnifit	Secur-Fit*	74	716	7	20	17	30	6.2 (4.6, 8.2)	10.0 (7.9, 12.6)	12.4 (9.9, 15.5)
Omnifit	Trident (Shell)	121	3497	12	28	20	61	3.1 (2.5, 3.7)	3.9 (3.2, 4.7)	5.5 (4.0, 7.4)
Secur-Fit Plus	**Trident (Shell)**	**146**	**5182**	**11**	**38**	**35**	**62**	**2.2 (1.8, 2.6)**	**3.2 (2.7, 3.8)**	**4.3 (3.4, 5.4)**
Spectron EF	Reflection (Shell)	225	4564	46	72	35	72	2.7 (2.2, 3.2)	5.7 (4.9, 6.6)	10.3 (8.6, 12.3)
Synergy	Reflection (Shell)	271	7238	23	52	92	104	2.5 (2.2, 2.9)	3.9 (3.4, 4.4)	6.3 (5.1, 7.9)
TOTAL		1032	25085	118	232	266	416			

Note: Only combinations with over 350 procedures have been listed
* denotes prosthesis combinations that have not had any reported use in primary total conventional hip procedures in 2015

Table FY2 Cumulative Percent Revision of Primary Total Knee Replacement Combinations with 15 Year Data (Primary Diagnosis OA)

Femoral Component	Tibial Component	N Revised	N Total	Type of Revision: TKR	Type of Revision: Femoral	Type of Revision: Tibial	Type of Revision: Other	5 Yrs	10 Yrs	15 Yrs
AGC	AGC	222	5020	79	4	24	115	3.1 (2.6, 3.6)	4.8 (4.2, 5.6)	7.7 (6.3, 9.3)
Advantim	Advantim*	54	1454	22	3	3	26	3.1 (2.3, 4.2)	4.7 (3.5, 6.2)	5.4 (3.9, 7.3)
Duracon	Duracon*	977	19830	227	29	65	656	3.4 (3.2, 3.7)	4.9 (4.6, 5.3)	6.8 (6.3, 7.5)
Genesis II CR	Genesis II	678	19727	133	46	42	457	3.4 (3.1, 3.7)	4.6 (4.2, 5.0)	5.7 (5.0, 6.5)
Genesis II CR	Profix Mobile*	89	1209	33	9	7	40	5.3 (4.2, 6.8)	7.4 (5.9, 9.2)	10.6 (8.4, 13.4)
Kinemax Plus	Kinemax Plus*	102	1815	55	3	5	39	3.2 (2.4, 4.1)	4.6 (3.7, 5.7)	7.9 (6.4, 9.8)
LCS CR	LCS	540	8290	215	23	83	219	4.4 (4.0, 4.9)	6.2 (5.7, 6.8)	7.9 (7.2, 8.7)
Natural Knee II	Natural Knee II	334	6443	124	8	58	144	2.8 (2.4, 3.3)	5.5 (4.9, 6.2)	10.1 (8.6, 11.9)
Nexgen CR	**Nexgen**	**308**	**10726**	**94**	**12**	**30**	**172**	**2.0 (1.7, 2.3)**	**3.0 (2.7, 3.4)**	**4.5 (3.8, 5.4)**
Nexgen LPS	Nexgen	266	6416	62	17	30	157	3.2 (2.8, 3.7)	5.0 (4.4, 5.7)	5.8 (5.1, 6.7)
PFC Sigma CR	PFC Sigma	532	21660	111	41	45	335	2.4 (2.2, 2.6)	3.5 (3.1, 3.8)	5.0 (4.2, 5.9)
Profix	Profix*	252	5370	52	13	18	169	3.7 (3.2, 4.3)	5.1 (4.5, 5.8)	5.4 (4.7, 6.2)
Scorpio CR	Series 7000	462	10880	112	22	39	289	3.4 (3.1, 3.8)	5.2 (4.7, 5.7)	6.4 (5.7, 7.2)
Scorpio PS	Series 7000	285	4659	92	7	58	128	4.7 (4.1, 5.4)	7.0 (6.2, 7.9)	11.5 (8.8, 14.8)
TOTAL		**5101**	**123499**	**1411**	**237**	**507**	**2946**			

Note: Only combinations with over 350 procedures have been listed

* denotes prosthesis combinations that have not had any reported use in primary total knee procedures in 2015

Hip Replacement

Hip Replacement

CATEGORIES OF HIP REPLACEMENT

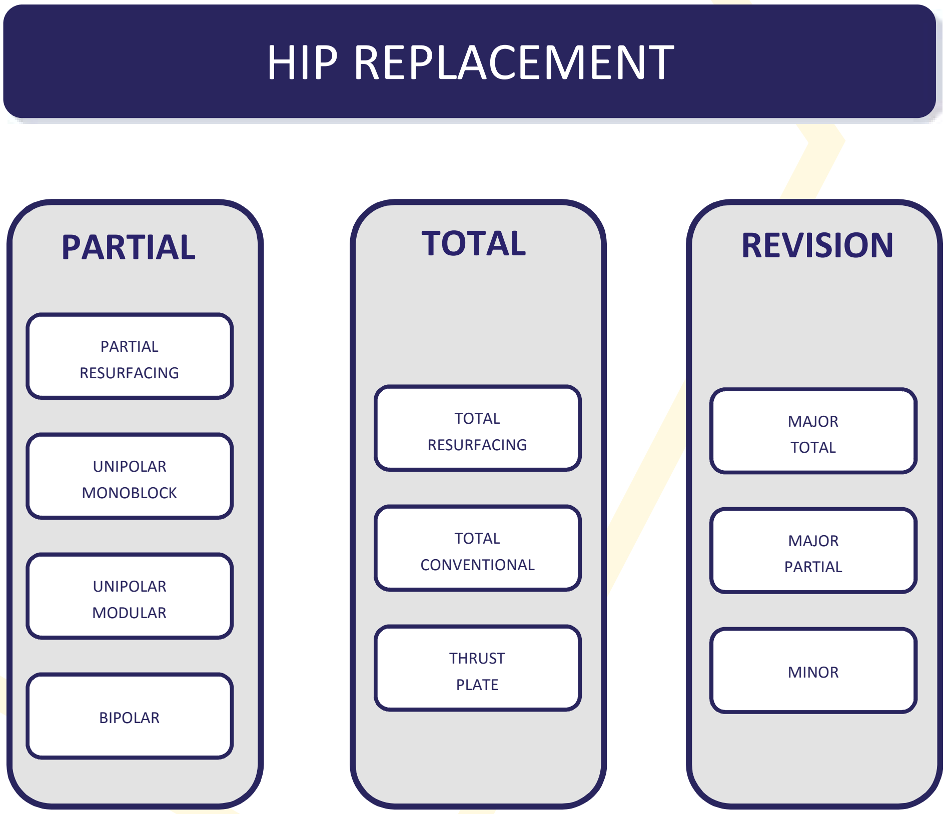
The Registry groups hip replacement into three broad categories: primary partial, primary total and revision hip replacement.

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 sub-categorised into classes depending on the type of prostheses used. Partial hip classes are partial resurfacing, unipolar monoblock, unipolar modular and bipolar. Total hip classes are resurfacing, conventional and thrust plate. Definitions for each of these 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 sub-categorised 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://aoanjrr.sahmri.com/annual-reports-2016



USE OF HIP REPLACEMENT

This report analyses 498,660 hip replacements reported to the Registry with a procedure date up to and including 31 December 2015. This is an additional 44,710 hip procedures compared to the number reported last year. When considering all hip procedures currently recorded by the Registry, primary partial hip accounts for 15.5%, primary total hip 72.9% and revision hip replacement 11.6% (Table H1).

Table H1 Number of Hip Replacements

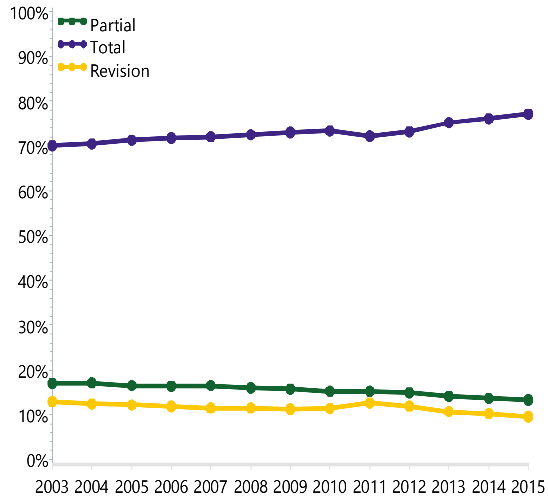
Hip Category	Number	Percent
Partial	77280	15.5
Total	363561	72.9
Revision	57819	11.6
TOTAL	498660	100.0

The number of hip replacement procedures undertaken in 2015 was 64.9% higher than undertaken in 2003. The corresponding increase in primary total hip replacement was 81.7%, primary partial 28.9%, and revision hip replacement 21.8%.

The number of hip replacements undertaken in 2015 increased by 1,126 (2.6%) compared to 2014. During this time, the use of primary total hip replacement increased by 4.1%, accounting for 77.2% of all hip replacement procedures in 2015. Primary partial hip replacement decreased by 0.3% accounting for 13.3% of hip procedures in 2015.

The proportion of revision hip procedures has declined from a peak of 12.9% in 2003 to 9.6% in 2015. This equates to 1,487 fewer revision procedures in 2015 than would have been expected if the proportion of revision procedures had remained at 12.9% (Figure H1).

Figure H1 Proportion of Hip Replacement



ASA SCORE AND BMI IN HIP REPLACEMENT

For the first time, the Registry is reporting demographic data for hip replacement procedures on 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 is ASA score data on 111,887 hip replacement procedures and BMI data on 33,584 procedures.

In 2015, the ASA score was reported in 99.0% of hip replacement procedures and BMI was reported in 76.2% of procedures.

There was some variation in reporting based on procedure type. In 2015, the percentage of procedures where the ASA score was reported for primary partial hips was 98.0%, primary total hip 99.2% and revision hip replacement 99.0%. BMI was reported for 40.6% of primary partial hip, 82.6% of primary total hip and 74.3% of revision hip replacements.

The Registry commenced collecting ASA score and BMI as both are known to impact the outcome of hip replacement surgery. These measures have not been collected for a sufficient length of time to enable outcome analyses to be undertaken. The Registry will be able to commence reporting the effect of BMI and ASA score on early outcomes in subsequent reports. This data will also be used for risk adjustment of a range of analyses in the future.

ASA SCORE

There are five ASA score classifications (https://www.asahq.org/resources/clinical-information/asa-physical-status-classification-system)

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 85.5% of patients have an ASA score of 2 or 3, 8.9% have a score of 1 and 5.5% have a score of 4. Very few patients have a score of 5.

There is a difference depending on the class of hip replacement. Patients having a partial hip replacement have a higher proportion of ASA scores 3 and 4 (84.9%) than those having primary total hip replacement (44.5%). Those having revision hip replacement also have higher ASA scores compared to primary total hip replacement, but not as high as partial hip replacement (56.5% have an ASA score of 3 or 4) (Table H2).

BMI

BMI is classified by the World Health Organisation into 6 main categories (http://apps.who.int/bmi/index.jsp?introPage=intro_3.html)

1.	Underweight	(<18.50)
2.	Average (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 hip replacements, the majority of patients are average or pre-obese (61.2%). The percentage of patients in each category of BMI is similar for primary total and revision hip replacement with 60.0% of primary total hip replacements being average or pre-obese and 60.7% of revision hip replacements in the same categories.

Patients having partial hip replacement generally have a lower BMI with most being average or underweight (57.2%) (Table H3).

There is a gender difference with a higher proportion of males in the average and pre-obese categories, which is most apparent in primary total and revision hip replacement (Figure H2).

Table H2 ASA Score by Hip Category

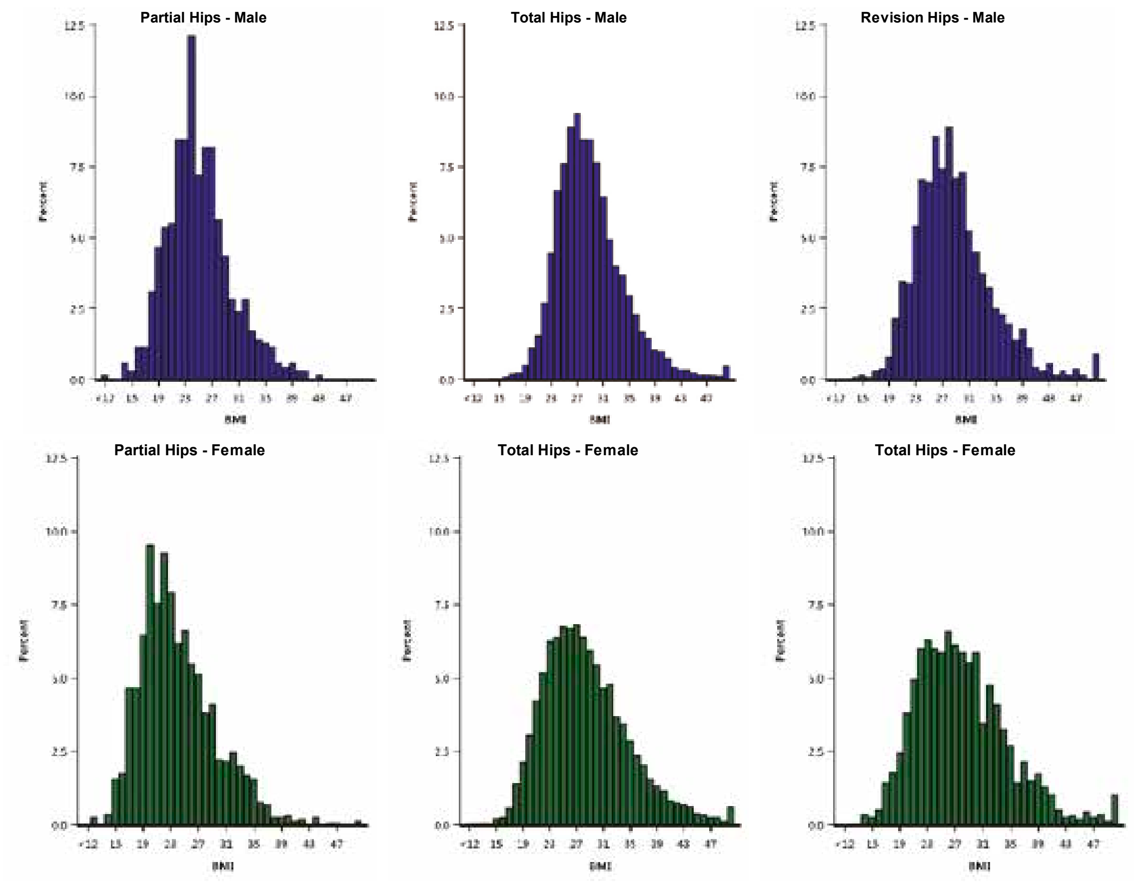
ASA Score	Partial N	Partial Col%	Total N	Total Col%	Revision N	Revision Col%	TOTAL N	TOTAL Col%
1	71	0.5	9324	10.9	584	5.2	9979	8.9
2	2128	14.2	46739	54.6	4327	38.3	53194	47.5
3	9032	60.4	27922	32.6	5517	48.9	42471	38.0
4	3657	24.5	1658	1.9	854	7.6	6169	5.5
5	61	0.4	9	0.0	4	0.0	74	0.1
TOTAL	14949	100.0	85652	100.0	11286	100.0	111887	100.0

Table H3 BMI Category for Hip Replacement by Hip Category

BMI Category	Partial N	Partial Col%	Total N	Total Col%	Revision N	Revision Col%	TOTAL N	TOTAL Col%
Underweight	218	9.1	313	1.1	66	2.1	597	1.8
Average	1153	48.1	6381	22.7	836	26.6	8370	24.9
Pre Obese	660	27.6	10458	37.3	1070	34.1	12188	36.3
Obese Class 1	255	10.6	6765	24.1	709	22.6	7729	23.0
Obese Class 2	86	3.6	2739	9.8	302	9.6	3127	9.3
Obese Class 3	23	1.0	1393	5.0	157	5.0	1573	4.7
TOTAL	2395	100.0	28049	100.0	3140	100.0	33584	100.0

Note: BMI has not been presented for patients aged 19 and under

Figure H2 BMI Distribution by Gender and Hip Category



Note: BMI has not been presented for patients aged 19 and under

Primary Partial Hip Replacement

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.
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 that replaces the natural femoral head.

There is a fifth class of partial hip replacement that has been reported to the Registry. It involves the use of a prosthesis referred to by the manufacturer as an 'acetabular buffer'. This is a polycarbonate urethane insert. Five procedures using this device have been reported to the Registry, four of which have been revised.

USE OF PARTIAL HIP REPLACEMENT

The most common class of primary partial hip replacement is unipolar modular. This accounts for 42.3% of all partial hip procedures followed by unipolar monoblock (35.6%) and bipolar (22.1%) (Table HP1).

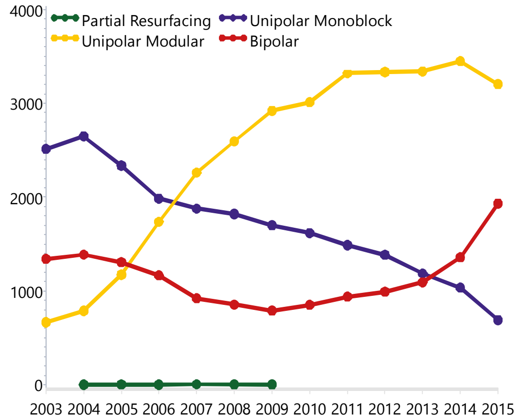
Table HP1 Primary Partial Hip Replacement by Class

Partial Hip Class	Number	Percent
Partial Resurfacing	14	0.0
Unipolar Monoblock	27532	35.6
Unipolar Modular	32691	42.3
Bipolar	17043	22.1
TOTAL	**77280**	**100.0**

There was a large increase in the use of bipolar partial hip replacements in 2015. The use of unipolar monoblock continues to decline (Figure HP1).

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-2016.

Figure HP1 Primary Partial Hip Replacement by Class



Partial resurfacing has only been used in 14 procedures, seven of which have been revised. The last procedure was recorded in 2009. Partial resurfacing is not presented in detail in this report.

"The use of unipolar monoblock hip replacement continues to decline. There has been a large increase in the use of bipolar partial hip replacement in 2015."

Detailed information on Partial Resurfacing is available in the supplementary report 'Outcomes of Classes No Longer Used Hip and Knee Arthroplasty' on the AOANJRR website https://aoanjrr.sahmri.com/annual-reports-2016.

Fractured neck of femur is the principal diagnosis for the three main classes of primary partial hip replacement.

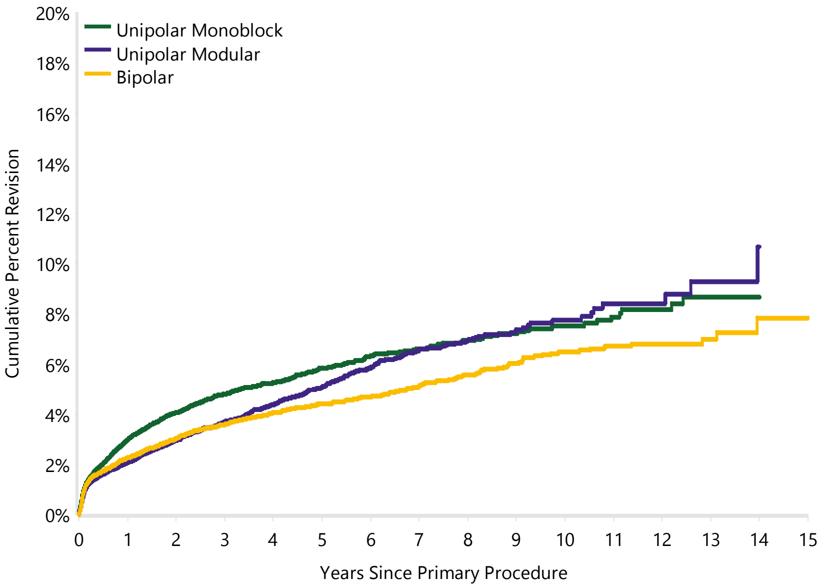
The outcome of primary partial hip replacement varies depending on the class. At 14 years, bipolar has the lowest cumulative percent revision, followed by unipolar monoblock and unipolar modular (Table HP2 and Figure HP2). The difference in outcome between classes is most apparent in those aged less than 75 years (Table HP3 and Figure HP3).

Partial hip replacement is associated with a high mortality rate. The mortality data are detailed in Table HP4. The prosthesis class variation is almost certainly due to patient selection.

Table HP2 Cumulative Percent Revision of Primary Partial Hip Replacement by Class

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Unipolar Monoblock	1034	27532	3.0 (2.7, 3.2)	4.8 (4.5, 5.1)	5.8 (5.4, 6.2)	6.6 (6.1, 7.1)	7.5 (6.9, 8.2)	8.7 (7.6, 9.8)
Unipolar Modular	1110	32691	2.1 (1.9, 2.2)	3.7 (3.4, 3.9)	5.1 (4.7, 5.4)	6.6 (6.1, 7.1)	7.7 (7.0, 8.5)	10.7 (8.0, 14.2)
Bipolar	589	17043	2.2 (2.0, 2.5)	3.6 (3.3, 3.9)	4.4 (4.0, 4.8)	5.1 (4.6, 5.6)	6.5 (5.8, 7.2)	7.8 (6.5, 9.4)
TOTAL	2733	77266						

Figure HP2 Cumulative Percent Revision of Primary Partial Hip Replacement by Class



HR - adjusted for age and gender

Unipolar Monoblock vs Bipolar
0 - 2Wk: HR=1.95 (1.34, 2.84),p<0.001
2Wk - 3Mth: HR=1.18 (0.99, 1.40),p=0.058
3Mth - 9Mth: HR=2.39 (1.94, 2.96),p<0.001
9Mth+: HR=1.62 (1.41, 1.86),p<0.001

Unipolar Modular vs Bipolar
0 - 2Wk: HR=1.10 (0.75, 1.63),p=0.617
2Wk - 1Mth: HR=0.82 (0.65, 1.05),p=0.116
1Mth - 2.5Yr: HR=1.09 (0.97, 1.24),p=0.156
2.5Yr+: HR=1.84 (1.54, 2.20),p<0.001

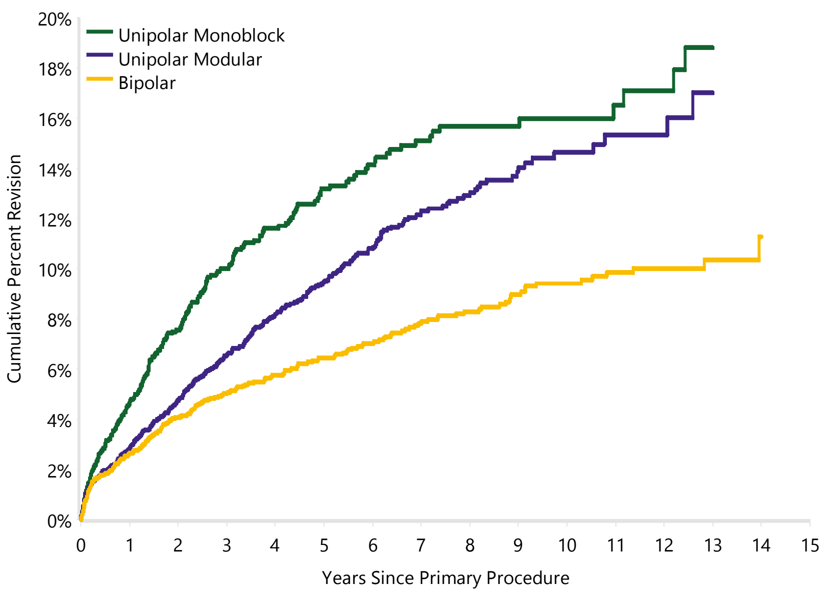
Unipolar Monoblock vs Unipolar Modular
Entire Period: HR=1.36 (1.25, 1.48),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Unipolar Monoblock	27532	16600	9485	5120	2726	966	129
Unipolar Modular	32691	22074	12631	6544	3072	739	62
Bipolar	17043	11650	7535	4965	3250	1548	152

Table HP3 Cumulative Percent Revision of Primary Partial Hip Replacement in Patients Aged <75 Years by Class

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Unipolar Monoblock	224	2409	4.6 (3.8, 5.6)	10.0 (8.6, 11.5)	13.2 (11.5, 15.1)	15.1 (13.2, 17.2)	16.0 (13.9, 18.3)	
Unipolar Modular	417	5678	2.8 (2.4, 3.3)	6.6 (5.8, 7.4)	9.4 (8.5, 10.5)	12.3 (11.1, 13.6)	14.6 (13.0, 16.4)	
Bipolar	221	3856	2.6 (2.1, 3.2)	5.0 (4.3, 5.9)	6.5 (5.6, 7.5)	7.8 (6.8, 9.0)	9.4 (8.2, 10.8)	11.3 (9.1, 13.9)
TOTAL	862	11943						

Figure HP3 Cumulative Percent Revision of Primary Partial Hip Replacement for Patients Aged <75 Years by Class



HR - adjusted for age and gender

Unipolar Monoblock vs Bipolar
Entire Period: HR=2.05 (1.69, 2.47),p<0.001

Unipolar Modular vs Bipolar
0 - 2.5Yr: HR=1.24 (1.02, 1.50),p=0.031
2.5Yr+: HR=2.09 (1.64, 2.66),p<0.001

Unipolar Monoblock vs Unipolar Modular
Entire Period: HR=1.38 (1.17, 1.63),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Unipolar Monoblock	2409	1610	1062	704	467	216	34
Unipolar Modular	5678	4184	2795	1787	1006	334	33
Bipolar	3856	2821	2052	1578	1210	729	95

Table HP4 Cumulative Percent Mortality of Primary Partial Hip Replacement by Class

Hip Class	N Deceased	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Unipolar Monoblock	22103	26829	36.4 (35.8, 37.0)	59.9 (59.3, 60.5)	75.7 (75.1, 76.2)	85.0 (84.5, 85.4)	92.5 (92.1, 92.9)	96.2 (95.8, 96.5)
Unipolar Modular	17360	31734	23.7 (23.2, 24.2)	43.1 (42.5, 43.7)	58.6 (58.0, 59.3)	70.2 (69.5, 70.8)	80.7 (79.9, 81.5)	88.4 (87.1, 89.5)
Bipolar	9773	16635	21.3 (20.6, 21.9)	38.9 (38.1, 39.7)	53.2 (52.3, 54.0)	64.6 (63.7, 65.5)	76.4 (75.6, 77.3)	86.1 (85.1, 87.1)
TOTAL	49236	75198						

UNIPOLAR MONOBLOCK

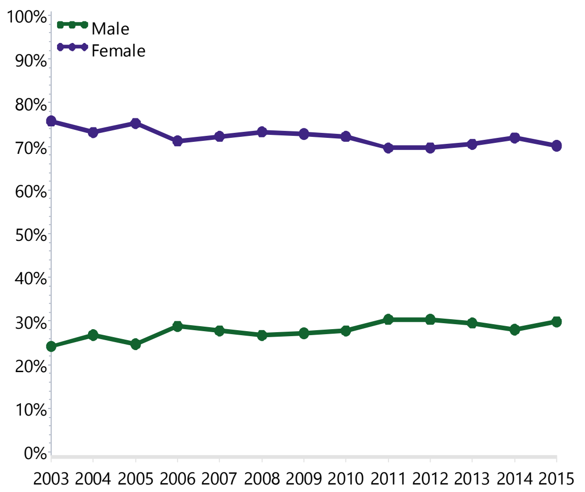
DEMOGRAPHICS

There have been 27,532 unipolar monoblock procedures reported to the Registry. This is an additional 773 procedures compared to the previous report.

The use of monoblock hip replacement in Australia continues to decline. The number of procedures reported in 2015 was 33.3% less than 2014 and 72.6% less than 2003.

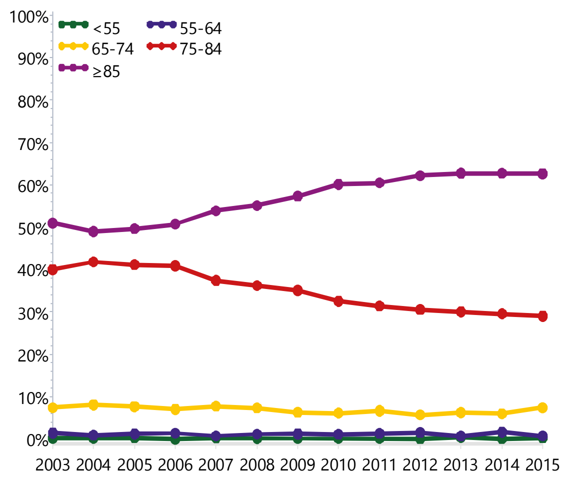
Fractured neck of femur is the principal diagnosis for primary unipolar monoblock hip replacement (97.6%).

Figure HP4 Primary Unipolar Monoblock Hip Replacement by Gender



The majority of patients are female (73.2%) and aged 75 years or older (91.3%). The proportion of patients aged 85 years or older has increased from 51.0% in 2003 to 62.6% in 2015. The mean age of patients is 84.5 years (Table HP5, Figures HP4 and HP5).

Figure HP5 Primary Unipolar Monoblock Hip Replacement by Age



The three types of unipolar monoblock prosthesis are the Austin-Moore type, Thompson type and Exeter Trauma Stem (ETS). In 2015, the use of the Austin-Moore type decreased by 42.2% compared to 2014 and 85.7% compared to 2003. The Thompson type decreased by 27.2% compared to 2014 and 63.3% compared to 2003. In 2015, the use of the ETS decreased by 23.7% compared to 2014 and accounted for 30.9% of all monoblock prostheses (Table HP6).

Table HP5 Age and Gender of Primary Unipolar Monoblock Hip Replacement

Gender	Number	Percent	Minimum	Maximum	Median	Mean	Std Dev
Male	7381	26.8%	32	107	84	83.4	7.7
Female	20151	73.2%	16	108	85	84.9	7.1
TOTAL	**27532**	**100.0%**	**16**	**108**	**85**	**84.5**	**7.3**

Table HP6 Most Used Monoblock Prostheses in Primary Unipolar Monoblock Hip Replacement

2003		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
1988	Austin-Moore Type	748	Austin-Moore Type	612	Austin-Moore Type	491	Austin-Moore Type	284	Austin-Moore Type
526	Thompson Type	324	Thompson Type	322	Thompson Type	279	ETS	213	ETS
		313	ETS	252	ETS	265	Thompson Type	193	Thompson Type
Most Used									
2514 (2)	100.0%	1385 (3)	100.0%	1186 (3)	100.0%	1035 (3)	100.0%	690 (3)	100.0%

OUTCOME FOR FRACTURED NECK OF FEMUR

The cumulative percent revision at 14 years for unipolar monoblock replacement undertaken for fractured neck of femur is 8.7% (Table HP7 and Figure HP6).

The main reason for revision is loosening/lysis (44.8%), followed by fracture (19.9%) and prosthesis dislocation (11.2%) (Table HP8). The majority of unipolar monoblock hip replacements are revised to a total hip replacement (60.1%). Revision to another unipolar hip replacement (femoral component only) has occurred in 18.4% of revisions (Table HP9).

Age and femoral stem fixation are risk factors for revision. The rate of revision decreases with increasing age (Table HP10 and Figure HP7). There is no difference in the outcome between males and females (Table HP11 and Figure HP8).

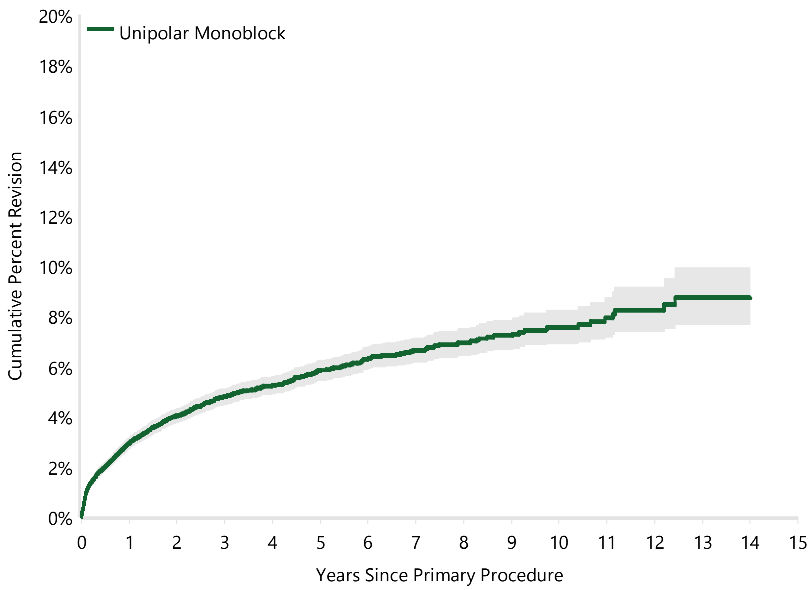
In the first 1.5 years, cementless fixation has a higher rate of revision, with no difference after this time (Table HP12 and Figure HP9).

The Austin-Moore cementless prosthesis has a higher rate of revision compared to the cemented ETS over the entire period. There is no difference in the rate of revision between the cemented ETS and cemented Thompson type prostheses (Table HP12 and Figure HP10).

Table HP7 Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement (Primary Diagnosis Fractured NOF)

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Unipolar Monoblock	1008	26868	2.9 (2.7, 3.2)	4.8 (4.5, 5.1)	5.8 (5.4, 6.2)	6.6 (6.1, 7.1)	7.5 (6.9, 8.2)	8.7 (7.7, 9.9)
TOTAL	1008	26868						

Figure HP6 Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement (Primary Diagnosis Fractured NOF)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Unipolar Monoblock	26868	16240	9271	4999	2657	945	125

Table HP8 Primary Unipolar Monoblock Hip Replacement by Reason for Revision (Primary Diagnosis Fractured NOF)

Reason for Revision	Number	Percent
Loosening/Lysis	452	44.8
Fracture	201	19.9
Prosthesis Dislocation	113	11.2
Infection	103	10.2
Pain	73	7.2
Chondrolysis/Acetab. Erosion	42	4.2
Malposition	11	1.1
Other	13	1.3
TOTAL	1008	100.0

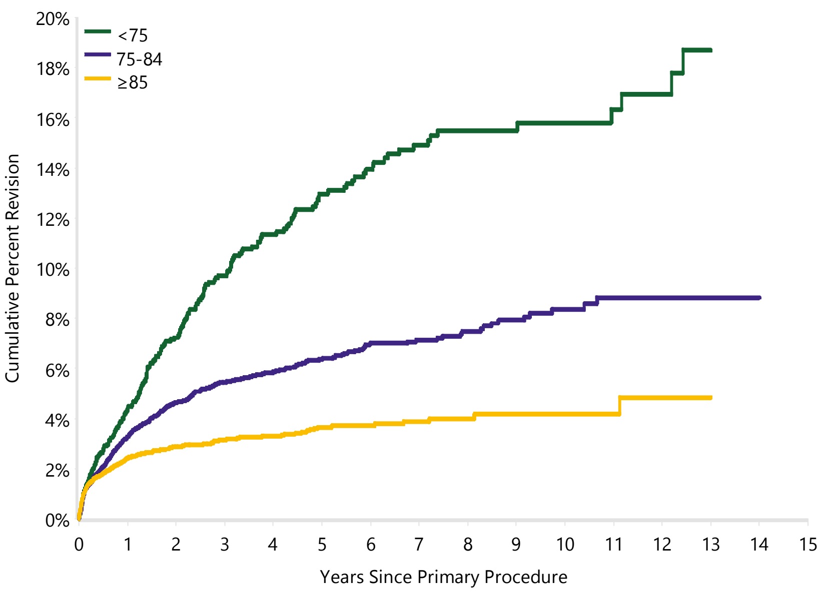
Table HP9 Primary Unipolar Monoblock Hip Replacement by Type of Revision (Primary Diagnosis Fractured NOF)

Type of Revision	Number	Percent
THR (Femoral/Acetabular)	606	60.1
Femoral Component	185	18.4
Bipolar Head and Femoral	97	9.6
Removal of Prostheses	52	5.2
Cement Spacer	42	4.2
Minor Components	17	1.7
Reinsertion of Components	6	0.6
Incomplete	1	0.1
Bipolar Only	1	0.1
Insert Only	1	0.1
TOTAL	1008	100.0

Table HP10 Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement by Age (Primary Diagnosis Fractured NOF)

Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
<75	214	2335	4.4 (3.5, 5.4)	9.7 (8.3, 11.3)	13.0 (11.3, 14.9)	14.9 (13.0, 17.1)	15.8 (13.7, 18.2)	
75-84	452	10127	3.3 (2.9, 3.7)	5.4 (4.9, 6.0)	6.3 (5.8, 7.0)	7.1 (6.4, 7.9)	8.4 (7.4, 9.5)	8.8 (7.7, 10.1)
≥85	342	14406	2.4 (2.1, 2.7)	3.1 (2.8, 3.5)	3.6 (3.2, 4.1)	3.9 (3.4, 4.4)	4.2 (3.6, 4.9)	
TOTAL	1008	26868						

Figure HP7 Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement by Age (Primary Diagnosis Fractured NOF)



HR - adjusted for gender

<75 vs ≥85
0 - 3Mth: HR=1.18 (0.83, 1.68),p=0.345
3Mth - 1Yr: HR=3.00 (2.13, 4.22),p<0.001
1Yr - 2Yr: HR=5.26 (3.64, 7.61),p<0.001
2Yr+: HR=7.23 (5.32, 9.82),p<0.001

75-84 vs ≥85
0 - 3Mth: HR=0.98 (0.79, 1.23),p=0.874
3Mth+: HR=2.30 (1.90, 2.78),p<0.001

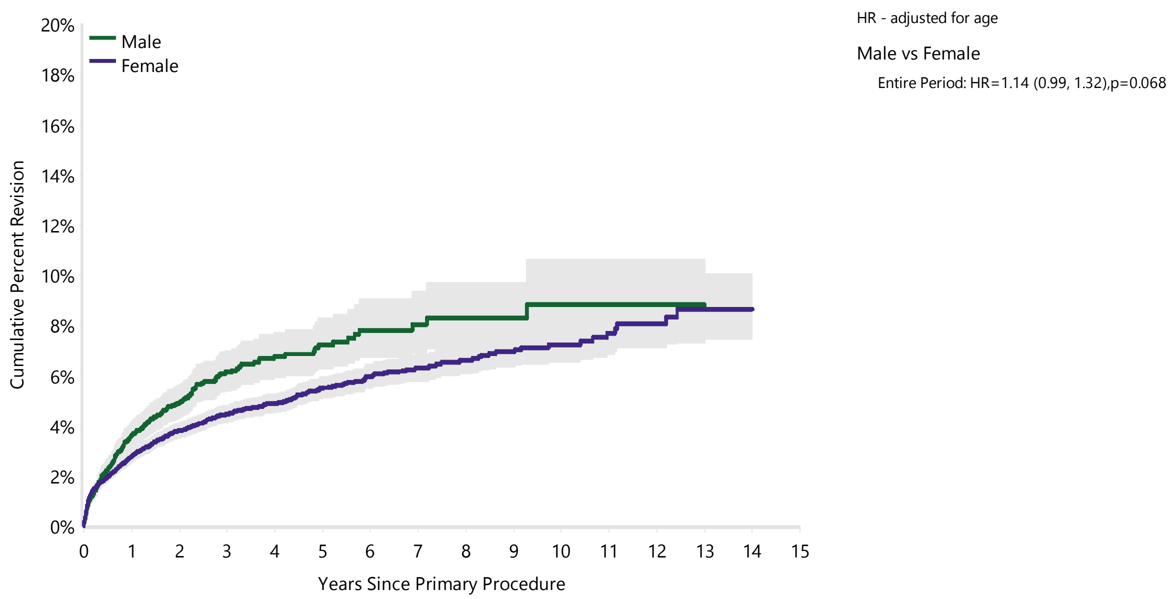
<75 vs 75-84
0 - 1.5Yr: HR=1.46 (1.18, 1.80),p<0.001
1.5Yr+: HR=2.80 (2.18, 3.60),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
<75	2335	1575	1044	691	460	214	34
75-84	10127	6557	4035	2388	1338	493	61
≥85	14406	8108	4192	1920	859	238	30

Table HP11 Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement by Gender (Primary Diagnosis Fractured NOF)

Gender	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Male	261	7206	3.6 (3.1, 4.2)	6.1 (5.4, 7.0)	7.2 (6.3, 8.3)	8.0 (6.9, 9.4)	8.8 (7.3, 10.6)	
Female	747	19662	2.8 (2.5, 3.0)	4.4 (4.1, 4.8)	5.5 (5.1, 5.9)	6.3 (5.8, 6.8)	7.2 (6.5, 8.0)	8.6 (7.4, 10.0)
TOTAL	1008	26868						

Figure HP8 Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement by Gender (Primary Diagnosis Fractured NOF)

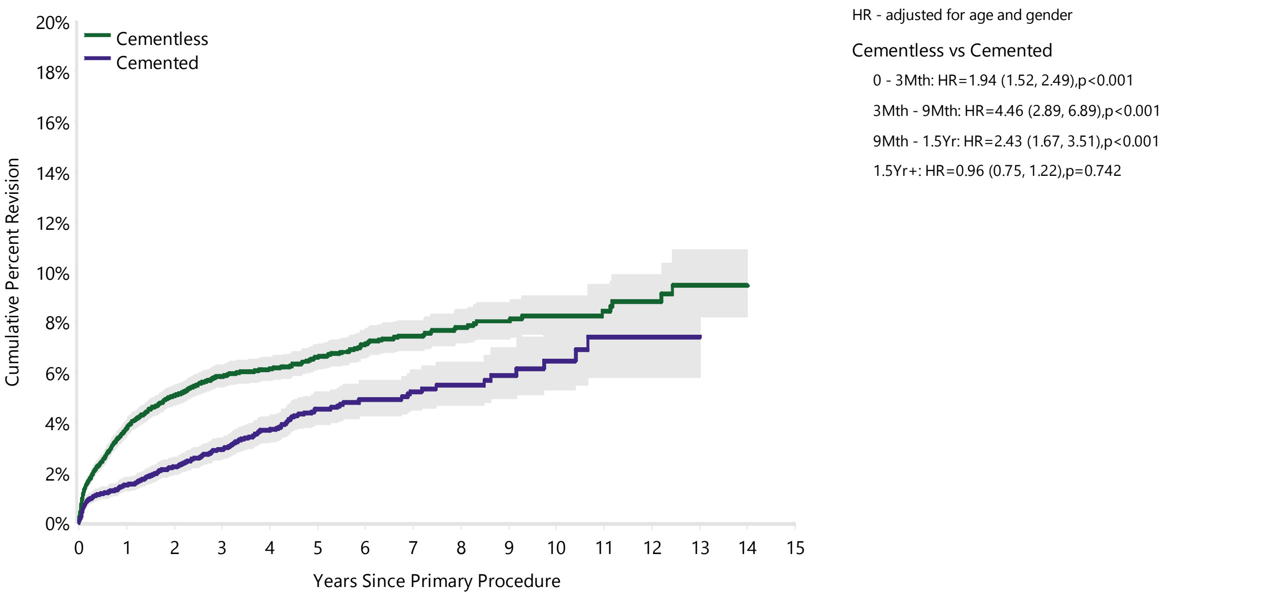


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Male	7206	3394	1578	740	390	135	26
Female	19662	12846	7693	4259	2267	810	99

Table HP12 Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement by Femoral Fixation and Prosthesis Type (Primary Diagnosis Fractured NOF)

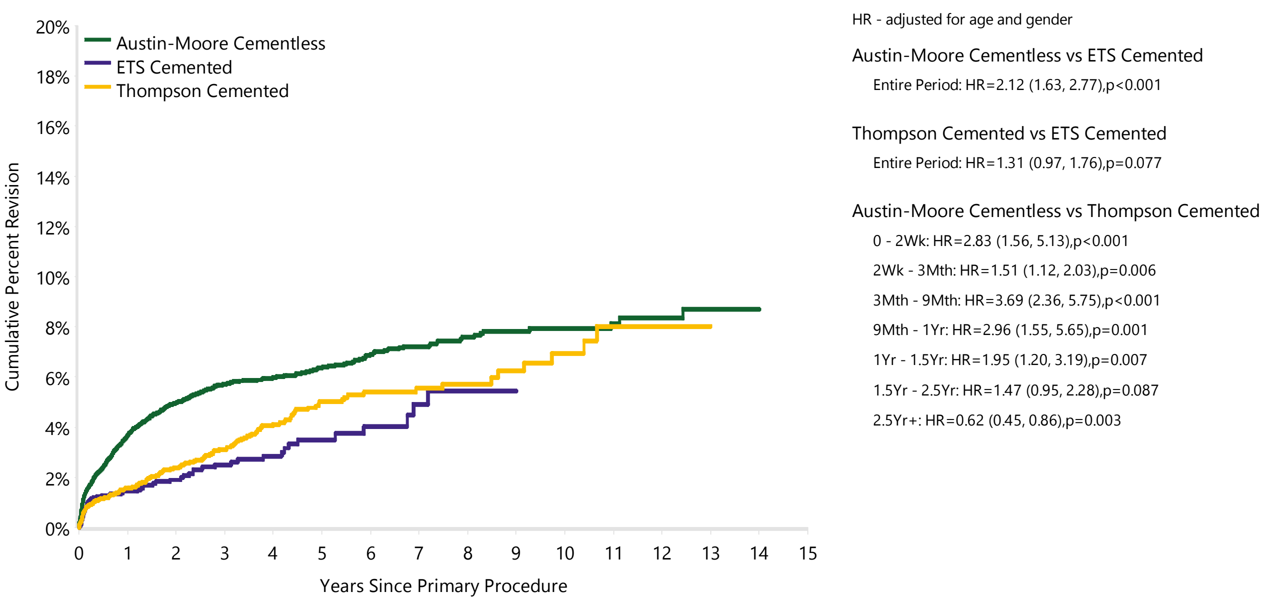
Femoral Fixation	Unipolar Monoblock	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cementless		762	17236	3.8 (3.5, 4.1)	5.8 (5.4, 6.3)	6.6 (6.1, 7.1)	7.4 (6.8, 8.1)	8.2 (7.5, 9.0)	9.4 (8.2, 10.9)
	Austin-Moore	714	16674	3.7 (3.3, 4.0)	5.7 (5.3, 6.2)	6.4 (5.9, 6.9)	7.2 (6.6, 7.8)	7.9 (7.2, 8.7)	8.7 (7.6, 9.9)
	Thompson	48	562	6.7 (4.8, 9.4)	9.5 (7.0, 13.0)	12.6 (9.2, 17.1)	13.3 (9.7, 18.1)		
Cemented		246	9632	1.5 (1.3, 1.8)	2.9 (2.5, 3.4)	4.5 (3.9, 5.2)	5.2 (4.5, 6.1)	6.4 (5.3, 7.9)	
	Austin-Moore	17	917	1.3 (0.7, 2.5)	3.0 (1.7, 5.0)	4.1 (2.3, 7.0)	4.1 (2.3, 7.0)		
	ETS	59	2704	1.4 (1.0, 2.0)	2.5 (1.9, 3.4)	3.5 (2.6, 4.7)	4.9 (3.4, 7.0)		
	Thompson	170	6011	1.6 (1.2, 1.9)	3.1 (2.6, 3.7)	5.0 (4.2, 5.9)	5.5 (4.6, 6.6)	6.9 (5.5, 8.7)	
TOTAL		1008	26868						

Figure HP9 Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement by Femoral Fixation (Primary Diagnosis Fractured NOF)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cementless	17236	10174	5864	3248	1778	693	94
Cemented	9632	6066	3407	1751	879	252	31

Figure HP10 Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement by Prosthesis Type (Primary Diagnosis Fractured NOF)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Austin-Moore Cementless	16674	9820	5652	3135	1712	670	88
ETS Cemented	2704	1710	947	450	199	22	0
Thompson Cemented	6011	3863	2201	1180	624	218	30

UNIPOLAR MODULAR

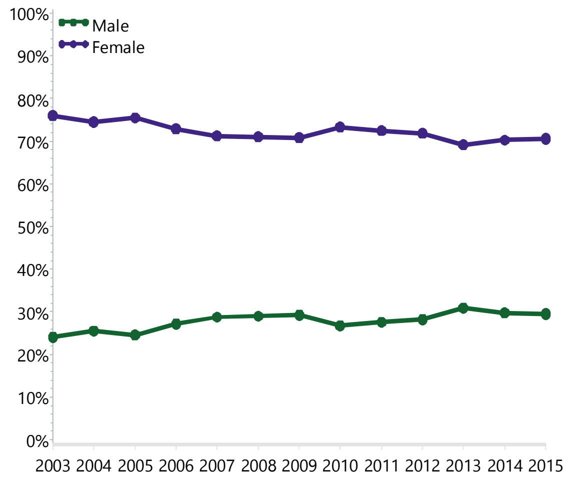
DEMOGRAPHICS

There have been 32,691 unipolar modular procedures reported to the Registry. This is an additional 3,280 procedures compared to the previous report.

In 2015, the number of unipolar modular procedures decreased by 7.1% compared to 2014 and increased by 381.1% since 2003.

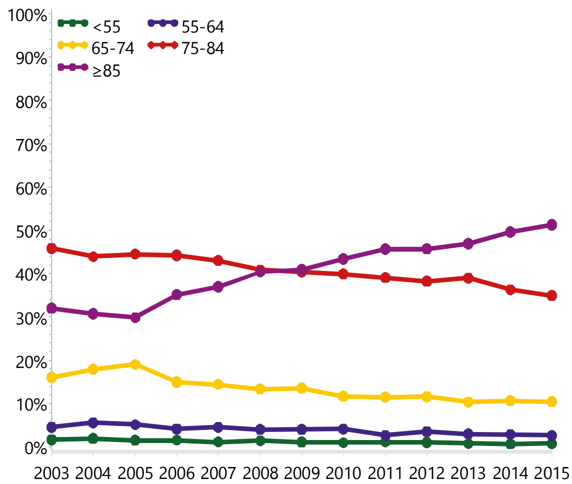
Fractured neck of femur is the principal diagnosis for primary unipolar modular hip replacement (94.7%).

Figure HP11 Primary Unipolar Modular Hip Replacement by Gender



The majority of patients are female (71.6%) and aged 75 years or older (82.6%). The proportion of patients aged 85 years or older has increased from 32.0% in 2003 to 51.2% in 2015. The mean age of patients is 81.8 years (Table HP13, Figures HP11 and HP12).

Figure HP12 Primary Unipolar Modular Hip Replacement by Age



Overall, there have been 205 unipolar modular head and stem combinations recorded by the Registry. The 10 most frequently used unipolar modular head prostheses and femoral stems are listed in Tables HP14 and HP15.

In 2015, 20 different unipolar modular head prostheses were used. The Unitrax head was the most frequently used (57.4%). The 10 most used unipolar modular head prostheses account for 99.0% of all primary unipolar modular hip procedures.

There were 44 different stem prostheses used in 2015, one less than in 2014. The most frequently used stem in 2015 was the Exeter V40 (56.1%). The 10 most used femoral stems account for 94.4% of all primary unipolar modular hip procedures.

Table HP13 Age and Gender of Primary Unipolar Modular Hip Replacement

Gender	Number	Percent	Minimum	Maximum	Median	Mean	Std Dev
Male	9270	28.4%	19	106	82	80.7	9.6
Female	23421	71.6%	18	108	84	82.3	8.6
TOTAL	**32691**	**100.0%**	**18**	**108**	**83**	**81.8**	**8.9**

Table HP14 10 Most Used Unipolar Head Prostheses in Primary Unipolar Modular Hip Replacement

2003		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
217	Unipolar Head (Zimmer)	1343	Unitrax	1475	Unitrax	1604	Unitrax	1838	Unitrax
193	Unitrax	947	Unipolar Head (S&N)	959	Unipolar Head (S&N)	951	Unipolar Head (S&N)	803	Unipolar Head (S&N)
127	Unipolar Head (S&N)	542	Unipolar Head (Zimmer)	576	Unipolar Head (Zimmer)	534	Unipolar Head (Zimmer)	198	Cathcart
64	Unipolar Head (Mathys)	158	Metasul	126	Cathcart	161	Cathcart	164	Unipolar Head (Zimmer)
46	Elite	113	Cathcart	71	Unipolar Head (Corin)	57	Pharo	61	Unipolar Head (Corin)
16	Ultima	92	U2	52	Metasul	52	Unipolar Head (Corin)	39	Unipolar Head (Lima)
1	Metasul	62	Unipolar Head (Corin)	27	Pharo	36	Unipolar Head (JRI)	20	Unipolar Head (JRI)
1	Optimom	27	Unipolar Head (Lima)	17	Unipolar Head (Lima)	25	Unipolar Head (Lima)	19	FMP
1	Unipolar Head (Sulzer)	16	Pharo	8	FMP	13	FMP	17	Pharo
		11	Conserve	8	Unipolar Head (JRI)	4	Femoral Head (Stryker)	14	Unipolar Head (Mathys)
10 Most Used									
666 (9) 100.0%		3311 (10) 99.4%		3319 (10) 99.4%		3437 (10) 99.7%		3173 (10) 99.0%	
Remainder									
0 (0) 0%		21 (10) 0.6%		21 (8) 0.6%		12 (6) 0.3%		31 (10) 1.0%	
TOTAL									
666 (9) 100.0%		3332 (20) 100.0%		3340 (18) 100.0%		3449 (16) 100.0%		3204 (20) 100.0%	

Table HP15 10 Most Used Femoral Stem Prostheses in Primary Unipolar Modular Hip Replacement

2003		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
180	Exeter V40	1303	Exeter V40	1437	Exeter V40	1549	Exeter V40	1798	Exeter V40
111	Alloclassic	590	CPT	570	CPT	561	CPCS	512	CPCS
91	CPT	480	CPCS	518	CPCS	482	CPT	181	Spectron EF
70	Spectron EF	239	Spectron EF	181	SL-Plus	185	Spectron EF	147	CPT
49	Fullfix	158	SL-Plus	178	Spectron EF	122	SL-Plus	104	C-Stem AMT
38	SL-Plus	92	E2	82	Corail	87	C-Stem AMT	96	Corail
33	Elite Plus	91	Corail	69	Metafix	74	Corail	67	SL-Plus
18	Basis	71	Alloclassic	55	Basis	56	Pharo	59	Metafix
15	CCA	57	Metafix	45	C-Stem AMT	52	Metafix	35	H-Max
15	Thompson Modular Stem	40	Basis	42	Alloclassic	44	Omnifit	24	Absolut
10 Most Used									
620 (10) 93.1%		3121 (10) 93.7%		3177 (10) 95.1%		3212 (10) 93.1%		3023 (10) 94.4%	
Remainder									
46 (13) 6.9%		211 (42) 6.3%		163 (26) 4.9%		237 (35) 6.9%		181 (34) 5.6%	
TOTAL									
666 (23) 100.0%		3332 (52) 100.0%		3340 (36) 100.0%		3449 (45) 100.0%		3204 (44) 100.0%	

OUTCOME FOR ALL DIAGNOSES

The Registry has recorded 1,110 revisions of primary unipolar modular hip replacement.

The main reasons for revision are prosthesis dislocation (20.2%), infection (18.8%), fracture (16.0%) and loosening/lysis (14.5%) (Table HP16). The majority of revisions are acetabular only revisions (45.2%), followed by total hip replacement (femoral/acetabular) revisions (17.8%) (Table HP17).

The cumulative percent revision of unipolar modular stem/head prosthesis combinations with more than 100 procedures is detailed in Table HP18.

Table HP16 Primary Unipolar Modular Hip Replacement by Reason for Revision

Reason for Revision	Number	Percent
Prosthesis Dislocation	224	20.2
Infection	209	18.8
Fracture	178	16.0
Loosening/Lysis	161	14.5
Chondrolysis/Acetab. Erosion	152	13.7
Pain	140	12.6
Malposition	3	0.3
Other	43	3.9
TOTAL	1110	100.0

Table HP17 Primary Unipolar Modular Hip Replacement by Type of Revision

Type of Revision	Number	Percent
Acetabular Component	502	45.2
THR (Femoral/Acetabular)	198	17.8
Femoral Component	129	11.6
Head Only	128	11.5
Cement Spacer	47	4.2
Minor Components	38	3.4
Bipolar Head and Femoral	31	2.8
Removal of Prostheses	25	2.3
Bipolar Only	7	0.6
Reinsertion of Components	4	0.4
Cement Only	1	0.1
TOTAL	1110	100.0

Note: Femoral heads are usually replaced when the acetabular component and/or femoral stem is revised

Table HP18 Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement by Prosthesis Type

Unipolar Head	Femoral Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cathcart	C-Stem AMT	3	286	1.3 (0.4, 4.1)					
Cathcart	Corail	67	1249	3.7 (2.7, 5.0)	6.0 (4.6, 7.7)	7.4 (5.7, 9.6)	10.1 (7.6, 13.4)		
Endo II	Taperloc	5	102	5.1 (2.2, 11.9)	5.1 (2.2, 11.9)				
Metasul	Alloclassic	15	345	2.5 (1.3, 4.9)	3.7 (2.1, 6.6)	4.3 (2.4, 7.7)			
Metasul	CPT	4	215	1.6 (0.5, 4.9)	2.7 (0.9, 7.4)				
Pharo	Pharo	5	132	2.6 (0.8, 7.9)					
U2	E2	2	232	0.0 (0.0, 0.0)	1.5 (0.4, 6.0)				
Ultima	Thompson Modular Stem	1	133	0.8 (0.1, 5.5)	0.8 (0.1, 5.5)	0.8 (0.1, 5.5)	0.8 (0.1, 5.5)		
Unipolar Head (Corin)	Metafix	13	406	2.1 (1.0, 4.4)	3.2 (1.6, 6.1)				
Unipolar Head (Corin)	Taper Fit	17	306	2.2 (1.0, 4.8)	5.7 (3.3, 9.7)	7.2 (4.3, 11.8)	8.2 (4.9, 13.5)		
Unipolar Head (Corin)	Tri-Fit	8	288	1.5 (0.6, 4.0)	2.7 (1.2, 5.9)	2.7 (1.2, 5.9)	4.8 (2.2, 10.1)		
Unipolar Head (JRI)	Furlong LOL	10	125	7.0 (3.4, 14.2)	11.2 (6.1, 20.1)				
Unipolar Head (Mathys)	CCA	9	357	1.0 (0.3, 3.0)	2.6 (1.2, 5.3)	2.6 (1.2, 5.3)	3.5 (1.7, 7.4)	3.5 (1.7, 7.4)	
Unipolar Head (Mathys)	Fullfix	8	226	1.5 (0.5, 4.7)	2.7 (1.1, 6.5)	2.7 (1.1, 6.5)	6.1 (2.9, 12.4)		
Unipolar Head (Plus)	SL-Plus	8	193	2.2 (0.8, 5.8)	3.6 (1.6, 8.0)	4.6 (2.2, 9.6)	5.9 (2.9, 11.9)		
Unipolar Head (S&N)	Basis	24	573	2.0 (1.1, 3.7)	3.3 (1.9, 5.5)	6.9 (4.4, 10.5)	7.5 (4.9, 11.4)		
Unipolar Head (S&N)	CPCS	104	4102	1.9 (1.5, 2.4)	3.0 (2.4, 3.8)	4.0 (3.2, 5.0)	4.8 (3.8, 6.2)		
Unipolar Head (S&N)	Platform	6	110	4.1 (1.5, 10.5)	4.1 (1.5, 10.5)	6.0 (2.4, 14.5)			
Unipolar Head (S&N)	SL-Plus	39	1020	2.3 (1.5, 3.5)	4.4 (3.1, 6.3)	4.9 (3.4, 7.1)	6.2 (4.1, 9.1)		
Unipolar Head (S&N)	Spectron EF	87	2747	1.5 (1.1, 2.1)	2.9 (2.3, 3.8)	4.1 (3.2, 5.2)	5.6 (4.4, 7.2)	7.9 (5.8, 10.7)	
Unipolar Head (Zimmer)	Alloclassic	59	1169	3.1 (2.2, 4.3)	4.3 (3.2, 5.8)	5.9 (4.5, 7.7)	7.6 (5.7, 10.0)	7.6 (5.7, 10.0)	
Unipolar Head (Zimmer)	CPT	143	4285	1.9 (1.5, 2.4)	3.6 (3.0, 4.4)	5.0 (4.1, 6.0)	6.3 (5.1, 7.8)	7.2 (5.6, 9.4)	
Unipolar Head (Zimmer)	VerSys	4	169	3.2 (1.2, 8.5)	3.2 (1.2, 8.5)				
Unitrax	Accolade I	7	130	0.8 (0.1, 5.6)	6.6 (3.0, 14.2)	6.6 (3.0, 14.2)			
Unitrax	Exeter V40	376	12050	1.8 (1.6, 2.1)	3.5 (3.1, 4.0)	5.2 (4.6, 5.8)	6.6 (5.8, 7.6)	8.5 (7.1, 10.0)	
Unitrax	Omnifit	7	253	2.7 (1.2, 5.9)	3.3 (1.6, 6.7)	3.3 (1.6, 6.7)			
Other (179)		79	1488	3.6 (2.7, 4.8)	5.7 (4.4, 7.3)	7.7 (6.1, 9.9)	10.0 (7.7, 12.9)	10.8 (8.2, 14.2)	
TOTAL		1110	32691						

Note: Only combinations with over 100 procedures have been listed

OUTCOME FOR FRACTURED NECK OF FEMUR

The cumulative percent revision at 14 years for unipolar modular hip replacement, when undertaken for fractured neck of femur, is 10.7% (Table HP19 and Figure HP13).

Age, gender and femoral stem fixation are risk factors for revision. The rate of revision decreases with increasing age (Table HP20 and Figure HP14). Males have a higher rate of revision in the first 1.5 years (Table HP21 and Figure HP15).

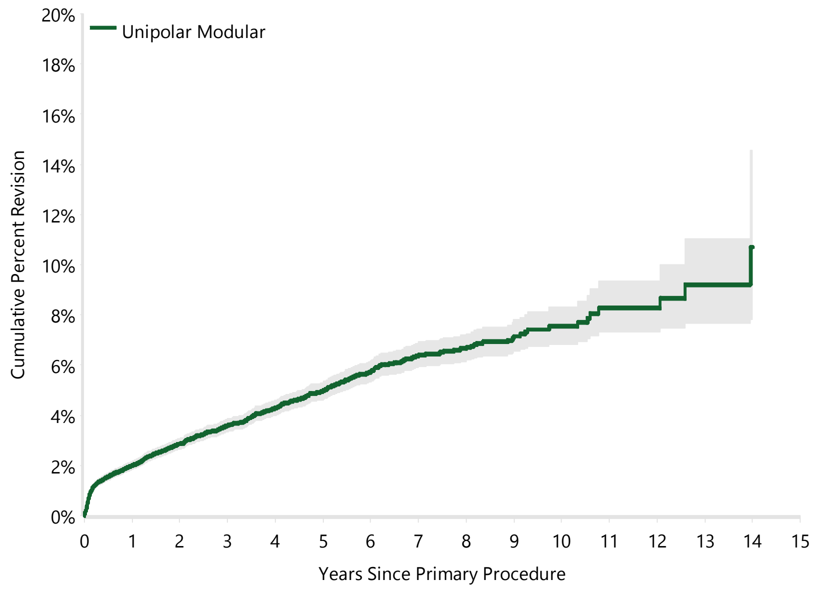
Cementless fixation has a higher rate of revision in the first nine months, with no difference after this time (Table HP22 and Figure HP16). The cumulative incidence for loosening/lysis and fracture is higher for cementless compared to cemented fixation (Figure HP17).

"When used for fractured neck of femur, cementless fixation has a higher rate of revision in the first nine months, with no difference after this time."

Table HP19 Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement (Primary Diagnosis Fractured NOF)

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Unipolar Modular	1024	30951	2.0 (1.8, 2.2)	3.6 (3.3, 3.8)	5.0 (4.6, 5.3)	6.4 (5.9, 6.9)	7.5 (6.8, 8.3)	10.7 (7.8, 14.5)
TOTAL	1024	30951						

Figure HP13 Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement (Primary Diagnosis Fractured NOF)

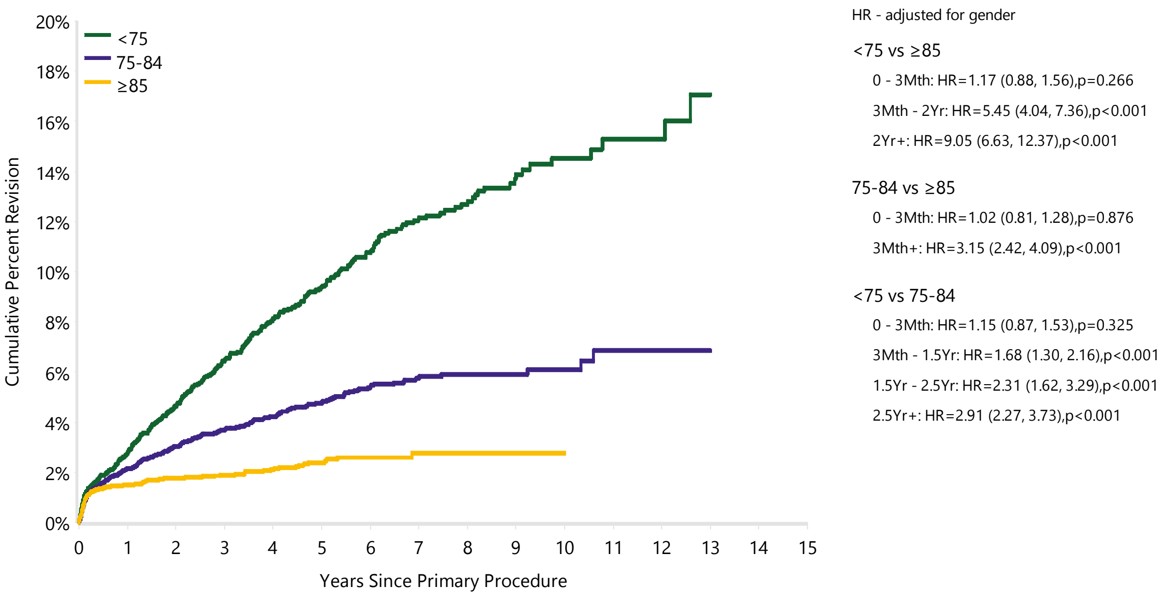


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Unipolar Modular	30951	20951	11956	6153	2869	688	57

Table HP20 Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement by Age (Primary Diagnosis Fractured NOF)

Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
<75	386	5235	2.7 (2.3, 3.3)	6.5 (5.7, 7.3)	9.4 (8.4, 10.4)	12.1 (10.9, 13.5)	14.5 (12.9, 16.4)	
75-84	424	12345	2.1 (1.9, 2.4)	3.7 (3.3, 4.1)	4.8 (4.3, 5.3)	5.7 (5.1, 6.4)	6.1 (5.4, 6.9)	
≥85	214	13371	1.5 (1.3, 1.7)	1.9 (1.6, 2.2)	2.4 (2.0, 2.8)	2.7 (2.2, 3.4)	2.7 (2.2, 3.4)	
TOTAL	1024	30951						

Figure HP14 Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement by Age (Primary Diagnosis Fractured NOF)

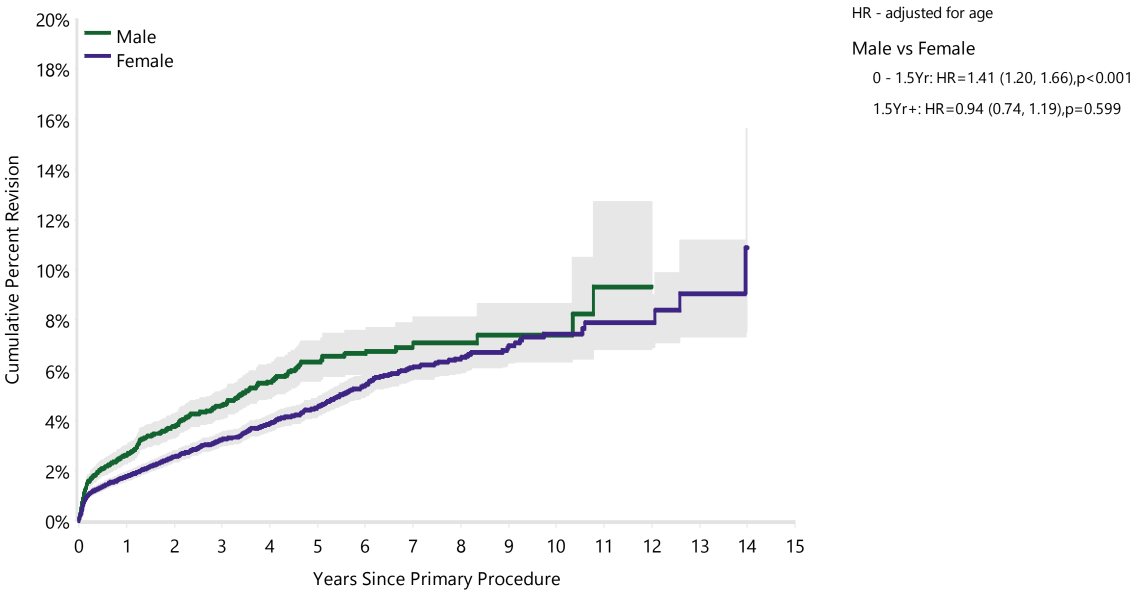


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
<75	5235	3936	2631	1666	932	311	30
75-84	12345	8930	5427	2907	1409	322	23
≥85	13371	8085	3898	1580	528	55	4

Table HP21 Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement by Gender (Primary Diagnosis Fractured NOF)

Gender	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Male	314	8762	2.6 (2.3, 3.0)	4.6 (4.1, 5.2)	6.3 (5.6, 7.2)	7.1 (6.1, 8.1)	7.4 (6.3, 8.6)	
Female	710	22189	1.8 (1.6, 2.0)	3.2 (2.9, 3.5)	4.5 (4.1, 4.9)	6.1 (5.6, 6.7)	7.4 (6.6, 8.3)	10.9 (7.5, 15.6)
TOTAL	1024	30951						

Figure HP15 Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement by Gender (Primary Diagnosis Fractured NOF)

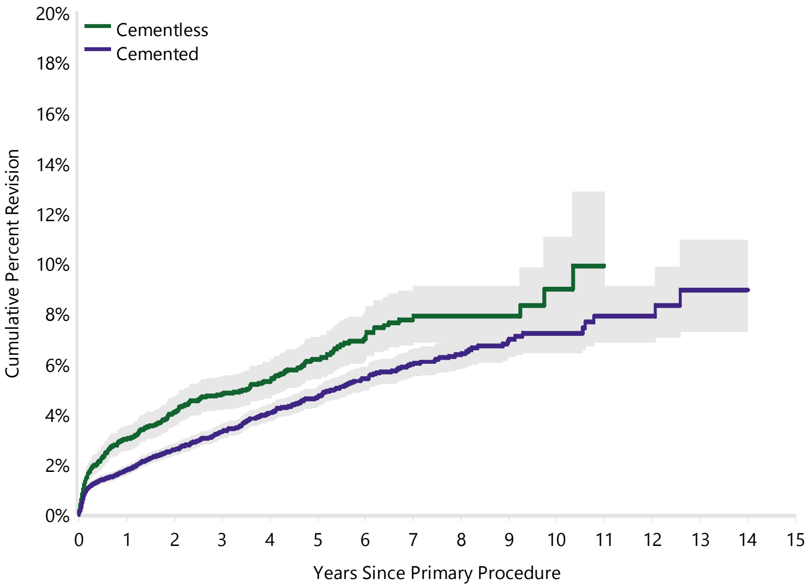


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Male	8762	5148	2570	1218	553	123	10
Female	22189	15803	9386	4935	2316	565	47

Table HP22 Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement by Femoral Fixation (Primary Diagnosis Fractured NOF)

Femoral Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cementless	267	5772	3.0 (2.6, 3.5)	4.8 (4.2, 5.5)	6.2 (5.4, 7.0)	7.9 (6.9, 9.1)	9.0 (7.3, 11.0)	
Cemented	757	25179	1.7 (1.6, 1.9)	3.3 (3.0, 3.6)	4.7 (4.3, 5.1)	6.0 (5.5, 6.5)	7.2 (6.4, 8.1)	8.9 (7.3, 10.9)
TOTAL	1024	30951						

Figure HP16 Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement by Femoral Fixation (Primary Diagnosis Fractured NOF)



HR - adjusted for age and gender

Cementless vs Cemented

0 - 3Mth: HR=1.53 (1.21, 1.94),p<0.001

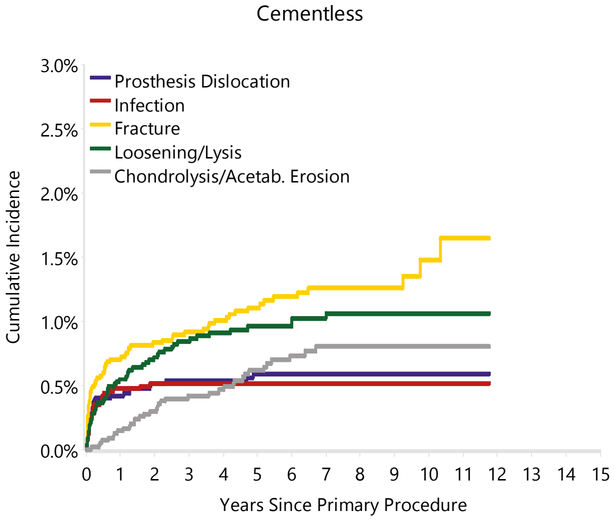
3Mth - 6Mth: HR=2.05 (1.26, 3.34),p=0.003

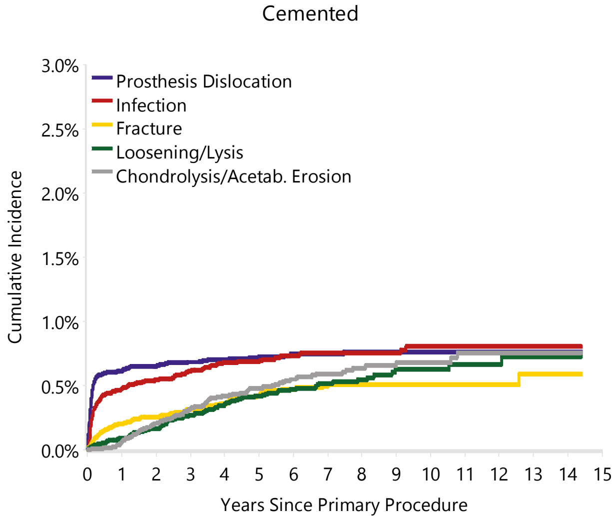
6Mth - 9Mth: HR=3.13 (1.80, 5.45),p<0.001

9Mth+: HR=1.13 (0.93, 1.38),p=0.220

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cementless	5772	4116	2557	1463	698	117	2
Cemented	25179	16835	9399	4690	2171	571	55

Figure HP17 Cumulative Incidence Revision Diagnosis of Primary Unipolar Modular Hip Replacement by Femoral Fixation (Primary Diagnosis Fractured NOF)





BIPOLAR

DEMOGRAPHICS

There have been 17,043 bipolar hip replacement procedures reported to the Registry. This is an additional 1,986 procedures compared to the previous report.

There has been an increase in the number of bipolar procedures undertaken each year since 2010, with 42.4% more procedures in 2015 compared to 2014. The total number of bipolar procedures has increased by 44.1% since 2003 (Figure HP1).

Fractured neck of femur is the principal diagnosis for bipolar hip replacement (90.8%).

The majority of patients are female (71.9%) and aged 75 years or older (77.4%). The proportion of patients aged 85 years or older has increased from 26.0% in 2003 to 47.8% in 2015. The mean age of patients is 80.2 years (Table HP23, Figures HP18 and HP19).

Figure HP18 Primary Bipolar Hip Replacement by Gender

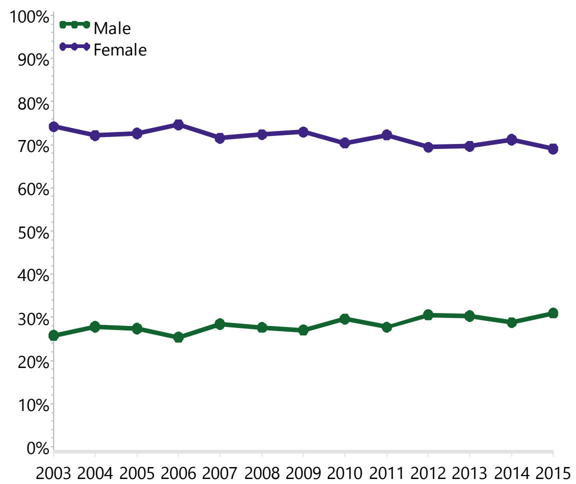
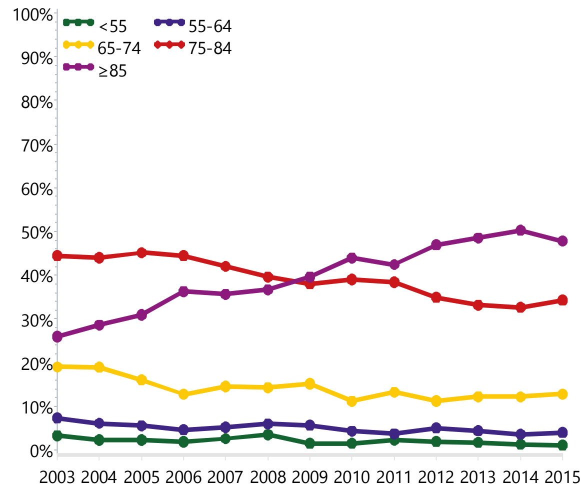


Figure HP19 Primary Bipolar Hip Replacement by Age



Overall, there have been 253 bipolar head and stem combinations reported to the Registry. In 2015, there were 11 different bipolar head and 44 different stem prostheses used.

In 2015, the UHR remains the most frequently used bipolar head (41.3%) and the Exeter V40 the most frequently used femoral stem (39.3%). The 10 most used bipolar head prostheses account for 99.9% of all bipolar hip procedures. The 10 most used femoral stems account for 90.9% of all bipolar hip procedures (Tables HP24 and HP25).

Table HP23 Age and Gender of Primary Bipolar Hip Replacement

Gender	Number	Percent	Minimum	Maximum	Median	Mean	Std Dev
Male	4788	28.1%	17	101	81	79.3	10.9
Female	12255	71.9%	15	107	82	80.5	9.7
TOTAL	17043	100.0%	15	107	82	80.2	10.0

Table HP24 10 Most Used Bipolar Head Prostheses in Primary Bipolar Hip Replacement

2003		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
760	UHR	524	UHR	596	UHR	771	UHR	798	UHR
140	Hastings	147	Tandem	155	Tandem	204	Multipolar Bipolar	740	Multipolar Bipolar
115	Convene	106	Multipolar Bipolar	130	Multipolar Bipolar	116	Tandem	176	Self-Centering
91	Bipolar Head (Zimmer)	58	Self-Centering	46	Bipolar Head (Lima)	86	Self-Centering	108	Tandem
87	Self-Centering	39	Bipolar Head (Lima)	38	Hastings	62	Bipolar Head (Medacta)	67	Bipolar Head (Medacta)
59	Multipolar Bipolar	36	Hastings	35	Self-Centering	33	Hastings	18	Ringloc
39	Bipolar Head (Mathys)	27	Bipolar Head (Medacta)	34	Bipolar Head (Medacta)	30	Bipolar Head (Lima)	16	Bipolar Head (Lima)
19	Bipolar Head (Lima)	22	Moonstone	22	Ringloc	28	Ringloc	3	Bipolar Head (Mathys)
19	Ringloc	17	Ringloc	8	Moonstone	13	AcuMatch L-Series	3	Hastings
5	UHL	3	Bipolar Head (Eska)	8	Pharo	5	Gladiator	2	Bipolar Head (Implantcast)
10 Most Used									
1334 (10) 99.5%		979 (10) 98.8%		1072 (10) 98.2%		1348 (10) 99.3%		1931 (10) 99.9%	
Remainder									
7 (2) 0.5%		12 (5) 1.2%		20 (7) 1.8%		9 (4) 0.7%		1 (1) 0.1%	
TOTAL									
1341 (12) 100.0%		991 (15) 100.0%		1092 (17) 100.0%		1357 (14) 100.0%		1932 (11) 100.0%	

Table HP25 10 Most Used Femoral Stem Prostheses in Primary Bipolar Hip Replacement

2003		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
630	Exeter V40	459	Exeter V40	577	Exeter V40	726	Exeter V40	760	Exeter V40
94	Elite Plus	95	CPCS	116	CPCS	168	CPT	647	CPT
75	Alloclassic	67	Corail	106	CPT	86	Corail	123	Corail
65	CPCS	65	CPT	55	Corail	84	CPCS	76	CPCS
61	C-Stem	53	Accolade I	28	Quadra-C	40	Accolade I	35	Quadra-C
59	Omnifit	26	C2	26	C2	26	Quadra-C	26	C-Stem AMT
33	VerSys	21	Basis	24	Basis	25	X-Acta	24	X-Acta
26	ABGII	21	Quadra-C	19	H-Max	20	H-Max	23	Alloclassic
25	CCA	19	Alloclassic	15	Accolade I	15	Alloclassic	21	Accolade I
25	Spectron EF	18	Hyperion	14	Alloclassic	13	C-Stem AMT	21	Summit
10 Most Used									
1093 (10) 81.5%		844 (10) 85.2%		980 (10) 89.7%		1203 (10) 88.7%		1756 (10) 90.9%	
Remainder									
248 (46) 18.5%		147 (30) 14.8%		112 (33) 10.3%		154 (37) 11.3%		176 (34) 9.1%	
TOTAL									
1341 (56) 100.0%		991 (40) 100.0%		1092 (43) 100.0%		1357 (47) 100.0%		1932 (44) 100.0%	

OUTCOME FOR ALL DIAGNOSES

The Registry has recorded 589 revisions of primary bipolar hip replacement.

The main reasons for revision are fracture (23.8%), infection (19.7%), prosthesis dislocation (18.8%), and loosening/lysis (18.7%) (Table HP26).

The majority of revisions are acetabular only revisions (35.8%), followed by total hip replacement (femoral/acetabular) revisions (22.2%) and bipolar head and femoral revisions (13.6%) (Table HP27).

The cumulative percent revision of bipolar stem/head prosthesis combinations with more than 100 procedures is detailed in Table HP28.

Table HP26 Primary Bipolar Hip Replacement by Reason for Revision

Reason for Revision	Number	Percent
Fracture	140	23.8
Infection	116	19.7
Prosthesis Dislocation	111	18.8
Loosening/Lysis	110	18.7
Pain	45	7.6
Chondrolysis/Acetab. Erosion	43	7.3
Malposition	3	0.5
Other	21	3.6
TOTAL	589	100.0

Table HP27 Primary Bipolar Hip Replacement by Type of Revision

Type of Revision	Number	Percent
Acetabular Component	211	35.8
THR (Femoral/Acetabular)	131	22.2
Bipolar Head and Femoral	80	13.6
Bipolar Only	64	10.9
Femoral Component	33	5.6
Cement Spacer	31	5.3
Head Only	15	2.5
Removal of Prostheses	13	2.2
Minor Components	11	1.9
TOTAL	589	100.0

Note: Femoral heads are usually replaced when the acetabular component and/or femoral stem is revised

Table HP28 Cumulative Percent Revision of Primary Bipolar Hip Replacement by Prosthesis Type

Bipolar Head	Femoral Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Bipolar Head (Medacta)	Quadra-C	3	145	2.7 (0.9, 8.2)					
Bipolar Head (Zimmer)	Alloclassic	13	358	0.9 (0.3, 2.8)	2.3 (1.1, 4.9)	2.8 (1.4, 5.4)	3.4 (1.7, 6.6)	6.8 (3.8, 12.0)	
Centrax	Exeter	7	200	2.1 (0.8, 5.5)	2.8 (1.2, 6.5)	2.8 (1.2, 6.5)	2.8 (1.2, 6.5)	3.9 (1.7, 9.0)	
Convene	CPCS	16	347	2.2 (1.1, 4.6)	3.3 (1.8, 6.1)	5.2 (3.1, 8.8)	5.9 (3.5, 9.8)	6.7 (4.0, 11.0)	
Convene	Spectron EF	8	123	2.6 (0.9, 8.0)	3.8 (1.4, 10.1)	6.6 (2.9, 14.4)	6.6 (2.9, 14.4)		
Hastings	C-Stem	10	208	2.5 (1.1, 5.9)	5.7 (3.1, 10.3)	5.7 (3.1, 10.3)	5.7 (3.1, 10.3)		
Hastings	Charnley	5	118	0.0 (0.0, 0.0)	2.5 (0.6, 9.5)	5.6 (2.1, 14.3)			
Hastings	Corail	16	358	3.3 (1.8, 5.9)	4.1 (2.4, 7.0)	4.8 (2.8, 8.3)	4.8 (2.8, 8.3)		
Hastings	Elite Plus	15	298	1.9 (0.8, 4.6)	4.3 (2.3, 7.9)	5.4 (3.1, 9.5)	6.8 (4.0, 11.4)	6.8 (4.0, 11.4)	
Hastings	Summit	3	102	2.5 (0.6, 9.6)	2.5 (0.6, 9.6)				
Multipolar Bipolar	Alloclassic	8	179	4.3 (2.1, 8.9)	4.3 (2.1, 8.9)				
Multipolar Bipolar	CPT	35	1341	2.6 (1.8, 3.8)	3.9 (2.6, 5.7)	4.6 (2.9, 7.1)	5.9 (3.4, 10.2)		
Multipolar Bipolar	VerSys	2	222	0.0 (0.0, 0.0)	1.8 (0.4, 6.8)	1.8 (0.4, 6.8)	1.8 (0.4, 6.8)		
Multipolar Bipolar	VerSys Heritage	11	275	1.7 (0.6, 4.5)	3.2 (1.5, 6.7)	4.0 (2.0, 8.0)	4.0 (2.0, 8.0)		
Ringloc	Mallory-Head	4	110	2.4 (0.6, 9.2)	2.4 (0.6, 9.2)				
Self-Centering	C-Stem	3	111	0.0 (0.0, 0.0)	1.2 (0.2, 8.2)	1.2 (0.2, 8.2)			
Self-Centering	Corail	14	409	3.7 (2.1, 6.3)	3.7 (2.1, 6.3)	3.7 (2.1, 6.3)			
Self-Centering	Elite Plus	3	238	0.0 (0.0, 0.0)	0.6 (0.1, 3.9)	1.3 (0.3, 5.2)	2.5 (0.8, 7.8)	2.5 (0.8, 7.8)	
Tandem	Basis	13	114	2.0 (0.5, 7.8)	13.1 (7.4, 22.6)				
Tandem	CPCS	29	1118	1.8 (1.1, 2.9)	3.0 (2.0, 4.5)	3.3 (2.2, 4.9)	4.2 (2.7, 6.4)		
Tandem	Spectron EF	6	155	2.2 (0.7, 6.6)	4.1 (1.7, 9.6)	5.4 (2.4, 11.9)			
UHR	ABGII	19	177	4.4 (2.1, 8.9)	5.1 (2.6, 10.1)	10.9 (6.5, 18.0)	13.7 (8.4, 21.9)		
UHR	Accolade I	14	303	2.9 (1.5, 5.7)	4.5 (2.5, 8.1)	4.5 (2.5, 8.1)			
UHR	Exeter	10	205	1.6 (0.5, 4.9)	3.5 (1.6, 7.7)	4.9 (2.5, 9.7)	4.9 (2.5, 9.7)	4.9 (2.5, 9.7)	
UHR	Exeter V40	191	7076	1.9 (1.6, 2.3)	3.0 (2.6, 3.5)	3.6 (3.1, 4.2)	4.1 (3.5, 4.8)	4.7 (3.9, 5.6)	
UHR	GMRS	8	106	3.1 (1.0, 9.2)	4.7 (1.7, 12.4)				
UHR	Omnifit	21	371	5.0 (3.1, 7.9)	5.3 (3.4, 8.3)	5.8 (3.7, 8.9)	7.0 (4.5, 10.8)	7.0 (4.5, 10.8)	
Other (226)		102	2276	3.0 (2.3, 3.8)	4.8 (3.8, 5.9)	5.4 (4.4, 6.7)	6.1 (4.9, 7.6)	8.2 (6.5, 10.4)	
TOTAL		**589**	**17043**						

Note: Only combinations with over 100 procedures have been listed

OUTCOME FOR FRACTURED NECK OF FEMUR

The cumulative percent revision at 14 years for bipolar hip replacement undertaken for fractured neck of femur is 6.9% (Table HP29 and Figure HP20).

Age and femoral stem fixation are risk factors for revision. Patients aged less than 75 years have a higher rate of revision compared to the two older age groups (Table HP30 and Figure HP21). There is no difference in outcome between males and females (Table HP31 and Figure HP22).

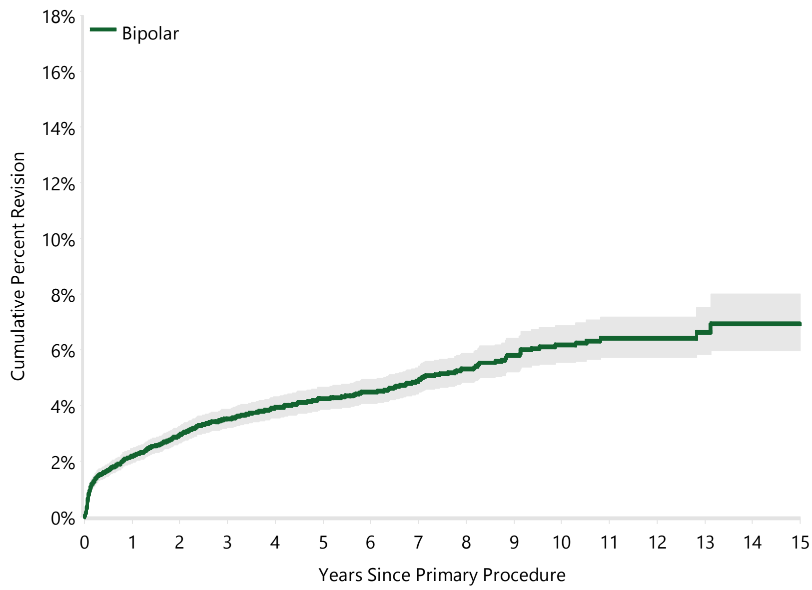
Cementless fixation has a higher rate of revision compared to cemented fixation (Table HP32 and Figure HP23). The cumulative incidence of fracture for cementless fixation is higher than for cemented fixation (Figure HP24).

"Cementless fixation has a higher rate of revision compared to cemented fixation."

Table HP29 Cumulative Percent Revision of Primary Bipolar Hip Replacement (Primary Diagnosis Fractured NOF)

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Bipolar	516	15477	2.2 (1.9, 2.4)	3.5 (3.2, 3.9)	4.2 (3.9, 4.7)	4.9 (4.4, 5.4)	6.2 (5.5, 6.9)	6.9 (6.0, 8.0)
TOTAL	516	15477						

Figure HP20 Cumulative Percent Revision of Primary Bipolar Hip Replacement (Primary Diagnosis Fractured NOF)

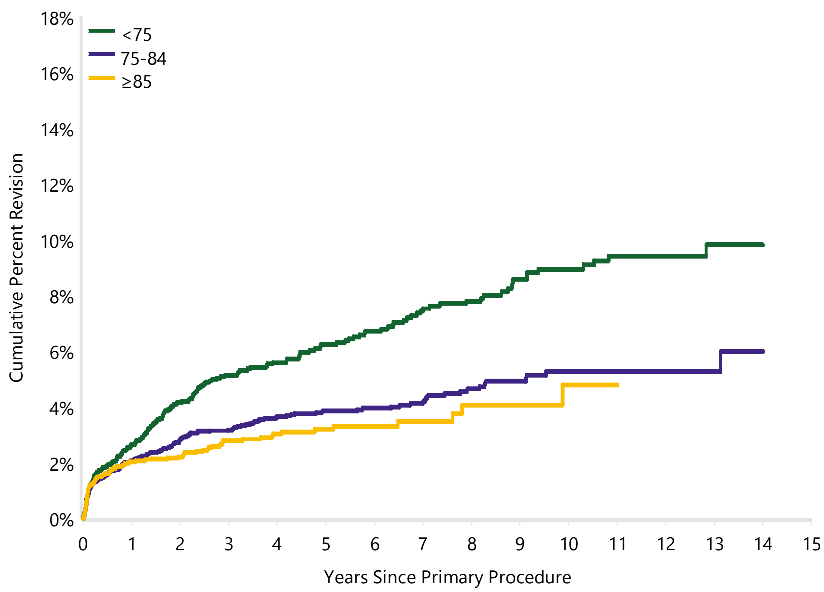


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Bipolar	15477	10644	6900	4546	2982	1412	134

Table HP30 Cumulative Percent Revision of Primary Bipolar Hip Replacement by Age (Primary Diagnosis Fractured NOF)

Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
<75	184	3208	2.7 (2.1, 3.3)	5.2 (4.4, 6.1)	6.2 (5.3, 7.3)	7.4 (6.4, 8.7)	8.9 (7.7, 10.4)	9.8 (8.3, 11.6)
75-84	200	6278	2.1 (1.7, 2.5)	3.2 (2.7, 3.7)	3.8 (3.3, 4.5)	4.1 (3.6, 4.8)	5.3 (4.5, 6.2)	6.0 (4.5, 7.9)
≥85	132	5991	2.0 (1.7, 2.5)	2.8 (2.3, 3.4)	3.2 (2.6, 3.9)	3.5 (2.8, 4.3)	4.8 (3.3, 6.9)	
TOTAL	516	15477						

Figure HP21 Cumulative Percent Revision of Primary Bipolar Hip Replacement by Age (Primary Diagnosis Fractured NOF)



HR - adjusted for gender

<75 vs ≥85
0 - 1Yr: HR=1.37 (1.02, 1.83),p=0.033
1Yr - 1.5Yr: HR=3.55 (1.85, 6.80),p<0.001
1.5Yr - 2Yr: HR=2.86 (1.45, 5.64),p=0.002
2Yr+: HR=2.30 (1.60, 3.31),p<0.001

75-84 vs ≥85
Entire Period: HR=1.15 (0.92, 1.43),p=0.226

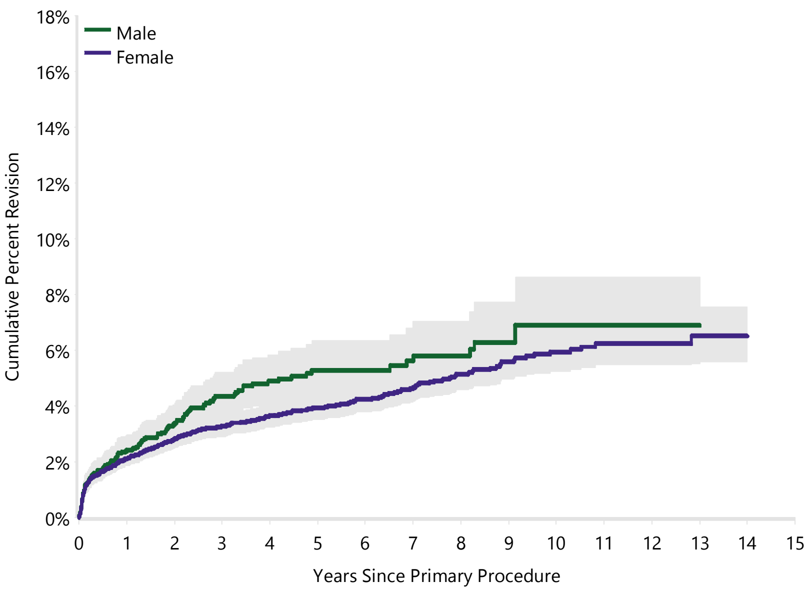
<75 vs 75-84
0 - 1Mth: HR=0.98 (0.62, 1.56),p=0.928
1Mth - 1Yr: HR=1.33 (0.95, 1.85),p=0.096
1Yr - 1.5Yr: HR=3.10 (1.63, 5.89),p<0.001
1.5Yr - 2.5Yr: HR=2.36 (1.45, 3.85),p<0.001
2.5Yr+: HR=1.95 (1.34, 2.83),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
<75	3208	2430	1799	1404	1087	650	81
75-84	6278	4597	3191	2181	1437	639	51
≥85	5991	3617	1910	961	458	123	2

Table HP31 Cumulative Percent Revision of Primary Bipolar Hip Replacement by Gender (Primary Diagnosis Fractured NOF)

Gender	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Male	142	4263	2.4 (1.9, 3.0)	4.4 (3.6, 5.2)	5.3 (4.4, 6.3)	5.6 (4.6, 6.8)	6.9 (5.5, 8.6)	
Female	374	11214	2.1 (1.8, 2.4)	3.3 (2.9, 3.7)	3.9 (3.5, 4.4)	4.6 (4.1, 5.2)	5.9 (5.2, 6.7)	6.5 (5.6, 7.5)
TOTAL	516	15477						

Figure HP22 Cumulative Percent Revision of Primary Bipolar Hip Replacement by Gender (Primary Diagnosis Fractured NOF)



HR - adjusted for age

Male vs Female

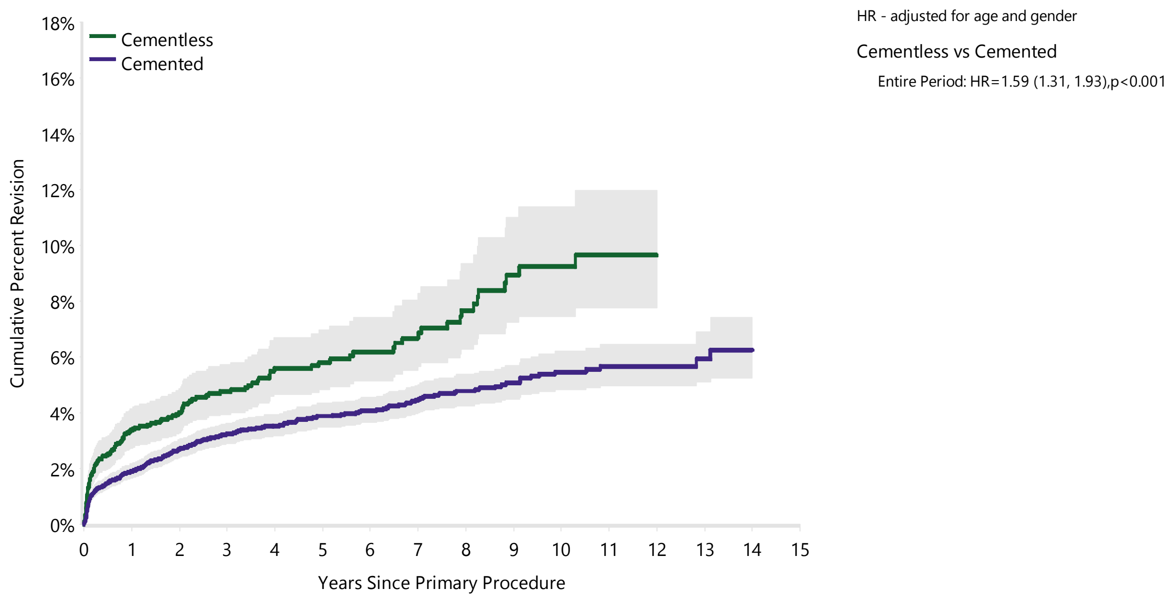
Entire Period: HR=1.16 (0.95, 1.40),p=0.144

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Male	4263	2563	1446	854	527	244	19
Female	11214	8081	5454	3692	2455	1168	115

Table HP32 Cumulative Percent Revision of Primary Bipolar Hip Replacement by Femoral Fixation (Primary Diagnosis Fractured NOF)

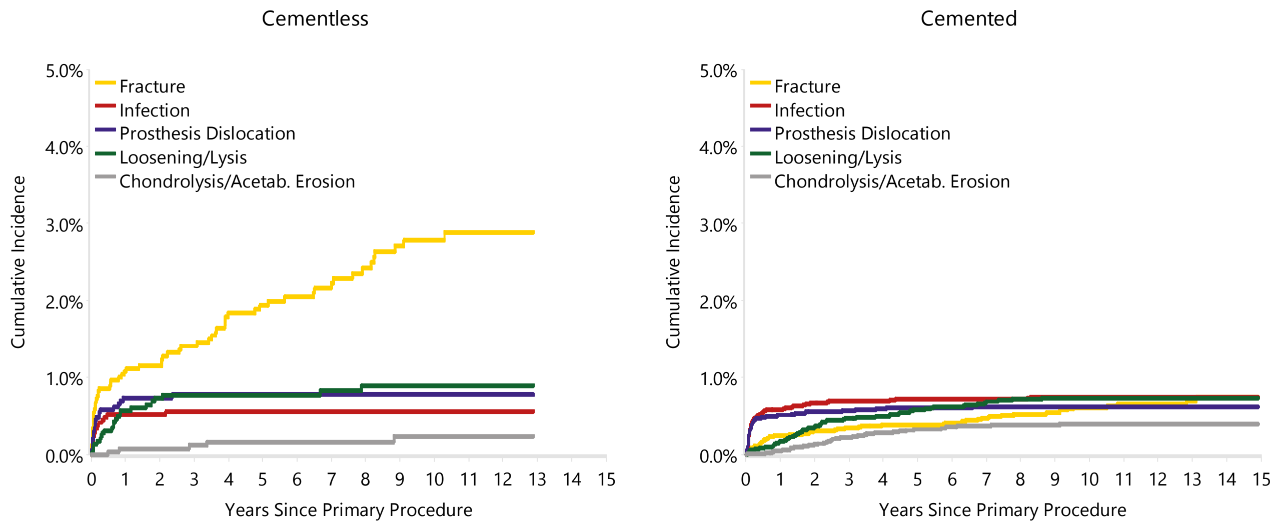
Femoral Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cementless	141	2934	3.4 (2.7, 4.1)	4.7 (3.9, 5.7)	5.8 (4.8, 7.0)	6.7 (5.5, 8.0)	9.2 (7.5, 11.4)	
Cemented	375	12543	1.9 (1.7, 2.2)	3.2 (2.9, 3.6)	3.9 (3.5, 4.3)	4.4 (4.0, 5.0)	5.5 (4.8, 6.2)	6.2 (5.2, 7.4)
TOTAL	516	15477						

Figure HP23 Cumulative Percent Revision of Primary Bipolar Hip Replacement by Femoral Fixation (Primary Diagnosis Fractured NOF)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cementless	2934	2056	1335	830	522	236	10
Cemented	12543	8588	5565	3716	2460	1176	124

Figure HP24 Cumulative Incidence Revision Diagnosis of Primary Bipolar Hip Replacement by Femoral Fixation (Primary Diagnosis Fractured NOF)



Primary Total Hip Replacement

CLASSES OF TOTAL HIP REPLACEMENT

The Registry sub-categorises primary total hip replacement into three classes. These are defined by the type of femoral prosthesis used. A total hip procedure replaces both the femoral and acetabular articular surfaces.

Total conventional includes acetabular replacement combined with resection of the femoral head and replacement with a stemmed femoral prosthesis and femoral head prosthesis.
Total resurfacing includes acetabular replacement and the use of a femoral prosthesis that replaces the femoral articular surface without resecting the head.
Thrust plate includes acetabular replacement combined with resection of the femoral head and replacement with a femoral component that has a lateral fixation plate and femoral head prosthesis.

Detailed information on Thrust Plate is available in the supplementary report 'Outcome of Classes No Longer Used - Hip and Knee Arthroplasty' on the AOANJRR website aoanjrr.sahmri.com/annual-reports-2016.

USE OF TOTAL HIP REPLACEMENT

The Registry has recorded 363,561 primary total hip replacement procedures. Of these, total conventional is the most common class (95.4%), followed by total resurfacing (4.5%). The Registry has recorded only a small number of thrust plate procedures and none have been recorded since 2012 (Table HT1).

Table HT1 Primary Total Hip Replacement by Class

Total Hip Class	Number	Percent
Total Conventional	346782	95.4
Total Resurfacing	16521	4.5
Thrust Plate	258	0.1
TOTAL	363561	100.0

Osteoarthritis is the principal diagnosis for primary total hip replacement (88.8%).

Total conventional hip replacement (all bearing surfaces included) has a lower cumulative percent revision compared to total resurfacing at 15 years (Table HT2).

Detailed demographic information on primary total hip replacement is available in the supplementary report 'Demographics of Hip, Knee and Shoulder Arthroplasty' on the AOANJRR website aoanjrr.sahmri.com/annual-reports-2016.

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	7 Yrs	10 Yrs	15 Yrs
Total Conventional	14880	346782	1.7 (1.6, 1.7)	2.8 (2.7, 2.8)	3.8 (3.8, 3.9)	5.0 (4.9, 5.1)	6.6 (6.5, 6.8)	9.7 (9.4, 10.0)
Total Resurfacing	1427	16521	1.8 (1.6, 2.0)	3.3 (3.0, 3.6)	5.1 (4.8, 5.5)	7.1 (6.7, 7.6)	9.8 (9.3, 10.4)	13.3 (12.3, 14.4)
Thrust Plate	17	258	0.8 (0.2, 3.1)	1.2 (0.4, 3.6)	3.9 (2.1, 7.2)	4.4 (2.5, 7.8)	6.5 (3.8, 10.9)	
TOTAL	16324	363561						

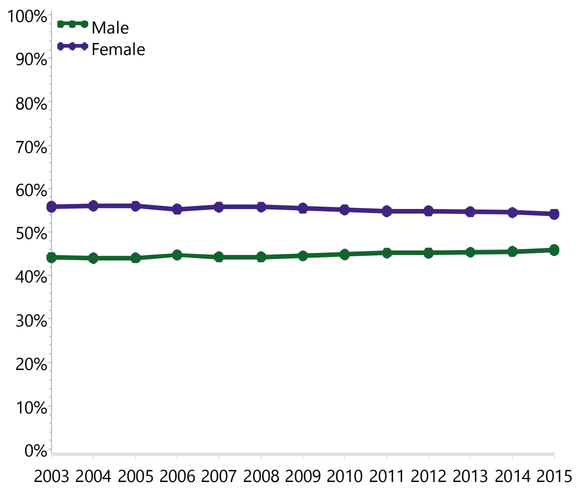
PRIMARY TOTAL CONVENTIONAL HIP REPLACEMENT

DEMOGRAPHICS

There have been 346,782 total conventional hip procedures reported to the Registry, an additional 33,954 procedures compared to the previous report.

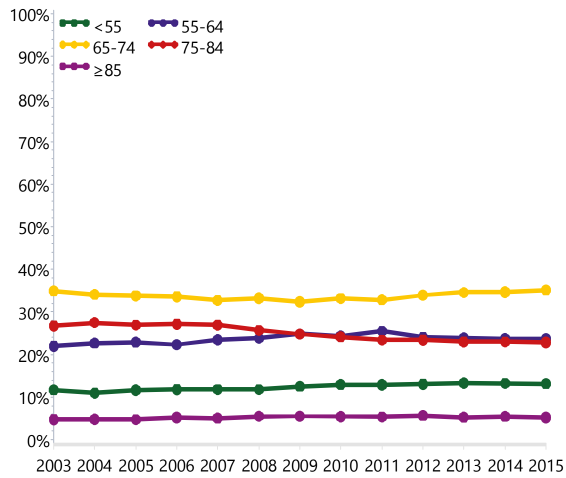
Total conventional hip replacement is more common in females (55.1%). This proportion has remained stable since 2003 (Figure HT1).

Figure HT1 Primary Total Conventional Hip Replacement by Gender



There has been minimal change in the proportion of patients aged 55 to 64 years (21.9% in 2003 to 23.7% in 2015) and younger than 55 years (11.7% in 2003 to 13.1% in 2015). The mean age of patients is 67.7 years (Table HT3 and Figure HT2).

Figure HT2 Primary Total Conventional Hip Replacement by Age



The use of cementless fixation has increased from 51.3% in 2003 to 63.3% in 2015. Cemented fixation has declined from 13.9% to 3.7% and hybrid fixation from 34.8% to 33.0% over the same period (Figure HT3).

Figure HT3 Primary Total Conventional Hip Replacement by Fixation

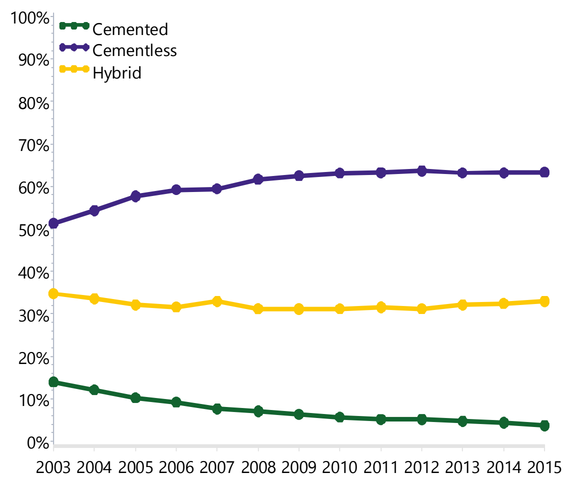


Table HT3 Age and Gender of Primary Total Conventional Hip Replacement

Gender	Number	Percent	Minimum	Maximum	Median	Mean	Std Dev
Male	155840	44.9%	13	102	67	66.3	11.5
Female	190942	55.1%	11	101	70	68.9	11.4
TOTAL	346782	100.0%	11	102	69	67.7	11.5

The Exeter V40, Corail, Quadra-H and Polarstem are the most used femoral stems for total conventional hip replacement (Table HT4). In 2015, 66.1% of total conventional hip replacements used stems in the 10 most used femoral component list. Seven of these are cementless. The 10 most used cemented and cementless stems are listed in Tables HT5 and HT6. In 2015, the 10 most used cemented stems accounted for 92.8% of procedures compared to 67.2% of cementless stems.

The Trident (Shell), Pinnacle and R3 remain the most frequently used acetabular prostheses for total conventional hip replacement. In 2015, 78.1% of total conventional hip procedures used acetabular components from the 10 most used list (Table HT7). Nine of the acetabular components in this list are cementless prostheses. The 10 most used cemented and cementless acetabular prostheses are listed separately in Tables HT8 and HT9.

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

2003		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
3901	Exeter V40	6255	Exeter V40	6931	Exeter V40	7386	Exeter V40	7346	Exeter V40
1029	ABGII	4442	Corail	4669	Corail	5030	Corail	5362	Corail
1000	Synergy	1916	Quadra-H	2258	Quadra-H	2910	Quadra-H	2793	Quadra-H
819	Alloclassic	1295	CPT	1462	CPT	1562	CPT	1496	Polarstem
809	VerSys	1080	Secur-Fit	1047	Polarstem	1195	Polarstem	1276	CPT
780	Spectron EF	772	Synergy	813	Secur-Fit	837	Anthology	895	Accolade II
713	Secur-Fit Plus	735	Polarstem	783	CPCS	718	CPCS	838	Taperloc
618	Omnifit	680	Anthology	765	Accolade I	716	Taperloc	791	CPCS
565	C-Stem	658	CPCS	731	Synergy	713	Secur-Fit	770	Anthology
485	S-Rom	655	Accolade I	642	Anthology	572	Synergy	579	Tri-Fit TS
10 Most Used									
10719 (10) 62.8%		18488 (10) 66.9%		20101 (10) 68.0%		21639 (10) 67.3%		22146 (10) 66.1%	
Remainder									
6354 (73) 37.2%		9141 (97) 33.1%		9459 (109) 32.0%		10510 (108) 32.7%		11356 (96) 33.9%	
TOTAL									
17073 (83) 100.0%		27629 (107) 100.0%		29560 (119) 100.0%		32149 (118) 100.0%		33502 (106) 100.0%	

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

2003		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
3901	Exeter V40	6255	Exeter V40	6931	Exeter V40	7386	Exeter V40	7345	Exeter V40
780	Spectron EF	1295	CPT	1462	CPT	1562	CPT	1276	CPT
565	C-Stem	658	CPCS	782	CPCS	717	CPCS	791	CPCS
477	CPT	426	Spectron EF	327	C-Stem AMT	378	C-Stem AMT	401	C-Stem AMT
445	Elite Plus	381	C-Stem AMT	317	Spectron EF	274	Spectron EF	326	MS 30
358	MS 30	194	MS 30	246	Omnifit	236	MS 30	279	Quadra-C
339	Omnifit	177	Omnifit	164	MS 30	189	Quadra-C	265	Evolve
321	Charnley	115	Quadra-C	118	Quadra-C	184	Omnifit	259	Short Exeter V40
244	CPCS	94	C-Stem	106	C-Stem	156	Evolve	237	Spectron EF
123	Exeter	89	E2	74	Absolut	122	Absolut	159	Taper Fit
10 Most Used									
7553 (10) 91.5%		9684 (10) 97.0%		10527 (10) 97.1%		11204 (10) 95.2%		11338 (10) 92.8%	
Remainder									
701 (36) 8.5%		300 (29) 3.0%		318 (38) 2.9%		567 (36) 4.8%		879 (31) 7.2%	
TOTAL									
8254 (46) 100.0%		9984 (39) 100.0%		10845 (48) 100.0%		11771 (46) 100.0%		12217 (41) 100.0%	

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

2003		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
1027	ABGII	4441	Corail	4669	Corail	5028	Corail	5359	Corail
979	Synergy	1916	Quadra-H	2257	Quadra-H	2909	Quadra-H	2791	Quadra-H
819	Alloclassic	1080	Secur-Fit	1046	Polarstem	1195	Polarstem	1495	Polarstem
739	VerSys	772	Synergy	813	Secur-Fit	836	Anthology	894	Accolade II
712	Secur-Fit Plus	735	Polarstem	765	Accolade I	716	Taperloc	838	Taperloc
485	S-Rom	679	Anthology	729	Synergy	712	Secur-Fit	769	Anthology
482	Secur-Fit	653	Accolade I	642	Anthology	572	Synergy	579	Tri-Fit TS
375	Corail	631	Taperloc	608	Taperloc	529	M/L Taper	561	Avenir
333	Accolade I	515	M/L Taper Kinectiv	448	Alloclassic	522	Accolade II	543	Secur-Fit
329	Mallory-Head	471	Alloclassic	433	Summit	478	Summit	471	Metafix
10 Most Used									
6280 (10)	71.2%	11893 (10)	67.4%	12410 (10)	66.3%	13497 (10)	66.2%	14300 (10)	67.2%
Remainder									
2539 (48)	28.8%	5752 (75)	32.6%	6305 (81)	33.7%	6881 (82)	33.8%	6985 (74)	32.8%
TOTAL									
8819 (58)	100.0%	17645 (85)	100.0%	18715 (91)	100.0%	20378 (92)	100.0%	21285 (84)	100.0%

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

2003		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
3986	Trident (Shell)	6210	Trident (Shell)	7018	Trident (Shell)	7322	Trident (Shell)	7350	Trident (Shell)
1748	Reflection (Shell)	5483	Pinnacle	5654	Pinnacle	6152	Pinnacle	6540	Pinnacle
1524	Trilogy	3024	R3	3336	R3	3429	R3	3578	R3
955	Vitalock	1836	Versafitcup CC	2132	Versafitcup CC	2814	Versafitcup CC	2966	Versafitcup CC
907	Duraloc	1333	Continuum	1504	Continuum	1487	Continuum	1564	Trinity
827	ABGII	1126	Trilogy	1022	Trilogy	1315	Trinity	1330	Continuum
793	Allofit	674	Allofit	778	Trinity	1092	Trilogy	877	Trilogy
729	Mallory-Head	674	Trident/Tritanium (Shell)	644	Allofit	652	Exeter X3 Rimfit	756	Trident/Tritanium (Shell)
539	Contemporary	597	DeltaMotion	630	Trident/Tritanium (Shell)	647	Trident/Tritanium (Shell)	615	Acetabular Shell (Global)
537	Pinnacle	577	Exceed	563	Delta-TT	611	Allofit	601	Exeter X3 Rimfit
10 Most Used									
12545 (10)	73.5%	21534 (10)	77.9%	23281 (10)	78.8%	25521 (10)	79.4%	26177 (10)	78.1%
Remainder									
4528 (69)	26.5%	6095 (62)	22.1%	6279 (69)	21.2%	6628 (77)	20.6%	7325 (65)	21.9%
TOTAL									
17073 (79)	100.0%	27629 (72)	100.0%	29560 (79)	100.0%	32149 (87)	100.0%	33502 (75)	100.0%

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

2003		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
539	Contemporary	502	Exeter X3 Rimfit	544	Exeter X3 Rimfit	652	Exeter X3 Rimfit	601	Exeter X3 Rimfit
256	Exeter	280	Contemporary	222	Contemporary	233	Contemporary	179	Contemporary
250	Reflection (Cup)	123	Marathon	130	Marathon	135	Marathon	129	Marathon
227	Exeter Contemporary	112	Brunswick	111	Brunswick	103	ZCA	101	ZCA
199	Charnley Ogee	112	Exeter Contemporary	108	Exeter Contemporary	74	Reflection (Cup)	80	Reflection (Cup)
149	Elite Plus LPW	98	Reflection (Cup)	96	ZCA	58	Exeter Contemporary	54	Exeter Contemporary
130	Low Profile Cup	94	ZCA	81	Reflection (Cup)	37	Brunswick	21	CCB
110	Elite Plus Ogee	46	Low Profile Cup	28	Low Profile Cup	23	Trabecular Metal (Shell)	21	Trabecular Metal (Shell)
102	Charnley	30	Polarcup	21	Trabecular Metal (Shell)	19	CCB	19	Low Profile Cup
90	ZCA	24	CCB	19	CCB	18	Low Profile Cup	17	Muller
10 Most Used									
2052 (10) 84.1%		1421 (10) 95.2%		1360 (10) 94.7%		1352 (10) 92.0%		1222 (10) 92.6%	
Remainder									
388 (35) 15.9%		72 (22) 4.8%		76 (24) 5.3%		118 (29) 8.0%		98 (22) 7.4%	
TOTAL									
2440 (45) 100.0%		1493 (32) 100.0%		1436 (34) 100.0%		1470 (39) 100.0%		1320 (32) 100.0%	

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

2003		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
3983	Trident (Shell)	6202	Trident (Shell)	7010	Trident (Shell)	7312	Trident (Shell)	7342	Trident (Shell)
1742	Reflection (Shell)	5482	Pinnacle	5653	Pinnacle	6151	Pinnacle	6535	Pinnacle
1524	Trilogy	3020	R3	3334	R3	3426	R3	3575	R3
954	Vitalock	1836	Versafitcup CC	2130	Versafitcup CC	2814	Versafitcup CC	2962	Versafitcup CC
902	Duraloc	1331	Continuum	1502	Continuum	1481	Continuum	1564	Trinity
826	ABGII	1124	Trilogy	1021	Trilogy	1315	Trinity	1325	Continuum
786	Allofit	674	Allofit	778	Trinity	1092	Trilogy	875	Trilogy
728	Mallory-Head	673	Trident/Tritanium (Shell)	644	Allofit	645	Trident/Tritanium (Shell)	751	Trident/Tritanium (Shell)
536	Pinnacle	597	DeltaMotion	625	Trident/Tritanium (Shell)	610	Allofit	615	Acetabular Shell (Global)
520	Fitmore	577	Exceed	563	Delta-TT	452	Acetabular Shell (Global)	535	G7
10 Most Used									
12501 (10) 85.4%		21516 (10) 82.3%		23260 (10) 82.7%		25298 (10) 82.5%		26079 (10) 81.0%	
Remainder									
2132 (41) 14.6%		4620 (43) 17.7%		4864 (52) 17.3%		5381 (54) 17.5%		6103 (49) 19.0%	
TOTAL									
14633 (51) 100.0%		26136 (53) 100.0%		28124 (62) 100.0%		30679 (64) 100.0%		32182 (59) 100.0%	

OUTCOME FOR ALL DIAGNOSES

Since 2014 the Registry has excluded large head metal/metal bearings from many analyses of primary conventional total hip outcomes. It is a bearing that is no longer used, it accounts for an increasingly small proportion of procedures (currently 4.7%), and it has a much higher revision rate than any other bearing used (22.1% at 10 years). In addition, it was also preferentially used in younger patients with cementless fixation and with particular femoral stem and acetabular prostheses combinations.

Consequently, in specific analyses it has the potential to be a major confounding factor. It is almost always excluded from general analysis. In prostheses specific analysis, prostheses with large head metal/metal bearings are identified separately. The Registry clearly identifies whether large head metal/metal bearings are excluded in any analyses.

Primary Diagnosis

Osteoarthritis is the principal diagnosis (88.5%), followed by fractured neck of femur (4.2%), osteonecrosis (3.4%), developmental dysplasia (1.3%) and rheumatoid arthritis (1.0%) (Table HT10).

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

Reason for Revision

The most common reasons for revision of primary total conventional hip replacement are loosening/lysis (27.6%), followed by prosthesis dislocation (23.5%), fracture (18.7%) and infection (17.5%) (Table HT11).

The most common reason for revision varies depending on time. In the first four years, dislocation is the most frequent reason for revision. After seven years, loosening/lysis is the predominant reason (Figure HT5).

Loosening refers to aseptic loosening. The Registry combines loosening and lysis as a single diagnosis. This is because of a common shared aetiology (particle related inflammation). This diagnosis is reported in 27.6% of all revisions and consists of 24.2% loosening, 2.1% lysis and 1.3% with both diagnoses reported together.

The Registry understands that 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.

Type of Revision

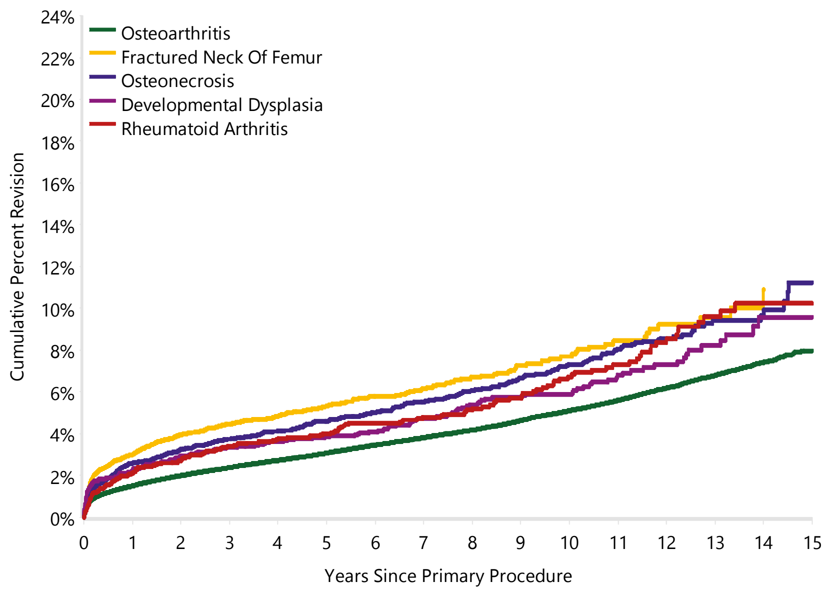
The five most common types of revision recorded by the Registry are femoral only (31.8%), acetabular only (22.5%), head and insert (19.5%), total hip replacement (femoral/acetabular) (11.8%), and head only (5.0%) (Table HT12).

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	7 Yrs	10 Yrs	15 Yrs
Osteoarthritis	10032	292565	1.5 (1.5, 1.6)	2.4 (2.3, 2.4)	3.1 (3.0, 3.1)	3.8 (3.7, 3.9)	5.1 (5.0, 5.2)	8.0 (7.7, 8.3)
Fractured Neck Of Femur	652	13919	3.0 (2.7, 3.3)	4.5 (4.1, 4.9)	5.3 (4.9, 5.8)	6.2 (5.6, 6.7)	7.7 (6.9, 8.6)	
Osteonecrosis	563	10970	2.6 (2.3, 2.9)	3.7 (3.4, 4.1)	4.6 (4.2, 5.1)	5.5 (5.0, 6.1)	7.3 (6.7, 8.1)	11.2 (9.5, 13.3)
Developmental Dysplasia	195	4088	2.3 (1.8, 2.8)	3.3 (2.8, 4.0)	3.8 (3.3, 4.5)	4.7 (4.0, 5.6)	5.9 (5.0, 6.9)	9.6 (7.8, 11.7)
Rheumatoid Arthritis	182	3487	2.1 (1.7, 2.7)	3.4 (2.8, 4.1)	4.0 (3.4, 4.8)	4.8 (4.0, 5.7)	6.7 (5.7, 7.9)	10.2 (8.5, 12.3)
Other (6)	283	5458	3.3 (2.8, 3.8)	4.8 (4.2, 5.5)	5.9 (5.1, 6.7)	6.8 (6.0, 7.8)	8.8 (7.6, 10.2)	
TOTAL	11907	330487						

Note: Only primary diagnoses with over 2,000 procedures have been listed
All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

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



HR - adjusted for age and gender

Fractured Neck Of Femur vs Osteoarthritis
0 - 2Wk: HR=1.60 (1.21, 2.11),p<0.001
2Wk - 3Mth: HR=2.47 (2.16, 2.83),p<0.001
3Mth - 1.5Yr: HR=1.94 (1.66, 2.26),p<0.001
1.5Yr+: HR=1.36 (1.18, 1.57),p<0.001

Osteonecrosis vs Osteoarthritis
0 - 6Mth: HR=1.53 (1.33, 1.77),p<0.001
6Mth - 9Mth: HR=2.77 (2.07, 3.72),p<0.001
9Mth - 1.5Yr: HR=1.25 (0.95, 1.66),p=0.117
1.5Yr+: HR=1.30 (1.15, 1.47),p<0.001

Developmental Dysplasia vs Osteoarthritis
0 - 2Wk: HR=2.42 (1.63, 3.58),p<0.001
2Wk - 1Mth: HR=1.87 (1.28, 2.75),p=0.001
1Mth+: HR=1.06 (0.90, 1.26),p=0.477

Rheumatoid Arthritis vs Osteoarthritis
Entire Period: HR=1.33 (1.15, 1.54),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Osteoarthritis	292565	256118	194208	141139	97065	50819	1783
Fractured Neck Of Femur	13919	10918	7110	4345	2422	871	17
Osteonecrosis	10970	9502	7265	5379	3789	2103	91
Developmental Dysplasia	4088	3556	2827	2178	1606	1042	46
Rheumatoid Arthritis	3487	3138	2574	2005	1530	884	58

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT11 Primary Total Conventional Hip Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	3286	27.6
Prosthesis Dislocation	2803	23.5
Fracture	2230	18.7
Infection	2081	17.5
Pain	220	1.8
Leg Length Discrepancy	164	1.4
Malposition	142	1.2
Instability	119	1.0
Implant Breakage Stem	117	1.0
Metal Related Pathology	104	0.9
Wear Acetabular Insert	96	0.8
Implant Breakage Acetabular Insert	92	0.8
Implant Breakage Acetabular	92	0.8
Incorrect Sizing	90	0.8
Implant Breakage Head	35	0.3
Other	236	2.0
TOTAL	11907	100.0

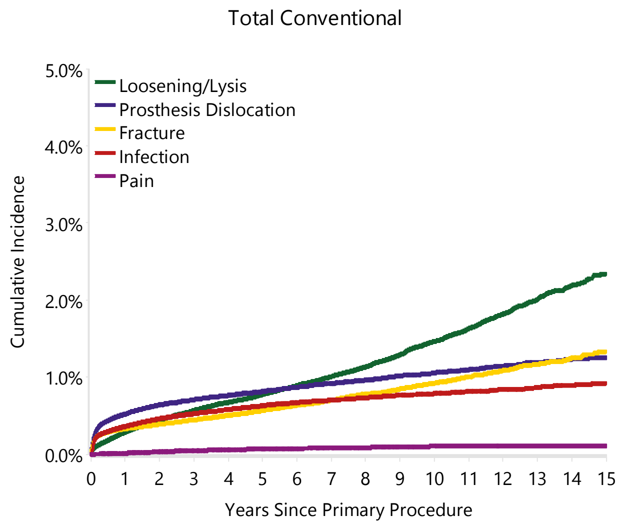
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT12 Primary Total Conventional Hip Replacement by Type of Revision

Type of Revision	Number	Percent
Femoral Component	3782	31.8
Acetabular Component	2678	22.5
Head/Insert	2316	19.5
THR (Femoral/Acetabular)	1410	11.8
Head Only	599	5.0
Cement Spacer	543	4.6
Minor Components	210	1.8
Insert Only	146	1.2
Removal of Prostheses	76	0.6
Head/Neck/Insert	66	0.6
Head/Neck	54	0.5
Reinsertion of Components	12	0.1
Neck Only	5	0.0
Bipolar Only	4	0.0
Total Femoral	3	0.0
Neck/Insert	1	0.0
Saddle	1	0.0
Bipolar Head and Femoral	1	0.0
TOTAL	11907	100.0

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded
Femoral heads are usually replaced when the acetabular component and/or femoral stem is revised

Figure HT5 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement



Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

PROSTHESIS TYPES

There are 2,687 different stem and acetabular combinations for primary total conventional hip replacement recorded by the Registry, an additional 116 prosthesis combinations since the previous report. This includes metal/metal prostheses with head size larger than 32mm.

The cumulative percent revision of the 107 prosthesis combinations with more than 500 procedures is listed in Tables HT13 – HT15. Although the listed combinations are a small proportion of the possible combinations, they represent 80.3% of all primary total conventional hip replacements.

The ‘Other’ group is the combined outcome of all prosthesis combinations with less than 500 procedures. This group accounts for 19.7% of all primary total conventional hip replacement procedures.

There are 10 total conventional stem and acetabular combinations with more than 500 procedures using cemented fixation. The MS 30/Low Profile Cup has the lowest 10 year cumulative percent revision of 2.7%. Two other combinations have a cumulative percent revision of less than 5.0% at 10 years (Table HT13).

There are 69 cementless total conventional stem and acetabular combinations listed. The Summit/Pinnacle has the lowest 10 year cumulative percent revision of 2.5%. Eleven other combinations have a cumulative percent revision of less than 5.0% at 10 years (Table HT14).

There are 28 combinations of total conventional hip replacement prostheses with hybrid fixation. The MS 30/Fitmore has the lowest cumulative percent revision at 10 years (2.7%). Eleven other combinations have a cumulative percent revision of less than 5.0% at 10 years (Table HT15).

Table HT13 Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Cemented Fixation

Femoral Component	Acetabular Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
CPCS	Reflection (Cup)	50	876	1.2 (0.6, 2.2)	2.4 (1.5, 3.7)	3.2 (2.1, 4.8)	4.1 (2.8, 6.0)	8.4 (6.0, 11.6)	
CPT	ZCA	32	879	0.7 (0.3, 1.5)	2.2 (1.4, 3.5)	2.9 (1.9, 4.4)	3.4 (2.2, 5.1)	5.3 (3.6, 7.7)	
Charnley	Charnley	37	591	0.5 (0.2, 1.6)	1.0 (0.5, 2.3)	2.2 (1.2, 3.8)	3.2 (2.0, 5.1)	6.5 (4.4, 9.3)	
Charnley	Charnley Ogee	55	709	1.0 (0.5, 2.1)	3.0 (1.9, 4.5)	4.8 (3.4, 6.7)	6.5 (4.8, 8.8)	8.2 (6.2, 10.7)	
Exeter V40	Contemporary	251	5302	1.7 (1.4, 2.1)	2.9 (2.5, 3.4)	3.5 (3.0, 4.1)	4.6 (4.0, 5.2)	6.3 (5.5, 7.2)	
Exeter V40	**Exeter**	**79**	**1712**	**0.8 (0.5, 1.4)**	**1.9 (1.3, 2.7)**	**3.1 (2.4, 4.1)**	**3.9 (3.0, 5.0)**	**4.9 (3.8, 6.2)**	
Exeter V40	**Exeter Contemporary**	**123**	**3190**	**1.4 (1.0, 1.8)**	**2.3 (1.8, 2.9)**	**3.0 (2.4, 3.7)**	**4.0 (3.3, 4.9)**	**4.7 (3.9, 5.7)**	
Exeter V40	Exeter X3 Rimfit	50	2574	1.4 (1.0, 1.9)	2.4 (1.8, 3.2)				
MS 30	**Low Profile Cup**	**17**	**703**	**0.6 (0.2, 1.5)**	**0.7 (0.3, 1.8)**	**1.1 (0.5, 2.4)**	**1.5 (0.8, 3.0)**	**2.7 (1.5, 4.7)**	
Spectron EF	Reflection (Cup)	103	1649	1.1 (0.7, 1.7)	1.7 (1.1, 2.4)	2.7 (2.0, 3.7)	4.0 (3.0, 5.2)	7.4 (6.0, 9.3)	
Other (422)		473	9148	1.6 (1.3, 1.9)	2.6 (2.3, 3.0)	3.8 (3.4, 4.2)	4.8 (4.3, 5.3)	6.6 (5.9, 7.3)	10.8 (9.7, 12.1)
TOTAL		1270	27333						

Note: Some cementless components have been cemented.
Only combinations with over 500 procedures have been listed

Table HT14 Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Cementless Fixation

Femoral Component	Acetabular Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
ABGII	ABGII	231	2954	1.8 (1.4, 2.4)	3.1 (2.6, 3.8)	4.2 (3.5, 5.0)	5.4 (4.6, 6.3)	6.8 (5.9, 7.8)	10.8 (9.4, 12.5)
ABGII	ABGII (Shell/Insert)	58	885	1.5 (0.9, 2.5)	2.3 (1.5, 3.5)	2.9 (2.0, 4.3)	4.3 (3.1, 6.0)	7.1 (5.4, 9.3)	
ABGII	Trident (Shell)	177	2471	2.6 (2.1, 3.4)	4.2 (3.5, 5.1)	5.2 (4.4, 6.2)	6.4 (5.4, 7.5)	8.5 (7.3, 10.0)	
AMIStem H	Versafitcup CC	5	539	1.3 (0.4, 4.1)	2.1 (0.8, 5.9)				
Accolade I	Trident (Shell)	402	9152	1.6 (1.4, 1.9)	3.0 (2.6, 3.3)	3.8 (3.4, 4.2)	4.5 (4.1, 5.0)	5.7 (5.1, 6.4)	
Accolade I	Trident/ Tritanium (Shell)	24	756	1.3 (0.7, 2.4)	2.5 (1.6, 3.9)	3.5 (2.3, 5.3)			
Accolade II	Trident (Shell)	12	1365	1.0 (0.6, 1.8)					
Alloclassic	Allofit	239	5586	1.4 (1.1, 1.8)	2.2 (1.9, 2.7)	3.0 (2.5, 3.5)	3.6 (3.1, 4.2)	5.3 (4.6, 6.1)	
Alloclassic	Durom[MoM]	71	621	1.3 (0.7, 2.6)	5.0 (3.5, 7.0)	6.9 (5.1, 9.2)	10.1 (7.9, 12.8)	14.0 (11.0, 17.6)	
Alloclassic	Fitmore	117	1849	3.1 (2.4, 4.0)	4.4 (3.6, 5.5)	5.5 (4.5, 6.7)	6.1 (5.0, 7.4)	7.1 (5.9, 8.6)	
Alloclassic	**Trabecular Metal (Shell)**	**37**	**1062**	**2.4 (1.6, 3.5)**	**3.0 (2.1, 4.2)**	**3.8 (2.8, 5.3)**	**3.8 (2.8, 5.3)**	**3.8 (2.8, 5.3)**	
Alloclassic	**Trilogy**	**14**	**916**	**0.7 (0.3, 1.5)**	**0.8 (0.4, 1.7)**	**1.1 (0.6, 2.1)**	**1.8 (1.0, 3.2)**	**2.7 (1.4, 5.1)**	
Anthology	R3	98	4767	1.7 (1.4, 2.1)	2.1 (1.7, 2.5)	2.3 (1.8, 2.8)	2.5 (2.0, 3.2)		
Anthology	Reflection (Shell)	25	966	1.6 (1.0, 2.6)	1.8 (1.1, 2.9)	2.5 (1.6, 3.7)	2.9 (2.0, 4.3)		
Apex	Fin II	37	1008	1.8 (1.1, 2.8)	2.5 (1.7, 3.7)	3.7 (2.6, 5.2)	4.3 (3.1, 6.1)		
Avenir	Continuum	14	882	1.5 (0.9, 2.6)	1.7 (1.0, 2.9)				
Avenir	Trilogy	5	555	0.7 (0.3, 1.9)	1.0 (0.4, 2.4)	1.0 (0.4, 2.4)			
C2	Delta-TT	10	505	1.3 (0.6, 2.8)	2.1 (1.1, 4.0)				
CLS	Allofit	51	846	1.6 (0.9, 2.7)	3.5 (2.4, 5.1)	3.8 (2.7, 5.4)	5.4 (3.9, 7.3)	6.7 (5.0, 8.9)	
CLS	Fitmore	42	727	1.8 (1.1, 3.1)	3.7 (2.5, 5.5)	4.3 (3.0, 6.1)	4.7 (3.3, 6.6)	5.7 (4.0, 7.9)	
Citation	**Trident (Shell)**	**46**	**1147**	**1.7 (1.1, 2.7)**	**2.5 (1.7, 3.5)**	**3.2 (2.3, 4.4)**	**3.5 (2.5, 4.7)**	**4.1 (3.0, 5.4)**	
Citation	Vitalock	42	555	0.5 (0.2, 1.7)	2.2 (1.2, 3.8)	2.8 (1.7, 4.5)	4.0 (2.6, 6.0)	6.8 (4.9, 9.3)	
Corail	ASR[MoM]	1149	2900	2.2 (1.7, 2.8)	11.1 (10.0, 12.4)	26.8 (25.2, 28.5)	38.4 (36.5, 40.2)	45.6 (43.4, 47.9)	
Corail	DeltaMotion	14	892	1.1 (0.6, 2.1)	1.6 (0.9, 2.7)	1.8 (1.1, 3.1)			
Corail	Duraloc	68	1433	1.4 (0.9, 2.2)	2.3 (1.6, 3.2)	3.0 (2.2, 4.0)	4.0 (3.0, 5.2)	5.6 (4.3, 7.3)	
Corail	Pinnacle	854	32072	1.7 (1.6, 1.9)	2.6 (2.4, 2.8)	3.2 (2.9, 3.4)	3.8 (3.5, 4.1)	5.0 (4.4, 5.8)	
Corail	Pinnacle[MoM]	90	966	2.2 (1.4, 3.3)	3.7 (2.6, 5.1)	5.9 (4.6, 7.6)	9.0 (7.2, 11.1)	12.2 (9.7, 15.3)	
Epoch	**Trilogy**	**41**	**1021**	**2.5 (1.7, 3.6)**	**3.4 (2.4, 4.7)**	**3.6 (2.6, 4.9)**	**4.0 (3.0, 5.5)**	**4.2 (3.1, 5.7)**	
F2L	SPH-Blind	52	615	3.1 (2.0, 4.8)	4.9 (3.5, 7.0)	6.1 (4.5, 8.3)	6.8 (5.1, 9.2)	7.6 (5.7, 10.0)	
H-Max	Delta-TT	17	913	1.2 (0.6, 2.2)	2.5 (1.5, 4.1)				
M/L Taper	Allofit	14	590	1.8 (1.0, 3.3)	2.2 (1.3, 3.9)	2.6 (1.5, 4.5)	3.9 (1.8, 8.2)		
M/L Taper	Continuum	27	967	2.2 (1.5, 3.4)	3.1 (2.1, 4.6)				
M/L Taper	**Trilogy**	**18**	**700**	**1.3 (0.7, 2.5)**	**1.7 (0.9, 3.0)**	**2.4 (1.4, 4.1)**	**3.9 (2.4, 6.3)**	**3.9 (2.4, 6.3)**	
M/L Taper Kinectiv	Continuum	55	1880	2.0 (1.4, 2.7)	3.0 (2.3, 3.9)	3.6 (2.7, 4.8)			
Mallory-Head	Mallory-Head	153	2913	1.8 (1.4, 2.4)	2.2 (1.8, 2.8)	3.1 (2.5, 3.8)	3.9 (3.2, 4.7)	5.2 (4.3, 6.2)	10.3 (8.4, 12.7)
Metafix	Trinity	28	1507	1.6 (1.1, 2.4)	2.2 (1.5, 3.3)	2.2 (1.5, 3.3)			
MiniHip	Trinity	13	561	2.1 (1.2, 3.8)	2.7 (1.6, 4.7)				
Nanos	R3	7	654	0.8 (0.3, 1.9)	1.2 (0.6, 2.5)	1.2 (0.6, 2.5)			
Natural Hip	**Fitmore**	**35**	**889**	**1.0 (0.5, 1.9)**	**1.6 (0.9, 2.7)**	**2.4 (1.6, 3.7)**	**3.0 (2.0, 4.4)**	**4.5 (3.2, 6.3)**	
Omnifit	Secur-Fit	59	508	3.2 (1.9, 5.1)	5.0 (3.4, 7.3)	6.6 (4.7, 9.2)	8.2 (6.1, 11.0)	10.8 (8.3, 14.0)	
Omnifit	Trident (Shell)	68	1278	1.9 (1.3, 2.8)	3.1 (2.3, 4.2)	4.0 (3.0, 5.3)	4.7 (3.6, 6.1)	5.5 (4.3, 7.0)	
Polarstem	EP-Fit Plus	3	716	0.4 (0.1, 1.3)	0.4 (0.1, 1.3)				
Polarstem	R3	92	4340	1.8 (1.4, 2.2)	2.6 (2.1, 3.3)	2.8 (2.3, 3.6)			

Femoral Component	Acetabular Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Quadra-H	Mpact	11	678	1.1 (0.5, 2.4)	2.5 (1.3, 4.8)				
Quadra-H	Versafitcup CC	261	11217	1.7 (1.5, 2.0)	2.7 (2.4, 3.0)	3.1 (2.7, 3.5)	4.0 (3.0, 5.3)		
S-Rom	**Duraloc Option**	**32**	**666**	**1.5 (0.8, 2.8)**	**2.4 (1.5, 3.9)**	**3.4 (2.2, 5.0)**	**4.0 (2.7, 5.8)**	**4.7 (3.3, 6.6)**	
S-Rom	Pinnacle	124	3019	2.4 (1.9, 3.0)	3.7 (3.0, 4.4)	4.1 (3.4, 4.9)	4.6 (3.8, 5.5)	5.3 (4.4, 6.5)	
SL-Plus	EP-Fit Plus	103	2276	1.7 (1.2, 2.3)	2.7 (2.1, 3.5)	3.5 (2.8, 4.3)	4.2 (3.4, 5.1)	5.6 (4.5, 6.8)	
SL-Plus	R3	48	1459	1.9 (1.3, 2.8)	3.3 (2.4, 4.4)	3.8 (2.8, 5.0)	3.9 (3.0, 5.2)		
Secur-Fit	DeltaMotion	16	741	0.7 (0.3, 1.6)	2.1 (1.3, 3.5)	2.3 (1.4, 3.7)			
Secur-Fit	**Trident (Shell)**	**288**	**8756**	**1.6 (1.4, 1.9)**	**2.6 (2.3, 3.0)**	**3.2 (2.8, 3.6)**	**3.9 (3.4, 4.4)**	**4.2 (3.7, 4.8)**	
Secur-Fit Plus	**Trident (Shell)**	**170**	**5616**	**1.2 (0.9, 1.5)**	**1.9 (1.5, 2.3)**	**2.3 (2.0, 2.8)**	**2.6 (2.2, 3.1)**	**3.4 (2.9, 4.0)**	**4.5 (3.6, 5.6)**
Summit	ASR^MoM	422	1118	1.2 (0.7, 2.0)	6.5 (5.2, 8.1)	19.7 (17.5, 22.2)	32.2 (29.5, 35.1)	42.8 (39.5, 46.3)	
Summit	**Pinnacle**	**77**	**4043**	**1.2 (0.9, 1.5)**	**1.7 (1.3, 2.2)**	**1.9 (1.5, 2.4)**	**2.5 (2.0, 3.2)**	**2.5 (2.0, 3.2)**	
Summit	Pinnacle^MoM	54	784	1.5 (0.9, 2.7)	2.2 (1.4, 3.5)	3.4 (2.3, 4.9)	5.0 (3.7, 6.9)	8.2 (6.2, 10.7)	
Synergy	BHR^MoM	73	819	1.6 (0.9, 2.7)	3.1 (2.1, 4.5)	4.9 (3.6, 6.6)	7.5 (5.9, 9.6)	11.7 (9.1, 15.0)	
Synergy	R3	93	3947	1.6 (1.3, 2.1)	2.3 (1.9, 2.9)	2.7 (2.2, 3.3)	2.7 (2.2, 3.3)		
Synergy	**Reflection (Shell)**	**308**	**7841**	**1.6 (1.3, 1.9)**	**2.4 (2.0, 2.7)**	**2.7 (2.3, 3.1)**	**3.1 (2.7, 3.5)**	**4.0 (3.6, 4.5)**	**6.8 (5.5, 8.4)**
Taperloc	Exceed	46	2030	1.5 (1.0, 2.1)	2.4 (1.8, 3.2)	2.6 (1.9, 3.5)	2.8 (2.1, 3.9)		
Taperloc	M2a^MoM	57	512	1.8 (0.9, 3.4)	4.4 (2.9, 6.5)	7.4 (5.4, 10.1)	8.8 (6.6, 11.6)	12.5 (9.7, 16.1)	
Taperloc	Mallory-Head	64	1597	1.9 (1.3, 2.7)	2.7 (2.0, 3.7)	3.2 (2.3, 4.3)	4.4 (3.3, 5.8)	5.3 (4.0, 6.9)	
Taperloc	Recap^MoM	44	500	2.4 (1.4, 4.2)	4.3 (2.8, 6.5)	6.2 (4.4, 8.8)	8.3 (6.1, 11.2)	11.2 (8.1, 15.5)	
Taperloc	Regenerex	10	520	1.6 (0.8, 3.1)	2.1 (1.1, 4.0)	2.1 (1.1, 4.0)			
Trabecular Metal	Continuum	37	635	4.9 (3.5, 6.9)	5.9 (4.3, 8.1)	6.2 (4.5, 8.5)			
Tri-Fit TS	Trinity	12	1292	1.0 (0.6, 1.9)	1.2 (0.7, 2.1)				
Tri-Lock	DeltaMotion	7	762	0.5 (0.2, 1.4)	0.7 (0.3, 1.6)	1.4 (0.6, 3.5)			
Tri-Lock	Pinnacle	12	582	1.6 (0.9, 3.1)	2.5 (1.4, 4.4)	2.5 (1.4, 4.4)			
VerSys	**Trilogy**	**201**	**4366**	**2.5 (2.1, 3.0)**	**3.3 (2.8, 3.9)**	**3.8 (3.3, 4.4)**	**4.2 (3.7, 4.9)**	**4.9 (4.2, 5.6)**	
twinSys	RM Cup	18	700	2.3 (1.4, 3.7)	2.5 (1.5, 4.0)				
Other	(1299)	2579	41596	2.3 (2.1, 2.4)	3.9 (3.7, 4.1)	5.4 (5.2, 5.7)	7.2 (6.9, 7.5)	9.3 (8.9, 9.7)	13.2 (12.1, 14.3)
TOTAL		**9781**	**206501**						

Note: Only combinations with over 500 procedures have been listed
Procedures using metal/metal prostheses with head size larger than 32mm have been included
MoM denotes metal/metal prostheses with head size larger than 32mm

Table HT15 Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Hybrid Fixation

Femoral Component	Acetabular Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
C-Stem	Duraloc	76	981	2.4 (1.6, 3.5)	3.1 (2.2, 4.4)	4.0 (2.9, 5.5)	5.1 (3.9, 6.8)	7.5 (5.8, 9.5)	
C-Stem	Pinnacle	24	799	1.8 (1.1, 3.0)	2.4 (1.5, 3.8)	2.6 (1.7, 4.1)	4.4 (2.8, 6.8)	4.4 (2.8, 6.8)	
C-Stem AMT	Pinnacle	34	1731	0.9 (0.5, 1.4)	2.2 (1.5, 3.2)	2.9 (2.0, 4.1)	3.6 (2.4, 5.4)		
CPCS	R3	82	3221	2.0 (1.6, 2.6)	2.6 (2.1, 3.3)	3.1 (2.4, 3.9)	3.6 (2.8, 4.7)		
CPCS	Reflection (Shell)	80	2917	0.9 (0.6, 1.3)	1.3 (0.9, 1.7)	1.7 (1.2, 2.2)	2.5 (1.9, 3.3)	4.2 (3.2, 5.4)	
CPT	Allofit	24	1029	1.3 (0.8, 2.2)	1.9 (1.2, 3.0)	3.0 (2.0, 4.6)	3.0 (2.0, 4.6)		
CPT	Continuum	73	2196	2.8 (2.2, 3.6)	3.5 (2.7, 4.4)	4.0 (3.2, 5.1)			
CPT	Trabecular Metal (Shell)	58	1448	2.1 (1.4, 3.0)	3.4 (2.5, 4.6)	4.7 (3.6, 6.1)	5.3 (4.0, 6.9)		
CPT	Trilogy	264	7351	1.7 (1.5, 2.1)	2.7 (2.3, 3.1)	3.4 (3.0, 3.9)	4.0 (3.5, 4.5)	5.0 (4.4, 5.8)	
Elite Plus	Duraloc	111	1078	2.0 (1.3, 3.0)	3.6 (2.7, 5.0)	5.4 (4.2, 7.0)	7.3 (5.8, 9.1)	9.7 (7.9, 11.8)	
Exeter	Vitalock	65	1218	1.6 (1.0, 2.5)	2.3 (1.6, 3.4)	2.5 (1.8, 3.6)	3.3 (2.4, 4.5)	4.8 (3.6, 6.2)	6.7 (5.2, 8.6)
Exeter V40	ABGII	41	1083	1.1 (0.6, 2.0)	1.4 (0.9, 2.3)	2.0 (1.3, 3.1)	3.1 (2.2, 4.4)	3.5 (2.5, 4.9)	
Exeter V40	Fixa	10	528	1.6 (0.8, 3.1)	2.2 (1.2, 4.0)				
Exeter V40	Hemispherical	24	698	2.2 (1.3, 3.6)	3.1 (2.0, 4.7)	3.3 (2.2, 4.9)	3.3 (2.2, 4.9)	4.6 (2.8, 7.5)	
Exeter V40	Mallory-Head	33	1359	0.5 (0.3, 1.1)	0.9 (0.5, 1.5)	1.0 (0.5, 1.7)	1.7 (1.0, 2.6)	3.1 (2.0, 4.6)	
Exeter V40	Pinnacle	36	1419	1.6 (1.0, 2.4)	2.2 (1.5, 3.2)	2.7 (1.9, 3.9)	3.5 (2.4, 5.2)		
Exeter V40	R3	35	1493	1.3 (0.8, 2.0)	2.3 (1.6, 3.3)	3.4 (2.4, 4.8)	3.4 (2.4, 4.8)		
Exeter V40	Trident (Shell)	1141	47207	1.2 (1.1, 1.3)	1.8 (1.7, 1.9)	2.4 (2.3, 2.6)	3.0 (2.8, 3.2)	4.0 (3.8, 4.3)	
Exeter V40	Trident/Tritanium (Shell)	48	2587	1.4 (1.0, 2.0)	2.0 (1.5, 2.7)	2.5 (1.8, 3.4)			
Exeter V40	Trilogy	19	606	1.7 (0.9, 3.1)	2.4 (1.4, 4.0)	2.6 (1.6, 4.3)	2.8 (1.7, 4.6)	4.4 (2.6, 7.3)	
Exeter V40	Vitalock	74	1959	0.9 (0.6, 1.5)	1.7 (1.2, 2.3)	2.3 (1.7, 3.1)	2.8 (2.2, 3.7)	3.4 (2.6, 4.3)	
MS 30	Allofit	48	1505	1.2 (0.8, 1.9)	1.7 (1.2, 2.6)	2.2 (1.5, 3.1)	3.0 (2.2, 4.1)	3.9 (2.8, 5.3)	
MS 30	Fitmore	16	603	0.3 (0.1, 1.3)	0.9 (0.4, 2.3)	1.4 (0.7, 3.0)	2.1 (1.1, 4.0)	2.7 (1.5, 5.0)	
Omnifit	Trident (Shell)	82	2643	1.9 (1.4, 2.5)	2.8 (2.2, 3.5)	3.0 (2.4, 3.8)	3.3 (2.7, 4.2)	3.6 (2.9, 4.6)	
Quadra-C	Versafitcup CC	17	657	2.4 (1.5, 4.0)	2.7 (1.7, 4.5)	2.7 (1.7, 4.5)			
Spectron EF	BHR MoM	53	532	0.8 (0.3, 2.0)	2.9 (1.8, 4.8)	6.3 (4.5, 8.9)	9.0 (6.7, 12.0)	14.6 (10.9, 19.4)	
Spectron EF	R3	40	1524	1.5 (1.0, 2.3)	2.6 (1.8, 3.6)	3.2 (2.3, 4.4)	3.4 (2.5, 4.8)		
Spectron EF	Reflection (Shell)	253	5127	1.1 (0.8, 1.4)	2.0 (1.6, 2.4)	2.8 (2.3, 3.3)	3.7 (3.2, 4.3)	5.8 (5.1, 6.7)	10.4 (8.8, 12.2)
Other (859)		968	17449	1.8 (1.6, 2.0)	3.1 (2.9, 3.4)	4.5 (4.1, 4.8)	5.8 (5.4, 6.2)	7.8 (7.3, 8.3)	10.8 (9.8, 11.8)
TOTAL		3829	112948						

Note: Only combinations with over 500 procedures have been listed
Procedures using metal/metal prostheses with head size larger than 32mm have been included
MoM denotes metal/metal prostheses with head size larger than 32mm

OUTCOME FOR OSTEOARTHRITIS - PATIENT CHARACTERISTICS

These analyses have been undertaken excluding all procedures using large head metal/metal bearing surface. The 15 year cumulative percent revision of primary total conventional hip replacement undertaken for osteoarthritis is 8.0% (Table HT16 and Figure HT6).

Age and Gender

There is a difference in the rate of revision with respect to age. Patients aged 75 years or older have a lower rate of revision than all other age groups after six months (Table HT17 and Figure HT7).

Males have a higher rate of revision after 1.5 years. The cumulative percent revision at 15 years is 8.5% for males and 7.6% 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 or older have a higher rate of revision initially compared to the younger age groups. However, this difference is no longer evident as time progresses (Table HT18 and Figure HT9).

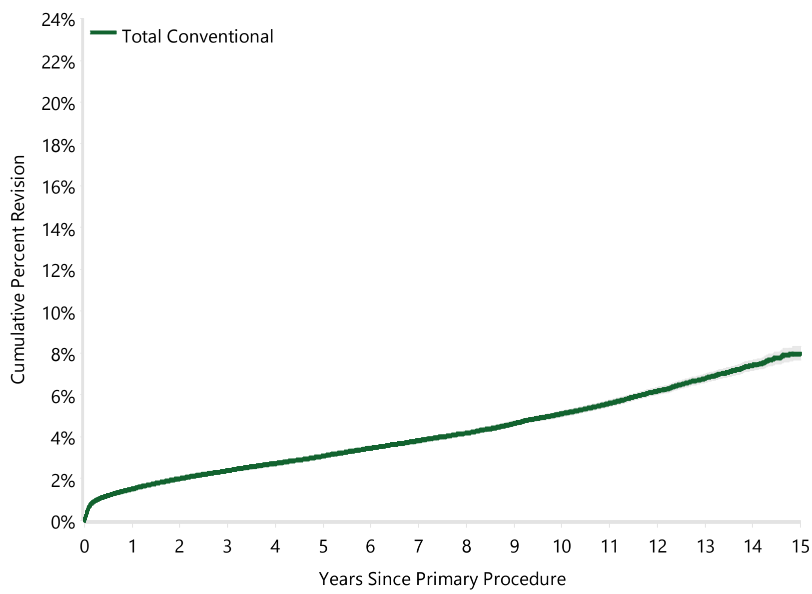
For females, the rate of revision decreases with increasing age. After three months, females aged less than 55 years have almost twice the rate of revision compared to females 75 years or older (Table HT18 and Figure HT10).

Table HT16 Cumulative Percent Revision of Primary Total Conventional Hip Replacement (Primary Diagnosis OA)

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Total Conventional	10032	292565	1.5 (1.5, 1.6)	2.4 (2.3, 2.4)	3.1 (3.0, 3.1)	3.8 (3.7, 3.9)	5.1 (5.0, 5.2)	8.0 (7.7, 8.3)
TOTAL	10032	292565						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure HT6 Cumulative Percent Revision of Primary Total Conventional Hip Replacement (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Total Conventional	292565	256118	194208	141139	97065	50819	1783

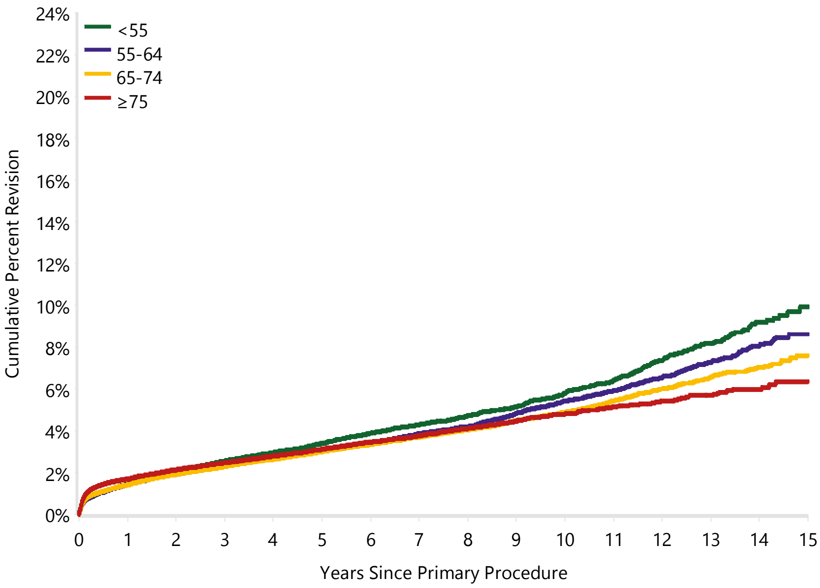
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

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	7 Yrs	10 Yrs	15 Yrs
<55	1210	30956	1.4 (1.3, 1.6)	2.5 (2.4, 2.7)	3.4 (3.2, 3.6)	4.3 (4.0, 4.6)	5.8 (5.4, 6.2)	9.9 (9.0, 11.0)
55-64	2505	69433	1.4 (1.3, 1.5)	2.3 (2.2, 2.5)	3.0 (2.9, 3.2)	3.9 (3.7, 4.0)	5.4 (5.2, 5.7)	8.6 (8.0, 9.2)
65-74	3507	103976	1.4 (1.3, 1.5)	2.3 (2.2, 2.4)	3.0 (2.9, 3.1)	3.7 (3.6, 3.8)	4.9 (4.7, 5.1)	7.6 (7.1, 8.1)
≥75	2810	88200	1.7 (1.6, 1.8)	2.5 (2.4, 2.6)	3.1 (3.0, 3.2)	3.8 (3.6, 3.9)	4.8 (4.6, 5.0)	6.3 (5.8, 6.9)
TOTAL	10032	292565						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

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



HR - adjusted for gender

<55 vs ≥75
0 - 2Wk: HR=1.00 (0.80, 1.26),p=0.991
2Wk - 3Mth: HR=0.59 (0.50, 0.70),p<0.001
3Mth - 6Mth: HR=1.02 (0.80, 1.31),p=0.877
6Mth+: HR=1.43 (1.32, 1.56),p<0.001

55-64 vs ≥75
0 - 2Wk: HR=0.86 (0.72, 1.02),p=0.088
2Wk - 3Mth: HR=0.66 (0.59, 0.74),p<0.001
3Mth - 6Mth: HR=0.82 (0.68, 1.00),p=0.055
6Mth+: HR=1.27 (1.18, 1.36),p<0.001

65-74 vs ≥75
0 - 6Mth: HR=0.76 (0.70, 0.83),p<0.001
6Mth - 1.5Yr: HR=1.19 (1.06, 1.33),p=0.002
1.5Yr+: HR=1.12 (1.05, 1.21),p=0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
<55	30956	26933	20014	14400	10044	6079	300
55-64	69433	61032	46781	34285	24101	13706	606
65-74	103976	91245	69725	51694	36625	19792	678
≥75	88200	76908	57688	40760	26295	11242	199

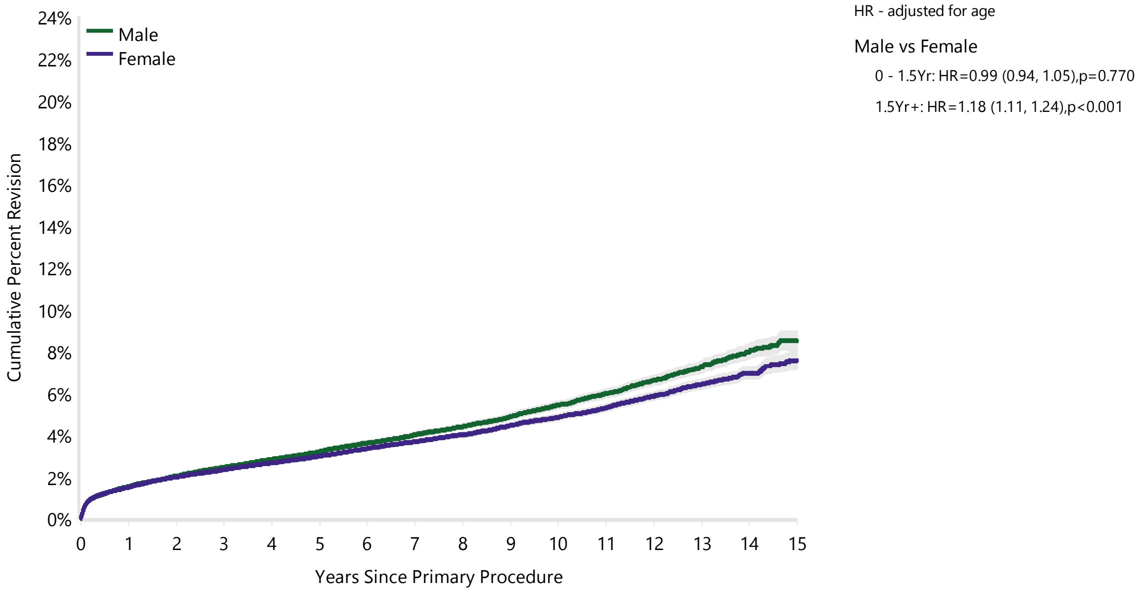
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT18 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Gender and Age (Primary Diagnosis OA)

Gender	Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male		**4725**	**133437**	**1.5 (1.5, 1.6)**	**2.4 (2.4, 2.5)**	**3.2 (3.1, 3.3)**	**4.0 (3.9, 4.1)**	**5.4 (5.2, 5.6)**	**8.5 (8.0, 9.0)**
	<55	596	16838	1.3 (1.1, 1.5)	2.3 (2.1, 2.6)	3.1 (2.8, 3.5)	3.9 (3.6, 4.3)	5.4 (4.9, 5.9)	9.0 (7.9, 10.3)
	55-64	1250	34191	1.5 (1.3, 1.6)	2.4 (2.2, 2.5)	3.0 (2.8, 3.2)	3.9 (3.6, 4.2)	5.4 (5.1, 5.8)	9.3 (8.5, 10.3)
	65-74	1640	48028	1.4 (1.3, 1.5)	2.3 (2.1, 2.4)	3.0 (2.9, 3.2)	3.8 (3.6, 4.0)	5.1 (4.9, 5.4)	7.8 (7.1, 8.5)
	≥75	1239	34380	1.9 (1.8, 2.1)	2.9 (2.7, 3.1)	3.6 (3.4, 3.9)	4.5 (4.2, 4.7)	5.8 (5.4, 6.2)	6.8 (6.2, 7.3)
Female		**5307**	**159128**	**1.5 (1.4, 1.6)**	**2.3 (2.3, 2.4)**	**3.0 (2.9, 3.1)**	**3.7 (3.6, 3.8)**	**4.8 (4.7, 5.0)**	**7.6 (7.1, 8.0)**
	<55	614	14118	1.6 (1.4, 1.9)	2.8 (2.5, 3.1)	3.7 (3.4, 4.1)	4.7 (4.3, 5.1)	6.3 (5.7, 6.9)	11.0 (9.4, 12.9)
	55-64	1255	35242	1.4 (1.3, 1.5)	2.3 (2.2, 2.5)	3.0 (2.8, 3.2)	3.8 (3.6, 4.1)	5.4 (5.0, 5.7)	7.8 (7.1, 8.6)
	65-74	1867	55948	1.5 (1.4, 1.6)	2.3 (2.2, 2.4)	3.0 (2.8, 3.1)	3.6 (3.4, 3.8)	4.7 (4.4, 4.9)	7.5 (6.8, 8.2)
	≥75	1571	53820	1.5 (1.4, 1.7)	2.2 (2.1, 2.4)	2.8 (2.6, 2.9)	3.3 (3.2, 3.5)	4.2 (4.0, 4.5)	6.0 (5.3, 6.8)
TOTAL		**10032**	**292565**						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

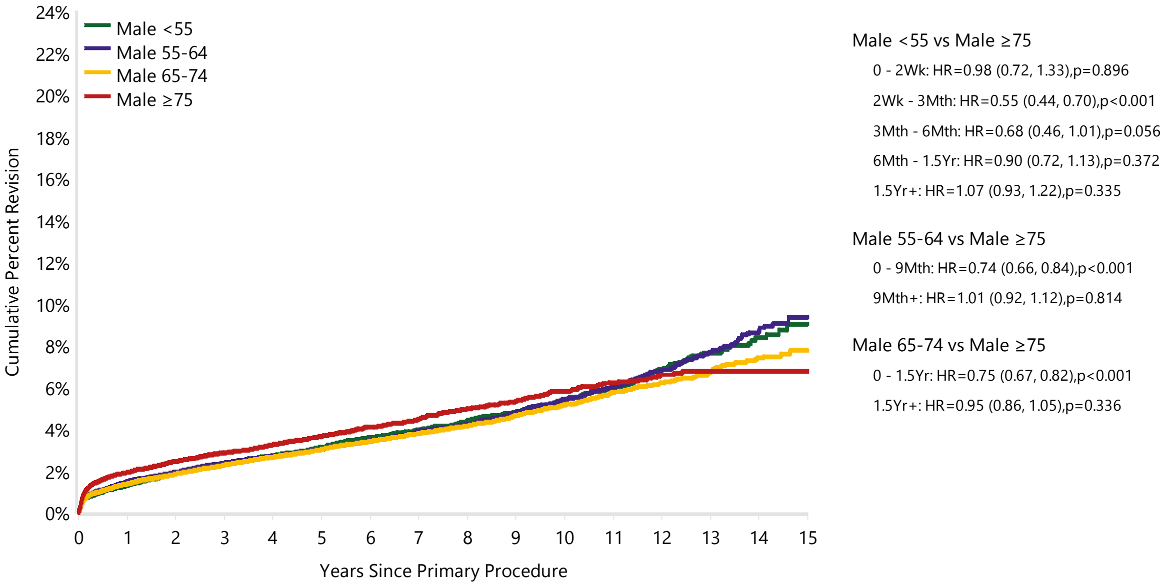
Figure HT8 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Gender (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	133437	116102	86856	62205	42460	22437	818
Female	159128	140016	107352	78934	54605	28382	965

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

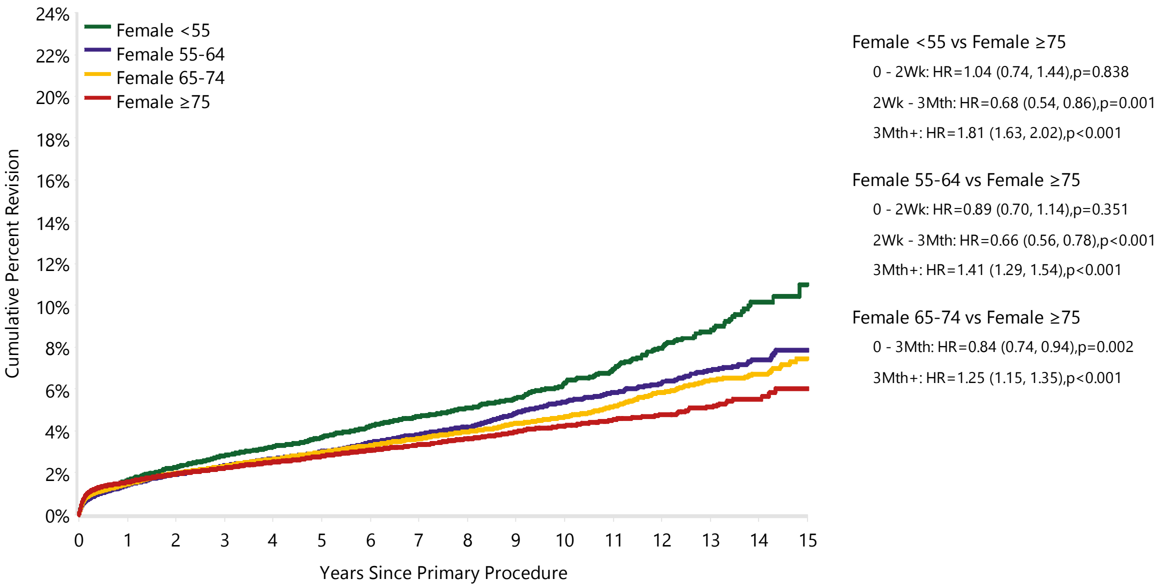
Figure HT9 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Males by Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	<55	16838	14551	10643	7460	5197	3237	182
	55-64	34191	29867	22632	16368	11551	6756	291
	65-74	48028	42173	32125	23700	16656	8894	296
	≥75	34380	29511	21456	14677	9056	3550	49

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure HT10 Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Females by Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Female	<55	14118	12382	9371	6940	4847	2842	118
	55-64	35242	31165	24149	17917	12550	6950	315
	65-74	55948	49072	37600	27994	19969	10898	382
	≥75	53820	47397	36232	26083	17239	7692	150

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

OUTCOME FOR OSTEOARTHRITIS - PROSTHESIS CHARACTERISTICS

These analyses have been undertaken excluding all procedures using large head metal/metal bearing surface.

Fixation

Hybrid fixation has a lower rate of revision compared to cemented fixation after six months and cementless fixation up to three years. Cementless fixation has a higher rate of revision compared to cemented fixation in the first month, but after three years the rate of revision is lower for cementless fixation. The cumulative percent revision at 15 years is 7.3% for hybrid, 7.9% for cementless and 9.8% for cemented fixation (Table HT19 and Figure HT11).

The outcome of fixation and age varies with time. For patients aged less than 55 years, hybrid fixation has a lower rate of revision than cemented over the entire period and cementless in the first 2.5 years. Cementless fixation has a lower rate of revision compared to cemented after 2.5 years (Table HT20 and Figure HT12).

For patients aged 55 to 64 years, cementless fixation has a lower rate of revision than cemented after the first nine months and for hybrid after three years. Cemented fixation has a higher rate of revision than hybrid fixation for the entire period (Table HT20 and Figure HT13).

For patients aged 65 to 74 years, there was no difference in the rate of revision between cementless and hybrid fixation after three months and there is a lower rate of revision compared to cemented fixation after six months. Hybrid fixation has a lower rate of revision than cemented fixation after two years (Table HT20 and Figure HT14).

For patients aged 75 years or older, cementless fixation has a higher rate of revision compared to cemented and hybrid fixation. There was no difference between hybrid and cemented fixation after two weeks (Table HT20 and Figure HT15).

Mini Stems

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

There have been 2,102 procedures using a mini stem prosthesis undertaken for osteoarthritis, representing less than one percent of all total conventional hip procedures. There were 317 procedures recorded in 2015 using a mini stem. This is a decrease of 24% compared to 2014. The 10 year cumulative percent revision for total conventional hip replacement using a mini stem is 6.6% compared to 5.1% for other femoral stems. There is no difference in the outcome when a mini stem is used (Table HT21 and Figure HT16).

The cumulative incidence of loosening/lysis for procedures using a mini stem is over twice that of other femoral stems at 10 years (3.3% compared to 1.5%) (Figure HT17). The types of revision are presented in Table HT22.

The Registry has information on 10 different mini stem prostheses. Revision rates vary depending on the type of prosthesis (Table HT23).

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 total conventional hip replacement.

The Registry has recorded 9,745 procedures using femoral stems with exchangeable necks undertaken for osteoarthritis. There were 450 procedures reported in 2015. This is a 34% decrease compared to 2014. The proportion of procedures using exchangeable necks peaked in 2010 at 6.6% of all primary total conventional hip procedures. This proportion continues to decrease, with 1.5% of all procedures using a stem with an exchangeable neck in 2015.

"The cumulative incidence of loosening/lysis for procedures using a mini stem is over twice that of other femoral stems at 10 years (3.3% compared to 1.5%)."

Femoral stems with exchangeable necks have twice the rate of revision compared to fixed stems. The cumulative percent revision at 10 years is 9.3% for stems with exchangeable necks compared to 4.9% for fixed neck stems (Table HT24 and Figure HT18). The increase in the rate of revision is due to a higher cumulative incidence of loosening/lysis (2.5% at 10 years compared to 1.4% for fixed femoral neck), dislocation (1.7% compared to 0.9%) and fracture (1.4% compared to 0.9%) (Figure HT19). Of the revisions for femoral stems with exchangeable necks, 2.5% are for implant breakage of the femoral component compared to 0.9% for fixed neck stems (Table HT25). The higher rate of revision when using stems with exchangeable necks is evident for all bearing surfaces (Figure HT20).

The Registry has previously identified that the stem/neck metal combination has an effect on the rate of revision. As in last year's report, only the two principal combinations are included in this analysis. These were titanium stem/titanium neck and titanium stem/cobalt chrome neck. The titanium/cobalt chrome combination has a higher rate of revision compared to the titanium/titanium combination (Table HT26 and Figure HT21).

The reason for this difference is a higher cumulative incidence for each of the five main reasons for revision with the exception of infection. Metal related pathology is the second most common reason for revision with the titanium/cobalt chrome combination. In the titanium/titanium combination metal related pathology is the lowest of the five main reasons for revision (Figure HT22).

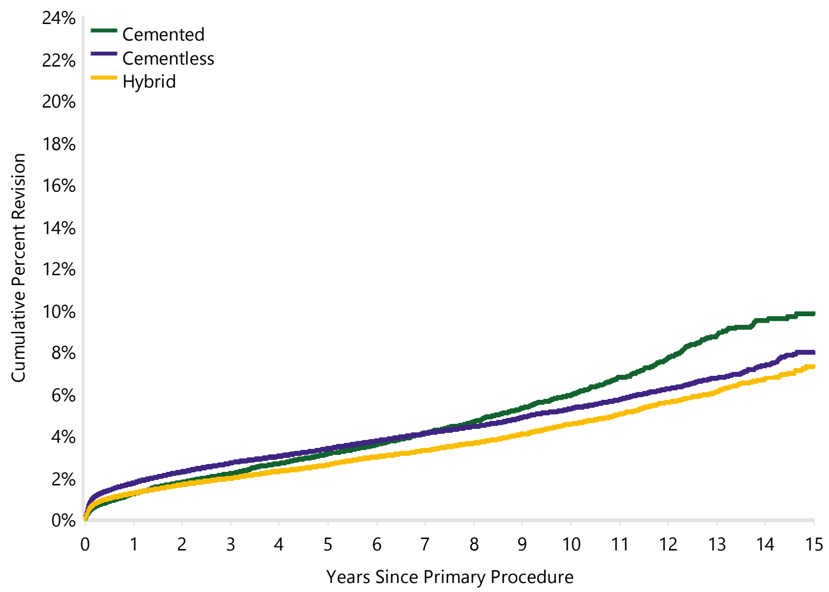
The Registry has information on 14 different exchangeable femoral neck prostheses that have been used in more than 60 procedures. The outcomes of each of these stems are detailed in Table HT27.

Table HT19 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	7 Yrs	10 Yrs	15 Yrs
Cemented	1019	21608	1.2 (1.1, 1.4)	2.2 (2.0, 2.4)	3.1 (2.9, 3.4)	4.1 (3.8, 4.4)	5.9 (5.5, 6.3)	9.8 (9.0, 10.7)
Cementless	6151	174811	1.7 (1.6, 1.8)	2.7 (2.6, 2.7)	3.3 (3.2, 3.4)	4.1 (4.0, 4.2)	5.3 (5.1, 5.4)	7.9 (7.5, 8.4)
Hybrid	2862	96146	1.2 (1.1, 1.3)	1.9 (1.8, 2.0)	2.6 (2.5, 2.7)	3.3 (3.1, 3.4)	4.5 (4.3, 4.7)	7.3 (6.7, 7.8)
TOTAL	10032	292565						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure HT11 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis OA)



HR - adjusted for age and gender
Cemented vs Hybrid
0 - 1Mth: HR=0.69 (0.53, 0.89),p=0.004
1Mth - 6Mth: HR=1.02 (0.83, 1.25),p=0.852
6Mth - 1.5Yr: HR=1.45 (1.21, 1.75),p<0.001
1.5Yr+: HR=1.47 (1.35, 1.61),p<0.001
Cementless vs Hybrid
0 - 2Wk: HR=1.83 (1.55, 2.17),p<0.001
2Wk - 1Mth: HR=1.40 (1.22, 1.61),p<0.001
1Mth - 3Mth: HR=1.28 (1.12, 1.46),p<0.001
3Mth - 1.5Yr: HR=1.29 (1.17, 1.42),p<0.001
1.5Yr - 3Yr: HR=1.35 (1.20, 1.51),p<0.001
3Yr+: HR=0.99 (0.92, 1.06),p=0.768
Cementless vs Cemented
0 - 2Wk: HR=2.66 (2.02, 3.52),p<0.001
2Wk - 1Mth: HR=2.04 (1.57, 2.64),p<0.001
1Mth - 3Mth: HR=1.19 (0.99, 1.43),p=0.069
3Mth - 1.5Yr: HR=0.99 (0.86, 1.15),p=0.937
1.5Yr - 3Yr: HR=0.92 (0.80, 1.04),p=0.179
3Yr - 3.5Yr: HR=0.62 (0.50, 0.78),p<0.001
3.5Yr - 5Yr: HR=0.74 (0.63, 0.86),p<0.001
5Yr - 5.5Yr: HR=0.71 (0.55, 0.91),p=0.006
5.5Yr+: HR=0.65 (0.59, 0.72),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	21608	20050	16963	13878	10786	6358	327
Cementless	174811	151553	112554	79496	52982	27560	763
Hybrid	96146	84515	64691	47765	33297	16901	693

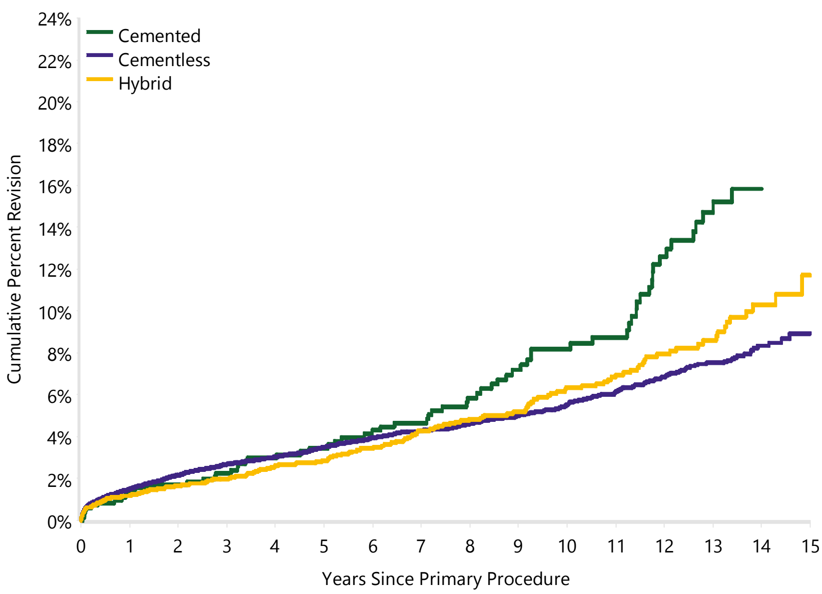
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT20 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	7 Yrs	10 Yrs	15 Yrs
<55		**1210**	**30956**	**1.4 (1.3, 1.6)**	**2.5 (2.4, 2.7)**	**3.4 (3.2, 3.6)**	**4.3 (4.0, 4.6)**	**5.8 (5.4, 6.2)**	**9.9 (9.0, 11.0)**
	Cemented	69	845	1.3 (0.7, 2.4)	2.3 (1.4, 3.6)	3.5 (2.4, 5.0)	4.7 (3.3, 6.5)	8.2 (6.2, 10.8)	
	Cementless	938	24885	1.5 (1.3, 1.7)	2.7 (2.5, 2.9)	3.5 (3.2, 3.8)	4.3 (4.0, 4.6)	5.5 (5.1, 5.9)	8.9 (7.9, 10.0)
	Hybrid	203	5226	1.2 (0.9, 1.5)	2.0 (1.6, 2.4)	2.9 (2.4, 3.4)	4.3 (3.6, 5.1)	6.3 (5.4, 7.4)	11.7 (9.2, 14.8)
55-64		**2505**	**69433**	**1.4 (1.3, 1.5)**	**2.3 (2.2, 2.5)**	**3.0 (2.9, 3.2)**	**3.9 (3.7, 4.0)**	**5.4 (5.2, 5.7)**	**8.6 (8.0, 9.2)**
	Cemented	199	2669	1.5 (1.1, 2.0)	2.9 (2.3, 3.6)	4.1 (3.3, 4.9)	5.3 (4.5, 6.4)	8.3 (7.1, 9.7)	13.2 (11.3, 15.5)
	Cementless	1739	50801	1.5 (1.4, 1.6)	2.4 (2.3, 2.6)	3.1 (2.9, 3.2)	3.8 (3.6, 4.0)	5.1 (4.9, 5.4)	7.8 (7.1, 8.5)
	Hybrid	567	15963	1.1 (1.0, 1.3)	1.9 (1.7, 2.2)	2.7 (2.4, 3.0)	3.6 (3.2, 3.9)	5.3 (4.8, 5.9)	9.4 (8.2, 10.7)
65-74		**3507**	**103976**	**1.4 (1.3, 1.5)**	**2.3 (2.2, 2.4)**	**3.0 (2.9, 3.1)**	**3.7 (3.6, 3.8)**	**4.9 (4.7, 5.1)**	**7.6 (7.1, 8.1)**
	Cemented	414	7297	1.1 (0.9, 1.4)	2.2 (1.9, 2.6)	3.2 (2.8, 3.6)	4.4 (3.9, 5.0)	6.4 (5.7, 7.1)	11.0 (9.7, 12.5)
	Cementless	2040	62060	1.6 (1.5, 1.7)	2.5 (2.4, 2.7)	3.2 (3.1, 3.4)	3.8 (3.7, 4.0)	4.8 (4.6, 5.1)	7.3 (6.5, 8.2)
	Hybrid	1053	34619	1.2 (1.1, 1.3)	1.9 (1.7, 2.0)	2.6 (2.4, 2.8)	3.2 (3.0, 3.4)	4.4 (4.1, 4.7)	6.6 (5.9, 7.4)
≥75		**2810**	**88200**	**1.7 (1.6, 1.8)**	**2.5 (2.4, 2.6)**	**3.1 (3.0, 3.2)**	**3.8 (3.6, 3.9)**	**4.8 (4.6, 5.0)**	**6.3 (5.8, 6.9)**
	Cemented	337	10797	1.1 (1.0, 1.4)	1.9 (1.6, 2.2)	2.8 (2.5, 3.1)	3.4 (3.0, 3.8)	4.3 (3.8, 4.9)	5.7 (4.8, 6.8)
	Cementless	1434	37065	2.3 (2.1, 2.5)	3.2 (3.0, 3.4)	3.8 (3.6, 4.1)	4.6 (4.4, 4.9)	5.9 (5.6, 6.3)	
	Hybrid	1039	40338	1.3 (1.2, 1.4)	2.0 (1.8, 2.1)	2.5 (2.3, 2.7)	3.0 (2.8, 3.3)	4.0 (3.7, 4.3)	5.2 (4.5, 6.0)
TOTAL		10032	292565						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure HT12 Cumulative Percent Revision of Primary Total Conventional Hip Replacement for Patients Aged <55 Years by Fixation (Primary Diagnosis OA)



HR - adjusted for age and gender

Cemented vs Hybrid

Entire Period: HR=1.43 (1.08, 1.88),p=0.011

Cementless vs Hybrid

0 - 6Mth: HR=1.25 (0.94, 1.67),p=0.130

6Mth - 2.5Yr: HR=1.67 (1.20, 2.31),p=0.002

2.5Yr+: HR=0.71 (0.58, 0.86),p<0.001

Cementless vs Cemented

0 - 3Mth: HR=0.90 (0.61, 1.34),p=0.603

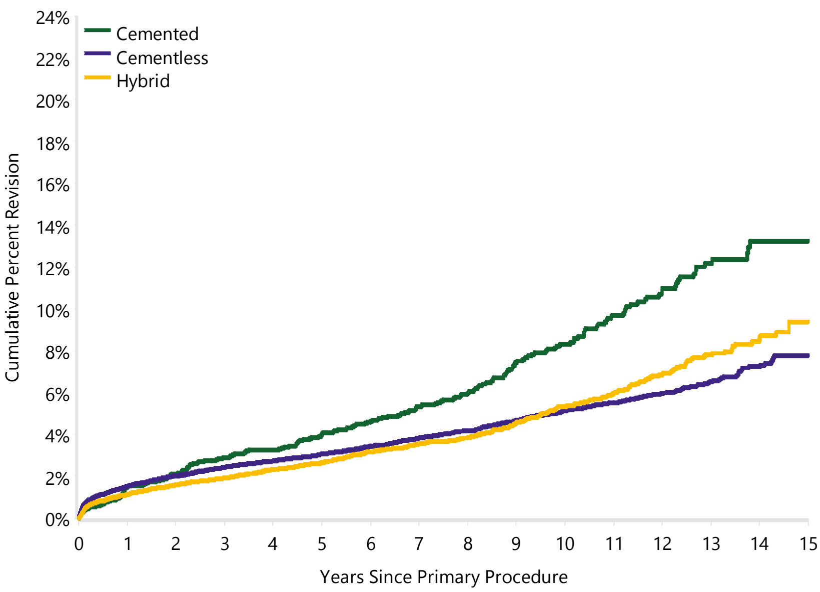
3Mth - 2.5Yr: HR=1.08 (0.76, 1.54),p=0.665

2.5Yr+: HR=0.50 (0.38, 0.65),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	845	796	686	587	501	333	28
Cementless	24885	21646	16019	11398	7800	4708	192
Hybrid	5226	4491	3309	2415	1743	1038	80

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure HT13 Cumulative Percent Revision of Primary Total Conventional Hip Replacement for Patients Aged 55-64 Years by Fixation (Primary Diagnosis OA)



HR - adjusted for age and gender

Cemented vs Hybrid
Entire Period: HR=1.56 (1.33, 1.84),p<0.001

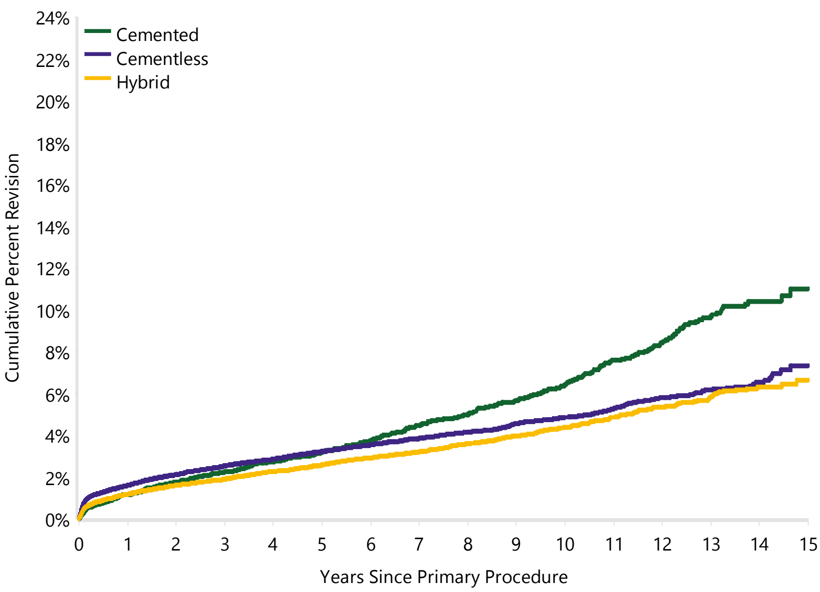
Cementless vs Hybrid
0 - 2Wk: HR=2.56 (1.65, 3.98),p<0.001
2Wk - 3Mth: HR=1.26 (1.00, 1.58),p=0.048
3Mth - 1.5Yr: HR=1.19 (0.98, 1.45),p=0.083
1.5Yr - 3Yr: HR=1.14 (0.89, 1.46),p=0.288
3Yr+: HR=0.76 (0.67, 0.87),p<0.001

Cemented vs Cementless
0 - 9Mth: HR=0.65 (0.43, 0.99),p=0.042
9Mth+: HR=2.02 (1.72, 2.37),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	2669	2509	2202	1872	1557	1039	73
Cementless	50801	44357	33601	24148	16567	9292	330
Hybrid	15963	14166	10978	8265	5977	3375	203

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure HT14 Cumulative Percent Revision of Primary Total Conventional Hip Replacement for Patients Aged 65-74 Years by Fixation (Primary Diagnosis OA)



HR - adjusted for age and gender

Cemented vs Hybrid
0 - 1Mth: HR=0.58 (0.36, 0.93),p=0.025
1Mth - 2Yr: HR=1.23 (1.00, 1.51),p=0.054
2Yr - 8Yr: HR=1.65 (1.39, 1.96),p<0.001
8Yr+: HR=2.21 (1.79, 2.73),p<0.001

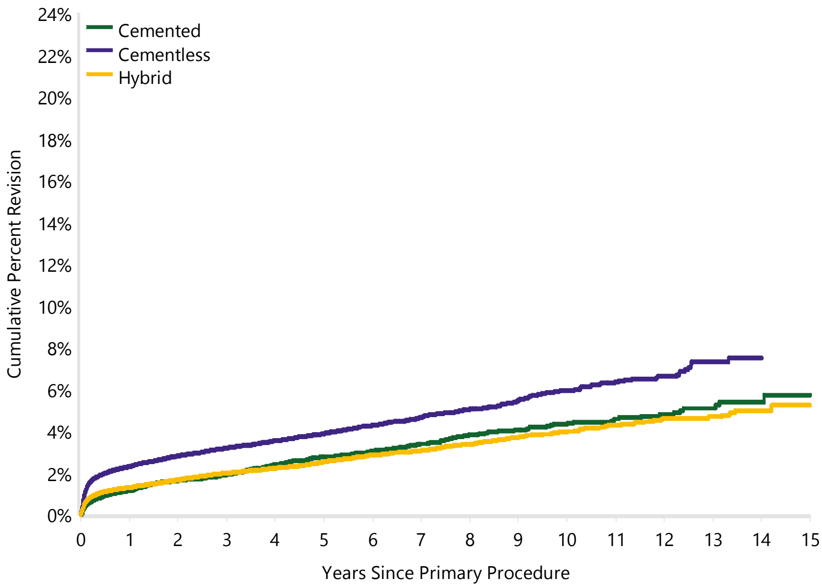
Cementless vs Hybrid
0 - 3Mth: HR=1.57 (1.35, 1.81),p<0.001
3Mth+: HR=1.06 (0.97, 1.16),p=0.187

Cementless vs Cemented
0 - 1Mth: HR=2.76 (1.72, 4.43),p<0.001
1Mth - 3Mth: HR=1.33 (0.92, 1.92),p=0.134
3Mth - 6Mth: HR=0.95 (0.63, 1.43),p=0.811
6Mth - 3Yr: HR=0.77 (0.66, 0.90),p<0.001
3Yr - 9Yr: HR=0.58 (0.50, 0.68),p<0.001
9Yr+: HR=0.47 (0.37, 0.59),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	7297	6824	5955	5077	4158	2728	151
Cementless	62060	53744	39771	28316	19050	9772	210
Hybrid	34619	30677	23999	18301	13417	7292	317

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure HT15 Cumulative Percent Revision of Primary Total Conventional Hip Replacement for Patients Aged ≥75 Years by Fixation (Primary Diagnosis OA)



HR - adjusted for age and gender

Cementless vs Cemented
0 - 2Wk: HR=4.42 (2.33, 8.37),p<0.001
2Wk - 3Mth: HR=1.77 (1.49, 2.11),p<0.001
3Mth+: HR=1.20 (1.05, 1.37),p=0.008

Hybrid vs Cemented
0 - 2Wk: HR=2.37 (1.23, 4.56),p=0.009
2Wk+: HR=0.89 (0.79, 1.01),p=0.077

Cementless vs Hybrid
0 - 3Mth: HR=1.87 (1.64, 2.14),p<0.001
3Mth+: HR=1.37 (1.24, 1.52),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	10797	9921	8120	6342	4570	2258	75
Cementless	37065	31806	23163	15634	9565	3788	31
Hybrid	40338	35181	26405	18784	12160	5196	93

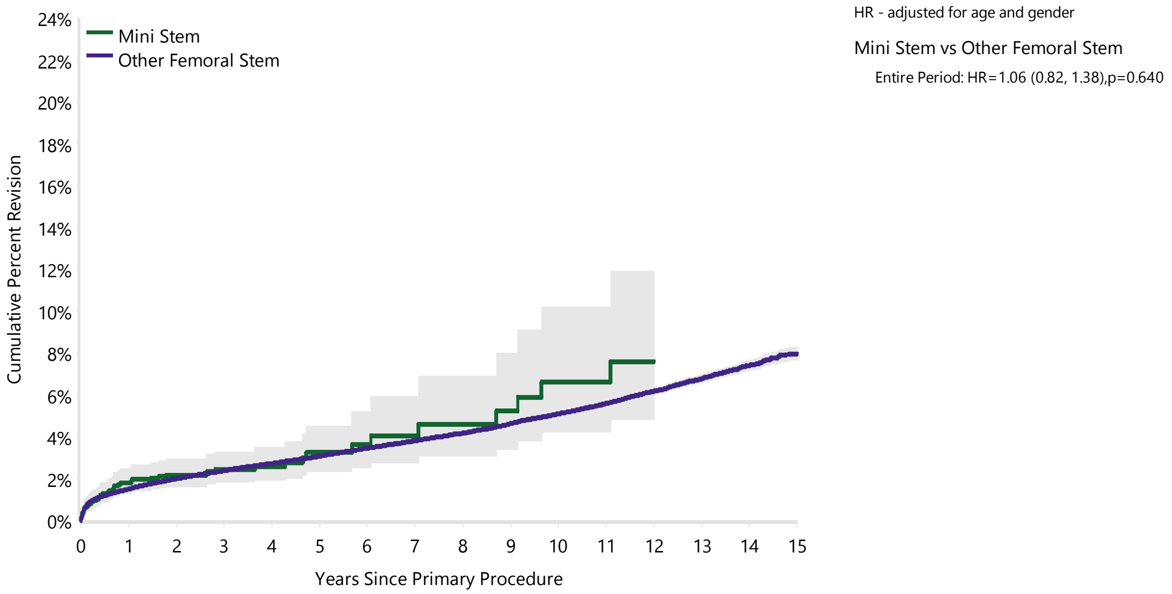
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT21 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	7 Yrs	10 Yrs	15 Yrs
Mini Stem	57	2102	1.8 (1.3, 2.5)	2.4 (1.8, 3.3)	3.2 (2.3, 4.5)	4.1 (2.8, 5.9)	6.6 (4.2, 10.2)	
Other Femoral Stem	9975	290463	1.5 (1.5, 1.5)	2.4 (2.3, 2.4)	3.1 (3.0, 3.1)	3.8 (3.7, 3.9)	5.1 (5.0, 5.2)	8.0 (7.7, 8.3)
TOTAL	10032	292565						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

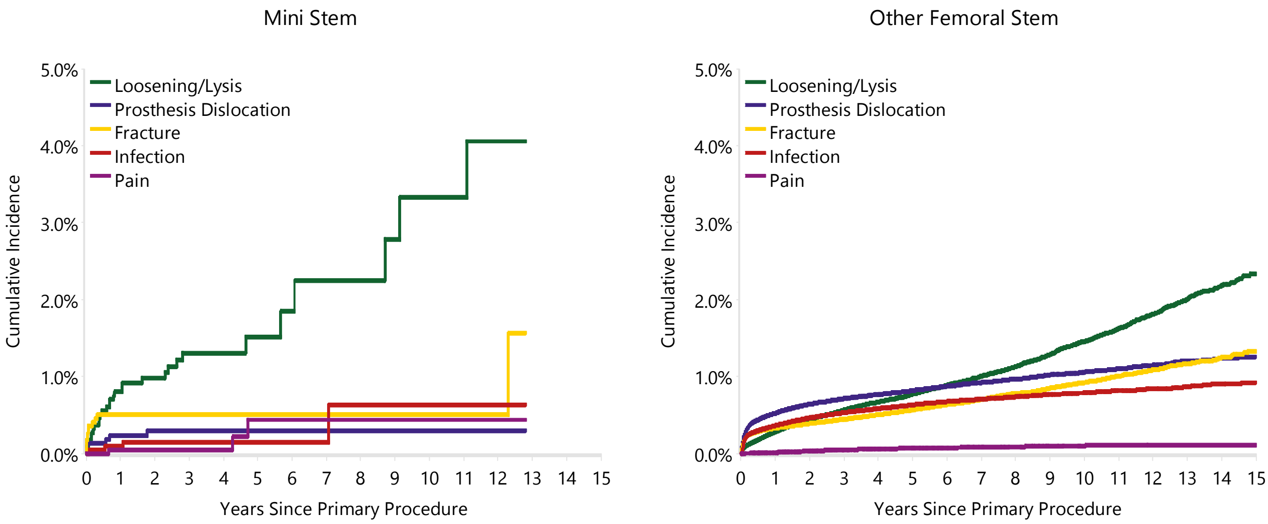
Figure HT16 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Stem Type (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Mini Stem	2102	1743	937	356	177	125	1
Other Femoral Stem	290463	254375	193271	140783	96888	50694	1782

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure HT17 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement by Stem Type (Primary Diagnosis OA)



Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT22 Primary Total Conventional Hip Replacement by Type of Revision and Stem Type (Primary Diagnosis OA)

Type of Revision	Mini Stem Number	Mini Stem % Primaries Revised	Mini Stem % Revisions	Other Femoral Stem Number	Other Femoral Stem % Primaries Revised	Other Femoral Stem % Revisions
Femoral Component	30	1.4	52.6	3205	1.1	32.1
Acetabular Component	14	0.7	24.6	2180	0.8	21.9
Head/Insert	3	0.1	5.3	1947	0.7	19.5
THR (Femoral/Acetabular)	3	0.1	5.3	1188	0.4	11.9
Head Only	4	0.2	7.0	498	0.2	5.0
Cement Spacer	2	0.1	3.5	461	0.2	4.6
Minor Components	1	0.0	1.8	180	0.1	1.8
Insert Only				126	0.0	1.3
Removal of Prostheses				64	0.0	0.6
Head/Neck/Insert				61	0.0	0.6
Head/Neck				47	0.0	0.5
Reinsertion of Components				8	0.0	0.1
Neck Only				4	0.0	0.0
Bipolar Only				3	0.0	0.0
Neck/Insert				1	0.0	0.0
Saddle				1	0.0	0.0
Total Femoral				1	0.0	0.0
N Revision	57	2.7	100.0	9975	3.4	100.0
N Primary	2102			290463		

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT23 Cumulative Percent Revision of Primary Total Conventional Hip Replacement using a Mini Stem by Femoral Stem (Primary Diagnosis OA)

Femoral Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
C.F.P.	10	124	4.0 (1.7, 9.4)	4.0 (1.7, 9.4)	4.9 (2.2, 10.5)	5.7 (2.8, 11.7)	7.7 (4.1, 14.4)	
Mallory-Head	3	90	2.3 (0.6, 9.0)	4.5 (1.4, 13.9)	4.5 (1.4, 13.9)			
Mayo	7	96	2.1 (0.5, 8.1)	4.2 (1.6, 10.8)	4.2 (1.6, 10.8)	5.4 (2.3, 12.6)	7.5 (3.3, 16.6)	
Metha	5	104	2.9 (0.9, 8.8)	5.0 (2.1, 11.5)				
MiniHip	16	623	2.0 (1.2, 3.6)	2.6 (1.5, 4.3)				
Nanos	7	657	0.8 (0.3, 1.9)	1.2 (0.6, 2.5)	1.2 (0.6, 2.5)			
Silent	2	50	4.0 (1.0, 15.1)	4.0 (1.0, 15.1)	4.0 (1.0, 15.1)			
Taperloc Microplasty	5	342	1.3 (0.5, 3.4)	1.3 (0.5, 3.4)	2.9 (0.9, 9.0)			
Other (2)	2	16	6.3 (0.9, 36.8)	6.3 (0.9, 36.8)	6.3 (0.9, 36.8)	6.3 (0.9, 36.8)		
TOTAL	57	2102						

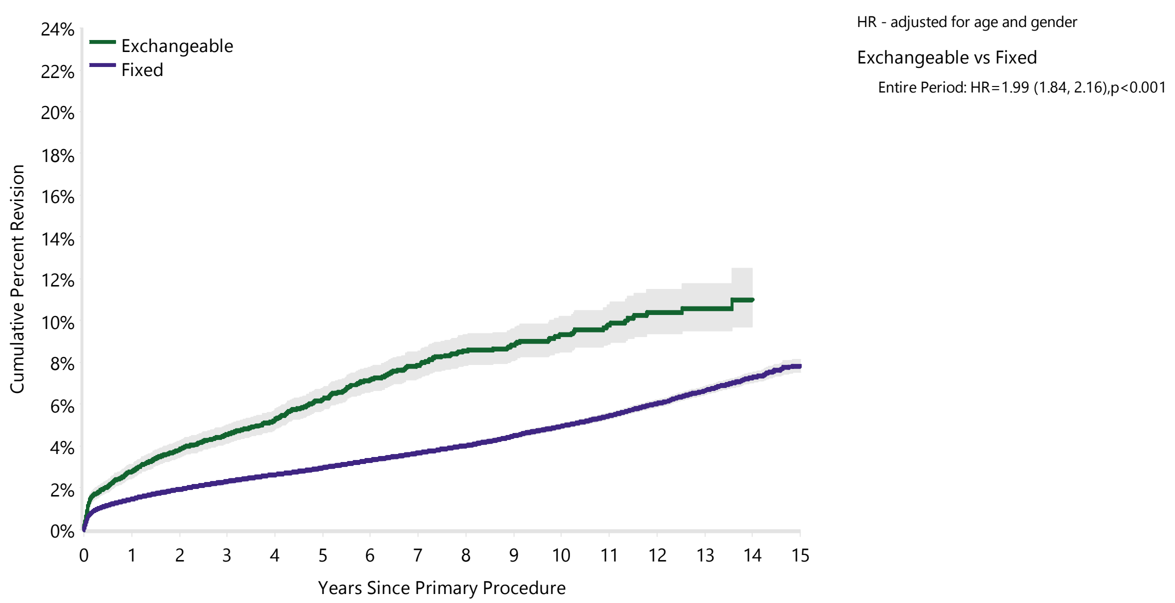
Note: Only prostheses with over 50 procedures have been listed
All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT24 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	7 Yrs	10 Yrs	15 Yrs
Exchangeable	635	9745	2.8 (2.5, 3.1)	4.6 (4.1, 5.0)	6.2 (5.7, 6.8)	7.9 (7.3, 8.6)	9.3 (8.5, 10.2)	
Fixed	9397	282820	1.5 (1.4, 1.5)	2.3 (2.2, 2.4)	3.0 (2.9, 3.0)	3.7 (3.6, 3.8)	4.9 (4.8, 5.1)	7.8 (7.5, 8.2)
TOTAL	10032	292565						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure HT18 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Type of Femoral Neck (Primary Diagnosis OA)



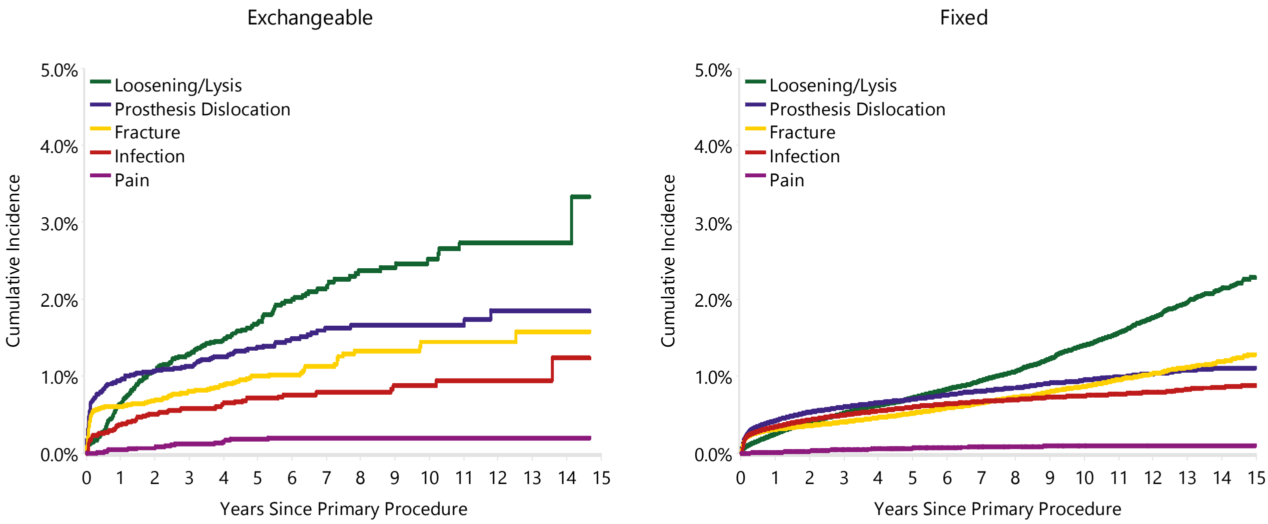
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Exchangeable	9745	8950	7334	4816	2572	1155	23
Fixed	282820	247168	186874	136323	94493	49664	1760

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT25 Reason for Revision for Primary Total Conventional Hip Replacement by Type of Femoral Neck (Primary Diagnosis OA)

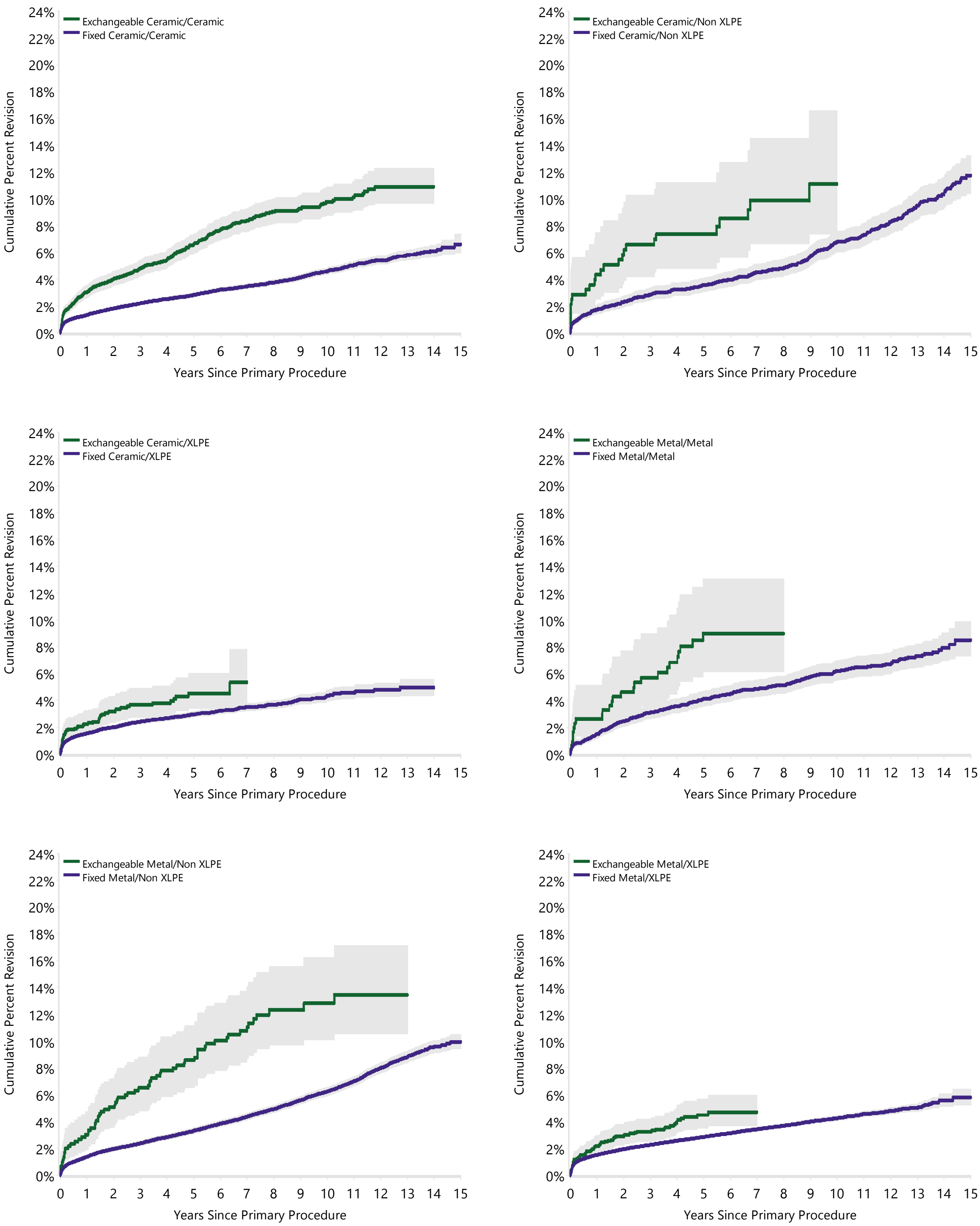
Revision Diagnosis	Exchangeable			Fixed		
	Number	% Primaries Revised	% Revisions	Number	% Primaries Revised	% Revisions
Loosening/Lysis	180	1.8	28.3	2661	0.9	28.3
Prosthesis Dislocation	138	1.4	21.7	2090	0.7	22.2
Fracture	103	1.1	16.2	1787	0.6	19.0
Infection	70	0.7	11.0	1690	0.6	18.0
Pain	16	0.2	2.5	177	0.1	1.9
Leg Length Discrepancy	6	0.1	0.9	138	0.0	1.5
Malposition	8	0.1	1.3	116	0.0	1.2
Instability	10	0.1	1.6	96	0.0	1.0
Wear Acetabular Insert				85	0.0	0.9
Implant Breakage Stem	16	0.2	2.5	81	0.0	0.9
Implant Breakage Acetabular Insert	10	0.1	1.6	76	0.0	0.8
Incorrect Sizing	7	0.1	1.1	74	0.0	0.8
Implant Breakage Acetabular	10	0.1	1.6	60	0.0	0.6
Metal Related Pathology	51	0.5	8.0	44	0.0	0.5
Implant Breakage Head	3	0.0	0.5	30	0.0	0.3
Wear Head	1	0.0	0.2	21	0.0	0.2
Heterotopic Bone				13	0.0	0.1
Tumour				12	0.0	0.1
Wear Acetabulum				12	0.0	0.1
Synovitis	1	0.0	0.2	1	0.0	0.0
Other	5	0.1	0.8	133	0.0	1.4
N Revision	635	6.5	100.0	9397	3.3	100.0
N Primary	9745			282820		

Figure HT19 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 with head size larger than 32mm have been excluded

Figure HT20 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Bearing Surface and Type of Femoral Neck (Primary Diagnosis OA)



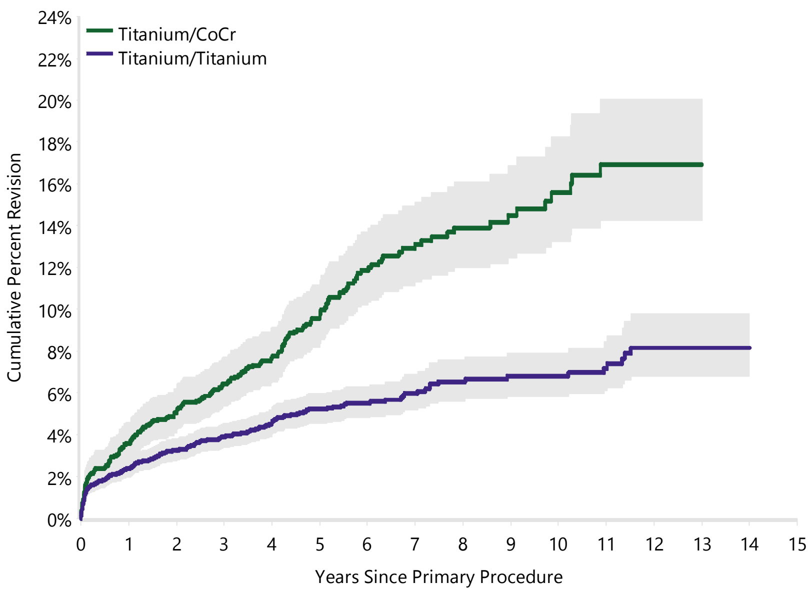
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT26 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Using an Exchangeable Femoral Neck by Stem/Neck Material (Primary Diagnosis OA)

Stem/Neck Material	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Titanium/CoCr	189	1676	3.6 (2.8, 4.6)	6.4 (5.4, 7.7)	9.6 (8.2, 11.2)	13.1 (11.3, 15.1)	15.6 (13.2, 18.2)	
Titanium/Titanium	234	4710	2.4 (2.0, 2.9)	3.9 (3.4, 4.5)	5.2 (4.6, 6.0)	6.0 (5.2, 6.9)	6.8 (5.8, 7.9)	
TOTAL	423	6386						

Note: Excludes Apex, Margron, M-Cor Femoral Neck Prostheses
All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure HT21 Cumulative Percent Revision of Primary Total Conventional Hip Replacement Using an Exchangeable Femoral Neck by Stem/Neck Material (Primary Diagnosis OA)



HR - adjusted for age and gender

Titanium/CoCr vs Titanium/Titanium

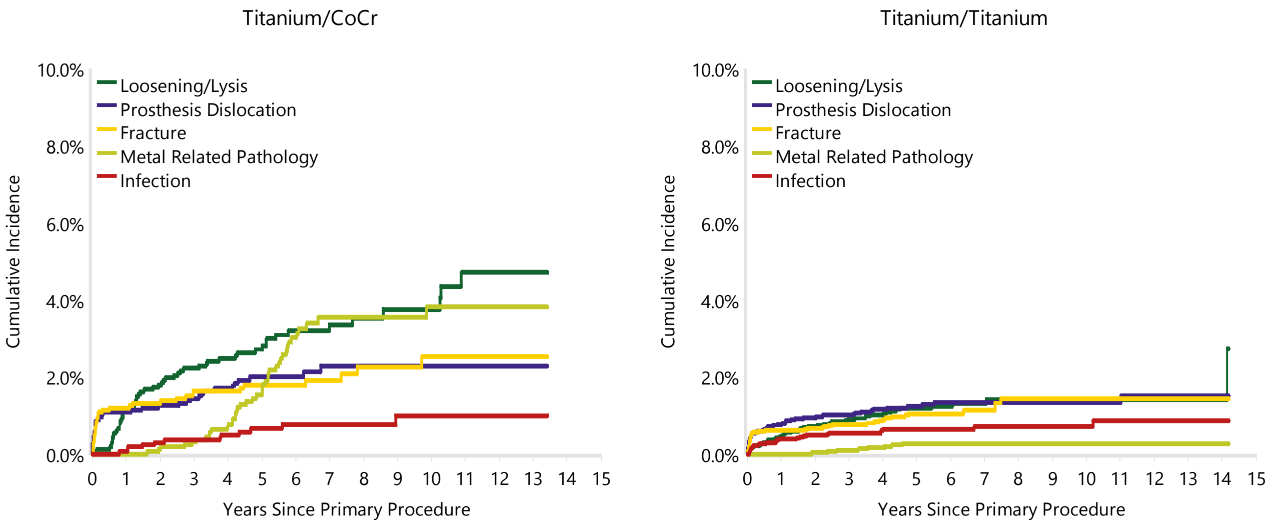
0 - 1.5Yr: HR=1.62 (1.22, 2.15),p<0.001

1.5Yr+: HR=2.46 (1.88, 3.22),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Titanium/CoCr	1676	1600	1429	926	477	216	0
Titanium/Titanium	4710	4288	3355	1970	872	560	10

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure HT22 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement Using an Exchangeable Femoral Neck by Stem/Neck Material (Primary Diagnosis OA)



Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT27 Cumulative Percent Revision of Primary Total Conventional Hip Replacement using an Exchangeable Femoral Neck by Prosthesis Type (Primary Diagnosis OA)

Femoral Neck	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
ABGII	61	228	4.0 (2.1, 7.5)	10.2 (6.9, 15.0)	19.4 (14.7, 25.3)			
Adapter	42	374	3.8 (2.2, 6.3)	7.3 (5.1, 10.5)	10.1 (7.4, 13.7)	13.0 (9.6, 17.4)		
Apex	121	2327	2.7 (2.1, 3.5)	4.1 (3.3, 5.0)	5.2 (4.3, 6.3)	6.2 (5.1, 7.4)	7.6 (6.1, 9.5)	
F2L	64	687	3.2 (2.1, 4.8)	5.4 (4.0, 7.4)	6.8 (5.1, 9.0)	7.6 (5.8, 9.9)	8.6 (6.7, 11.0)	
Femoral Neck (Amplitude)	15	474	1.1 (0.4, 2.5)	2.3 (1.2, 4.3)	4.6 (2.6, 7.8)	5.2 (3.0, 8.8)		
H-Max	1	71	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	3.3 (0.5, 21.4)			
M-Cor	6	110	0.0 (0.0, 0.0)	2.8 (0.9, 8.4)	4.7 (2.0, 11.0)	5.7 (2.6, 12.3)		
M/L Taper Kinectiv	107	2810	2.1 (1.7, 2.7)	3.4 (2.8, 4.2)	4.7 (3.9, 5.7)			
MBA	51	630	2.1 (1.2, 3.5)	4.1 (2.8, 6.0)	5.8 (4.2, 8.1)	6.8 (5.0, 9.3)	9.9 (7.4, 13.1)	
MSA	17	174	7.5 (4.4, 12.6)	9.3 (5.8, 14.7)				
Margron	76	552	5.3 (3.7, 7.5)	7.3 (5.4, 9.9)	9.4 (7.2, 12.2)	12.5 (10.0, 15.6)	14.1 (11.4, 17.4)	
Metha	11	84	10.7 (5.7, 19.6)	11.9 (6.6, 21.0)	13.3 (7.6, 22.8)			
Profemur	52	934	3.0 (2.1, 4.3)	4.7 (3.5, 6.3)	5.3 (4.0, 6.9)	6.3 (4.7, 8.4)	6.7 (5.0, 9.0)	
R120	5	178	1.1 (0.3, 4.4)	2.4 (0.9, 6.4)	2.4 (0.9, 6.4)	3.7 (1.5, 9.2)		
Other (5)	6	112	1.9 (0.5, 7.3)	4.2 (1.6, 10.8)	6.6 (3.0, 14.2)			
TOTAL	635	9745						

Note: Only Femoral Neck Prostheses with over 60 procedures have been listed
All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

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 identified three types of femoral head (metal, ceramic and ceramicised metal) and four types of acetabular articular surface (XLPE, non XLPE, ceramic and metal).

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 nine bearing surfaces, seven of which have been used in more than 5,000 procedures.

Comparing the cumulative revision rates for these bearings, ceramicised metal/XLPE has the lowest rate of revision. 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 combination of femoral and acetabular prostheses.

Of the remaining bearing surfaces ceramic/XLPE and metal/XLPE have the lowest revision rates. Although the outcomes of these two bearings are similar, ceramic/XLPE has a lower rate of revision after three years compared to metal/XLPE (Table HT28 and Figure HT23).

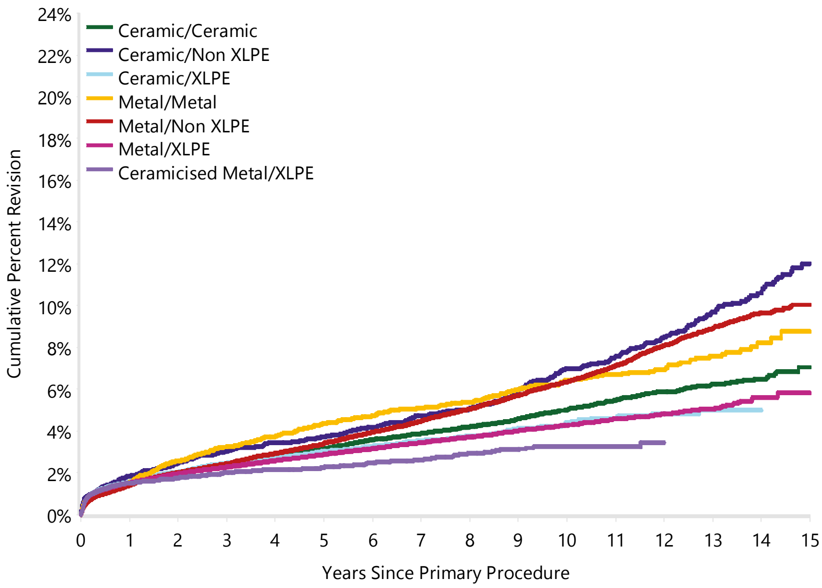
Detailed information on the analysis of metal/metal and metal and ceramic bearing surfaces are available in the supplementary reports 'Metal on Metal Bearing Surface Conventional Hip Arthroplasty' and 'Metal and Ceramic Bearing Surface in Total Conventional Hip Arthroplasty' on the AOANJRR website aoanjrr.sahmri.com/annual-reports-2016.

Table HT28 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	7 Yrs	10 Yrs	15 Yrs
Ceramic/Ceramic	2409	72139	1.5 (1.4, 1.6)	2.4 (2.3, 2.5)	3.1 (3.0, 3.3)	3.9 (3.7, 4.1)	5.0 (4.8, 5.3)	7.1 (6.4, 7.8)
Ceramic/Non XLPE	388	5836	1.8 (1.5, 2.2)	3.0 (2.6, 3.5)	3.7 (3.2, 4.3)	4.7 (4.2, 5.4)	7.0 (6.3, 7.8)	12.0 (10.7, 13.5)
Ceramic/XLPE	973	39349	1.6 (1.5, 1.7)	2.5 (2.3, 2.6)	3.0 (2.8, 3.2)	3.6 (3.3, 3.8)	4.4 (4.0, 4.8)	
Ceramic/Metal	18	299	1.7 (0.7, 4.0)	3.7 (2.1, 6.6)	4.4 (2.6, 7.4)	8.3 (4.9, 13.9)		
Metal/Metal	323	5147	1.5 (1.2, 1.9)	3.3 (2.8, 3.8)	4.4 (3.8, 5.0)	5.1 (4.5, 5.8)	6.4 (5.7, 7.2)	8.8 (7.6, 10.1)
Metal/Non XLPE	2127	34267	1.4 (1.3, 1.5)	2.4 (2.3, 2.6)	3.4 (3.2, 3.6)	4.5 (4.3, 4.7)	6.3 (6.1, 6.6)	10.0 (9.5, 10.6)
Metal/XLPE	3399	118982	1.5 (1.5, 1.6)	2.3 (2.2, 2.4)	2.9 (2.8, 3.0)	3.4 (3.3, 3.6)	4.3 (4.1, 4.5)	5.8 (5.2, 6.5)
Ceramicised Metal/Non XLPE	33	288	1.7 (0.7, 4.1)	3.9 (2.2, 7.0)	4.3 (2.5, 7.5)	7.8 (5.1, 11.8)	13.0 (9.2, 18.2)	
Ceramicised Metal/XLPE	353	16078	1.5 (1.3, 1.7)	2.0 (1.8, 2.2)	2.3 (2.0, 2.5)	2.6 (2.3, 2.9)	3.2 (2.9, 3.7)	
TOTAL	10023	292385						

Note: Excludes 169 procedures with unknown bearing surface, one procedure with Ceramicised Metal/Ceramic bearing surface and 10 procedures with Metal/Ceramic bearing surface
All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure HT23 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=1.07 (1.01, 1.13),p=0.013
Ceramic/Non XLPE vs Metal/XLPE	0 - 3Yr: HR=1.33 (1.14, 1.56),p<0.001
	3Yr - 5Yr: HR=1.07 (0.75, 1.53),p=0.722
	5Yr - 9Yr: HR=1.78 (1.42, 2.24),p<0.001
	9Yr - 11Yr: HR=2.69 (1.96, 3.69),p<0.001
	11Yr+: HR=3.23 (2.42, 4.33),p<0.001
Ceramic/XLPE vs Metal/XLPE	0 - 3Yr: HR=1.08 (1.00, 1.17),p=0.064
	3Yr+: HR=0.82 (0.70, 0.96),p=0.015
Metal/Metal vs Metal/XLPE	Entire Period: HR=1.39 (1.24, 1.56),p<0.001
Metal/Non XLPE vs Metal/XLPE	0 - 1Mth: HR=0.78 (0.66, 0.92),p=0.003
	1Mth - 6Mth: HR=1.00 (0.86, 1.17),p=0.964
	6Mth - 1Yr: HR=1.37 (1.14, 1.66),p<0.001
	1Yr - 5Yr: HR=1.39 (1.27, 1.52),p<0.001
	5Yr - 7Yr: HR=1.78 (1.54, 2.05),p<0.001
	7Yr - 9Yr: HR=2.04 (1.74, 2.40),p<0.001
	9Yr - 12Yr: HR=2.54 (2.17, 2.97),p<0.001
	12Yr+: HR=2.22 (1.69, 2.93),p<0.001
Ceramicised Metal/XLPE vs Metal/XLPE	0 - 1Yr: HR=1.03 (0.90, 1.18),p=0.620
	1Yr+: HR=0.55 (0.46, 0.66),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Ceramic/Ceramic	72139	64031	48314	34036	22657	11948	261
Ceramic/Non XLPE	5836	5278	4572	4017	3540	2654	345
Ceramic/XLPE	39349	30284	18586	11044	6242	2210	17
Metal/Metal	5147	5010	4747	4432	3850	2565	86
Metal/Non XLPE	34267	32914	30315	27192	22959	15564	980
Metal/XLPE	118982	104133	77281	53619	33463	14319	91
Ceramicised Metal/XLPE	16078	13726	9702	6188	3989	1374	0

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Cross-linked Polyethylene

XLPE has been used in 174,409 procedures reported to the Registry. This includes 5,013 procedures that have XLPE with the addition of an antioxidant.

XLPE has a lower rate of revision compared to non XLPE after six months (Table HT29 and Figure HT24). The difference increases with time and at 15 years the cumulative percent revision is 5.6% and 10.5% respectively. The cumulative incidence of loosening/lysis and prosthesis dislocation at 15 years is 1.1% and 1.2% for XLPE, compared to 3.6% and 1.6% for non XLPE bearings respectively (Figure HT25).

Revision varies depending on head size. This is most evident for non XLPE where the rate of revision increases with larger head size (greater than 32mm). For XLPE, 32mm head size has the lowest rate of revision. There is no difference between head sizes less than 32mm and greater than 32mm (Table HT29, Figures HT26 and HT27).

The use of XLPE has been associated with increased use of larger head sizes when compared to non XLPE. Head sizes of 32mm or greater have been used in 73.5% of XLPE procedures and only 11.7% of non XLPE procedures. The Registry has previously shown that this increased use of larger head size with XLPE is the reason for reduced revision for dislocation associated with this bearing.

Reduced cumulative incidence of loosening/lysis when XLPE is used is evident for the most common head sizes of less than 32mm and 32mm when compared to non XLPE (Figure HT28).

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 HT29).

Prosthesis Specific

Further analysis has been undertaken for specific acetabular prostheses that have both XLPE and non XLPE bearing options and a follow up time of seven or more years. Six prostheses fulfil these criteria. Four have a reduced rate of revision when XLPE is used and for two prostheses there is no difference.

The Allofit Shell has a 10 year follow up with an insert using both types of polyethylene. XLPE is used in 89.7% of Allofit Shell total conventional hip procedures. XLPE has a lower rate of revision than non XLPE (Table HT30 and Figure HT30).

The Duraloc Shell has a 10 year follow up with an insert using both types of polyethylene. XLPE is used in 36.4% of Duraloc Shell total conventional hip procedures. XLPE has a lower rate of revision compared to non XLPE (Table HT30 and Figure HT31).

The Mallory-Head Shell has a seven year follow up with an insert using both types of polyethylene. XLPE is used in 39.3% of Mallory-Head Shell total conventional hip procedures. There is no difference in the rate of revision between XLPE and non XLPE (Table HT30 and Figure HT32).

The Reflection Shell has a 10 year follow up with an insert using both types of polyethylene. XLPE is used in 83.5% of Reflection Shell total conventional hip procedures. XLPE has a lower rate of revision after three months compared to non XLPE (Table HT30 and Figure HT33).

"XLPE has a lower rate of revision than non XLPE regardless of the femoral head used."

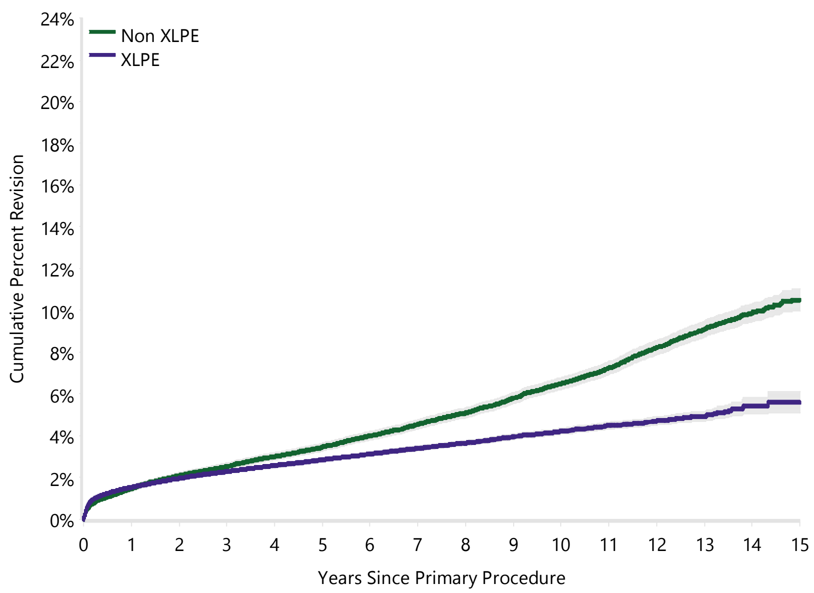
The Vitalock Shell has a 10 year follow up with an insert using both types of polyethylene. XLPE is used in 22.7% of Vitalock Shell total conventional hip procedures. There is no difference in the rate of revision between XLPE and non XLPE (Table HT30 and Figure HT34).

The Reflection Cup has a 10 year follow up for both types of polyethylene. XLPE has been used in 51.2% of Reflection Cup total conventional hip procedures. After one year, XLPE has a lower rate of revision than non XLPE (Table HT30 and Figure HT35).

Table HT29 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	7 Yrs	10 Yrs	15 Yrs
Non XLPE		2548	40391	1.5 (1.3, 1.6)	2.5 (2.4, 2.7)	3.5 (3.3, 3.7)	4.5 (4.3, 4.8)	6.5 (6.2, 6.8)	10.5 (10.0, 11.0)
	<32mm	2340	35664	1.4 (1.3, 1.6)	2.5 (2.3, 2.6)	3.4 (3.2, 3.6)	4.5 (4.2, 4.7)	6.5 (6.2, 6.8)	10.5 (9.9, 11.0)
	32mm	185	4432	1.6 (1.3, 2.0)	3.0 (2.5, 3.5)	3.7 (3.1, 4.4)	4.9 (4.2, 5.8)	5.9 (5.0, 6.9)	
	>32mm	23	295	3.8 (2.1, 6.7)	6.3 (3.9, 9.9)	8.7 (5.6, 13.2)	10.6 (6.9, 16.0)		
XLPE		4725	174409	1.5 (1.5, 1.6)	2.3 (2.2, 2.4)	2.8 (2.8, 2.9)	3.4 (3.3, 3.5)	4.2 (4.1, 4.4)	5.6 (5.1, 6.1)
	<32mm	1648	46263	1.5 (1.4, 1.6)	2.3 (2.2, 2.5)	2.9 (2.8, 3.1)	3.5 (3.3, 3.7)	4.4 (4.1, 4.6)	5.8 (5.2, 6.3)
	32mm	1675	71991	1.5 (1.4, 1.6)	2.2 (2.1, 2.3)	2.6 (2.5, 2.7)	3.1 (3.0, 3.3)	3.8 (3.6, 4.1)	
	>32mm	1402	56155	1.6 (1.5, 1.7)	2.4 (2.2, 2.5)	3.1 (2.9, 3.2)	3.5 (3.3, 3.8)	4.4 (4.0, 4.8)	
TOTAL		7273	214800						

Figure HT24 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=0.83 (0.74, 0.94),p=0.002

3Mth - 6Mth: HR=1.05 (0.83, 1.32),p=0.704

6Mth - 1.5Yr: HR=1.49 (1.30, 1.70),p<0.001

1.5Yr - 2.5Yr: HR=1.30 (1.09, 1.54),p=0.002

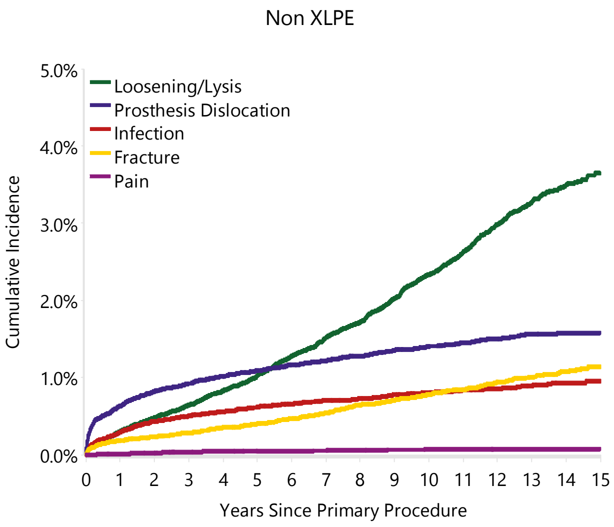
2.5Yr - 6.5Yr: HR=1.73 (1.56, 1.91),p<0.001

6.5Yr - 9Yr: HR=2.29 (1.96, 2.68),p<0.001

9Yr+: HR=3.14 (2.61, 3.78),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Non XLPE	40391	38472	35141	31443	26701	18346	1325
XLPE	174409	148143	105569	70851	43694	17903	108

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



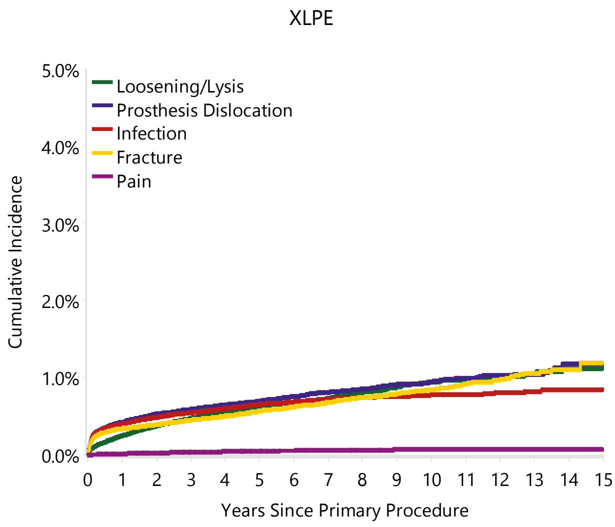
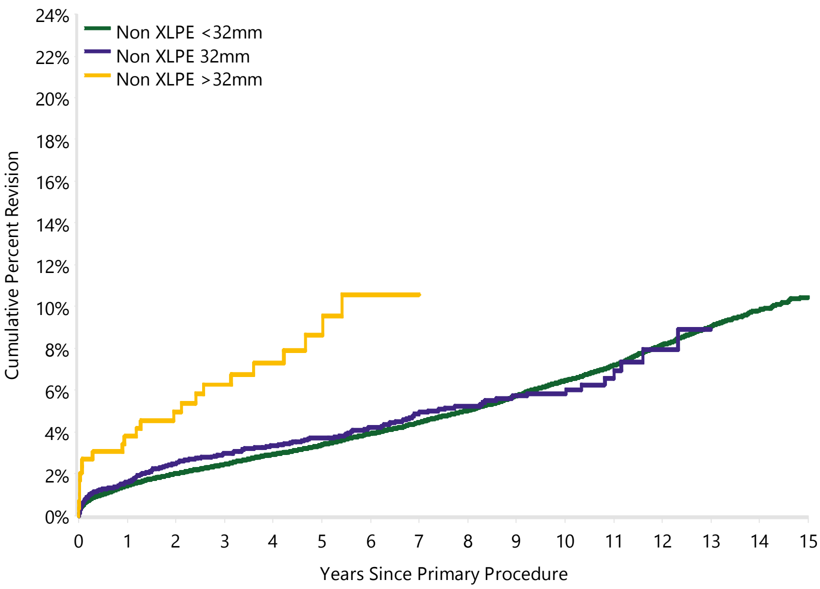


Figure HT26 Cumulative Percent Revision of Primary Total Conventional Hip Replacement using Non XLPE by Head Size (Primary Diagnosis OA)



HR - adjusted for age and gender

Non XLPE 32mm vs Non XLPE <32mm

Entire Period: HR=1.12 (0.96, 1.31),p=0.135

Non XLPE >32mm vs
Non XLPE <32mm

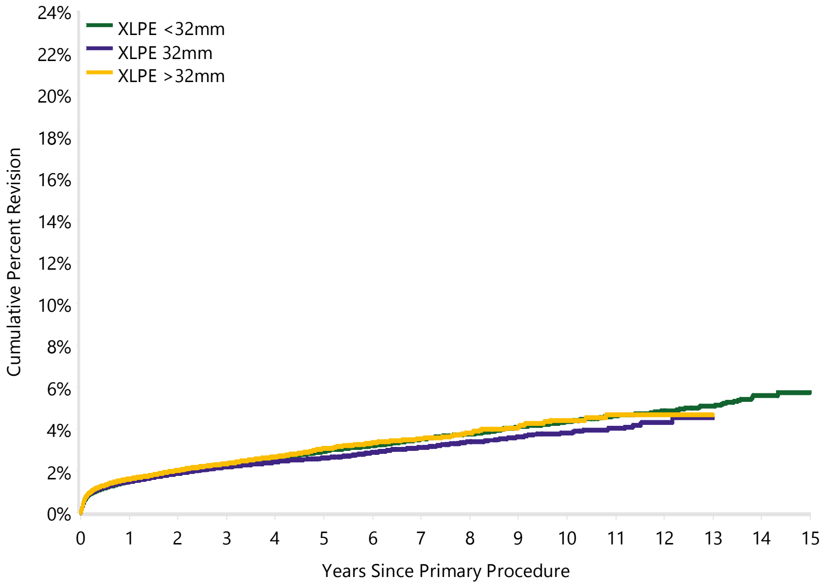
Entire Period: HR=2.46 (1.63, 3.71),p<0.001

Non XLPE >32mm vs Non XLPE 32mm

Entire Period: HR=2.19 (1.42, 3.37),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Non XLPE	<32mm	35664	34157	31665	28917	25158	17821	1322
	32mm	4432	4054	3280	2423	1497	508	3
	>32mm	295	261	196	103	46	17	0

Figure HT27 Cumulative Percent Revision of Primary Total Conventional Hip Replacement using XLPE by Head Size (Primary Diagnosis OA)



HR - adjusted for age and gender

XLPE <32mm vs XLPE 32mm

0 - 1Mth: HR=0.96 (0.83, 1.10),p=0.542

1Mth+: HR=1.14 (1.06, 1.24),p<0.001

XLPE >32mm vs XLPE 32mm

Entire Period: HR=1.11 (1.03, 1.19),p=0.005

XLPE >32mm vs XLPE <32mm

Entire Period: HR=1.01 (0.94, 1.09),p=0.813

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
XLPE	<32mm	46263	43228	37281	30882	24308	13773	107
	32mm	71991	59314	38929	23558	12544	3039	1
	>32mm	56155	45601	29359	16411	6842	1091	0

Figure HT28 **Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement by Polyethylene Type and Head Size (Primary Diagnosis OA)**

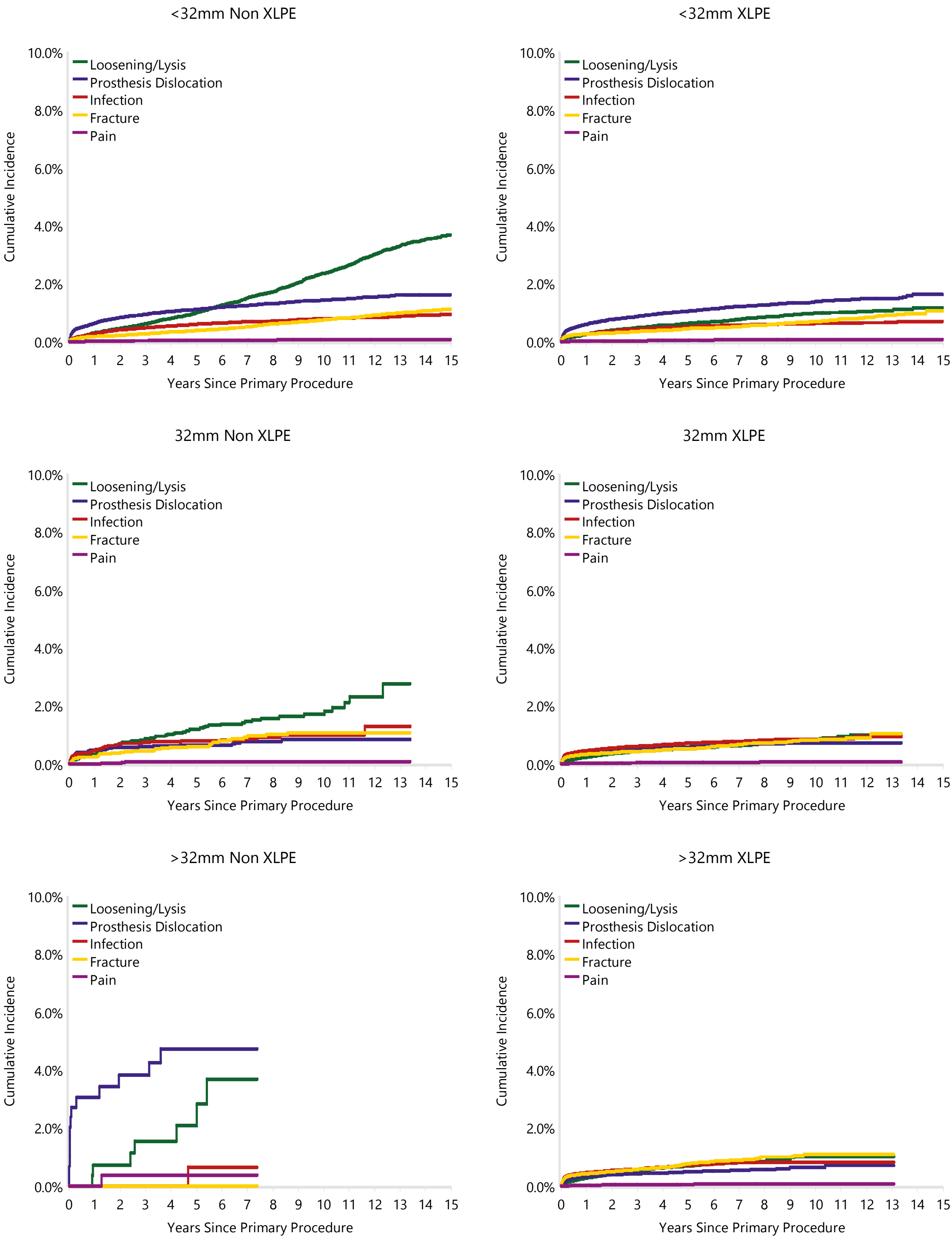


Figure HT29 **Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Head Surface and Polyethylene Type (Primary Diagnosis OA)**

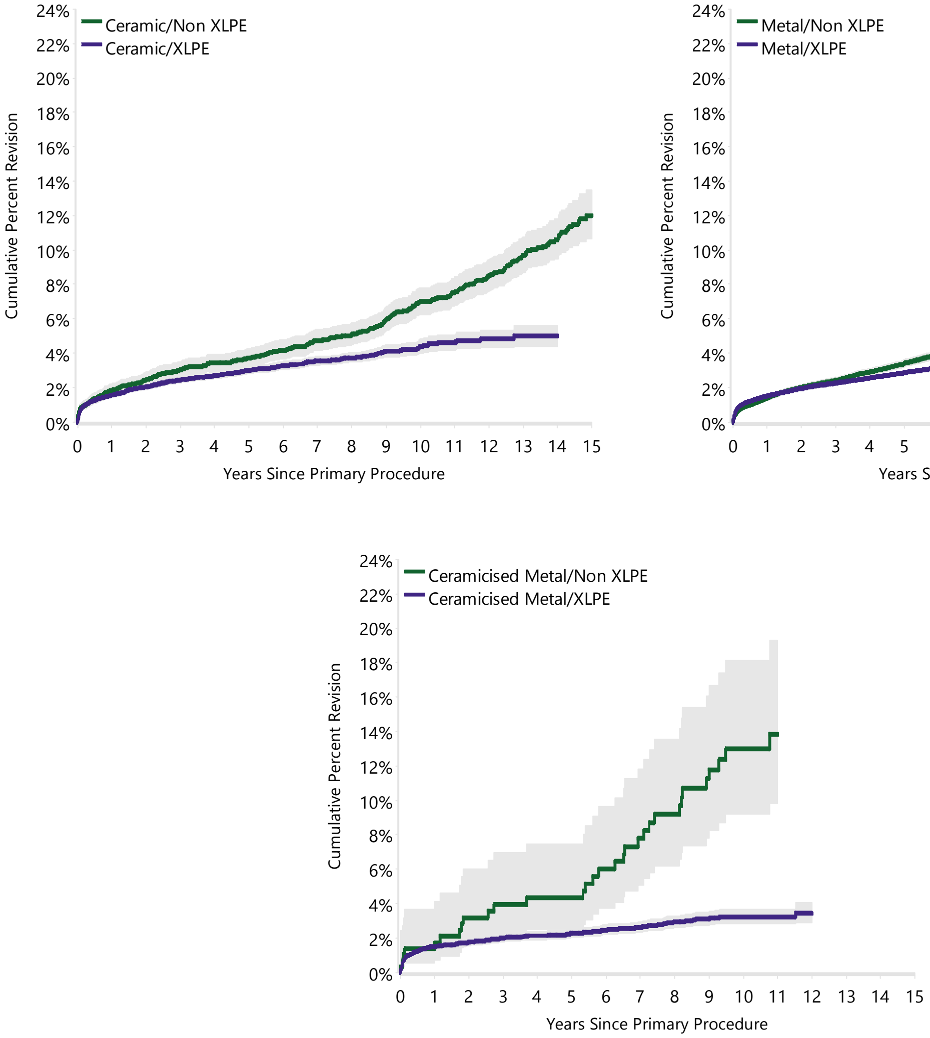
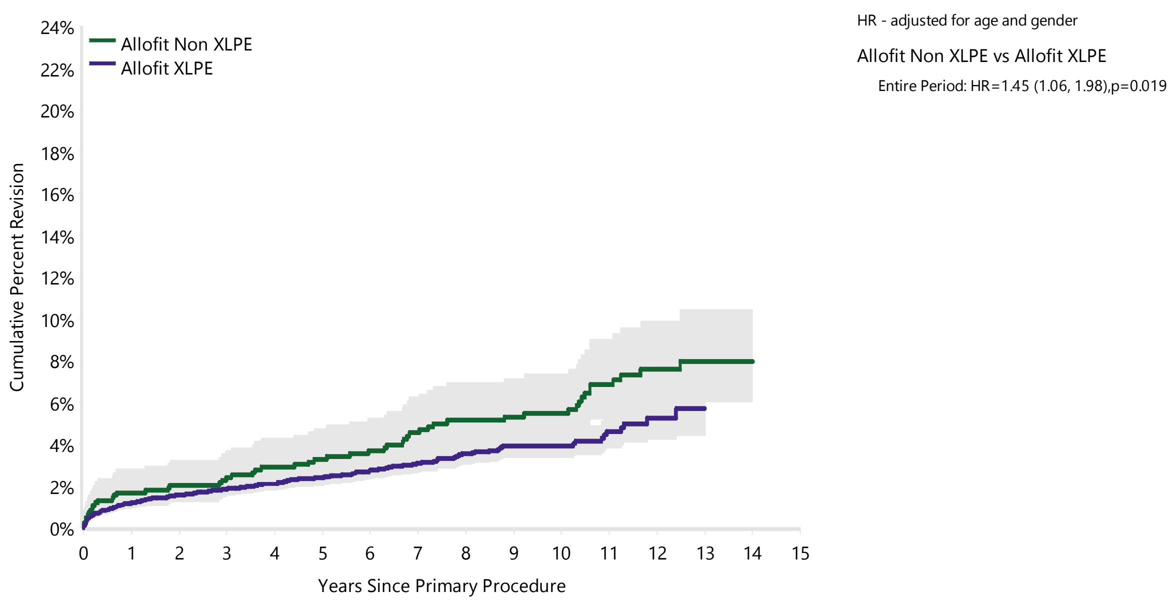


Table HT30 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Prosthesis Type and Polyethylene Type (Primary Diagnosis OA)

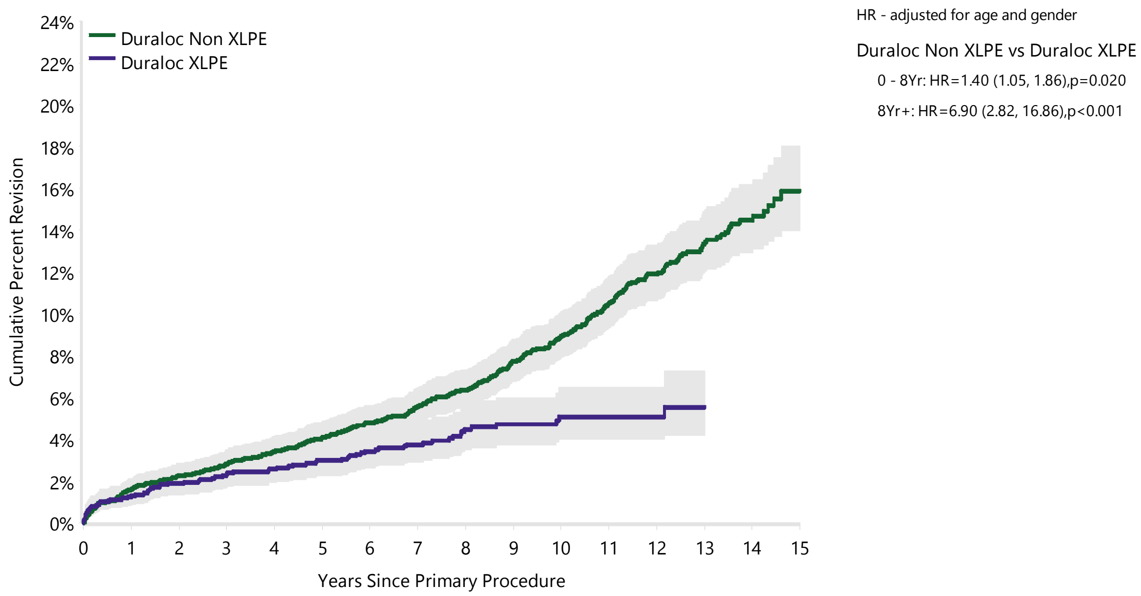
Acetabular Component	Polyethylene Type	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Allofit		258	8256	1.2 (1.0, 1.5)	1.9 (1.6, 2.2)	2.5 (2.2, 2.9)	3.3 (2.9, 3.8)	4.2 (3.6, 4.8)	
	Non XLPE	54	848	1.7 (1.0, 2.8)	2.4 (1.5, 3.7)	3.3 (2.3, 4.7)	4.5 (3.3, 6.2)	5.5 (4.1, 7.3)	
	XLPE	204	7408	1.2 (1.0, 1.5)	1.8 (1.5, 2.2)	2.4 (2.0, 2.8)	3.1 (2.7, 3.6)	3.9 (3.3, 4.6)	
Duraloc		390	4710	1.5 (1.2, 1.9)	2.6 (2.2, 3.1)	3.7 (3.2, 4.3)	4.9 (4.3, 5.6)	7.8 (7.0, 8.7)	14.0 (12.3, 16.0)
	Non XLPE	319	2994	1.6 (1.2, 2.1)	2.8 (2.3, 3.5)	4.1 (3.4, 4.8)	5.6 (4.8, 6.5)	8.9 (7.9, 10.1)	15.9 (14.0, 18.0)
	XLPE	71	1716	1.3 (0.9, 2.0)	2.3 (1.6, 3.1)	3.0 (2.3, 3.9)	3.7 (2.9, 4.8)	5.1 (4.0, 6.5)	
Mallory-Head		278	6730	1.5 (1.2, 1.8)	2.0 (1.7, 2.4)	2.6 (2.2, 3.0)	3.3 (2.9, 3.9)	4.5 (3.9, 5.1)	9.0 (7.6, 10.8)
	Non XLPE	226	4084	1.4 (1.1, 1.8)	2.1 (1.7, 2.5)	2.7 (2.3, 3.3)	3.5 (3.0, 4.2)	4.7 (4.1, 5.5)	9.2 (7.7, 11.0)
	XLPE	52	2646	1.6 (1.1, 2.1)	2.0 (1.5, 2.6)	2.3 (1.7, 3.0)	2.4 (1.8, 3.3)		
Reflection (Cup)		148	2211	0.8 (0.5, 1.3)	1.7 (1.2, 2.3)	2.9 (2.2, 3.7)	4.3 (3.4, 5.4)	8.2 (6.8, 9.8)	
	Non XLPE	122	1079	0.6 (0.3, 1.2)	1.9 (1.2, 3.0)	3.3 (2.3, 4.6)	5.6 (4.3, 7.2)	11.0 (9.1, 13.4)	
	XLPE	26	1132	1.1 (0.6, 1.9)	1.4 (0.8, 2.3)	2.4 (1.6, 3.6)	2.6 (1.7, 3.8)	3.0 (1.9, 4.7)	
Reflection (Shell)		547	14060	1.2 (1.0, 1.4)	1.9 (1.7, 2.1)	2.4 (2.1, 2.6)	3.1 (2.8, 3.4)	4.6 (4.2, 5.0)	8.5 (7.4, 9.8)
	Non XLPE	248	2321	1.6 (1.2, 2.2)	3.2 (2.6, 4.0)	4.3 (3.5, 5.2)	6.1 (5.1, 7.2)	9.6 (8.4, 11.0)	15.6 (13.7, 17.7)
	XLPE	299	11739	1.1 (0.9, 1.3)	1.6 (1.4, 1.9)	2.0 (1.7, 2.2)	2.4 (2.2, 2.8)	3.1 (2.8, 3.5)	
Vitalock		232	4619	1.0 (0.8, 1.4)	1.9 (1.5, 2.3)	2.5 (2.1, 3.0)	3.1 (2.7, 3.7)	4.5 (3.9, 5.2)	7.1 (6.1, 8.3)
	Non XLPE	192	3569	1.2 (0.9, 1.6)	2.0 (1.6, 2.5)	2.6 (2.1, 3.1)	3.2 (2.6, 3.8)	4.7 (4.0, 5.4)	7.3 (6.2, 8.5)
	XLPE	40	1050	0.7 (0.3, 1.4)	1.6 (1.0, 2.5)	2.4 (1.6, 3.5)	3.0 (2.1, 4.3)	3.9 (2.9, 5.4)	
TOTAL		1853	40586						

Figure HT30 Cumulative Percent Revision of Allofit Primary Total Conventional Hip Replacement by Polyethylene Type (Primary Diagnosis OA)



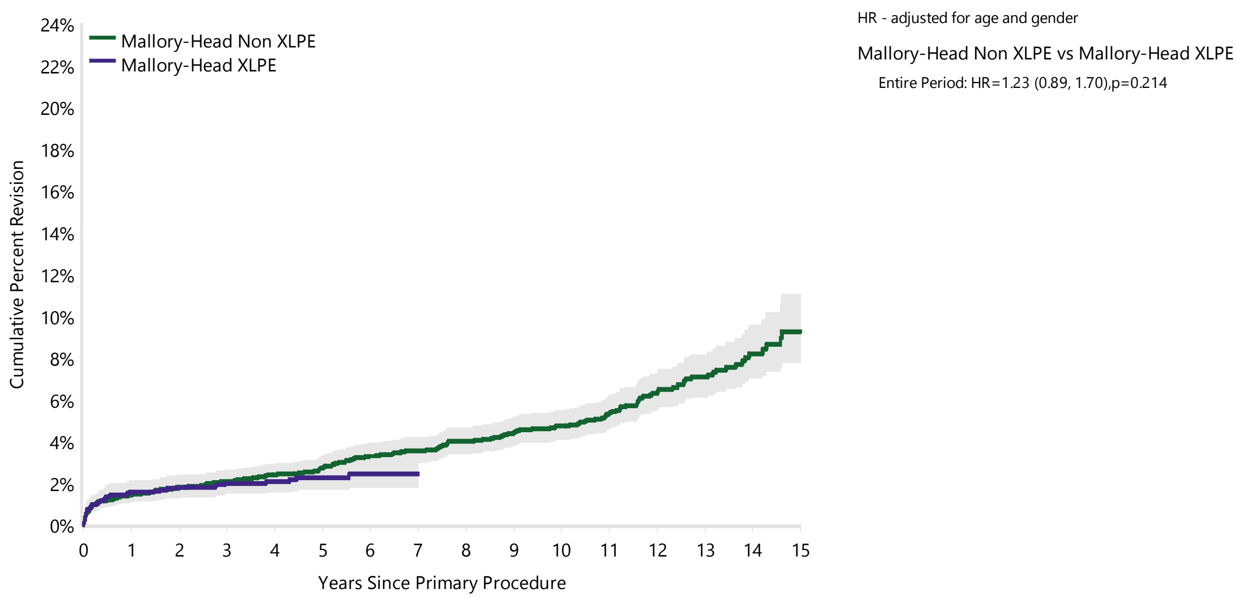
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Allofit	Non XLPE	848	828	793	737	655	508	7
	XLPE	7408	6778	5448	4082	2642	978	0

Figure HT31 Cumulative Percent Revision of Duraloc Primary Total Conventional Hip Replacement by Polyethylene Type (Primary Diagnosis OA)



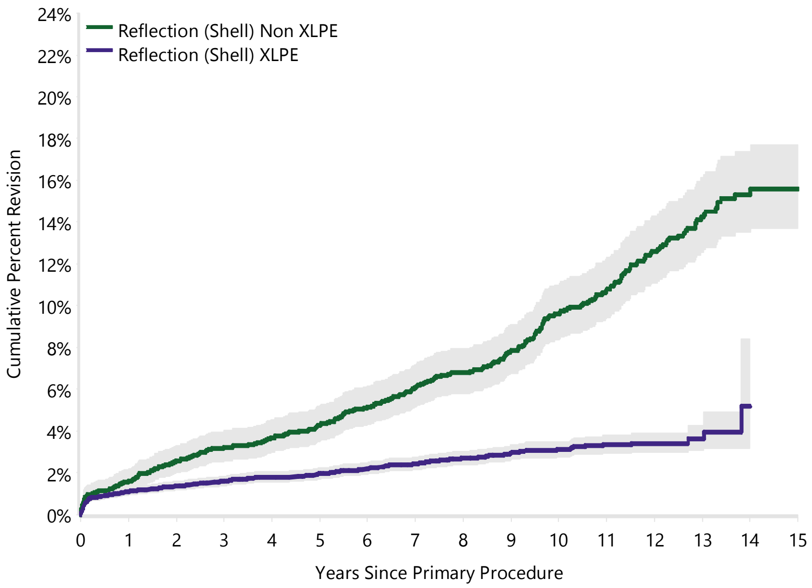
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Duraloc	Non XLPE	2994	2915	2743	2568	2352	1859	101
	XLPE	1716	1668	1573	1378	1094	514	0

Figure HT32 Cumulative Percent Revision of Mallory-Head Primary Total Conventional Hip Replacement by Prosthesis Type and Polyethylene Type (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Mallory-Head	Non XLPE	4084	3976	3807	3617	3359	2329	191
	XLPE	2646	2284	1576	767	216	0	0

Figure HT33 **Cumulative Percent Revision of Reflection (Shell) Primary Total Conventional Hip Replacement by Polyethylene Type (Primary Diagnosis OA)**



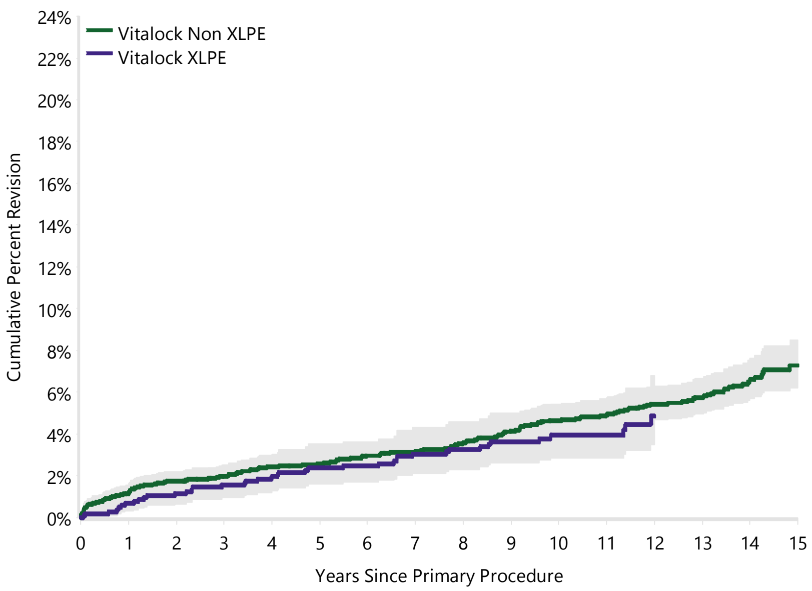
HR - adjusted for age and gender

Reflection (Shell) Non XLPE vs
Reflection (Shell) XLPE

- 0 - 1Mth: HR=1.54 (0.92, 2.57),p=0.099
- 1Mth - 3Mth: HR=0.62 (0.22, 1.74),p=0.362
- 3Mth - 1Yr: HR=2.20 (1.18, 4.13),p=0.013
- 1Yr - 3Yr: HR=3.25 (2.13, 4.96),p<0.001
- 3Yr - 5Yr: HR=3.18 (1.86, 5.41),p<0.001
- 5Yr - 10Yr: HR=4.49 (3.30, 6.10),p<0.001
- 10Yr+: HR=7.57 (3.83, 14.96),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Reflection (Shell)	Non XLPE	2321	2242	2115	1964	1771	1309	107
	XLPE	11739	11156	9869	8619	6751	2934	6

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



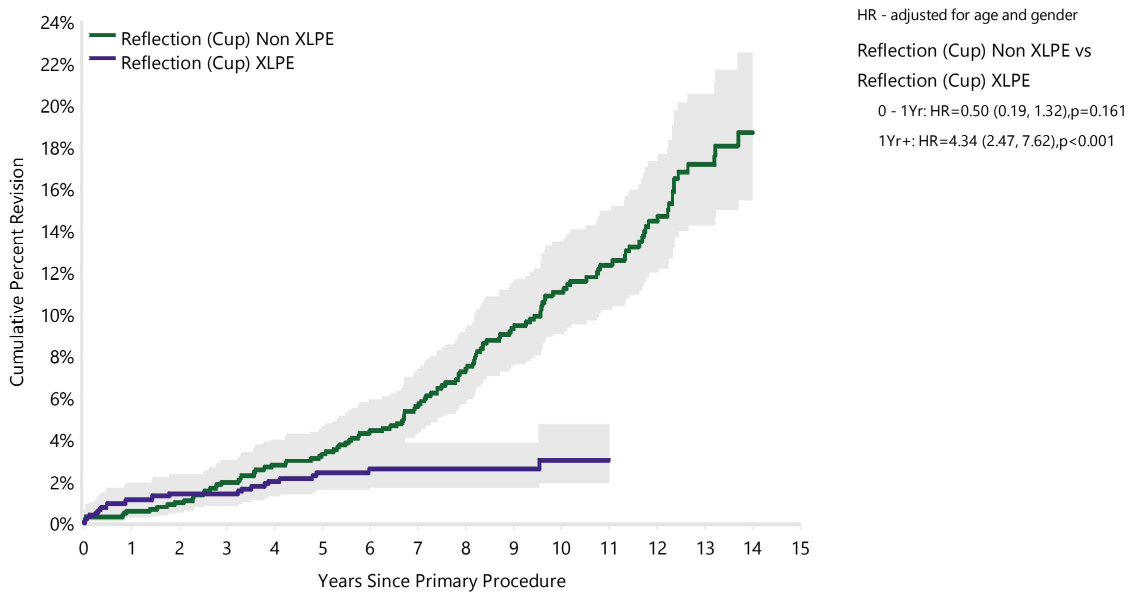
HR - adjusted for age and gender

Vitalock Non XLPE vs Vitalock XLPE

Entire Period: HR=1.14 (0.81, 1.61),p=0.448

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Vitalock	Non XLPE	3569	3477	3331	3162	2957	2560	369
	XLPE	1050	1032	985	936	861	580	0

Figure HT35 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	7 Yrs	10 Yrs	15 Yrs
Reflection (Cup)	Non XLPE	1079	1051	975	895	778	518	30
	XLPE	1132	1039	871	690	499	195	0

Ceramic/Ceramic Bearing

Ceramic/ceramic bearings have been used in 72,139 primary total conventional hip replacements undertaken for osteoarthritis. This is the second most common bearing reported to the Registry.

Head Size

To evaluate the effect of head size, an analysis was undertaken comparing four head size groups (≤28, 32, 36-38 and ≥40mm). Head sizes 36 and 38mm have been combined in this analysis.

The follow up period for the 40mm or larger head size is five years compared to over 10 years follow up for the other three head sizes.

Head size 32mm has a lower rate of revision compared to head sizes 28mm or less. There is no difference when head size 32mm is compared to the 36-38mm head size group.

Head sizes 40mm or larger have a lower rate of revision compared to 32mm after three months (Table HT31 and Figure HT36). Head sizes 28mm or less have a higher rate of revision for prosthesis dislocation compared to the other head size groups.

At one year, the cumulative incidence of dislocation is 0.9% for head sizes 28mm or less compared to 0.4% for 32mm, 0.3% for 36-38mm and 0.1% for head sizes 40mm or larger (Figure HT37).

Fixation

The majority of procedures using ceramic/ceramic bearing surfaces are cementless (85.2%). Hybrid fixation accounts for 14.8%. Hybrid fixation has a lower rate of revision compared to cementless fixation within the first year (Table HT32 and Figure HT38).

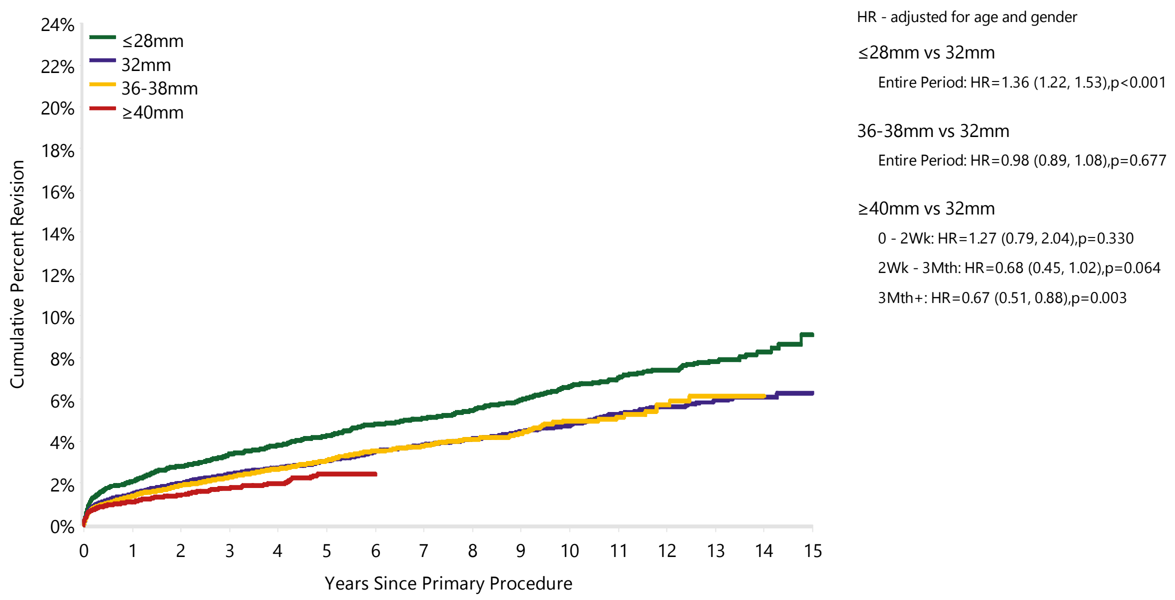
When using cementless fixation, head sizes 40mm or larger have a lower rate of revision compared to 32mm after two weeks. There remains a higher rate of revision for head sizes 28mm or less compared to 32mm (Table HT33 and Figure HT39).

For hybrid fixation, head sizes 28mm or less have a higher rate of revision compared to 32mm over the entire period. Head size 32mm shows no difference compared to 36-38mm and 40mm or greater head sizes (Table HT34 and Figure HT40).

Table HT31 Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)

Bearing Surface	Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Ceramic/Ceramic	≤28mm	432	6652	2.1 (1.8, 2.5)	3.4 (3.0, 3.8)	4.3 (3.8, 4.8)	5.1 (4.6, 5.7)	6.6 (6.0, 7.3)	9.1 (7.9, 10.5)
	32mm	973	26128	1.5 (1.3, 1.6)	2.4 (2.2, 2.6)	3.1 (2.9, 3.3)	3.8 (3.6, 4.1)	4.8 (4.4, 5.1)	6.3 (5.7, 7.0)
	36-38mm	902	33799	1.4 (1.3, 1.5)	2.3 (2.1, 2.5)	3.1 (2.9, 3.3)	3.8 (3.5, 4.1)	5.0 (4.5, 5.5)	
	≥40mm	102	5560	1.1 (0.9, 1.4)	1.8 (1.4, 2.2)	2.4 (2.0, 3.0)			
TOTAL		2409	72139						

Figure HT36 Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
≤28mm	6652	6370	5950	5489	4970	3712	139
32mm	26128	24089	20221	15906	11917	6700	104
36-38mm	33799	28634	18992	11379	5757	1536	18
≥40mm	5560	4938	3151	1262	13	0	0

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

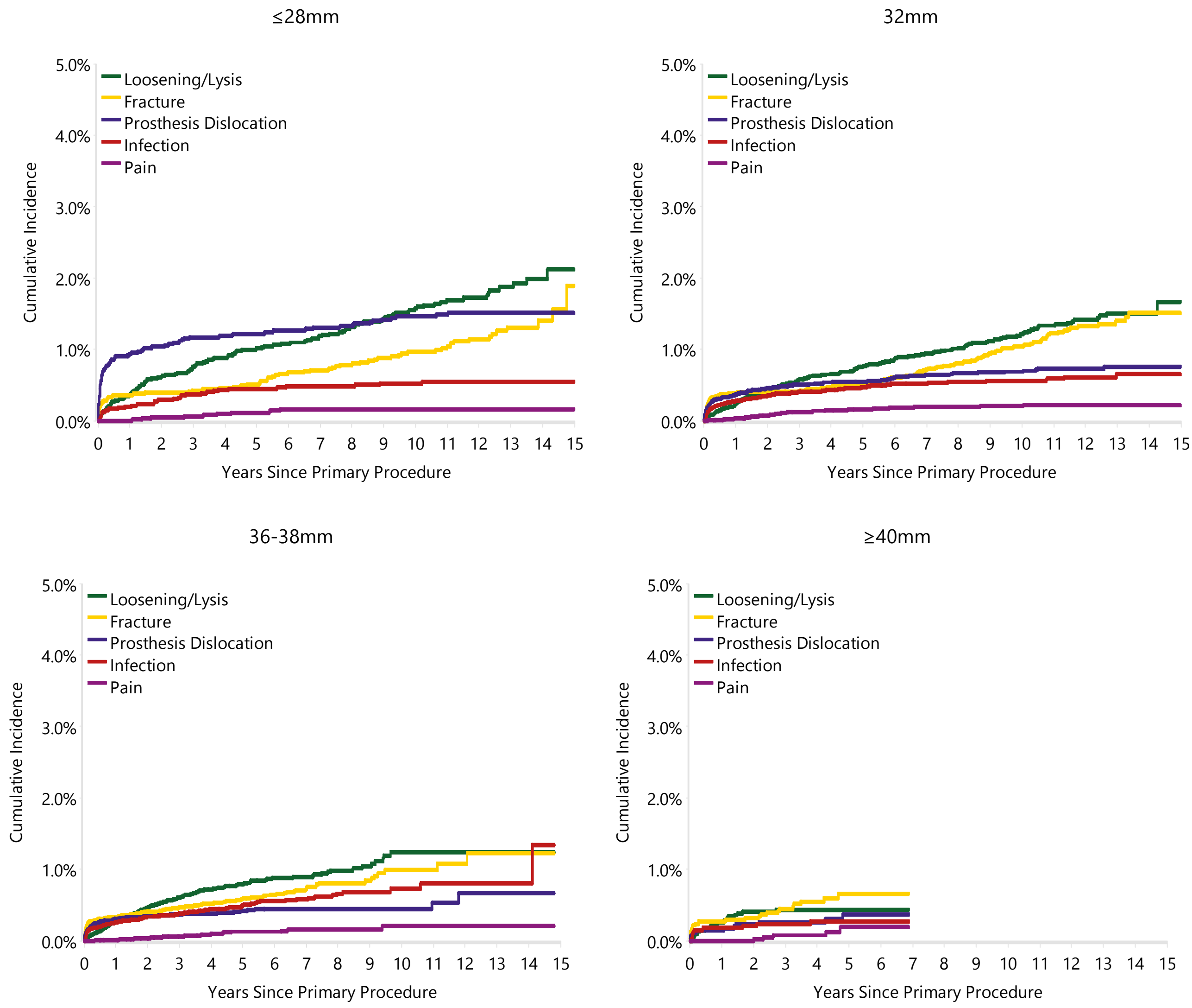
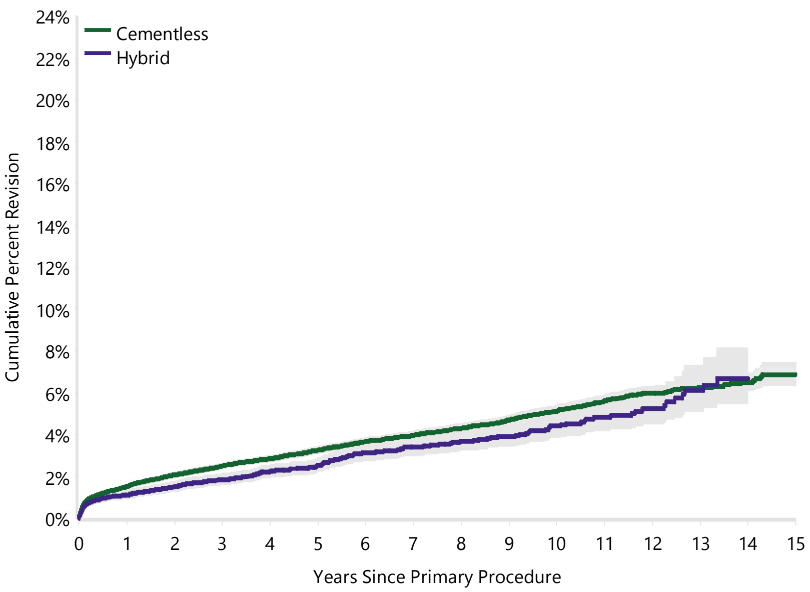


Table HT32 Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis OA)

Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	3	27	3.7 (0.5, 23.5)	7.7 (2.0, 27.5)	7.7 (2.0, 27.5)	7.7 (2.0, 27.5)	16.9 (5.1, 48.2)	
Cementless	2096	61469	1.5 (1.4, 1.6)	2.5 (2.4, 2.6)	3.2 (3.1, 3.4)	4.0 (3.8, 4.2)	5.1 (4.9, 5.4)	6.9 (6.3, 7.4)
Hybrid	310	10643	1.1 (0.9, 1.3)	1.9 (1.6, 2.1)	2.5 (2.2, 2.9)	3.4 (3.0, 3.9)	4.4 (3.8, 5.0)	
TOTAL	2409	72139						

Figure HT38 Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis OA)



HR - adjusted for age and gender

Cementless vs Hybrid

0 - 3Mth: HR=1.25 (0.99, 1.57),p=0.056

3Mth - 1Yr: HR=1.74 (1.21, 2.50),p=0.003

1Yr - 2.5Yr: HR=1.31 (0.98, 1.74),p=0.067

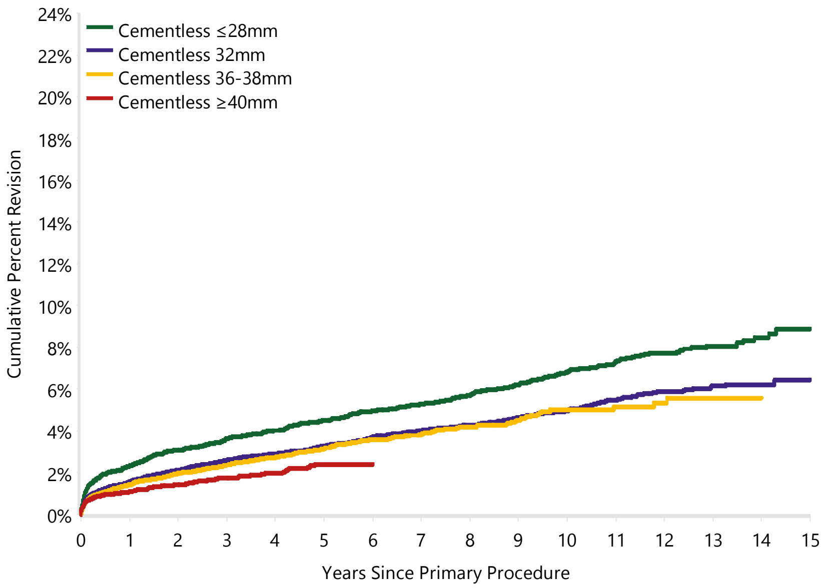
2.5Yr+: HR=1.04 (0.87, 1.24),p=0.680

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cementless	61469	54413	40783	28548	18927	10376	256
Hybrid	10643	9592	7508	5469	3714	1565	5

Table HT33 Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement with Cementless Fixation by Head Size (Primary Diagnosis OA)

Fixation	Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cementless	≤28mm	361	5233	2.3 (1.9, 2.8)	3.6 (3.1, 4.2)	4.5 (3.9, 5.1)	5.3 (4.7, 5.9)	6.8 (6.1, 7.6)	8.9 (7.9, 10.0)
	32mm	816	20523	1.6 (1.4, 1.7)	2.6 (2.4, 2.8)	3.3 (3.0, 3.5)	4.0 (3.7, 4.3)	5.0 (4.6, 5.3)	6.4 (5.8, 7.2)
	36-38mm	820	30245	1.4 (1.3, 1.6)	2.4 (2.2, 2.6)	3.1 (2.9, 3.4)	3.8 (3.5, 4.1)	5.0 (4.5, 5.6)	
	≥40mm	99	5468	1.1 (0.8, 1.4)	1.7 (1.4, 2.1)	2.4 (1.9, 3.0)			
TOTAL		2096	61469						

Figure HT39 Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement with Cementless Fixation by Head Size (Primary Diagnosis OA)



HR - adjusted for age and gender

Cementless ≤28mm vs Cementless 32mm
Entire Period: HR=1.37 (1.21, 1.55),p<0.001

Cementless 36-38mm vs Cementless 32mm
Entire Period: HR=0.95 (0.86, 1.05),p=0.306

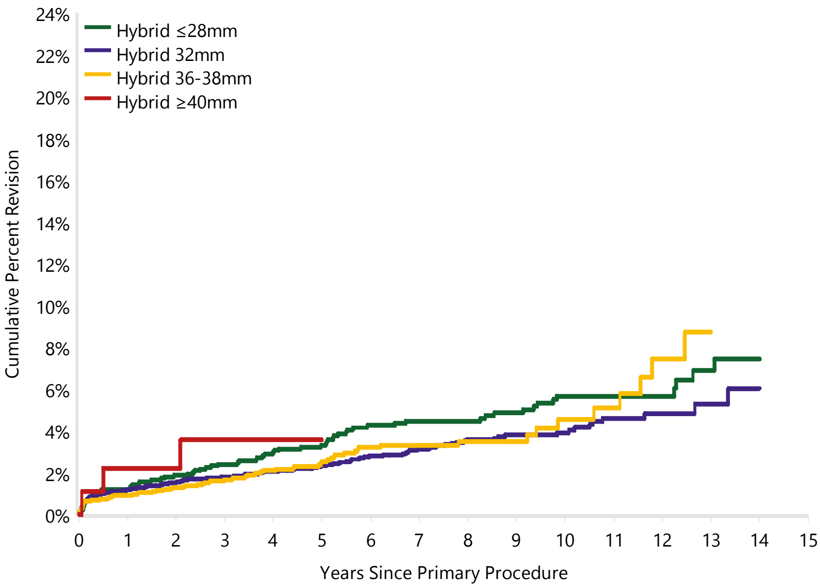
Cementless ≥40mm vs Cementless 32mm
0 - 2Wk: HR=1.20 (0.74, 1.93),p=0.462
2Wk+: HR=0.63 (0.50, 0.79),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cementless	≤28mm	5233	5003	4699	4417	4096	3178	134
	32mm	20523	18910	15977	12764	9843	5884	104
	36-38mm	30245	25643	16999	10121	4975	1314	18
	≥40mm	5468	4857	3108	1246	13	0	0

Table HT34 Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement with Hybrid Fixation by Head Size (Primary Diagnosis OA)

Fixation	Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Hybrid	≤28mm	69	1413	1.2 (0.8, 1.9)	2.4 (1.7, 3.4)	3.3 (2.5, 4.4)	4.5 (3.4, 5.8)	5.7 (4.4, 7.3)	
	32mm	156	5590	1.2 (0.9, 1.5)	1.8 (1.5, 2.2)	2.3 (1.9, 2.8)	3.1 (2.6, 3.7)	3.9 (3.3, 4.7)	
	36-38mm	82	3548	0.9 (0.7, 1.3)	1.7 (1.3, 2.2)	2.5 (2.0, 3.3)	3.3 (2.6, 4.3)	4.6 (3.3, 6.3)	
	≥40mm	3	92	2.2 (0.6, 8.6)	3.6 (1.2, 10.7)	3.6 (1.2, 10.7)			
TOTAL		310	10643						

Figure HT40 Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement with Hybrid Fixation by Head Size (Primary Diagnosis OA)



HR - adjusted for age and gender

Hybrid ≤28mm vs Hybrid 32mm
Entire Period: HR=1.37 (1.02, 1.84),p=0.034

Hybrid 36-38mm vs Hybrid 32mm
Entire Period: HR=1.01 (0.77, 1.34),p=0.920

Hybrid ≥40mm vs Hybrid 32mm
Entire Period: HR=1.73 (0.55, 5.44),p=0.348

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Hybrid	≤28mm	1413	1361	1246	1069	871	533	5
	32mm	5590	5165	4230	3130	2064	811	0
	36-38mm	3548	2985	1989	1254	779	221	0
	≥40mm	92	81	43	16	0	0	0

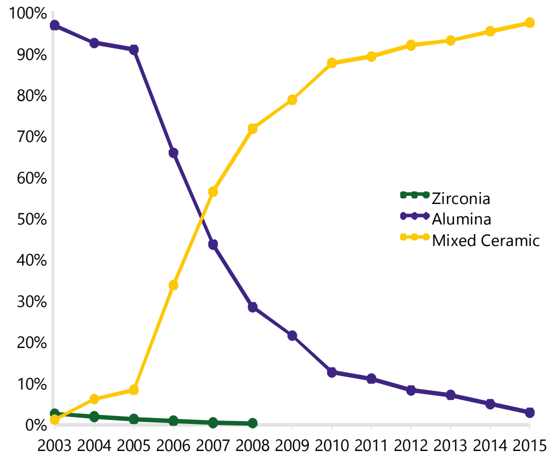
Ceramic Types

There are three types of ceramic femoral heads. They are zirconia, alumina, and zirconia/alumina combination (referred to as mixed ceramic).

Use

When the Registry commenced data collection alumina was the most common type of ceramic femoral head used. The use of mixed ceramic in Australia was first reported in 2003 and within four years its use exceeded alumina. In 2015, 97.4% of ceramic femoral heads used were mixed ceramic; the remaining femoral heads were alumina. Zirconia femoral heads have only been reported in small numbers and their use ceased in 2008 (Figure HT41).

Figure HT41 Primary Total Conventional Hip Replacement with Ceramic Femoral Head by Ceramic Type



Ceramic femoral heads have been used in 117,637 primary total conventional hip replacements undertaken for osteoarthritis. The proportion of procedures with zirconia femoral heads is 1.2%, alumina 28.1% and mixed ceramic 70.7% (Table HT35).

At 10 years, the cumulative percent revision for zirconia is 7.7%, alumina 5.4% and 4.3% for mixed ceramic. When the outcome of the different ceramics is compared, zirconia has a higher rate of revision than both alumina and mixed ceramic femoral heads. Alumina has a higher rate of revision after three months compared to mixed ceramic (Table HT35 and Figure HT42). This difference is due to an increased rate of revision for loosening/lysis and dislocation in the zirconia group (Figure HT43).

"In 2015, 97.4% of ceramic femoral heads used were mixed ceramic."

There are a number of potential confounders that may be contributing to this result. These include femoral head size, bearing surface and the type of femoral and acetabular prostheses used.

Head Size

Four head sizes were compared (≤28mm, 32mm, 36-38mm and ≥40mm).

Almost all zirconia femoral heads used were 28mm or less. Eleven procedures used 32mm head size. The cumulative percent revision at 15 years for head sizes 28mm or less is 12.9% (Table HT36).

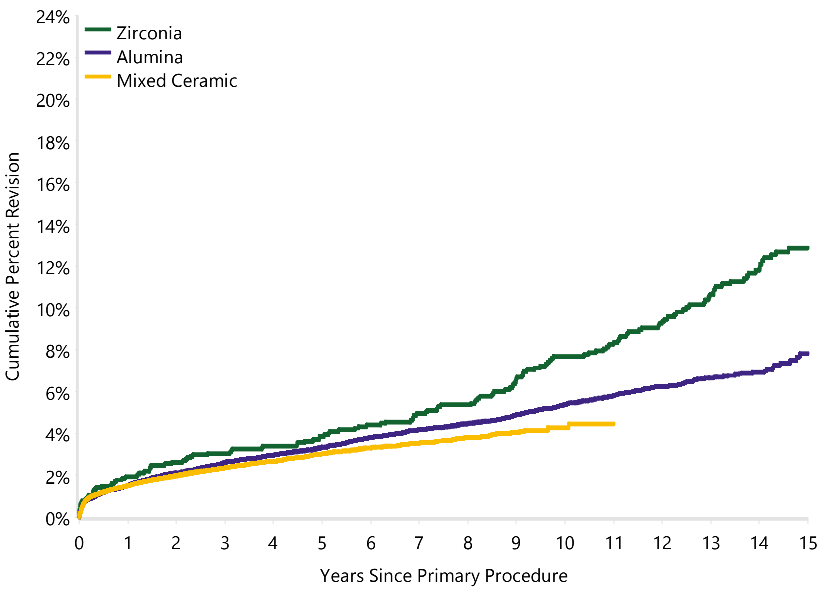
The most common alumina femoral head size is 32mm (52.4%) followed by 28mm or less (33.1%) and 36-38mm (14.4%). Only a small proportion of alumina femoral heads with a head size 40mm or larger have been used (0.1%). The cumulative percent revision at 10 years is 6.1% for 28mm or less, 4.6% for 32mm and 6.3% for 36-38mm. Head sizes 32mm have a lower rate of revision compared to both 28mm or less and 36-38mm (Table HT36 and Figure HT44).

The most used mixed ceramic femoral head size is 36-38mm (56.9%), followed by 32mm (30.5%) and 40mm or larger (7.3%). Head sizes 28mm or less accounted for only 5.3% of procedures. The cumulative percent revision at seven years is 4.3% for 28mm or less, 3.5% for 32mm and 3.6% for 36-38mm. Head sizes of 40mm or larger have a shorter follow up and the cumulative percent revision at five years is 2.4%. Head sizes 40mm or larger have a lower rate of revision compared to both 28mm or less and 32mm over the entire period, and 36-38mm after six months (Table HT36 and Figure HT45).

Table HT35 Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Ceramic Femoral Head by Ceramic Type (Primary Diagnosis OA)

Ceramic Type	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Zirconia	144	1420	1.9 (1.3, 2.8)	3.0 (2.3, 4.1)	3.9 (3.0, 5.0)	5.0 (3.9, 6.2)	7.7 (6.4, 9.3)	12.9 (11.0, 15.1)
Alumina	1663	33012	1.5 (1.4, 1.7)	2.6 (2.4, 2.8)	3.3 (3.2, 3.6)	4.2 (3.9, 4.4)	5.4 (5.1, 5.7)	7.8 (7.1, 8.6)
Mixed Ceramic	1982	83205	1.5 (1.4, 1.6)	2.4 (2.3, 2.5)	3.0 (2.9, 3.2)	3.5 (3.4, 3.7)	4.3 (3.9, 4.7)	
TOTAL	3789	117637						

Figure HT42 Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Ceramic Femoral Head by Ceramic Type (Primary Diagnosis OA)



HR - adjusted for age and gender

Zirconia vs Mixed Ceramic
0 - 2Wk: HR=2.22 (1.14, 4.30),p=0.018
2Wk - 3Mth: HR=0.59 (0.26, 1.32),p=0.196
3Mth - 1.5Yr: HR=1.86 (1.19, 2.90),p=0.006
1.5Yr - 2.5Yr: HR=1.23 (0.58, 2.60),p=0.584
2.5Yr - 3Yr: HR=0.38 (0.05, 2.74),p=0.339
3Yr - 4.5Yr: HR=1.16 (0.55, 2.46),p=0.695
4.5Yr - 5.5Yr: HR=1.80 (0.88, 3.65),p=0.105
5.5Yr+: HR=2.66 (2.08, 3.39),p<0.001

Alumina vs Mixed Ceramic
0 - 3Mth: HR=0.92 (0.81, 1.05),p=0.232
3Mth+: HR=1.25 (1.15, 1.36),p<0.001

Zirconia vs Alumina
Entire Period: HR=1.57 (1.32, 1.87),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Zirconia	1420	1381	1334	1266	1197	1015	241
Alumina	33012	31883	29447	26460	22836	15259	383
Mixed Ceramic	83205	66634	40989	21627	8478	542	0

Figure HT43 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement with Ceramic Femoral Head by Ceramic Type (Primary Diagnosis OA)

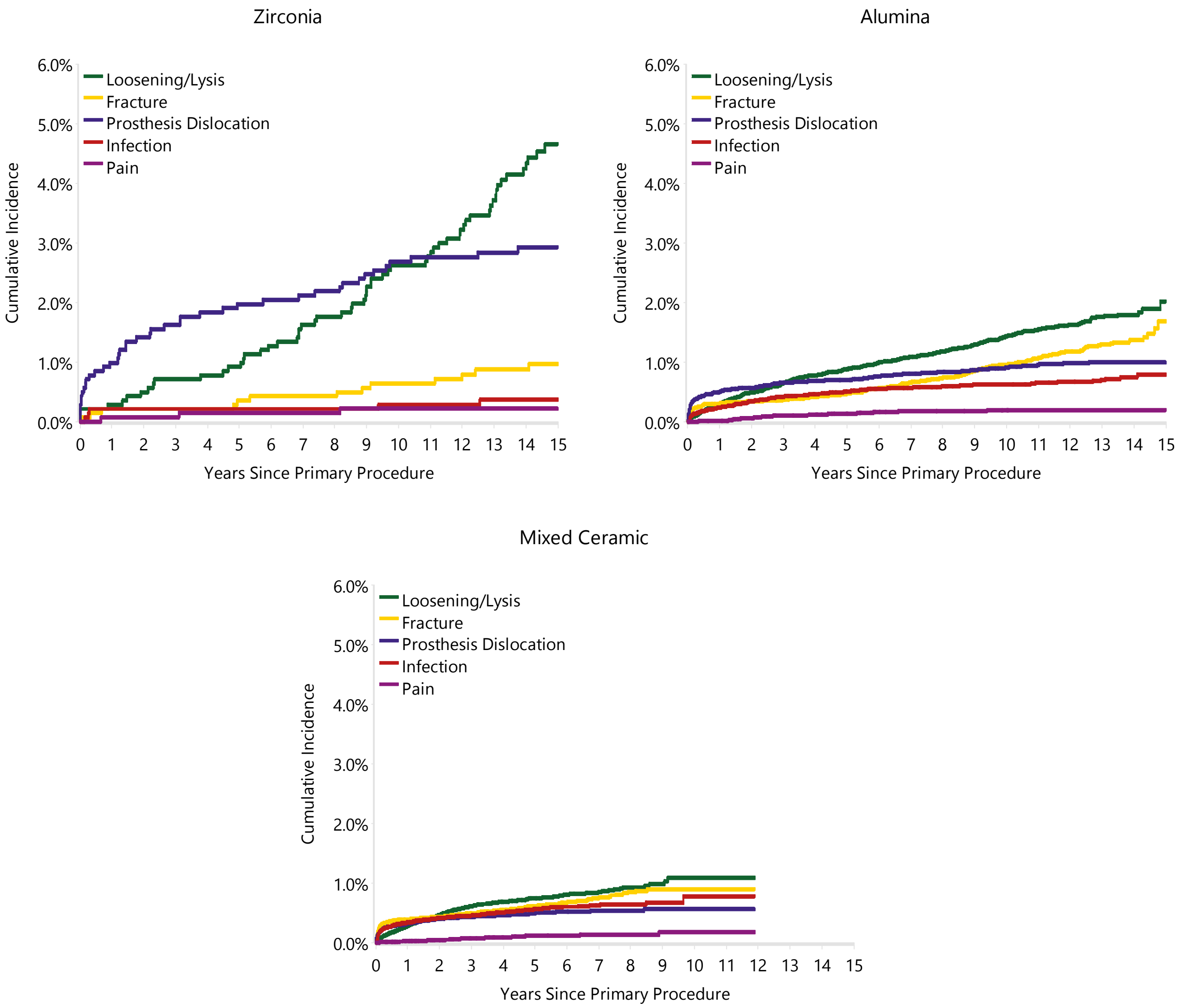
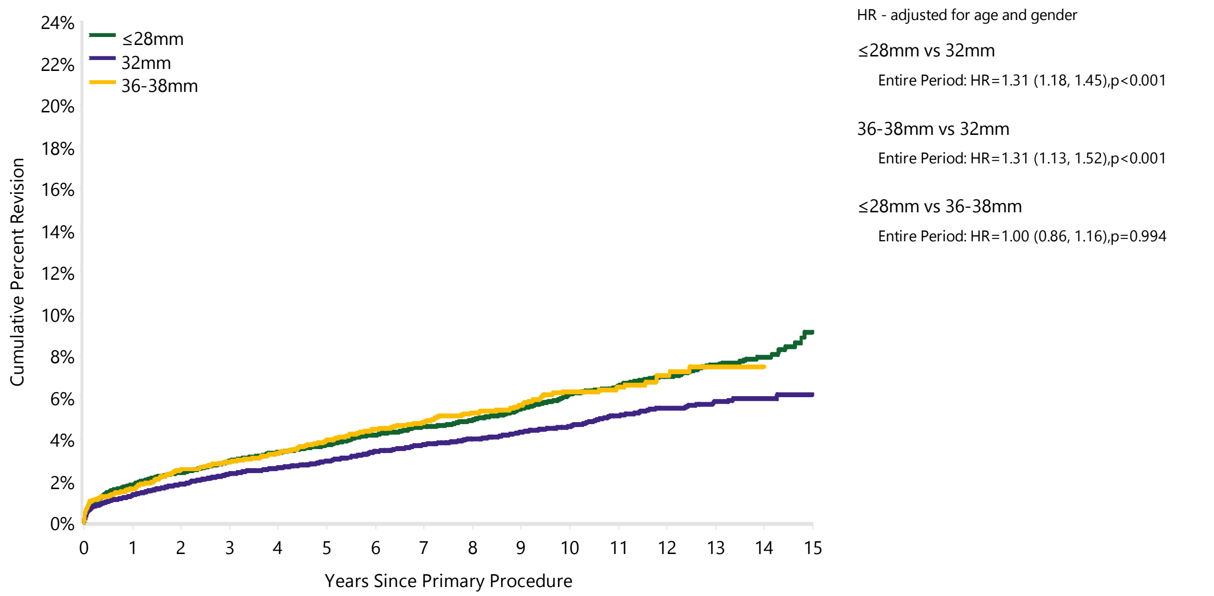


Table HT36 Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Ceramic Femoral Head by Ceramic Type and Head Size (Primary Diagnosis OA)

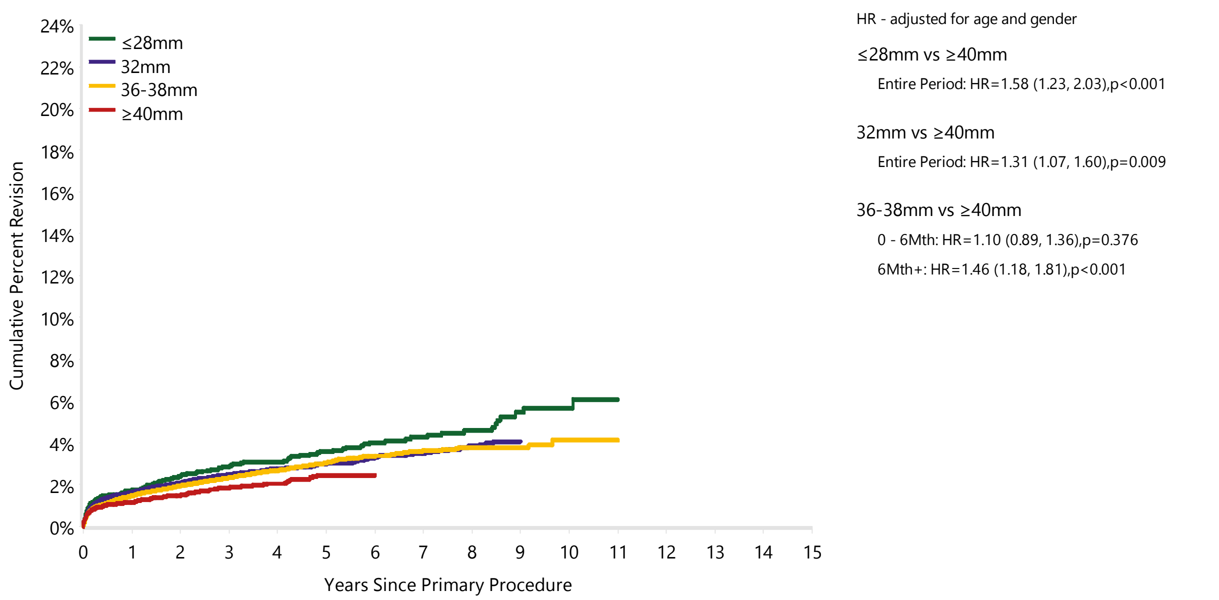
Ceramic Type	Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Zirconia	≤28mm	144	1409	1.9 (1.3, 2.8)	3.1 (2.3, 4.1)	3.9 (3.0, 5.1)	5.0 (4.0, 6.3)	7.7 (6.4, 9.3)	12.9 (11.0, 15.2)
	32mm	0	11	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	
Alumina	≤28mm	685	10929	1.8 (1.6, 2.1)	2.9 (2.6, 3.3)	3.7 (3.4, 4.1)	4.6 (4.2, 5.0)	6.1 (5.7, 6.6)	9.1 (8.0, 10.3)
	32mm	732	17284	1.3 (1.1, 1.5)	2.3 (2.1, 2.6)	3.0 (2.7, 3.2)	3.7 (3.4, 4.0)	4.6 (4.3, 4.9)	6.1 (5.5, 6.8)
	36-38mm	244	4753	1.6 (1.3, 2.0)	2.9 (2.4, 3.4)	3.9 (3.4, 4.6)	4.8 (4.2, 5.5)	6.3 (5.5, 7.1)	
	≥40mm	2	46	4.3 (1.1, 16.3)	4.3 (1.1, 16.3)				
Mixed Ceramic	≤28mm	142	4442	1.7 (1.4, 2.2)	2.9 (2.4, 3.5)	3.6 (3.0, 4.3)	4.3 (3.5, 5.1)	5.7 (4.6, 7.0)	
	32mm	623	25411	1.6 (1.5, 1.8)	2.5 (2.3, 2.7)	3.0 (2.8, 3.3)	3.5 (3.2, 3.8)		
	36-38mm	1103	47323	1.5 (1.4, 1.6)	2.3 (2.2, 2.5)	3.0 (2.8, 3.2)	3.6 (3.4, 3.9)	4.1 (3.6, 4.8)	
	≥40mm	114	6029	1.2 (0.9, 1.5)	1.8 (1.5, 2.2)	2.4 (2.0, 3.0)			
TOTAL		3789	117637						

Figure HT44 Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Alumina Femoral Head by Head Size (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
≤28mm	10929	10568	10047	9373	8578	6643	262
32mm	17284	16757	15296	13463	11448	7320	103
36-38mm	4753	4514	4079	3623	2810	1296	18

Figure HT45 Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Mixed Ceramic Femoral Head by Head Size (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
≤28mm	4442	3610	2365	1539	999	237	0
32mm	25411	19988	12457	6930	3066	12	0
36-38mm	47323	37694	22716	11793	4400	293	0
≥40mm	6029	5342	3451	1365	13	0	0

Constrained Acetabular Prosthesis

Constrained acetabular prostheses have a mechanism to lock the femoral head into the acetabular component. Although often considered 'revision' components, there have been 1,853 constrained acetabular prostheses used for primary total conventional hip replacement. Of these, 664 are constrained acetabular inserts and 1,189 constrained cups. There were 61 procedures reported in 2015. This is a decrease of 37% compared to 2014.

Constrained acetabular prostheses are used more commonly for fractured neck of femur, tumour, failed internal fixation and fracture/dislocation compared to all other acetabular components (Table HT37).

When all diagnoses are included there is no difference in the revision rate for constrained prostheses compared to other acetabular prostheses (Table HT38 and Figure HT46). This is also true when only those procedures with a diagnosis of osteoarthritis are included (Table HT39 and Figure HT47). Gender does not impact on revision rate (Table HT40 and Figure HT48).

There is, however, an age difference. Patients with a constrained cup have a higher rate of revision if they are aged less than 70 years (Table HT41 and Figure HT49). There is no difference in the rate of revision related to fixation (Table HT42 and Figure HT50).

When used for fractured neck of femur, constrained prostheses have a lower rate of revision compared to other acetabular prostheses (Table HT43 and Figure HT51).

Dual Mobility Acetabular Prosthesis

Dual mobility prostheses have a femoral head which moves within a polyethylene component, which also moves within a fixed acetabular shell.

There have been 2,640 primary total conventional hip replacements using dual mobility prostheses. Compared to other acetabular prostheses, dual mobility acetabular prostheses are used more frequently for fractured neck of femur, tumour and failed internal fixation (Table HT44).

When all diagnoses are included, dual mobility prostheses have a higher rate of revision compared to other acetabular prostheses (Table HT45 and Figure HT52).

For the diagnoses of osteoarthritis or fractured neck of femur, there is no difference in the rate of revision when dual mobility prostheses are used (Table HT46 and Figure HT53; Table HT47 and Figure HT54).

Table HT37 Primary Total Conventional Hip Replacement by Primary Diagnosis and Acetabular Type

	Constrained Prosthesis		Other Acetabular Prosthesis	
Primary Diagnosis	N	Col%	N	Col%
Osteoarthritis	747	40.3	291818	88.8
Fractured Neck Of Femur	661	35.7	13258	4.0
Osteonecrosis	69	3.7	10901	3.3
Developmental Dysplasia	16	0.9	4072	1.2
Rheumatoid Arthritis	21	1.1	3466	1.1
Tumour	199	10.7	1667	0.5
Failed Internal Fixation	103	5.6	1393	0.4
Other Inflammatory Arthritis	5	0.3	1455	0.4
Fracture/Dislocation	23	1.2	361	0.1
Arthrodesis Takedown	6	0.3	107	0.0
Other	3	0.2	136	0.0
TOTAL	**1853**	**100.0**	**328634**	**100.0**

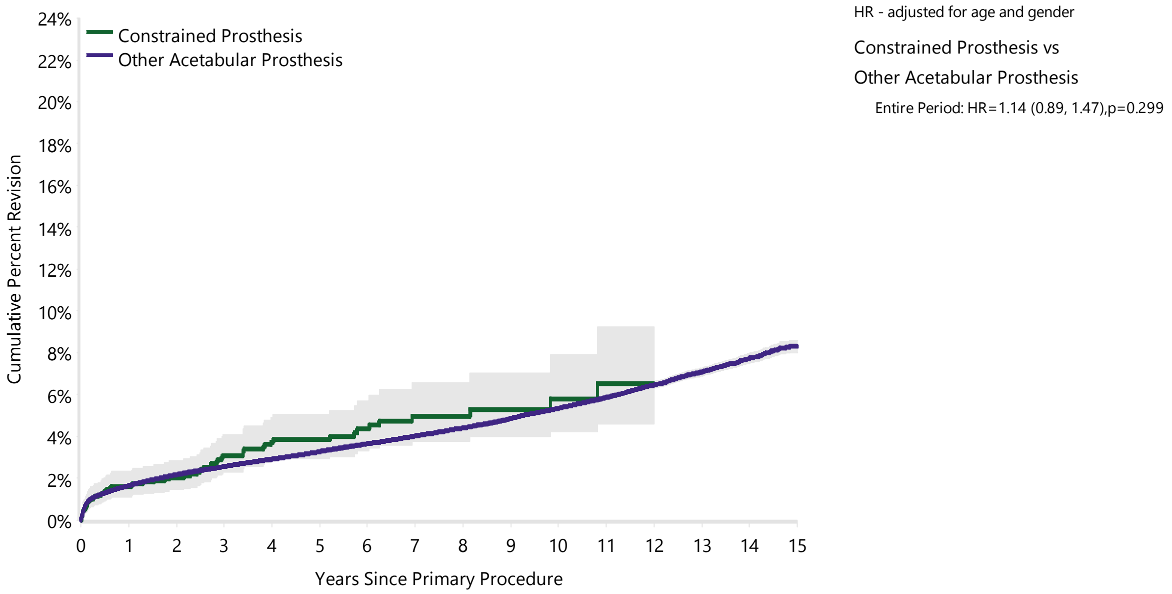
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT38 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	7 Yrs	10 Yrs	15 Yrs
Constrained Prosthesis	62	1853	1.6 (1.1, 2.3)	3.1 (2.3, 4.1)	3.8 (2.9, 5.0)	5.0 (3.8, 6.6)	5.8 (4.2, 7.9)	
Other Acetabular Prosthesis	11845	328634	1.6 (1.6, 1.7)	2.6 (2.5, 2.6)	3.3 (3.2, 3.3)	4.0 (3.9, 4.1)	5.3 (5.2, 5.5)	8.3 (8.0, 8.6)
TOTAL	11907	330487						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure HT46 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	7 Yrs	10 Yrs	15 Yrs
Constrained Prosthesis	1853	1506	1031	666	397	176	4
Other Acetabular Prosthesis	328634	285658	215560	156118	107170	56155	2022

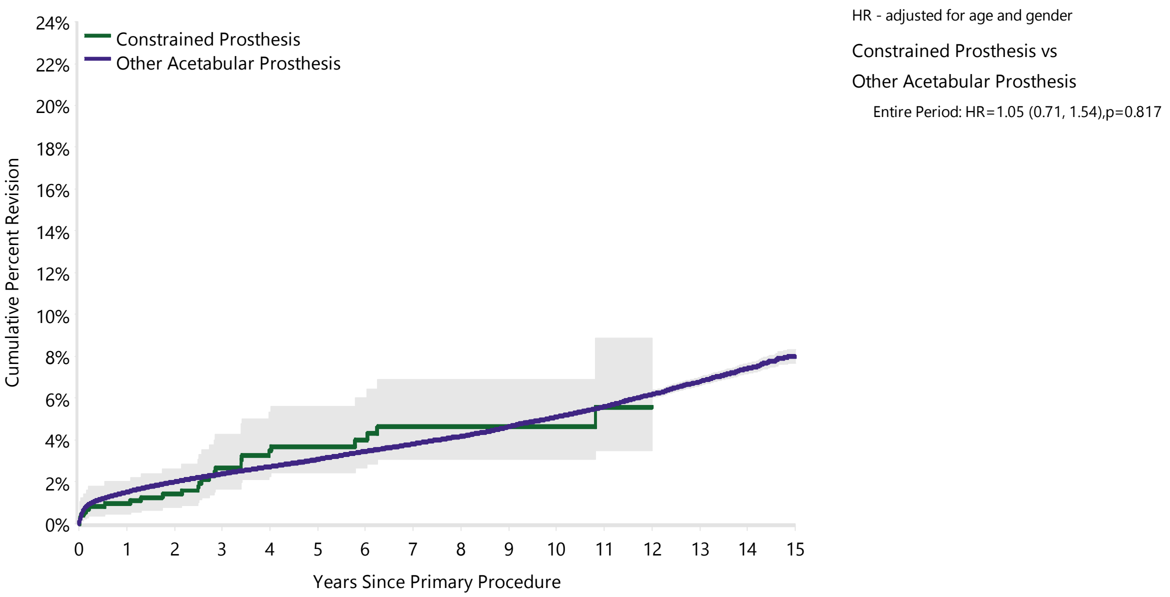
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT39 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	7 Yrs	10 Yrs	15 Yrs
Constrained Prosthesis	26	747	1.0 (0.5, 2.0)	2.7 (1.7, 4.3)	3.7 (2.4, 5.6)	4.6 (3.1, 6.9)	4.6 (3.1, 6.9)	
Other Acetabular Prosthesis	10006	291818	1.5 (1.5, 1.6)	2.4 (2.3, 2.4)	3.1 (3.0, 3.1)	3.8 (3.7, 3.9)	5.1 (5.0, 5.2)	8.0 (7.7, 8.3)
TOTAL	10032	292565						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure HT47 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Type (Primary Diagnosis OA)



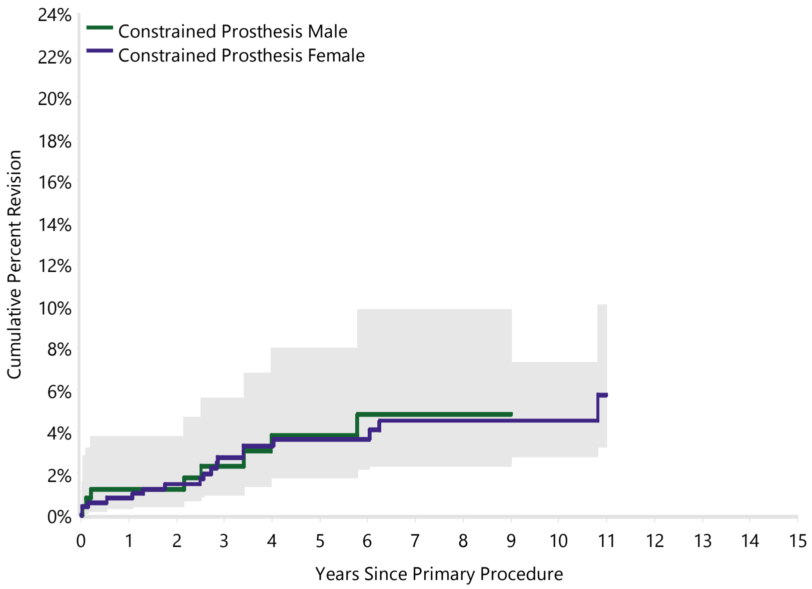
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Constrained Prosthesis	747	677	522	373	253	135	2
Other Acetabular Prosthesis	291818	255441	193686	140766	96812	50684	1781

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

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

Gender	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	8	247	1.2 (0.4, 3.8)	2.4 (1.0, 5.6)	3.8 (1.8, 8.0)	4.8 (2.4, 9.8)		
Female	18	500	0.8 (0.3, 2.2)	2.8 (1.6, 4.8)	3.6 (2.2, 6.0)	4.5 (2.8, 7.3)	4.5 (2.8, 7.3)	
TOTAL	26	747						

Figure HT48 Cumulative Percent Revision of Constrained Primary Total Conventional Hip Replacement by Gender (Primary Diagnosis OA)



HR - adjusted for age

Constrained Prosthesis Female vs

Constrained Prosthesis Male

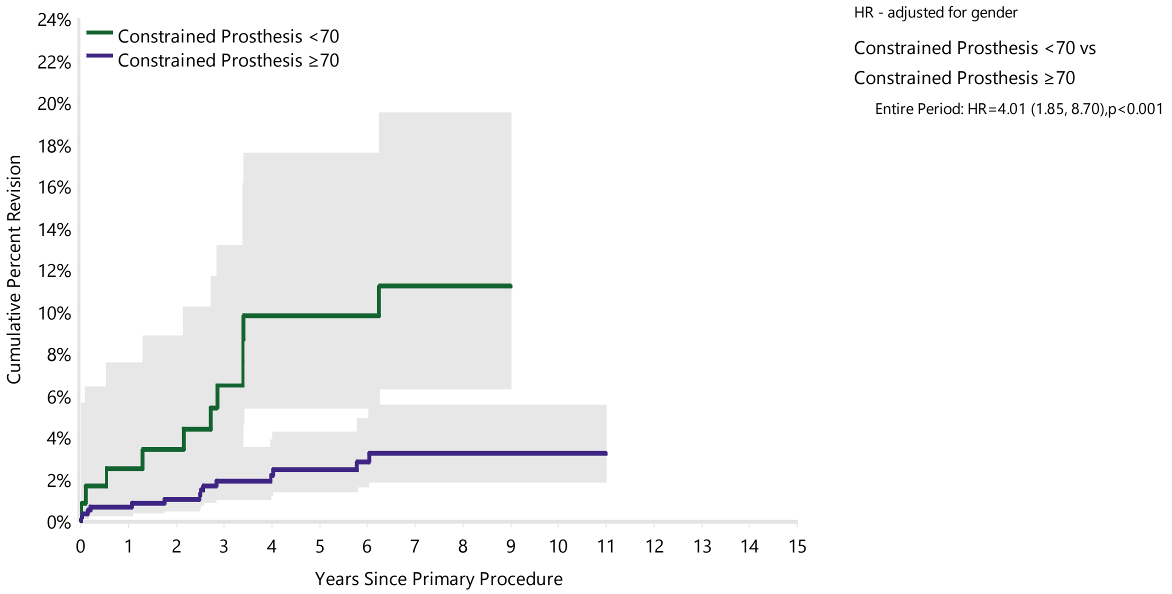
Entire Period: HR=1.04 (0.45, 2.40),p=0.924

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	247	216	151	109	67	31	0
Female	500	461	371	264	186	104	2

Table HT41 Cumulative Percent Revision of Constrained Primary Total Conventional Hip Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
<70	12	124	2.5 (0.8, 7.5)	6.5 (3.1, 13.1)	9.8 (5.4, 17.6)	11.2 (6.3, 19.5)		
≥70	14	623	0.7 (0.2, 1.7)	1.9 (1.0, 3.5)	2.4 (1.4, 4.2)	3.2 (1.9, 5.5)	3.2 (1.9, 5.5)	
TOTAL	26	747						

Figure HT49 Cumulative Percent Revision of Constrained Primary Total Conventional Hip Replacement by Age (Primary Diagnosis OA)

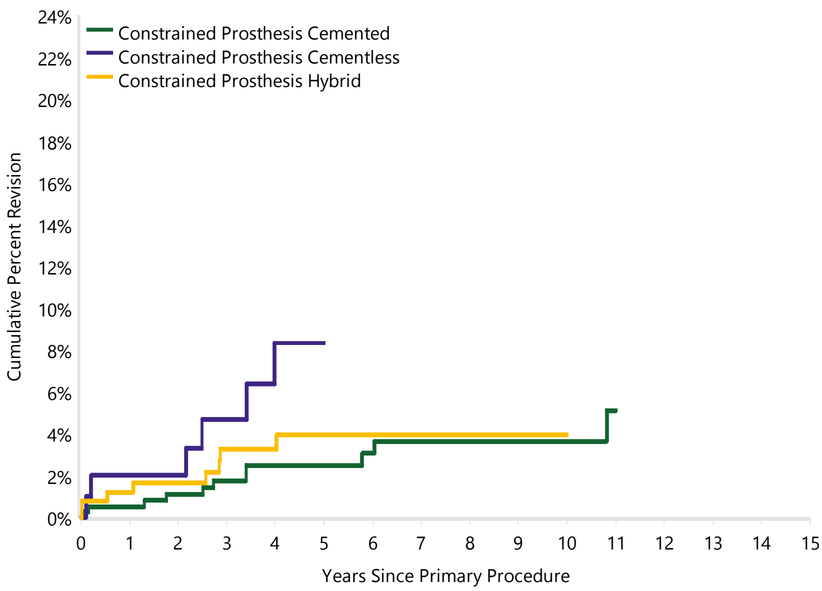


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
<70	124	110	86	72	56	36	0
≥70	623	567	436	301	197	99	2

Table HT42 Cumulative Percent Revision of Constrained Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis OA)

Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	11	388	0.5 (0.1, 2.1)	1.8 (0.8, 3.9)	2.5 (1.2, 4.9)	3.6 (1.9, 6.9)	3.6 (1.9, 6.9)	
Cementless	7	103	2.0 (0.5, 7.8)	4.7 (1.8, 12.2)	8.3 (3.7, 18.1)			
Hybrid (Femur Cemented)	8	256	1.2 (0.4, 3.7)	3.3 (1.6, 6.8)	3.9 (2.0, 7.8)	3.9 (2.0, 7.8)	3.9 (2.0, 7.8)	
TOTAL	26	747						

Figure HT50 Cumulative Percent Revision of Constrained Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis OA)



HR - adjusted for age and gender

Constrained Prosthesis Cementless vs Constrained Prosthesis Cemented
Entire Period: HR=1.97 (0.69, 5.61),p=0.205

Constrained Prosthesis Hybrid vs Constrained Prosthesis Cemented
Entire Period: HR=1.08 (0.43, 2.72),p=0.866

Constrained Prosthesis Cementless vs Constrained Prosthesis Hybrid
Entire Period: HR=1.82 (0.63, 5.27),p=0.270

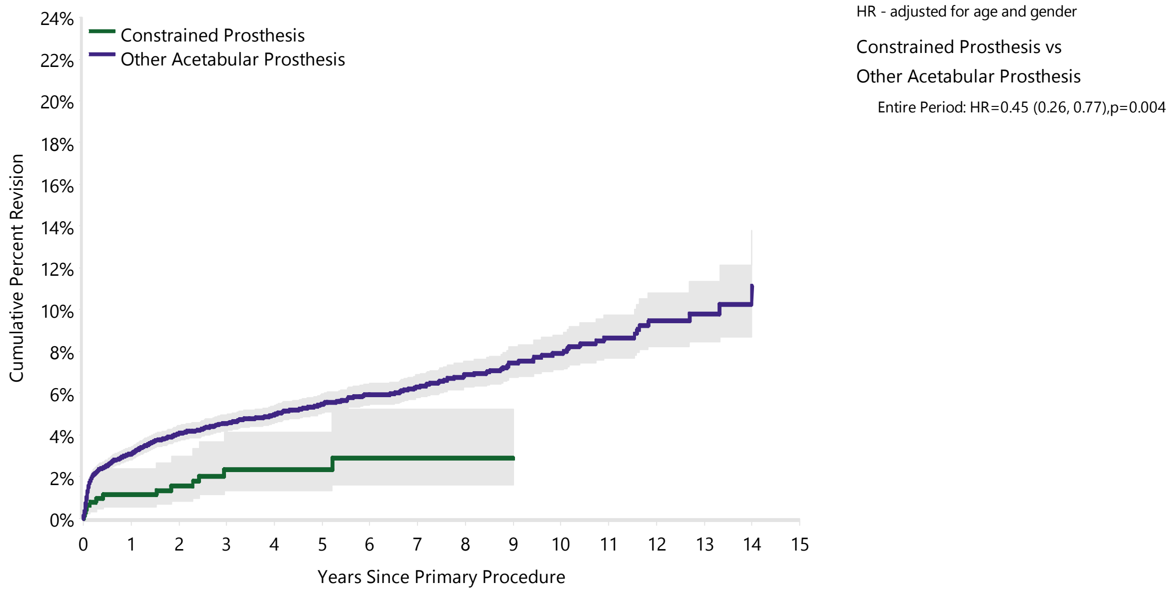
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	388	363	288	206	144	80	0
Cementless	103	84	63	43	27	14	0
Hybrid	256	230	171	124	82	41	2

Table HT43 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	7 Yrs	10 Yrs	15 Yrs
Constrained Prosthesis	13	661	1.1 (0.5, 2.4)	2.3 (1.3, 4.1)	2.3 (1.3, 4.1)	2.9 (1.6, 5.2)		
Other Acetabular Prosthesis	639	13258	3.1 (2.8, 3.4)	4.6 (4.2, 5.0)	5.5 (5.0, 6.0)	6.3 (5.8, 6.9)	7.9 (7.1, 8.8)	
TOTAL	652	13919						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure HT51 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Type (Primary Diagnosis Fractured NOF)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Constrained Prosthesis	661	524	331	190	94	21	1
Other Acetabular Prosthesis	13258	10394	6779	4155	2328	850	16

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT44 Primary Diagnosis of Primary Total Conventional Hip Replacement by Acetabular Mobility

Primary Diagnosis	Dual Mobility Prosthesis N	Dual Mobility Prosthesis Col%	Other Acetabular Prosthesis N	Other Acetabular Prosthesis Col%
Osteoarthritis	1625	61.6	290940	88.7
Fractured Neck Of Femur	642	24.3	13277	4.0
Osteonecrosis	116	4.4	10854	3.3
Developmental Dysplasia	41	1.6	4047	1.2
Rheumatoid Arthritis	15	0.6	3472	1.1
Tumour	92	3.5	1774	0.5
Failed Internal Fixation	68	2.6	1428	0.4
Other Inflammatory Arthritis	9	0.3	1451	0.4
Fracture/Dislocation	23	0.9	361	0.1
Arthrodesis Takedown	7	0.3	106	0.0
Other	2	0.1	137	0.0
TOTAL	2640	100.0	327847	100.0

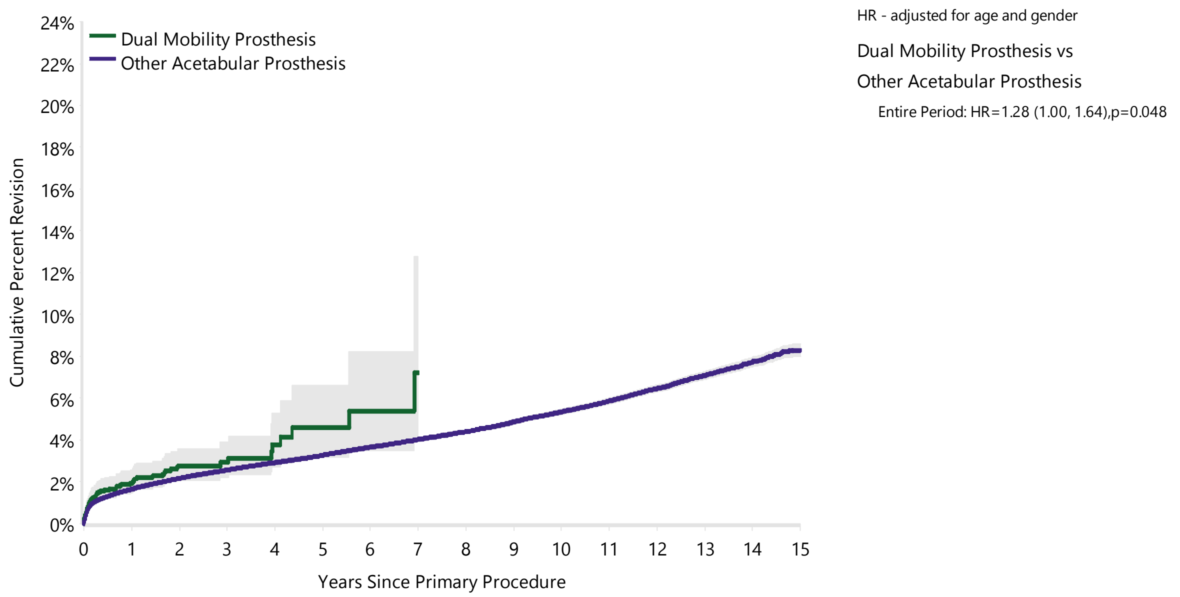
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT45 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	7 Yrs	10 Yrs	15 Yrs
Dual Mobility Prosthesis	64	2640	1.9 (1.5, 2.6)	2.9 (2.2, 3.9)	4.6 (3.2, 6.6)	7.2 (4.0, 12.8)		
Other Acetabular Prosthesis	11843	327847	1.6 (1.6, 1.7)	2.6 (2.5, 2.6)	3.3 (3.2, 3.3)	4.0 (3.9, 4.1)	5.3 (5.2, 5.5)	8.3 (8.0, 8.6)
TOTAL	11907	330487						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure HT52 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	7 Yrs	10 Yrs	15 Yrs
Dual Mobility Prosthesis	2640	1577	483	150	48	0	0
Other Acetabular Prosthesis	327847	285587	216108	156634	107519	56331	2026

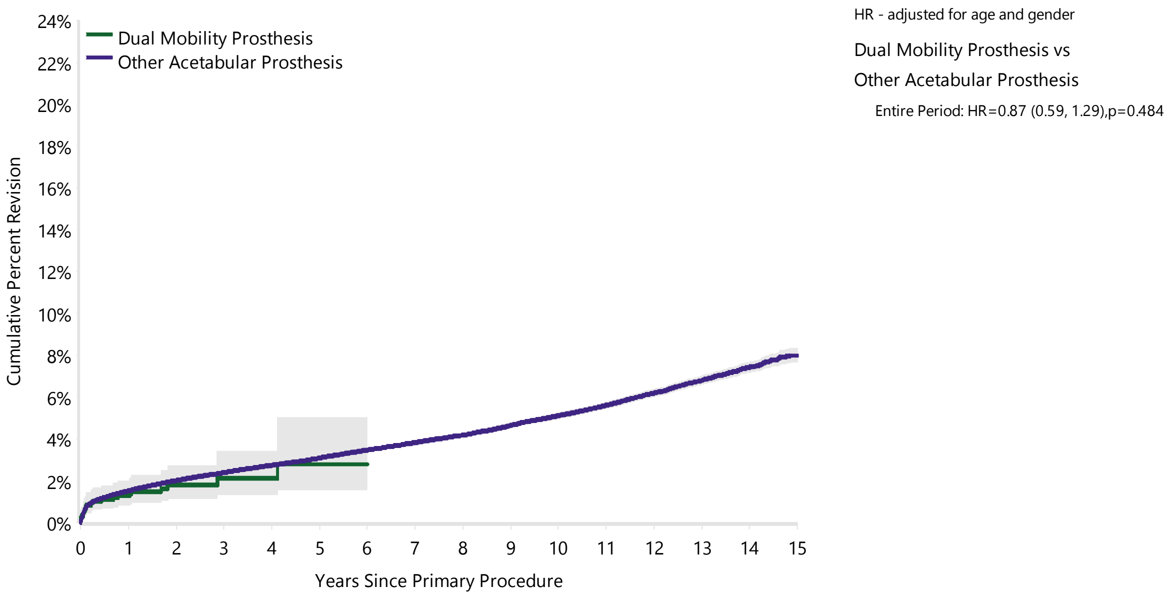
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT46 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	7 Yrs	10 Yrs	15 Yrs
Dual Mobility Prosthesis	25	1625	1.3 (0.8, 2.0)	2.1 (1.3, 3.4)	2.8 (1.5, 5.0)			
Other Acetabular Prosthesis	10007	290940	1.5 (1.5, 1.6)	2.4 (2.3, 2.4)	3.1 (3.0, 3.2)	3.8 (3.7, 3.9)	5.1 (5.0, 5.2)	8.0 (7.7, 8.3)
TOTAL	10032	292565						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure HT53 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Mobility (Primary Diagnosis OA)



Number at Risk	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Dual Mobility Prosthesis	979	284	71	20	0	0
Other Acetabular Prosthesis	255139	193924	141068	97045	50819	1783

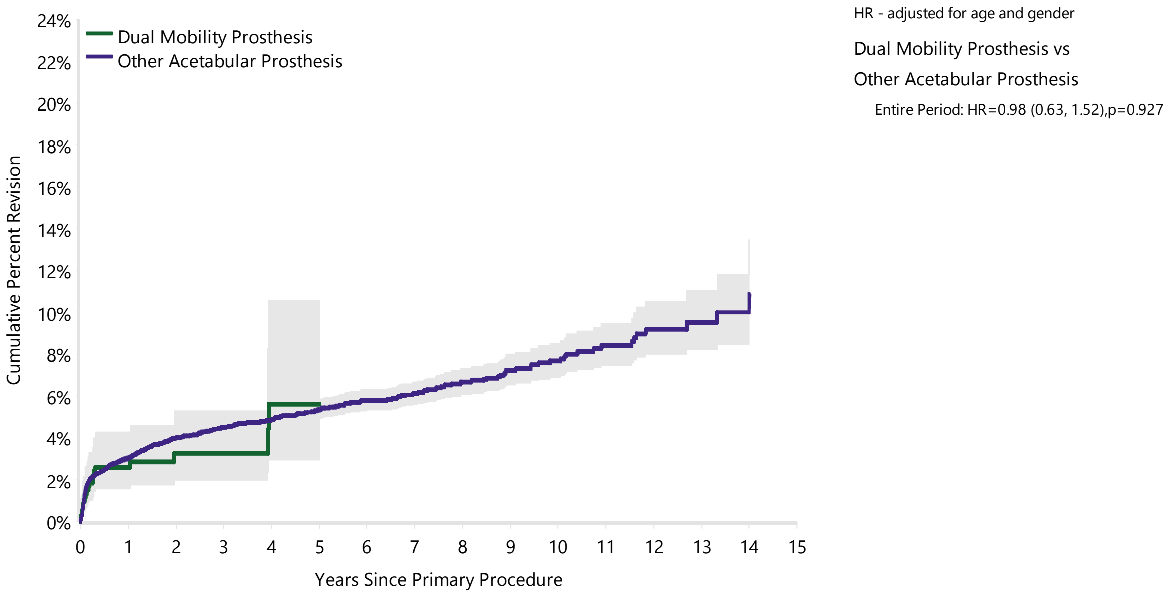
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT47 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	7 Yrs	10 Yrs	15 Yrs
Dual Mobility Prosthesis	21	642	2.6 (1.6, 4.3)	3.3 (2.0, 5.3)	5.6 (2.9, 10.6)			
Other Acetabular Prosthesis	631	13277	3.0 (2.7, 3.3)	4.5 (4.1, 4.9)	5.3 (4.9, 5.8)	6.1 (5.6, 6.7)	7.7 (6.9, 8.5)	
TOTAL	652	13919						

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure HT54 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Mobility (Primary Diagnosis Fractured NOF)



Number at Risk	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Dual Mobility Prosthesis	387	125	54	20	0	0
Other Acetabular Prosthesis	10531	6985	4291	2402	871	17

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

PRIMARY TOTAL RESURFACING HIP REPLACEMENT

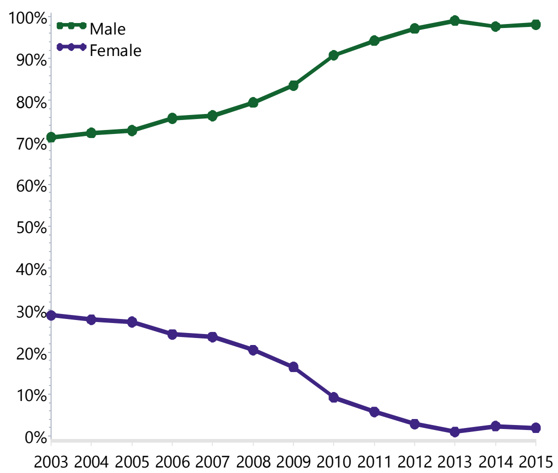
DEMOGRAPHICS

There have been 16,521 total resurfacing hip replacement procedures reported to the Registry, an additional 367 procedures compared to the last report.

The use of total resurfacing hip replacement in Australia has been declining since 2005. In 2015, the number of total resurfacing procedures is 4.8% less than in 2014 and 80.3% less than 2005. Total resurfacing hip replacement represents 0.8% of all hip replacements performed in 2015.

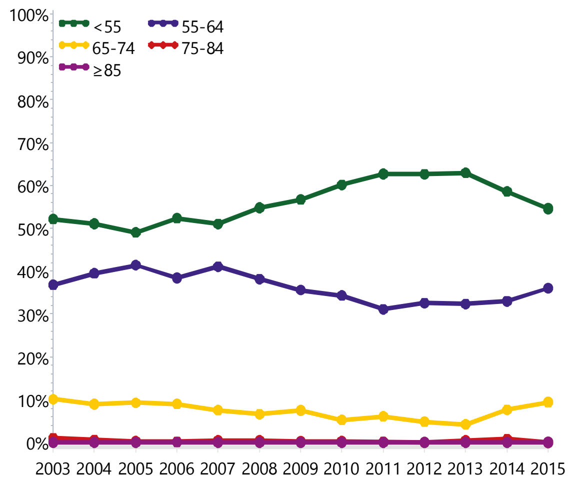
In 2015, 98.1% of total resurfacing hip replacements were undertaken in males (Figure HT55).

Figure HT55 Primary Total Resurfacing Hip Replacement by Gender



In recent years there has been a small increase in the proportion of patients aged 65 to 74 years receiving total resurfacing hip replacement. There has also been a small decrease in the proportion aged less than 55 years undergoing this procedure (Figure HT56). The mean age of total resurfacing hip replacement is 53.1 years (Table HT48).

Figure HT56 Primary Total Resurfacing Hip Replacement by Age



There were only two different types of resurfacing prostheses used in 2015, with the Adept the most commonly used accounting for 54.0% of procedures (Table HT49).

Table HT48 Age and Gender of Primary Total Resurfacing Hip Replacement

Gender	Number	Percent	Minimum	Maximum	Median	Mean	Std Dev
Male	12945	78.4%	13	93	54	53.5	9.0
Female	3576	21.6%	14	81	53	51.6	8.6
TOTAL	**16521**	**100.0%**	**13**	**93**	**54**	**53.1**	**8.9**

Table HT49 Most Used Resurfacing Heads in Primary Total Resurfacing Hip Replacement

2003		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
1359	BHR	341	BHR	267	BHR	285	BHR	195	Adept
58	Durom	90	Adept	126	Adept	94	Adept	166	BHR
43	ASR	10	Mitch TRH	5	Icon				
42	Cormet	7	ACCIS	4	Cormet				
38	Cormet 2000 HAP	4	Cormet						
7	Conserve Plus								
Most Used									
1547 (6)	100.0%	452 (5)	100.0%	402 (4)	100.0%	379 (2)	100.0%	361 (2)	100.0%

OUTCOME FOR ALL DIAGNOSES

Primary Diagnosis

The principal diagnosis is osteoarthritis (95.3%), followed by developmental dysplasia (2.4%) and osteonecrosis (1.6%) (Table HT50). Primary total resurfacing hip replacement for osteoarthritis has a lower rate of revision compared to developmental dysplasia. There is no difference in the rate of revision for osteonecrosis compared to osteoarthritis (Figure HT57).

Reasons for Revision

The main reasons for revision of primary total resurfacing hip replacement are loosening/lysis (32.7%), metal related pathology (27.5%) and fracture (19.1%) (Table HT51).

The five most common reasons for revision are shown in Figure HT58. The cumulative incidence of fracture increases rapidly in the first year. After this time the incidence increases at a slower rate. Loosening/lysis shows a linear increase and after four years exceeds fracture to have the highest cumulative incidence. The cumulative incidence of metal related pathology continues to increase to be the second most common reason for revision after six years.

Type of Revision

The most common type of revision for total resurfacing hip replacement is revision of both the femoral and acetabular components (68.5%). Femoral only revision is much less common (25.2%) and acetabular only revision is rarely undertaken (3.4%) (Table HT52).

Prosthesis Types

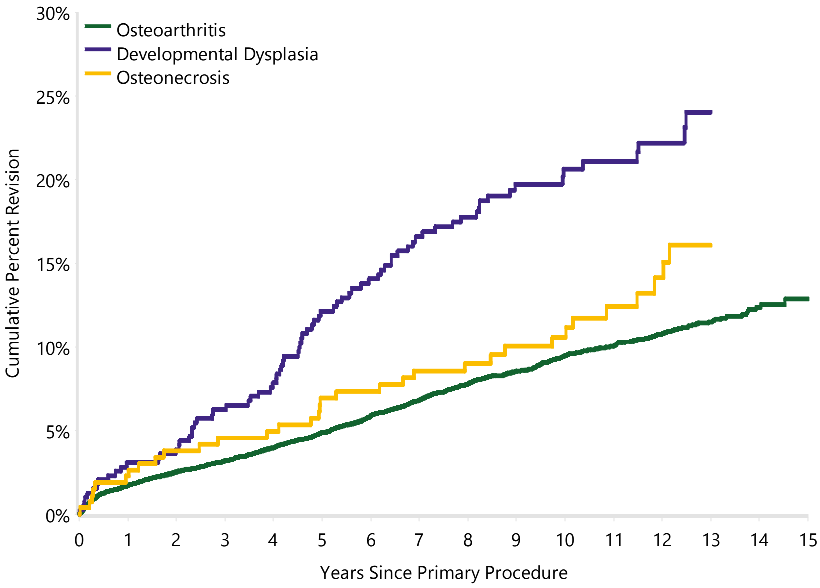
The cumulative percent revision of different total resurfacing hip prostheses combinations with more than 100 procedures is listed in Table HT53. The Adept (3.5%), Mitch TRH (3.8%) and BHR (4.9%) have the lowest cumulative percent revision at seven years. Of the four prostheses with 10 year data, the BHR resurfacing prosthesis has the lowest cumulative percent revision (6.9%).

Table HT50 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Primary Diagnosis

Primary Diagnosis	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Osteoarthritis	1297	15739	1.7 (1.5, 1.9)	3.2 (2.9, 3.5)	4.9 (4.5, 5.2)	6.8 (6.4, 7.2)	9.5 (9.0, 10.0)	12.9 (11.8, 14.0)
Developmental Dysplasia	79	390	3.1 (1.8, 5.4)	6.2 (4.2, 9.2)	12.1 (9.2, 15.9)	16.6 (13.2, 20.8)	20.6 (16.7, 25.2)	
Osteonecrosis	33	265	2.3 (1.0, 5.0)	4.6 (2.6, 7.9)	6.9 (4.4, 10.8)	8.6 (5.7, 12.7)	10.6 (7.3, 15.2)	
Other (6)	18	127	3.1 (1.2, 8.2)	6.5 (3.3, 12.6)	10.8 (6.4, 17.9)	11.7 (7.1, 19.0)	15.4 (9.8, 23.8)	
TOTAL	1427	16521						

Note: Only primary diagnoses with over 100 procedures have been listed

Figure HT57 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Primary Diagnosis



HR - adjusted for age and gender

Developmental Dysplasia vs Osteoarthritis
Entire Period: HR=1.55 (1.23, 1.96),p<0.001

Osteonecrosis vs Osteoarthritis
Entire Period: HR=1.32 (0.93, 1.88),p=0.116

Developmental Dysplasia vs Osteonecrosis
Entire Period: HR=1.17 (0.78, 1.77),p=0.443

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Osteoarthritis	15739	15100	14061	12743	10406	5926	78
Developmental Dysplasia	390	374	353	324	287	180	4
Osteonecrosis	265	258	245	236	218	158	6

Table HT51 Primary Total Resurfacing Hip Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	467	32.7
Metal Related Pathology	392	27.5
Fracture	273	19.1
Infection	92	6.4
Pain	82	5.7
Osteonecrosis	36	2.5
Prosthesis Dislocation	23	1.6
Malposition	20	1.4
Other	42	2.9
TOTAL	1427	100.0

Table HT52 Primary Total Resurfacing Hip Replacement by Type of Revision

Type of Revision	Number	Percent
THR (Femoral/Acetabular)	978	68.5
Femoral Component	360	25.2
Acetabular Component	49	3.4
Cement Spacer	31	2.2
Removal of Prostheses	6	0.4
Bipolar Head and Femoral	3	0.2
TOTAL	1427	100.0

Figure HT58 Cumulative Incidence Revision Diagnosis of Primary Total Resurfacing Hip Replacement

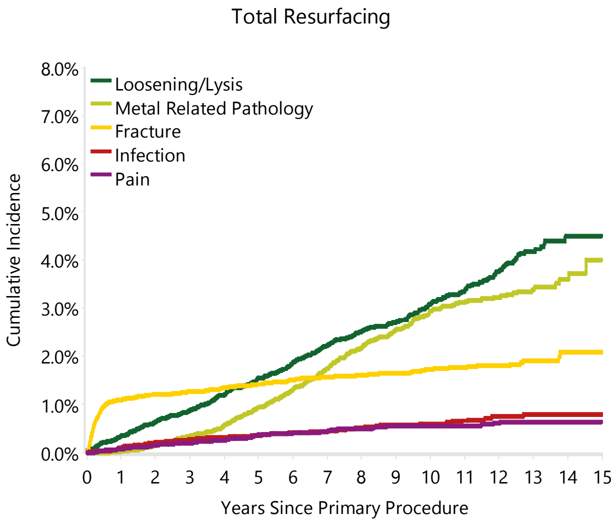


Table HT53 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Prosthesis Combination

Head Component	Acetabular Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
ASR	ASR	331	1168	3.4 (2.5, 4.6)	7.2 (5.9, 8.8)	15.3 (13.4, 17.5)	22.8 (20.5, 25.3)	30.1 (27.4, 33.1)	
Adept	Adept	26	947	1.1 (0.6, 2.0)	1.7 (1.0, 2.8)	2.3 (1.4, 3.8)	3.5 (2.2, 5.5)		
BHR	BHR	724	11208	1.4 (1.2, 1.7)	2.5 (2.2, 2.8)	3.5 (3.2, 3.9)	4.9 (4.5, 5.3)	6.9 (6.4, 7.5)	10.1 (9.1, 11.3)
Bionik	Bionik	47	200	3.5 (1.7, 7.2)	12.0 (8.2, 17.4)	17.1 (12.5, 23.1)	20.0 (15.0, 26.3)		
Cormet	Cormet	99	626	2.1 (1.2, 3.6)	5.6 (4.1, 7.7)	9.6 (7.5, 12.2)	13.3 (10.8, 16.3)	16.1 (13.2, 19.5)	
Durom	Durom	88	847	3.2 (2.2, 4.6)	5.4 (4.1, 7.2)	7.5 (5.9, 9.5)	8.6 (6.9, 10.7)	10.9 (8.9, 13.3)	
Icon	Icon	11	118	1.7 (0.4, 6.6)	4.2 (1.8, 9.9)	6.0 (2.9, 12.1)	7.7 (4.1, 14.3)		
Mitch TRH	Mitch TRH	41	1024	1.2 (0.7, 2.1)	2.1 (1.4, 3.2)	2.6 (1.8, 3.8)	3.8 (2.8, 5.3)		
Recap	Recap	24	195	5.1 (2.8, 9.3)	8.7 (5.5, 13.7)	10.3 (6.8, 15.5)	11.6 (7.8, 17.1)		
Other (8)		36	188	5.3 (2.9, 9.7)	7.5 (4.5, 12.3)	9.6 (6.2, 14.9)	11.9 (8.0, 17.6)	16.8 (12.1, 23.2)	
TOTAL		1427	16521						

Note:Only combinations with over 100 procedures have been listed

OUTCOME FOR OSTEOARTHRITIS

The cumulative percent revision at 15 years for primary total resurfacing hip replacement undertaken for osteoarthritis is 12.9% (Table HT54 and Figure HT59).

Age and Gender

Patients aged 65 years or older have a higher rate of revision compared to patients aged less than 55 years and 55 to 64 years for the first six months only. After six months, patients 65 years or older have a lower rate of revision compared to patients aged less than 55 years (Table HT55 and Figure HT60).

> **"This effect of femoral component head size is evident in both males and females."**

Females have a higher rate of revision compared to males. After one year, the rate of revision is over two times higher for females compared to males (Table HT56 and Figure HT61). While there is no age related difference in the rate of revision for females, males aged 65 years or older have a higher rate of revision compared to males aged less than 55 and 55 to 64 years for the first six months only (Table HT56, Figures HT62 and HT63).

Head Size

The rate of revision decreases as the femoral component head size increases. Femoral head sizes of 44mm or less and 45-49mm have over twice the rate of revision compared to head sizes 55mm or larger. There is no difference for head sizes 50-54mm compared to 55mm or larger (Table HT57 and Figure HT64).

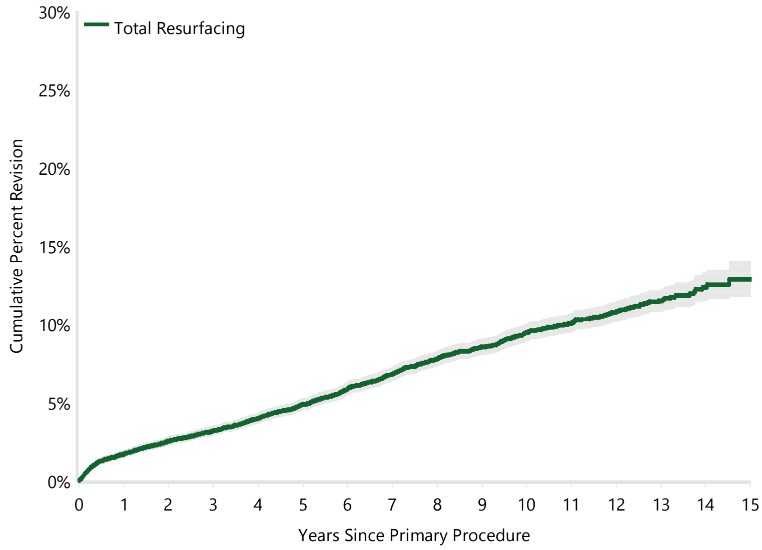
The reason for revision varies with head size. Head sizes less than 50mm have a higher cumulative incidence of loosening/lysis, metal related pathology, fracture, infection and pain compared to head sizes 50mm or larger (Figure HT65).

This effect of femoral component head size is evident in both males and females (Table HT58 and Figure HT66).

Table HT54 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement (Primary Diagnosis OA)

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Total Resurfacing	1297	15739	1.7 (1.5, 1.9)	3.2 (2.9, 3.5)	4.9 (4.5, 5.2)	6.8 (6.4, 7.2)	9.5 (9.0, 10.0)	12.9 (11.8, 14.0)
TOTAL	1297	15739						

Figure HT59 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement (Primary Diagnosis OA)

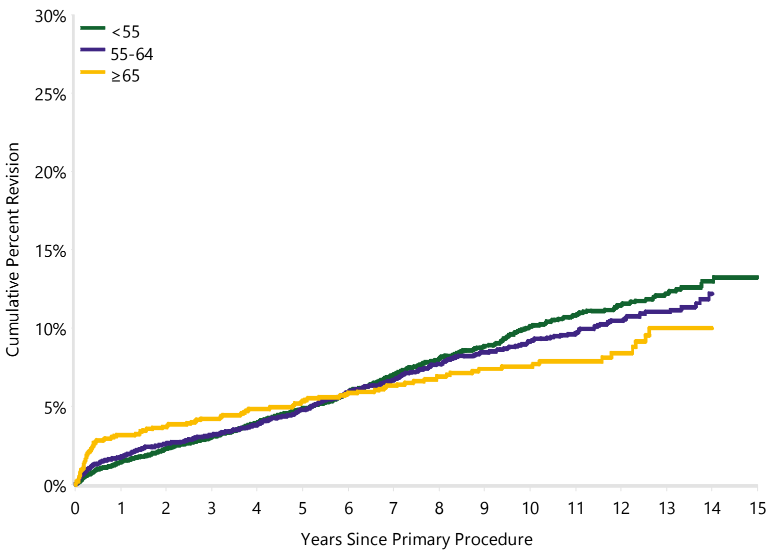


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Total Resurfacing	15739	15100	14061	12743	10406	5926	78

Table HT55 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	7 Yrs	10 Yrs	15 Yrs
<55	700	8277	1.4 (1.2, 1.7)	3.0 (2.7, 3.4)	4.9 (4.4, 5.4)	7.0 (6.4, 7.6)	10.1 (9.4, 10.9)	13.2 (12.0, 14.6)
55-64	495	6056	1.8 (1.5, 2.1)	3.2 (2.7, 3.6)	4.8 (4.3, 5.4)	6.7 (6.0, 7.4)	9.1 (8.3, 10.0)	
≥65	102	1406	3.2 (2.4, 4.2)	4.2 (3.3, 5.4)	5.3 (4.2, 6.7)	6.3 (5.1, 7.8)	7.5 (6.2, 9.2)	
TOTAL	1297	15739						

Figure HT60 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=1.31 (1.04, 1.64),p=0.022

1.5Yr+: HR=0.88 (0.77, 1.00),p=0.057

≥65 vs <55

0 - 6Mth: HR=3.32 (2.30, 4.79),p<0.001

6Mth+: HR=0.71 (0.55, 0.92),p=0.009

≥65 vs 55-64

0 - 6Mth: HR=2.52 (1.74, 3.64),p<0.001

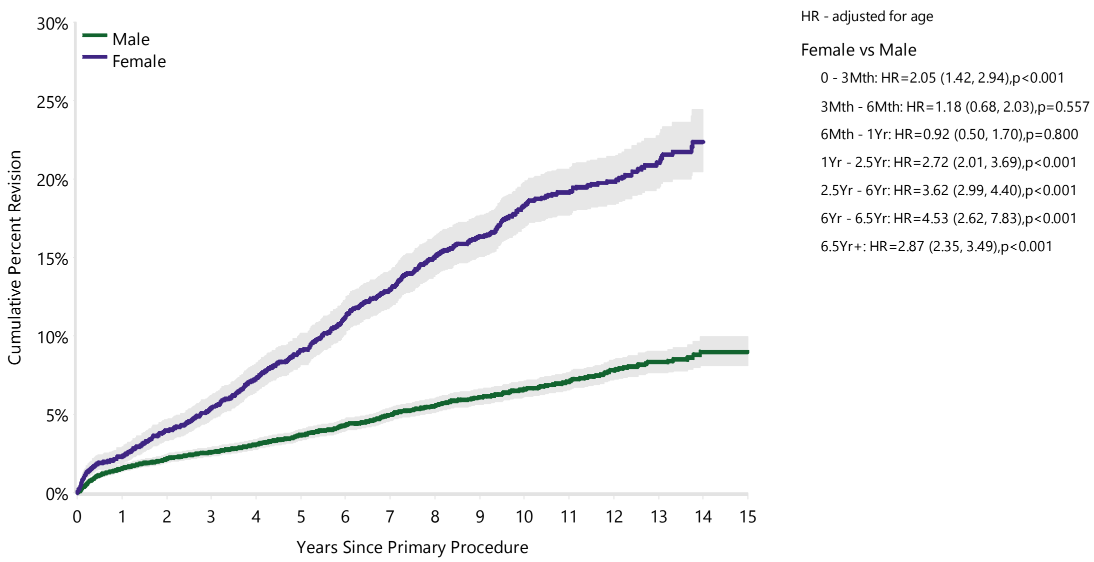
6Mth+: HR=0.77 (0.59, 1.00),p=0.051

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
<55	8277	7964	7366	6578	5268	2989	52
55-64	6056	5814	5453	5012	4160	2359	23
≥65	1406	1322	1242	1153	978	578	3

Table HT56 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender and Age (Primary Diagnosis OA)

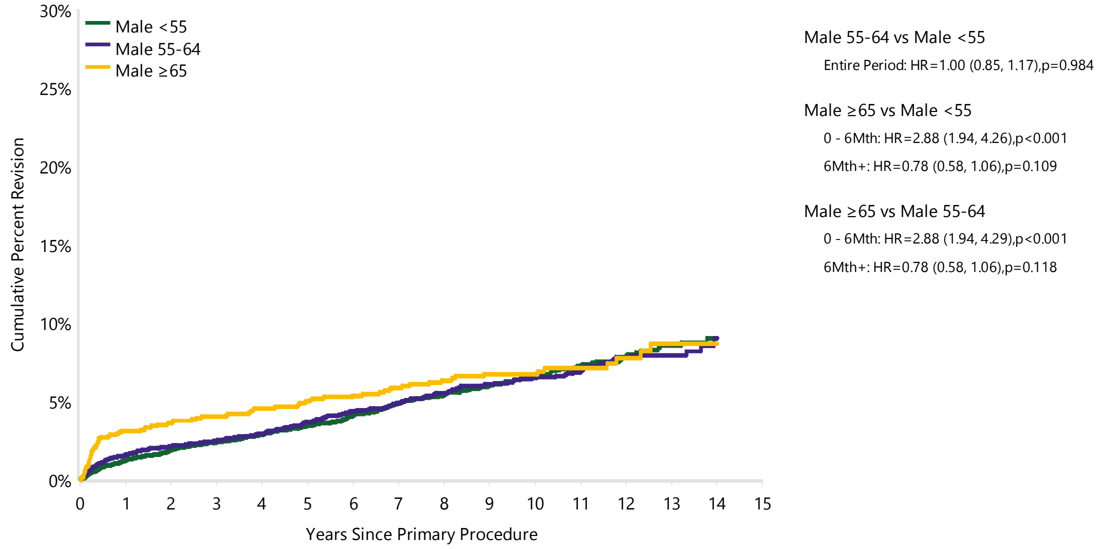
Gender	Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male		**712**	**12480**	**1.6 (1.4, 1.8)**	**2.6 (2.3, 2.9)**	**3.7 (3.3, 4.0)**	**5.0 (4.6, 5.4)**	**6.6 (6.1, 7.1)**	**9.0 (8.1, 9.9)**
	<55	354	6404	1.2 (1.0, 1.5)	2.4 (2.0, 2.8)	3.4 (3.0, 3.9)	4.9 (4.3, 5.5)	6.7 (6.0, 7.5)	
	55-64	275	4803	1.6 (1.3, 2.0)	2.5 (2.1, 3.0)	3.6 (3.1, 4.2)	4.9 (4.3, 5.6)	6.5 (5.8, 7.4)	
	≥65	83	1273	3.1 (2.3, 4.2)	4.0 (3.1, 5.3)	5.0 (3.9, 6.4)	5.9 (4.7, 7.4)	6.7 (5.4, 8.4)	
Female		**585**	**3259**	**2.3 (1.8, 2.9)**	**5.4 (4.7, 6.2)**	**9.1 (8.2, 10.1)**	**12.9 (11.8, 14.1)**	**18.3 (16.9, 19.7)**	
	<55	346	1873	2.1 (1.6, 2.9)	5.1 (4.2, 6.2)	9.3 (8.1, 10.7)	13.2 (11.8, 14.9)	19.1 (17.3, 21.1)	
	55-64	220	1253	2.4 (1.7, 3.4)	5.7 (4.5, 7.1)	8.8 (7.4, 10.6)	12.8 (11.0, 14.8)	17.5 (15.4, 19.9)	
	≥65	19	133	3.8 (1.6, 8.8)	6.1 (3.1, 11.7)	8.4 (4.7, 14.6)	10.0 (5.9, 16.5)	14.0 (8.9, 21.6)	
TOTAL		1297	15739						

Figure HT61 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender (Primary Diagnosis OA)



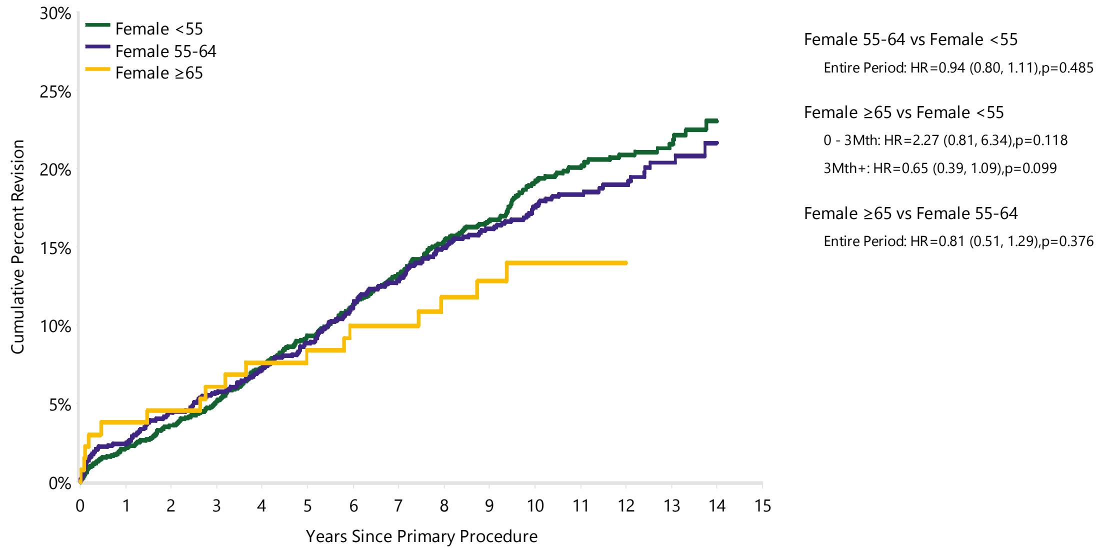
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	12480	11926	11004	9857	7878	4365	56
Female	3259	3174	3057	2886	2528	1561	22

Figure HT62 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement for Males by Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	<55	6404	6136	5602	4923	3827	2127	36
	55-64	4803	4595	4282	3899	3178	1727	17
	≥65	1273	1195	1120	1035	873	511	3

Figure HT63 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement for Females by Age (Primary Diagnosis OA)



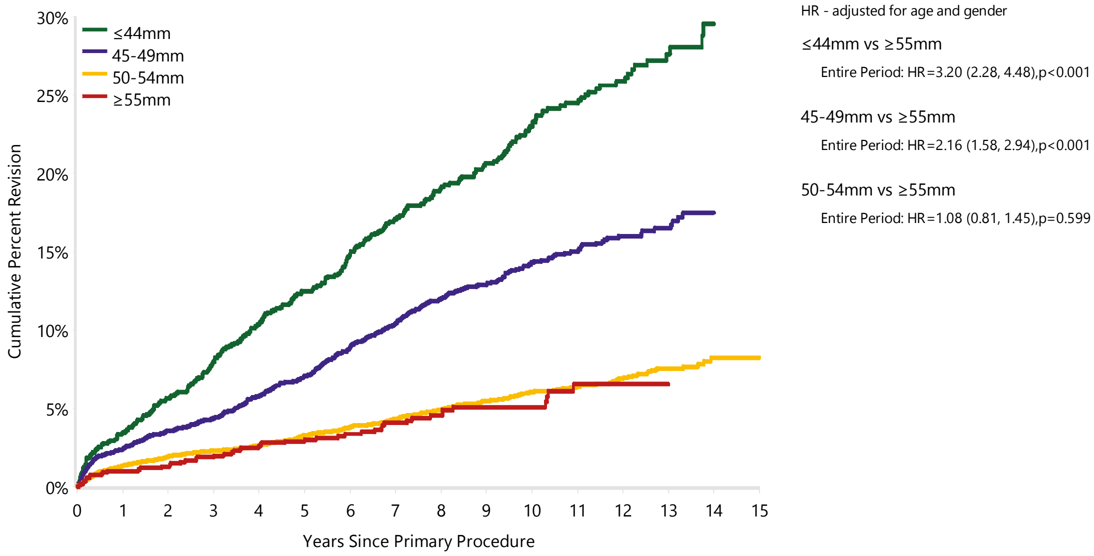
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Female	<55	1873	1828	1764	1655	1441	862	16
	55-64	1253	1219	1171	1113	982	632	6
	≥65	133	127	122	118	105	67	0

Table HT57 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	7 Yrs	10 Yrs	15 Yrs
≤44mm	279	1196	3.4 (2.5, 4.6)	8.0 (6.6, 9.7)	12.5 (10.7, 14.5)	17.1 (15.0, 19.4)	23.0 (20.6, 25.6)	
45-49mm	460	3638	2.4 (1.9, 2.9)	4.4 (3.8, 5.1)	7.0 (6.2, 7.9)	10.4 (9.4, 11.5)	14.3 (13.1, 15.7)	
50-54mm	509	9788	1.3 (1.1, 1.6)	2.3 (2.0, 2.6)	3.3 (2.9, 3.7)	4.3 (3.9, 4.7)	6.0 (5.5, 6.6)	8.2 (7.3, 9.3)
≥55mm	49	1116	1.0 (0.6, 1.8)	1.9 (1.2, 2.9)	2.9 (2.0, 4.1)	4.0 (3.0, 5.5)	5.1 (3.8, 6.8)	
TOTAL	1297	15738						

Note: Excludes one procedure with unknown head size

Figure HT64 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Head Size (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
≤44mm	1196	1152	1090	1021	888	546	8
45-49mm	3638	3473	3285	2999	2466	1329	13
50-54mm	9788	9406	8700	7841	6401	3734	52
≥55mm	1116	1068	985	881	651	317	5

Figure HT65 Cumulative Incidence Revision Diagnosis of Primary Total Resurfacing Hip Replacement by Head Size (Primary Diagnosis OA)

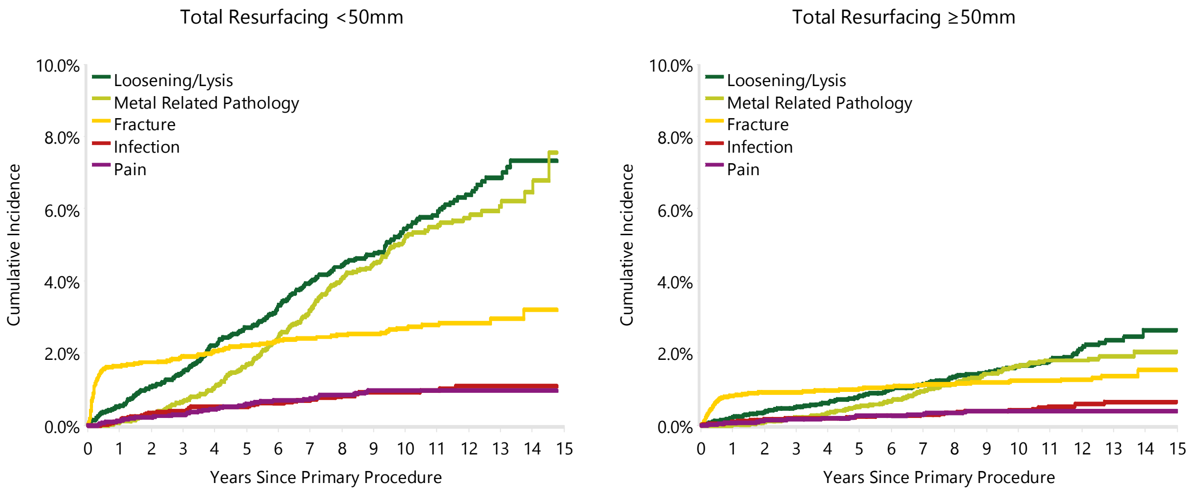
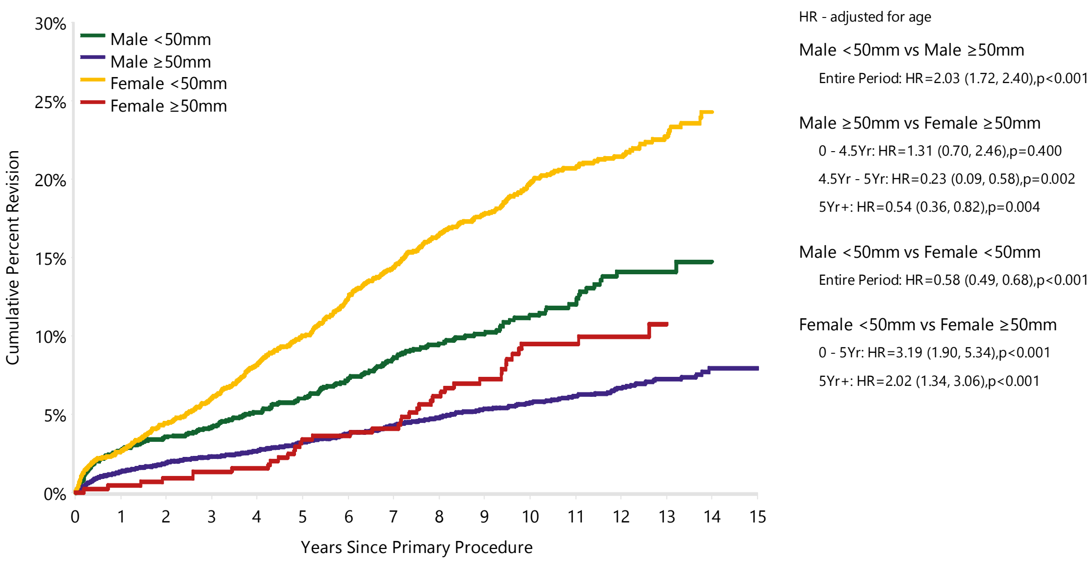


Table HT58 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender and Head Size (Primary Diagnosis OA)

Gender	Femoral Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male		712	12479	1.6 (1.4, 1.8)	2.6 (2.3, 2.9)	3.7 (3.3, 4.0)	5.0 (4.6, 5.4)	6.6 (6.1, 7.1)	9.0 (8.1, 9.9)
	<50mm	193	2026	2.7 (2.1, 3.5)	4.2 (3.4, 5.2)	6.0 (5.0, 7.2)	8.6 (7.4, 10.0)	11.3 (9.7, 13.1)	
	≥50mm	519	10453	1.3 (1.1, 1.6)	2.3 (2.0, 2.6)	3.2 (2.9, 3.6)	4.3 (3.9, 4.7)	5.7 (5.2, 6.3)	7.9 (7.0, 9.0)
Female		585	3259	2.3 (1.8, 2.9)	5.4 (4.7, 6.2)	9.1 (8.2, 10.1)	12.9 (11.8, 14.1)	18.3 (16.9, 19.7)	
	<50mm	546	2808	2.6 (2.1, 3.3)	6.0 (5.2, 7.0)	10.0 (9.0, 11.2)	14.4 (13.1, 15.7)	19.7 (18.2, 21.3)	
	≥50mm	39	451	0.4 (0.1, 1.8)	1.3 (0.6, 3.0)	3.4 (2.1, 5.6)	4.1 (2.6, 6.4)	9.5 (6.9, 12.9)	
TOTAL		1297	15738						

Note: Excludes one male procedure with unknown head size

Figure HT66 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender and Head Size (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	<50mm	2026	1898	1759	1556	1215	583	3
	≥50mm	10453	10027	9244	8300	6663	3782	53
Female	<50mm	2808	2727	2616	2464	2139	1292	18
	≥50mm	451	447	441	422	389	269	4

Knee Replacement

Knee Replacement

CATEGORIES OF KNEE REPLACEMENT

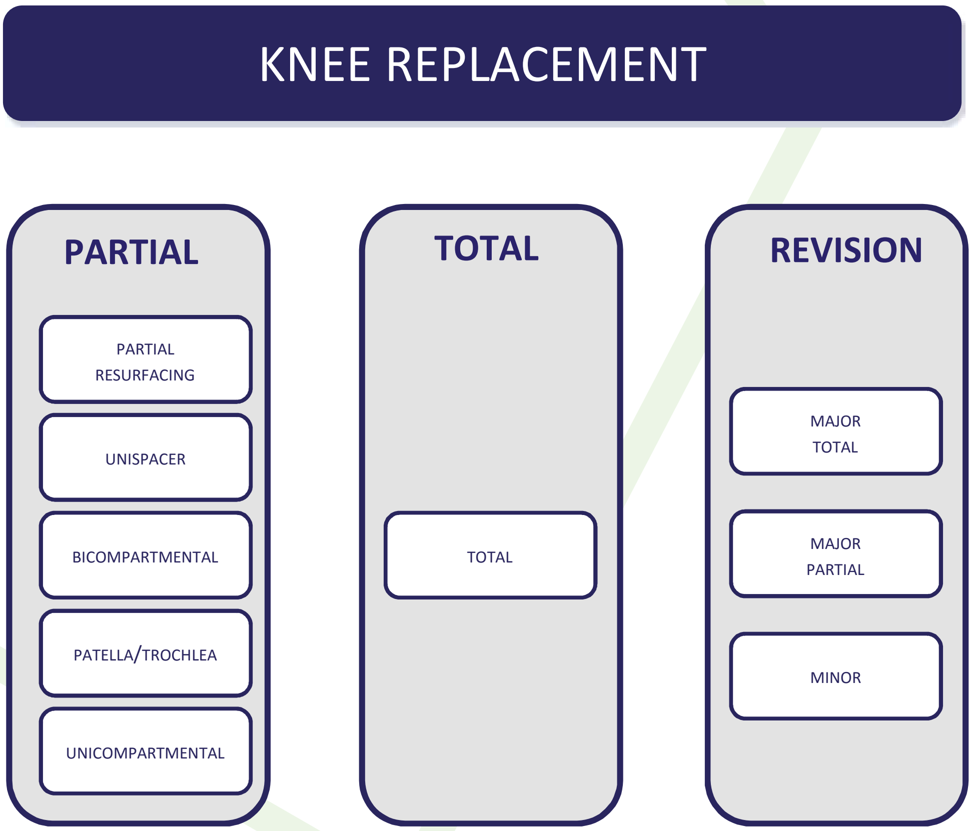
The Registry groups knee replacement into three broad categories: primary partial, primary total and revision knee replacement.

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 sub-categorised 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 sub-categorised into three classes: major total, major partial, or 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 aoanjrr.sahmri.com/annual-reports-2016



USE OF KNEE REPLACEMENT

This report analyses 592,577 knee replacements reported to the Registry with a procedure date up to and including 31 December 2015. This is an additional 57,860 knee procedures compared to the number reported last year. When considering all knee procedures currently recorded by the Registry, primary partial knees account for 8.4%, primary total knees 83.5% and revision knee replacement 8.2% (Table K1).

Table K1 Number of Knee Replacements

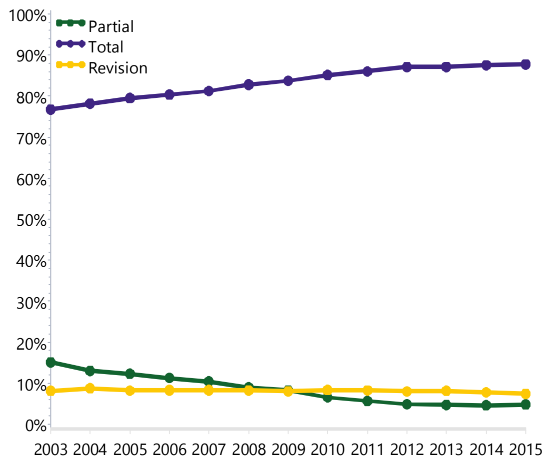
Knee Category	Number	Percent
Partial	49504	8.4
Total	494571	83.5
Revision	48502	8.2
TOTAL	592577	100.0

In 2015, the number of knee replacements undertaken increased by 3,162 (5.9%) compared to 2014. During the last year, primary partial and primary total knee replacement increased by 10.0% and 6.1% respectively. There was a slight increase in revision knee replacement (0.7%).

Since 2003, the number of knee replacement procedures undertaken per year has increased by 101.5%. Primary total knee replacement has increased by 130.4% and revision knee replacement by 82.9%. Primary partial knee replacement has decreased by 35.4%.

In 2015, primary total knee replacement accounted for 87.7% of all knee replacement procedures. This has increased from 76.7% in 2003. Primary partial knee replacement decreased from 15.1% in 2003 to 4.8% in 2015. The proportion of revision knee procedures has declined from a peak of 8.8% in 2004 to 7.4% in 2015. This equates to 795 less revision procedures in 2015 than would have been expected if the proportion of revision procedures had remained at 8.8% (Figure K1).

Figure K1 Proportion of Knee Replacements



ASA SCORE AND BMI IN KNEE REPLACEMENT

For the first time, the Registry is reporting demographic data for knee replacement procedures on 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 is ASA score data on 145,698 knee replacement procedures and BMI data on 47,703 procedures. In 2015 the ASA score was reported in 99.2% of knee replacement procedures and BMI was reported in 83.3% of procedures. In 2015 the percentage of procedures where the ASA score was reported for primary partial knees was 99.1%, primary total knee 99.3% and revision knee replacement 98.9%. BMI was reported for 86.0% of primary partial knees, 83.5% of primary total knees and 79.8% of revision knee replacements.

The Registry commenced collecting ASA score and BMI as both are known to impact on the outcome of knee replacement surgery. These measures have not been collected for a sufficient length of time to enable outcome analyses to be undertaken. The Registry will be able to commence reporting the effect of BMI and ASA score on early outcomes in subsequent reports. This data will also be used for risk adjustment of a range of analyses in the future.

ASA SCORE

There are five ASA score classifications (https://www.asahq.org/resources/clinical-information/asa-physical-status-classification-system)

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 92.0% of patients have an ASA score of 2 or 3, 6.7% have a score of 1 and 1.3% have a score of 4. Very few patients have a score of 5.

There is a difference depending on the class of knee replacement. Patients who underwent a partial knee replacement have lower ASA scores (1 or 2) than those who underwent primary total knee replacement (76.6% and 63.6% respectively). Those having revision knee replacement surgery have higher ASA scores compared to both primary partial and primary total knee replacement (Table K2).

BMI

BMI is classified by the World Health Organisation into 6 main categories (http://apps.who.int/bmi/index.jsp?introPage=intro_3.html)

1. Underweight (<18.50)
2. Average (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 patients are either pre-obese or obese class 1 (61.3%). There is almost no difference in BMI when primary total and revision knee replacement are compared. BMI is lower for patients undergoing partial knee replacement with 56.5% being either average or pre-obese compared to 42.4% for primary total knee and 41.7% for revision knee replacement (Table K3).

There is a gender difference with men having a higher proportion in the average and pre-obese categories, which is most apparent in primary partial knee replacement (Figure K2).

Table K2 ASA Score by Knee Category

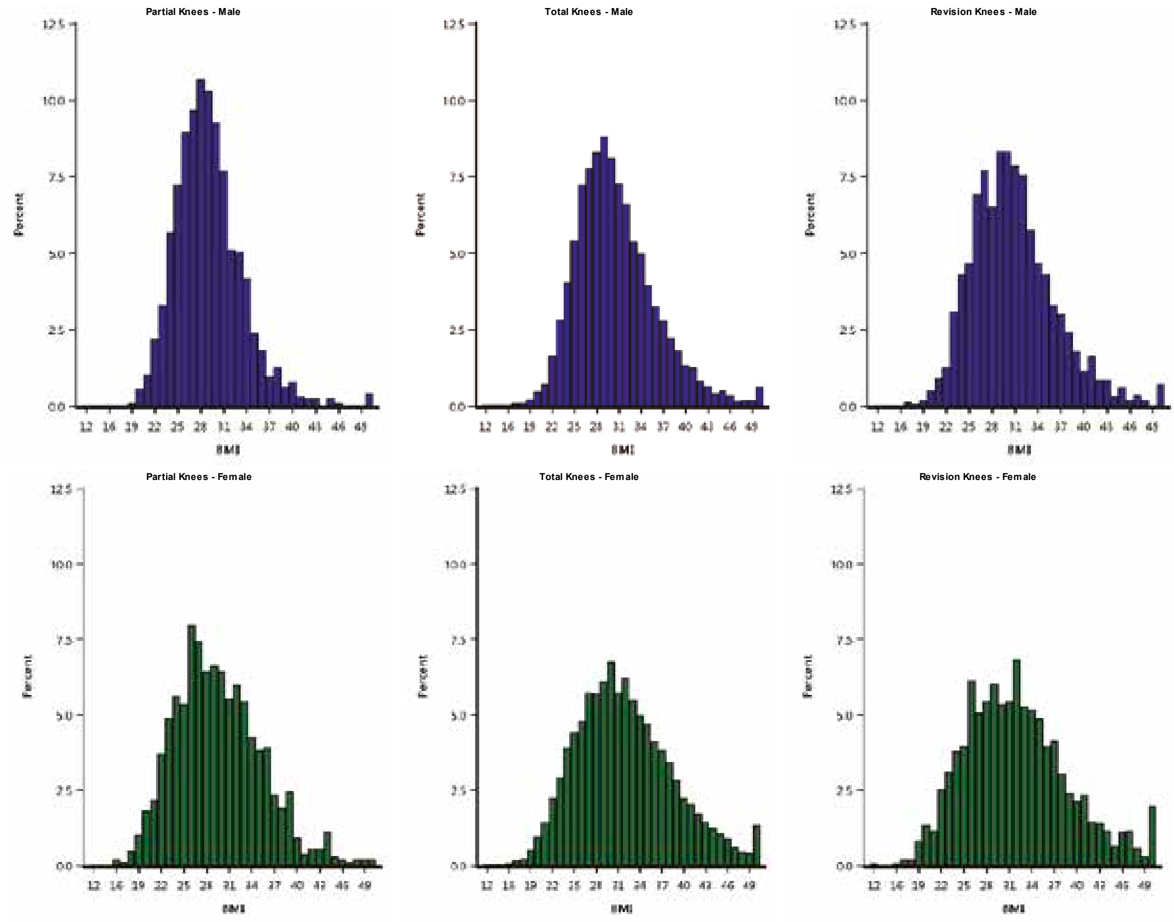
ASA Score	Partial N	Partial Col%	Total N	Total Col%	Revision N	Revision Col%	TOTAL N	TOTAL Col%
1	1051	15.1	8167	6.4	488	4.4	9706	6.7
2	4274	61.5	72929	57.2	5317	47.4	82520	56.6
3	1590	22.9	44927	35.2	5004	44.6	51521	35.4
4	29	0.4	1509	1.2	401	3.6	1939	1.3
5	1	0.0	9	0.0	2	0.0	12	0.0
TOTAL	6945	100.0	127541	100.0	11212	100.0	145698	100.0

Table K3 BMI Category for Knee Replacement by Knee Category

BMI Category	Partial N	Partial Col%	Total N	Total Col%	Revision N	Revision Col%	TOTAL N	TOTAL Col%
Underweight	6	0.3	107	0.3	8	0.2	121	0.3
Average	377	15.8	4610	11.0	394	11.5	5381	11.3
Pre Obese	969	40.7	13156	31.4	1035	30.2	15160	31.8
Obese Class 1	703	29.5	12777	30.5	1059	30.9	14539	30.5
Obese Class 2	248	10.4	6994	16.7	568	16.6	7810	16.4
Obese Class 3	79	3.3	4254	10.2	359	10.5	4692	9.8
TOTAL	2382	100.0	41898	100.0	3423	100.0	47703	100.0

Note: BMI has not been presented for patients aged 19 and under

Figure K2 BMI Distribution by Gender and Knee Category



Note: BMI has not been presented for patients aged 19 and under

Primary Partial Knee Replacement

CLASSES OF PARTIAL KNEE REPLACEMENT

The Registry sub-categorises partial knee replacement into five classes. These are defined by the type of prostheses used.

1. **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.
2. **Unispacer** involves the use of a medial or lateral femorotibial compartment articular spacer.
3. **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.
4. **Patella/trochlea** involves the use of a trochlear prosthesis to replace the femoral trochlear articular surface and on most occasions a patellar prosthesis.
5. **Unicompartmental** involves the replacement of the femoral and tibial articular surface of either the medial or lateral femorotibial compartment using unicompartmental femoral and tibial prostheses.

Detailed information on demographics of each class of primary partial 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-2016

USE OF PARTIAL KNEE REPLACEMENT

Unicompartmental knee remains the most common primary partial knee replacement, accounting for 93.1% of all partial knee replacement procedures. The second most common is patella/trochlea replacement (6.0%). The three remaining partial knee procedures are reported in small numbers (partial resurfacing, unispacer and bicompartmental knee replacement) (Table KP1).

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. Neither of these classes of partial knee replacement are presented in detail in this report.

Detailed information on unispacer and bicompartmental knee replacement is available in the supplementary report 'Outcomes of Classes No Longer Used - Hip and Knee Arthroplasty' on the AOANJRR website aoanjrr.sahmri.com/annual-reports-2016.

Osteoarthritis is the principal diagnosis for the five classes of partial knee replacement (98.9%). There is considerable variation in the outcome of primary partial knee replacement depending on the class (Table KP2).

Table KP1 Partial Knee Replacement by Class

Partial Knee Class	Number	Percent
Partial Resurfacing	224	0.5
Unispacer	40	0.1
Bicompartmental	165	0.3
Patella/Trochlea	2981	6.0
Unicompartmental	46094	93.1
TOTAL	49504	100.0

Table KP2 Cumulative Percent Revision of Primary Partial Knee Replacement by Class

Partial Knee Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Partial Resurfacing	63	224	5.5 (3.2, 9.5)	17.2 (12.7, 23.0)	24.4 (18.9, 31.2)	32.8 (26.3, 40.4)		
Unispacer	31	40	42.5 (29.0, 59.2)	67.5 (53.0, 81.2)	67.5 (53.0, 81.2)	75.0 (61.0, 87.0)	77.5 (63.7, 88.8)	
Bicompartmental	23	165	6.1 (3.3, 11.0)	11.7 (7.6, 17.7)	14.3 (9.7, 20.7)	14.3 (9.7, 20.7)		
Patella/Trochlea	517	2981	2.2 (1.7, 2.8)	8.4 (7.4, 9.6)	14.3 (12.9, 15.8)	20.1 (18.4, 22.0)	27.4 (25.1, 29.9)	
Unicompartmental	5324	46094	2.2 (2.1, 2.4)	5.7 (5.5, 6.0)	8.1 (7.9, 8.4)	10.6 (10.3, 10.9)	14.6 (14.2, 15.0)	21.0 (20.1, 21.9)
TOTAL	5958	49504						

PARTIAL RESURFACING

DEMOGRAPHICS

The Registry has recorded 224 partial resurfacing procedures, an additional 10 procedures compared to the number reported last year. The use of partial resurfacing procedures has decreased from a peak of 42 procedures in 2006.

The most common reason for undertaking a partial resurfacing procedure is osteoarthritis (88.4%). The mean age of patients with partial resurfacing knee replacement was 50.7 years and 50.9% were males (Table KP3).

All recorded partial resurfacing procedures used the 'Hemicap' range of prostheses.

Of the 224 procedures, 166 have one cap implanted, 53 have two, and five procedures have three caps implanted. Of those with one cap implanted, there were 135 femoral, 10 patellar, 11 trochlear, eight tibial and two unknown. When two caps were implanted, there were 50 femoral/trochlear and patellar, one femoral and patellar, and two where both devices were used on the femoral articular surface. When three caps were implanted, four involved patellar, trochlear and femoral articular surfaces, and one resurfaced the patellar, trochlear, femoral and tibial articular surfaces.

There are 79 procedures that involve resurfacing of the patella/trochlear joint either on one side (24) or both sides (55). This is eight more patella/trochlear procedures than reported last year. The five year cumulative percent revision for one side is 20.1% and 39.4% when both sides are resurfaced.

The main reasons for revision are progression of disease (55.6%), loosening/lysis (14.3%) and pain (9.5%).

Most primary partial resurfacing replacements are revised to either total knee replacement (57.1%) or unicompartmental (22.2%). The remainder include revision to a patella/trochlea (6.3%), addition of another resurfacing component (6.3%), patella only (6.3%), or removal of the prosthesis (1.6%).

"Most primary partial resurfacing replacements are revised to either total knee replacement (57.1%) or unicompartmental (22.2%)."

The cumulative percent revision of partial resurfacing procedures undertaken for osteoarthritis is 5.7% at one year and 36.2% at seven years (Table KP4 and Figure KP1).

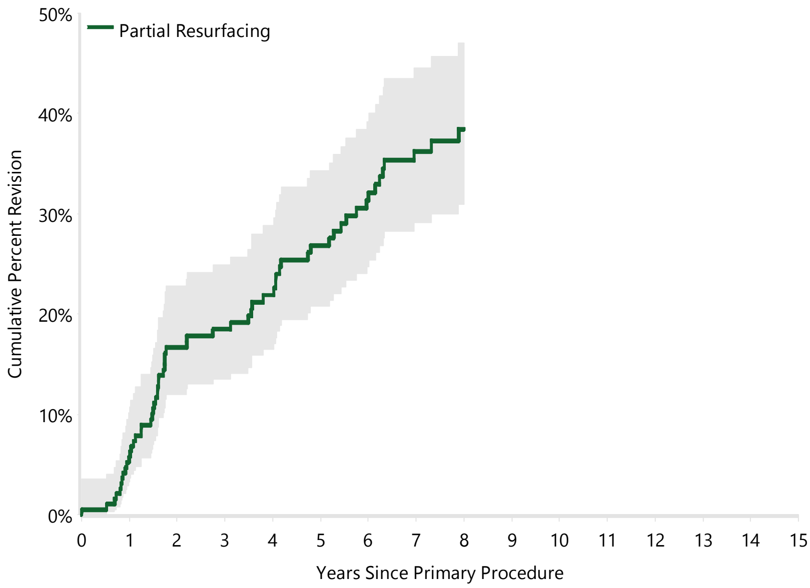
Table KP3 Age and Gender of Primary Partial Resurfacing Knee Replacement

Gender	Number	Percent	Minimum	Maximum	Median	Mean	Std Dev
Male	114	50.9%	17	85	50	50.0	14.2
Female	110	49.1%	30	88	51	51.4	12.0
TOTAL	**224**	**100.0%**	**17**	**88**	**51**	**50.7**	**13.2**

Table KP4 Cumulative Percent Revision of Primary Partial Resurfacing Knee Replacement (Primary Diagnosis OA)

Knee Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Partial Resurfacing	60	198	5.7 (3.2, 10.1)	18.4 (13.5, 24.9)	26.8 (20.7, 34.3)	36.2 (29.1, 44.5)		
TOTAL	60	198						

Figure KP1 Cumulative Percent Revision of Primary Partial Resurfacing Knee Replacement (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Partial Resurfacing	198	178	125	102	69	5	0

PATELLA/TROCHLEA

DEMOGRAPHICS

There have been 2,981 patella/trochlea knee replacements reported to the Registry. This is an additional 242 procedures compared to the previous report.

The principal diagnosis for patella/trochlear procedures is osteoarthritis (98.9%). This procedure is most frequently undertaken in females (77.1%). The mean age of patients is 59.1 years (Table KP5, Figures KP2 and KP3).

Figure KP2 Primary Patella/Trochlea Knee Replacement by Gender

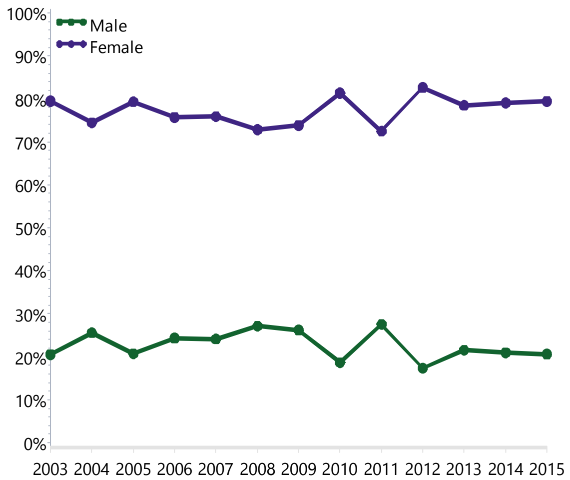
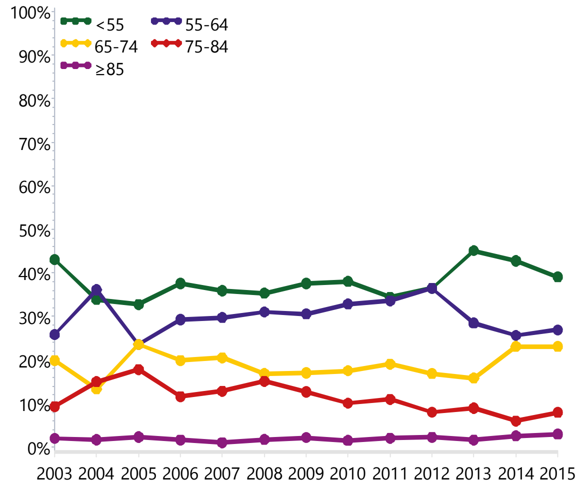


Figure KP3 Primary Patella/Trochlea Knee Replacement by Age



In 2015, the four most common resurfacing trochlear prostheses were the Gender Solutions, RBK, Journey, and Avon. The Gender Solutions prosthesis was first reported in 2009 and since 2010 it has remained the most frequently used prosthesis in this class (Table KP6).

Table KP5 Age and Gender of Primary Patella/Trochlea Knee Replacement

Gender	Number	Percent	Minimum	Maximum	Median	Mean	Std Dev
Male	683	22.9%	25	95	60	60.8	13.1
Female	2298	77.1%	22	95	58	58.6	12.0
TOTAL	**2981**	**100.0%**	**22**	**95**	**58**	**59.1**	**12.3**

Table KP6 Most Used Resurfacing Trochlear Prostheses in Primary Patella/Trochlea Knee Replacement

2003		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
56	LCS	84	Gender Solutions	94	Gender Solutions	115	Gender Solutions	111	Gender Solutions
43	Avon	46	Journey	47	RBK	41	Avon	39	RBK
29	Lubinus	41	Avon	42	Journey	37	RBK	38	Journey
13	Themis	39	RBK	26	Avon	32	Journey	36	Avon
9	MOD III	12	Sigma HP	20	Sigma HP	7	Sigma HP	7	Sigma HP
1	RBK	3	Vanguard	14	Vanguard	1	HLS Kneetec	5	Restoris MCK
				3	HLS Kneetec	1	Vanguard	2	Vanguard
Most Used									
151 (6)	100.0%	225 (6)	100.0%	246 (7)	100.0%	234 (7)	100.0%	238 (7)	100.0%

OUTCOME FOR ALL DIAGNOSES

The Registry has recorded 517 revisions of primary patella/trochlea knee replacement.

The most common reason for revision is progression of disease (45.6%), followed by loosening/lysis (19.1%) and pain (13.0%) (Table KP7).

A primary patella/trochlear procedure is usually revised to a total knee replacement (84.7%) (Table KP8).

The outcomes of patella/trochlear prosthesis combinations with more than 20 procedures are presented in Table KP9.

Table KP7 Primary Patella/Trochlea Knee Replacement by Reason for Revision

Reason for Revision	Number	Percent
Progression Of Disease	236	45.6
Loosening/Lysis	99	19.1
Pain	67	13.0
Implant Breakage Patella	22	4.3
Wear Patella	18	3.5
Malalignment	14	2.7
Infection	13	2.5
Other	48	9.3
TOTAL	517	100.0

Table KP8 Primary Patella/Trochlea Knee Replacement by Type of Revision

Type of Revision	Number	Percent
TKR (Tibial/Femoral)	438	84.7
Patella Only	50	9.7
Patella/Trochlea Resurfacing	20	3.9
UKR (Uni Tibial/Uni Femoral)	5	1.0
Removal of Prostheses	2	0.4
Cement Spacer	2	0.4
TOTAL	517	100.0

Table KP9 Cumulative Percent Revision of Primary Patella/Trochlea Knee Replacement by Prosthesis Combination

Resurfacing Trochlea	Patella	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Avon	Avon	48	343	0.9 (0.3, 2.8)	7.2 (4.7, 10.8)	12.8 (9.3, 17.4)	16.3 (12.1, 21.6)		
Avon	Kinemax Plus	74	307	2.0 (0.9, 4.3)	4.9 (3.0, 8.0)	11.9 (8.8, 16.2)	17.9 (13.9, 22.8)	22.7 (18.1, 28.1)	
Avon	Triathlon	1	60	0.0 (0.0, 0.0)	2.7 (0.4, 17.7)				
Gender Solutions	Natural Knee Flex	5	28	0.0 (0.0, 0.0)	14.7 (4.9, 39.0)	14.7 (4.9, 39.0)			
Gender Solutions	Nexgen	30	570	1.6 (0.8, 3.2)	5.6 (3.7, 8.5)	6.5 (4.3, 9.7)			
Journey	Genesis II	40	398	1.6 (0.7, 3.6)	7.2 (4.9, 10.5)	12.1 (8.7, 16.6)	15.0 (10.9, 20.4)		
LCS	LCS	140	395	3.5 (2.1, 5.9)	11.7 (8.9, 15.3)	20.9 (17.2, 25.3)	27.9 (23.7, 32.7)	38.2 (32.9, 44.0)	
Lubinus	Duracon	23	77	2.6 (0.7, 10.0)	9.2 (4.5, 18.4)	16.0 (9.4, 26.4)	18.8 (11.6, 29.6)	25.3 (16.6, 37.2)	
Lubinus	Lubinus	18	39	5.1 (1.3, 19.0)	18.1 (9.1, 34.3)	20.9 (11.0, 37.6)	29.4 (17.4, 46.9)	35.3 (22.2, 53.0)	
MOD III	MOD III	20	63	4.8 (1.6, 14.0)	14.3 (7.7, 25.7)	17.5 (10.1, 29.4)	19.2 (11.4, 31.4)	26.2 (16.9, 39.2)	39.1 (26.3, 55.4)
RBK	RBK	60	443	2.4 (1.3, 4.4)	8.5 (6.1, 11.9)	13.9 (10.6, 18.2)	19.7 (15.3, 25.3)		
Sigma HP	PFC Sigma	17	102	4.1 (1.6, 10.5)	16.0 (9.8, 25.7)				
Themis	Themis	10	38	2.6 (0.4, 17.2)	2.6 (0.4, 17.2)	8.0 (2.6, 22.7)	8.0 (2.6, 22.7)	18.9 (9.5, 35.6)	
Vanguard	Series A	9	41	2.5 (0.4, 16.5)	16.6 (7.8, 33.5)				
Other (25)		22	77	4.2 (1.4, 12.4)	13.1 (7.0, 23.7)	16.3 (9.4, 27.6)	28.6 (18.6, 42.5)	39.2 (26.2, 55.9)	
TOTAL		517	2981						

Note: Only combinations with over 20 procedures have been listed

OUTCOME FOR OSTEOARTHRITIS

The cumulative percent revision for primary patella/trochlea knee replacement undertaken for osteoarthritis is 14.3% at five years and 27.4% at 10 years (Table KP10 and Figure KP4).

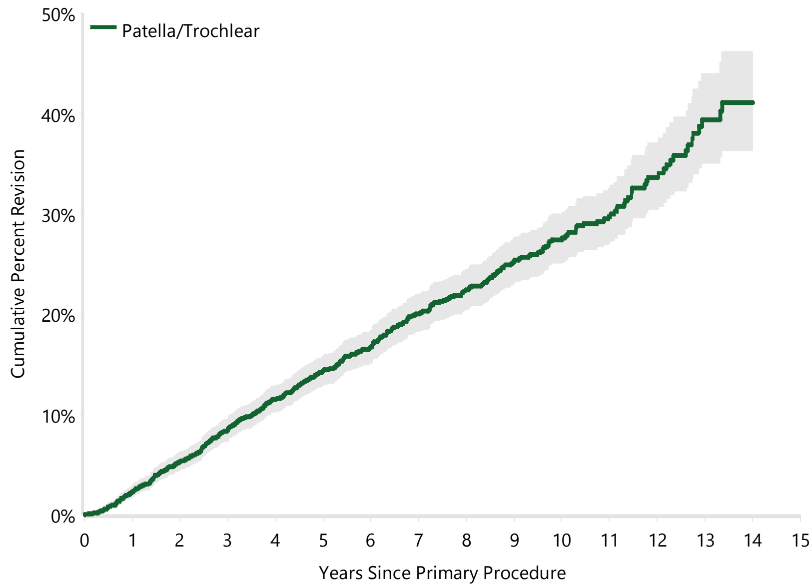
Age and gender are risk factors for revision. Patients younger than 65 years of age have a higher rate of revision than patients 65 years or older (Table KP11 and Figure KP5).

Males have a higher rate of revision than females (Table KP12 and Figure KP6).

Table KP10 Cumulative Percent Revision of Primary Patella/Trochlea Knee Replacement (Primary Diagnosis OA)

Knee Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Patella/Trochlea	510	2948	2.3 (1.8, 2.9)	8.4 (7.4, 9.6)	14.3 (12.9, 15.8)	20.0 (18.3, 21.9)	27.4 (25.1, 29.9)	
TOTAL	510	2948						

Figure KP4 Cumulative Percent Revision of Primary Patella/Trochlea Knee Replacement (Primary Diagnosis OA)

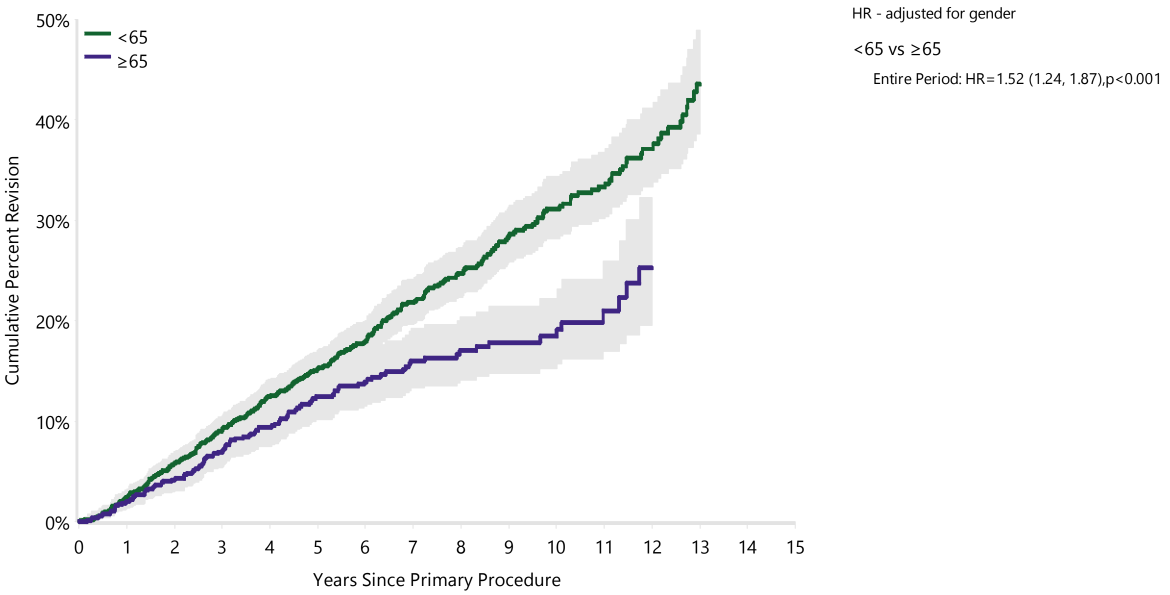


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Patella/Trochlea	2948	2648	2003	1444	935	400	14

Table KP11 Cumulative Percent Revision of Primary Patella/Trochlea Knee Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
<65	393	2010	2.4 (1.8, 3.2)	9.1 (7.8, 10.5)	15.2 (13.5, 17.1)	21.8 (19.6, 24.2)	31.1 (28.2, 34.3)	
≥65	117	938	1.9 (1.2, 3.1)	6.9 (5.4, 8.9)	12.4 (10.2, 15.1)	16.0 (13.3, 19.3)	18.4 (15.2, 22.2)	
TOTAL	510	2948						

Figure KP5 Cumulative Percent Revision of Primary Patella/Trochlea Knee Replacement by Age (Primary Diagnosis OA)

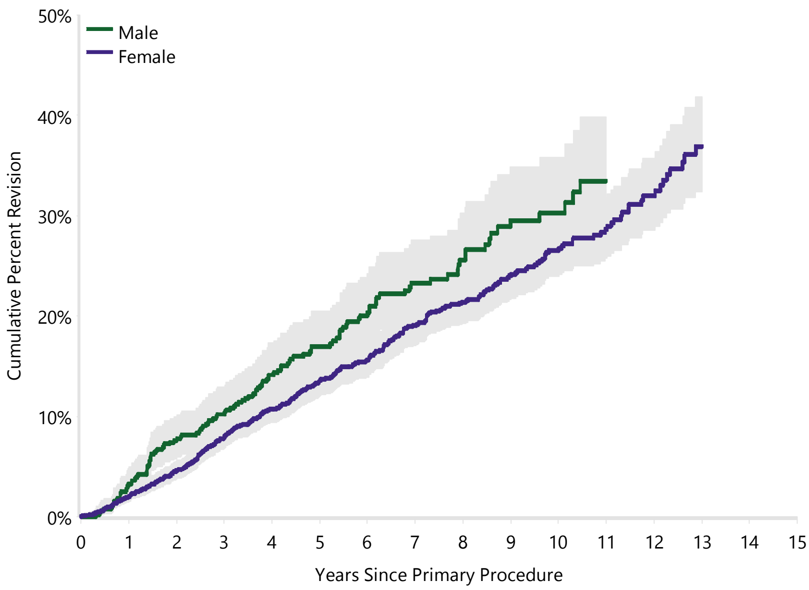


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
<65	2010	1813	1374	995	640	280	14
≥65	938	835	629	449	295	120	0

Table KP12 Cumulative Percent Revision of Primary Patella/Trochlea Knee Replacement by Gender (Primary Diagnosis OA)

Gender	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	136	677	3.3 (2.1, 5.0)	10.2 (8.0, 12.9)	17.0 (14.0, 20.5)	23.3 (19.6, 27.5)	30.3 (25.5, 35.8)	
Female	374	2271	1.9 (1.4, 2.6)	7.9 (6.8, 9.2)	13.5 (12.0, 15.2)	19.0 (17.1, 21.2)	26.5 (23.9, 29.4)	
TOTAL	510	2948						

Figure KP6 Cumulative Percent Revision of Primary Patella/Trochlea Knee Replacement by Gender (Primary Diagnosis OA)



HR - adjusted for age

Male vs Female

Entire Period: HR=1.30 (1.07, 1.59),p=0.008

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	677	606	454	322	203	75	4
Female	2271	2042	1549	1122	732	325	10

UNICOMPARTMENTAL

DEMOGRAPHICS

This year the Registry is reporting on 46,094 unicompartmental knee procedures, an additional 2,551 procedures compared to the last report.

The use of unicompartmental knee replacement increased by 11.1% in 2015 compared to 2014, however its usage has decreased by 38.9% since 2003. As a percentage of all knee replacements, unicompartmental knee replacement has increased from 4.2% in 2014 to 4.4% in 2015. This remains considerably less than 14.5% which was the percentage in 2003.

Osteoarthritis is the principal diagnosis, accounting for 99.0% of primary unicompartmental knee replacement procedures.

This procedure is undertaken more often in males (52.6%) (Table KP13). The proportion of males has steadily increased from 50.3% in 2007 to 56.4% in 2015 (Figure KP7).

Unicompartmental knee replacement is most frequently undertaken in patients aged between 55 and 74 years (65.9%). The age distribution has remained relatively stable since 2003 (Figure KP8). The mean age of patients is 65.3 years (Table KP13).

Figure KP8 Primary Unicompartmental Knee Replacement by Age

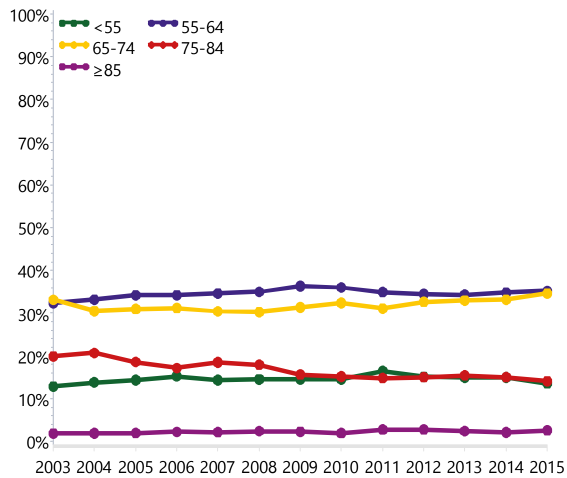
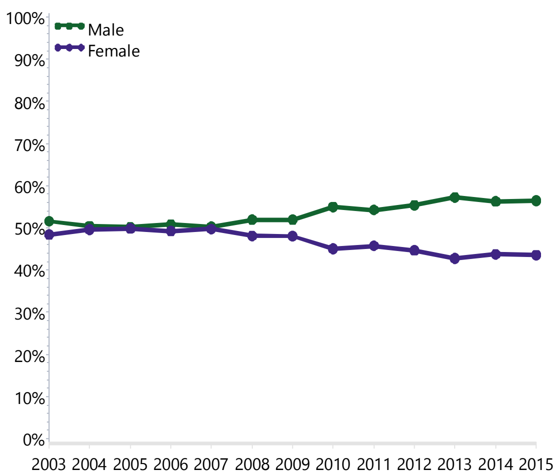


Figure KP7 Primary Unicompartmental Knee Replacement by Gender



In 2015, the 10 most used tibial prostheses accounted for 94.7% of all unicompartmental procedures. The ZUK, Oxford and Oxford 3 remain the most used prostheses in 2015 (Table KP14).

Table KP13 Age and Gender of Primary Unicompartmental Knee Replacement

Gender	Number	Percent	Minimum	Maximum	Median	Mean	Std Dev
Male	24253	52.6%	24	98	65	65.7	9.6
Female	21841	47.4%	25	95	64	64.8	10.3
TOTAL	46094	100.0%	24	98	65	65.3	10.0

Table KP14 10 Most Used Tibial Prostheses in Primary Unicompartmental Knee Replacement

2003		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
1366	Oxford 3	490	ZUK	577	ZUK	669	ZUK	728	ZUK
444	Repicci II	421	Oxford	492	Oxford	657	Oxford	706	Oxford
373	Preservation Fixed	390	Oxford 3	389	Oxford 3	380	Oxford 3	374	Oxford 3
353	M/G	208	Unix	167	Unix	130	Sigma HP	145	Restoris MCK
336	Allegretto Uni	90	Repicci II	96	Sigma HP	95	Unix	127	Sigma HP
321	GRU	69	Sigma HP	68	Repicci II	52	Journey Deuce	113	Unix
275	Genesis	68	Freedom PKR/Active	64	Journey Deuce	51	Freedom PKR/Active	54	Triathlon PKR
260	Unix	64	Journey Deuce	63	Freedom PKR/Active	47	Endo-Model Sled	46	GRU
121	Preservation Mobile	55	GRU	37	Endo-Model Sled	33	Repicci II	45	Repicci II
101	Endo-Model Sled	46	Journey	36	BalanSys Uni Fixed	28	BalanSys Uni Fixed	40	Journey Deuce
10 Most Used									
3950 (10)	96.1%	1901 (10)	88.6%	1989 (10)	93.2%	2142 (10)	94.7%	2378 (10)	94.7%
Remainder									
159 (7)	3.9%	245 (12)	11.4%	146 (10)	6.8%	119 (10)	5.3%	134 (10)	5.3%
TOTAL									
4109 (17)	100.0%	2146 (22)	100.0%	2135 (20)	100.0%	2261 (20)	100.0%	2512 (20)	100.0%

OUTCOME FOR ALL DIAGNOSES

The Registry has recorded 5,324 revisions of primary unicompartmental knee replacements.

The main reasons for revision are loosening/lysis (43.5%), progression of disease (29.4%) and pain (9.5%) (Table KP15 and Figure KP9).

The main type of revision is to a total knee replacement (86.6%) (Table KP16).

The outcomes of unicompartmental knee prosthesis combinations with more than 200 procedures reported to the Registry are presented in Table KP17.

Table KP15 Primary Unicompartmental Knee Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	2317	43.5
Progression Of Disease	1566	29.4
Pain	508	9.5
Infection	220	4.1
Fracture	122	2.3
Bearing Dislocation	108	2.0
Wear Tibial Insert	65	1.2
Malalignment	56	1.1
Instability	55	1.0
Wear Tibial	47	0.9
Other	260	4.9
TOTAL	5324	100.0

Table KP16 Primary Unicompartmental Knee Replacement by Type of Revision

Type of Revision	Number	Percent
TKR (Tibial/Femoral)	4612	86.6
Uni Insert Only	310	5.8
Uni Tibial Component	196	3.7
Uni Femoral Component	68	1.3
UKR (Uni Tibial/Uni Femoral)	62	1.2
Cement Spacer	43	0.8
Patellar/Trochlear Resurfacing	9	0.2
Removal of Prostheses	7	0.1
Reinsertion of Components	6	0.1
Patella Only	5	0.1
Femoral Component*	3	0.1
Cement Only	2	0.0
Insert Only	1	0.0
TOTAL	5324	100.0

*Bicompartmental Component

Figure KP9 Cumulative Incidence Revision Diagnosis of Primary Unicompartmental Knee Replacement

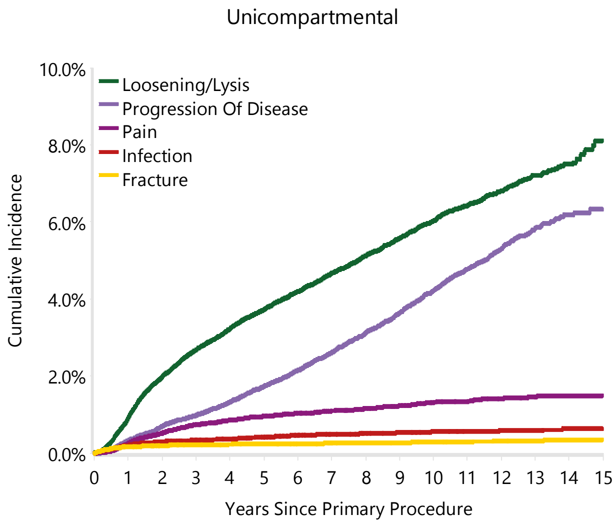


Table KP17 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Prosthesis Combination

Uni Femoral	Uni Tibial	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Allegretto Uni	Allegretto Uni	295	2035	3.2 (2.5, 4.0)	5.8 (4.9, 6.9)	8.0 (6.9, 9.3)	10.3 (9.0, 11.7)	14.5 (12.9, 16.2)	19.7 (17.4, 22.2)
BalanSys Uni	BalanSys Uni Fixed	19	374	1.7 (0.8, 3.7)	2.9 (1.6, 5.3)	4.1 (2.4, 7.0)	5.6 (3.4, 9.2)	8.8 (5.3, 14.4)	
Endo-Model Sled	Endo-Model Sled	141	1189	1.0 (0.6, 1.8)	4.8 (3.7, 6.2)	7.7 (6.2, 9.5)	9.6 (7.9, 11.6)	14.6 (12.3, 17.3)	
Freedom PKR/Active	Freedom PKR/Active	257	1488	1.6 (1.1, 2.4)	7.4 (6.1, 8.9)	12.7 (11.1, 14.7)	17.4 (15.4, 19.6)	24.0 (21.2, 27.1)	
GRU	GRU	222	2037	1.4 (0.9, 2.0)	4.4 (3.6, 5.5)	6.1 (5.1, 7.2)	8.2 (7.1, 9.6)	12.7 (11.1, 14.5)	
Genesis	Genesis	294	1864	2.7 (2.0, 3.5)	8.3 (7.1, 9.6)	10.9 (9.6, 12.4)	13.1 (11.6, 14.7)	16.3 (14.6, 18.2)	
Journey	Journey	15	228	1.3 (0.4, 4.1)	6.3 (3.7, 10.6)	7.6 (4.6, 12.3)			
Journey	Journey Deuce	10	241	2.4 (1.0, 5.7)	4.5 (2.2, 9.1)	4.5 (2.2, 9.1)			
M/G	M/G	241	2135	1.6 (1.1, 2.2)	4.1 (3.4, 5.1)	6.4 (5.4, 7.5)	8.1 (7.0, 9.3)	10.5 (9.2, 12.0)	
Oxford	Oxford 3	21	954	1.7 (1.0, 2.9)	2.5 (1.6, 4.0)	4.7 (2.3, 9.4)			
Oxford 3	Oxford	153	3177	3.0 (2.4, 3.7)	5.1 (4.3, 6.0)	7.0 (5.8, 8.3)			
Oxford 3	Oxford 3	1682	12084	2.3 (2.0, 2.6)	6.0 (5.5, 6.4)	8.5 (8.0, 9.1)	11.1 (10.5, 11.7)	14.9 (14.2, 15.7)	21.6 (20.1, 23.3)
Preservation	Preservation Fixed	352	2318	2.4 (1.9, 3.1)	7.1 (6.1, 8.2)	9.5 (8.4, 10.8)	11.8 (10.5, 13.2)	15.4 (13.9, 17.0)	
Preservation	Preservation Mobile	120	400	5.3 (3.5, 7.9)	15.5 (12.3, 19.5)	19.1 (15.6, 23.3)	21.7 (17.9, 26.1)	27.1 (23.0, 31.9)	
Repicci II	Repicci II	502	3026	1.6 (1.2, 2.1)	4.5 (3.8, 5.3)	7.5 (6.6, 8.5)	10.6 (9.5, 11.8)	17.3 (15.8, 18.9)	
Sigma HP	Sigma HP	24	700	1.1 (0.5, 2.3)	3.4 (2.1, 5.3)	4.8 (3.1, 7.4)	5.5 (3.5, 8.7)		
Uniglide	Uniglide	124	743	4.9 (3.6, 6.7)	10.7 (8.7, 13.2)	13.0 (10.7, 15.7)	16.0 (13.4, 18.9)	18.9 (15.9, 22.3)	
Unix	Unix	360	3798	2.4 (2.0, 3.0)	5.3 (4.6, 6.1)	7.1 (6.3, 8.0)	8.9 (7.9, 9.9)	11.7 (10.5, 13.0)	
ZUK	ZUK	214	5201	1.4 (1.1, 1.8)	3.6 (3.0, 4.2)	4.6 (4.0, 5.3)	5.7 (4.9, 6.6)	8.1 (6.5, 10.2)	
Other (32)		278	2102	3.6 (2.8, 4.5)	8.5 (7.3, 9.9)	11.0 (9.6, 12.6)	14.7 (13.0, 16.6)	19.7 (17.5, 22.2)	
TOTAL		**5324**	**46094**						

Note: Only combinations with over 200 procedures have been listed

OUTCOME FOR OSTEOARTHRITIS

The cumulative percent revision at 15 years for primary unicompartmental knee replacement undertaken for osteoarthritis is 21.0% (Table KP18 and Figure KP10).

Age is a major factor affecting the outcome of primary unicompartmental knee replacement, with the rate of revision decreasing with increasing age (Table KP19 and Figure KP11).

Females have a higher rate of revision, and the effect of age on the rate of revision is evident in both males and females (Table KP20 and Figures KP12 - KP14).

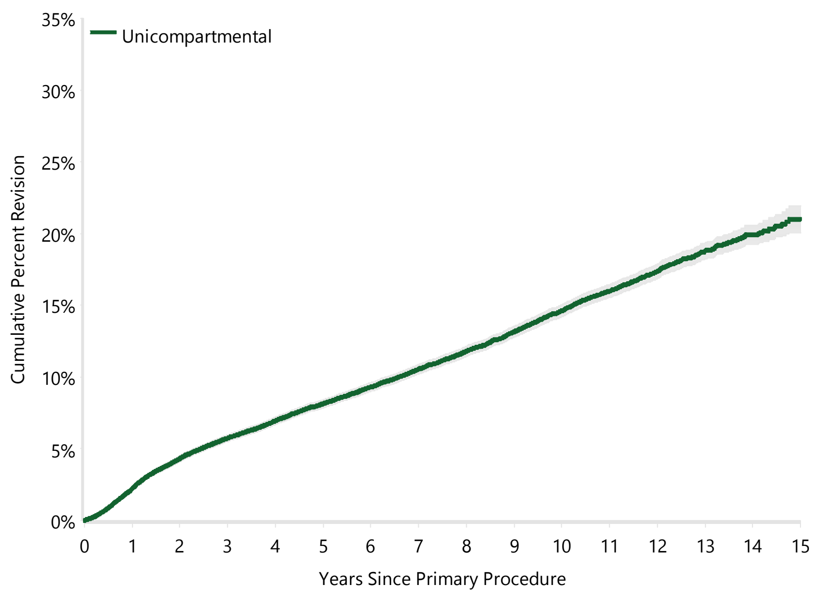
Comparison of Medial and Lateral Unicompartmental Knee Replacement

The Registry has information on 1,885 lateral procedures undertaken for osteoarthritis. There is no difference in the rate of revision when compared to medial unicompartmental knee replacement (Table KP21 and Figure KP15). The outcome of prosthesis combinations with more than 50 procedures used in lateral unicompartmental knee replacement is presented in Table KP22.

Table KP18 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement (Primary Diagnosis OA)

Knee Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Unicompartmental	5260	45615	2.2 (2.1, 2.4)	5.7 (5.5, 6.0)	8.1 (7.9, 8.4)	10.5 (10.2, 10.9)	14.6 (14.2, 15.0)	21.0 (20.1, 21.9)
TOTAL	5260	45615						

Figure KP10 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement (Primary Diagnosis OA)

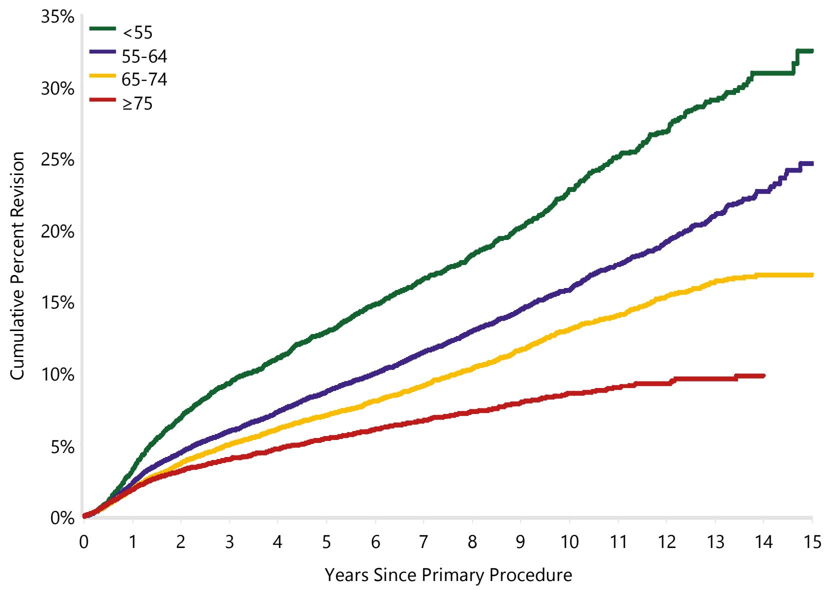


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Unicompartmental	45615	41978	35694	29856	23357	13014	306

Table KP19 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
<55	1211	6531	3.3 (2.8, 3.7)	9.3 (8.6, 10.0)	12.8 (12.0, 13.7)	16.6 (15.6, 17.6)	22.8 (21.5, 24.1)	32.5 (29.7, 35.4)
55-64	1992	15455	2.3 (2.1, 2.6)	6.0 (5.6, 6.4)	8.7 (8.2, 9.2)	11.5 (10.9, 12.0)	15.8 (15.1, 16.5)	24.6 (22.8, 26.5)
65-74	1477	14644	1.9 (1.7, 2.1)	5.0 (4.6, 5.4)	7.0 (6.6, 7.5)	9.1 (8.6, 9.7)	13.0 (12.3, 13.7)	16.8 (15.9, 17.9)
≥75	580	8985	1.8 (1.6, 2.1)	4.0 (3.6, 4.4)	5.4 (4.9, 5.9)	6.7 (6.1, 7.3)	8.6 (7.9, 9.3)	
TOTAL	5260	45615						

Figure KP11 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Age (Primary Diagnosis OA)



HR - adjusted for gender

55-64 vs ≥75

0 - 6Mth: HR=1.07 (0.84, 1.37),p=0.578

6Mth - 2Yr: HR=1.55 (1.34, 1.79),p<0.001

2Yr - 4.5Yr: HR=1.96 (1.67, 2.30),p<0.001

4.5Yr - 6Yr: HR=2.06 (1.66, 2.55),p<0.001

6Yr - 8Yr: HR=2.49 (2.04, 3.04),p<0.001

8Yr - 10Yr: HR=2.41 (1.88, 3.08),p<0.001

10Yr+: HR=4.01 (3.09, 5.22),p<0.001

65-74 vs ≥75

0 - 1.5Yr: HR=1.12 (0.96, 1.31),p=0.142

1.5Yr - 4Yr: HR=1.58 (1.35, 1.84),p<0.001

4Yr - 7Yr: HR=1.55 (1.30, 1.85),p<0.001

7Yr+: HR=2.17 (1.77, 2.67),p<0.001

<55 vs ≥75

0 - 6Mth: HR=1.31 (0.97, 1.76),p=0.073

6Mth - 2Yr: HR=2.50 (2.14, 2.93),p<0.001

2Yr - 5Yr: HR=2.88 (2.44, 3.40),p<0.001

5Yr - 7Yr: HR=3.14 (2.52, 3.91),p<0.001

7Yr - 9Yr: HR=3.18 (2.47, 4.11),p<0.001

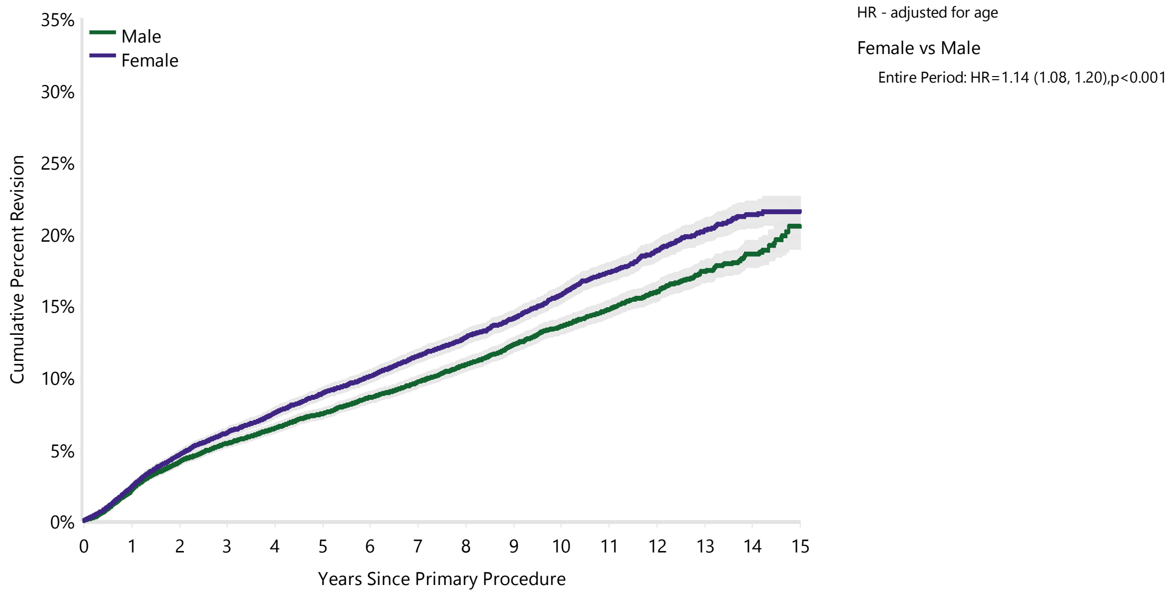
9Yr+: HR=4.99 (3.88, 6.42),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
<55	6531	5989	4993	4143	3259	1828	51
55-64	15455	14216	12186	10287	8064	4581	101
65-74	14644	13473	11491	9686	7657	4397	119
≥75	8985	8300	7024	5740	4377	2208	35

Table KP20 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Gender and Age (Primary Diagnosis OA)

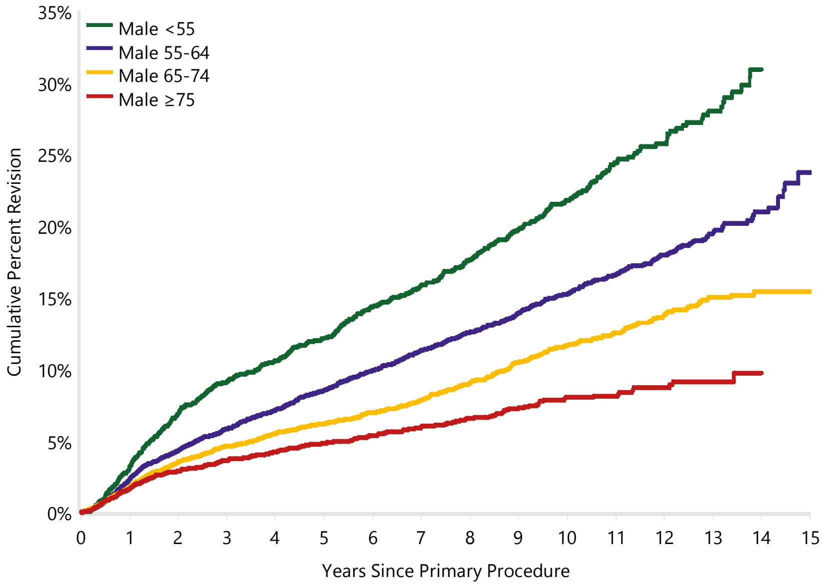
Gender	Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male		**2493**	**24049**	**2.1 (1.9, 2.3)**	**5.4 (5.1, 5.7)**	**7.5 (7.1, 7.8)**	**9.7 (9.3, 10.1)**	**13.5 (13.0, 14.1)**	**20.5 (18.9, 22.1)**
	<55	507	2876	3.2 (2.6, 3.9)	9.1 (8.1, 10.3)	12.2 (10.9, 13.5)	15.9 (14.4, 17.4)	21.8 (20.0, 23.8)	
	55-64	994	8192	2.3 (2.0, 2.7)	5.8 (5.3, 6.4)	8.5 (7.9, 9.2)	11.3 (10.6, 12.1)	15.2 (14.3, 16.2)	23.7 (21.1, 26.6)
	65-74	721	8202	1.7 (1.5, 2.0)	4.6 (4.1, 5.1)	6.2 (5.6, 6.8)	7.8 (7.2, 8.5)	11.7 (10.8, 12.6)	15.4 (14.1, 16.8)
	≥75	271	4779	1.6 (1.3, 2.0)	3.6 (3.1, 4.2)	4.8 (4.2, 5.5)	6.0 (5.2, 6.8)	8.0 (7.0, 9.1)	
Female		**2767**	**21566**	**2.4 (2.2, 2.6)**	**6.1 (5.8, 6.5)**	**8.9 (8.5, 9.3)**	**11.5 (11.0, 11.9)**	**15.7 (15.1, 16.3)**	**21.5 (20.6, 22.6)**
	<55	704	3655	3.3 (2.8, 3.9)	9.4 (8.4, 10.4)	13.4 (12.2, 14.6)	17.1 (15.8, 18.5)	23.5 (21.8, 25.2)	
	55-64	998	7263	2.3 (2.0, 2.7)	6.1 (5.5, 6.7)	8.9 (8.2, 9.6)	11.6 (10.8, 12.5)	16.3 (15.3, 17.4)	
	65-74	756	6442	2.1 (1.7, 2.5)	5.5 (4.9, 6.1)	8.1 (7.4, 8.9)	10.6 (9.8, 11.5)	14.6 (13.6, 15.7)	18.5 (17.1, 20.0)
	≥75	309	4206	2.1 (1.7, 2.6)	4.3 (3.8, 5.0)	6.1 (5.3, 6.9)	7.4 (6.6, 8.4)	9.2 (8.2, 10.3)	
TOTAL		**5260**	**45615**						

Figure KP12 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Gender (Primary Diagnosis OA)



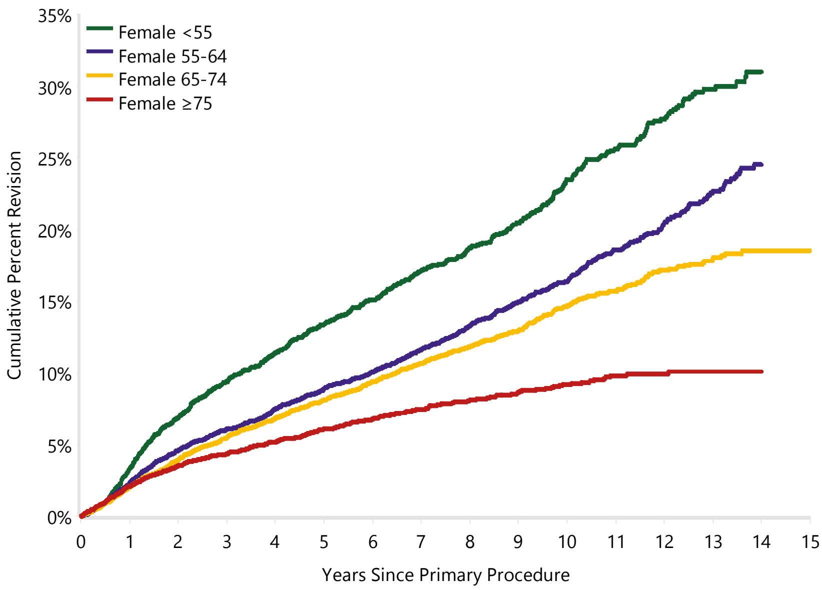
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	24049	22021	18482	15306	11821	6478	156
Female	21566	19957	17212	14550	11536	6536	150

Figure KP13 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement in Males by Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	<55	2876	2619	2168	1785	1396	761	17
	55-64	8192	7504	6364	5341	4154	2356	66
	65-74	8202	7518	6334	5289	4149	2359	57
	≥75	4779	4380	3616	2891	2122	1002	16

Figure KP14 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement in Females by Age (Primary Diagnosis OA)



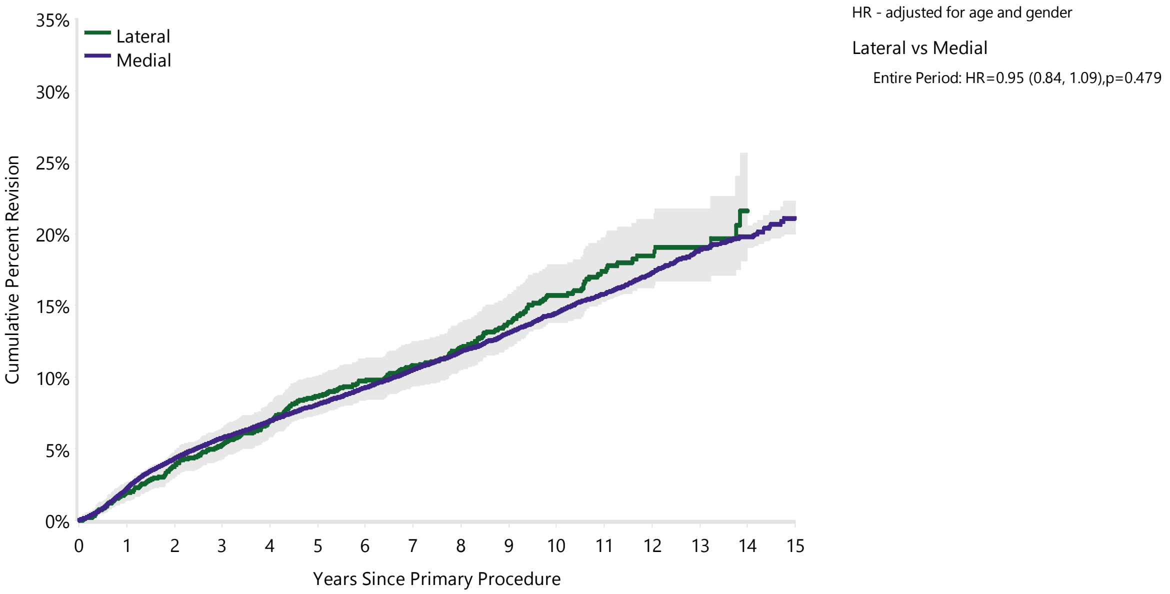
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Female	<55	3655	3370	2825	2358	1863	1067	34
	55-64	7263	6712	5822	4946	3910	2225	35
	65-74	6442	5955	5157	4397	3508	2038	62
	≥75	4206	3920	3408	2849	2255	1206	19

Table KP21 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Position (Primary Diagnosis OA)

Position	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Lateral	240	1885	2.0 (1.4, 2.7)	5.3 (4.3, 6.4)	8.6 (7.4, 10.1)	10.8 (9.4, 12.4)	15.7 (13.8, 17.8)	
Medial	4504	39660	2.2 (2.1, 2.4)	5.7 (5.5, 6.0)	8.1 (7.8, 8.4)	10.5 (10.2, 10.8)	14.4 (14.0, 14.9)	21.1 (20.0, 22.2)
TOTAL	4744	41545						

Note: Analysis excludes 4,070 primary unicompartmental knee procedures with unknown/missing position

Figure KP15 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Position (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Lateral	1885	1775	1553	1325	1076	593	18
Medial	39660	36708	31193	25909	20035	10815	221

Table KP22 Cumulative Percent Revision of Lateral Primary Unicompartmental Knee Replacement by Prosthesis Type (Primary Diagnosis OA)

Femoral Component	Tibial Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Endo-Model Sled	Endo-Model Sled	14	135	0.0 (0.0, 0.0)	4.1 (1.7, 9.6)	7.8 (4.1, 14.6)	9.1 (4.9, 16.3)		
Freedom PKR/Active	Freedom PKR/Active	17	140	0.7 (0.1, 5.1)	6.0 (3.0, 11.6)	10.5 (6.2, 17.5)	12.7 (7.8, 20.3)		
GRU	GRU	22	192	2.6 (1.1, 6.2)	4.8 (2.5, 9.0)	5.9 (3.3, 10.4)	7.7 (4.6, 12.7)	13.4 (8.8, 20.0)	
Genesis	Genesis	22	137	1.5 (0.4, 5.7)	5.8 (3.0, 11.3)	9.6 (5.7, 15.9)	12.0 (7.5, 18.8)	16.7 (11.2, 24.5)	
M/G	M/G	6	57	1.8 (0.2, 11.8)	3.5 (0.9, 13.4)	3.5 (0.9, 13.4)	3.5 (0.9, 13.4)	10.4 (4.4, 23.5)	
Oxford 3	Oxford	5	76	2.6 (0.7, 10.2)	4.3 (1.4, 12.9)	6.3 (2.4, 16.2)			
Oxford 3	Oxford 3	28	104	8.7 (4.6, 16.1)	11.6 (6.8, 19.6)	15.7 (9.9, 24.3)	18.8 (12.4, 27.9)	26.0 (18.3, 36.1)	
Preservation	Preservation Fixed	15	149	0.0 (0.0, 0.0)	3.4 (1.4, 8.0)	6.8 (3.7, 12.3)	8.3 (4.8, 14.1)	10.3 (6.2, 16.9)	
Repicci II	Repicci II	59	257	2.3 (1.1, 5.2)	6.7 (4.2, 10.6)	12.9 (9.3, 17.8)	16.0 (12.0, 21.3)	20.9 (16.1, 26.9)	
Unix	Unix	18	180	1.1 (0.3, 4.4)	3.5 (1.6, 7.7)	7.4 (4.3, 12.7)	10.3 (6.4, 16.4)	12.7 (8.0, 19.8)	
ZUK	ZUK	5	146	0.0 (0.0, 0.0)	1.7 (0.4, 6.6)	3.2 (1.0, 10.2)			
Other (27)		29	312	2.7 (1.4, 5.4)	5.8 (3.6, 9.4)	7.7 (5.0, 11.8)	9.5 (6.4, 14.1)	14.0 (9.5, 20.4)	
TOTAL		240	1885						

Note: Only combinations with over 50 procedures have been listed.

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 replacement.

In this report, the Registry details the outcome of total knee replacement based on specific patient and prosthesis characteristics. In addition, it presents the outcome for different types of total knee prostheses.

Individual prostheses are usually available as part of a knee system. The Registry subdivides knee systems into specific prosthesis types based on distinguishing prosthesis characteristics. The initial characteristic used to subdivide is the method of fixation. Further subdivision of specific knee systems is based on additional prosthesis characteristics. These include mobility, stability and flexion capacity. This further system subdivision, however, is not uniformly applied to all knee systems at this time.

High use prosthesis systems are more likely to be subdivided if there are specific reasons to do so. These may include differences or potential differences in outcome between prostheses with different characteristics within a single system.

Low use systems are unlikely to be subdivided because of small numbers or insufficient follow up. The exception is if the system is identified as having a higher than anticipated rate of revision. The Registry then undertakes catalogue range specific analysis to determine if the higher than anticipated rate of revision is associated with specific prosthesis characteristics.

To enable the Registry to undertake range specific analysis uniformly across all knee systems it is necessary to link the different catalogue ranges to the specific prosthesis characteristics. This is an ongoing process.

DEMOGRAPHICS

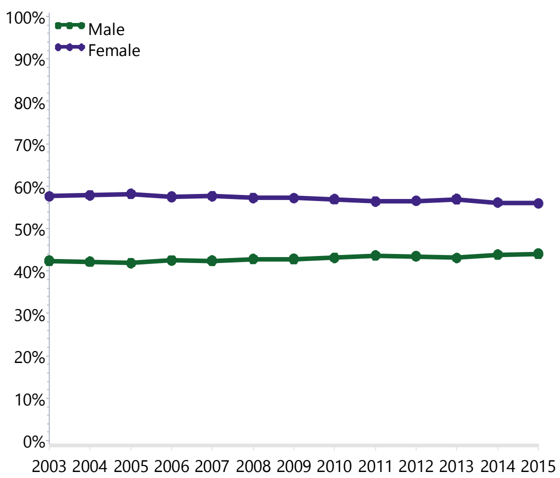
There have been 494,571 primary total knee procedures reported to the Registry, an additional 50,623 procedures compared to the last report.

Primary total knee replacement continues to increase. In 2015, there were 6.1% more procedures than 2014 and 130.4% more than 2003. As a proportion of all knee replacement procedures, primary total knee replacement increased from 76.7% in 2003 to 87.7% in 2015. Osteoarthritis is the most common diagnosis for primary total knee replacement (97.5%).

"There have been 494,571 primary total knee procedures reported to the Registry, an additional 50,623 procedures compared to the last report."

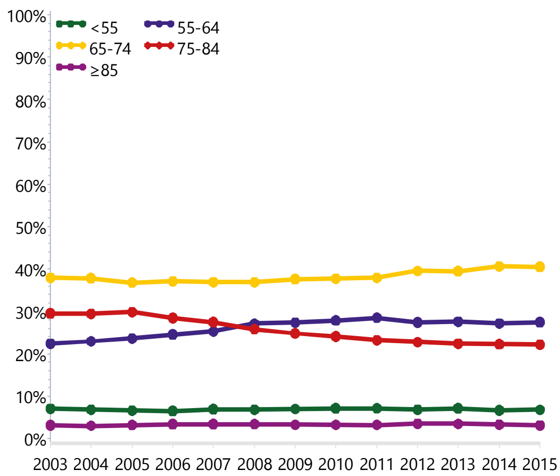
In 2015, primary total knee replacement remains more common in females (55.9%). This proportion has remained constant since 2003 (Figure KT1). The mean age of patients is 68.6 years (Table KT1).

Figure KT1 Primary Total Knee Replacement by Gender



There has been a decrease in the proportion of patients aged 75-84 years from 29.5% in 2003 to 22.2% in 2015. The proportion of patients aged less than 55 years remains small (6.8% in 2015) (Figure KT2).

Figure KT2 Primary Total Knee Replacement by Age



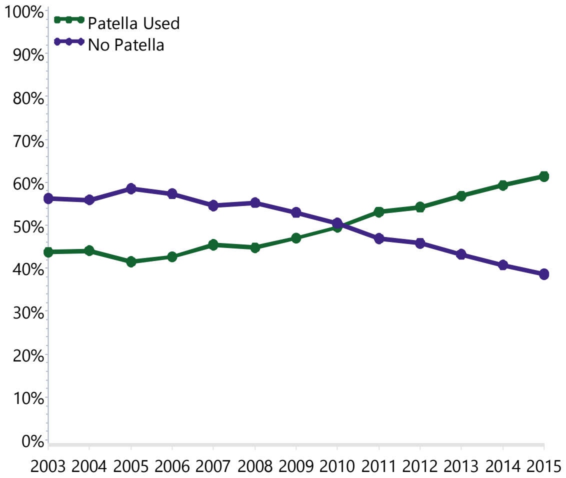
Detailed demographic information on primary total knee replacement is available in the supplementary report 'Demographics of Hip, Knee and Shoulder Arthroplasty' on the AOANJRR website aoanjrr.sahmri.com/annual-reports-2016.

Table KT1 Age and Gender of Primary Total Knee Replacement

Gender	Number	Percent	Minimum	Maximum	Median	Mean	Std Dev
Male	213255	43.1%	8	101	68	68.2	9.2
Female	281316	56.9%	11	105	69	68.9	9.5
TOTAL	494571	100.0%	8	105	69	68.6	9.4

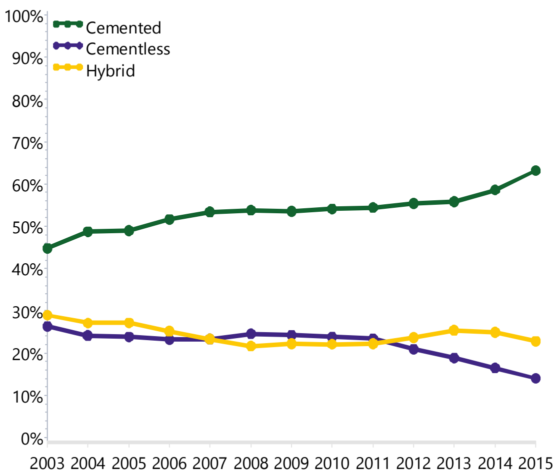
Patellar resurfacing at the time of the primary total knee replacement continues to increase from a low of 41.5% in 2005 to 61.4% in 2015 (Figure KT3).

Figure KT3 Primary Total Knee Replacement by Patella Usage



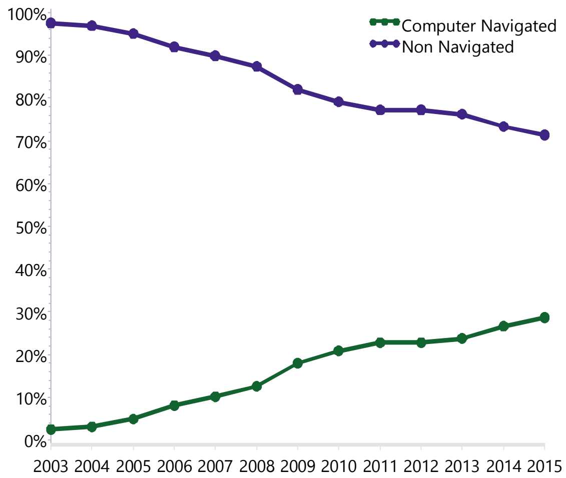
The most common method of fixation is cementing both femoral and tibial components. This has increased from 44.8% in 2003 to 63.2% in 2015. The use of cementless fixation continues to decrease from a peak of 26.3% in 2003 to 14.0% in 2015 (Figure KT4).

Figure KT4 Primary Total Knee Replacement by Fixation



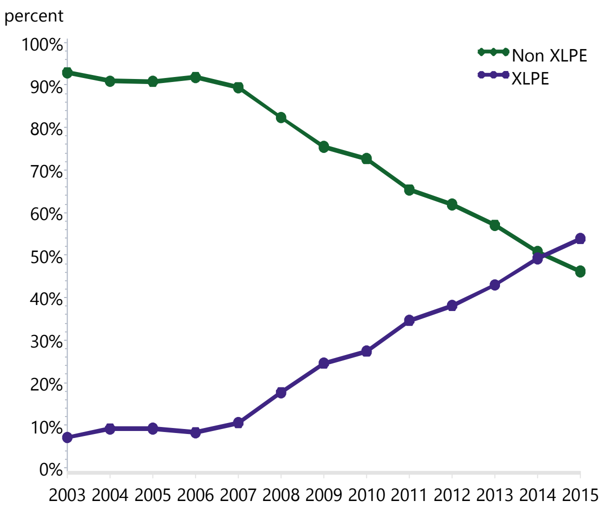
The proportion of primary total knee replacement procedures inserted with computer navigation has increased from 2.4% in 2003 to 28.6% in 2015 (Figure KT5).

Figure KT5 Primary Total Knee Replacement by Computer Navigation



The use of XLPE in primary total knee replacement continues to increase. The proportion of procedures using XLPE was 7.1% in 2003 compared to 53.9% in 2015 (Figure KT6).

Figure KT6 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. In 2015, the most commonly used femoral prosthesis was the Triathlon CR (17.1%), followed by Nexgen CR Flex (12.4%) and Vanguard CR (6.6%) (Table KT2). The reporting of the 10 most used systems for cemented, cementless and hybrid primary total knee replacement is based on the femoral prosthesis (Tables KT3 - KT5).

Table KT2 10 Most Used Femoral Prostheses in Primary Total Knee Replacement

2003		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
3184	LCS CR	6858	Triathlon CR	7403	Triathlon CR	8078	Triathlon CR	8575	Triathlon CR
2847	Duracon	5353	Nexgen CR Flex	6174	Nexgen CR Flex	6370	Nexgen CR Flex	6232	Nexgen CR Flex
2150	Nexgen CR	3315	LCS CR	3259	LCS CR	3211	LCS CR	3281	Vanguard CR
1419	PFC Sigma CR	2856	PFC Sigma CR	2813	Nexgen LPS Flex	3003	Vanguard CR	3069	Nexgen LPS Flex
1354	Scorpio CR	2725	Vanguard CR	2698	PFC Sigma CR	2891	Nexgen LPS Flex	2890	LCS CR
1058	Genesis II CR	2623	Nexgen LPS Flex	2654	Vanguard CR	2283	PFC Sigma CR	2197	Attune CR
1002	Natural Knee II	1763	Genesis II CR	1596	Genesis II CR	2013	Legion Oxinium PS	1989	Legion Oxinium PS
902	Nexgen LPS	1687	Genesis II Oxinium PS	1536	Genesis II Oxinium PS	1506	Genesis II CR	1440	PFC Sigma CR
883	Profix	1339	Genesis II PS	1390	Legion Oxinium PS	1403	Genesis II Oxinium PS	1383	Genesis II CR
751	Scorpio PS	1236	PFC Sigma PS	1292	PFC Sigma PS	1252	Genesis II PS	1380	Genesis II Oxinium PS
10 Most Used									
15550 (10)	71.5%	29755 (10)	70.1%	30815 (10)	69.3%	32010 (10)	67.8%	32436 (10)	64.8%
Remainder									
6184 (47)	28.5%	12699 (69)	29.9%	13667 (74)	30.7%	15187 (70)	32.2%	17645 (74)	35.2%
TOTAL									
21734 (57)	100.0%	42454 (79)	100.0%	44482 (84)	100.0%	47197 (80)	100.0%	50081 (84)	100.0%

Table KT3 10 Most Used Femoral Prostheses in Cemented Primary Total Knee Replacement

2003		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
1214	Duracon	3287	Triathlon CR	3396	Triathlon CR	4046	Triathlon CR	4619	Triathlon CR
948	LCS CR	2228	Nexgen LPS Flex	2389	Nexgen LPS Flex	2541	Nexgen LPS Flex	2715	Nexgen LPS Flex
824	Nexgen LPS	1916	Nexgen CR Flex	2264	Nexgen CR Flex	2354	Nexgen CR Flex	2708	Nexgen CR Flex
761	Nexgen CR	1686	Genesis II Oxinium PS	1536	Genesis II Oxinium PS	2013	Legion Oxinium PS	2197	Attune CR
690	Nexgen LPS Flex	1306	Genesis II PS	1388	Legion Oxinium PS	1403	Genesis II Oxinium PS	1989	Legion Oxinium PS
641	Genesis II CR	1192	PFC Sigma CR	1205	Genesis II PS	1283	Vanguard CR	1379	Genesis II Oxinium PS
495	Profix	1167	Genesis II CR	1170	Vanguard CR	1223	Genesis II PS	1316	Vanguard CR
471	Genesis II Oxinium CR	1103	PFC Sigma PS	1091	PFC Sigma CR	1020	PFC Sigma CR	1181	Genesis II PS
471	PFC Sigma PS	1068	Vanguard CR	1088	PFC Sigma PS	943	Genesis II CR	1119	GMK Sphere Primary
419	Genesis II PS	1031	Legion Oxinium PS	995	Genesis II CR	925	PFC Sigma PS	1069	Evolution
10 Most Used									
6934 (10)	71.3%	15984 (10)	68.0%	16522 (10)	66.6%	17751 (10)	64.2%	20292 (10)	64.1%
Remainder									
2794 (41)	28.7%	7533 (65)	32.0%	8302 (70)	33.4%	9909 (68)	35.8%	11345 (71)	35.9%
TOTAL									
9728 (51)	100.0%	23517 (75)	100.0%	24824 (80)	100.0%	27660 (78)	100.0%	31637 (81)	100.0%

Table KT4 10 Most Used Femoral Prostheses in Cementless Primary Total Knee Replacement

2003		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
1470	LCS CR	1714	Triathlon CR	1725	Triathlon CR	1660	Nexgen CR Flex	1530	Nexgen CR Flex
793	Nexgen CR	1670	Nexgen CR Flex	1707	Nexgen CR Flex	1614	Triathlon CR	1343	Triathlon CR
500	Natural Knee II	1462	LCS CR	1476	LCS CR	1425	LCS CR	1254	LCS CR
487	Active Knee	575	RBK	436	RBK	404	Vanguard CR	398	Vanguard CR
476	Duracon	458	Vanguard CR	412	Vanguard CR	384	RBK	359	Scorpio NRG CR
320	Scorpio CR	378	PFC Sigma CR	354	PFC Sigma CR	269	Score	343	RBK
314	PFC Sigma CR	375	Active Knee	248	ACS	248	Scorpio NRG CR	253	Score
303	RBK	294	Nexgen LPS Flex	242	Nexgen LPS Flex	237	PFC Sigma CR	240	Nexgen LPS Flex
187	Profix	196	Score	237	Score	203	Nexgen LPS Flex	181	PFC Sigma CR
181	Scorpio PS	195	Scorpio NRG CR	230	Active Knee	176	GMK Primary	128	ACS
10 Most Used									
5031 (10)	88.1%	7317 (10)	82.3%	7067 (10)	84.5%	6620 (10)	85.1%	6029 (10)	85.9%
Remainder									
681 (14)	11.9%	1570 (26)	17.7%	1300 (24)	15.5%	1161 (22)	14.9%	993 (19)	14.1%
TOTAL									
5712 (24)	100.0%	8887 (36)	100.0%	8367 (34)	100.0%	7781 (32)	100.0%	7022 (29)	100.0%

Table KT5 10 Most Used Femoral Prostheses in Hybrid Primary Total Knee Replacement

2003		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
1157	Duracon	1857	Triathlon CR	2282	Triathlon CR	2418	Triathlon CR	2613	Triathlon CR
766	LCS CR	1767	Nexgen CR Flex	2203	Nexgen CR Flex	2356	Nexgen CR Flex	1994	Nexgen CR Flex
764	PFC Sigma CR	1286	PFC Sigma CR	1253	PFC Sigma CR	1316	Vanguard CR	1567	Vanguard CR
737	Scorpio CR	1199	Vanguard CR	1072	Vanguard CR	1026	PFC Sigma CR	762	LCS CR
596	Nexgen CR	844	LCS CR	888	LCS CR	878	LCS CR	515	Genesis II CR
364	Genesis II CR	523	Genesis II CR	547	Genesis II CR	505	Genesis II CR	389	Scorpio CR
255	Maxim	316	Scorpio CR	351	Scorpio CR	376	Scorpio CR	361	Legion CR
247	Natural Knee II	312	Triathlon PS	319	Triathlon PS	290	Triathlon PS	361	PFC Sigma CR
204	AGC	262	Natural Knee Flex	204	PFC Sigma PS	286	Legion CR	322	Score
203	Scorpio PS	191	Legion CR	196	Active Knee	281	ACS	302	Natural Knee Flex
10 Most Used									
5293 (10)	84.1%	8557 (10)	85.1%	9315 (10)	82.5%	9732 (10)	82.8%	9186 (10)	80.4%
Remainder									
1001 (27)	15.9%	1493 (35)	14.9%	1976 (36)	17.5%	2024 (33)	17.2%	2236 (37)	19.6%
TOTAL									
6294 (37)	100.0%	10050 (45)	100.0%	11291 (46)	100.0%	11756 (43)	100.0%	11422 (47)	100.0%

OUTCOME FOR ALL DIAGNOSES

Primary Diagnosis

The most common primary diagnosis is osteoarthritis (97.5%), followed by rheumatoid arthritis (1.4%), 'other inflammatory arthritis' (0.5%) and osteonecrosis (0.3%). Rheumatoid arthritis has a lower rate of revision compared to osteoarthritis after nine months. Osteonecrosis and 'other inflammatory arthritis' have a higher rate of revision compared to osteoarthritis, however this is only evident in the first three months for the diagnosis of 'other inflammatory arthritis' (Table KT6 and Figure KT7).

Reason for Revision

Loosening/lysis (28.1%) is the main reason for revision, followed by infection (22.5%), patellofemoral pain (11.6%), pain (8.7%) and instability (6.7%) (Table KT7).

The Registry combines loosening and lysis as a single diagnosis. This is because of a common shared aetiology (particle related inflammation). This diagnosis is reported in 28.1% of all revisions and consists of 25.2% loosening, 1.9% lysis and 1.0% with both diagnoses reported together.

The Registry understands that 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.

"Loosening/lysis exceeds infection to become the most common reason for revision after three years."

The five most common reasons for revision are shown on Figure KT8. Infection is the most common reason for early revision. Loosening/lysis exceeds infection to become the most common reason after three years.

Type of Revision

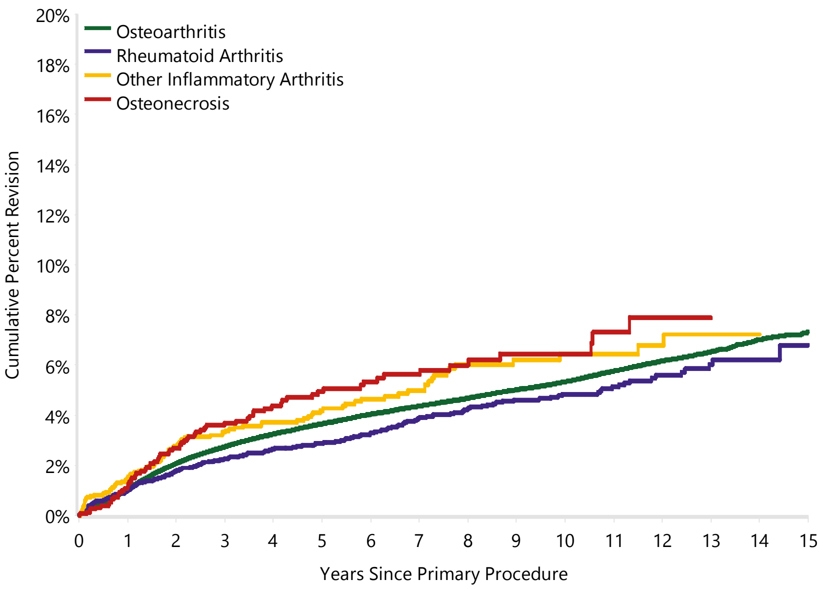
The most common types of revision are replacement of both the femoral and tibial prostheses (25.4%), insert only exchange (21.1%) and patella only replacement (20.8%) (Table KT8).

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	7 Yrs	10 Yrs	15 Yrs
Osteoarthritis	17213	482373	1.0 (1.0, 1.1)	2.7 (2.7, 2.8)	3.6 (3.6, 3.7)	4.4 (4.3, 4.4)	5.3 (5.2, 5.4)	7.3 (7.1, 7.6)
Rheumatoid Arthritis	246	7074	1.0 (0.8, 1.3)	2.3 (1.9, 2.6)	2.9 (2.5, 3.3)	3.9 (3.4, 4.5)	4.8 (4.2, 5.5)	6.8 (5.4, 8.5)
Other Inflammatory Arthritis	102	2433	1.5 (1.1, 2.1)	3.3 (2.6, 4.2)	4.2 (3.4, 5.2)	5.0 (4.0, 6.1)	6.4 (5.2, 8.0)	
Osteonecrosis	74	1621	1.1 (0.7, 1.8)	3.7 (2.8, 4.8)	4.9 (3.8, 6.3)	5.6 (4.4, 7.1)	6.4 (5.0, 8.2)	
Other (5)	95	1070	2.4 (1.6, 3.7)	7.7 (6.1, 9.9)	10.4 (8.3, 13.0)	12.6 (10.1, 15.7)	16.3 (12.9, 20.6)	
TOTAL	17730	494571						

Note: Only primary diagnoses with over 1,000 procedures have been listed

Figure KT7 Cumulative Percent Revision of Primary Total Knee Replacement by Primary Diagnosis



HR - adjusted for age and gender

Rheumatoid Arthritis vs Osteoarthritis
0 - 9Mth: HR=0.93 (0.72, 1.21),p=0.598
9Mth - 1.5Yr: HR=0.49 (0.35, 0.69),p<0.001
1.5Yr+: HR=0.69 (0.59, 0.81),p<0.001

Other Inflammatory Arthritis vs Osteoarthritis
0 - 3Mth: HR=2.20 (1.38, 3.49),p<0.001
3Mth - 1.5Yr: HR=0.83 (0.56, 1.22),p=0.334
1.5Yr+: HR=0.99 (0.76, 1.28),p=0.919

Osteonecrosis vs Osteoarthritis
Entire Period: HR=1.32 (1.05, 1.66),p=0.015

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Osteoarthritis	482373	425331	322059	232848	158068	73984	2040
Rheumatoid Arthritis	7074	6384	5221	4044	3029	1629	75
Other Inflammatory Arthritis	2433	2103	1589	1141	786	394	21
Osteonecrosis	1621	1418	1057	795	551	268	3

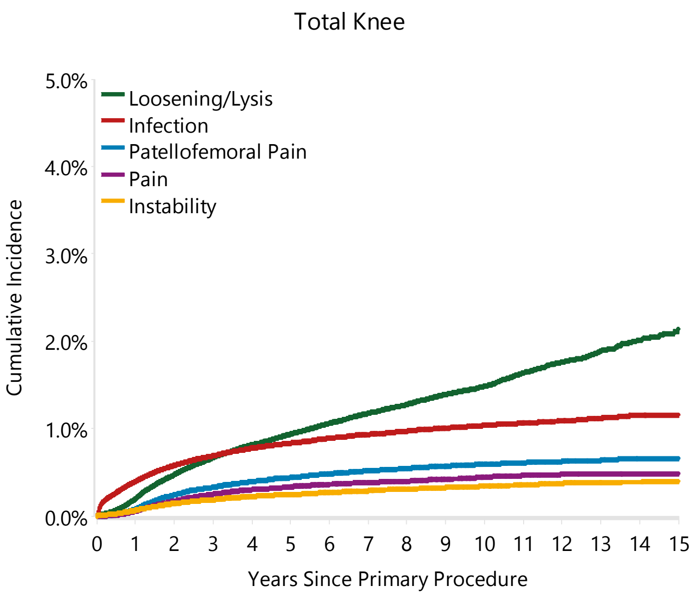
Table KT7 Primary Total Knee Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	4990	28.1
Infection	3985	22.5
Patellofemoral Pain	2059	11.6
Pain	1535	8.7
Instability	1194	6.7
Patella Erosion	772	4.4
Arthrofibrosis	611	3.4
Fracture	486	2.7
Malalignment	403	2.3
Wear Tibial Insert	290	1.6
Metal Related Pathology	286	1.6
Incorrect Sizing	222	1.3
Other	897	5.1
TOTAL	17730	100.0

Table KT8 Primary Total Knee Replacement by Type of Revision

Type of Revision	Number	Percent
TKR (Tibial/Femoral)	4508	25.4
Insert Only	3736	21.1
Patella Only	3690	20.8
Tibial Component	1786	10.1
Insert/Patella	1734	9.8
Femoral Component	1081	6.1
Cement Spacer	1017	5.7
Removal of Prostheses	105	0.6
Minor Components	47	0.3
Cement Only	9	0.1
Total Femoral	9	0.1
Reinsertion of Components	8	0.0
TOTAL	17730	100.0

Figure KT8 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement



PROSTHESIS TYPES

There are 502 femoral and tibial prosthesis combinations used in primary total knee replacement recorded by the Registry, 16 more than 2014. The cumulative percent revision of the 139 combinations with more than 400 procedures per combination are listed in Tables KT9 – KT11. Although the listed combinations are a small proportion of all possible combinations, they represent 95.9% of all primary total knee replacement. The 'Other' group is the combined outcome of the remaining 363 prosthesis combinations with less than 400 procedures reported per combination.

There are 60 cemented femoral and tibial prosthesis combinations with more than 400 procedures. Of those with a 15 year cumulative percent revision, the Nexgen CR/Nexgen is the lowest at 5.3% (Table KT9).

There are 39 cementless femoral and tibial prosthesis combinations with more than 400 procedures. Of those with a 15 year cumulative percent revision, the Nexgen CR/Nexgen is the lowest at 4.5% (Table KT10).

"The Nexgen CR/Nexgen has the lowest 15 year cumulative percent revision."

There are 40 combinations of primary total knee replacement with hybrid fixation with more than 400 procedures. The Nexgen CR/Nexgen has the lowest 15 year cumulative percent revision (4.2%) (Table KT11).

Table KT9 Cumulative Percent Revision of Primary Total Knee Replacement with Cemented Fixation

Femoral Component	Tibial Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
AGC	AGC	176	3493	0.5 (0.4, 0.9)	2.4 (2.0, 3.0)	3.5 (2.9, 4.2)	4.1 (3.5, 4.9)	5.4 (4.6, 6.3)	8.9 (7.1, 11.1)
Active Knee	Active Knee	40	1430	1.0 (0.6, 1.6)	2.4 (1.6, 3.4)	3.6 (2.6, 5.0)	4.4 (3.0, 6.3)	4.9 (3.3, 7.2)	
Advance	Advance II	54	918	1.5 (0.9, 2.6)	4.1 (3.0, 5.6)	4.8 (3.6, 6.4)	6.0 (4.5, 8.0)	7.2 (5.4, 9.6)	
Apex Knee CR	Apex Knee	2	586	0.2 (0.0, 1.2)	0.6 (0.1, 2.5)				
Apex Knee PS	Apex Knee	4	1116	0.4 (0.1, 1.2)					
Attune CR	Attune	17	3199	0.5 (0.3, 0.9)					
Attune PS	Attune	7	1632	0.4 (0.2, 0.9)					
BalanSys	BalanSys	20	1417	0.2 (0.0, 0.6)	1.5 (0.8, 2.5)	1.9 (1.1, 3.2)	2.6 (1.5, 4.5)	3.9 (2.2, 7.1)	
Duracon	Duracon	424	8968	1.0 (0.8, 1.2)	2.4 (2.1, 2.8)	3.3 (2.9, 3.7)	3.9 (3.5, 4.3)	4.8 (4.3, 5.3)	7.0 (5.9, 8.2)
E.Motion	E.Motion	18	446	1.9 (0.9, 3.7)	4.8 (3.0, 7.6)				
Evolis	Evolis	12	730	0.3 (0.1, 1.1)	1.1 (0.5, 2.3)	1.6 (0.8, 3.1)	2.9 (1.5, 5.3)		
Evolution	Evolution	8	1636	0.5 (0.2, 1.3)	1.5 (0.7, 3.3)				
GMK Primary	GMK Primary	10	549	0.8 (0.3, 2.1)	2.4 (1.2, 4.7)	4.2 (1.7, 10.2)			
GMK Sphere Primary	GMK Primary	23	1602	1.6 (1.0, 2.6)					
Genesis II CR	Genesis II	421	13019	0.9 (0.8, 1.1)	2.4 (2.2, 2.7)	3.1 (2.8, 3.5)	4.0 (3.6, 4.4)	4.3 (3.9, 4.7)	5.6 (4.7, 6.7)
Genesis II CR	Profix Mobile	32	490	1.7 (0.8, 3.3)	3.4 (2.1, 5.5)	5.6 (3.8, 8.2)	6.7 (4.6, 9.6)	9.2 (6.3, 13.3)	
Genesis II Oxinium CR	Genesis II	309	6923	1.0 (0.8, 1.3)	2.8 (2.4, 3.2)	3.7 (3.2, 4.2)	4.7 (4.1, 5.3)	6.2 (5.5, 7.0)	
Genesis II Oxinium PS	Genesis II	686	14338	1.5 (1.3, 1.7)	3.8 (3.5, 4.2)	5.2 (4.8, 5.7)	6.2 (5.8, 6.8)	7.7 (7.0, 8.4)	
Genesis II PS	Genesis II	518	14812	1.2 (1.1, 1.4)	2.8 (2.6, 3.1)	3.7 (3.4, 4.1)	4.3 (3.9, 4.7)	5.0 (4.5, 5.5)	
Journey Oxinium	Journey	220	3032	1.4 (1.0, 1.9)	4.5 (3.8, 5.3)	6.4 (5.5, 7.4)	8.8 (7.6, 10.0)		
Kinemax Plus	Kinemax Plus	101	1826	0.9 (0.6, 1.5)	2.4 (1.8, 3.3)	3.1 (2.4, 4.0)	3.9 (3.1, 4.9)	4.5 (3.6, 5.6)	7.8 (6.3, 9.7)
LCS CR	LCS	294	3936	1.0 (0.7, 1.4)	3.8 (3.2, 4.4)	5.0 (4.4, 5.8)	6.1 (5.4, 6.9)	7.2 (6.4, 8.1)	9.4 (8.1, 10.8)
LCS CR	MBT	303	9848	0.7 (0.6, 0.9)	2.4 (2.0, 2.7)	3.3 (2.9, 3.7)	4.1 (3.6, 4.6)	5.0 (4.4, 5.6)	
LCS PS	MBT	33	492	1.4 (0.7, 3.0)	5.8 (4.0, 8.3)	7.5 (5.3, 10.5)			
Legion CR	Genesis II	22	975	1.4 (0.8, 2.5)	2.6 (1.6, 4.0)	3.6 (2.3, 5.7)			

Femoral Component	Tibial Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Legion Oxinium CR	Genesis II	43	2180	0.8 (0.5, 1.3)	2.3 (1.7, 3.1)	2.7 (2.0, 3.8)	3.3 (2.1, 5.1)		
Legion Oxinium PS	Genesis II	183	7996	1.1 (0.9, 1.4)	3.2 (2.8, 3.8)	3.9 (3.3, 4.7)	4.2 (3.5, 5.0)		
Legion PS	Genesis II	51	3208	0.9 (0.6, 1.3)	1.9 (1.4, 2.6)	2.2 (1.6, 3.0)			
MRK	MRK	6	402	0.8 (0.3, 2.4)	1.7 (0.8, 3.8)	1.7 (0.8, 3.8)			
Maxim	Maxim	36	498	1.2 (0.5, 2.7)	2.6 (1.5, 4.5)	4.8 (3.2, 7.1)	5.2 (3.6, 7.6)	6.6 (4.7, 9.4)	
Natural Knee Flex	Natural Knee II	23	1129	0.8 (0.4, 1.5)	2.5 (1.6, 3.8)	3.0 (2.0, 4.7)	3.0 (2.0, 4.7)		
Natural Knee II	Natural Knee II	48	1754	0.5 (0.2, 0.9)	1.3 (0.9, 2.0)	1.9 (1.4, 2.7)	2.7 (2.0, 3.7)	3.6 (2.6, 4.9)	
Nexgen CR	Nexgen	109	3735	0.5 (0.3, 0.8)	1.4 (1.0, 1.8)	1.8 (1.4, 2.3)	2.1 (1.7, 2.6)	2.8 (2.3, 3.4)	5.3 (3.8, 7.4)
Nexgen CR Flex	Natural Knee II	6	786	0.3 (0.1, 1.0)	0.6 (0.2, 1.6)	0.6 (0.2, 1.6)			
Nexgen CR Flex	Nexgen	254	16286	0.7 (0.6, 0.8)	1.5 (1.3, 1.7)	2.0 (1.8, 2.3)	2.3 (2.0, 2.6)	2.7 (2.2, 3.2)	
Nexgen LCCK	Nexgen	24	604	1.8 (0.9, 3.2)	3.5 (2.2, 5.5)	5.0 (3.2, 7.6)	5.0 (3.2, 7.6)		
Nexgen LPS	Nexgen	221	5618	1.0 (0.7, 1.3)	2.3 (1.9, 2.7)	2.9 (2.5, 3.4)	3.7 (3.2, 4.3)	4.8 (4.2, 5.5)	5.7 (4.9, 6.6)
Nexgen LPS Flex	Nexgen	838	27014	0.9 (0.8, 1.0)	2.3 (2.1, 2.5)	3.2 (3.0, 3.4)	3.9 (3.6, 4.2)	5.0 (4.7, 5.5)	
Optetrak-PS	Optetrak	159	2398	1.5 (1.1, 2.1)	4.7 (3.9, 5.7)	6.6 (5.6, 7.8)	7.9 (6.7, 9.2)	9.6 (8.1, 11.4)	
Optetrak-PS	Optetrak-RBK	37	720	1.6 (0.9, 2.8)	3.9 (2.7, 5.9)	5.3 (3.7, 7.5)	6.9 (4.9, 9.7)		
PFC Sigma CR	MBT	24	1125	0.7 (0.4, 1.4)	1.5 (0.9, 2.4)	1.8 (1.2, 2.8)	2.1 (1.4, 3.3)	2.8 (1.8, 4.3)	
PFC Sigma CR	PFC Sigma	277	11461	0.8 (0.7, 1.0)	1.9 (1.6, 2.2)	2.4 (2.1, 2.7)	2.9 (2.5, 3.3)	3.4 (3.0, 3.9)	
PFC Sigma PS	MBT	204	5828	0.9 (0.7, 1.1)	2.6 (2.2, 3.1)	3.5 (3.0, 4.1)	4.1 (3.6, 4.7)	4.6 (3.9, 5.3)	
PFC Sigma PS	PFC Sigma	241	7167	1.2 (1.0, 1.5)	2.6 (2.2, 3.0)	3.2 (2.7, 3.6)	3.5 (3.1, 4.0)	4.5 (3.9, 5.3)	
Profix	Profix	139	3285	1.1 (0.8, 1.5)	2.6 (2.1, 3.2)	3.2 (2.6, 3.9)	3.9 (3.3, 4.7)	4.6 (3.9, 5.4)	
Profix Oxinium	Profix	78	999	1.9 (1.2, 3.0)	5.0 (3.8, 6.5)	6.6 (5.2, 8.3)	7.4 (5.9, 9.3)	8.0 (6.4, 10.0)	
RBK	RBK	76	2157	0.9 (0.6, 1.5)	2.6 (1.9, 3.4)	3.4 (2.6, 4.3)	4.1 (3.2, 5.3)	5.7 (4.4, 7.5)	
SAIPH	SAIPH	6	719	0.3 (0.1, 1.3)	1.7 (0.7, 4.1)				
Score	Score	10	515	1.1 (0.5, 2.7)	1.7 (0.8, 3.5)	2.1 (1.0, 4.3)			
Scorpio CR	Series 7000	85	1780	0.9 (0.5, 1.4)	2.2 (1.6, 3.1)	2.9 (2.2, 3.8)	4.1 (3.2, 5.2)	5.0 (4.0, 6.2)	
Scorpio NRG CR	Series 7000	27	1387	0.7 (0.4, 1.3)	1.4 (0.9, 2.3)	2.2 (1.4, 3.4)	3.0 (2.0, 4.5)		
Scorpio NRG PS	Series 7000	54	2555	0.6 (0.4, 1.0)	1.7 (1.2, 2.3)	2.3 (1.8, 3.1)	2.6 (1.9, 3.5)		
Scorpio PS	Scorpio	30	510	1.2 (0.5, 2.6)	3.8 (2.4, 5.9)	4.4 (2.9, 6.6)	5.3 (3.6, 7.7)	6.4 (4.5, 9.1)	
Scorpio PS	Scorpio+	57	900	1.2 (0.7, 2.2)	4.0 (2.9, 5.5)	5.6 (4.3, 7.4)	6.0 (4.6, 7.8)	6.9 (5.3, 9.0)	
Scorpio PS	Series 7000	170	3205	1.1 (0.8, 1.5)	2.9 (2.3, 3.5)	4.0 (3.3, 4.8)	5.0 (4.3, 5.9)	6.8 (5.8, 8.1)	
Triathlon CR	Triathlon	497	25632	0.8 (0.7, 0.9)	2.1 (1.9, 2.3)	2.6 (2.4, 2.8)	3.0 (2.7, 3.4)	3.8 (3.2, 4.5)	
Triathlon PS	Triathlon	185	5886	1.5 (1.2, 1.8)	3.2 (2.7, 3.7)	4.0 (3.4, 4.6)	4.6 (3.9, 5.3)		
Vanguard CR	Maxim	133	6778	0.6 (0.4, 0.8)	2.2 (1.8, 2.7)	2.8 (2.4, 3.4)	3.3 (2.7, 4.0)		
Vanguard CR	Vanguard	14	967	0.5 (0.2, 1.3)	1.4 (0.8, 2.5)	1.7 (0.9, 3.2)			
Vanguard PS	Maxim	166	3500	1.9 (1.5, 2.4)	4.6 (3.9, 5.4)	5.7 (4.9, 6.7)	6.8 (5.7, 8.0)		
Other (177)		497	8717	1.6 (1.3, 1.8)	4.1 (3.6, 4.6)	5.9 (5.3, 6.5)	7.1 (6.5, 7.8)	8.6 (7.9, 9.5)	12.0 (10.0, 14.4)
TOTAL		8762	266814						

Note: Some cementless components have been cemented
Only combinations with over 400 procedures have been listed

Table KT10 Cumulative Percent Revision of Primary Total Knee Replacement with Cementless Fixation

Femoral Component	Tibial Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
ACS	ACS Fixed	21	457	2.0 (1.0, 4.0)	6.7 (4.3, 10.3)				
Active Knee	Active Knee	362	4894	1.4 (1.1, 1.7)	3.8 (3.3, 4.4)	5.4 (4.8, 6.1)	6.8 (6.1, 7.6)	9.1 (8.1, 10.1)	
Advance	Advance	24	575	2.0 (1.1, 3.6)	4.7 (3.1, 7.1)	5.0 (3.3, 7.5)			
Advantim	Advantim	51	1255	0.7 (0.4, 1.4)	2.8 (2.0, 3.9)	3.5 (2.6, 4.7)	3.8 (2.8, 5.2)	5.1 (3.8, 6.9)	
Columbus	Columbus	53	500	3.2 (2.0, 5.2)	7.7 (5.6, 10.4)	9.8 (7.5, 12.9)	11.4 (8.7, 14.7)		
Duracon	Duracon	182	3539	1.1 (0.8, 1.4)	2.7 (2.2, 3.3)	3.7 (3.1, 4.4)	4.3 (3.7, 5.1)	5.2 (4.4, 6.0)	7.0 (5.7, 8.6)
GMK Primary	GMK Primary	19	608	1.7 (0.9, 3.3)	4.3 (2.7, 6.6)				
Genesis II CR	Genesis II	22	489	1.3 (0.6, 2.8)	4.8 (3.1, 7.4)	5.3 (3.4, 8.1)	6.3 (3.9, 10.3)		
Genesis II CR	Profix Mobile	30	505	1.4 (0.7, 2.9)	2.0 (1.1, 3.7)	3.0 (1.8, 4.9)	3.4 (2.2, 5.5)	4.2 (2.7, 6.4)	8.2 (5.6, 11.8)
Genesis II PS	Genesis II	16	420	1.8 (0.8, 3.7)	3.5 (2.0, 5.9)	4.2 (2.5, 6.9)	4.7 (2.8, 7.6)		
LCS CR	LCS	143	2341	1.4 (1.0, 2.0)	3.4 (2.7, 4.2)	4.2 (3.5, 5.1)	4.8 (4.0, 5.7)	5.8 (4.9, 6.9)	6.9 (5.9, 8.1)
LCS CR	MBT	265	7036	1.1 (0.9, 1.4)	3.4 (3.0, 3.9)	4.3 (3.8, 4.9)	5.1 (4.4, 5.8)	5.6 (4.9, 6.4)	
LCS CR	MBT Duofix	547	12107	1.3 (1.1, 1.5)	3.3 (3.0, 3.7)	4.2 (3.8, 4.6)	4.8 (4.4, 5.2)	5.5 (5.0, 6.0)	
LCS Duofix	MBT Duofix	437	3649	1.6 (1.2, 2.1)	6.2 (5.5, 7.0)	10.1 (9.2, 11.1)	12.0 (11.0, 13.1)		
Maxim	Maxim	37	612	1.6 (0.9, 3.0)	3.0 (1.9, 4.7)	3.3 (2.2, 5.1)	3.3 (2.2, 5.1)	4.8 (3.3, 6.9)	
Natural Knee Flex	Natural Knee II	28	1087	1.0 (0.5, 1.8)	2.4 (1.6, 3.6)	2.9 (2.0, 4.2)	4.0 (2.4, 6.7)		
Natural Knee II	Natural Knee II	210	2890	1.0 (0.7, 1.4)	2.2 (1.8, 2.9)	3.5 (2.9, 4.2)	4.5 (3.8, 5.4)	7.3 (6.3, 8.5)	
Nexgen CR	Nexgen	102	3369	0.5 (0.3, 0.9)	1.7 (1.3, 2.2)	2.1 (1.7, 2.7)	2.6 (2.1, 3.2)	3.0 (2.5, 3.7)	4.5 (3.2, 6.4)
Nexgen CR	Nexgen TM CR	39	657	1.4 (0.7, 2.7)	4.6 (3.2, 6.7)	6.4 (4.7, 8.8)	6.7 (4.9, 9.1)	7.1 (5.2, 9.7)	
Nexgen CR Flex	Nexgen	143	6205	1.0 (0.8, 1.3)	2.2 (1.8, 2.6)	2.7 (2.2, 3.2)	3.0 (2.5, 3.5)	3.7 (3.0, 4.5)	
Nexgen CR Flex	Nexgen TM CR	164	8165	0.6 (0.4, 0.8)	1.9 (1.6, 2.2)	2.4 (2.0, 2.8)	2.7 (2.3, 3.1)	3.3 (2.6, 4.2)	
Nexgen LPS	Nexgen TM LPS	22	1024	0.9 (0.5, 1.8)	1.4 (0.8, 2.4)	2.6 (1.7, 4.0)	2.9 (1.9, 4.4)		
Nexgen LPS Flex	Nexgen	13	521	2.5 (1.4, 4.5)	3.4 (1.9, 6.0)				
Nexgen LPS Flex	Nexgen TM LPS	22	854	1.1 (0.6, 2.1)	2.3 (1.5, 3.7)	3.6 (2.2, 5.7)			
PFC Sigma CR	AMK Duofix	52	1911	0.7 (0.4, 1.2)	1.6 (1.1, 2.2)	2.3 (1.7, 3.2)	2.7 (2.0, 3.6)	3.3 (2.4, 4.4)	
PFC Sigma CR	MBT	59	994	2.3 (1.5, 3.5)	4.9 (3.7, 6.4)	6.1 (4.6, 8.0)	6.9 (5.2, 9.0)	7.4 (5.6, 9.7)	
PFC Sigma CR	MBT Duofix	105	2414	1.2 (0.8, 1.8)	3.4 (2.7, 4.3)	4.3 (3.5, 5.2)	4.6 (3.7, 5.6)	5.6 (4.5, 7.0)	
Profix	Profix	85	1488	1.1 (0.7, 1.8)	3.5 (2.6, 4.5)	4.5 (3.6, 5.7)	5.7 (4.6, 7.1)	6.3 (5.1, 7.8)	
RBK	RBK	250	6027	1.4 (1.1, 1.7)	3.2 (2.8, 3.7)	4.2 (3.6, 4.8)	4.8 (4.2, 5.5)	5.5 (4.8, 6.4)	
Score	Score	74	1705	1.3 (0.8, 2.0)	4.5 (3.5, 5.8)	6.1 (4.8, 7.7)	7.1 (5.5, 9.0)		
Scorpio CR	Series 7000	183	3130	1.3 (1.0, 1.8)	3.4 (2.8, 4.1)	4.7 (4.0, 5.6)	5.5 (4.7, 6.4)	7.2 (6.2, 8.3)	
Scorpio NRG CR	Series 7000	42	1968	0.9 (0.6, 1.5)	2.0 (1.4, 2.8)	2.5 (1.8, 3.5)	3.4 (2.4, 4.8)		
Scorpio NRG PS	Series 7000	60	970	1.3 (0.7, 2.3)	5.7 (4.3, 7.5)	7.2 (5.6, 9.3)	7.6 (6.0, 9.8)		
Scorpio PS	Series 7000	44	570	2.5 (1.5, 4.1)	5.3 (3.7, 7.5)	6.2 (4.5, 8.6)	7.0 (5.2, 9.5)	7.7 (5.7, 10.3)	
Triathlon CR	Triathlon	265	12017	1.0 (0.9, 1.2)	2.1 (1.8, 2.4)	2.8 (2.4, 3.1)	3.3 (2.9, 3.8)		
Triathlon PS	Triathlon	46	991	2.1 (1.4, 3.3)	3.8 (2.8, 5.3)	4.9 (3.7, 6.5)	4.9 (3.7, 6.5)		
Vanguard CR	Maxim	32	581	1.2 (0.6, 2.5)	3.8 (2.5, 5.8)	5.4 (3.8, 7.6)	5.8 (4.0, 8.1)		
Vanguard CR	Regenerex	43	1192	1.1 (0.6, 1.9)	3.9 (2.8, 5.4)	5.3 (3.9, 7.3)			
Vanguard CR	Vanguard	29	1183	1.1 (0.6, 1.9)	3.1 (2.1, 4.4)	3.1 (2.1, 4.4)			
Other (68)		509	5103	2.8 (2.4, 3.3)	7.6 (6.9, 8.4)	9.4 (8.6, 10.3)	10.8 (9.9, 11.8)	12.0 (11.0, 13.1)	
TOTAL		4830	106003						

Note: Only combinations with over 400 procedures have been listed

Table KT11 Cumulative Percent Revision of Primary Total Knee Replacement with Hybrid Fixation

Femoral Component	Tibial Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
ACS	ACS Fixed	22	653	1.3 (0.6, 2.8)	7.9 (4.8, 12.9)				
AGC	AGC	52	1642	0.6 (0.3, 1.1)	1.4 (0.9, 2.1)	2.1 (1.5, 3.0)	2.6 (1.9, 3.6)	3.5 (2.6, 4.7)	5.5 (3.7, 8.2)
Active Knee	Active Knee	75	1965	0.5 (0.3, 1.0)	2.7 (2.0, 3.6)	3.6 (2.8, 4.7)	4.5 (3.5, 5.8)	5.9 (4.6, 7.5)	
Advance	Advance II	21	430	1.2 (0.5, 2.8)	2.7 (1.5, 4.9)	3.6 (2.2, 6.1)	4.3 (2.7, 7.0)	6.1 (3.9, 9.5)	
Apex Knee CR	Apex Knee	5	466	1.3 (0.5, 3.5)					
Duracon	Duracon	401	7963	1.2 (1.0, 1.5)	2.7 (2.4, 3.1)	3.5 (3.1, 3.9)	4.1 (3.7, 4.6)	5.0 (4.5, 5.5)	6.6 (5.9, 7.5)
Genesis II CR	Genesis II	252	6746	0.9 (0.7, 1.2)	2.8 (2.4, 3.3)	3.8 (3.3, 4.3)	4.3 (3.8, 4.9)	4.9 (4.3, 5.6)	5.7 (4.9, 6.6)
Genesis II PS	Genesis II	53	695	1.7 (1.0, 3.1)	4.5 (3.2, 6.4)	5.5 (4.0, 7.5)	6.6 (4.9, 8.8)	8.8 (6.7, 11.4)	
LCS CR	LCS	130	2362	1.0 (0.7, 1.5)	2.7 (2.1, 3.5)	3.8 (3.1, 4.6)	4.7 (3.9, 5.7)	5.3 (4.4, 6.3)	6.9 (5.6, 8.4)
LCS CR	MBT	208	7787	0.7 (0.5, 0.9)	2.1 (1.8, 2.5)	2.9 (2.5, 3.3)	3.2 (2.8, 3.7)	4.1 (3.5, 4.9)	
LCS CR	MBT Duofix	27	816	1.7 (1.0, 2.9)	4.1 (2.8, 6.1)	4.5 (3.0, 6.5)	4.5 (3.0, 6.5)		
LCS Duofix	MBT	66	822	1.5 (0.8, 2.6)	5.5 (4.1, 7.3)	7.1 (5.5, 9.1)	8.2 (6.5, 10.4)		
Legion CR	Genesis II	27	1158	1.2 (0.7, 2.1)	3.7 (2.4, 5.6)	4.5 (2.9, 6.9)			
Maxim	Maxim	88	1407	0.8 (0.4, 1.4)	2.7 (1.9, 3.7)	3.9 (3.0, 5.1)	4.8 (3.8, 6.1)	6.5 (5.2, 8.0)	
Natural Knee Flex	Natural Knee II	15	1484	0.4 (0.2, 0.9)	1.0 (0.5, 1.8)	1.4 (0.8, 2.6)	2.2 (1.2, 4.1)		
Natural Knee II	Natural Knee II	85	1966	1.2 (0.8, 1.8)	2.2 (1.6, 3.0)	2.6 (1.9, 3.4)	2.9 (2.2, 3.8)	4.1 (3.2, 5.2)	
Nexgen CR	Nexgen	107	4007	0.4 (0.3, 0.7)	1.5 (1.2, 2.0)	2.0 (1.6, 2.6)	2.3 (1.9, 2.9)	3.1 (2.5, 3.8)	4.2 (3.3, 5.2)
Nexgen CR Flex	Nexgen	255	14550	0.8 (0.7, 1.0)	1.8 (1.6, 2.1)	2.2 (1.9, 2.5)	2.3 (2.1, 2.7)	2.8 (2.4, 3.3)	
Nexgen CR Flex	Nexgen TM CR	14	762	0.5 (0.2, 1.4)	1.4 (0.7, 2.5)	1.5 (0.8, 2.7)	2.0 (1.2, 3.3)	2.0 (1.2, 3.3)	
Nexgen LPS	Nexgen	44	970	0.4 (0.2, 1.1)	2.5 (1.6, 3.7)	4.0 (2.9, 5.5)	5.0 (3.7, 6.7)	5.2 (3.9, 7.0)	
Nexgen LPS Flex	Nexgen	26	707	2.3 (1.4, 3.8)	4.6 (3.1, 6.7)	4.6 (3.1, 6.7)			
Nexgen LPS Flex	Nexgen TM LPS	13	500	0.6 (0.2, 1.9)	1.8 (1.0, 3.5)	2.0 (1.1, 3.8)	2.5 (1.4, 4.4)		
Optetrak-CR	Optetrak	28	548	1.9 (1.0, 3.6)	3.9 (2.5, 6.3)	4.9 (3.1, 7.5)	6.6 (4.4, 9.6)	7.6 (5.2, 11.1)	
PFC Sigma CR	MBT	163	3529	1.3 (1.0, 1.7)	3.3 (2.7, 4.0)	4.4 (3.7, 5.2)	5.0 (4.2, 5.8)	5.4 (4.6, 6.3)	
PFC Sigma CR	PFC Sigma	267	10620	0.6 (0.5, 0.8)	1.9 (1.6, 2.2)	2.5 (2.1, 2.8)	2.8 (2.4, 3.2)	3.5 (3.1, 4.1)	4.5 (3.7, 5.3)
PFC Sigma PS	MBT Duofix	119	1786	1.8 (1.3, 2.5)	5.0 (4.1, 6.2)	7.0 (5.8, 8.4)	7.7 (6.4, 9.2)	8.3 (6.9, 9.8)	
Profix	Profix	34	769	0.8 (0.4, 1.7)	2.5 (1.6, 3.9)	3.9 (2.7, 5.6)	4.6 (3.3, 6.4)	4.8 (3.4, 6.6)	
Profix	Profix Mobile	54	592	1.9 (1.0, 3.4)	5.7 (4.1, 7.9)	7.4 (5.6, 9.9)	8.2 (6.2, 10.8)	9.3 (7.2, 12.1)	
RBK	RBK	41	1283	1.0 (0.6, 1.8)	2.8 (2.0, 3.9)	3.9 (2.8, 5.4)	4.5 (3.2, 6.2)	4.9 (3.5, 7.0)	
Score	Score	13	646	1.6 (0.8, 3.2)	4.0 (2.0, 7.8)				
Scorpio CR	Scorpio+	124	1893	1.0 (0.6, 1.6)	2.8 (2.2, 3.7)	4.2 (3.4, 5.3)	5.7 (4.7, 6.9)	7.1 (5.9, 8.5)	
Scorpio CR	Series 7000	206	6213	0.7 (0.5, 1.0)	2.0 (1.7, 2.4)	2.8 (2.4, 3.3)	3.4 (2.9, 3.9)	4.2 (3.6, 4.9)	5.5 (4.6, 6.6)
Scorpio NRG CR	Series 7000	17	760	0.3 (0.1, 1.1)	1.7 (1.0, 3.1)	2.3 (1.3, 4.1)	4.6 (2.6, 8.0)		
Scorpio PS	Scorpio+	41	905	1.0 (0.5, 1.9)	2.6 (1.7, 3.9)	3.4 (2.4, 4.8)	3.6 (2.6, 5.1)	4.6 (3.3, 6.3)	
Scorpio PS	Series 7000	80	1071	1.1 (0.6, 2.0)	4.3 (3.2, 5.7)	5.7 (4.4, 7.3)	6.5 (5.1, 8.2)	7.5 (5.9, 9.4)	
Triathlon CR	Triathlon	192	13698	0.6 (0.5, 0.8)	1.5 (1.3, 1.8)	2.0 (1.7, 2.4)	2.6 (2.1, 3.1)		
Triathlon PS	Triathlon	55	2030	1.7 (1.2, 2.4)	2.7 (2.0, 3.5)	3.5 (2.6, 4.6)	3.5 (2.6, 4.6)		
Vanguard CR	Maxim	152	6207	0.9 (0.6, 1.1)	2.6 (2.1, 3.1)	3.7 (3.1, 4.4)	4.3 (3.6, 5.2)		
Vanguard CR	Vanguard	56	2410	0.6 (0.4, 1.1)	2.3 (1.7, 3.1)	2.9 (2.2, 3.8)	4.3 (3.0, 6.1)		
Vanguard PS	Maxim	20	509	1.7 (0.9, 3.5)	4.2 (2.6, 6.6)	5.1 (3.2, 8.0)	5.8 (3.6, 9.2)		
Other (118)		490	6427	2.1 (1.8, 2.5)	5.9 (5.3, 6.5)	7.1 (6.5, 7.9)	8.2 (7.5, 9.0)	10.4 (9.5, 11.5)	12.9 (11.5, 14.6)
TOTAL		**4138**	**121754**						

Note: Only combinations with over 400 procedures have been listed

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 15 years, the cumulative percent revision of primary total knee replacement undertaken for osteoarthritis is 7.3% (Table KT12 and Figure KT9).

Age and Gender

Age is a major factor affecting the outcome of primary total knee replacement. The rate of revision lessens with increasing age, and this difference becomes more evident with time. After four years, those aged less than 55 years have over four times the rate of revision compared to those aged 75 years or older (Table KT13 and Figure KT10). Males have a higher rate of revision compared to females (Table KT14 and Figure KT11).

Loosening/lysis is the most common reason for revision in both males and females. Males have a higher incidence of revision for surgeon reported infection than females, with a 15 year cumulative incidence of 1.6% and 0.8% respectively (Figure KT12).

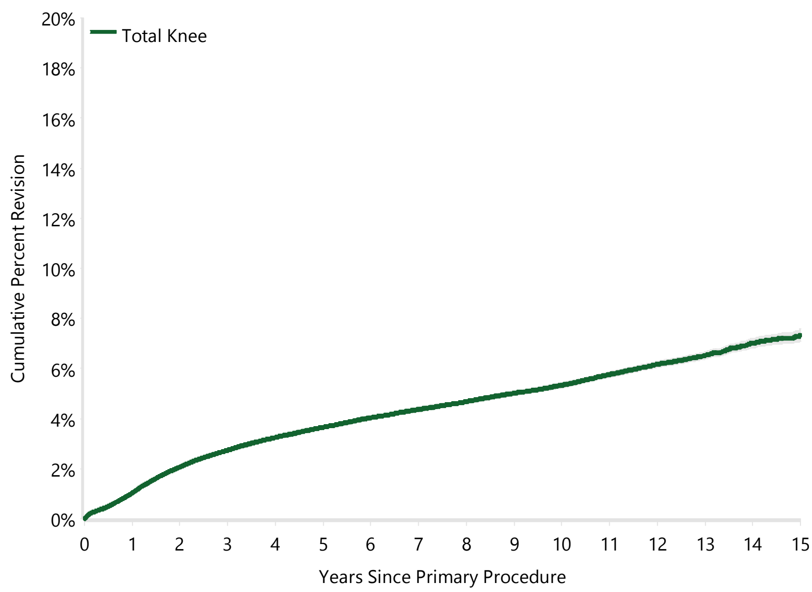
"At 15 years, the cumulative percent revision of primary total knee replacement undertaken for osteoarthritis is 7.3%."

Age related differences in outcome are evident within both males and females (Table KT14, Figures KT13 and KT14).

Table KT12 Cumulative Percent Revision of Primary Total Knee Replacement (Primary Diagnosis OA)

Knee Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Total Knee	17213	482373	1.0 (1.0, 1.1)	2.7 (2.7, 2.8)	3.6 (3.6, 3.7)	4.4 (4.3, 4.4)	5.3 (5.2, 5.4)	7.3 (7.1, 7.6)
TOTAL	17213	482373						

Figure KT9 Cumulative Percent Revision of Primary Total Knee Replacement (Primary Diagnosis OA)

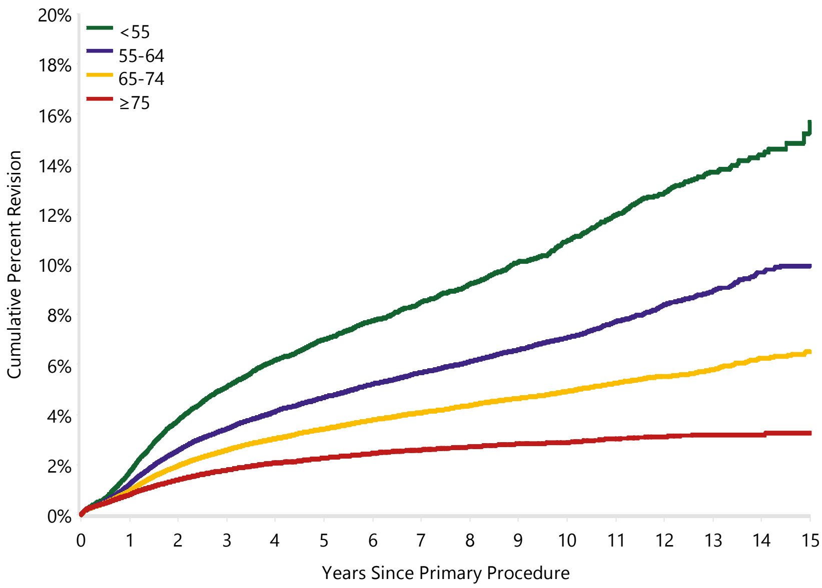


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Total Knee	482373	425331	322059	232848	158068	73984	2040

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	7 Yrs	10 Yrs	15 Yrs
<55	2300	31774	1.7 (1.6, 1.9)	5.1 (4.8, 5.4)	7.0 (6.7, 7.3)	8.5 (8.1, 8.9)	10.9 (10.4, 11.4)	15.7 (14.2, 17.3)
55-64	5883	126044	1.2 (1.2, 1.3)	3.4 (3.3, 3.5)	4.7 (4.5, 4.8)	5.7 (5.5, 5.8)	7.1 (6.9, 7.3)	9.9 (9.5, 10.4)
65-74	6170	186540	0.9 (0.9, 1.0)	2.6 (2.5, 2.7)	3.4 (3.3, 3.5)	4.1 (4.0, 4.2)	4.9 (4.8, 5.1)	6.5 (6.2, 6.8)
≥75	2860	138015	0.8 (0.7, 0.8)	1.8 (1.7, 1.9)	2.3 (2.2, 2.3)	2.6 (2.5, 2.7)	2.9 (2.8, 3.0)	3.2 (3.0, 3.5)
TOTAL	17213	482373						

Figure KT10 Cumulative Percent Revision of Primary Total Knee Replacement by Age (Primary Diagnosis OA)



HR - adjusted for gender

<55 vs ≥75

0 - 9Mth: HR=1.78 (1.57, 2.02),p<0.001

9Mth - 1.5Yr: HR=3.49 (3.15, 3.88),p<0.001

1.5Yr - 2Yr: HR=3.51 (3.04, 4.06),p<0.001

2Yr - 4Yr: HR=3.67 (3.31, 4.06),p<0.001

4Yr - 7Yr: HR=4.65 (4.01, 5.39),p<0.001

7Yr - 10Yr: HR=7.89 (6.42, 9.69),p<0.001

10Yr+: HR=8.53 (6.61, 11.02),p<0.001

55-64 vs ≥75

0 - 3Mth: HR=1.05 (0.92, 1.20),p=0.449

3Mth - 9Mth: HR=1.54 (1.38, 1.73),p<0.001

9Mth - 4Yr: HR=2.29 (2.15, 2.43),p<0.001

4Yr - 4.5Yr: HR=3.52 (2.80, 4.42),p<0.001

4.5Yr - 6.5Yr: HR=2.86 (2.48, 3.29),p<0.001

6.5Yr - 7Yr: HR=3.82 (2.89, 5.05),p<0.001

7Yr - 9Yr: HR=4.20 (3.46, 5.10),p<0.001

9Yr+: HR=5.41 (4.42, 6.63),p<0.001

65-74 vs ≥75

0 - 1Mth: HR=1.00 (0.85, 1.18),p=0.985

1Mth - 6Mth: HR=1.10 (0.98, 1.24),p=0.106

6Mth - 9Mth: HR=1.18 (1.02, 1.35),p=0.021

9Mth - 4Yr: HR=1.63 (1.54, 1.73),p<0.001

4Yr - 4.5Yr: HR=2.53 (2.02, 3.17),p<0.001

4.5Yr - 6.5Yr: HR=1.87 (1.62, 2.15),p<0.001

6.5Yr - 7.5Yr: HR=2.27 (1.82, 2.84),p<0.001

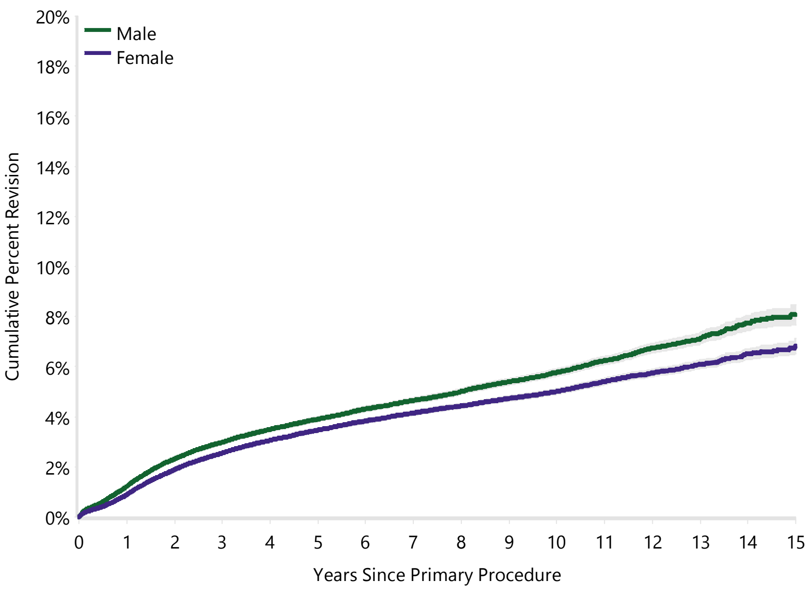
7.5Yr+: HR=2.72 (2.27, 3.27),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
<55	31774	27978	21166	15481	10758	5450	182
55-64	126044	110834	83732	60356	40968	19779	611
65-74	186540	164106	123760	90062	62229	30605	937
≥75	138015	122413	93401	66949	44113	18150	310

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	7 Yrs	10 Yrs	15 Yrs
Male		**7983**	**209495**	**1.2 (1.2, 1.3)**	**3.0 (2.9, 3.1)**	**3.9 (3.8, 4.0)**	**4.6 (4.5, 4.8)**	**5.8 (5.6, 5.9)**	**8.1 (7.7, 8.5)**
	<55	995	13630	2.0 (1.8, 2.3)	5.3 (4.9, 5.7)	6.9 (6.5, 7.4)	8.4 (7.8, 9.0)	10.8 (10.0, 11.5)	15.1 (13.5, 17.0)
	55-64	2863	57444	1.4 (1.3, 1.5)	3.7 (3.5, 3.9)	4.9 (4.7, 5.1)	6.0 (5.8, 6.2)	7.6 (7.2, 7.9)	10.7 (10.0, 11.4)
	65-74	2890	83068	1.1 (1.1, 1.2)	2.8 (2.6, 2.9)	3.6 (3.5, 3.8)	4.3 (4.1, 4.5)	5.2 (5.0, 5.5)	7.0 (6.5, 7.7)
	≥75	1235	55353	0.9 (0.9, 1.0)	2.0 (1.8, 2.1)	2.4 (2.3, 2.6)	2.8 (2.6, 2.9)	3.2 (3.0, 3.4)	3.8 (3.3, 4.3)
Female		**9230**	**272878**	**0.9 (0.8, 0.9)**	**2.5 (2.5, 2.6)**	**3.5 (3.4, 3.5)**	**4.1 (4.1, 4.2)**	**5.0 (4.9, 5.1)**	**6.8 (6.5, 7.1)**
	<55	1305	18144	1.5 (1.3, 1.7)	4.9 (4.6, 5.3)	7.0 (6.6, 7.5)	8.6 (8.1, 9.1)	11.1 (10.4, 11.7)	16.1 (13.9, 18.7)
	55-64	3020	68600	1.1 (1.0, 1.1)	3.2 (3.0, 3.3)	4.5 (4.3, 4.6)	5.4 (5.2, 5.6)	6.7 (6.4, 6.9)	9.3 (8.7, 9.9)
	65-74	3280	103472	0.8 (0.7, 0.9)	2.4 (2.3, 2.5)	3.3 (3.1, 3.4)	3.9 (3.8, 4.0)	4.7 (4.5, 4.8)	6.1 (5.7, 6.5)
	≥75	1625	82662	0.7 (0.6, 0.8)	1.7 (1.6, 1.8)	2.1 (2.0, 2.2)	2.4 (2.3, 2.6)	2.7 (2.6, 2.8)	2.9 (2.8, 3.1)
TOTAL		17213	482373						

Figure KT11 Cumulative Percent Revision of Primary Total Knee Replacement by Gender (Primary Diagnosis OA)



HR - adjusted for age

Male vs Female

0 - 9Mth: HR=1.40 (1.31, 1.50),p<0.001

9Mth - 1.5Yr: HR=1.13 (1.06, 1.21),p<0.001

1.5Yr - 2.5Yr: HR=1.03 (0.96, 1.11),p=0.373

2.5Yr - 3.5Yr: HR=0.93 (0.85, 1.02),p=0.135

3.5Yr - 6Yr: HR=1.03 (0.95, 1.11),p=0.432

6Yr+: HR=1.16 (1.08, 1.26),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	209495	183553	137630	98170	65640	30059	806
Female	272878	241778	184429	134678	92428	43925	1234

Figure KT12 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by Gender (Primary Diagnosis OA)

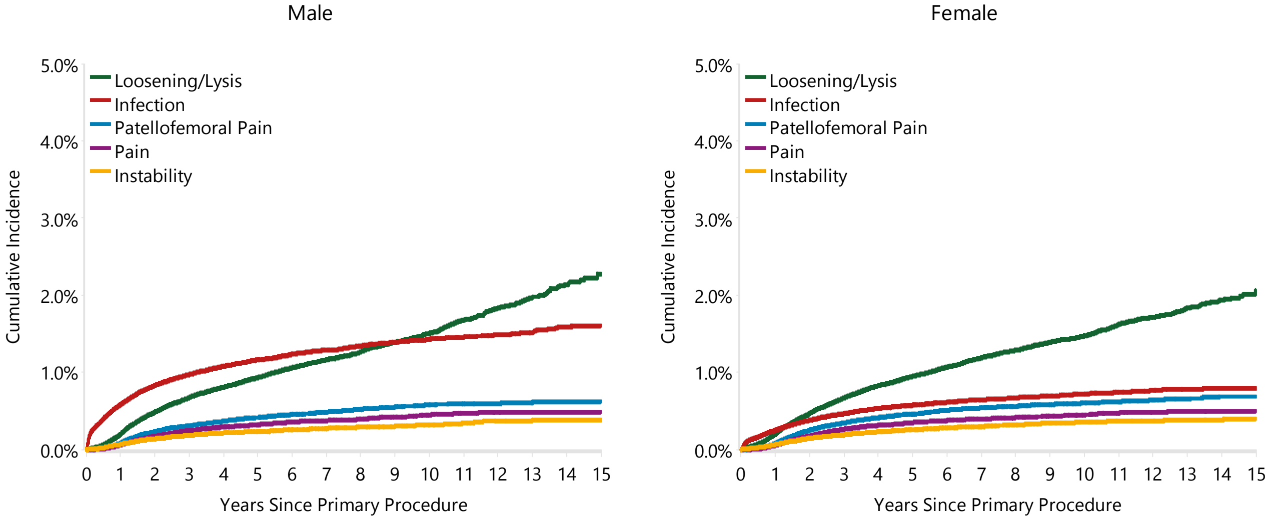
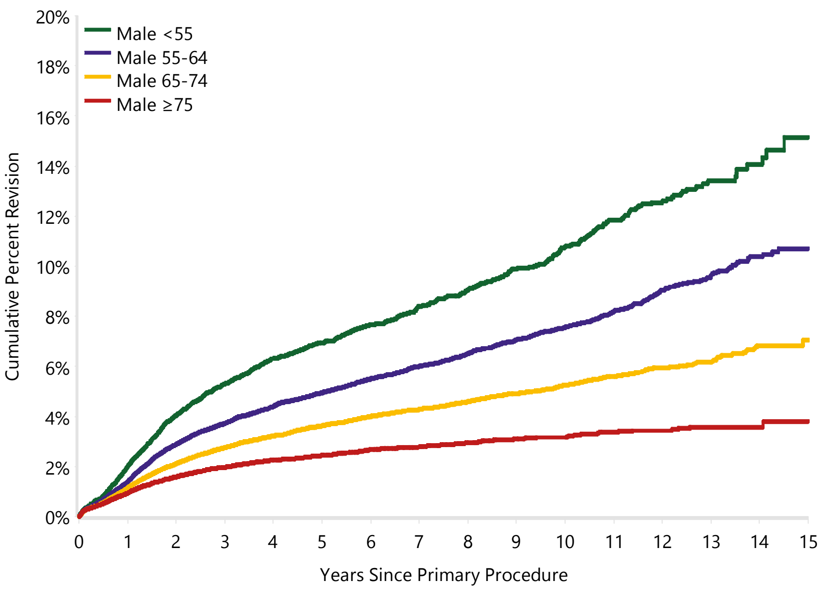


Figure KT13 Cumulative Percent Revision of Primary Total Knee Replacement in Males by Age (Primary Diagnosis OA)



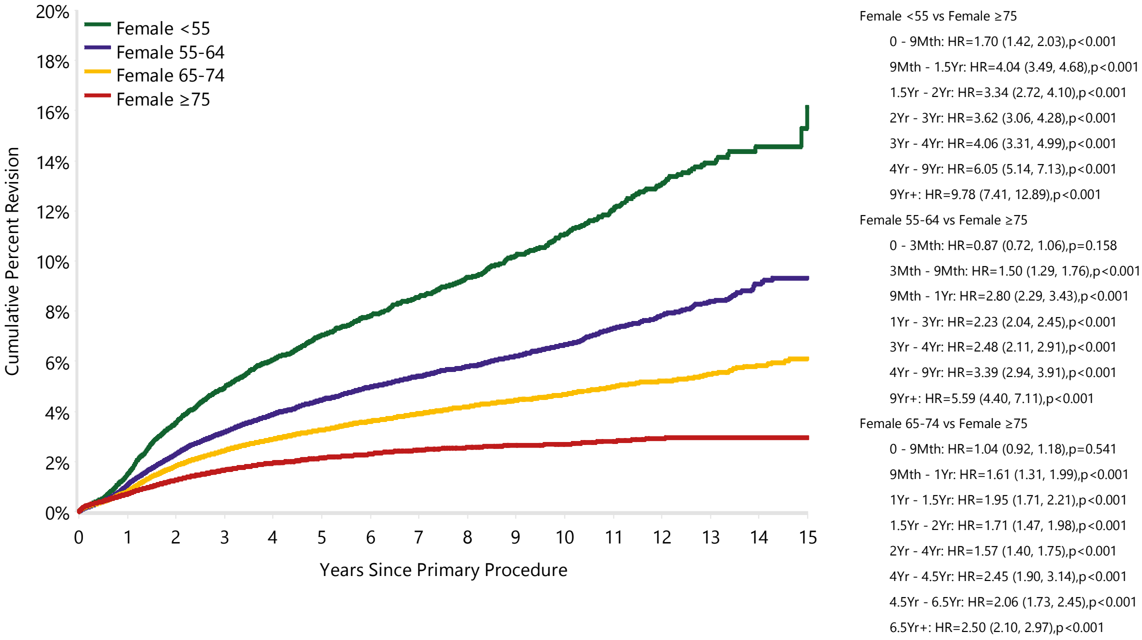
Male <55 vs Male ≥75
- 0 - 9Mth: HR=1.90 (1.60, 2.26),p<0.001
- 9Mth - 1.5Yr: HR=2.80 (2.36, 3.31),p<0.001
- 1.5Yr - 2Yr: HR=3.97 (3.14, 5.03),p<0.001
- 2Yr - 2.5Yr: HR=3.22 (2.48, 4.19),p<0.001
- 2.5Yr - 3.5Yr: HR=3.70 (2.95, 4.64),p<0.001
- 3.5Yr - 7Yr: HR=4.01 (3.34, 4.80),p<0.001
- 7Yr+: HR=5.19 (4.19, 6.42),p<0.001

Male 55-64 vs Male ≥75
- 0 - 9Mth: HR=1.44 (1.28, 1.63),p<0.001
- 9Mth - 1Yr: HR=1.71 (1.41, 2.07),p<0.001
- 1Yr - 1.5Yr: HR=2.17 (1.88, 2.50),p<0.001
- 1.5Yr - 2Yr: HR=2.51 (2.09, 3.02),p<0.001
- 2Yr - 4Yr: HR=2.41 (2.13, 2.73),p<0.001
- 4Yr - 4.5Yr: HR=3.01 (2.30, 3.95),p<0.001
- 4.5Yr - 7Yr: HR=2.95 (2.50, 3.48),p<0.001
- 7Yr - 8.5Yr: HR=3.20 (2.50, 4.09),p<0.001
- 8.5Yr+: HR=3.73 (3.05, 4.56),p<0.001

Male 65-74 vs Male ≥75
- 0 - 6Mth: HR=1.14 (0.99, 1.31),p=0.062
- 6Mth - 1.5Yr: HR=1.35 (1.21, 1.50),p<0.001
- 1.5Yr - 2.5Yr: HR=1.68 (1.45, 1.94),p<0.001
- 2.5Yr+: HR=1.91 (1.70, 2.13),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Male	<55	13630	11974	9145	6719	4685	2425	85
	55-64	57444	50285	37900	27229	18351	8780	281
	65-74	83068	72707	54326	38989	26567	12628	346
	≥75	55353	48587	36259	25233	16037	6226	94

Figure KT14 Cumulative Percent Revision of Primary Total Knee Replacement in Females by Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Female	<55	18144	16004	12021	8762	6073	3025	97
	55-64	68600	60549	45832	33127	22617	10999	330
	65-74	103472	91399	69434	51073	35662	17977	591
	≥75	82662	73826	57142	41716	28076	11924	216

OUTCOME FOR OSTEOARTHRITIS - PROSTHESIS CHARACTERISTICS

Fixed and Mobile Bearing

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.

Mobile bearings include inserts that move in one of three ways: rotating, sliding, or both rotating and sliding. Fixed bearings include non-modular tibial prostheses as well as fixed inserts that do not move relative to the baseplate.

Fixed bearing prostheses have a lower rate of revision compared to rotating and rotating-sliding after two years. There is no difference between fixed and sliding prostheses (Table KT15 and Figure KT15).

There is no difference when comparing all-polyethylene to fixed modular tibial prostheses. All-polyethylene tibial prostheses, however, have a higher rate of revision compared to moulded non-modular tibial prostheses (Table KT16 and Figure KT16).

There is prosthesis variation within the all-polyethylene tibial component group. One prosthesis, the Optetrak PS, has a high cumulative percent revision of 22.0% at 10 years (Table KT17).

Stability

Stability refers to particular prosthetic features intended to substitute for the intrinsic stability of knee ligaments. The two major categories are minimally and posterior stabilised.

"Posterior stabilised prostheses have a higher rate of revision compared to minimally stabilised."

The Registry defines minimally stabilised prostheses as those that have a flat or dished tibial articulation regardless of congruency. Posterior stabilised prostheses provide additional posterior stability, most commonly using a peg and box design or, less frequently, a cam and groove.

In procedures using either minimally stabilised or posterior stabilised prostheses, minimally stabilised account for 72.8%. The use of posterior stabilised prostheses peaked in 2008 (32.9%). Since that time, it has decreased to 27.5% in 2015 (Figure KT17).

Fully stabilised (large peg and box design) and hinged are additional prostheses that provide collateral as well as posterior ligament stability. These prostheses are used in 0.8% of primary procedures (Table KT18). They are usually used in complex clinical situations and have therefore been excluded from any comparative outcome analysis for primary total knee replacement.

Posterior stabilised prostheses have a higher rate of revision compared to minimally stabilised (Table KT18 and Figure KT18).

Patellar Resurfacing

Resurfacing the patella has a lower rate of revision compared to procedures without patellar resurfacing (Table KT19 and Figure KT19). 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 KT20 and Figure KT20).

Outcomes related to the use of patellar resurfacing vary depending on the type of prosthesis used. Most have a lower rate of revision when the patella is resurfaced. However, for some prostheses, for example the Duracon, there is no difference in the rate of revision depending on whether the patella is resurfaced or not (Table KT21and Figure KT21).

Fixation

The rate of revision varies depending on fixation. Hybrid fixation has a lower rate of revision compared to both cemented and cementless fixation. Cemented fixation has a lower rate of revision than cementless fixation (Table KT22 and Figure KT22).

The effect of fixation varies depending on whether the knee replacement is minimally or posteriorly stabilised. With a minimally stabilised prosthesis there is no difference between cemented and hybrid fixation and both have a lower rate of revision compared to cementless fixation (Table KT23 and Figure KT23). When a posterior stabilised knee is used, cemented fixation has a lower rate of revision compared to hybrid (Table KT24 and Figure KT24).

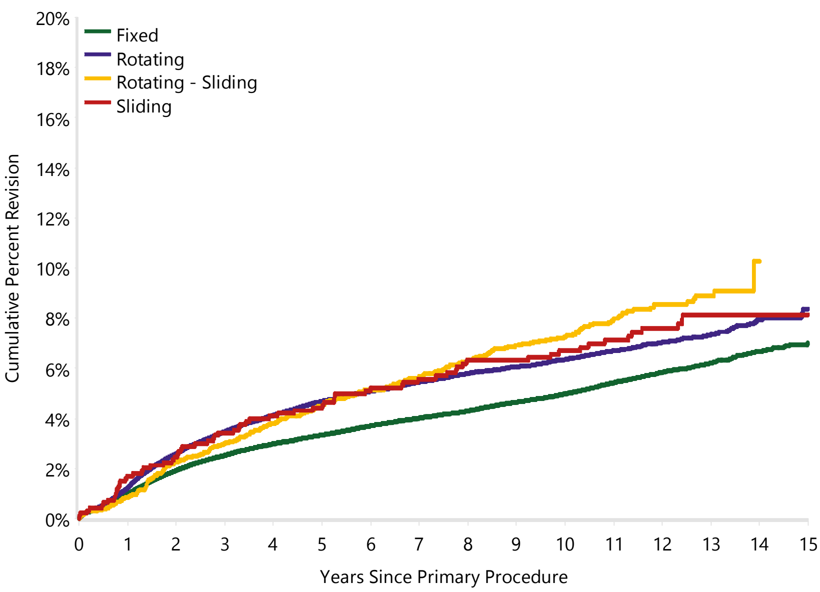
"Hybrid fixation has a lower rate of revision compared to both cemented and cementless fixation for minimally stabilised prostheses."

Table KT15 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	7 Yrs	10 Yrs	15 Yrs
Fixed	12076	376294	1.0 (0.9, 1.0)	2.5 (2.5, 2.6)	3.3 (3.3, 3.4)	4.0 (3.9, 4.1)	5.0 (4.9, 5.1)	7.0 (6.7, 7.3)
Rotating	4727	100111	1.2 (1.2, 1.3)	3.5 (3.3, 3.6)	4.7 (4.5, 4.8)	5.4 (5.3, 5.6)	6.3 (6.2, 6.5)	8.4 (7.8, 9.0)
Rotating - Sliding	335	4849	0.9 (0.6, 1.2)	3.0 (2.5, 3.5)	4.5 (3.9, 5.1)	5.7 (5.0, 6.4)	7.3 (6.5, 8.1)	
Sliding	69	948	1.7 (1.0, 2.8)	3.4 (2.4, 4.8)	4.4 (3.3, 6.0)	5.6 (4.3, 7.3)	6.7 (5.2, 8.5)	8.1 (6.4, 10.2)
TOTAL	17207	482202						

Note: Excluding 171 procedures with unknown bearing mobility

Figure KT15 Cumulative Percent Revision of Primary Total Knee Replacement by Bearing Mobility (Primary Diagnosis OA)



HR - adjusted for age and gender

Rotating vs Fixed

Entire Period: HR=1.28 (1.24, 1.32),p<0.001

Rotating - Sliding vs Fixed

0 - 2Yr: HR=1.11 (0.92, 1.34),p=0.292

2Yr+: HR=1.58 (1.39, 1.81),p<0.001

Sliding vs Fixed

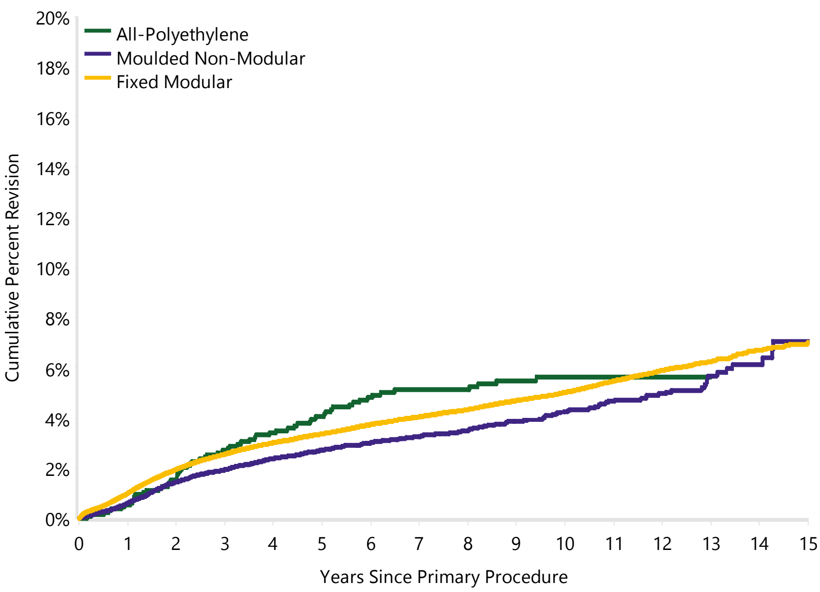
Entire Period: HR=1.18 (0.93, 1.50),p=0.172

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Fixed	376294	328422	243654	171559	113722	52407	1415
Rotating	100111	91135	73037	56362	39880	18685	442
Rotating - Sliding	4849	4703	4359	3982	3589	2139	6
Sliding	948	925	883	846	794	706	175

Table KT16 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	7 Yrs	10 Yrs	15 Yrs
All-Polyethylene	63	1359	0.5 (0.3, 1.1)	2.7 (1.9, 3.8)	4.1 (3.1, 5.3)	5.1 (4.0, 6.6)	5.6 (4.4, 7.2)	
Moulded Non-Modular	598	20736	0.6 (0.5, 0.7)	1.9 (1.8, 2.2)	2.7 (2.5, 3.0)	3.3 (3.0, 3.6)	4.3 (3.9, 4.7)	7.1 (5.8, 8.6)
Fixed Modular	11415	354199	1.0 (1.0, 1.0)	2.6 (2.5, 2.6)	3.4 (3.3, 3.4)	4.0 (4.0, 4.1)	5.0 (4.9, 5.1)	7.0 (6.7, 7.3)
TOTAL	12076	376294						

Figure KT16 Cumulative Percent Revision of Primary Total Knee Replacement by Fixed Bearing Type (Primary Diagnosis OA)



HR - adjusted for age and gender

All-Polyethylene vs Moulded Non-Modular
Entire Period: HR=1.55 (1.19, 2.01),p<0.001

Fixed Modular vs Moulded Non-Modular
0 - 1Mth: HR=4.11 (2.13, 7.92),p<0.001
1Mth - 1.5Yr: HR=1.43 (1.24, 1.65),p<0.001
1.5Yr+: HR=1.12 (1.01, 1.24),p=0.025

All-Polyethylene vs Fixed Modular
Entire Period: HR=1.26 (0.98, 1.61),p=0.070

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
All-Polyethylene	1359	1258	1122	1019	885	504	3
Moulded Non-Modular	20736	19339	15469	11134	7408	3011	108
Fixed Modular	354199	307825	227063	159406	105429	48892	1304

Table KT17 Cumulative Percent Revision of All-Polyethylene Primary Total Knee Replacement by Prosthesis Type (Primary Diagnosis OA)

Prosthesis Type	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Scorpio	38	694	0.6 (0.2, 1.5)	2.8 (1.8, 4.4)	4.3 (3.0, 6.2)	5.3 (3.8, 7.3)	5.9 (4.3, 8.0)	
Profix	6	152	0.7 (0.1, 4.6)	2.0 (0.7, 6.1)	3.5 (1.5, 8.1)	4.2 (1.9, 9.2)		
Nexgen	4	149	0.7 (0.1, 4.8)	2.4 (0.8, 7.2)	2.4 (0.8, 7.2)	3.6 (1.3, 9.4)	3.6 (1.3, 9.4)	
Genesis II	2	132	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	2.2 (0.6, 8.7)		
Triathlon	1	80	1.6 (0.2, 10.6)					
PFC Sigma	0	55	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)		
Optetrak-PS	11	52	0.0 (0.0, 0.0)	13.5 (6.7, 26.2)	17.4 (9.4, 30.7)	19.4 (10.9, 33.1)	22.0 (12.8, 36.4)	
Other (3)	1	45	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	2.6 (0.4, 16.8)	2.6 (0.4, 16.8)	2.6 (0.4, 16.8)	
TOTAL	63	1359						

Note: Only prostheses with over 50 procedures have been listed

Figure KT17 Primary Total Knee Replacement by Stability (Primary Diagnosis OA)

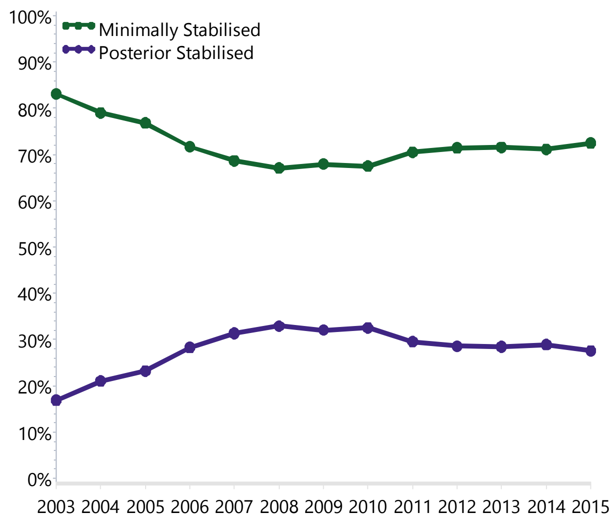
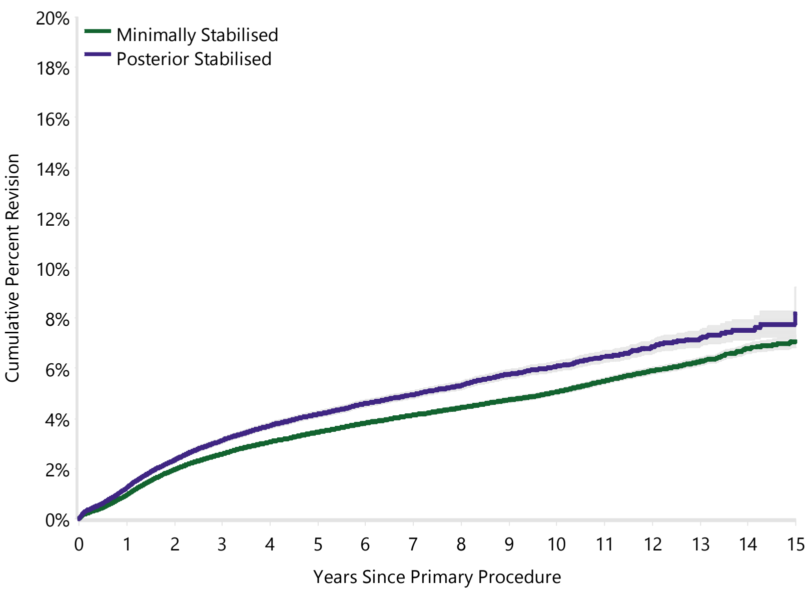


Table KT18 Cumulative Percent Revision of Primary Total Knee Replacement by Stability (Primary Diagnosis OA)

Stability	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Minimally Stabilised	12001	348016	0.9 (0.9, 1.0)	2.6 (2.5, 2.6)	3.4 (3.4, 3.5)	4.1 (4.0, 4.2)	5.0 (4.9, 5.2)	7.1 (6.8, 7.3)
Posterior Stabilised	5078	130328	1.2 (1.2, 1.3)	3.1 (3.0, 3.2)	4.2 (4.0, 4.3)	4.9 (4.8, 5.1)	6.1 (5.9, 6.3)	8.2 (7.2, 9.2)
Fully Stabilised	94	3334	1.9 (1.4, 2.5)	3.9 (3.1, 4.9)	5.3 (4.2, 6.8)	6.0 (4.7, 7.8)	7.0 (5.3, 9.3)	
Hinged	34	542	2.1 (1.2, 3.8)	5.2 (3.5, 7.8)	6.7 (4.6, 9.8)	8.5 (5.8, 12.4)		
TOTAL	17207	482220						

Note: Excluding 153 procedures with unknown stability

Figure KT18 Cumulative Percent Revision of Primary Total Knee Replacement by Stability (Primary Diagnosis OA)



HR - adjusted for age and gender

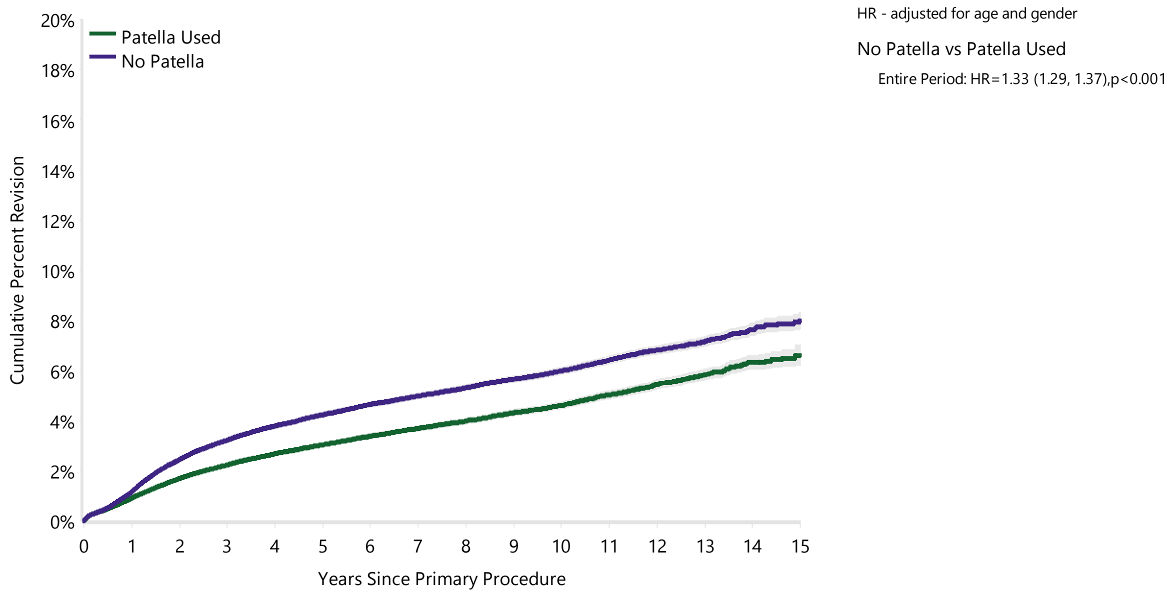
Posterior Stabilised vs Minimally Stabilised
0 - 1Yr: HR=1.30 (1.23, 1.39),p<0.001
1Yr - 2Yr: HR=1.09 (1.02, 1.16),p=0.014
2Yr+: HR=1.21 (1.15, 1.27),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Minimally Stabilised	348016	307973	235071	171574	120115	60616	1827
Posterior Stabilised	130328	114848	85796	60505	37523	13185	210

Table KT19 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	7 Yrs	10 Yrs	15 Yrs
Patella Used	6896	242199	0.9 (0.9, 0.9)	2.2 (2.2, 2.3)	3.0 (2.9, 3.1)	3.7 (3.6, 3.8)	4.6 (4.5, 4.7)	6.6 (6.2, 7.0)
No Patella	10317	240174	1.1 (1.1, 1.2)	3.2 (3.1, 3.3)	4.2 (4.1, 4.3)	5.0 (4.9, 5.1)	6.0 (5.9, 6.1)	8.0 (7.7, 8.3)
TOTAL	17213	482373						

Figure KT19 Cumulative Percent Revision of Primary Total Knee Replacement by Patella Usage (Primary Diagnosis OA)

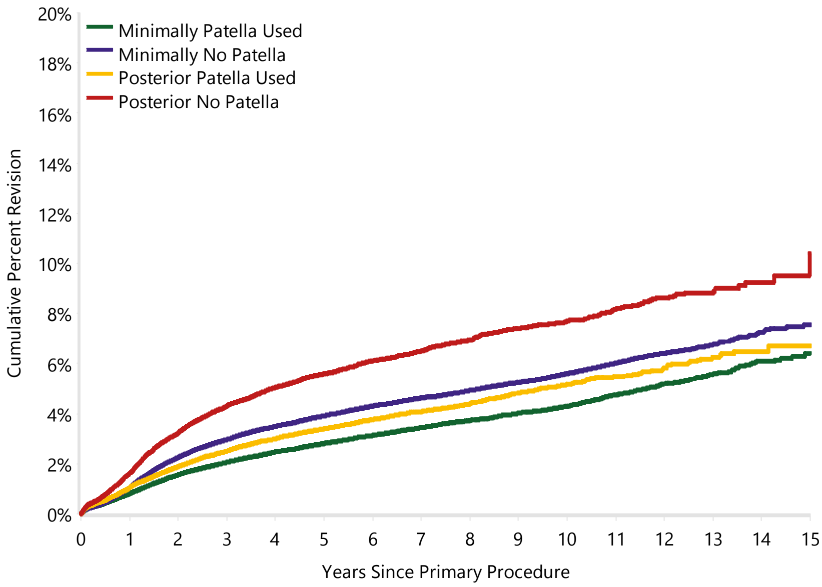


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Patella Used	242199	208638	151097	104630	69069	31707	656
No Patella	240174	216693	170962	128218	88999	42277	1384

Table KT20 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	7 Yrs	10 Yrs	15 Yrs
Minimally	Patella Used	4151	151210	0.8 (0.8, 0.8)	2.0 (2.0, 2.1)	2.8 (2.7, 2.9)	3.4 (3.3, 3.6)	4.3 (4.1, 4.4)	6.4 (6.0, 6.9)
	No Patella	7850	196806	1.0 (1.0, 1.1)	3.0 (2.9, 3.0)	3.9 (3.8, 4.0)	4.6 (4.5, 4.7)	5.6 (5.5, 5.7)	7.5 (7.2, 7.9)
Posterior	Patella Used	2683	88609	1.0 (1.0, 1.1)	2.5 (2.4, 2.6)	3.4 (3.2, 3.5)	4.1 (3.9, 4.2)	5.2 (4.9, 5.4)	6.7 (6.1, 7.4)
	No Patella	2395	41719	1.6 (1.5, 1.7)	4.3 (4.1, 4.5)	5.6 (5.3, 5.8)	6.5 (6.2, 6.8)	7.7 (7.4, 8.0)	10.4 (8.6, 12.5)
TOTAL		17079	478344						

Figure KT20 Cumulative Percent Revision of Primary Total Knee Replacement by Stability and Patella Usage (Primary Diagnosis OA)



HR - adjusted for age and gender

Minimally Patella Used vs Minimally No Patella
Entire Period: HR=0.76 (0.73, 0.79),p<0.001

Minimally No Patella vs Posterior No Patella
0 - 1.5Yr: HR=0.65 (0.61, 0.70),p<0.001
1.5Yr - 2Yr: HR=0.76 (0.66, 0.88),p<0.001
2Yr - 3Yr: HR=0.63 (0.56, 0.70),p<0.001
3Yr - 3.5Yr: HR=0.82 (0.67, 0.99),p=0.041
3.5Yr - 4Yr: HR=0.61 (0.50, 0.74),p<0.001
4Yr+: HR=0.82 (0.74, 0.89),p<0.001

Minimally Patella Used vs Posterior Patella Used
0 - 2Yr: HR=0.80 (0.75, 0.85),p<0.001
2Yr - 2.5Yr: HR=0.74 (0.65, 0.85),p<0.001
2.5Yr - 3.5Yr: HR=0.85 (0.75, 0.95),p=0.003
3.5Yr+: HR=1.00 (0.93, 1.08),p=0.919

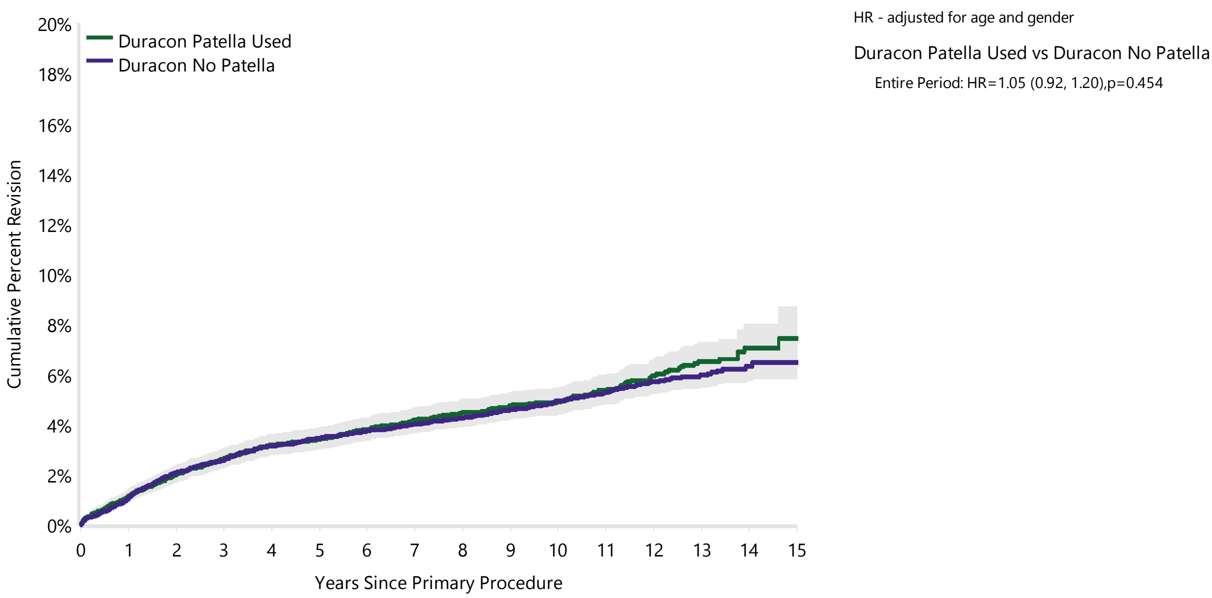
Posterior Patella Used vs Posterior No Patella
Entire Period: HR=0.62 (0.59, 0.66),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Minimally	Patella Used	151210	130906	96036	67955	46986	24041	546
	No Patella	196806	177067	139035	103619	73129	36575	1281
Posterior	Patella Used	88609	76307	54458	36308	21900	7587	109
	No Patella	41719	38541	31338	24197	15623	5598	101

Table KT21 Cumulative Percent Revision of Duracon Primary Total Knee Replacement by Patella Usage (Primary Diagnosis OA)

Model	Patella Usage	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Duracon	Patella Used	366	7186	1.1 (0.9, 1.4)	2.6 (2.3, 3.0)	3.4 (3.0, 3.9)	4.2 (3.7, 4.7)	4.9 (4.4, 5.5)	7.4 (6.3, 8.7)
	No Patella	611	12644	1.1 (0.9, 1.3)	2.6 (2.3, 2.9)	3.5 (3.1, 3.8)	4.0 (3.7, 4.4)	4.9 (4.5, 5.4)	6.5 (5.8, 7.2)
TOTAL		977	19830						

Figure KT21 Cumulative Percent Revision of Duracon Primary Total Knee Replacement by Patella Usage (Primary Diagnosis OA)



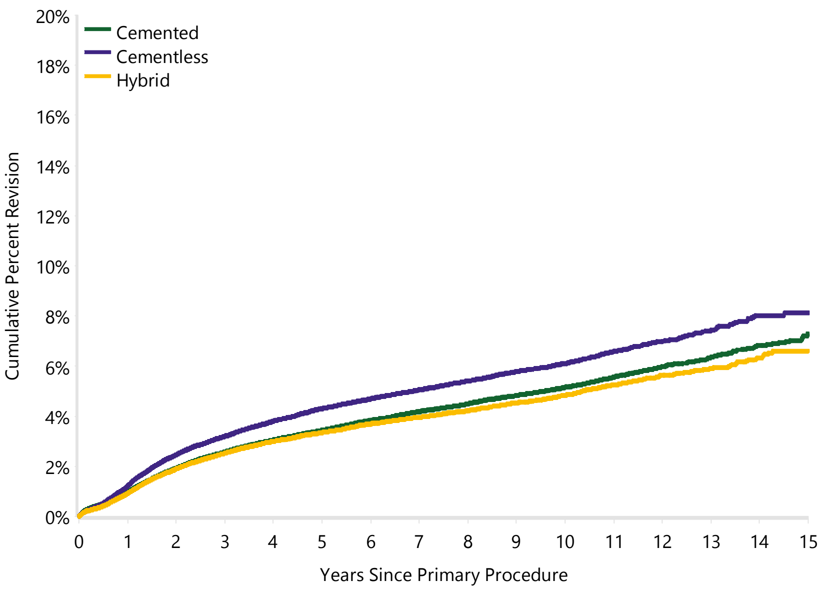
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Duracon	Patella Used	7186	7026	6688	6321	5461	3496	123
	No Patella	12644	12352	11804	11157	10014	5869	194

Table KT22 Cumulative Percent Revision of Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)

Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	8439	258789	1.0 (0.9, 1.0)	2.6 (2.5, 2.6)	3.4 (3.4, 3.5)	4.2 (4.1, 4.3)	5.1 (5.0, 5.3)	7.3 (6.9, 7.7)
Cementless	4612	103903	1.2 (1.1, 1.3)	3.2 (3.1, 3.3)	4.3 (4.2, 4.4)	5.0 (4.9, 5.2)	6.1 (5.9, 6.3)	8.1 (7.7, 8.6)
Hybrid	3964	119262	0.9 (0.9, 1.0)	2.5 (2.4, 2.6)	3.3 (3.2, 3.5)	3.9 (3.8, 4.1)	4.8 (4.7, 5.0)	6.6 (6.2, 7.0)
TOTAL	17015	481954						

Note: Excluding cementless Genesis Oxinium and Profix Oxinium femoral prostheses

Figure KT22 Cumulative Percent Revision of Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)



HR - adjusted for age and gender

Cemented vs Hybrid
Entire Period: HR=1.07 (1.03, 1.11),p<0.001

Cementless vs Hybrid
Entire Period: HR=1.19 (1.15, 1.25),p<0.001

Cementless vs Cemented
Entire Period: HR=1.12 (1.08, 1.16),p<0.001

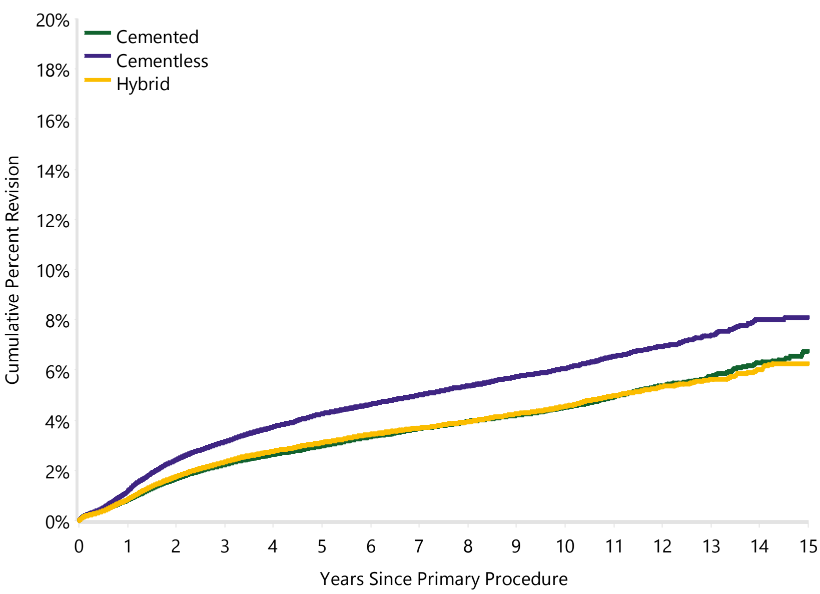
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	258789	223744	165617	117331	77569	34035	886
Cementless	103903	95123	76159	56213	38417	18420	493
Hybrid	119262	106108	80052	59085	41875	21354	661

Table KT23 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	7 Yrs	10 Yrs	15 Yrs
Cemented	4155	141842	0.8 (0.8, 0.9)	2.2 (2.1, 2.3)	3.0 (2.9, 3.1)	3.7 (3.5, 3.8)	4.5 (4.4, 4.7)	6.7 (6.3, 7.2)
Cementless	4302	97369	1.2 (1.1, 1.2)	3.1 (3.0, 3.3)	4.2 (4.1, 4.4)	5.0 (4.8, 5.2)	6.1 (5.9, 6.3)	8.1 (7.7, 8.5)
Hybrid	3346	108386	0.8 (0.8, 0.9)	2.3 (2.2, 2.4)	3.1 (3.0, 3.2)	3.7 (3.6, 3.8)	4.5 (4.4, 4.7)	6.3 (5.9, 6.6)
TOTAL	11803	347597						

Note: Excluding cementless Genesis Oxinium and Profix Oxinium femoral prostheses

Figure KT23 Cumulative Percent Revision of Minimally Stabilised Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)



HR - adjusted for age and gender

Cementless vs Cemented

Entire Period: HR=1.25 (1.20, 1.31),p<0.001

Hybrid vs Cemented

Entire Period: HR=0.99 (0.94, 1.03),p=0.598

Cementless vs Hybrid

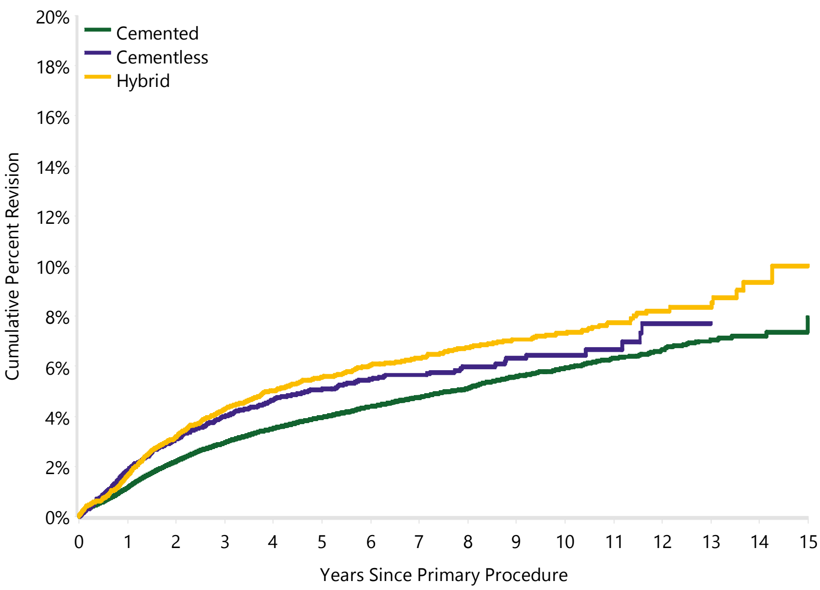
Entire Period: HR=1.27 (1.21, 1.32),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	141842	122320	91381	65719	45985	22816	733
Cementless	97369	89240	71485	52923	36597	17908	489
Hybrid	108386	96057	71974	52713	37326	19717	605

Table KT24 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	7 Yrs	10 Yrs	15 Yrs
Cemented	4156	113016	1.1 (1.1, 1.2)	2.9 (2.8, 3.1)	4.0 (3.8, 4.1)	4.8 (4.6, 4.9)	5.9 (5.7, 6.1)	7.9 (6.8, 9.3)
Cementless	308	6506	1.9 (1.5, 2.2)	4.0 (3.5, 4.5)	5.1 (4.5, 5.7)	5.6 (5.0, 6.3)	6.4 (5.6, 7.3)	
Hybrid	614	10806	1.6 (1.4, 1.9)	4.3 (3.9, 4.7)	5.6 (5.1, 6.0)	6.3 (5.8, 6.8)	7.3 (6.7, 7.9)	10.0 (8.3, 12.0)
TOTAL	5078	130328						

Figure KT24 Cumulative Percent Revision of Posterior Stabilised Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)



HR - adjusted for age and gender

Cementless vs Cemented

Entire Period: HR=1.12 (1.00, 1.26),p=0.055

Hybrid vs Cemented

Entire Period: HR=1.29 (1.18, 1.40),p<0.001

Hybrid vs Cementless

Entire Period: HR=1.15 (1.00, 1.32),p=0.047

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Cemented	113016	99001	73115	50897	31200	11069	152
Cementless	6506	5856	4653	3273	1807	502	2
Hybrid	10806	9991	8028	6335	4516	1614	56

Computer Navigation

There have been 80,472 primary total knee replacements reported to the Registry that have used computer navigation. In 2015, computer navigation was used in 28.6% of all primary total knee replacement. Patients aged less than 65 years have a lower cumulative percent revision when computer navigation is used. There is no difference in the rate of revision for the 65 and older age group (Table KT25 and Figure KT25). There is, however, a reduction in the rate of revision for navigated knee replacement for loosening/lysis in both age groups (Figure KT26).

Image Derived Instrumentation (IDI)

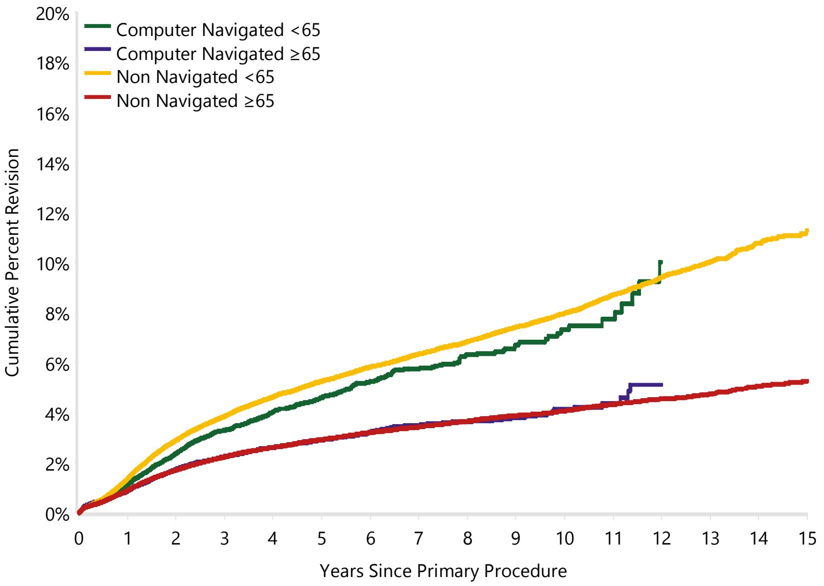
The Registry has recorded 15,681 primary total knee procedures undertaken using IDI since 2009. In 2015, IDI was used in 9.1% of all primary total knee procedures. Of those undertaken for osteoarthritis, there is no difference in the rate of revision between procedures with or without IDI usage (Table KT26 and Figure KT27).

"There is no difference in the rate of revision between procedures with or without IDI usage."

Table KT25 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	7 Yrs	10 Yrs	15 Yrs
Computer Navigated		2114	80472	0.9 (0.9, 1.0)	2.6 (2.5, 2.8)	3.5 (3.4, 3.7)	4.3 (4.1, 4.5)	5.3 (4.9, 5.7)	
	<65	979	28337	1.1 (1.0, 1.2)	3.3 (3.1, 3.5)	4.6 (4.3, 4.9)	5.8 (5.4, 6.2)	7.3 (6.6, 8.1)	
	≥65	1135	52135	0.9 (0.8, 0.9)	2.2 (2.1, 2.4)	2.9 (2.7, 3.1)	3.5 (3.3, 3.7)	4.1 (3.7, 4.6)	
Non Navigated		15099	401901	1.0 (1.0, 1.1)	2.8 (2.7, 2.8)	3.7 (3.6, 3.7)	4.4 (4.3, 4.4)	5.3 (5.3, 5.4)	7.3 (7.1, 7.6)
	<65	7204	129481	1.4 (1.3, 1.4)	3.8 (3.7, 4.0)	5.2 (5.1, 5.4)	6.3 (6.2, 6.5)	8.0 (7.8, 8.2)	11.3 (10.8, 11.8)
	≥65	7895	272420	0.9 (0.8, 0.9)	2.2 (2.2, 2.3)	2.9 (2.8, 3.0)	3.4 (3.3, 3.5)	4.1 (4.0, 4.2)	5.3 (5.0, 5.5)
TOTAL		17213	482373						

Figure KT25 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 - 3Mth: HR=1.01 (0.81, 1.27),p=0.931

3Mth - 2Yr: HR=1.44 (1.29, 1.61),p<0.001

2Yr - 2.5Yr: HR=2.06 (1.67, 2.53),p<0.001

2.5Yr - 3.5Yr: HR=1.51 (1.23, 1.86),p<0.001

3.5Yr+: HR=2.15 (1.85, 2.50),p<0.001

Computer Navigated ≥65 vs Non Navigated ≥65

Entire Period: HR=1.01 (0.95, 1.07),p=0.783

Computer Navigated<65 vs Non Navigated < 65

Entire Period: HR=0.87 (0.82, 0.93),p<0.001

Non Navigated ≥65 vs Non Navigated <65

0 - 2Wk: HR=0.93 (0.73, 1.20),p=0.590

2Wk - 1Mth: HR=0.99 (0.82, 1.19),p=0.911

1Mth - 3Mth: HR=0.86 (0.74, 1.01),p=0.061

3Mth - 9Mth: HR=0.62 (0.57, 0.68),p<0.001

9Mth - 1.5Yr: HR=0.54 (0.50, 0.58),p<0.001

1.5Yr - 3Yr: HR=0.52 (0.49, 0.56),p<0.001

3Yr - 3.5Yr: HR=0.52 (0.45, 0.59),p<0.001

3.5Yr - 4.5Yr: HR=0.48 (0.43, 0.53),p<0.001

4.5Yr - 5Yr: HR=0.47 (0.39, 0.55),p<0.001

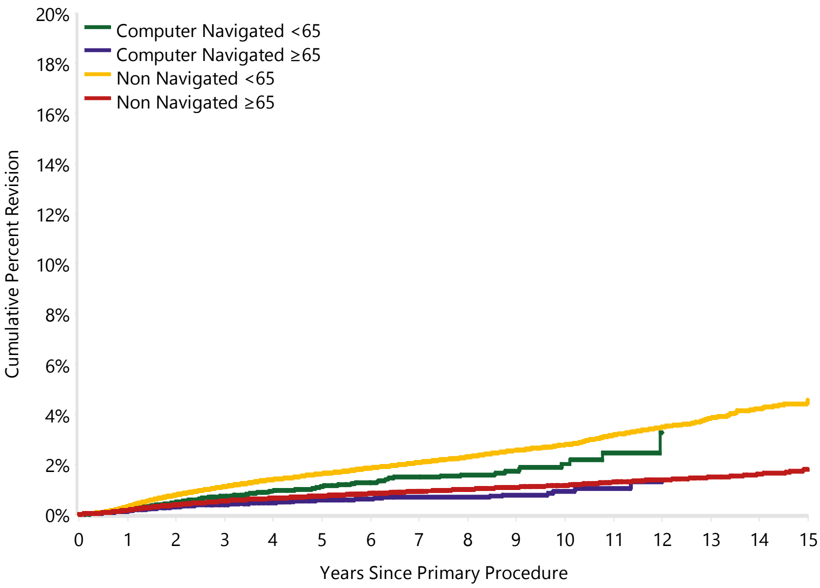
5Yr - 6.5Yr: HR=0.47 (0.42, 0.52),p<0.001

6.5Yr - 7Yr: HR=0.38 (0.30, 0.48),p<0.001

7Yr - 11Yr: HR=0.39 (0.35, 0.43),p<0.001

11Yr+: HR=0.31 (0.25, 0.38),p<0.001

Figure KT26 Cumulative Percent Revision for Loosening/Lysis 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 - 1.5Yr: HR=1.50 (1.15, 1.95),p=0.002

1.5Yr+: HR=2.35 (1.89, 2.91),p<0.001

Computer Navigated ≥65 vs Non Navigated ≥65

Entire Period: HR=0.77 (0.66, 0.89),p<0.001

Computer Navigated <65 vs Non Navigated <65

Entire Period: HR=0.67 (0.59, 0.77),p<0.001

Non Navigated <65 vs Non Navigated ≥65

0 - 3Mth: HR=1.27 (0.91, 1.76),p=0.158

3Mth - 9Mth: HR=1.85 (1.53, 2.24),p<0.001

9Mth - 1.5Yr: HR=2.18 (1.92, 2.48),p<0.001

1.5Yr - 3Yr: HR=2.11 (1.88, 2.37),p<0.001

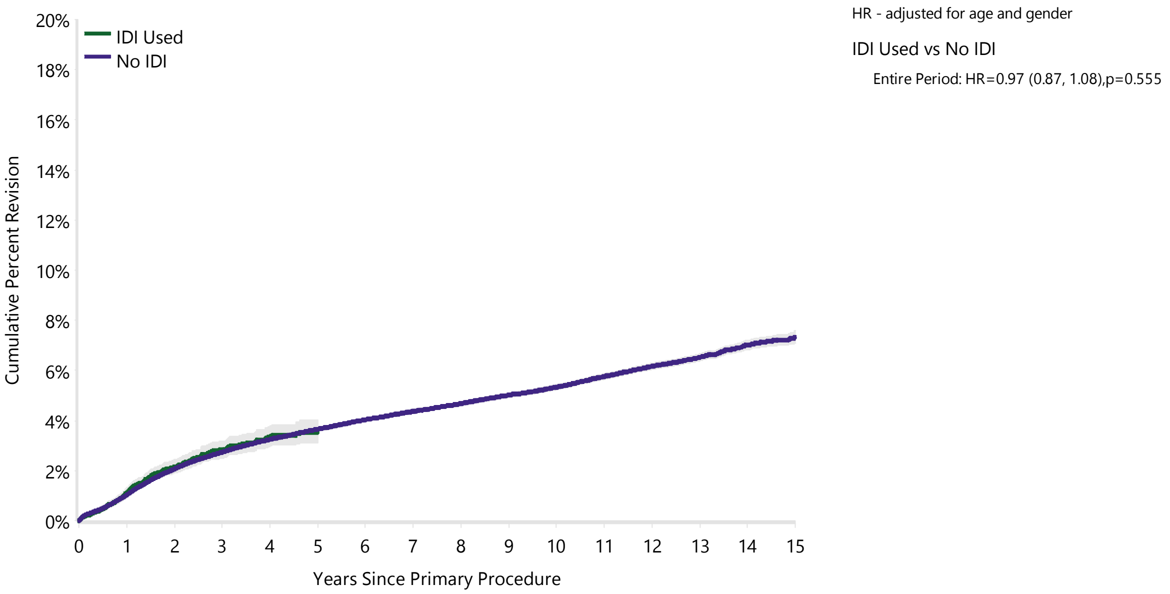
3Yr+: HR=2.77 (2.53, 3.02),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Computer Navigated		80472	65374	41289	22655	9614	1784	0
	<65	28337	23082	14945	8228	3520	657	0
	≥65	52135	42292	26344	14427	6094	1127	0
Non Navigated		401901	359957	280770	210193	148454	72200	2040
	<65	129481	115730	89953	67609	48206	24572	793
	≥65	272420	244227	190817	142584	100248	47628	1247

Table KT26 Cumulative Percent Revision of Primary Total Knee Replacement by IDI Usage (Primary Diagnosis OA)

IDI Usage	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
IDI Used	319	15681	1.1 (0.9, 1.3)	2.8 (2.5, 3.2)	3.5 (3.1, 4.0)			
No IDI	16894	466692	1.0 (1.0, 1.1)	2.7 (2.7, 2.8)	3.6 (3.6, 3.7)	4.4 (4.3, 4.4)	5.3 (5.2, 5.4)	7.3 (7.1, 7.6)
TOTAL	17213	482373						

Figure KT27 Cumulative Percent Revision of Primary Total Knee Replacement by IDI Usage (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
IDI Used	15681	11037	4897	764	0	0	0
No IDI	466692	414294	317162	232084	158068	73984	2040

BEARING SURFACE

There are two tibial bearing surfaces used in primary total knee replacement: non cross-linked polyethylene (non XLPE) and cross-linked polyethylene (XLPE). XLPE has been classified as ultra high molecular weight polyethylene that has been irradiated by high dose (≥50kGy) gamma or electron beam radiation. XLPE also includes 5,716 procedures that have used XLPE with the addition of an antioxidant.

Prostheses using XLPE have a cumulative percent revision of 3.6% at 10 years, compared to 5.7% for non XLPE (Table KT27 and Figure KT28). At 10 years, there is a difference in the cumulative incidence of revision for loosening/lysis, 0.8% for XLPE compared to 1.6% for non XLPE (Figure KT29).

In primary total knee replacement, XLPE is now used more frequently (53.9%) than non XLPE although there is considerable prosthesis variation in its use. Consequently, any observed difference in the rate of revision may be confounded by prosthesis type. For this reason, subsequent analysis has been limited to specific prostheses that have both XLPE and non XLPE options.

The criteria for inclusion are a minimum of 2,500 procedures in at least one of the polyethylene groups and a follow up time of five or more years for both groups. Five primary total knee prostheses fulfilled these criteria: Natural Knee II, Triathlon, Nexgen, Scorpio NRG/Series 7000 and Legion Oxinium PS/Genesis II. The analysis for each of these prostheses includes age, reasons for revision and stability of the prosthesis.

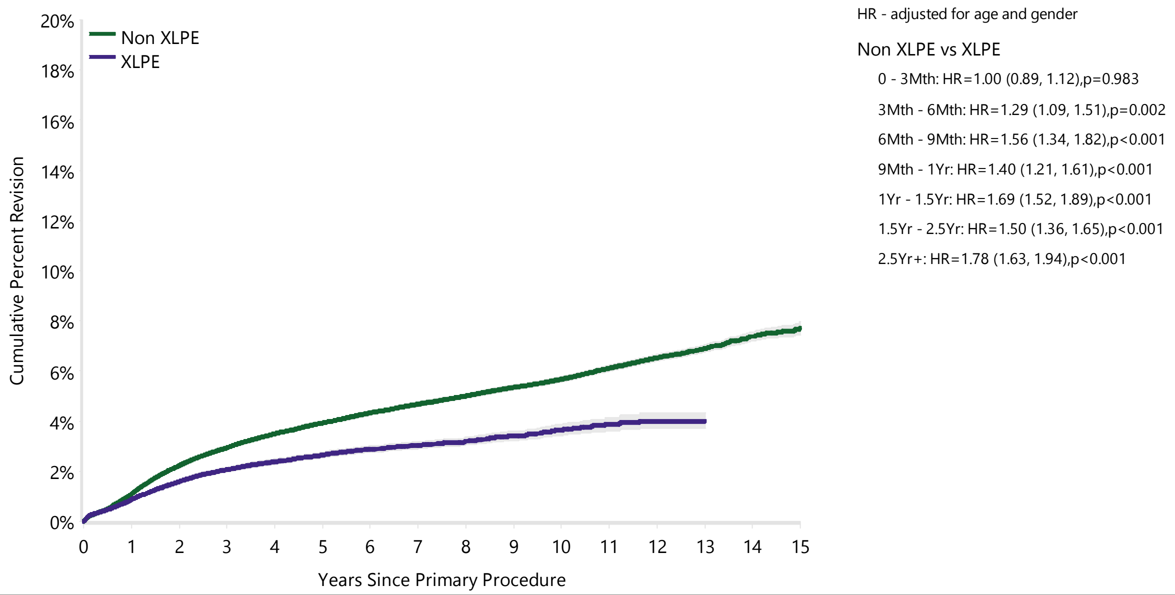
"There is considerable prosthesis variation in use and outcome of XLPE in total knee replacement."

Table KT27 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	7 Yrs	10 Yrs	15 Yrs
Non XLPE	14679	348736	1.1 (1.0, 1.1)	2.9 (2.9, 3.0)	3.9 (3.9, 4.0)	4.7 (4.6, 4.8)	5.7 (5.6, 5.8)	7.7 (7.4, 8.0)
XLPE	2529	133487	0.9 (0.8, 0.9)	2.1 (2.0, 2.2)	2.6 (2.5, 2.8)	3.0 (2.9, 3.2)	3.6 (3.4, 3.9)	
TOTAL	17208	482223						

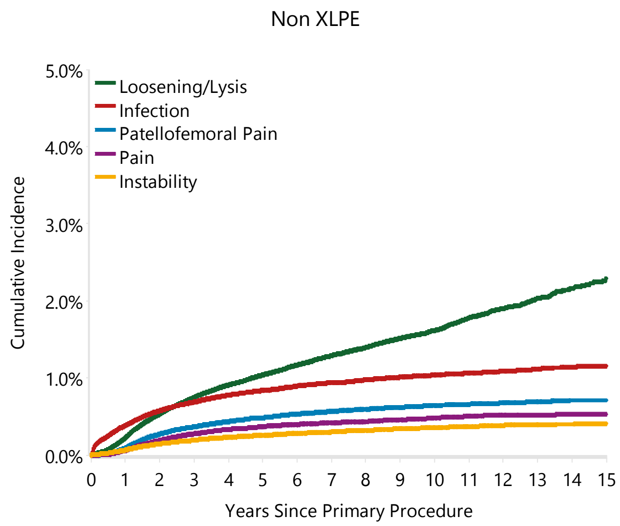
Note: Including 5716 procedures using XLPE with Antioxidant
Excluding 150 procedures with unknown bearing surface

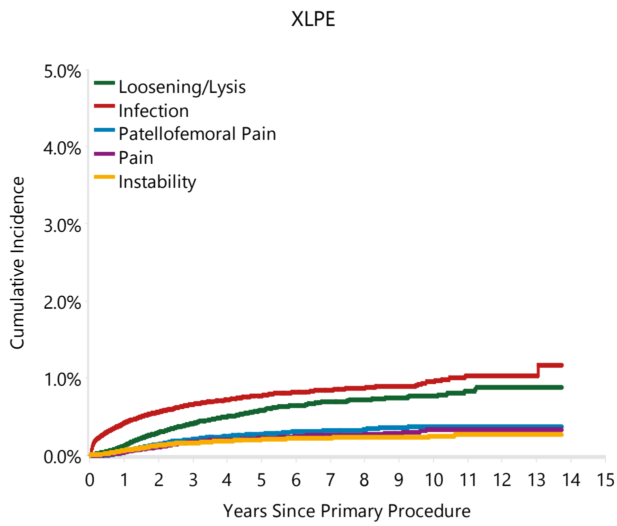
Figure KT28 Cumulative Percent Revision of Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Non XLPE	348736	319787	259761	200158	143141	69100	2038
XLPE	133487	105398	62172	32591	14844	4837	0

Figure KT29 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA)





PROSTHESIS SPECIFIC ANALYSIS

Natural Knee II

The analysis for the Natural Knee II only includes minimally stabilised prostheses as the posterior stabilised option has rarely been used. The Registry has 10 year follow up for both types of polyethylene. XLPE is used in 55.6% of procedures and has a lower rate of revision after 3.5 years (Table KT28 and Figure KT30). This difference is evident regardless of age. However, the difference occurs later and is of greater magnitude for those aged less than 65 years (Table KT28 and Figure KT31). The 10 year cumulative incidence for loosening/lysis is 1.0% for XLPE and 3.1% for non XLPE (Figures KT32 and KT33).

Triathlon

The minimally and posterior stabilised Triathlon knee has a seven year follow up for both XLPE and non XLPE.

XLPE is used in 81.9% of minimally stabilised Triathlon knees. There is no difference in the rate of revision when comparing XLPE and non XLPE (Table KT29 and Figure KT34). Age has no effect on this outcome (Table KT30 and Figure KT35). There is no difference in the reasons for revision between XLPE and non XLPE except in those aged less than 65 years. In this age group, non XLPE has a higher rate of revision for infection (Figure KT36).

XLPE is used in 57.3% of posterior stabilised Triathlon knees and has a lower rate of revision compared to non XLPE (Table KT29 and Figure KT34). There is a lower rate of revision for XLPE in patients aged less than 65 years compared to non XLPE (Table KT31 and Figure KT37). There is no difference in the reasons for revision between XLPE and non XLPE (Figure KT38).

Nexgen

The minimally stabilised Nexgen knee has a 10 year follow up for both XLPE and non XLPE and seven year follow up for the posterior stabilised prostheses.

XLPE is used in 80.3% of minimally stabilised Nexgen CR and CR Flex knees and has a lower rate of revision after one year (Table KT32 and Figure KT39). When comparing age groups, this difference is only evident in those aged less than 65 years (Table KT33 and Figure KT40). For those aged less than 65 years, XLPE has a lower rate of revision for loosening/lysis compared to non XLPE (Figure KT41).

XLPE is used in 38.8% of posterior stabilised Nexgen LPS and LPS Flex knees. There is no difference in the rate of revision when comparing XLPE and non XLPE (Table KT32 and Figure KT39). There is also no age related difference and no difference in the reasons for revision (Table KT34, Figures KT42 and KT43).

Scorpio NRG/Series 7000

The Scorpio NRG/Series 7000 knee has a seven year follow up and XLPE was used in 90.0% of procedures. There is no difference in the rate of revision within minimally and posterior stabilised Scorpio NRG/Series 7000 prostheses when comparing XLPE and non XLPE (Table KT35 and Figure KT44). Age also has no effect on this outcome and there is no difference in the reasons for revision between XLPE and non XLPE (Tables KT36 and KT37, Figures KT45 - KT48).

Legion Oxinium PS/Genesis II

The posterior stabilised Legion Oxinium/Genesis II combination has a five year follow-up, with XLPE used in 45.6% of procedures. There is a lower rate of revision when XLPE is used (Table KT38 and Figure KT49). The reasons for revision are presented in Figure KT50. Those 65 years and older showed a lower rate of revision with XLPE, while the younger group did not (Table KT38, Figures KT51 and KT52).

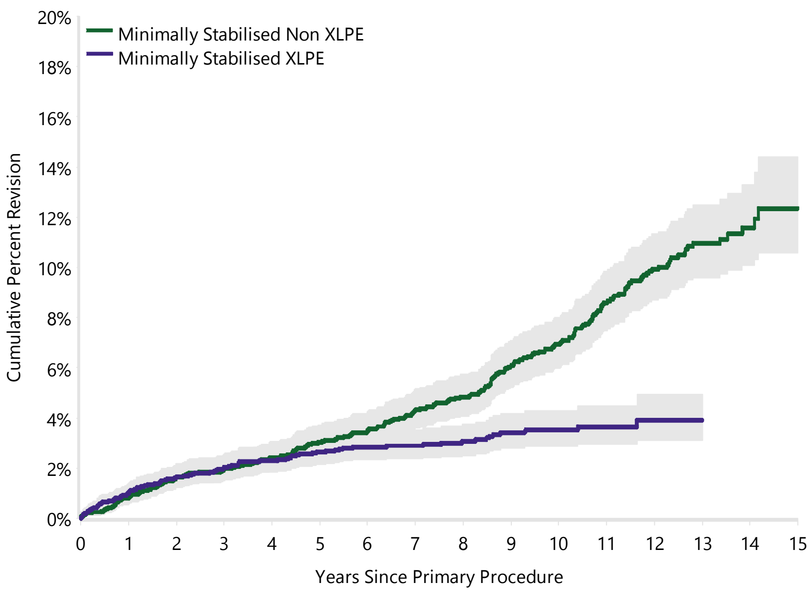
Summary

A lower rate of revision has been identified for the two minimally stabilised knees using XLPE with 10 year follow up (Natural Knee II and Nexgen). This difference is most evident in younger patients and may be associated with a reduced rate of revision for loosening/lysis. There is a lower rate of revision for posterior stabilised Triathlon and the posterior stabilised Legion Oxinium/Genesis II combination when using XLPE. No difference is identified with either minimally or posterior stabilised Scorpio NRG/Series 7000, the minimally stabilised Triathlon, or the posterior stabilised Nexgen.

Table KT28 Cumulative Percent Revision of Minimally Stabilised Natural Knee II/Natural Knee II 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	7 Yrs	10 Yrs	15 Yrs
Non XLPE		230	2861	0.8 (0.5, 1.2)	2.0 (1.5, 2.5)	3.0 (2.4, 3.7)	4.3 (3.6, 5.1)	6.9 (6.0, 8.0)	12.3 (10.6, 14.4)
	<65	118	766	1.0 (0.5, 2.1)	3.0 (2.0, 4.5)	4.6 (3.3, 6.4)	6.8 (5.2, 8.9)	12.0 (9.9, 14.7)	
	≥65	112	2095	0.7 (0.4, 1.2)	1.6 (1.1, 2.2)	2.4 (1.8, 3.2)	3.3 (2.6, 4.2)	4.7 (3.8, 5.8)	
XLPE		103	3576	1.0 (0.7, 1.4)	2.0 (1.6, 2.5)	2.6 (2.1, 3.2)	2.9 (2.4, 3.5)	3.5 (2.9, 4.3)	
	<65	57	1092	1.7 (1.0, 2.6)	3.5 (2.5, 4.8)	4.6 (3.4, 6.0)	4.9 (3.8, 6.5)	5.9 (4.5, 7.6)	
	≥65	46	2484	0.7 (0.5, 1.2)	1.4 (1.0, 1.9)	1.7 (1.3, 2.4)	1.9 (1.4, 2.6)	2.4 (1.8, 3.3)	
TOTAL		333	6437						

Figure KT30 Cumulative Percent Revision of Minimally Stabilised Natural Knee II/Natural Knee II Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA)



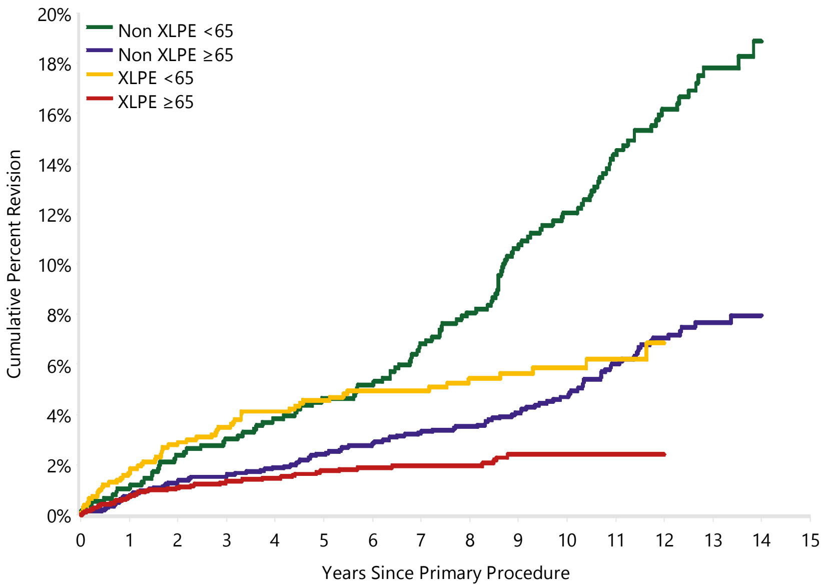
HR - adjusted for age and gender

Minimally Stabilised XLPE vs
Minimally Stabilised Non XLPE

0 - 6Mth: HR=1.78 (0.85, 3.75),p=0.126
6Mth - 3.5Yr: HR=0.87 (0.59, 1.28),p=0.470
3.5Yr+: HR=0.24 (0.16, 0.36),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Minimally Stabilised	Non XLPE	2861	2803	2665	2492	2291	1645	51
	XLPE	3576	3461	2968	2424	1900	864	0

Figure KT31 Cumulative Percent Revision of Minimally Stabilised Natural Knee II/Natural Knee II Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)



HR - adjusted for gender

Non XLPE <65 vs Non XLPE ≥65
Entire Period: HR=2.39 (1.84, 3.09),p<0.001

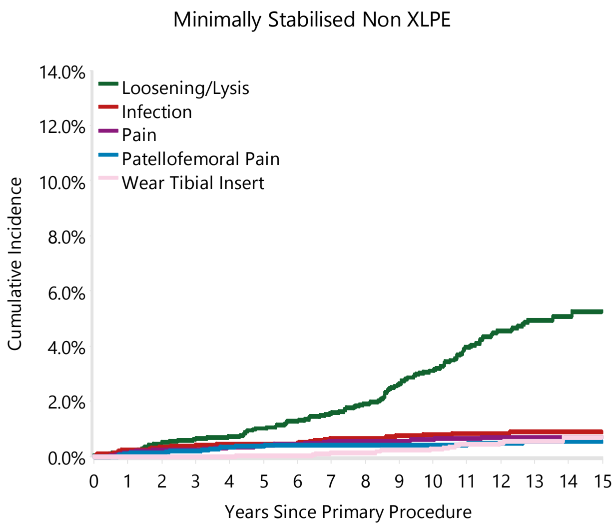
Non XLPE ≥65 vs XLPE ≥65
0 - 1.5Yr: HR=0.90 (0.53, 1.52),p=0.687
1.5Yr+: HR=2.94 (1.85, 4.68),p<0.001

Non XLPE <65 vs XLPE <65
0 - 2Yr: HR=0.83 (0.47, 1.45),p=0.516
2Yr - 2.5Yr: HR=1.60 (0.41, 6.22),p=0.500
2.5Yr - 3Yr: HR=1.04 (0.21, 5.03),p=0.964
3Yr - 4.5Yr: HR=1.49 (0.65, 3.39),p=0.344
4.5Yr - 7.5Yr: HR=3.97 (2.16, 7.32),p<0.001
7.5Yr - 9Yr: HR=6.20 (2.93, 13.12),p<0.001
9Yr+: HR=3.81 (2.05, 7.06),p<0.001

XLPE <65 vs XLPE ≥65
Entire Period: HR=2.57 (1.74, 3.80),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Non XLPE	<65	766	755	732	708	679	531	28
	≥65	2095	2048	1933	1784	1612	1114	23
XLPE	<65	1092	1057	938	804	648	326	0
	≥65	2484	2404	2030	1620	1252	538	0

Figure KT32 Cumulative Incidence Revision Diagnosis of Minimally Stabilised Natural Knee II/Natural Knee II Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA)



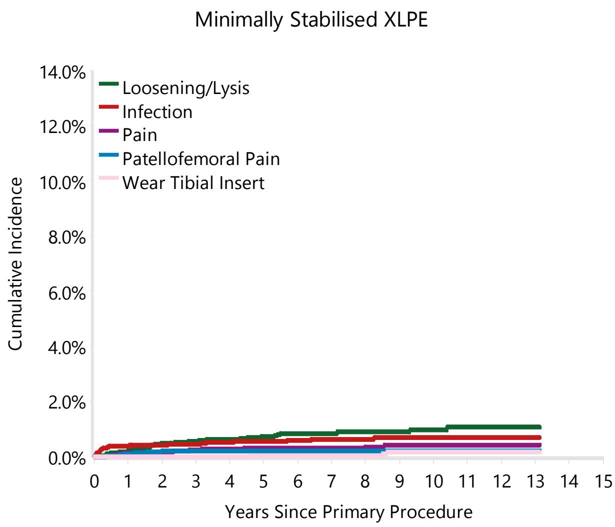


Figure KT33 Cumulative Incidence Revision Diagnosis of Minimally Stabilised Natural Knee II/Natural Knee II Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

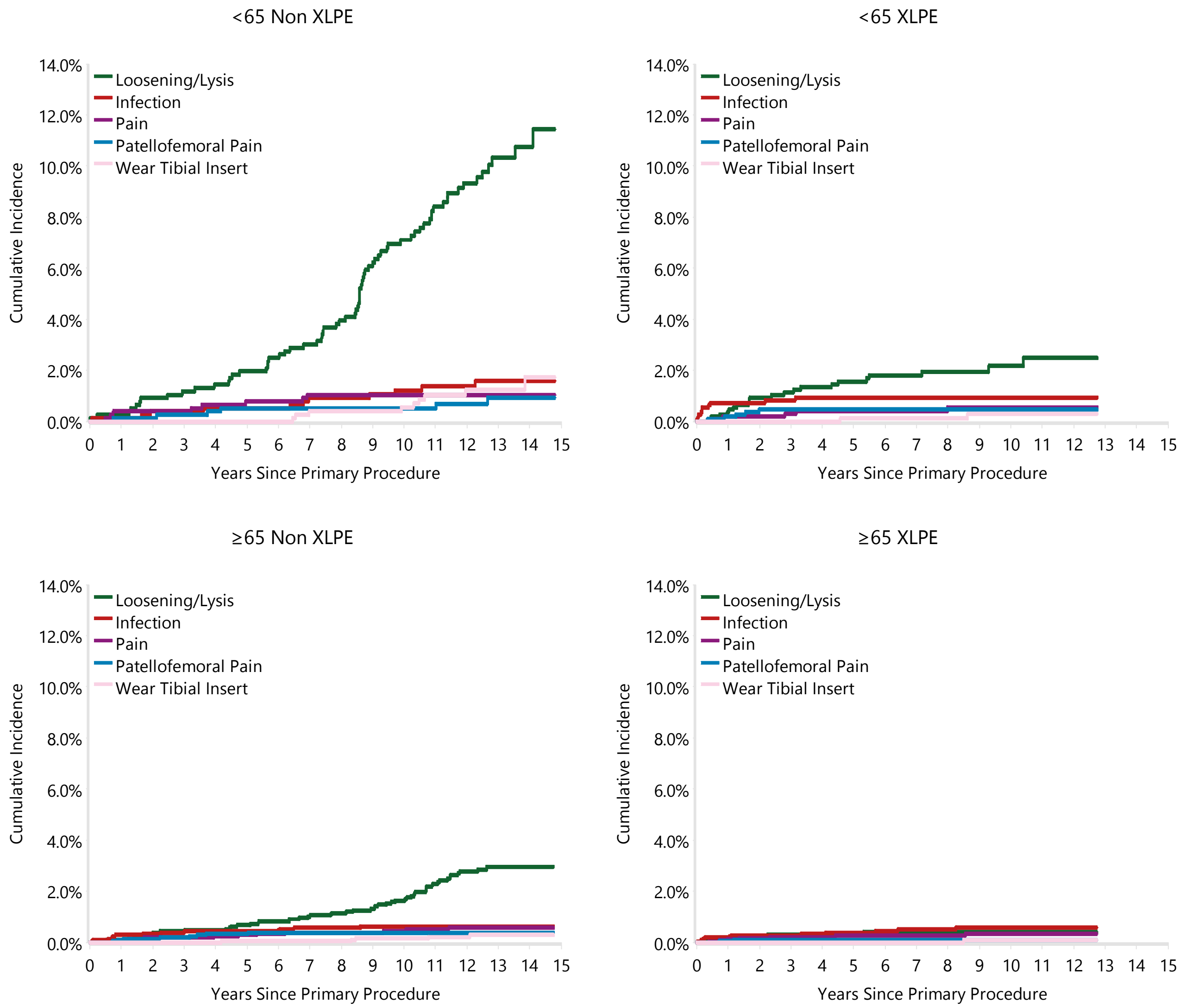
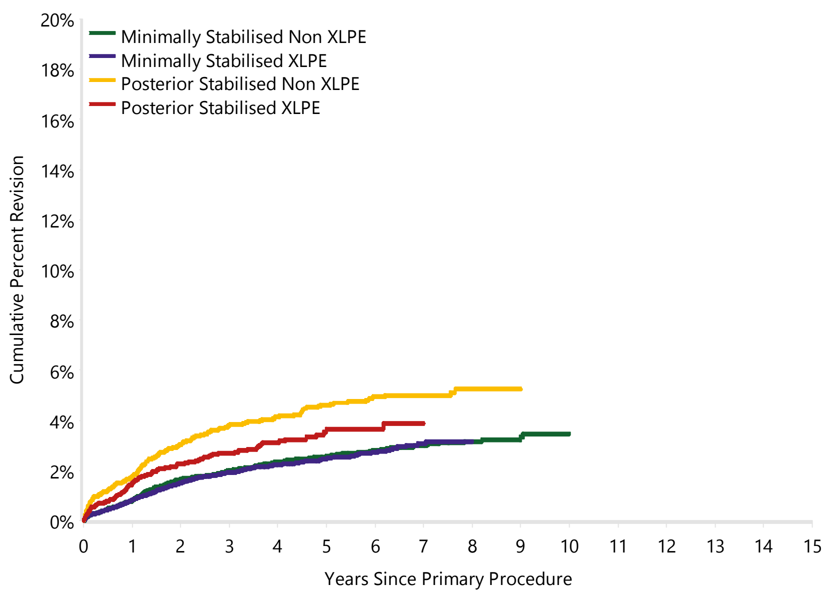


Table KT29 Cumulative Percent Revision of Triathlon/Triathlon Primary Total Knee Replacement by Stability and Polyethylene Type (Primary Diagnosis OA)

Stability	Polyethylene Type	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Minimally Stabilised		929	50357	0.8 (0.7, 0.9)	1.9 (1.8, 2.1)	2.5 (2.3, 2.6)	3.0 (2.7, 3.2)	3.4 (3.0, 3.9)	
	Non XLPE	233	9095	0.8 (0.6, 1.0)	2.0 (1.7, 2.3)	2.5 (2.2, 2.9)	3.0 (2.6, 3.4)	3.4 (2.9, 4.0)	
	XLPE	696	41262	0.8 (0.7, 0.9)	1.9 (1.8, 2.1)	2.5 (2.3, 2.7)	3.1 (2.7, 3.4)		
Posterior Stabilised		279	8504	1.6 (1.4, 1.9)	3.2 (2.8, 3.6)	4.1 (3.6, 4.6)	4.4 (3.9, 5.0)		
	Non XLPE	157	3633	1.8 (1.4, 2.3)	3.8 (3.2, 4.5)	4.6 (3.9, 5.4)	5.0 (4.3, 5.8)		
	XLPE	122	4871	1.5 (1.2, 1.9)	2.7 (2.2, 3.2)	3.6 (3.0, 4.4)	3.9 (3.1, 4.8)		
TOTAL		1208	58861						

Note: The minimally stabilised group includes Triathlon CR/Triathlon prosthesis combination
The posterior stabilised group includes Triathlon PS/Triathlon prosthesis combination

Figure KT34 Cumulative Percent Revision of Triathlon/Triathlon Primary Total Knee Replacement by Stability and Polyethylene Type (Primary Diagnosis OA)



HR - adjusted for age and gender

Minimally Stabilised Non XLPE vs Minimally Stabilised XLPE
Entire Period: HR=1.05 (0.90, 1.22),p=0.531

Minimally Stabilised XLPE vs Posterior Stabilised XLPE
0 - 2Wk: HR=0.36 (0.15, 0.88),p=0.024
2Wk - 1Mth: HR=0.96 (0.42, 2.21),p=0.921
1Mth - 3Mth: HR=0.32 (0.19, 0.55),p<0.001
3Mth+: HR=0.77 (0.62, 0.96),p=0.021

Minimally Stabilised Non XLPE vs Posterior Stabilised Non XLPE
0 - 3Mth: HR=0.32 (0.20, 0.52),p<0.001
3Mth - 1.5Yr: HR=0.64 (0.48, 0.87),p=0.003
1.5Yr+: HR=0.66 (0.50, 0.87),p=0.003

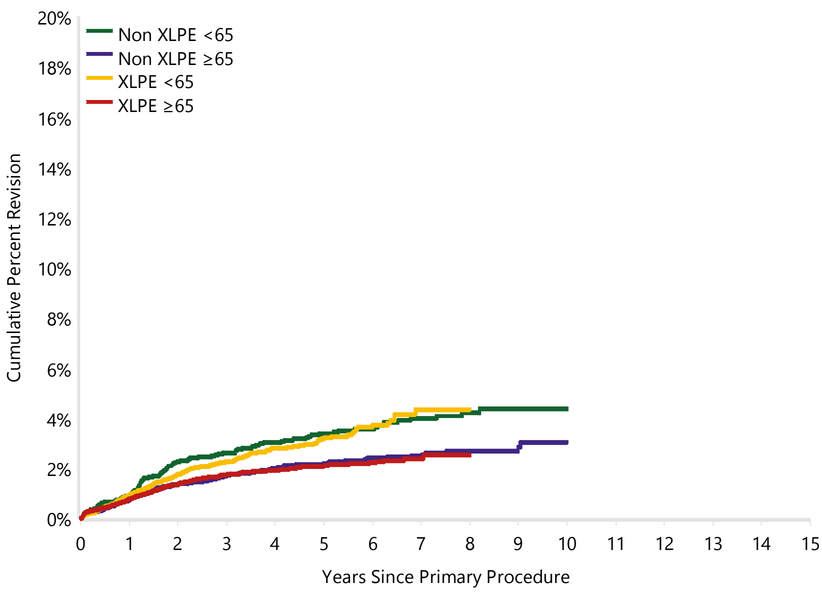
Posterior Stabilised Non XLPE vs Posterior Stabilised XLPE
Entire Period: HR=1.32 (1.04, 1.68),p=0.022

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Minimally Stabilised		50357	41335	25487	12763	4747	148	0
	Non XLPE	9095	8417	7105	5445	3544	148	0
	XLPE	41262	32918	18382	7318	1203	0	0
Posterior Stabilised		8504	7324	5049	2904	1241	26	0
	Non XLPE	3633	3362	2745	2037	1049	26	0
	XLPE	4871	3962	2304	867	192	0	0

Table KT30 Cumulative Percent Revision of Triathlon CR/Triathlon 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	7 Yrs	10 Yrs	15 Yrs
Non XLPE		233	9095	0.8 (0.6, 1.0)	2.0 (1.7, 2.3)	2.5 (2.2, 2.9)	3.0 (2.6, 3.4)	3.4 (2.9, 4.0)	
	<65	98	2855	0.9 (0.6, 1.3)	2.6 (2.1, 3.3)	3.4 (2.7, 4.2)	4.0 (3.3, 4.9)	4.4 (3.5, 5.4)	
	≥65	135	6240	0.7 (0.5, 1.0)	1.7 (1.4, 2.1)	2.2 (1.8, 2.6)	2.5 (2.1, 3.0)	3.0 (2.4, 3.8)	
XLPE		696	41262	0.8 (0.7, 0.9)	1.9 (1.8, 2.1)	2.5 (2.3, 2.7)	3.1 (2.7, 3.4)		
	<65	293	13783	0.9 (0.8, 1.1)	2.2 (2.0, 2.5)	3.2 (2.8, 3.6)	4.3 (3.6, 5.2)		
	≥65	403	27479	0.8 (0.7, 0.9)	1.7 (1.6, 1.9)	2.1 (1.9, 2.3)	2.4 (2.1, 2.7)		
TOTAL		929	50357						

Figure KT35 Cumulative Percent Revision of Triathlon CR/Triathlon Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)



HR - adjusted for gender

Non XLPE <65 vs Non XLPE ≥65
Entire Period: HR=1.56 (1.21, 2.03),p<0.001

Non XLPE ≥65 vs XLPE ≥65
Entire Period: HR=1.01 (0.83, 1.24),p=0.886

Non XLPE <65 vs XLPE <65
Entire Period: HR=1.07 (0.85, 1.35),p=0.569

XLPE <65 vs XLPE ≥65
0 - 3Mth: HR=0.77 (0.55, 1.10),p=0.154
3Mth+: HR=1.58 (1.34, 1.86),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Non XLPE		9095	8417	7105	5445	3544	148	0
	<65	2855	2654	2267	1730	1143	56	0
	≥65	6240	5763	4838	3715	2401	92	0
XLPE		41262	32918	18382	7318	1203	0	0
	<65	13783	11117	6356	2547	426	0	0
	≥65	27479	21801	12026	4771	777	0	0

Figure KT36 **Cumulative Incidence Revision Diagnosis of Triathlon CR/Triathlon Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)**

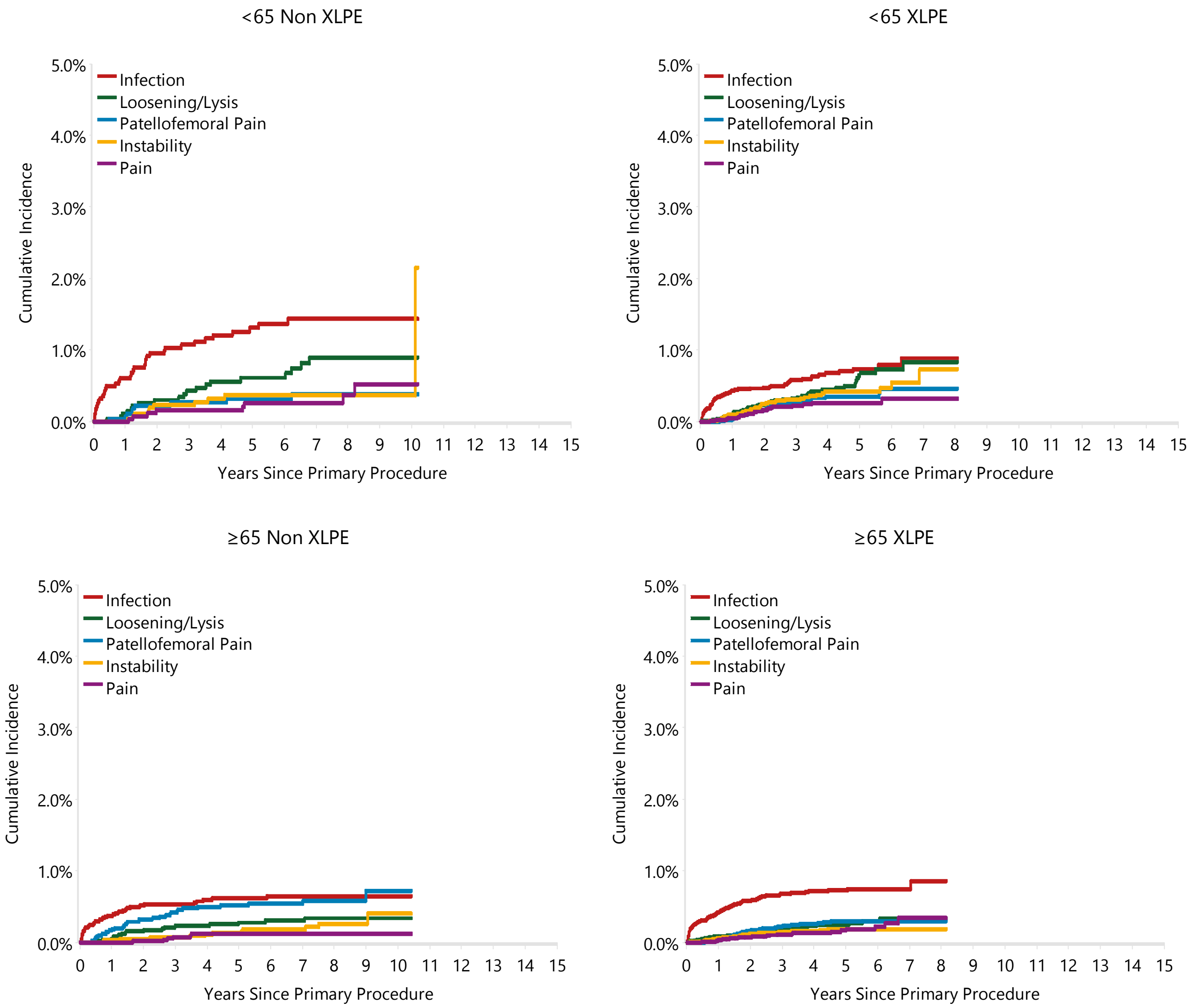
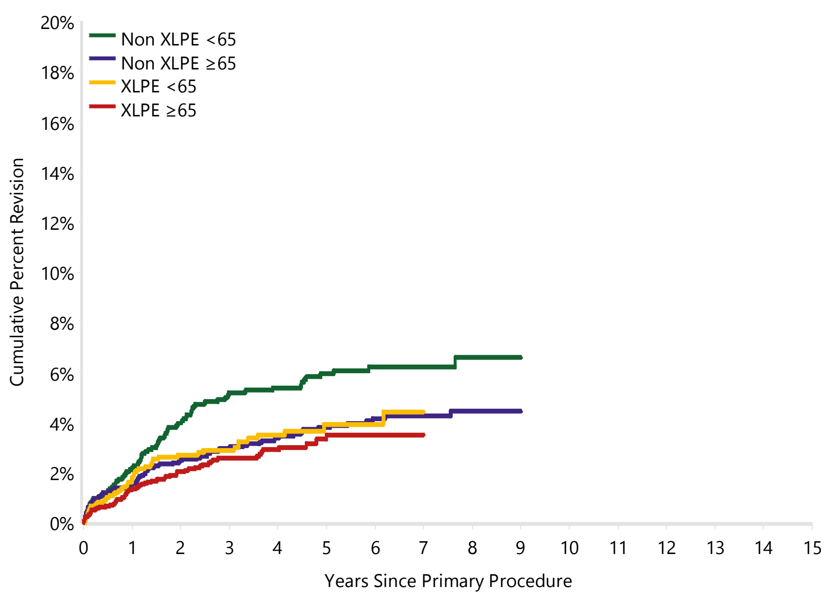


Table KT31 Cumulative Percent Revision of Triathlon PS/Triathlon Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

Polyethylene Type	Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Non XLPE		**157**	**3633**	**1.8 (1.4, 2.3)**	**3.8 (3.2, 4.5)**	**4.6 (3.9, 5.4)**	**5.0 (4.3, 5.8)**		
	<65	75	1352	2.2 (1.5, 3.1)	5.2 (4.1, 6.6)	5.9 (4.7, 7.4)	6.2 (5.0, 7.8)		
	≥65	82	2281	1.5 (1.1, 2.1)	3.0 (2.3, 3.8)	3.8 (3.0, 4.7)	4.2 (3.4, 5.3)		
XLPE		**122**	**4871**	**1.5 (1.2, 1.9)**	**2.7 (2.2, 3.2)**	**3.6 (3.0, 4.4)**	**3.9 (3.1, 4.8)**		
	<65	51	1732	1.8 (1.3, 2.6)	2.9 (2.1, 3.9)	3.9 (2.9, 5.3)	4.4 (3.1, 6.2)		
	≥65	71	3139	1.3 (1.0, 1.8)	2.6 (2.0, 3.3)	3.5 (2.7, 4.6)	3.5 (2.7, 4.6)		
TOTAL		**279**	**8504**						

Figure KT37 Cumulative Percent Revision of Triathlon PS/Triathlon Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)



HR - adjusted for gender

Non XLPE <65 vs Non XLPE ≥65
Entire Period: HR=1.53 (1.12, 2.09),p=0.007

Non XLPE ≥65 vs XLPE ≥65
Entire Period: HR=1.22 (0.89, 1.68),p=0.224

Non XLPE <65 vs XLPE <65
Entire Period: HR=1.50 (1.05, 2.15),p=0.025

XLPE <65 vs XLPE ≥65
Entire Period: HR=1.24 (0.87, 1.78),p=0.241

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Non XLPE		**3633**	**3362**	**2745**	**2037**	**1049**	**26**	**0**
	<65	1352	1253	1033	775	373	11	0
	≥65	2281	2109	1712	1262	676	15	0
XLPE		**4871**	**3962**	**2304**	**867**	**192**	**0**	**0**
	<65	1732	1425	882	353	96	0	0
	≥65	3139	2537	1422	514	96	0	0

Figure KT38 Cumulative Incidence Revision Diagnosis of Triathlon PS/Triathlon Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

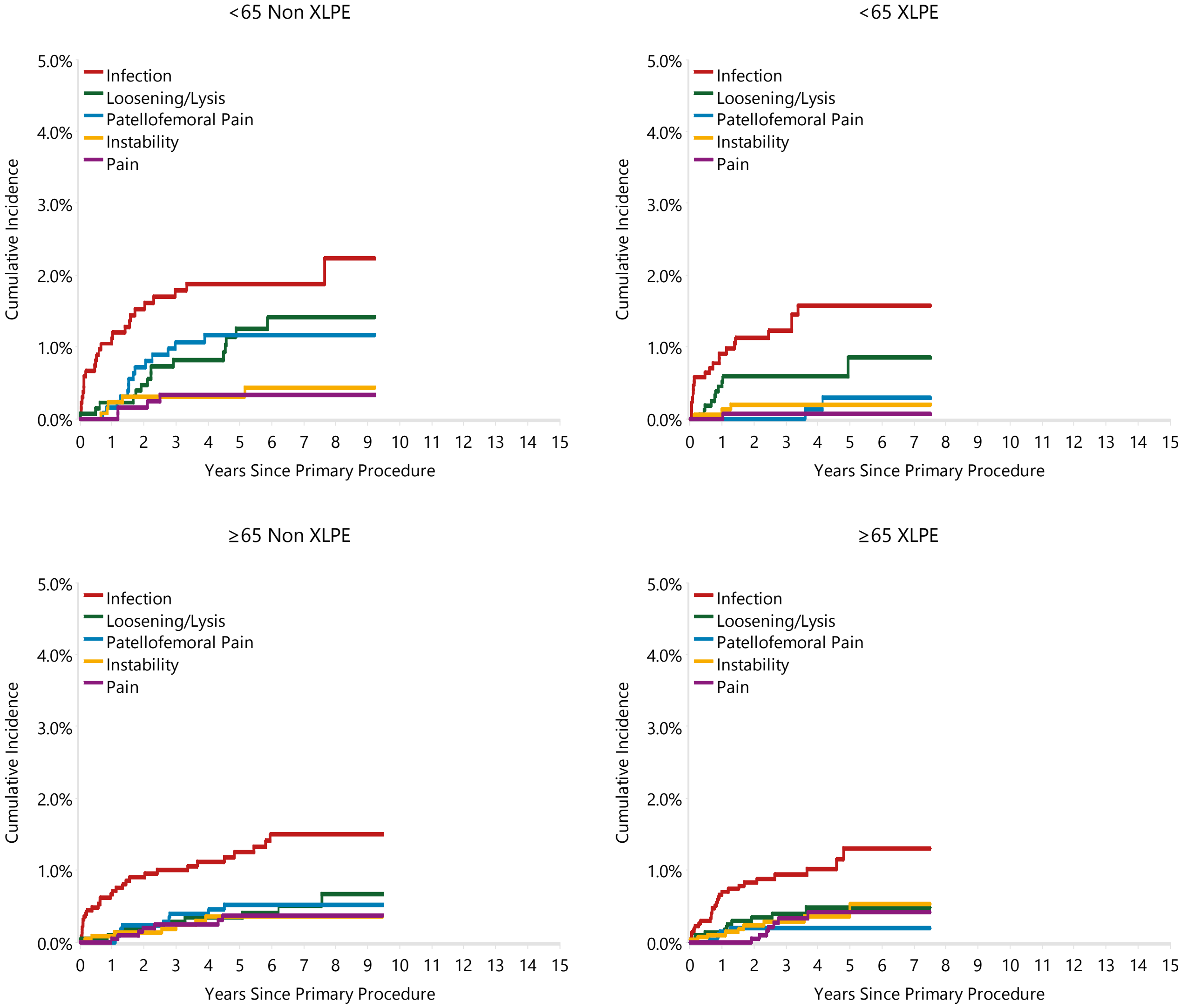
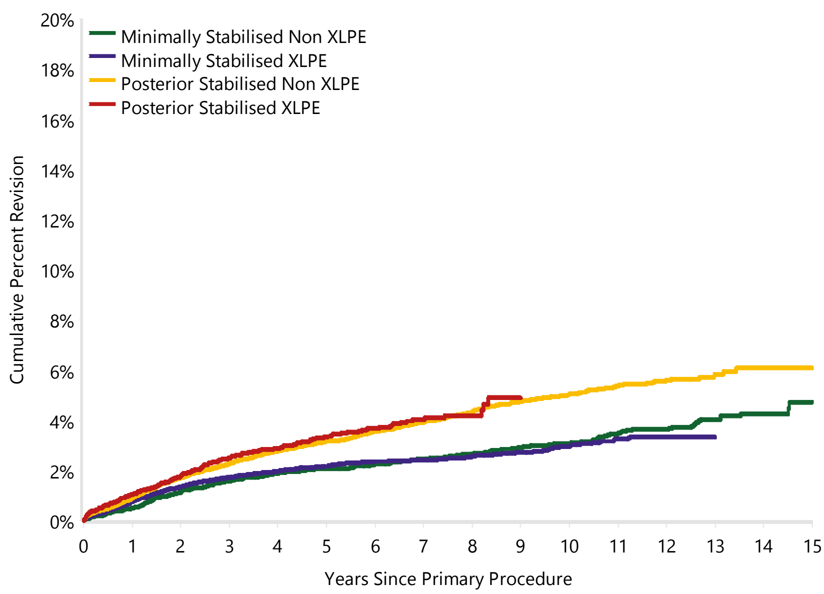


Table KT32 Cumulative Percent Revision of Nexgen/Nexgen Primary Total Knee Replacement by Stability and Polyethylene Type (Primary Diagnosis OA)

Stability	Polyethylene Type	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Minimally Stabilised		943	47121	0.7 (0.6, 0.8)	1.7 (1.6, 1.8)	2.1 (2.0, 2.3)	2.4 (2.3, 2.6)	3.0 (2.8, 3.2)	4.5 (3.8, 5.4)
	Non XLPE	252	9269	0.5 (0.4, 0.7)	1.6 (1.3, 1.9)	2.1 (1.8, 2.4)	2.4 (2.1, 2.8)	3.1 (2.7, 3.5)	4.7 (3.9, 5.7)
	XLPE	691	37852	0.8 (0.7, 0.8)	1.7 (1.6, 1.9)	2.2 (2.0, 2.3)	2.4 (2.2, 2.6)	3.0 (2.7, 3.2)	
Posterior Stabilised		1113	33818	0.9 (0.8, 1.1)	2.3 (2.2, 2.5)	3.2 (3.0, 3.4)	4.0 (3.7, 4.2)	5.1 (4.8, 5.4)	6.1 (5.5, 6.8)
	Non XLPE	798	20684	0.9 (0.8, 1.0)	2.3 (2.1, 2.5)	3.2 (2.9, 3.4)	3.9 (3.6, 4.2)	5.0 (4.7, 5.4)	6.1 (5.5, 6.7)
	XLPE	315	13134	1.0 (0.9, 1.2)	2.5 (2.2, 2.8)	3.3 (2.9, 3.7)	4.0 (3.5, 4.6)		
TOTAL		2056	80939						

Note: The minimally stabilised Nexgen includes Nexgen CR/Nexgen and Nexgen CR Flex/Nexgen prosthesis combinations
The posterior stabilised Nexgen includes Nexgen LPS/Nexgen and Nexgen LPS Flex/Nexgen prosthesis combinations

Figure KT39 Cumulative Percent Revision of Nexgen/Nexgen Primary Total Knee Replacement by Stability and Polyethylene Type (Primary Diagnosis OA)



HR - adjusted for age and gender

Minimally Stabilised Non XLPE vs Minimally Stabilised XLPE
0 - 1Yr: HR=0.81 (0.59, 1.10),p=0.172
1Yr - 1.5Yr: HR=1.41 (0.98, 2.03),p=0.060
1.5Yr+: HR=1.23 (1.03, 1.48),p=0.026

Minimally Stabilised XLPE vs Posterior Stabilised XLPE
Entire Period: HR=0.64 (0.56, 0.74),p<0.001

Minimally Stabilised Non XLPE vs Posterior Stabilised Non XLPE
Entire Period: HR=0.69 (0.60, 0.80),p<0.001

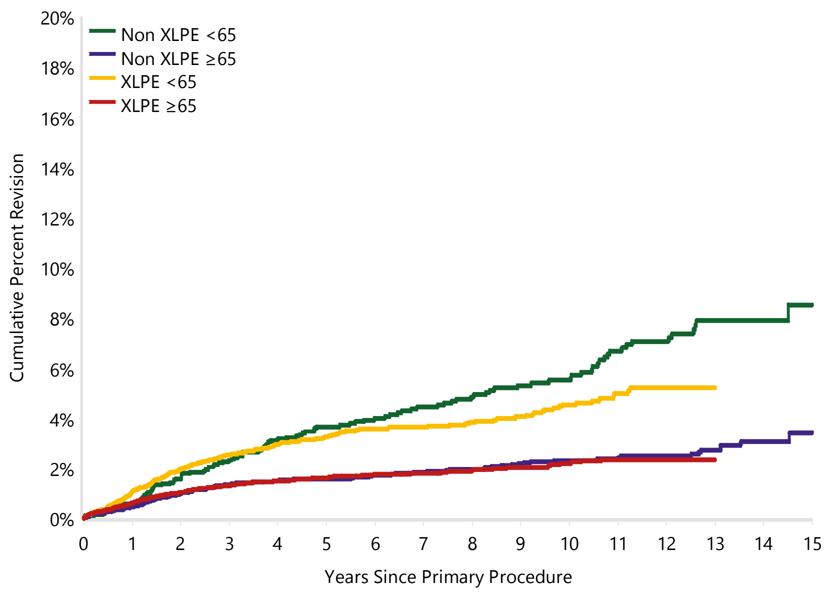
Posterior Stabilised Non XLPE vs Posterior Stabilised XLPE
Entire Period: HR=0.99 (0.86, 1.13),p=0.860

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Minimally Stabilised		47121	40942	29159	20270	14169	7299	203
	Non XLPE	9269	8866	7782	6414	5075	3339	203
	XLPE	37852	32076	21377	13856	9094	3960	0
Posterior Stabilised		33818	30101	23368	17490	11830	5168	66
	Non XLPE	20684	19702	16972	13668	10419	5168	66
	XLPE	13134	10399	6396	3822	1411	0	0

Table KT33 Cumulative Percent Revision of Minimally Stabilised Nexgen 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	7 Yrs	10 Yrs	15 Yrs
Non XLPE		252	9269	0.5 (0.4, 0.7)	1.6 (1.3, 1.9)	2.1 (1.8, 2.4)	2.4 (2.1, 2.8)	3.1 (2.7, 3.5)	4.7 (3.9, 5.7)
	<65	111	2111	0.6 (0.4, 1.1)	2.3 (1.7, 3.1)	3.7 (2.9, 4.6)	4.4 (3.6, 5.5)	5.5 (4.5, 6.7)	8.5 (6.7, 10.7)
	≥65	141	7158	0.5 (0.3, 0.7)	1.4 (1.1, 1.7)	1.6 (1.3, 1.9)	1.8 (1.5, 2.2)	2.3 (1.9, 2.7)	3.4 (2.6, 4.5)
XLPE		691	37852	0.8 (0.7, 0.8)	1.7 (1.6, 1.9)	2.2 (2.0, 2.3)	2.4 (2.2, 2.6)	3.0 (2.7, 3.2)	
	<65	345	12689	1.1 (0.9, 1.3)	2.5 (2.2, 2.8)	3.3 (2.9, 3.6)	3.6 (3.2, 4.1)	4.5 (4.0, 5.2)	
	≥65	346	25163	0.6 (0.5, 0.7)	1.3 (1.2, 1.5)	1.6 (1.4, 1.8)	1.8 (1.6, 2.0)	2.2 (1.9, 2.5)	
TOTAL		943	47121						

Figure KT40 Cumulative Percent Revision of Minimally Stabilised Nexgen Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)



HR - adjusted for gender

Non XLPE <65 vs Non XLPE ≥65
0 - 1.5Yr: HR=1.60 (1.05, 2.43),p=0.029
1.5Yr+: HR=3.12 (2.37, 4.12),p<0.001

Non XLPE ≥65 vs XLPE ≥65
Entire Period: HR=1.01 (0.83, 1.23),p=0.948

Non XLPE <65 vs XLPE <65
0 - 1.5Yr: HR=0.86 (0.57, 1.28),p=0.445
1.5Yr+: HR=1.49 (1.15, 1.94),p=0.002

XLPE <65 vs XLPE ≥65
0 - 1.5Yr: HR=1.75 (1.43, 2.12),p<0.001
1.5Yr+: HR=2.31 (1.86, 2.85),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Non XLPE		9269	8866	7782	6414	5075	3339	203
	<65	2111	2022	1806	1513	1231	854	75
	≥65	7158	6844	5976	4901	3844	2485	128
XLPE		37852	32076	21377	13856	9094	3960	0
	<65	12689	10703	7043	4605	3058	1402	0
	≥65	25163	21373	14334	9251	6036	2558	0

Figure KT41 Cumulative Incidence Revision Diagnosis of Minimally Stabilised Nexgen Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

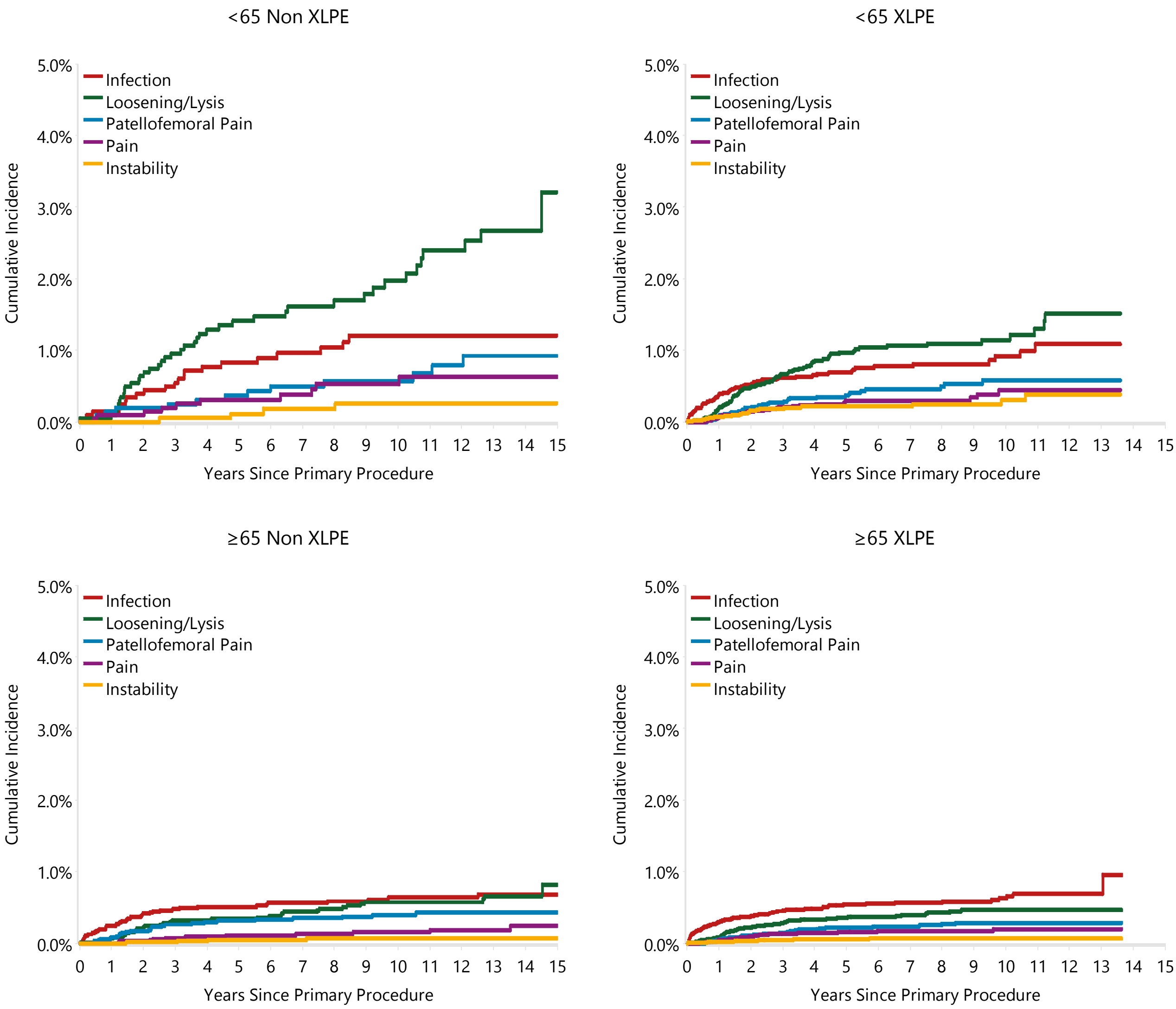
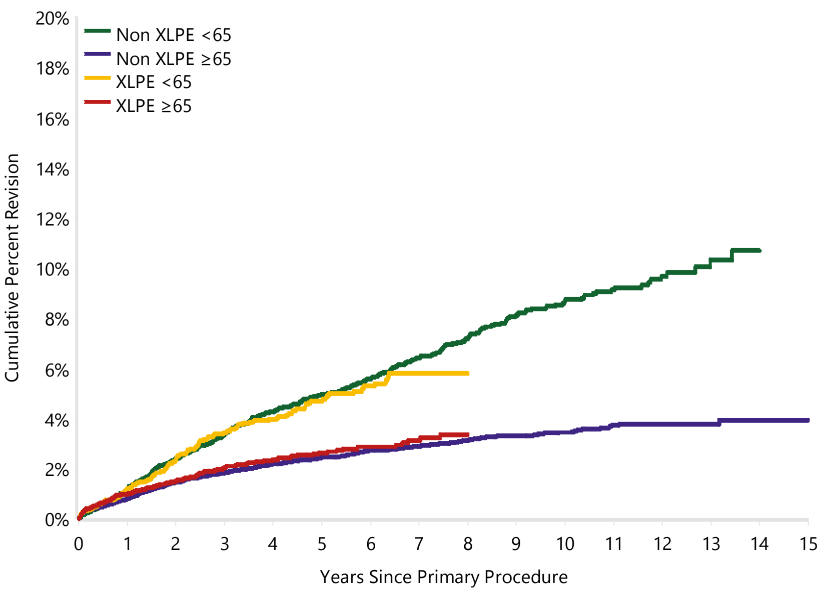


Table KT34 Cumulative Percent Revision of Posterior Stabilised Nexgen Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

Polyethylene Type	Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Non XLPE		798	20684	0.9 (0.8, 1.0)	2.3 (2.1, 2.5)	3.2 (2.9, 3.4)	3.9 (3.6, 4.2)	5.0 (4.7, 5.4)	6.1 (5.5, 6.7)
	<65	396	5917	1.1 (0.9, 1.4)	3.3 (2.9, 3.8)	4.9 (4.4, 5.5)	6.4 (5.7, 7.1)	8.7 (7.8, 9.6)	
	≥65	402	14767	0.8 (0.6, 0.9)	1.8 (1.6, 2.1)	2.4 (2.2, 2.7)	2.9 (2.6, 3.2)	3.4 (3.1, 3.8)	3.9 (3.4, 4.5)
XLPE		315	13134	1.0 (0.9, 1.2)	2.5 (2.2, 2.8)	3.3 (2.9, 3.7)	4.0 (3.5, 4.6)		
	<65	147	4424	1.2 (0.9, 1.6)	3.4 (2.8, 4.1)	4.7 (3.9, 5.6)	5.8 (4.8, 6.9)		
	≥65	168	8710	1.0 (0.8, 1.2)	2.0 (1.7, 2.4)	2.6 (2.2, 3.1)	3.1 (2.6, 3.7)		
TOTAL		1113	33818						

Figure KT42 Cumulative Percent Revision of Posterior Stabilised Nexgen 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=0.79 (0.46, 1.34),p=0.379
- 3Mth - 2Yr: HR=1.95 (1.55, 2.44),p<0.001
- 2Yr - 6Yr: HR=2.57 (2.08, 3.19),p<0.001
- 6Yr+: HR=4.07 (3.00, 5.53),p<0.001

Non XLPE ≥65 vs XLPE ≥65
- Entire Period: HR=0.91 (0.76, 1.10),p=0.324

Non XLPE <65 vs XLPE <65
- Entire Period: HR=1.11 (0.91, 1.34),p=0.310

XLPE <65 vs XLPE ≥65
- 0 - 9Mth: HR=0.93 (0.68, 1.28),p=0.654
- 9Mth+: HR=2.26 (1.74, 2.93),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Non XLPE		20684	19702	16972	13668	10419	5168	66
	<65	5917	5650	4924	4060	3191	1703	23
	≥65	14767	14052	12048	9608	7228	3465	43
XLPE		13134	10399	6396	3822	1411	0	0
	<65	4424	3526	2177	1325	480	0	0
	≥65	8710	6873	4219	2497	931	0	0

Figure KT43 Cumulative Incidence Revision Diagnosis of Posterior Stabilised Nexgen Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

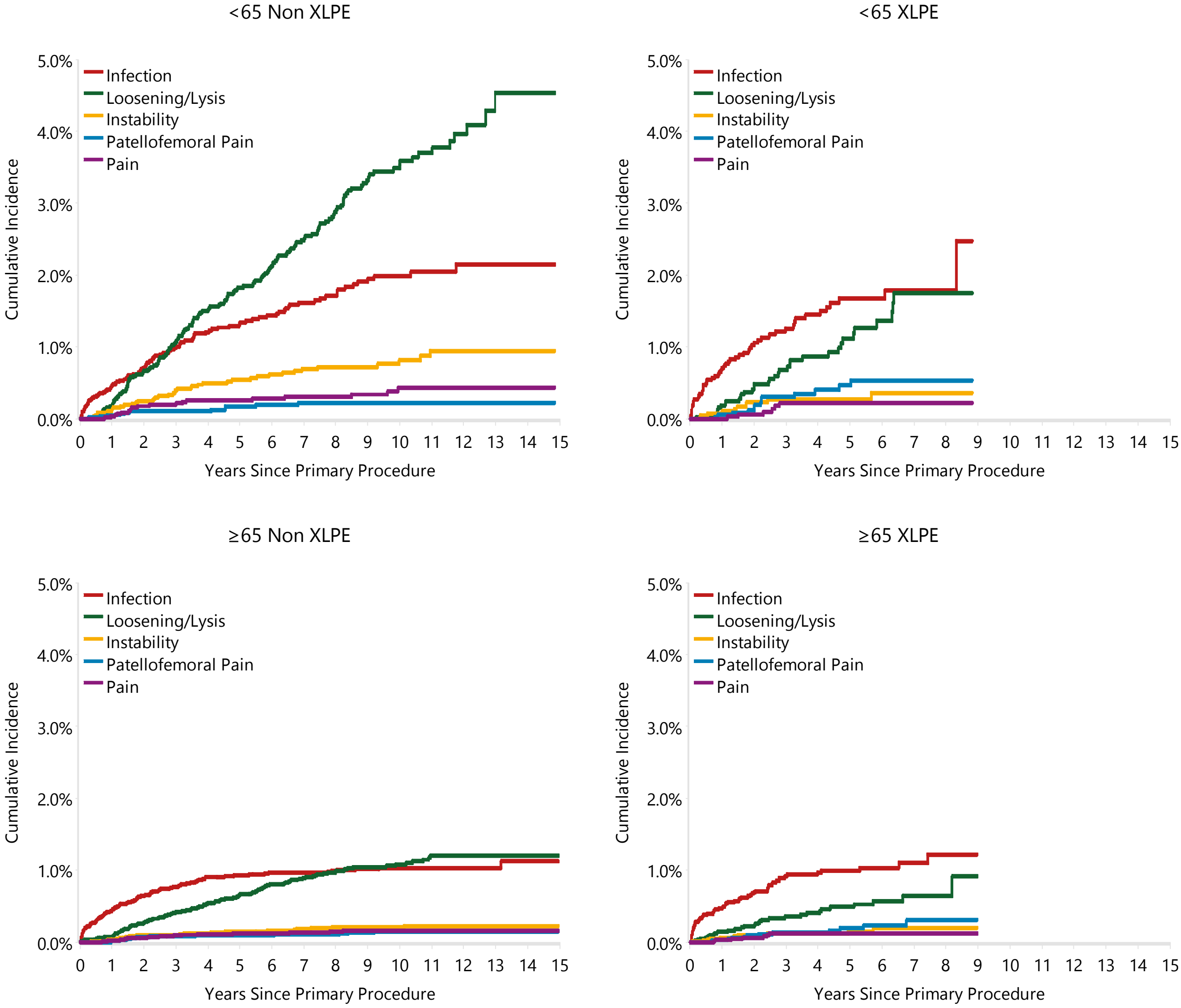
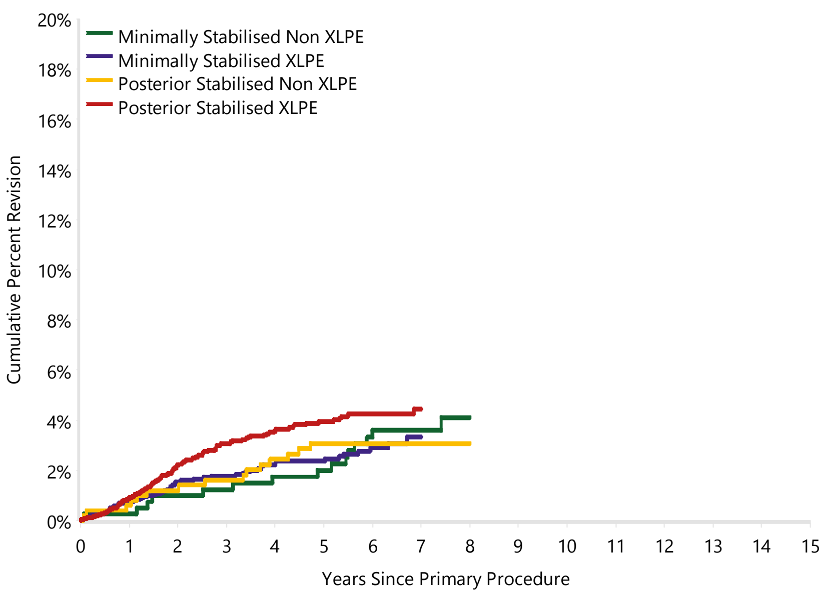


Table KT35 Cumulative Percent Revision of Scorpio NRG/Series 7000 Primary Total Knee Replacement by Stability and Polyethylene Type (Primary Diagnosis OA)

Stability	Polyethylene Type	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Minimally Stabilised		**84**	**4058**	**0.7 (0.5, 1.0)**	**1.7 (1.3, 2.2)**	**2.3 (1.8, 3.0)**	**3.5 (2.7, 4.4)**		
	Non XLPE	16	406	0.2 (0.0, 1.7)	1.2 (0.5, 3.0)	2.0 (1.0, 4.0)	3.6 (2.1, 6.0)		
	XLPE	68	3652	0.7 (0.5, 1.1)	1.8 (1.3, 2.3)	2.4 (1.8, 3.1)	3.3 (2.5, 4.4)		
Posterior Stabilised		**128**	**3708**	**0.8 (0.6, 1.2)**	**2.8 (2.3, 3.5)**	**3.8 (3.2, 4.6)**	**4.2 (3.5, 5.0)**		
	Non XLPE	15	504	0.6 (0.2, 1.8)	1.6 (0.8, 3.2)	3.1 (1.9, 5.1)	3.1 (1.9, 5.1)		
	XLPE	113	3204	0.9 (0.6, 1.3)	3.1 (2.5, 3.8)	3.9 (3.3, 4.7)	4.4 (3.6, 5.4)		
TOTAL		212	7766						

Note: The minimally stabilised group includes Scorpio NRG CR/Series 7000 prosthesis combination
The posterior stabilised group includes Scorpio NRG PS/Series 7000 prosthesis combination

Figure KT44 Cumulative Percent Revision of Scorpio NRG/Series 7000 Primary Total Knee Replacement by Stability and Polyethylene Type (Primary Diagnosis OA)



HR - adjusted for age and gender

Minimally Stabilised Non XLPE vs
Minimally Stabilised XLPE
Entire Period: HR=1.26 (0.73, 2.19),p=0.407

Minimally Stabilised XLPE vs
Posterior Stabilised XLPE
Entire Period: HR=0.71 (0.52, 0.96),p=0.024

Minimally Stabilised Non XLPE vs
Posterior Stabilised Non XLPE
Entire Period: HR=1.36 (0.67, 2.76),p=0.390

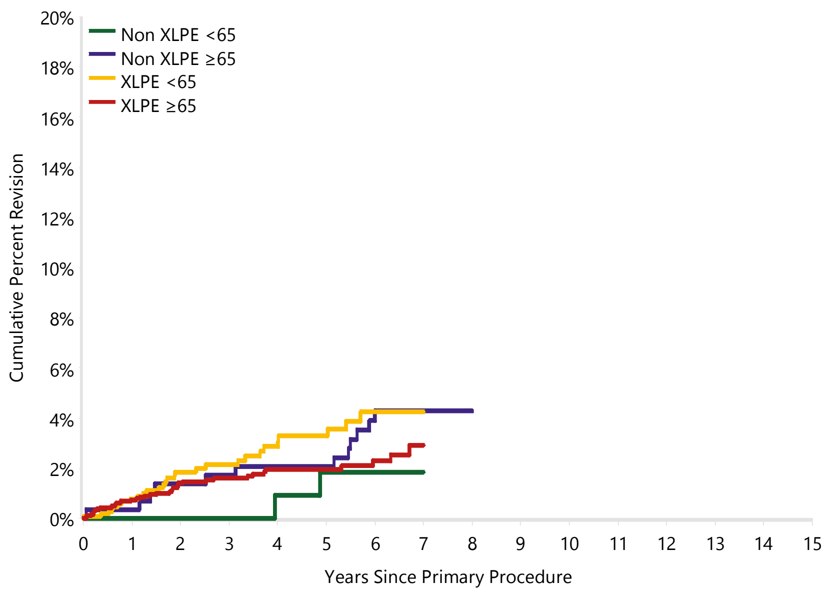
Posterior Stabilised Non XLPE vs
Posterior Stabilised XLPE
Entire Period: HR=0.65 (0.38, 1.14),p=0.131

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Minimally Stabilised		**4058**	**3371**	**2304**	**1483**	**494**	**0**	**0**
	Non XLPE	406	402	396	378	246	0	0
	XLPE	3652	2969	1908	1105	248	0	0
Posterior Stabilised		**3708**	**3495**	**2861**	**1904**	**786**	**0**	**0**
	Non XLPE	504	496	480	444	395	0	0
	XLPE	3204	2999	2381	1460	391	0	0

Table KT36 Cumulative Percent Revision of Scorpio NRG CR/Series 7000 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	7 Yrs	10 Yrs	15 Yrs
Non XLPE		16	406	0.2 (0.0, 1.7)	1.2 (0.5, 3.0)	2.0 (1.0, 4.0)	3.6 (2.1, 6.0)		
	<65	3	111	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	1.8 (0.5, 7.1)	1.8 (0.5, 7.1)		
	≥65	13	295	0.3 (0.0, 2.4)	1.7 (0.7, 4.0)	2.0 (0.9, 4.5)	4.3 (2.4, 7.4)		
XLPE		68	3652	0.7 (0.5, 1.1)	1.8 (1.3, 2.3)	2.4 (1.8, 3.1)	3.3 (2.5, 4.4)		
	<65	28	1159	0.8 (0.4, 1.6)	2.1 (1.4, 3.3)	3.3 (2.2, 4.9)	4.2 (2.8, 6.3)		
	≥65	40	2493	0.7 (0.5, 1.2)	1.6 (1.1, 2.3)	1.9 (1.4, 2.7)	2.9 (1.9, 4.4)		
TOTAL		84	4058						

Figure KT45 Cumulative Percent Revision of Scorpio NRG CR/Series 7000 Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)



HR - adjusted for gender

Non XLPE <65 vs Non XLPE ≥65
Entire Period: HR=0.59 (0.17, 2.06),p=0.404

Non XLPE ≥65 vs XLPE ≥65
Entire Period: HR=1.42 (0.74, 2.73),p=0.291

Non XLPE <65 vs XLPE <65
Entire Period: HR=0.55 (0.17, 1.85),p=0.338

XLPE <65 vs XLPE ≥65
Entire Period: HR=1.50 (0.93, 2.43),p=0.099

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Non XLPE		406	402	396	378	246	0	0
	<65	111	110	110	106	74	0	0
	≥65	295	292	286	272	172	0	0
XLPE		3652	2969	1908	1105	248	0	0
	<65	1159	940	595	346	87	0	0
	≥65	2493	2029	1313	759	161	0	0

Figure KT46 Cumulative Incidence Revision Diagnosis of Scorpio NRG CR/Series 7000 Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

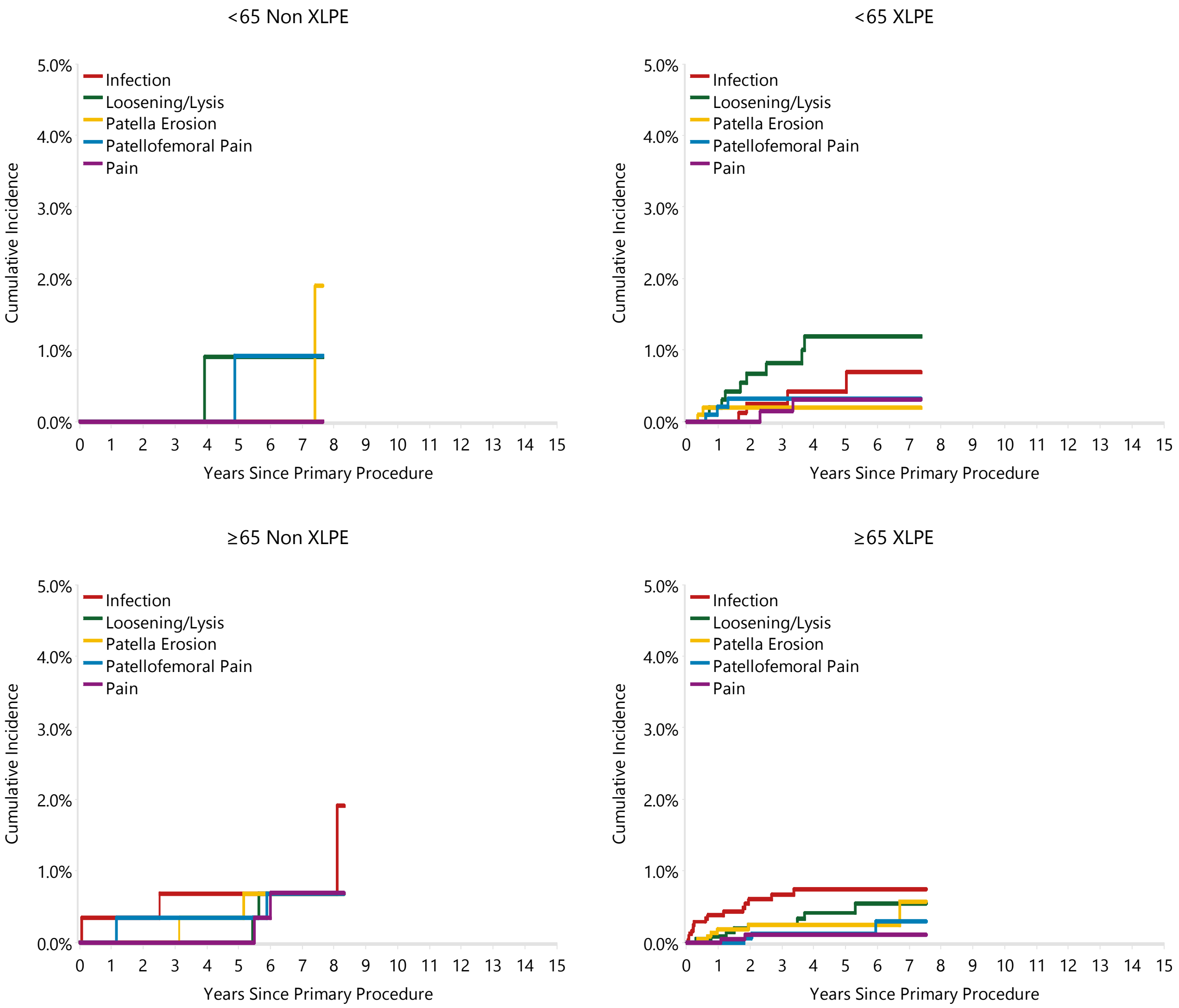
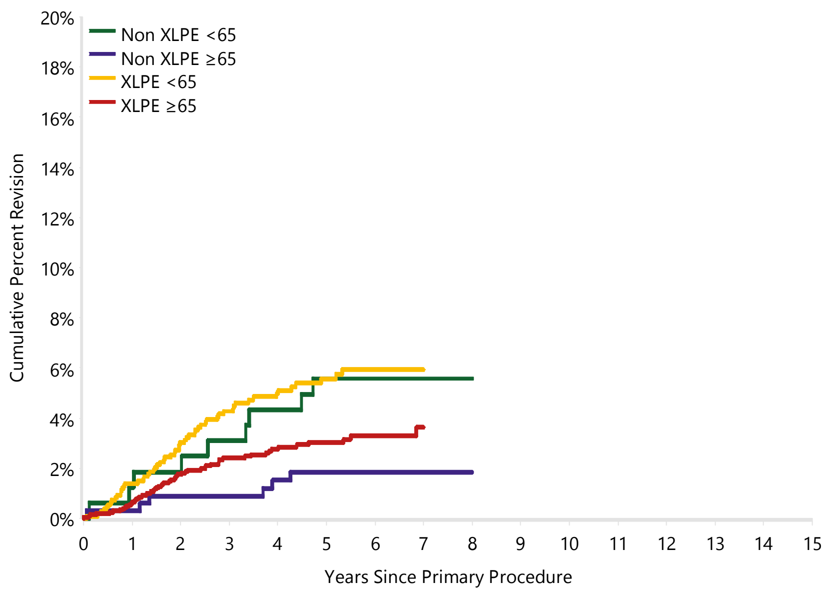


Table KT37 Cumulative Percent Revision of Scorpio NRG PS/Series 7000 Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

Polyethylene Type	Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Non XLPE		15	504	0.6 (0.2, 1.8)	1.6 (0.8, 3.2)	3.1 (1.9, 5.1)	3.1 (1.9, 5.1)		
	<65	9	163	1.2 (0.3, 4.8)	3.1 (1.3, 7.3)	5.6 (2.9, 10.4)	5.6 (2.9, 10.4)		
	≥65	6	341	0.3 (0.0, 2.1)	0.9 (0.3, 2.7)	1.8 (0.8, 4.0)	1.8 (0.8, 4.0)		
XLPE		113	3204	0.9 (0.6, 1.3)	3.1 (2.5, 3.8)	3.9 (3.3, 4.7)	4.4 (3.6, 5.4)		
	<65	56	1116	1.4 (0.8, 2.3)	4.3 (3.2, 5.7)	5.6 (4.3, 7.2)	5.9 (4.6, 7.7)		
	≥65	57	2088	0.6 (0.3, 1.0)	2.4 (1.8, 3.2)	3.0 (2.3, 4.0)	3.6 (2.7, 4.9)		
TOTAL		128	3708						

Figure KT47 Cumulative Percent Revision of Scorpio NRG PS/Series 7000 Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)



HR - adjusted for gender

Non XLPE <65 vs Non XLPE ≥65
Entire Period: HR=2.99 (1.07, 8.41),p=0.037

Non XLPE ≥65 vs XLPE ≥65
Entire Period: HR=0.52 (0.22, 1.22),p=0.131

Non XLPE <65 vs XLPE <65
Entire Period: HR=0.90 (0.44, 1.83),p=0.767

XLPE <65 vs XLPE ≥65
Entire Period: HR=1.74 (1.20, 2.52),p=0.003

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Non XLPE		504	496	480	444	395	0	0
	<65	163	160	157	151	141	0	0
	≥65	341	336	323	293	254	0	0
XLPE		3204	2999	2381	1460	391	0	0
	<65	1116	1055	863	552	158	0	0
	≥65	2088	1944	1518	908	233	0	0

Figure KT48 Cumulative Incidence Revision Diagnosis of Scorpio NRG PS/Series 7000 Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

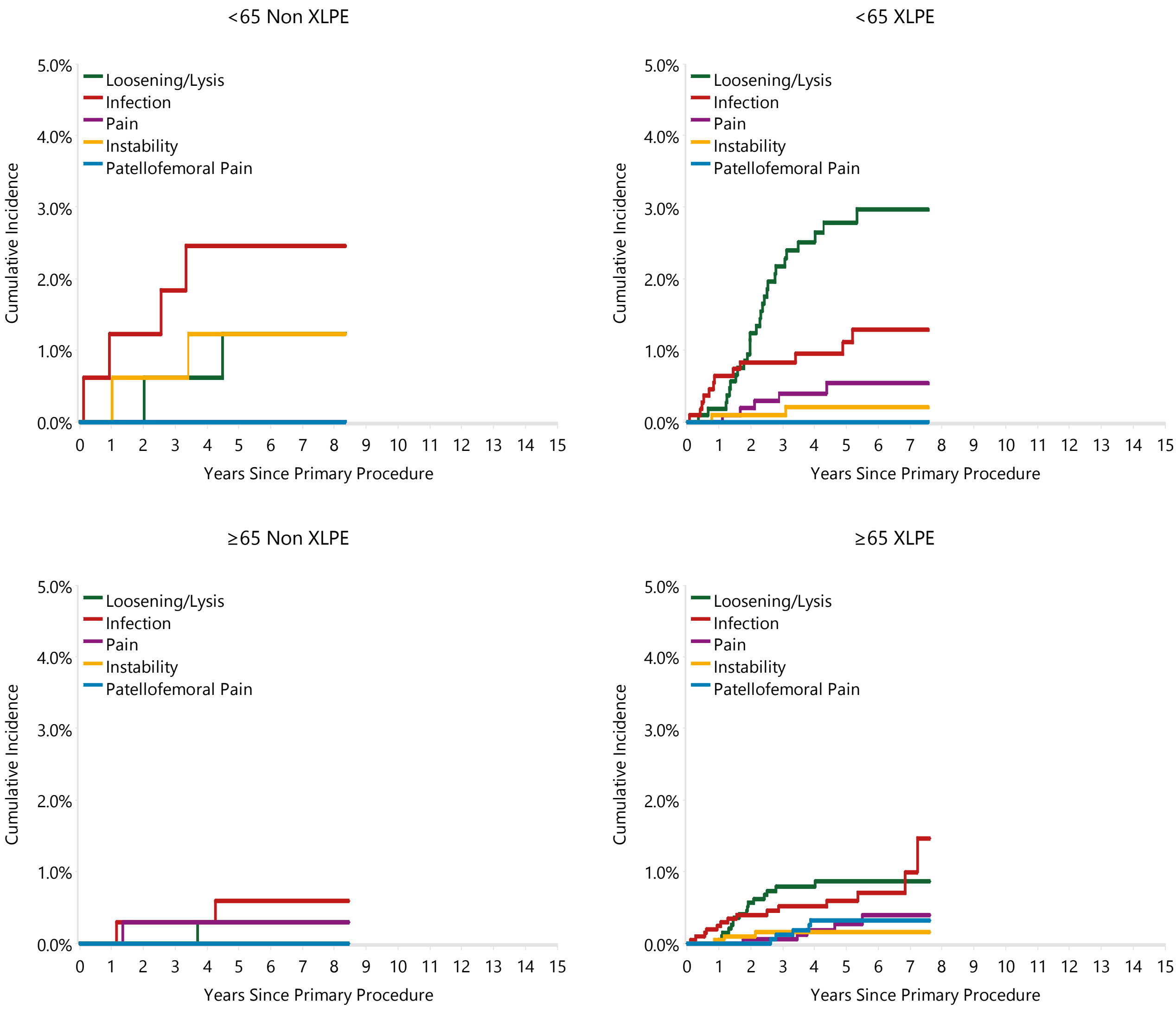
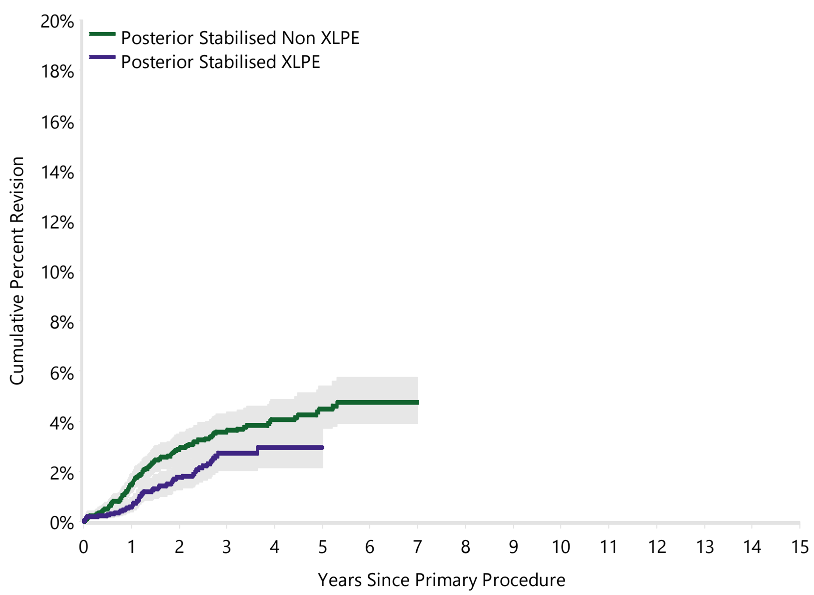


Table KT38 Cumulative Percent Revision of Legion Oxinium PS/Genesis II Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA)

Polyethylene Type	Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Non XLPE		129	4255	1.5 (1.1, 1.9)	3.6 (3.0, 4.4)	4.5 (3.7, 5.4)	4.7 (3.9, 5.8)		
	<65	62	1615	2.2 (1.5, 3.0)	4.6 (3.5, 5.9)	5.5 (4.2, 7.2)	5.5 (4.2, 7.2)		
	≥65	67	2640	1.0 (0.7, 1.5)	3.1 (2.4, 4.0)	3.8 (2.9, 5.1)	4.3 (3.2, 5.7)		
XLPE		51	3566	0.6 (0.4, 1.0)	2.7 (2.0, 3.7)	2.9 (2.2, 4.0)			
	<65	34	1753	0.8 (0.5, 1.5)	3.6 (2.5, 5.1)	3.6 (2.5, 5.1)			
	≥65	17	1813	0.3 (0.1, 0.8)	1.8 (1.1, 3.1)				
TOTAL		180	7821						

Figure KT49 Cumulative Percent Revision of Legion Oxinium PS/Genesis II Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA)



HR - adjusted for age and gender

Posterior Stabilised Non XLPE vs Posterior Stabilised XLPE

Entire Period: HR=1.65 (1.19, 2.30),p=0.002

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Posterior Stabilised	Non XLPE	4255	3556	1669	801	166	0	0
	XLPE	3566	2228	765	81	0	0	0

Figure KT50 Cumulative Incidence Revision Diagnosis of Legion Oxinium PS/Genesis II Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA)

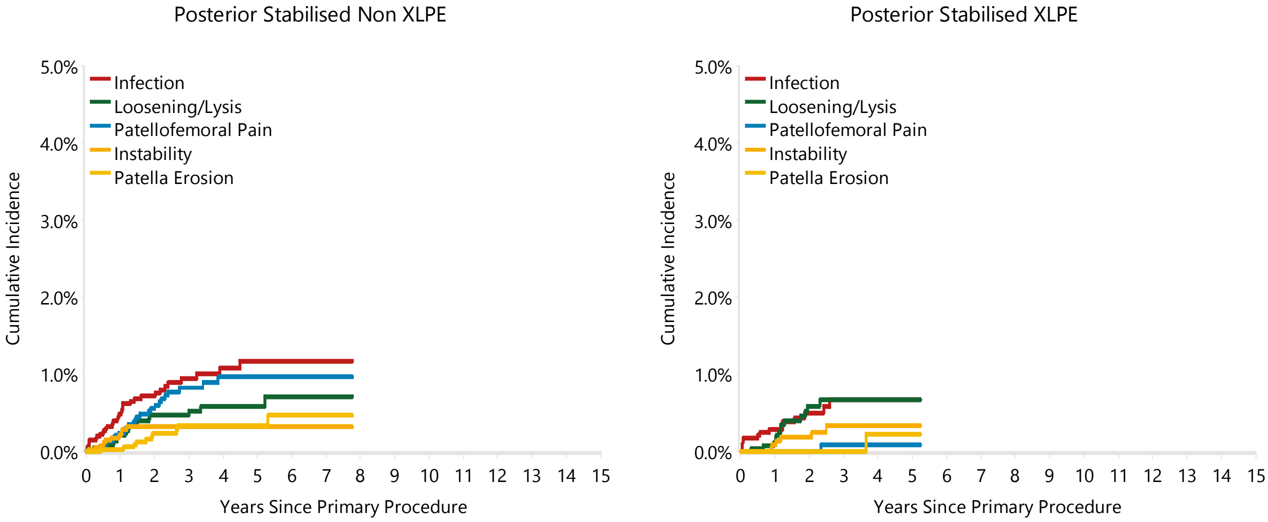
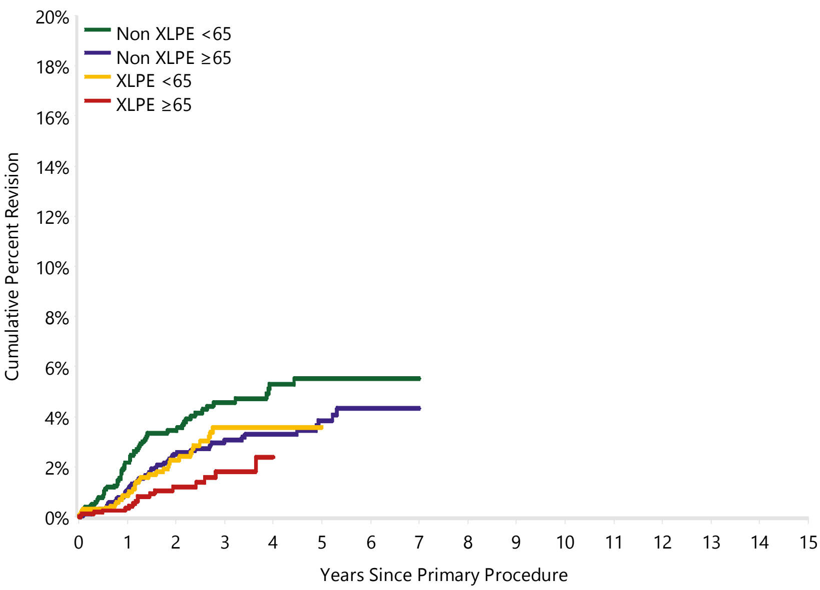


Figure KT51 Cumulative Percent Revision of Legion Oxinium PS/Genesis II Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)



HR - adjusted for gender

Non XLPE <65 vs Non XLPE ≥65
Entire Period: HR=1.51 (1.07, 2.14),p=0.018

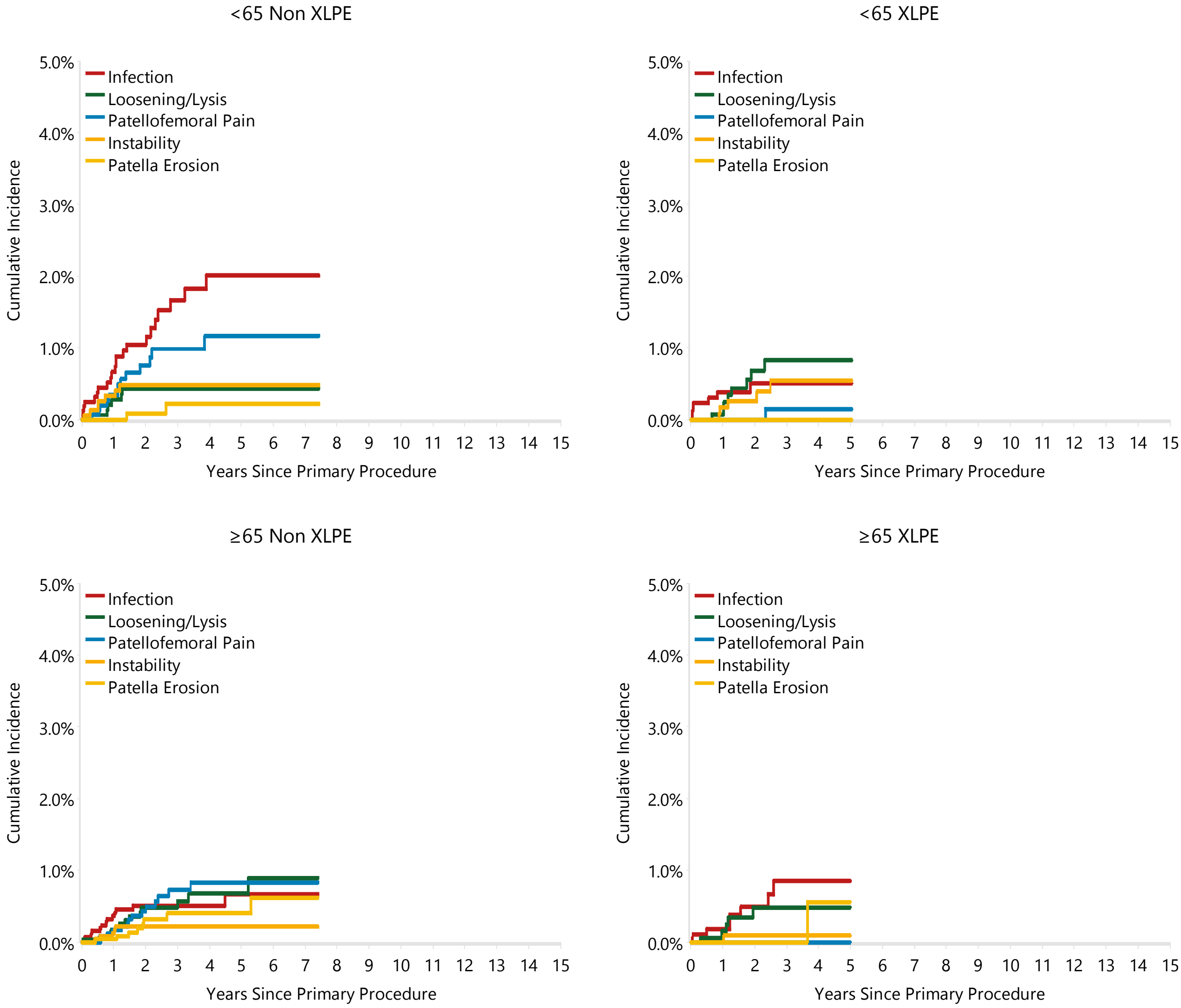
Non XLPE ≥65 vs XLPE ≥65
Entire Period: HR=1.88 (1.10, 3.21),p=0.020

Non XLPE <65 vs XLPE <65
Entire Period: HR=1.51 (0.99, 2.30),p=0.053

XLPE <65 vs XLPE ≥65
Entire Period: HR=1.88 (1.05, 3.37),p=0.033

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	15 Yrs
Non XLPE	<65	1615	1337	628	343	75	0	0
	≥65	2640	2219	1041	458	91	0	0
XLPE	<65	1753	1145	424	42	0	0	0
	≥65	1813	1083	341	39	0	0	0

Figure KT52 Cumulative Incidence Revision Diagnosis of Legion Oxinium PS/Genesis II Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)



Shoulder Replacement

Shoulder Replacement

CATEGORIES OF SHOULDER REPLACEMENT

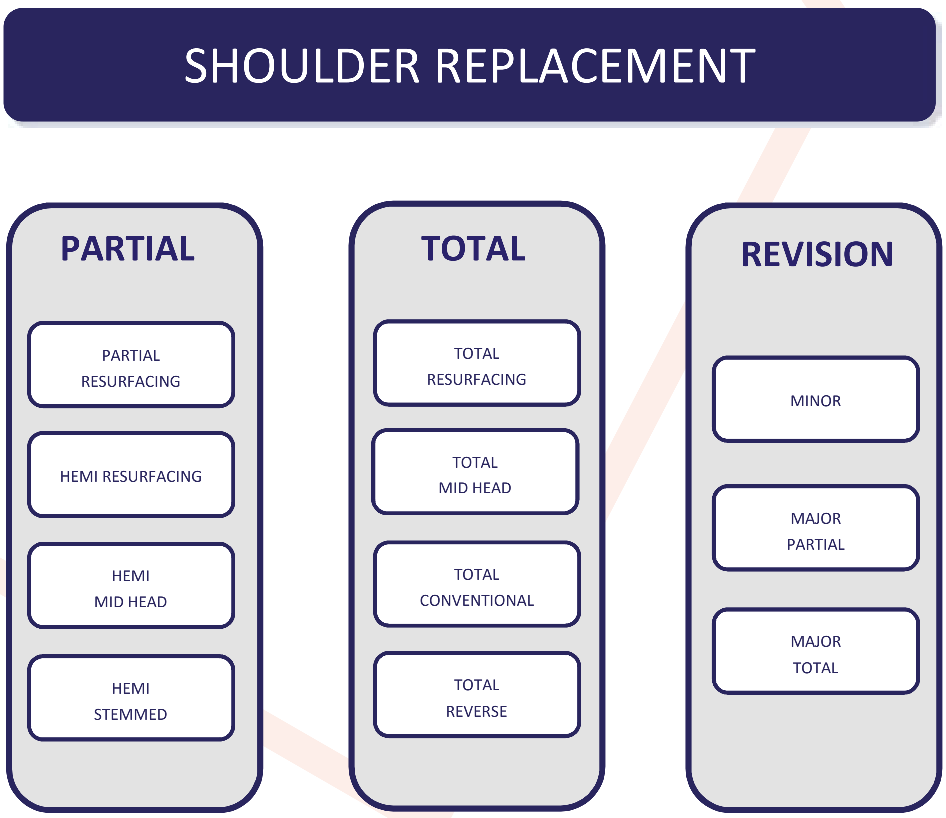
The Registry groups shoulder replacement into three broad categories: primary partial, primary total and revision shoulder replacement.

A primary replacement is the initial joint replacement procedure and involves replacing either part (partial) or all (total) of the articular surface.

Primary partial and primary total shoulder replacements are further sub-categorised into classes depending on the type of prostheses used. Partial shoulder classes include: partial resurfacing, hemi resurfacing, hemi mid head, hemi stemmed and humeral ball replacement. Total shoulder classes include: total resurfacing, total mid head, total conventional and total reverse shoulder replacement. Definitions for each of these are detailed in the subsequent sections.

Revision procedures are re-operations of previous shoulder replacements where one or more of the prosthetic components are replaced, removed, or another component is added. Revision procedures include re-operation of primary partial, primary total, or previous revision procedures.

Shoulder revision procedures are sub-categorised into three classes: minor, major partial and major total.



USE OF SHOULDER REPLACEMENT

This Report is an analysis of 32,406 shoulder replacement procedures reported to the Registry with a procedure date up to and including 31 December 2015, an additional 5,170 shoulder procedures since the last report.

Registry shoulder data collection commenced in 2004 and full national collection was implemented by 2008.

The number of shoulder replacement procedures undertaken in 2015 increased by 338 (7.3%) compared to the previous year and by 88.5% since 2008.

"Shoulder replacement procedures increased by 7.3% in 2015."

When considering all shoulder procedures currently recorded by the Registry, primary total shoulder replacement is the most common category (71.8%), followed by primary partial (17.9%) and revision procedures (10.3%) (Table S1).

The proportion of total shoulder replacement has increased from 57.5% in 2008 to 82.1% in 2015. Between 2008 and 2015, partial shoulder replacement decreased from 32.6% to 7.2%. The proportion of revision procedures increased from 9.9% in 2008, to 10.8% in 2012 and remains at 10.8% in 2015. This equates to an additional 45 revision procedures in 2015 than would have been expected if the proportion of revision procedures had remained at 9.9% (Figure S1).

Most patients are aged between 65 and 84 years (71.0%). The proportion of patients in this age group varies depending on the category of shoulder replacement: primary partial (57.6%), primary total (75.2%) and revision shoulder replacement (65.2%) (Table S1).

The mean age varies by gender; 73.1 years for females and 68.6 years for males. Shoulder replacement is more common in females (62.4%) (Table S2).

Figure S1 Proportion of Shoulder Replacement by Shoulder Category

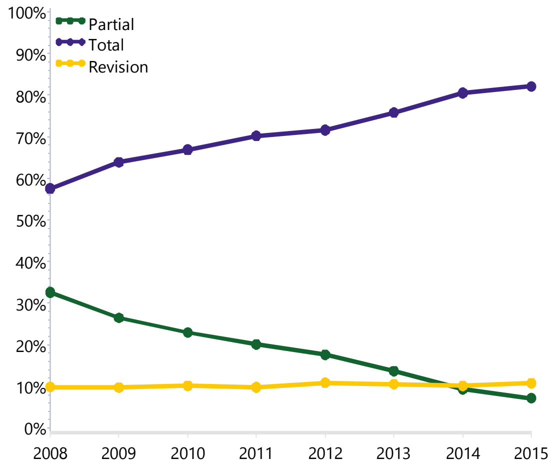


Table S1 Number of Shoulder Replacements by Age

Shoulder Category	<55		55-64		65-74		75-84		≥85		TOTAL	
	N	%	N	%	N	%	N	%	N	%	N	%
Primary Partial	734	12.6	1201	20.7	1745	30.0	1606	27.6	524	9.0	5810	17.9
Primary Total	739	3.2	3424	14.7	9052	38.9	8432	36.3	1605	6.9	23252	71.8
Revision	265	7.9	657	19.7	1235	37.0	962	28.8	223	6.7	3342	10.3
TOTAL	1738	5.4	5282	16.3	12032	37.1	11000	33.9	2352	7.3	32404	100.0

Note: Excludes two humeral ball procedures

Table S2 Shoulder Replacements by Age and Gender

Gender	Number	Percent	Minimum	Maximum	Median	Mean	Std Dev
Male	12185	37.6%	14	96	70	68.6	10.7
Female	20221	62.4%	13	102	74	73.1	9.3
TOTAL	32406	100.0%	13	102	72	71.4	10.1

ASA SCORE AND BMI IN SHOULDER REPLACEMENT

For the first time, the Registry is reporting demographic data for shoulder replacement procedures on 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 is ASA score data on 11,469 shoulder replacement procedures and BMI data on 3,488 shoulder procedures.

In 2015, the ASA score was reported in 96.4% of shoulder replacement procedures and BMI was reported in 69.5% of procedures.

In 2015, the percentage of procedures where the ASA score was reported for primary partial shoulders was 96.6%, primary total shoulder 96.4% and revision shoulder replacement 96.3%. There was some variation in reporting of BMI based on procedure type. BMI was reported for 59.7% of primary partial shoulders, 70.6% of primary total shoulders and 67.4% of revision shoulder replacements.

The Registry commenced collecting ASA score and BMI as both are known to have an impact on the outcome of shoulder replacement surgery. These measures have not been collected for a sufficient length of time to enable outcome analyses to be undertaken. The Registry will be able to commence reporting the effect of BMI and ASA score particularly on early outcomes in subsequent reports. This data will also be used for risk adjustment of a range of analyses in the future.

ASA SCORE

There are five ASA score classifications (https://www.asahq.org/resources/clinical-information/asa-physical-status-classification-system)

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 91.8% of patients have an ASA score of 2 or 3, 5.3% have a score of 1 and 2.8% have a score of 4. One patient has a score of 5.

Patients having a revision shoulder replacement procedure have a higher proportion of ASA score of 3 (49.9%) than those having primary partial shoulder replacement (45.3%), or total shoulder replacement (43.9%) (Table S3).

BMI

BMI is classified by the World Health Organisation into six main categories (http://apps.who.int/bmi/index.jsp?introPage=intro_3.html)

1. Underweight (<18.50)
2. Average (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 patients are pre-obese or obese class 1 (61.6%). There is a higher proportion of patients undergoing primary total shoulder replacement that are pre-obese or obese class 1 (62.3%), compared to partial shoulder replacement (55.8%), and revision shoulder replacement (59.8%) (Table S4).

There is a gender difference with a higher proportion of females in obese categories for all procedure groups (Figure S2).

Table S3 ASA Score by Shoulder Category

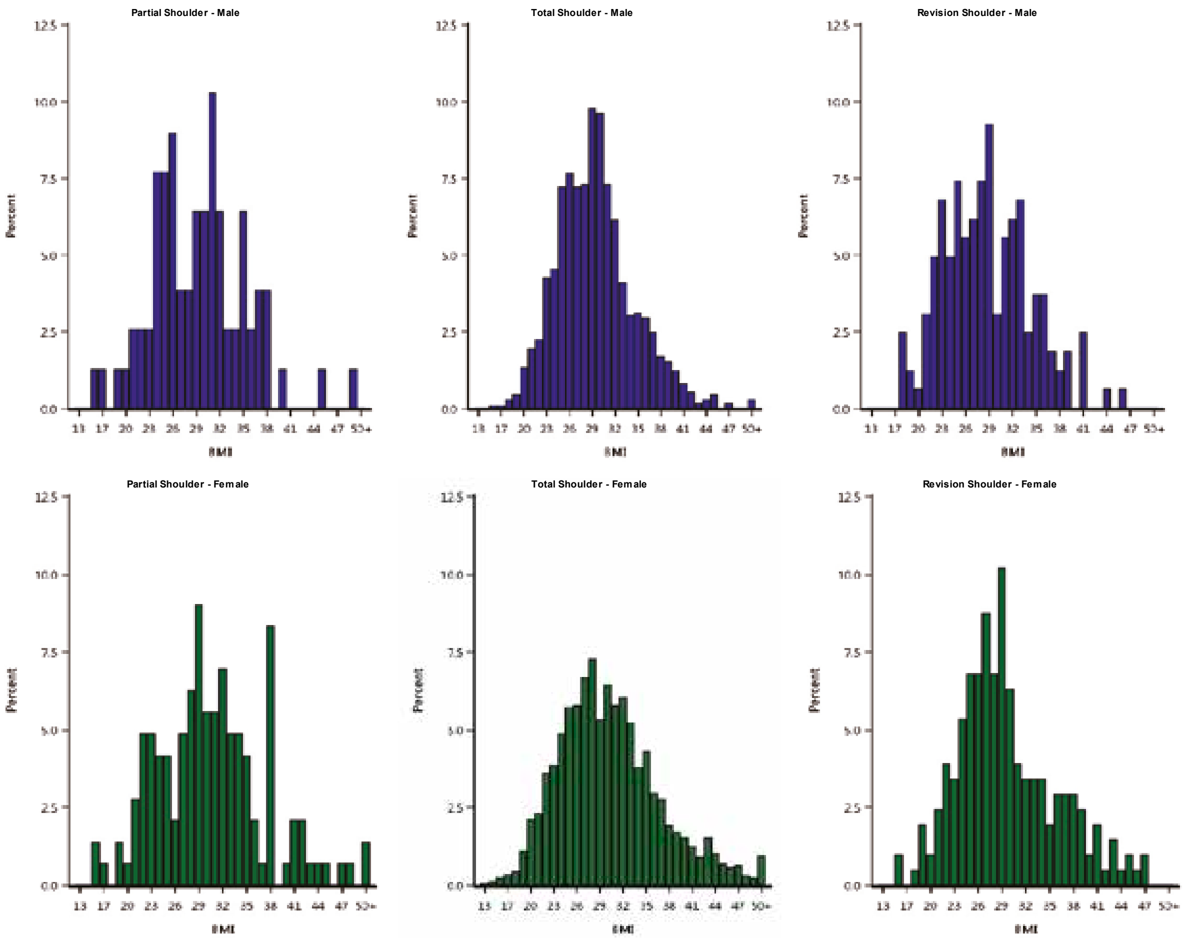
ASA Score	Partial N	Partial Col%	Total N	Total Col%	Revision N	Revision Col%	TOTAL N	TOTAL Col%
1	88	8.3	469	5.1	55	4.6	612	5.3
2	447	42.2	4451	48.3	513	42.6	5411	47.2
3	480	45.3	4038	43.9	601	49.9	5119	44.6
4	44	4.2	247	2.7	35	2.9	326	2.8
5			1	0.0			1	0.0
TOTAL	1059	100.0	9206	100.0	1204	100.0	11469	100.0

Table S4 BMI Category for Shoulder Replacement by Shoulder Category

BMI Category	Partial N	Partial Col%	Total N	Total Col%	Revision N	Revision Col%	TOTAL N	TOTAL Col%
Underweight	5	2.3	22	0.8	3	0.8	30	0.9
Average	41	18.5	485	16.7	76	20.7	602	17.3
Pre Obese	62	27.9	984	34.0	139	37.8	1185	34.0
Obese Class 1	62	27.9	821	28.3	81	22.0	964	27.6
Obese Class 2	35	15.8	373	12.9	47	12.8	455	13.0
Obese Class 3	17	7.7	213	7.3	22	6.0	252	7.2
TOTAL	222	100.0	2898	100.0	368	100.0	3488	100.0

Note: BMI has not been presented for patients aged 19 and under

Figure S2 BMI Distribution by Gender and Shoulder Category



Note: BMI has not been presented for patients aged 19 and under

Primary Partial Shoulder Replacement

CLASSES OF PARTIAL SHOULDER REPLACEMENT

The Registry sub-categorises primary partial shoulder replacement into four main classes. These are defined as:

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 includes the use of a humeral prosthesis that replaces the humeral articular surface only without resecting the head.
Hemi mid head includes resection of part of the humeral head and replacement with a cone stemmed humeral head prosthesis.
Hemi stemmed includes the resection of the humeral head and replacement with a stemmed humeral prosthesis and humeral head prosthesis.

There is a fifth class of partial shoulder placement reported to the Registry. This is a spherical non-stemmed humeral head prosthesis referred to as the Humeral Ball. It is used following partial resection of the humeral head. Only two procedures in this class using this device have been reported to the Registry. The Registry has no further information on these procedures.

USE OF PARTIAL SHOULDER REPLACEMENT

There have been 5,812 primary partial shoulder replacements reported to the Registry up to 31 December 2015. This is an additional 396 procedures compared to the number reported last year.

The most common class of primary partial shoulder replacement is hemi stemmed. This accounts for 74.8% of all partial shoulder replacement, followed by hemi resurfacing (22.2%), partial resurfacing (2.6%) and hemi mid head (0.4%) (Table SP1).

The use of the two main classes of partial shoulder replacement has declined over recent years. The number of hemi resurfacing procedures decreased from 178 in 2012, to 69 in 2015. The number of hemi stemmed procedures decreased from 523 in 2012, to 272 in 2015 (Figure SP1).

Primary partial shoulder replacement is more common in females (65.9%). There is, however, gender variation depending on the class of primary partial shoulder replacement: hemi stemmed (73.8%), hemi mid head (54.2%), hemi resurfacing (44.6%) and partial resurfacing (22.8%) (Table SP1).

Most patients are aged between 65 and 84 years (57.6%). The proportion of patients in this age group varies depending on class of primary partial shoulder replacement: hemi stemmed (61.3%) hemi mid head (50.0%) hemi resurfacing (50.0%) and partial resurfacing (20.1%) (Table SP2).

Overall males having a partial shoulder replacement are younger (mean age 62.7 years compared to 71.9 years in females) (Table SP3). The main reason for undertaking this procedure is fracture (46.6%), followed by osteoarthritis (39.4%) (Table SP4).

The five year cumulative percent revision varies depending on class. Partial resurfacing and hemi mid head have only been used in small numbers (149 and 24 respectively). This makes any assessment of comparative performance difficult. There is, however, a clear difference in the two more commonly used classes. These devices have longer follow up and the cumulative percent revision at seven years of hemi resurfacing is greater than hemi stemmed replacement (13.4% compared to 9.3%) (Table SP5 and Figure SP2). When the diagnosis of osteoarthritis is considered, hemi resurfacing has a higher rate of revision, compared to hemi stemmed, after 2.5 years (Table SP6 and Figure SP3).

Table SP1 Primary Partial Shoulder Replacement by Gender and Class

	Female		Male		TOTAL	
Shoulder Class	N	%	N	%	N	%
Partial Resurfacing	34	22.8	115	77.2	149	2.6
Hemi Resurfacing	576	44.6	716	55.4	1292	22.2
Hemi Stemmed	3207	73.8	1138	26.2	4345	74.8
Hemi Mid Head	13	54.2	11	45.8	24	0.4
TOTAL	3830	65.9	1980	34.1	5810	100.0

Note: Excludes two humeral ball procedures

Table SP2 Primary Partial Shoulder Replacement by Age and Class

	<55		55-64		65-74		75-84		≥85		TOTAL	
Shoulder Class	N	%	N	%	N	%	N	%	N	%	N	%
Partial Resurfacing	103	69.1	13	8.7	17	11.4	13	8.7	3	2.0	149	2.6
Hemi Resurfacing	242	18.7	355	27.5	403	31.2	243	18.8	49	3.8	1292	22.2
Hemi Stemmed	383	8.8	828	19.1	1317	30.3	1346	31.0	471	10.8	4345	74.8
Hemi Mid Head	6	25.0	5	20.8	8	33.3	4	16.7	1	4.2	24	0.4
TOTAL	734	12.6	1201	20.7	1745	30.0	1606	27.6	524	9.0	5810	100.0

Note: Excludes two humeral ball procedures

Table SP3 Primary Partial Shoulder Replacement by Age and Gender

Gender	Number	Percent	Minimum	Maximum	Median	Mean	Std Dev
Male	1982	34.1%	14	93	64	62.7	14.4
Female	3830	65.9%	13	101	73	71.9	11.1
TOTAL	5812	100.0%	13	101	70	68.7	13.1

Note: Includes two humeral ball procedures

Figure SP1 Primary Partial Shoulder Replacement by Class

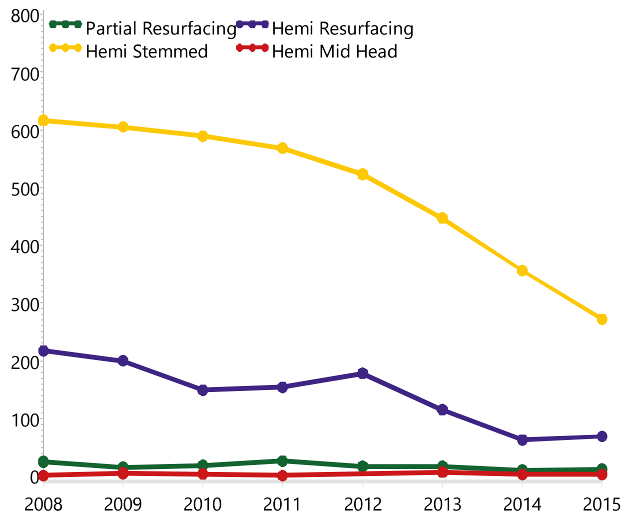


Table SP4 Primary Partial Shoulder Replacement by Primary Diagnosis and Gender

Primary Diagnosis	Male N	Male Col%	Female N	Female Col%	TOTAL N	TOTAL Col%
Fracture	573	28.9	2137	55.8	2710	46.6
Osteoarthritis	1064	53.7	1225	32.0	2289	39.4
Rotator Cuff Arthropathy	108	5.4	163	4.3	271	4.7
Osteonecrosis	63	3.2	98	2.6	161	2.8
Tumour	59	3.0	52	1.4	111	1.9
Rheumatoid Arthritis	15	0.8	87	2.3	102	1.8
Dislocation	27	1.4	37	1.0	64	1.1
Instability	47	2.4	13	0.3	60	1.0
Other Inflammatory Arthritis	10	0.5	12	0.3	22	0.4
Hill-Sachs Defect	14	0.7	4	0.1	18	0.3
Osteochondritis Dissecans	2	0.1			2	0.0
Other			2	0.1	2	0.0
TOTAL	**1982**	**100.0**	**3830**	**100.0**	**5812**	**100.0**

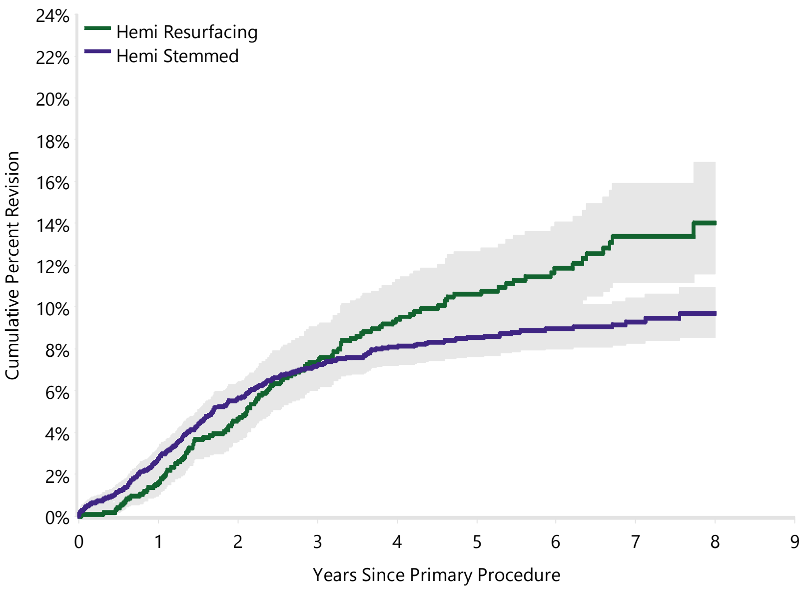
Note: Includes two humeral ball procedures

Table SP5 Cumulative Percent Revision of Primary Partial Shoulder Replacement by Class

Shoulder Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Partial Resurfacing	5	149	0.7 (0.1, 5.0)	1.5 (0.4, 5.8)	1.5 (0.4, 5.8)		
Hemi Resurfacing	128	1292	1.6 (1.0, 2.5)	7.4 (6.0, 9.0)	10.6 (8.9, 12.7)	13.4 (11.2, 15.9)	
Hemi Stemmed	314	4345	2.8 (2.3, 3.3)	7.2 (6.4, 8.1)	8.5 (7.6, 9.5)	9.3 (8.3, 10.4)	
Hemi Mid Head	3	24	4.2 (0.6, 26.1)	17.2 (5.5, 46.8)	17.2 (5.5, 46.8)		
TOTAL	**450**	**5810**					

Note: Excludes two humeral ball procedures

Figure SP2 Cumulative Percent Revision of Primary Partial Shoulder Replacement by Class



HR - adjusted for age and gender

Hemi Resurfacing vs Hemi Stemmed

0 - 1Yr: HR=0.53 (0.33, 0.86),p=0.009

1Yr - 1.5Yr: HR=1.16 (0.72, 1.85),p=0.545

1.5Yr - 2Yr: HR=0.69 (0.35, 1.33),p=0.267

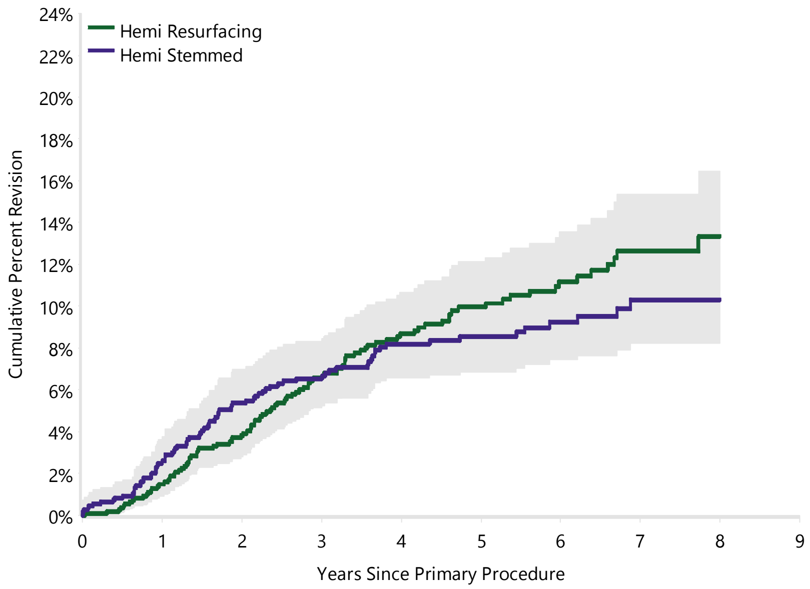
2Yr+: HR=1.97 (1.44, 2.69),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Hemi Resurfacing	1292	1196	939	588	269	17
Hemi Stemmed	4345	3791	2681	1588	618	24

Table SP6 Cumulative Percent Revision of Primary Partial Shoulder Replacement by Class (Primary Diagnosis OA)

Shoulder Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Hemi Resurfacing	103	1121	1.5 (0.9, 2.4)	6.6 (5.2, 8.3)	10.0 (8.2, 12.1)	12.6 (10.4, 15.4)	
Hemi Stemmed	83	1092	2.6 (1.8, 3.8)	6.5 (5.1, 8.3)	8.5 (6.9, 10.6)	10.3 (8.2, 12.9)	
TOTAL	186	2213					

Figure SP3 Cumulative Percent Revision of Primary Partial Shoulder Replacement by Class (Primary Diagnosis OA)



HR - adjusted for age and gender

Hemi Resurfacing vs Hemi Stemmed

0 - 2.5Yr: HR=0.76 (0.52, 1.10),p=0.142

2.5Yr+: HR=1.81 (1.08, 3.02),p=0.023

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Hemi Resurfacing	1121	1037	816	508	242	14
Hemi Stemmed	1092	968	725	486	205	6

PRIMARY PARTIAL RESURFACING SHOULDER REPLACEMENT

DEMOGRAPHICS AND OUTCOMES

There have been 149 primary partial resurfacing shoulder replacement procedures reported to the Registry. This is an additional 20 procedures compared to the previous report.

This procedure is undertaken more commonly in males (77.2%). The mean age for females is 60.1 years compared to 40.7 years for males (Table SP7).

The most common primary diagnosis is instability (47.7%), followed by osteoarthritis (39.6%) (Table SP8).

The cumulative percent revision at five years is 1.5% (Table SP5). Of the five revisions, four were for glenoid erosion and one was for instability/dislocation. All were revised to a total conventional shoulder replacement.

Table SP7 Primary Partial Resurfacing Shoulder Replacement by Age and Gender

Gender	Number	Percent	Minimum	Maximum	Median	Mean	Std Dev
Male	115	77.2%	15	87	38	40.7	18.0
Female	34	22.8%	17	88	64	60.1	18.5
TOTAL	**149**	**100.0%**	**15**	**88**	**43**	**45.1**	**19.8**

Table SP8 Primary Partial Resurfacing Shoulder Replacement by Primary Diagnosis and Gender

	Male		Female		TOTAL	
Primary Diagnosis	N	Col%	N	Col%	N	Col%
Instability	59	51.3	12	35.3	71	47.7
Osteoarthritis	41	35.7	18	52.9	59	39.6
Fracture	8	7.0	2	5.9	10	6.7
Osteonecrosis	2	1.7	2	5.9	4	2.7
Osteochondritis Dissecans	2	1.7			2	1.3
Rotator Cuff Arthropathy	2	1.7			2	1.3
Tumour	1	0.9			1	0.7
TOTAL	**115**	**100.0**	**34**	**100.0**	**149**	**100.0**

Note: Instability includes Instability, Dislocation and Hill-Sachs Defect

PRIMARY HEMI RESURFACING SHOULDER REPLACEMENT

DEMOGRAPHICS

There have been 1,292 primary hemi resurfacing shoulder replacements reported to the Registry. This is an additional 75 procedures compared to the previous report. The use of primary hemi resurfacing has declined by 68.2% since 2008.

This procedure is more common in males (55.4%). The mean age is 68.8 years for females and 61.8 years for males (Table SP9).

Osteoarthritis is the most common primary diagnosis (86.8%). The range of diagnoses is similar for males and females (Table SP10).

The three most used prostheses in 2015 were the Copeland, PyroTITAN and Global Cap (Table SP11).

Table SP9 Primary Hemi Resurfacing Shoulder Replacement by Age and Gender

Gender	Number	Percent	Minimum	Maximum	Median	Mean	Std Dev
Male	716	55.4%	19	90	62	61.8	12.0
Female	576	44.6%	27	93	70	68.8	11.1
TOTAL	1292	100.0%	19	93	66	64.9	12.1

Table SP10 Primary Hemi Resurfacing Shoulder Replacement by Primary Diagnosis and Gender

	Male		Female		TOTAL	
Primary Diagnosis	N	Col%	N	Col%	N	Col%
Osteoarthritis	623	87.0	498	86.5	1121	86.8
Rotator Cuff Arthropathy	49	6.8	34	5.9	83	6.4
Osteonecrosis	16	2.2	16	2.8	32	2.5
Rheumatoid Arthritis	5	0.7	15	2.6	20	1.5
Instability	11	1.5	4	0.7	15	1.2
Fracture	9	1.3	4	0.7	13	1.0
Other Inflammatory Arthritis	3	0.4	5	0.9	8	0.6
TOTAL	716	100.0	576	100.0	1292	100.0

Table SP11 Most Used Humeral Head Prostheses in Primary Hemi Resurfacing Shoulder Replacement

2008		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
124	Copeland	81	PyroTITAN	35	Copeland	29	Copeland	26	Copeland
45	Global CAP	45	Copeland	33	PyroTITAN	19	Global CAP	21	PyroTITAN
34	SMR	22	SMR	19	Global CAP	9	SMR	15	Global CAP
11	Aequalis	19	Global CAP	14	Aequalis	4	Aequalis	4	Aequalis
2	Epoca RH	11	Aequalis	14	SMR	1	Custom Made (Copeland)	3	SMR
1	Buechel-Pappas					1	Epoca RH		
Most Used									
217 (6)	100.0%	178 (5)	100.0%	115 (5)	100.0%	63 (6)	100.0%	69 (5)	100.0%

OUTCOME FOR ALL DIAGNOSES

Reason for Revision

The main reasons for revision of hemi resurfacing replacement are pain (24.2%), glenoid erosion (24.2%), rotator cuff insufficiency (15.6%) and loosening/lysis (14.8%) (Table SP12).

Type of Revision

The most common type of revision is to a total shoulder replacement (88.3%) (Table SP13). Of these, 58 (51.3%) were revised to a total reverse shoulder and 55 (48.7%) to a total conventional shoulder replacement.

OUTCOME FOR OSTEOARTHRITIS

Age and Gender

Age is a risk factor for revision. Those aged 75 years or older have a lower rate of revision after 2.5 years compared to those less than 55 years (Table SP14 and Figure SP4).

The revision rate does not vary by gender (Table SP15 and Figure SP5).

The outcomes of the most commonly used prostheses are listed in Table SP16.

Table SP12 Primary Hemi Resurfacing Shoulder Replacement by Reason for Revision

Reason for Revision	Number	Percent
Pain	31	24.2
Glenoid Erosion	31	24.2
Rotator Cuff Insufficiency	20	15.6
Loosening/Lysis	19	14.8
Instability/Dislocation	16	12.5
Infection	2	1.6
Malposition	2	1.6
Implant Breakage Head	2	1.6
Arthrofibrosis	1	0.8
Incorrect Sizing	1	0.8
Implant Breakage Humeral	1	0.8
Fracture	1	0.8
Other	1	0.8
TOTAL	128	100.0

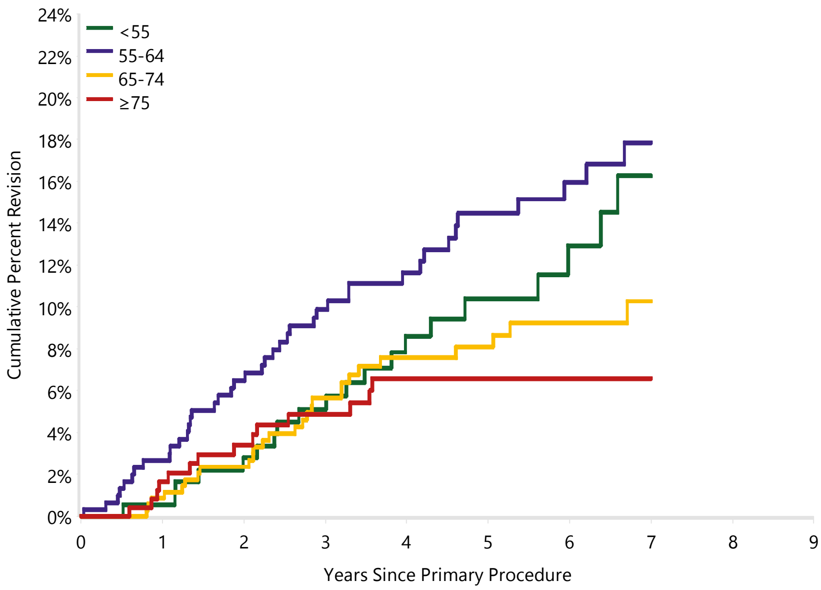
Table SP13 Primary Hemi Resurfacing Shoulder Replacement by Type of Revision

Type of Revision	Number	Percent
Humeral/Glenoid	113	88.3
Glenoid Component	6	4.7
Humeral Component	6	4.7
Removal of Prostheses	1	0.8
Reoperation	1	0.8
Head Only	1	0.8
TOTAL	128	100.0

Table SP14 Cumulative Percent Revision of Primary Hemi Resurfacing Shoulder Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
<55	20	197	0.5 (0.1, 3.8)	5.1 (2.7, 9.6)	10.4 (6.4, 16.5)	16.3 (10.3, 25.2)	
55-64	41	310	2.7 (1.3, 5.3)	9.9 (6.9, 14.0)	14.5 (10.6, 19.6)	17.8 (13.1, 24.0)	
65-74	28	359	0.9 (0.3, 2.7)	5.6 (3.6, 8.8)	8.1 (5.5, 11.9)	10.3 (6.9, 15.1)	
≥75	14	255	1.7 (0.6, 4.4)	4.9 (2.7, 8.6)	6.6 (3.9, 10.9)	6.6 (3.9, 10.9)	
TOTAL	103	1121					

Figure SP4 Cumulative Percent Revision of Primary Hemi Resurfacing Shoulder Replacement by Age (Primary Diagnosis OA)



HR - adjusted for gender

55-64 vs <55
0 - 9Mth: HR=7.67 (1.51, 38.92),p=0.014
9Mth+: HR=1.12 (0.64, 1.95),p=0.698

65-74 vs <55
Entire Period: HR=0.73 (0.41, 1.32),p=0.298

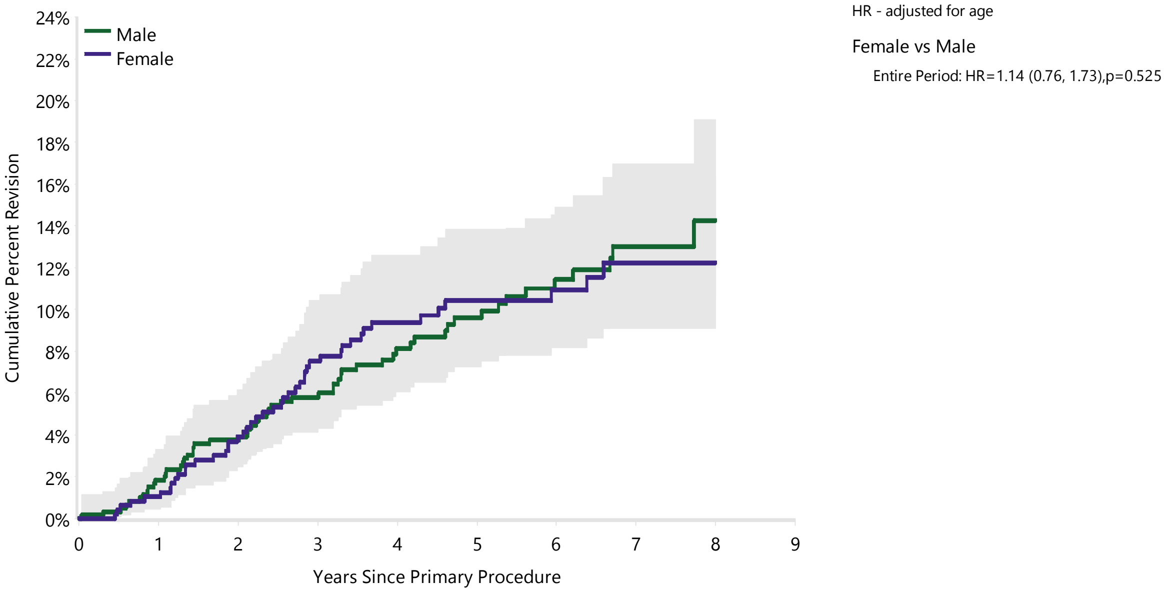
≥75 vs <55
0 - 2.5Yr: HR=0.79 (0.35, 1.79),p=0.572
2.5Yr+: HR=0.28 (0.09, 0.83),p=0.022

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
<55	197	180	149	88	41	3
55-64	310	286	223	136	69	6
65-74	359	337	263	166	76	4
≥75	255	234	181	118	56	1

Table SP15 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	9 Yrs
Male	57	623	1.8 (1.0, 3.3)	5.8 (4.2, 8.1)	9.6 (7.3, 12.6)	13.0 (9.9, 17.0)	
Female	46	498	1.0 (0.4, 2.5)	7.5 (5.4, 10.4)	10.4 (7.8, 13.8)	12.2 (9.1, 16.3)	
TOTAL	103	1121					

Figure SP5 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	9 Yrs
Male	623	575	450	276	134	8
Female	498	462	366	232	108	6

Table SP16 Cumulative Percent Revision of Primary Hemi Resurfacing Shoulder Replacement by Humeral Head (Primary Diagnosis OA)

Humeral Head	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Aequalis	8	78	1.3 (0.2, 9.0)	9.0 (4.1, 19.0)	9.0 (4.1, 19.0)	24.1 (10.1, 51.3)	
Copeland	44	517	1.6 (0.8, 3.2)	5.7 (4.0, 8.2)	9.1 (6.7, 12.2)	10.2 (7.6, 13.5)	
Global CAP	21	196	0.5 (0.1, 3.7)	9.1 (5.6, 14.6)	12.8 (8.4, 19.2)	13.8 (9.2, 20.6)	
PyroTITAN	10	168	3.3 (1.4, 7.7)	6.7 (3.6, 12.0)			
SMR	16	139	0.0 (0.0, 0.0)	4.0 (1.7, 9.3)	11.1 (6.4, 18.8)		
Other (3)	4	23	4.3 (0.6, 27.1)	13.9 (4.7, 37.3)	13.9 (4.7, 37.3)	21.7 (8.4, 49.7)	
TOTAL	103	1121					

Note: Only Humeral Heads with over 50 procedures have been listed

PRIMARY HEMI MID HEAD SHOULDER REPLACEMENT

DEMOGRAPHICS AND OUTCOME

This device is used in small numbers. There have only been 24 primary hemi mid head shoulder replacement procedures reported to the Registry. This includes an additional three procedures compared to the previous report.

This procedure is undertaken more commonly in females (54.2%). The mean age for females is 66.2 years and for males it is 61.3 years (Table SP17). Osteoarthritis is the most common primary diagnosis (62.5%) (Table SP18).

There have been three revisions reported in this class of prostheses: one for fracture and two for loosening/lysis.

The most common humeral stem and head prosthesis combinations are the Eclipse (10 procedures), followed by the Affiniti (seven procedures) and the Affinis (five procedures).

Table SP17 Primary Hemi Mid Head Shoulder Replacement by Age and Gender

Gender	Number	Percent	Minimum	Maximum	Median	Mean	Std Dev
Male	11	45.8%	46	83	59	61.3	13.0
Female	13	54.2%	30	85	67	66.2	14.3
TOTAL	24	100.0%	30	85	66	64.0	13.7

Table SP18 Primary Hemi Mid Head Shoulder Replacement by Primary Diagnosis and Gender

	Male		Female		TOTAL	
Primary Diagnosis	N	Col%	N	Col%	N	Col%
Osteoarthritis	8	72.7	7	53.8	15	62.5
Osteonecrosis	2	18.2	3	23.1	5	20.8
Fracture	.	.	2	15.4	2	8.3
Rotator Cuff Arthropathy	1	9.1			1	4.2
Rheumatoid Arthritis			1	7.7	1	4.2
TOTAL	11	100.0	13	100.0	24	100.0

PRIMARY HEMI STEMMED SHOULDER REPLACEMENT

DEMOGRAPHICS

There have been 4,345 primary hemi stemmed shoulder replacement procedures reported to the Registry. This is an additional 297 procedures compared to the previous report.

This procedure is more common in females (73.8%). The mean age is 72.6 years for females and 65.5 years for males (Table SP19).

The most common primary diagnosis is fracture (61.8%), followed by osteoarthritis (25.1%) (Table SP20). The number of primary hemi stemmed shoulder replacements undertaken for fracture has decreased from 361 in 2012, to 152 in 2015. The number of primary hemi stemmed shoulder replacements undertaken for osteoarthritis has decreased from 95 in 2012 to 80 in 2015 (Figure SP6).

The most common humeral stem prostheses used in 2015 were the SMR, Global Unite and Global AP (Table SP21). The 10 most used stem prostheses accounted for 88.2% of all primary hemi stemmed procedures in 2015. This has decreased from 97.2% in 2008.

The most common humeral head prostheses used in 2015 were the SMR, Aequalis and Global Unite (Table SP22). The 10 most used humeral head prostheses accounted for 86.8% of all primary hemi stemmed procedures in 2015. This has decreased from 98.2% in 2008.

Table SP19 Primary Hemi Stemmed Shoulder Replacement by Age and Gender

Gender	Number	Percent	Minimum	Maximum	Median	Mean	Std Dev
Male	1138	26.2%	14	93	66	65.5	13.3
Female	3207	73.8%	13	101	74	72.6	10.8
TOTAL	4345	100.0%	13	101	72	70.7	11.9

Table SP20 Primary Hemi Stemmed Shoulder Replacement by Primary Diagnosis and Gender

	Male		Female		TOTAL	
Primary Diagnosis	N	Col%	N	Col%	N	Col%
Fracture	556	48.9	2129	66.4	2685	61.8
Osteoarthritis	390	34.3	702	21.9	1092	25.1
Rotator Cuff Arthropathy	56	4.9	129	4.0	185	4.3
Osteonecrosis	43	3.8	77	2.4	120	2.8
Tumour	58	5.1	52	1.6	110	2.5
Rheumatoid Arthritis	10	0.9	71	2.2	81	1.9
Instability	18	1.6	38	1.2	56	1.3
Other Inflammatory Arthritis	7	0.6	7	0.2	14	0.3
Other			2	0.1	2	0.0
TOTAL	1138	100.0	3207	100.0	4345	100.0

Note: Instability includes Instability and Dislocation

Figure SP6 Primary Hemi Stemmed Shoulder Replacement by Primary Diagnosis

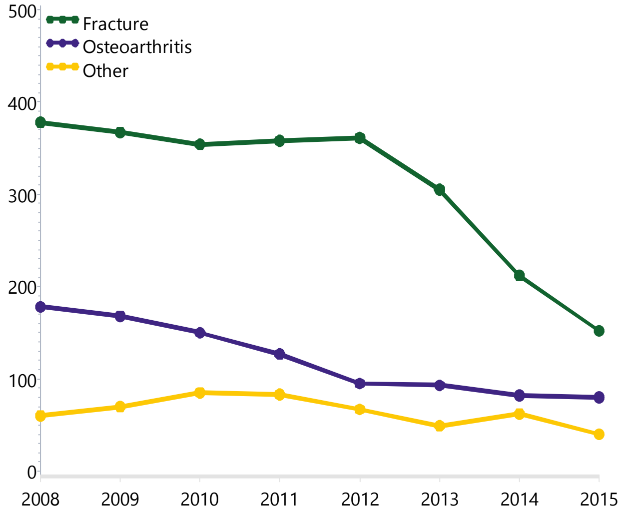


Table SP21 10 Most Used Humeral Stem Prostheses in Primary Hemi Stemmed Shoulder Replacement

2008		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
207	SMR	180	SMR	128	SMR	101	SMR	55	SMR
138	Global FX	82	Global FX	66	Global FX	49	Aequalis	35	Global Unite
98	Aequalis	80	Aequalis	64	Aequalis	44	Global FX	33	Global AP
81	Global Advantage	47	Bigliani/Flatow TM	42	Global AP	38	Global AP	29	Aequalis Ascend
26	Bigliani/Flatow TM	36	Global AP	37	Global Unite	29	Aequalis Ascend	28	Global FX
13	Solar	20	Comprehensive	27	Bigliani/Flatow TM	26	Bigliani/Flatow TM	19	Bigliani/Flatow TM
11	Bigliani/Flatow	20	Global Advantage	26	Comprehensive	25	Global Unite	18	Aequalis
11	Bio-Modular	15	Global Unite	15	Global Advantage	11	Comprehensive	13	Comprehensive
8	Global AP	10	Delta Xtend	7	Delta Xtend	7	Global Advantage	5	Delta Xtend
6	Univers 3D	5	Solar	4	Ascend	6	Delta Xtend	5	Equinoxe
10 Most Used									
599 (10)	97.2%	495 (10)	94.6%	416 (10)	93.1%	336 (10)	94.4%	240 (10)	88.2%
Remainder									
17 (7)	2.8%	28 (15)	5.4%	31 (13)	6.9%	20 (8)	5.6%	32 (10)	11.8%
TOTAL									
616 (17)	100.0%	523 (25)	100.0%	447 (23)	100.0%	356 (18)	100.0%	272 (20)	100.0%

Table SP22 10 Most Used Humeral Head Prostheses in Primary Hemi Stemmed Shoulder Replacement

2008		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
197	Global Advantage	156	SMR	109	SMR	81	SMR	46	SMR
177	SMR	96	Global Advantage	71	Global Advantage	73	Aequalis	43	Aequalis
98	Aequalis	80	Aequalis	64	Aequalis	47	Global Advantage	35	Global Unite
38	Bigliani/Flatow	51	Bigliani/Flatow	37	Global Unite	29	Bigliani/Flatow	29	Global Advantage
31	SMR CTA	24	SMR CTA	33	Bigliani/Flatow	29	Global AP	26	Bigliani/Flatow
22	Global Advantage CTA	20	Global AP	26	Global AP	25	Global Unite	26	Global AP
15	Bio-Modular	16	Global AP CTA	19	SMR CTA	20	SMR CTA	9	Bio-Modular
13	Solar	15	Global Unite	16	Global AP CTA	9	Global AP CTA	9	SMR CTA
8	Global AP	12	Comprehensive	14	Comprehensive	7	Bio-Modular	7	Global AP CTA
6	Univers 3D	10	Delta Xtend	12	Bio-Modular	6	Delta Xtend	6	Ascend
10 Most Used									
605 (10)	98.2%	480 (10)	91.8%	401 (10)	89.7%	326 (10)	91.6%	236 (10)	86.8%
Remainder									
11 (4)	1.8%	43 (16)	8.2%	46 (14)	10.3%	30 (9)	8.4%	36 (10)	13.2%
TOTAL									
616 (14)	100.0%	523 (26)	100.0%	447 (24)	100.0%	356 (19)	100.0%	272 (20)	100.0%

OUTCOME FOR ALL DIAGNOSES

Primary Diagnosis

The outcome of primary hemi stemmed shoulder replacement by primary diagnosis is listed in Table SP23.

There is no difference in the rate of revision when primary hemi stemmed shoulder replacement is performed for fracture or osteoarthritis (Figure SP7).

Reason for Revision

The most common reasons for revision are rotator cuff insufficiency (22.3%), instability/dislocation (19.7%), glenoid erosion (12.4%) and pain (12.1%) (Table SP25). Reasons for revision vary depending on primary diagnosis. Rotator cuff insufficiency occurs more frequently in hemi stemmed shoulder replacement undertaken for fracture, whereas glenoid erosion occurs more frequently in those undertaken for osteoarthritis (Table SP24).

"There is no difference in the rate of revision when primary hemi stemmed shoulder replacement is performed for fracture or osteoarthritis."

Type of Revision

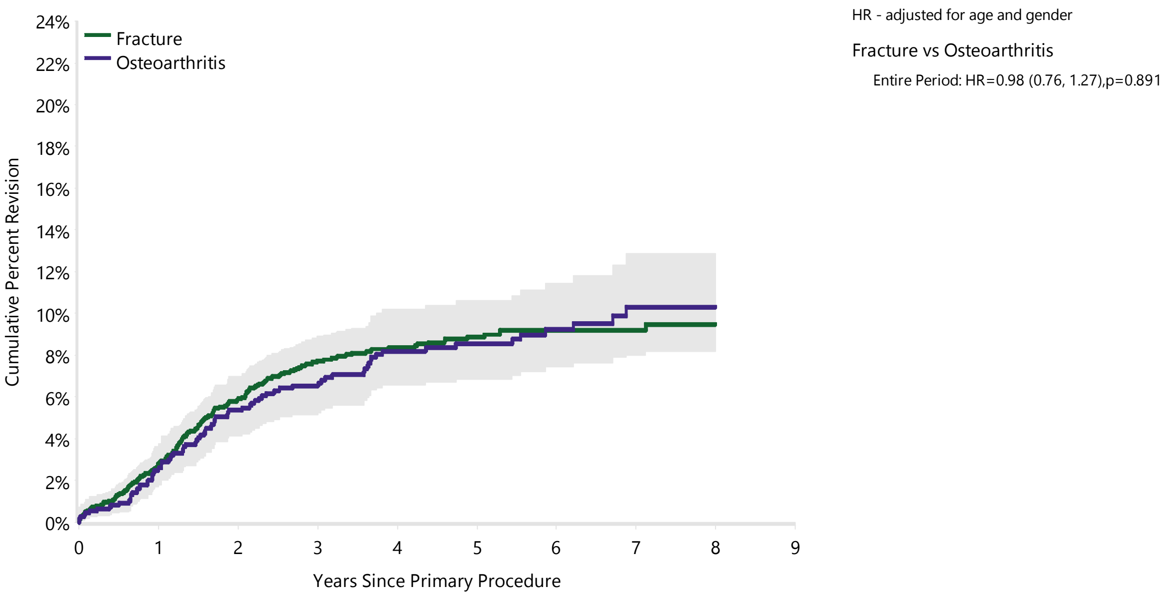
The most common type of revision is total shoulder replacement (65.0%). Of the 204 revised, 190 (93.1%) were revised to a total reverse shoulder replacement. Glenoid component only revision occurs in 12.7% of procedures (Table SP26).

Table SP23 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	9 Yrs
Fracture	199	2685	2.8 (2.2, 3.5)	7.7 (6.7, 8.9)	8.9 (7.7, 10.2)	9.2 (8.0, 10.6)	
Osteoarthritis	83	1092	2.6 (1.8, 3.8)	6.5 (5.1, 8.3)	8.5 (6.9, 10.6)	10.3 (8.2, 12.9)	
Rotator Cuff Arthropathy	10	185	2.2 (0.8, 5.8)	5.7 (3.0, 10.7)	6.5 (3.5, 11.8)		
Osteonecrosis	6	120	1.7 (0.4, 6.7)	3.6 (1.3, 9.2)	4.9 (2.0, 11.6)		
Tumour	8	110	5.9 (2.5, 13.8)				
Other (4)	8	153	2.7 (1.0, 7.1)	4.9 (2.4, 10.1)	4.9 (2.4, 10.1)		
TOTAL	314	4345					

Note: Only primary diagnoses with over 100 procedures have been listed

Figure SP7 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	9 Yrs
Fracture	2685	2351	1633	917	345	10
Osteoarthritis	1092	968	725	486	205	6

Table SP24 Primary Hemi Stemmed Shoulder Replacement by Reason for Revision and Primary Diagnosis

Reason for Revision	Fracture			Osteoarthritis		
	Number	% Primaries Revised	% Revisions	Number	% Primaries Revised	% Revisions
Rotator Cuff Insufficiency	52	1.9	26.1	12	1.1	14.5
Instability/Dislocation	40	1.5	20.1	15	1.4	18.1
Glenoid Erosion	10	0.4	5.0	24	2.2	28.9
Pain	23	0.9	11.6	10	0.9	12.0
Loosening/Lysis	18	0.7	9.0	9	0.8	10.8
Infection	17	0.6	8.5	3	0.3	3.6
Fracture	16	0.6	8.0	4	0.4	4.8
Arthrofibrosis	7	0.3	3.5	2	0.2	2.4
Malposition	6	0.2	3.0	1	0.1	1.2
Dissociation	3	0.1	1.5	1	0.1	1.2
Incorrect Sizing	1	0.0	0.5			
Osteonecrosis				1	0.1	1.2
Other	6	0.2	3.0	1	0.1	1.2
N Revision	199	7.4	100.0	83	7.6	100.0
N Primary	2685			1092		

Table SP25 Primary Hemi Stemmed Shoulder Replacement by Reason for Revision

Reason for Revision	Number	Percent
Rotator Cuff Insufficiency	70	22.3
Instability/Dislocation	62	19.7
Glenoid Erosion	39	12.4
Pain	38	12.1
Loosening/Lysis	28	8.9
Infection	25	8.0
Fracture	21	6.7
Arthrofibrosis	10	3.2
Malposition	7	2.2
Dissociation	4	1.3
Incorrect Sizing	1	0.3
Osteonecrosis	1	0.3
Other	8	2.5
TOTAL	314	100.0

Table SP26 Primary Hemi Stemmed Shoulder Replacement by Type of Revision

Type of Revision	Number	Percent
Humeral/Glenoid	204	65.0
Glenoid Component	40	12.7
Humeral Component	32	10.2
Head Only	17	5.4
Cement Spacer	8	2.5
Removal of Prostheses	5	1.6
Reoperation	4	1.3
Cement Only	2	0.6
Minor Components	1	0.3
Head/Insert	1	0.3
TOTAL	314	100.0

Note: Humeral heads are usually replaced when the humeral component is revised

OUTCOME FOR FRACTURE

Age and Gender

Patients aged 75 years and older have a lower cumulative percent revision compared to all other age groups. There is no difference between the outcome for patients aged less than 55 years, 55 to 64 years and 65 to 74 years (Table SP27 and Figure SP8).

There is no gender difference in revision outcome (Table SP28 and Figure SP9).

Humeral Stem

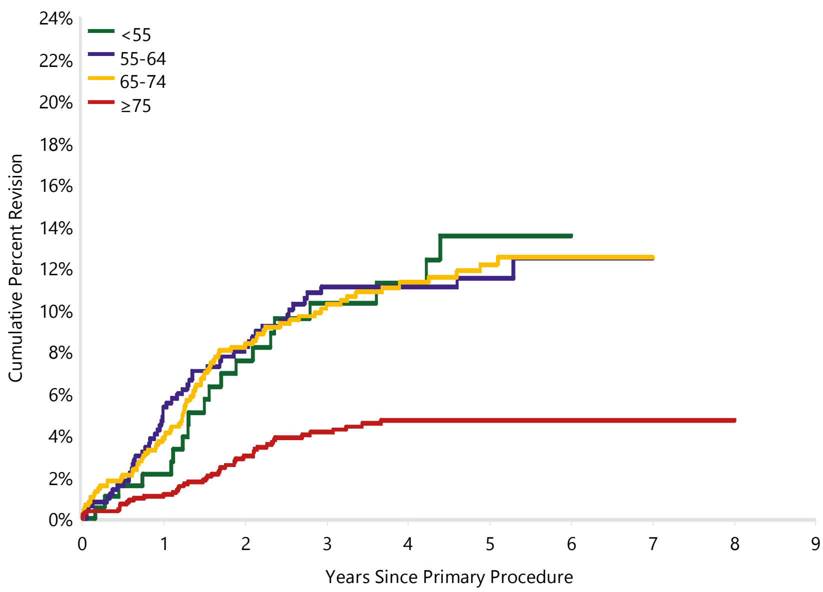
There is no difference in the rate of revision for fracture humeral stems compared to non fracture humeral stems (Table SP29 and Figure SP10).

The outcomes of the prostheses used in the treatment of fracture are listed in Table SP30. The outcomes for individual fracture stems are presented separately in Table SP31 and non fracture humeral stems in Table SP32.

Table SP27 Cumulative Percent Revision of Primary Hemi Stemmed Shoulder Replacement by Age (Primary Diagnosis Fracture)

Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
<55	20	194	2.1 (0.8, 5.6)	10.3 (6.5, 16.1)	13.5 (8.8, 20.6)		
55-64	54	519	5.3 (3.6, 7.7)	11.1 (8.5, 14.4)	11.5 (8.8, 14.9)	12.5 (9.6, 16.2)	
65-74	80	784	3.8 (2.7, 5.5)	10.2 (8.2, 12.8)	12.2 (9.8, 15.0)	12.5 (10.1, 15.4)	
≥75	45	1188	1.2 (0.7, 2.0)	4.1 (3.0, 5.6)	4.7 (3.5, 6.3)	4.7 (3.5, 6.3)	
TOTAL	**199**	**2685**					

Figure SP8 Cumulative Percent Revision of Primary Hemi Stemmed Shoulder Replacement by Age (Primary Diagnosis Fracture)



HR - adjusted for gender

<55 vs ≥75

Entire Period: HR=3.05 (1.76, 5.27),p<0.001

55-64 vs ≥75

Entire Period: HR=2.85 (1.91, 4.24),p<0.001

65-74 vs ≥75

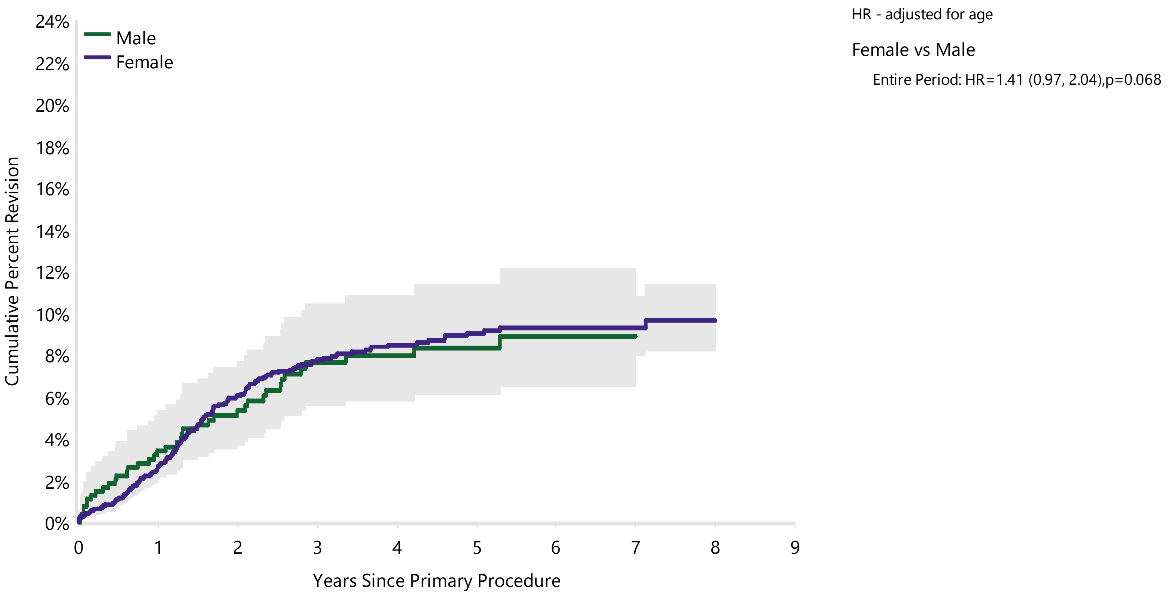
Entire Period: HR=2.74 (1.90, 3.95),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
<55	194	169	115	63	23	0
55-64	519	441	314	197	83	0
65-74	784	687	478	270	99	6
≥75	1188	1054	726	387	140	4

Table SP28 Cumulative Percent Revision of Primary Hemi Stemmed Shoulder Replacement by Gender (Primary Diagnosis Fracture)

Gender	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Male	39	556	3.4 (2.2, 5.3)	7.6 (5.5, 10.5)	8.3 (6.1, 11.4)	8.9 (6.5, 12.1)	
Female	160	2129	2.7 (2.0, 3.5)	7.8 (6.6, 9.1)	9.0 (7.7, 10.5)	9.3 (8.0, 10.8)	
TOTAL	199	2685					

Figure SP9 Cumulative Percent Revision of Primary Hemi Stemmed Shoulder Replacement by Gender (Primary Diagnosis Fracture)

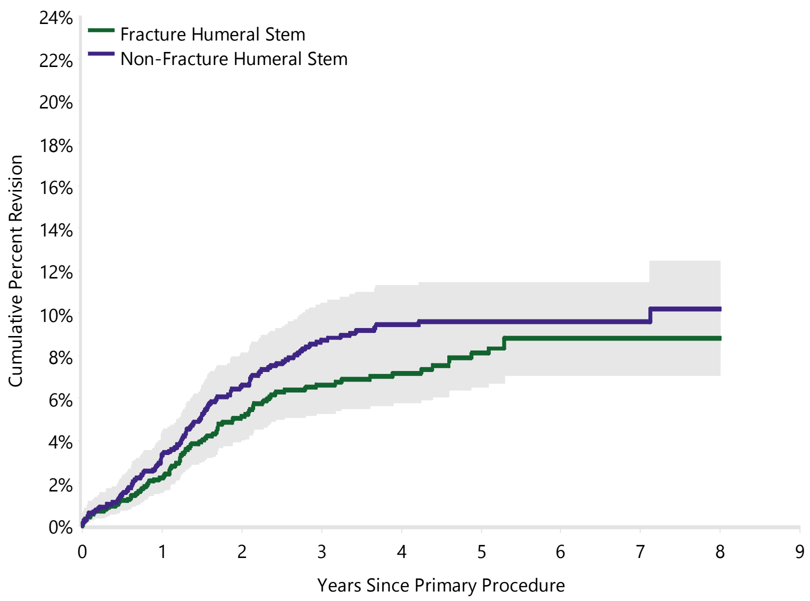


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Male	556	475	329	181	69	1
Female	2129	1876	1304	736	276	9

Table SP29 Cumulative Percent Revision of Primary Hemi Stemmed Shoulder Replacement by Stem Type (Primary Diagnosis Fracture)

Stem Type	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Fracture Humeral Stem	86	1298	2.3 (1.6, 3.3)	6.6 (5.3, 8.3)	8.1 (6.5, 10.1)	8.8 (7.1, 10.9)	
Non Fracture Humeral Stem	113	1387	3.3 (2.5, 4.5)	8.7 (7.3, 10.5)	9.6 (8.0, 11.5)	9.6 (8.0, 11.5)	
TOTAL	199	2685					

Figure SP10 Cumulative Percent Revision of Primary Hemi Stemmed Shoulder Replacement by Stem Type (Primary Diagnosis Fracture)



HR - adjusted for age and gender

Non-Fracture Humeral Stem vs Fracture Humeral Stem

Entire Period: HR=1.20 (0.91, 1.60),p=0.192

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Fracture Humeral Stem	1298	1138	770	425	182	4
Non Fracture Humeral Stem	1387	1213	863	492	163	6

Table SP30 Cumulative Percent Revision of Primary Hemi Stemmed Shoulder Replacement by Humeral Head and Stem (Primary Diagnosis Fracture)

Humeral Head	Humeral Stem	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Aequalis	Aequalis	25	418	2.7 (1.5, 4.8)	6.0 (4.0, 8.9)	7.0 (4.7, 10.4)	7.0 (4.7, 10.4)	
Bigliani/Flatow	Bigliani/Flatow TM	6	274	1.2 (0.4, 3.6)	2.5 (1.1, 5.5)	2.5 (1.1, 5.5)		
Bio-Modular	Comprehensive	2	59	1.8 (0.3, 12.0)	3.9 (1.0, 14.9)	3.9 (1.0, 14.9)		
Global Advantage	Global Advantage	9	52	7.8 (3.0, 19.4)	16.3 (8.5, 30.1)	18.7 (10.1, 32.9)	18.7 (10.1, 32.9)	
Global Advantage	Global FX	47	675	2.2 (1.3, 3.6)	6.2 (4.5, 8.4)	8.0 (6.0, 10.7)	9.1 (6.8, 12.0)	
Global Unite	Global Unite	11	98	2.3 (0.6, 9.1)				
SMR	SMR	82	832	3.7 (2.6, 5.2)	10.4 (8.4, 12.9)	11.7 (9.5, 14.4)	11.7 (9.5, 14.4)	
SMR CTA	SMR	2	33	3.3 (0.5, 21.4)	7.7 (2.0, 27.9)	7.7 (2.0, 27.9)		
Solar	Solar	4	40	7.9 (2.6, 22.5)	10.5 (4.1, 25.7)	10.5 (4.1, 25.7)	10.5 (4.1, 25.7)	
Other (24)		11	204	2.2 (0.8, 5.7)	6.9 (3.9, 12.2)	6.9 (3.9, 12.2)		
TOTAL		199	2685					

Note: Only combinations with over 30 procedures have been listed

Table SP31 Cumulative Percent Revision of Primary Hemi Stemmed Shoulder Replacement by Humeral Head and Fracture Stem (Primary Diagnosis Fracture)

Humeral Head	Fracture Stem	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Aequalis	Aequalis	24	403	2.5 (1.4, 4.7)	6.0 (4.0, 9.0)	7.1 (4.7, 10.6)	7.1 (4.7, 10.6)	
Bio-Modular	Comprehensive	2	59	1.8 (0.3, 12.0)	3.9 (1.0, 14.9)	3.9 (1.0, 14.9)		
Global Advantage	Global FX	47	675	2.2 (1.3, 3.6)	6.2 (4.5, 8.4)	8.0 (6.0, 10.7)	9.1 (6.8, 12.0)	
Global Unite	Global Unite	11	98	2.3 (0.6, 9.1)				
Other (6)		2	63	1.9 (0.3, 12.9)	4.0 (1.0, 15.0)			
TOTAL		86	1298					

Note: Only combinations with over 30 procedures have been listed

Table SP32 Cumulative Percent Revision of Primary Hemi Stemmed Shoulder Replacement by Humeral Head and Non Fracture Humeral Stem (Primary Diagnosis Fracture)

Humeral Head	Non Fracture Humeral Stem	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Bigliani/Flatow	Bigliani/Flatow TM	6	274	1.2 (0.4, 3.6)	2.5 (1.1, 5.5)	2.5 (1.1, 5.5)		
Global Advantage	Global Advantage	9	52	7.8 (3.0, 19.4)	16.3 (8.5, 30.1)	18.7 (10.1, 32.9)	18.7 (10.1, 32.9)	
SMR	SMR	82	832	3.7 (2.6, 5.2)	10.4 (8.4, 12.9)	11.7 (9.5, 14.4)	11.7 (9.5, 14.4)	
SMR CTA	SMR	2	33	3.3 (0.5, 21.4)	7.7 (2.0, 27.9)	7.7 (2.0, 27.9)		
Solar	Solar	4	40	7.9 (2.6, 22.5)	10.5 (4.1, 25.7)	10.5 (4.1, 25.7)	10.5 (4.1, 25.7)	
Other (23)		10	156	2.7 (1.0, 7.1)	7.7 (4.2, 13.9)	7.7 (4.2, 13.9)		
TOTAL		113	1387					

Note: Only combinations with over 30 procedures have been listed

OUTCOME FOR OSTEOARTHRITIS

Age and Gender

The rate of revision is lower for those aged 75 years or older compared to patients aged less than 55 and 55-64 years (Table SP33 and Figure SP11).

Gender is not a risk factor for revision (Table SP34 and Figure SP12).

Humeral Head

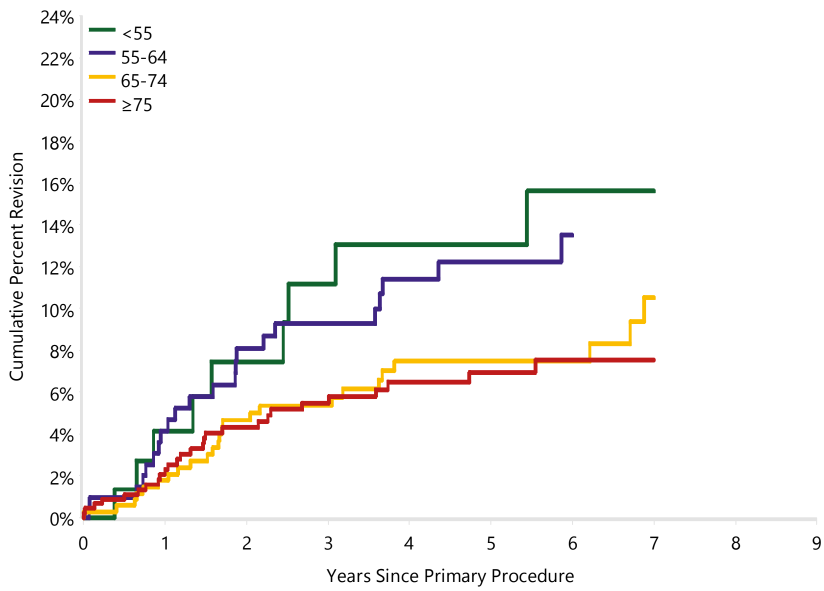
There is no difference in the rate of revision when a CTA (Cuff Tear Arthropathy) humeral head is used, compared to a standard head (Table SP35 and Figure SP13).

The outcomes for the most used prosthesis combinations for osteoarthritis are listed in Table SP36.

Table SP33 Cumulative Percent Revision of Primary Hemi Stemmed Shoulder Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
<55	9	79	4.1 (1.4, 12.3)	11.2 (5.4, 22.2)	13.1 (6.7, 24.6)	15.6 (8.3, 28.3)	
55-64	22	208	4.1 (2.1, 8.1)	9.3 (5.9, 14.5)	12.2 (8.1, 18.3)		
65-74	25	352	1.8 (0.8, 3.9)	5.4 (3.4, 8.5)	7.5 (5.0, 11.2)	10.5 (6.8, 16.1)	
≥75	27	453	2.3 (1.2, 4.2)	5.5 (3.6, 8.2)	7.0 (4.7, 10.1)	7.5 (5.1, 11.0)	
TOTAL	83	1092					

Figure SP11 Cumulative Percent Revision of Primary Hemi Stemmed Shoulder Replacement by Age (Primary Diagnosis OA)



HR - adjusted for gender

<55 vs ≥75
Entire Period: HR=2.21 (1.02, 4.81),p=0.044

55-64 vs ≥75
Entire Period: HR=1.91 (1.07, 3.42),p=0.028

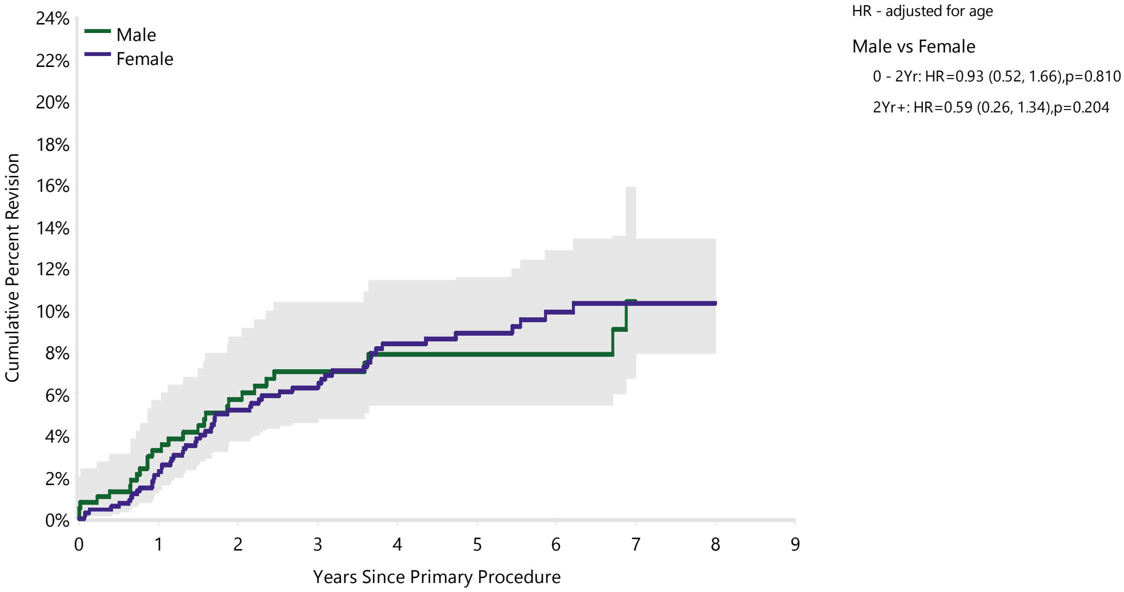
65-74 vs ≥75
Entire Period: HR=1.18 (0.68, 2.03),p=0.559

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
<55	79	67	47	35	17	0
55-64	208	178	138	98	39	2
65-74	352	319	238	166	73	1
≥75	453	404	302	187	76	3

Table SP34 Cumulative Percent Revision of Primary Hemi Stemmed Shoulder Replacement by Gender (Primary Diagnosis OA)

Gender	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Male	28	390	3.3 (1.9, 5.7)	7.0 (4.8, 10.3)	7.9 (5.4, 11.4)	10.4 (6.7, 15.9)	
Female	55	702	2.2 (1.4, 3.7)	6.3 (4.6, 8.5)	8.9 (6.8, 11.6)	10.3 (7.9, 13.4)	
TOTAL	83	1092					

Figure SP12 Cumulative Percent Revision of Primary Hemi Stemmed Shoulder Replacement by Gender (Primary Diagnosis OA)

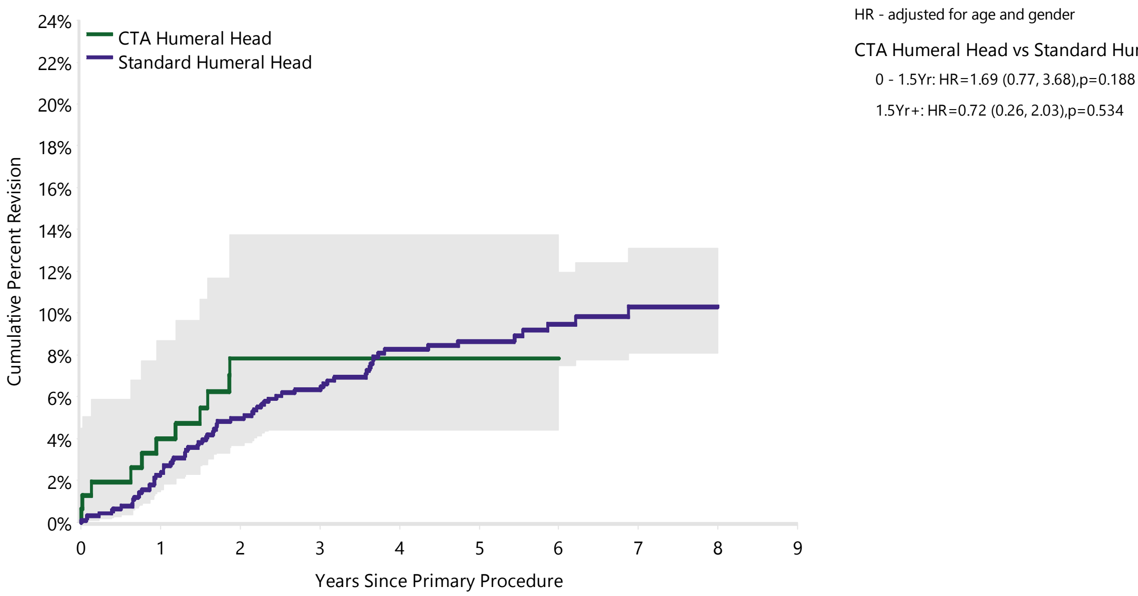


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Male	390	337	251	161	64	3
Female	702	631	474	325	141	3

Table SP35 Cumulative Percent Revision of Primary Hemi Stemmed Shoulder Replacement by Head Type (Primary Diagnosis OA)

Head Type	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
CTA Humeral Head	12	155	4.0 (1.8, 8.7)	7.8 (4.4, 13.7)	7.8 (4.4, 13.7)		
Standard Humeral Head	71	937	2.4 (1.6, 3.6)	6.3 (4.9, 8.2)	8.7 (6.8, 10.9)	10.3 (8.1, 13.1)	
TOTAL	83	1092					

Figure SP13 Cumulative Percent Revision of Primary Hemi Stemmed Shoulder Replacement by Head Type (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
CTA Humeral Head	155	136	99	71	36	1
Standard Humeral Head	937	832	626	415	169	5

Table SP36 Cumulative Percent Revision of Primary Hemi Stemmed Shoulder Replacement by Humeral Head and Stem Prostheses (Primary Diagnosis OA)

Humeral Head	Humeral Stem	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Aequalis	Aequalis	7	136	1.5 (0.4, 5.9)	3.9 (1.7, 9.2)	5.0 (2.3, 10.9)		
Aequalis	Aequalis Ascend	0	39	0.0 (0.0, 0.0)				
Bigliani/Flatow	Bigliani/Flatow TM	3	50	4.1 (1.0, 15.4)	6.3 (2.1, 18.4)	6.3 (2.1, 18.4)		
Delta Xtend	Delta Xtend	1	24	0.0 (0.0, 0.0)	5.3 (0.8, 31.9)	5.3 (0.8, 31.9)		
Global AP	Global AP	7	139	0.8 (0.1, 5.5)	4.6 (1.9, 10.8)			
Global AP CTA	Global AP	4	38	2.6 (0.4, 17.2)	12.2 (4.7, 29.4)	12.2 (4.7, 29.4)		
Global Advantage	Global Advantage	11	143	0.7 (0.1, 4.9)	5.1 (2.5, 10.4)	7.6 (4.2, 13.7)	8.6 (4.8, 15.1)	
Global Advantage	Global FX	3	30	3.4 (0.5, 22.1)	11.5 (3.8, 31.7)	11.5 (3.8, 31.7)	11.5 (3.8, 31.7)	
Global Advantage CTA	Global Advantage	1	36	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	4.8 (0.7, 29.3)	
SMR	SMR	32	264	4.3 (2.4, 7.6)	8.8 (5.8, 13.0)	12.1 (8.5, 17.0)	14.6 (10.4, 20.3)	
SMR CTA	SMR	6	79	5.2 (2.0, 13.2)	8.2 (3.8, 17.5)	8.2 (3.8, 17.5)	8.2 (3.8, 17.5)	
Other (24)		8	114	3.7 (1.4, 9.5)	7.1 (3.4, 14.4)	8.9 (4.4, 17.3)		
TOTAL		83	1092					

Note: Only combinations with over 20 procedures have been listed

Primary Total Shoulder Replacement

CLASSES OF TOTAL SHOULDER REPLACEMENT

The Registry sub-categorises primary total shoulder replacement into four classes. These are defined by the type of prostheses used.

Total resurfacing includes glenoid replacement and the use of a humeral prosthesis that replaces the humeral articular surface without resecting the head.
Total mid head includes glenoid replacement combined with resection of part of the humeral head and replacement with a cone stemmed humeral head prosthesis.
Total conventional includes glenoid replacement combined with resection of the humeral head and replacement with a stemmed humeral prosthesis and humeral head prosthesis.
Total reverse includes glenoid replacement with a glenoid head prosthesis combined with resection of the humeral head and replacement with a stemmed humeral prosthesis and humeral cup prosthesis.

USE OF TOTAL SHOULDER REPLACEMENT

There have been 23,252 total shoulder replacements reported to the Registry. This is an additional 4,193 procedures compared to the previous report.

Primary total shoulder replacement is more common in females (62.2%). There is variation within this group depending on the class of primary total shoulder replacement: total reverse (65.9%), total mid head (58.7%), total conventional (58.4%) and total resurfacing (37.9%) (Table ST1).

Most patients are aged between 65 and 84 years (75.2%). The proportion of patients in this age group varies depending on class: total reverse (80.1%), total conventional (70.1%), total mid head (66.9%) and total resurfacing (50.5%) (Table ST2).

The mean age for total shoulder replacement is 73.6 years for females and 70.1 years for males (Table ST3).

The principal diagnosis is osteoarthritis (68.3%), followed by rotator cuff arthropathy (18.3%) and fracture (8.2%). Rheumatoid arthritis and osteonecrosis account for 2.1% and 1.3%, respectively (Table ST4).

The two main classes of primary total shoulder replacement are total reverse (53.2%) and total conventional (44.0%). Total resurfacing and total mid head shoulder replacement are used infrequently (0.9% and 2.0% respectively) (Table ST2). The proportion of total reverse shoulder replacements has increased from 43.7% in 2010 to 64.1% in 2015 (Figure ST1).

Only 198 total resurfacing shoulder replacements have been reported to the Registry, 11 of which have been revised. The cumulative percent revision at five years is 7.3% (Table ST5).

Total mid head shoulder replacement has been used in 462 procedures. There have been five revisions and the three year cumulative percent revision is 1.6% (Table ST5).

At nine years, the cumulative percent revision for total conventional and total reverse shoulder replacement is 11.2% and 6.5% respectively. Total reverse shoulder replacement has a higher rate of revision compared to total conventional in the first three months. However, after three months, total reverse shoulder replacement has a lower rate of revision (Table ST5 and Figure ST2).

"After excluding the SMR prostheses from both total and reverse shoulder procedures, the seven year cumulative percent revision for total conventional and total reverse shoulder is 5.4% and 4.7% respectively."

Additional analysis has been carried out excluding both the SMR total reverse shoulder prosthesis and the SMR total conventional shoulder prostheses. These prostheses have a higher than anticipated rate of revision and account for a higher proportion of primary procedures in each class (SMR total conventional 27.4% and SMR total reverse 32.0%). Consequently, the inclusion of these prostheses would have a confounding influence.

After excluding the SMR prostheses from both total and reverse shoulder procedures, the seven year cumulative percent revision for total conventional and total reverse shoulder replacement is 5.4% and 4.7% respectively. The total reverse shoulder replacement continues to have a higher rate of revision in the first three months. After this time there is no difference in the rate of revision of the remaining total conventional and total reverse shoulder replacements when the SMR prostheses are excluded from both classes (Table ST6 and Figure ST3).

Table ST1 Primary Total Shoulder Replacement by Gender and Class

	Female		Male		TOTAL	
Shoulder Class	N	%	N	%	N	%
Total Resurfacing	75	37.9	123	62.1	198	0.9
Total Conventional	5976	58.4	4254	41.6	10230	44.0
Total Reverse	8148	65.9	4214	34.1	12362	53.2
Total Mid Head	271	58.7	191	41.3	462	2.0
TOTAL	14470	62.2	8782	37.8	23252	100.0

Table ST2 Primary Total Shoulder Replacement by Age and Class

	<55		55-64		65-74		75-84		≥85		TOTAL	
Shoulder Class	N	%	N	%	N	%	N	%	N	%	N	%
Total Resurfacing	30	15.2	67	33.8	85	42.9	15	7.6	1	0.5	198	0.9
Total Conventional	503	4.9	2267	22.2	4443	43.4	2727	26.7	290	2.8	10230	44.0
Total Reverse	171	1.4	982	7.9	4312	34.9	5593	45.2	1304	10.5	12362	53.2
Total Mid Head	35	7.6	108	23.4	212	45.9	97	21.0	10	2.2	462	2.0
TOTAL	739	3.2	3424	14.7	9052	38.9	8432	36.3	1605	6.9	23252	100.0

Table ST3 Primary Total Shoulder Replacement by Age and Gender

Gender	Number	Percent	Minimum	Maximum	Median	Mean	Std Dev
Male	8782	37.8%	21	96	71	70.1	9.1
Female	14470	62.2%	14	102	74	73.6	8.6
TOTAL	23252	100.0%	14	102	73	72.3	8.9

Table ST4 Primary Total Shoulder Replacement by Primary Diagnosis and Gender

Primary Diagnosis	Male		Female		TOTAL	
	N	Col%	N	Col%	N	Col%
Osteoarthritis	6414	73.0	9470	65.4	15884	68.3
Rotator Cuff Arthropathy	1747	19.9	2515	17.4	4262	18.3
Fracture	287	3.3	1625	11.2	1912	8.2
Rheumatoid Arthritis	109	1.2	382	2.6	491	2.1
Osteonecrosis	63	0.7	235	1.6	298	1.3
Instability	72	0.8	115	0.8	187	0.8
Other Inflammatory Arthritis	31	0.4	73	0.5	104	0.4
Tumour	49	0.6	49	0.3	98	0.4
Other	10	0.1	6	0.0	16	0.1
TOTAL	8782	100.0	14470	100.0	23252	100.0

Note: Instability includes Instability and Dislocation

Figure ST1 Proportion of Primary Total Shoulder Replacement by Class

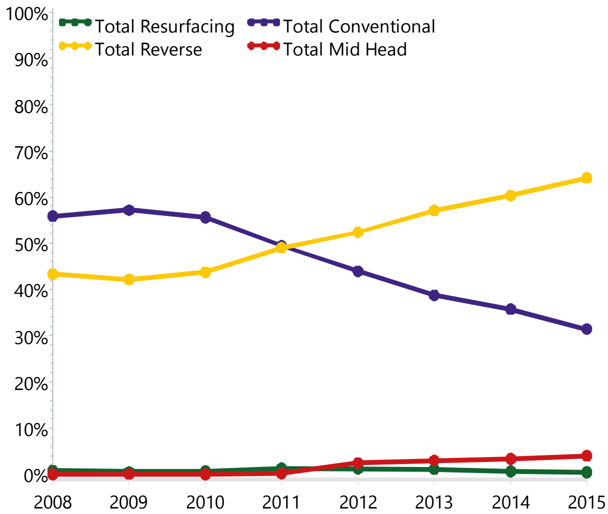
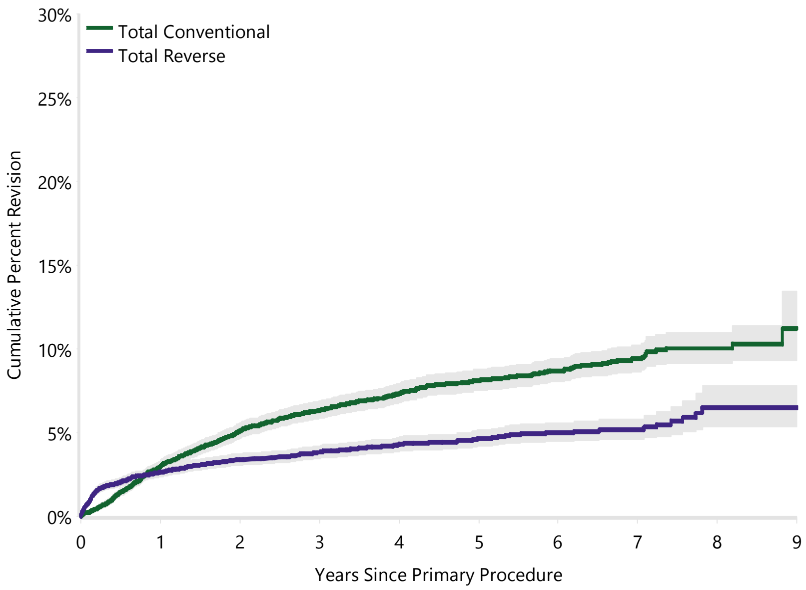


Table ST5 Cumulative Percent Revision of Primary Total Shoulder Replacement by Class

Shoulder Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Total Resurfacing	11	198	2.1 (0.8, 5.5)	5.3 (2.8, 10.0)	7.3 (4.0, 13.0)		
Total Conventional	667	10230	3.0 (2.7, 3.3)	6.3 (5.8, 6.9)	8.1 (7.5, 8.8)	9.4 (8.6, 10.2)	11.2 (9.3, 13.4)
Total Reverse	439	12362	2.6 (2.4, 2.9)	3.8 (3.5, 4.2)	4.6 (4.2, 5.1)	5.2 (4.6, 5.8)	6.5 (5.4, 7.8)
Total Mid Head	5	462	1.2 (0.4, 3.1)	1.6 (0.7, 3.8)			
TOTAL	1122	23252					

Figure ST2 Cumulative Percent Revision of Primary Total Shoulder Replacement by Class



HR - adjusted for age and gender

Total Conventional vs Total Reverse

0 - 3Mth: HR=0.30 (0.23, 0.41),p<0.001

3Mth+: HR=2.27 (1.95, 2.66),p<0.001

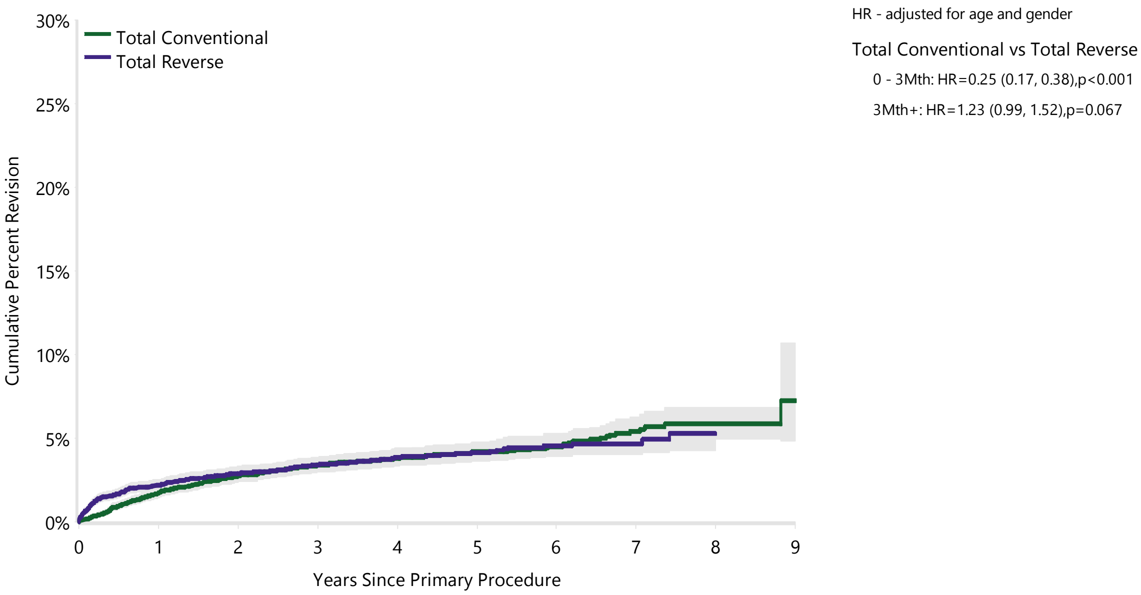
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Total Conventional	10230	8596	5709	3196	1120	75
Total Reverse	12362	9278	4979	2221	692	42

Table ST6 Cumulative Percent Revision of Primary Total Shoulder Replacement by Class (excluding SMR)

Shoulder Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Total Conventional	256	7423	1.7 (1.4, 2.1)	3.4 (3.0, 3.9)	4.2 (3.7, 4.7)	5.4 (4.7, 6.3)	7.2 (4.9, 10.7)
Total Reverse	255	8402	2.2 (1.9, 2.5)	3.4 (3.0, 3.9)	4.1 (3.6, 4.7)	4.7 (4.0, 5.5)	
TOTAL	**511**	**15825**					

Note: The SMR total reverse shoulder prosthesis and the SMR total conventional shoulder prosthesis have both been excluded

Figure ST3 Cumulative Percent Revision of Primary Total Shoulder Replacement by Class (excluding SMR)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Total Conventional	7423	6230	4119	2277	762	53
Total Reverse	8402	6213	3174	1389	408	27

Note: The SMR total reverse shoulder prosthesis and the SMR total conventional shoulder prosthesis have both been excluded

PRIMARY TOTAL RESURFACING SHOULDER REPLACEMENT

DEMOGRAPHICS AND OUTCOME

There have been 198 primary total resurfacing shoulder replacements reported to the Registry. This is an additional 17 procedures compared to the previous report.

Primary total resurfacing shoulder replacement is undertaken more often in males (62.1%). The mean age is 66.7 years for females and 62.0 years for males (Table ST7).

Osteoarthritis is the most common primary diagnosis (94.9%) (Table ST8).

There were four different types of total resurfacing prostheses used in 2015. The Global CAP/Global glenoid was used in 10 of the 17 procedures reported in 2015 (Tables ST9 and ST10).

The cumulative percent revision at five years is 7.3% (Table ST5). There have been 11 revisions of this procedure. The main reasons for revision are presented in Table ST11. The most common type of revision involves replacing the humeral component only (36.4%) (Table ST12).

Table ST7 Primary Total Resurfacing Shoulder Replacement by Age and Gender

Gender	Number	Percent	Minimum	Maximum	Median	Mean	Std Dev
Male	123	62.1%	35	83	63	62.0	9.7
Female	75	37.9%	46	86	67	66.7	7.0
TOTAL	**198**	**100.0%**	**35**	**86**	**65**	**63.8**	**9.1**

Table ST8 Primary Total Resurfacing Shoulder Replacement by Primary Diagnosis and Gender

	Male		Female		TOTAL	
Primary Diagnosis	N	Col%	N	Col%	N	Col%
Osteoarthritis	118	95.9	70	93.3	188	94.9
Rheumatoid Arthritis	1	0.8	2	2.7	3	1.5
Fracture	1	0.8	1	1.3	2	1.0
Other Inflammatory Arthritis			1	1.3	1	0.5
Instability	1	0.8	.	.	1	0.5
Rotator Cuff Arthropathy			1	1.3	1	0.5
Osteonecrosis	1	0.8			1	0.5
Other	1	0.8			1	0.5
TOTAL	**123**	**100.0**	**75**	**100.0**	**198**	**100.0**

Note: Instability includes Instability and Dislocation

Table ST9 Most Used Humeral Head Prostheses in Primary Total Resurfacing Shoulder Replacement

2008		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
5	SMR	31	Global CAP	27	Global CAP	17	Global CAP	10	Global CAP
4	Aequalis	4	Aequalis	5	Aequalis	6	Aequalis	4	Epoca RH
2	Copeland	1	SMR	3	Epoca RH	1	Epoca RH	2	Aequalis
1	Global CAP			1	SMR			1	SMR
Most Used									
12 (4)	100.0%	36 (3)	100.0%	36 (4)	100.0%	24 (3)	100.0%	17 (4)	100.0%

Table ST10 Most Used Glenoid Prostheses in Primary Total Resurfacing Shoulder Replacement

2008		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
5	SMR	31	Global	27	Global	17	Global	10	Global
4	Aequalis	4	Aequalis	5	Aequalis	6	Aequalis	4	Epoca
2	Copeland	1	SMR	3	Epoca	1	Epoca	2	Aequalis
1	Global			1	SMR			1	SMR
Most Used									
12 (4)	100.0%	36 (3)	100.0%	36 (4)	100.0%	24 (3)	100.0%	17 (4)	100.0%

Table ST11 Primary Total Resurfacing Shoulder Replacement by Reason for Revision

Reason for Revision	Number	Percent
Implant Breakfage Glenoid	3	27.2
Loosening/Lysis	2	18.2
Instability/Dislocation	2	18.2
Infection	2	18.2
Fracture	1	9.1
Rotator Cuff Insufficiency	1	9.1
TOTAL	11	100.0

Table ST12 Primary Total Resurfacing Shoulder Replacement by Type of Revision

Type of Revision	Number	Percent
Humeral Component	4	36.4
Humeral/Glenoid	3	27.3
Insert Only	2	18.2
Cement Spacer	1	9.1
Head Only	1	9.1
TOTAL	11	100.0

Note: Humeral heads are usually replaced when the humeral component is revised

PRIMARY TOTAL MID HEAD SHOULDER REPLACEMENT

DEMOGRAPHICS AND OUTCOME

There have been 462 primary total mid head shoulder replacements reported to the Registry. This is an additional 172 procedures compared to the previous report.

Primary total mid head shoulder replacement is undertaken more often in females (58.7%). The mean age is 69.8 years for females and 65.8 years for males (Table ST13).

Osteoarthritis is the most common primary diagnosis (95.5%) (Table ST14).

The cumulative percent revision at three years is 1.6% (Table ST5). There have been five revisions of this procedure. Two were revised for loosening/lysis, one to a stemmed hemi and the other had the prostheses removed. One was revised to a total reverse shoulder due to instability/dislocation. The remaining two were revised for infection with removal of the prostheses and the use of a cement spacer.

The Affinis was the most used total mid head shoulder prosthesis in 2015 (Tables ST15 and ST16).

Table ST13 Primary Total Mid Head Shoulder Replacement by Age and Gender

Gender	Number	Percent	Minimum	Maximum	Median	Mean	Std Dev
Male	191	41.3%	40	89	67	65.8	9.4
Female	271	58.7%	46	87	70	69.8	7.9
TOTAL	462	100.0%	40	89	69	68.1	8.8

Table ST14 Primary Total Mid Head Shoulder Replacement by Primary Diagnosis and Gender

	Male		Female		TOTAL	
Primary Diagnosis	N	Col%	N	Col%	N	Col%
Osteoarthritis	184	96.3	257	94.8	441	95.5
Osteonecrosis	3	1.6	8	3.0	11	2.4
Rheumatoid Arthritis	1	0.5	2	0.7	3	0.6
Other Inflammatory Arthritis			3	1.1	3	0.6
Instability	2	1.0			2	0.4
Rotator Cuff Arthropathy			1	0.4	1	0.2
Other	1	0.5			1	0.2
TOTAL	191	100.0	271	100.0	462	100.0

Table ST15 Most Used Humeral Component Prostheses in Primary Total Mid Head Shoulder Replacement

2011		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
2	Simpliciti	46	Affinis	59	Affinis	60	Simpliciti	108	Affinis
2	TESS	25	Simpliciti	36	Simpliciti	52	Affinis	44	Sidus
1	Affinis			3	Sidus	12	Sidus	11	Simpliciti
Most Used									
5 (3)	100.0%	71 (2)	100.0%	98 (3)	100.0%	124 (3)	100.0%	163 (3)	100.0%

Table ST16 Most Used Glenoid Prostheses in Primary Total Mid Head Shoulder Replacement

2011		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
2	Aequalis	46	Affinis	59	Affinis	60	Aequalis	108	Affinis
1	Affinis	25	Aequalis	36	Aequalis	52	Affinis	18	Anatomical Shoulder
1	Comprehensive			2	Bigliani/Flatow TM	7	Bigliani/Flatow TM	15	Bigliani/Flatow
1	TESS			1	Bigliani/Flatow	3	Bigliani/Flatow	11	Aequalis
						2	Anatomical Shoulder	10	Bigliani/Flatow TM
								1	Global
Most Used									
5 (4)	100.0%	71 (2)	100.0%	98 (4)	100.0%	124 (5)	100.0%	163 (6)	100.0%

PRIMARY TOTAL CONVENTIONAL SHOULDER REPLACEMENT

DEMOGRAPHICS

There have been 10,230 total conventional shoulder replacements reported to the Registry. This is an additional 1,324 procedures compared to the previous report.

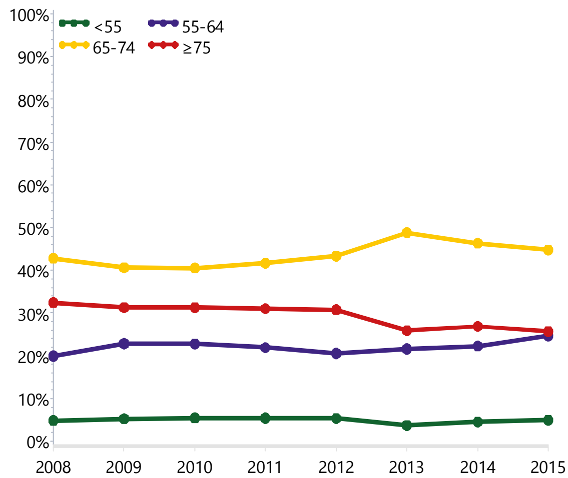
The use of total conventional shoulder replacement has declined from 55.9% of all total shoulder replacements in 2008 to 31.4% in 2015 (Figure ST1).

Osteoarthritis is the most common primary diagnosis, accounting for 94.1% of procedures (Table ST18).

"The use of total conventional shoulder replacement has declined from 55.9% of all total shoulder replacements in 2008 to 31.4% in 2015."

This procedure is most commonly undertaken in females (58.4%). The proportion of males has increased from 38.7% in 2008 to 45.2% in 2015 (Figure ST4).

Figure ST5 Proportion of Primary Total Conventional Shoulder Replacements by Age



The mean age is 70.9 years for females and 67.3 years for males (Table ST17). In 2015, most procedures were undertaken in the 65 to 74 year age group, which accounted for 44.8% of all patients (Figure ST5).

Figure ST4 Proportion of Primary Total Conventional Shoulder Replacements by Gender

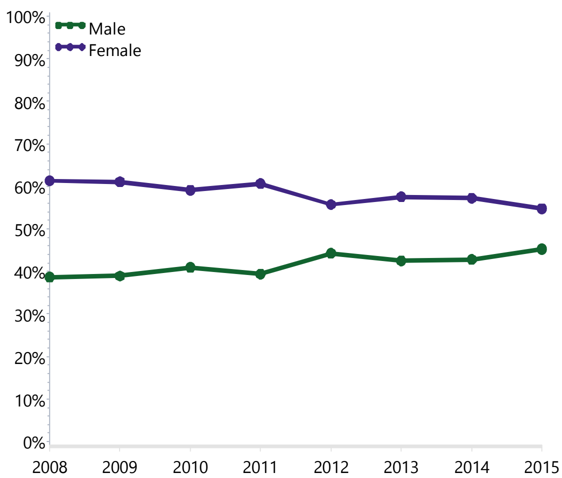


Table ST17 Primary Total Conventional Shoulder Replacement by Age and Gender

Gender	Number	Percent	Minimum	Maximum	Median	Mean	Std Dev
Male	4254	41.6%	21	93	68	67.3	8.9
Female	5976	58.4%	21	96	71	70.9	8.5
TOTAL	10230	100.0%	21	96	70	69.4	8.8

In 2015, 69.8% of procedures used hybrid fixation (cementless humerus and cemented glenoid). In 2008, cementless fixation was used in 28.8% of all procedures and its use peaked in 2011 at 33.7%. In 2015, cementless fixation declined to 25.1% of all procedures (Figure ST6).

The 10 most used humeral stem and glenoid prostheses are listed in Tables ST19 and ST20. The SMR, Global AP and Global Unite were the most commonly used humeral stem prostheses in 2015. The 10 most used humeral stem prostheses accounted for 96.9% of all primary total conventional shoulder procedures. The Global, SMR and Aequalis were the most commonly used glenoid prostheses in 2015. The 10 most used glenoid prostheses accounted for 99.3% of all primary total conventional shoulder replacements.

Figure ST6 Proportion of Primary Total Conventional Shoulder Replacements by Fixation

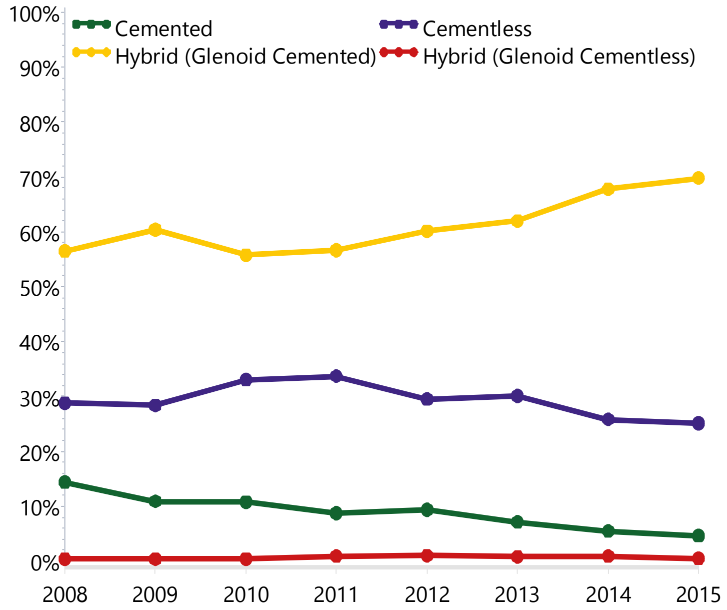


Table ST18 Primary Total Conventional Shoulder Replacement by Primary Diagnosis and Gender

	Male		Female		TOTAL	
Primary Diagnosis	N	Col%	N	Col%	N	Col%
Osteoarthritis	4065	95.6	5559	93.0	9624	94.1
Rheumatoid Arthritis	52	1.2	145	2.4	197	1.9
Osteonecrosis	36	0.8	117	2.0	153	1.5
Fracture	22	0.5	81	1.4	103	1.0
Other Inflammatory Arthritis	21	0.5	36	0.6	57	0.6
Rotator Cuff Arthropathy	31	0.7	18	0.3	49	0.5
Instability	18	0.4	12	0.2	30	0.3
Tumour	4	0.1	5	0.1	9	0.1
Other	5	0.1	3	0.1	8	0.1
TOTAL	4254	100.0	5976	100.0	10230	100.0

Table ST19 10 Most Used Humeral Stem Prostheses in Primary Total Conventional Shoulder Replacement

2008		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
298	SMR	380	Global AP	372	Global AP	387	Global AP	265	SMR
167	Aequalis	338	SMR	333	SMR	289	SMR	252	Global AP
117	Global Advantage	235	Aequalis	192	Aequalis	146	Aequalis Ascend	200	Global Unite
91	Global AP	114	Bigliani/Flatow TM	120	Bigliani/Flatow TM	144	Aequalis	118	Bigliani/Flatow TM
40	Bigliani/Flatow	54	Ascend	103	Ascend	132	Bigliani/Flatow TM	103	Aequalis
37	Bigliani/Flatow TM	40	Global Advantage	51	Global Advantage	77	Global Advantage	81	Ascend
32	Solar	29	Solar	26	Equinoxe	44	Comprehensive	68	Aequalis Ascend
27	Affinis	23	Comprehensive	21	Comprehensive	32	Equinoxe	65	Comprehensive
11	Univers 3D	17	Vaios	13	Solar	26	Turon	49	Global Advantage
10	Cofield 2	15	Affinis	7	Epoca	22	Ascend	41	Equinoxe
10 Most Used									
830 (10)	97.9%	1245 (10)	96.9%	1238 (10)	98.3%	1299 (10)	97.5%	1242 (10)	96.9%
Remainder									
18 (7)	2.1%	40 (6)	3.1%	22 (8)	1.7%	33 (9)	2.5%	40 (4)	3.1%
TOTAL									
848 (17)	100.0%	1285 (16)	100.0%	1260 (18)	100.0%	1332 (19)	100.0%	1282 (14)	100.0%

Table ST20 10 Most Used Glenoid Prostheses in Primary Total Conventional Shoulder Replacement

2008		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
294	SMR	425	Global	412	Global	449	Global	480	Global
209	Global	338	SMR	333	SMR	310	Aequalis	259	SMR
167	Aequalis	289	Aequalis	295	Aequalis	284	SMR	252	Aequalis
79	Bigliani/Flatow	82	Bigliani/Flatow TM	81	Bigliani/Flatow TM	94	Bigliani/Flatow TM	85	Bigliani/Flatow TM
32	Solar	40	Bigliani/Flatow	40	Bigliani/Flatow	44	Bigliani/Flatow	66	Comprehensive
27	Affinis	29	Solar	26	Equinoxe	44	Comprehensive	41	Equinoxe
11	Univers 3D	23	Comprehensive	20	Comprehensive	32	Equinoxe	35	Bigliani/Flatow
10	Cofield 2	17	Vaios	15	Global Advantage	27	Global Advantage	24	Turon
7	Promos	15	Affinis	13	Solar	26	Turon	22	Global Advantage
4	Epoca	10	Equinoxe	7	Epoca	7	Anatomical Shoulder	9	Anatomical Shoulder
10 Most Used									
840 (10)	99.1%	1268 (10)	98.7%	1242 (10)	98.6%	1317 (10)	98.9%	1273 (10)	99.3%
Remainder									
8 (5)	0.9%	17 (4)	1.3%	18 (6)	1.4%	15 (6)	1.1%	9 (2)	0.7%
TOTAL									
848 (15)	100.0%	1285 (14)	100.0%	1260 (16)	100.0%	1332 (16)	100.0%	1282 (12)	100.0%

OUTCOME FOR ALL DIAGNOSES

Primary Diagnosis

The cumulative percent revision of total conventional shoulder replacement for osteoarthritis is 11.2% at nine years. There is no difference in the rate of revision when osteoarthritis is compared to fracture, osteonecrosis and rheumatoid arthritis (Table ST21 and Figure ST7).

Reason for Revision

Instability/dislocation is the most common reason for revision of primary total conventional shoulder replacement. This accounts for 25.2% of all revisions, followed by rotator cuff insufficiency (21.0%) and loosening/lysis (17.4%) (Table ST22). The cumulative incidence of the five most common reasons for revision is presented in Figure ST8.

Type of Revision

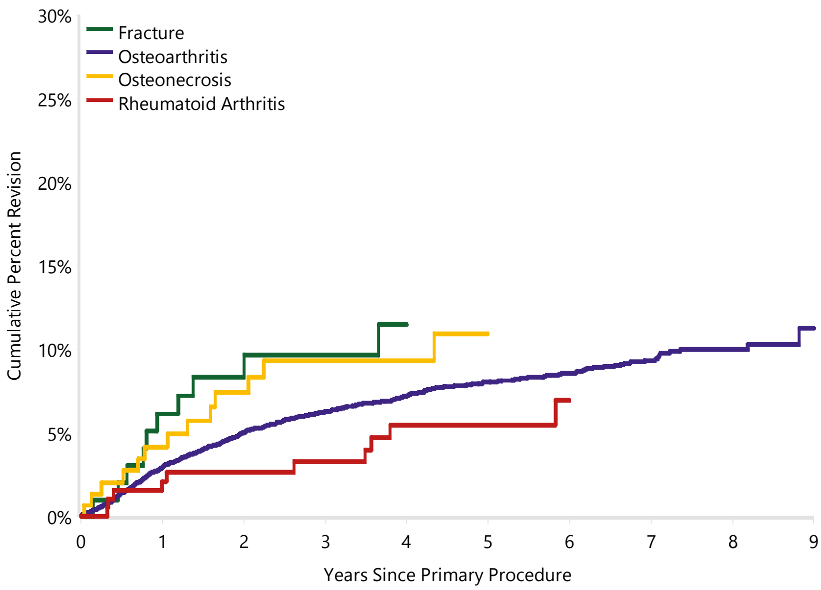
The main type of revision is of the humeral component only (56.2%). This may include the revision of a humeral component (epiphysis and/or humeral stem) and additional minor components such as the humeral head (Table ST23). Of the 375 humeral component revisions, 322 (85.8%) were revised to a total reverse shoulder replacement. The stem was not revised in 308 (82.1%) procedures.

Table ST21 Cumulative Percent Revision of Primary Total Conventional Shoulder Replacement by Primary Diagnosis

Primary Diagnosis	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Osteoarthritis	618	9624	2.9 (2.6, 3.3)	6.2 (5.7, 6.8)	8.0 (7.4, 8.7)	9.3 (8.5, 10.2)	11.2 (9.2, 13.7)
Rheumatoid Arthritis	10	197	2.1 (0.8, 5.5)	3.3 (1.5, 7.1)	5.5 (2.8, 10.3)		
Osteonecrosis	13	153	4.2 (1.9, 9.0)	9.3 (5.4, 15.9)	10.9 (6.3, 18.5)		
Fracture	11	103	6.1 (2.8, 13.1)	9.7 (5.1, 17.8)			
Other Inflammatory Arthritis	2	57	0.0 (0.0, 0.0)	2.1 (0.3, 14.2)	4.8 (1.2, 17.9)	4.8 (1.2, 17.9)	
Rotator Cuff Arthropathy	7	49	6.5 (2.2, 19.0)	17.3 (8.5, 33.3)	17.3 (8.5, 33.3)		
Other (4)	6	47	7.0 (2.3, 20.1)	17.4 (8.0, 35.3)	17.4 (8.0, 35.3)		
TOTAL	667	10230					

Note: Only primary diagnoses with over 30 procedures have been listed

Figure ST7 Cumulative Percent Revision of Primary Total Conventional Shoulder Replacement by Primary Diagnosis



HR - adjusted for age and gender

Fracture vs Osteoarthritis

Entire Period: HR=1.60 (0.88, 2.91),p=0.124

Osteonecrosis vs Osteoarthritis

Entire Period: HR=1.17 (0.67, 2.04),p=0.575

Rheumatoid Arthritis vs Osteoarthritis

Entire Period: HR=0.59 (0.31, 1.11),p=0.100

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Fracture	103	90	58	32	8	1
Osteoarthritis	9624	8076	5340	2979	1055	69
Osteonecrosis	153	128	85	47	17	1
Rheumatoid Arthritis	197	183	144	93	28	2

Table ST22 Primary Total Conventional Shoulder Replacement by Reason for Revision

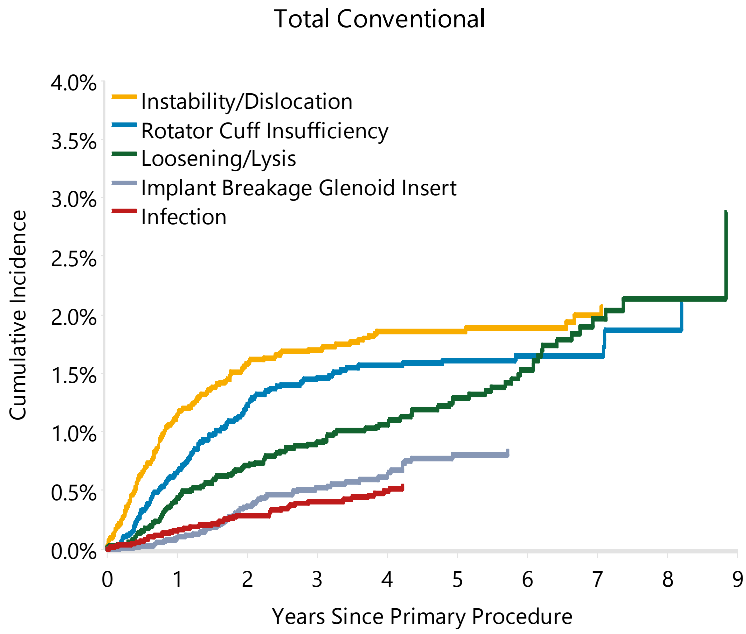
Reason for Revision	Number	Percent
Instability/Dislocation	168	25.2
Rotator Cuff Insufficiency	140	21.0
Loosening/Lysis	116	17.4
Implant Breakage Glenoid Insert	57	8.5
Infection	41	6.1
Dissociation	29	4.3
Implant Breakage Glenoid	19	2.8
Incorrect Sizing	15	2.2
Fracture	13	1.9
Arthrofibrosis	12	1.8
Pain	11	1.6
Metal Related Pathology	10	1.5
Malposition	6	0.9
Wear Glenoid Insert	4	0.6
Wear Glenoid	1	0.1
Glenoid Erosion	1	0.1
Other	24	3.6
TOTAL	667	100.0

Table ST23 Primary Total Conventional Shoulder Replacement by Type of Revision

Type of Revision	Number	Percent
Humeral Component	375	56.2
Humeral/Glenoid	102	15.3
Head Only	68	10.2
Glenoid Component	55	8.2
Head/Insert	30	4.5
Cement Spacer	18	2.7
Removal of Prostheses	11	1.6
Minor Components	4	0.6
Reoperation	3	0.4
Reinsertion of Components	1	0.1
TOTAL	667	100.0

Note: Humeral heads are usually replaced when the humeral component is revised

Figure ST8 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Shoulder Replacement



OUTCOME FOR OSTEOARTHRITIS

Age and Gender

There is no difference in the rate of revision between those aged less than 55 years compared to those aged 55 to 64 years. Patients aged 65 to 74 and 75 years and older have a lower revision rate compared to those aged less than 55 years (Table ST24 and Figure ST9). There is no difference in the rate of revision between males and females (Table ST25 and Figure ST10).

Fixation

Cementless fixation has a higher rate of revision compared to both cemented and hybrid fixation (glenoid cemented). There is no difference between cemented and hybrid fixation (glenoid cemented) (Table ST26 and Figure ST11).

The fixation analysis was repeated excluding the SMR prosthesis because it has a higher than anticipated rate of revision. The SMR is predominately used with cementless fixation and accounts for a high proportion of the procedures in this class. The outcome of fixation remained the same, with cementless fixation of the glenoid being associated with a higher rate of revision when the SMR was excluded (Table ST27 and Figure ST12).

"The revision rate is increased if the glenoid is not cemented."

Glenoid Type and Design

Further analysis was undertaken to determine the impact of glenoid type. There are three broad glenoid types: modular metal backed (99.8% cementless), fixed metal backed (93.3% cementless) and all polyethylene (99.4% cemented). All polyethylene glenoid prostheses were used in 69.8% of total conventional shoulder replacements. These prostheses have a lower rate of revision compared to metal backed glenoid prostheses with modular or fixed inserts. A metal backed glenoid with a modular insert has a higher rate of revision compared to a glenoid with a fixed insert (Table ST28 and Figure ST13).

When a metal backed glenoid with modular insert was revised, 89.5% retained the glenoid component and replaced the modular insert with a glenosphere. The humeral stem was also revised in only small number of these revisions (13/321).

The above analysis was repeated excluding the SMR and the results remain consistent (Table ST29 and Figure ST14).

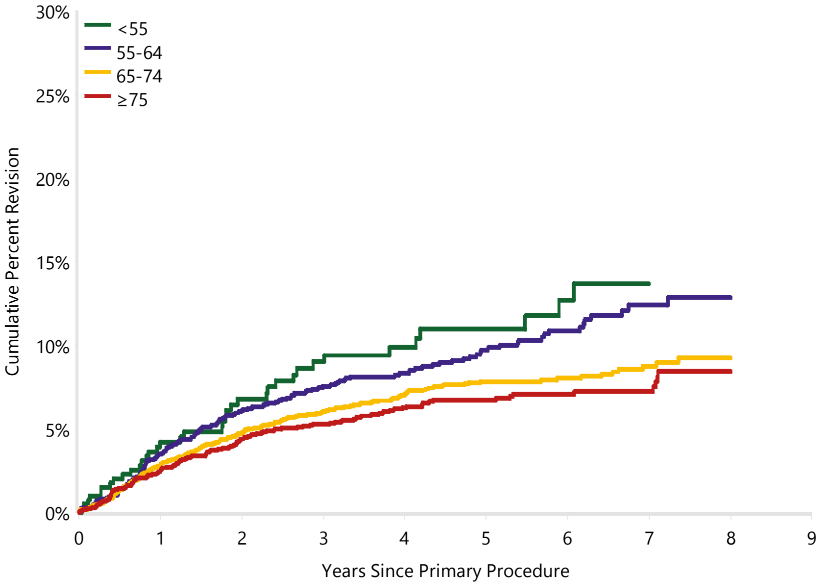
Pegged and keeled all polyethylene glenoid prostheses were also compared. The majority of all polyethylene glenoid prostheses are pegged (88.3%). There is no difference in the rate of revision when these prostheses are compared (Table ST30 and Figure ST15).

The outcomes of the most commonly used prostheses are listed in Table ST31.

Table ST24 Cumulative Percent Revision of Primary Total Conventional Shoulder Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
<55	37	407	4.2 (2.6, 6.8)	9.0 (6.3, 12.7)	11.0 (7.9, 15.2)	13.7 (9.7, 19.1)	
55-64	166	2100	3.5 (2.7, 4.4)	7.5 (6.4, 8.9)	9.7 (8.3, 11.4)	12.4 (10.4, 14.7)	
65-74	256	4228	2.8 (2.4, 3.4)	6.0 (5.3, 6.9)	7.8 (6.9, 8.9)	8.8 (7.6, 10.0)	
≥75	159	2889	2.5 (1.9, 3.1)	5.3 (4.5, 6.3)	6.7 (5.7, 7.9)	7.2 (6.1, 8.5)	
TOTAL	618	9624					

Figure ST9 Cumulative Percent Revision of Primary Total Conventional Shoulder Replacement by Age (Primary Diagnosis OA)



HR - adjusted for gender

55-64 vs <55

Entire Period: HR=0.88 (0.62, 1.26),p=0.485

65-74 vs <55

Entire Period: HR=0.67 (0.48, 0.95),p=0.025

≥75 vs <55

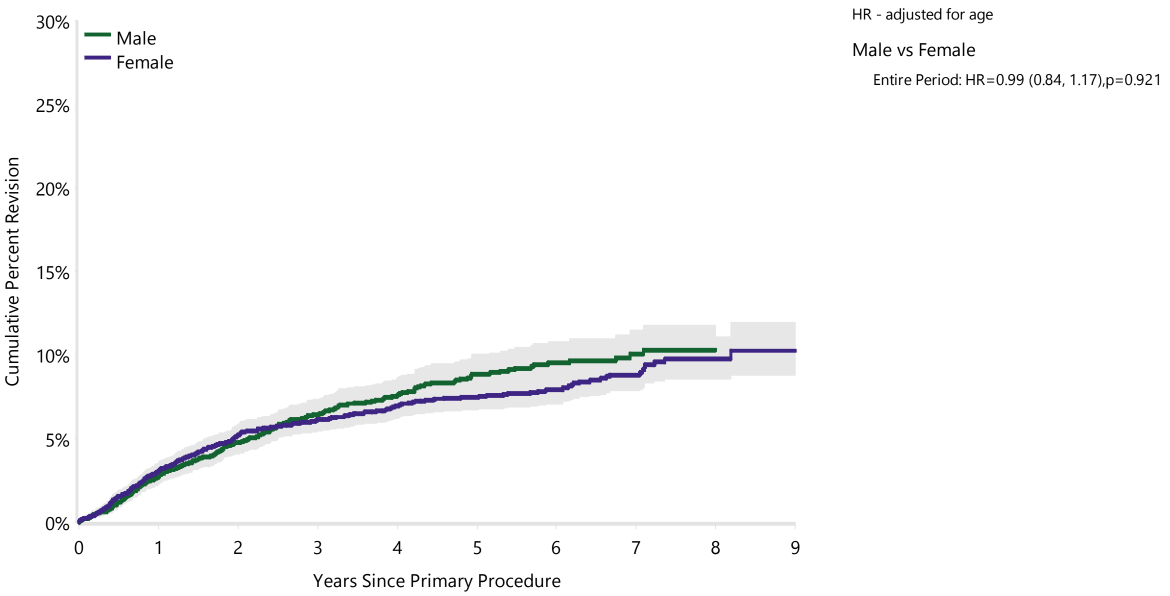
Entire Period: HR=0.60 (0.41, 0.86),p=0.005

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
<55	407	334	232	129	52	2
55-64	2100	1725	1149	667	228	15
65-74	4228	3548	2275	1268	461	31
≥75	2889	2469	1684	915	314	21

Table ST25 Cumulative Percent Revision of Primary Total Conventional Shoulder Replacement by Gender (Primary Diagnosis OA)

Gender	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Male	267	4065	2.7 (2.3, 3.3)	6.4 (5.6, 7.3)	8.9 (7.8, 10.0)	10.1 (8.8, 11.5)	
Female	351	5559	3.1 (2.6, 3.6)	6.1 (5.5, 6.9)	7.5 (6.7, 8.3)	8.8 (7.8, 9.9)	10.3 (8.8, 12.0)
TOTAL	618	9624					

Figure ST10 Cumulative Percent Revision of Primary Total Conventional Shoulder Replacement by Gender (Primary Diagnosis OA)

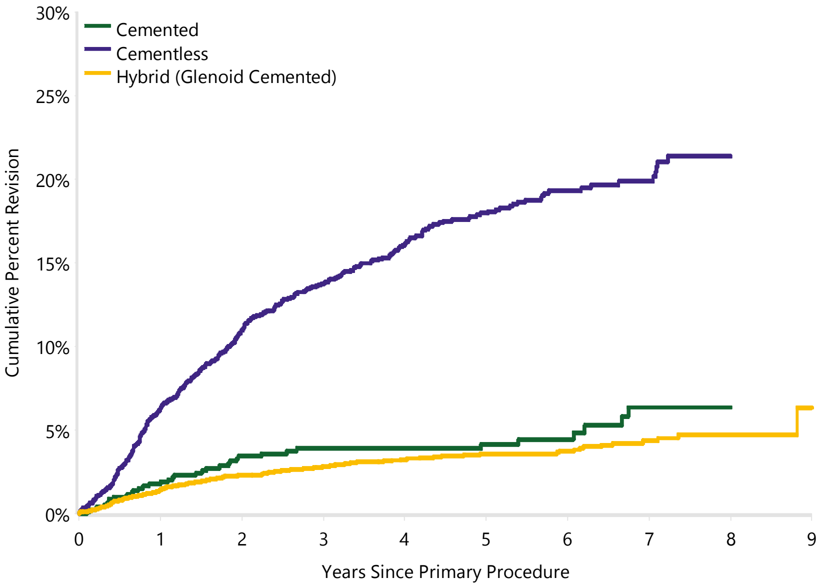


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Male	4065	3373	2187	1185	412	28
Female	5559	4703	3153	1794	643	41

Table ST26 **Cumulative Percent Revision of Primary Total Conventional Shoulder Replacement by Fixation (Primary Diagnosis OA)**

Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Cemented	35	818	1.8 (1.1, 3.0)	3.9 (2.7, 5.6)	4.2 (2.9, 5.9)	6.3 (4.3, 9.3)	
Cementless	407	2819	6.2 (5.4, 7.2)	13.7 (12.4, 15.2)	18.0 (16.3, 19.7)	19.9 (18.0, 21.9)	
Hybrid (Glenoid Cemented)	169	5933	1.4 (1.1, 1.8)	2.8 (2.4, 3.3)	3.6 (3.0, 4.2)	4.3 (3.6, 5.2)	6.3 (3.8, 10.6)
Hybrid (Glenoid Cementless)	7	54	9.4 (4.0, 21.1)	12.0 (5.5, 25.1)	17.2 (7.9, 35.4)		
TOTAL	618	9624					

Figure ST11 **Cumulative Percent Revision of Primary Total Conventional Shoulder Replacement by Fixation (Primary Diagnosis OA)**



HR - adjusted for age and gender

Cemented vs Hybrid (Glenoid Cemented)
Entire Period: HR=1.32 (0.92, 1.90),p=0.136

Cementless vs Hybrid (Glenoid Cemented)
0 - 6Mth: HR=3.45 (2.42, 4.94),p<0.001
6Mth+: HR=5.73 (4.68, 7.02),p<0.001

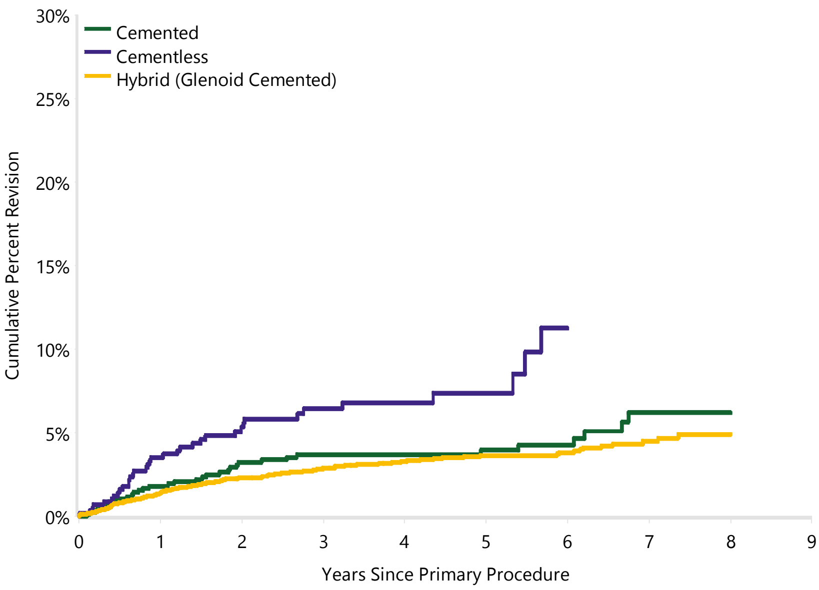
Cementless vs Cemented
Entire Period: HR=3.92 (2.77, 5.54),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Cemented	818	747	574	364	148	7
Cementless	2819	2332	1499	811	282	18
Hybrid (Glenoid Cemented)	5933	4953	3238	1795	622	44

Table ST27 Cumulative Percent Revision of Primary Total Conventional Shoulder Replacement by Fixation (Primary Diagnosis OA, excluding SMR)

Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Cemented	33	804	1.8 (1.1, 3.0)	3.7 (2.5, 5.3)	4.0 (2.7, 5.7)	6.2 (4.2, 9.1)	
Cementless	38	595	3.5 (2.2, 5.4)	6.4 (4.5, 9.1)	7.3 (5.2, 10.4)		
Hybrid (Glenoid Cemented)	160	5581	1.4 (1.1, 1.8)	2.9 (2.4, 3.4)	3.6 (3.1, 4.3)	4.5 (3.7, 5.4)	
Hybrid (Glenoid Cementless)	2	19	10.5 (2.7, 35.9)	10.5 (2.7, 35.9)	10.5 (2.7, 35.9)		
TOTAL	233	6999					

Figure ST12 Cumulative Percent Revision of Primary Total Conventional Shoulder Replacement by Fixation (Primary Diagnosis OA, excluding SMR)



HR - adjusted for age and gender

Cemented vs Hybrid (Glenoid Cemented)
Entire Period: HR=1.23 (0.85, 1.80),p=0.271

Cementless vs Hybrid (Glenoid Cemented)
Entire Period: HR=2.47 (1.73, 3.52),p<0.001

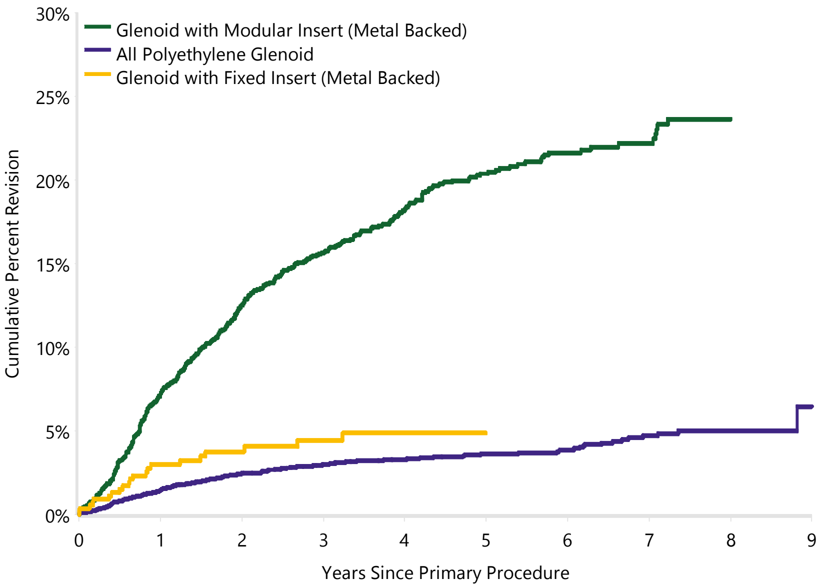
Cementless vs Cemented
Entire Period: HR=2.00 (1.25, 3.20),p=0.003

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Cemented	804	734	565	359	146	7
Cementless	595	480	285	102	18	4
Hybrid (Glenoid Cemented)	5581	4637	2990	1654	548	36

Table ST28 Cumulative Percent Revision of Primary Total Conventional Shoulder Replacement by Glenoid Type (Primary Diagnosis OA)

Glenoid Type	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Glenoid with Modular Insert (Metal Backed)	392	2319	7.1 (6.1, 8.3)	15.6 (14.1, 17.3)	20.4 (18.5, 22.4)	22.2 (20.1, 24.4)	
All Polyethylene Glenoid	202	6656	1.4 (1.2, 1.8)	3.0 (2.6, 3.5)	3.6 (3.1, 4.2)	4.7 (4.0, 5.6)	6.4 (4.1, 10.1)
Glenoid with Fixed Insert (Metal Backed)	22	558	3.0 (1.8, 4.9)	4.4 (2.8, 6.8)	4.9 (3.1, 7.5)		
TOTAL	616	9533					

Figure ST13 Cumulative Percent Revision of Primary Total Conventional Shoulder Replacement by Glenoid Type (Primary Diagnosis OA)



HR - adjusted for age and gender

Glenoid with Modular Insert (Metal Backed) vs All Polyethylene Glenoid

Entire Period: HR=5.61 (4.73, 6.65),p<0.001

Glenoid with Fixed Insert (Metal Backed) vs All Polyethylene Glenoid

Entire Period: HR=1.56 (1.00, 2.42),p=0.048

Glenoid with Modular Insert (Metal Backed) vs Glenoid with Fixed Insert (Metal Backed)

0 - 6Mth: HR=2.56 (1.52, 4.31),p<0.001

6Mth - 1Yr: HR=3.89 (2.28, 6.62),p<0.001

1Yr - 1.5Yr: HR=3.77 (2.09, 6.82),p<0.001

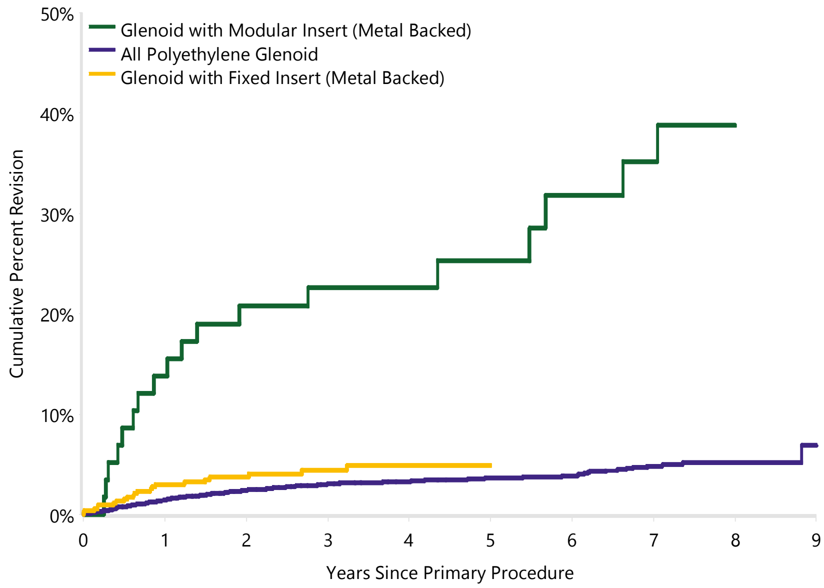
1.5Yr+: HR=4.21 (2.61, 6.79),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Glenoid with Modular Insert (Metal Backed)	2319	1933	1276	738	285	18
All Polyethylene Glenoid	6656	5658	3771	2108	728	50
Glenoid with Fixed Insert (Metal Backed)	558	428	238	82	0	0

Table ST29 **Cumulative Percent Revision of Primary Total Conventional Shoulder Replacement by Glenoid Type (Primary Diagnosis OA, excluding SMR)**

Glenoid Type	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Glenoid with Modular Insert (Metal Backed)	18	59	13.8 (7.1, 25.7)	22.6 (13.8, 35.7)	25.3 (15.7, 39.2)	35.2 (22.8, 51.7)	
All Polyethylene Glenoid	191	6291	1.4 (1.2, 1.8)	3.0 (2.6, 3.5)	3.7 (3.1, 4.3)	4.8 (4.0, 5.7)	6.9 (4.1, 11.2)
Glenoid with Fixed Insert (Metal Backed)	22	558	3.0 (1.8, 4.9)	4.4 (2.8, 6.8)	4.9 (3.1, 7.5)		
TOTAL	231	6908					

Figure ST14 **Cumulative Percent Revision of Primary Total Conventional Shoulder Replacement by Glenoid Type (Primary Diagnosis OA, excluding SMR)**



HR - adjusted for age and gender

Glenoid with Modular Insert (Metal Backed) vs All Polyethylene Glenoid

Entire Period: HR=8.75 (5.38, 14.23),p<0.001

Glenoid with Fixed Insert (Metal Backed) vs All Polyethylene Glenoid

Entire Period: HR=1.56 (1.00, 2.44),p=0.047

Glenoid with Modular Insert (Metal Backed) vs Glenoid with Fixed Insert (Metal Backed)

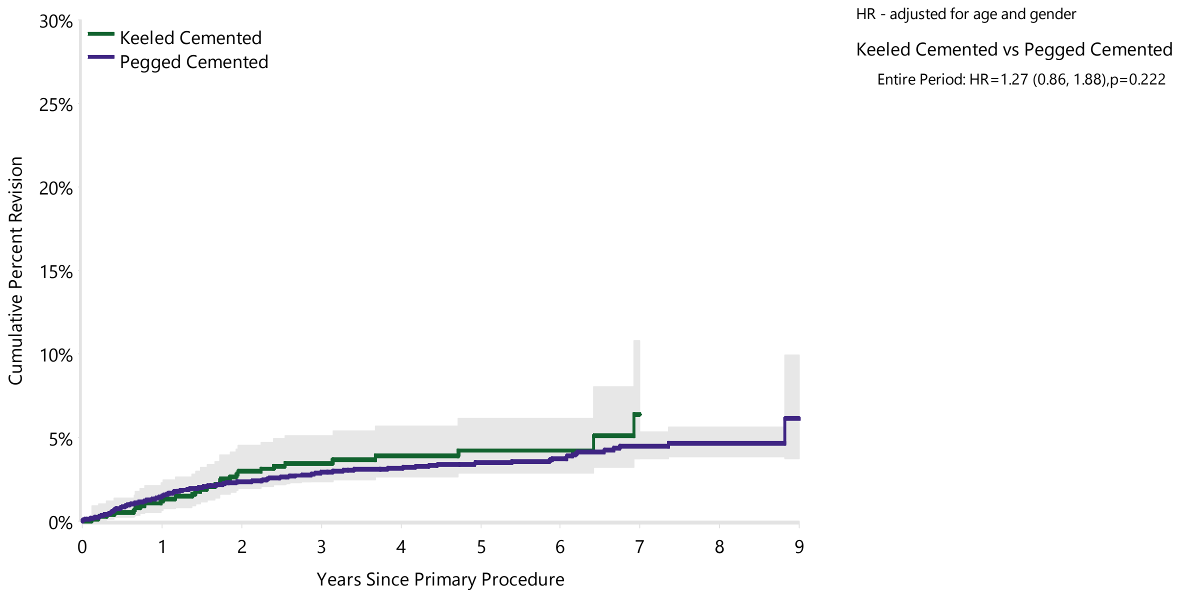
Entire Period: HR=5.59 (2.98, 10.49),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Glenoid with Modular Insert (Metal Backed)	59	50	42	23	18	4
All Polyethylene Glenoid	6291	5330	3514	1962	652	42
Glenoid with Fixed Insert (Metal Backed)	558	428	238	82	0	0

Table ST30 **Cumulative Percent Revision of All Polyethylene Primary Total Conventional Shoulder Replacement with Cemented Fixation by Glenoid Design (Primary Diagnosis OA)**

Glenoid Design	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Keeled Cemented	30	772	1.2 (0.6, 2.3)	3.5 (2.3, 5.1)	4.2 (2.9, 6.2)	6.4 (3.7, 10.8)	
Pegged Cemented	170	5847	1.5 (1.2, 1.9)	2.9 (2.5, 3.4)	3.5 (3.0, 4.1)	4.5 (3.7, 5.3)	6.1 (3.7, 9.9)
TOTAL	200	6619					

Figure ST15 **Cumulative Percent Revision of All Polyethylene Primary Total Conventional Shoulder Replacement by Glenoid Design (Primary Diagnosis OA)**



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Keeled Cemented	772	728	496	257	70	1
Pegged Cemented	5847	4897	3254	1847	657	49

Table ST31 Cumulative Percent Revision of Primary Total Conventional Shoulder Replacement by Prosthesis Combination (Primary Diagnosis OA)

Humeral Stem	Glenoid	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Aequalis	Aequalis	42	1543	1.3 (0.8, 2.0)	2.5 (1.8, 3.4)	2.9 (2.1, 4.0)	4.1 (2.7, 6.0)	
Aequalis Ascend	Aequalis	0	200	0.0 (0.0, 0.0)				
Affinis	Affinis	10	168	0.0 (0.0, 0.0)	1.8 (0.6, 5.6)	5.8 (2.9, 11.4)		
Ascend	Aequalis	6	264	0.8 (0.2, 3.3)	3.2 (1.4, 7.2)			
Bigliani/Flatow	Bigliani/Flatow	8	140	2.2 (0.7, 6.5)	3.7 (1.5, 8.6)	3.7 (1.5, 8.6)	6.2 (2.9, 13.0)	
Bigliani/Flatow TM	Bigliani/Flatow	19	340	2.5 (1.3, 4.9)	5.1 (3.1, 8.3)	6.5 (4.1, 10.3)		
Bigliani/Flatow TM	Bigliani/Flatow TM	20	500	2.8 (1.6, 4.8)	4.3 (2.7, 6.8)	4.7 (3.0, 7.4)		
Comprehensive	Comprehensive	6	163	4.4 (2.0, 9.5)				
Equinoxe	Equinoxe	2	110	1.1 (0.2, 7.9)				
Global AP	Global	57	2215	1.6 (1.1, 2.2)	2.7 (2.1, 3.6)	2.9 (2.2, 3.8)	3.6 (2.6, 5.0)	
Global Advantage	Global	22	551	1.5 (0.7, 3.0)	3.6 (2.3, 5.6)	3.6 (2.3, 5.6)	5.1 (3.3, 7.7)	
Global Advantage	Global Advantage	0	59	0.0 (0.0, 0.0)				
Global Unite	Global	1	200					
SMR	SMR	385	2623	6.2 (5.4, 7.3)	13.7 (12.3, 15.2)	17.8 (16.2, 19.6)	19.0 (17.2, 20.9)	
Solar	Solar	6	169	0.6 (0.1, 4.1)	2.4 (0.9, 6.3)	3.3 (1.4, 7.9)	3.3 (1.4, 7.9)	
Turon	Turon	1	60	1.7 (0.2, 11.2)				
Other (30)		33	319	3.6 (2.0, 6.5)	8.1 (5.5, 12.0)	11.1 (7.8, 15.6)	13.5 (9.5, 19.0)	
TOTAL		618	9624					

Note: Only combinations with over 50 procedures have been listed

PRIMARY TOTAL REVERSE SHOULDER REPLACEMENT

DEMOGRAPHICS

There have been 12,362 total reverse shoulder replacements reported to the Registry. This is an increase of 2,680 compared to the previous report. Primary total reverse shoulder replacement has increased from 43.3% of all total shoulder replacements in 2008 to 64.1% in 2015 (Figure ST1).

The most common primary diagnoses are osteoarthritis (45.6%), rotator cuff arthropathy (34.1%) and fracture (14.6%) (Table ST33).

The proportion of total reverse shoulder replacements for osteoarthritis declined from 57.8% in 2008 to 40.5% in 2013, increasing to 43.8% in 2015. The diagnosis of rotator cuff arthropathy was added to the procedure form in 2008. The proportion of primary total reverse shoulder procedures undertaken for rotator cuff arthropathy increased from 21.0% in 2008 to 38.0% in 2013, and was 36.0% in 2015 (Figure ST16).

Figure ST16 Proportion of Primary Total Reverse Shoulder Replacements by Primary Diagnosis

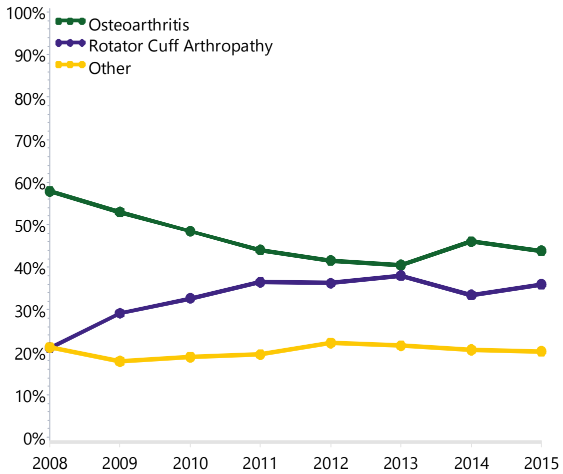
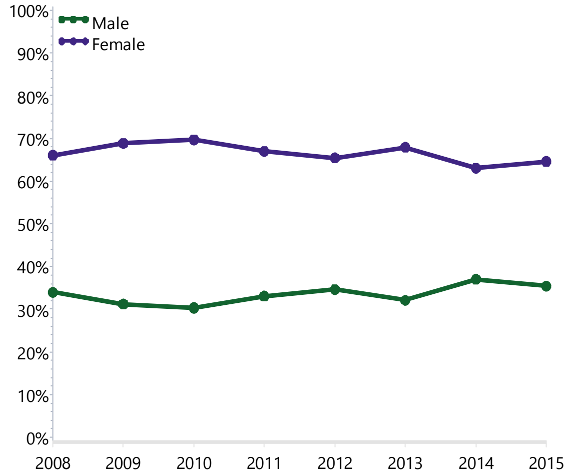


Figure ST17 Proportion of Primary Total Reverse Shoulder Replacements by Gender



Primary total reverse shoulder replacement is most commonly undertaken in females (65.9%) (Table ST32). There has been little change in gender distribution since 2008 (Figure ST17). The mean age is 75.8 years for females and 73.4 years for males. The proportion of patients aged 75 years and older has declined from 61.4% in 2010 to 51.9% in 2015 (Figure ST18).

The majority of procedures use cementless fixation (76.1% in 2015). Hybrid fixation (glenoid cementless) was used in 23.9% of procedures. There has been little variation in the use of fixation since 2008 (Figure ST19).

The most used humeral stems and glenoid prostheses are listed in Table ST34 and Table ST35. The Delta Xtend, SMR and Aequalis remain the three most commonly used prostheses.

"The most common primary diagnoses are osteoarthritis (45.6%), rotator cuff arthropathy (34.1%) and fracture (14.6%)."

Table ST32 Primary Total Reverse Shoulder Replacement by Age and Gender

Gender	Number	Percent	Minimum	Maximum	Median	Mean	Std Dev
Male	4214	34.1%	24	96	74	73.4	8.2
Female	8148	65.9%	14	102	76	75.8	8.0
TOTAL	12362	100.0%	14	102	76	75.0	8.1

Figure ST18 Proportion of Primary Total Reverse Shoulder Replacements by Age

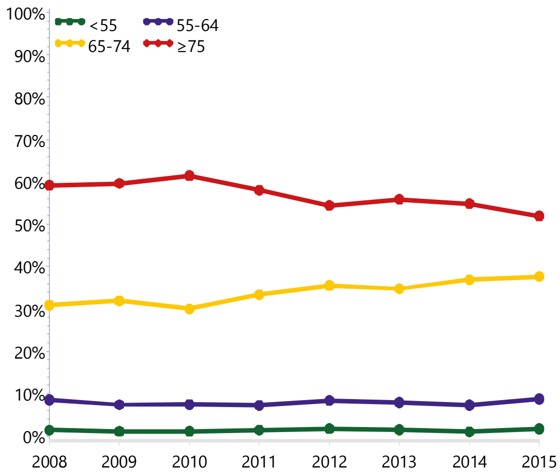


Figure ST19 Proportion of Primary Total Reverse Shoulder Replacements by Fixation

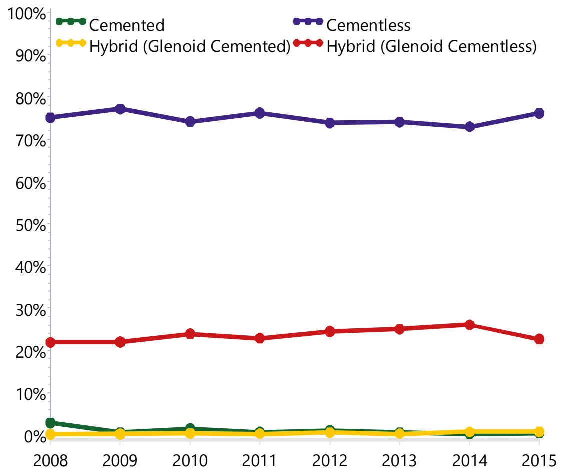


Table ST33 Primary Total Reverse Shoulder Replacement by Primary Diagnosis and Gender

Primary Diagnosis	Male N	Male Col%	Female N	Female Col%	TOTAL N	TOTAL Col%
Osteoarthritis	2047	48.6	3584	44.0	5631	45.6
Rotator Cuff Arthropathy	1716	40.7	2495	30.6	4211	34.1
Fracture	264	6.3	1543	18.9	1807	14.6
Rheumatoid Arthritis	55	1.3	233	2.9	288	2.3
Instability	51	1.2	103	1.3	154	1.2
Osteonecrosis	23	0.5	110	1.4	133	1.1
Tumour	45	1.1	44	0.5	89	0.7
Other Inflammatory Arthritis	10	0.2	33	0.4	43	0.3
Other	3	0.1	3	0.0	6	0.0
TOTAL	**4214**	**100.0**	**8148**	**100.0**	**12362**	**100.0**

Note: Instability includes Instability and Dislocation

Table ST34 10 Most Used Humeral Stem Prostheses in Primary Total Reverse Shoulder Replacement

2008		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
262	SMR	554	Delta Xtend	711	Delta Xtend	842	Delta Xtend	940	Delta Xtend
252	Delta Xtend	511	SMR	567	SMR	626	SMR	706	SMR
76	Aequalis	295	Aequalis	307	Aequalis	255	Aequalis	260	Aequalis
42	Trabecular Metal	119	Trabecular Metal	142	Trabecular Metal	138	Trabecular Metal	191	Trabecular Metal
21	Delta CTA	16	Comprehensive	38	RSP	111	RSP	132	RSP
2	Custom Made (Lima)	12	Vaios	36	Comprehensive	83	Aequalis Ascend	101	Equinoxe
1	Generic Humeral Stem	9	Equinoxe	14	Equinoxe	79	Comprehensive	98	Comprehensive
1	Promos	8	Mets	13	Global Unite	45	Global Unite	66	Global Unite
		4	Global Unite	12	Affinis	32	Equinoxe	46	Aequalis Ascend
		2	Affinis	7	Vaios	18	Anatomical Shoulder	42	Anatomical Shoulder
10 Most Used									
657 (8)	100.0%	1530 (10)	99.9%	1847 (10)	99.4%	2229 (10)	99.1%	2582 (10)	98.7%
Remainder									
0 (0)	0%	2 (2)	0.1%	11 (3)	0.6%	20 (4)	0.9%	34 (2)	1.3%
TOTAL									
657 (8)	100.0%	1532 (12)	100.0%	1858 (13)	100.0%	2249 (14)	100.0%	2616 (12)	100.0%

Table ST35 10 Most Used Glenoid Prostheses in Primary Total Reverse Shoulder Replacement

2008		2012		2013		2014		2015	
N	Model	N	Model	N	Model	N	Model	N	Model
264	SMR	558	Delta Xtend	724	Delta Xtend	887	Delta Xtend	1006	Delta Xtend
252	Delta Xtend	510	SMR	562	SMR	621	SMR	704	SMR
76	Aequalis	296	Aequalis	312	Aequalis	340	Aequalis	306	Aequalis
42	Trabecular Metal	119	Trabecular Metal	144	Trabecular Metal	147	Trabecular Metal	215	Trabecular Metal
21	Delta CTA	16	Comprehensive Reverse	38	RSP	111	RSP	132	RSP
1	Generic Metaglene	12	Vaios	36	Comprehensive Reverse	77	Comprehensive Reverse	101	Equinoxe
1	Promos	9	Equinoxe	14	Equinoxe	32	Equinoxe	96	Comprehensive Reverse
		8	Mets	12	Affinis	10	Affinis	28	Affinis
		2	Affinis	7	Vaios	10	Anatomical Shoulder	18	Anatomical Shoulder
		1	Mutars	6	Mets	8	Mets	6	Mets
10 Most Used									
657 (7)	100.0%	1531 (10)	99.9%	1855 (10)	99.8%	2243 (10)	99.7%	2612 (10)	99.8%
Remainder									
0 (0)	0%	1 (1)	0.1%	3 (2)	0.2%	6 (3)	0.3%	4 (2)	0.2%
TOTAL									
657 (7)	100.0%	1532 (11)	100.0%	1858 (12)	100.0%	2249 (13)	100.0%	2616 (12)	100.0%

OUTCOME FOR ALL DIAGNOSES

Primary Diagnosis

There is no difference in the rate of revision of total reverse shoulder replacement when primary diagnosis is considered (Table ST36 and Figure ST20).

Reason for Revision

Instability/dislocation is the most common reason for revision (38.5%), followed by infection (18.0%), loosening/lysis (18.0%) and fracture (12.3%) (Table ST37 and Figure ST21).

Type of Revision

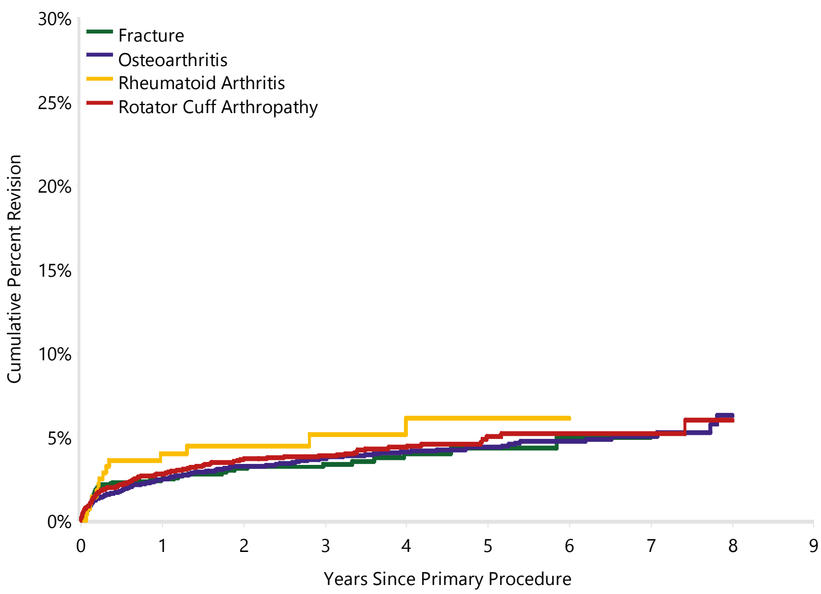
The main types of revision are: replacement of both cup (liner) and glenosphere (25.7%), cup only (20.7%), humeral component only (18.0%), which may include the revision of an epiphysis and/or humeral stem and additional minor components, and humeral head only converted to a hemi arthroplasty (15.0%) (Table ST38).

Table ST36 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	9 Yrs
Fracture	56	1807	2.5 (1.8, 3.3)	3.3 (2.5, 4.4)	4.3 (3.1, 5.8)	4.9 (3.4, 7.1)	
Osteoarthritis	194	5631	2.4 (2.0, 2.9)	3.7 (3.2, 4.3)	4.4 (3.7, 5.1)	5.0 (4.2, 5.9)	
Osteonecrosis	4	133	1.5 (0.4, 5.9)	4.6 (1.7, 12.6)			
Rheumatoid Arthritis	14	288	4.0 (2.2, 7.1)	5.1 (3.0, 8.7)	6.1 (3.5, 10.5)		
Rotator Cuff Arthropathy	152	4211	2.8 (2.3, 3.3)	3.8 (3.3, 4.5)	5.0 (4.1, 6.0)	5.2 (4.3, 6.2)	
Other (5)	19	292	4.8 (2.8, 8.1)	6.8 (4.1, 11.2)	6.8 (4.1, 11.2)		
TOTAL	439	12362					

Note: Only primary diagnoses with over 100 procedures have been listed

Figure ST20 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Primary Diagnosis



HR - adjusted for age and gender

Fracture vs Osteoarthritis
Entire Period: HR=1.14 (0.84, 1.55),p=0.388

Rheumatoid Arthritis vs Osteoarthritis
Entire Period: HR=1.40 (0.80, 2.42),p=0.235

Rotator Cuff Arthropathy vs Osteoarthritis
Entire Period: HR=1.07 (0.87, 1.33),p=0.511

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Fracture	1807	1308	629	239	66	2
Osteoarthritis	5631	4301	2427	1214	407	20
Rheumatoid Arthritis	288	231	135	65	24	4
Rotator Cuff Arthropathy	4211	3130	1621	610	156	16

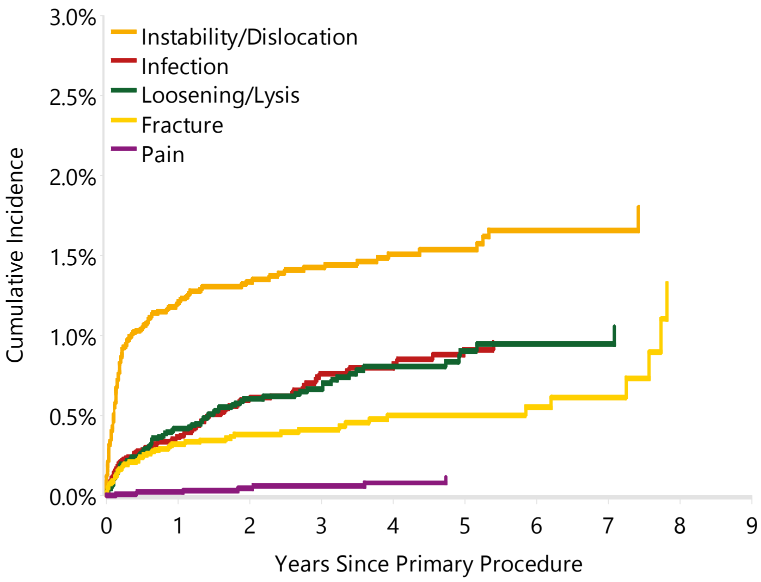
Table ST37 Primary Total Reverse Shoulder Replacement by Reason for Revision

Reason for Revision	Number	Percent
Instability/Dislocation	169	38.5
Infection	79	18.0
Loosening/Lysis	79	18.0
Fracture	54	12.3
Pain	7	1.6
Incorrect Sizing	6	1.4
Malposition	5	1.1
Dissociation	5	1.1
Implant Breakage Glenoid	4	0.9
Arthrofibrosis	3	0.7
Rotator Cuff Insufficiency	2	0.5
Wear Glenoid Insert	1	0.2
Implant Breakage Glenoid Insert	1	0.2
Metal Related Pathology	1	0.2
Haematoma	1	0.2
Other	22	5.0
TOTAL	439	100.0

Table ST38 Primary Total Reverse Shoulder Replacement by Type of Revision

Type of Revision	Number	Percent
Cup/Glenosphere	113	25.7
Cup Only	91	20.7
Humeral Component	79	18.0
Humeral Head Only	66	15.0
Glenoid Component	28	6.4
Humeral/Glenoid	25	5.7
Cement Spacer	18	4.1
Removal of Prostheses	8	1.8
Minor Components	3	0.7
Glenosphere Only	2	0.5
Reoperation	2	0.5
Cement Only	2	0.5
Head/Insert	1	0.2
Reinsertion of Components	1	0.2
TOTAL	439	100.0

Figure ST21 Cumulative Incidence Revision Diagnosis of Primary Total Reverse Shoulder Replacement



OUTCOME FOR OSTEOARTHRITIS

Age and Gender

Age is not a risk factor for revision of total reverse shoulder replacement undertaken for osteoarthritis (Table ST39 and Figure ST22). Males have a higher rate of revision compared to females (Table ST40 and Figure ST23).

Fixation

Fixation is not a risk factor for revision (Table ST41 and Figure ST24). This is also the case when the SMR prosthesis is excluded from the analysis (Table ST42 and Figure ST25).

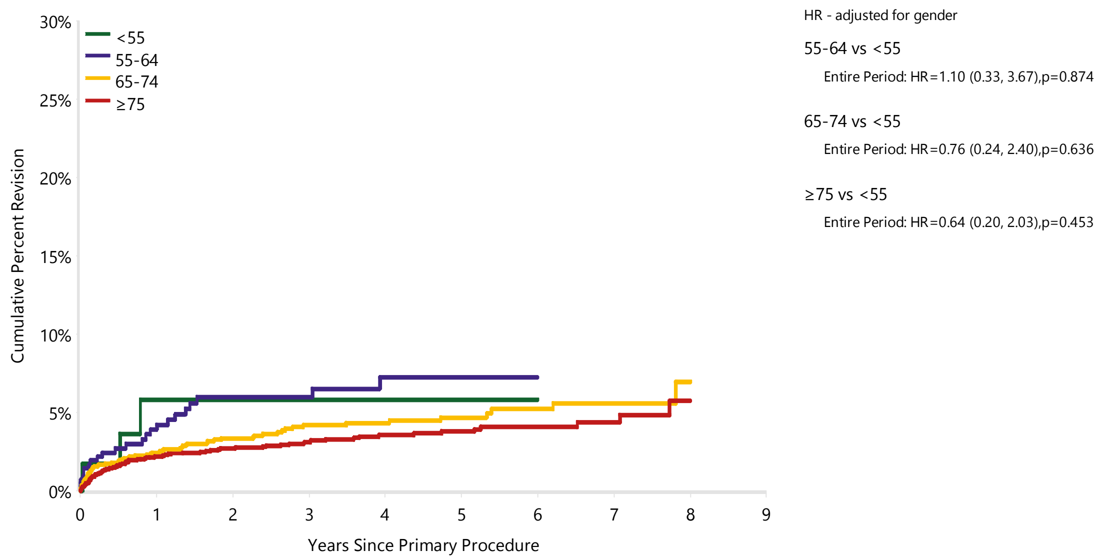
The outcomes of the most commonly used prostheses are listed in Table ST43.

"Fixation is not a risk factor for revision."

Table ST39 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	9 Yrs
<55	3	59	5.8 (1.9, 17.1)	5.8 (1.9, 17.1)	5.8 (1.9, 17.1)		
55-64	23	421	3.9 (2.4, 6.4)	6.0 (3.9, 9.1)	7.2 (4.7, 11.0)		
65-74	72	1963	2.4 (1.8, 3.3)	4.2 (3.3, 5.3)	4.7 (3.6, 6.0)	5.6 (4.2, 7.4)	
≥75	96	3188	2.2 (1.7, 2.8)	3.1 (2.5, 3.8)	3.8 (3.0, 4.7)	4.4 (3.4, 5.6)	
TOTAL	194	5631					

Figure ST22 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Age (Primary Diagnosis OA)

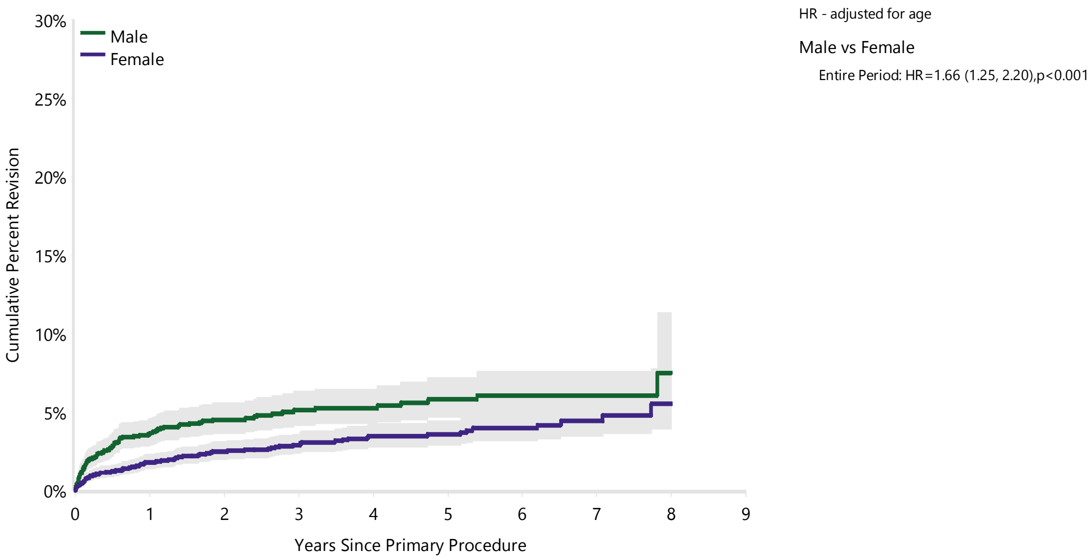


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
<55	59	43	25	13	6	1
55-64	421	307	174	92	34	3
65-74	1963	1479	806	417	149	6
≥75	3188	2472	1422	692	218	10

Table ST40 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	9 Yrs
Male	94	2047	3.6 (2.8, 4.5)	5.1 (4.1, 6.3)	5.8 (4.6, 7.2)	6.0 (4.8, 7.6)	
Female	100	3584	1.8 (1.4, 2.3)	2.9 (2.3, 3.6)	3.5 (2.9, 4.4)	4.4 (3.4, 5.6)	
TOTAL	194	5631					

Figure ST23 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Gender (Primary Diagnosis OA)

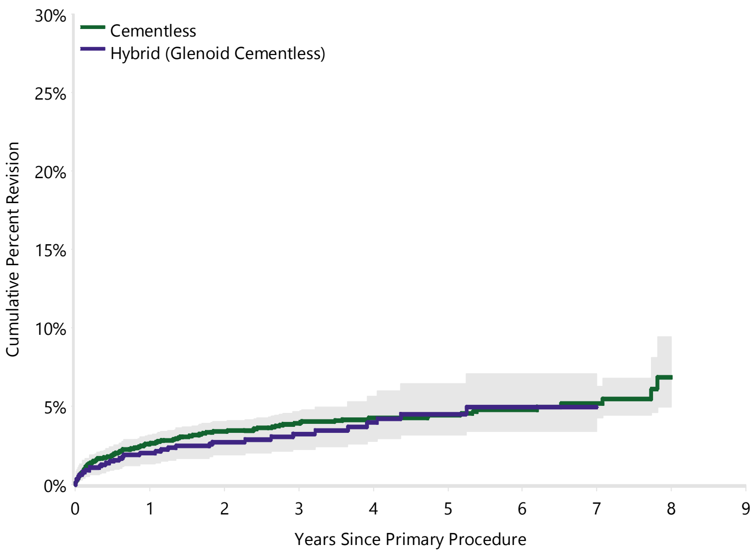


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Male	2047	1521	827	401	135	5
Female	3584	2780	1600	813	272	15

Table ST41 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	9 Yrs
Cemented	0	59	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	158	4429	2.6 (2.1, 3.1)	3.9 (3.3, 4.6)	4.4 (3.7, 5.2)	5.1 (4.2, 6.2)	
Hybrid (Glenoid Cemented)	0	22	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)			
Hybrid (Glenoid Cementless)	36	1121	2.0 (1.3, 3.0)	3.2 (2.2, 4.6)	4.5 (3.1, 6.4)	4.9 (3.4, 7.1)	
TOTAL	194	5631					

Figure ST24 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Fixation (Primary Diagnosis OA)



HR - adjusted for age and gender

Cementless vs Hybrid (Glenoid Cementless)

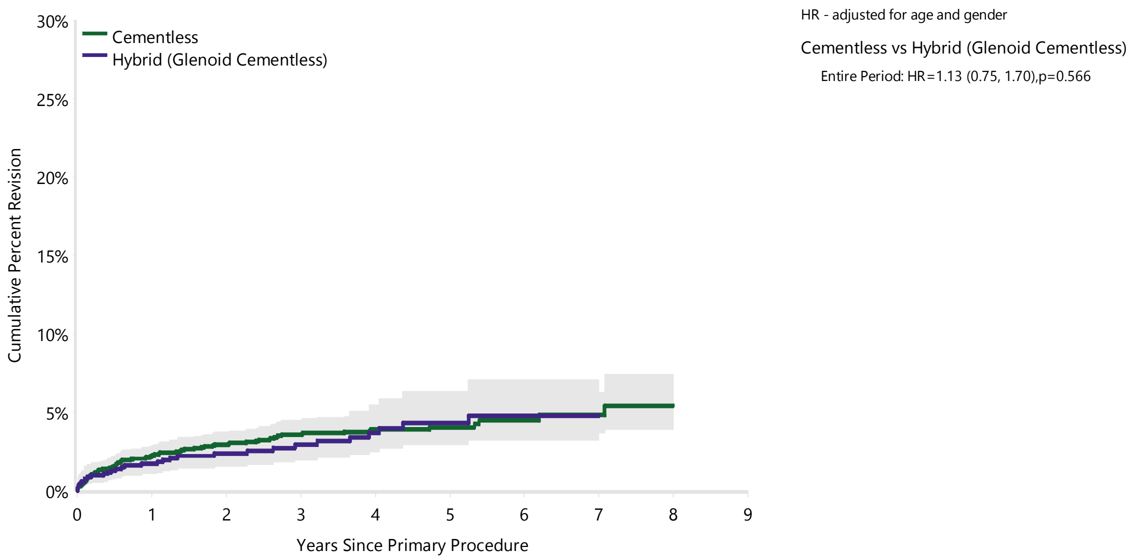
Entire Period: HR=1.15 (0.80, 1.65),p=0.459

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Cementless	4429	3340	1867	938	306	20
Hybrid (Glenoid Cementless)	1121	890	507	245	86	0

Table ST42 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Fixation (Primary Diagnosis OA, excluding SMR)

Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Cemented	0	58	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	85	2724	2.2 (1.7, 2.8)	3.6 (2.8, 4.5)	4.0 (3.2, 5.1)	4.8 (3.7, 6.3)	
Hybrid (Glenoid Cemented)	0	18	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)			
Hybrid (Glenoid Cementless)	31	1053	1.7 (1.1, 2.7)	2.9 (2.0, 4.3)	4.3 (2.9, 6.3)	4.8 (3.2, 7.1)	
TOTAL	116	3853					

Figure ST25 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Fixation (Primary Diagnosis OA, excluding SMR)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Cementless	2724	2022	1079	527	165	13
Hybrid (Glenoid Cementless)	1053	833	469	222	81	0

Table ST43 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	9 Yrs
Aequalis	Aequalis	35	801	2.1 (1.3, 3.4)	4.6 (3.2, 6.6)	5.9 (4.1, 8.3)	6.6 (4.5, 9.5)	
Aequalis Ascend	Aequalis	2	69	3.5 (0.9, 13.6)				
Comprehensive	Comprehensive Reverse	5	129	4.4 (1.8, 10.3)				
Delta CTA	Delta CTA	7	64	7.8 (3.3, 17.8)	9.4 (4.3, 19.8)	9.4 (4.3, 19.8)	11.6 (5.7, 22.9)	11.6 (5.7, 22.9)
Delta Xtend	Delta Xtend	44	2036	1.7 (1.2, 2.3)	2.1 (1.5, 2.9)	2.5 (1.8, 3.5)	3.0 (2.1, 4.3)	
Equinoxe	Equinoxe	3	83	3.4 (0.8, 13.4)				
Global Unite	Delta Xtend	0	50	0.0 (0.0, 0.0)				
Promos	Promos	2	40	0.0 (0.0, 0.0)	5.0 (1.3, 18.5)	5.0 (1.3, 18.5)		
RSP	RSP	4	138	3.4 (1.2, 8.9)				
SMR	SMR	78	1775	3.4 (2.6, 4.3)	4.5 (3.6, 5.7)	5.1 (4.0, 6.4)	5.8 (4.4, 7.5)	
Trabecular Metal	Trabecular Metal	11	362	1.5 (0.6, 3.7)	3.5 (1.8, 6.7)	5.2 (2.7, 9.6)		
Other (13)		3	84	1.6 (0.2, 10.9)	6.3 (2.0, 18.9)			
TOTAL		194	5631					

Note: Only combinations with over 25 procedures have been listed

OUTCOME FOR ROTATOR CUFF ARTHROPATHY

Age and Gender

Age is not a risk factor for revision of total reverse shoulder replacement undertaken for rotator cuff arthropathy (Table ST44 and Figure ST26).

Males have a higher rate of revision of total reverse shoulder replacement undertaken for rotator cuff arthropathy compared to females (Table ST45 and Figure ST27).

Fixation

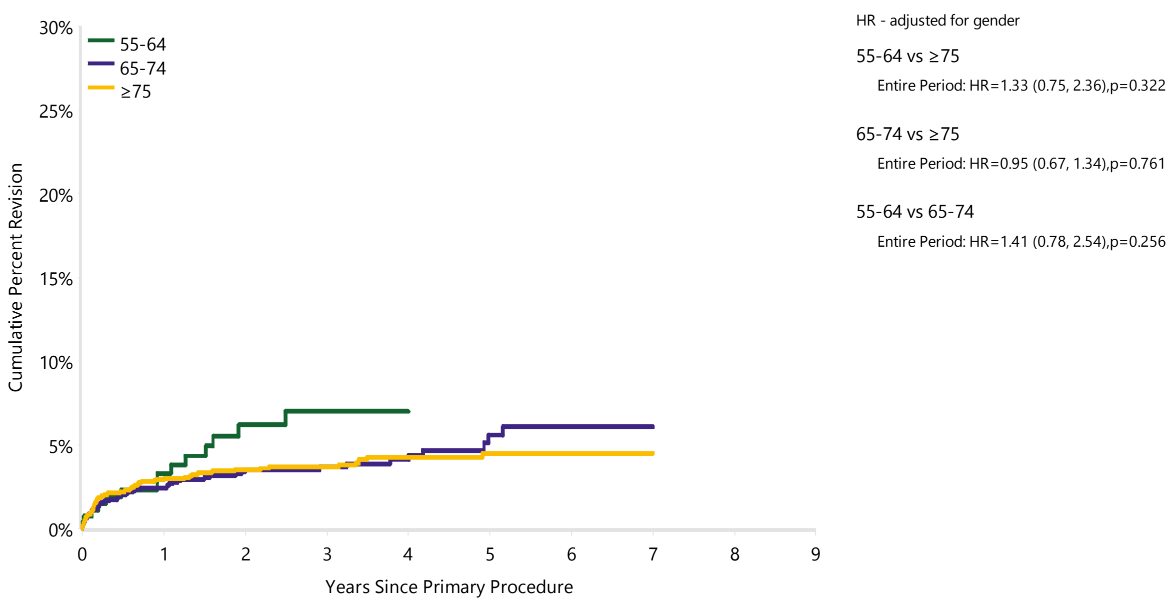
Fixation is not a risk factor for revision (Table ST46 and Figure ST28). This is also the case when the SMR total reverse shoulder prosthesis is excluded from the analysis (Table ST47 and Figure ST29).

The outcomes of the most commonly used prostheses are listed in Table ST48.

Table ST44 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	9 Yrs
<55	0	28	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)			
55-64	14	278	3.3 (1.6, 6.5)	7.0 (4.1, 11.7)			
65-74	53	1503	2.4 (1.7, 3.4)	3.7 (2.7, 4.9)	5.6 (4.0, 7.9)	6.1 (4.3, 8.6)	
≥75	85	2402	3.0 (2.3, 3.7)	3.7 (2.9, 4.6)	4.5 (3.5, 5.7)	4.5 (3.5, 5.7)	
TOTAL	**152**	**4211**					

Figure ST26 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Age (Primary Diagnosis Rotator Cuff Arthropathy)

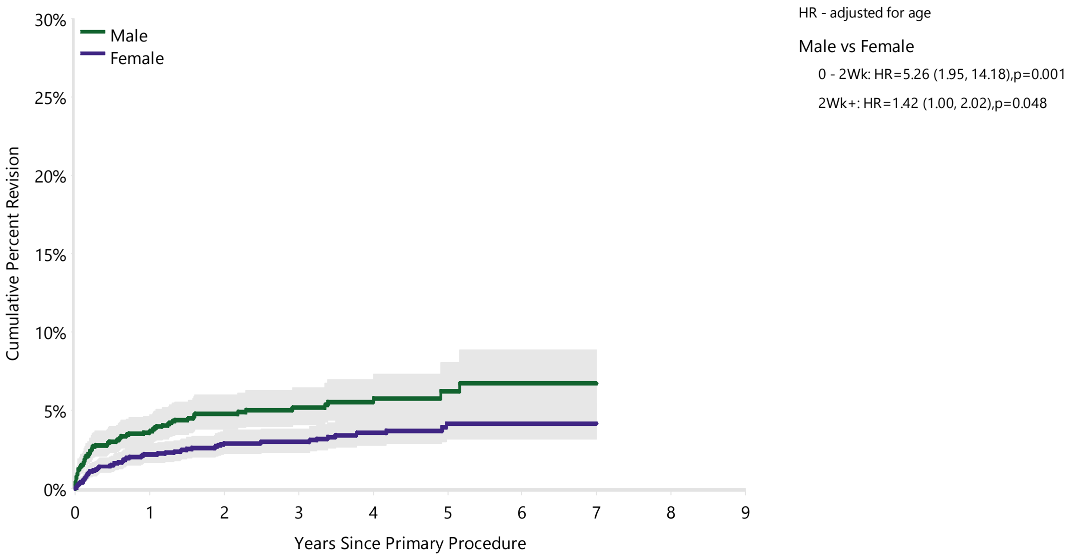


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
55-64	278	192	100	32	10	1
65-74	1503	1105	571	201	59	6
≥75	2402	1818	941	374	85	9

Table ST45 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	9 Yrs
Male	80	1716	3.6 (2.8, 4.7)	5.1 (4.1, 6.4)	6.2 (4.8, 8.0)	6.7 (5.1, 8.8)	
Female	72	2495	2.2 (1.6, 2.8)	3.0 (2.3, 3.8)	4.2 (3.2, 5.4)	4.2 (3.2, 5.4)	
TOTAL	152	4211					

Figure ST27 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Gender (Primary Diagnosis Rotator Cuff Arthropathy)

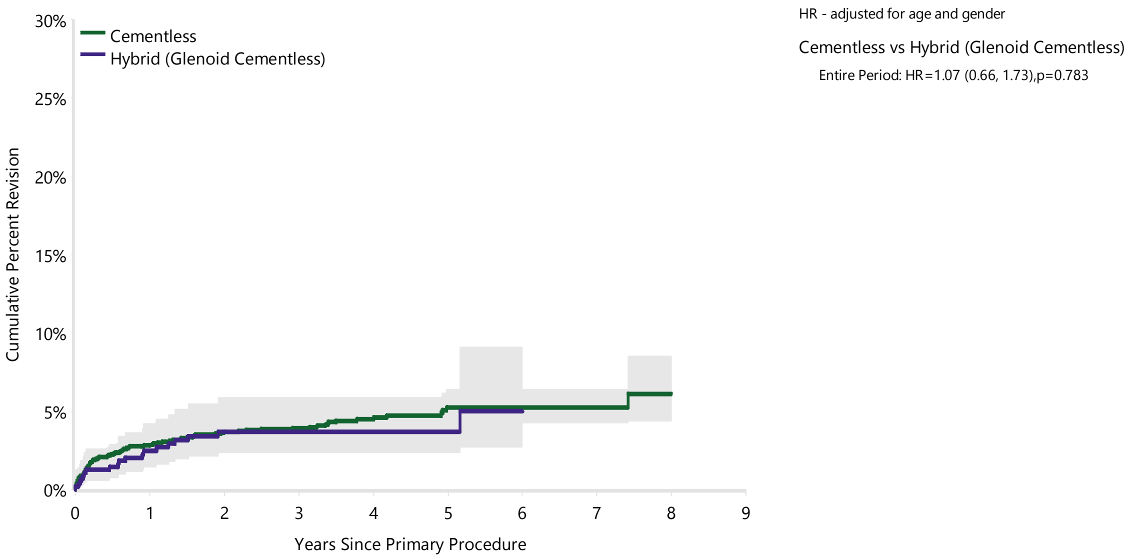


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Male	1716	1248	602	205	62	6
Female	2495	1882	1019	405	94	10

Table ST46 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	9 Yrs
Cemented	0	11	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)		
Cementless	133	3607	2.8 (2.3, 3.5)	3.9 (3.3, 4.7)	5.2 (4.3, 6.4)	5.2 (4.3, 6.4)	
Hybrid (Glenoid Cemented)	0	21	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)			
Hybrid (Glenoid Cementless)	19	572	2.5 (1.4, 4.2)	3.7 (2.3, 5.8)	3.7 (2.3, 5.8)		
TOTAL	152	4211					

Figure ST28 Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Fixation (Primary Diagnosis Rotator Cuff Arthropathy)

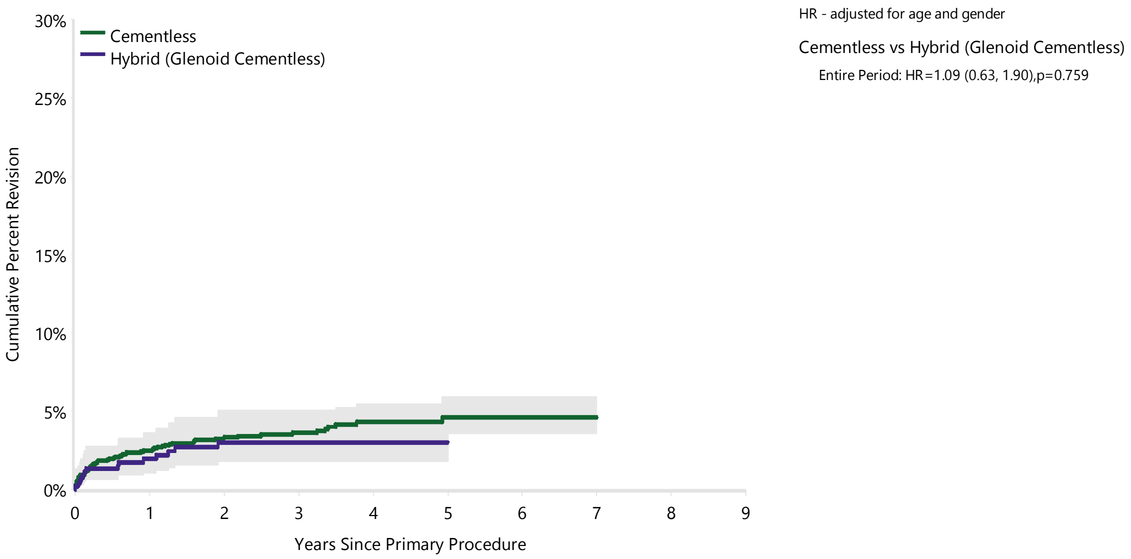


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Cementless	3607	2653	1396	521	142	15
Hybrid (Glenoid Cementless)	572	451	213	83	12	1

Table ST47 **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Fixation (Primary Diagnosis Rotator Cuff Arthropathy, excluding SMR)**

Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Cemented	0	8	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)		
Cementless	78	2368	2.5 (1.9, 3.2)	3.6 (2.8, 4.6)	4.6 (3.5, 5.9)	4.6 (3.5, 5.9)	
Hybrid (Glenoid Cemented)	0	17	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)			
Hybrid (Glenoid Cementless)	15	541	2.0 (1.1, 3.6)	3.0 (1.8, 5.1)	3.0 (1.8, 5.1)		
TOTAL	93	2934					

Figure ST29 **Cumulative Percent Revision of Primary Total Reverse Shoulder Replacement by Fixation (Primary Diagnosis Rotator Cuff Arthropathy, excluding SMR)**



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Cementless	2368	1706	856	325	78	9
Hybrid (Glenoid Cementless)	541	426	199	76	10	1

Table ST48 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	9 Yrs
Aequalis	Aequalis	21	555	1.7 (0.9, 3.3)	3.7 (2.3, 5.9)	4.6 (2.9, 7.3)		
Aequalis Ascend	Aequalis	1	52	2.3 (0.3, 15.4)				
Comprehensive	Comprehensive Reverse	2	62	3.3 (0.8, 12.7)	3.3 (0.8, 12.7)			
Delta Xtend	Delta Xtend	49	1658	2.2 (1.6, 3.1)	3.3 (2.4, 4.4)	4.0 (2.9, 5.6)		
Equinoxe	Equinoxe	1	44	2.3 (0.3, 15.1)				
Global Unite	Delta Xtend	0	40	0.0 (0.0, 0.0)				
RSP	RSP	2	98	3.1 (0.7, 12.7)				
SMR	SMR	59	1275	3.7 (2.8, 5.0)	4.8 (3.6, 6.2)	6.6 (4.9, 8.9)	6.6 (4.9, 8.9)	
Trabecular Metal	Trabecular Metal	13	344	3.3 (1.9, 6.0)	3.7 (2.1, 6.5)			
Other (10)		4	83	5.2 (2.0, 13.3)	5.2 (2.0, 13.3)	5.2 (2.0, 13.3)	5.2 (2.0, 13.3)	
TOTAL		**152**	**4211**					

Note: Only combinations with over 25 procedures have been listed

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. Outcomes data are necessary to enable an evidence-based approach to prosthesis selection. For many prostheses, the only source of outcomes data are Registry reports.

It is evident from Registry data that most prostheses have similar outcomes. A number, however, have revision rates that are 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 revision rate. 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 revision rates.

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

either:

3. there are at least 10 primary procedures for that component,

or

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 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 Australian Orthopaedic Association 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 the prostheses which continue to have a higher than anticipated rate of revision and provides information on its 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 a snap shot 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 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.

This year, 19 independent arthroplasty specialists together with the Chairperson of the AOANJRR Committee, AOANJRR Director, three Deputy Directors and two assistant Deputy Directors attended the two day Hip and Knee Surgeon Review Workshop.

Nine upper limb specialists attended the Shoulder Review Workshop under the leadership of Professor Richard Page, together with the AOANJRR Director and two Deputy Directors.

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://aoanjrr.sahmri.com/annual-reports-2016.

PRIMARY PARTIAL HIP REPLACEMENT

UNIPOLAR MODULAR

There are no unipolar modular prostheses being identified for the first time this year.

Table IP1 Revision Rate of Individual Unipolar Modular Hip Prostheses Identified as having a Higher than Anticipated Rate of Revision

Head/Femoral	N Revised	N Total	Obs. Yrs	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Re-Identified and still used	.	.	.	.	
Unipolar Head (JRI)/Furlong LOL	10	125	300	3.33	Entire Period: HR=2.63 (1.41, 4.90),p=0.002

Note: All components have been compared to all other Unipolar Modular Hip components

Table IP2 Cumulative Percent Revision of Individual Unipolar Modular Hip Prostheses Identified as having a Higher than Anticipated Rate of Revision

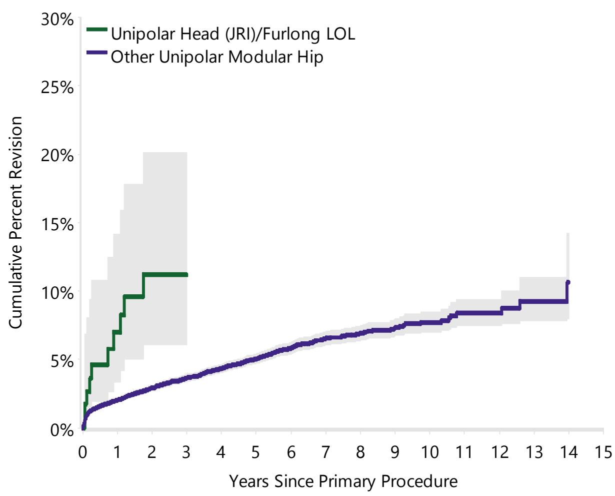
CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs
Re-Identified and still used					
Unipolar Head (JRI)/Furlong LOL	7.0 (3.4, 14.2)	11.2 (6.1, 20.1)			

Table IP3 Yearly Usage of Individual Unipolar Modular Hip Prostheses Identified as having a Higher than Anticipated Rate of Revision

Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Re-Identified and still used	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Unipolar Head (JRI)/Furlong LOL	.	.	.	.	.	12	18	10	13	10	8	7	32	15

Figure IP1 Cumulative Percent Revision of Re-identified and still used Individual Unipolar Modular Hip Prostheses

Re-identified and still used



BIPOLAR

There is one primary bipolar hip prosthesis combination identified for the first time.

The Bipolar Head (Medacta)/Quadra-H combination has been used in 50 procedures since 2009. The cumulative percent revision at three years is 14.4%. All five revisions were major: two acetabular component, two bipolar head/femoral and one femoral/acetabular. The main reasons for revision were prosthesis dislocation (40.0%) and fracture (40.0%). All revisions were of procedures with a primary diagnosis of fractured neck of femur.

Table IP4 Revision Rate of Individual Bipolar Hip Prostheses Identified as having a Higher than Anticipated Rate of Revision

Bipolar/Femoral	N Revised	N Total	Obs. Yrs	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Newly Identified	.	.	.	.	
Bipolar Head (Medacta)/Quadra-H	5	50	89	5.61	Entire Period: HR=4.44 (1.84, 10.71),p<0.001
Re-Identified and still used	.	.	.	.	
Tandem/Basis	13	114	390	3.34	0 - 1.5Yr: HR=1.28 (0.48, 3.42),p=0.627
	.	.	.	.	1.5Yr+: HR=6.00 (3.07, 11.74),p<0.001
Identified and no longer used	.	.	.	.	
UHR/ABGII	19	177	867	2.19	Entire Period: HR=2.67 (1.69, 4.21),p<0.001
UHR/Omnifit (cless)	7	40	222	3.16	Entire Period: HR=3.56 (1.69, 7.51),p<0.001
**Synergy	8	54	342	2.34	Entire Period: HR=2.62 (1.30, 5.28),p=0.006

Note: All components have been compared to all other bipolar hip components
** Femoral Component

Table IP5 Cumulative Percent Revision of Individual Bipolar Hip Prostheses Identified as having a Higher than Anticipated Rate of Revision

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs
Newly Identified					
Bipolar Head (Medacta)/Quadra-H	8.3 (2.8, 23.7)	14.4 (5.2, 36.7)			
Re-Identified and still used					
Tandem/Basis	2.0 (0.5, 7.8)	13.1 (7.4, 22.6)			
Identified and no longer used					
UHR/ABGII	4.4 (2.1, 8.9)	5.1 (2.6, 10.1)	10.9 (6.5, 18.0)		
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)	
**Synergy	7.5 (2.9, 18.7)	9.7 (4.1, 21.8)	12.4 (5.7, 25.9)	18.5 (9.5, 34.2)	

Note: ** Femoral Component

Table IP6 Yearly Usage of Individual Bipolar Hip Prostheses Identified as having a Higher than Anticipated Rate of Revision

Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Newly Identified	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bipolar Head (Medacta)/Quadra-H	.	.	.	.	.	.	.	10	7	5	6	3	11	8
Re-Identified and still used	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tandem/Basis	.	.	.	10	13	9	11	4	7	8	21	24	6	1
Identified and no longer used	.	.	.	.	.	.	.	.	.	.	.	.	.	.
UHR/ABGII	25	25	36	34	10	15	20	7	5	.	.	.	.	.
UHR/Omnifit (cless)	11	10	7	5	4	1	2	.	.	.	.	.	.	.
**Synergy	12	13	9	10	3	2	1	1	.	1	.	2	.	.

Note: ** Femoral Component

Figure IP2 Cumulative Percent Revision of Newly Identified Individual Bipolar Hip Prostheses

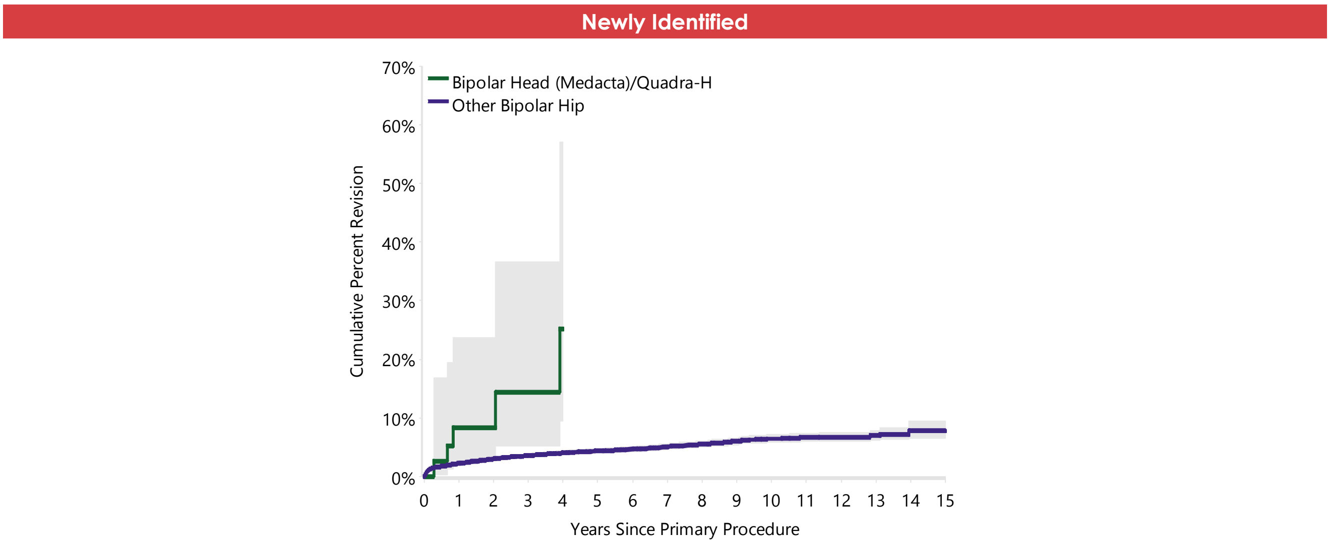
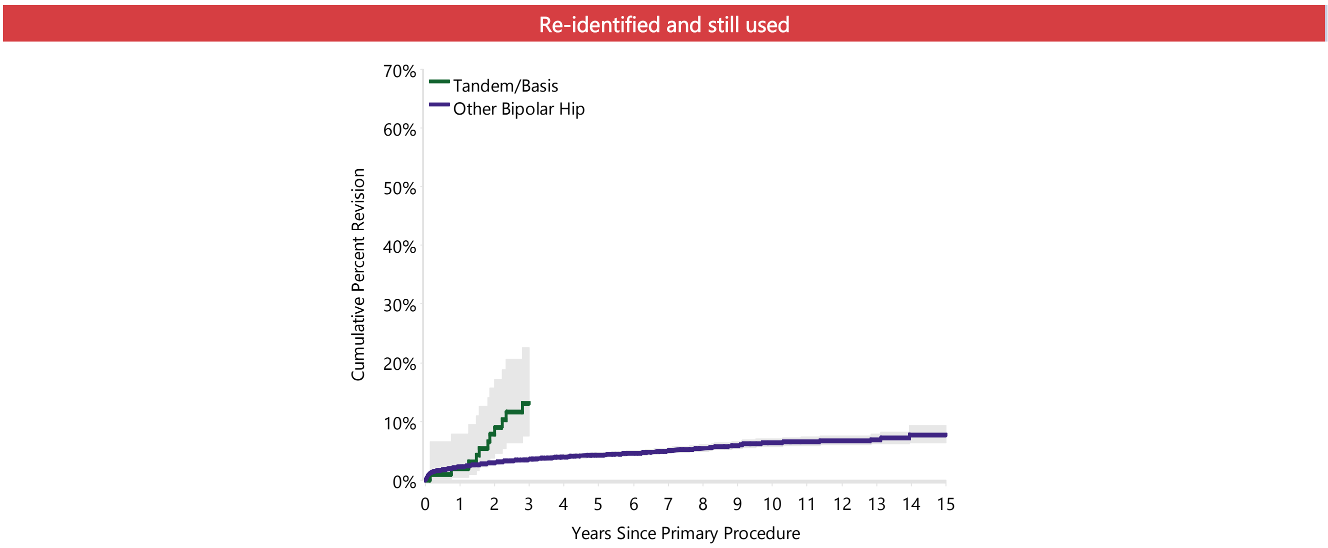


Figure IP3 Cumulative Percent Revision of Re-identified and still used Individual Bipolar Hip Prostheses



PRIMARY TOTAL HIP REPLACEMENT

TOTAL CONVENTIONAL

Large head metal/metal bearings have been removed from the comparator group for all primary total conventional hip investigations.

The Profemur TL/Dynasty combination and Delta-One TT acetabular component are no longer identified. The Profemur TL/Dynasty is no longer used. There have been an additional 14 procedures using the Delta-One TT acetabular component and no further revisions.

There are three primary total conventional hip prostheses identified for the first time.

This year the Registry identified the Apex stem in combination with five acetabular components in Stage 1. As per our approach to identifying prostheses with higher than anticipated revision, an additional analysis was performed on the individual stem.

There were 106 revisions from 2,204 reported cases and the cumulative percent revision at 10 years was 8.6%. There were 81 major revisions and the Apex stem was combined with 30 different acetabular components. There were 24 revisions for loosening/lysis, 25 for dislocation and 17 for infection. There were revisions in all five states and territories that used the device.

As the Apex femoral stem is now identified individually, the Apex/Trilogy combination is no longer listed.

The Furlong Evolution is a cementless femoral stem that has been used in 81 procedures since 2013. The cumulative percent revision at one year is 5.3%. Two revisions were femoral only and two were acetabular only. The main reasons for revision were loosening/lysis (33.3%) and infection (33.3%).

Previously the AOANJRR has identified the seleXys acetabular component as a prosthesis with a higher than anticipated rate of revision. The Registry has information on four different seleXys acetabular components. Three of these are included in this year's Investigation on the higher than anticipated rate of revision of the seleXys. There has been no reported use of these three components since 2014. The seleXys is now listed in the section 'Identified and no longer used'. The one remaining seleXys acetabular component is the titanium porous coated beaded seleXys (seleXys PC). There has been increasing use of this prosthesis over the last year. Although the follow up remains short, it is not associated with a higher than anticipated rate of revision.

The BMHR VST femoral stem has been identified for the first time and is no longer used.

Table IP7 Revision Rate of Individual Total Conventional Hip Prostheses Identified as having a Higher than Anticipated Rate of Revision

Femoral/Acetabular	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Newly Identified	.	.	.	.	
*Apex	106	2204	10842	0.98	Entire Period: HR=1.45 (1.20, 1.75),p<0.001
*Furlong Evolution	6	81	108	5.56	Entire Period: HR=4.27 (1.92, 9.49),p<0.001
Re-Identified and still used	.	.	.	.	
Corail/Trabecular Metal (Shell)	9	84	336	2.68	Entire Period: HR=3.69 (1.92, 7.09),p<0.001
CPT/Fitmore	12	198	763	1.57	Entire Period: HR=2.21 (1.26, 3.90),p=0.005
CPT/Low Profile Cup	10	133	572	1.75	Entire Period: HR=2.60 (1.40, 4.83),p=0.002
Metafix/Trinity	28	1507	2916	0.96	0 - 2Wk: HR=2.16 (1.12, 4.17),p=0.021
	.	.	.	.	2Wk+: HR=0.71 (0.45, 1.11),p=0.135
Profemur L/Dynasty	14	473	406	3.45	Entire Period: HR=1.99 (1.18, 3.37),p=0.009
Taperloc Microplasty/Regenerex	4	46	160	2.50	Entire Period: HR=3.30 (1.24, 8.78),p=0.016
*CBH Stem	30	274	1436	2.09	Entire Period: HR=3.19 (2.23, 4.56),p<0.001
*Emperion	30	460	1928	1.56	Entire Period: HR=2.09 (1.46, 2.99),p<0.001
*Excia (cless)	16	250	791	2.02	Entire Period: HR=2.54 (1.56, 4.15),p<0.001
*Furlong	24	493	2386	1.01	Entire Period: HR=1.49 (1.00, 2.23),p=0.048
*ML Taper Kinectiv	122	3097	11304	1.08	Entire Period: HR=1.41 (1.18, 1.69),p<0.001
*Novation	29	845	1635	1.77	Entire Period: HR=1.68 (1.17, 2.42),p=0.005
*Taper Fit	41	689	3062	1.34	0 - 3Mth: HR=0.86 (0.38, 1.91),p=0.705
	.	.	.	.	3Mth+: HR=2.50 (1.79, 3.49),p<0.001
*Trabecular Metal	91	1760	7054	1.29	0 - 1Mth: HR=2.60 (1.81, 3.73),p<0.001
	.	.	.	.	1Mth+: HR=1.51 (1.17, 1.94),p=0.001
*UniSyn	41	442	2733	1.50	Entire Period: HR=2.37 (1.74, 3.22),p<0.001
**Continuum	258	8191	22742	1.13	0 - 3Mth: HR=1.78 (1.52, 2.10),p<0.001
	.	.	.	.	3Mth+: HR=0.95 (0.78, 1.15),p=0.581
**Fin II	101	2025	10140	1.00	Entire Period: HR=1.49 (1.23, 1.82),p<0.001
**Furlong	29	556	2163	1.34	Entire Period: HR=1.80 (1.25, 2.59),p=0.001
**Plasmacup	29	459	1721	1.68	Entire Period: HR=2.24 (1.56, 3.22),p<0.001
**Procotyl L	49	963	3509	1.40	Entire Period: HR=1.84 (1.39, 2.44),p<0.001
Identified and no longer used	.	.	.	.	
+*BMHR VST	18	259	1247	1.44	Entire Period: HR=1.95 (1.23, 3.10),p=0.004
Anatomic II/Duraloc Option	7	60	472	1.48	Entire Period: HR=2.56 (1.23, 5.35),p=0.012
Anca-Fit/Pinnacle	13	101	715	1.82	Entire Period: HR=3.15 (1.83, 5.42),p<0.001
Friendly Hip/Cup (Exactech)	12	97	797	1.51	Entire Period: HR=2.64 (1.50, 4.66),p<0.001
F2L/Delta-PF	16	107	890	1.80	Entire Period: HR=3.12 (1.91, 5.09),p<0.001
H Moos/Mueller	9	19	135	6.67	Entire Period: HR=10.84 (5.65, 20.79),p<0.001
Secur-Fit Plus/Secur-Fit	20	197	1980	1.01	Entire Period: HR=1.73 (1.12, 2.68),p=0.014
Taperloc/M2a MoM	58	515	4470	1.30	Entire Period: HR=2.22 (1.72, 2.88),p<0.001
*ABGII (exch neck)	64	246	1228	5.21	0 - 1Mth: HR=3.79 (1.70, 8.45),p=0.001
	.	.	.	.	1Mth - 2.5Yr: HR=3.46 (2.05, 5.85),p<0.001
	.	.	.	.	2.5Yr - 4Yr: HR=11.27 (6.52, 19.47),p<0.001
	.	.	.	.	4Yr - 4.5Yr: HR=35.16 (19.27, 64.15),p<0.001
	.	.	.	.	4.5Yr+: HR=21.16 (13.61, 32.91),p<0.001
*Adapter (ctd)	28	148	915	3.06	0 - 6Mth: HR=2.24 (0.84, 5.98),p=0.106
	.	.	.	.	6Mth+: HR=5.20 (3.49, 7.77),p<0.001
*Adapter (cless)	107	744	4591	2.33	0 - 2Wk: HR=3.96 (1.97, 7.94),p<0.001
	.	.	.	.	2Wk - 1Mth: HR=1.79 (0.75, 4.32),p=0.191
	.	.	.	.	1Mth - 6Mth: HR=0.84 (0.31, 2.24),p=0.724
	.	.	.	.	6Mth - 3Yr: HR=3.57 (2.52, 5.06),p<0.001

Femoral/Acetabular	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
	.	.	.	.	3Yr+: HR=6.00 (4.63, 7.78),p<0.001
*Edinburgh	17	138	778	2.19	Entire Period: HR=3.64 (2.27, 5.85),p<0.001
*Elite Plus	219	2841	26583	0.82	0 - 1Mth: HR=0.28 (0.12, 0.66),p=0.004
	.	.	.	.	1Mth - 9Mth: HR=1.04 (0.69, 1.55),p=0.853
	.	.	.	.	9Mth+: HR=1.74 (1.51, 2.01),p<0.001
*K2	63	601	3147	2.00	Entire Period: HR=3.08 (2.40, 3.94),p<0.001
*LYDERIC II	15	164	1256	1.19	Entire Period: HR=2.09 (1.26, 3.47),p=0.004
*Margron	102	688	6591	1.55	Entire Period: HR=2.64 (2.18, 3.21),p<0.001
*Mayo	14	168	1331	1.05	Entire Period: HR=1.81 (1.07, 3.05),p=0.027
*Metha (exch neck)	13	88	415	3.13	Entire Period: HR=4.48 (2.60, 7.71),p<0.001
*MSA	23	224	900	2.55	Entire Period: HR=3.33 (2.21, 5.01),p<0.001
*Profemur Z	22	186	1527	1.44	Entire Period: HR=2.49 (1.64, 3.79),p<0.001
**2000 Plus	15	135	885	1.70	Entire Period: HR=2.83 (1.70, 4.69),p<0.001
**Adept	16	121	764	2.09	Entire Period: HR=3.28 (2.01, 5.36),p<0.001
**Artek	62	179	1930	3.21	0 - 1.5Yr: HR=1.96 (0.94, 4.12),p=0.074
	.	.	.	.	1.5Yr+: HR=6.65 (5.09, 8.68),p<0.001
**ASR	1706	4421	28961	5.89	0 - 1.5Yr: HR=1.50 (1.26, 1.79),p<0.001
	.	.	.	.	1.5Yr - 2Yr: HR=6.16 (4.75, 7.98),p<0.001
	.	.	.	.	2Yr - 3Yr: HR=12.96 (11.19, 15.00),p<0.001
	.	.	.	.	3Yr - 5Yr: HR=23.77 (21.60, 26.16),p<0.001
	.	.	.	.	5Yr - 5.5Yr: HR=28.14 (23.36, 33.91),p<0.001
	.	.	.	.	5.5Yr - 6Yr: HR=23.07 (18.74, 28.39),p<0.001
	.	.	.	.	6Yr - 8.5Yr: HR=15.86 (14.00, 17.96),p<0.001
	.	.	.	.	8.5Yr+: HR=5.66 (4.10, 7.82),p<0.001
**BHR	304	2986	21702	1.40	0 - 2Wk: HR=0.83 (0.39, 1.75),p=0.623
	.	.	.	.	2Wk - 1Mth: HR=0.17 (0.04, 0.69),p=0.012
	.	.	.	.	1Mth - 1.5Yr: HR=0.94 (0.68, 1.31),p=0.729
	.	.	.	.	1.5Yr+: HR=3.55 (3.13, 4.02),p<0.001
**Bionik	109	608	3911	2.79	0 - 3Mth: HR=1.71 (0.95, 3.09),p=0.076
	.	.	.	.	3Mth - 3Yr: HR=3.91 (2.79, 5.48),p<0.001
	.	.	.	.	3Yr - 3.5Yr: HR=11.59 (6.38, 21.04),p<0.001
	.	.	.	.	3.5Yr - 7Yr: HR=8.38 (6.29, 11.16),p<0.001
	.	.	.	.	7Yr+: HR=2.70 (1.12, 6.50),p=0.026
**Cormet	80	803	5976	1.34	0 - 1.5Yr: HR=1.07 (0.66, 1.72),p=0.784
	.	.	.	.	1.5Yr+: HR=3.12 (2.43, 4.00),p<0.001
**DeltaLox	20	222	785	2.55	Entire Period: HR=3.35 (2.16, 5.18),p<0.001
**Duraloc	469	5354	49464	0.95	0 - 3Mth: HR=0.87 (0.65, 1.15),p=0.322
	.	.	.	.	3Mth - 9Mth: HR=1.36 (0.95, 1.95),p=0.097
	.	.	.	.	9Mth - 2Yr: HR=1.57 (1.20, 2.06),p=0.001
	.	.	.	.	2Yr - 2.5Yr: HR=0.75 (0.37, 1.51),p=0.422
	.	.	.	.	2.5Yr - 3Yr: HR=1.79 (1.10, 2.90),p=0.018
	.	.	.	.	3Yr - 5.5Yr: HR=1.49 (1.16, 1.92),p=0.002
	.	.	.	.	5.5Yr+: HR=2.42 (2.13, 2.76),p<0.001
**Durom	128	1245	9936	1.29	0 - 1.5Yr: HR=0.76 (0.49, 1.20),p=0.237
	.	.	.	.	1.5Yr+: HR=3.16 (2.61, 3.82),p<0.001
**ExpanSys	10	71	590	1.70	Entire Period: HR=2.96 (1.59, 5.51),p<0.001
**Hedrocel	9	46	464	1.94	Entire Period: HR=3.26 (1.70, 6.27),p<0.001
**Icon	65	401	2646	2.46	0 - 2.5Yr: HR=2.54 (1.70, 3.78),p<0.001
	.	.	.	.	2.5Yr+: HR=5.88 (4.32, 7.99),p<0.001
**Inter-Op	9	33	324	2.78	Entire Period: HR=4.74 (2.47, 9.11),p<0.001

Femoral/Acetabular	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
**MBA	17	124	973	1.75	Entire Period: HR=3.04 (1.89, 4.89),p<0.001
**Mitch TRH	76	732	4886	1.56	0 - 3Mth: HR=0.63 (0.26, 1.50),p=0.294
	.	.	.	.	3Mth+: HR=3.25 (2.57, 4.10),p<0.001
**seleXys (excluding seleXys PC)	39	391	1742	2.24	Entire Period: HR=3.18 (2.33, 4.36),p<0.001
**SPH-Blind	102	952	9679	1.05	0 - 1Mth: HR=2.57 (1.57, 4.20),p<0.001
	.	.	.	.	1Mth+: HR=1.72 (1.39, 2.13),p<0.001

Note: All components have been compared to all other total conventional hip components, excluding metal/metal bearings with head size larger than 32mm
* Femoral Component, ** Acetabular Component
+ Newly identified and no longer used

Table IP8 Cumulative Percent Revision of Individual Total Conventional Hip Prostheses Identified as having a Higher than Anticipated Rate of Revision

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs
Newly Identified					
*Apex	2.2 (1.6, 2.9)	3.3 (2.6, 4.2)	4.8 (3.9, 6.0)	8.6 (6.6, 11.3)	
*Furlong Evolution	5.3 (2.0, 13.5)				
Re-Identified and still used					
Corail/Trabecular Metal (Shell)	4.9 (1.8, 12.4)	9.2 (4.5, 18.4)	12.9 (6.8, 23.7)		
CPT/Fitmore	4.7 (2.5, 8.9)	5.4 (2.9, 9.7)	6.9 (3.6, 13.0)		
CPT/Low Profile Cup	4.6 (2.1, 9.9)	6.3 (3.2, 12.3)	8.8 (4.8, 16.0)		
Metafix/Trinity	1.6 (1.1, 2.4)	2.2 (1.5, 3.3)	2.2 (1.5, 3.3)		
Profemur L/Dynasty	3.5 (2.0, 5.8)				
Taperloc Microplasty/Regenerex	9.0 (3.5, 22.1)	9.0 (3.5, 22.1)	9.0 (3.5, 22.1)		
*CBH Stem	4.1 (2.3, 7.2)	7.5 (4.9, 11.4)	10.1 (6.9, 14.7)		
*Emperion	4.2 (2.7, 6.5)	5.3 (3.5, 7.9)	6.8 (4.6, 9.8)		
*Excia (cless)	5.0 (2.8, 8.6)	6.0 (3.6, 9.9)	7.3 (4.2, 12.4)		
*Furlong	2.7 (1.6, 4.6)	4.4 (2.8, 6.7)	5.3 (3.6, 8.0)		
*ML Taper Kinectiv	2.3 (1.8, 2.9)	3.5 (2.9, 4.3)	4.8 (4.0, 5.8)		
*Novation	3.1 (2.1, 4.5)	4.2 (2.9, 6.1)			
*Taper Fit	1.4 (0.7, 2.7)	3.1 (1.9, 5.1)	6.5 (4.4, 9.6)	13.4 (9.7, 18.5)	
*Trabecular Metal	3.3 (2.6, 4.3)	4.7 (3.7, 5.8)	5.5 (4.5, 6.8)		
*UniSyn	3.4 (2.1, 5.6)	6.3 (4.3, 9.1)	7.2 (5.0, 10.2)	11.9 (8.6, 16.4)	
**Continuum	2.5 (2.2, 2.9)	3.3 (2.9, 3.7)	4.0 (3.5, 4.6)		
**Fin II	2.6 (2.0, 3.4)	3.6 (2.9, 4.6)	4.9 (4.0, 6.0)		
**Furlong	3.5 (2.3, 5.5)	5.4 (3.7, 7.8)	5.8 (4.0, 8.5)		
**Plasmacup	4.8 (3.2, 7.3)	6.1 (4.2, 8.8)	7.2 (4.9, 10.5)		
**Procotyl L	3.7 (2.6, 5.1)	5.2 (3.9, 6.9)	5.7 (4.3, 7.4)		
Identified and no longer used					
+*BMHR VST	1.9 (0.8, 4.6)	4.7 (2.7, 8.1)	7.0 (4.3, 11.3)		
Anatomic II/Duraloc Option	1.7 (0.2, 11.2)	6.7 (2.6, 16.8)	10.1 (4.7, 21.1)		
Anca-Fit/Pinnacle	5.0 (2.1, 11.5)	8.0 (4.1, 15.4)	11.1 (6.3, 19.1)		
Friendly Hip/Cup (Exactech)	2.1 (0.5, 8.0)	3.2 (1.0, 9.5)	6.5 (3.0, 14.0)	14.5 (8.4, 24.2)	
F2L/Delta-PF	5.6 (2.6, 12.1)	10.3 (5.9, 17.9)	12.3 (7.3, 20.2)	15.5 (9.8, 24.0)	
H Moos/Mueller	5.6 (0.8, 33.4)	33.3 (16.6, 59.6)	38.9 (20.8, 64.7)	46.5 (26.2, 72.4)	
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)	12.6 (9.8, 16.2)	
*ABGII (exch neck)	4.1 (2.2, 7.5)	10.3 (7.1, 14.9)	19.2 (14.7, 24.8)		
*Adapter (ctd)	4.1 (1.9, 8.9)	9.1 (5.4, 15.2)	17.0 (11.6, 24.5)		
*Adapter (cless)	3.2 (2.2, 4.8)	6.7 (5.1, 8.8)	11.5 (9.3, 14.1)		

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs
*Edinburgh	6.0 (3.1, 11.7)	9.6 (5.6, 16.4)	12.5 (7.7, 20.1)		
*Elite Plus	1.5 (1.1, 2.0)	2.8 (2.3, 3.5)	4.2 (3.5, 5.1)	7.6 (6.6, 8.8)	11.7 (9.9, 13.7)
*K2	5.2 (3.7, 7.3)	7.5 (5.7, 10.0)	10.0 (7.8, 12.7)		
*LYDERIC II	3.1 (1.3, 7.2)	5.7 (3.0, 10.6)	7.1 (4.0, 12.5)	12.6 (7.4, 21.0)	
*Margron	5.8 (4.3, 7.9)	8.4 (6.5, 10.8)	10.2 (8.2, 12.8)	15.0 (12.5, 18.0)	
*Mayo	3.0 (1.3, 7.0)	6.6 (3.7, 11.6)	6.6 (3.7, 11.6)	8.6 (4.9, 14.6)	
*Metha (exch neck)	12.5 (7.1, 21.4)	13.6 (8.0, 22.8)	15.0 (9.0, 24.5)		
*MSA	5.8 (3.4, 9.8)	9.0 (5.9, 13.7)	11.0 (7.4, 16.2)		
*Profemur Z	6.0 (3.4, 10.5)	10.4 (6.7, 15.8)	10.9 (7.2, 16.4)	12.2 (8.2, 18.0)	
**2000 Plus	3.0 (1.1, 7.8)	6.8 (3.6, 12.7)	9.2 (5.3, 15.7)		
**Adept	4.1 (1.7, 9.6)	8.4 (4.6, 15.0)	9.3 (5.3, 16.2)		
**Artek	2.8 (1.2, 6.7)	8.0 (4.8, 13.1)	15.6 (11.0, 21.9)	24.7 (18.9, 32.0)	
**ASR	1.9 (1.5, 2.3)	9.6 (8.7, 10.5)	24.2 (22.9, 25.5)	44.5 (42.7, 46.3)	
**BHR	1.1 (0.8, 1.6)	3.2 (2.6, 3.9)	6.0 (5.2, 7.0)	13.7 (12.1, 15.5)	
**Bionik	3.6 (2.4, 5.5)	7.6 (5.7, 10.0)	14.1 (11.6, 17.3)		
**Cormet	1.4 (0.8, 2.5)	3.4 (2.3, 4.9)	5.1 (3.8, 6.9)	14.7 (11.6, 18.5)	
**DeltaLox	5.9 (3.5, 9.9)	8.7 (5.7, 13.3)			
**Duraloc	1.8 (1.5, 2.2)	3.0 (2.6, 3.5)	4.1 (3.6, 4.6)	8.4 (7.6, 9.3)	15.0 (13.2, 16.9)
**Durom	1.1 (0.7, 1.9)	3.6 (2.7, 4.8)	5.4 (4.3, 6.8)	12.2 (10.2, 14.5)	
**ExpanSys	2.8 (0.7, 10.8)	5.7 (2.2, 14.4)	10.2 (5.0, 20.2)	14.9 (8.3, 26.0)	
**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)	12.4 (9.5, 16.2)		
**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)	
**MBA	4.0 (1.7, 9.4)	8.2 (4.5, 14.8)	10.2 (5.9, 17.2)	16.2 (9.9, 25.7)	
**Mitch TRH	1.5 (0.8, 2.7)	4.6 (3.3, 6.4)	7.5 (5.8, 9.7)		
**seleXys (excluding seleXys PC)	4.6 (2.9, 7.2)	7.9 (5.6, 11.2)	11.4 (8.3, 15.5)		
**SPH-Blind	3.8 (2.8, 5.2)	5.8 (4.5, 7.5)	7.3 (5.8, 9.2)	10.3 (8.5, 12.5)	

Note: * Femoral Component, **Acetabular Component
+ Newly identified and no longer used

Table IP9 Yearly Usage of Individual Total Conventional Hip Prostheses Identified as having a Higher than Anticipated Rate of Revision

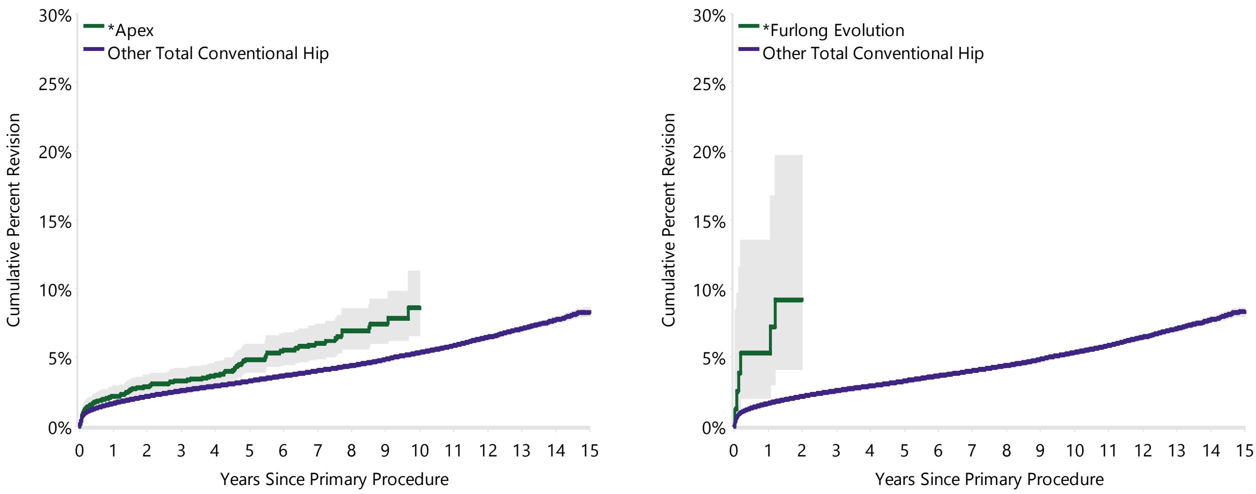
Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Newly Identified	.	.	.	.	.	.	.	.	.	.	.	.	.	.
*Apex	.	.	.	75	247	223	265	197	169	189	219	246	188	186
*Furlong Evolution	.	.	.	.	.	.	.	.	.	.	.	29	23	29
Re-Identified and still used	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Corail/Trabecular Metal (Shell)	.	.	.	.	.	5	10	17	21	8	8	8	6	1
CPT/Fitmore	.	.	19	6	6	4	16	12	15	24	14	30	30	22
CPT/Low Profile Cup	.	.	15	9	8	7	7	6	9	16	26	20	6	4
Metafix/Trinity	.	.	.	.	.	.	.	.	52	114	223	293	358	467
Profemur L/Dynasty	.	.	.	.	.	.	.	.	.	.	.	23	171	279
Taperloc Microplasty/Regenerex	.	.	.	.	.	.	.	.	12	14	12	2	3	3
*CBH Stem	.	.	12	7	14	37	28	27	45	53	43	7	.	1
*Emperion	.	.	.	1	13	21	26	65	87	72	44	53	38	40
*Excia (cless)	.	.	.	.	.	.	6	34	8	47	58	38	17	42
*Furlong	27	4	.	.	1	35	80	73	61	59	53	37	33	30
*ML Taper Kinectiv	.	.	.	.	.	.	36	341	647	576	515	384	346	252
*Novation	.	.	.	.	.	.	.	4	32	53	130	137	226	263
*Taper Fit	30	34	65	50	66	26	18	6	8	17	55	45	110	159

Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
*Trabecular Metal	.	.	.	.	6	101	147	198	242	272	276	186	221	111
*UniSyn	1	14	41	74	33	37	46	48	36	23	19	23	27	20
**Continuum	.	.	.	.	.	.	.	175	1117	1245	1333	1504	1487	1330
**Fin II	.	.	.	39	128	175	251	269	318	287	205	247	100	6
**Furlong	27	4	.	.	.	4	7	61	90	84	73	76	64	66
**Plasmacup	.	.	.	10	16	13	7	54	60	59	77	70	44	49
**Procotyl L	.	.	.	.	.	.	8	32	267	341	67	26	120	102
Identified and no longer used	.	.	.	.	.	.	.	.	.	.	.	.	.	.
+*BMHR VST	.	.	.	.	.	.	2	65	81	71	22	13	5	.
Anatomic II/Duraloc Option	.	.	.	4	33	23	.	.	.	.	.	.	.	.
Anca-Fit/Pinnacle	.	.	.	.	30	55	16	.	.	.	.	.	.	.
Friendly Hip/Cup (Exactech)	8	16	18	16	19	12	2	6	.	.	.	.	.	.
F2L/Delta-PF	.	.	7	62	28	10	.	.	.	.	.	.	.	.
H Moos/Mueller	19	.	.	.	.	.	.	.	.	.	.	.	.	.
Secur-Fit Plus/Secur-Fit	101	27	21	26	22	.	.	.	.	.	.	.	.	.
Taperloc/M2a MoM	18	79	113	74	38	43	76	49	23	2	.	.	.	.
*ABGII (exch neck)	.	.	.	.	.	10	39	69	58	63	7	.	.	.
*Adapter (ctd)	.	.	.	7	41	52	33	8	7	.	.	.	.	.
*Adapter (cless)	.	.	.	19	140	131	122	158	113	60	.	1	.	.
*Edinburgh	.	.	.	20	37	29	18	23	10	1	.	.	.	.
*Elite Plus	1609	445	353	249	112	46	26	.	.	1	.	.	.	.
*K2	.	.	.	.	1	22	80	172	204	122	.	.	.	.
*LYDERIC II	33	16	64	23	12	8	8	.	.	.	.	.	.	.
*Margron	214	123	140	96	85	28	2	.	.	.	.	.	.	.
*Mayo	10	11	14	23	24	25	29	30	2	.	.	.	.	.
*Metha (exch neck)	.	.	.	.	.	.	.	20	53	15	.	.	.	.
*MSA	.	.	.	.	.	2	3	11	58	76	46	21	7	.
*Profemur Z	.	.	41	79	56	6	1	2	1	.	.	.	.	.
**2000 Plus	.	.	.	11	23	42	14	18	25	2	.	.	.	.
**Adept	.	.	.	.	19	20	29	30	11	12	.	.	.	.
**Artek	179	.	.	.	.	.	.	.	.	.	.	.	.	.
**ASR	.	.	84	584	958	1186	1179	430	.	.	.	.	.	.
**BHR	39	66	127	288	550	581	476	404	276	134	27	13	5	.
**Bionik	.	.	.	11	147	136	138	134	38	4	.	.	.	.
**Cormet	9	53	74	103	114	73	129	124	93	26	4	1	.	.
**DeltaLox	.	.	.	.	.	.	.	.	32	86	72	24	8	.
**Duraloc	2147	907	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	37	9	.	.	.	.	.	.	.	.	.	.	.	.
**Icon	.	.	3	40	80	84	68	78	37	11	.	.	.	.
**Inter-Op	33	.	.	.	.	.	.	.	.	.	.	.	.	.
**MBA	49	29	19	11	9	5	2	.	.	.	.	.	.	.
**Mitch TRH	.	.	.	.	45	274	164	130	82	37	.	.	.	.
**seleXys (excluding seleXys PC)	.	.	.	.	35	33	20	21	53	70	89	57	13	.
**SPH-Blind	376	262	205	41	49	19	.	.	.	.	.	.	.	.

Note: * Femoral Component, **Acetabular Component
+ Newly identified and no longer used

Figure IP4 Cumulative Percent Revision of Newly Identified Individual Total Conventional Hip Prostheses

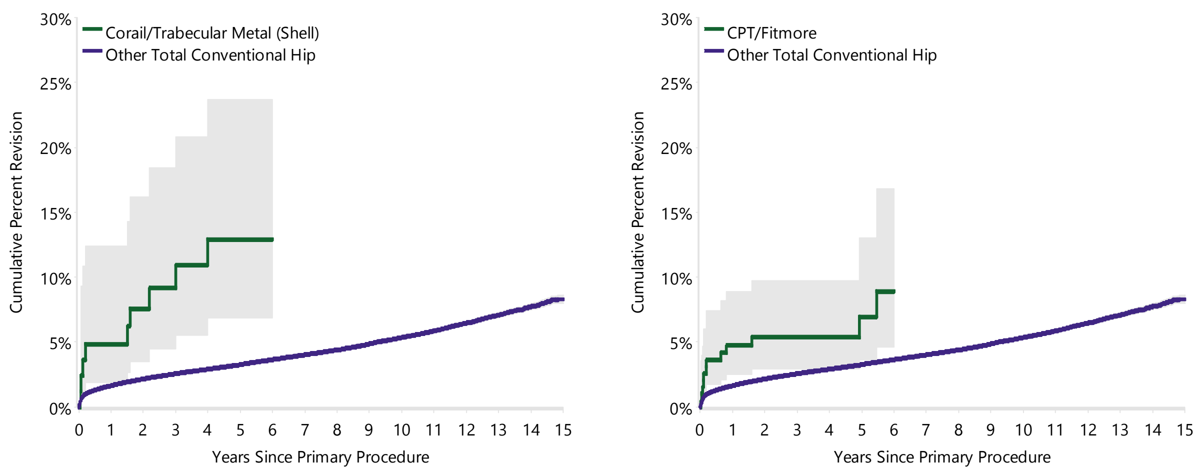
Newly Identified

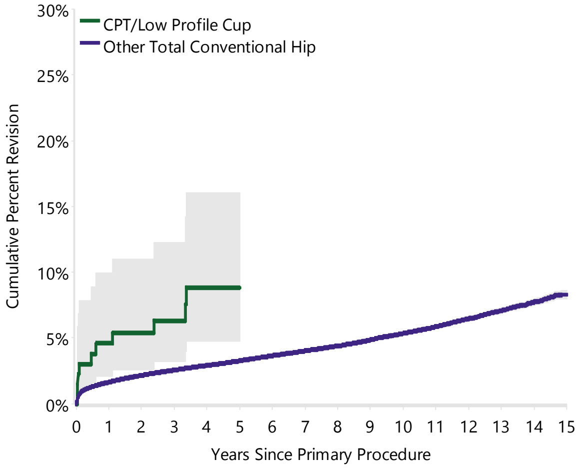


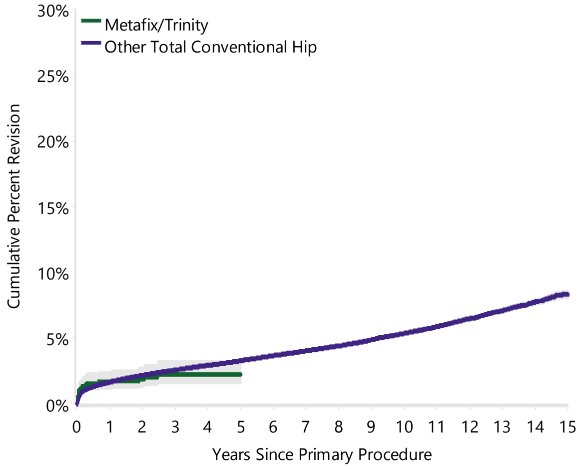
Note: * Femoral Component

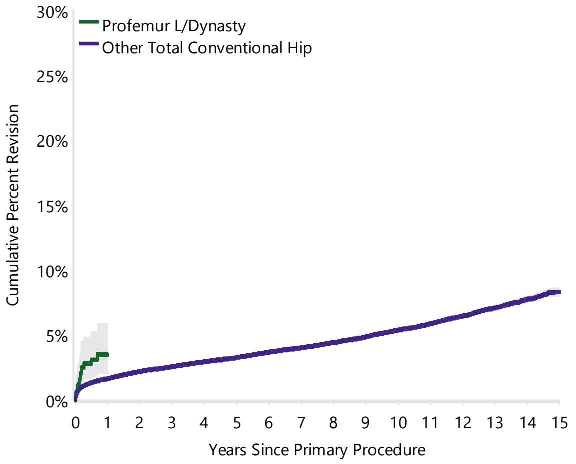
Figure IP5 Cumulative Percent Revision of Re-identified and still used Individual Total Conventional Hip Prostheses

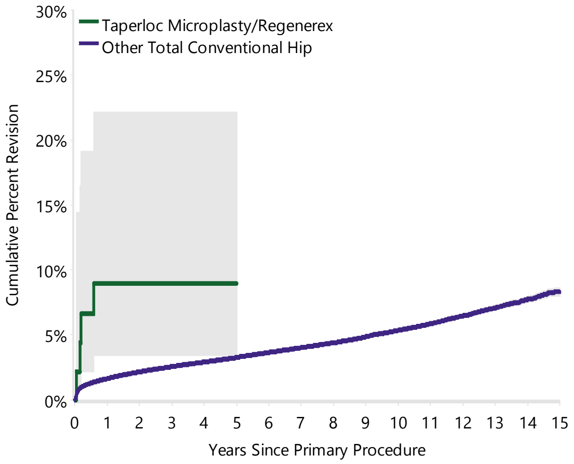
Re-identified and still used

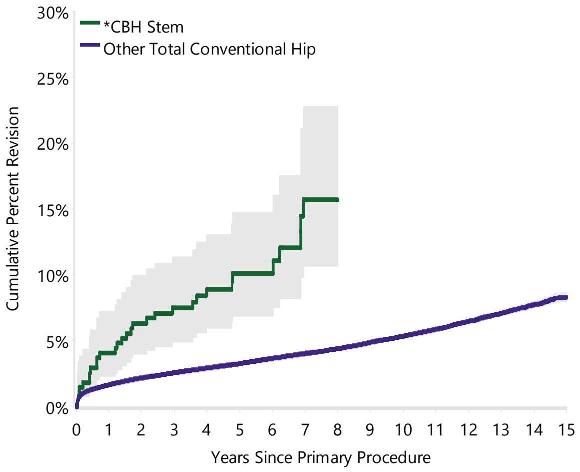


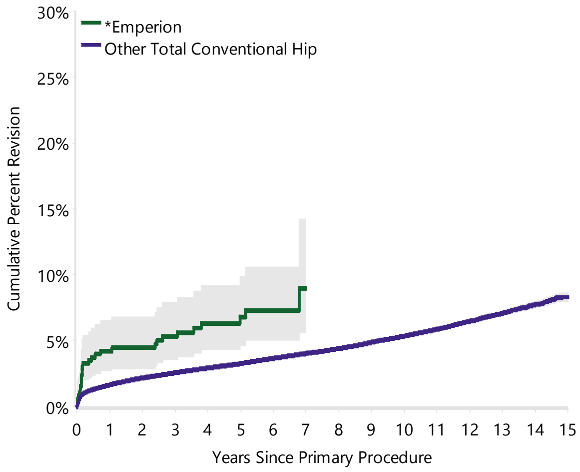

CPT/Low Profile Cup
Other Total Conventional Hip
Cumulative Percent Revision
Years Since Primary Procedure

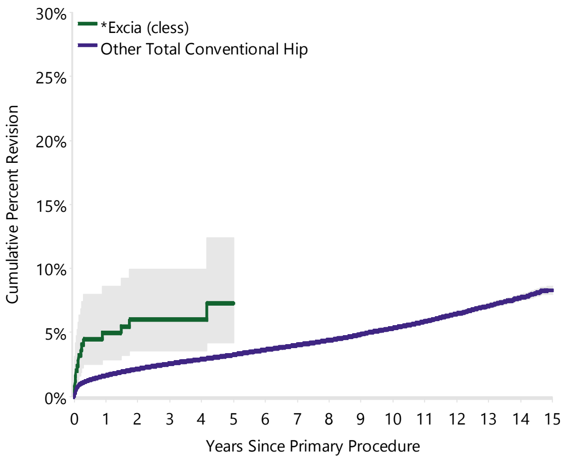

Metafix/Trinity
Other Total Conventional Hip
Cumulative Percent Revision
Years Since Primary Procedure

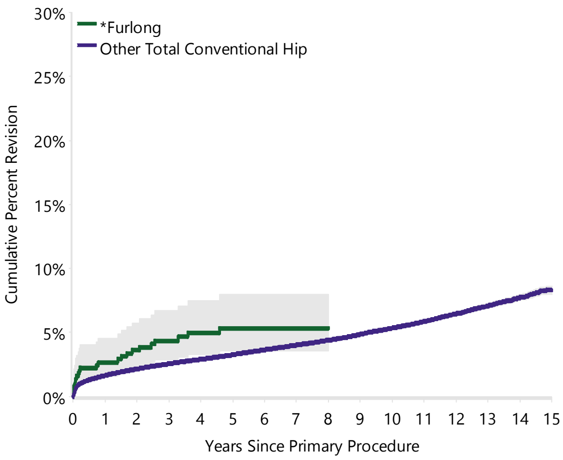

Profemur L/Dynasty
Other Total Conventional Hip
Cumulative Percent Revision
Years Since Primary Procedure

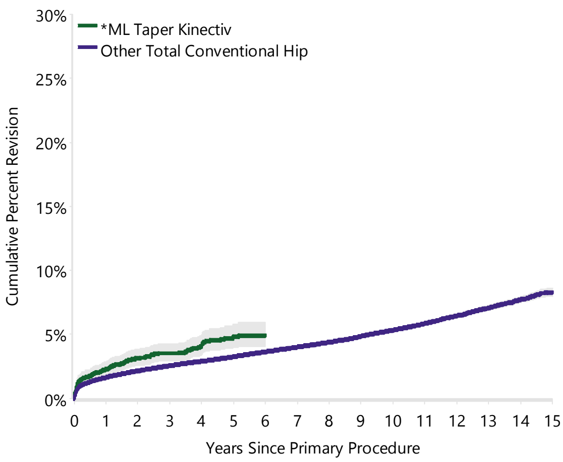

Taperloc Microplasty/Regenerex
Other Total Conventional Hip
Cumulative Percent Revision
Years Since Primary Procedure

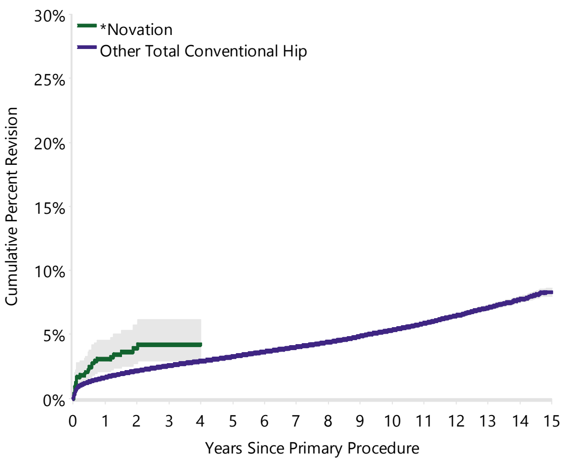

*CBH Stem
Other Total Conventional Hip
Cumulative Percent Revision
Years Since Primary Procedure

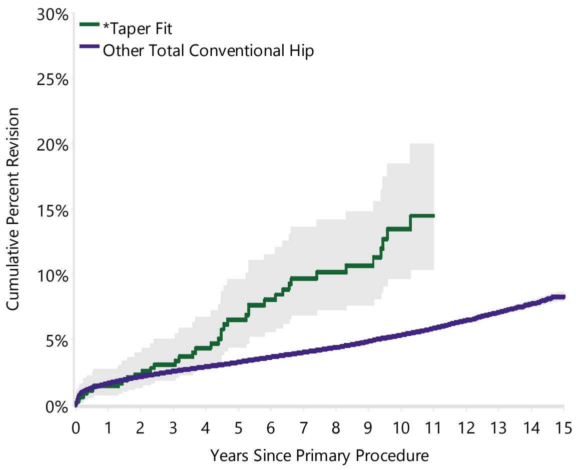

*Emperion
Other Total Conventional Hip
Cumulative Percent Revision
Years Since Primary Procedure

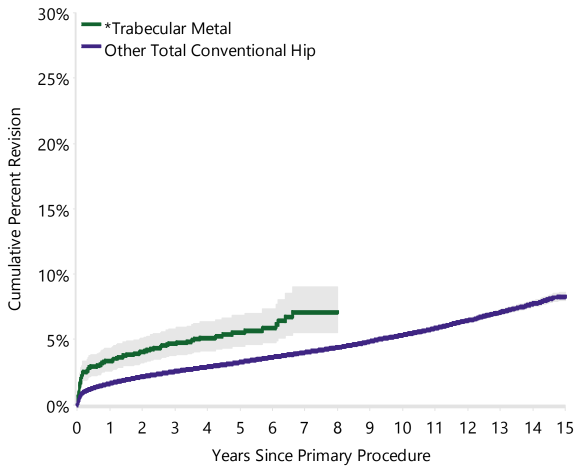

*Excia (cless)
Other Total Conventional Hip
Cumulative Percent Revision
Years Since Primary Procedure

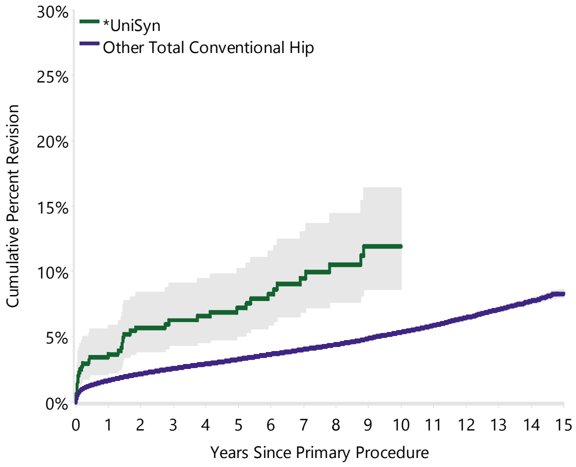

*Furlong
Other Total Conventional Hip
Cumulative Percent Revision
Years Since Primary Procedure

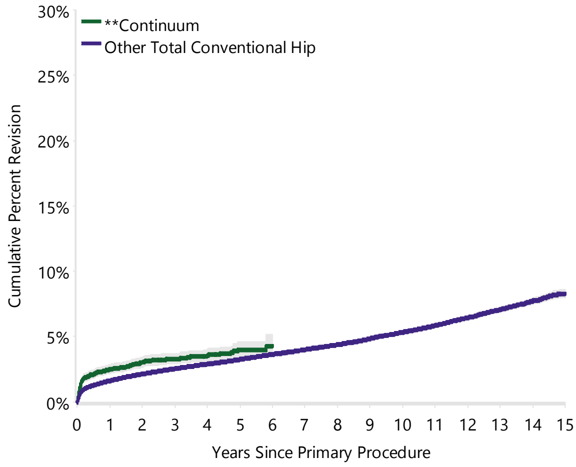

*ML Taper Kinectiv
Other Total Conventional Hip
Cumulative Percent Revision
Years Since Primary Procedure

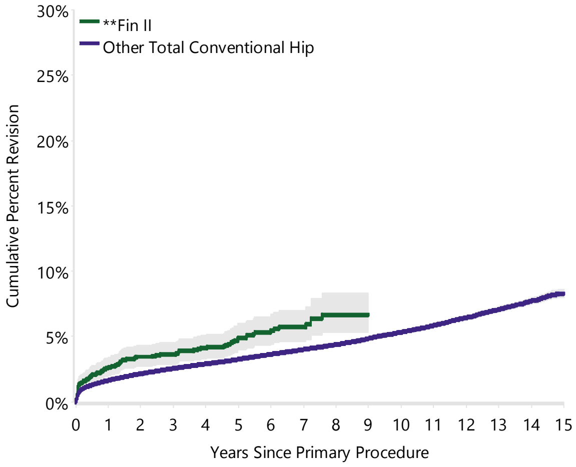

*Novation
Other Total Conventional Hip
Cumulative Percent Revision
Years Since Primary Procedure

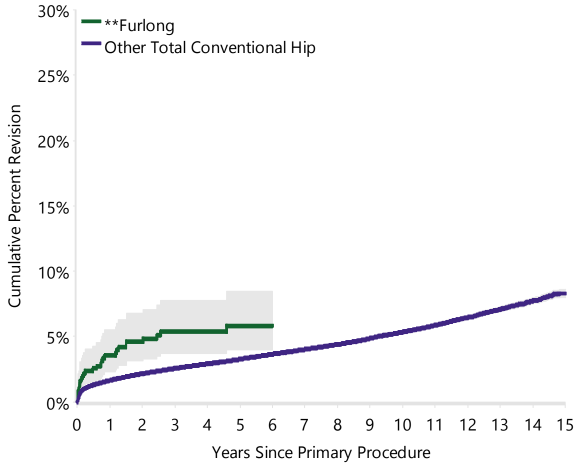

*Taper Fit
Other Total Conventional Hip
Cumulative Percent Revision
Years Since Primary Procedure

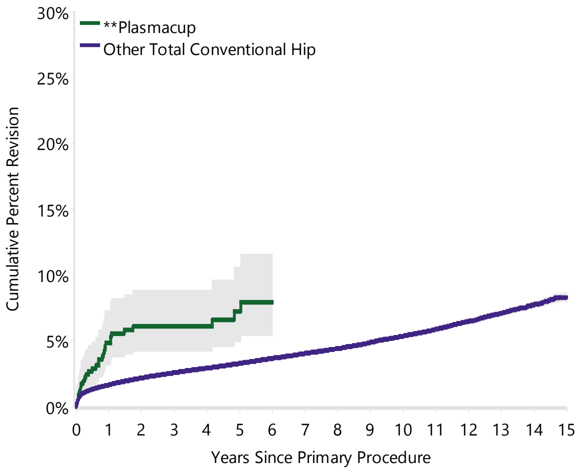

*Trabecular Metal
Other Total Conventional Hip
Cumulative Percent Revision
Years Since Primary Procedure

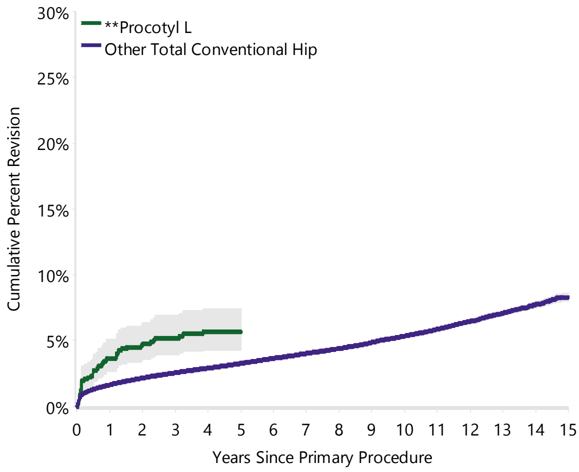












Note: * Femoral Component, **Acetabular Component

TOTAL RESURFACING

There are no newly identified total resurfacing hip prostheses.

Table IP10 Revision Rate of Individual Total Resurfacing Hip Prostheses Identified as having a Higher than Anticipated Rate of Revision

Head/Acetabular	N Revised	N Total	Obs. Yrs	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Identified and no longer used	.	.	.	.	
ASR/ASR	331	1168	9399	3.52	0 - 3Mth: HR=1.76 (1.07, 2.88),p=0.025
	.	.	.	.	3Mth - 6Mth: HR=2.16 (1.17, 4.00),p=0.013
	.	.	.	.	6Mth - 3Yr: HR=2.45 (1.83, 3.28),p<0.001
	.	.	.	.	3Yr - 4Yr: HR=4.90 (3.30, 7.27),p<0.001
	.	.	.	.	4Yr - 4.5Yr: HR=6.82 (4.29, 10.85),p<0.001
	.	.	.	.	4.5Yr - 5Yr: HR=9.09 (5.70, 14.50),p<0.001
	.	.	.	.	5Yr - 6Yr: HR=6.10 (4.28, 8.69),p<0.001
	.	.	.	.	6Yr+: HR=4.60 (3.70, 5.72),p<0.001
Bionik/Bionik	47	200	1329	3.54	Entire Period: HR=3.69 (2.75, 4.93),p<0.001
Cormet/Cormet	99	626	5089	1.95	Entire Period: HR=1.86 (1.52, 2.28),p<0.001
Durom/Durom	88	847	7492	1.17	0 - 4.5Yr: HR=1.72 (1.32, 2.23),p<0.001
	.	.	.	.	4.5Yr+: HR=0.73 (0.50, 1.08),p=0.111
Recap/Recap	24	195	1423	1.69	0 - 6Mth: HR=2.41 (1.07, 5.43),p=0.033
	.	.	.	.	6Mth - 1.5Yr: HR=5.22 (2.56, 10.65),p<0.001
	.	.	.	.	1.5Yr+: HR=0.98 (0.53, 1.83),p=0.957
*Cormet 2000 HAP	23	95	1002	2.30	Entire Period: HR=2.50 (1.66, 3.78),p<0.001

Note: All components have been compared to all other total resurfacing hip components
* Resurfacing Head Component

Table IP11 Cumulative Percent Revision of Individual Total Resurfacing Hip Prostheses Identified as having a Higher than Anticipated Rate of Revision

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs
Identified and no longer used					
ASR/ASR	3.4 (2.5, 4.6)	7.2 (5.9, 8.8)	15.3 (13.4, 17.5)	30.1 (27.4, 33.1)	
Bionik/Bionik	3.5 (1.7, 7.2)	12.0 (8.2, 17.4)	17.1 (12.5, 23.1)		
Cormet/Cormet	2.1 (1.2, 3.6)	5.6 (4.1, 7.7)	9.6 (7.5, 12.2)	16.1 (13.2, 19.5)	
Durom/Durom	3.2 (2.2, 4.6)	5.4 (4.1, 7.2)	7.5 (5.9, 9.5)	10.9 (8.9, 13.3)	
Recap/Recap	5.1 (2.8, 9.3)	8.7 (5.5, 13.7)	10.3 (6.8, 15.5)		
*Cormet 2000 HAP	6.3 (2.9, 13.5)	8.4 (4.3, 16.1)	9.5 (5.0, 17.4)	20.0 (13.3, 29.6)	

Note: * Resurfacing Head Component

Table IP12 Yearly Usage of Individual Total Resurfacing Hip Prostheses Identified as having a Higher than Anticipated Rate of Revision

Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Identified and no longer used	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ASR/ASR	.	43	165	302	258	176	133	91	.	.	.	.	.	.
Bionik/Bionik	.	.	.	12	33	33	46	54	20	2	.	.	.	.
Cormet/Cormet	62	42	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	9	42	46	38	16	3	.	.	.	.
*Cormet 2000 HAP	18	38	39	.	.	.	.	.	.	.	.	.	.	.

Note: * Resurfacing Head Component

PRIMARY PARTIAL KNEE REPLACEMENT

PATELLA/TROCHLEA

There are no newly identified patella/trochlear knee prostheses.

The PFC Sigma/Sigma HP combination is no longer identified. This combination is still used. There have been an additional seven procedures and two further revisions.

Table IP13 Revision Rate of Individual Patella/Trochlear Knee Prostheses Identified as having a Higher than Anticipated Rate of Revision

Patella/Trochlea	N Revised	N Total	Obs. Yrs	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Re-Identified and still used	.	.	.	.	
**Vanguard	10	45	164	6.10	Entire Period: HR=2.02 (1.08, 3.78),p=0.028
Identified and no longer used	.	.	.	.	
**LCS	147	413	3074	4.78	Entire Period: HR=1.68 (1.38, 2.03),p<0.001

Note: All components have been compared to all other patella/trochlear knee components
** Trochlear Component

Table IP14 Cumulative Percent Revision of Individual Patella/Trochlear Knee Prostheses Identified as having a Higher than Anticipated Rate of Revision

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs
Re-Identified and still used					
**Vanguard	2.3 (0.3, 15.1)	18.0 (8.9, 34.3)	31.7 (17.7, 52.6)		
Identified and no longer used					
**LCS	3.9 (2.4, 6.2)	11.9 (9.1, 15.4)	20.7 (17.1, 25.0)	38.7 (33.4, 44.4)	

Note: ** Trochlear Component

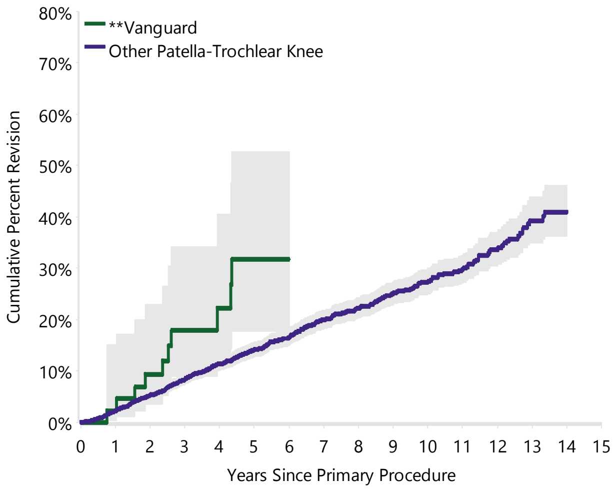
Table IP15 Yearly Usage of Individual Patella/Trochlear Knee Prostheses Identified as having a Higher than Anticipated Rate of Revision

Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Re-Identified and still used	.	.	.	.	.	.	.	.	.	.	.	.	.	.
**Vanguard	.	.	.	.	.	4	5	2	1	13	3	14	1	2
Identified and no longer used	.	.	.	.	.	.	.	.	.	.	.	.	.	.
**LCS	26	56	68	47	65	64	60	27	.	.	.	.	.	.

Note: ** Trochlear Component

Figure IP6 Cumulative Percent Revision of Re-identified and still used Individual Patella/Trochlear Knee Prostheses

Re-Identified and still used



Note: ** Trochlear Component

UNICOMPARTMENTAL

There are no newly identified unicompartmental knee prostheses.

The Eius/Eius combination is no longer identified. This combination is no longer used.

Table IP16 Revision Rate of Individual Unicompartmental Knee Prostheses Identified as having a Higher than Anticipated Rate of Revision

Femoral/Tibial	N Revised	N Total	Obs. Yrs	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Re-Identified and still used	.	.	.	.	
GMK-UNI/GMK-UNI	13	95	234	5.56	Entire Period: HR=2.93 (1.70, 5.06),p<0.001
Uniglide/Uniglide	124	743	5352	2.32	0 - 1.5Yr: HR=2.01 (1.53, 2.66),p<0.001
	.	.	.	.	1.5Yr+: HR=1.09 (0.86, 1.37),p=0.475
Identified and no longer used	.	.	.	.	
Advance/Advance	15	37	261	5.74	Entire Period: HR=3.79 (2.29, 6.30),p<0.001
BalanSys Uni/BalanSys Uni Mobile	40	199	1585	2.52	0 - 6Mth: HR=4.46 (2.22, 8.97),p<0.001
	.	.	.	.	6Mth - 2Yr: HR=2.07 (1.22, 3.50),p=0.006
	.	.	.	.	2Yr+: HR=0.99 (0.62, 1.57),p=0.963
**Preservation Mobile	120	400	3796	3.16	0 - 1.5Yr: HR=2.26 (1.62, 3.16),p<0.001
	.	.	.	.	1.5Yr - 3Yr: HR=2.77 (1.89, 4.06),p<0.001
	.	.	.	.	3Yr+: HR=1.30 (1.00, 1.68),p=0.049

Note: All components have been compared to all other unicompartmental knee components
** Unicompartmental Tibial Component

Table IP17 Cumulative Percent Revision of Individual Unicompartmental Knee Prostheses Identified as having a Higher than Anticipated Rate of Revision

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs
Re-Identified and still used					
GMK-UNI/GMK-UNI	7.2 (3.3, 15.3)	15.1 (8.5, 25.9)	24.8 (12.8, 44.6)		
Uniglide/Uniglide	4.9 (3.6, 6.7)	10.7 (8.7, 13.2)	13.0 (10.7, 15.7)	18.9 (15.9, 22.3)	
Identified and no longer used					
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)	21.5 (16.1, 28.3)	
**Preservation Mobile	5.3 (3.5, 7.9)	15.5 (12.3, 19.5)	19.1 (15.6, 23.3)	27.1 (23.0, 31.9)	

Note: ** Unicompartmental Tibial Component

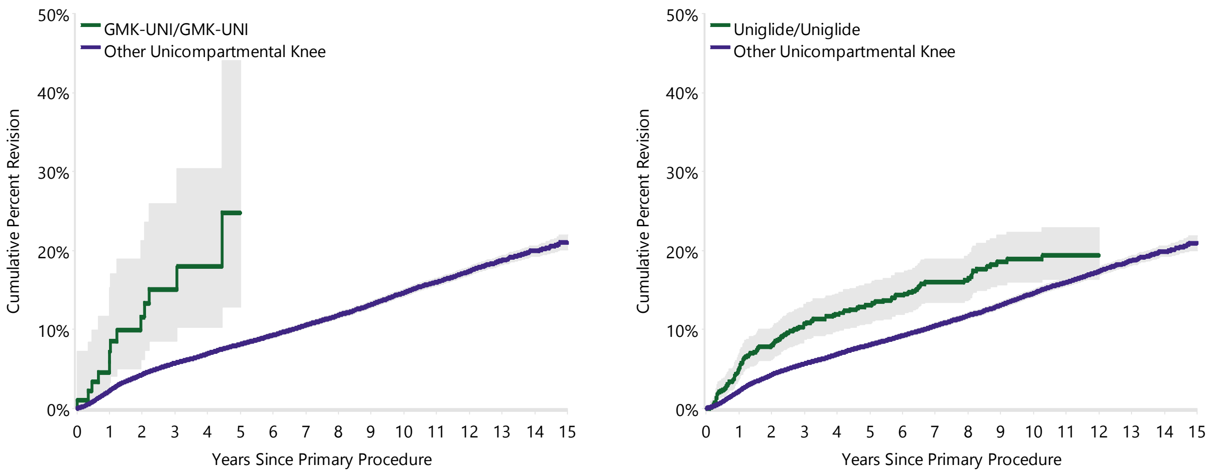
Table IP18 Yearly Usage of Individual Unicompartmental Knee Prostheses Identified as having a Higher than Anticipated Rate of Revision

Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Re-Identified and still used	.	.	.	.	.	.	.	.	.	.	.	.	.	.
GMK-UNI/GMK-UNI	.	.	.	.	.	.	5	10	2	.	21	22	16	19
Uniglide/Uniglide	.	80	66	123	84	107	93	61	30	38	25	22	9	5
Identified and no longer used	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Advance/Advance	.	13	11	7	2	3	1	.	.	.	.	.	.	.
BalanSys Uni/BalanSys Uni Mobile	.	.	37	51	63	33	9	2	4	.	.	.	.	.
**Preservation Mobile	164	121	59	26	17	13	.	.	.	.	.	.	.	.

Note: ** Unicompartmental Tibial Component

Figure IP7 Cumulative Percent Revision of Re-identified and still used Individual Unicompartmental Knee Prostheses

Re-identified and still used



PRIMARY TOTAL KNEE REPLACEMENT

There is one total knee prosthesis combination identified for the first time.

Investigation of the Active Knee was carried out after the TGA requested further information regarding a high rate of patellar component failures that had previously instigated a recall notice in 2012. When the whole class of Active Knees are considered there is not a higher than anticipated rate of revision. However, there is a higher than anticipated rate of revision if only cementless fixation is considered.

The Active Knee (cementless)/Active Knee combination has been used in 6,848 procedures since 2001. The cumulative percent revision at 10 years is 8.3%. There have been 433 revisions, 43.0% major and 57.0% minor. The main reasons for revision are loosening/lysis (24.0%), infection (14.1%) and patellofemoral pain (14.1%). While no further patellar component breakages have occurred in procedures implanted since 2012, the cementless Active Knee still has a higher than anticipated rate of revision when revisions for this unusual problem are excluded.

For the past three years, the ACS knee has been identified as having a higher than anticipated rate of revision. Last year, both the fixed bearing and mobile bearing versions were individually identified. Further analysis has demonstrated that there are also differences related to fixation. The cemented ACS knee (both fixed and mobile bearings) do not have a higher than anticipated rate of revision. The higher than anticipated rate of revision is only associated with the use of some of the cementless ACS components.

There are a number of different types of ACS cementless tibial and ACS cementless femoral components. They are classified as either Porous Coated (PC) or commercially pure titanium/tricalcium phosphate (cpTi/TCP). The higher than anticipated rates of revision are associated with PC cementless components.

For the ACS fixed bearing knee using PC femoral and PC tibial components the higher than anticipated rate of revision is evident for both hybrid (ACS femoral PC component with cemented ACS tibial component) and cementless (ACS femoral PC and ACS tibial PC components). For the ACS mobile bearing knee it is only the cementless combination (ACS femoral PC and ACS tibial PC components) that has a higher than anticipated rate of revision.

There has been no reported use of the ACS mobile tibial PC component since 2014 and therefore the ACS PC cementless/ACS PC cementless mobile bearing knee is listed as identified but no longer used. The higher than anticipated rate of revision for the fixed bearing ACS knee is evident not only for the cementless knee (ACS PC cementless/ACS PC cementless) but also when hybrid fixation is used (ACS PC cementless/ACS cemented). As the ACS PC cementless femoral components are still used, the fixed bearing ACS is listed as Identified and still used. The higher than anticipated rate of revision for the hybrid fixed bearing ACS knee is in part due to a high rate of patella revision which accounted for 50% of all revisions reported for this combination of prostheses up to the end of 2015.

Table IP19 Revision Rate of Individual Total Knee Prostheses Identified as having a Higher than Anticipated Rate of Revision

Femoral/Tibial	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Newly Identified	.	.	.	.	
Active Knee (cless)/Active Knee	433	6848	45804	0.95	0 - 3Yr: HR=1.18 (1.03, 1.34),p=0.017
	.	.	.	.	3Yr+: HR=1.77 (1.54, 2.02),p<0.001
Re-Identified and still used	.	.	.	.	
ACS (cless)/ACS Fixed	43	1110	1896	2.27	Entire Period: HR=2.19 (1.63, 2.96),p<0.001
Advance/Advance	32	657	2800	1.14	Entire Period: HR=1.48 (1.04, 2.09),p=0.027
Buechel-Pappas/Buechel-Pappas	38	479	2843	1.34	Entire Period: HR=1.86 (1.36, 2.56),p<0.001
Columbus/Columbus	81	1077	5558	1.46	Entire Period: HR=2.18 (1.75, 2.71),p<0.001
E.Motion/E.Motion	41	793	2158	1.90	0 - 1.5Yr: HR=2.75 (1.94, 3.89),p<0.001
	.	.	.	.	1.5Yr+: HR=1.16 (0.60, 2.22),p=0.664
GMK Primary (cless)/GMK Primary (cless)	19	610	1186	1.60	Entire Period: HR=1.67 (1.06, 2.62),p=0.025
Optetrak-PS/Optetrak	176	2572	15568	1.13	Entire Period: HR=1.75 (1.51, 2.03),p<0.001
Optetrak-PS/Optetrak-RBK	62	903	4710	1.32	Entire Period: HR=1.98 (1.54, 2.54),p<0.001

Femoral/Tibial	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Score (cless)/Score (cless)	73	1680	5840	1.25	Entire Period: HR=1.35 (1.07, 1.70),p=0.010
Scorpio NRG PS (cless)/Series 7000 (cless)	63	998	4715	1.34	Entire Period: HR=1.57 (1.22, 2.01),p<0.001
Trekking/Trekking	21	591	1501	1.40	0 - 1.5Yr: HR=1.81 (1.11, 2.96),p=0.017
	.	.	.	.	1.5Yr+: HR=0.90 (0.38, 2.17),p=0.817
Vanguard PS/Maxim	187	4026	15558	1.20	0 - 1.5Yr: HR=1.84 (1.52, 2.21),p<0.001
	.	.	.	.	1.5Yr+: HR=1.26 (1.01, 1.58),p=0.042
Vanguard PS/Regenerex	12	260	1047	1.15	0 - 1Yr: HR=3.20 (1.67, 6.15),p<0.001
	.	.	.	.	1Yr+: HR=0.48 (0.16, 1.50),p=0.210
*LCS PS	52	638	2794	1.86	Entire Period: HR=2.47 (1.88, 3.24),p<0.001
Identified and no longer used	.	.	.	.	
ACS/ACS Mobile PC (cless)	23	130	343	6.70	Entire Period: HR=6.64 (4.41, 9.99),p<0.001
AMK/AMK	23	203	2201	1.05	Entire Period: HR=1.97 (1.31, 2.97),p=0.001
Eska RP/Eska RP	8	40	263	3.04	Entire Period: HR=5.43 (2.73, 10.80),p<0.001
Gemini MK II/Gemini MK II	7	21	186	3.76	Entire Period: HR=6.25 (2.98, 13.10),p<0.001
Genesis (ctd)/Genesis (ctd)	9	62	586	1.53	Entire Period: HR=2.99 (1.56, 5.76),p=0.001
Genesis II CR (cless)/Profix Mobile (ctd)	28	241	2096	1.34	Entire Period: HR=2.39 (1.65, 3.46),p<0.001
Genesis II Oxinium CR (cless)/Genesis II	45	110	788	5.71	0 - 1Yr: HR=10.25 (5.95, 17.67),p<0.001
	.	.	.	.	1Yr - 1.5Yr: HR=18.02 (9.96, 32.58),p<0.001
	.	.	.	.	1.5Yr - 2.5Yr: HR=20.79 (12.52, 34.53),p<0.001
	.	.	.	.	2.5Yr+: HR=2.33 (1.04, 5.18),p=0.038
Genesis II Oxinium CR (cless)/Profix Mobile	56	88	498	11.3	0 - 6Mth: HR=7.72 (2.89, 20.58),p<0.001
	.	.	.	.	6Mth - 9Mth: HR=46.77 (25.85, 84.63),p<0.001
	.	.	.	.	9Mth - 1.5Yr: HR=32.48 (21.15, 49.88),p<0.001
	.	.	.	.	1.5Yr - 2Yr: HR=27.12 (12.91, 56.97),p<0.001
	.	.	.	.	2Yr+: HR=7.09 (4.12, 12.23),p<0.001
Genesis II Oxinium PS (ctd)/Genesis II (cless)	17	56	251	6.76	Entire Period: HR=7.70 (4.79, 12.39),p<0.001
Genesis II Oxinium PS (ctd)/Genesis II (keel)	59	269	2004	2.94	Entire Period: HR=4.71 (3.65, 6.08),p<0.001
HLS Noetos/HLS Noetos	32	294	1781	1.80	Entire Period: HR=2.64 (1.87, 3.73),p<0.001
IB II/IB II	33	199	2159	1.53	0 - 2Yr: HR=0.81 (0.26, 2.52),p=0.718
	.	.	.	.	2Yr - 2.5Yr: HR=4.55 (1.47, 14.12),p=0.008
	.	.	.	.	2.5Yr+: HR=4.48 (3.07, 6.54),p<0.001
Interax/Interax	11	52	484	2.27	0 - 3.5Yr: HR=1.42 (0.36, 5.69),p=0.617
	.	.	.	.	3.5Yr+: HR=8.54 (4.45, 16.39),p<0.001
Journey Oxinium/Journey	220	3033	16333	1.35	0 - 3Mth: HR=0.30 (0.10, 0.94),p=0.038
	.	.	.	.	3Mth - 1.5Yr: HR=1.92 (1.53, 2.40),p<0.001
	.	.	.	.	1.5Yr - 2Yr: HR=1.44 (0.93, 2.24),p=0.104
	.	.	.	.	2Yr - 2.5Yr: HR=1.88 (1.22, 2.89),p=0.004
	.	.	.	.	2.5Yr - 3.5Yr: HR=1.57 (1.05, 2.35),p=0.028
	.	.	.	.	3.5Yr+: HR=2.73 (2.17, 3.44),p<0.001
Optetrak-PS/Optetrak-PS	13	55	405	3.21	Entire Period: HR=5.86 (3.40, 10.09),p<0.001
Profix Oxinium (ctd)/Profix Mobile	25	228	2325	1.08	Entire Period: HR=1.65 (1.11, 2.44),p=0.012
Profix Oxinium (cless)/Profix Mobile	70	158	1107	6.32	Entire Period: HR=10.13 (8.01, 12.81),p<0.001
Profix Oxinium (cless)/Profix	31	75	565	5.49	Entire Period: HR=8.23 (5.79, 11.71),p<0.001
Profix/Profix Mobile	101	1005	9320	1.08	0 - 2.5Yr: HR=2.52 (1.95, 3.24),p<0.001
	.	.	.	.	2.5Yr+: HR=1.40 (1.03, 1.90),p=0.031
Rotaglide Plus/Rotaglide Plus	66	631	5993	1.10	0 - 1.5Yr: HR=1.21 (0.68, 2.12),p=0.518
	.	.	.	.	1.5Yr - 2Yr: HR=2.95 (1.47, 5.91),p=0.002
	.	.	.	.	2Yr+: HR=2.20 (1.64, 2.94),p<0.001

Femoral/Tibial	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
SAL/SAL	12	56	618	1.94	0 - 8.5Yr: HR=1.42 (0.53, 3.78),p=0.486
	.	.	.	.	8.5Yr+: HR=9.98 (4.98, 20.01),p<0.001
Trac/Trac	23	138	1434	1.60	Entire Period: HR=2.79 (1.85, 4.19),p<0.001
*LCS Duofix	565	4866	34415	1.64	0 - 2Yr: HR=1.75 (1.51, 2.03),p<0.001
	.	.	.	.	2Yr - 3.5Yr: HR=3.56 (3.03, 4.19),p<0.001
	.	.	.	.	3.5Yr - 4Yr: HR=4.80 (3.58, 6.44),p<0.001
	.	.	.	.	4Yr - 4.5Yr: HR=3.93 (2.79, 5.53),p<0.001
	.	.	.	.	4.5Yr - 5.5Yr: HR=4.52 (3.57, 5.73),p<0.001
	.	.	.	.	5.5Yr - 7Yr: HR=2.67 (2.04, 3.50),p<0.001
	.	.	.	.	7Yr+: HR=1.32 (0.84, 2.07),p=0.236
*Renasys	13	121	1020	1.27	Entire Period: HR=2.23 (1.29, 3.84),p=0.003

Note: All components have been compared to all other total knee components
* Femoral Component

Table IP20 Cumulative Percent Revision of Individual Total Knee Prostheses Identified as having a Higher than Anticipated Rate of Revision

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs
Newly Identified					
Active Knee (cless)/Active Knee	1.1 (0.9, 1.4)	3.5 (3.1, 4.0)	4.9 (4.4, 5.5)	8.3 (7.5, 9.2)	
Re-Identified and still used					
ACS (cless)/ACS Fixed	1.6 (1.0, 2.7)	6.9 (5.0, 9.6)			
Advance/Advance	2.2 (1.3, 3.8)	4.7 (3.2, 6.9)	5.3 (3.7, 7.7)	9.6 (5.9, 15.6)	
Buechel-Pappas/Buechel-Pappas	1.9 (1.0, 3.6)	5.5 (3.8, 8.0)	7.8 (5.7, 10.6)		
Columbus/Columbus	2.0 (1.3, 3.1)	6.2 (4.8, 7.9)	7.8 (6.3, 9.8)		
E.Motion/E.Motion	2.7 (1.7, 4.1)	6.6 (4.8, 8.9)	6.6 (4.8, 8.9)		
GMK Primary (cless)/GMK Primary (cless)	1.7 (0.9, 3.3)	4.2 (2.7, 6.6)			
Optetrak-PS/Optetrak	1.5 (1.1, 2.1)	4.8 (4.0, 5.8)	6.7 (5.7, 7.8)	9.7 (8.3, 11.3)	
Optetrak-PS/Optetrak-RBK	2.2 (1.4, 3.4)	5.6 (4.2, 7.5)	7.1 (5.4, 9.2)		
Score (cless)/Score (cless)	1.2 (0.8, 1.9)	4.5 (3.5, 5.8)	6.0 (4.8, 7.6)		
Scorpio NRG PS (cless)/Series 7000 (cless)	1.3 (0.7, 2.2)	5.9 (4.5, 7.7)	7.4 (5.8, 9.4)		
Trekking/Trekking	2.4 (1.4, 4.1)	3.9 (2.5, 6.2)			
Vanguard PS/Maxim	1.9 (1.5, 2.3)	4.6 (3.9, 5.3)	5.6 (4.9, 6.5)		
Vanguard PS/Regenerex	3.6 (1.9, 6.8)	4.9 (2.8, 8.6)	4.9 (2.8, 8.6)		
*LCS PS	2.1 (1.2, 3.5)	6.9 (5.2, 9.3)	9.0 (6.9, 11.7)		
Identified and no longer used					
ACS/ACS Mobile PC (cless)	7.7 (4.2, 13.9)	17.9 (12.1, 26.1)			
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)	13.2 (8.9, 19.4)
Eska RP/Eska RP	7.5 (2.5, 21.5)	12.7 (5.5, 27.9)	18.2 (9.1, 34.5)		
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)	7.4 (4.6, 11.6)	8.8 (5.8, 13.4)	12.0 (8.2, 17.4)	
Genesis II Oxinium CR (cless)/Genesis II	11.9 (7.1, 19.7)	39.2 (30.7, 49.1)	40.2 (31.6, 50.1)	41.2 (32.5, 51.2)	
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)		
Genesis II Oxinium PS (ctd)/Genesis II (keel)	4.5 (2.6, 7.7)	14.5 (10.8, 19.3)	18.7 (14.5, 23.9)		
HLS Noetos/HLS Noetos	3.4 (1.8, 6.2)	8.6 (5.9, 12.4)	10.1 (7.1, 14.2)		
IB II/IB II	0.0 (0.0, 0.0)	3.6 (1.7, 7.3)	7.8 (4.8, 12.7)	15.4 (10.9, 21.5)	
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)	4.5 (3.8, 5.3)	6.4 (5.5, 7.4)		
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)	
Profix Oxinium (ctd)/Profix Mobile	1.8 (0.7, 4.6)	6.3 (3.8, 10.4)	8.6 (5.5, 13.1)	10.9 (7.4, 15.8)	

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	15 Yrs
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 (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/Profix Mobile	2.3 (1.5, 3.4)	6.4 (5.0, 8.1)	8.2 (6.6, 10.1)	10.0 (8.2, 12.1)	
Rotaglide Plus/Rotaglide Plus	0.8 (0.3, 1.9)	4.1 (2.8, 6.0)	5.8 (4.2, 8.0)	10.9 (8.5, 13.8)	
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)	
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)	
*LCS Duofix	1.5 (1.2, 1.9)	5.9 (5.3, 6.6)	9.6 (8.8, 10.5)		
*Renasys	2.5 (0.8, 7.5)	4.2 (1.8, 9.8)	8.5 (4.6, 15.1)		

Note: * Femoral Component

Table IP21 Yearly Usage of Individual Total Knee Prostheses Identified as having a Higher than Anticipated Rate of Revision

Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Newly Identified	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Active Knee (cless)/Active Knee	221	613	790	691	468	510	483	412	479	601	500	427	318	335
Re-Identified and still used	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ACS (cless)/ACS Fixed	.	.	.	.	.	.	.	.	.	41	119	283	337	330
Advance/Advance	54	.	8	12	16	2	5	43	115	138	74	7	92	91
Buechel-Pappas/Buechel-Pappas	.	.	.	1	39	51	84	100	148	44	4	.	7	1
Columbus/Columbus	.	.	.	49	91	90	148	156	134	136	108	69	36	60
E.Motion/E.Motion	.	.	.	.	.	.	.	12	87	114	129	236	106	109
GMK Primary (cless)/GMK Primary (cless)	.	.	.	.	.	.	.	.	3	3	109	193	176	126
Optetrak-PS/Optetrak	126	130	155	252	253	216	168	202	198	202	200	151	117	202
Optetrak-PS/Optetrak-RBK	.	.	.	1	81	173	166	119	82	40	37	50	99	55
Score (cless)/Score (cless)	.	.	.	1	.	11	135	212	187	204	195	238	251	246
Scorpio NRG PS (cless)/Series 7000 (cless)	.	.	.	.	.	76	185	171	166	114	68	71	75	72
Trekking/Trekking	.	.	.	.	.	.	.	.	35	102	133	107	108	106
Vanguard PS/Maxim	.	.	.	22	82	146	318	424	479	600	561	444	512	438
Vanguard PS/Regenerex	.	.	.	.	.	.	.	4	121	54	27	15	21	18
*LCS PS	.	.	.	.	.	.	8	157	203	109	51	69	39	2
Identified and no longer used	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ACS/ACS Mobile PC (cless)	.	.	.	.	.	.	.	.	.	20	37	57	16	.
AMK/AMK	200	2	1	.	.	.	.	.	.	.	.	.	.	.
Eska RP/Eska RP	.	.	.	9	24	5	.	2	.	.	.	.	.	.
Gemini MK II/Gemini MK II	14	7	.	.	.	.	.	.	.	.	.	.	.	.
Genesis (ctd)/Genesis (ctd)	45	6	3	8	.	.	.	.	.	.	.	.	.	.
Genesis II CR (cless)/Profix Mobile (ctd)	126	26	10	4	2	5	12	6	9	17	2	22	.	.
Genesis II Oxinium CR (cless)/Genesis II	4	106	.	.	.	.	.	.	.	.	.	.	.	.
Genesis II Oxinium CR (cless)/Profix Mobile	22	66	.	.	.	.	.	.	.	.	.	.	.	.
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	187	12	.	.	.	.	.	.	.	.	.	.	.	.
Interax/Interax	52	.	.	.	.	.	.	.	.	.	.	.	.	.
Journey Oxinium/Journey	.	.	.	.	134	337	541	555	464	334	343	325	.	.
Optetrak-PS/Optetrak-PS	.	.	8	14	18	15	.	.	.	.	.	.	.	.
Profix Oxinium (ctd)/Profix Mobile	72	31	91	24	3	4	1	2	.	.	.	.	.	.
Profix Oxinium (cless)/Profix Mobile	63	95	.	.	.	.	.	.	.	.	.	.	.	.

Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Profix Oxinium (cless)/Profix	10	65	.	.	.	.	.	.	.	.	.	.	.	.
Profix/Profix Mobile	197	173	258	245	51	56	11	12	2	.	.	.	.	.
Rotaglide Plus/Rotaglide Plus	181	151	110	101	43	30	15	.	.	.	.	.	.	.
SAL/SAL	56	.	.	.	.	.	.	.	.	.	.	.	.	.
Trac/Trac	128	9	1	.	.	.	.	.	.	.	.	.	.	.
*LCS Duofix	.	.	.	.	843	1636	1532	854	1	.	.	.	.	.
*Renasys	.	.	.	51	53	3	14	.	.	.	.	.	.	.

Note: * Femoral Component

Figure IP8 Cumulative Percent Revision of Newly Identified Individual Total Knee Prostheses

Newly identified

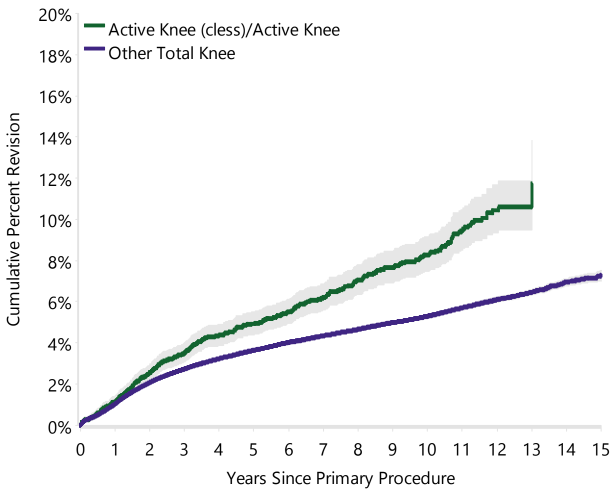
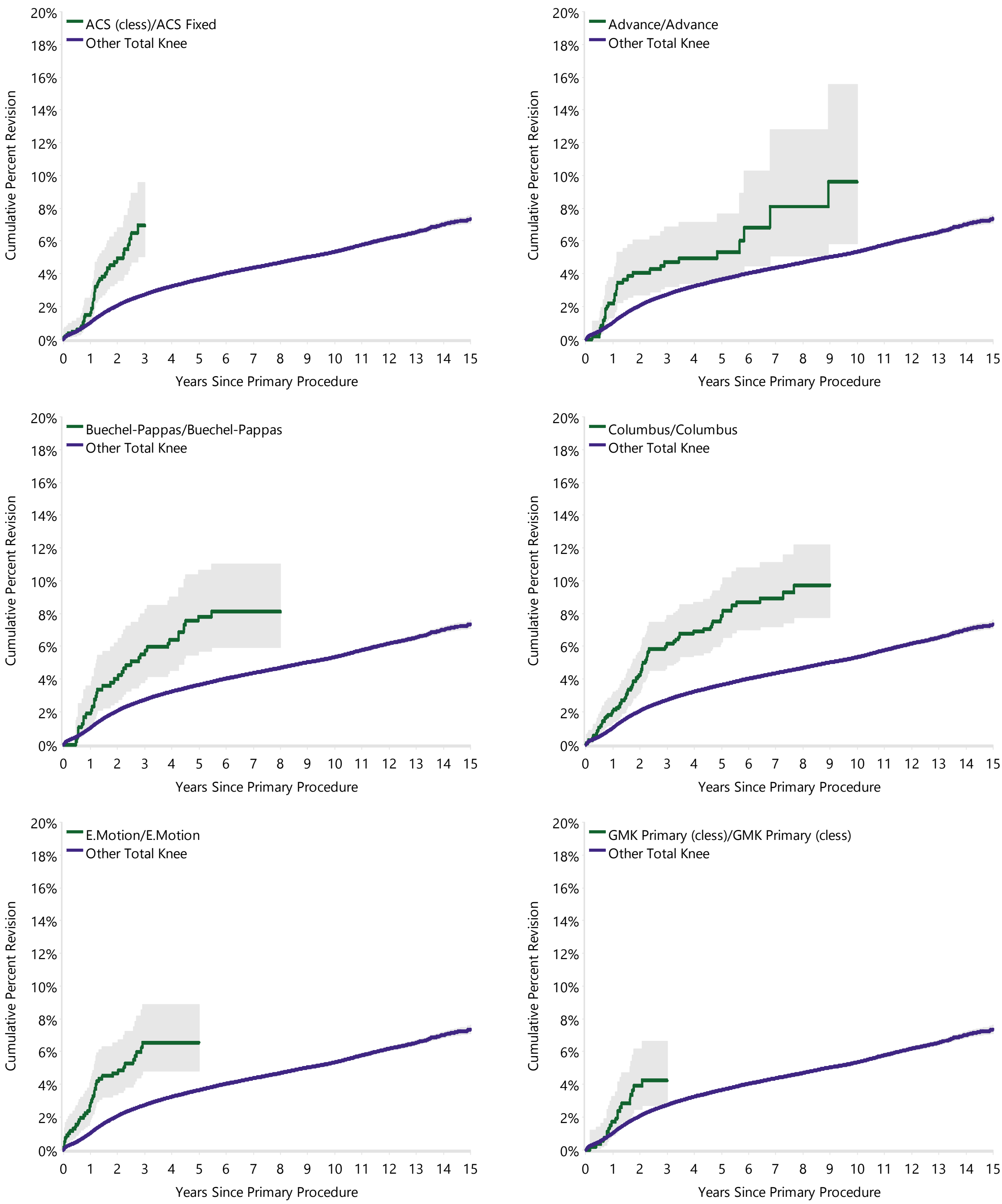
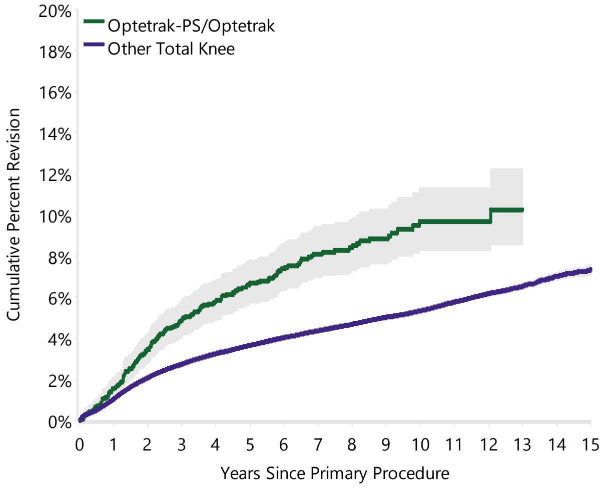


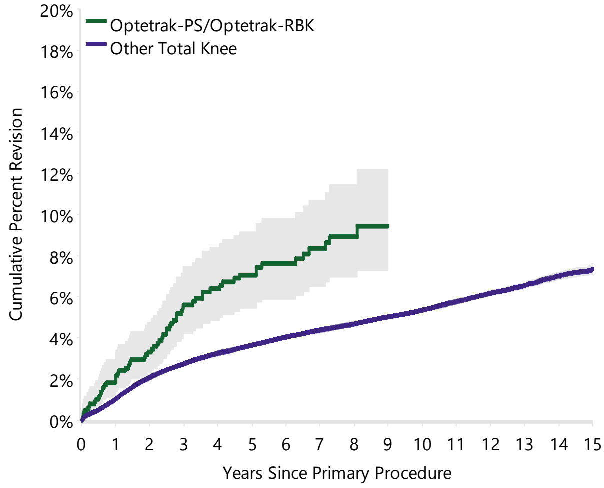
Figure IP9 Cumulative Percent Revision of Re-identified and still used Individual Total Knee Prostheses

Re-identified and still used

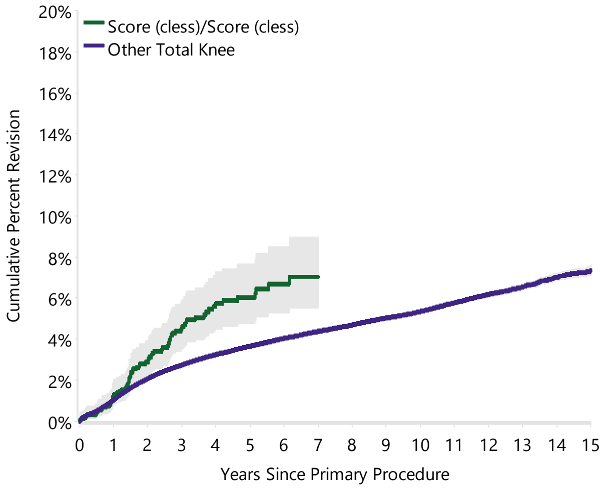




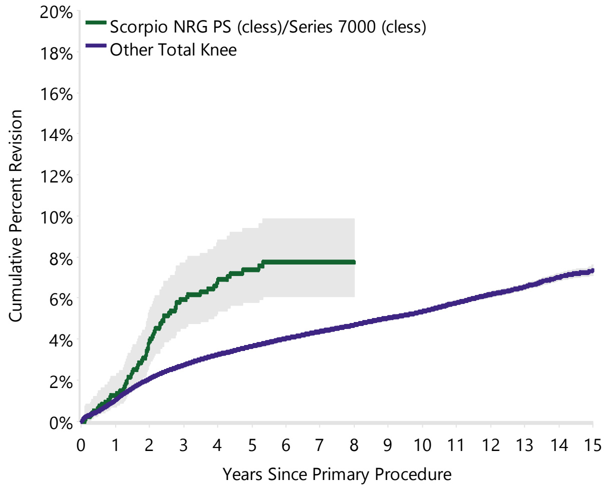
Optetrak-PS/Optetrak
Other Total Knee
Cumulative Percent Revision
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Years Since Primary Procedure



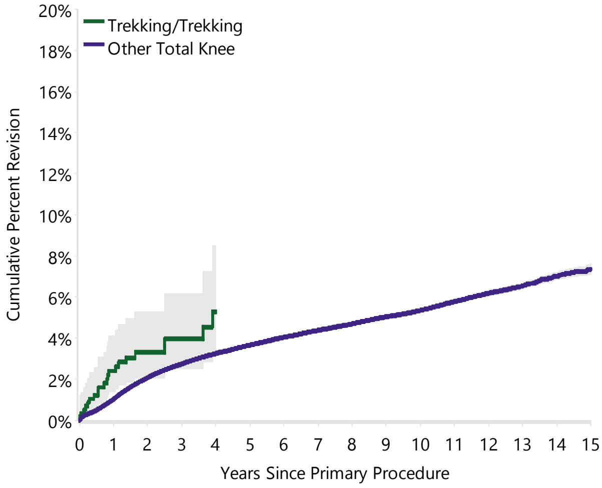
Optetrak-PS/Optetrak-RBK
Other Total Knee
Cumulative Percent Revision
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Years Since Primary Procedure

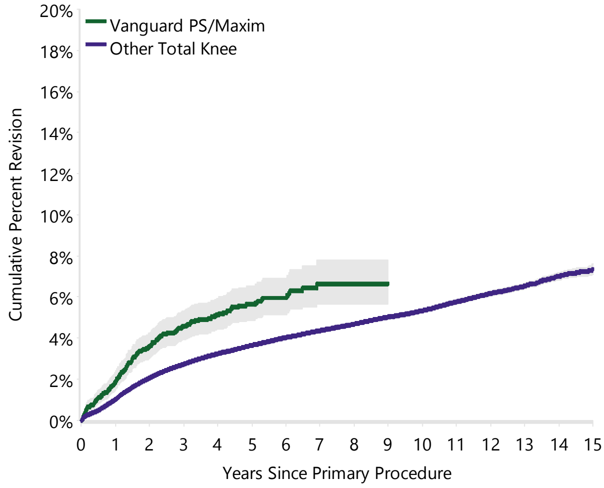


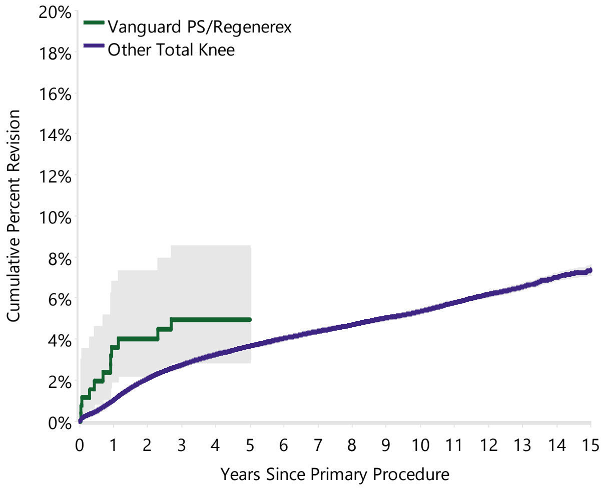
Score (cless)/Score (cless)
Other Total Knee
Cumulative Percent Revision
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Years Since Primary Procedure

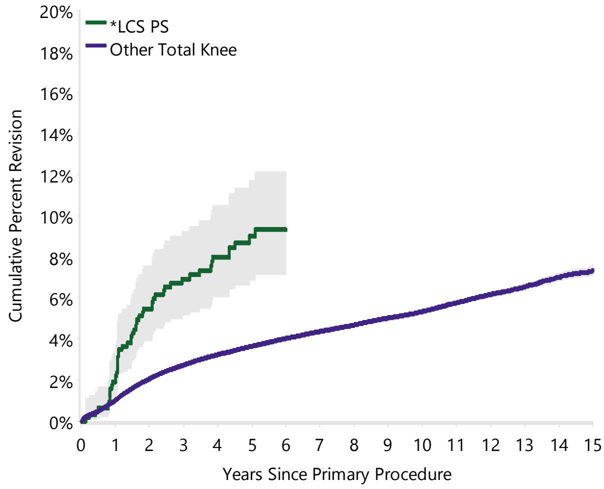


Scorpio NRG PS (cless)/Series 7000 (cless)
Other Total Knee
Cumulative Percent Revision
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Years Since Primary Procedure









Note: * Femoral Component

PRIMARY PARTIAL SHOULDER REPLACEMENT

HEMI STEMMED

There are no newly identified hemi stemmed shoulder prostheses.

Table IP22 Revision Rate of Individual Hemi Stemmed Shoulder Prostheses Identified as having a Higher than Anticipated Rate of Revision

Humeral/Head	N Revised	N Total	Obs. Yrs	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Re-Identified and still used	.	.	.	.	
Delta Xtend/Delta Xtend	8	58	205	3.90	Entire Period: HR=2.20 (1.09, 4.44),p=0.028
Global Unite/Global Unite	11	112	174	6.31	Entire Period: HR=1.97 (1.07, 3.63),p=0.028

Note: All components have been compared to all other hemi stemmed shoulder components

Table IP23 Cumulative Percent Revision of Individual Hemi Stemmed Shoulder Prostheses Identified as having a Higher than Anticipated Rate of Revision

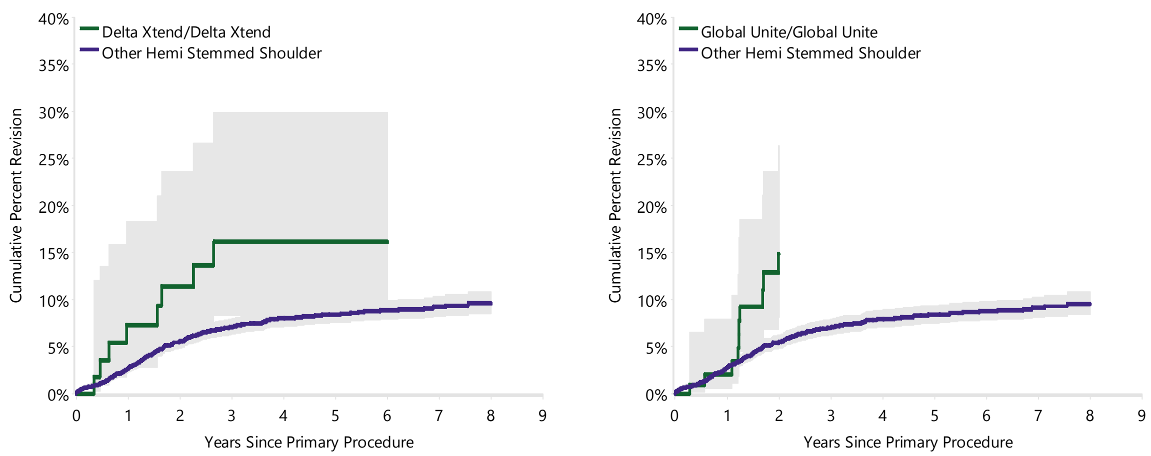
CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Re-Identified and still used					
Delta Xtend/Delta Xtend	7.3 (2.8, 18.3)	16.1 (8.3, 29.9)	16.1 (8.3, 29.9)		
Global Unite/Global Unite	2.0 (0.5, 7.9)				

Table IP24 Yearly Usage of Individual Hemi Stemmed Shoulder Prostheses Identified as having a Higher than Anticipated Rate of Revision

Year of Implant	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Re-Identified and still used	.	.	.	.	.	.	.	.	.	.	.	.
Delta Xtend/Delta Xtend	.	.	.	2	5	9	9	5	10	7	6	5
Global Unite/Global Unite	.	.	.	.	.	.	.	.	15	37	25	35

Figure IP10 Cumulative Percent Revision of Re-Identified and Still Used Hemi Stemmed Shoulder Prostheses

Re-Identified and still used



PRIMARY TOTAL SHOULDER REPLACEMENT

TOTAL CONVENTIONAL

There are no newly identified total conventional shoulder prostheses.

Table IP25 Revision Rate of Individual Total Conventional Shoulder Prostheses Identified as having a Higher than Anticipated Rate of Revision

Humeral Stem/Glenoid	N Revised	N Total	Obs. Yrs	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Re-Identified and still used	.	.	.	.	
SMR/SMR L1	156	1558	5508	2.83	Entire Period: HR=1.80 (1.50, 2.15),p<0.001
Identified and no longer used	.	.	.	.	
SMR/SMR L2	244	856	3331	7.32	0 - 1.5Yr: HR=4.42 (3.54, 5.51),p<0.001
	.	.	.	.	1.5Yr+: HR=8.97 (7.04, 11.42),p<0.001
Univers 3D/Univers 3D	11	34	213	5.17	Entire Period: HR=3.84 (2.11, 6.97),p<0.001
Vaios/Vaios	10	36	114	8.74	Entire Period: HR=4.42 (2.36, 8.25),p<0.001

Note: All components have been compared to all other total conventional shoulder components

Table IP26 Cumulative Percent Revision of Individual Total Conventional Shoulder Prostheses Identified as having a Higher than Anticipated Rate of Revision

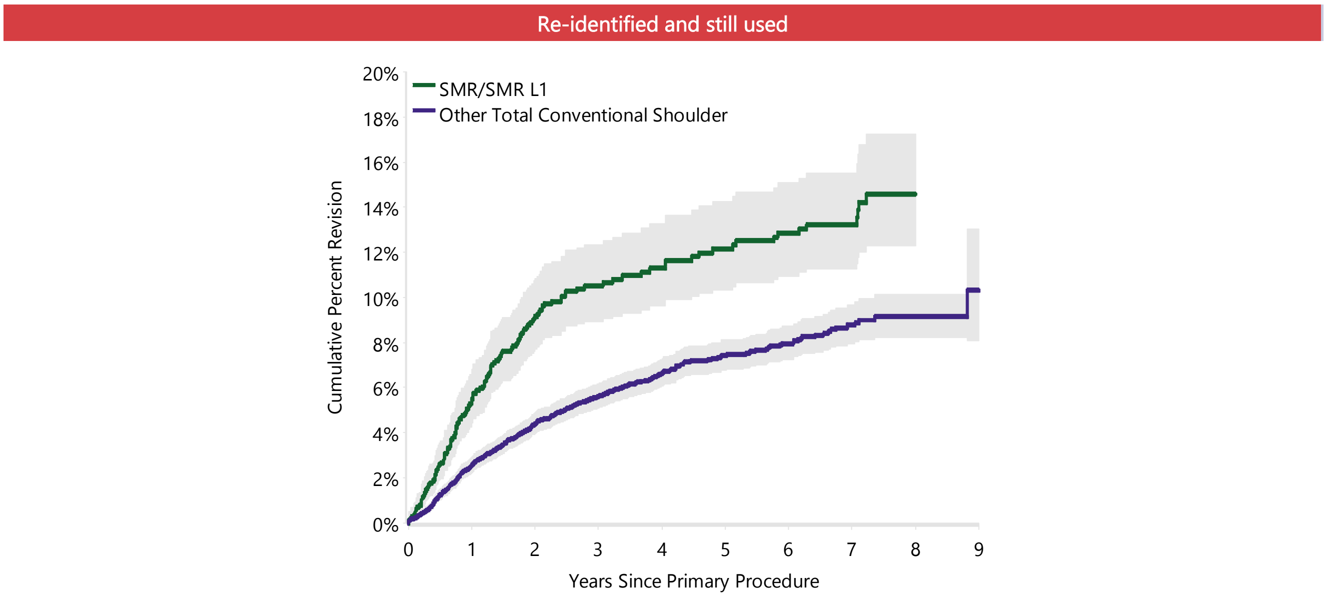
CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Re-Identified and still used					
SMR/SMR L1	5.4 (4.4, 6.7)	10.5 (8.9, 12.4)	12.2 (10.3, 14.3)	13.2 (11.3, 15.5)	
Identified and no longer used					
SMR/SMR L2	9.5 (7.7, 11.7)	22.2 (19.6, 25.2)	29.5 (26.4, 32.8)		
Univers 3D/Univers 3D	5.9 (1.5, 21.5)	14.7 (6.4, 31.8)	21.2 (10.7, 39.4)	31.0 (18.0, 50.1)	
Vaios/Vaios	13.9 (6.0, 30.2)	25.4 (14.1, 43.2)			

Table IP27 Yearly Usage of Individual Total Conventional Shoulder Prostheses Identified as having a Higher than Anticipated Rate of Revision

Year of Implant	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Re-Identified and still used	.	.	.	.	.	.	.	.	.	.	.	.
SMR/SMR L1	.	.	16	119	237	247	.	.	157	300	253	229
Identified and no longer used	.	.	.	.	.	.	.	.	.	.	.	.
SMR/SMR L2	.	.	.	.	.	43	343	336	134	.	.	.
Univers 3D/Univers 3D	.	1	6	16	11	.	.	.	.	.	.	.
Vaios/Vaios	.	.	.	.	.	.	.	16	17	2	1	.

Note: The SMR L1 was not used in 2010 and 2011 due to the exclusive use of the SMR L2 in total conventional shoulder replacement

Figure IP11 Cumulative Percent Revision of Re-identified and still used Individual Total Conventional Shoulder Prostheses



PRIMARY TOTAL REVERSE SHOULDER REPLACEMENT

There are no newly identified total reverse shoulder prostheses.

Table IP28 Revision Rate of Individual Total Reverse Shoulder Prostheses Identified as having a Higher than Anticipated Rate of Revision

Humeral Stem/Glenoid	N Revised	N Total	Obs. Yrs	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Re-Identified and still used	.	.	.	.	
SMR/SMR L1	128	2812	7340	1.74	Entire Period: HR=1.48 (1.20, 1.82),p<0.001

Note: All components have been compared to all other total reverse shoulder components

Table IP29 Cumulative Percent Revision of Individual Total Reverse Shoulder Prostheses Identified as having a Higher than Anticipated Rate of Revision

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Re-Identified and still used					
SMR/SMR L1	3.7 (3.1, 4.6)	5.0 (4.1, 6.0)	5.9 (4.8, 7.2)	6.5 (5.3, 8.0)	

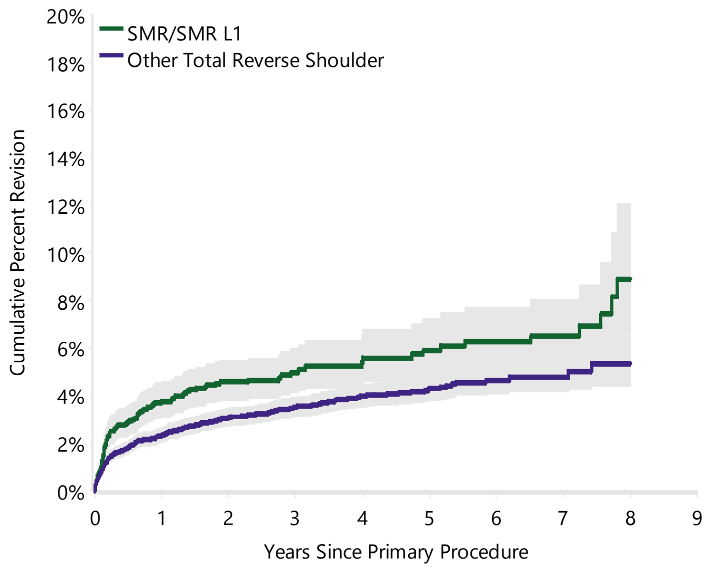
Table IP30 Yearly Usage of Individual Total Reverse Shoulder Prostheses Identified as having a Higher than Anticipated Rate of Revision

Year of Implant	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Re-Identified and still used	.	.	.	.	.	.	.	.	.	.	.	.
SMR/SMR L1	.	2	19	124	261	271	.	.	249	562	620	704

Note: The SMR L1 was not used in 2010 and 2011 due to the exclusive use of the SMR L2 in Total Reverse Shoulder Replacement

Figure IP12 Cumulative Percent Revision of Re-identified and still used Individual Total Reverse Shoulder Prostheses

Re-identified and still used



PRIMARY TOTAL ANKLE REPLACEMENT

There are no newly identified total ankle prostheses.

Table IP31 Revision Rate of Individual Total Ankle Prostheses Identified as having a Higher than Anticipated Rate of Revision

Talar/Tibial Tray	N Revised	N Total	Obs. Yrs	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Re-Identified and still used	.	.	.	.	
S.T.A.R/S.T.A.R	7	44	107	6.52	Entire Period: HR=2.64 (1.23, 5.66),p=0.012

Note: All components have been compared to all other total ankle components

Table IP32 Cumulative Percent Revision of Individual Total Ankle Prostheses Identified as having a Higher than Anticipated Rate of Revision

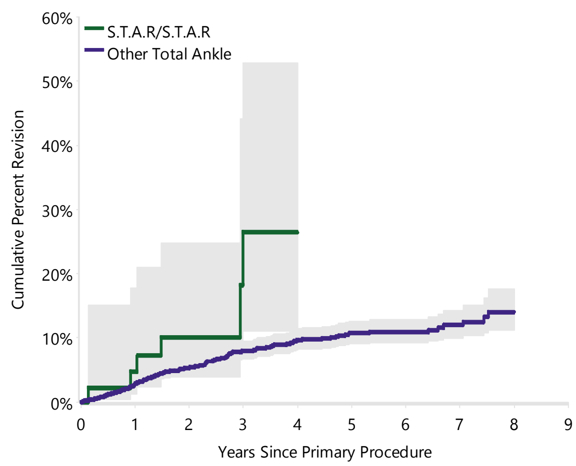
CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Re-Identified and still used					
S.T.A.R/S.T.A.R	4.8 (1.2, 17.8)	26.4 (11.0, 55.5)			

Table IP33 Yearly Usage of Individual Total Ankle Prostheses Identified as having a Higher than Anticipated Rate of Revision

Year of Implant	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Re-Identified and still used	.	.	.	.	.	.	.	.	.	.
S.T.A.R/S.T.A.R	.	1	.	3	3	4	2	15	12	4

Figure IP13 Cumulative Percent Revision of Re-identified and still used Individual Total Ankle Prostheses

Re-Identified and still used



Appendices

APPENDIX 1

PARTICIPATING HOSPITALS & COORDINATORS

VICTORIA

PUBLIC HOSPITALS

Austin Health	Ross Kentish/Bev Murray
Bairnsdale Regional Health Service	Sian Guns
Ballarat Health Services	Bernie Anderson/Kellie Livingston
Bass Coast Regional Health	Debbie Rogers/Simonne Liberman
Bendigo Health Care Group	Catherine Jensen/Shelly Sharp
Box Hill Hospital	Helga Ploschke
Cohuna District Hospital	Karyn Storm
Colac Area Health	Amanda Tout
Dandenong Hospital	Karen Ferguson/Melanie Murray
Djerriwarrh Health Services	Linda Aykens/Judy Dehnert
East Grampians Health Service	Jane Smith/Jenny Sargent
Echuca Regional Health	Kerryn Giorgianni
Goulburn Valley Health	Cara Disint
Hamilton Base Hospital	Rosalie Broadfoot
Kyabram & District Health Services	Lynda Walker
Latrobe Regional Hospital	Simone Lovison
Maroondah Hospital	Satish Singh
Mildura Base Hospital	Katrina Allen
Monash Medical Centre, Clayton	Candice Brown
Monash Medical Centre, Moorabbin	Carol Jackson/Lisa Mason
Northeast Health Wangaratta	Lynn Reid/Larissa Benci
Peninsula Health Service, Frankston	Donna Anderson
Portland Hospital	Julie Sealey
Sandringham & District Memorial	Rebecca Harouche
Seymour District Memorial Hospital	Karen Lamaro
South West Healthcare	Tony Kelly
St Vincent's Public Hospital	Shazeli Osman/Ridwaan Khan
Stawell Regional Health	Sue Campigli/Barb Savage
Sunshine Hospital	Cassandra Mules
Swan Hill District Hospital	Helen Wilkins
The Alfred	Caroline McMurray
The Geelong Hospital, Barwon Health	Michelle Quinn/David Barber
The Northern Hospital	Siew Perry
The Royal Children's Hospital	Sonia Mouat
The Royal Melbourne Hospital	Abigail Ryburn
West Gippsland Healthcare Group	Stefanie Backman/Bernie Norman
West Wimmera Health Service	Sharon Sanderson/Christine Dufty
Western Hospital	Vicki Mahaljcek/Cassandra Mules
Williamstown Hospital	Paul Buso/Maureen Clark
Wimmera Health Care Group	Maree Markby

PRIVATE HOSPITALS

Beleura Private Hospital	Jean Leyland
Bellbird Private Hospital	Belinda Van Denberg
Cabrini Private Hospital, Brighton	Jodie Reynolds
Cabrini Private Hospital, Malvern	Jodie Reynolds
Como Private Hospital	Gillian Wilson/Nicole Groves
Cotham Private Hospital	Marianne Westley
Epworth Hospital	Lynne Moyes
Epworth Eastern Hospital	Kylie Longley/Janine Cope
Epworth Freemason Hospital	Claudia Nozzolillo
Essendon Private Hospital	Elaine Jordan
Geelong Private Hospital	Wilna Steyn
Glenferrie Private Hospital	Samantha Jervios
John Fawkner Hospital	Belinda Emmett
Knox Private Hospital	Bronwyn Hawkins/Laura Tilley
Linacre Private Hospital	Melissa Dillon/Denice Tyler
Maryvale Private Hospital	Glenda Chambers
Masada Private Hospital	Anna Bonato/Lisa Butler
Melbourne Private Hospital	Karen Grant/Tracey Perkins
Mildura Private Hospital	Sue Malcolm
Mitcham Private Hospital	Julie Nankivell/Joshie Lonthyil
Northpark Private Hospital	Kath Morris
Peninsula Private Hospital	Ruth Honan
Ringwood Private Hospital	Carol Burns
Shepparton Private Hospital	Niki Miller
St John of God Ballarat Hospital	Gitty Mathachan
St John of God Bendigo Hospital	Margaret Brown
St John of God Geelong Hospital	Colin Hay
St John of God Warrnambool	Leanne McPherson/Gill Wheaton
St John of God Hospital, Berwick	Rebecca Jamieson
St Vincent's Private East Melb	Jan Gammon
St Vincent's Private Fitzroy	N Carter/D Dellevirgini/K Kellett
St Vincent's Private Kew	Nicole Campbell
The Avenue Hospital	John Davidson
The Bays	Romany Goonan
The Melbourne East Private	Jay Phillpotts
The Valley Private Hospital	Anthony Puzon
Wangaratta Private Hospital	Janet McKie
Warringal Hospital	Marilyn Dey/Annabelle Coretico
Waverley Private Hospital	Anna Gottliebsen
Western Private Hospital	Rachel Cassar

NEW SOUTH WALES

PUBLIC HOSPITALS

Albury Base Hospital	Elwyn Black
Armidale Hospital	Cheryl Fardon
Bankstown/Lidcombe Hospital	Karen Och
Bathurst Base Hospital	Kylie Peers
Bega District Hospital	Lena Lee
Blacktown Hospital	June Tsang
Bowral and District Hospital	Barbara Wise
Broken Hill Health Service	Sue Beahl/Brock Roberts
Campbelltown Hospital	Susan Birch
Canterbury Hospital	Jenny Cubitt
Coffs Harbour Health Campus	Annie Fitzgerald
Concord Repatriation Hospital	David Debello
Dubbo Base Hospital	Kathy Chapman
Fairfield Hospital	Caroline Youkhana
Gosford Hospital	Kirstie Brown/Toni Hoad
Goulburn Base Hospital	Karen Goode/Debbie Hay
Grafton Base Hospital	Anthony Corkett
Hornsby & Ku-Ring-Gai Hospital	Bessie Chu
Inst Rheum & Orthopaedic Surgery	Maria Hatziandreou/Elena Katz
John Hunter Hospital	Felicia Bristow
Lismore Base Hospital	Glen Nettle
Liverpool Health Service	John Murphy
Maitland Hospital	Karen Cheers
Manly District Hospital	Heather Liddle/Maryann Howell
Manning Rural Referral Hospital	Grahame Cooke
Mona Vale Hospital	Bronwyn Friend
Mt Druitt Hospital	Charmaine Boyd
Murwillumbah District Hospital	Linda Gahan
Nepean Hospital	Debbie Dobbs
Orange Health Service	Alexandra Woods
Port Macquarie Base Hospital	Pam Campbell/Jo Atkins
Royal Newcastle Centre	Graham Cutler
Royal North Shore Hospital	Kay Crawford
Royal Prince Alfred Hospital	Lisa Hatton/Jennifer Wilkie
Ryde Hospital	Karen Jones
Shoalhaven District Memorial Hospital	Leanne McTavish
St George Hospital	Simon Cheng
St Vincent's Public Hospital	MT Butler/L Black/A Baker
Sutherland Hospital	Sara Hogan
Tamworth Base Hospital	David Marsh
The Children's Hospital Westmead	Ariella Galstaun
The Prince of Wales Hospital	F O'Brien/C Castillo/C Noema
The Tweed Hospital	Amanda Budd/Neroli Prestage
Wagga Wagga Base Hospital	Alison Giese/Melissa O'Reilly
Westmead Public Hospital	Dee Martic
Wollongong Hospital	Carol Jackson
Wyong Hospital	Marilyn Randall

PRIVATE HOSPITALS

Albury Wodonga Private Hospital	Ben Sutton
Armidale Private Hospital	Katherine Latter
Baringa Private Hospital	Lesley Berry
Bathurst Private Hospital	Diane Carter
Berkeley Vale Private Hospital	Michelle Turner
Brisbane Waters Private Hospital	Adele Ryan
Calvary Health Care Riverina	Annette Somerville
Campbelltown Private Hospital	Yvonne Quinn
Dalcross Adventist Hospital	Anne Carroll/Kerrie Legg
Delmar Private Hospital	Cathy Byrne
Dubbo Private Hospital	Sallie Cross/Kim Troth
Dudley Private Hospital	Michele Englart/Pam Fullgrabe
East Sydney Private	Dane Browne/Jane Telfer
Forster Private Hospital	Sue Ross
Gosford Private Hospital	Melissa McLean
Hawkesbury District Health Service	Sharon Garden/Elizabeth Jones
Holroyd Private Hospital	Christine Aldana
Hospital for Specialist Surgery	Hailey MacAllister
Hunters Hill Private	Jenny May
Hunter Valley Private	Renae Ross
Hurstville Private	Rima Chaurasia
Insight Clinic Private Hospital	Debbie van de Stadt
Kareena Private Hospital	Tanja Radic
Lake Macquarie Private Hospital	Robert Reddie/Fiona Lindsay
Lingard Private Hospital	Nicole Garland
Maitland Private Hospital	Martine Mead
Macquarie University Hospital	Simmy Masuku
Mayo Private Hospital	Janet Hickman
National Day Surgery Sydney	Stephanie Schofield/Kerry Gardner
Nepean Private Hospital	Lauren Bradford
Newcastle Private Hospital	Darren Fogarty
North Shore Private Hospital	Satheesh Jose/Joanne Gregg
Norwest Private Hospital	Lucy Richardson
Nowra Private Hospital	Linda Wright
Port Macquarie Private Hospital	Tresna Bell
Shellharbour Private Hospital	Jenny Fraser
Southern Highlands Hospital	Lynne Byrne
St George Private & Medical Centre	Lee Mayo/Susy Tanevska
St Luke's Care	Robbie Bentley
St Vincent's Private Darlinghurst	Fiona Crawford/ Vivien Law
St Vincent's Private Lismore	Janelle Hospers
Strathfield Private Hospital	Michael Paulusz
Sydney Adventist Hospital	Jill Parker/Melissa Ng
Sydney Private Hospital	Margaret Haughton
Sydney South West Private	Julieanne James
Tamara Private Hospital	Kris Wall
The Mater Hospital	Namor Guerrero
The Prince of Wales Private	Ellaine Perez/Paula Civit Diez
Toronto Private Hospital	Stephanie Keys
Waratah Private Hospital	Kim Bassot
Warners Bay Private Hospital	Annette Harrison
Westmead Private Hospital	Karen O'Shaughnessy
Wollongong Private Hospital	Kim Dyer/Mandy Holmes

QUEENSLAND

PUBLIC HOSPITALS

Bundaberg Base Hospital	J Anderson/J Larsen/D Norman
Cairns Base Hospital	Sharon Ryrie
Gold Coast Hospital, Robina Campus	Annemarie Brooks/Helen McGuire
Gold Coast Surgical Hospital	Damien Knight
Gold Coast University Hospital	Karen Morton
Hervey Bay Hospital	Sarah Smith
Ipswich Hospital	Ross Howells/Jannah O'Sullivan
Lady Cilento Children's Hospital	Andrew Jesbert/Aimee Reid
Logan Hospital	Denise Maher
Mackay Base Hospital	Renee Hutchison/Beth Keogh
Maryborough Hospital	H Zillmann/B Christiansen
Mater Misericordiae Public Adult's	Craig Steains
Nambour General Hospital	Kay Friend/Fiona Tognolini
Prince Charles Hospital	Louise Tuppin/Rose Seddon
Princess Alexandra Hospital	Jo-Anne de Plater
Queen Elizabeth II Jubilee Hospital	Donna Cal
Redcliffe Hospital	Gemma van Fleet/Emily Currie
Redland Public Hospital	Sara Mackenzie
Rockhampton Base Hospital	John Barton
Royal Brisbane & Women's	Emma Babao/Anna Dowe
Toowoomba Hospital	Amanda Lostroh/Freya Chadwick
Townsville Hospital	Tara Cudmore

PRIVATE HOSPITALS

Allamanda Private Hospital	Kathryn Schott
Brisbane Private Hospital	Julie Oddy
Caboolture Private Hospital	Dee Ireland
Cairns Private Hospital	Louisa Smit
Friendly Society's Hospital	Karen Smith
Greenslopes Private Hospital	Kelly Williams/Rhonda Griffin
Hervey Bay Surgical Centre	Margo Christensen
Hillcrest Rockhampton Private	Lyn Martin
Holy Spirit Northside Hospital	Lexie Shannon
John Flynn Hospital	Paula Archer
Mater Health Services North Qld	Jo Humphreys/Anjela Hunt
Mater Misericordiae Bundaberg	Catherine Hackney
Mater Misericordiae Gladstone	Saroj Saini
Mater Misericordiae Mackay	Judith McDonald
Mater Misericordiae Rockhampton	Michelle Havik/Tim Harkin
Mater Misericordiae Private Hospital	Justine Jones
Mater Private Hospital Redland	Merryl Hoey
Mater Private Springfield	Carole James/Krystal Lording
Nambour Selangor Private Hospital	Simon Pfeiffer/Trevor Dempsey
Noosa Hospital	Janet McMeekin
North West Private Hospital	Teressa Auckland/David Campbell
Peninsula Private Hospital	Lesley Henderson
Pindara Private Hospital	Michael Young/Esther Moire
St Andrew's Private Hospital, Ipswitch	Mel Grant
St Andrew's Hospital, Toowoomba	Jeff van Leeuwen
St Andrew's War Memorial Hospital	Wendy Smith
St Stephen's Private Hospital	Wendy Simmers
St Vincent's Hospital, Toowoomba	Judy Plotecki
Sunnybank Private Hospital	Francina Robinston
Sunshine Coast University Private	Lynette Whiting
The Sunshine Coast Hospital	Phil Hall
Wesley Hospital	Carole Gregory/Kalpana Patel

WESTERN AUSTRALIA

PUBLIC HOSPITALS

Albany Regional Hospital	Jodie Hayton
Armadale Health Service	Eleri Griffiths/Deb Carkeek
Bunbury Regional Hospital	Anthea Amonini
Fremantle Hospital	Elsy Jiji
Fiona Stanley Hospital	Jarrod Duncan
Geraldton Hospital	Vicki Richards
Kalgoorlie Regional Hospital	Nicole Hintz
Osborne Park Hospital	Jenny Misiewicz
Rockingham General Hospital	Carol Beaney
Royal Perth Hospital, Wellington St	Carmel McCormack
Sir Charles Gairdner Hospital	Angela Bibb

PRIVATE HOSPITALS

Bethesda Hospital	H Hanekom/H Collis/J Fitzroy
Hollywood Private Hospital	Martin Coulter
Joondalup Health Campus	D Crowley/J Smith/E Yates
Mount Hospital	Jacqui McDonald
Peel Health Campus	Nicolle Turton
South Perth Hospital	Deb Waters
St John of God Health Care Bunbury	Alison Hawkes
St John of God Health Care Geraldton	Teresa Wood
St John of God Health Care Midland	Grace Loh
St John of God Health Care Murdoch	Christopher Sheen
St John of God Mt Lawley	Francisco Campos/Stuart Meek
St John of God Health Care Subiaco	Andy Sullivan
Waikiki Private Hospital	Bill Muir

SOUTH AUSTRALIA

PUBLIC HOSPITALS

Clare Hospital and Health Services	Melissa Bradley/Jo Knappstein
Flinders Medical Centre	Jasmine Platten/Amy Ware
Gawler Health Service	Sharon Mewett
Lyell McEwin Hospital	Fiona Brinkies
Modbury Public Hospital	Lisa Pearson
Mt Barker DSM Hospital	Emma Crowder
Mt Gambier Regional Hospital	Kylie Duncan
Murray Bridge Soldiers Memorial	Janine Colwell
Naracoorte Health Service	Trina Berry
Noarlunga Hospital	Carole Dawson
Port Augusta	Leandre Turner/Paola Williams
Port Lincoln Hospital	Christine Weber
Port Pirie Hospital	Sue Wilkinson
Queen Elizabeth Hospital	Renae Wauchope
Repatriation General Hospital	Joy Telfer/Elspeth Raymond
Riverland Regional Hospital	Leanne Zerna
Royal Adelaide Hospital	Lisa Lewington
South Coast District Hospital	Anne Price/Gail Mogg
Whyalla Health Service	Michael Prunty
Women's and Children's Hospital	Margaret Betterman

PRIVATE HOSPITALS

Ashford Community Hospital	Lisa Kowalik
Burnside War Memorial Hospital	Brooke Drechsler
Calvary Central Districts Hospital	Adele Alves
Calvary North Adelaide Hospital	Maria Young
Calvary Wakefield Hospital	F Hansen/I Snowball/C Gordon
Flinders Private Hospital	Marcus Ender
Glenelg Community Hospital	N Russell-Higgins/VLawrence
North Eastern Community Hospital	Anne Sciacca
Parkwynd Private Hospital	Anna-Claire Naylor
Sportsmed SA	F Penning/S Smith/K Stapleton/M Odgaard
St Andrew's Private Hospital	H Crosby/L White
Stirling District Hospital	Nick Clarke/Tanya Hanlon
The Memorial Hospital	E Carroll/J Castro/J Ohlson
Western Hospital	Sharon Bradley

TASMANIA

PUBLIC HOSPITALS

Launceston General Hospital	E Davidson/M Postmus
North West Regional, Burnie Campus	B Kerr/ R Dicker
Royal Hobart Hospital	Stuart Kirkham

PRIVATE HOSPITALS

Calvary Health Care, St John's	Cate Farrell
Calvary Health Care, St Luke's	Gary Stratton/Toni Morice
Calvary Hospital	B Stephensen/A Copping/S Ransley
Hobart Private Hospital	Janine Dohnt
North-West Private Hospital	Roz Watkins/Kylie Smith

AUSTRALIAN CAPITAL TERRITORY

PUBLIC HOSPITALS

The Canberra Hospital	Helen Boyd/Milton Jamieson
Calvary Health Care ACT	Rebecca Covington

PRIVATE HOSPITALS

Calvary John James Memorial Hospital	Samjith Sreesan
The National Capital Private	M Liebhardt/G Palada
Calvary Health Care ACT	Rebecca Covington
Canberra Private Hospital	A Glyde/M Gower/L Tuohy/S Tyrrell

NORTHERN TERRITORY

PUBLIC HOSPITALS

Alice Springs Hospital	Debra Mullan
Royal Darwin Hospital	Tanya Anderson/Wendy Rogers

PRIVATE HOSPITALS

Darwin Private Hospital	Beverley Hinchcliffe/Vanessa Frewin

APPENDIX 2

GLOSSARY

Statistical Terms

Adjustment: The process of re-estimating a crude measure, such as a rate or rate ratio, to minimise the effects of a difference in the distribution of a characteristic, such as age, between groups being compared on that measure. Adjustment may be carried out in the context of a modelling procedure, for example, linear or proportional hazards regression models, or by standardising the data set against a reference population with a known age distribution, for example, the World Standard Population or the Australian population defined by the Australian Bureau of Statistics Census in a specified year.

Censoring: When the outcome of interest is the time to a defined event, for example, revision of a prosthesis, the event may not occur during the available period of observation. For example, the Registry analyses its data on prosthesis revision for the period ending 31 December each year, and many prostheses will not have been revised by that time. Unless the prosthesis was revised prior to 31 December the outcome is unknown. For the majority, we only know that up until 31 December they had not yet been revised. The times to revision for these prostheses are said to have been censored at 31 December. Statistical methods exist to ensure that censored data are not ignored in analysis, rather information on survival up until the time of censoring is used to give the best possible estimates of survival or revision probabilities.

Chi-Square Test (χ2) 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 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, an IRR of 1 results.

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 (31/12/2015) 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 1/1/2015 was revised on 1/7/2015. 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 1/1/2015 died without being revised on 1/4/2015. This procedure contributes 0.25 component years.
A primary procedure occurs on 1/1/2015 and has not been revised. This procedure contributes 1 component year (as observation time is censored at 31/12/2015).

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 FOR REVISION HIP REPLACEMENT

Rank	Diagnosis	Category
1 2	Tumour Infection	*Dominant diagnosis independent of prosthesis/surgery*
3 4 5	Leg Length Discrepancy Incorrect Sizing Malposition	*Surgical procedure*
6 7	Metal Related Pathology Loosening/Lysis	*Reaction to prosthesis*
8 9 10 11 12 13 14	Wear Hip Insert Wear Acetabular Cup/Shell Wear Head Implant Breakage Head Implant Breakage Stem Implant Breakage Hip Insert Implant Breakage Acetabular Cup/Shell	*Wear and implant breakage*
15 16	Prosthesis Dislocation Instability	*Stability of prosthesis*
17	Fracture (Femur/Acetabular/Neck/Periprosthetic)	*Fracture of bone*
18 19	Chondrolysis/Acetabular Erosion Progression of Disease	*Progression of disease on non-operated part of joint*
20 21 22	Synovitis Osteonecrosis/AVN Heterotopic Bone	*New diseases occurring in association with joint replacement*
23	Pain	*Pain*
24	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/Lysis	
8	Wear Knee Insert	*Wear and implant breakage*
9	Wear Tibial Tray	
10	Wear Femoral	
11	Wear Patella	
12	Implant Breakage Femoral	
13	Implant Breakage Knee Insert	
14	Implant Breakage Tibial Tray	
15	Implant Breakage Patella	
16	Bearing Dislocation	*Stability of prosthesis/knee*
17	Patellar Dislocation	
18	Prosthesis Dislocation	
19	Instability	
20	Patellar Maltracking	
21	Fracture (Femur/Tibia/Patella/Periprosthetic)	*Fracture of bone*
22	Progression of Disease	*Progression of disease on non-operated part of joint*
23	Patellar Erosion	
24	Synovitis	*New diseases occurring in association with joint replacement*
25	Arthrofibrosis	
26	Osteonecrosis/AVN	
27	Heterotopic Bone	
28	Patellofemoral Pain	*Pain*
29	Pain	
30	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/Lysis	
8	Wear Glenoid Insert	*Wear and implant breakage*
9	Wear Glenoid	
10	Wear Humeral	
11	Implant Breakage Glenoid Insert	
12	Implant Breakage Glenoid	
13	Implant Breakage Humeral	
14	Implant Breakage Head	
15	Instability/ Dislocation	*Stability of prosthesis*
16	Rotator Cuff Insufficiency	
17	Dissociation	
18	Fracture (Glenoid/Humeral/Periprosthetic)	*Fracture of bone*
19	Progression of Disease	*Progression of disease on non-operated part of joint*
20	Glenoid Erosion	
21	Synovitis	*New diseases occurring in association with joint replacement*
22	Arthrofibrosis	
23	Osteonecrosis/AVN	
24	Heterotopic Bone	
25	Pain	*Pain*
26	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

Joint replacement patients will not be contacted directly by the Registry. No individual patient will be identified during analysis or in reports and publications produced by the Registry. Patient operative and prostheses data is managed in accordance with the Guidelines for the Protection of Privacy in the Conduct of Medical Research. Personal data collected are for use by the AOA National Joint Replacement Registry only. The Registry has been listed as a Federal Quality Assurance Activity and all information is protected *(refer to section below)*.

DATA MANAGEMENT & 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, Mr Ian Harris
- Assistant Deputy Director, Mr James Stoney
- Assistant Deputy Director, Bill Donnelly
- Manager, Ms Cindy Turner
- Research Coordinator, Dr Sophia Rainbird
- Administration Assistant, Ms Rychelle Brittain
- 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. In addition to this, the AOANJRR Committee made a decision in October 1999 to remove surgeon name from Registry forms. The Board of the AOA ratified this decision and consequently Registry staff blackout surgeon name, whether it is hand written or printed on the hospital patient identification, on all forms received by the Registry.

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 internet 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 and is permanently removed from Registry forms.

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 2016. 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

INTRODUCTION - *about the Registry*

You are about to have a joint replacement. This operation is very successful and most people do not require any further surgery following this procedure. However, a number of people who have a joint replacement may at some time in the future require another operation on that joint. This may occur due to a variety of reasons; the most common being that the joint replacement has worn out. Furthermore, differences between the many types of artificial joints available may affect the time at which they wear out and require replacing. In order to improve the success of this surgery, the Australian Orthopaedic Association has set up a National Joint Replacement Registry so that joint replacement and prostheses can be monitored.

The purpose of the Registry is to assess the performance of all joint replacement. If a joint replacement is identified as having a problem, the Registry can assist hospitals to locate those people that may be affected. To do this it is important to record information on every person having a joint replacement. More than 90,000 people have joint replacement surgery each year in Australia. It is also important to record details on any subsequent operations and the reason the surgery was performed. By analysing this information it will be possible to identify the cause of any problems as well as determine which types of joint replacement have the best results. To be successful, the Registry needs to gather information on as many people having joint replacement surgery as possible. We are asking you to participate in the Registry, by allowing us to document information relevant to your operation.

Your Involvement - *the information we need*

The information we require includes your name, date of birth, address, Medicare number, hospital identity number, the name of the hospital and the reason you are having a joint replacement. This information is necessary to accurately link you to the artificial joint 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 artificial joint used. No other personal information is recorded. Hospitals and Government will from time to time provide information that enables the Registry to check the accuracy of its data.

Information - *how we will keep your information confidential*

Your personal information is confidential and cannot be used outside the Registry. Procedures are in place to protect your information and to keep it confidential. When your details have been entered into the Registry your record will be given a specific Registry number. In addition, you cannot be identified in any reports produced by the Registry.

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 Registry computer.

Risks and Benefits - *to you*

There are no risks to you by having your details in the Registry. Your information is protected and we are not allowed to identify you by law. The Registry produces general reports on a variety of factors that influence the success of joint replacement surgery. This will improve the quality of future joint replacement surgery.

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 Ms Cindy Turner, 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 OF NATIONAL JOINT REPLACEMENT REGISTRY FOR HIP, KNEE & SHOULDER

The Registry was implemented in a staged manner on a state-by-state basis. The table below shows the commencement date for each state. 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.

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

HIP REPLACEMENT

PARTIAL HIP REPLACEMENT

49315-00	Partial arthroplasty (excludes Austin-Moore)
47522-00	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 of hip 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 REPLACEMENT

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 patellar 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	Patellar resurfacing

SHOULDER REPLACEMENT

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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CURA ET PATIENTIA

AOA

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