Hip and Knee Arthroplasty

ANNUAL REPORT 2014

AOA
AUSTRALIAN ORTHOPAEDIC ASSOCIATION

National Joint Replacement Registry

AUSTRALIAN ORTHOPAEDIC ASSOCIATION
NATIONAL JOINT REPLACEMENT REGISTRY

ANNUAL REPORT

Prepared by

Deputy Directors
Mr David Davidson
Professor Richard de Steiger
Mr Peter Lewis
Assistant Deputy Director
Mr James Stoney

Director
Professor Stephen Graves

Coordinators
Ms Ann Tomkins
Ms Robyn Vial
Ms Lisa Miller

Data Management & Analysis Centre
University of Adelaide

Professor John Lynch
Ms Liddy Griffith
Ms Grace O'Donohue
Ms Michelle Lorimer
Mr Yen-Liang Liu
Mr Tyman Stanford
Ms Alana Cuthbert
Dr Lan Kelly

The AOANJRR is funded by the Commonwealth Government

Director: Professor Stephen Graves

AOA National Joint Replacement Registry
Discipline of Public Health
School of Population Health
UNIVERSITY OF ADELAIDE SA 5005

T: +61 8 8313 3592
F: +61 8 8223 4075
E: segraves@aoanjrr.org.au

Coordinator: Ms Ann Tomkins

AOA National Joint Replacement Registry
Discipline of Public Health
School of Population Health
UNIVERSITY OF ADELAIDE SA 5005

T: +61 8 8313 3592
F: +61 8 8223 4075
E: atomkins@aoanjrr.org.au

www.aoa.org.au

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EXECUTIVE SUMMARY

This summary gives an overview of the 2014 Annual Report, outlining additions to the Registry analysis as well as highlighting major findings.

Each year the AOANJRR sets out to provide new information as well as build on data previously provided. This year is no exception. Two new chapters have been included. The first involves an analysis of patella resurfacing in both primary and revision total knee replacement. The second examines the impact of a variety of factors in combination with head size on the rate of revision for dislocation following primary conventional total hip replacement.

The Registry has previously reported that patella resurfacing in primary total knee replacement is associated with a reduced revision rate. Although this is true for patients with osteoarthritis it is not evident in those with rheumatoid arthritis.

The reduced rate of revision in osteoarthritis is due to less patellofemoral problems requiring subsequent patella resurfacing.

There are differences depending on the type of prosthesis used to resurface the patella. Metal-backed have a higher rate of revision than all-polyethylene prostheses due to increased revisions for loosening and lysis. Onlay and inset all-polyethylene patellar prostheses have a similar rate of revision.

The revision rate also varies depending on the type of total knee prosthesis. The difference between resurfacing and not resurfacing is less apparent for minimally stabilised compared to posterior stabilised prostheses. Although most of the commonly used minimally and posterior stabilised prostheses have a lower revision rate when the patella is resurfaced, there are some prostheses in both groups where it has made no difference. In the minimally stabilised group there was one prosthesis that had a higher revision rate when the patella was resurfaced.

Subsequent resurfacing of a patella not resurfaced at the time of the primary total knee replacement is not a benign procedure. At seven years patella only revision has a cumulative percent re-revision of 16.2%.

This year the Registry is providing a more detailed analysis on revision for dislocation following both primary and revision conventional total hip replacement. Dislocation is the most common reason for revision in the first four years following primary conventional total hip replacement and the second most common after seven years. The approach taken with this analysis is to determine how a variety of factors in combination with head size impact on the rate of revision for dislocation.

There has been increasing use of larger femoral head sizes since 2003. The revision rate for dislocation in the first two years decreased by over 50% between 2003 and 2011 with most of the decrease occurring by 2007.

Smaller head sizes (28mm and less) have a higher rate of revision for dislocation regardless of age, gender, fixation and bearing surface. When considering all diagnoses, most of the reduction in revision for dislocation associated with larger head sizes is achieved using 32mm heads. There is a further small reduction in revision for dislocation in males and all patients aged 75 years or older operated on for osteoarthritis when 36mm heads are used. If a ceramic/ceramic bearing is used there is a reduced rate of revision for dislocation for head sizes 38mm and above.

When compared to other reasons for revision, revision for dislocation has the highest rate of subsequent revision for dislocation.

The Registry continues to highlight 10 year revision rates of primary conventional total hip replacement and primary total knee replacement prostheses that have reached this important milestone, as long as more than 350 procedures have been undertaken. There are 58 femoral stem and acetabular component combinations with a 10 year cumulative percent revision which ranged from 1.9% to 13.2%. The 10 year cumulative percent revision (for any reason) is less than 5.0% for fifty percent of the combinations.

There are 41 total knee combinations with a 10 year cumulative percent revision which ranged from 3.0% to 10.6%. The 10 year cumulative percent revision (for any reason) is less than 5.0% for 24.4% of the combinations.

The number of hip and knee replacement procedures undertaken each year continues to increase. In 2013, the number of procedures undertaken increased by 5.4% compared to 2012 (2.4% for hips and 3.4% for knees). Most procedures were undertaken in the private sector (59.7% for hips and 70.0% for knees in 2013).

Last year, detailed analyses comparing the outcome of different classes of partial and total hip replacement used to treat fractured neck of femur were presented in a separate chapter. This year the Registry has returned to its usual format of considering partial hip and total hip replacements separately.

Partial hip replacement is principally used for the treatment of fractured neck of femur. Unipolar monoblock prostheses continue to decline in use, having decreased by a further 16.6% compared to 2012. This class of prosthesis is used mainly in the 85 years and older age group.

Unipolar modular prostheses, now the most common class of partial hip replacement, also decreased in use in 2013. The reduction of 13.0% compared to 2012 is the first time that the Registry has not reported increased use of this class.

The use of bipolar prostheses increased by 8.1% in 2013 compared to 2012. Bipolar partial hip replacements are revised less frequently than other partial hips and the use

of cement fixation reduces the rate of revision regardless of the class of partial hip replacement.

This outcome for different prostheses types in each class of partial hip replacement is presented in the relevant sections of this chapter.

The number of individual femoral stem and acetabular components used in primary total conventional hip replacement each year has been decreasing in recent years. This trend reversed in 2013 with the number of femoral stems increasing from 105 in 2012 to 118 in 2013. The number of acetabular components also increased from 68 in 2012 to 74 in 2013.

There were 196 new femoral and acetabular prostheses combinations used in 2013. This is an increase compared to the 131 new combinations used in 2012. The Registry now has data on 2,293 femoral stem and acetabular prostheses combinations used in primary total conventional hip replacement.

This year large head (>32mm) metal/metal bearings are excluded from any comparative analysis undertaken for primary conventional total hip replacement. The outcomes for individual large head metal/metal prostheses are still reported in the appropriate tables.

At 10 years cement fixation has the highest rate of revision in patients aged less 55 years, 55-64 and 65-74 years. Cementless fixation has a lower rate of revision compared to hybrid fixation in those aged less than 65 years. Cementless fixation has a higher rate of revision compared to both hybrid and cement fixation in the 75 years and older age group. There is no difference in the rate of revision comparing hybrid and cemented fixation in this age group.

The Registry continues to report that exchangeable neck prostheses have a high rate of revision compared to fixed neck femoral stems. This is independent of bearing surface. This year the outcome by stem/neck material combination is reported for the first time. There were two main material combinations identified; titanium stem/titanium neck and titanium stem/cobalt chrome neck. This analysis excluded large head metal/metal bearings. Titanium/cobalt chrome combination has a higher rate of revision. When comparing reasons for the higher rate of revision, metal related pathology is one of the main reasons and this is with large head metal/metal bearings excluded from the analysis.

The lower revision rate of cross-linked polyethylene compared to non cross-linked polyethylene is becoming increasingly apparent as time progresses. This is due to a reduced rate of revision for loosening and lysis. There is also an early reduction in the rate of revision for dislocation, which is a consequence of larger head size use with cross-linked polyethylene.

Last year for the first time, the Registry presented prosthesis specific data on four commonly used acetabular prostheses, with follow up greater than seven years and use of large numbers of both cross-linked and non cross-linked polyethylene. All four prostheses had a lower rate of revision when cross-linked polyethylene was used. The analysis was repeated this year and an additional acetabular component fulfilled the inclusion criteria. The four reported last year continue to have a lower rate of revision when cross-linked polyethylene is used. The additional prosthesis reported this year (Vitalock shell) did not demonstrate any difference in the rate of revision based on the type of polyethylene.

The main factor affecting the outcome of ceramic/ceramic bearings is head size. Head sizes less than 32mm have a higher rate of revision compared to all larger head sizes. There is no difference in the rate of revision when 32mm heads are compared to larger head sizes.

For the first time a comparison of different types of ceramic has been undertaken. Three different types were identified; Zirconia, Alumina, and Zirconia and Alumina combined which is referred to as Mixed Ceramic. An analysis was undertaken examining head size and the type of bearing surface. As Zirconia has not been used since 2008 and was only reported in small numbers the main comparison is between Alumina and Mixed Ceramic. Alumina femoral heads have a higher rate of breakage compared to Mixed Ceramic heads. There is little difference in the rate of revision comparing Alumina and Mixed Ceramic for specific femoral head sizes when used with cross-linked polyethylene or Alumina acetabular bearings. Alumina femoral heads larger than 32mm have a higher rate of revision when combined with Mixed Ceramic acetabular bearings compared to Mixed Ceramic femoral heads. Mixed Ceramic heads of 40mm combined with a Mixed Ceramic acetabular bearing only have a three year follow up. Early data would indicate that the performance is satisfactory.

The use of primary total resurfacing hip replacement continues to decline, reducing by 13.5% in 2013 compared to 2012. It accounted for only 1.3% of all hip procedures in 2013. The Registry previously identified that younger males had the best outcome for this procedure. Only four females had a resurfacing procedure in 2013 and 95.2% of all resurfacing procedures were aged less than 65 years.

The findings for knee replacement are similar to previous reports.

Patella/trochlear replacement is the second most common partial knee replacement. There has been little change in use over the last four years with only 245 procedures undertaken in 2013. The cumulative percent revision at 10 years for patients with osteoarthritis is 28.6%.

Unicompartmental knee replacement is by far the most common partial knee replacement. Its use has been declining for a number of years but has almost plateaued in 2013, reducing by only 2.7% compared to 2012. The cumulative percent revision at 13 years for patients with osteoarthritis is 19.1%. Age is the most important factor affecting the revision rate, at 13 years those aged less than 55 years have a cumulative percent revision of 29.4% and for the 55-64 year age group it is 21.7%.

The use of primary total knee has increased by over a hundred percent since 2003. The number of different types of knee prostheses used during 2013 has not

increased and has changed very little over the last four years. Many factors affect the revision rate. The impact of gender and age has been described previously, as has the higher rate of revision associated with cementless fixation, mobile compared to fixed and posterior compared to minimally stabilised designs.

Last year it was reported that there was no difference in the rate of revision when computer assisted surgery was used. Analysis undertaken this year has identified a reduced rate of revision for patients aged less than 65 years. The reduction in the rate of revision is due to fewer revisions for loosening/lysis.

This year the Registry is reporting on Image Derived Instrumentation for the first time. There is no difference in the rate of revision at three years compared to non Image Derived Instrumentation.

The Registry is again reporting on the use of cross-linked polyethylene in primary total knee replacement. The evidence presented last year suggested that the effect of cross-linked polyethylene varied by prosthesis but may be associated with a reduced rate of revision for some minimally stabilised designs.

The result of repeating the analysis this year is similar. A lower rate of revision is identified when cross-linked polyethylene is used for two minimally stabilised knees with 10 year follow up. This is most evident in younger patients and is associated with a reduced rate of revision for loosening/lysis. No difference is identified for two other minimally stabilised designs with a follow up of seven years or less. In addition, no difference is identified for three posterior stabilised prostheses when the revision rate of both cross-linked and non cross-linked polyethylene for each individual design are compared.

The Registry specifically highlights prostheses or prostheses combinations identified as having a higher than anticipated rate of revision. These have been reported in the section 'Prostheses with Higher than Anticipated Rates of Revision'.

This year the Registry has identified 117 prostheses or prostheses combinations (69 hip and 48 knee). Of these, 10 hip and six knee prostheses are reported for the first time. Three of the hips identified for the first time are no longer used. Detailed analyses of all identified prostheses and prostheses combinations are available as a supplementary report on the Registry website.

This year the Registry is publishing 15 supplementary reports covering a number of different topics. These reports will be available on the Registry website *aoanjrr.dmac.adelaide.edu.au/annual-reports-2014*.

INTRODUCTION

The 2014 Hip and Knee Arthroplasty Report is based on the analysis of 891,208 primary and revision hip and knee procedures recorded by the Registry with a procedure date up to and including 31 December 2013. This is an increase of 91,393 procedures compared to the 2013 Annual Report.

In addition, there are 15 supplementary reports that complete the AOANJRR Annual Report for 2014.

1. Lay Summary
2. Demographics of Hip Arthroplasty
3. Demographics of Knee Arthroplasty
4. Cement in Hip and Knee Arthroplasty
5. Mortality of Hip and Knee Arthroplasty
6. Revision of Hip and Knee Arthroplasty
7. Metal/Metal Bearing Surface in Total Conventional Hip Arthroplasty
8. Metal/Ceramic Bearing Surface in Total Conventional Hip Arthroplasty
9. Unispacer Knee Arthroplasty
10. Demographics and Outcome of Shoulder Arthroplasty
11. Demographics and Outcome of Elbow and Wrist Arthroplasty
12. Demographics and Outcome of Ankle Arthroplasty
13. Demographics of Spinal Disc Arthroplasty
14. Investigations of Prostheses with Higher than Anticipated Rates of Revision
15. Analysis of State and Territory Health Data – All Arthroplasty 1993/1994 – 2012/2013

These reports are available on the Registry website *aoanjrr.dmac.adelaide.edu.au/annual-reports-2014*.

Data are submitted to the Registry by all hospitals (public and private) undertaking joint replacement. Currently there are 305 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 rate of joint replacement surgery is continuing to increase. In 2013, the number of hip replacement procedures increased by 2.4% and the number of knees procedures by 3.4% compared to the previous year. Since 2003, the first year of complete national data collection, the number of hip procedures has increased by 46.5% and the number of knee procedures by 77.2%. It is anticipated that this rate of increase will continue in the future.

The Registry has previously detailed the rate of increase from 1993/1994 by comparing the number and type of joint replacements undertaken each year using data supplied by the State and Territory Health Departments. These data are presented in the supplementary report 'Analysis of State and Territory Health Data – All Arthroplasty 1993/1994 – 2012/2013'.

There are many factors known to influence the outcome of joint replacement surgery. Some of these include age, gender and diagnosis of patients and the type of prosthesis and surgical techniques used. Superimposed on this 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 the outcome remains uncertain.

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. It was not apparent who was receiving joint replacement or the types of prostheses and techniques used to implant them.

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) agreed to fund the AOA to establish the Registry.

The Registry began 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 (Appendix 6). 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 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

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

Benefits

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 (240 in 2013). 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 regulatory bodies to monitor all 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.

Although it is a relatively short time since full national implementation of the Registry, it has already influenced joint replacement in a beneficial manner.

The percentage of revision hip replacement decreased from 11.8% in 2012 to 10.6% in 2013.

The percentage of revision knee procedures has declined from a peak of 8.8% in 2004 to 8.0% in 2013, equating to 391 less knee revisions in 2013.

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

Governance

The AOANJRR is an initiative of the AOA. At the time it was established, the Federal Board of the AOA nominated a committee to develop and manage AOANJRR policies. The AOANJRR Committee reports to the AOA Board. Members include the Chairman, AOANJRR Director, three AOANJRR Deputy Directors, an orthopaedic surgeon from each state and the ACT and a representative from each of the AOA specialty arthroplasty groups. A complete list of the current AOANJRR Committee is provided on the inside front cover of this report.

The Director, Deputy Directors and Assistant Deputy Director are appointed by the Board and are responsible for the day-to-day management. In addition, the AOA employs a Coordinator and an Assistant Coordinator who are involved in maintaining the cooperation of hospitals, surgeons and Government as well as implementing new strategies and coordinating the preparation of the annual report.

The Data Management & Analysis Centre (DMAC), University of Adelaide, is contracted by the AOA to provide data management and independent data analysis services for the Registry.

In 2009, the Commonwealth established the AOANJRR Consultative Committee. This was a restructure of the Registry Advisory Committee. The AOANJRR Consultative Committee is administered and chaired by the Commonwealth. The aim is to provide advice on the overall strategic direction of the Registry.

Committee members include: -

- Chair, Department of Health
- AOANJRR Director

  a representative of
- Department of Health
- Australian Orthopaedic Association
- Consumer's Health Forum
- Therapeutic Goods Administration
- Prostheses List Advisory Committee
- Private Healthcare Australia
- Australian Private Hospitals Association
- Orthopaedic Industry (2)
  - Medical Technology Association of Australia
  - Non Medical Technology Association of Australia

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.dmac.adelaide.edu.au/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:

- Registry procedure records for procedures notified to state/territory health departments by hospitals.
- State/territory records for procedures not submitted to the Registry by hospitals.
- 'Exact match' procedures, that is, records held by the Registry and state/territory health departments.
- 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 mis-matches 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 2012/13 financial year, the Registry received 1,451 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 hip and knee replacement undertaken in Australia. On initial submission of forms from participating hospitals, the Registry's capture rate is 96.0%. 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 and knee 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.

In previous annual reports, the Registry has reported the revisions per 100 observed component years. This statistic provides a good estimate of the rate of revision, however, it does not allow for changes in the rate of revision over time. A more informative estimate of the rate of revision over time is the cumulative percent revision. As the Registry is now reporting 13 year follow up, the revisions per 100 observed component years have not been included in this report.

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 revision rates. 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, and 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 CPRs 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 (for example, 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. Revision diagnosis cumulative incidence 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

[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.

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 section of the report.

Report Review Prior to Publication

Members of the AOA 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 9 and 10 August 2014. Following the workshop the report was provided to the AOA Board for consideration and final approval prior to publication.

Presentation of 2014 Annual Report

New chapters in the 2014 Annual Report include 'Patella Resurfacing in Total Knee Replacement' and 'Dislocation related to Femoral Head Size. The chapter on 10 year prostheses outcomes has been updated.

Following these first three chapters the format of the report remains similar to previous years and includes chapters on Primary Hip, Primary Knee, and Prostheses with Higher than Anticipated Rates of Revision. The Primary Hip and Knee sections are divided into Introduction, Partial and Total. The Prostheses with Higher than Anticipated Rates of Revision section includes both hip and knee procedures.

Detailed analyses of prostheses or combinations of prostheses identified as having a higher than anticipated rate of revision are provided as a separate supplementary report on the website. These analyses provide information on reasons for revision, type of revision, regional variation, annual use and catalogue range specific analysis.

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 in Appendix 1.

PATELLA RESURFACING IN TOTAL KNEE REPLACEMENT

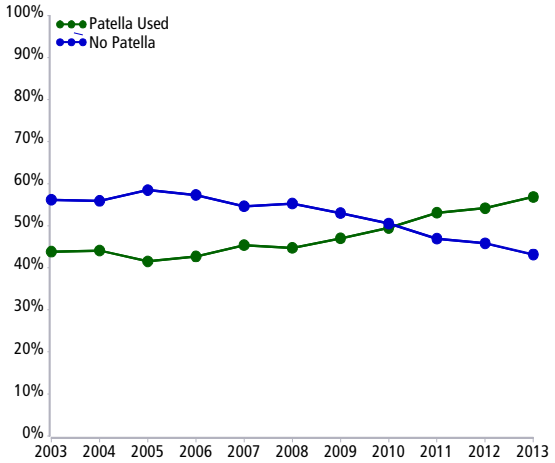
Introduction

The Registry has previously reported a lower rate of revision following primary total knee replacement when a patellar prosthesis is used. The purpose of this chapter is to provide a more detailed analysis on the use of patella resurfacing, including trends in use, revision rates for different types of patellar prostheses and variation in the effect of patella resurfacing with different total knee prostheses. In addition, data on the outcome of subsequently revising an unresurfaced patella are provided.

Usage

The two principal diagnoses for primary total knee replacement are osteoarthritis (97.4%) and rheumatoid arthritis (2.0%). There were 392,331 procedures reported to the Registry to the end of December 2013 (osteoarthritis 386,242 and rheumatoid arthritis 6,089). A patellar prosthesis has been used in 47.9% of all primary total knee procedures undertaken for these two diagnoses. The use of patella resurfacing has increased each year since 2008.

Figure PR1: Primary Total Knee Replacement by Patella Usage (Primary Diagnosis OA and RA)



Outcomes

There is no difference in the outcome related to patella use for rheumatoid arthritis. The cumulative percent revision for the patella used group is 5.4% compared to 6.0% for the no patella used group at 13 years.

In osteoarthritis there is a lower rate of revision in primary total knee replacement at 13 years when a patellar prosthesis is used (6.0%) compared to when a patellar prosthesis is not used (7.4%) (Table PR1 and Figure PR2). The remainder of the analysis has been undertaken on primary total knee replacements with a diagnosis of osteoarthritis.

Reason for Revision

The higher rate of revision when a patella is not resurfaced is due to increased revision for patello-femoral pain, pain, and patella erosion (Table PR2 and Figure PR3).

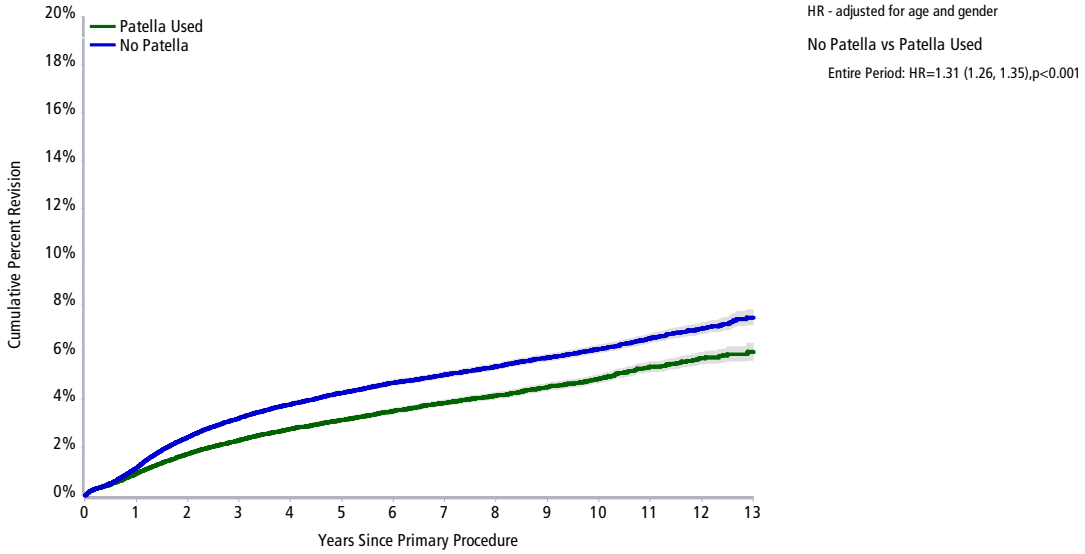
Types of Revision

When the patella is not resurfaced the extra revisions are due to additional isolated patella resurfacing procedures or a patella resurfacing combined with an insert change (Table PR3).

Table PR1: 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	13 Yrs
Patella Used	5151	184333	0.9 (0.9, 1.0)	2.3 (2.2, 2.4)	3.2 (3.1, 3.2)	3.9 (3.7, 4.0)	4.9 (4.7, 5.0)	6.0 (5.7, 6.3)
No Patella	8126	201909	1.2 (1.1, 1.2)	3.2 (3.1, 3.3)	4.3 (4.2, 4.4)	5.0 (4.9, 5.2)	6.1 (6.0, 6.3)	7.4 (7.1, 7.7)
TOTAL	**13277**	**386242**						

Figure PR2: 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	13 Yrs
Patella Used	184333	157185	109929	73822	46051	16798	776
No Patella	201909	179517	135484	95545	61424	22441	1629

Table PR2: Revision Diagnosis of Primary Total Knee Replacement by Patella Usage (Primary Diagnosis OA)

	Patella Used			No Patella		
Revision Diagnosis	Number	% Revision	% Primary	Number	% Revision	% Primary
Loosening/Lysis	1871	36.3	1.0	2018	24.8	1.0
Patellofemoral Pain				1607	19.8	0.8
Infection	1464	28.4	0.8	1460	18.0	0.7
Pain	331	6.4	0.2	906	11.1	0.4
Instability	365	7.1	0.2	441	5.4	0.2
Patella Erosion				419	5.2	0.2
Arthrofibrosis	208	4.0	0.1	273	3.4	0.1
Fracture	172	3.3	0.1	157	1.9	0.1
Other	740	14.4	0.4	845	10.4	0.4
N Revision	**5151**	**100.0**	**2.8**	**8126**	**100.0**	**4.0**
N Primary	**184333**			**201909**		

Figure PR3: Revision Diagnosis Cumulative Incidence of Primary Total Knee Replacement by Patella Usage (Primary Diagnosis OA)

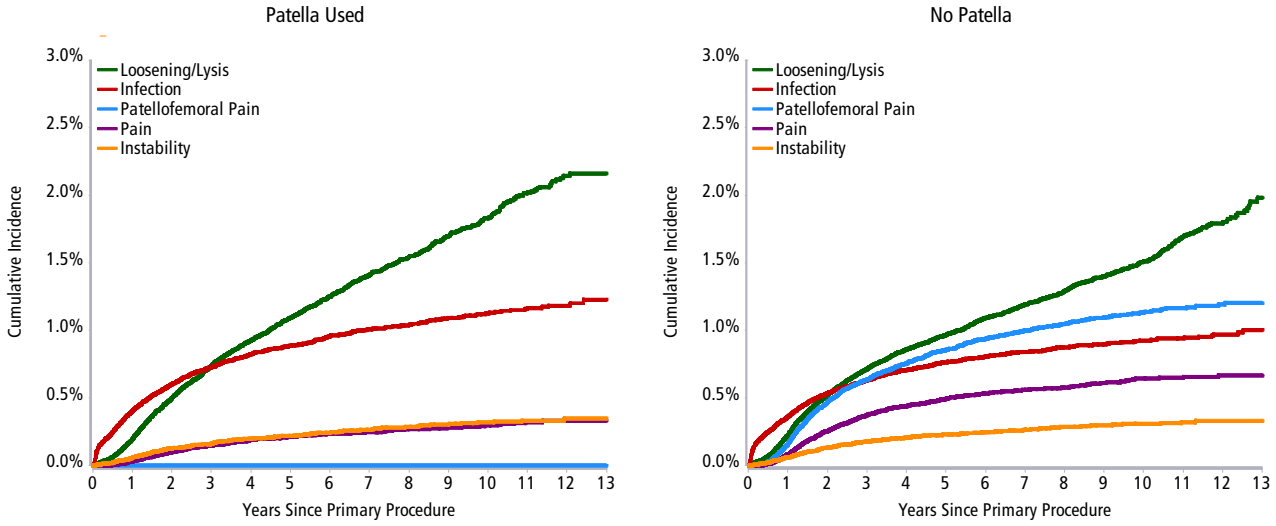


Table PR3: Type of Revision of Primary Total Knee Replacement by Patella Usage (Primary Diagnosis OA)

	Patella Used			No Patella		
Type of Revision	**Number**	**% Revision**	**% Primary**	**Number**	**% Revision**	**% Primary**
Patella Only	314	6.1	0.2	2507	30.9	1.2
TKR (Tibial/Femoral)	1596	31.0	0.9	1754	21.6	0.9
Insert Only	1537	29.8	0.8	1206	14.8	0.6
Insert/Patella	161	3.1	0.1	1044	12.8	0.5
Tibial Component	731	14.2	0.4	709	8.7	0.4
Femoral Component	354	6.9	0.2	484	6.0	0.2
Cement Spacer	392	7.6	0.2	375	4.6	0.2
Removal of Prostheses	38	0.7	0.0	27	0.3	0.0
Other	28	0.5	0.0	20	0.2	0.0
N Revision	**5151**	**100.0**	**2.8**	**8126**	**100.0**	**4.0**
N Primary	**184333**			**201909**		

Prosthesis Characteristics

The Registry has undertaken an analysis to determine the impact of a number of factors relevant to the use of a patellar prosthesis. These include the type of patellar prosthesis, stability of the total knee replacement and variation with individual total knee prostheses.

Type of Patella

The Registry has categorised patellar prostheses as all-polyethylene or metal-backed. All-polyethylene patellar prostheses have been subcategorised as onlay and inset.

Most patellar prostheses are all-polyethylene (93.5%), and they have a lower rate of revision compared to metal-backed prostheses (Table PR4 and Figure PR4). Metal-backed prostheses are more frequently revised for loosening/lysis, metal related pathology, and breakage (Table PR5 and Figure PR5). The type of revision also varies, with metal-backed patellar prostheses being associated with a higher proportion of major revision procedures (Table PR6).

To determine if there is any difference in the revision rates for onlay and inset patellar prostheses, the analysis was confined to patellar prostheses with both onlay and inset patellar designs. An additional requirement was that there were more than 500 procedures in each group. These criteria were met for three different knee systems. They were Genesis II, Triathlon and Scorpio. There is no difference in rate of revision when onlay and inset are compared. The cumulative percent revision at 10 years is 4.5% for onlay designs and 4.7% for inset designs (Table PR7 and Figure PR6).

Prosthesis Stability

The revision rate varies with stability. The rate of revision is lower in both minimally and posterior stabilised procedures when patellar prostheses are used. The difference in the rate of revision when a patellar prosthesis is used compared to not used is greatest in the posterior stabilised group (Table PR8 and Figure PR7).

Prosthesis Type

The rate of revision with or without patella resurfacing varies depending on the type of total knee prosthesis.

The cumulative percent revision for the 10 most common minimally stabilised femoral components is shown in Table PR9. All had seven or more years follow up. Six have a lower rate of revision when a patellar prosthesis is used, there is no difference for three and one has a higher rate of revision (Table PR9). Examples of these three different outcomes include Scorpio CR/Series 7000, Duracon/Duracon and the LCS CR/MBT (Table PR9 and Figures PR8 - PR10).

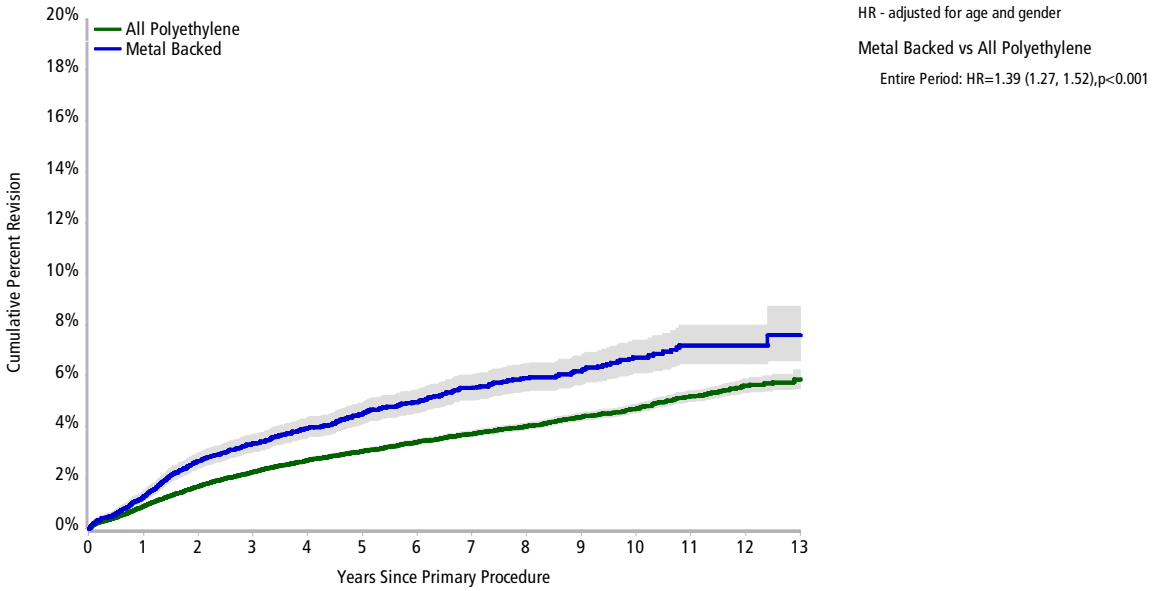
A similar analysis of the 10 most used posterior stabilised femoral components was also undertaken. Eight of the 10 prostheses had seven or more years follow up. Six of these have a lower revision rate when the patella is used although this was only for the first two years with one of the prostheses. There was no difference for the remaining two prostheses. Two prostheses have five years or less follow up; there is no difference for either of these prostheses (Table PR10). Examples include the PFC Sigma PS/MBT, Nexgen LPS/Nexgen and the Nexgen LPS Flex/Nexgen (Table PR10 and Figures PR11 - PR13).

Table PR4: Cumulative Percent Revision of Primary Total Knee Replacement by Type of Patella (Primary Diagnosis OA)

Type of Patella	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
All Polyethylene	4615	172342	0.9 (0.8, 0.9)	2.2 (2.1, 2.3)	3.0 (2.9, 3.1)	3.7 (3.6, 3.8)	4.7 (4.5, 4.9)	5.9 (5.5, 6.2)
Metal Backed	531	11968	1.3 (1.1, 1.5)	3.3 (3.0, 3.7)	4.5 (4.1, 4.9)	5.5 (5.0, 6.0)	6.7 (6.1, 7.4)	7.6 (6.6, 8.7)
TOTAL	**5146**	**184310**						

Note: Excluding 23 procedures with unknown patella types

Figure PR4: Cumulative Percent Revision of Primary Total Knee Replacement by Type of Patella (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
All Polyethylene	172342	146364	101830	67778	42124	15236	680
Metal Backed	11968	10799	8079	6027	3916	1555	94

Table PR5: Revision Diagnosis of Primary Total Knee Replacement by Type of Patella (Primary Diagnosis OA)

	All Polyethylene			Metal Backed		
Revision Diagnosis	Number	% Revision	% Primary	Number	% Revision	% Primary
Loosening/Lysis	1638	35.5	1.0	231	43.5	1.9
Infection	1368	29.6	0.8	96	18.1	0.8
Instability	334	7.2	0.2	31	5.8	0.3
Pain	300	6.5	0.2	31	5.8	0.3
Arthrofibrosis	186	4.0	0.1	22	4.1	0.2
Fracture	158	3.4	0.1	13	2.4	0.1
Malalignment	131	2.8	0.1	17	3.2	0.1
Incorrect Sizing	95	2.1	0.1	9	1.7	0.1
Wear Tibial Insert	78	1.7	0.0	7	1.3	0.1
Bearing Dislocation	47	1.0	0.0	5	0.9	0.0
Metal Related Pathology	45	1.0	0.0	29	5.5	0.2
Implant Breakage Patella	37	0.8	0.0	7	1.3	0.1
Other	198	4.3	0.1	33	6.2	0.3
N Revision	**4615**	**100.0**	**2.7**	**531**	**100.0**	**4.4**
N Primary	**172342**			**11968**		

Figure PR5: Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by Type of Patella (Primary Diagnosis OA)

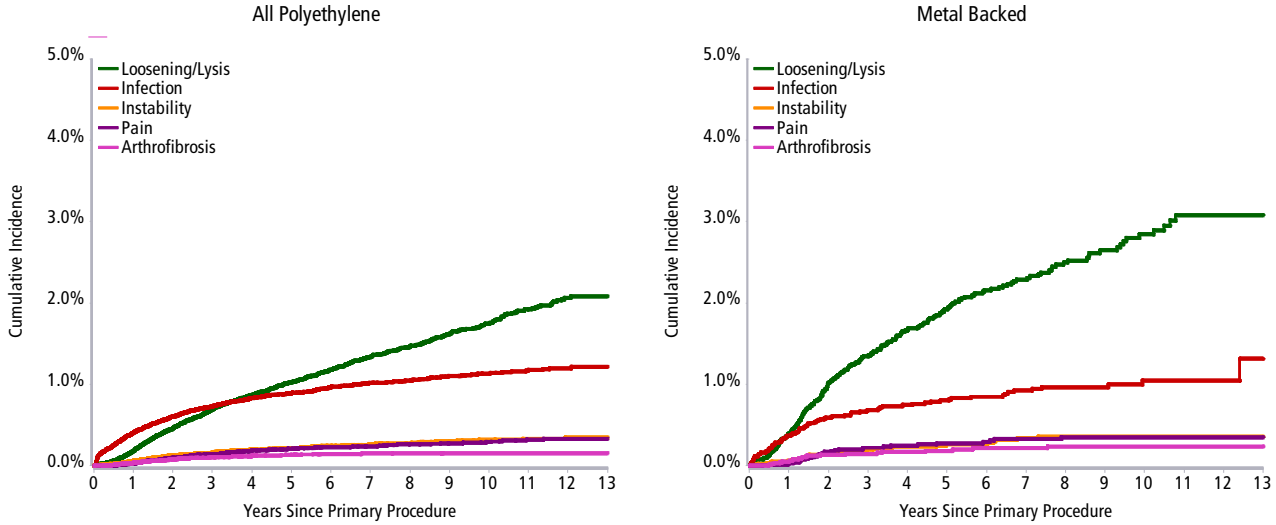


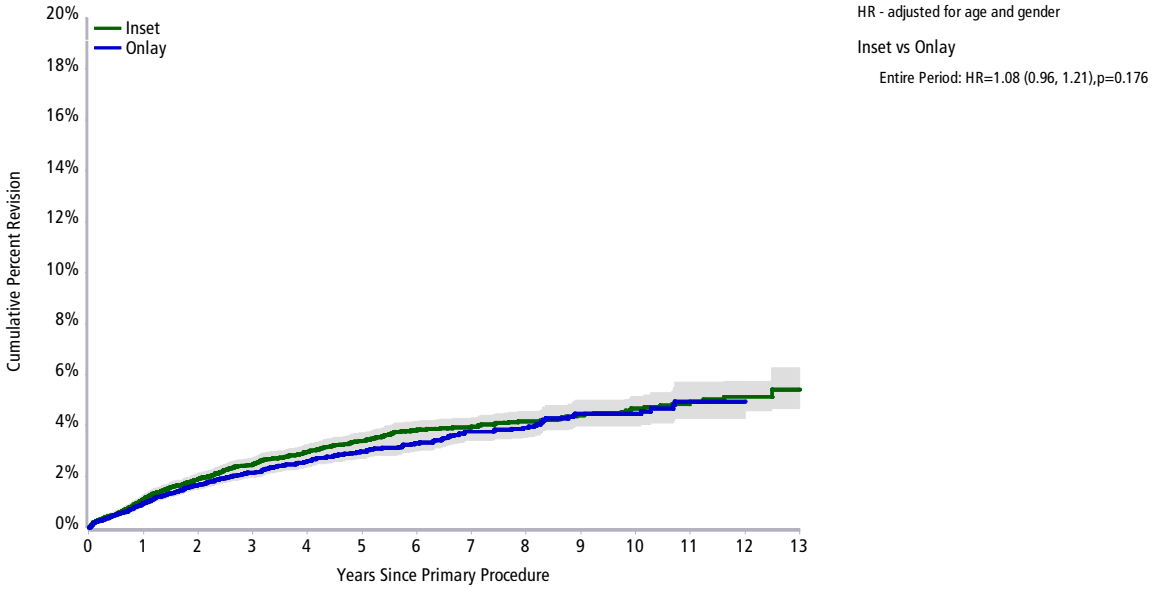
Table PR6: Type of Revision of Primary Total Knee Replacement by Type of Patella (Primary Diagnosis OA)

	All Polyethylene			Metal Backed		
Type of Revision	Number	% Revision	% Primary	Number	% Revision	% Primary
Insert Only	1453	31.5	0.8	82	15.4	0.7
TKR (Tibial/Femoral)	1373	29.8	0.8	221	41.6	1.8
Tibial Component	657	14.2	0.4	74	13.9	0.6
Cement Spacer	364	7.9	0.2	28	5.3	0.2
Femoral Component	318	6.9	0.2	36	6.8	0.3
Patella Only	273	5.9	0.2	41	7.7	0.3
Insert/Patella	119	2.6	0.1	41	7.7	0.3
Removal of Prostheses	31	0.7	0.0	7	1.3	0.1
Other	27	0.6	0.0	1	0.2	0.0
N Revision	**4615**	**100.0**	**2.7**	**531**	**100.0**	**4.4**
N Primary	**172342**			**11968**		

Table PR7: Cumulative Percent Revision of Primary Total Knee Replacement by Patella Design (Primary Diagnosis OA)

Patella Type	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Inset	589	19706	1.1 (1.0, 1.3)	2.5 (2.2, 2.7)	3.4 (3.1, 3.7)	4.0 (3.6, 4.3)	4.7 (4.2, 5.1)	5.4 (4.7, 6.3)
Onlay	588	28185	0.9 (0.8, 1.1)	2.2 (2.0, 2.4)	3.0 (2.7, 3.3)	3.8 (3.4, 4.2)	4.5 (4.0, 5.0)	
TOTAL	**1177**	**47891**						

Figure PR6: Cumulative Percent Revision of Primary Total Knee Replacement by Patella Design (Primary Diagnosis OA)

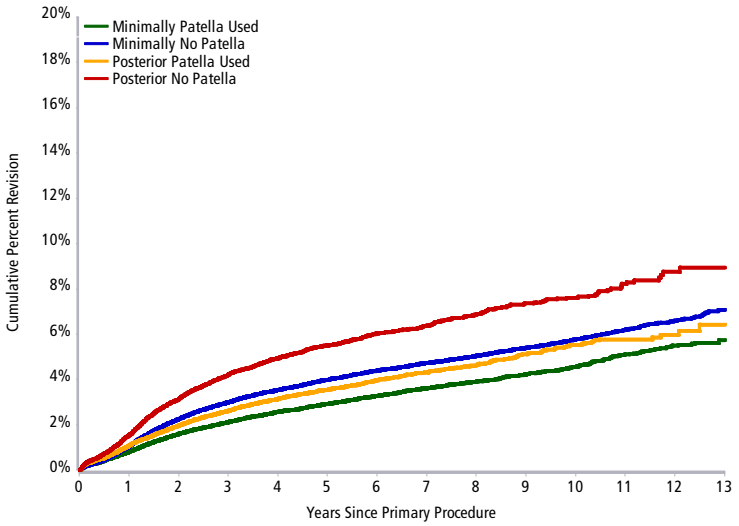


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Inset	19706	17242	12331	8291	5363	1930	124
Onlay	28185	21880	12023	6570	3287	1024	36

Table PR8: 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	13 Yrs
Minimally	Patella Used	3155	116318	0.8 (0.8, 0.9)	2.1 (2.0, 2.2)	2.9 (2.8, 3.0)	3.6 (3.5, 3.8)	4.6 (4.4, 4.7)	5.7 (5.4, 6.1)
	No Patella	6206	164405	1.1 (1.0, 1.1)	3.0 (2.9, 3.1)	4.0 (3.9, 4.1)	4.7 (4.6, 4.9)	5.8 (5.6, 5.9)	7.1 (6.7, 7.4)
Posterior	Patella Used	1974	67273	1.1 (1.0, 1.2)	2.6 (2.5, 2.8)	3.5 (3.4, 3.7)	4.3 (4.1, 4.5)	5.5 (5.2, 5.9)	6.4 (5.7, 7.3)
	No Patella	1883	36876	1.6 (1.4, 1.7)	4.2 (4.0, 4.4)	5.5 (5.2, 5.8)	6.4 (6.1, 6.7)	7.6 (7.2, 8.0)	8.9 (8.2, 9.8)
TOTAL		**13218**	**384872**						

Figure PR7: 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=0.77 (0.74, 0.80),p<0.001

Minimally No Patella vs Posterior No Patella

Entire Period: HR=0.72 (0.68, 0.76),p<0.001

Minimally Patella Used vs Posterior Patella Used

0 - 1Yr: HR=0.78 (0.71, 0.85),p<0.001

1Yr - 1.5Yr: HR=0.81 (0.71, 0.92),p=0.001

1.5Yr - 2Yr: HR=0.81 (0.71, 0.92),p=0.001

2Yr - 2.5Yr: HR=0.75 (0.64, 0.87),p<0.001

2.5Yr - 4.5Yr: HR=0.86 (0.78, 0.96),p=0.005

4.5Yr+: HR=1.02 (0.92, 1.13),p=0.681

Posterior Patella Used vs Posterior No Patella

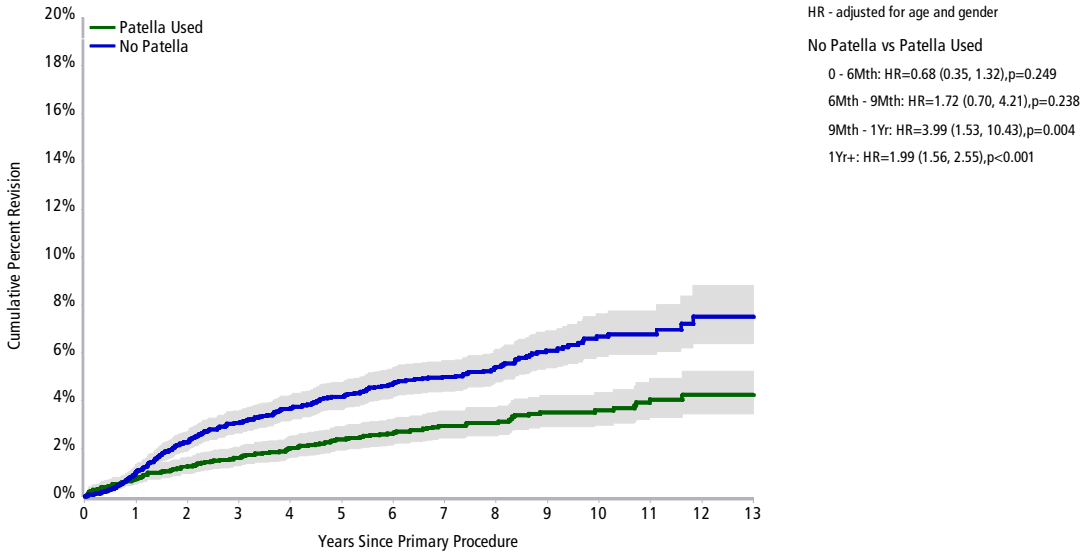
Entire Period: HR=0.66 (0.62, 0.70),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Minimally	Patella Used	116318	99891	71386	50200	33593	13548	644
	No Patella	164405	145736	109447	78466	52166	20014	1505
Posterior	Patella Used	67273	56760	38228	23446	12348	3209	130
	No Patella	36876	33296	25690	16847	9102	2375	122

Table PR9: Cumulative Percent Revision of Minimally Stabilised Primary Total Knee Replacement by 10 Most Used Femoral/Tibial Prosthesis Combinations and Patella Usage (Primary Diagnosis OA)

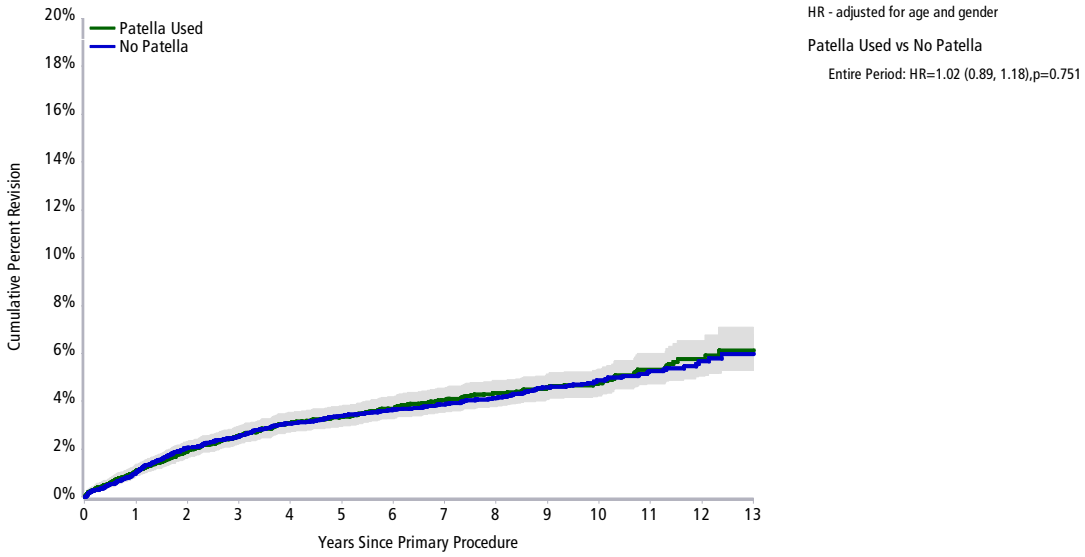
Model	Patella Usage	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Duracon / Duracon	Patella Used	312	7081	1.1 (0.9, 1.4)	2.6 (2.2, 3.0)	3.4 (3.0, 3.8)	4.1 (3.6, 4.6)	4.8 (4.2, 5.3)	6.1 (5.3, 7.1)
	No Patella	531	12413	1.0 (0.9, 1.2)	2.5 (2.3, 2.8)	3.4 (3.1, 3.7)	3.9 (3.5, 4.2)	4.9 (4.4, 5.3)	6.0 (5.3, 6.8)
Genesis II CR / Genesis II	Patella Used	189	6844	1.0 (0.7, 1.2)	2.3 (1.9, 2.7)	3.0 (2.6, 3.5)	3.8 (3.2, 4.4)	4.0 (3.4, 4.7)	4.1 (3.5, 4.9)
	No Patella	339	10040	0.9 (0.7, 1.1)	2.8 (2.5, 3.2)	3.6 (3.2, 4.1)	4.3 (3.9, 4.9)	4.9 (4.3, 5.5)	5.3 (4.6, 6.0)
LCS CR / MBT	Patella Used	204	5808	1.0 (0.8, 1.3)	3.1 (2.6, 3.6)	4.2 (3.6, 4.9)	5.1 (4.4, 6.0)	6.1 (5.2, 7.2)	
	No Patella	340	13861	0.7 (0.6, 0.9)	2.2 (2.0, 2.5)	3.0 (2.7, 3.4)	3.6 (3.2, 4.1)	5.1 (4.3, 6.0)	
LCS CR / MBT Duofix	Patella Used	104	2746	1.3 (0.9, 1.8)	3.1 (2.5, 3.9)	3.7 (3.0, 4.6)	4.4 (3.6, 5.4)	5.2 (4.2, 6.5)	
	No Patella	346	8224	1.3 (1.0, 1.5)	3.2 (2.9, 3.6)	4.1 (3.7, 4.6)	4.7 (4.2, 5.2)	5.3 (4.8, 6.0)	
Nexgen CR / Nexgen	Patella Used	68	3473	0.4 (0.2, 0.7)	1.1 (0.8, 1.5)	1.4 (1.0, 1.8)	1.6 (1.2, 2.1)	2.3 (1.8, 2.9)	2.8 (2.1, 3.7)
	No Patella	207	6750	0.5 (0.4, 0.7)	1.8 (1.5, 2.2)	2.3 (1.9, 2.7)	2.7 (2.3, 3.1)	3.3 (2.9, 3.9)	5.8 (4.5, 7.4)
Nexgen CR Flex / Nexgen	Patella Used	131	12053	0.5 (0.4, 0.7)	1.2 (1.0, 1.4)	1.6 (1.3, 1.9)	1.7 (1.4, 2.0)		
	No Patella	255	13652	0.9 (0.8, 1.1)	1.9 (1.7, 2.2)	2.5 (2.2, 2.8)	2.8 (2.4, 3.2)		
PFC Sigma CR / PFC Sigma	Patella Used	163	9531	0.6 (0.5, 0.8)	1.5 (1.3, 1.8)	1.9 (1.6, 2.3)	2.5 (2.1, 3.0)	3.0 (2.5, 3.7)	3.8 (2.9, 4.9)
	No Patella	263	9150	0.9 (0.7, 1.1)	2.4 (2.0, 2.7)	3.1 (2.7, 3.5)	3.5 (3.1, 4.0)	4.9 (4.2, 5.7)	5.1 (4.3, 6.0)
Scorpio CR / Series 7000	Patella Used	123	4418	0.7 (0.5, 1.0)	1.6 (1.3, 2.1)	2.4 (1.9, 2.9)	2.9 (2.4, 3.6)	3.6 (3.0, 4.3)	4.2 (3.4, 5.2)
	No Patella	269	5623	1.0 (0.8, 1.3)	3.1 (2.6, 3.6)	4.2 (3.6, 4.8)	5.0 (4.4, 5.7)	6.7 (5.8, 7.6)	7.5 (6.4, 8.8)
Triathlon CR / Triathlon	Patella Used	171	15376	0.6 (0.5, 0.8)	1.3 (1.1, 1.6)	1.7 (1.5, 2.1)	2.2 (1.7, 2.8)		
	No Patella	380	18523	0.8 (0.7, 1.0)	2.4 (2.1, 2.7)	3.2 (2.9, 3.6)	3.7 (3.2, 4.2)		
Vanguard CR / Maxim	Patella Used	74	3955	0.8 (0.5, 1.1)	2.2 (1.7, 2.8)	2.9 (2.2, 3.7)	3.4 (2.6, 4.4)		
	No Patella	129	4842	0.9 (0.7, 1.3)	2.9 (2.4, 3.6)	4.6 (3.8, 5.6)	6.2 (4.3, 8.8)		
Other (148)	Patella Used	1616	45033	0.9 (0.8, 1.0)	2.5 (2.4, 2.7)	3.5 (3.4, 3.8)	4.4 (4.2, 4.6)	5.7 (5.4, 6.0)	7.3 (6.6, 8.1)
	No Patella	3147	61327	1.3 (1.2, 1.4)	3.8 (3.7, 4.0)	5.1 (4.9, 5.3)	6.1 (5.9, 6.4)	7.3 (7.0, 7.6)	8.6 (8.2, 9.1)
TOTAL		**9361**	**280723**						

Figure PR8: Cumulative Percent Revision of Minimally Stabilised Scorpio CR/Series 7000 Primary Total Knee Replacement by Patella Usage (Primary Diagnosis OA)



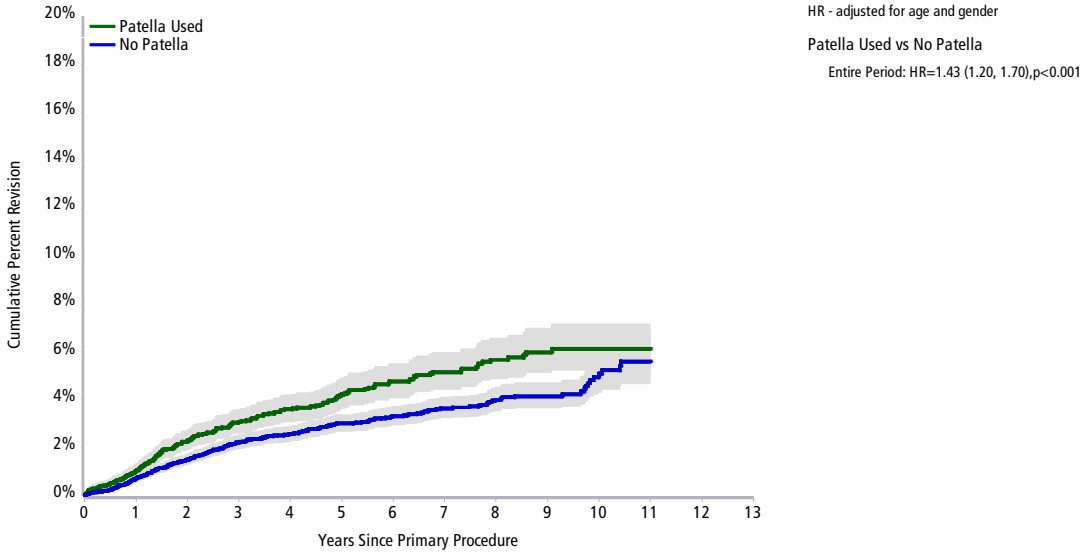
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Patella Used	4418	4096	3483	2903	2348	1110	61
No Patella	5623	5291	4524	3710	2649	950	69

Figure PR9: Cumulative Percent Revision of Minimally Stabilised Duracon/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	13 Yrs
Patella Used	7081	6924	6586	5797	4555	2181	142
No Patella	12413	12132	11574	10538	7961	3354	231

Figure PR10: Cumulative Percent Revision of Minimally Stabilised LCS CR/MBT Primary Total Knee Replacement by Patella Usage (Primary Diagnosis OA)

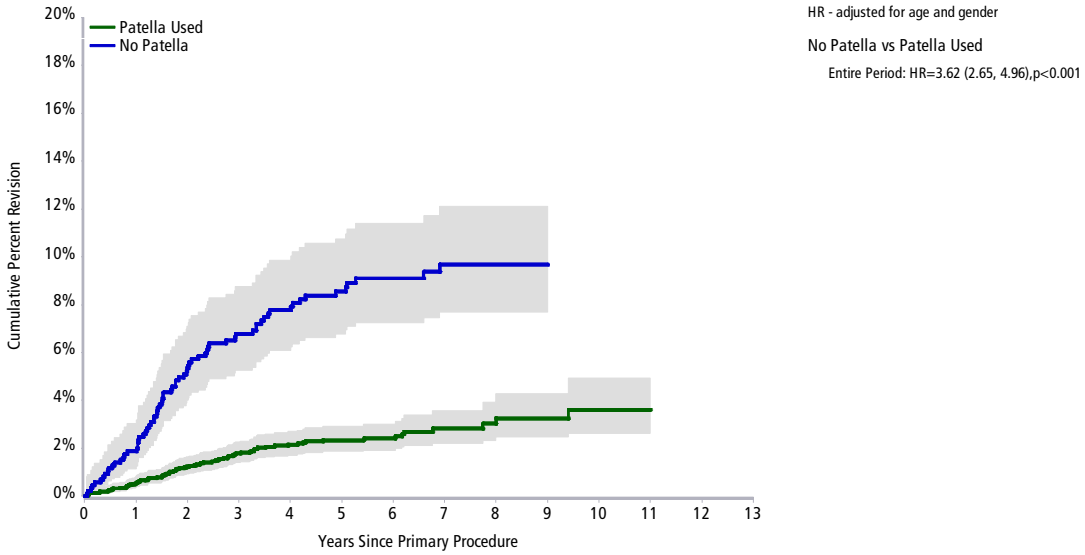


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Patella Used	5808	5014	3251	2154	1497	392	0
No Patella	13861	11710	7799	5386	3109	674	0

Table PR10: Cumulative Percent Revision of Posterior Stabilised Primary Total Knee Replacement by 10 Most Used Femoral/Tibial Prosthesis Combinations and Patella Usage (Primary Diagnosis OA)

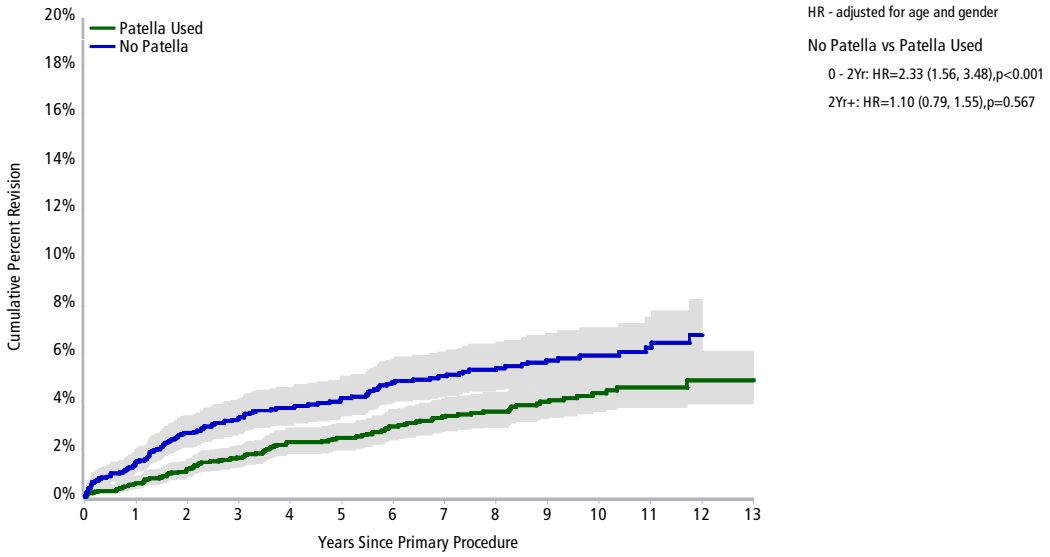
Model	Patella Usage	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Genesis II Oxinium PS / Genesis II	Patella Used	294	7436	1.6 (1.3, 1.9)	3.7 (3.2, 4.2)	5.2 (4.6, 5.9)	6.1 (5.4, 6.9)	7.6 (6.3, 9.2)	
	No Patella	202	3857	1.8 (1.4, 2.3)	4.6 (3.9, 5.4)	6.2 (5.3, 7.1)	7.0 (6.0, 8.1)		
Genesis II PS / Genesis II	Patella Used	222	7807	1.2 (1.0, 1.5)	2.5 (2.2, 2.9)	3.3 (2.9, 3.8)	3.8 (3.2, 4.3)	4.8 (4.0, 5.7)	
	No Patella	241	5220	1.5 (1.2, 1.9)	3.9 (3.4, 4.5)	5.1 (4.5, 5.9)	5.9 (5.1, 6.7)	6.5 (5.6, 7.5)	
Legion Oxinium PS / Genesis II	Patella Used	52	3170	1.1 (0.8, 1.6)	2.7 (2.0, 3.6)	3.3 (2.3, 4.8)			
	No Patella	26	752	1.5 (0.8, 2.8)	4.7 (3.1, 6.9)				
Nexgen LPS / Nexgen	Patella Used	111	3450	0.6 (0.4, 0.9)	1.7 (1.3, 2.2)	2.5 (2.0, 3.1)	3.4 (2.7, 4.1)	4.3 (3.6, 5.3)	4.9 (3.9, 6.1)
	No Patella	124	2462	1.4 (1.0, 2.0)	3.3 (2.6, 4.1)	4.1 (3.4, 5.1)	5.0 (4.2, 6.1)	5.9 (4.9, 7.1)	
Nexgen LPS Flex / Nexgen	Patella Used	425	15613	0.9 (0.7, 1.0)	2.1 (1.9, 2.4)	3.1 (2.8, 3.5)	4.1 (3.6, 4.5)	5.3 (4.6, 5.9)	
	No Patella	205	6120	1.0 (0.8, 1.3)	3.0 (2.5, 3.5)	3.7 (3.2, 4.3)	4.4 (3.8, 5.2)	5.5 (4.7, 6.5)	
PFC Sigma PS / MBT	Patella Used	87	4499	0.5 (0.4, 0.8)	1.8 (1.4, 2.3)	2.3 (1.9, 2.9)	2.8 (2.2, 3.6)	3.6 (2.6, 4.9)	
	No Patella	72	874	1.9 (1.2, 3.0)	6.8 (5.2, 8.7)	8.6 (6.8, 10.8)	9.7 (7.7, 12.1)		
PFC Sigma PS / PFC Sigma	Patella Used	84	4363	0.8 (0.6, 1.1)	1.7 (1.4, 2.2)	2.0 (1.6, 2.6)	2.3 (1.9, 3.0)	3.2 (2.3, 4.2)	
	No Patella	80	1605	1.8 (1.3, 2.6)	3.8 (3.0, 4.9)	5.0 (3.9, 6.2)	5.1 (4.0, 6.4)	6.7 (5.1, 8.7)	
Scorpio NRG PS / Series 7000	Patella Used	80	2726	0.8 (0.5, 1.2)	3.3 (2.6, 4.1)	4.2 (3.4, 5.3)			
	No Patella	27	688	1.1 (0.5, 2.2)	3.2 (2.1, 4.9)	4.5 (3.1, 6.6)			
Scorpio PS / Series 7000	Patella Used	73	1927	0.9 (0.6, 1.5)	2.8 (2.1, 3.7)	3.5 (2.7, 4.5)	4.1 (3.2, 5.3)	6.0 (4.4, 8.1)	
	No Patella	163	2569	1.6 (1.2, 2.1)	4.3 (3.5, 5.1)	5.6 (4.7, 6.6)	6.7 (5.7, 7.8)	8.1 (6.8, 9.5)	9.0 (7.4, 10.8)
Triathlon PS / Triathlon	Patella Used	70	3200	1.6 (1.2, 2.1)	2.4 (1.9, 3.0)	2.6 (2.0, 3.4)	3.7 (2.6, 5.2)		
	No Patella	128	3131	2.0 (1.6, 2.6)	4.1 (3.4, 5.0)	5.3 (4.4, 6.4)	5.5 (4.6, 6.7)		
Other (96)	Patella Used	476	13082	1.4 (1.2, 1.6)	3.4 (3.0, 3.8)	4.7 (4.2, 5.1)	5.6 (5.1, 6.2)	7.2 (6.3, 8.1)	
	No Patella	615	9598	1.7 (1.4, 2.0)	5.1 (4.7, 5.6)	6.8 (6.3, 7.4)	8.0 (7.4, 8.7)	9.7 (8.8, 10.7)	
TOTAL		**3857**	**104149**						

Figure PR11: Cumulative Percent Revision of Posterior Stabilised PFC Sigma PS/MBT Primary Total Knee Replacement by Patella Usage (Primary Diagnosis OA)



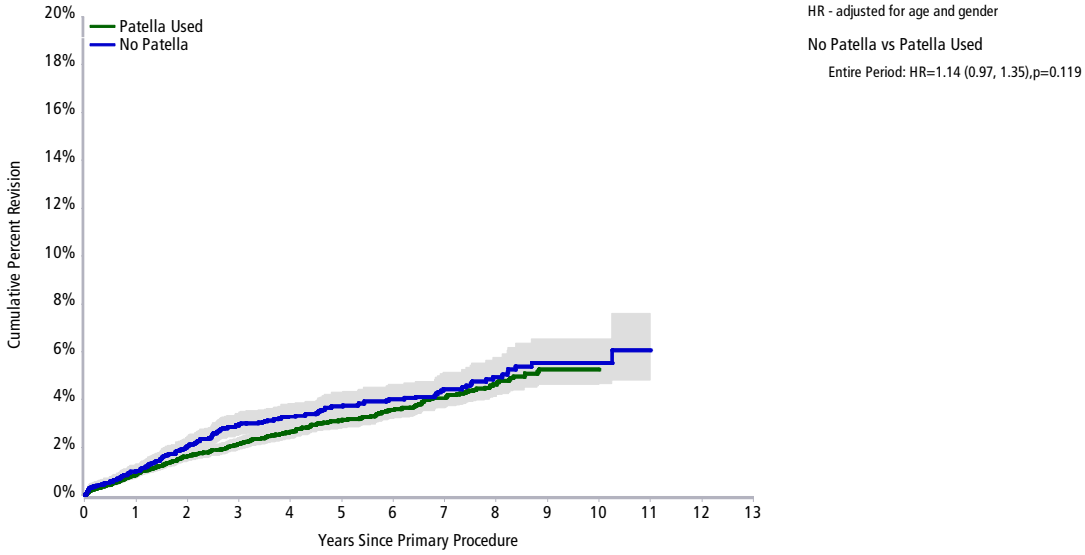
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Patella Used	4499	3891	2849	1701	672	195	0
No Patella	874	810	685	513	291	33	0

Figure PR12: Cumulative Percent Revision of Posterior Stabilised Nexgen LPS/Nexgen 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	13 Yrs
Patella Used	3450	3266	2864	2341	1843	893	49
No Patella	2462	2321	2008	1731	1417	768	31

Figure PR13: Cumulative Percent Revision of Posterior Stabilised Nexgen LPS Flex/Nexgen 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	13 Yrs
Patella Used	15613	13412	9507	5979	3068	321	0
No Patella	6120	5367	4081	2613	1445	254	0

Patella Resurfacing in Revision Surgery

The Registry regards resurfacing a patella subsequent to the initial primary procedure as a revision of that primary. This analysis compares the results of this procedure to other total knee replacement first revision procedures.

The Registry classifies revisions as major or minor. A major revision is a revision of one or more major prostheses. A major prosthesis is one that interfaces with bone with the exception of a patellar prosthesis. Major revisions of a total knee replacement therefore include revisions of the tibial or femoral component or both. A major total knee replacement revision may or may not include patella resurfacing.

As a patellar prosthesis is not a major component, subsequent resurfacing of a patella that does not involve the removal or exchange of the tibial and/or femoral prostheses is regarded as a minor revision. There are three main types of minor revision of a total knee replacement; patella only, insert/patella, and insert only.

There is no difference in the re-revision rate of patella only and insert/patella revisions. Both have a lower rate of re-revision compared to insert only revisions. For patella only revision this difference is evident for the first 1.5 years and for insert/patella revisions for the first year. The cumulative percent re-revision at seven years for insert only revisions is 26.3%, for insert/patella it is 18.5% and for patella only it is 15.4% (Table PR11 Fig PR14). The increased re-revision rate for insert only revisions is due to a higher rate of re-revision for infection, instability (including dislocation) and patellofemoral pain (Table PR12).

Minor revisions that involve patella resurfacing (i.e. patella only combined with insert/patella revisions) were compared to two types of major revisions (with and without patella resurfacing). Only revisions of primary total knee replacement where the patella was not replaced were included in this analysis.

Patella resurfacing revisions have a lower rate of re-revision compared to both types of major revision. Major revisions with the patella resurfaced have a lower rate of re-revision compared to those that do not but this difference is only evident for the first 1.5 years. The cumulative percent re-revision at seven years for major revisions without patella resurfacing is 23.1%, with patella resurfacing 19.3% and minor revisions that involve patella resurfacing 16.2% (Table PR13 and Figure PR15). The increased re-revision rate for the major revisions is due to a higher rate of re-revision for loosening/lysis and infection.

Re-revision for patellofemoral pain is one of the reasons that major revisions without patella resurfacing have a higher rate of re-revision compared to those with patella resurfacing. The two main reasons for re-revision of minor revisions involving patella resurfacing are loosening/lysis and infection (Table PR14)

Conclusion

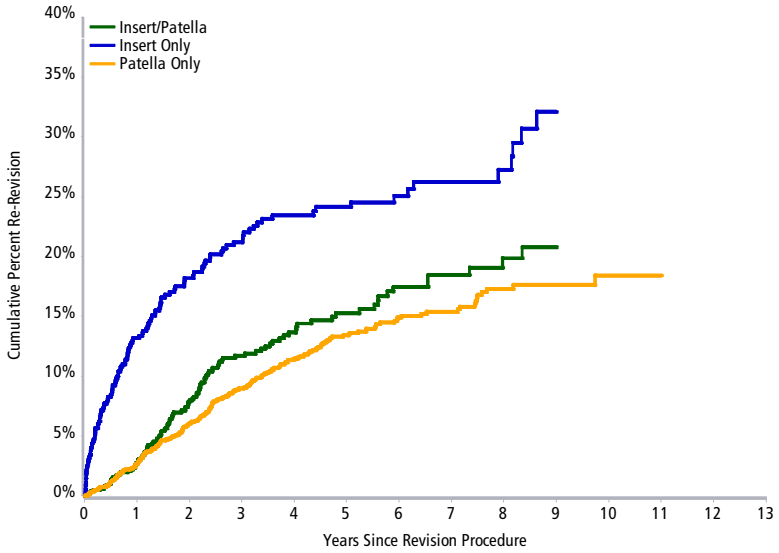
The benefit or otherwise of resurfacing the patella at the time of a primary total knee replacement for osteoarthritis is dependent on the type of total knee prosthesis used. Metal-backed patellar prostheses have a higher rate of revision. There is no difference between all-polyethylene onlay and inset patellar prostheses.

At seven years the cumulative percent re-revision for patella only revisions is 16.2% compared to the re-revision of major revisions with the addition of a patella which is 19.3%. Revising the insert at the same time does not appear to provide additional benefit up to seven years. There may be a benefit to using a patellar prosthesis in a major revision if the patella has not been previously resurfaced.

Table PR11: Cumulative Percent Re-revision of Known Primary Total Knee Replacement by Type of Minor Revision (Primary Diagnosis OA, excluding Revision for Infection)

Type of Revision	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Insert/Patella	117	1022	2.7 (1.8, 4.0)	11.7 (9.6, 14.2)	15.3 (12.7, 18.4)	18.5 (15.2, 22.3)		
Insert Only	125	551	13.2 (10.6, 16.4)	21.2 (17.8, 25.1)	24.1 (20.5, 28.3)	26.3 (22.2, 30.9)		
Patella Only	263	2496	2.7 (2.1, 3.4)	9.0 (7.8, 10.3)	13.4 (11.8, 15.2)	15.4 (13.6, 17.4)	18.4 (15.8, 21.4)	
TOTAL	**505**	**4069**						

Figure PR14: Cumulative Percent Re-Revision of Known Primary Total Knee Replacement by Type of Minor Revision (Primary Diagnosis OA, excluding Revision for Infection)



HR - adjusted for age and gender

Insert/Patella vs Patella Only

Entire Period: HR=1.15 (0.92, 1.43),p=0.220

Insert Only vs Patella Only

0 - 2Wk: HR=76.93 (10.00, 591.7),p<0.001

2Wk - 3Mth: HR=7.64 (4.05, 14.41),p<0.001

3Mth - 9Mth: HR=3.43 (2.13, 5.53),p<0.001

9Mth - 1.5Yr: HR=2.30 (1.48, 3.58),p<0.001

1.5Yr+: HR=1.08 (0.76, 1.53),p=0.668

Insert Only vs Insert/Patella

0 - 3Mth: HR=9.86 (5.50, 17.67),p<0.001

3Mth - 1Yr: HR=3.16 (2.06, 4.83),p<0.001

1Yr - 1.5Yr: HR=1.53 (0.87, 2.71),p=0.140

1.5Yr+: HR=0.94 (0.65, 1.36),p=0.746

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Insert/Patella	1022	828	482	266	148	37	2
Insert Only	551	429	290	187	95	29	0
Patella Only	2496	2126	1387	817	412	84	2

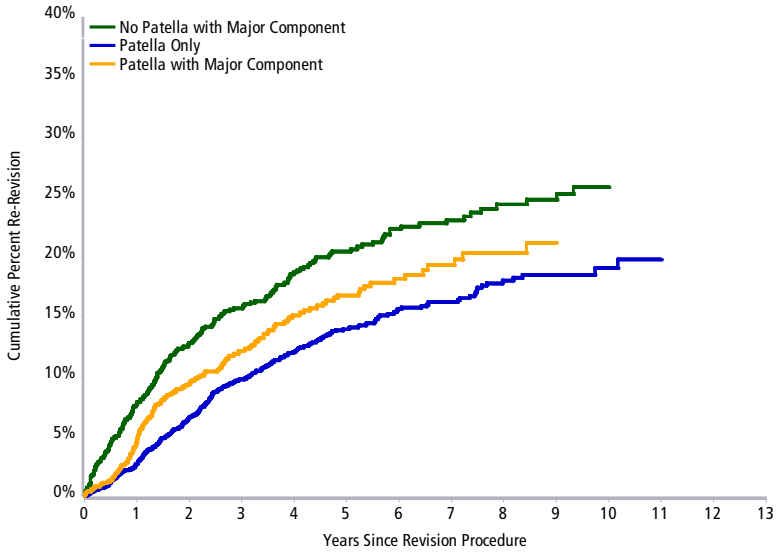
Table PR12: Re-Revision Diagnosis of Known Primary Total Knee Replacement by Type of Minor Revision (Primary Diagnosis OA, excluding Revision for Infection)

Re-Revision Diagnosis	Insert/Patella			Insert Only			Patella Only		
	Number	% Re-Revision	% Revision	Number	% Re-Revision	% Revision	Number	% Re-Revision	% Revision
Loosening/Lysis	37	31.6	3.6	30	24.0	5.4	95	36.1	3.8
Infection	23	19.7	2.3	38	30.4	6.9	55	20.9	2.2
Pain	18	15.4	1.8	5	4.0	0.9	37	14.1	1.5
Instability	17	14.5	1.7	18	14.4	3.3	23	8.7	0.9
Malalignment	1	0.9	0.1	1	0.8	0.2	18	6.8	0.7
Arthrofibrosis	7	6.0	0.7	4	3.2	0.7	13	4.9	0.5
Patellofemoral Pain				8	6.4	1.5			
Other	14	12.0	1.4	21	16.8	3.8	22	8.4	0.9
N Re-Revision	**117**	**100.0**	**11.4**	**125**	**100.0**	**22.7**	**263**	**100.0**	**10.5**
N Revision	**1022**			**551**			**2496**		

Table PR13: Cumulative Percent Re-revision of Known Primary Total Knee Replacement by Type of Revision (Primary Diagnosis OA, excluding Revision for Infection)

Patella Usage in Revision	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
No Patella with Major Component	228	1284	7.9 (6.5, 9.5)	15.7 (13.7, 18.0)	20.4 (18.0, 23.2)	23.1 (20.3, 26.1)	25.8 (22.5, 29.4)	
Patella Only	380	3518	2.7 (2.2, 3.3)	9.7 (8.7, 10.9)	13.9 (12.6, 15.4)	16.2 (14.6, 18.0)	19.0 (16.8, 21.5)	
Patella with Major Component	163	1301	4.7 (3.7, 6.1)	12.1 (10.3, 14.4)	16.8 (14.3, 19.6)	19.3 (16.4, 22.6)		
TOTAL	**771**	**6103**						

Figure PR15: Cumulative Percent Re-Revision of Known Primary Total Knee Replacement by Type of Revision (Primary Diagnosis OA, excluding Revision for Infection)



HR - adjusted for age and gender

No Patella with Major Component vs Patella Only

0 - 3Mth: HR=4.86 (2.97, 7.96),p<0.001

3Mth - 9Mth: HR=2.09 (1.41, 3.10),p<0.001

9Mth+: HR=1.26 (1.04, 1.53),p=0.018

Patella with Major Component vs Patella Only

Entire Period: HR=1.22 (1.02, 1.47),p=0.031

No Patella with Major Component vs Patella with Major Component

0 - 3Mth: HR=3.97 (2.40, 6.58),p<0.001

3Mth - 1.5Yr: HR=1.40 (1.06, 1.84),p=0.016

1.5Yr+: HR=0.94 (0.72, 1.22),p=0.651

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
No Patella with Major Component	1284	1052	700	434	264	76	1
Patella Only	3518	2954	1869	1083	560	121	4
Patella with Major Component	1301	1019	606	349	170	28	0

Table PR14: Re-Revision Diagnosis of Known Primary Total Knee Replacement by Type of Revision (Primary Diagnosis OA, excluding Revision for Infection)

	No Patella with Major Component			Patella Only			Patella with Major Component		
Re-Revision Diagnosis	Number	% Re-Revision	% Revision	Number	% Re-Revision	% Revision	Number	% Re-Revision	% Revision
Loosening/Lysis	92	40.4	7.2	132	34.7	3.8	72	44.2	5.5
Infection	62	27.2	4.8	78	20.5	2.2	43	26.4	3.3
Pain	13	5.7	1.0	55	14.5	1.6	12	7.4	0.9
Instability	13	5.7	1.0	40	10.5	1.1	8	4.9	0.6
Arthrofibrosis	4	1.8	0.3	20	5.3	0.6	7	4.3	0.5
Malalignment	1	0.4	0.1	19	5.0	0.5	2	1.2	0.2
Patellofemoral Pain	19	8.3	1.5						
Other	24	10.5	1.9	36	9.5	1.0	19	11.7	1.5
N Re-Revision	**228**	**100.0**	**17.8**	**380**	**100.0**	**10.8**	**163**	**100.0**	**12.5**
N Revision	**1284**			**3518**			**1301**		

DISLOCATION RELATED TO FEMORAL HEAD SIZE

Introduction

The Registry has undertaken an analysis to determine how a variety of factors in combination with head size affects revision for dislocation in primary total conventional hip replacement. The analysis excluded large head (>32mm) metal/metal bearing surface procedures.

Head sizes analysed include 22mm, 26mm, 28mm, 32mm, 36mm, 38mm, and greater than or equal to 40mm. Diagnoses included osteoarthritis, fractured neck of femur, osteonecrosis, developmental dysplasia and rheumatoid arthritis. In the osteoarthritis group the effect of age, gender, fixation and bearing surface was further analysed.

A separate analysis was also undertaken to determine the effect of head size on the outcome of revision total conventional hip replacement. The re-revision rate for dislocation was compared for two types of revision; revisions for dislocation and revisions for any other reason.

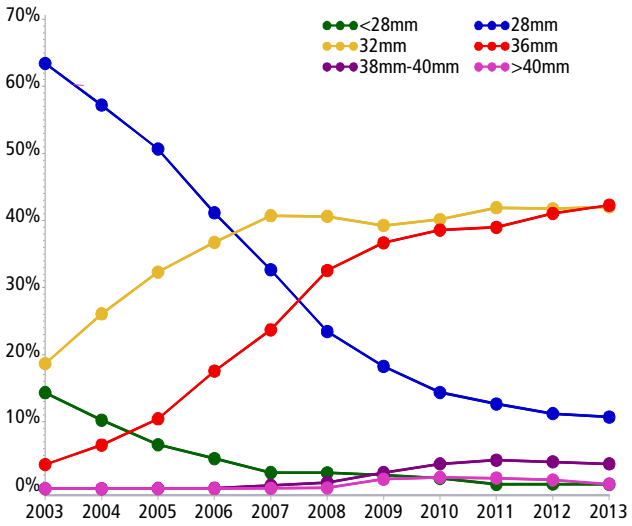
Head Size Usage

There has been increased use of head sizes greater than or equal to 32mm since 2003 (Figure D1).

The proportion of 32mm and 36mm heads increased from 18.7% to 42.0% and 3.6% to 42.3% respectively between 2003 and 2013. The use of 38mm and 40mm and larger heads also increased but only accounted for 3.7% and 0.7% of all procedures in 2013.

The use of 28mm heads decreased from 63.4% to 10.7% between 2003 and 2013. Head sizes less than 28mm decreased from 14.3% to 0.6% over the same period.

Figure D1: Primary Total Conventional Hip Replacement by Procedure Year and Head Size



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

Outcome

Outcome for all Primary Diagnoses

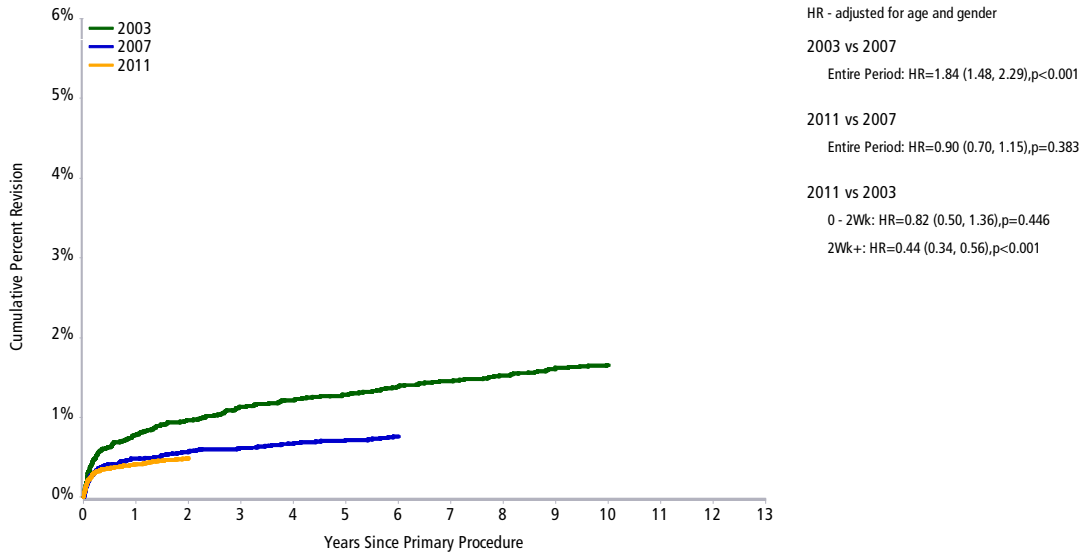
There has been a reduction in revision for dislocation since 2003. Comparing procedures undertaken in 2003 to those undertaken in 2007 and 2011, the rate of revision decreased by 40% at two years follow up in 2007 and that decrease was maintained in 2011 (Table D1 and Figure D2).

The rate of revision for dislocation varies depending on diagnosis. Rheumatoid arthritis and fractured neck of femur have the highest rate and osteoarthritis the lowest. Revisions for dislocation decrease with increasing head size up to 32mm for all diagnoses. Head sizes larger than 32mm are not associated with a reduced rate of revision for dislocation (Table D2).

Table D1: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement by Primary Procedure Year

Procedure Year	N Revised	N Total	1 Yr	2 Yrs	3 Yrs	5 Yrs	7 Yrs	10 Yrs
2003	263	16653	0.8 (0.7, 0.9)	1.0 (0.8, 1.1)	1.1 (1.0, 1.3)	1.3 (1.1, 1.5)	1.5 (1.3, 1.7)	1.7 (1.5, 1.9)
2007	129	17222	0.5 (0.4, 0.6)	0.6 (0.5, 0.7)	0.6 (0.5, 0.7)	0.7 (0.6, 0.9)		
2011	132	26381	0.4 (0.3, 0.5)	0.5 (0.4, 0.6)				
TOTAL	**524**	**60256**						

Figure D2: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement by Primary Procedure Year



Number at Risk	0 Yr	1 Yr	2 Yrs	3 Yrs	5 Yrs	7 Yrs	10 Yrs
2003	16653	16028	15634	15220	14327	13195	11483
2007	17222	16643	16246	15823	14907	0	0
2011	26381	25539	25058	0	0	0	0

Table D2: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement by Primary Diagnosis and Head Size

Primary Diagnosis	Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Osteoarthritis		**1798**	**33660**	**0.5 (0.4, 0.5)**	**0.7 (0.6, 0.7)**	**0.8 (0.7, 0.8)**	**0.9 (0.9, 1.0)**	**1.1 (1.1, 1.2)**	**1.4 (1.2, 1.5)**
	≤28mm	1121	86468	0.6 (0.6, 0.7)	0.9 (0.9, 1.0)	1.1 (1.1, 1.2)	1.3 (1.2, 1.4)	1.5 (1.5, 1.6)	1.8 (1.6, 1.9)
	32mm	410	79308	0.4 (0.3, 0.4)	0.5 (0.4, 0.6)	0.5 (0.5, 0.6)	0.7 (0.6, 0.7)	0.7 (0.7, 0.8)	1.1 (0.6, 2.1)
	36mm	251	61744	0.3 (0.3, 0.4)	0.4 (0.4, 0.5)	0.5 (0.4, 0.6)	0.5 (0.5, 0.6)	0.6 (0.5, 0.8)	
	>36mm	16	6140	0.2 (0.1, 0.4)	0.3 (0.2, 0.4)	0.4 (0.2, 0.8)			
Fractured Neck Of Femur		**164**	**10610**	**1.3 (1.1, 1.6)**	**1.7 (1.4, 1.9)**	**1.8 (1.5, 2.1)**	**1.9 (1.6, 2.3)**	**2.1 (1.7, 2.6)**	
	≤28mm	72	3222	1.6 (1.2, 2.2)	2.3 (1.8, 2.9)	2.5 (2.0, 3.2)	2.7 (2.1, 3.4)	2.9 (2.3, 3.7)	
	32mm	57	4332	1.2 (0.9, 1.6)	1.5 (1.1, 1.9)	1.5 (1.1, 1.9)	1.5 (1.1, 1.9)	1.5 (1.1, 1.9)	
	36mm	33	2826	1.1 (0.8, 1.6)	1.2 (0.9, 1.7)	1.2 (0.9, 1.7)	1.5 (1.0, 2.4)		
	>36mm	2	230	0.4 (0.1, 3.0)	1.0 (0.3, 4.2)				
Osteonecrosis		**118**	**9010**	**1.0 (0.8, 1.2)**	**1.2 (1.0, 1.5)**	**1.4 (1.1, 1.7)**	**1.5 (1.2, 1.8)**	**1.7 (1.4, 2.1)**	**1.8 (1.4, 2.3)**
	≤28mm	73	3863	1.2 (0.9, 1.6)	1.6 (1.2, 2.1)	1.8 (1.4, 2.3)	1.9 (1.5, 2.4)	2.2 (1.7, 2.8)	2.3 (1.8, 3.0)
	32mm	24	2957	0.8 (0.5, 1.2)	0.8 (0.5, 1.2)	0.9 (0.6, 1.3)	0.9 (0.6, 1.3)	1.2 (0.6, 2.1)	
	36mm	17	2025	0.8 (0.5, 1.3)	0.9 (0.6, 1.5)	0.9 (0.6, 1.5)	0.9 (0.6, 1.5)		
	>36mm	4	165	2.5 (0.9, 6.5)	2.5 (0.9, 6.5)				
Developmental Dysplasia		**42**	**3258**	**1.0 (0.7, 1.4)**	**1.2 (0.9, 1.6)**	**1.4 (1.0, 1.9)**	**1.4 (1.0, 1.9)**	**1.5 (1.1, 2.1)**	**1.5 (1.1, 2.1)**
	≤28mm	29	1495	1.6 (1.0, 2.3)	1.8 (1.2, 2.6)	1.9 (1.3, 2.7)	2.0 (1.4, 2.8)	2.1 (1.4, 3.0)	2.1 (1.4, 3.0)
	32mm	9	1029	0.6 (0.3, 1.3)	0.7 (0.3, 1.5)	1.2 (0.6, 2.3)	1.2 (0.6, 2.3)	1.2 (0.6, 2.3)	
	36mm	4	656	0.5 (0.2, 1.4)	0.7 (0.2, 1.8)	0.7 (0.2, 1.8)	0.7 (0.2, 1.8)		
	>36mm	0	78	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)				
Rheumatoid Arthritis		**58**	**3039**	**1.0 (0.7, 1.4)**	**1.6 (1.2, 2.2)**	**1.7 (1.3, 2.2)**	**1.9 (1.4, 2.5)**	**2.2 (1.7, 3.0)**	**5.0 (3.0, 8.2)**
	≤28mm	43	1572	1.2 (0.8, 1.9)	2.1 (1.5, 3.0)	2.1 (1.5, 3.0)	2.3 (1.7, 3.3)	2.8 (2.0, 3.9)	5.8 (3.5, 9.4)
	32mm	9	950	0.5 (0.2, 1.3)	0.8 (0.4, 1.7)	1.0 (0.5, 2.0)	1.2 (0.6, 2.4)	1.2 (0.6, 2.4)	
	36mm	6	482	1.1 (0.5, 2.6)	1.4 (0.6, 3.1)	1.4 (0.6, 3.1)	1.4 (0.6, 3.1)		
	>36mm	0	35	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)				

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

Outcome for Osteoarthritis

The rate of revision for dislocation was compared for six different head sizes; 22mm, 26mm, 28mm, 32mm, 36mm and 38mm or larger.

After three months, head sizes 22mm and 26mm have over 3.5 times the rate of revision for dislocation compared to head size 32mm. Head size of 28mm also has a higher rate of revision for dislocation and after six months is almost twice the rate of 32mm. There is no difference in the rate of revision for dislocation with head sizes 32mm compared to 36mm and 38mm or larger (Table D3 and Figure D3).

Patient Characteristics

Gender

Females have a higher rate of revision for dislocation compared to males. In females the three smaller head sizes have a higher rate of revision than 32mm heads. There is no difference when comparing 32mm to 36mm or 38mm or larger. Head sizes smaller than 32mm also have a higher rate of revision for dislocation in males however 36mm and 38mm or larger have a lower rate of revision for dislocation compared to 32mm. (Table D4 and Figures D4 and D5).

Age

Head sizes were compared within each age range; less than 55 years, 55-64, 65-74 and 75 years or older. All age ranges have a higher rate of revision for dislocation for the smaller head sizes 22mm, 26mm, and 28mm compared to 32mm, with the exception of less than 55 years where there is no difference between 28mm and 32mm (Table D5 and Figures D6 – D9).

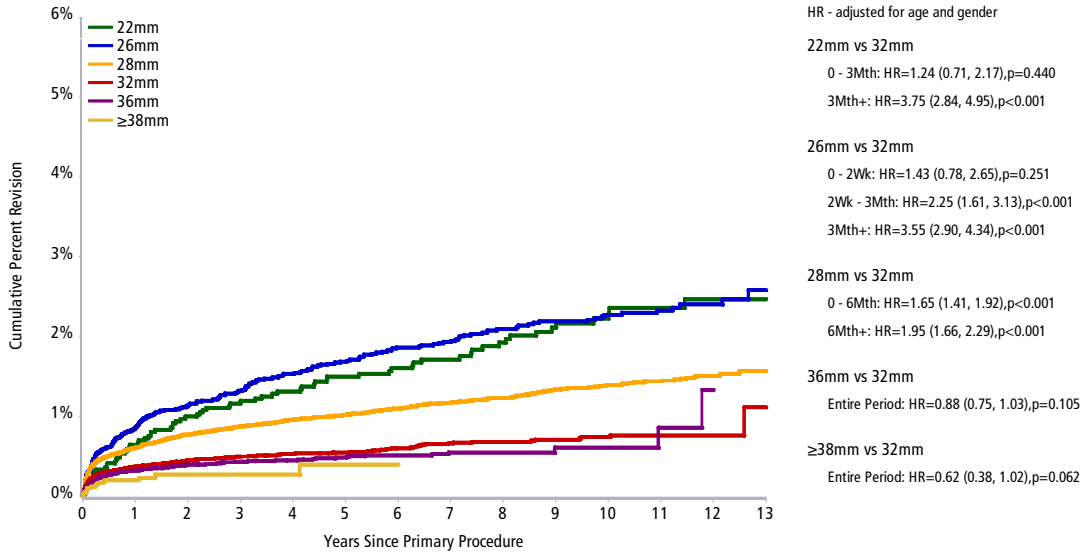
For those aged less than 75 years, there is no difference in the rate of revision for dislocation when comparing head size 32mm to larger head sizes (Table D5 and Figures D6 – D8). For those aged 75 years or older, there is a lower rate of revision for dislocation with head size 36mm compared to 32mm (Table D5 and Figure D9).

Table D3: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)

Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
22mm	75	3955	0.6 (0.4, 1.0)	1.2 (0.9, 1.6)	1.5 (1.2, 1.9)	1.7 (1.3, 2.2)	2.2 (1.8, 2.8)	2.5 (1.9, 3.1)
26mm	206	9932	0.9 (0.7, 1.1)	1.3 (1.1, 1.6)	1.7 (1.4, 2.0)	1.9 (1.7, 2.2)	2.3 (2.0, 2.6)	2.6 (2.2, 3.0)
28mm	840	72581	0.6 (0.6, 0.7)	0.9 (0.8, 0.9)	1.0 (0.9, 1.1)	1.2 (1.1, 1.3)	1.4 (1.3, 1.5)	1.6 (1.4, 1.7)
32mm	410	79308	0.4 (0.3, 0.4)	0.5 (0.4, 0.6)	0.5 (0.5, 0.6)	0.7 (0.6, 0.7)	0.7 (0.7, 0.8)	1.1 (0.6, 2.1)
36mm	251	61744	0.3 (0.3, 0.4)	0.4 (0.4, 0.5)	0.5 (0.4, 0.6)	0.5 (0.5, 0.6)	0.6 (0.5, 0.8)	
≥38mm	16	6140	0.2 (0.1, 0.4)	0.3 (0.2, 0.4)	0.4 (0.2, 0.8)			
TOTAL	**1798**	**233660**						

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

Figure D3: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)



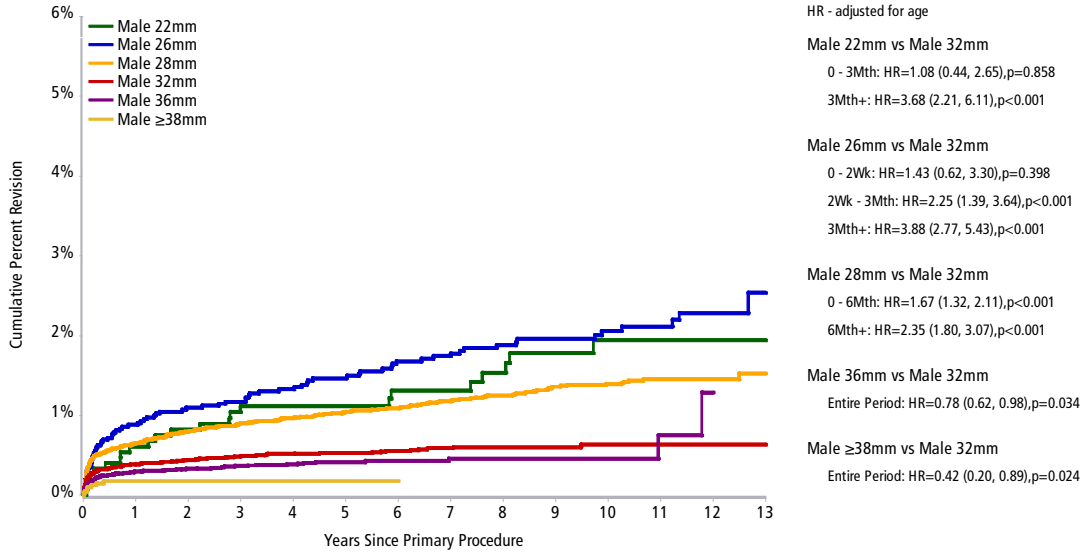
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
22mm	3955	3740	3452	3022	2468	1496	164
26mm	9932	9619	8971	7975	7017	4330	541
28mm	72581	67989	59771	50590	39530	18354	1230
32mm	79308	66938	45744	29224	16513	4223	112
36mm	61744	49251	29012	13487	5057	806	18
≥38mm	6140	4830	2062	207	9	0	0

Table D4: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement by Gender and Head Size (Primary Diagnosis OA)

Gender by Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male	**729**	**105826**	**0.4 (0.4, 0.5)**	**0.6 (0.5, 0.6)**	**0.7 (0.6, 0.8)**	**0.8 (0.7, 0.9)**	**1.0 (0.9, 1.1)**	**1.2 (1.0, 1.4)**
22mm	23	1502	0.6 (0.3, 1.2)	1.0 (0.6, 1.7)	1.1 (0.7, 1.8)	1.3 (0.8, 2.1)	1.9 (1.3, 3.0)	1.9 (1.3, 3.0)
26mm	82	4356	0.9 (0.6, 1.2)	1.2 (0.9, 1.5)	1.5 (1.1, 1.9)	1.7 (1.4, 2.2)	2.1 (1.6, 2.6)	2.5 (1.9, 3.4)
28mm	330	27816	0.7 (0.6, 0.8)	0.9 (0.8, 1.0)	1.0 (0.9, 1.2)	1.2 (1.1, 1.3)	1.4 (1.2, 1.6)	1.5 (1.3, 1.8)
32mm	159	31834	0.4 (0.3, 0.5)	0.5 (0.4, 0.6)	0.5 (0.5, 0.6)	0.6 (0.5, 0.7)	0.6 (0.5, 0.8)	0.6 (0.5, 0.8)
36mm	128	36227	0.3 (0.2, 0.4)	0.4 (0.3, 0.4)	0.4 (0.3, 0.5)	0.5 (0.4, 0.6)	0.5 (0.4, 0.6)	
≥38mm	7	4091	0.2 (0.1, 0.4)	0.2 (0.1, 0.4)	0.2 (0.1, 0.4)			
Female	**1069**	**127834**	**0.5 (0.4, 0.5)**	**0.7 (0.7, 0.8)**	**0.8 (0.8, 0.9)**	**1.0 (0.9, 1.1)**	**1.2 (1.2, 1.3)**	**1.5 (1.3, 1.7)**
22mm	52	2453	0.7 (0.4, 1.1)	1.2 (0.9, 1.8)	1.7 (1.3, 2.4)	2.0 (1.5, 2.6)	2.4 (1.8, 3.2)	2.8 (2.1, 3.7)
26mm	124	5576	0.8 (0.6, 1.1)	1.4 (1.1, 1.8)	1.9 (1.5, 2.2)	2.1 (1.7, 2.5)	2.4 (2.0, 2.9)	2.6 (2.2, 3.2)
28mm	510	44765	0.6 (0.5, 0.7)	0.9 (0.8, 1.0)	1.0 (0.9, 1.1)	1.2 (1.1, 1.3)	1.4 (1.3, 1.5)	1.6 (1.4, 1.8)
32mm	251	47474	0.4 (0.3, 0.4)	0.5 (0.4, 0.6)	0.6 (0.5, 0.6)	0.7 (0.6, 0.8)	0.8 (0.7, 1.0)	1.7 (0.7, 4.5)
36mm	123	25517	0.4 (0.3, 0.4)	0.5 (0.4, 0.6)	0.6 (0.5, 0.7)	0.7 (0.5, 0.8)	0.9 (0.5, 1.7)	
≥38mm	9	2049	0.3 (0.1, 0.6)	0.4 (0.2, 0.9)	0.7 (0.3, 1.7)			

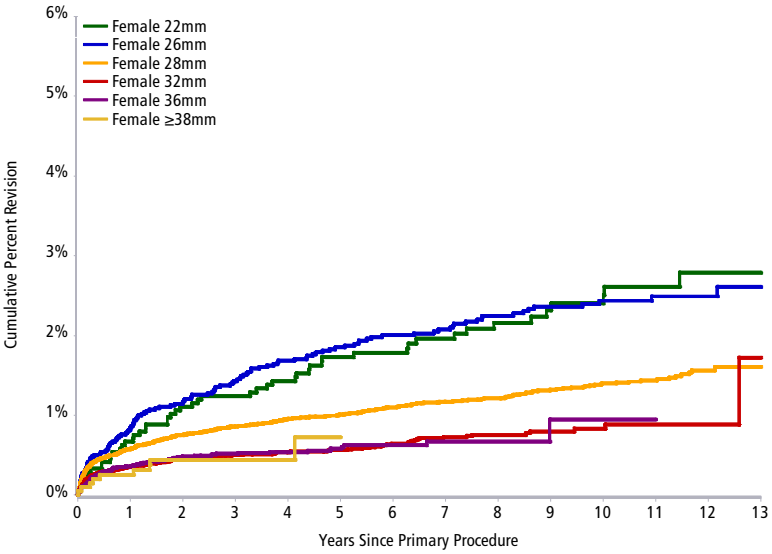
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure D4: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement by Head Size for Males (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male	22mm	1502	1432	1306	1141	914	554	65
	26mm	4356	4188	3865	3376	2955	1824	249
	28mm	27816	26211	23403	20133	16033	7944	557
	32mm	31834	27239	19370	13089	7973	2225	60
	36mm	36227	28847	16953	8137	3396	654	17
	≥38mm	4091	3162	1193	149	8	0	0

Figure D5: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement by Head Size for Females (Primary Diagnosis OA)



HR - adjusted for age

Female 22mm vs Female 32mm

0 - 6Mth: HR=1.45 (0.77, 2.74),p=0.251

6Mth+: HR=3.92 (2.80, 5.48),p<0.001

Female 26mm vs Female 32mm

0 - 6Mth: HR=1.91 (1.30, 2.80),p<0.001

6Mth+: HR=3.58 (2.79, 4.60),p<0.001

Female 28mm vs Female 32mm

Entire Period: HR=1.70 (1.46, 1.99),p<0.001

Female 36mm vs Female 32mm

Entire Period: HR=1.00 (0.80, 1.24),p=0.984

Female ≥38mm vs Female 32mm

Entire Period: HR=0.95 (0.49, 1.86),p=0.890

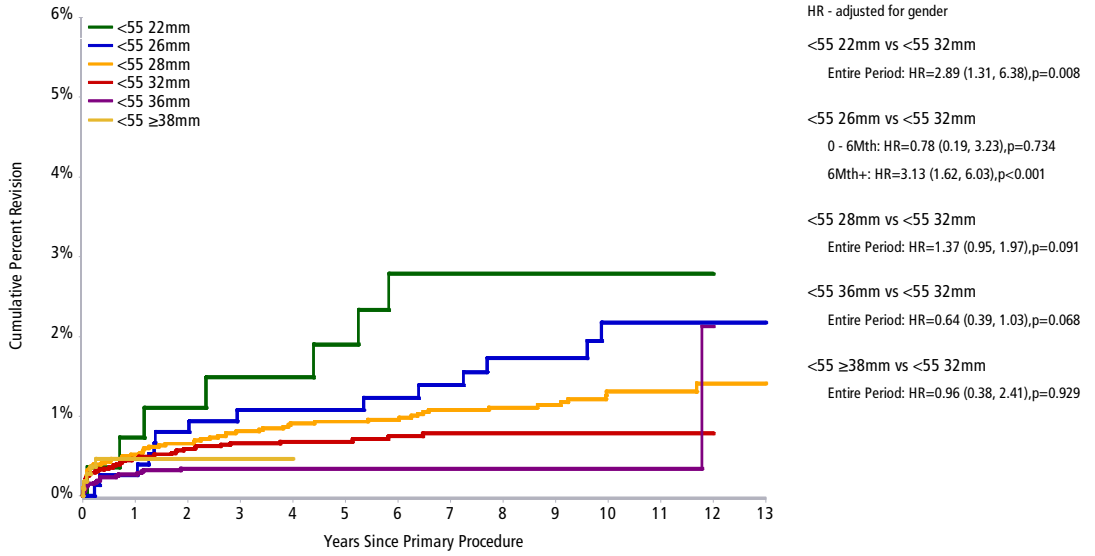
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Female	22mm	2453	2308	2146	1881	1554	942	99
	26mm	5576	5431	5106	4599	4062	2506	292
	28mm	44765	41778	36368	30457	23497	10410	673
	32mm	47474	39699	26374	16135	8540	1998	52
	36mm	25517	20404	12059	5350	1661	152	1
	≥38mm	2049	1668	869	58	1	0	0

Table D5: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement by Age and Head Size (Primary Diagnosis OA)

Age by Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Age <55	**169**	**23806**	**0.4 (0.3, 0.5)**	**0.6 (0.5, 0.8)**	**0.7 (0.6, 0.8)**	**0.8 (0.7, 1.0)**	**1.1 (0.9, 1.3)**	**1.2 (1.0, 1.5)**
22mm	7	278	0.7 (0.2, 2.9)	1.5 (0.6, 3.9)	1.9 (0.8, 4.5)	2.8 (1.3, 5.8)	2.8 (1.3, 5.8)	
26mm	14	758	0.3 (0.1, 1.1)	1.1 (0.5, 2.1)	1.1 (0.5, 2.1)	1.4 (0.7, 2.6)	2.2 (1.3, 3.7)	2.2 (1.3, 3.7)
28mm	66	6085	0.5 (0.4, 0.7)	0.8 (0.6, 1.1)	0.9 (0.7, 1.2)	1.1 (0.8, 1.4)	1.3 (1.0, 1.7)	1.4 (1.1, 1.9)
32mm	53	8246	0.5 (0.3, 0.6)	0.7 (0.5, 0.9)	0.7 (0.5, 0.9)	0.8 (0.6, 1.0)	0.8 (0.6, 1.0)	
36mm	24	7339	0.3 (0.2, 0.4)	0.3 (0.2, 0.5)	0.3 (0.2, 0.5)	0.3 (0.2, 0.5)	0.3 (0.2, 0.5)	
≥38mm	5	1100	0.5 (0.2, 1.1)	0.5 (0.2, 1.1)				
Age 55-64	**376**	**55037**	**0.4 (0.3, 0.4)**	**0.6 (0.5, 0.6)**	**0.7 (0.6, 0.7)**	**0.8 (0.7, 0.9)**	**1.0 (0.9, 1.2)**	**1.3 (1.1, 1.6)**
22mm	13	676	0.8 (0.3, 1.8)	1.4 (0.7, 2.7)	1.6 (0.8, 2.9)	1.6 (0.8, 2.9)	2.3 (1.3, 3.9)	2.3 (1.3, 3.9)
26mm	33	2012	0.7 (0.4, 1.1)	1.0 (0.6, 1.5)	1.2 (0.8, 1.8)	1.5 (1.1, 2.2)	1.8 (1.3, 2.6)	1.8 (1.3, 2.6)
28mm	182	15066	0.5 (0.4, 0.7)	0.9 (0.7, 1.0)	1.0 (0.8, 1.2)	1.2 (1.0, 1.4)	1.4 (1.2, 1.7)	1.7 (1.4, 2.1)
32mm	91	19841	0.3 (0.3, 0.4)	0.4 (0.3, 0.5)	0.5 (0.4, 0.6)	0.5 (0.4, 0.7)	0.6 (0.5, 0.8)	1.5 (0.5, 4.1)
36mm	57	15709	0.3 (0.2, 0.4)	0.4 (0.3, 0.5)	0.4 (0.3, 0.6)	0.5 (0.4, 0.7)	0.5 (0.4, 0.7)	
≥38mm	0	1733	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)				
Age 65-74	**624**	**82842**	**0.4 (0.4, 0.5)**	**0.6 (0.6, 0.7)**	**0.8 (0.7, 0.8)**	**0.9 (0.8, 1.0)**	**1.1 (1.0, 1.2)**	**1.4 (1.2, 1.6)**
22mm	25	1421	0.4 (0.2, 1.0)	0.9 (0.5, 1.5)	1.4 (0.9, 2.3)	1.5 (1.0, 2.4)	1.9 (1.2, 2.8)	2.3 (1.5, 3.5)
26mm	85	3695	1.0 (0.7, 1.3)	1.3 (1.0, 1.7)	1.9 (1.5, 2.4)	2.0 (1.6, 2.5)	2.3 (1.9, 2.9)	3.0 (2.3, 4.0)
28mm	310	26696	0.6 (0.5, 0.7)	0.8 (0.7, 1.0)	1.0 (0.9, 1.2)	1.2 (1.0, 1.3)	1.4 (1.2, 1.5)	1.5 (1.3, 1.7)
32mm	111	27822	0.3 (0.2, 0.3)	0.4 (0.3, 0.5)	0.5 (0.4, 0.6)	0.5 (0.4, 0.7)	0.5 (0.4, 0.7)	
36mm	87	21230	0.3 (0.2, 0.4)	0.4 (0.3, 0.5)	0.5 (0.4, 0.7)	0.6 (0.5, 0.8)	0.6 (0.5, 0.8)	
≥38mm	6	1978	0.2 (0.1, 0.5)	0.4 (0.2, 0.8)	0.4 (0.2, 0.8)			
Age ≥75	**629**	**71975**	**0.6 (0.5, 0.6)**	**0.8 (0.7, 0.8)**	**0.9 (0.8, 1.0)**	**1.0 (1.0, 1.1)**	**1.3 (1.2, 1.4)**	**1.4 (1.2, 1.6)**
22mm	30	1580	0.8 (0.4, 1.4)	1.3 (0.8, 2.0)	1.4 (0.9, 2.2)	1.8 (1.2, 2.6)	2.5 (1.7, 3.8)	
26mm	74	3467	1.0 (0.7, 1.4)	1.6 (1.2, 2.1)	1.9 (1.5, 2.4)	2.2 (1.7, 2.8)	2.5 (2.0, 3.1)	2.5 (2.0, 3.1)
28mm	282	24734	0.7 (0.6, 0.8)	0.9 (0.8, 1.1)	1.1 (0.9, 1.2)	1.2 (1.0, 1.3)	1.4 (1.2, 1.6)	1.5 (1.3, 1.8)
32mm	155	23399	0.5 (0.4, 0.6)	0.6 (0.5, 0.7)	0.7 (0.6, 0.8)	0.9 (0.7, 1.1)	1.2 (0.9, 1.5)	
36mm	83	17466	0.4 (0.3, 0.5)	0.5 (0.4, 0.6)	0.5 (0.4, 0.7)	0.6 (0.5, 0.7)	0.9 (0.4, 2.0)	
≥38mm	5	1329	0.3 (0.1, 0.8)	0.3 (0.1, 0.8)	0.7 (0.2, 2.4)			

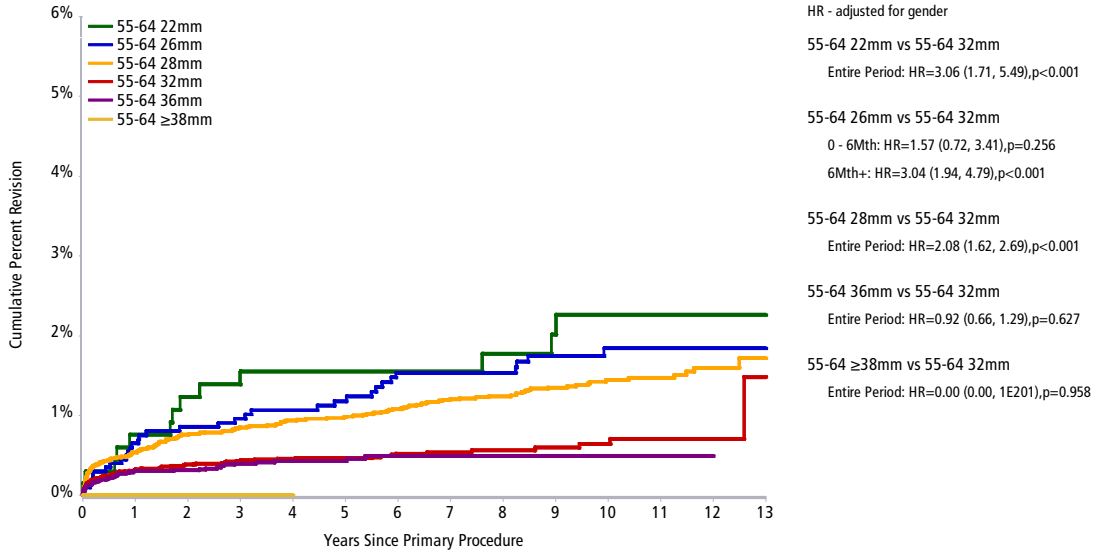
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure D6: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement by Head Size for Patients Aged <55 years (Primary Diagnosis OA)



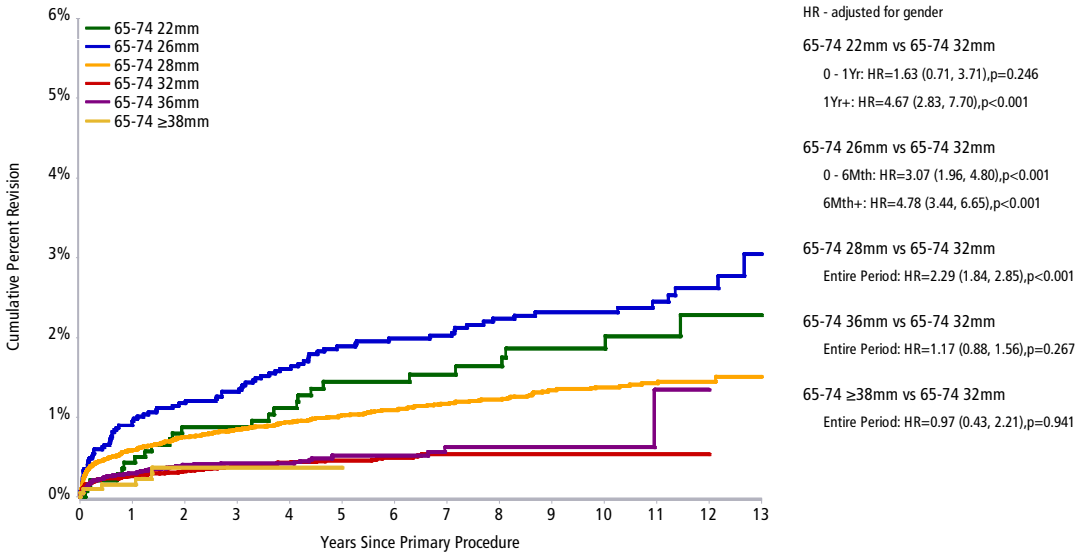
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
<55	22mm	278	266	256	232	202	138	24
	26mm	758	751	711	651	600	417	72
	28mm	6085	5703	5068	4432	3716	2162	183
	32mm	8246	7019	4972	3417	2284	839	34
	36mm	7339	5768	3280	1492	659	140	4
	≥38mm	1100	859	359	18	0	0	0

Figure D7: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement by Head Size for Patients Aged 55-64 years (Primary Diagnosis OA)



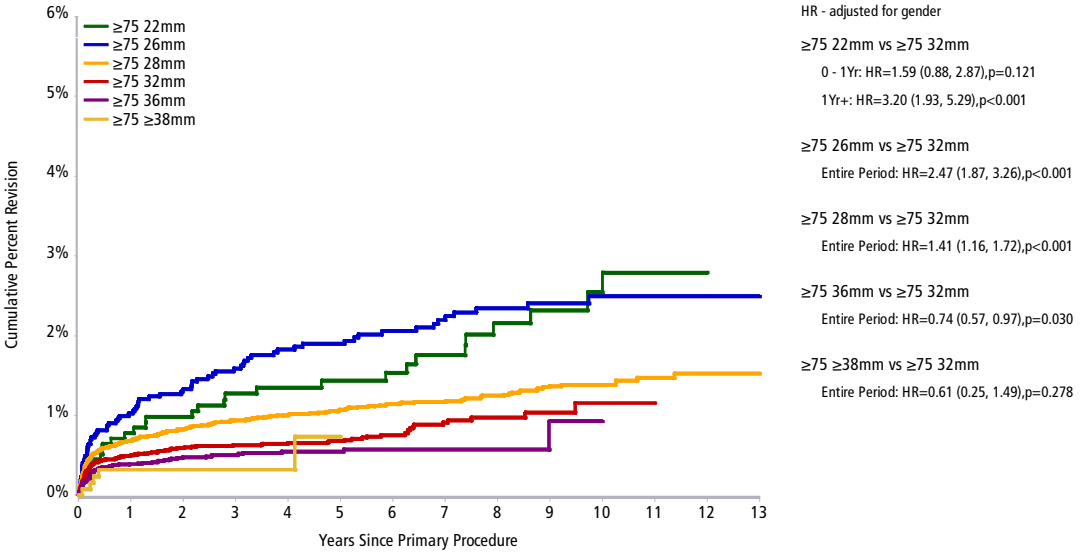
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
55-64	22mm	676	638	601	545	470	336	48
	26mm	2012	1972	1860	1703	1562	1032	159
	28mm	15066	14178	12632	10982	8977	4622	386
	32mm	19841	17001	12004	8035	4974	1537	46
	36mm	15709	12631	7416	3461	1371	261	10
	≥38mm	1733	1370	531	31	1	0	0

Figure D8: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement by Head Size for Patients Aged 65-74 years (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
65-74	22mm	1421	1360	1278	1146	982	627	65
	26mm	3695	3610	3424	3090	2804	1815	216
	28mm	26696	25110	22308	19276	15536	7332	477
	32mm	27822	23426	16102	10345	5741	1344	28
	36mm	21230	16904	10080	4728	1780	294	4
	≥38mm	1978	1540	645	65	4	0	0

Figure D9: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement by Head Size for Patients Aged ≥75 years (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
≥75	22mm	1580	1476	1317	1099	814	395	27
	26mm	3467	3286	2976	2531	2051	1066	94
	28mm	24734	22998	19763	15900	11301	4238	184
	32mm	23399	19492	12666	7427	3514	503	4
	36mm	17466	13948	8236	3806	1247	111	0
	≥38mm	1329	1061	527	93	4	0	0

Prosthesis Characteristics

Fixation

The rate of revision for dislocation of primary total conventional hip replacement for all types of fixation is higher for head sizes 28mm or smaller compared to 32mm (Table D6 and Figures D10-12). For cementless fixation, head size 38mm or larger has a lower rate of revision for dislocation compared to 32mm (Figure D11). There is no difference in the rate of revision for dislocation when the larger head sizes are compared to 32mm for either cemented or hybrid fixation (Figures D10 and D12).

Bearing Surfaces

For all bearing surfaces other than metal/metal, the rate of revision for dislocation is higher for procedures using head size 28mm or smaller compared to 32mm and there is no difference between 32mm and 36mm. For head size 38mm or larger, there is a lower rate of revision for dislocation compared to 32mm with ceramic/ceramic bearing surface. There is no difference for metal/cross-linked polyethylene bearings (Table D7 and Figures D13 – D16).

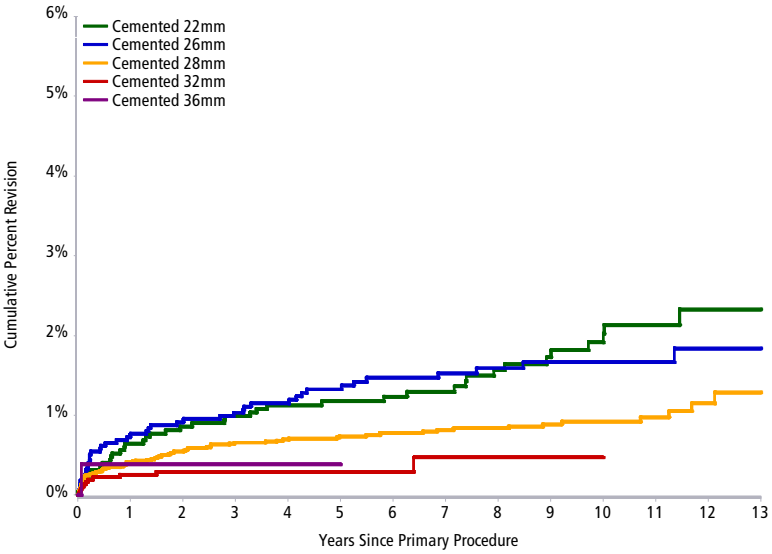
There is no difference in revision for dislocation for ceramic/ceramic, ceramic/cross-linked polyethylene and metal/cross-linked polyethylene for head sizes 32mm and 36mm (Table D7 and Figures D17-D19).

Table D6: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement by Fixation and Head Size (Primary Diagnosis OA)

Fixation by Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cemented	**179**	**19677**	**0.5 (0.4, 0.6)**	**0.7 (0.6, 0.8)**	**0.8 (0.7, 1.0)**	**0.9 (0.8, 1.1)**	**1.1 (1.0, 1.3)**	**1.5 (1.2, 1.8)**
22mm	41	2527	0.6 (0.4, 1.1)	1.0 (0.7, 1.5)	1.2 (0.8, 1.7)	1.3 (0.9, 1.9)	1.9 (1.4, 2.7)	2.3 (1.7, 3.3)
26mm	42	2773	0.8 (0.5, 1.2)	1.0 (0.7, 1.5)	1.3 (1.0, 1.8)	1.5 (1.1, 2.1)	1.7 (1.2, 2.3)	1.8 (1.3, 2.6)
28mm	84	10408	0.4 (0.3, 0.6)	0.7 (0.5, 0.8)	0.7 (0.6, 0.9)	0.8 (0.7, 1.0)	0.9 (0.7, 1.2)	1.3 (0.9, 1.8)
32mm	11	3699	0.3 (0.1, 0.5)	0.3 (0.2, 0.5)	0.3 (0.2, 0.5)	0.5 (0.2, 1.1)	0.5 (0.2, 1.1)	
36mm	1	263	0.4 (0.1, 2.7)	0.4 (0.1, 2.7)	0.4 (0.1, 2.7)			
≥38mm	0	7	0.0 (0.0, 0.0)					
Cementless	**996**	**136263**	**0.5 (0.4, 0.5)**	**0.6 (0.6, 0.7)**	**0.8 (0.7, 0.8)**	**0.9 (0.8, 1.0)**	**1.1 (1.0, 1.2)**	**1.3 (1.2, 1.6)**
22mm	10	225	0.5 (0.1, 3.4)	2.5 (1.0, 5.9)	4.2 (2.1, 8.2)	5.4 (3.0, 9.9)	5.4 (3.0, 9.9)	
26mm	77	3007	0.9 (0.6, 1.4)	1.5 (1.1, 2.0)	2.0 (1.5, 2.6)	2.2 (1.8, 2.9)	2.8 (2.3, 3.6)	3.5 (2.5, 5.0)
28mm	415	31396	0.7 (0.6, 0.8)	1.0 (0.9, 1.1)	1.2 (1.0, 1.3)	1.3 (1.2, 1.5)	1.6 (1.4, 1.7)	1.7 (1.5, 1.8)
32mm	285	49574	0.4 (0.3, 0.5)	0.5 (0.5, 0.6)	0.6 (0.5, 0.7)	0.7 (0.6, 0.8)	0.8 (0.7, 0.9)	1.2 (0.6, 2.2)
36mm	196	46443	0.3 (0.3, 0.4)	0.4 (0.4, 0.5)	0.5 (0.4, 0.6)	0.6 (0.5, 0.7)	0.7 (0.5, 0.9)	
≥38mm	13	5618	0.2 (0.1, 0.3)	0.2 (0.1, 0.4)	0.4 (0.2, 0.9)			
Hybrid	**623**	**77720**	**0.5 (0.4, 0.5)**	**0.7 (0.6, 0.7)**	**0.8 (0.7, 0.9)**	**1.0 (0.9, 1.0)**	**1.2 (1.1, 1.3)**	**1.4 (1.2, 1.6)**
22mm	24	1203	0.7 (0.3, 1.3)	1.3 (0.8, 2.1)	1.7 (1.1, 2.6)	1.9 (1.2, 2.9)	2.3 (1.6, 3.5)	2.3 (1.6, 3.5)
26mm	87	4152	0.9 (0.6, 1.2)	1.4 (1.1, 1.8)	1.7 (1.3, 2.2)	2.0 (1.6, 2.5)	2.3 (1.8, 2.8)	2.4 (1.9, 3.0)
28mm	341	30777	0.6 (0.5, 0.7)	0.8 (0.7, 0.9)	1.0 (0.9, 1.1)	1.1 (1.0, 1.3)	1.4 (1.2, 1.5)	1.6 (1.3, 1.9)
32mm	114	26035	0.3 (0.3, 0.4)	0.4 (0.3, 0.5)	0.5 (0.4, 0.6)	0.6 (0.5, 0.7)	0.7 (0.5, 0.9)	
36mm	54	15038	0.3 (0.2, 0.4)	0.4 (0.3, 0.5)	0.4 (0.3, 0.5)	0.4 (0.3, 0.6)	0.4 (0.3, 0.6)	
≥38mm	3	515	0.6 (0.2, 1.9)	0.6 (0.2, 1.9)	0.6 (0.2, 1.9)			

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

Figure D10: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement with Cemented Fixation by Head Size (Primary Diagnosis OA)



HR - adjusted for age and gender

Cemented 22mm vs Cemented 32mm
Entire Period: HR=3.76 (1.91, 7.37),p<0.001

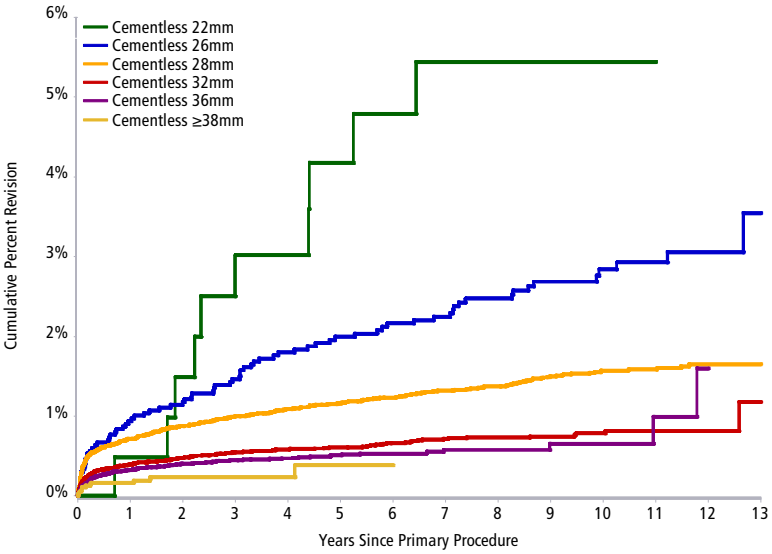
Cemented 26mm vs Cemented 32mm
Entire Period: HR=3.47 (1.77, 6.80),p<0.001

Cemented 28mm vs Cemented 32mm
Entire Period: HR=1.99 (1.06, 3.74),p=0.033

Cemented 36mm vs Cemented 32mm
Entire Period: HR=1.31 (0.17, 10.15),p=0.796

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cemented 22mm	2527	2399	2201	1895	1523	904	84
26mm	2773	2682	2526	2086	1682	1006	77
28mm	10408	9804	8548	7039	5334	2358	248
32mm	3699	3009	1696	948	416	47	0
36mm	263	211	117	47	3	0	0

Figure D11: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement with Cementless Fixation by Head Size (Primary Diagnosis OA)



HR - adjusted for age and gender

Cementless 22mm vs Cementless 32mm
0 - 1.5Yr: HR=1.12 (0.16, 8.00),p=0.908
1.5Yr+: HR=14.32 (7.30, 28.07),p<0.001

Cementless 26mm vs Cementless 32mm
0 - 3Mth: HR=2.07 (1.26, 3.39),p=0.004
3Mth+: HR=4.30 (3.23, 5.74),p<0.001

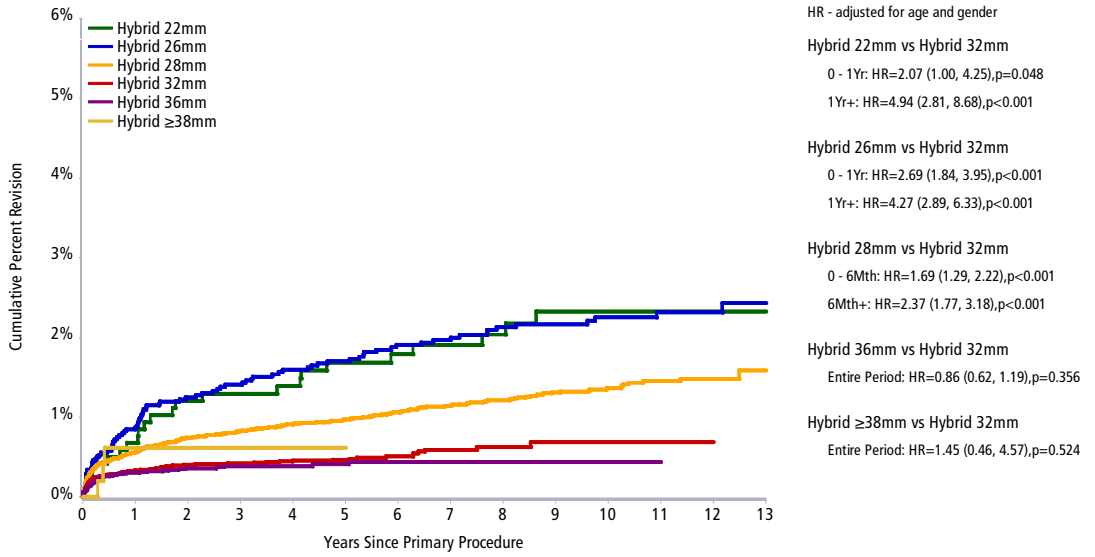
Cementless 28mm vs Cementless 32mm
Entire Period: HR=1.87 (1.61, 2.18),p<0.001

Cementless 36mm vs Cementless 32mm
0 - 2Wk: HR=0.66 (0.43, 1.02),p=0.062
2Wk+: HR=0.89 (0.73, 1.08),p=0.233

Cementless ≥38mm vs Cementless 32mm
Entire Period: HR=0.52 (0.30, 0.90),p=0.020

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cementless 22mm	225	201	189	159	141	86	6
26mm	3007	2935	2691	2436	2203	1210	111
28mm	31396	29469	26300	22732	18476	9497	596
32mm	49574	42459	30190	20418	12613	3525	108
36mm	46443	36859	21661	10139	3984	615	18
≥38mm	5618	4409	1856	157	6	0	0

Figure D12: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement with Hybrid Fixation by Head Size (Primary Diagnosis OA)



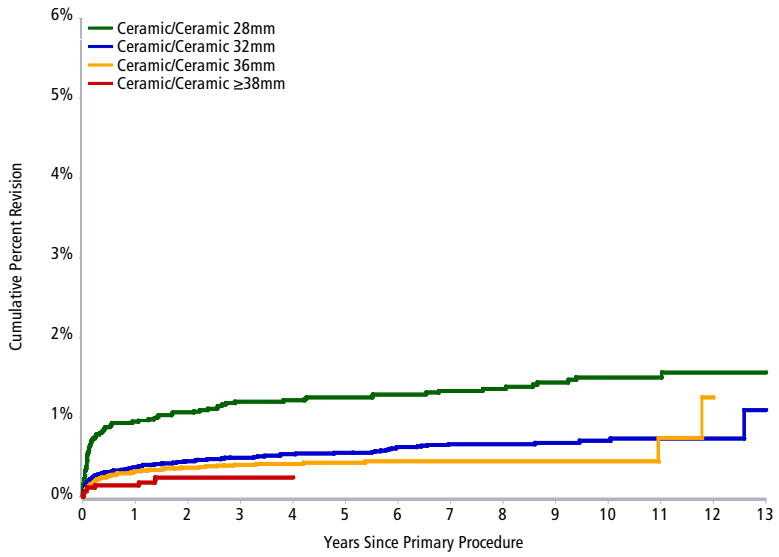
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Hybrid	22mm	1203	1140	1062	968	804	506	74
	26mm	4152	4002	3754	3453	3132	2114	353
	28mm	30777	28716	24923	20819	15720	6499	386
	32mm	26035	21470	13858	7858	3484	651	4
	36mm	15038	12181	7234	3301	1070	191	0
	≥38mm	515	415	205	50	3	0	0

Table D7: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement by Bearing Surface and Head Size (Primary Diagnosis OA)

Bearing Surface by Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Ceramic/Ceramic	**322**	**57828**	**0.4 (0.4, 0.5)**	**0.5 (0.5, 0.6)**	**0.6 (0.5, 0.6)**	**0.7 (0.6, 0.7)**	**0.7 (0.6, 0.8)**	**1.0 (0.7, 1.4)**
<28mm	0	2	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)		
28mm	89	6403	0.9 (0.7, 1.2)	1.2 (1.0, 1.5)	1.2 (1.0, 1.6)	1.3 (1.1, 1.7)	1.5 (1.2, 1.9)	1.6 (1.3, 1.9)
32mm	131	22826	0.4 (0.3, 0.5)	0.5 (0.4, 0.6)	0.6 (0.5, 0.7)	0.7 (0.6, 0.8)	0.7 (0.6, 0.8)	1.1 (0.6, 2.1)
36mm	93	24410	0.3 (0.3, 0.4)	0.4 (0.3, 0.5)	0.4 (0.3, 0.5)	0.4 (0.4, 0.6)	0.4 (0.4, 0.6)	
≥38mm	9	4187	0.1 (0.1, 0.3)	0.2 (0.1, 0.5)				
Ceramic/Cross-Linked Polyethylene	**103**	**23829**	**0.3 (0.2, 0.3)**	**0.4 (0.3, 0.5)**	**0.5 (0.4, 0.6)**	**0.6 (0.5, 0.8)**	**1.0 (0.7, 1.4)**	
<28mm	2	150	0.7 (0.1, 4.7)	0.7 (0.1, 4.7)	1.4 (0.3, 5.4)	1.4 (0.3, 5.4)	1.4 (0.3, 5.4)	
28mm	43	3996	0.5 (0.4, 0.8)	0.9 (0.6, 1.2)	0.9 (0.6, 1.3)	1.1 (0.8, 1.5)	1.6 (1.1, 2.3)	
32mm	31	9318	0.2 (0.2, 0.4)	0.4 (0.2, 0.5)	0.4 (0.3, 0.6)	0.5 (0.3, 0.7)	0.5 (0.3, 0.7)	
36mm	26	9997	0.2 (0.1, 0.3)	0.3 (0.2, 0.5)	0.3 (0.2, 0.5)	0.4 (0.2, 0.6)		
≥38mm	1	368	0.3 (0.0, 2.0)	0.3 (0.0, 2.0)				
Metal/Metal	**56**	**5078**	**0.4 (0.3, 0.7)**	**0.8 (0.6, 1.1)**	**0.9 (0.7, 1.3)**	**1.1 (0.8, 1.4)**	**1.3 (1.0, 1.7)**	**1.3 (1.0, 1.7)**
28mm	38	2936	0.5 (0.3, 0.8)	0.9 (0.6, 1.3)	1.0 (0.7, 1.5)	1.2 (0.8, 1.7)	1.4 (1.0, 2.0)	1.4 (1.0, 2.0)
32mm	18	2142	0.4 (0.2, 0.8)	0.7 (0.4, 1.1)	0.9 (0.5, 1.4)	0.9 (0.6, 1.5)	0.9 (0.6, 1.5)	
Metal/Cross-Linked Polyethylene	**724**	**94620**	**0.5 (0.4, 0.5)**	**0.7 (0.6, 0.7)**	**0.8 (0.7, 0.9)**	**1.0 (0.9, 1.1)**	**1.3 (1.1, 1.4)**	**1.4 (1.2, 1.6)**
<28mm	87	3875	0.8 (0.6, 1.1)	1.3 (1.0, 1.7)	1.8 (1.4, 2.3)	2.2 (1.7, 2.7)	2.8 (2.3, 3.5)	
28mm	362	32329	0.6 (0.5, 0.7)	0.9 (0.8, 1.0)	1.1 (0.9, 1.2)	1.2 (1.1, 1.4)	1.4 (1.3, 1.6)	1.6 (1.4, 1.8)
32mm	178	36335	0.4 (0.3, 0.4)	0.5 (0.4, 0.6)	0.5 (0.5, 0.6)	0.7 (0.6, 0.8)	0.9 (0.6, 1.3)	
36mm	93	20868	0.3 (0.3, 0.4)	0.5 (0.4, 0.6)	0.5 (0.4, 0.7)	0.7 (0.5, 0.9)	0.9 (0.5, 1.5)	
≥38mm	4	1213	0.3 (0.1, 0.8)	0.3 (0.1, 0.8)	0.6 (0.2, 1.8)			
TOTAL	**1205**	**181355**						

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

Figure D13: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement with Ceramic/Ceramic Bearing Surface by Head Size (Primary Diagnosis OA)



HR - adjusted for age and gender

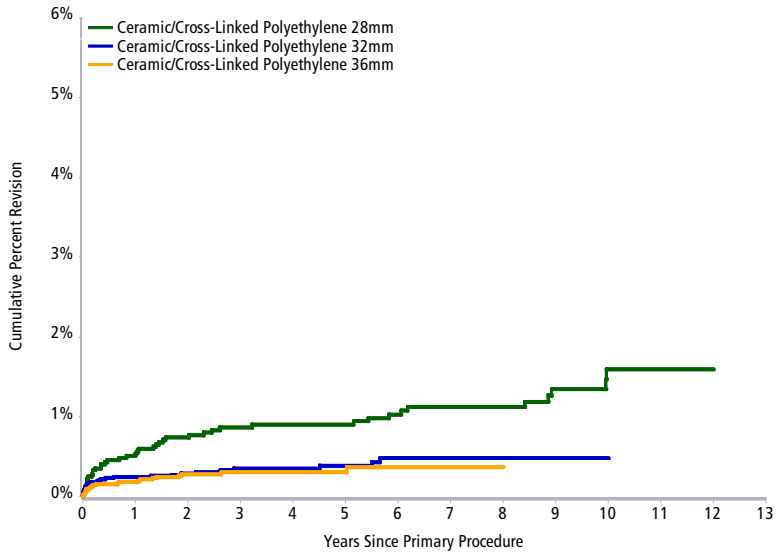
Ceramic/Ceramic 28mm vs
Ceramic/Ceramic 32mm
0 - 3Mth: HR=2.90 (2.04, 4.14),p<0.001
3Mth+: HR=1.58 (1.07, 2.32),p=0.020

Ceramic/Ceramic 36mm vs
Ceramic/Ceramic 32mm
Entire Period: HR=0.79 (0.60, 1.04),p=0.091

Ceramic/Ceramic ≥38mm vs
Ceramic/Ceramic 32mm
Entire Period: HR=0.50 (0.25, 0.98),p=0.044

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Ceramic/Ceramic 28mm	6403	6126	5682	5169	4387	2474	148
32mm	22826	20690	16361	12378	8746	3388	108
36mm	24410	19564	11816	6023	2602	575	18
≥38mm	4187	3224	1296	14	0	0	0

Figure D14: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement with Ceramic/Cross-Linked Polyethylene Bearing Surface by Head Size (Primary Diagnosis OA)



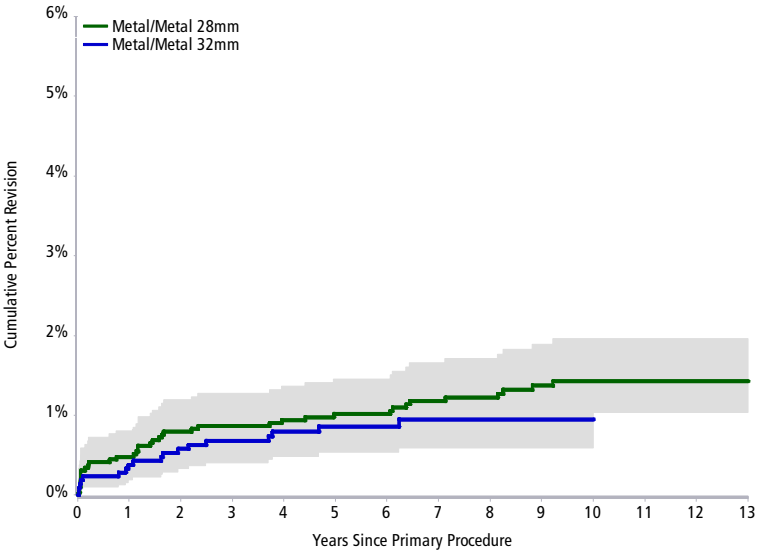
HR - adjusted for age and gender

Ceramic/Cross-Linked Polyethylene 28mm vs
Ceramic/Cross-Linked Polyethylene 32mm
Entire Period: HR=2.47 (1.54, 3.97),p<0.001

Ceramic/Cross-Linked Polyethylene 36mm vs
Ceramic/Cross-Linked Polyethylene 32mm
Entire Period: HR=0.99 (0.58, 1.68),p=0.957

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Ceramic/Cross-Linked Polyethylene 28mm	3996	3593	2934	2414	1929	788	15
32mm	9318	7239	4313	2531	1176	86	0
36mm	9997	7593	3968	1451	289	8	0

Figure D15: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement with Metal/Metal Bearing Surface by Head Size (Primary Diagnosis OA)

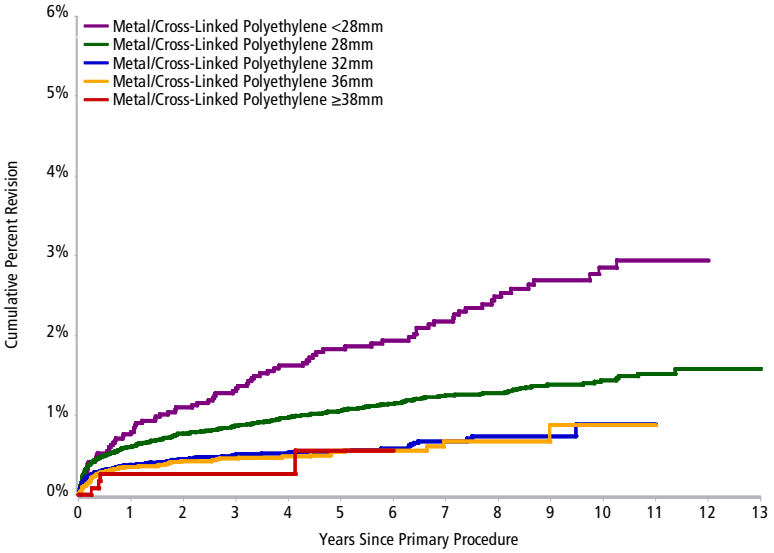


HR - adjusted for age and gender

Metal/Metal 28mm vs
Metal/Metal 32mm
Entire Period: HR=1.30 (0.73, 2.31),p=0.366

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Metal/Metal	28mm	2936	2865	2744	2569	2293	1565	92
	32mm	2142	2057	1859	1462	885	105	0

Figure D16: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement with Metal/Cross-Linked Polyethylene Bearing Surface by Head Size (Primary Diagnosis OA)



HR - adjusted for age and gender

Metal/Cross-Linked Polyethylene <28mm vs
Metal/Cross-Linked Polyethylene 32mm
0 - 1Mth: HR=1.30 (0.60, 2.79),p=0.505
1Mth - 1Yr: HR=2.83 (1.82, 4.42),p<0.001
1Yr+: HR=4.45 (3.22, 6.15),p<0.001

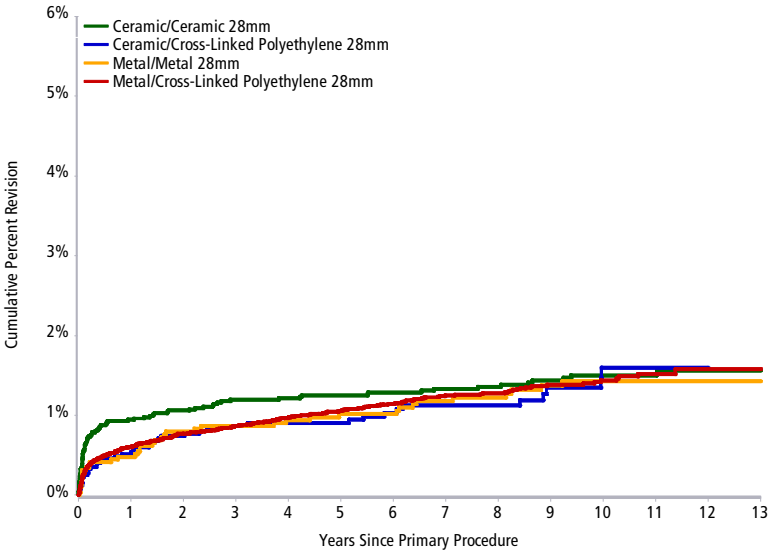
Metal/Cross-Linked Polyethylene 28mm vs
Metal/Cross-Linked Polyethylene 32mm
Entire Period: HR=1.79 (1.49, 2.14),p<0.001

Metal/Cross-Linked Polyethylene 36mm vs
Metal/Cross-Linked Polyethylene 32mm
Entire Period: HR=0.94 (0.73, 1.21),p=0.619

Metal/Cross-Linked Polyethylene ≥38mm vs
Metal/Cross-Linked Polyethylene 32mm
Entire Period: HR=0.72 (0.27, 1.95),p=0.519

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Metal/Cross-Linked Polyethylene	<28mm	3875	3651	3221	2752	2358	1177	27
	28mm	32329	29767	25011	19835	14234	4789	88
	32mm	36335	29626	18098	9519	3892	384	1
	36mm	20868	16948	10418	4573	1609	210	0
	≥38mm	1213	1006	584	177	5	0	0

Figure D17: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement with 28mm Head Size by Bearing Surface (Primary Diagnosis OA)



HR - adjusted for age and gender

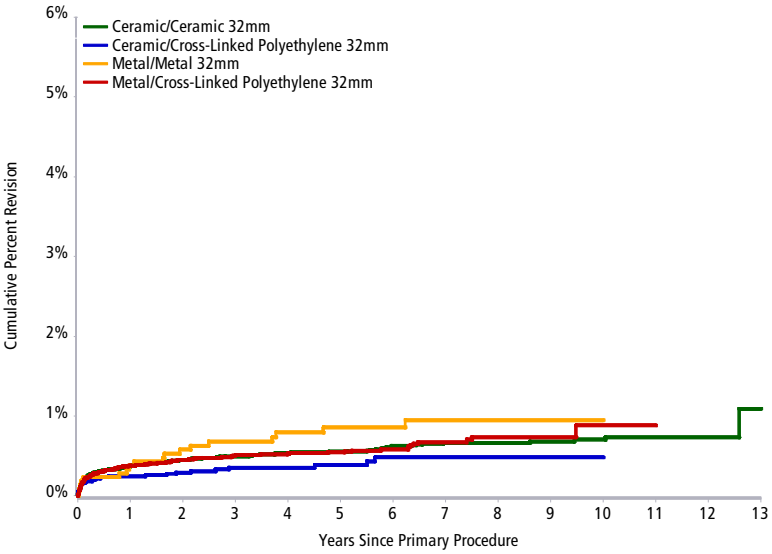
Ceramic/Ceramic 28mm vs
Metal/Cross-Linked Polyethylene 28mm
0 - 2Wk: HR=2.76 (1.55, 4.92),p<0.001
2Wk - 6Mth: HR=1.65 (1.15, 2.38),p=0.006
6Mth+: HR=0.67 (0.46, 0.97),p=0.033

Ceramic/Cross-Linked Polyethylene 28mm vs
Metal/Cross-Linked Polyethylene 28mm
Entire Period: HR=0.98 (0.71, 1.35),p=0.913

Metal/Metal 28mm vs
Metal/Cross-Linked Polyethylene 28mm
Entire Period: HR=1.00 (0.71, 1.41),p=0.993

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Ceramic/Ceramic	28mm	6403	6126	5682	5169	4387	2474	148
Ceramic/Cross-Linked Polyethylene	28mm	3996	3593	2934	2414	1929	788	15
Metal/Metal	28mm	2936	2865	2744	2569	2293	1565	92
Metal/Cross-Linked Polyethylene	28mm	32329	29767	25011	19835	14234	4789	88

Figure D18: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement with 32mm Head Size by Bearing Surface (Primary Diagnosis OA)



HR - adjusted for age and gender

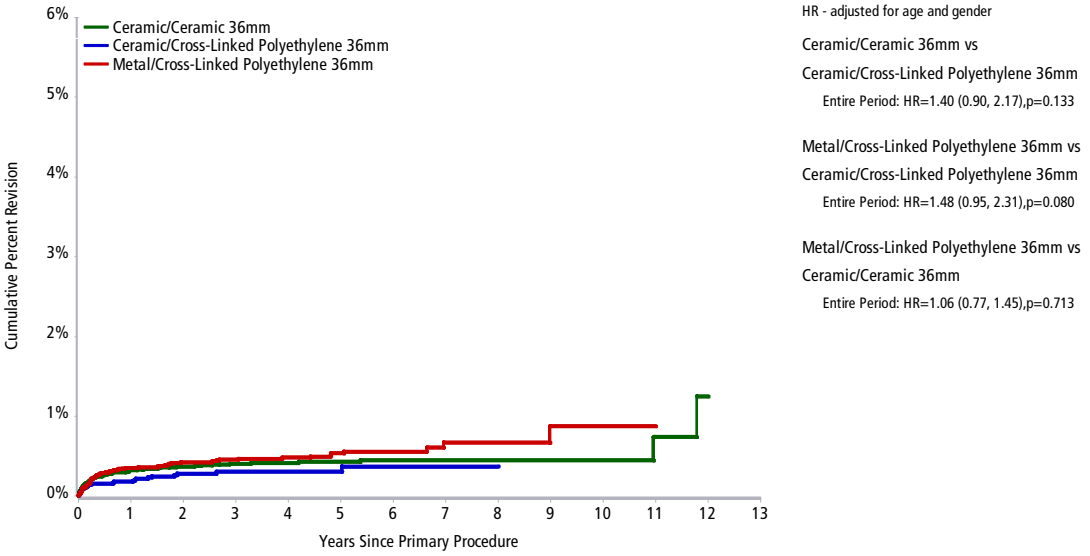
Ceramic/Ceramic 32mm vs
Metal/Cross-Linked Polyethylene 32mm
Entire Period: HR=1.02 (0.80, 1.31),p=0.858

Ceramic/Cross-Linked Polyethylene 32mm vs
Metal/Cross-Linked Polyethylene 32mm
Entire Period: HR=0.71 (0.48, 1.05),p=0.087

Metal/Metal 32mm vs
Metal/Cross-Linked Polyethylene 32mm
Entire Period: HR=1.44 (0.88, 2.35),p=0.146

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Ceramic/Ceramic	32mm	22826	20690	16361	12378	8746	3388	108
Ceramic/Cross-Linked Polyethylene	32mm	9318	7239	4313	2531	1176	86	0
Metal/Metal	32mm	2142	2057	1859	1462	885	105	0
Metal/Cross-Linked Polyethylene	32mm	36335	29626	18098	9519	3892	384	1

Figure D19: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement with 36mm Head Size by Bearing Surface (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Ceramic/Ceramic	36mm	24410	19564	11816	6023	2602	575	18
Ceramic/Cross-Linked Polyethylene	36mm	9997	7593	3968	1451	289	8	0
Metal/Cross-Linked Polyethylene	36mm	20868	16948	10418	4573	1609	210	0

Outcome of Revision

The cumulative percent re-revision for dislocation following a first revision for dislocation is compared to a first revision for all other diagnoses. Following revision of a primary for dislocation, the cumulative percent re-revision for dislocation at seven years is lowest for 36mm and 38mm or larger (8.0% and 8.1% respectively). When compared to 32mm there is no difference in the rate of re-revision for prosthesis dislocation. Following revision of a primary for any other reason, the rate of re-revision at seven years is lowest for head sizes 36mm (2.1%) (Table D8).

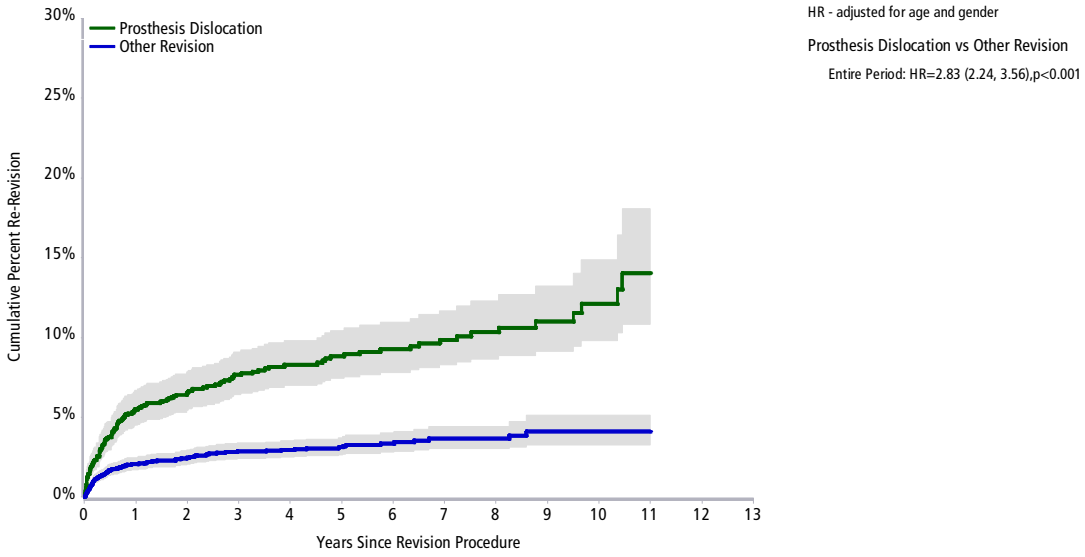
First revisions for prosthesis dislocation have a higher rate of re-revision for prosthesis dislocation than first revisions for other diagnoses (Table D8 and Figure D20).

Table D8: Cumulative Percent Re-revision for Dislocation of Known Primary Total Conventional Hip Replacement by First Revision Diagnosis and Head Size (Primary Diagnosis OA)

1st Revision Diagnosis By Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs
Prosthesis Dislocation	**145**	**1797**	**5.5 (4.5, 6.7)**	**7.7 (6.4, 9.1)**	**8.8 (7.4, 10.4)**	**9.8 (8.3, 11.7)**	**12.1 (9.8, 14.9)**
22mm	13	180	5.8 (3.1, 10.5)	6.5 (3.6, 11.4)	7.7 (4.3, 13.4)	9.2 (5.2, 16.0)	
26mm	7	51	10.2 (4.4, 22.8)	12.5 (5.8, 25.8)	14.9 (7.3, 28.7)	14.9 (7.3, 28.7)	14.9 (7.3, 28.7)
28mm	46	473	5.5 (3.7, 8.1)	9.3 (6.8, 12.7)	10.5 (7.7, 14.1)	11.6 (8.5, 15.5)	13.0 (9.6, 17.5)
32mm	50	599	5.6 (4.0, 7.8)	7.6 (5.7, 10.2)	8.6 (6.4, 11.5)	9.6 (7.1, 12.8)	
36mm	26	432	5.3 (3.5, 8.0)	6.3 (4.2, 9.2)	6.9 (4.6, 10.2)	8.0 (5.2, 12.1)	
≥38mm	3	62	1.7 (0.2, 11.2)	4.1 (1.0, 15.6)	8.1 (2.5, 24.6)	8.1 (2.5, 24.6)	
Other Revision	**146**	**5780**	**2.1 (1.7, 2.5)**	**2.9 (2.4, 3.4)**	**3.1 (2.6, 3.7)**	**3.7 (3.0, 4.4)**	**4.1 (3.3, 5.1)**
22mm	3	101	1.5 (0.2, 10.0)	3.0 (0.8, 11.5)			
26mm	7	148	3.7 (1.5, 8.6)	3.7 (1.5, 8.6)	3.7 (1.5, 8.6)	5.3 (2.3, 12.1)	
28mm	54	1488	2.8 (2.0, 3.8)	4.0 (3.0, 5.2)	4.3 (3.2, 5.6)	4.9 (3.7, 6.4)	5.2 (3.9, 7.0)
32mm	53	2076	2.1 (1.5, 2.8)	3.0 (2.3, 3.9)	3.3 (2.5, 4.4)	3.6 (2.6, 5.0)	
36mm	28	1786	1.4 (1.0, 2.2)	1.9 (1.3, 2.8)	2.1 (1.4, 3.1)	2.1 (1.4, 3.1)	
≥38mm	1	181	0.6 (0.1, 4.1)	0.6 (0.1, 4.1)			
TOTAL	**291**	**7577**					

Note: All primary procedures using metal/metal prostheses with head size larger than 32mm have been excluded
Also excludes 1 procedure with 30mm head size and 8 procedures with unknown head size.

Figure D20: Cumulative Percent Re-Revision for Dislocation of Known Primary Total Conventional Hip Replacement by First Revision Diagnosis (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Prosthesis Dislocation	1797	1439	985	636	423	124	6
Other Revision	5780	4036	2495	1457	764	192	4

Conclusion

The three smaller head sizes of 22mm, 26mm, and 28mm have a higher rate of revision for dislocation regardless of age, gender, fixation and bearing surface, with the exception of 28mm in those aged less than 55 years and also when using metal/metal bearing surface.

For all primary diagnoses analysed, head sizes 32mm and larger have the lowest rates of revision for dislocation. For osteoarthritis there is a lower rate of revision using 36mm compared to 32mm in males and all patients aged 75 years or older.

If a ceramic/ceramic bearing surface is used there is a reduced rate of revision for dislocation for head sizes 38mm and larger.

Following a revision for dislocation there is a higher rate of re-revision for dislocation compared to procedures initially revised for other reasons.

TEN YEAR PROSTHESES OUTCOMES

This chapter summarises the 10 year outcome for primary total hip and total knee replacement. This outcome is widely regarded as an important milestone in assessing the performance of prostheses. The Registry first reported 10 year outcomes in 2011. Since that time, the Registry has reported on an increased number of hip and knee prostheses that have achieved this milestone.

In this year's analysis the Registry has applied the same rule it uses for other comparative analyses to avoid imprecise estimates when the number at risk is low (refer Introduction Page 5). This has resulted in some minor changes compared to the prostheses reported in previous years.

Hip Replacement

The Registry is reporting the 10 year cumulative percent revision for femoral stem and acetabular prostheses combinations used in primary total conventional hip replacement. A combination is included if the Registry has recorded more than 350 procedures with 10 or more years follow up. When combinations include a variety of bearing surfaces, large head metal/metal surfaces have been analysed separately. Combinations with large head metal/metal bearings are reported when the number of procedures exceeds 350 and the follow up is at least 10 years. Two combinations with large head metal/metal bearings are being reported for the first time, the Summit/Pinnacle and the Taperloc/M2a.

There are 58 femoral and acetabular combinations with 10 year data. These prostheses combinations account for 62.6% of all primary total conventional hip procedures. Of these, 20 combinations were not used in 2013. They account for 6.0% of all primary total conventional hip procedures.

The 10 year cumulative percent revision for the femoral stem and acetabular component combinations range from 1.9% to 13.2% (Table TY1). There are 29 hip prostheses combinations with a 10 year cumulative percent revision (for any reason) of less than 5.0%.

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

Femoral Stem	Acetabular Combination	N Revised	N Total	Type of Revision				1 Yr	5 Yrs	10 Yrs
				THR	Femoral Component	Acetabular Component	Other Component			
ABGII	ABGII	176	2721	24	80	45	27	1.7 (1.3, 2.3)	4.0 (3.3, 4.9)	6.8 (5.8, 7.9)
ABGII	ABGII (Shell/Insert)	42	814	8	24	6	4	1.5 (0.8, 2.6)	3.0 (2.0, 4.4)	7.3 (5.2, 10.0)
ABGII	Trident (Shell)	121	2190	6	68	18	29	2.2 (1.7, 2.9)	4.6 (3.8, 5.6)	7.6 (6.2, 9.3)
Accolade I	Trident (Shell)	302	8065	33	118	66	85	1.6 (1.3, 1.9)	3.8 (3.3, 4.2)	5.9 (5.0, 6.9)
Alloclassic	Allofit	151	4571	17	52	33	49	1.2 (0.9, 1.6)	2.8 (2.3, 3.3)	4.6 (3.8, 5.5)
Alloclassic	Fitmore	82	1527	10	43	11	18	2.8 (2.1, 3.8)	5.0 (4.0, 6.3)	6.4 (5.1, 7.9)
Alloclassic	Metasul*	19	371	3	2	9	5	0.8 (0.3, 2.5)	3.6 (2.1, 6.1)	5.0 (3.1, 7.9)
C-Stem	Duraloc*	62	894	8	15	10	29	2.0 (1.3, 3.2)	3.8 (2.7, 5.3)	7.7 (5.9, 10.2)
C-Stem	Elite Plus LPW*	15	367	6	3	6	.	0.6 (0.1, 2.2)	2.7 (1.4, 5.0)	5.4 (3.1, 9.2)
CLS	Allofit	34	724	3	17	9	5	1.3 (0.7, 2.4)	3.8 (2.6, 5.6)	5.6 (3.9, 8.0)
CLS	Fitmore	29	591	2	14	6	7	1.7 (0.9, 3.2)	4.4 (3.0, 6.6)	5.4 (3.8, 7.8)
CPCS	Reflection (Cup)	25	617	5	2	9	9	0.7 (0.2, 1.8)	2.7 (1.6, 4.6)	7.8 (4.9, 12.2)
CPCS	Reflection (Shell)	52	2325	3	20	9	20	0.8 (0.5, 1.3)	1.7 (1.2, 2.3)	4.9 (3.3, 7.2)
CPT	Trilogy	161	5506	17	42	24	78	1.3 (1.1, 1.7)	2.9 (2.4, 3.4)	4.7 (3.9, 5.7)
CPT	ZCA	23	669	9	4	5	5	0.5 (0.1, 1.4)	2.3 (1.3, 3.9)	4.9 (3.1, 7.7)
Charnley	Charnley Ogee*	47	630	26	6	3	12	1.1 (0.5, 2.3)	5.0 (3.5, 7.1)	8.8 (6.5, 11.8)
Charnley	Charnley*	33	563	25	5	3	.	0.5 (0.2, 1.7)	2.3 (1.3, 4.0)	7.4 (5.0, 11.0)
Charnley	Vitalock*	29	370	4	12	2	11	1.9 (0.9, 3.9)	4.4 (2.7, 7.1)	7.3 (5.0, 10.7)
Citation	Trident (Shell)*	35	1035	3	7	8	17	1.7 (1.1, 2.8)	3.1 (2.2, 4.3)	3.9 (2.7, 5.4)
Citation	Vitalock*	21	508	2	2	7	10	0.4 (0.1, 1.6)	2.0 (1.1, 3.7)	4.7 (3.1, 7.2)
Corail	Duraloc	45	1267	3	19	8	15	1.0 (0.6, 1.8)	2.4 (1.6, 3.4)	4.9 (3.5, 6.9)
Corail	Pinnacle	442	20343	41	133	69	199	1.5 (1.3, 1.6)	3.0 (2.6, 3.3)	4.5 (3.7, 5.5)
Elite Plus	Duraloc*	81	953	12	49	4	16	1.6 (1.0, 2.6)	5.1 (3.9, 6.8)	8.9 (7.1, 11.1)
Epoch	Trilogy*	39	990	.	9	6	24	2.4 (1.6, 3.6)	3.5 (2.5, 4.9)	5.0 (3.4, 7.4)
Exeter	Contemporary*	31	427	7	6	11	7	1.9 (1.0, 3.8)	4.2 (2.6, 6.6)	6.0 (4.0, 8.9)
Exeter	Vitalock*	49	1076	5	8	22	14	1.4 (0.8, 2.3)	2.3 (1.5, 3.4)	4.6 (3.4, 6.1)
Exeter V40	ABGII	28	947	7	9	6	6	0.9 (0.4, 1.7)	1.7 (1.0, 2.8)	3.4 (2.4, 5.0)
Exeter V40	Contemporary	154	4023	32	26	72	24	1.3 (1.0, 1.7)	3.0 (2.5, 3.6)	5.5 (4.6, 6.6)
Exeter V40	Exeter Contemporary	83	2643	21	21	24	17	1.3 (0.9, 1.8)	2.9 (2.3, 3.6)	4.4 (3.4, 5.6)

Femoral Stem	Acetabular Combination	N Revised	N Total	Type of Revision				1 Yr	5 Yrs	10 Yrs
				THR	Femoral Component	Acetabular Component	Other Component			
Exeter V40	Exeter*	50	1526	5	11	20	14	0.9 (0.5, 1.5)	2.8 (2.1, 3.8)	3.7 (2.8, 5.0)
Exeter V40	Mallory-Head	23	1191	2	15	1	5	0.5 (0.2, 1.2)	1.1 (0.6, 2.0)	3.4 (2.2, 5.3)
Exeter V40	Trident (Shell)	682	32350	82	185	118	297	1.0 (0.9, 1.1)	2.2 (2.0, 2.4)	4.1 (3.7, 4.6)
Exeter V40	Trilogy	16	510	2	4	2	8	2.0 (1.1, 3.6)	2.6 (1.5, 4.5)	5.1 (2.6, 9.8)
Exeter V40	Vitalock*	55	1795	14	16	15	10	0.8 (0.5, 1.4)	2.3 (1.7, 3.1)	3.0 (2.3, 4.0)
F2L	SPH-Blind*	46	571	4	16	13	13	2.8 (1.7, 4.5)	6.1 (4.4, 8.4)	7.6 (5.7, 10.2)
MS 30	Allofit	36	1276	4	9	13	10	1.4 (0.9, 2.2)	2.3 (1.5, 3.3)	3.5 (2.4, 5.0)
MS 30	Fitmore	8	436	.	1	4	3	0.0 (0.0, 0.0)	1.2 (0.4, 3.1)	2.3 (1.1, 4.9)
MS 30	Low Profile Cup	11	559	4	2	4	1	0.4 (0.1, 1.4)	1.0 (0.4, 2.4)	2.6 (1.4, 4.9)
Mallory-Head	Mallory-Head	119	2690	10	11	37	61	1.8 (1.4, 2.4)	3.0 (2.4, 3.8)	5.3 (4.3, 6.5)
Meridian	Vitalock*	21	354	2	2	9	8	0.9 (0.3, 2.6)	3.5 (2.0, 6.1)	5.7 (3.7, 8.8)
Natural Hip	Allofit	9	527	.	3	3	3	0.8 (0.3, 2.0)	1.2 (0.5, 2.6)	1.9 (0.9, 3.8)
Natural Hip	Fitmore*	24	882	2	2	8	12	0.5 (0.2, 1.2)	1.8 (1.1, 3.0)	3.6 (2.4, 5.5)
Omnifit	Secur-Fit*	70	716	6	19	16	29	2.4 (1.5, 3.8)	6.2 (4.6, 8.2)	10.0 (7.9, 12.6)
Omnifit	Trident (Shell)	104	3195	10	26	18	50	1.6 (1.2, 2.1)	3.2 (2.6, 3.9)	4.0 (3.2, 4.8)
S-Rom	Duraloc Option*	23	524	4	9	4	6	1.7 (0.9, 3.3)	3.3 (2.1, 5.2)	4.7 (3.1, 7.0)
S-Rom	Pinnacle	61	1907	7	35	6	13	2.0 (1.4, 2.7)	3.3 (2.5, 4.3)	4.3 (3.2, 5.7)
SL-Plus	EPF-Plus	87	2034	4	39	18	26	1.6 (1.1, 2.2)	3.6 (2.9, 4.6)	7.0 (4.9, 10.1)
Secur-Fit	Trident (Shell)	199	6981	19	76	43	61	1.5 (1.2, 1.8)	3.1 (2.6, 3.6)	4.1 (3.5, 4.8)
Secur-Fit Plus	Trident (Shell)	128	4800	8	34	27	59	1.1 (0.8, 1.4)	2.2 (1.8, 2.7)	3.4 (2.8, 4.1)
Spectron EF	Reflection (Cup)	76	1373	27	10	33	6	1.0 (0.6, 1.6)	2.7 (1.9, 3.7)	8.5 (6.6, 10.8)
Spectron EF	Reflection (Shell)	192	4418	40	58	30	64	1.0 (0.7, 1.3)	2.7 (2.3, 3.3)	6.1 (5.2, 7.2)
Stability	Duraloc*	36	373	1	9	11	15	0.5 (0.1, 2.1)	2.2 (1.1, 4.3)	9.1 (6.5, 12.8)
Summit	Pinnacle	47	3060	2	10	11	24	0.9 (0.6, 1.4)	1.6 (1.2, 2.2)	2.3 (1.6, 3.2)
Summit	Pinnacle [MoM]	37	730	2	4	7	24	1.4 (0.7, 2.5)	3.2 (2.1, 4.8)	7.6 (5.3, 10.8)
Synergy	Reflection (Shell)	232	7012	23	40	77	92	1.4 (1.2, 1.7)	2.5 (2.2, 2.9)	4.1 (3.5, 4.7)
Taperloc	M2a [MoM]	46	471	10	2	32	2	1.5 (0.7, 3.1)	6.8 (4.8, 9.5)	13.2 (9.7, 17.8)
Taperloc	Mallory-Head	39	1145	3	8	14	14	1.6 (1.0, 2.6)	2.9 (2.0, 4.1)	4.6 (3.3, 6.4)
VerSys	Trilogy	169	4181	9	63	30	67	2.3 (1.9, 2.8)	3.6 (3.1, 4.2)	4.6 (4.0, 5.4)
TOTAL		**5057**	**155314**	**648**	**1535**	**1135**	**1739**			

Note: Only prostheses with over 350 procedures have been listed

[MoM] denotes prosthesis combinations that have used large heads (>32mm) metal/metal bearings.

* denotes prosthesis combinations with no reported use in Primary Total Conventional Hip Procedures in 2013

Knee Replacement

There are 41 total knee replacement combinations with over 350 procedures that have 10 year outcome data. This is seven more than last year. This increase is because CR and PS femoral components are now reported separately in the annual report if a model has more than 400 procedures recorded for CR and PS combined.

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. This group of knee prostheses accounts for 65.1% of all primary total knee replacement procedures reported to the Registry. Eleven prostheses were not used in 2013, accounting for 11.2% of all primary total knee procedures.

The 10 year cumulative percent revision ranges from 3.0% to 10.6% (Table TY2). There are 10 knee prostheses with a 10 year cumulative percent revision (for any reason) of less than 5.0%.

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	TKR	Type of Revision			1 Yr	5 Yrs	10 Yrs
					Femoral Component	Tibial Component	Other Component			
AGC	AGC	188	4903	65	4	19	100	0.6 (0.4, 0.8)	3.1 (2.6, 3.6)	4.8 (4.2, 5.6)
Active Knee	Active Knee	334	7092	94	22	29	189	1.1 (0.9, 1.4)	4.5 (4.0, 5.1)	7.9 (6.9, 8.9)
Advance	Advance II	84	1516	26	2	12	44	1.6 (1.0, 2.4)	5.2 (4.1, 6.6)	7.4 (5.9, 9.2)
Advantim	Advantim	36	1443	15	3	3	15	0.7 (0.4, 1.4)	2.5 (1.7, 3.6)	3.9 (2.7, 5.6)
BalanSys	BalanSys	18	931	5	1	2	10	0.4 (0.1, 1.1)	3.0 (1.7, 5.3)	5.1 (2.9, 8.9)
Duracon	Duracon*	871	19829	200	29	61	581	1.1 (1.0, 1.3)	3.4 (3.2, 3.7)	4.9 (4.6, 5.3)
Genesis II CR	Genesis II	529	16891	108	37	36	348	0.9 (0.8, 1.1)	3.4 (3.1, 3.7)	4.5 (4.1, 5.0)
Genesis II CR	Profix Mobile	72	1209	24	9	6	33	2.0 (1.3, 2.9)	5.2 (4.0, 6.7)	7.2 (5.7, 9.2)
Genesis II Oxinium CR Cted	Genesis II	239	5945	43	23	18	155	1.1 (0.9, 1.4)	3.6 (3.1, 4.2)	6.2 (5.3, 7.2)
Genesis II Oxinium PS Cted	Genesis II	499	11333	56	14	103	326	1.7 (1.5, 1.9)	5.6 (5.1, 6.1)	8.0 (7.0, 9.2)
Genesis II PS	Genesis II	463	13049	65	21	34	343	1.3 (1.1, 1.6)	4.1 (3.7, 4.5)	5.6 (5.0, 6.3)
Kinemax Plus	Kinemax Plus*	89	1815	44	3	5	37	0.9 (0.6, 1.5)	3.1 (2.4, 4.0)	4.6 (3.7, 5.8)
LCS CR	LCS*	500	8281	190	23	77	210	1.1 (0.9, 1.3)	4.4 (3.9, 4.8)	6.2 (5.6, 6.7)
LCS CR	MBT	545	19674	178	23	78	266	0.8 (0.7, 1.0)	3.4 (3.1, 3.7)	5.4 (4.8, 6.0)
LCS CR	MBT Duofix	451	10971	119	22	34	276	1.3 (1.1, 1.5)	4.0 (3.6, 4.4)	5.3 (4.8, 5.9)
MBK (Zimmer)	Nexgen*	26	448	13	1	1	11	0.9 (0.3, 2.4)	4.1 (2.6, 6.5)	5.9 (4.0, 8.6)
Maxim	Maxim*	135	2447	30	12	12	81	1.1 (0.7, 1.6)	4.0 (3.3, 4.8)	6.4 (5.3, 7.6)
Natural Knee II	Natural Knee II	284	6178	96	8	54	126	0.9 (0.7, 1.2)	2.9 (2.5, 3.4)	6.2 (5.5, 7.1)
Nexgen CR	Nexgen	276	10231	85	10	27	154	0.5 (0.4, 0.6)	2.0 (1.7, 2.3)	3.0 (2.6, 3.4)
Nexgen CR	Nexgen TM CR	38	727	10	3	8	17	1.4 (0.8, 2.7)	5.6 (4.0, 7.7)	7.0 (4.9, 10.1)
Nexgen LPS	Nexgen	235	5918	56	16	27	136	0.9 (0.7, 1.2)	3.2 (2.7, 3.7)	5.0 (4.4, 5.7)
Nexgen LPS Flex	Nexgen	631	21755	149	28	125	329	0.9 (0.8, 1.0)	3.3 (3.0, 3.6)	5.3 (4.8, 5.9)
Optetrak-CR	Optetrak	24	442	3	2	3	16	1.4 (0.6, 3.2)	5.4 (3.6, 8.2)	6.6 (4.4, 9.7)
Optetrak-PS	Optetrak	146	2205	37	5	25	79	1.5 (1.0, 2.1)	6.9 (5.8, 8.2)	10.3 (8.5, 12.5)
PFC Sigma CR	AMK Duofix	45	1890	15	.	1	29	0.7 (0.4, 1.2)	2.5 (1.8, 3.4)	3.5 (2.5, 4.9)
PFC Sigma CR	MBT	212	5227	27	24	35	126	1.4 (1.1, 1.7)	4.3 (3.7, 5.0)	5.4 (4.7, 6.2)
PFC Sigma CR	MBT Duofix	89	2014	11	13	2	63	1.5 (1.0, 2.1)	4.6 (3.7, 5.7)	5.5 (4.2, 7.0)
PFC Sigma CR	PFC Sigma	426	18688	80	38	36	272	0.7 (0.6, 0.9)	2.5 (2.3, 2.8)	4.0 (3.6, 4.6)
PFC Sigma PS	MBT	159	5382	41	8	8	102	0.8 (0.6, 1.1)	3.5 (3.0, 4.1)	4.7 (3.8, 5.7)
PFC Sigma PS	MBT Duofix	98	1517	12	2	2	82	1.8 (1.2, 2.6)	7.2 (5.9, 8.8)	7.8 (6.4, 9.4)
PFC Sigma PS	PFC Sigma	164	5985	48	6	16	94	1.1 (0.9, 1.4)	2.9 (2.5, 3.4)	4.2 (3.5, 5.2)
Profix	Profix Mobile*	90	986	24	6	5	55	2.3 (1.6, 3.5)	8.2 (6.6, 10.1)	9.7 (7.9, 11.9)
Profix	Profix*	239	5368	48	13	17	161	1.0 (0.8, 1.4)	3.8 (3.3, 4.3)	5.2 (4.6, 5.9)
Profix Oxinium Cted	Profix*	85	1049	17	4	14	50	2.1 (1.4, 3.2)	7.2 (5.7, 9.0)	9.1 (7.4, 11.3)
RBK	RBK	282	8082	90	9	33	150	1.3 (1.0, 1.5)	4.1 (3.6, 4.6)	5.5 (4.8, 6.4)
Rotaglide Plus	Rotaglide Plus*	56	616	18	1	5	32	0.8 (0.3, 2.0)	5.8 (4.1, 8.0)	10.6 (8.2, 13.7)
Scorpio CR	Scorpio+	128	2448	31	10	16	71	0.9 (0.6, 1.4)	4.0 (3.3, 4.9)	6.3 (5.3, 7.6)
Scorpio CR	Series 7000	392	10043	94	19	33	246	0.9 (0.7, 1.1)	3.4 (3.0, 3.8)	5.3 (4.7, 5.8)
Scorpio PS	Scorpio*	29	524	8	.	8	13	1.2 (0.5, 2.6)	4.5 (3.0, 6.7)	6.5 (4.5, 9.5)
Scorpio PS	Scorpio+*	117	2036	28	12	7	70	1.4 (1.0, 2.1)	5.0 (4.1, 6.1)	6.8 (5.6, 8.2)
Scorpio PS	Series 7000	236	4508	73	4	50	109	1.3 (1.0, 1.7)	4.7 (4.1, 5.4)	7.1 (6.1, 8.3)
TOTAL		**9560**	**251596**	**2376**	**490**	**1087**	**5607**			

Note: Only prosthesis combinations with over 350 procedures have been listed.
* denotes prosthesis combinations with no reported use in Primary Total Knee Procedures in 2013

HIP REPLACEMENT

Categories of Hip Replacement

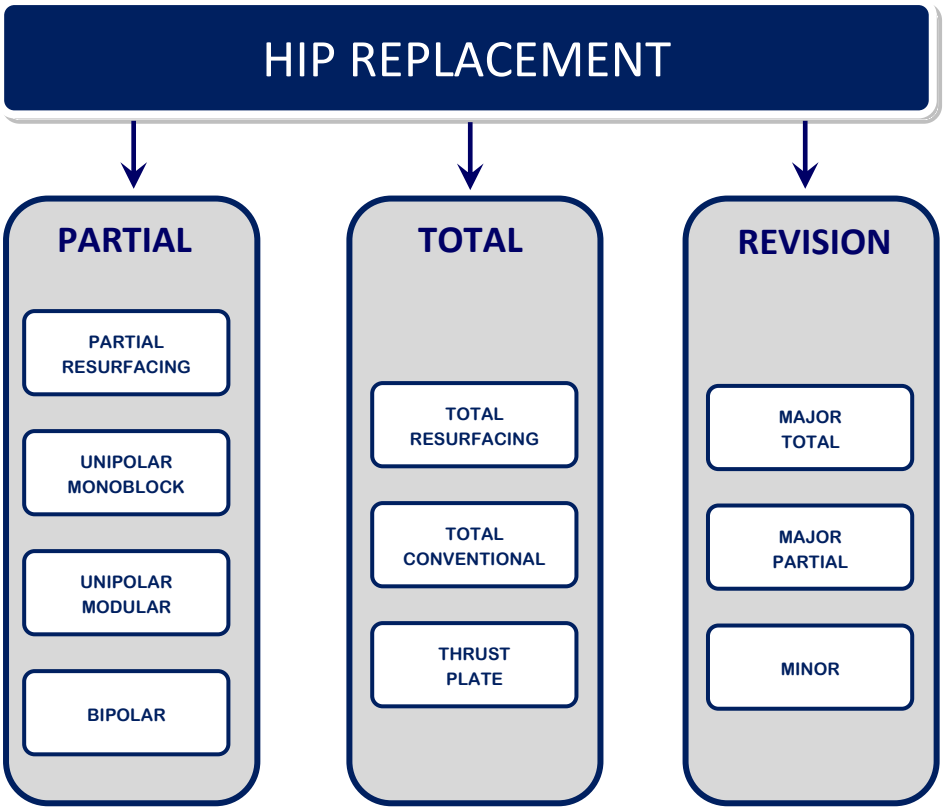
The Registry groups hip replacement into three broad categories; primary partial, primary total and revision hip replacement.

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 relevant chapters.

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 revision hip replacement is provided in a supplementary report available on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2014.



Use of Hip Replacement

This report analyses 410,767 hip replacements reported to the Registry with a procedure date up to and including 31 December 2013. This is an additional 40,180 hip procedures compared to the number reported last year. When considering all hip procedures currently recorded by the Registry, primary partial hips account for 15.9% of all hip replacements, primary total hips 72.2% and revision hip replacement 11.9% (Table H1).

Table H1: Number of Hip Replacements

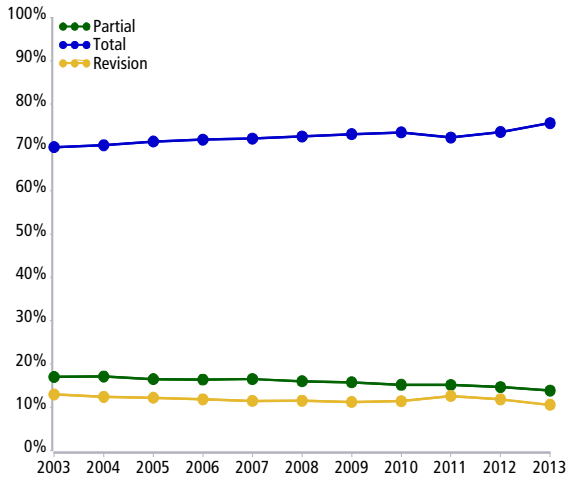
Hip Category	Number	Percent
Partial	65214	15.9
Total	296550	72.2
Revision	49003	11.9
TOTAL	**410767**	**100.0**

The number of hip replacement procedures undertaken in 2013 was 46.5% higher than undertaken in 2003. The corresponding increase in primary total hip replacement was 58.1%, primary partial 19.3% and revision hip replacement 19.5%.

The number of hip replacements undertaken in 2013 increased by 900 (2.4%) compared to 2012. During this time, the use of primary total hip replacement increased by 5.3%, accounting for 75.6% of all hip replacement procedures in 2013. Primary partial hip replacement decreased by 3.3%, accounting for 13.8% of hip procedures in 2013.

The number of revision hip procedures decreased by 391 (8.7%) in 2013. As a percentage of all hip replacement, revisions have decreased from 12.6% in 2011 to 10.6% in 2013 (Figure H1).

Figure H1: Proportion of Hip Replacement



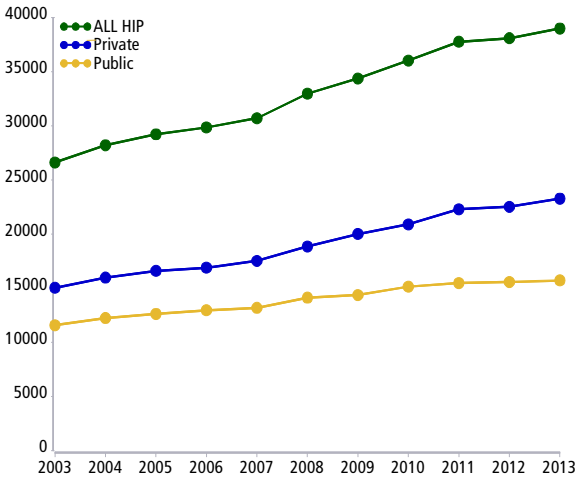
Detailed information on demographics of each category of hip replacement is provided in the supplementary report 'Demographics of Hip Arthroplasty' available on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2014.

Public and Private Sector

More than half of all hip replacement procedures reported to the Registry are undertaken in private hospitals (59.7% in 2013).

There were 23,269 private sector hip replacements reported in 2013, an increase of 3.3% compared to 2012. In the public sector, there were 15,712 hip replacements, an increase of 0.9% compared to 2012.

Figure H2: Hip Replacement by Hospital Sector



Since 2003, hip replacement in the private sector has increased by 54.8% compared to 35.8% in the public sector (Figure H2).

Primary partial hip replacement has decreased in both the public and private sector since 2012 (2.3% and 7.9% respectively). In 2013, there were 4,549 primary partial hip replacements reported in the public sector and 846 in the private sector. Since 2003, primary partial hip replacement has increased in the public sector by 26.7% compared to a decrease of 9.0% in the private sector.

In 2013, 19,955 private sector primary total hip replacements were reported, an increase of 6.2% compared to 2012. In the public sector, there were 9,517 primary total hip replacements, an increase of 3.3% compared to 2012. Since 2003, primary total hip replacement has increased in the private sector by 65.8% compared to an increase of 44.1% in the public sector.

There were 2,468 revision hip replacements reported in the private sector in 2013, a decrease of 12.1% compared to 2012. In the public sector, there were 1,646 revision hip replacements, a decrease of 2.9% compared to 2012. Since 2003, revision hip replacement in the private sector has increased by 19.2% compared to 19.8% in the public sector.

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.

1. **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.
2. **Unipolar monoblock** involves the use of a femoral stem prosthesis with a fixed large head that replaces the natural femoral head.
3. **Unipolar modular** involves the use of a femoral stem and exchangeable large head prosthesis that replaces the natural femoral head.
4. **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

This year, the most common class of primary partial hip replacement is unipolar modular. This accounts for 39.7% of all partial hip procedures. In previous years, the unipolar monoblock has been the most common partial hip but its use has declined by fifty percent in the past 10 years. This accounts for 39.3% of all partial hip procedures. Bipolar hip replacement accounts for 21.0%. Partial resurfacing prostheses have been rarely used (Table HP1).

Fractured neck of femur is the principal diagnosis for all primary partial hip replacement with the exception of partial resurfacing. This diagnosis accounts for 97.5% of unipolar monoblock, 94.2% of unipolar modular and 90.0% of bipolar hip replacements.

The outcome of primary partial hip replacement varies depending on the class. At 10 years, bipolar has the lowest cumulative percent revision followed by unipolar monoblock and unipolar modular (Table HP2). This difference is most apparent in those aged less than 75 years (Table HP4 and Figure HP1).

Partial hip replacement is associated with a high mortality. The mortality data are detailed in Table HP3. The prosthesis class variation is almost certainly due to patient selection.

Detailed information on demographics of each class of primary partial hip replacement is provided in the supplementary report 'Demographics of Hip Arthroplasty' available on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2014.

Table HP1: Partial Hip Replacement by Class

Partial Hip Class	Number	Percent
Partial Resurfacing	14	0.0
Unipolar Monoblock	25631	39.3
Unipolar Modular	25872	39.7
Bipolar	13697	21.0
TOTAL	**65214**	**100.0**

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

Partial Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Unipolar Monoblock	960	25631	3.0 (2.8, 3.2)	4.8 (4.5, 5.2)	5.9 (5.5, 6.3)	6.8 (6.3, 7.3)	7.7 (7.0, 8.5)	9.5 (7.5, 12.1)
Unipolar Modular	850	25872	2.1 (1.9, 2.3)	3.7 (3.5, 4.0)	5.1 (4.8, 5.6)	6.8 (6.2, 7.4)	8.6 (7.5, 9.9)	
Bipolar	469	13697	2.2 (1.9, 2.5)	3.4 (3.1, 3.8)	4.2 (3.8, 4.7)	4.9 (4.4, 5.4)	6.3 (5.6, 7.1)	6.8 (5.9, 7.9)
TOTAL	**2279**	**65200**						

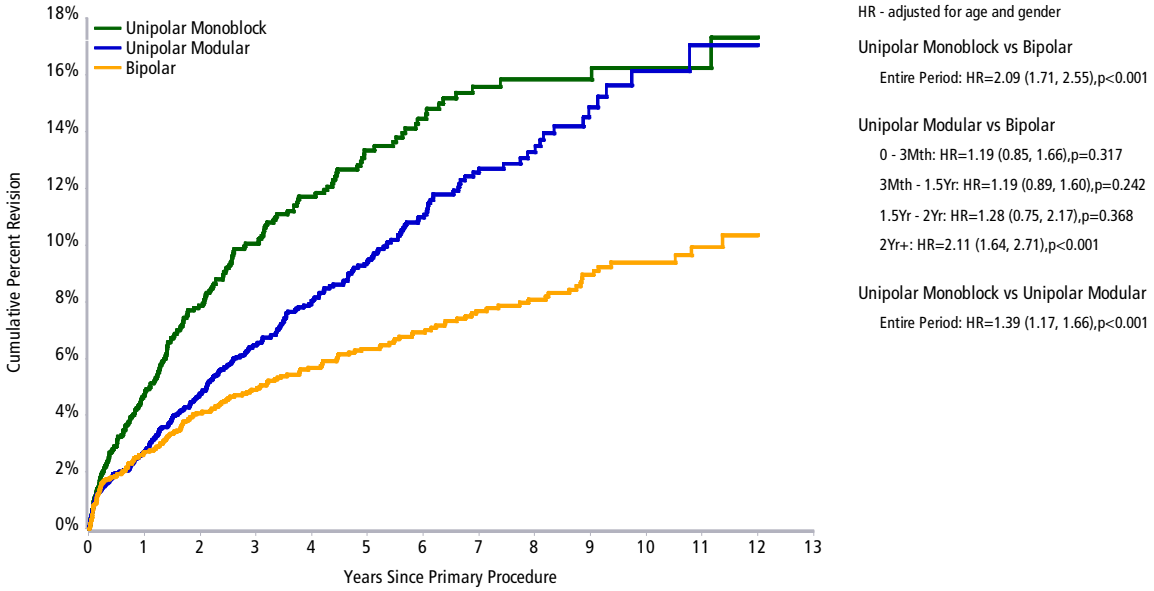
Table HP3: Cumulative Percent Mortality of Primary Partial Hip Replacement by Class

Partial Hip Class	N Deceased	N Total	1 Yr CPM	3 Yrs CPM	5 Yrs CPM	7 Yrs CPM	10 Yrs CPM	13 Yrs CPM
Unipolar Monoblock	19998	25631	35.6 (35.1, 36.2)	59.3 (58.7, 59.9)	75.2 (74.6, 75.8)	84.6 (84.1, 85.1)	92.3 (91.9, 92.8)	95.4 (94.8, 95.9)
Unipolar Modular	12393	25872	22.7 (22.2, 23.2)	41.6 (40.9, 42.3)	56.9 (56.1, 57.7)	68.2 (67.3, 69.1)	78.9 (77.7, 80.1)	
Bipolar	7849	13697	20.6 (20.0, 21.3)	37.9 (37.0, 38.8)	51.8 (50.9, 52.8)	63.5 (62.5, 64.4)	75.1 (74.1, 76.1)	82.7 (81.1, 84.3)
TOTAL	**40240**	**65200**						

Table HP4: Cumulative Percent Revision of Primary Partial Hip Replacement in Patients <75 Years by Class

Partial Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Unipolar Monoblock	210	2266	4.7 (3.9, 5.8)	10.0 (8.6, 11.6)	13.3 (11.6, 15.3)	15.6 (13.5, 17.9)	16.2 (14.0, 18.8)	
Unipolar Modular	327	4719	2.7 (2.3, 3.2)	6.5 (5.7, 7.4)	9.4 (8.3, 10.6)	12.7 (11.2, 14.3)	16.1 (13.8, 18.8)	
Bipolar	188	3279	2.7 (2.2, 3.4)	4.9 (4.1, 5.8)	6.3 (5.4, 7.4)	7.7 (6.6, 8.9)	9.4 (8.0, 10.9)	
TOTAL	**725**	**10264**						

Figure HP1: Cumulative Percent Revision of Primary Partial Hip Replacement in Patients <75 Years by Class



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Unipolar Monoblock	2266	1520	977	628	382	136	12
Unipolar Modular	4719	3443	2150	1238	609	146	14
Bipolar	3279	2483	1832	1412	1002	451	31

Partial Resurfacing

The Registry has recorded 14 partial resurfacing hip procedures and five of these have been revised. The last recorded procedure was in 2009. Osteonecrosis is the principal diagnosis (50%) and the majority of procedures are undertaken in males (78.6%). All but one of these prostheses are used to replace part of the femoral articular surface. The remaining procedure is a partial acetabular surface replacement.

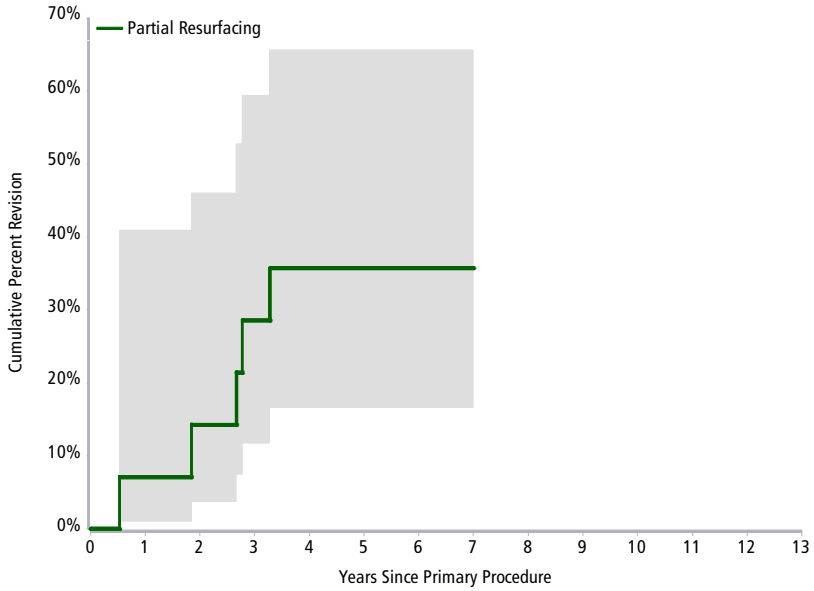
The cumulative percent revision is 7.1% at one year and 35.7% at seven years (Table HP5 and Figure HP2).

Of the five revisions, two are for loosening/lysis, two for osteonecrosis and one for prosthesis dislocation. All have been revised to a total hip replacement.

Table HP5: Cumulative Percent Revision of Primary Partial Resurfacing Hip Replacement

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Partial Resurfacing	5	14	7.1 (1.0, 40.9)	28.6 (11.8, 59.4)	35.7 (16.7, 65.7)	35.7 (16.7, 65.7)		

Figure HP2: Cumulative Percent Revision of Primary Partial Resurfacing Hip Replacement



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Partial Resurfacing	14	13	10	9	3	0	0

Unipolar Monoblock

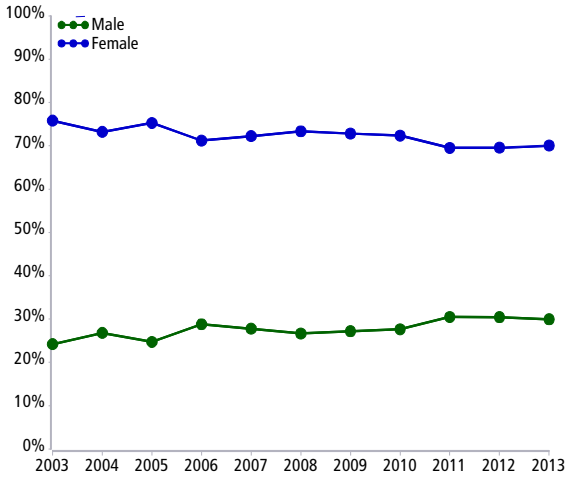
Demographics

There have been 25,631 unipolar monoblock procedures reported to the Registry. This is an additional 1,302 procedures compared to the previous report.

The use of monoblock hip replacement in Australia continues to decline. The number of procedures reported in 2013 was 16.6% less than 2012 and 56.3% less than 2003.

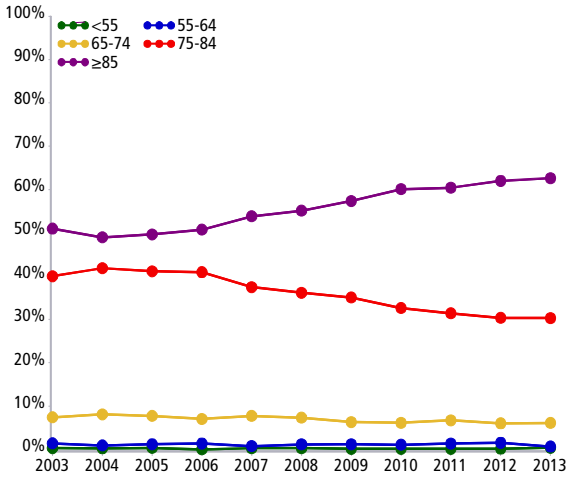
Fractured neck of femur is the principal diagnosis for primary unipolar monoblock hip replacement (97.5%).

Figure HP3: Primary Unipolar Monoblock Hip Replacement by Gender



The majority of patients are female (73.3%) and aged 75 years or older (91.2%). The proportion of patients aged 85 years or older has increased from 51.0% in 2003 to 62.6% in 2013 (Figures HP3 and HP4).

Figure HP4: Primary Unipolar Monoblock Hip Replacement by Age



The three types of unipolar monoblock prostheses are the Austin Moore type, Thompson type and Exeter Trauma Stem (ETS). In 2013, the use of the Austin-Moore type decreased by 20.1% compared to 2012 and 72.0% compared to 2003. The Thompson type decreased by 3.5% compared to 2012 and 42.0% compared to 2003. In 2013, the use of the ETS decreased by 22.2% compared to 2012 and accounted for 21.7% of all monoblock prostheses (Table HP6).

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

2003		2010		2011		2012		2013	
N	Model	N	Model	N	Model	N	Model	N	Model
1988	Austin-Moore Type	870	Austin-Moore Type	767	Austin-Moore Type	696	Austin-Moore Type	556	Austin-Moore Type
526	Thompson Type	473	Thompson Type	377	Thompson Type	316	Thompson Type	305	Thompson Type
		260	ETS	336	ETS	306	ETS	238	ETS
Most Used									
2514	(2) 100.0%	1603	(3) 100.0%	1480	(3) 100.0%	1318	(3) 100.0%	1099	(3) 100.0%

Outcome for all Diagnoses

The Registry has recorded 960 revisions of primary unipolar monoblock hip replacement. The main reason for revision is loosening/lysis (46.7%), followed by fracture (18.9%) and prosthesis dislocation (11.4%) (Table HP7).

The majority of unipolar monoblock hip replacements are revised to a total hip replacement (62.0%). Revision to another unipolar hip replacement (femoral component only) has occurred in 18.0% of revisions (Table HP8).

Table HP7: Primary Unipolar Monoblock Hip Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	448	46.7
Fracture	181	18.9
Prosthesis Dislocation	109	11.4
Infection	92	9.6
Pain	69	7.2
Chondrolysis/Acetab. Erosion	37	3.9
Malposition	10	1.0
Other	14	1.5
TOTAL	**960**	**100.0**

Table HP8: Primary Unipolar Monoblock Hip Replacement by Type of Revision

Type of Revision	Number	Percent
THR (Femoral/Acetabular)	595	62.0
Femoral Component	173	18.0
Bipolar Head and Femoral	92	9.6
Cement Spacer	39	4.1
Removal of Prostheses	38	4.0
Minor Components	14	1.5
Reinsertion of Components	5	0.5
Incomplete	1	0.1
Bipolar Only	1	0.1
Insert Only	1	0.1
Cement Only	1	0.1
TOTAL	**960**	**100.0**

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

Outcome for Fractured Neck of Femur

The cumulative percent revision at 13 years for unipolar monoblock when undertaken for fractured neck of femur is 9.6% (Table HP9 and Figure HP5).

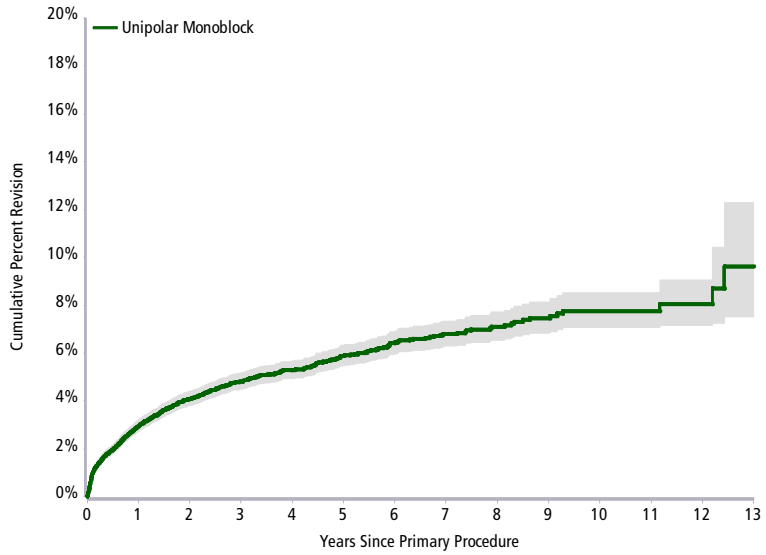
Age and femoral stem fixation are risk factors for revision. The rate of revision decreases with increasing age (Table HP10 and Figure HP6). There is no difference in the outcome between males and females (Table HP11 and Figure HP7). In the first one and a half years, cementless fixation has a higher rate of revision, with no difference after this time (Table HP12 and Figure HP8).

The Austin Moore cementless prosthesis has a higher rate of revision compared to the cemented ETS over the entire period. When compared to the cemented Thompson type, the Austin Moore has a higher rate of revision in the first 1.5 years and a lower rate of revision after 2.5 years. There is no difference in the rate of revision between the cemented ETS and cemented Thompson type prostheses (Table HP12 and Figure HP9).

Table HP9: 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	13 Yrs
Unipolar Monoblock	933	24997	3.0 (2.7, 3.2)	4.8 (4.5, 5.2)	5.9 (5.5, 6.3)	6.8 (6.3, 7.3)	7.8 (7.1, 8.5)	9.6 (7.5, 12.3)

Figure HP5: Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement (Primary Diagnosis Fractured NOF)

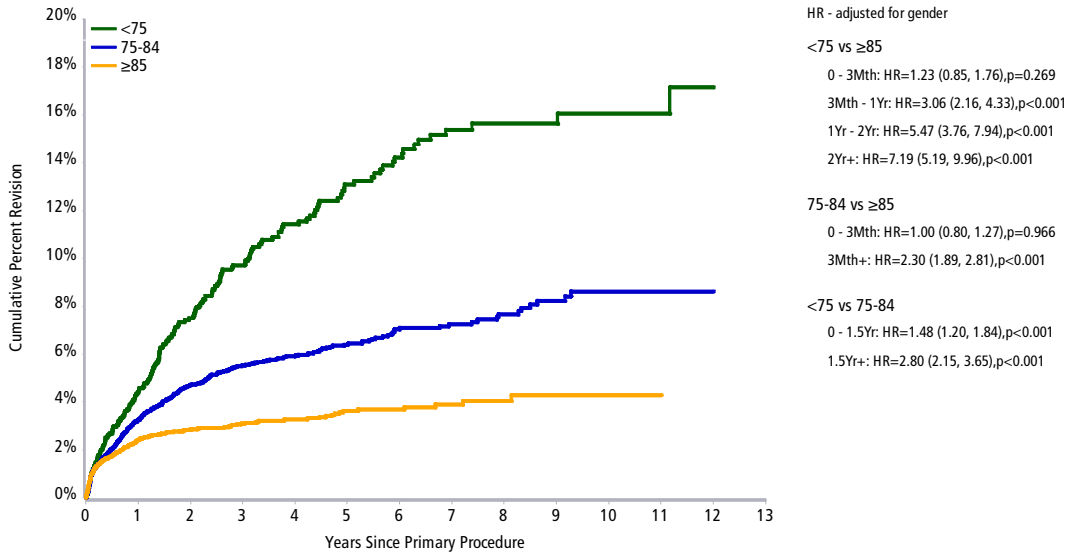


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Unipolar Monoblock	24997	14984	8350	4364	2198	612	40

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	13 Yrs
<75	200	2195	4.5 (3.6, 5.5)	9.7 (8.3, 11.3)	13.1 (11.3, 15.1)	15.4 (13.3, 17.7)	16.1 (13.8, 18.6)	
75-84	425	9577	3.3 (2.9, 3.7)	5.5 (5.0, 6.1)	6.4 (5.8, 7.1)	7.2 (6.5, 8.1)	8.6 (7.5, 9.8)	
≥85	308	13225	2.4 (2.1, 2.7)	3.1 (2.7, 3.5)	3.6 (3.2, 4.1)	3.9 (3.4, 4.5)	4.3 (3.6, 5.1)	
TOTAL	**933**	**24997**						

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

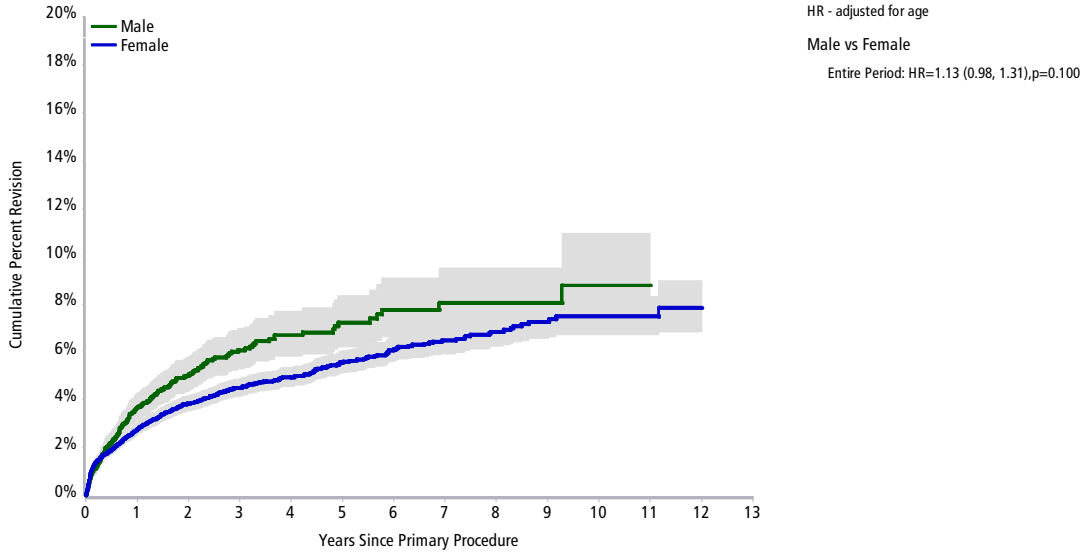


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Age <75	2195	1487	961	617	376	134	12
Age 75-84	9577	6166	3682	2104	1117	314	21
Age ≥85	13225	7331	3707	1643	705	164	7

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	13 Yrs
Male	238	6668	3.7 (3.2, 4.3)	6.1 (5.3, 7.0)	7.2 (6.2, 8.4)	8.0 (6.8, 9.5)	8.8 (7.0, 10.9)	
Female	695	18329	2.8 (2.5, 3.0)	4.5 (4.1, 4.9)	5.6 (5.1, 6.0)	6.5 (5.9, 7.1)	7.5 (6.7, 8.3)	
TOTAL	**933**	**24997**						

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

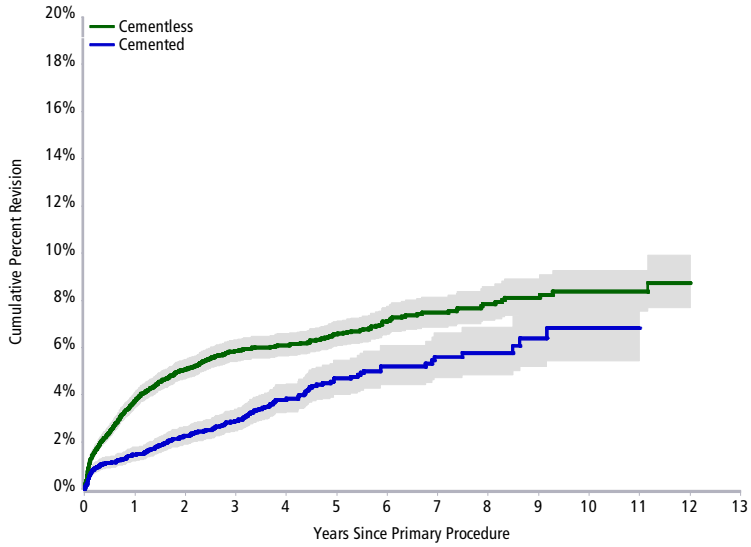


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male	6668	3113	1377	642	307	81	10
Female	18329	11871	6973	3722	1891	531	30

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

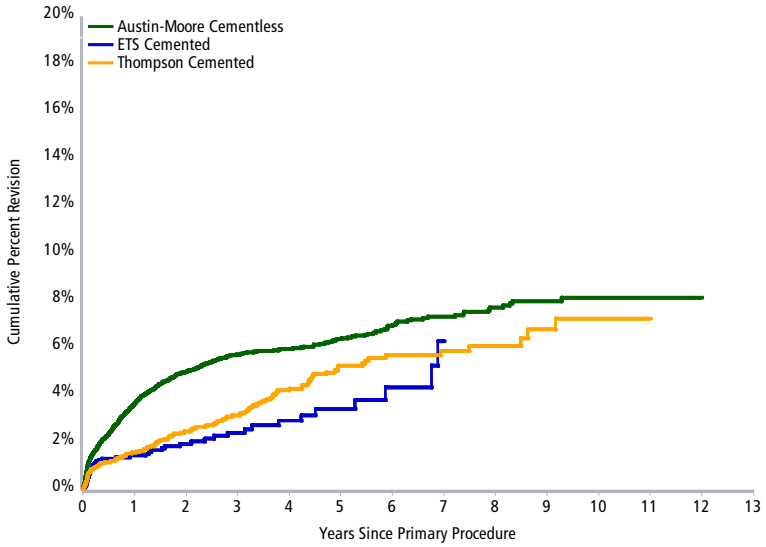
Fixation by Prosthesis	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cementless	**718**	**16418**	**3.8 (3.4, 4.1)**	**5.8 (5.4, 6.3)**	**6.6 (6.1, 7.1)**	**7.5 (6.9, 8.1)**	**8.4 (7.6, 9.3)**	
Austin-Moore Cementless	674	15886	3.6 (3.3, 4.0)	5.7 (5.3, 6.2)	6.4 (5.9, 6.9)	7.3 (6.7, 8.0)	8.1 (7.3, 9.0)	
Thompson Cementless	44	532	6.9 (4.9, 9.8)	9.9 (7.2, 13.6)	12.0 (8.7, 16.6)	12.0 (8.7, 16.6)		
Cemented	**215**	**8579**	**1.5 (1.2, 1.8)**	**2.9 (2.5, 3.4)**	**4.7 (4.0, 5.5)**	**5.6 (4.7, 6.6)**	**6.8 (5.4, 8.5)**	
Austin-Moore Cemented	12	825	0.9 (0.4, 2.2)	2.6 (1.4, 5.0)	4.0 (2.1, 7.6)	4.0 (2.1, 7.6)		
ETS Cemented	46	2196	1.4 (1.0, 2.1)	2.4 (1.7, 3.3)	3.4 (2.4, 4.8)	6.3 (3.8, 10.4)		
Thompson Cemented	157	5558	1.6 (1.2, 2.0)	3.1 (2.6, 3.8)	5.2 (4.4, 6.2)	5.8 (4.9, 7.0)	7.2 (5.7, 9.2)	

Figure HP8: 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	13 Yrs
Cementless	16418	9654	5496	2962	1541	475	31
Cemented	8579	5330	2854	1402	657	137	9

Figure HP9: 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	13 Yrs
Austin-Moore Cementless	15886	9322	5307	2865	1489	456	27
ETS Cemented	2196	1373	675	286	87	0	0
Thompson Cemented	5558	3534	1967	1014	523	136	9

Unipolar Modular

Demographics

There have been 25,872 unipolar modular procedures reported to the Registry. This is an additional 3,420 procedures compared to the previous report.

In 2013, the number of unipolar modular procedures decreased by 1.3% compared to 2012 but since 2003 has increased by 386.5%.

Fractured neck of femur is the principal diagnosis for primary unipolar modular hip replacement (94.2%).

The majority of patients are female (71.9%) and aged 75 years or older (81.8%). The proportion of patients aged 85 years or older has increased from 32.0% in 2003 to 47.0% in 2013 (Figures HP10 and HP11).

Figure HP10: Primary Unipolar Modular Hip Replacement by Gender

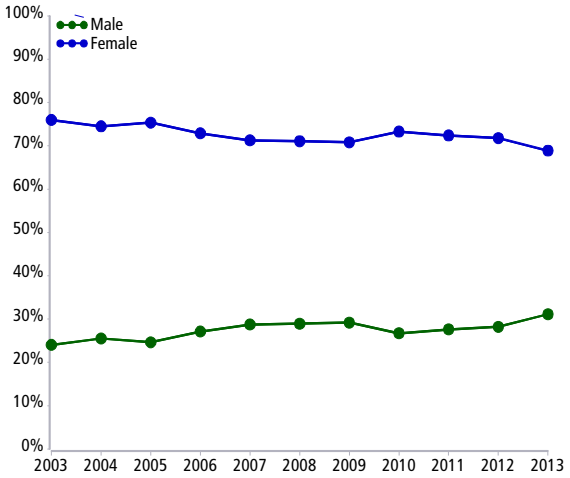
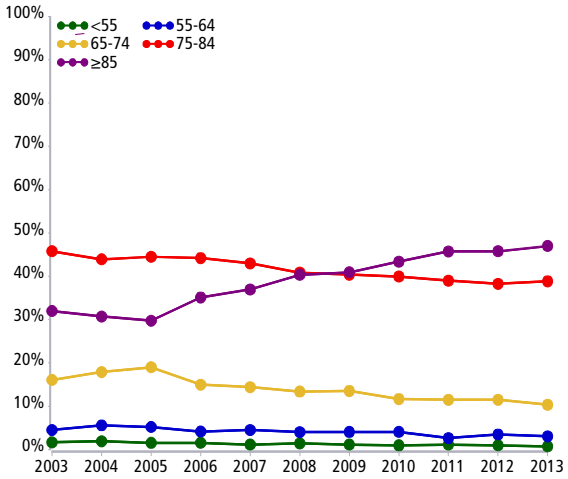


Figure HP11: Primary Unipolar Modular Hip Replacement by Age



Overall there have been 181 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 HP13 and HP14.

In 2013, 18 different unipolar modular head prostheses were used. The Unitrax head was the most frequent (44.1%). The 10 most used unipolar modular head prostheses account for 99.4% of all primary unipolar modular hip procedures.

There were 35 different stem prostheses used in 2013, a decrease from 50 in 2012. The most frequently used stem in 2013 was the Exeter V40 stem (43.1%). The 10 most used femoral stems account for 95.3% of all primary unipolar modular hip procedures.

Table HP13: 10 Most Used Unipolar Head Prostheses in Primary Unipolar Modular Hip Replacement

2003		2010		2011		2012		2013	
N	Model	N	Model	N	Model	N	Model	N	Model
217	Unipolar (Zimmer)	1170	Unitrax	1315	Unitrax	1329	Unitrax	1430	Unitrax
193	Unitrax	785	Unipolar (S&N)	772	Unipolar (S&N)	929	Unipolar (S&N)	937	Unipolar (S&N)
127	Unipolar (S&N)	603	Unipolar (Zimmer)	625	Unipolar (Zimmer)	529	Unipolar (Zimmer)	556	Unipolar (Zimmer)
64	Unipolar (Mathys)	188	Cathcart	153	Metasul	154	Metasul	123	Cathcart
46	Elite	82	Unipolar (Corin)	145	Cathcart	113	Cathcart	68	Unipolar (Corin)
16	Ultima	69	Metasul	114	U2	92	U2	50	Metasul
1	Metasul	22	U2	73	Unipolar (Corin)	62	Unipolar (Corin)	24	Pharo
1	Optimom	21	Conserve	42	Unipolar (Lima)	27	Unipolar (Lima)	17	Unipolar (Lima)
1	Unipolar (Sulzer)	21	Femoral (JRI)	25	Conserve	15	Pharo	8	FMP
		15	Unipolar (Lima)	13	Femoral (JRI)	11	Conserve	8	Femoral (JRI)
10 Most Used									
666	(9) 100.0%	2976	(10) 98.9%	3277	(10) 99.1%	3261	(10) 99.4%	3221	(10) 99.4%
Remainder									
0	(0) 0%	33	(10) 1.1%	29	(12) 0.9%	21	(10) 0.6%	19	(8) 0.6%
TOTAL									
666	(9) 100.0%	3009	(20) 100.0%	3306	(22) 100.0%	3282	(20) 100.0%	3240	(18) 100.0%

Table HP14: 10 Most Used Femoral Stem Prostheses in Primary Unipolar Modular Hip Replacement

2003		2010		2011		2012		2013	
N	Model	N	Model	N	Model	N	Model	N	Model
180	Exeter V40	1119	Exeter V40	1261	Exeter V40	1289	Exeter V40	1395	Exeter V40
111	Alloclassic	502	CPT	580	CPT	577	CPT	550	CPT
91	CPT	333	CPCS	331	CPCS	471	CPCS	501	CPCS
70	Spectron EF	271	Spectron EF	277	Spectron EF	233	Spectron EF	180	SL-Plus
49	Fullfix Stem	168	Corail	163	Alloclassic	155	SL-Plus	175	Spectron EF
38	SL-Plus	151	Alloclassic	129	Corail	92	E2	79	Corail
33	Elite Plus	82	SL-Plus	112	E2	91	Corail	67	Metafix
18	Basis	63	Basis	81	SL-Plus	69	Alloclassic	55	Basis
15	CCA	56	Metafix	58	Basis	57	Metafix	45	C-Stem AMT
15	Thompson Mod Stem	38	Omnifit	52	Metafix	39	Basis	41	Alloclassic
10 Most Used									
620	(10) 93.1%	2783	(10) 92.5%	3044	(10) 92.1%	3073	(10) 93.6%	3088	(10) 95.3%
Remainder									
46	(13) 6.9%	226	(39) 7.5%	262	(41) 7.9%	209	(40) 6.4%	152	(25) 4.7%
TOTAL									
666	(23) 100.0%	3009	(49) 100.0%	3306	(51) 100.0%	3282	(50) 100.0%	3240	(35) 100.0%

Outcome for all Diagnoses

The Registry has recorded 850 revisions of primary unipolar modular hip replacement.

The main reasons for revision are prosthesis dislocation (19.9%), infection (19.1%), loosening/lysis (16.0%) and fracture (15.5%) (Table HP15).

The majority of revisions are acetabular only revisions (45.3%), followed by THR (femoral/acetabular) revisions (18.6%) (Table HP16).

The cumulative percent revision of individual combinations of unipolar modular stem/head prostheses with 100 or more procedures are detailed in Table HP17.

Table HP15: Primary Unipolar Modular Hip Replacement by Reason for Revision

Reason for Revision	Number	Percent
Prosthesis Dislocation	169	19.9
Infection	162	19.1
Loosening/Lysis	136	16.0
Fracture	132	15.5
Pain	108	12.7
Chondrolysis/Acetab. Erosion	108	12.7
Malposition	2	0.2
Other	33	3.9
TOTAL	**850**	**100.0**

Table HP16: Primary Unipolar Modular Hip Replacement by Type of Revision

Type of Revision	Number	Percent
Acetabular Component	385	45.3
THR (Femoral/Acetabular)	158	18.6
Femoral Component	105	12.4
Head Only	95	11.2
Cement Spacer	37	4.4
Minor Components	26	3.1
Removal of Prostheses	19	2.2
Bipolar Head and Femoral	18	2.1
Bipolar Only	4	0.5
Reinsertion of Components	2	0.2
Cement Only	1	0.1
TOTAL	**850**	**100.0**

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

Table HP17: 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	13 Yrs
Cathcart	Corail	54	1077	3.8 (2.8, 5.3)	6.2 (4.7, 8.2)	7.6 (5.7, 10.1)			
Endo II	Taperloc	5	102	5.1 (2.2, 11.9)	5.1 (2.2, 11.9)				
Metasul	Alloclassic	12	342	2.5 (1.3, 5.0)	3.9 (2.2, 7.1)				
Metasul	CPT	3	213	1.7 (0.5, 5.4)					
U2	E2	0	226	0.0 (0.0, 0.0)					
Ultima	Thompson Mod 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 (Corin)	Metafix	3	293	0.4 (0.0, 2.5)	0.4 (0.0, 2.5)				
Unipolar (Corin)	Taper Fit	15	305	2.2 (1.0, 4.8)	5.8 (3.4, 9.9)	7.6 (4.5, 12.7)			
Unipolar (Corin)	Tri-Fit	7	288	1.5 (0.6, 4.0)	2.6 (1.2, 5.9)	2.6 (1.2, 5.9)	4.5 (1.8, 11.3)		
Unipolar (Mathys)	CCA	9	357	1.0 (0.3, 3.0)	2.6 (1.2, 5.3)	2.6 (1.2, 5.3)	3.6 (1.7, 7.6)		
Unipolar (Mathys)	Fullfix Stem	6	210	1.1 (0.3, 4.3)	2.4 (0.9, 6.4)	2.4 (0.9, 6.4)	5.2 (2.2, 12.2)		
Unipolar (Plus)	SL-Plus	8	193	2.2 (0.8, 5.8)	3.6 (1.6, 8.0)	4.6 (2.2, 9.7)			
Unipolar (S&N)	Basis	18	534	1.8 (0.9, 3.5)	3.3 (1.8, 5.9)	6.2 (3.7, 10.2)	7.1 (4.3, 11.6)		
Unipolar (S&N)	CPCS	83	3007	2.0 (1.5, 2.6)	3.6 (2.8, 4.5)	4.4 (3.4, 5.7)	5.6 (4.1, 7.7)		
Unipolar (S&N)	Platform	5	110	4.1 (1.5, 10.5)	4.1 (1.5, 10.5)				
Unipolar (S&N)	SL-Plus	25	827	2.0 (1.2, 3.3)	3.8 (2.4, 6.0)	4.6 (2.8, 7.5)	5.5 (3.2, 9.4)		
Unipolar (S&N)	Spectron EF	65	2370	1.5 (1.1, 2.2)	2.9 (2.2, 3.9)	3.8 (2.9, 5.1)	4.9 (3.6, 6.7)	7.0 (4.7, 10.4)	
Unipolar (Zimmer)	Alloclassic	49	1138	3.0 (2.1, 4.3)	4.3 (3.2, 5.8)	5.5 (4.1, 7.4)	6.1 (4.6, 8.2)		
Unipolar (Zimmer)	CPT	111	3626	1.7 (1.3, 2.3)	3.6 (2.9, 4.5)	5.1 (4.1, 6.3)	7.2 (5.6, 9.4)	8.3 (5.9, 11.7)	
Unipolar (Zimmer)	VerSys	2	156	1.8 (0.4, 7.4)	1.8 (0.4, 7.4)				
Unitrax	Accolade I	7	115	0.9 (0.1, 6.3)	6.9 (3.2, 14.9)				
Unitrax	Exeter V40	278	8650	1.8 (1.6, 2.2)	3.6 (3.1, 4.1)	5.7 (4.9, 6.6)	7.6 (6.5, 9.0)	10.9 (8.4, 14.1)	
Unitrax	Omnifit	5	199	3.0 (1.2, 7.1)	3.0 (1.2, 7.1)				
Other (158)		79	1401	4.1 (3.1, 5.4)	6.2 (4.8, 7.9)	7.9 (6.2, 10.2)	10.7 (8.2, 13.9)		
TOTAL		**850**	**25872**						

Note: Only combinations with over 100 procedures have been listed.

Outcome for Fractured Neck of Femur

The cumulative percent revision at 10 years for unipolar modular hip replacement when undertaken for fractured neck of femur is 8.4% (Table HP18 and Figure HP12).

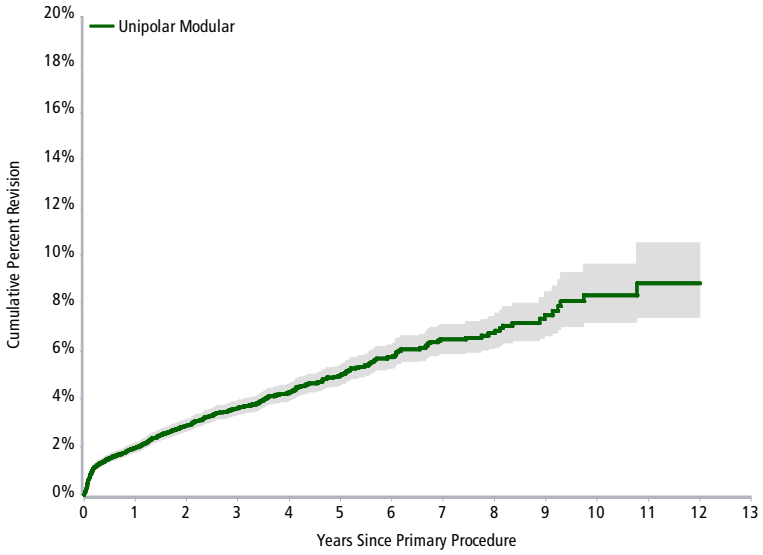
Age, gender and femoral stem fixation are risk factors for revision. The rate of revision decreases with increasing age (Table HP19 and Figure HP13). Males have a higher rate of revision in the first one and half years (Table HP20 and Figure HP14).

Cementless fixation has a higher rate of revision in the first nine months, with no difference after this time (Table HP21 and Figure HP15). At nine months, the revision rate for loosening/lysis and fracture is over five times higher for cementless compared to cemented fixation (Figure HP16).

Table HP18: 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	13 Yrs
Unipolar Modular	775	24372	2.0 (1.8, 2.2)	3.6 (3.3, 3.9)	5.0 (4.6, 5.4)	6.5 (5.9, 7.1)	8.4 (7.2, 9.7)	

Figure HP12: Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement (Primary Diagnosis Fractured NOF)

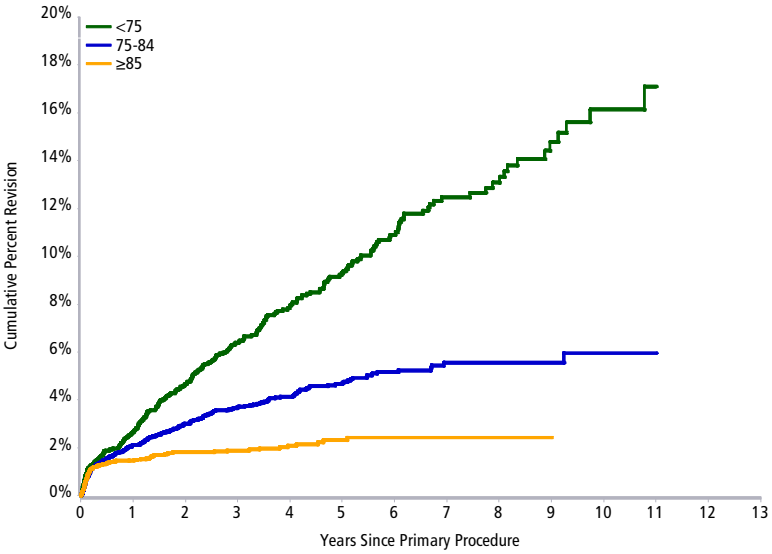


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Unipolar Modular	24372	16199	8524	4006	1606	313	20

Table HP19: 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	13 Yrs
<75	301	4328	2.7 (2.2, 3.2)	6.4 (5.6, 7.3)	9.3 (8.2, 10.5)	12.5 (11.0, 14.1)	16.1 (13.7, 19.0)	
75-84	318	9989	2.1 (1.8, 2.4)	3.7 (3.3, 4.1)	4.7 (4.2, 5.3)	5.6 (4.9, 6.4)	6.0 (5.0, 7.1)	
≥85	156	10055	1.5 (1.2, 1.8)	1.9 (1.6, 2.2)	2.3 (1.9, 2.8)	2.4 (2.0, 3.0)		
TOTAL	**775**	**24372**						

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



HR - adjusted for gender

<75 vs ≥85

0 - 3Mth: HR=1.13 (0.82, 1.56),p=0.455

3Mth - 1Yr: HR=4.42 (2.87, 6.82),p<0.001

1Yr - 1.5Yr: HR=7.99 (4.85, 13.16),p<0.001

1.5Yr - 3.5Yr: HR=8.19 (5.46, 12.29),p<0.001

3.5Yr - 4.5Yr: HR=6.81 (3.56, 13.03),p<0.001

4.5Yr+: HR=15.76 (8.71, 28.52),p<0.001

75-84 vs ≥85

0 - 3Mth: HR=0.99 (0.76, 1.29),p=0.933

3Mth+: HR=3.23 (2.35, 4.42),p<0.001

<75 vs 75-84

0 - 1.5Yr: HR=1.44 (1.17, 1.77),p<0.001

1.5Yr - 2.5Yr: HR=2.14 (1.43, 3.18),p<0.001

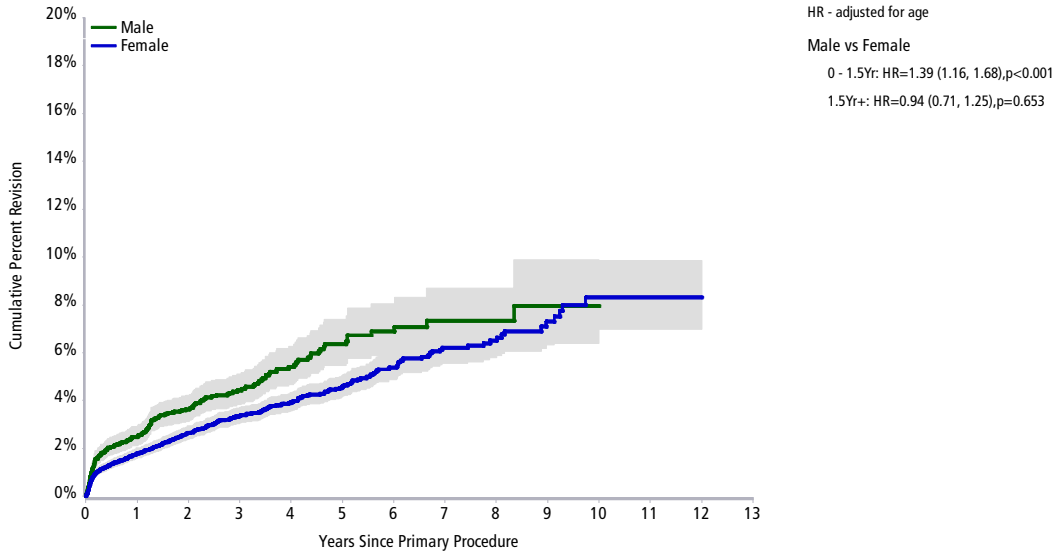
2.5Yr+: HR=3.41 (2.50, 4.66),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Age <75	4328	3225	2006	1146	567	139	14
Age 75-84	9989	7021	3909	1937	803	154	6
Age ≥85	10055	5953	2609	923	236	20	0

Table HP20: 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	13 Yrs
Male	235	6822	2.5 (2.1, 2.9)	4.4 (3.8, 5.1)	6.4 (5.5, 7.4)	7.3 (6.2, 8.7)	8.0 (6.4, 9.9)	
Female	540	17550	1.8 (1.6, 2.0)	3.4 (3.0, 3.7)	4.6 (4.2, 5.1)	6.2 (5.5, 6.9)	8.3 (7.0, 9.9)	
TOTAL	**775**	**24372**						

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

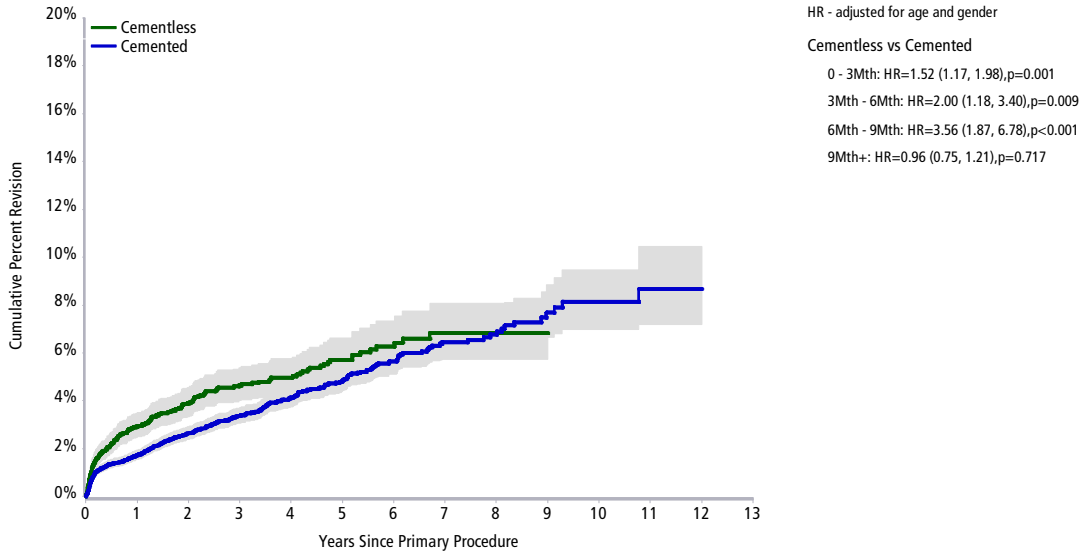


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male	6822	3877	1837	804	285	51	4
Female	17550	12322	6687	3202	1321	262	16

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

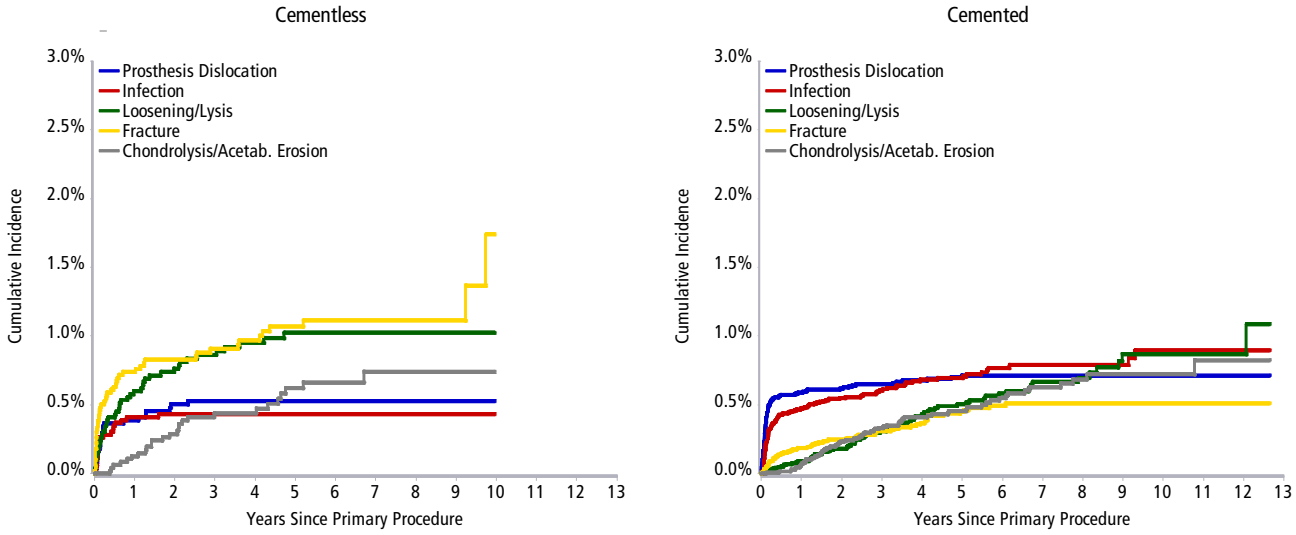
Femoral Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cementless	203	4970	2.9 (2.5, 3.5)	4.6 (4.0, 5.4)	5.7 (4.9, 6.6)	6.8 (5.7, 8.1)		
Cemented	572	19402	1.7 (1.5, 1.9)	3.4 (3.1, 3.7)	4.8 (4.4, 5.3)	6.5 (5.8, 7.2)	8.1 (7.0, 9.5)	
TOTAL	**775**	**24372**						

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



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cementless	4970	3460	2025	975	351	34	0
Cemented	19402	12739	6499	3031	1255	279	20

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



Bipolar

Demographics

There have been 13,697 bipolar procedures reported to the Registry. This is an additional 1099 procedures compared to the previous report.

The number of bipolar procedures undertaken in 2013 was 8.1% more than 2012 but 21.3% less than 2003.

Fractured neck of femur is the principal diagnosis for bipolar hip replacement (90.0%).

The majority of patients are female (72.4%) and aged 75 years or older (76.1%). The proportion of patients aged 85 years or older has increased from 26.0% in 2003 to 48.7% in 2012 (Figures HP17 and HP18).

Figure HP17: Primary Bipolar Hip Replacement by Gender

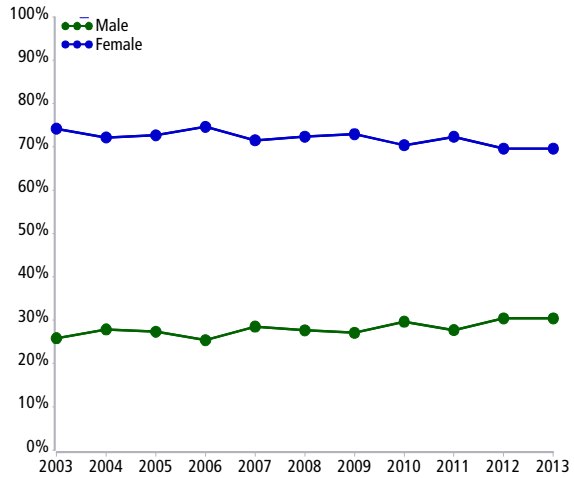
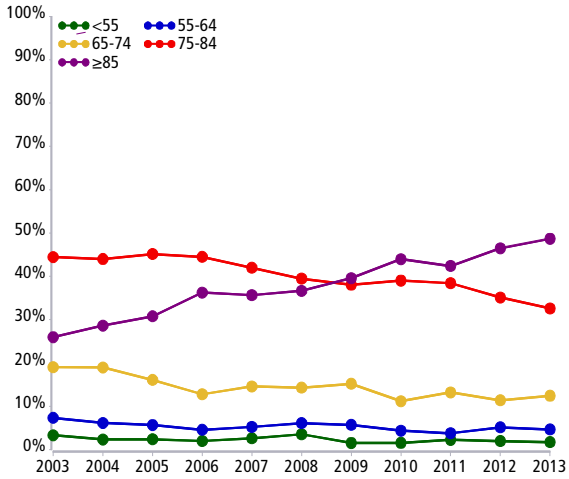


Figure HP18: Primary Bipolar Hip Replacement by Age



Overall there have been 235 bipolar head and stem combinations reported to the Registry. In 2013, there were 17 different bipolar head and 43 different stem prostheses used.

The UHR remains the most frequently used bipolar head (55.1%) and the Exeter V40 the most frequently used femoral stem (53.3%) in 2013.

The 10 most used bipolar head prostheses account for 98.1% of all bipolar hip procedures. The 10 most used femoral stems account for 89.7% of all bipolar hip procedures (Tables HP22 and HP23).

Table HP22: 10 Most Used Bipolar Head Prostheses in Primary Bipolar Hip Replacement

2003		2010		2011		2012		2013	
N	Model	N	Model	N	Model	N	Model	N	Model
760	UHR	461	UHR	433	UHR	515	UHR	582	UHR
140	Hastings	128	Tandem	137	Multipolar Bipolar	147	Tandem	151	Tandem
115	Convene	101	Multipolar Bipolar	113	Tandem	103	Multipolar Bipolar	126	Multipolar Bipolar
91	Bipolar (Zimmer)	72	Hastings	71	Self-Centering	57	Self-Centering	38	Bipolar (Lima)
87	Self-Centering	35	Self-Centering	56	Hastings	38	Bipolar (Lima)	38	Hastings
59	Multipolar Bipolar	13	Ringloc	31	Bipolar (Lima)	35	Hastings	34	Self-Centering
39	Bipolar (Mathys)	12	Bipolar (Medacta)	29	Bipolar (Medacta)	27	Bipolar (Medacta)	30	Bipolar (Medacta)
19	Bipolar (Lima)	10	Moonstone	25	Ringloc	23	Moonstone	21	Ringloc
19	Ringloc	5	Bipolar (Lima)	23	Moonstone	17	Ringloc	8	Moonstone
5	UHL	5	UHL	8	Bipolar (ISP)	3	Bipolar (Eska)	8	Pharo
10 Most Used									
1334	(10) 99.5%	842	(10) 98.9%	926	(10) 99.4%	965	(10) 98.8%	1036	(10) 98.1%
Remainder									
7	(2) 0.5%	9	(4) 1.1%	6	(3) 0.6%	12	(5) 1.2%	20	(7) 1.9%
TOTAL									
1341	(12) 100.0%	851	(14) 100.0%	932	(13) 100.0%	977	(15) 100.0%	1056	(17) 100.0%

Table HP23: 10 Most Used Femoral Stem Prostheses in Primary Bipolar Hip Replacement

2003		2010		2011		2012		2013	
N	Model	N	Model	N	Model	N	Model	N	Model
630	Exeter V40	410	Exeter V40	412	Exeter V40	451	Exeter V40	563	Exeter V40
94	Elite Plus	96	CPCS	85	CPT	95	CPCS	113	CPCS
75	Alloclassic	57	Corail	77	CPCS	66	Corail	103	CPT
65	CPCS	55	CPT	56	Corail	62	CPT	54	Corail
61	C-Stem	31	Accolade I	28	Accolade I	53	Accolade I	24	Basis
59	Omnifit	22	VerSys Heritage	24	Quadra-C	25	C2	24	Quadra-C
33	VerSys	14	Spectron EF	22	Spectron EF	21	Basis	21	C2
26	ABGII	13	C-Stem	21	Summit	21	Quadra-C	16	H-Max
25	CCA	13	Hyperion	18	Alloclassic	19	Alloclassic	15	Accolade I
25	Spectron EF	11	GMRS	17	Hyperion	18	Hyperion	14	Alloclassic
10 Most Used									
1093	(10) 81.5%	722	(10) 84.8%	760	(10) 81.5%	831	(10) 85.1%	947	(10) 89.7%
Remainder									
248	(46) 18.5%	129	(37) 15.2%	172	(34) 18.5%	146	(29) 14.9%	109	(33) 10.3%
TOTAL									
1341	(56) 100.0%	851	(47) 100.0%	932	(44) 100.0%	977	(39) 100.0%	1056	(43) 100.0%

Outcome for all Diagnoses

The Registry has recorded 469 revisions of primary bipolar hip replacement.

The main reasons for revision are fracture (23.5%), loosening/lysis (20.5%), infection (18.6%) and prosthesis dislocation (17.9%) (Table HP24).

The majority of revisions are acetabular only revisions (36.5%), followed by THR (femoral/acetabular) revisions (23.7%) and bipolar head and femoral revisions (13.6%) (Table HP25).

The cumulative percent revision of individual combinations of bipolar stem/head prostheses with 100 or more procedures are detailed in Table HP26.

Table HP24: Primary Bipolar Hip Replacement by Reason for Revision

Reason for Revision	Number	Percent
Fracture	110	23.5
Loosening/Lysis	96	20.5
Infection	87	18.6
Prosthesis Dislocation	84	17.9
Pain	38	8.1
Chondrolysis/Acetab. Erosion	36	7.7
Malposition	2	0.4
Other	16	3.4
TOTAL	**469**	**100.0**

Table HP25: Primary Bipolar Hip Replacement by Type of Revision

Type of Revision	Number	Percent
Acetabular Component	171	36.5
THR (Femoral/Acetabular)	111	23.7
Bipolar Head and Femoral	64	13.6
Bipolar Only	43	9.2
Cement Spacer	25	5.3
Femoral Component	24	5.1
Head Only	14	3.0
Minor Components	9	1.9
Removal of Prostheses	8	1.7
TOTAL	**469**	**100.0**

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

Table HP26: 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	13 Yrs
Bipolar Head (Zimmer)	Alloclassic	12	358	0.9 (0.3, 2.8)	2.3 (1.1, 4.9)	2.8 (1.4, 5.4)	2.8 (1.4, 5.4)		
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	346	2.2 (1.1, 4.6)	3.3 (1.8, 6.1)	5.2 (3.1, 8.8)	5.9 (3.5, 9.8)		
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, 10.4)	5.7 (3.1, 10.4)	5.7 (3.1, 10.4)		
Hastings	Charnley	5	113	0.0 (0.0, 0.0)	2.7 (0.7, 10.3)	6.0 (2.3, 15.5)			
Hastings	Corail	11	327	3.0 (1.6, 5.7)	3.6 (1.9, 6.6)	3.6 (1.9, 6.6)	3.6 (1.9, 6.6)		
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	100	2.6 (0.7, 9.9)	2.6 (0.7, 9.9)	2.6 (0.7, 9.9)			
Multipolar Bipolar	Alloclassic	5	140	3.1 (1.2, 8.1)	3.1 (1.2, 8.1)				
Multipolar Bipolar	CPT	13	520	2.6 (1.4, 4.6)	3.0 (1.7, 5.3)	3.0 (1.7, 5.3)			
Multipolar Bipolar	VerSys	2	196	0.0 (0.0, 0.0)	1.8 (0.5, 7.2)	1.8 (0.5, 7.2)	1.8 (0.5, 7.2)		
Multipolar Bipolar	VerSys Heritage	9	275	1.7 (0.6, 4.5)	3.3 (1.6, 6.8)	4.1 (2.0, 8.3)			
Self-Centering	C-Stem	3	107	0.0 (0.0, 0.0)	1.2 (0.2, 8.4)	1.2 (0.2, 8.4)			
Self-Centering	Corail	9	230	3.7 (1.9, 7.3)	3.7 (1.9, 7.3)	3.7 (1.9, 7.3)			
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)		
Tandem	Basis	8	107	2.4 (0.6, 9.3)					
Tandem	CPCS	24	955	1.8 (1.1, 3.1)	3.2 (2.1, 4.9)	3.6 (2.3, 5.5)	4.1 (2.6, 6.5)		
Tandem	Spectron EF	6	146	2.3 (0.7, 6.9)	4.5 (1.9, 10.7)				
UHR	ABGII	16	177	4.4 (2.1, 8.9)	5.1 (2.6, 10.1)	10.2 (5.9, 17.3)	11.6 (6.8, 19.3)		
UHR	Accolade I	12	253	3.5 (1.8, 6.9)	5.7 (3.1, 10.2)	5.7 (3.1, 10.2)			
UHR	Exeter	9	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	149	5569	1.8 (1.5, 2.3)	2.8 (2.3, 3.3)	3.5 (2.9, 4.1)	4.1 (3.4, 4.9)	4.6 (3.8, 5.6)	
UHR	Omnifit	21	364	5.1 (3.2, 8.0)	5.4 (3.4, 8.5)	5.8 (3.8, 9.0)	7.2 (4.6, 11.0)	7.2 (4.6, 11.0)	
Other (211)		93	2142	2.9 (2.2, 3.7)	4.6 (3.6, 5.7)	5.4 (4.3, 6.7)	6.2 (5.0, 7.8)	7.9 (6.1, 10.2)	
TOTAL		**469**	**13697**						

Note: Only combinations with over 100 procedures have been listed.

Outcome for Fractured Neck of Femur

The cumulative percent revision at 13 years for bipolar hip replacement when undertaken for fractured neck of femur is 6.3% (Table HP27 and Figure HP19).

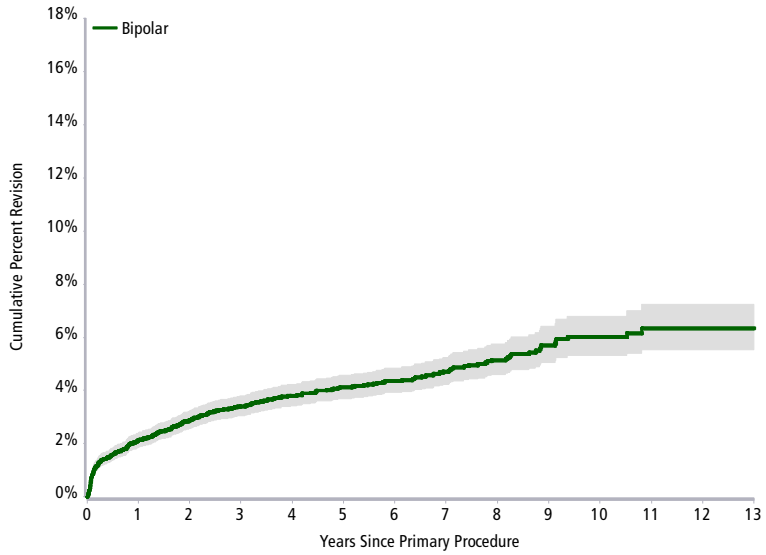
Age and femoral stem fixation are risk factors for revision. Patients aged less than 75 years have a higher rate of revision compared to the two older age groups (Table HP28 and Figure HP20). There is no difference in outcome between males and females (Table HP29 and Figure HP21).

Cementless fixation has a higher rate of revision compared to cemented fixation (Table HP30 and Figure HP22). The cumulative incidence for fracture for cementless fixation is 4.5 times that of cemented fixation at 10 years (2.8% and 0.6% respectively) (Figure HP23).

Table HP27: 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	13 Yrs
Bipolar	411	12332	2.1 (1.9, 2.4)	3.4 (3.1, 3.8)	4.1 (3.7, 4.6)	4.7 (4.2, 5.2)	6.0 (5.3, 6.8)	6.3 (5.5, 7.3)

Figure HP19: Cumulative Percent Revision of Primary Bipolar Hip Replacement (Primary Diagnosis Fractured NOF)

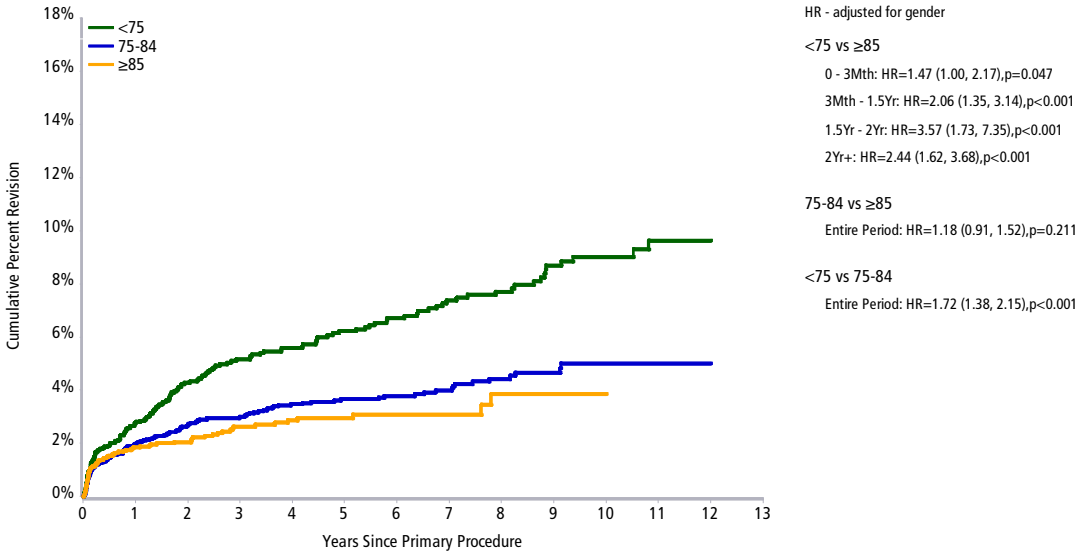


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Bipolar	12332	8955	5946	3969	2475	830	49

Table HP28: 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	13 Yrs
<75	158	2700	2.8 (2.2, 3.5)	5.2 (4.3, 6.2)	6.2 (5.2, 7.4)	7.4 (6.2, 8.7)	9.0 (7.6, 10.7)	
75-84	160	5208	2.0 (1.6, 2.4)	3.0 (2.5, 3.5)	3.7 (3.1, 4.3)	4.0 (3.4, 4.7)	5.0 (4.1, 6.0)	
≥85	93	4424	1.9 (1.5, 2.3)	2.6 (2.1, 3.3)	2.9 (2.4, 3.7)	3.1 (2.4, 3.9)	3.9 (2.8, 5.4)	
TOTAL	**411**	**12332**						

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

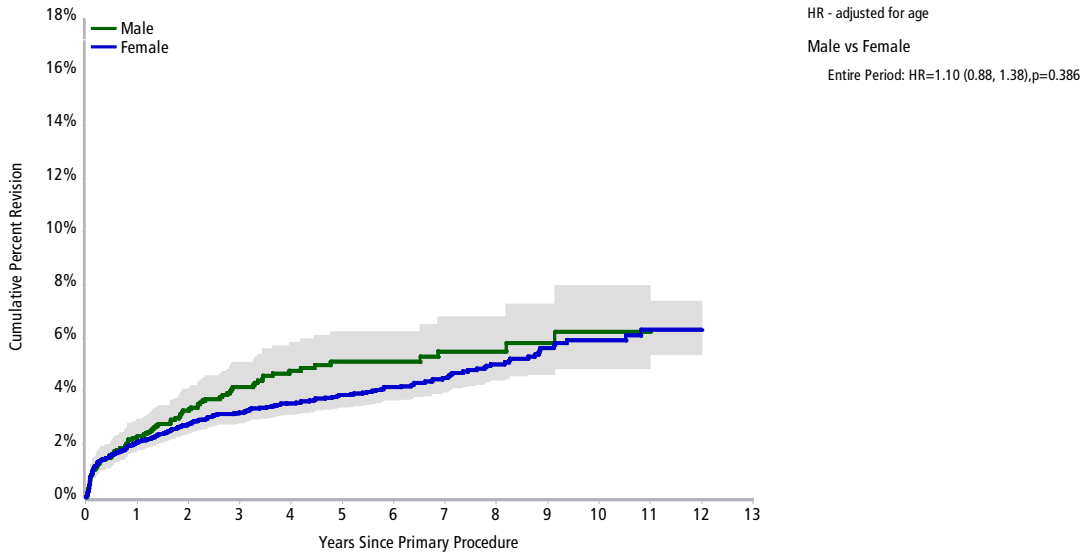


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Age <75	2700	2134	1599	1260	904	399	27
Age 75-84	5208	3999	2802	1919	1212	370	21
Age ≥85	4424	2822	1545	790	359	61	1

Table HP29: 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	13 Yrs
Male	108	3318	2.3 (1.8, 3.0)	4.1 (3.4, 5.1)	5.1 (4.2, 6.2)	5.5 (4.4, 6.8)	6.2 (4.8, 7.9)	
Female	303	9014	2.1 (1.8, 2.4)	3.2 (2.8, 3.6)	3.8 (3.4, 4.3)	4.5 (4.0, 5.1)	5.9 (5.1, 6.8)	
TOTAL	**411**	**12332**						

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

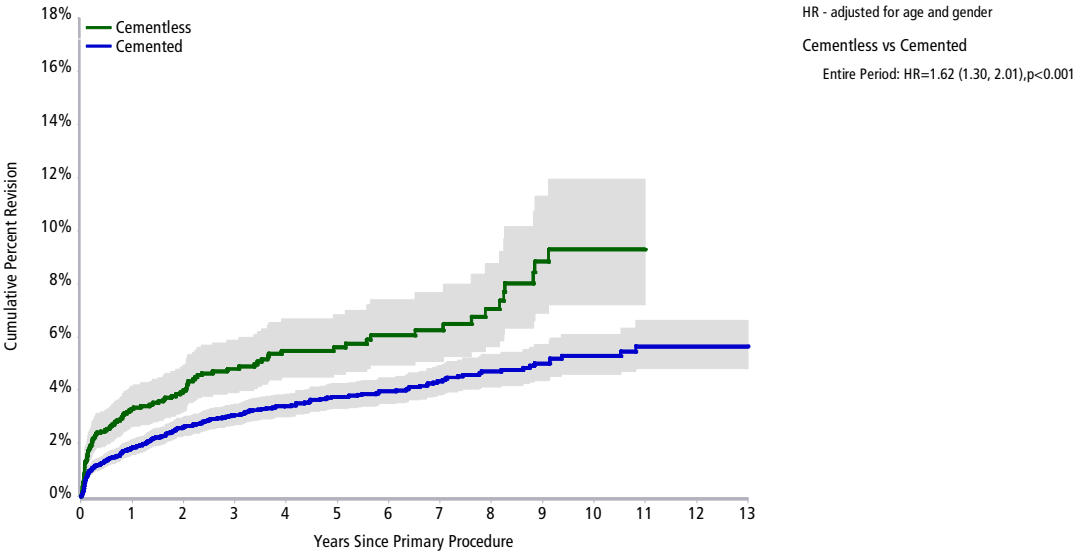


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male	3318	2117	1230	740	440	144	11
Female	9014	6838	4716	3229	2035	686	38

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

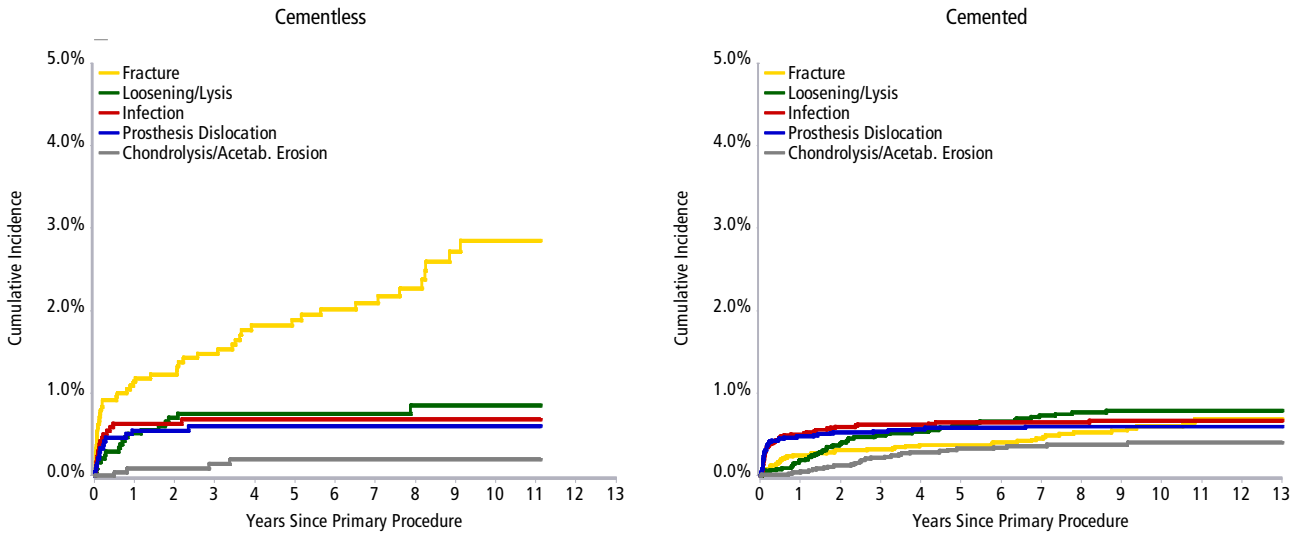
Femoral Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cementless	114	2416	3.3 (2.6, 4.1)	4.8 (3.9, 5.9)	5.6 (4.6, 6.8)	6.3 (5.1, 7.7)	9.3 (7.2, 11.9)	
Cemented	297	9916	1.8 (1.6, 2.2)	3.1 (2.7, 3.5)	3.8 (3.3, 4.3)	4.3 (3.8, 4.9)	5.3 (4.6, 6.1)	5.7 (4.8, 6.6)
TOTAL	**411**	**12332**						

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cementless	2416	1749	1114	706	413	110	5
Cemented	9916	7206	4832	3263	2062	720	44

Figure HP23: 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.

1. **Total conventional** includes acetabular replacement combined with resection of the femoral head and replacement with a stemmed femoral prosthesis and femoral head prosthesis.

2. **Total resurfacing** includes acetabular replacement and the use of a femoral prosthesis that replaces the femoral articular surface without resecting the head.

3. **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.

Use of Total Hip Replacement

The Registry has recorded 296,550 primary total hip replacement procedures. Of these, total conventional is the most common (94.6%), followed by total resurfacing (5.3%). The Registry has recorded only a small number of thrust plate procedures and there were no procedures recorded in 2013. (Table HT1).

Table HT1: Total Hip Replacement by Class

Total Hip Class	Number	Percent
Total Conventional	280522	94.6
Total Resurfacing	15770	5.3
Thrust Plate	258	0.1
TOTAL	**296550**	**100.0**

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

Total conventional hip replacement has a lower cumulative percent revision compared to total resurfacing at 13 years (Table HT2).

Detailed information on demographics of each class of primary total hip replacement is provided in the supplementary report 'Demographics of Hip Arthroplasty' available on the Registry website aoanjrr.dmac.adelaide.edu.au/annual-reports-2014.

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	13 Yrs
Total Conventional	11442	280522	1.6 (1.6, 1.7)	2.8 (2.7, 2.8)	4.0 (3.9, 4.1)	5.2 (5.1, 5.3)	6.8 (6.6, 6.9)	8.9 (8.6, 9.3)
Total Resurfacing	1170	15770	1.8 (1.6, 2.0)	3.3 (3.1, 3.6)	5.3 (4.9, 5.7)	7.5 (7.0, 7.9)	9.8 (9.2, 10.4)	11.6 (10.6, 12.6)
Thrust Plate	12	258	0.8 (0.2, 3.1)	1.2 (0.4, 3.6)	3.9 (2.1, 7.4)	4.5 (2.4, 8.3)	6.2 (3.5, 11.1)	
TOTAL	**12624**	**296550**						

Primary Total Conventional Hip Replacement

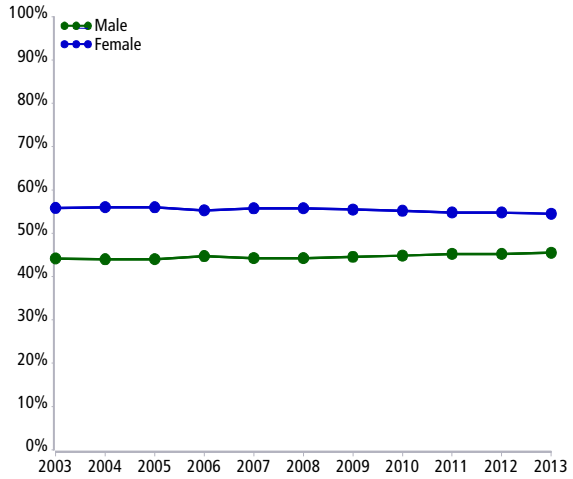
Demographics

There have been 280,522 total conventional hip procedures reported to the Registry, an additional 29,675 procedures compared to the previous report.

Osteoarthritis is the principal diagnosis (88.5%), followed by fractured neck of femur (4.0%), osteonecrosis (3.5%), developmental dysplasia (1.3%) and rheumatoid arthritis (1.1%).

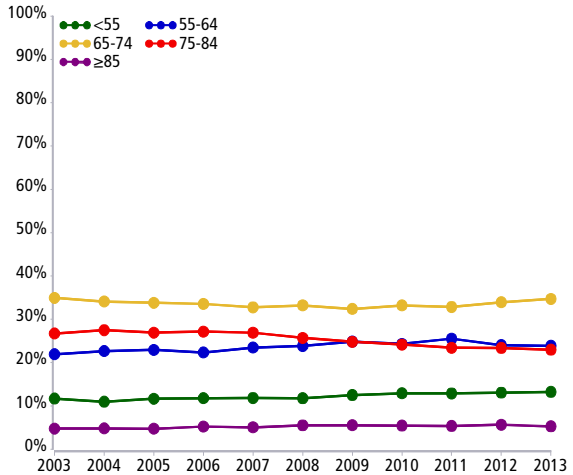
Total conventional hip replacement is more common in females (55.2%). This proportion has remained stable since 2003 (Figure HT1).

Figure HT1: Primary Total Conventional Hip Replacement by Gender



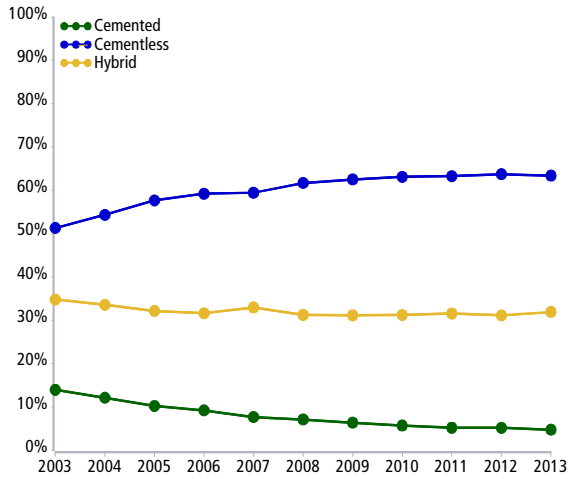
There has been almost no change in the proportion of patients aged 55-64 years (21.9% in 2003 to 23.9% in 2013) and less than 55 years (11.7% in 2003 to 13.2% in 2013) (Figure HT2).

Figure HT2: Primary Total Conventional Hip Replacement by Age



The use of cementless fixation has increased from 51.3% in 2003 to 63.4% in 2013. Cement fixation has declined from 13.9% to 4.7% and hybrid fixation from 34.8% to 31.9% over the same period (Figure HT3).This trend has stabilised over the last four years.

Figure HT3: Primary Total Conventional Hip Replacement by Fixation



The Exeter V40, Corail, Quadra-H and CPT remain the most used femoral stems for total conventional hip replacement (Table HT3). In 2013, 68.0% 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 2013, 97.2% of cemented total conventional hip replacements used stems in the 10 most used cemented femoral component list compared to 66.6% in the cementless list.

The Trident, Pinnacle and R3 remain the most frequently used acetabular prostheses for total conventional hip replacement. In 2013, 79.0% of total conventional hip replacements used acetabular components from the 10 most used acetabular component list (Table HT4). All of the acetabular components in this list are cementless prostheses. The 10 most used cemented and cementless acetabular prostheses are listed separately in Tables HT7 and HT8.

Table HT3: 10 Most Used Femoral Components in Primary Total Conventional Hip Replacement

2003		2010		2011		2012		2013	
N	Model	N	Model	N	Model	N	Model	N	Model
3901	Exeter V40	5668	Exeter V40	6166	Exeter V40	6222	Exeter V40	6802	Exeter V40
1029	ABGII	4023	Corail	4289	Corail	4433	Corail	4614	Corail
1000	Synergy	1195	CPT	1424	Quadra-H	1911	Quadra-H	2214	Quadra-H
819	Alloclassic	1036	Secur-Fit	1241	CPT	1292	CPT	1430	CPT
809	VerSys	979	Quadra-H	1119	Secur-Fit	1079	Secur-Fit	1040	Polarstem
780	Spectron EF	979	Synergy	869	Synergy	768	Synergy	809	Secur-Fit
713	Secur-Fit Plus	908	Accolade I	823	Accolade I	731	Polarstem	753	Accolade I
618	Omnifit	755	Anthology	687	Anthology	705	Taperloc	745	CPCS
565	C-Stem	687	Alloclassic	637	CPCS	678	Anthology	728	Synergy
485	S-Rom	647	M/L Taper Kinectiv	576	M/L Taper Kinectiv	656	Accolade I	649	Taperloc
10 Most Used									
10719	(10) 62.8%	16877	(10) 66.2%	17831	(10) 66.8%	18475	(10) 67.1%	19784	(10) 68.0%
Remainder									
6355	(72) 37.2%	8601	(103) 33.8%	8848	(101) 33.2%	9065	(95) 32.9%	9296	(108) 32.0%
TOTAL									
17074	(82) 100.0%	25478	(113) 100.0%	26679	(111) 100.0%	27540	(105) 100.0%	29080	(118) 100.0%

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

2003		2010		2011		2012		2013	
N	Model	N	Model	N	Model	N	Model	N	Model
3986	Trident (Shell)	6194	Trident (Shell)	6220	Trident (Shell)	6179	Trident (Shell)	6894	Trident (Shell)
1748	Reflection (Shell)	5119	Pinnacle	5123	Pinnacle	5466	Pinnacle	5585	Pinnacle
1524	Trilogy	2452	R3	2656	R3	3009	R3	3269	R3
955	Vitalock	1223	Trilogy	1416	Versafit	1848	Versafit	2100	Versafit
907	Duraloc	1117	Continuum	1317	Trilogy	1332	Continuum	1487	Continuum
827	ABGII	814	Reflection (Shell)	1245	Continuum	1125	Trilogy	1013	Trilogy
793	Allofit	812	Versafit	773	Trident/Tritanium (Shell)	674	Trident/Tritanium (Shell)	764	Trinity
729	Mallory-Head	795	Allofit	749	Allofit	671	Allofit	635	Allofit
539	Contemporary	688	DeltaMotion	684	DeltaMotion	597	DeltaMotion	617	Trident/Tritanium (Shell)
537	Pinnacle	597	Trident/Tritanium (Shell)	596	Reflection (Shell)	576	Exceed	607	Delta PF
10 Most Used									
12545	(10) 73.5%	19811	(10) 77.8%	20779	(10) 77.9%	21477	(10) 78.0%	22971	(10) 79.0%
Remainder									
4529	(67) 26.5%	5667	(75) 22.2%	5900	(68) 22.1%	6063	(58) 22.0%	6109	(64) 21.0%
TOTAL									
17074	(77) 100.0%	25478	(85) 100.0%	26679	(78) 100.0%	27540	(68) 100.0%	29080	(74) 100.0%

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

2003		2010		2011		2012		2013	
N	Model	N	Model	N	Model	N	Model	N	Model
3901	Exeter V40	5667	Exeter V40	6165	Exeter V40	6222	Exeter V40	6802	Exeter V40
780	Spectron EF	1194	CPT	1241	CPT	1292	CPT	1430	CPT
565	C-Stem	640	Spectron EF	637	CPCS	653	CPCS	744	CPCS
477	CPT	628	CPCS	497	Spectron EF	426	Spectron EF	322	C-Stem AMT
445	Elite Plus	237	Omnifit	305	C-Stem AMT	379	C-Stem AMT	315	Spectron EF
358	MS 30	217	C-Stem AMT	159	Omnifit	193	MS 30	240	Omnifit
339	Omnifit	179	MS 30	130	MS 30	172	Omnifit	163	MS 30
321	Charnley	158	C-Stem	107	C-Stem	115	Quadra-C	117	Quadra-C
244	CPCS	59	Charnley	104	E2	94	C-Stem	106	C-Stem
123	Exeter	44	Profemur XM	61	Quadra-C	89	E2	73	Absolut
10 Most Used									
7553	(10) 91.5%	9023	(10) 96.8%	9406	(10) 96.6%	9635	(10) 97.0%	10312	(10) 97.2%
Remainder									
702	(38) 8.5%	298	(34) 3.2%	330	(28) 3.4%	297	(29) 3.0%	302	(39) 2.8%
TOTAL									
8255	(48) 100.0%	9321	(44) 100.0%	9736	(38) 100.0%	9932	(39) 100.0%	10614	(49) 100.0%

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

2003		2010		2011		2012		2013	
N	Model	N	Model	N	Model	N	Model	N	Model
1027	ABGII	4020	Corail	4288	Corail	4432	Corail	4614	Corail
979	Synergy	1036	Secur-Fit	1422	Quadra-H	1911	Quadra-H	2213	Quadra-H
819	Alloclassic	979	Quadra-H	1119	Secur-Fit	1079	Secur-Fit	1039	Polarstem
739	VerSys	979	Synergy	869	Synergy	768	Synergy	809	Secur-Fit
712	Secur-Fit Plus	908	Accolade I	823	Accolade I	731	Polarstem	753	Accolade I
484	S-Rom	753	Anthology	687	Anthology	705	Taperloc	726	Synergy
482	Secur-Fit	687	Alloclassic	576	M/L Taper Kinectiv	677	Anthology	648	Taperloc
375	Corail	646	M/L Taper Kinectiv	560	Alloclassic	654	Accolade I	628	Anthology
333	Accolade I	514	Summit	525	Taperloc	514	M/L Taper Kinectiv	443	Alloclassic
329	Mallory-Head	477	SL-Plus	423	Summit	470	Alloclassic	432	Summit
10 Most Used									
6279	(10) 71.2%	10999	(10) 68.1%	11292	(10) 66.6%	11941	(10) 67.8%	12305	(10) 66.6%
Remainder									
2540	(47) 28.8%	5158	(84) 31.9%	5651	(81) 33.4%	5667	(73) 32.2%	6161	(78) 33.4%
TOTAL									
8819	(57) 100.0%	16157	(94) 100.0%	16943	(91) 100.0%	17608	(83) 100.0%	18466	(88) 100.0%

Table HT7: 10 Most Used Acetabular Components in Primary Total Conventional Hip Replacement with Cement Fixation

2003		2010		2011		2012		2013	
N	Model	N	Model	N	Model	N	Model	N	Model
539	Contemporary	382	Exeter Contemporary	338	Exeter X3 Rimfit	502	Exeter X3 Rimfit	539	Exeter X3 Rimfit
256	Exeter	303	Contemporary	282	Contemporary	276	Contemporary	217	Contemporary
250	Reflection (Cup)	142	Marathon	206	Exeter Contemporary	123	Marathon	125	Marathon
227	Exeter Contemporary	127	Reflection (Cup)	138	Marathon	112	Exeter Contemporary	108	Exeter Contemporary
199	Charnley Ogee	123	Exeter	122	Brunswick	111	Brunswick	106	Brunswick
149	Elite Plus LPW	113	ZCA	94	Reflection (Cup)	97	Reflection (Cup)	95	ZCA
130	Low Profile Cup	101	Brunswick	88	ZCA	94	ZCA	79	Reflection (Cup)
110	Elite Plus Ogee	48	Exeter X3 Rimfit	31	CCB	46	Low Profile Cup	27	Low Profile Cup
102	Charnley	46	CCB	29	Low Profile Cup	30	Polarcup	19	CCB
90	ZCA	30	Low Profile Cup	18	Polarcup	23	CCB	19	Trabecular Metal (Shell)
10 Most Used									
2052	(10) 84.1%	1415	(10) 93.0%	1346	(10) 93.4%	1414	(10) 95.3%	1334	(10) 94.8%
Remainder									
388	(34) 15.9%	106	(29) 7.0%	95	(26) 6.6%	70	(22) 4.7%	73	(21) 5.2%
TOTAL									
2440	(44) 100.0%	1521	(39) 100.0%	1441	(36) 100.0%	1484	(32) 100.0%	1407	(31) 100.0%

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

2003		2010		2011		2012		2013	
N	Model	N	Model	N	Model	N	Model	N	Model
3983	Trident (Shell)	6182	Trident (Shell)	6203	Trident (Shell)	6171	Trident (Shell)	6887	Trident (Shell)
1742	Reflection (Shell)	5118	Pinnacle	5119	Pinnacle	5465	Pinnacle	5584	Pinnacle
1524	Trilogy	2446	R3	2652	R3	3005	R3	3268	R3
954	Vitalock	1223	Trilogy	1416	Versafit	1846	Versafit	2097	Versafit
902	Duraloc	1116	Continuum	1313	Trilogy	1330	Continuum	1484	Continuum
826	ABGII	812	Versafit	1242	Continuum	1123	Trilogy	1012	Trilogy
786	Allofit	806	Reflection (Shell)	770	Trident/Tritanium (Shell)	673	Trident/Tritanium (Shell)	764	Trinity
728	Mallory-Head	794	Allofit	749	Allofit	671	Allofit	635	Allofit
536	Pinnacle	688	DeltaMotion	684	DeltaMotion	597	DeltaMotion	612	Trident/Tritanium (Shell)
521	Fitmore	594	Trident/Tritanium (Shell)	590	Reflection (Shell)	576	Exceed	607	Delta PF
10 Most Used									
12502	(10) 85.4%	19779	(10) 82.6%	20738	(10) 82.2%	21457	(10) 82.3%	22950	(10) 82.9%
Remainder									
2132	(40) 14.6%	4178	(50) 17.4%	4500	(48) 17.8%	4599	(40) 17.7%	4723	(48) 17.1%
TOTAL									
14634	(50) 100.0%	23957	(60) 100.0%	25238	(58) 100.0%	26056	(50) 100.0%	27673	(58) 100.0%

Outcome for all Diagnoses

This year the outcome of primary total conventional hip replacement has been analysed excluding all procedures using metal/metal bearing prostheses with femoral head size larger than 32mm. This group consists of 16,284 procedures, accounting for 5.8% of all primary total conventional hip replacement. The number of total conventional hip procedures included in the analysis is 264,238.

When including procedures with large head metal/metal bearings, the 13 year cumulative percent revision for primary total conventional hip replacement is 8.9% (Table HT2).

Large head metal/metal bearings are now rarely used (14 in 2013). The reason for excluding this group is that it has a confounding effect on the risk factors for revision. This is due to its high rate of revision (21.9% at 10 years) and it is predominantly used in cementless procedures (87.6%). At 10 years the rate of revision is over 4.6 times higher compared to all other primary total conventional hip replacements (analysis not shown).

Primary Diagnosis

The outcomes of the five most common primary diagnoses, osteoarthritis, fractured neck of femur, osteonecrosis, developmental dysplasia and rheumatoid arthritis are listed in Table HT9. The rate of revision varies depending on the primary diagnosis.

Osteoarthritis has a lower rate of revision compared to fractured neck of femur, osteonecrosis and rheumatoid arthritis (Figure HT4). This is also true for developmental dysplasia for the first month only, with no difference for the remaining follow up period.

Reason for Revision

The most common reasons for revision of primary total conventional hip replacement are loosening/lysis (28.4%), followed by prosthesis dislocation (25.0%), fracture (17.5%) and infection (17.1%) (Table HT10).

The cumulative incidence of revision for dislocation is highest in the first four years. As is the case with revision for dislocation, the rate of revision for infection and fracture is higher early in the follow up period (Figure HT5).

Loosening/lysis occurs at a fairly constant rate over time and at three years exceeds dislocation to become the most common reason for revision. The Registry combines loosening and lysis as a single diagnosis. This is because when lysis occurs it may be in association with loosening. Loosening/lysis accounts for 28.4% of revision procedures; lysis not associated with loosening has occurred in 2.0% with 25.2% of revision procedures undertaken for loosening not associated with lysis. In 1.2% of revision procedures both loosening and lysis have been reported.

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

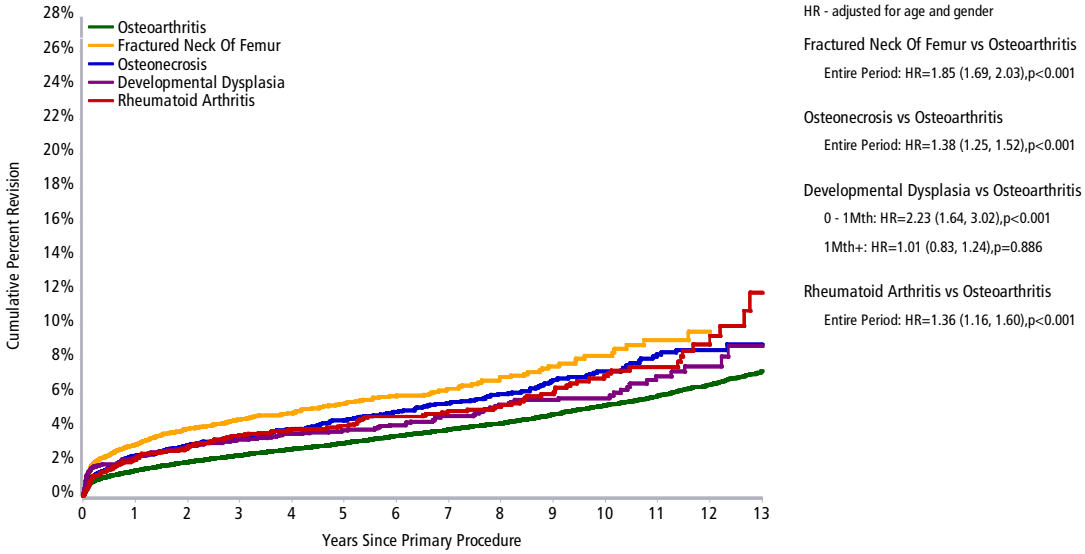
The five most common types of revision recorded by the Registry are femoral only (31.1%), acetabular only (23.3%), head and insert (18.9%), THR (femoral/acetabular) (12.0%) and head only (5.1%) (Table HT11).

Table HT9: 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	13 Yrs
Osteoarthritis	7586	233774	1.5 (1.4, 1.5)	2.4 (2.3, 2.4)	3.1 (3.0, 3.2)	3.9 (3.8, 4.0)	5.3 (5.2, 5.4)	7.3 (7.0, 7.6)
Fractured Neck Of Femur	486	10627	3.0 (2.7, 3.3)	4.5 (4.1, 4.9)	5.4 (4.9, 6.0)	6.3 (5.6, 6.9)	8.2 (7.1, 9.3)	
Osteonecrosis	422	9019	2.4 (2.1, 2.7)	3.5 (3.1, 3.9)	4.4 (4.0, 4.9)	5.4 (4.9, 6.0)	7.3 (6.5, 8.1)	8.9 (7.7, 10.2)
Developmental Dysplasia	145	3264	2.3 (1.8, 2.8)	3.3 (2.7, 4.0)	3.8 (3.2, 4.6)	4.7 (3.9, 5.6)	5.7 (4.8, 6.8)	8.8 (6.7, 11.3)
Rheumatoid Arthritis	152	3041	2.1 (1.7, 2.7)	3.5 (2.9, 4.3)	4.1 (3.4, 4.9)	4.9 (4.1, 5.9)	7.0 (5.8, 8.4)	11.9 (8.8, 16.0)
Other (6)	203	4513	3.0 (2.5, 3.6)	4.5 (3.8, 5.2)	5.3 (4.6, 6.2)	6.0 (5.1, 7.0)	7.9 (6.6, 9.4)	
TOTAL	**8994**	**264238**						

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



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Osteoarthritis	233774	202476	149105	104577	70646	29227	2066
Fractured Neck Of Femur	10627	8212	5176	2922	1527	473	26
Osteonecrosis	9019	7793	5812	4188	2899	1295	103
Developmental Dysplasia	3264	2874	2205	1640	1249	622	53
Rheumatoid Arthritis	3041	2728	2163	1652	1220	580	62

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

Table HT10: Primary Total Conventional Hip Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	2550	28.4
Prosthesis Dislocation	2251	25.0
Fracture	1576	17.5
Infection	1534	17.1
Pain	168	1.9
Leg Length Discrepancy	122	1.4
Malposition	108	1.2
Implant Breakage Stem	82	0.9
Instability	77	0.9
Incorrect Sizing	73	0.8
Implant Breakage Acetabular	72	0.8
Implant Breakage Acetabular Insert	69	0.8
Wear Acetabular Insert	58	0.6
Metal Related Pathology	49	0.5
Implant Breakage Head	26	0.3
Other	179	2.0
TOTAL	**8994**	**100.0**

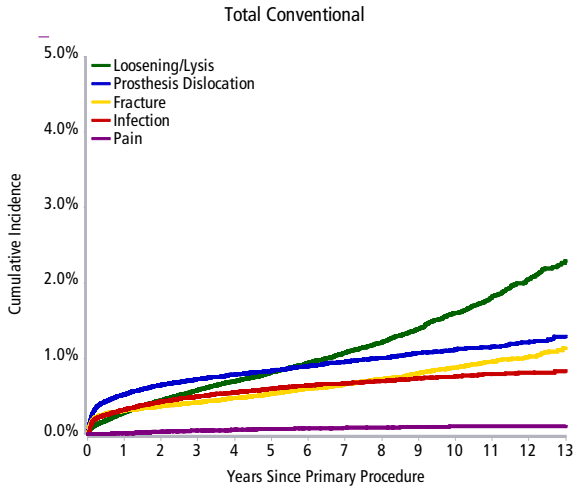
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT11: Primary Total Conventional Hip Replacement by Type of Revision

Type of Revision	Number	Percent
Femoral Component	2800	31.1
Acetabular Component	2093	23.3
Head/Insert	1696	18.9
THR (Femoral/Acetabular)	1078	12.0
Head Only	458	5.1
Cement Spacer	417	4.6
Minor Components	154	1.7
Insert Only	120	1.3
Removal of Prostheses	59	0.7
Head/Neck/Insert	52	0.6
Head/Neck	46	0.5
Reinsertion of Components	9	0.1
Neck Only	4	0.0
Bipolar Only	3	0.0
Total Femoral	2	0.0
Neck/Insert	1	0.0
Saddle	1	0.0
Bipolar Head and Femoral	1	0.0
TOTAL	**8994**	**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

Prostheses Types

There are 2,362 different stem and acetabular combinations for primary total conventional hip replacement recorded by the Registry. This includes metal/metal with head size larger than 32mm. The cumulative percent revision of the 91 combinations with more than 500 procedures is listed in Tables HT12 – HT14. Although the listed combinations are a small proportion of the possible combinations, they represent 78.1% of all primary total conventional hip replacements.

The 'Other' group is the combined outcome of all prostheses combinations with less than 500 procedures. This group accounts for 21.9% of all primary total conventional hip replacement procedures.

There are 10 total conventional stem and acetabular combinations with more than 500 procedures using cement fixation. The MS30/Low Profile Cup and the Exeter V40/Exeter have the lowest 10 year cumulative percent revision of 2.9% and 4.2% respectively (Table HT12).

There are 56 cementless total conventional stem and acetabular combinations listed. Of the six combinations reported with a 13 year cumulative percent revision, the Secure-Fit Plus/Trident (Shell) and VerSys/Trilogy combinations have the lowest cumulative percentage revision both at 4.7% (Table HT13).

There are 25 combinations of total conventional hip replacement with hybrid fixation. The Exeter V40/Vitalock has the lowest cumulative percent revision at 10 years (3.2%) Eight other combinations have a cumulative percent revision less than 5.0% at 10 years (Table HT14).

Table HT12: Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Cement Fixation

Femoral Component	Acetabular Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
CPCS	Reflection (Cup)	32	776	1.2 (0.6, 2.3)	2.4 (1.4, 3.8)	3.3 (2.2, 5.1)	4.1 (2.7, 6.2)	7.8 (5.1, 11.8)	
CPT	ZCA	27	769	0.5 (0.2, 1.4)	2.1 (1.3, 3.6)	2.7 (1.7, 4.4)	3.3 (2.1, 5.2)	5.1 (3.3, 7.8)	
Charnley	Charnley	33	591	0.5 (0.2, 1.6)	1.0 (0.5, 2.3)	2.2 (1.2, 3.8)	3.6 (2.2, 5.8)	7.1 (4.8, 10.6)	
Charnley	Charnley Ogee	52	709	1.0 (0.5, 2.1)	3.0 (1.9, 4.5)	4.8 (3.4, 6.7)	6.7 (4.9, 9.0)	8.6 (6.5, 11.5)	
Exeter V40	Contemporary	193	4910	1.5 (1.2, 1.9)	2.6 (2.2, 3.2)	3.2 (2.7, 3.8)	4.2 (3.6, 4.9)	6.0 (5.1, 7.0)	
Exeter V40	Exeter	64	1712	0.8 (0.5, 1.4)	1.9 (1.3, 2.7)	3.0 (2.3, 4.0)	3.9 (3.0, 5.0)	4.2 (3.3, 5.5)	
Exeter V40	Exeter Contemporary	99	3084	1.3 (1.0, 1.8)	2.3 (1.8, 2.9)	2.9 (2.4, 3.6)	3.7 (3.0, 4.6)	4.4 (3.5, 5.6)	
Exeter V40	Exeter X3 Rimfit	18	1410	1.2 (0.7, 2.0)					
MS 30	Low Profile Cup	15	679	0.6 (0.2, 1.6)	0.8 (0.3, 1.8)	1.2 (0.6, 2.4)	1.6 (0.8, 3.1)	2.9 (1.7, 5.1)	4.5 (2.4, 8.3)
Spectron EF	Reflection (Cup)	84	1622	1.0 (0.6, 1.6)	1.6 (1.1, 2.4)	2.5 (1.8, 3.5)	4.0 (3.0, 5.3)	8.3 (6.6, 10.5)	11.3 (8.5, 14.8)
Other (372)		397	8375	1.4 (1.2, 1.7)	2.4 (2.1, 2.8)	3.7 (3.2, 4.2)	4.7 (4.2, 5.2)	6.7 (6.0, 7.4)	9.9 (8.7, 11.3)
TOTAL		**1014**	**24637**						

Note: Some cementless components have been cemented
Only combinations with over 500 procedures have been listed.
Procedures using metal/metal prostheses with head size larger than 32mm have been included

Table HT13: 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	13 Yrs
ABGII	ABGII	189	2928	1.8 (1.4, 2.4)	3.1 (2.5, 3.8)	4.1 (3.4, 4.9)	5.3 (4.5, 6.2)	6.8 (5.8, 7.9)	10.1 (7.4, 13.7)
ABGII	ABGII (Shell/Insert)	44	862	1.5 (0.9, 2.6)	2.4 (1.5, 3.7)	3.1 (2.1, 4.5)	4.2 (3.0, 5.9)	7.2 (5.2, 9.9)	
ABGII	Trident (Shell)	136	2313	2.4 (1.9, 3.1)	4.1 (3.3, 5.0)	5.0 (4.2, 6.0)	6.0 (5.0, 7.2)	7.9 (6.5, 9.6)	
Accolade I	Trident (Shell)	331	8746	1.6 (1.3, 1.9)	2.9 (2.5, 3.2)	3.8 (3.4, 4.2)	4.6 (4.1, 5.2)	5.9 (5.1, 6.9)	
Accolade I	Trident/Tritanium (Shell)	11	648	1.3 (0.6, 2.5)	1.9 (1.0, 3.4)				
Alloclassic	Allofit	187	5304	1.4 (1.1, 1.8)	2.3 (1.9, 2.7)	3.1 (2.6, 3.6)	3.6 (3.1, 4.2)	4.9 (4.2, 5.8)	
Alloclassic	Durom [MoM]	65	621	1.3 (0.7, 2.6)	5.0 (3.5, 7.0)	6.9 (5.1, 9.3)	11.3 (8.8, 14.5)		
Alloclassic	Fitmore	91	1695	2.8 (2.1, 3.7)	4.0 (3.2, 5.1)	5.0 (4.0, 6.2)	5.5 (4.5, 6.8)	6.4 (5.2, 7.9)	
Alloclassic	Trabecular Metal (Shell)	33	996	2.2 (1.4, 3.3)	3.0 (2.0, 4.3)	4.0 (2.8, 5.6)	4.0 (2.8, 5.6)		
Alloclassic	Trilogy	9	796	0.5 (0.2, 1.4)	0.7 (0.3, 1.6)	1.0 (0.5, 2.2)	2.0 (0.9, 4.5)		
Anthology	R3	57	3236	1.6 (1.2, 2.1)	1.9 (1.4, 2.4)	2.0 (1.5, 2.6)			
Anthology	Reflection (Shell)	17	887	1.4 (0.8, 2.4)	1.6 (1.0, 2.7)	1.9 (1.2, 3.1)	2.1 (1.3, 3.4)		
Apex	Fin II	29	940	1.8 (1.1, 2.9)	2.4 (1.6, 3.7)	3.7 (2.4, 5.5)	5.0 (3.3, 7.5)		
CLS	Allofit	38	780	1.4 (0.8, 2.6)	3.4 (2.3, 5.1)	3.8 (2.6, 5.5)	5.2 (3.7, 7.3)	5.9 (4.2, 8.2)	
CLS	Fitmore	31	646	1.9 (1.1, 3.3)	4.0 (2.7, 5.9)	4.4 (3.0, 6.4)	4.8 (3.4, 6.9)	5.1 (3.5, 7.3)	
Citation	Trident (Shell)	40	1147	1.7 (1.1, 2.7)	2.5 (1.7, 3.5)	3.0 (2.2, 4.2)	3.2 (2.3, 4.4)	3.9 (2.8, 5.3)	
Citation	Vitalock	32	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)	6.5 (4.7, 9.2)	6.5 (4.7, 9.2)
Corail	ASR [MoM]	976	2900	2.2 (1.7, 2.8)	11.1 (10.0, 12.4)	26.6 (25.0, 28.3)	39.2 (37.1, 41.3)		
Corail	DeltaMotion	7	587	0.8 (0.3, 2.1)	1.5 (0.6, 3.3)				
Corail	Duraloc	57	1433	1.4 (0.9, 2.2)	2.2 (1.6, 3.1)	2.8 (2.0, 3.8)	3.9 (2.9, 5.3)	5.6 (4.1, 7.5)	
Corail	Pinnacle	513	22250	1.6 (1.4, 1.7)	2.4 (2.2, 2.7)	3.1 (2.8, 3.4)	3.6 (3.2, 4.1)	4.8 (3.9, 5.9)	
Corail	Pinnacle [MoM]	68	966	2.2 (1.4, 3.3)	3.7 (2.6, 5.1)	6.1 (4.7, 7.9)	9.0 (6.8, 11.7)		
Epoch	Trilogy	40	1020	2.5 (1.7, 3.6)	3.4 (2.4, 4.7)	3.6 (2.6, 5.0)	4.1 (3.0, 5.6)	4.4 (3.2, 6.1)	
F2L	SPH-Blind	49	614	3.1 (2.0, 4.8)	4.9 (3.5, 7.0)	6.1 (4.5, 8.4)	6.8 (5.1, 9.2)	7.6 (5.7, 10.0)	
H-Max	Delta PF	12	598	2.1 (1.1, 3.7)					
M/L Taper	Continuum	13	570	2.0 (1.1, 3.6)					
M/L Taper	Trilogy	13	569	1.4 (0.7, 2.8)	1.7 (0.9, 3.2)	2.4 (1.3, 4.4)	3.3 (1.8, 6.0)		
M/L Taper Kinectiv	Continuum	36	1402	2.1 (1.5, 3.1)	3.0 (2.2, 4.2)				
Mallory-Head	Mallory-Head	133	2780	1.9 (1.4, 2.5)	2.4 (1.9, 3.0)	3.2 (2.5, 3.9)	4.0 (3.3, 4.9)	5.7 (4.7, 6.9)	9.4 (7.5, 11.8)
Metafix	Trinity	16	679	2.0 (1.2, 3.4)	3.8 (2.0, 7.3)				
Nanos	R3	4	513	0.7 (0.2, 2.0)	1.0 (0.4, 2.8)				
Natural Hip	Fitmore	29	889	1.0 (0.5, 1.9)	1.6 (0.9, 2.7)	2.2 (1.4, 3.5)	2.7 (1.8, 4.0)	4.2 (2.9, 6.1)	
Omnifit	Secur-Fit	55	508	3.2 (1.9, 5.1)	5.0 (3.4, 7.3)	6.6 (4.7, 9.2)	8.0 (5.9, 10.7)	10.8 (8.2, 14.0)	
Omnifit	Trident (Shell)	58	1245	1.9 (1.2, 2.8)	3.1 (2.3, 4.3)	4.0 (3.0, 5.3)	4.7 (3.6, 6.1)	5.3 (4.1, 6.9)	
Polarstem	R3	36	2099	1.7 (1.2, 2.4)	2.3 (1.5, 3.4)	2.3 (1.5, 3.4)			
Quadra-H	Versafit	140	6314	1.9 (1.6, 2.3)	3.1 (2.6, 3.7)	3.2 (2.6, 3.8)			
S-Rom	Duraloc Option	31	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, 6.7)	
S-Rom	Pinnacle	87	2582	2.1 (1.6, 2.7)	3.2 (2.6, 4.0)	3.5 (2.8, 4.4)	4.2 (3.3, 5.2)	4.4 (3.5, 5.5)	
SL-Plus	EPF-Plus	94	2256	1.7 (1.2, 2.3)	2.8 (2.2, 3.6)	3.6 (2.9, 4.5)	4.6 (3.7, 5.7)	6.6 (4.7, 9.3)	
SL-Plus	R3	37	1182	2.0 (1.3, 3.0)	3.4 (2.4, 4.8)	4.0 (2.9, 5.6)			
Secur-Fit	DeltaMotion	13	713	0.7 (0.3, 1.7)	2.1 (1.2, 3.7)				
Secur-Fit	Trident (Shell)	219	7580	1.5 (1.3, 1.8)	2.5 (2.2, 2.9)	3.1 (2.7, 3.6)	3.7 (3.2, 4.3)	4.0 (3.5, 4.7)	
Secur-Fit Plus	Trident (Shell)	150	5200	1.2 (0.9, 1.5)	1.9 (1.6, 2.3)	2.4 (2.0, 2.9)	2.7 (2.2, 3.2)	3.6 (3.1, 4.3)	4.7 (3.6, 6.2)
Summit	ASR [MoM]	353	1118	1.2 (0.7, 2.0)	6.5 (5.2, 8.1)	19.8 (17.6, 22.3)	32.9 (30.0, 36.1)		
Summit	Pinnacle	50	3244	1.0 (0.7, 1.4)	1.4 (1.1, 2.0)	1.6 (1.2, 2.2)	2.2 (1.6, 3.1)	2.2 (1.6, 3.1)	
Summit	Pinnacle [MoM]	40	784	1.5 (0.9, 2.7)	2.2 (1.4, 3.5)	3.2 (2.2, 4.8)	4.9 (3.5, 6.8)	7.6 (5.4, 10.8)	
Synergy	BHR [MoM]	55	817	1.6 (0.9, 2.7)	3.1 (2.1, 4.5)	4.6 (3.4, 6.4)	7.5 (5.7, 9.9)		
Synergy	R3	70	3161	1.6 (1.2, 2.2)	2.4 (1.8, 3.0)	2.9 (2.2, 3.9)			
Synergy	Reflection (Shell)	265	7605	1.5 (1.3, 1.8)	2.3 (2.0, 2.7)	2.6 (2.3, 3.0)	3.1 (2.7, 3.5)	4.3 (3.7, 4.9)	5.4 (4.5, 6.4)
Taperloc	Exceed	31	1653	1.1 (0.7, 1.8)	2.3 (1.6, 3.3)	2.5 (1.7, 3.8)			
Taperloc	M2a [MoM]	50	514	1.8 (0.9, 3.4)	4.3 (2.9, 6.5)	7.3 (5.3, 10.0)	8.7 (6.5, 11.7)	13.1 (9.8, 17.6)	
Taperloc	Mallory-Head	41	1230	1.7 (1.1, 2.6)	2.4 (1.7, 3.5)	2.8 (2.0, 4.1)	4.1 (2.9, 5.6)	4.3 (3.1, 5.9)	
Taperloc	Recap [MoM]	35	502	2.4 (1.4, 4.2)	4.1 (2.6, 6.2)	6.1 (4.3, 8.7)	8.1 (5.8, 11.2)		

Femoral Component	Acetabular Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Trabecular Metal	Continuum	28	529	4.9 (3.3, 7.1)	6.1 (4.2, 9.0)				
Tri-Lock	DeltaMotion	2	663	0.3 (0.1, 1.2)	0.3 (0.1, 1.2)				
VerSys	Trilogy	175	4234	2.4 (2.0, 2.9)	3.2 (2.7, 3.8)	3.7 (3.2, 4.3)	4.1 (3.5, 4.7)	4.7 (4.1, 5.5)	4.7 (4.1, 5.5)
Other (1135)		2068	37376	2.2 (2.1, 2.4)	3.9 (3.7, 4.2)	5.5 (5.3, 5.8)	7.3 (6.9, 7.6)	9.3 (8.9, 9.8)	12.4 (11.4, 13.5)
TOTAL		**7489**	**164645**						

Note: Only combinations with over 500 procedures have been listed.
Procedures using metal/metal prostheses with head size larger than 32mm have been included
Models with both fixed and exchangeable neck stems are reported separately.
MoM denotes prosthesis combinations that have used large heads (>32mm) metal/metal bearings

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

Femoral Component	Acetabular Component	N Revised	N Total	1 Yr CPR	3 Yrs CPR	5 Yrs CPR	7 Yrs CPR	10 Yrs CPR	13 Yrs CPR
C-Stem	Duraloc	70	981	2.4 (1.6, 3.5)	3.1 (2.2, 4.4)	4.0 (2.9, 5.5)	5.2 (3.9, 6.9)	8.1 (6.3, 10.4)	
C-Stem	Pinnacle	22	700	2.1 (1.2, 3.5)	2.8 (1.8, 4.5)	2.8 (1.8, 4.5)	4.9 (3.0, 7.9)		
C-Stem AMT	Pinnacle	13	1147	0.5 (0.2, 1.1)	1.4 (0.7, 2.5)	1.8 (0.9, 3.4)			
CPCS	R3	42	2077	1.7 (1.2, 2.4)	2.4 (1.7, 3.3)	2.5 (1.8, 3.5)			
CPCS	Reflection (Shell)	67	2668	1.0 (0.6, 1.4)	1.3 (0.9, 1.8)	1.8 (1.3, 2.4)	2.7 (2.0, 3.6)	5.3 (3.7, 7.5)	
CPT	Allofit	15	841	1.1 (0.6, 2.1)	1.6 (0.9, 2.8)	2.6 (1.5, 4.5)	2.6 (1.5, 4.5)		
CPT	Continuum	40	1416	2.4 (1.7, 3.4)	3.3 (2.4, 4.6)				
CPT	Trabecular Metal (Shell)	47	1112	2.2 (1.5, 3.3)	3.7 (2.7, 5.1)	4.9 (3.6, 6.5)	6.2 (4.3, 8.8)		
CPT	Trilogy	196	6131	1.5 (1.3, 1.9)	2.4 (2.1, 2.9)	3.1 (2.7, 3.7)	3.8 (3.3, 4.4)	5.1 (4.3, 6.1)	
Elite Plus	Duraloc	98	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)	9.9 (8.0, 12.0)	14.2 (10.2, 19.4)
Exeter	Vitalock	59	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)	4.7 (3.6, 6.2)	5.7 (4.4, 7.4)
Exeter V40	ABGII	35	1064	1.1 (0.6, 2.0)	1.4 (0.9, 2.4)	2.1 (1.4, 3.2)	3.2 (2.2, 4.5)	3.7 (2.6, 5.2)	
Exeter V40	Hemispherical	20	649	2.0 (1.2, 3.5)	3.2 (2.0, 4.9)	3.4 (2.2, 5.3)	3.4 (2.2, 5.3)		
Exeter V40	Mallory-Head	23	1249	0.5 (0.2, 1.1)	0.9 (0.5, 1.6)	1.0 (0.6, 1.8)	1.7 (1.0, 2.9)	3.3 (2.1, 5.0)	
Exeter V40	Pinnacle	19	1037	1.1 (0.6, 2.0)	2.0 (1.2, 3.2)	2.2 (1.4, 3.6)	3.1 (1.6, 5.8)		
Exeter V40	R3	22	1021	1.1 (0.6, 2.0)	2.3 (1.4, 3.7)	3.8 (2.3, 6.3)			
Exeter V40	Trident (Shell)	833	36720	1.1 (1.0, 1.3)	1.8 (1.6, 1.9)	2.4 (2.2, 2.6)	3.1 (2.8, 3.3)	4.4 (4.0, 4.9)	
Exeter V40	Trident/Tritanium (Shell)	20	1509	1.0 (0.6, 1.6)	1.7 (1.0, 2.9)				
Exeter V40	Trilogy	18	598	1.7 (0.9, 3.1)	2.5 (1.5, 4.1)	2.7 (1.6, 4.5)	3.0 (1.8, 4.8)	4.9 (2.6, 9.1)	
Exeter V40	Vitalock	62	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)	3.2 (2.5, 4.1)	
MS 30	Allofit	41	1365	1.4 (0.9, 2.1)	1.9 (1.3, 2.8)	2.4 (1.7, 3.4)	3.1 (2.2, 4.4)	4.0 (2.9, 5.7)	
Omnifit	Trident (Shell)	73	2334	1.8 (1.3, 2.5)	2.9 (2.3, 3.7)	3.2 (2.6, 4.1)	3.5 (2.8, 4.4)	3.9 (3.1, 4.9)	
Spectron EF	BHR MoM	39	532	0.8 (0.3, 2.0)	2.9 (1.8, 4.8)	6.6 (4.7, 9.4)	9.2 (6.6, 12.8)		
Spectron EF	R3	27	1197	1.5 (1.0, 2.4)	2.6 (1.8, 3.8)	2.6 (1.8, 3.8)			
Spectron EF	Reflection (Shell)	214	4969	1.1 (0.8, 1.4)	2.0 (1.6, 2.4)	2.8 (2.3, 3.3)	3.8 (3.2, 4.4)	6.2 (5.3, 7.2)	11.1 (8.7, 14.1)
Other (764)		824	15668	1.8 (1.6, 2.0)	3.2 (2.9, 3.5)	4.5 (4.1, 4.9)	5.7 (5.3, 6.1)	7.5 (6.9, 8.0)	9.1 (8.2, 10.0)
TOTAL		**2939**	**91240**						

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 prosthesis combinations that have used large heads (>32mm) metal/metal bearings

Outcome for Osteoarthritis - Patient Characteristics

The outcome has been analysed excluding all procedures using metal/metal bearing prostheses with femoral head size larger than 32mm. The 13 year cumulative percent revision of primary total conventional hip replacement when undertaken for osteoarthritis is 7.3% when this group is excluded (Table HT15 and Figure HT6).

Age and Gender

There is a difference in the rate of revision with respect to age. Patients aged 75 or older have a lower rate of revision than all other age groups after six months (Table HT16 and Figure HT7).

Males have a slightly higher rate of revision. The cumulative percent revision at 13 years is 7.6% for males and 7.0% for females (Table HT17 and Figure HT8).

The Registry continues to report a difference in the rate of revision between age groups within gender. For females, the rate of revision decreases with increasing age. Females aged less than 55 years have almost twice the rate of revision compared to females 75 years or older after three months (Table HT17 and Figure HT9).

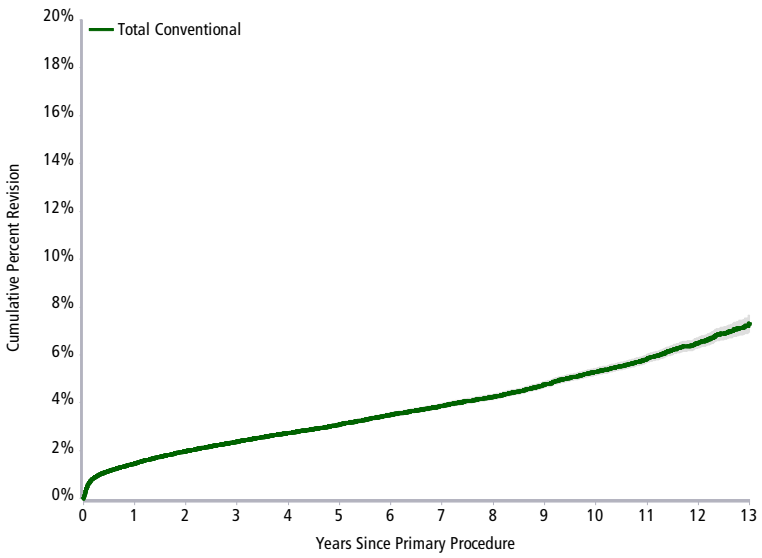
The relationship between revision rate and age for males is not as apparent, although there is a higher cumulative percent revision at 13 years in the two age groups below 65 years compared to the two older age groups (Table HT17 and Figure HT10).

Table HT15: Cumulative Percent Revision of Primary Total Conventional Hip Replacement (Primary Diagnosis OA)

Hip Type	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Total Conventional	7586	233774	1.5 (1.4, 1.5)	2.4 (2.3, 2.4)	3.1 (3.0, 3.2)	3.9 (3.8, 4.0)	5.3 (5.2, 5.4)	7.3 (7.0, 7.6)

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	13 Yrs
Total Conventional	233774	202476	149105	104577	70646	29227	2066

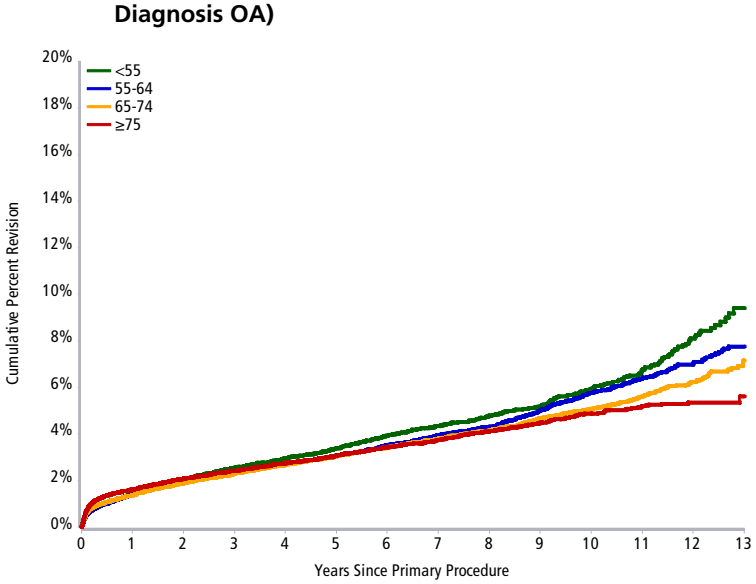
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT16: 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	13 Yrs
<55	876	23818	1.4 (1.3, 1.6)	2.5 (2.3, 2.8)	3.4 (3.1, 3.7)	4.3 (4.0, 4.7)	6.0 (5.5, 6.4)	9.4 (8.3, 10.6)
55-64	1868	55049	1.4 (1.3, 1.5)	2.4 (2.2, 2.5)	3.1 (2.9, 3.3)	4.0 (3.8, 4.2)	5.8 (5.5, 6.1)	7.8 (7.2, 8.4)
65-74	2671	82889	1.4 (1.3, 1.5)	2.3 (2.2, 2.4)	3.1 (2.9, 3.2)	3.8 (3.6, 4.0)	5.1 (4.9, 5.3)	7.2 (6.6, 7.8)
≥75	2171	72018	1.6 (1.5, 1.7)	2.4 (2.3, 2.5)	3.1 (2.9, 3.2)	3.7 (3.6, 3.9)	4.9 (4.6, 5.1)	5.6 (5.0, 6.3)
TOTAL	**7586**	**233774**						

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=1.01 (0.77, 1.31),p=0.961
	2Wk - 3Mth: HR=0.60 (0.49, 0.72),p<0.001
	3Mth - 6Mth: HR=1.05 (0.79, 1.39),p=0.746
	6Mth - 2Yr: HR=1.42 (1.21, 1.66),p<0.001
	2Yr - 5Yr: HR=1.33 (1.13, 1.56),p<0.001
	5Yr - 7Yr: HR=1.46 (1.16, 1.83),p=0.001
	7Yr - 10Yr: HR=1.37 (1.09, 1.72),p=0.007
	10Yr+: HR=2.32 (1.74, 3.10),p<0.001
55 -64 vs ≥75	0 - 2Wk: HR=0.87 (0.71, 1.07),p=0.192
	2Wk - 1Mth: HR=0.59 (0.49, 0.71),p<0.001
	1Mth - 3Mth: HR=0.70 (0.59, 0.84),p<0.001
	3Mth - 6Mth: HR=0.87 (0.70, 1.09),p=0.224
	6Mth - 1Yr: HR=1.55 (1.30, 1.84),p<0.001
	1Yr - 3Yr: HR=1.20 (1.06, 1.35),p=0.003
	3Yr - 6Yr: HR=1.14 (1.00, 1.30),p=0.057
	6Yr+: HR=1.47 (1.29, 1.68),p<0.001
65 – 74 vs ≥75	0 - 6Mth: HR=0.78 (0.72, 0.86),p<0.001
	6Mth+: HR=1.16 (1.08, 1.25),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
<55	23818	20377	14655	10249	7467	3699	317
55-64	55049	47801	35055	24763	17359	7788	649
65-74	82889	71995	53874	38680	26867	11419	790
≥75	72018	62303	45521	30885	18953	6321	310

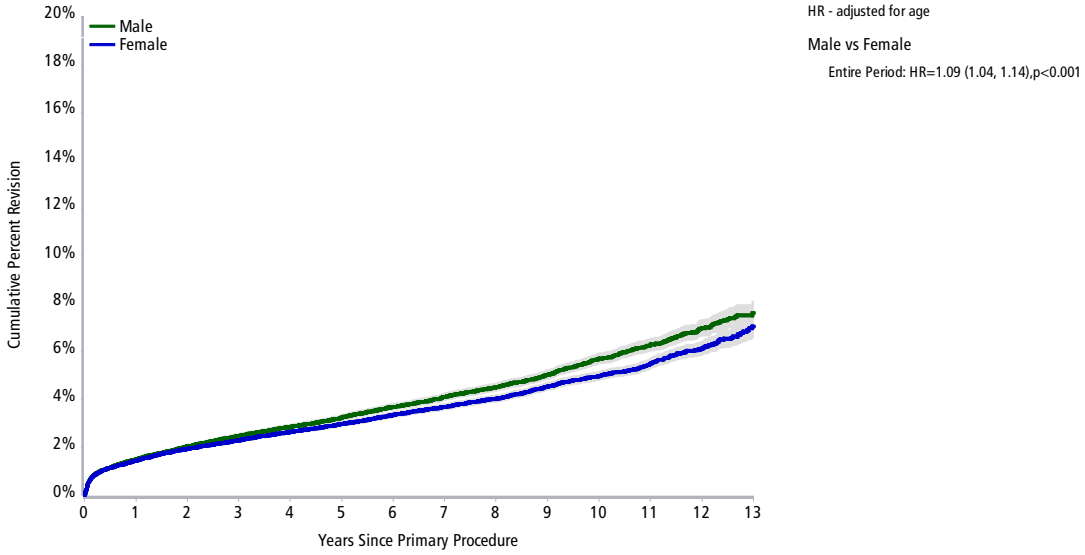
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT17: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Age and Gender (Primary Diagnosis OA)

Gender by Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male	**3582**	**105876**	**1.5 (1.4, 1.6)**	**2.5 (2.4, 2.6)**	**3.2 (3.1, 3.4)**	**4.1 (4.0, 4.3)**	**5.7 (5.5, 5.9)**	**7.6 (7.1, 8.1)**
<55	413	12748	1.2 (1.0, 1.4)	2.2 (2.0, 2.5)	3.0 (2.6, 3.3)	3.8 (3.4, 4.3)	5.5 (4.9, 6.1)	8.3 (7.0, 9.7)
55-64	939	26885	1.5 (1.3, 1.6)	2.5 (2.3, 2.7)	3.1 (2.9, 3.4)	4.1 (3.8, 4.4)	5.9 (5.5, 6.4)	8.0 (7.2, 8.9)
65-74	1268	38488	1.3 (1.2, 1.5)	2.3 (2.2, 2.5)	3.1 (2.9, 3.3)	3.9 (3.7, 4.2)	5.4 (5.1, 5.8)	7.1 (6.4, 8.0)
≥75	962	27755	1.9 (1.7, 2.0)	2.9 (2.7, 3.1)	3.6 (3.4, 3.9)	4.5 (4.2, 4.8)	5.9 (5.4, 6.4)	6.6 (5.9, 7.3)
Female	**4004**	**127898**	**1.4 (1.4, 1.5)**	**2.3 (2.2, 2.4)**	**3.0 (2.9, 3.1)**	**3.7 (3.6, 3.8)**	**5.0 (4.8, 5.2)**	**7.0 (6.6, 7.6)**
<55	463	11070	1.7 (1.5, 1.9)	2.9 (2.6, 3.3)	3.8 (3.4, 4.3)	4.9 (4.4, 5.5)	6.5 (5.8, 7.2)	10.8 (9.0, 12.9)
55-64	929	28164	1.3 (1.2, 1.5)	2.3 (2.1, 2.5)	3.0 (2.8, 3.3)	3.8 (3.6, 4.1)	5.6 (5.2, 6.1)	7.5 (6.6, 8.4)
65-74	1403	44401	1.4 (1.3, 1.5)	2.3 (2.1, 2.4)	3.0 (2.8, 3.2)	3.7 (3.5, 3.9)	4.8 (4.5, 5.1)	7.2 (6.4, 8.1)
≥75	1209	44263	1.5 (1.4, 1.6)	2.2 (2.0, 2.3)	2.7 (2.6, 2.9)	3.3 (3.1, 3.5)	4.3 (4.0, 4.6)	5.1 (4.3, 6.0)

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

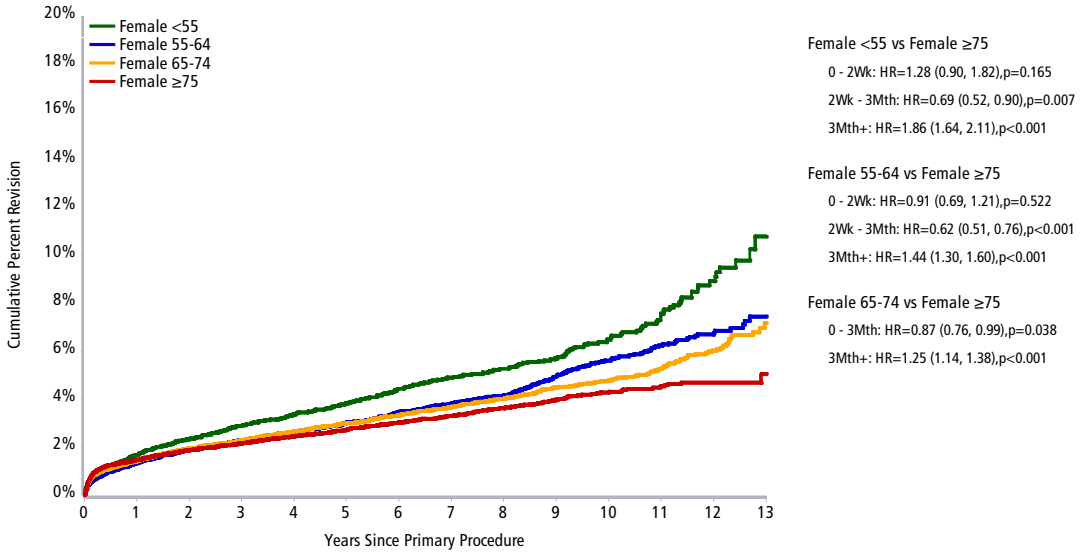
Figure HT8: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Gender (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male	105876	91127	66133	46057	31303	13208	948
Female	127898	111349	82972	58520	39343	16019	1118

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

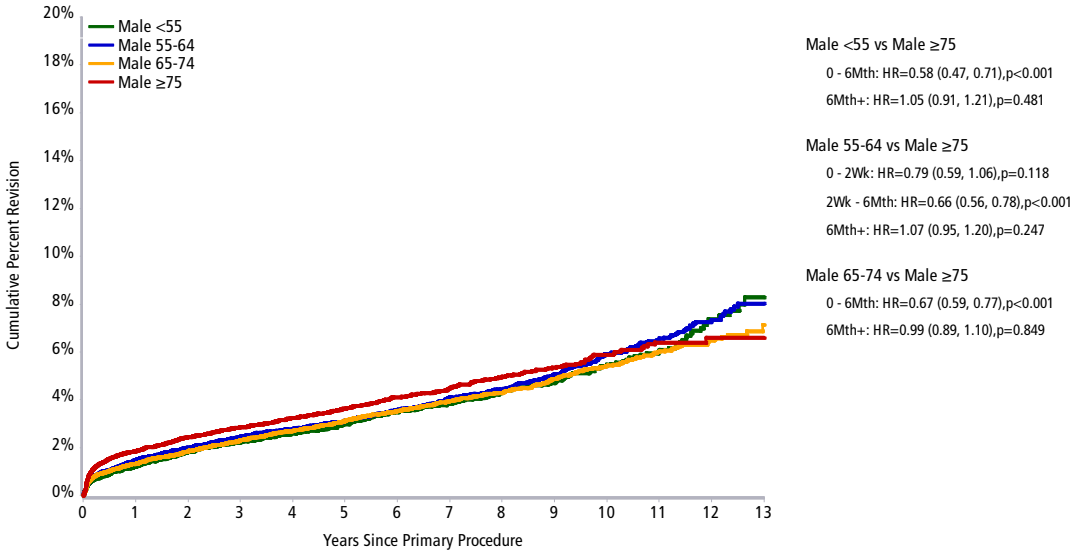
Figure HT9: Cumulative Percent Revision of Primary Total Conventional Hip Replacement for Females by Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Female	<55	11070	9544	7055	4936	3510	1678	127
	55-64	28164	24608	18267	12829	8815	3780	332
	65-74	44401	38593	28931	20888	14512	6209	438
	≥75	44263	38604	28719	19867	12506	4352	221

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 for Males by Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male	<55	12748	10833	7600	5313	3957	2021	190
	55-64	26885	23193	16788	11934	8544	4008	317
	65-74	38488	33402	24943	17792	12355	5210	352
	≥75	27755	23699	16802	11018	6447	1969	89

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

Outcome for Osteoarthritis - Prostheses Characteristics

The outcome has been analysed excluding all procedures with metal/metal bearings using femoral heads larger than 32mm.

Fixation

Hybrid fixation has a lower rate of revision compared to cemented and cementless fixation. Cementless fixation has a higher rate of revision compared to cemented fixation in the first three months, but after three years the rate of revision is lower for cementless fixation (Figure HT11). The cumulative percent revision at 13 years is 6.7% for hybrid, 7.1% for cementless and 9.0% for cemented fixation (Table HT18).

The outcome of fixation is dependent on age. For patients aged less than 55 and 55-64 years, cementless fixation has a higher rate of revision initially then a lower rate of revision compared to both cemented and hybrid fixation. Hybrid fixation has a lower rate of revision compared to cemented fixation (Table HT19 and Figures HT12 and HT13).

For patients aged 65-74 years, hybrid fixation has a lower rate of revision compared to cementless fixation in the first three months only, with no difference after this time. Cemented fixation has a higher rate of revision compared to both hybrid and cementless fixation after six months (Table HT19 and Figure HT14).

For patients aged 75 years or older, there is no difference in the rate of revision between hybrid and cement fixation after two weeks. Both hybrid and cement fixation have a lower rate of revision compared to cementless fixation (Table HT19 and Figure HT15).

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 hip replacement.

The Registry has recorded 8,686 procedures using femoral stems with exchangeable necks for osteoarthritis. The proportion of procedures using exchangeable necks peaked in 2010 at 6.6% of all primary total conventional hip procedures. This proportion continued to decrease with 2.7% of all procedures in 2013 using an exchangeable neck.

Femoral stems with exchangeable necks have twice the rate of revision compared to fixed stems. The cumulative percent revision at 10 years is 9.8% for stems with exchangeable necks compared to 5.1% for fixed stems (Table HT20 and Figure HT16). The increase in the rate of revision is due to a higher incidence of revision for loosening/lysis (3.1% at 10 years compared to 1.5% for fixed femoral neck), dislocation (1.7% compared to 1.0%) and fracture (1.3% compared to 0.8%) (Figure HT17). Of the revisions for exchangeable femoral necks, 2.1% are for implant breakage of the femoral component compared to 0.8% for fixed stems. The higher rate of revision when using exchangeable necks is evident for all bearing surfaces (Table HT21 and Figure HT18).

For the first time the Registry has undertaken an analysis to determine whether the stem/neck metal combination has an effect on the revision rate. Two principal combinations were identified, titanium stem/titanium neck and titanium stem/cobalt chrome neck. This analysis excluded large head metal/metal bearings (Table HT22).

Titanium/cobalt chrome combination has a higher rate of revision (Figure HT19). The reason for the difference is a higher incidence of revision 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 cobalt chrome/titanium combination. In the titanium/titanium combination metal related pathology is the lowest of the five main reasons for revision (Figure HT20).

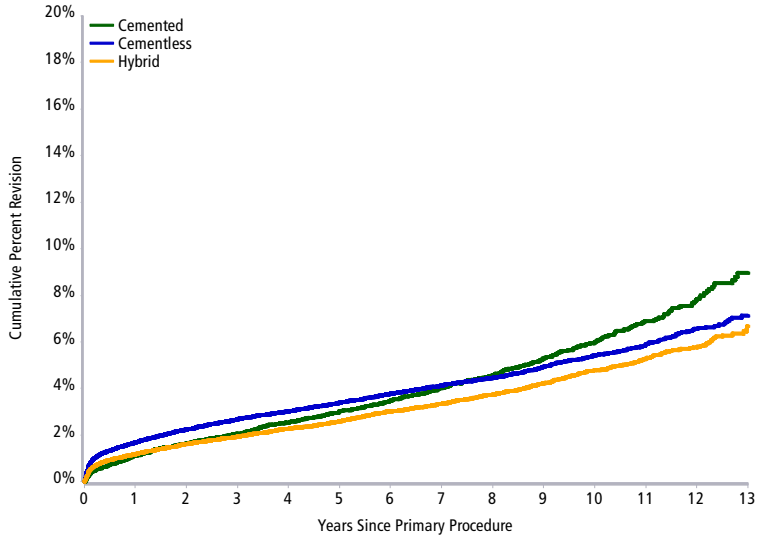
There are six exchangeable femoral neck prostheses with a cumulative percent revision at seven or more years. All have a higher rate of revision than fixed neck stems (Table HT23).

Table HT18: 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	13 Yrs
Cemented	824	19695	1.1 (1.0, 1.3)	2.1 (1.9, 2.3)	3.0 (2.8, 3.3)	4.0 (3.7, 4.4)	6.0 (5.5, 6.4)	9.0 (8.1, 9.9)
Cementless	4551	136311	1.7 (1.6, 1.8)	2.7 (2.6, 2.8)	3.4 (3.3, 3.5)	4.1 (4.0, 4.3)	5.4 (5.2, 5.6)	7.1 (6.7, 7.6)
Hybrid	2211	77768	1.2 (1.1, 1.3)	1.9 (1.8, 2.0)	2.6 (2.5, 2.7)	3.4 (3.2, 3.5)	4.8 (4.5, 5.0)	6.7 (6.1, 7.3)
TOTAL	**7586**	**233774**						

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=0.61 (0.46, 0.81),p<0.001
	1Mth - 6Mth: HR=0.92 (0.73, 1.15),p=0.469
	6Mth - 1.5Yr: HR=1.49 (1.22, 1.81),p<0.001
	1.5Yr+: HR=1.40 (1.26, 1.54),p<0.001
Cementless vs Hybrid	0 - 2Wk: HR=1.78 (1.47, 2.14),p<0.001
	2Wk - 3Mth: HR=1.39 (1.25, 1.55),p<0.001
	3Mth - 6Mth: HR=1.13 (0.94, 1.37),p=0.187
	6Mth - 2Yr: HR=1.34 (1.20, 1.50),p<0.001
	2Yr - 3Yr: HR=1.42 (1.21, 1.66),p<0.001
	3Yr - 4Yr: HR=0.94 (0.79, 1.13),p=0.518
	4Yr - 4.5Yr: HR=1.38 (1.04, 1.81),p=0.023
	4.5Yr+: HR=0.93 (0.84, 1.02),p=0.121
Cementless vs Cemented	0 - 1Mth: HR=2.52 (1.91, 3.33),p<0.001
	1Mth - 3Mth: HR=1.36 (1.10, 1.67),p=0.003
	3Mth - 1.5Yr: HR=1.01 (0.87, 1.18),p=0.888
	1.5Yr - 3Yr: HR=0.99 (0.85, 1.14),p=0.836
	3Yr - 3.5Yr: HR=0.69 (0.54, 0.88),p=0.003
	3.5Yr - 5Yr: HR=0.76 (0.64, 0.90),p=0.001
	5Yr+: HR=0.66 (0.59, 0.74),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cemented	19695	18129	15104	12030	8969	4321	410
Cementless	136311	116379	82931	56072	37444	14938	839
Hybrid	77768	67968	51070	36475	24233	9968	817

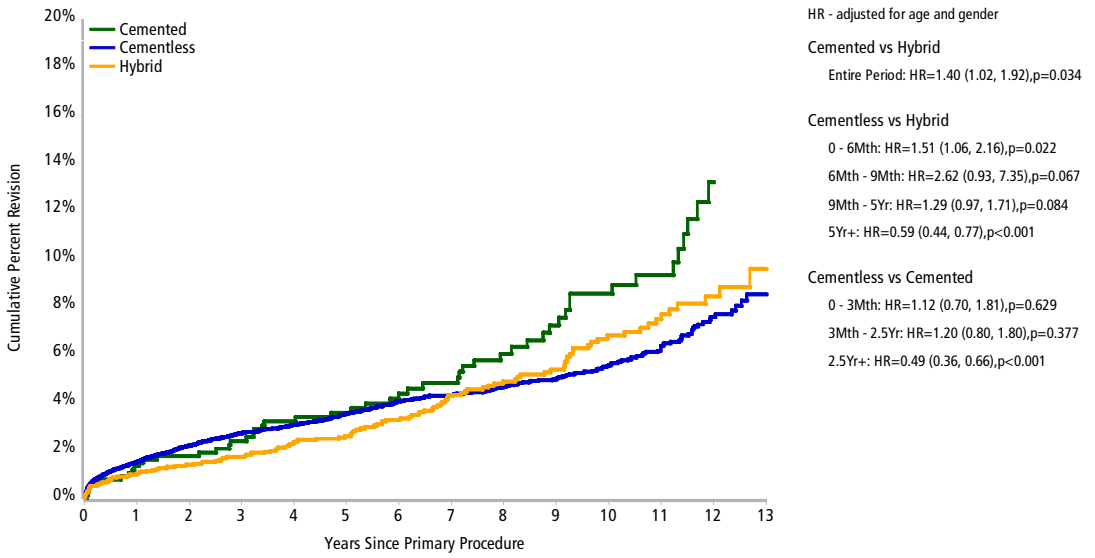
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT19: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Fixation and Age (Primary Diagnosis OA)

Age	Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
<55		**876**	**23818**	**1.4 (1.3, 1.6)**	**2.5 (2.3, 2.8)**	**3.4 (3.1, 3.7)**	**4.3 (4.0, 4.7)**	**6.0 (5.5, 6.4)**	**9.4 (8.3, 10.6)**
	Cemented	54	775	1.3 (0.7, 2.5)	2.4 (1.5, 3.8)	3.6 (2.4, 5.3)	4.8 (3.4, 6.8)	8.5 (6.3, 11.5)	
	Cementless	680	19116	1.5 (1.4, 1.7)	2.7 (2.5, 3.0)	3.5 (3.2, 3.9)	4.3 (4.0, 4.7)	5.6 (5.1, 6.1)	8.5 (7.4, 9.8)
	Hybrid	142	3927	1.0 (0.8, 1.4)	1.7 (1.3, 2.2)	2.6 (2.1, 3.2)	4.3 (3.5, 5.3)	6.8 (5.6, 8.2)	9.6 (7.5, 12.2)
55-64		**1868**	**55049**	**1.4 (1.3, 1.5)**	**2.4 (2.2, 2.5)**	**3.1 (2.9, 3.3)**	**4.0 (3.8, 4.2)**	**5.8 (5.5, 6.1)**	**7.8 (7.2, 8.4)**
	Cemented	156	2460	1.4 (1.0, 2.0)	2.8 (2.2, 3.6)	4.0 (3.2, 4.9)	5.2 (4.3, 6.3)	8.6 (7.3, 10.2)	12.4 (10.1, 15.1)
	Cementless	1285	39749	1.5 (1.4, 1.6)	2.5 (2.3, 2.6)	3.1 (2.9, 3.3)	3.9 (3.7, 4.2)	5.4 (5.1, 5.8)	6.8 (6.2, 7.5)
	Hybrid	427	12840	1.1 (1.0, 1.3)	2.0 (1.7, 2.2)	2.7 (2.4, 3.1)	3.8 (3.4, 4.2)	5.7 (5.1, 6.4)	8.3 (7.2, 9.6)
65-74		**2671**	**82889**	**1.4 (1.3, 1.5)**	**2.3 (2.2, 2.4)**	**3.1 (2.9, 3.2)**	**3.8 (3.6, 4.0)**	**5.1 (4.9, 5.3)**	**7.2 (6.6, 7.8)**
	Cemented	342	6688	1.0 (0.8, 1.3)	2.2 (1.8, 2.6)	3.2 (2.8, 3.7)	4.5 (4.0, 5.1)	6.6 (5.9, 7.4)	10.0 (8.6, 11.6)
	Cementless	1507	48063	1.6 (1.5, 1.7)	2.5 (2.4, 2.7)	3.3 (3.1, 3.5)	3.9 (3.7, 4.2)	5.0 (4.7, 5.3)	6.5 (5.7, 7.5)
	Hybrid	822	28138	1.2 (1.0, 1.3)	1.9 (1.8, 2.1)	2.6 (2.4, 2.9)	3.3 (3.0, 3.6)	4.6 (4.2, 5.0)	6.5 (5.6, 7.5)
≥75		**2171**	**72018**	**1.6 (1.5, 1.7)**	**2.4 (2.3, 2.5)**	**3.1 (2.9, 3.2)**	**3.7 (3.6, 3.9)**	**4.9 (4.6, 5.1)**	**5.6 (5.0, 6.3)**
	Cemented	272	9772	1.1 (0.9, 1.3)	1.7 (1.5, 2.0)	2.6 (2.3, 3.0)	3.2 (2.8, 3.6)	4.2 (3.6, 4.8)	4.6 (3.9, 5.4)
	Cementless	1079	29383	2.2 (2.1, 2.4)	3.2 (3.0, 3.4)	3.9 (3.6, 4.1)	4.7 (4.4, 5.0)	6.0 (5.6, 6.5)	6.5 (5.9, 7.1)
	Hybrid	820	32863	1.2 (1.1, 1.4)	1.9 (1.8, 2.1)	2.5 (2.3, 2.7)	3.1 (2.9, 3.4)	4.1 (3.8, 4.5)	5.2 (4.1, 6.6)

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

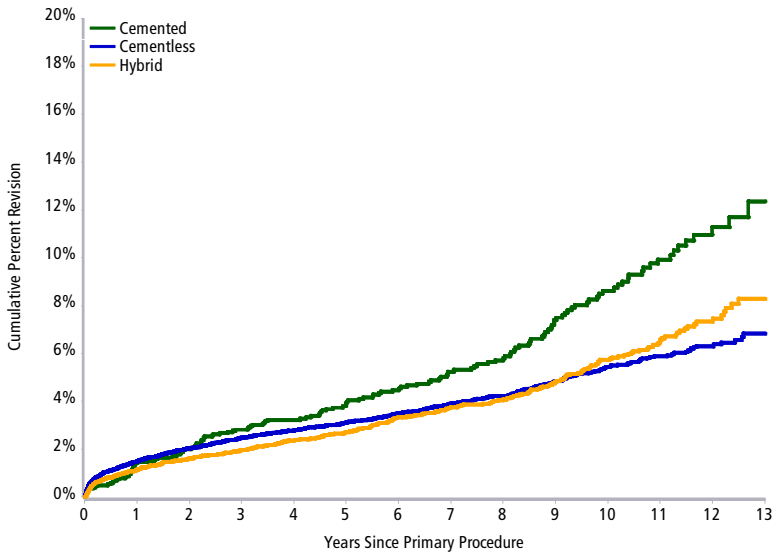
Figure HT12: Cumulative Percent Revision of Primary Total Conventional Hip Replacement for Patients Aged <55 Years by Fixation (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cemented	775	705	603	511	411	248	28
Cementless	19116	16303	11576	7937	5770	2779	199
Hybrid	3927	3369	2476	1801	1286	672	90

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=1.47 (1.23, 1.77),p<0.001

Cementless vs Hybrid

0 - 2Wk: HR=2.35 (1.46, 3.79),p<0.001
2Wk - 3Mth: HR=1.28 (0.98, 1.67),p=0.070
3Mth - 1.5Yr: HR=1.17 (0.94, 1.44),p=0.155
1.5Yr - 2.5Yr: HR=1.14 (0.83, 1.57),p=0.428
2.5Yr - 7Yr: HR=0.87 (0.71, 1.05),p=0.147
7Yr+: HR=0.68 (0.54, 0.86),p=0.001

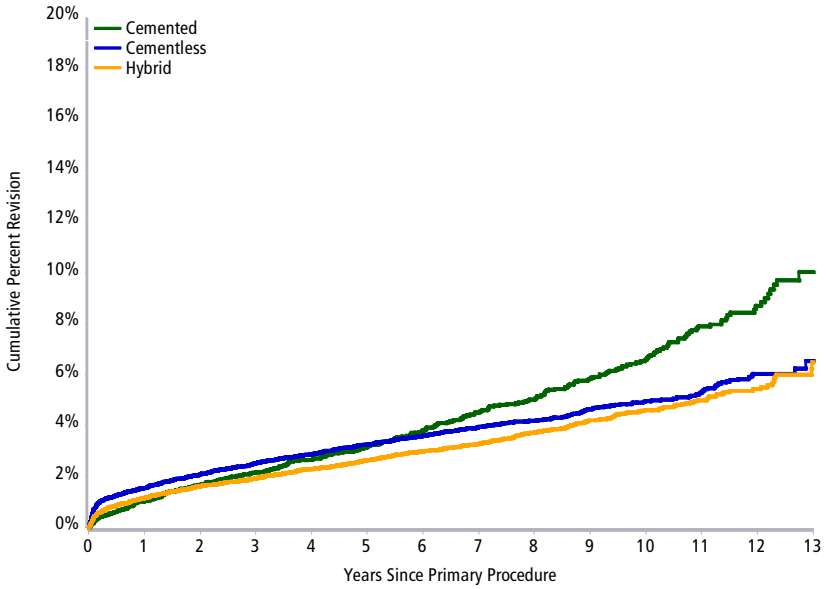
Cemented vs Cementless

0 - 9Mth: HR=0.60 (0.38, 0.95),p=0.028
9Mth - 1Yr: HR=3.65 (2.10, 6.34),p<0.001
1Yr - 1.5Yr: HR=0.69 (0.28, 1.68),p=0.408
1.5Yr - 2.5Yr: HR=2.26 (1.43, 3.57),p<0.001
2.5Yr - 3Yr: HR=0.94 (0.34, 2.57),p=0.903
3Yr+: HR=1.98 (1.58, 2.48),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cemented	2460	2287	1940	1612	1292	725	81
Cementless	39749	34276	24630	16983	11778	5078	349
Hybrid	12840	11238	8485	6168	4289	1985	219

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 - 6Mth: HR=0.73 (0.52, 1.01),p=0.055
6Mth - 2Yr: HR=1.35 (1.04, 1.76),p=0.025
2Yr - 4Yr: HR=1.37 (1.02, 1.82),p=0.034
4Yr+: HR=1.98 (1.66, 2.37),p<0.001

Cementless vs Hybrid

0 - 3Mth: HR=1.65 (1.39, 1.94),p<0.001
3Mth+: HR=1.03 (0.93, 1.14),p=0.530

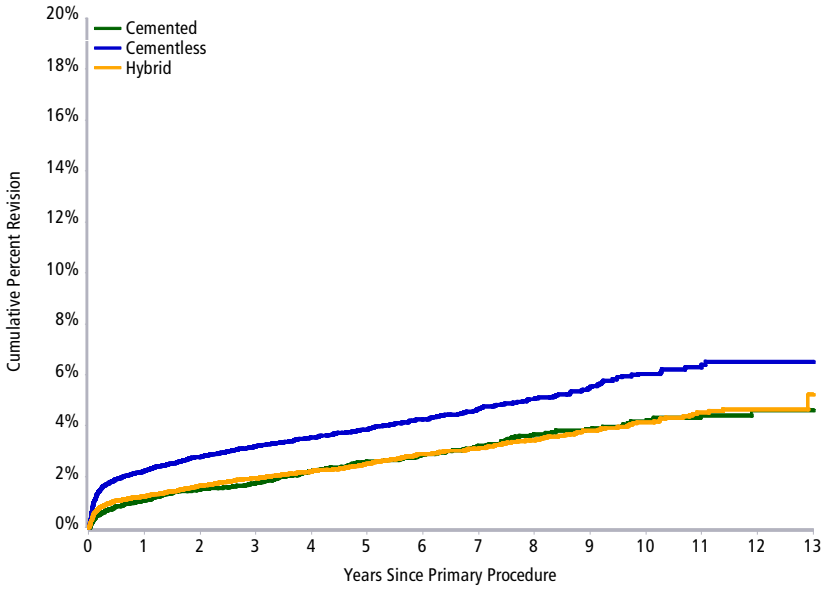
Cementless vs Cemented

0 - 1Mth: HR=3.59 (2.06, 6.25),p<0.001
1Mth - 3Mth: HR=1.61 (1.06, 2.46),p=0.026
3Mth - 6Mth: HR=0.96 (0.60, 1.52),p=0.856
6Mth - 1.5Yr: HR=0.70 (0.57, 0.87),p=0.001
1.5Yr - 3Yr: HR=0.79 (0.63, 1.00),p=0.045
3Yr - 9Yr: HR=0.58 (0.49, 0.68),p<0.001
9Yr+: HR=0.44 (0.32, 0.62),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cemented	6688	6222	5360	4440	3546	1837	185
Cementless	48063	40955	29407	20063	13374	5240	240
Hybrid	28138	24818	19107	14177	9947	4342	365

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=4.54 (2.22, 9.29),p<0.001

2Wk - 3Mth: HR=1.95 (1.60, 2.36),p<0.001

3Mth+: HR=1.27 (1.09, 1.47),p=0.001

Hybrid vs Cemented

0 - 2Wk: HR=2.63 (1.27, 5.45),p=0.009

2Wk+: HR=0.96 (0.83, 1.11),p=0.574

Cementless vs Hybrid

0 - 3Mth: HR=1.87 (1.61, 2.18),p<0.001

3Mth+: HR=1.34 (1.20, 1.51),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cemented	9772	8915	7201	5467	3720	1511	116
Cementless	29383	24845	17318	11089	6522	1841	51
Hybrid	32863	28543	21002	14329	8711	2969	143

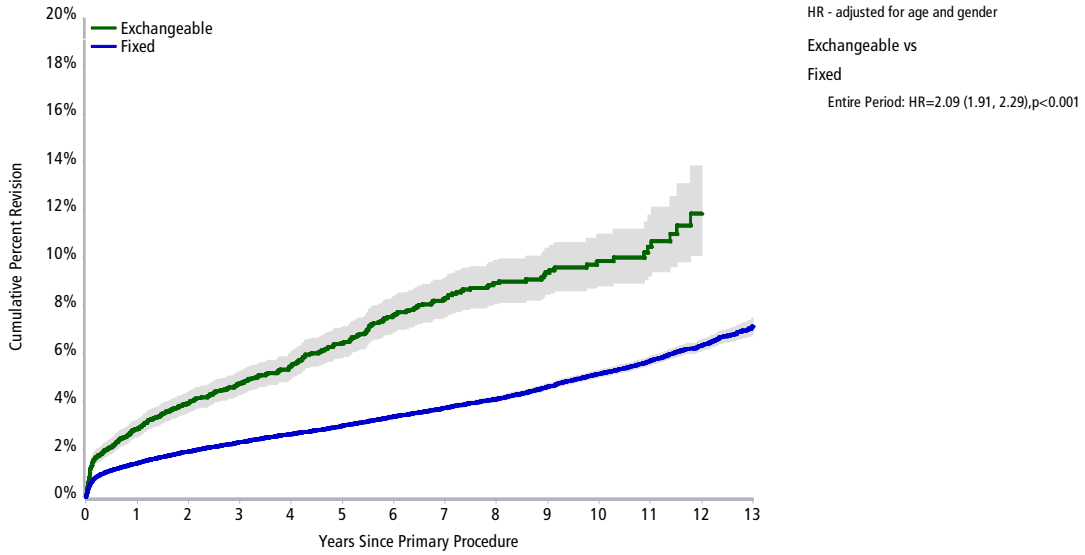
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT20: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Type of Femoral Neck (Primary Diagnosis OA)

Femoral Neck	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Exchangeable	512	8686	2.8 (2.5, 3.2)	4.7 (4.3, 5.2)	6.4 (5.8, 7.1)	8.3 (7.5, 9.2)	9.8 (8.8, 11.0)	
Fixed	7074	225088	1.4 (1.4, 1.5)	2.3 (2.2, 2.4)	3.0 (2.9, 3.1)	3.7 (3.6, 3.8)	5.1 (5.0, 5.3)	7.1 (6.8, 7.5)
TOTAL	**7586**	**233774**						

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 Type of Femoral Neck (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Exchangeable	8686	7673	5128	2775	1667	640	26
Fixed	225088	194803	143977	101802	68979	28587	2040

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 Type of Femoral Neck (Primary Diagnosis OA)

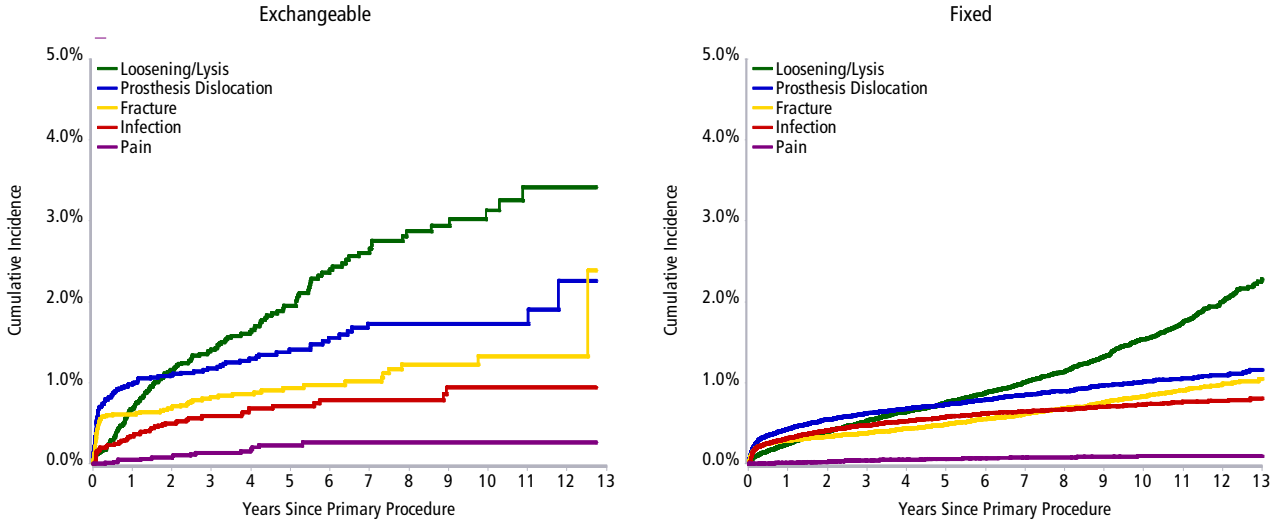
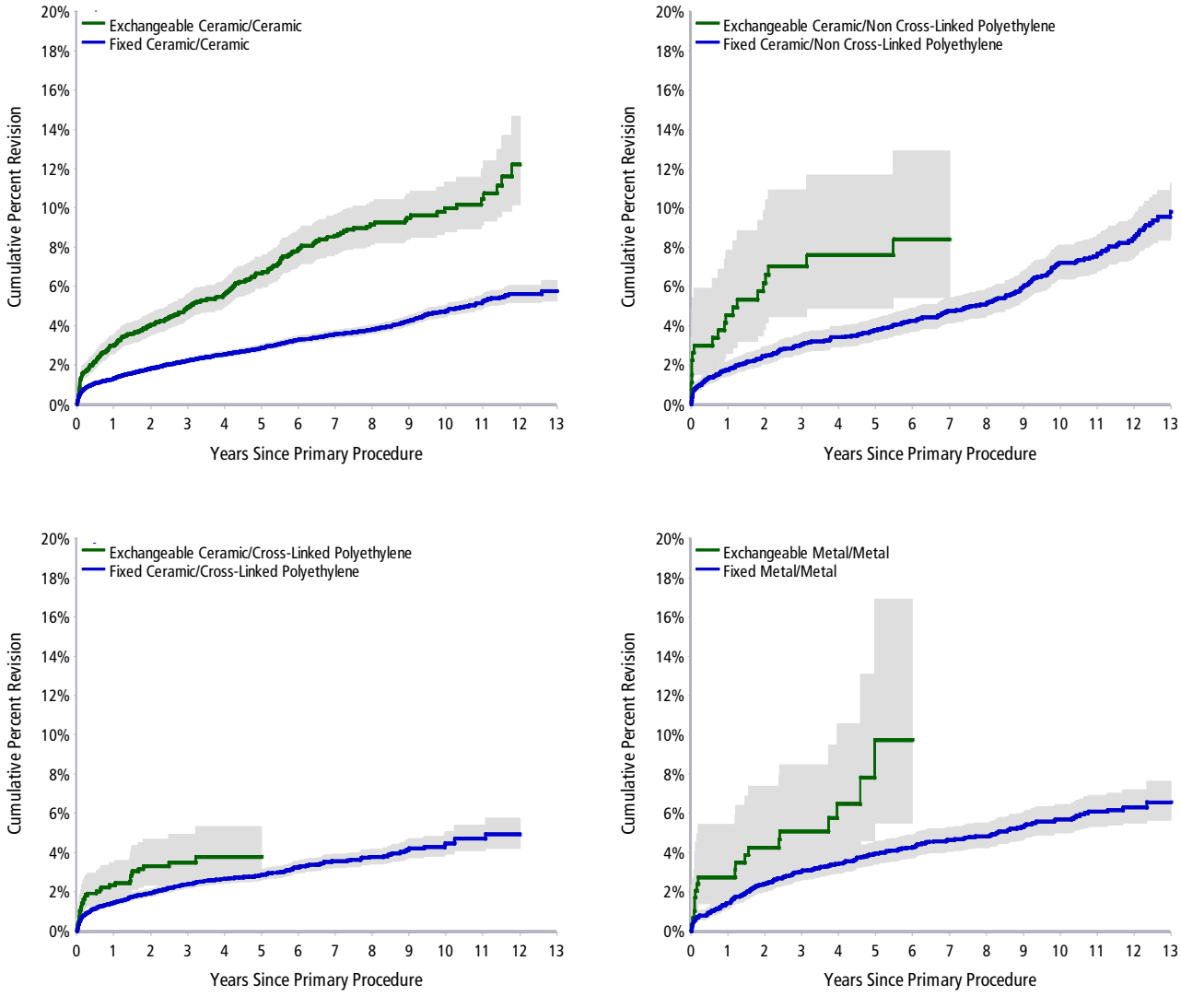


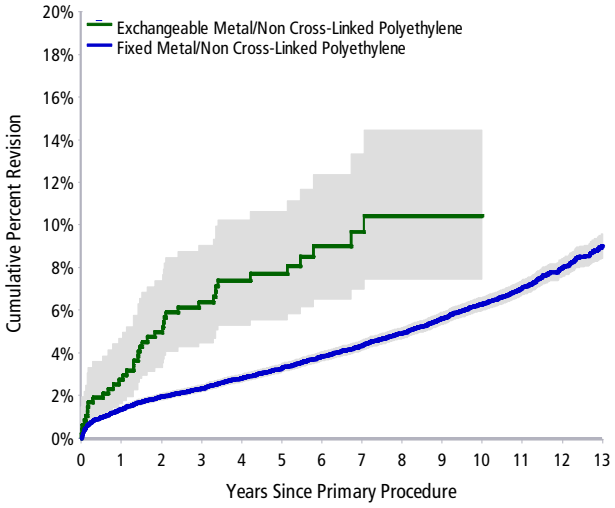
Table HT21: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Type of Femoral Neck and Bearing Surface (Primary Diagnosis OA)

Bearing Surface	Femoral Neck	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Ceramic/Ceramic	Exchangeable	326	4912	3.0 (2.6, 3.6)	4.9 (4.3, 5.6)	6.7 (5.9, 7.5)	8.6 (7.6, 9.6)	10.0 (8.8, 11.3)	
Ceramic/Ceramic	Fixed	1492	52916	1.3 (1.2, 1.4)	2.2 (2.1, 2.4)	2.9 (2.7, 3.1)	3.6 (3.4, 3.8)	4.7 (4.5, 5.0)	5.8 (5.3, 6.3)
Ceramic/Non XL Polyethylene	Exchangeable	20	267	4.5 (2.6, 7.9)	7.0 (4.5, 10.9)	7.6 (4.9, 11.7)	8.4 (5.4, 12.9)		
Ceramic/Non XL Polyethylene	Fixed	296	5156	1.8 (1.4, 2.2)	3.1 (2.6, 3.6)	3.8 (3.3, 4.4)	4.7 (4.1, 5.4)	7.2 (6.4, 8.1)	9.8 (8.5, 11.2)
Ceramic/XL Polyethylene	Exchangeable	37	1051	2.3 (1.6, 3.5)	3.5 (2.5, 4.9)	3.8 (2.7, 5.3)			
Ceramic/XL Polyethylene	Fixed	551	22778	1.5 (1.3, 1.6)	2.4 (2.2, 2.6)	2.9 (2.6, 3.2)	3.6 (3.2, 3.9)	4.5 (3.9, 5.1)	
Metal/Metal	Exchangeable	19	294	2.7 (1.4, 5.4)	5.1 (3.0, 8.5)	9.7 (5.5, 16.9)			
Metal/Metal	Fixed	244	4784	1.4 (1.1, 1.8)	3.1 (2.6, 3.6)	4.0 (3.4, 4.6)	4.6 (4.1, 5.3)	5.7 (5.0, 6.5)	6.6 (5.6, 7.6)
Metal/Non XL Polyethylene	Exchangeable	39	480	2.7 (1.6, 4.7)	6.4 (4.5, 9.0)	7.7 (5.6, 10.6)	9.7 (7.0, 13.3)	10.4 (7.5, 14.5)	
Metal/Non XL Polyethylene	Fixed	1777	33713	1.4 (1.2, 1.5)	2.3 (2.2, 2.5)	3.3 (3.1, 3.5)	4.3 (4.1, 4.6)	6.3 (6.0, 6.6)	9.0 (8.4, 9.6)
Metal/XL Polyethylene	Exchangeable	71	1665	2.4 (1.8, 3.3)	3.8 (2.9, 5.0)	6.1 (4.5, 8.2)	8.5 (6.0, 12.0)	11.9 (8.2, 17.1)	
Metal/XL Polyethylene	Fixed	2438	92955	1.5 (1.4, 1.5)	2.2 (2.1, 2.3)	2.8 (2.7, 2.9)	3.4 (3.3, 3.6)	4.3 (4.1, 4.5)	4.6 (4.3, 4.9)
Other (5)	Exchangeable	0	6	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)				
Other (5)	Fixed	267	12635	1.4 (1.2, 1.6)	1.9 (1.7, 2.2)	2.2 (1.9, 2.5)	2.7 (2.3, 3.1)	3.9 (3.3, 4.7)	
TOTAL		**7577**	**233612**						

Note: Excludes 162 procedures where the bearing surface is yet to be identified.
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 and Bearing Surface (Primary Diagnosis OA)




Exchangeable Metal/Non Cross-Linked Polyethylene
Fixed Metal/Non Cross-Linked Polyethylene
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
Years Since Primary Procedure

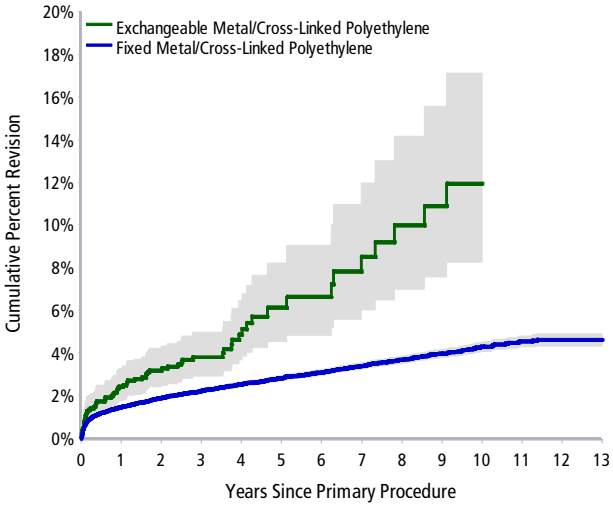
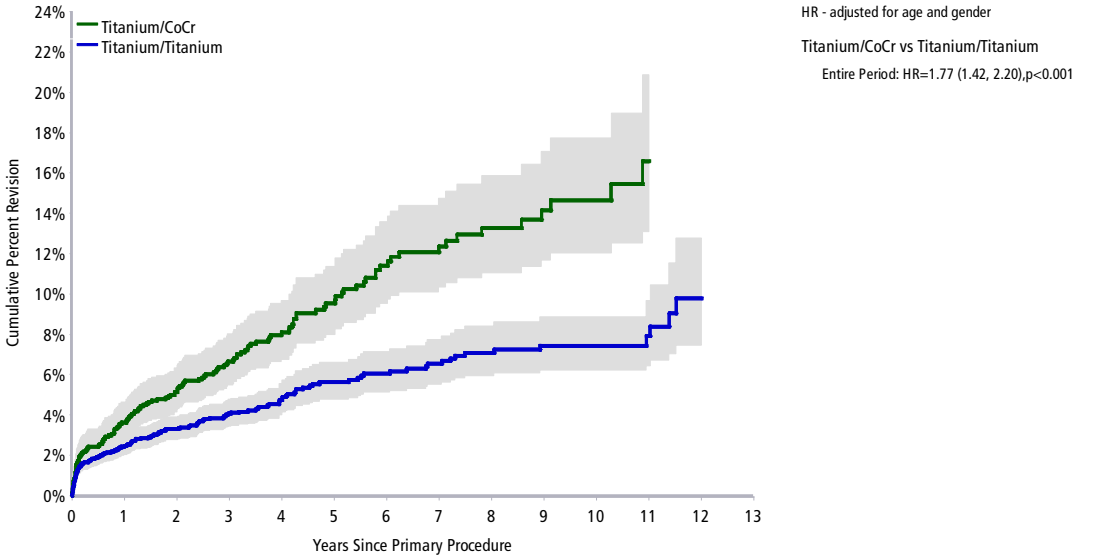

Exchangeable Metal/Cross-Linked Polyethylene
Fixed Metal/Cross-Linked Polyethylene
Cumulative Percent Revision
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13
Years Since Primary Procedure

Table HT22: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Stem/Neck Material (Primary Diagnosis OA)

Stem/Neck Material	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Titanium/CoCr	147	1659	3.6 (2.8, 4.6)	6.6 (5.5, 8.0)	9.5 (8.0, 11.4)	12.4 (10.3, 14.7)	14.6 (12.1, 17.7)	
Titanium/Titanium	184	4022	2.5 (2.0, 3.0)	4.1 (3.5, 4.8)	5.6 (4.8, 6.6)	6.5 (5.5, 7.7)	7.4 (6.2, 8.9)	
TOTAL	**331**	**5681**						

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 HT19: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Stem/Neck Material (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Titanium/CoCr	1659	1516	1012	529	313	120	0
Titanium/Titanium	4022	3480	2071	930	720	326	11

Figure HT20: Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement by Stem/Neck Material (Primary Diagnosis OA)

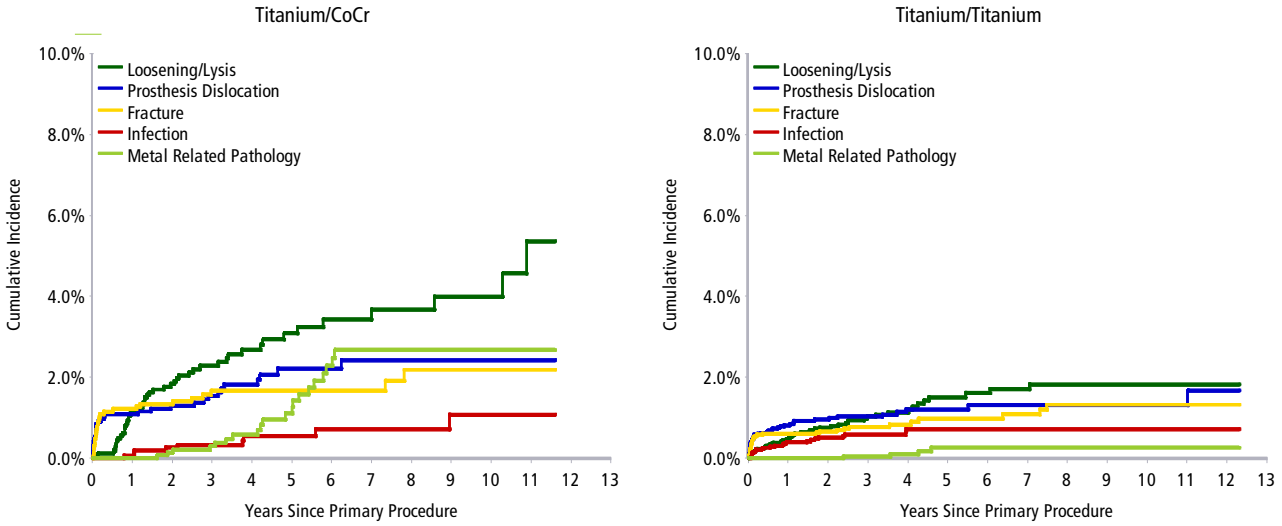


Table HT23: Cumulative Percent Revision of Primary Total Conventional Hip Replacement using an Exchangeable Femoral Neck by Prosthesis Type (Primary Diagnosis OA)

Femoral Neck	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
ABGII (exch neck)	40	228	4.0 (2.1, 7.5)	10.4 (6.9, 15.4)				
Adapter	34	372	3.8 (2.3, 6.3)	7.4 (5.1, 10.6)	10.1 (7.2, 14.0)	10.8 (7.7, 15.2)		
Apex	91	1992	2.7 (2.1, 3.5)	4.2 (3.3, 5.2)	5.0 (4.0, 6.2)	6.6 (5.1, 8.4)		
F2L	60	687	3.2 (2.1, 4.8)	5.4 (4.0, 7.4)	6.8 (5.1, 9.0)	7.4 (5.7, 9.7)	8.5 (6.6, 10.9)	
Femoral Neck (Amplitude)	10	379	0.8 (0.3, 2.4)	2.3 (1.0, 5.2)	5.0 (2.4, 10.2)			
H-Max (exch neck)	0	63	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)				
M-Cor	6	110	0.0 (0.0, 0.0)	2.8 (0.9, 8.4)	4.7 (2.0, 11.0)			
M/L Taper Kinectiv	72	2244	2.2 (1.6, 2.9)	3.3 (2.6, 4.2)				
MBA (exch neck)	43	630	2.1 (1.2, 3.5)	4.1 (2.8, 6.1)	5.7 (4.0, 8.1)	6.9 (4.9, 9.5)	9.3 (6.8, 12.7)	
MSA	16	167	7.6 (4.4, 13.1)					
Margron	76	552	5.3 (3.7, 7.5)	7.3 (5.4, 9.9)	9.4 (7.2, 12.2)	12.6 (10.0, 15.7)	14.7 (11.8, 18.2)	
Metha (exch neck)	10	84	10.7 (5.7, 19.6)	11.9 (6.6, 21.0)				
Profemur (exch neck)	46	927	3.0 (2.1, 4.4)	4.8 (3.5, 6.5)	5.3 (3.9, 7.2)	6.7 (4.8, 9.4)		
R120	4	155	1.3 (0.3, 5.1)	2.9 (1.1, 7.5)	2.9 (1.1, 7.5)			
Other (5)	4	96	1.0 (0.1, 7.2)	3.4 (1.1, 10.2)	4.7 (1.8, 12.2)			
TOTAL	**512**	**8686**						

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 (cross-linked polyethylene, non cross-linked polyethylene, ceramic and metal).

Cross-linked polyethylene (XLPE) is classified as ultra high molecular weight polyethylene that has been irradiated by high dose (≥50kGy) Gamma or electron beam radiation. The Registry recently audited prostheses classified as cross-linked and identified a small number that were incorrectly classified as cross-linked polyethylene and these have been subsequently changed.

All procedures with metal/metal bearings using femoral heads larger than 32mm have been excluded from the outcome analysis.

Comparison of Bearing Surfaces

The Registry has information on 11 bearing surfaces. The most common bearings are metal/cross-linked polyethylene, ceramic/ceramic, metal/non cross-linked polyethylene and ceramic/cross-linked polyethylene.

Of the five bearing surfaces with 13 year cumulative percent revision, the lowest is cross-linked polyethylene with metal femoral heads (4.7%). (Table HT24).

When using cross-linked polyethylene with either metal or ceramic femoral heads, there is no difference in the rate of revision (Tables HT24 and Figure HT21). Although ceramicised metal femoral heads have a lower rate of revision after one year, this result should be interpreted with caution. 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.

Metal/cross-linked polyethylene has a lower rate of revision compared to ceramic/ceramic and metal/metal bearings as well as non cross-linked polyethylene when used with either ceramic or metal femoral heads. Using ceramic or metal femoral heads with non cross-linked polyethylene results in the highest cumulative percent revision at 13 years (9.9% and 9.1% respectively) (Tables HT24 and Figure HT21).

A more detailed analysis of cross-linked polyethylene and ceramic/ceramic bearing surfaces follows. In addition, the Registry has information on two types of ceramic and metal bearings. These have been used in small numbers (299 ceramic/metal and 6 metal/ceramic).

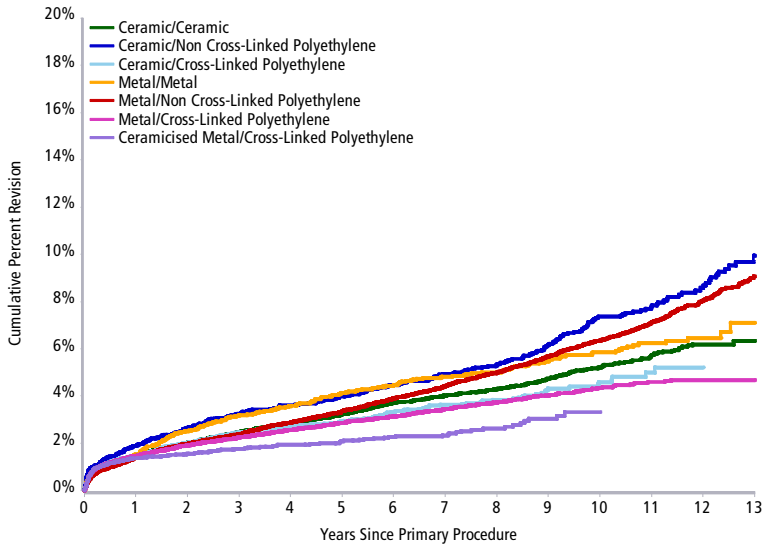
A supplementary report on the analysis of metal/metal is available on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2014.

Table HT24: 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	13 Yrs
Ceramic/Ceramic	1818	57828	1.5 (1.4, 1.6)	2.5 (2.3, 2.6)	3.2 (3.1, 3.4)	4.0 (3.8, 4.2)	5.2 (4.9, 5.5)	6.3 (5.8, 6.9)
Ceramic/Non XL Polyethylene	316	5423	1.9 (1.6, 2.3)	3.3 (2.8, 3.8)	4.0 (3.5, 4.6)	4.9 (4.3, 5.6)	7.4 (6.5, 8.3)	9.9 (8.7, 11.4)
Ceramic/XL Polyethylene	588	23829	1.5 (1.4, 1.7)	2.4 (2.2, 2.7)	2.9 (2.7, 3.2)	3.6 (3.3, 4.0)	4.6 (4.0, 5.2)	
Ceramic/Metal	12	299	1.7 (0.7, 4.0)	3.7 (2.1, 6.6)	3.7 (2.1, 6.6)			
Metal/Metal	263	5078	1.5 (1.2, 1.9)	3.2 (2.7, 3.7)	4.1 (3.6, 4.7)	4.8 (4.2, 5.5)	5.8 (5.2, 6.6)	7.1 (6.0, 8.4)
Metal/Non XL Polyethylene	1816	34193	1.4 (1.3, 1.5)	2.4 (2.2, 2.6)	3.4 (3.2, 3.6)	4.4 (4.2, 4.7)	6.3 (6.0, 6.7)	9.1 (8.5, 9.7)
Metal/XL Polyethylene	2509	94620	1.5 (1.4, 1.5)	2.2 (2.1, 2.3)	2.9 (2.7, 3.0)	3.4 (3.3, 3.6)	4.3 (4.1, 4.6)	4.7 (4.4, 5.0)
Ceramicised Metal/Non XL Polyethylene	25	288	1.8 (0.7, 4.2)	4.0 (2.2, 7.0)	4.4 (2.5, 7.5)	8.1 (5.3, 12.3)		
Ceramicised Metal/XL Polyethylene	230	12047	1.4 (1.2, 1.6)	1.8 (1.5, 2.0)	2.1 (1.8, 2.4)	2.3 (2.0, 2.7)	3.3 (2.7, 4.1)	
TOTAL	**7577**	**233605**						

Note: 'Cross-linked Polyethylene' is reported as 'XL Polyethylene' in the above table
All procedures using metal/metal prostheses with head size larger than 32mm have been excluded.
162 procedures with unknown bearing surface, one procedure with Ceramicised Metal/Ceramic bearing surface and six procedures with Metal/Ceramic bearing surface have also been excluded.

Figure HT21: 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/XL	Entire Period: HR=1.10 (1.03, 1.17),p=0.004
Ceramic/Non XL vs Metal/XL	Entire Period: HR=1.56 (1.38, 1.75),p<0.001
Ceramic/XL vs Metal/XL	Entire Period: HR=1.03 (0.94, 1.13),p=0.488
Metal/Metal vs Metal/XL	Entire Period: HR=1.28 (1.13, 1.46),p<0.001
Metal/Non XL vs Metal/XL	0 - 1Mth: HR=0.77 (0.65, 0.92),p=0.004
	1Mth - 3Mth: HR=1.03 (0.84, 1.25),p=0.797
	3Mth - 6Mth: HR=0.98 (0.76, 1.27),p=0.887
	6Mth - 1Yr: HR=1.41 (1.17, 1.72),p<0.001
	1Yr - 3Yr: HR=1.22 (1.08, 1.38),p=0.001
	3Yr - 6Yr: HR=1.61 (1.43, 1.81),p<0.001
	6Yr+: HR=2.00 (1.78, 2.25),p<0.001
Ceramicised Metal/XL vs Metal/XL	0 - 1Yr: HR=0.97 (0.82, 1.14),p=0.703
	1Yr+: HR=0.51 (0.41, 0.65),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Ceramic/Ceramic	57828	49606	35157	23586	15737	6437	274
Ceramic/Non XL Polyethylene	5423	4859	4129	3649	3089	1923	343
Ceramic/XL Polyethylene	23829	18866	11441	6538	3532	958	18
Metal/Metal	5078	4922	4603	4031	3178	1670	92
Metal/Non XL Polyethylene	34193	32529	29375	25291	20421	11382	1220
Metal/XL Polyethylene	94620	80998	57332	36856	22098	6560	116
Ceramicised Metal/XL Polyethylene	12047	9968	6426	4226	2333	233	0

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded.
Only bearing surfaces with more than 1,000 procedures are included in the analysis

Cross-linked Polyethylene

Cross-linked polyethylene has been used in 130,496 procedures reported to the Registry. This includes 2,016 procedures that have cross-linked polyethylene with the addition of an antioxidant.

Cross-linked polyethylene has a lower rate of revision compared to non cross-linked polyethylene and this is evident only after six months (Table HT25 and Figure HT22). The difference increases with time and at 13 years the cumulative percent revision is 4.7% and 9.2% respectively. The cumulative incidence for loosening/lysis and prosthesis dislocation is 3.4% and 1.5% at 13 years for non cross-linked compared to 1.1% and 1.1% for cross-linked polyethylene bearings respectively (Figure HT23).

When considering all reasons for revision the rate of revision varies depending on head size. This is most evident for non cross-linked polyethylene where the rate of revision increases with head size. For cross-linked polyethylene, 32mm head size has the lowest rate of revision and there is no difference between less than 32mm and greater than 32mm (Table HT25 and Figures HT24 and HT25).

At one year, the cumulative incidence of revision for prosthesis dislocation is 0.4% for cross-linked compared to 0.6% for non cross-linked polyethylene (Figure HT23). Head sizes of 32mm or more were used in 67.5% of cross-linked polyethylene procedures and only 13.2% of non cross-linked polyethylene procedures. The rate of revision for dislocation differs between cross-linked and non cross-linked polyethylene due to a higher proportion of larger head sizes used with cross-linked polyethylene.

At 13 years, the cumulative incidence of revision for loosening/lysis is 1.1% for cross-linked compared to 3.4% for non cross-linked polyethylene (Figure HT23). This lower cumulative incidence for loosening/lysis when cross-linked polyethylene is used is evident within each head size group (Figure HT26).

Cross-linked polyethylene and non cross-linked polyethylene are combined with three different femoral head bearing surfaces; ceramic, metal and ceramicised metal. Within each bearing surface, cross-linked polyethylene has a lower rate of revision than non cross-linked polyethylene (Figure HT27). For a ceramic head, this difference is over the entire period. For metal and ceramicised metal heads, the difference is only apparent after six months and 1.5 years respectively (data not shown).

Prosthesis Specific

Further analysis has been undertaken for specific acetabular prostheses that have both cross-linked and non cross-linked polyethylene options and a follow up time of seven or more years. Five prostheses fulfilled these criteria.

The Allofit Shell has an 11 year follow up with an insert using both types of polyethylene. Cross-linked polyethylene is used in 88.3% of Allofit Shell total conventional hip procedures. There is no difference in the rate of revision between cross-linked polyethylene and non cross-linked polyethylene (Table HT26 and Figure HT28).

The Duraloc Shell has an 11 year follow up with an insert using both types of polyethylene. Cross-linked polyethylene is used in 36.4% of Duraloc Shell total conventional hip procedures. After 4.5 years, cross-linked polyethylene has a lower rate of revision compared to non cross-linked polyethylene (Table HT26 and Figure HT29). All cross-linked and non cross-linked polyethylene procedures use head sizes 32mm or less. The cumulative incidence of loosening/lysis is over twice that of the other diagnoses combined for non cross-linked polyethylene at 13 years. The 10 year cumulative incidence of revision for loosening/lysis is 1.2% for cross-linked and 4.2% for non cross-linked polyethylene (analysis not shown).

The Reflection Cup has a nine year follow up for both types of polyethylene. Cross-linked polyethylene has been used in 48.7% of Reflection Cup total conventional hip procedures. After 3.5 years, cross-linked polyethylene has a lower rate of revision than non cross-linked polyethylene (Table HT26 and Figure HT30). Almost all non cross-linked (97.8%) and 70.8% of cross-linked polyethylene procedures use head sizes 32mm or less. The lower rate of revision in cross-linked polyethylene may be attributed to a lower rate of revision for loosening/lysis (analysis not shown). For procedures with head sizes 32mm or less, the five year cumulative incidence of revision for loosening/lysis is 0.6% for cross-linked and 1.0% for non cross-linked polyethylene

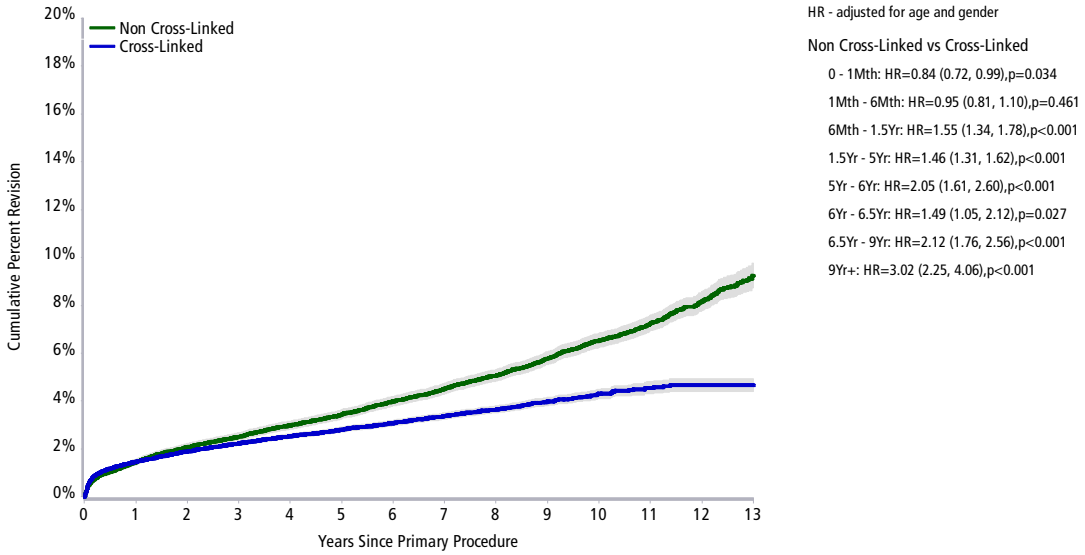
The Reflection Shell has a 12 year follow up with an insert using both types of polyethylene. Cross-linked polyethylene is used in 82.6% of Reflection Shell total conventional hip procedures. Cross-linked polyethylene has a lower rate of revision after three months compared to non cross-linked polyethylene (Table HT26 and Figure HT31). All non cross-linked and 79.0% of cross-linked polyethylene procedures use head sizes 32mm or less. At 10 years, the cumulative incidence of revision for loosening/lysis and prosthesis dislocation are 4.3% and 2.0% for non cross-linked polyethylene compared to 0.9% and 0.8% for cross-linked polyethylene respectively. The disparity for prosthesis dislocation between cross-linked (0.2%) and non cross-linked (0.7%) is even evident at one year (analysis not shown).

The Vitalock Shell has a 10 year follow up with an insert using both types of polyethylene. Cross-linked polyethylene is used in 22.7% of Vitalock Shell total conventional hip procedures. There is no difference in the rate of revision between cross-linked polyethylene and non cross-linked polyethylene (Table HT26 and Figure HT32).

Table HT25: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Type of Polyethylene and Head Size (Primary Diagnosis OA)

Polyethylene Surface	Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Non Cross-Linked		**2157**	**39904**	**1.4 (1.3, 1.6)**	**2.5 (2.4, 2.7)**	**3.4 (3.3, 3.6)**	**4.5 (4.3, 4.7)**	**6.5 (6.2, 6.8)**	**9.2 (8.7, 9.8)**
	<32mm	1971	34645	1.4 (1.3, 1.5)	2.4 (2.3, 2.6)	3.4 (3.2, 3.6)	4.4 (4.2, 4.7)	6.5 (6.2, 6.8)	9.2 (8.7, 9.7)
	32mm	149	4389	1.4 (1.1, 1.8)	2.8 (2.3, 3.4)	3.6 (3.0, 4.3)	4.8 (4.0, 5.8)	5.6 (4.6, 6.9)	
	>32mm	37	870	2.6 (1.7, 4.0)	5.5 (3.8, 7.9)	8.0 (5.4, 11.7)			
Cross-Linked		**3327**	**130496**	**1.5 (1.4, 1.5)**	**2.2 (2.1, 2.3)**	**2.8 (2.7, 2.9)**	**3.4 (3.3, 3.5)**	**4.3 (4.1, 4.5)**	**4.7 (4.4, 4.9)**
	<32mm	1409	42453	1.5 (1.4, 1.6)	2.3 (2.2, 2.5)	2.9 (2.8, 3.1)	3.6 (3.4, 3.8)	4.5 (4.2, 4.7)	4.9 (4.6, 5.2)
	32mm	1062	49932	1.4 (1.3, 1.5)	2.1 (2.0, 2.3)	2.5 (2.3, 2.7)	3.0 (2.8, 3.2)	3.8 (3.4, 4.3)	
	>32mm	856	38111	1.5 (1.4, 1.6)	2.3 (2.1, 2.4)	3.0 (2.8, 3.2)	3.4 (3.2, 3.8)	4.6 (3.7, 5.7)	
TOTAL		**5484**	**170400**						

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



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Non Cross-Linked	39904	37661	33753	29166	23688	13338	1563
Cross-Linked	130496	109832	75199	47620	27963	7751	134

Figure HT23: Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement by Type of Polyethylene (Primary Diagnosis OA)

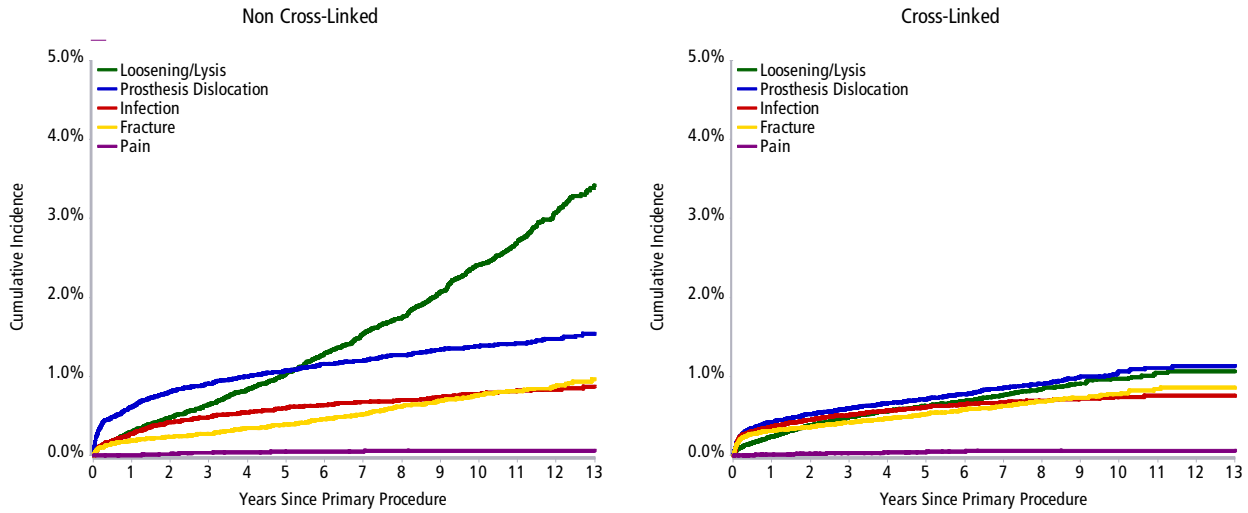
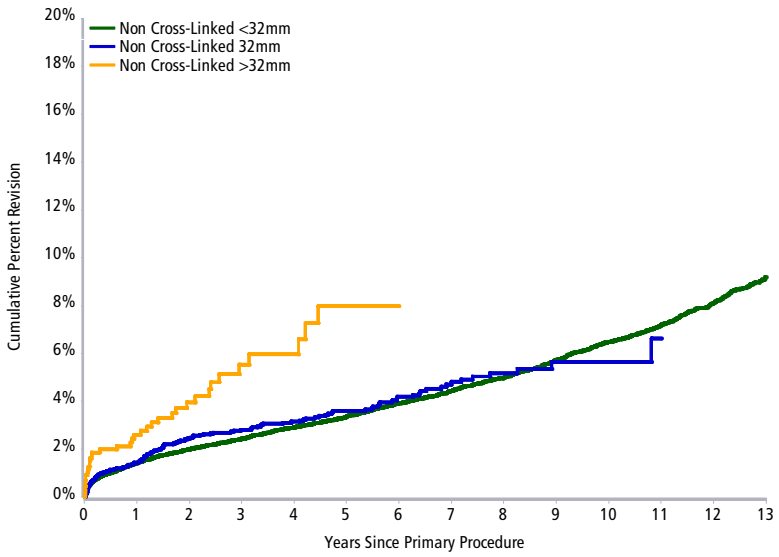


Figure HT24: Cumulative Percent Revision of Primary Total Conventional Hip Replacement using Non Cross-linked Polyethylene by Head Size (Primary Diagnosis OA)



HR - adjusted for age and gender

Non Cross-Linked 32mm vs Non Cross-Linked <32mm

Entire Period: HR=1.11 (0.94, 1.31),p=0.230

Non Cross-Linked >32mm vs Non Cross-Linked <32mm

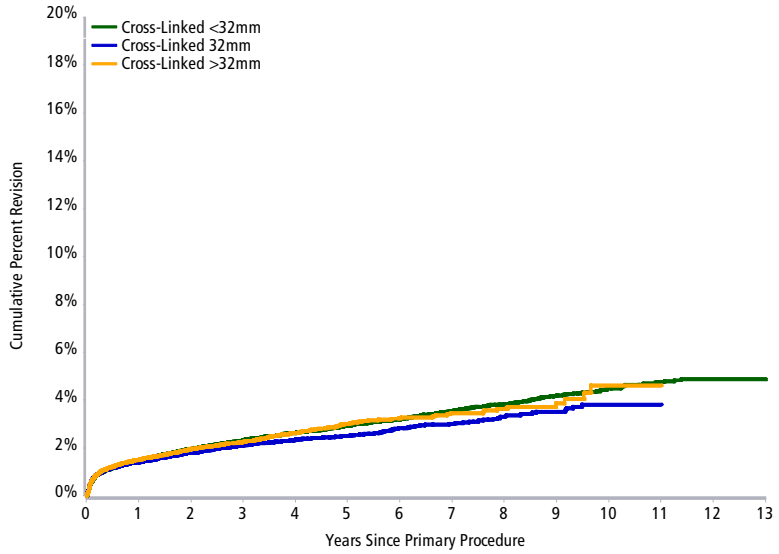
Entire Period: HR=2.00 (1.44, 2.78),p<0.001

Non Cross-Linked >32mm vs Non Cross-Linked 32mm

Entire Period: HR=1.80 (1.26, 2.59),p=0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Non Cross-Linked	<32mm	34645	33230	30798	27325	22717	13173	1560
Non Cross-Linked	32mm	4389	3824	2724	1733	934	165	3
Non Cross-Linked	>32mm	870	607	231	108	37	0	0

Figure HT25: Cumulative Percent Revision of Primary Total Conventional Hip Replacement using Cross-linked Polyethylene by Head Size (Primary Diagnosis OA)



HR - adjusted for age and gender

Cross-Linked 32mm vs Cross-Linked <32mm

0 - 1Mth: HR=1.05 (0.90, 1.22),p=0.544

1Mth+: HR=0.83 (0.76, 0.91),p<0.001

Cross-Linked >32mm vs Cross-Linked <32mm

Entire Period: HR=0.98 (0.90, 1.07),p=0.718

Cross-Linked >32mm vs Cross-Linked 32mm

0 - 1Mth: HR=0.96 (0.81, 1.15),p=0.668

1Mth+: HR=1.17 (1.05, 1.30),p=0.003

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cross-Linked	<32mm	42453	39097	32941	26503	19599	6957	133
Cross-Linked	32mm	49932	40349	24784	13640	5940	563	1
Cross-Linked	>32mm	38111	30386	17474	7477	2424	231	0

Figure HT26: Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement by Type of Polyethylene and Head Size (Primary Diagnosis OA)

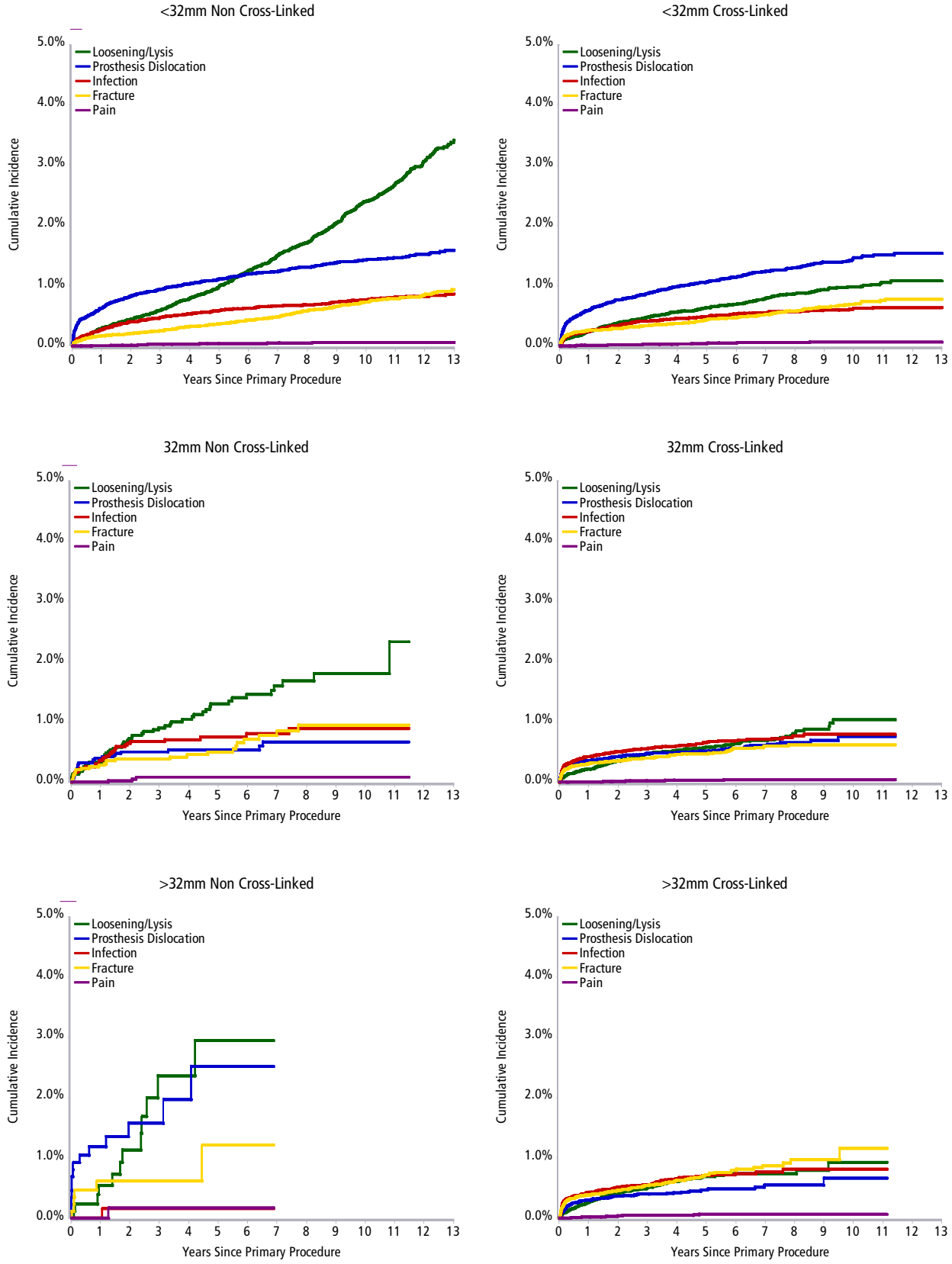
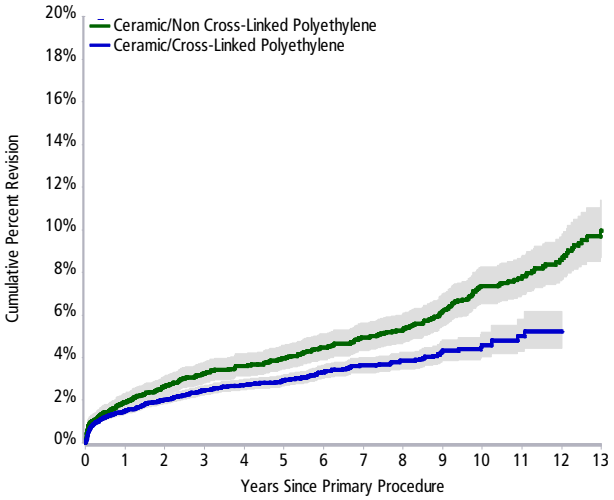
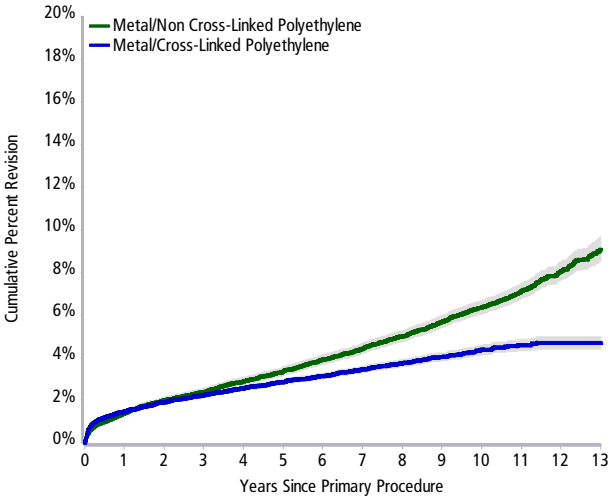


Figure HT27: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Head Surface and Type of Polyethylene (Primary Diagnosis OA)





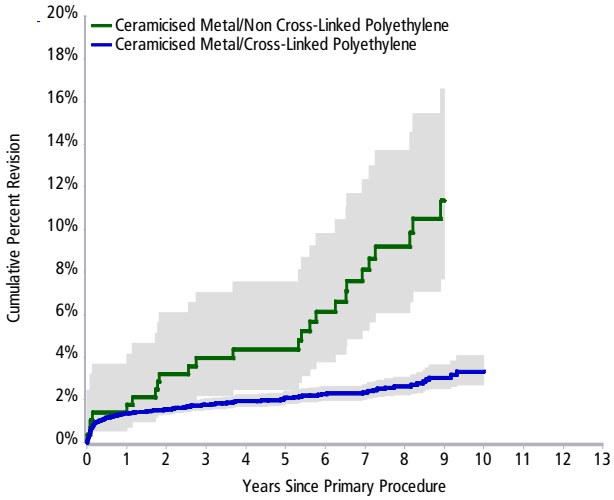
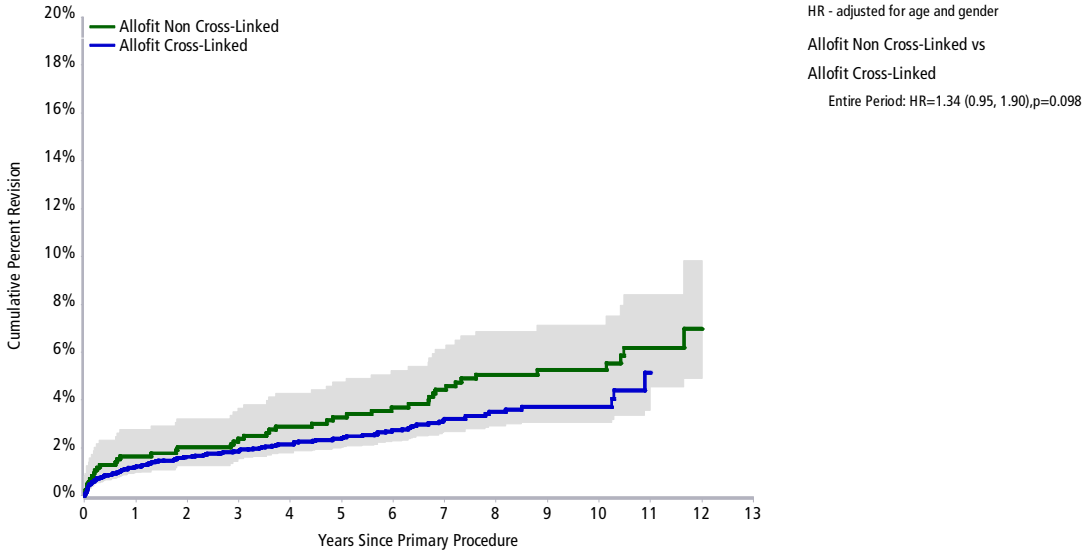


Table HT26: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Prosthesis Type and Polyethylene Bearing Surface (Primary Diagnosis OA)

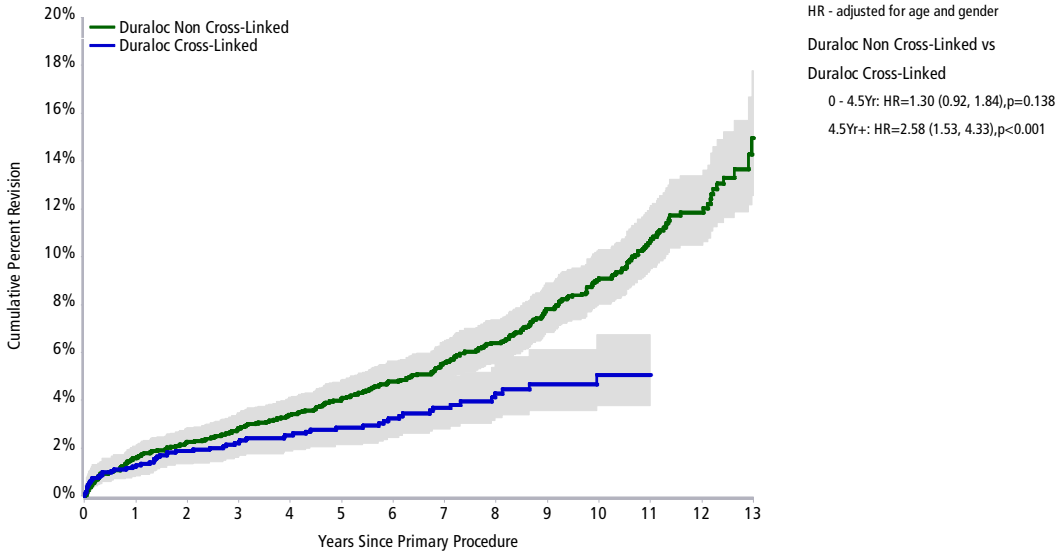
Acetabular Component	Type of Polyethylene	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Allofit		**201**	**7239**	**1.3 (1.0, 1.6)**	**1.9 (1.6, 2.3)**	**2.5 (2.2, 3.0)**	**3.4 (2.9, 4.0)**	**4.0 (3.4, 4.7)**	
	Non Cross-Linked	44	848	1.7 (1.0, 2.8)	2.4 (1.5, 3.7)	3.3 (2.3, 4.7)	4.4 (3.2, 6.1)	5.3 (3.9, 7.1)	
	Cross-Linked	157	6391	1.2 (1.0, 1.5)	1.9 (1.6, 2.3)	2.4 (2.0, 2.9)	3.2 (2.7, 3.8)	3.7 (3.1, 4.5)	
Duraloc		**332**	**4709**	**1.5 (1.2, 1.9)**	**2.6 (2.2, 3.1)**	**3.6 (3.1, 4.2)**	**5.0 (4.4, 5.7)**	**8.1 (7.2, 9.1)**	**13.7 (11.4, 16.4)**
	Non Cross-Linked	271	2993	1.6 (1.2, 2.1)	2.8 (2.3, 3.5)	4.1 (3.4, 4.8)	5.6 (4.8, 6.5)	9.1 (8.0, 10.3)	15.0 (12.6, 17.8)
	Cross-Linked	61	1716	1.3 (0.9, 2.0)	2.2 (1.6, 3.0)	2.8 (2.1, 3.8)	3.7 (2.8, 4.8)	5.1 (3.8, 6.7)	
Reflection (Cup)		**113**	**2101**	**0.8 (0.5, 1.3)**	**1.7 (1.2, 2.4)**	**2.8 (2.1, 3.7)**	**4.4 (3.5, 5.5)**	**8.7 (7.1, 10.7)**	
	Non Cross-Linked	94	1077	0.6 (0.3, 1.2)	1.9 (1.3, 3.0)	3.3 (2.4, 4.6)	5.6 (4.3, 7.2)	11.0 (8.9, 13.5)	
	Cross-Linked	19	1024	1.1 (0.6, 2.0)	1.3 (0.8, 2.3)	2.1 (1.3, 3.3)	2.3 (1.5, 3.7)		
Reflection (Shell)		**465**	**13331**	**1.2 (1.0, 1.4)**	**1.9 (1.7, 2.1)**	**2.4 (2.1, 2.7)**	**3.2 (2.8, 3.5)**	**5.2 (4.6, 5.8)**	**9.4 (7.6, 11.7)**
	Non Cross-Linked	208	2320	1.6 (1.2, 2.2)	3.2 (2.6, 4.0)	4.3 (3.5, 5.2)	6.1 (5.2, 7.2)	9.6 (8.3, 11.1)	14.5 (12.2, 17.2)
	Cross-Linked	257	11011	1.1 (0.9, 1.3)	1.6 (1.4, 1.8)	1.9 (1.7, 2.2)	2.4 (2.1, 2.7)	3.3 (2.9, 3.9)	
Vitalock		**197**	**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)**	**4.3 (3.8, 5.0)**	**5.3 (4.5, 6.2)**
	Non Cross-Linked	162	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)	4.4 (3.8, 5.2)	5.4 (4.6, 6.4)
	Cross-Linked	35	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)	4.0 (2.8, 5.6)	
TOTAL		**1308**	**31999**						

Figure HT28: Cumulative Percent Revision of Allofit Primary Total Conventional Hip Replacement by Type of Polyethylene (Primary Diagnosis OA)



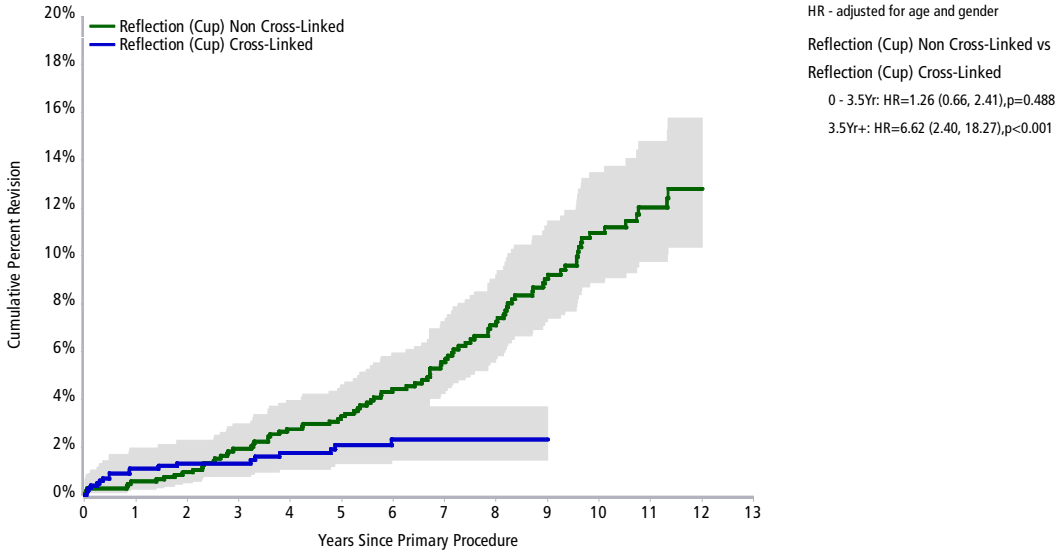
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Allofit	Non Cross-Linked	848	828	792	734	622	350	11
Allofit	Cross-Linked	6391	5680	4317	2878	1661	346	0

Figure HT29: Cumulative Percent Revision of Duraloc Primary Total Conventional Hip Replacement by Type of Polyethylene (Primary Diagnosis OA)



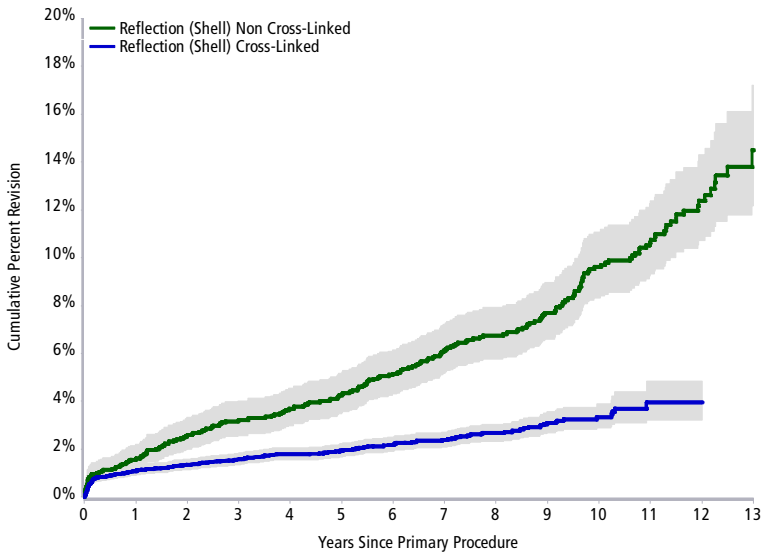
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Duraloc	Non Cross-Linked	2993	2914	2742	2567	2300	1491	120
Duraloc	Cross-Linked	1716	1665	1487	1185	754	246	0

Figure HT30: Cumulative Percent Revision of Reflection (Cup) Primary Total Conventional Hip Replacement by Type of Polyethylene (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Reflection (Cup) Non Cross-Linked	1077	1050	973	878	726	409	37
Reflection (Cup) Cross-Linked	1024	935	756	550	315	28	0

Figure HT31: Cumulative Percent Revision of Reflection (Shell) Primary Total Conventional Hip Replacement by Type of Polyethylene (Primary Diagnosis OA)



HR - adjusted for age and gender

Reflection (Shell) Non Cross-Linked vs Reflection (Shell) Cross-Linked

0 - 1Mth: HR=1.57 (0.93, 2.63),p=0.089

1Mth - 3Mth: HR=0.60 (0.21, 1.69),p=0.329

3Mth - 3.5Yr: HR=2.62 (1.86, 3.69),p<0.001

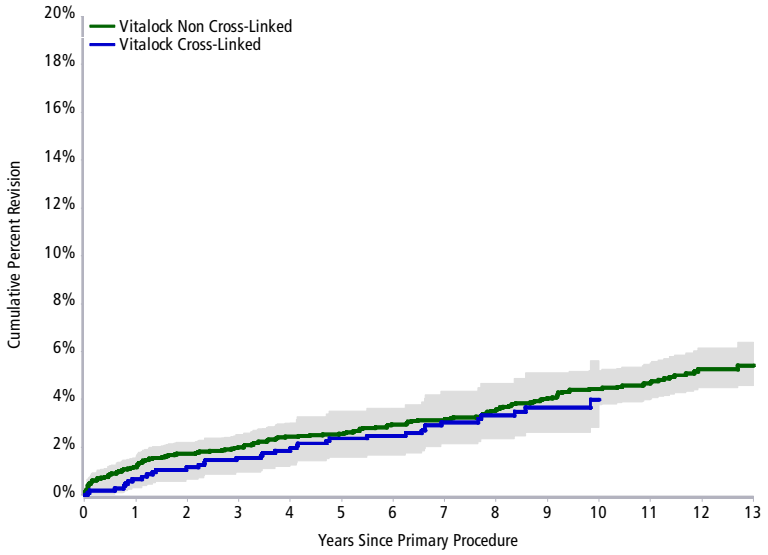
3.5Yr - 4Yr: HR=5.52 (1.92, 15.92),p=0.001

4Yr - 10Yr: HR=3.86 (2.81, 5.30),p<0.001

10Yr+: HR=3.11 (1.07, 9.05),p=0.037

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Reflection (Shell) Non Cross-Linked	2320	2241	2115	1962	1684	1028	121
Reflection (Shell) Cross-Linked	11011	10312	9079	7336	4667	1040	7

Figure HT32: Cumulative Percent Revision of Vitalock Primary Total Conventional Hip Replacement by Type of Polyethylene (Primary Diagnosis OA)



HR - adjusted for age and gender

Vitalock Non Cross-Linked vs Vitalock Cross-Linked

Entire Period: HR=1.10 (0.76, 1.60),p=0.600

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Vitalock Non Cross-Linked	3569	3477	3330	3161	2956	2257	425
Vitalock Cross-Linked	1050	1032	985	936	812	256	0

Ceramic/Ceramic Bearing

Ceramic/ceramic bearings have been used in 57,828 primary total conventional hip replacements undertaken for osteoarthritis. This is the second most common bearing reported to the Registry. This analysis includes outcome by head size and fixation.

Head Size

To evaluate the effect of head size an analysis was undertaken comparing four head size groups (≤28, 32, 36-38, and ≥40mm). The follow up period for the ≥40mm head size is four years compared to over 10 years follow up for the other three head sizes. Head sizes 32mm have a lower rate of revision compared to head sizes 28mm or less. There is no difference when head size 32mm is compared to the two larger head size groups (Table HT27 and Figure HT33). Head sizes 28mm or less have a higher rate of revision for prosthesis dislocation compared to the other head size groups (refer to chapter on dislocation). 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 HT34).

Fixation

The majority of procedures using ceramic/ceramic bearing surfaces are cementless (84.7%). Hybrid fixation accounts for 15.2%. Hybrid fixation has a lower rate of revision compared to cementless fixation over the entire period (Table HT28 and Figure HT35).

When using cementless fixation, head size 40mm or larger has a lower rate of revision compared to 32mm. There remains a higher rate of revision for head sizes 28mm or less compared to 32mm (Table HT29 and Figure HT36). 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 significant difference compared to 36-38 and 40mm or greater head size groups (Table HT30 and Figure HT37).

Table HT27: Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)

Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
≤28mm	380	6405	2.1 (1.7, 2.4)	3.4 (3.0, 3.9)	4.3 (3.8, 4.8)	5.2 (4.6, 5.8)	6.6 (6.0, 7.3)	7.7 (6.9, 8.6)
32mm	756	22826	1.4 (1.3, 1.6)	2.4 (2.2, 2.6)	3.0 (2.8, 3.3)	3.8 (3.5, 4.1)	4.8 (4.4, 5.2)	5.9 (5.1, 6.9)
36-38mm	619	24414	1.4 (1.3, 1.6)	2.4 (2.2, 2.7)	3.3 (3.0, 3.6)	4.0 (3.6, 4.4)	5.3 (4.6, 6.1)	
≥40mm	63	4183	1.1 (0.8, 1.4)	1.8 (1.4, 2.3)				
TOTAL	**1818**	**57828**						

Figure HT33: Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)

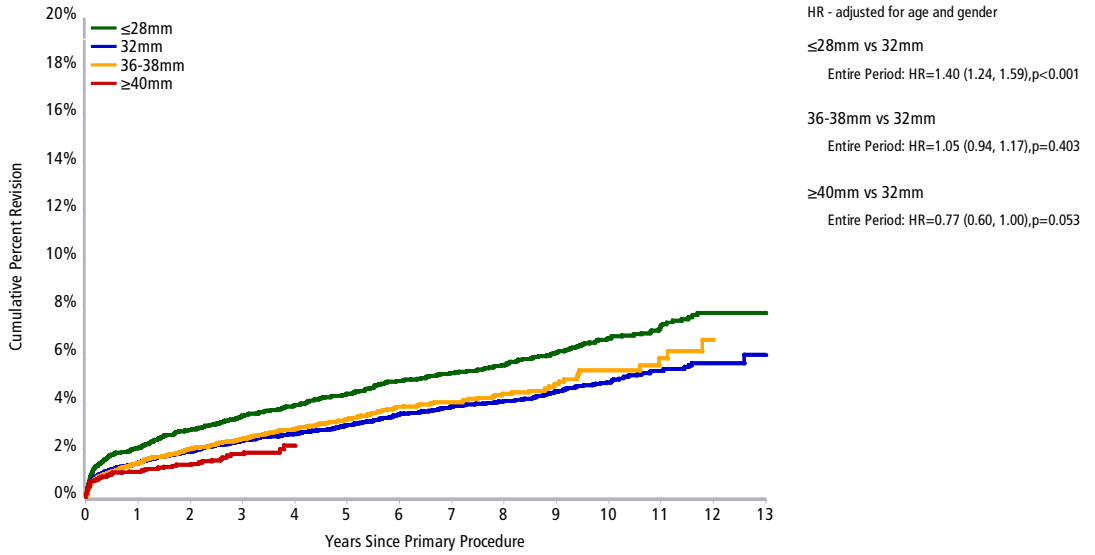
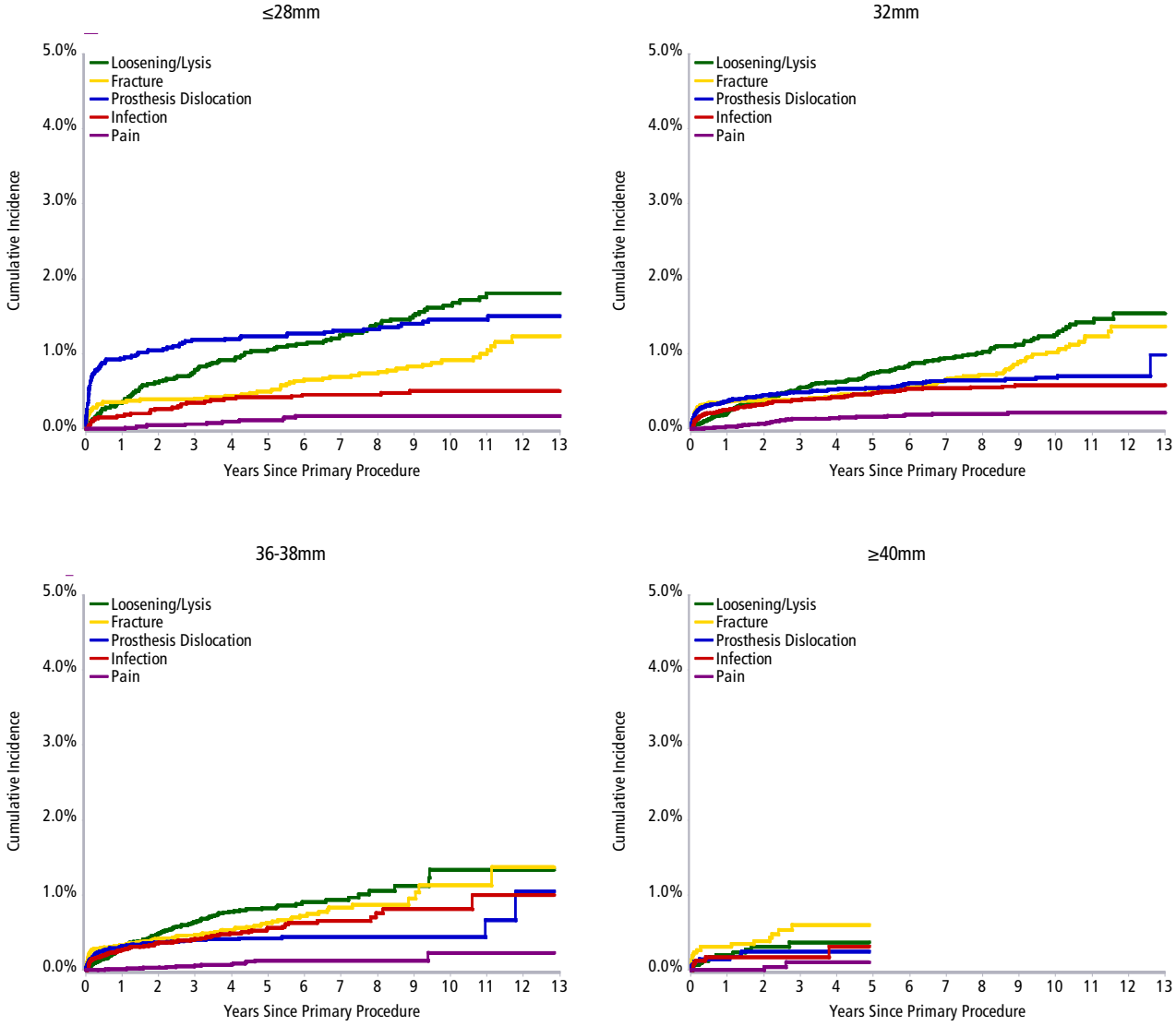


Figure HT34: Cumulative Incidence Revision Diagnosis of Ceramic/Ceramic Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)

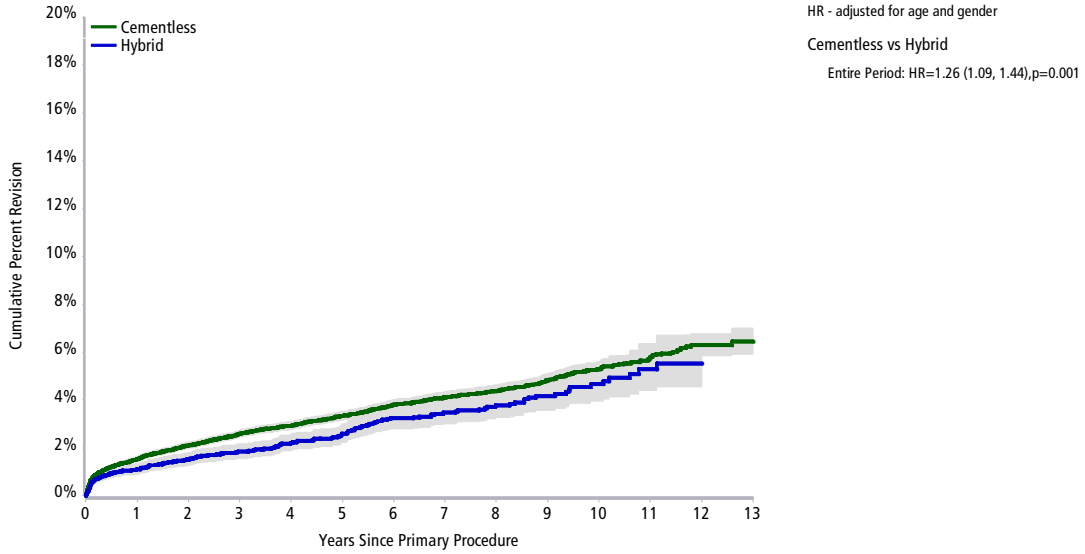


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
≤28mm	6405	6128	5684	5171	4389	2474	148
32mm	22826	20690	16361	12378	8746	3388	108
36-38mm	24414	19568	11820	6023	2602	575	18
≥40mm	4183	3220	1292	14	0	0	0

Table HT28: 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	13 Yrs
Cemented	2	25	0.0 (0.0, 0.0)	4.5 (0.7, 28.1)	4.5 (0.7, 28.1)	4.5 (0.7, 28.1)		
Cementless	1583	48999	1.5 (1.4, 1.7)	2.6 (2.4, 2.7)	3.3 (3.2, 3.5)	4.1 (3.9, 4.3)	5.3 (5.0, 5.6)	6.4 (5.9, 7.0)
Hybrid	233	8804	1.1 (0.9, 1.3)	1.8 (1.6, 2.2)	2.6 (2.2, 3.0)	3.5 (3.0, 4.0)	4.7 (4.0, 5.5)	
TOTAL	**1818**	**57828**						

Figure HT35: Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis OA)

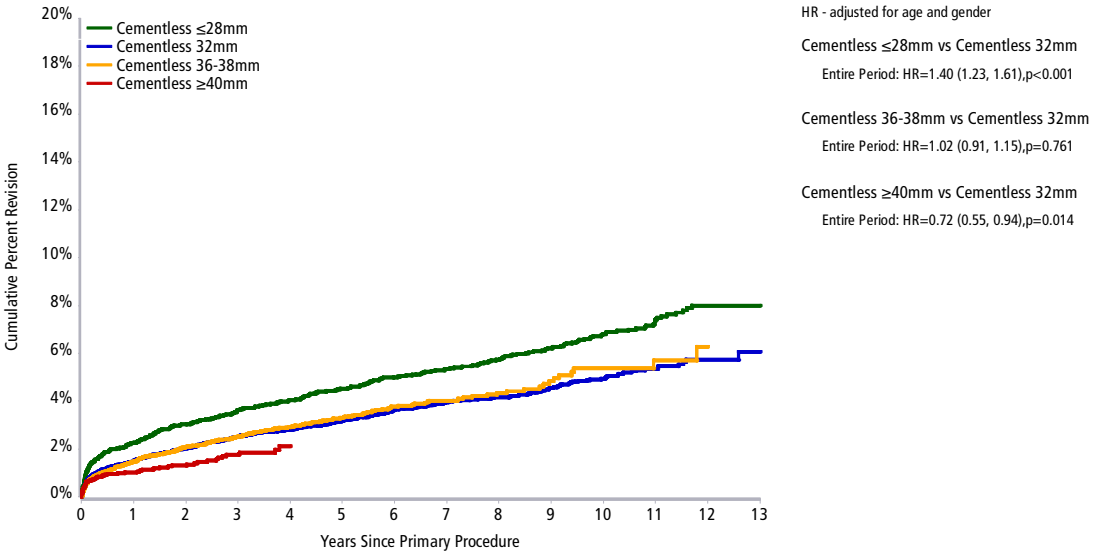


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cementless	48999	41834	29460	19674	13494	5676	268
Hybrid	8804	7747	5676	3896	2233	760	6

Table HT29: 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	13 Yrs
Cementless	≤28mm	320	5046	2.3 (1.9, 2.7)	3.6 (3.1, 4.2)	4.5 (4.0, 5.1)	5.3 (4.7, 6.0)	6.8 (6.1, 7.6)	8.0 (7.1, 9.0)
	32mm	639	17970	1.5 (1.3, 1.7)	2.5 (2.3, 2.8)	3.2 (2.9, 3.5)	4.0 (3.6, 4.3)	4.9 (4.5, 5.4)	6.1 (5.2, 7.0)
	36-38mm	563	21878	1.5 (1.3, 1.7)	2.5 (2.3, 2.8)	3.3 (3.0, 3.6)	4.0 (3.6, 4.4)	5.4 (4.6, 6.3)	
	≥40mm	61	4105	1.0 (0.8, 1.4)	1.8 (1.3, 2.3)				
TOTAL		**1583**	**48999**						

Figure HT36: Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement with Cementless Fixation by Head Size (Primary Diagnosis OA)

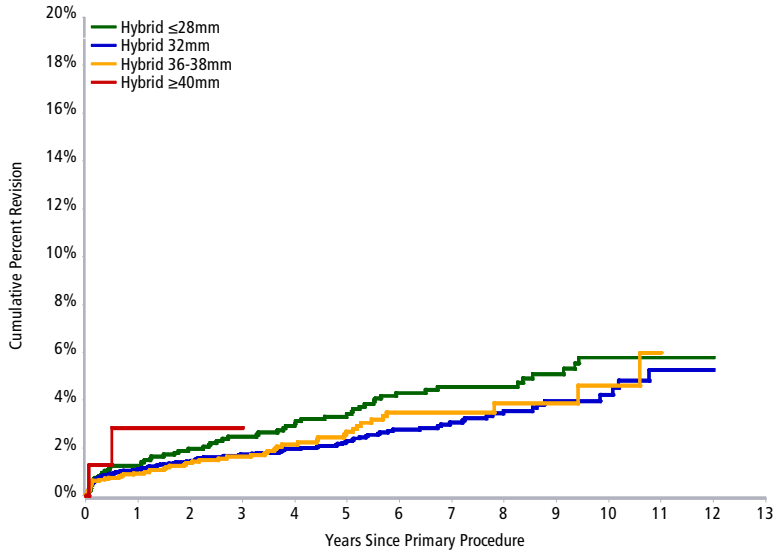


Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cementless	≤28mm	5046	4833	4562	4242	3705	2163	142
	32mm	17970	16343	13113	10213	7551	3044	108
	36-38mm	21878	17484	10509	5205	2238	469	18
	≥40mm	4105	3174	1276	14	0	0	0

Table HT30: 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	13 Yrs
Hybrid	≤28mm	58	1353	1.3 (0.8, 2.0)	2.5 (1.7, 3.5)	3.4 (2.5, 4.6)	4.6 (3.5, 6.0)	5.8 (4.4, 7.6)	
	32mm	117	4842	1.1 (0.9, 1.5)	1.7 (1.4, 2.2)	2.3 (1.9, 2.8)	3.1 (2.5, 3.8)	4.2 (3.3, 5.4)	
	36-38mm	56	2531	0.9 (0.6, 1.4)	1.6 (1.2, 2.3)	2.7 (2.0, 3.6)	3.5 (2.6, 4.7)	4.6 (3.0, 6.9)	
	≥40mm	2	78	2.8 (0.7, 10.9)	2.8 (0.7, 10.9)				
TOTAL		**233**	**8804**						

Figure HT37: 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=1.41 (1.02, 1.95),p=0.037

Hybrid 36-38mm vs Hybrid 32mm

Entire Period: HR=1.02 (0.73, 1.42),p=0.904

Hybrid ≥40mm vs Hybrid 32mm

Entire Period: HR=1.94 (0.48, 7.88),p=0.354

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Hybrid	≤28mm	1353	1289	1118	926	681	311	6
	32mm	4842	4333	3235	2155	1189	343	0
	36-38mm	2531	2079	1307	815	363	106	0
	≥40mm	78	46	16	0	0	0	0

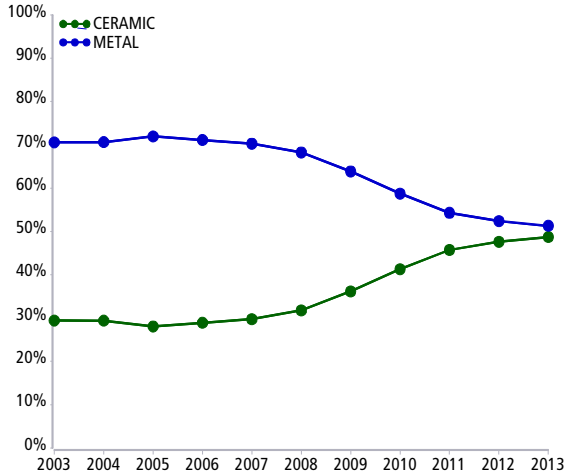
Ceramic Types

This year the Registry has compared the outcome of the different types of ceramic femoral head. They are Zirconia, Alumina, and Zirconia/Alumina combination which is referred to as Mixed Ceramic.

Use

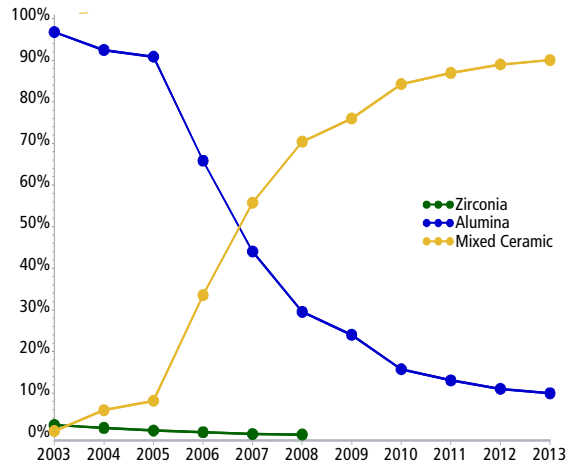
Since 2003, the proportion of primary total conventional hips using a ceramic head has increased from 29.4% to 48.7% in 2013. The increase occurred particularly after 2007 (Figure HT38).

Figure HT38: Usage of Primary Total Conventional Hip Replacement by Bearing Surface of Femoral Head



When the Registry commenced data collection Alumina was the most common type of ceramic used. The use of Mixed Ceramic in Australia was first reported in 2003 and within four years its use exceeded Alumina. In 2013, 90% of ceramic femoral heads were Mixed Ceramic and the remaining femoral heads were Alumina. Zirconia femoral heads have only been reported in small numbers and their use ceased in 2008 (Figure HT 39).

Figure HT39: Usage of Primary Total Conventional Hip Replacement with Ceramic Femoral Head by Ceramic Type



Ceramic femoral heads have been used in 87,387 primary total conventional hip replacements undertaken for osteoarthritis. The analysis is based on these procedures. The proportion of procedures with Zirconia femoral heads is 1.4%, Alumina 38.2% and Mixed Ceramic 60.4% (Table HT31).

Femoral head breakage rate

There was only one femoral head breakage reported for the small number of Zirconia femoral heads (1:1433). There is a significant difference in the rate of femoral head breakage when Alumina and Mixed Ceramic are compared. Although the rate of breakage is small, Mixed Ceramic has a significantly lower rate of revision for breakage (HR=15.71 (2.07, 119) p=0.007).

The breakage rate for Alumina is 6.48/10,000 procedures and for Mixed Ceramic is 0.17/10,000 procedures.

Revision for any reason

When the outcome of the different ceramics is compared, Zirconia has a higher rate of revision than both Alumina and Mixed Ceramic femoral heads. There is no difference in the rate of revision between Alumina and Mixed Ceramic. At seven years, the cumulative percent revision for Zirconia is 5.2%, Alumina 4.1% and 3.8% for Mixed Ceramic (Table HT31 and Figure HT40). This difference is due to an increased rate of revision for loosening/lysis and dislocation in the Zirconia group (Figure HT41).

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 were 28mm or less. Only a small number of procedures (10) used one other head size (32mm). The cumulative percent revision at seven years for 28mm or less is 5.2% (Table HT32).

The most common Alumina femoral head is 32mm (52.2%) followed by 28mm or less (32.2%) and 36-38mm (15.5%). Only a small proportion of Alumina heads with a head size of 40mm or larger have been used (0.1%). Head sizes 32mm have a lower rate of revision compared to both 28mm or less and 36-38mm. The cumulative percent revision at seven years is 4.6% for 28mm or less, 3.7% for 32mm and 4.5% for 36-38mm (Table HT32 and Figure HT42).

The most used Mixed Ceramic femoral head size is 36-38mm (56.6%) followed by 32mm (29.1%) and 40mm or larger (8.6%). Head sizes 28mm or less accounted for only 5.7%. Head sizes 40mm or larger have a lower rate of revision compared to 28mm or less over the entire period and 36-38mm after six months. There is no difference in the rate of revision between 32mm and 40mm or larger. The cumulative percent revision at seven years is 4.3% for 28mm or less, 3.8% for 32mm and

3.8% for 36-38mm. Head sizes of 40mm or larger have a shorter follow up and the cumulative percent revision at three years is 1.8% (Table HT32 and Figure HT43).

As Zirconia femoral heads have been used almost exclusively with 28mm or less it is only possible to compare the outcome of all three ceramics with this particular head size. This comparison demonstrates that Zirconia has a higher rate of revision compared to Alumina and Mixed Ceramic. There is no difference in the rate of revision of Alumina compared to Mixed Ceramic for the head sizes of 28mm or less (Figure HT44).

There is infrequent use of Alumina 40mm or larger femoral heads. It is therefore only possible to compare Alumina and Mixed Ceramic for 32mm and 36-38mm head sizes. There is no difference in the rate of revision for Alumina 32mm compared to Mixed Ceramic 32mm after the first three months, and for the entire period for Mixed Ceramic 36-38mm. Alumina 36-38mm has a higher rate of revision than Alumina 32mm. (Figure HT45).

Head size and Bearing Surface

Outcome related to head size may be affected by the bearing surface. A ceramic femoral head may be combined with polyethylene (non cross-linked or cross-linked) or ceramic (Alumina or Mixed Ceramic).

Zirconia femoral heads (≤28mm) have been used almost exclusively with polyethylene and most have been used with non cross-linked polyethylene. When the three ceramics are compared for this head size and bearing surface, Zirconia femoral heads have a higher rate of revision than Alumina heads but there is no difference compared to Mixed Ceramic heads. When cross-linked polyethylene is used there is no difference in the rate of revision for the three different ceramics (Figures HT46 and HT47).

Cross-linked polyethylene has a lower rate of revision compared to non cross-linked polyethylene regardless of ceramic type used for head sizes 32mm and 36-38mm (Figures HT 48 and HT49).

When Alumina and Mixed Ceramic femoral heads are used in combination with an Alumina acetabular bearing surface there is no difference in the rate of revision and it does not vary with head size (32mm v 36-38mm) (Figure HT50).

There is however a difference depending on head size when Alumina and Mixed Ceramic femoral heads are combined with a Mixed Ceramic acetabular bearing surface. There is no difference between the Alumina and Mixed Ceramic femoral heads for the 32mm head size. There is a higher rate of revision for Alumina heads when combined with a Mixed Ceramic acetabular bearing for 36-38mm (Figure HT51).

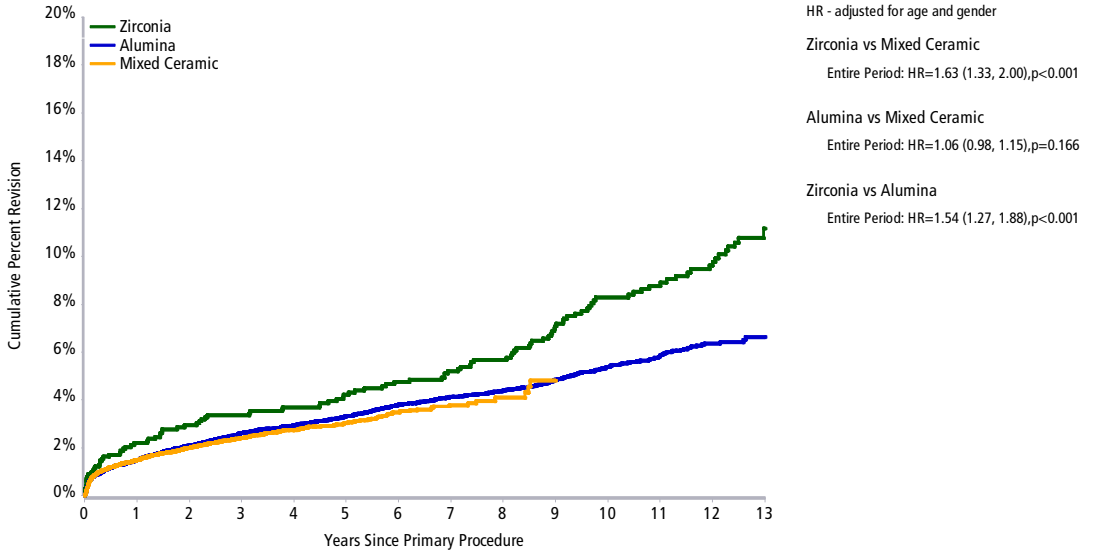
Mixed Ceramic head sizes 40mm or larger have mostly been used with Mixed Ceramic acetabular bearings (92%). There is only three years follow up for this bearing and the cumulative percent revision is 1.8%.

Table HT31: 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	13 Yrs
Zirconia	110	1227	2.2 (1.5, 3.2)	3.4 (2.5, 4.5)	4.2 (3.2, 5.5)	5.2 (4.1, 6.6)	8.3 (6.8, 10.1)	11.2 (9.2, 13.5)
Alumina	1439	33419	1.5 (1.4, 1.6)	2.6 (2.4, 2.8)	3.3 (3.1, 3.5)	4.1 (3.9, 4.4)	5.4 (5.1, 5.7)	6.6 (6.1, 7.2)
Mixed Ceramic	1186	52741	1.5 (1.4, 1.6)	2.4 (2.3, 2.6)	3.0 (2.8, 3.2)	3.8 (3.5, 4.1)		
TOTAL	**2735**	**87387**						

Note: excluding 6 procedures with unknown ceramic type.

Figure HT40: Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Ceramic Femoral Head by Ceramic Type (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Zirconia	1227	1191	1155	1095	1029	796	218
Alumina	33419	31505	28039	24032	19343	8493	418
Mixed Ceramic	52741	40941	21797	8722	1992	32	0

Figure HT41: Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement with Ceramic Femoral Head by Ceramic Type (Primary Diagnosis OA)

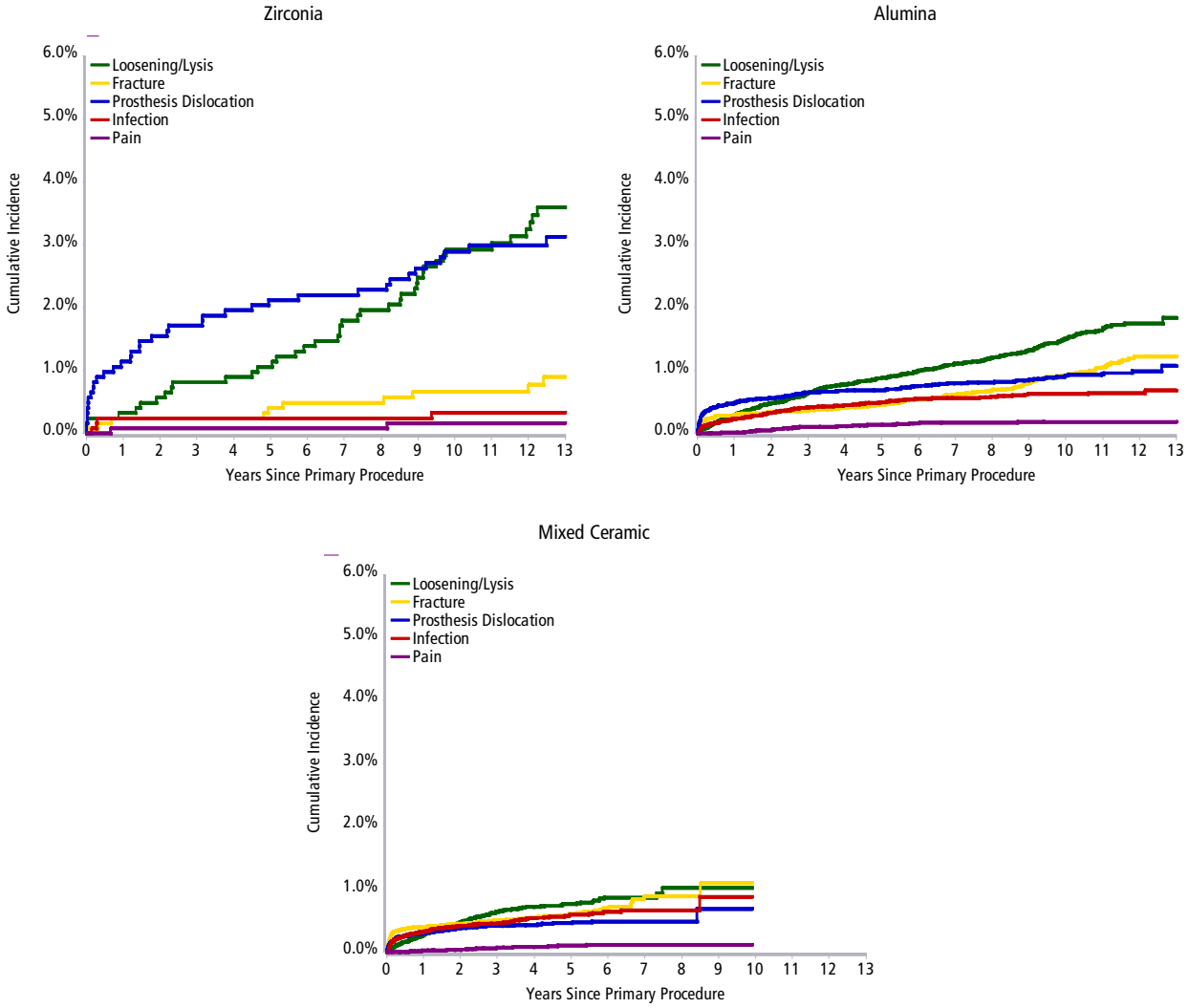
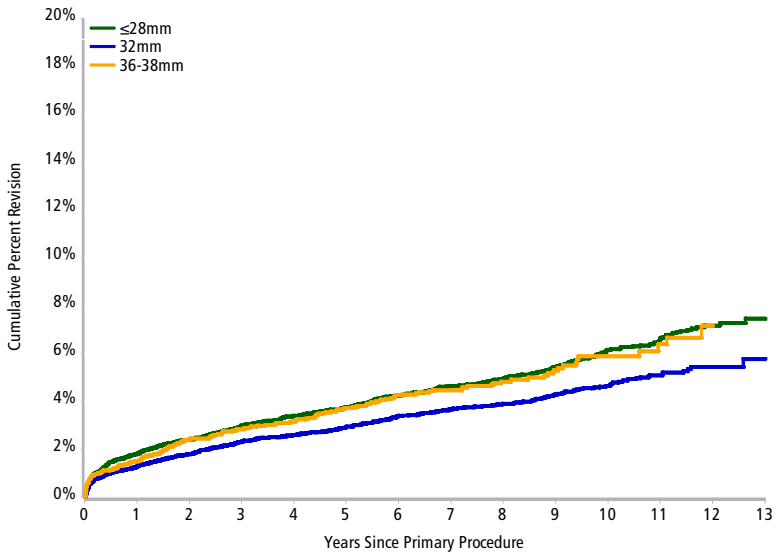


Table HT32: Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Ceramic Femoral Head by Ceramic Type and Head Size (Primary Diagnosis OA)

Ceramic Type	Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Zirconia	≤28mm	110	1217	2.2 (1.5, 3.2)	3.4 (2.5, 4.6)	4.3 (3.2, 5.6)	5.2 (4.1, 6.7)	8.3 (6.8, 10.1)	11.2 (9.3, 13.5)
	32mm	0	10	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	598	10772	1.8 (1.6, 2.1)	3.0 (2.7, 3.3)	3.8 (3.4, 4.1)	4.6 (4.2, 5.1)	6.1 (5.7, 6.7)	7.4 (6.7, 8.2)
	32mm	630	17430	1.3 (1.1, 1.5)	2.3 (2.1, 2.6)	2.9 (2.7, 3.2)	3.7 (3.4, 4.0)	4.6 (4.3, 5.0)	5.8 (5.0, 6.7)
	36-38mm	209	5172	1.5 (1.2, 1.9)	2.8 (2.4, 3.4)	3.7 (3.2, 4.3)	4.5 (3.9, 5.2)	5.9 (5.0, 6.9)	
	≥40mm	2	45	4.9 (1.2, 18.2)					
Mixed Ceramic	≤28mm	95	3007	1.8 (1.4, 2.3)	3.0 (2.4, 3.8)	3.5 (2.8, 4.4)	4.3 (3.4, 5.4)		
	32mm	348	15345	1.5 (1.4, 1.8)	2.4 (2.1, 2.7)	2.9 (2.6, 3.2)	3.8 (3.2, 4.5)		
	36-38mm	671	29846	1.5 (1.4, 1.6)	2.5 (2.3, 2.7)	3.1 (2.9, 3.4)	3.8 (3.4, 4.3)		
	≥40mm	72	4543	1.2 (0.9, 1.5)	1.8 (1.4, 2.4)				
TOTAL		**2735**	**87387**						

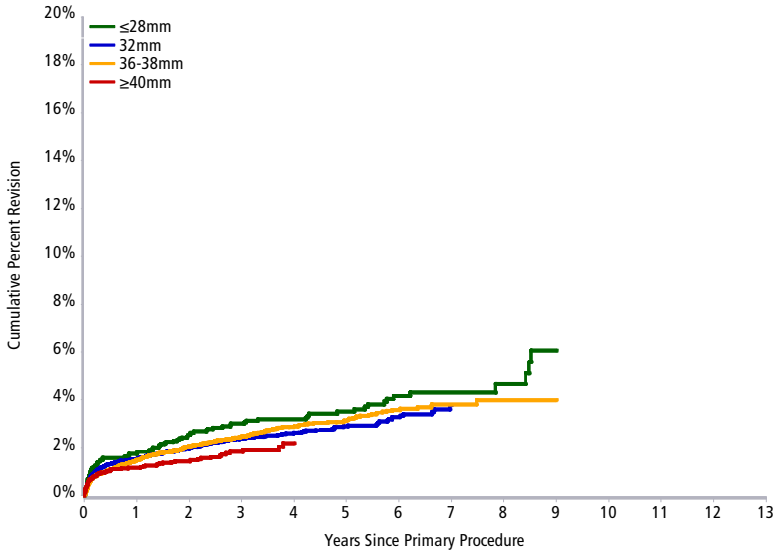
Note: excluding 6 procedures with unknown ceramic type.

Figure HT42: Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Alumina Femoral Head by Head Size (Primary Diagnosis OA)



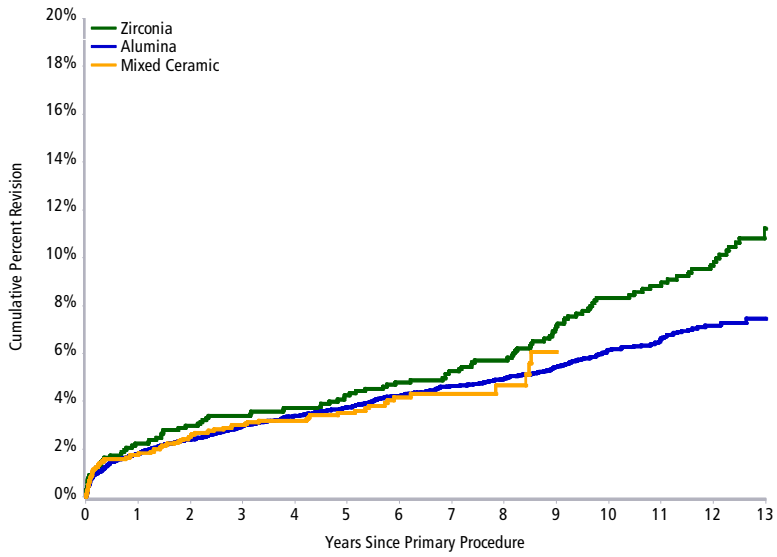
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
≤28mm	10772	10396	9779	9045	7946	4408	293
32mm	17430	16334	14209	11973	9486	3508	107
36-38mm	5172	4750	4049	3014	1911	577	18

Figure HT43: 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	13 Yrs
≤28mm	3007	2422	1597	1032	470	26	0
32mm	15345	12104	6789	3128	534	0	0
36-38mm	29846	22887	12012	4548	988	6	0
≥40mm	4543	3528	1399	14	0	0	0

Figure HT44: Cumulative Percent Revision of Primary Total Conventional Hip Replacement with ≤28mm Ceramic Femoral Head by Ceramic Type (Primary Diagnosis OA)



HR - adjusted for age and gender

Zirconia vs Alumina

Entire Period: HR=1.36 (1.11, 1.67),p=0.003

Mixed Ceramic vs Alumina

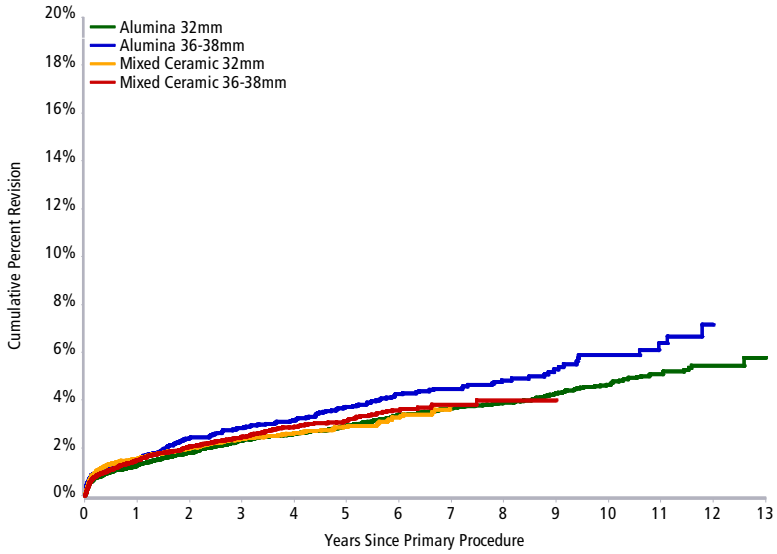
Entire Period: HR=1.02 (0.82, 1.28),p=0.849

Zirconia vs Mixed Ceramic

Entire Period: HR=1.33 (1.00, 1.77),p=0.049

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Zirconia	1217	1181	1145	1086	1023	795	217
Alumina	10772	10396	9779	9045	7946	4408	293
Mixed Ceramic	3007	2422	1597	1032	470	26	0

Figure HT45: Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Ceramic Femoral Head by Ceramic Type and Head Size (Primary Diagnosis OA)



HR - adjusted for age and gender

Alumina 36-38mm vs Alumina 32mm

Entire Period: HR=1.26 (1.07, 1.48),p=0.004

Mixed Ceramic 32mm vs Alumina 32mm

0 - 3Mth: HR=1.35 (1.11, 1.64),p=0.002

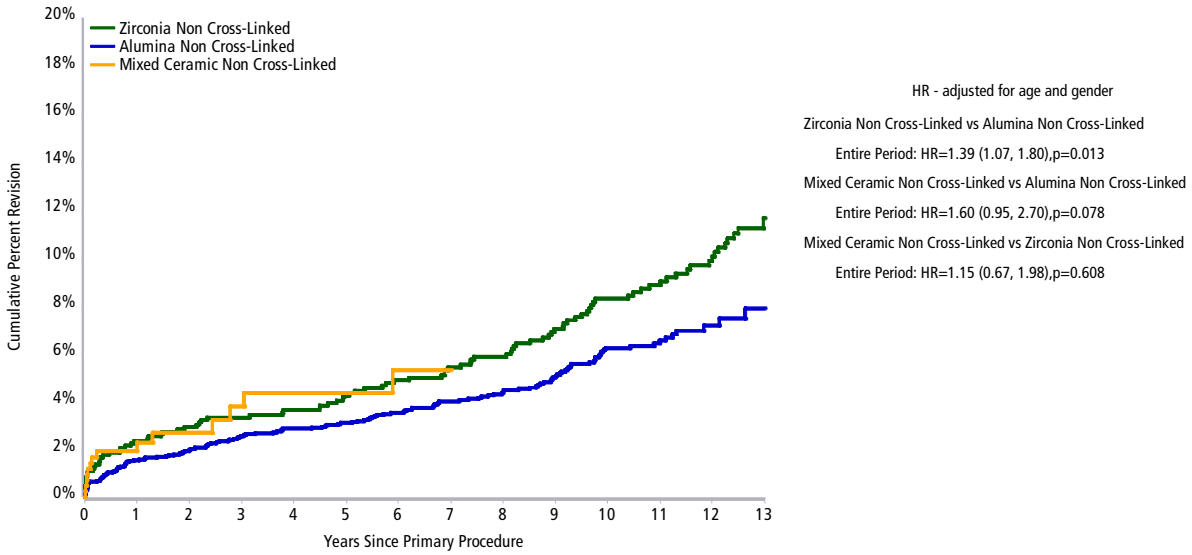
3Mth+: HR=0.87 (0.73, 1.03),p=0.104

Mixed Ceramic 36-38mm vs Alumina 32mm

Entire Period: HR=1.09 (0.97, 1.22),p=0.144

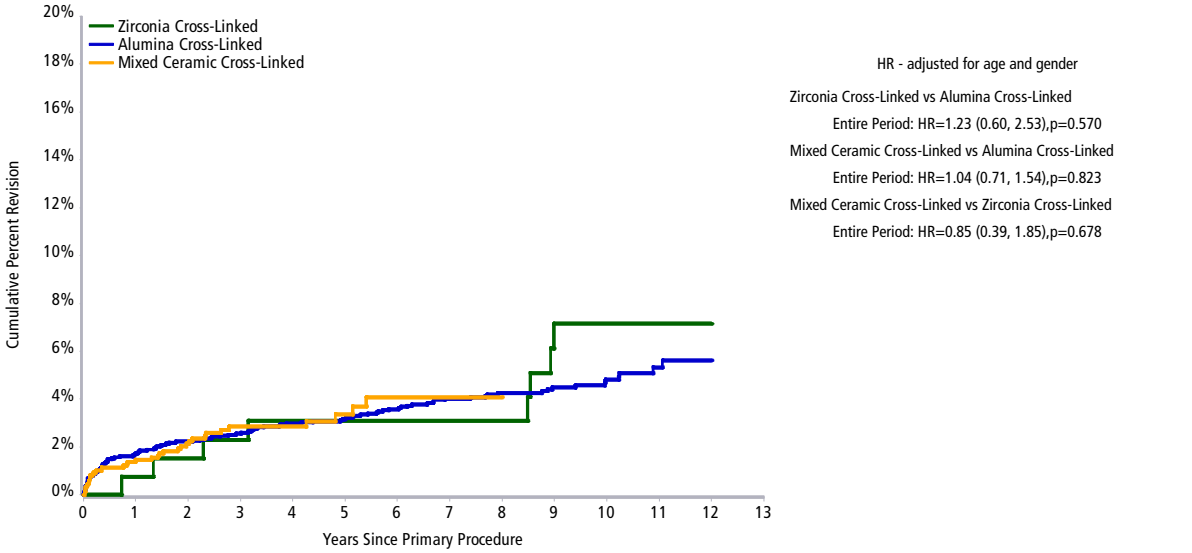
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Alumina 32mm	17430	16334	14209	11973	9486	3508	107
Alumina 36-38mm	5172	4750	4049	3014	1911	577	18
Mixed Ceramic 32mm	15345	12104	6789	3128	534	0	0
Mixed Ceramic 36-38mm	29846	22887	12012	4548	988	6	0

Figure HT46: Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Ceramic/Non Cross-Linked Polyethylene Bearing Surface and ≤28mm Head by Ceramic Type (Primary Diagnosis OA)



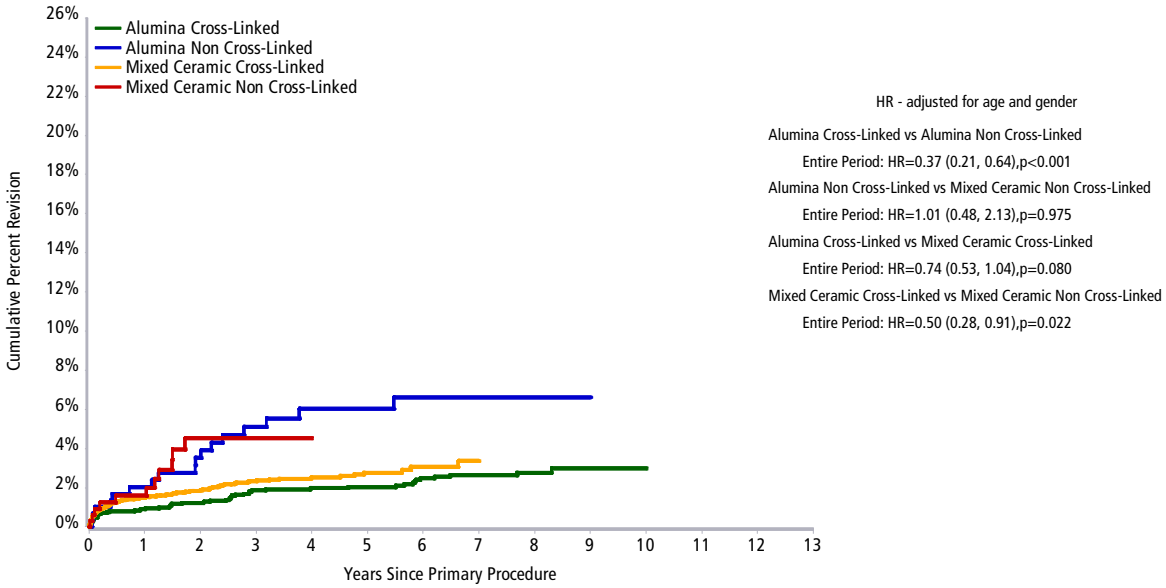
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Zirconia	Non Cross-Linked	1032	999	972	922	870	686	203
Alumina	Non Cross-Linked	2968	2844	2606	2376	2039	1203	140
Mixed Ceramic	Non Cross-Linked	433	276	169	133	71	0	0

Figure HT47: Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Ceramic/Cross-Linked Polyethylene Bearing Surface and ≤28mm Head by Ceramic Type (Primary Diagnosis OA)



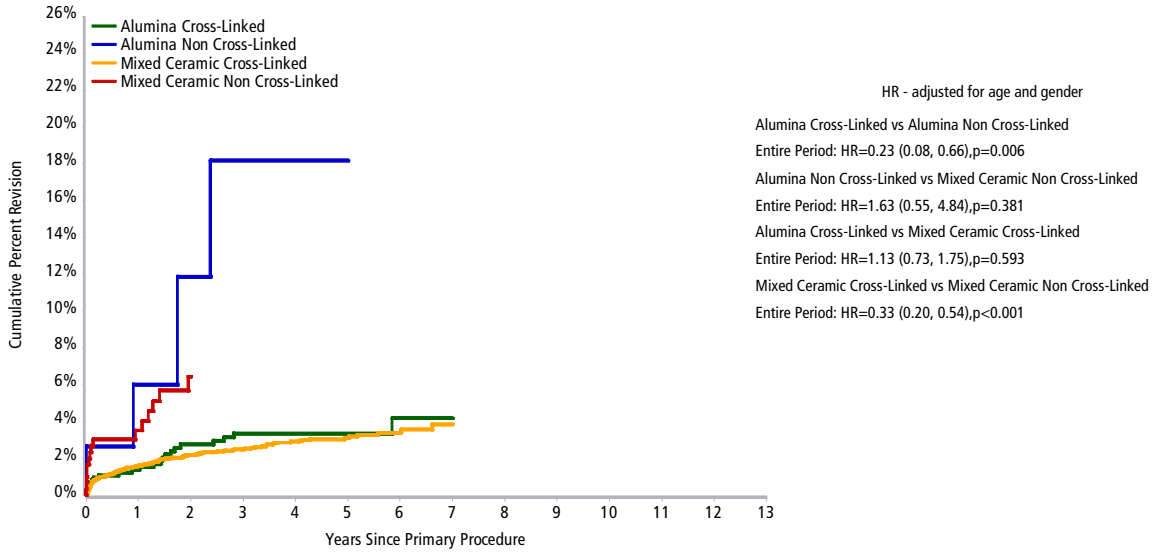
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Zirconia	Cross-Linked	131	130	123	115	106	85	12
Alumina	Cross-Linked	2497	2410	2294	2129	1862	778	6
Mixed Ceramic	Cross-Linked	1518	1201	662	312	99	1	0

Figure HT48: Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Ceramic/Polyethylene Bearing Surface and 32mm Head by Ceramic Type and Type of Polyethylene (Primary Diagnosis OA)



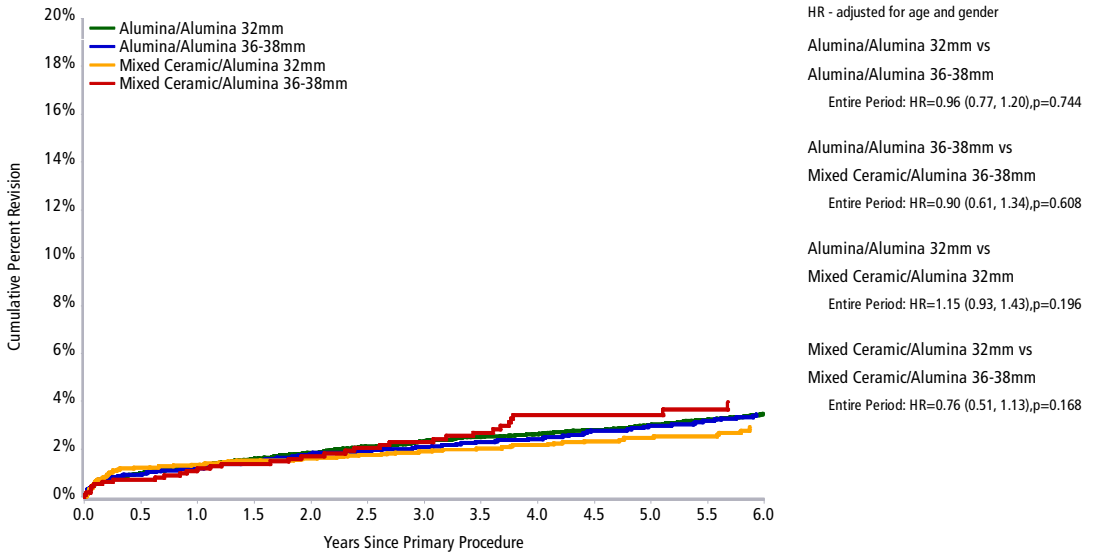
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Alumina	Cross-Linked	2277	2127	1813	1483	1003	86	0
Alumina	Non Cross-Linked	300	274	221	167	89	34	0
Mixed Ceramic	Cross-Linked	7040	5111	2499	1047	173	0	0
Mixed Ceramic	Non Cross-Linked	330	234	102	26	8	0	0

Figure HT49: Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Ceramic/Polyethylene Bearing Surface and 36-38mm Head by Ceramic Type and Type of Polyethylene (Primary Diagnosis OA)



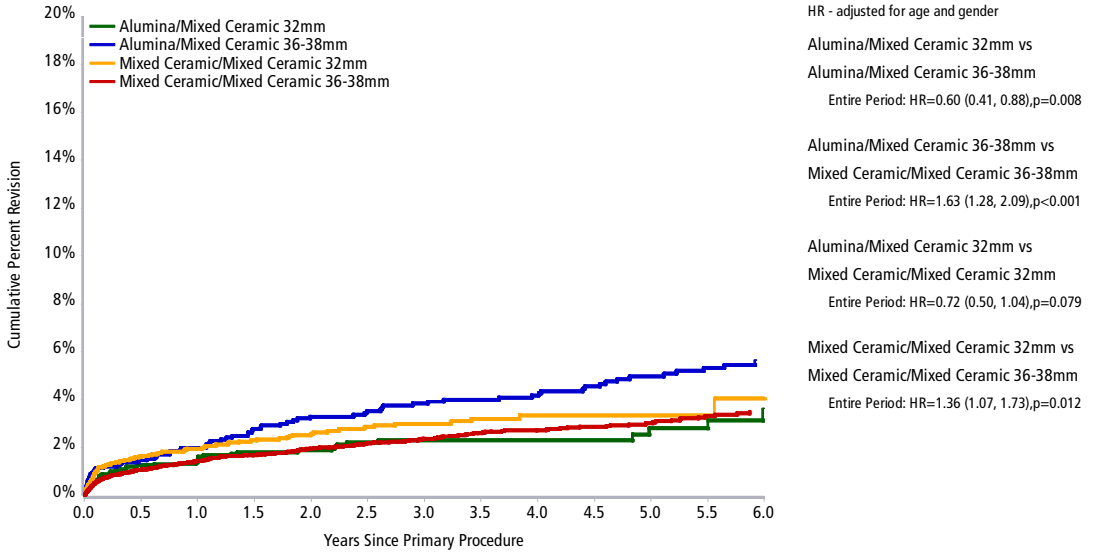
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Alumina	Cross-Linked	758	630	468	187	71	2	0
Alumina	Non Cross-Linked	38	26	12	6	3	0	0
Mixed Ceramic	Cross-Linked	9249	6968	3500	1264	218	6	0
Mixed Ceramic	Non Cross-Linked	303	193	39	13	4	0	0

Figure HT50: Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Ceramic/Alumina Ceramic Bearing Surface by Ceramic Type and Head Size (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs
Alumina/Alumina	32mm	12795	12298	11842	11252	10654	9949	9195	8290
Alumina/Alumina	36-38mm	2774	2657	2526	2377	2237	1967	1735	1454
Mixed Ceramic/Alumina	32mm	4488	4007	3565	3046	2455	1790	1100	351
Mixed Ceramic/Alumina	36-38mm	1129	1018	898	765	604	433	275	90

Figure HT51: Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Ceramic/Mixed Ceramic Bearing Surface by Ceramic Type and Head Size (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs
Alumina/Mixed Ceramic	32mm	2055	1632	1278	920	605	372	208	102
Alumina/Mixed Ceramic	36-38mm	1599	1434	1275	1189	1060	851	625	383
Mixed Ceramic/Mixed Ceramic	32mm	3486	2751	1928	1141	600	265	62	2
Mixed Ceramic/Mixed Ceramic	36-38mm	18912	14459	10692	7489	4638	2772	1278	675

Primary Total Resurfacing Hip Replacement

Demographics

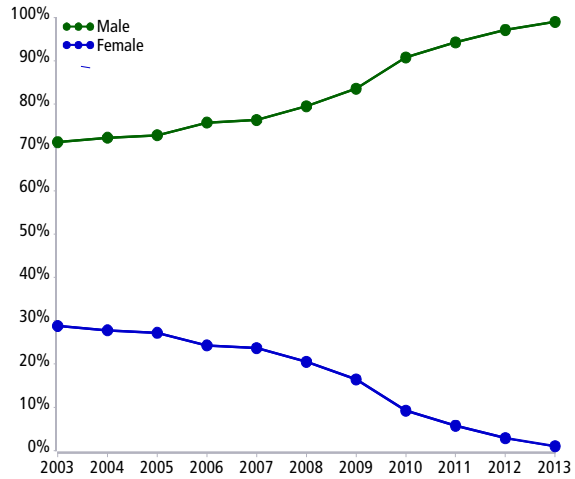
There have been 15,770 total resurfacing hip replacement procedures reported to the Registry, an additional 410 procedures compared to the last report.

The use of resurfacing hip replacement in Australia has been declining since 2005. In 2013, the number of total resurfacing procedures was 13.5% less than in 2012 and 78.6% less than 2005. Resurfacing hip replacement represented 1.3% of hip replacements performed in 2013.

The principal diagnosis is osteoarthritis (95.2%), followed by developmental dysplasia (2.4%) and osteonecrosis (1.7%).

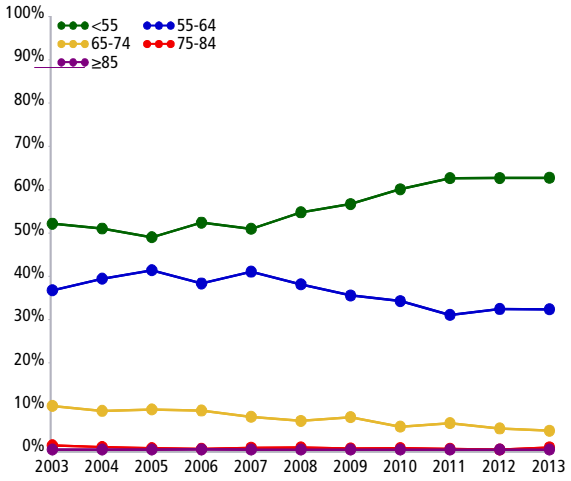
The majority of patients are male (77.4%) and in 2013 only four procedures were undertaken in females (1.0%) (Figure HT52).

Figure HT52: Primary Total Resurfacing Hip Replacement by Gender



The age of patients receiving total resurfacing hip replacment has also changed over the past 10 years (Figure HT53). The majority of procedures are now performed on patients aged less than 65 years. The proportion of those aged less than 55 years has increased from 52.2% in 2003 to 62.8% in 2013. Over the same period, the proportion of patients aged 65 years or older has declined from 11.1% to 4.8%.

Figure HT53: Primary Total Resurfacing Hip Replacement by Age



The majority of total resurfacing procedures use hybrid fixation (99.0% in 2013). This has remained stable over the past 10 years.

Of the four resurfacing prostheses used in 2013, only two were used in more than 10 procedures. The BHR remains the most used resurfacing hip prosthesis and was used in 66.6% of resurfacing procedures in 2013 (Table HT33).

Table HT33: Most Used Resurfacing Heads in Primary Total Resurfacing Hip Replacement

2003		2010		2011		2012		2013	
N	Model	N	Model	N	Model	N	Model	N	Model
1359	BHR	604	BHR	445	BHR	341	BHR	261	BHR
58	Durom	188	Mitch TRH	93	Mitch TRH	91	Adept	122	Adept
43	ASR	53	Adept	27	Adept	10	Mitch TRH	5	Icon
42	Cormet	50	Cormet	10	Cormet	7	ACCIS	4	Cormet
38	Cormet 2000 HAP	24	Durom	10	Durom	4	Cormet		
7	Conserve Plus	20	Bionik	3	Recap				
		16	Recap	2	ACCIS				
		10	Icon	2	Bionik				
Most Used									
1547	(6) 100.0%	965	(8) 100.0%	592	(8) 100.0%	453	(5) 100.0%	392	(4) 100.0%

Outcome for all Diagnoses

Primary Diagnosis

The outcomes for osteoarthritis, developmental dysplasia and osteonecrosis are listed in Table HT34. 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 HT54).

Reasons for Revision

The main reasons for revision of primary total resurfacing hip replacement are loosening/lysis (33.1%), metal related pathology (24.3%) and fracture (21.0%) (Table HT35).

The five most common reasons for revision are shown in Figure HT55. The incidence of revision for fracture increases rapidly in the first year, however after this time the incidence increases at a slower rate. Loosening/lysis shows a linear increase and at five years exceeds fracture to have the highest incidence of revision. The incidence of revision for metal related pathology continues to increase to be the second most common reason for revision after six years.

Type of Revision

The main types of revision of resurfacing hip replacement are total hip replacement (63.5%), femoral only (29.8%), and acetabular only (3.9%) (Table HT36). Since the 2011 Annual Report, revision of both the acetabular and femoral components to a total conventional hip replacement has been the most common type of revision. Revision of the femoral or acetabular component only continues to decline.

Prosthesis Types

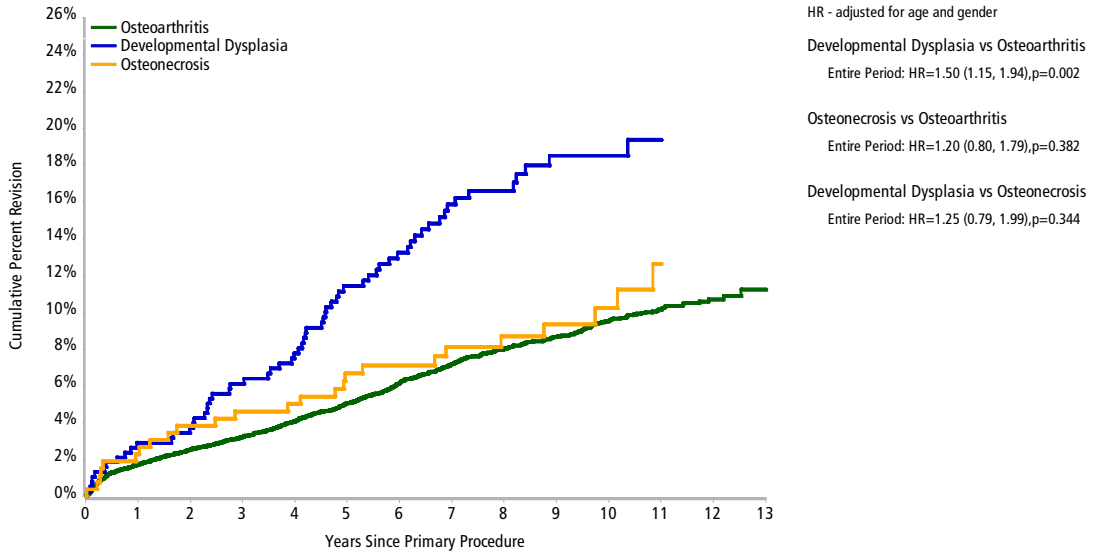
The cumulative percent revision of total resurfacing hip prostheses with more than 100 procedures are listed in Table HT37. Of the three prostheses with 10 year cumulative percent revision, the BHR resurfacing prosthesis has the lowest (6.9%). Of those with seven year data, the Adept (3.6%), Mitch TRH (3.6%) and BHR (5.0%) have the lowest cumulative percent revision.

Table HT34: 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	13 Yrs
Osteoarthritis	1067	15006	1.7 (1.5, 2.0)	3.2 (3.0, 3.5)	5.1 (4.7, 5.4)	7.2 (6.7, 7.7)	9.5 (8.9, 10.1)	11.2 (10.2, 12.4)
Developmental Dysplasia	64	380	2.9 (1.6, 5.2)	6.1 (4.1, 9.1)	11.4 (8.6, 15.1)	15.9 (12.4, 20.1)	18.5 (14.6, 23.2)	
Osteonecrosis	25	262	2.3 (1.0, 5.0)	4.6 (2.7, 8.0)	6.7 (4.2, 10.5)	8.1 (5.3, 12.3)	10.2 (6.8, 15.2)	
Other (6)	14	122	2.5 (0.8, 7.4)	5.1 (2.3, 10.9)	9.5 (5.4, 16.6)	10.5 (6.1, 17.8)		
TOTAL	**1170**	**15770**						

Note: Only Primary Diagnoses with over 100 procedures have been listed.

Figure HT54: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Primary Diagnosis



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Osteoarthritis	15006	14342	13059	10735	7715	3042	82
Developmental Dysplasia	380	365	345	304	239	110	4
Osteonecrosis	262	254	242	223	176	94	6

Table HT35: Primary Total Resurfacing Hip Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	387	33.1
Metal Related Pathology	284	24.3
Fracture	246	21.0
Infection	75	6.4
Pain	70	6.0
Osteonecrosis	32	2.7
Prosthesis Dislocation	23	2.0
Malposition	19	1.6
Other	34	2.9
TOTAL	**1170**	**100.0**

Table HT36: Primary Total Resurfacing Hip Replacement by Type of Revision

Type of Revision	Number	Percent
THR (Femoral/Acetabular)	743	63.5
Femoral Component	349	29.8
Acetabular Component	46	3.9
Cement Spacer	27	2.3
Removal of Prostheses	4	0.3
Bipolar Head and Femoral	1	0.1
TOTAL	**1170**	**100.0**

Figure HT55: Cumulative Incidence Revision Diagnosis of Primary Total Resurfacing Hip Replacement

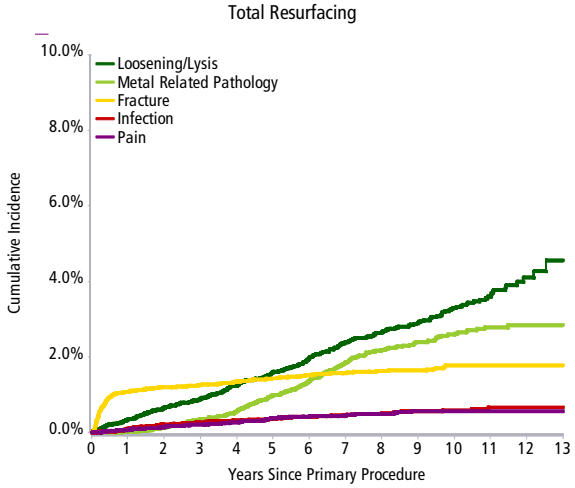


Table HT37: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Prosthesis Type

Head Component	Acetabular Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
ASR	ASR	284	1167	3.4 (2.5, 4.6)	7.2 (5.9, 8.8)	15.3 (13.3, 17.5)	23.9 (21.4, 26.6)		
Adept	Adept	16	655	1.1 (0.5, 2.3)	1.8 (0.9, 3.3)	2.3 (1.3, 4.1)	3.6 (2.1, 6.2)		
BHR	BHR	581	10750	1.4 (1.2, 1.6)	2.4 (2.2, 2.8)	3.6 (3.2, 3.9)	5.0 (4.6, 5.4)	6.9 (6.3, 7.5)	8.4 (7.4, 9.5)
Bionik	Bionik	34	200	3.5 (1.7, 7.2)	12.0 (8.2, 17.4)	16.7 (12.1, 22.9)			
Cormet	Cormet	88	626	2.1 (1.2, 3.6)	5.7 (4.1, 7.8)	10.1 (7.9, 12.8)	14.2 (11.4, 17.6)	18.7 (14.9, 23.4)	
Durom	Durom	77	847	3.2 (2.2, 4.6)	5.4 (4.1, 7.2)	7.6 (6.0, 9.6)	8.9 (7.1, 11.1)	10.3 (8.2, 12.9)	
Icon	Icon	8	118	1.7 (0.4, 6.6)	2.6 (0.8, 7.8)	4.5 (1.9, 10.4)	6.8 (3.3, 13.7)		
Mitch TRH	Mitch TRH	30	1024	1.2 (0.7, 2.1)	2.2 (1.4, 3.3)	2.8 (2.0, 4.1)	3.6 (2.4, 5.2)		
Recap	Recap	22	195	5.1 (2.8, 9.3)	8.7 (5.5, 13.7)	10.4 (6.8, 15.7)	11.7 (7.6, 17.8)		
Other (8)		30	188	5.3 (2.9, 9.7)	7.5 (4.5, 12.4)	9.8 (6.3, 15.1)	12.2 (8.2, 18.0)	17.5 (12.4, 24.4)	
TOTAL		**1170**	**15770**						

Note: Only combinations with over 100 procedures have been listed.

Outcome for Osteoarthritis

The cumulative percent revision at 13 years for primary total resurfacing hip replacement undertaken for osteoarthritis is 11.2% (Table HT38 and Figure HT56).

Age and Gender

Patients 65 years or older have a higher rate of revision compared to patients aged less than 55 years and 55-64 years for the first six months only. After six months, patients 65 years or older have a lower rate of revision, but this is only significant when compared to patients aged less than 55 years. There is no difference in the rate of revision between patients aged less than 55 years and 55-64 years (Table HT39 and Figure HT57).

Females have a higher rate of revision compared to males. After one year, the rate of revision is over three times higher for females compared to males (Table HT40 and Figure HT58). While there is no age related difference in the rate of revision for females (Table HT40 and Figure HT59), males aged 65 years or older have a higher rate of revision compared to males aged less than 65 years in the first six months only. There is no difference after this time (Table HT40 and Figure HT60).

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 HT41 and Figure HT61).

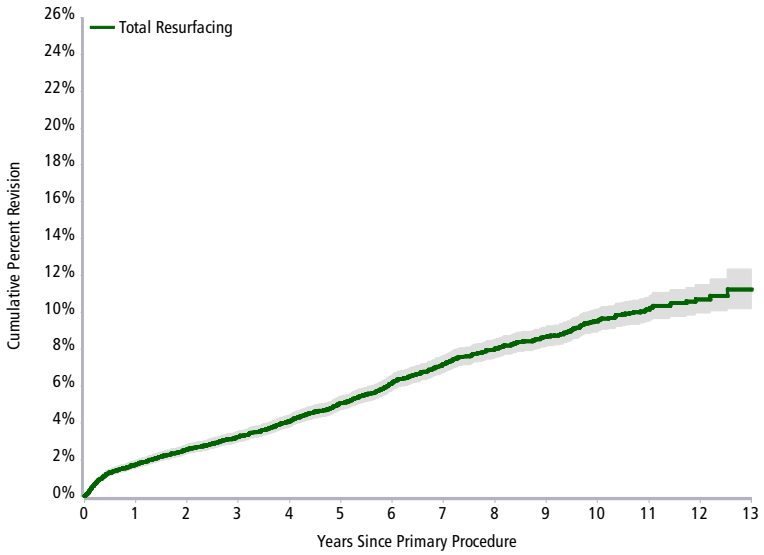
The reason for revision varies with head size. Head sizes less than 50mm have a higher cumulative incidence of loosening/lysis, metal related pathology, fracture, infection and pain compared to head sizes 50mm or larger (Figure HT62).

This effect of femoral component head size is evident within both males and females (Table HT42 and Figure HT63).

Table HT38: 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	13 Yrs
Total Resurfacing	1067	15006	1.7 (1.5, 2.0)	3.2 (3.0, 3.5)	5.1 (4.7, 5.4)	7.2 (6.7, 7.7)	9.5 (8.9, 10.1)	11.2 (10.2, 12.4)

Figure HT56: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement (Primary Diagnosis OA)

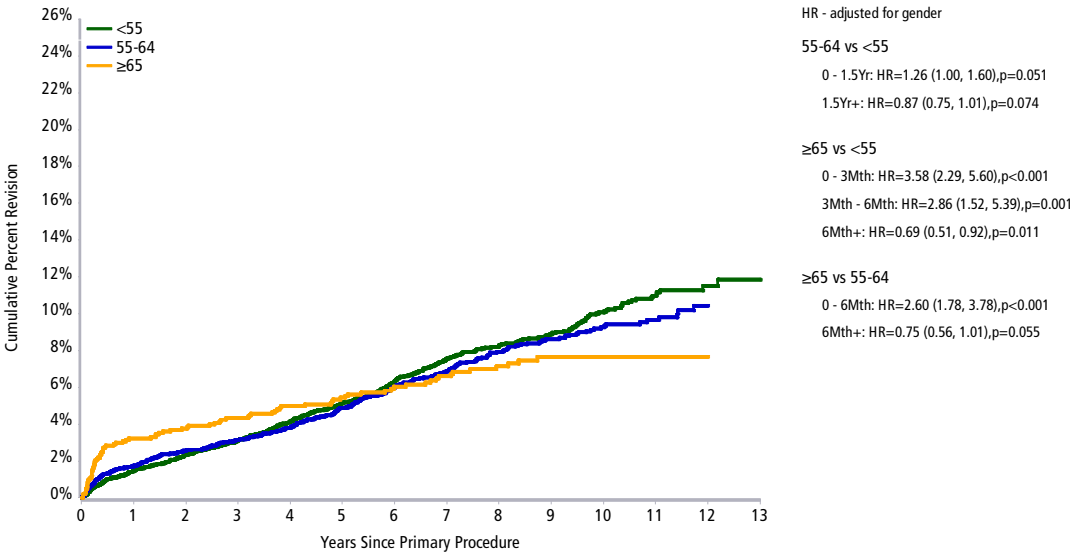


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Total Resurfacing	15006	14342	13059	10735	7715	3042	82

Table HT39: 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	13 Yrs
<55	571	7864	1.5 (1.2, 1.8)	3.1 (2.8, 3.5)	5.2 (4.7, 5.7)	7.6 (6.9, 8.3)	10.1 (9.2, 11.0)	11.8 (10.6, 13.2)
55-64	408	5800	1.7 (1.4, 2.1)	3.1 (2.7, 3.6)	4.9 (4.3, 5.5)	6.9 (6.2, 7.6)	9.3 (8.4, 10.3)	
≥65	88	1342	3.2 (2.4, 4.3)	4.3 (3.3, 5.6)	5.4 (4.3, 6.8)	6.6 (5.3, 8.2)	7.7 (6.2, 9.4)	
TOTAL	**1067**	**15006**						

Figure HT57: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Age (Primary Diagnosis OA)

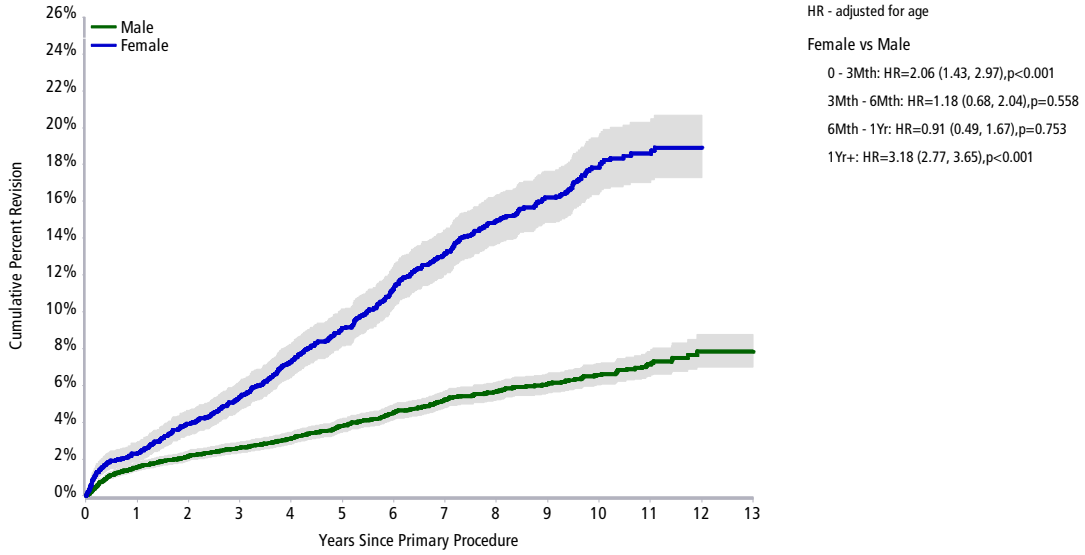


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
<55	7864	7507	6737	5423	3875	1586	53
55-64	5800	5562	5136	4295	3069	1158	25
≥65	1342	1273	1186	1017	771	298	4

Table HT40: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender and Age (Primary Diagnosis OA)

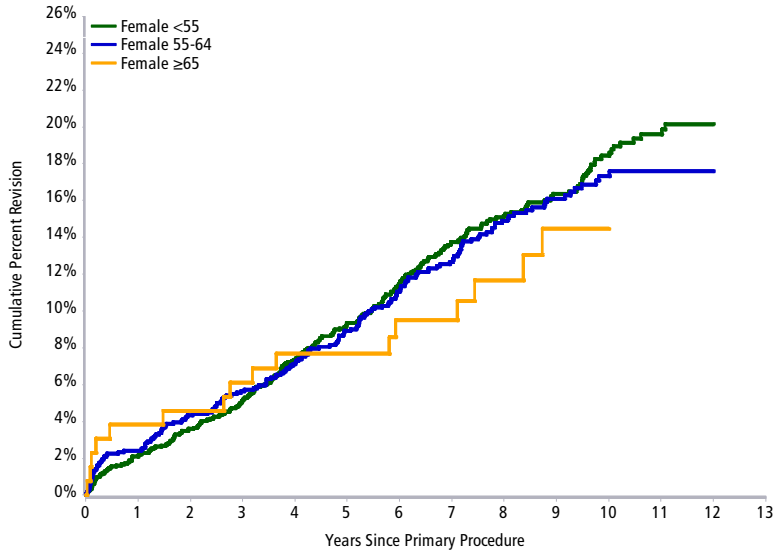
Gender by Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male	**580**	**11761**	**1.6 (1.4, 1.8)**	**2.6 (2.3, 2.9)**	**3.8 (3.5, 4.2)**	**5.2 (4.8, 5.7)**	**6.6 (6.0, 7.2)**	**7.8 (7.0, 8.8)**
Age <55	283	5997	1.3 (1.0, 1.6)	2.4 (2.1, 2.9)	3.6 (3.2, 4.2)	5.2 (4.6, 5.9)	6.6 (5.8, 7.5)	
Age 55-64	225	4553	1.6 (1.2, 2.0)	2.4 (2.0, 2.9)	3.7 (3.1, 4.3)	5.0 (4.4, 5.8)	6.5 (5.6, 7.5)	
Age ≥65	72	1211	3.2 (2.3, 4.3)	4.1 (3.1, 5.4)	5.2 (4.0, 6.6)	6.3 (5.0, 7.9)	6.8 (5.4, 8.5)	
Female	**487**	**3245**	**2.3 (1.8, 2.9)**	**5.4 (4.7, 6.2)**	**9.1 (8.2, 10.2)**	**13.1 (12.0, 14.4)**	**17.8 (16.3, 19.5)**	
Age <55	288	1867	2.1 (1.6, 2.9)	5.2 (4.3, 6.3)	9.3 (8.1, 10.8)	13.7 (12.2, 15.5)	18.4 (16.4, 20.6)	
Age 55-64	183	1247	2.4 (1.7, 3.4)	5.6 (4.5, 7.1)	8.9 (7.5, 10.7)	12.7 (10.9, 14.7)	17.3 (15.1, 19.9)	
Age ≥65	16	131	3.8 (1.6, 8.9)	6.1 (3.1, 11.8)	7.7 (4.2, 13.8)	9.5 (5.5, 16.2)	14.5 (9.0, 22.9)	

Figure HT58: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender (Primary Diagnosis OA)



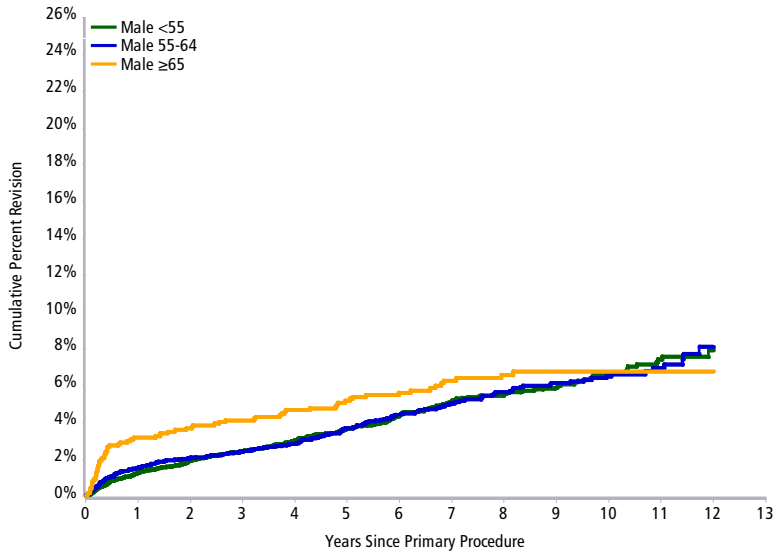
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male	11761	11179	10043	8079	5715	2199	58
Female	3245	3163	3016	2656	2000	843	24

Figure HT59: 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	13 Yrs
Female	<55	1867	1822	1740	1513	1123	473	17
	55-64	1247	1215	1155	1036	788	330	7
	≥65	131	126	121	107	89	40	0

Figure HT60: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement for Males by Age (Primary Diagnosis OA)



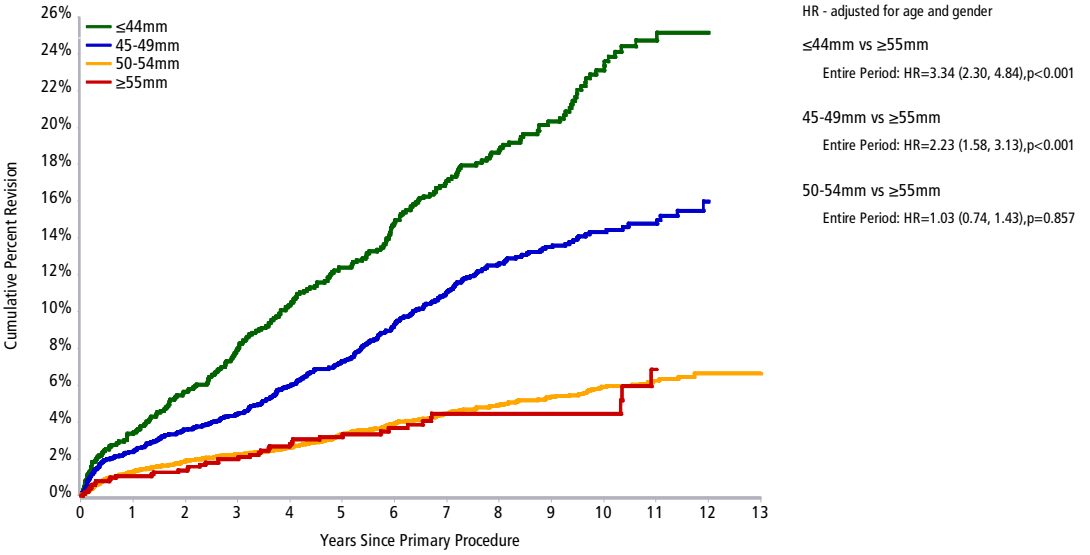
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male	<55	5997	5685	4997	3910	2752	1113	36
	55-64	4553	4347	3981	3259	2281	828	18
	≥65	1211	1147	1065	910	682	258	4

Table HT41: 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	13 Yrs
≤44mm	237	1194	3.4 (2.5, 4.6)	8.0 (6.6, 9.7)	12.4 (10.6, 14.4)	17.1 (15.0, 19.4)	23.1 (20.4, 26.1)	
45-49mm	386	3504	2.4 (2.0, 3.0)	4.5 (3.8, 5.2)	7.3 (6.5, 8.3)	11.1 (10.0, 12.3)	14.3 (12.9, 15.8)	
50-54mm	404	9271	1.3 (1.1, 1.6)	2.3 (2.0, 2.6)	3.3 (3.0, 3.8)	4.5 (4.0, 4.9)	5.9 (5.3, 6.6)	6.6 (5.9, 7.5)
≥55mm	40	1036	1.1 (0.6, 1.9)	2.0 (1.3, 3.1)	3.2 (2.2, 4.5)	4.5 (3.2, 6.2)	4.5 (3.2, 6.2)	
TOTAL	**1067**	**15005**						

Note: Excludes one procedure with unknown head size.

Figure HT61: 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	13 Yrs
≤44mm	1194	1149	1077	942	690	324	10
45-49mm	3504	3366	3102	2585	1776	655	13
50-54mm	9271	8828	7980	6543	4820	1918	53
≥55mm	1036	998	899	665	429	145	6

Figure HT62: Cumulative Incidence Revision Diagnosis of Primary Total Resurfacing Hip Replacement by Head Size (Primary Diagnosis OA)

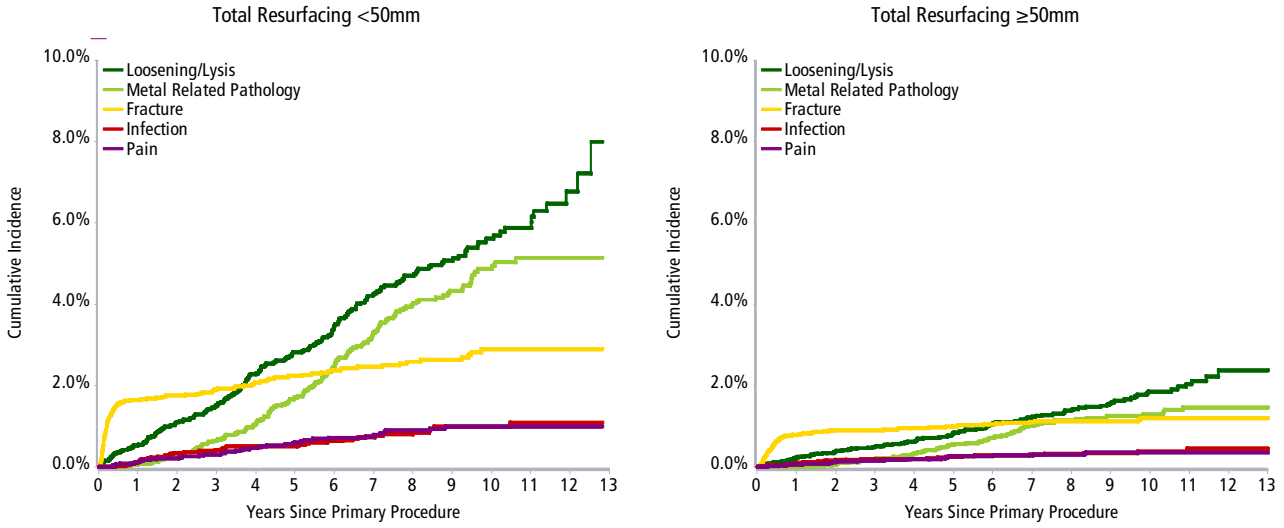
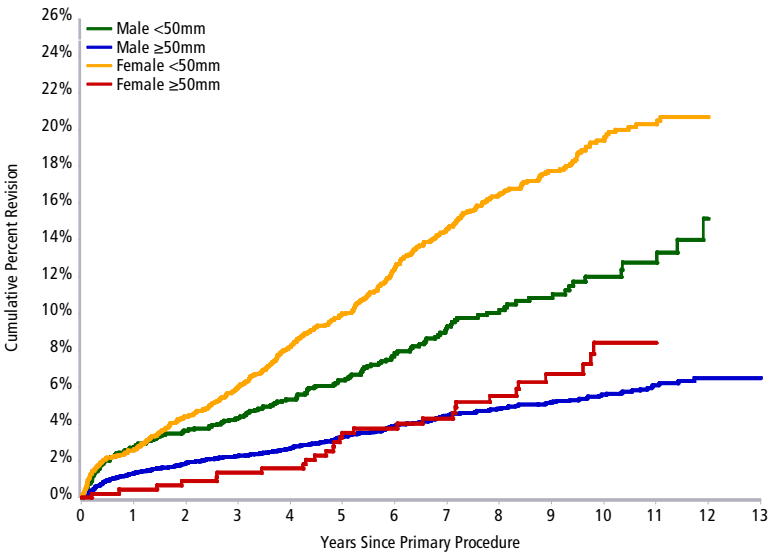


Table HT42: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender and Head Size (Primary Diagnosis OA)

Gender by Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male	**580**	**11760**	**1.6 (1.4, 1.8)**	**2.6 (2.3, 2.9)**	**3.8 (3.5, 4.2)**	**5.2 (4.8, 5.7)**	**6.6 (6.0, 7.2)**	**7.8 (7.0, 8.8)**
Head Size <50mm	164	1901	2.8 (2.1, 3.6)	4.3 (3.5, 5.4)	6.4 (5.3, 7.6)	9.3 (7.9, 10.9)	12.0 (10.2, 14.1)	
Head Size ≥50mm	416	9859	1.3 (1.1, 1.6)	2.3 (2.0, 2.6)	3.3 (3.0, 3.7)	4.5 (4.0, 4.9)	5.6 (5.0, 6.2)	6.5 (5.7, 7.4)
Female	**487**	**3245**	**2.3 (1.8, 2.9)**	**5.4 (4.7, 6.2)**	**9.1 (8.2, 10.2)**	**13.1 (12.0, 14.4)**	**17.8 (16.3, 19.5)**	
Head Size <50mm	459	2797	2.6 (2.1, 3.3)	6.0 (5.2, 7.0)	10.0 (8.9, 11.2)	14.6 (13.3, 16.0)	19.4 (17.7, 21.2)	
Head Size ≥50mm	28	448	0.4 (0.1, 1.8)	1.4 (0.6, 3.0)	3.5 (2.1, 5.8)	4.3 (2.7, 6.8)	8.4 (5.7, 12.2)	

Note: Excludes one male procedure with unknown head size.

Figure HT63: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender and Head Size (Primary Diagnosis OA)



HR - adjusted for age

Male <50mm vs Male ≥50mm

Entire Period: HR=2.16 (1.80, 2.59),p<0.001

Male ≥50mm vs Female ≥50mm

0 - 4.5Yr: HR=1.31 (0.70, 2.45),p=0.406

4.5Yr - 5Yr: HR=0.24 (0.09, 0.63),p=0.003

5Yr+: HR=0.65 (0.37, 1.15),p=0.136

Male <50mm vs Female <50mm

Entire Period: HR=0.62 (0.52, 0.75),p<0.001

Female <50mm vs Female ≥50mm

Entire Period: HR=2.89 (1.97, 4.23),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male	<50mm	1901	1798	1594	1263	789	280	3
	≥50mm	9859	9380	8448	6816	4926	1919	55
Female	<50mm	2797	2717	2585	2264	1677	699	20
	≥50mm	448	446	431	392	323	144	4

KNEE REPLACEMENT

Categories of Knee Replacement

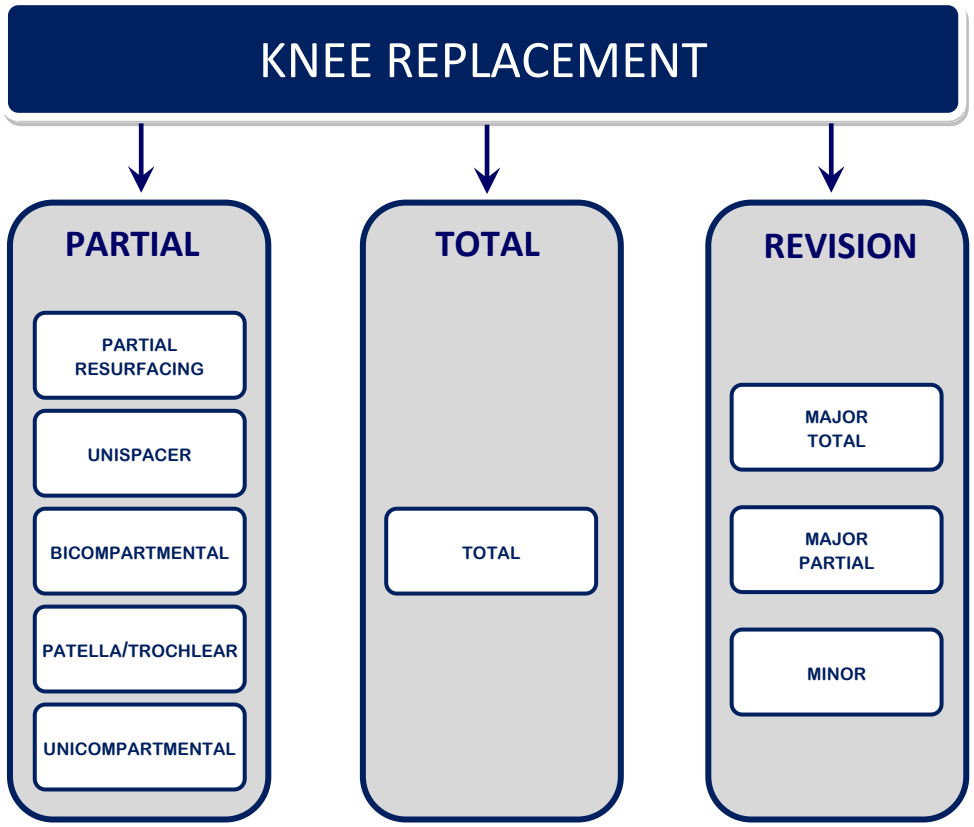
The Registry groups knee replacement into three broad categories; primary partial, primary total and revision knee replacement.

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/trochlear and unicompartmental. These are defined in the primary partial knee replacement chapter.

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 information on revision knee replacement is provided in a supplementary report available on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2014.



Use of Knee Replacement

This report analyses 480,440 knee replacements reported to the Registry with a procedure date up to and including 31 December 2013. This is an additional 51,212 knee procedures compared to the number reported last year. When considering all knee procedures currently recorded by the Registry, primary partial knees account for 9.2%, primary total knees 82.5% and revision knee replacement 8.3% (Table K1).

Table K1: Number of Knee Replacements

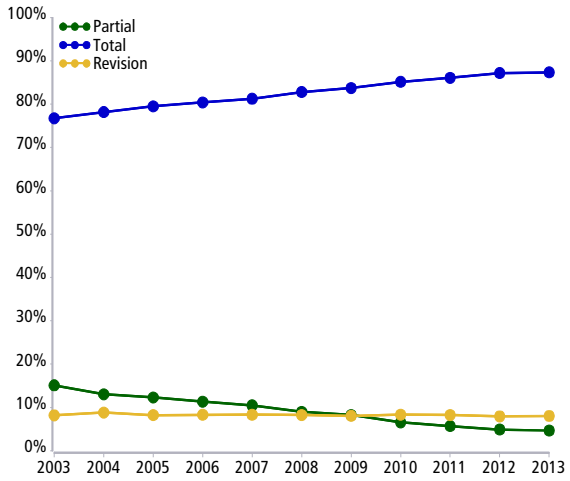
Knee Category	Number	Percent
Partial	44147	9.2
Total	396472	82.5
Revision	39821	8.3
TOTAL	**480440**	**100.0**

In 2013, the number of knee replacements undertaken increased by 1,643 (3.4%) compared to 2012. During the last year, primary partial knees decreased by 1.6%, and primary total and revision knee replacement increased by 3.6% and 4.5% respectively.

Since 2003, the number of knee replacement procedures undertaken per year has increased by 77.2%. Primary total knee replacement has increased by 101.6% and revision knee replacement by 73.8%. Primary partial knee replacement has decreased by 45.4%.

In 2013, primary total knee replacement accounted for 87.3% of all knee replacement procedures. This has increased from 76.7% in 2003. Primary partial knee replacement decreased from 15.1% in 2003 to 4.7% in 2013. The proportion of revision knee procedures has declined from a peak of 8.8% in 2004 to 8.0% in 2013. This equates to 392 less revision procedures in 2013 than would have been expected if the proportion of revision procedures had remained at 8.8% (Figure K1).

Figure K1: Proportion of Knee Replacement



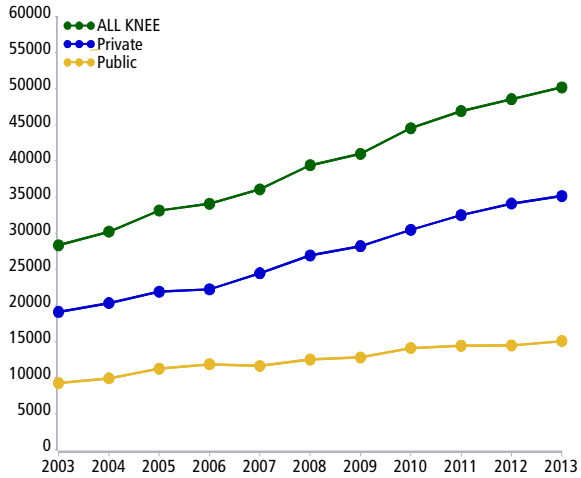
Detailed information on the demographics of knee replacement is provided in the supplementary report 'Demographics of Knee Arthroplasty' available on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2014.

Public and Private Sector

In 2013, 70.0% of all knee replacement procedures reported to the Registry were undertaken in private hospitals.

In the last year there was in increase in the number of knee replacements recorded in both the private and public sector. The private sector recorded 35,135 procedures, an increase of 3.1%, and the public sector recorded 15,049 procedures, an increase of 4.2% compared to 2012.

Figure K2: Knee Replacement by Hospital Sector



Since 2003, knee replacement has increased by 84.1% in the private sector compared to 62.9% in the public sector (Figure K2).

There were 1,972 primary partial knee replacements reported for the private sector in 2013, a decrease of 4.6% compared to 2012 and 42.2% since 2003. In the public sector, there were 362 partial knee replacements, an increase of 18.7% compared to 2012 and a decrease of 58.0% since 2003.

In 2013, 30,369 primary total knee replacements were reported in the private sector, an increase of 3.6% compared to 2012. In the public sector, there were 13,457 primary total knee replacements, an increase of 3.4% compared to 2012. Since 2003, primary total knee replacement has increased by 115.8% in the private sector compared to 75.7% in the public sector.

There were 2,794 private sector revision knee replacements reported in 2013. This is an increase of 2.7% compared to 2012. In the public sector, there were 1,230 revision knee replacements, an increase of 8.7% compared to 2012. Since 2003, revision knee replacement has increased by 75.0% in the private sector compared to 71.3% in the public sector.

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 patella prosthesis.
4. **Patella/trochlear** involves the use of a trochlear prosthesis to replace the femoral trochlear articular surface and on most occasions a patella prosthesis.
5. **Unicompartmental** procedure involves the replacement of the femoral and tibial articular surface of either the medial or lateral femorotibial compartment using unicompartmental femoral and tibial prostheses.

Use of Partial Knee Replacement

Unicompartmental knee remains the most common primary partial knee replacement, accounting for 93.4% of all partial knee replacement procedures. The second most common is the patella/trochlear replacement (5.7%). 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 (Table KP2).

Table KP1: Partial Knee Replacement by Class

Partial Knee Class	Number	Percent
Partial Resurfacing	197	0.4
Unispacer	40	0.1
Bicompartmental	165	0.4
Patella/Trochlear	2495	5.7
Unicompartmental	41250	93.4
TOTAL	**44147**	**100.0**

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 depending on the class (Table KP2).

Detailed information on demographics of each class of primary partial knee replacement is provided in the supplementary report 'Demographics of Knee Arthroplasty' available on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2014.

Table KP2: Cumulative Percent Revision of Primary Partial Knee Replacement by Partial Knee Class

Partial Knee Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Partial Resurfacing	49	197	5.5 (3.0, 10.0)	16.8 (11.9, 23.2)	25.1 (19.1, 32.7)			
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)		
Bicompartmental	21	165	6.1 (3.3, 11.0)	11.2 (7.2, 17.3)	13.8 (9.2, 20.5)			
Patella/Trochlear	396	2495	2.3 (1.8, 3.0)	8.7 (7.6, 10.0)	15.3 (13.7, 17.1)	21.3 (19.2, 23.6)	28.7 (25.7, 31.8)	
Unicompartmental	4362	41250	2.2 (2.1, 2.4)	5.9 (5.7, 6.1)	8.3 (8.1, 8.6)	10.8 (10.5, 11.2)	15.1 (14.6, 15.6)	19.1 (18.2, 20.0)
TOTAL	**4859**	**44147**						

Partial Resurfacing

The Registry has recorded 197 partial resurfacing procedures, an additional 21 procedures compared to the number reported last year.

The most common reason for undertaking a partial resurfacing procedure is osteoarthritis (87.8%). The majority of partial resurfacing procedures have been on patients aged less than 55 years (70.1%) and is undertaken slightly more frequently in males (51.3%).

In 2013, the number of partial resurfacings increased by 81.8% compared to 2012. Of these, 65.0% were undertaken in patients aged 55 years or older and 70.0% were female.

All recorded partial resurfacing procedures use the 'Hemicap' range of prostheses.

Of the 197 procedures, 153 have one cap implanted, 39 have two and five procedures have three caps implanted. Of those with one cap implanted there were 128 femoral, 10 patella, 6 tibial, 7 trochlear and 2 unknown. When two caps were implanted, there were 36 femoral/trochlear and patella, one femoral and patella, and two where both devices were used on the femoral articular surface. When three caps were implanted, four involved patella, trochlear and femoral articular surfaces and one procedure resurfaced the patella, trochlear, femoral and tibial articular surfaces.

There are 61 procedures that involve resurfacing of the patella/trochlear joint either on one side (20) or both sides (41). The three year cumulative percent revision for one side is 10.3% and 18.7% when both sides are resurfaced.

The cumulative percent revision of partial resurfacing procedures undertaken for osteoarthritis is 5.1% at one year and 26.9% at five years (Table KP3 and Figure KP1).

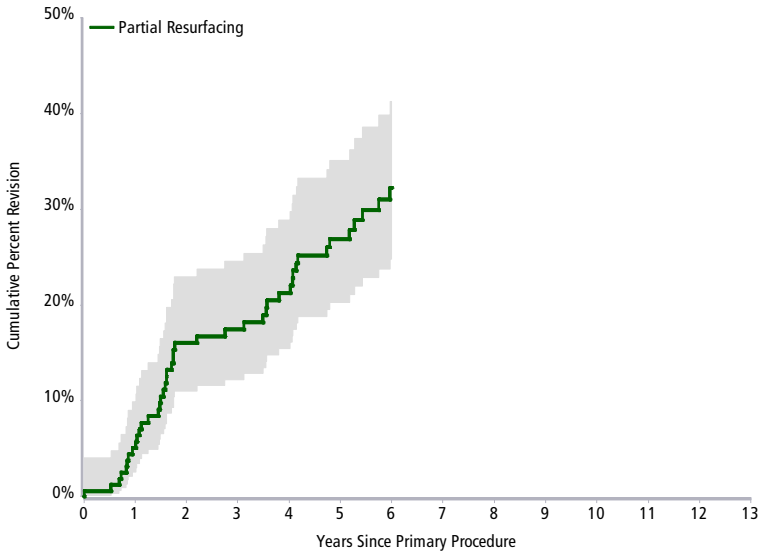
The main reasons for revision are progression of disease (57.1%), loosening (14.3%) and pain (8.2%).

Most primary partial resurfacings are revised to either total knee replacement (53.1%) or unicompartmental (26.5%). The remainder include revision to a patella/trochlear (8.2%), addition of another resurfacing component (8.2%), patella only (2.0%), or removal of the prosthesis (2.0%).

Table KP3: 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	13 Yrs
Partial Resurfacing	45	173	5.1 (2.6, 9.9)	17.4 (12.2, 24.6)	26.9 (20.3, 35.1)			

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	13 Yrs
Partial Resurfacing	173	145	114	80	30	0	0

Bicompartmental

The Registry has recorded 165 bicompartmental procedures. There have been no further procedures recorded since July 2012.

The principal diagnosis for bicompartmental knee replacement is osteoarthritis (97.0%). It is used more frequently in females (60.6%) and 55.8% of patients are aged less than 65 years at the time of surgery.

The bicompartmental knee replacement is a single company product. One femoral component, the Journey Deuce, has been combined with two different tibial components, the Journey (32.1%) and the Journey Deuce (67.3%). The majority of primary bicompartmental procedures include resurfacing of the patella (84.2%).

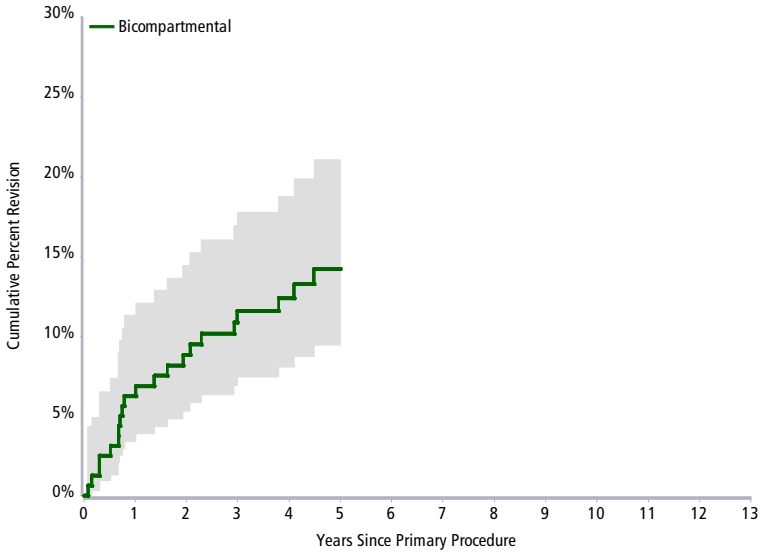
The cumulative percent revision of bicompartmental knee replacement when undertaken for osteoarthritis is 6.2% at one year and 14.2% at five years (Table KP4 and Figure KP2).

The main reasons for revision are pain (23.8%), and patellofemoral pain (19.0%). Of the 21 revisions, 10 have been revised to a total knee replacement and nine involve addition of a patella prosthesis (one is combined with a unicompartmental tibial insert). The remaining two revisions involve a cement spacer and replacement of the unicompartmental tibial component.

Table KP4: Cumulative Percent Revision of Primary Bicompartmental Knee Replacement (Primary Diagnosis OA)

Knee Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Bicompartmental	21	160	6.2 (3.4, 11.3)	11.6 (7.4, 17.8)	14.2 (9.5, 21.1)			

Figure KP2: Cumulative Percent Revision of Primary Bicompartmental Knee Replacement (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Bicompartmental	160	150	123	74	3	0	0

Patella/Trochlear

Demographics

There have been 2,495 patella/trochlear knee replacements reported to the Registry. This is an additional 245 procedures compared to the previous report.

The principal diagnosis for patella/trochlear procedures is osteoarthritis (98.8%). This procedure is most frequently undertaken in females (76.6%) and patients less than 65 years of age (68.6%) (Figures KP3 and KP4).

Figure KP3: Primary Patella/Trochlear Knee Replacement by Gender

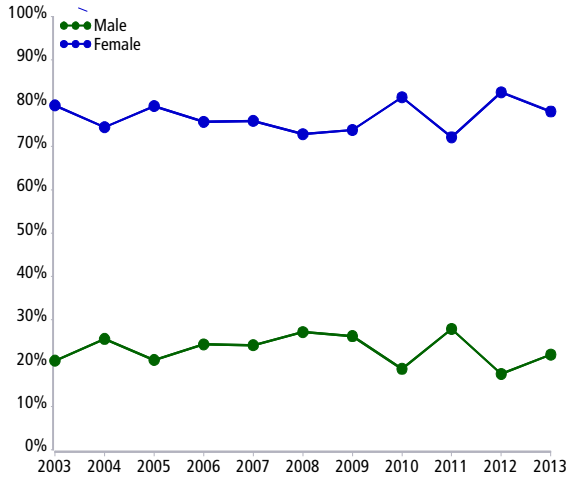
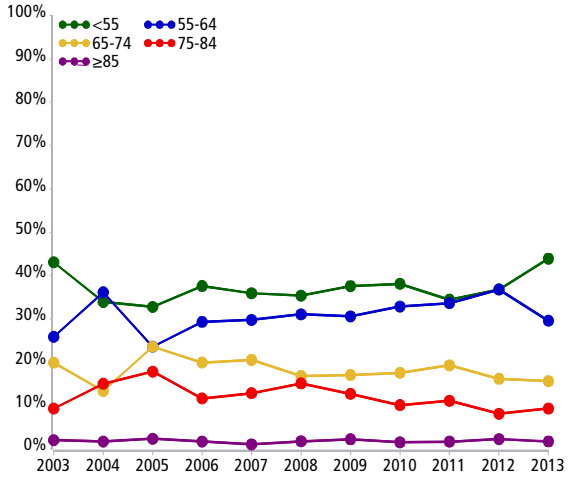


Figure KP4: Primary Patella/Trochlear Knee Replacement by Age



In 2013, the four most common patella/trochlear prostheses were the Gender Solutions, RBK, Competitor, 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 KP5).

Table KP5: Most Used Resurfacing Trochlear Prostheses in Primary Patella/Trochlear Knee Replacement

2003		2010		2011		2012		2013	
N	Model	N	Model	N	Model	N	Model	N	Model
56	LCS	82	Gender Solutions	71	Gender Solutions	84	Gender Solutions	91	Gender Solutions
43	Avon	71	Avon	65	Competitor	46	Competitor	44	RBK
29	Lubinus	50	RBK	43	RBK	41	Avon	40	Competitor
13	Themis	48	Competitor	38	Avon	37	RBK	26	Avon
9	MOD III	16	Sigma HP	15	Sigma HP	12	Sigma HP	19	Sigma HP
1	RBK	1	Vanguard	12	Vanguard	3	Vanguard	14	Vanguard
								3	HLS Kneetec
Most Used									
151	(6) 100.0%	268	(6) 100.0%	244	(6) 100.0%	223	(6) 100.0%	237	(7) 100.0%

Outcome for all Diagnoses

The Registry has recorded 396 revisions of primary patella/trochlear knee replacement.

The most common reason for revision is progression of disease (43.7%), followed by loosening/lysis (20.5%) and pain (13.4%) (Table KP6).

A primary patella/trochlear procedure is usually revised to a total knee replacement (81.8%) (Table KP7).

The outcomes of patella/trochlear prostheses with more than 20 procedures are presented in Table KP8.

Table KP6: Primary Patella/Trochlear Knee Replacement by Reason for Revision

Reason for Revision	Number	Percent
Progression Of Disease	173	43.7
Loosening/Lysis	81	20.5
Pain	53	13.4
Implant Breakage Patella	16	4.0
Wear Patella	15	3.8
Malalignment	11	2.8
Infection	11	2.8
Other	36	9.1
TOTAL	**396**	**100.0**

Table KP7: Primary Patella/Trochlear Knee Replacement by Type of Revision

Type of Revision	Number	Percent
TKR (Tibial/Femoral)	324	81.8
Patella Only	48	12.1
Patella/Trochlear Resurfacing	17	4.3
UKR (Uni Tibial/Uni Femoral)	4	1.0
Removal of Prostheses	2	0.5
Cement Spacer	1	0.3
TOTAL	**396**	**100.0**

Table KP8: Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement by Prosthesis Type

Resurfacing Trochlear	Patella Prosthesis	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Avon	Avon	35	294	0.7 (0.2, 2.8)	7.2 (4.6, 11.2)	12.9 (9.0, 18.4)	18.2 (12.8, 25.4)		
Avon	Kinemax Plus	66	307	2.0 (0.9, 4.3)	4.9 (3.0, 8.0)	12.1 (8.8, 16.4)	18.8 (14.6, 24.1)	23.4 (18.5, 29.4)	
Avon	Triathlon	0	33	0.0 (0.0, 0.0)					
Competitor	Genesis II	24	326	1.4 (0.5, 3.6)	6.9 (4.3, 11.0)	11.5 (7.6, 17.3)			
Gender Solutions	Nexgen	11	348	1.7 (0.7, 4.1)	5.3 (2.9, 9.8)				
LCS	LCS	123	395	3.5 (2.1, 5.9)	11.7 (8.9, 15.3)	20.9 (17.2, 25.4)	29.5 (25.0, 34.6)		
Lubinus	Duracon	19	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)	24.7 (15.9, 37.1)	
Lubinus	Lubinus	15	39	5.1 (1.3, 19.0)	18.1 (9.1, 34.3)	20.9 (11.0, 37.6)	27.0 (15.5, 44.6)	33.2 (20.3, 51.3)	
MOD III	MOD III	19	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)	27.0 (17.4, 40.5)	43.9 (27.5, 64.5)
RBK	RBK	42	363	2.4 (1.2, 4.7)	9.3 (6.4, 13.3)	15.1 (11.0, 20.3)	18.8 (13.8, 25.4)		
Sigma HP	PFC Sigma	12	87	3.9 (1.3, 11.8)	17.0 (9.4, 29.7)				
Themis	Themis	6	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)	23.3 (9.3, 51.3)	
Vanguard	Series A	7	37	4.0 (0.6, 25.2)	24.0 (10.6, 48.9)				
Other (25)		17	88	3.6 (1.2, 10.8)	12.9 (7.1, 22.7)	15.1 (8.5, 25.9)	27.4 (16.5, 43.5)	31.7 (19.3, 49.3)	
TOTAL		**396**	**2495**						

Note: Only combinations with over 20 procedures have been listed.

Outcome for Osteoathritis

The cumulative percent revision for primary patella/trochlear knee replacement undertaken for osteoarthritis is 15.3% at five years and 28.6% at 10 years (Table KP9 and Figure KP5).

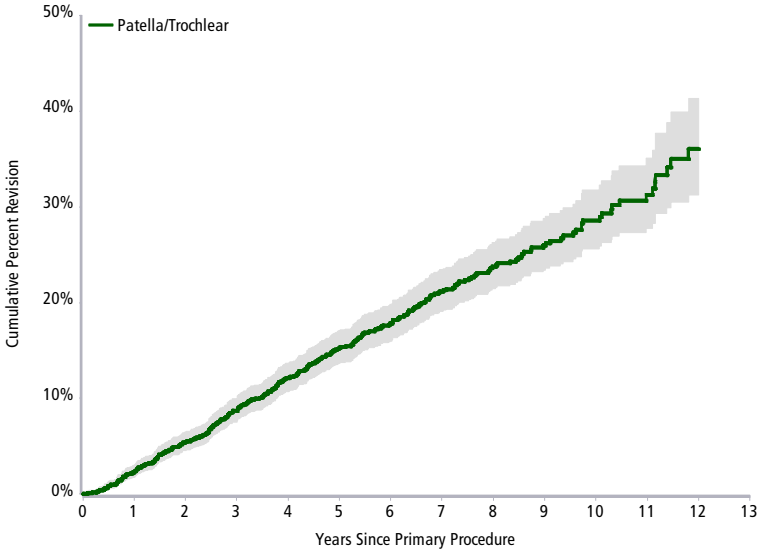
Age and gender are risk factors for revision. Patients younger than 65 years of age have a higher rate of revision than patients 65 years or older (Table KP10 and Figure KP6).

Males have a higher rate of revision than females (Table KP11 and Figure KP7).

Table KP9: Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement (Primary Diagnosis OA)

Knee Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Patella/Trochlear	389	2466	2.3 (1.8, 3.0)	8.7 (7.5, 10.0)	15.3 (13.6, 17.1)	21.2 (19.1, 23.4)	28.6 (25.6, 31.8)	

Figure KP5: Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement (Primary Diagnosis OA)

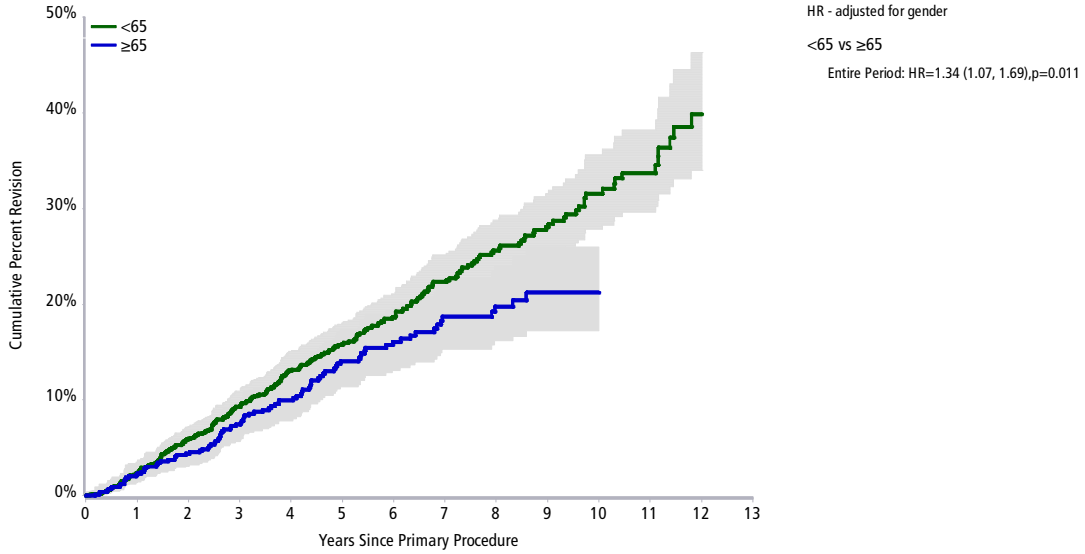


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Patella/Trochlear	2466	2173	1574	1025	629	195	17

Table KP10: Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
<65	289	1687	2.4 (1.7, 3.3)	9.3 (7.9, 10.9)	15.8 (13.9, 18.1)	22.3 (19.8, 25.1)	31.5 (27.9, 35.6)	
≥65	100	779	2.2 (1.3, 3.5)	7.4 (5.7, 9.7)	14.0 (11.4, 17.3)	18.7 (15.3, 22.7)	21.2 (17.2, 25.9)	
TOTAL	**389**	**2466**						

Figure KP6: Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement by Age (Primary Diagnosis OA)

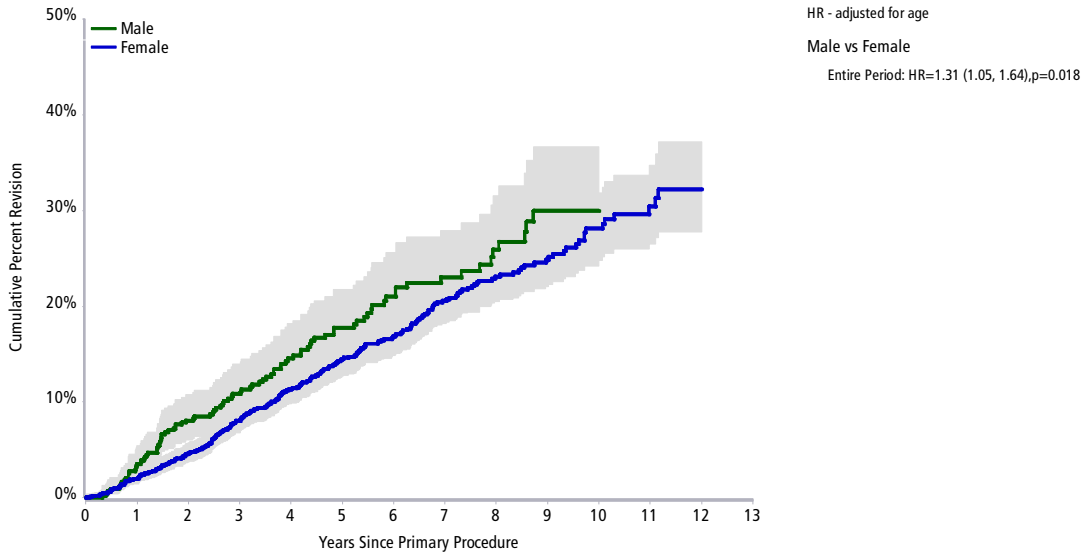


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
<65	1687	1479	1074	695	430	139	16
≥65	779	694	500	330	199	56	1

Table KP11: Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement by Gender (Primary Diagnosis OA)

Gender	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male	106	579	3.5 (2.3, 5.5)	10.8 (8.4, 13.9)	17.7 (14.4, 21.7)	23.0 (18.9, 27.9)	29.9 (24.2, 36.7)	
Female	283	1887	2.0 (1.4, 2.7)	8.0 (6.8, 9.5)	14.5 (12.7, 16.5)	20.6 (18.2, 23.2)	28.1 (24.8, 31.8)	
TOTAL	**389**	**2466**						

Figure KP7: Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement by Gender (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male	579	506	359	231	132	40	4
Female	1887	1667	1215	794	497	155	13

Unicompartmental

Demographics

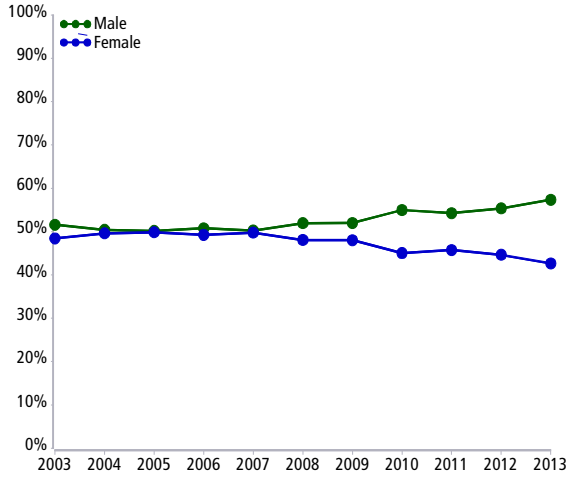
This year the Registry is reporting on 41,250 unicompartmental knee procedures, an additional 2,148 procedures compared to the last report.

The use of unicompartmental knee replacement continues to decline. In 2013, the number of unicompartmental knee procedures decreased by 2.7% compared to 2012 and 49.5% compared to 2003. As a percentage of all knee replacement, unicompartmental has decreased from 14.5% in 2003 to 4.1% in 2013.

Osteoarthritis is the principal diagnosis, accounting for 98.9% of primary unicompartmental knee replacement.

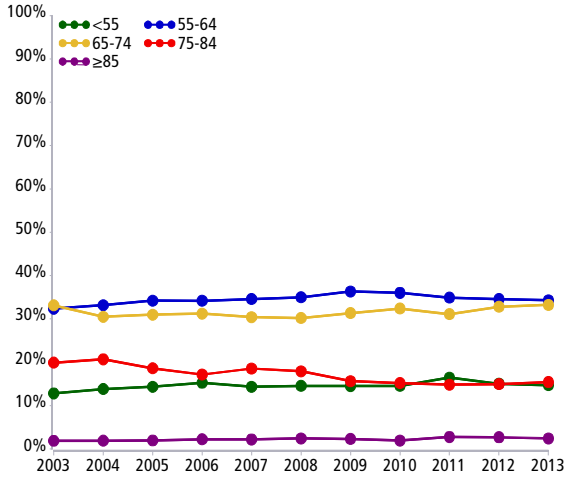
There continues to be a higher proportion of males undergoing unicompartmental knee replacement. This proportion has increased by 7.1% since 2007 (Figure KP8).

Figure KP8: Primary Unicompartmental Knee Replacement by Gender



Unicompartmental knee replacement is most frequently undertaken in patients aged between 55 and 74 years (65.5%). The age distribution has remained relatively stable since 2003 (Figure KP9).

Figure KP9: Primary Unicompartmental Knee Replacement by Age



In 2013, the 10 most used prostheses accounted for 93.3% of all unicompartmental procedures. This proportion has increased by 4.7% compared to 2012. The ZUK, Oxford and Oxford 3 remain the most used prostheses in 2013. The Oxford is a cementless unicompartmental knee prosthesis introduced in 2007 and reported separately from the Oxford 3 (Table KP12).

Table KP12: 10 Most Used Tibial Prostheses in Primary Unicompartmental Knee Replacement

2003		2010		2011		2012		2013	
N	Model	N	Model	N	Model	N	Model	N	Model
1366	Oxford 3	602	Oxford 3	514	ZUK	487	ZUK	557	ZUK
444	Repicci II	552	ZUK	513	Oxford 3	419	Oxford	482	Oxford
373	Preservation Fixed	354	Oxford	370	Oxford	387	Oxford 3	381	Oxford 3
353	M/G	273	Unix	291	Unix	208	Unix	160	Unix
336	Allegretto Uni	102	Freedom PKR/Active	108	Sigma HP	89	Repicci II	95	Sigma HP
321	GRU	93	Genesis	75	Freedom PKR/Active	69	Sigma HP	65	Repicci II
275	Genesis	83	Repicci II	72	Repicci II	68	Freedom PKR/Active	64	Journey Deuce
260	Unix	81	GRU	71	Journey	64	Journey Deuce	62	Freedom PKR/Active
121	Preservation Mobile	79	Allegretto Uni	69	GRU	55	GRU	37	Endo-Model Sled
101	Endo-Model Sled	64	Sigma HP	61	Genesis	46	Journey	35	BalanSys Uni Fixed
10 Most Used									
3950	(10) 96.1%	2283	(10) 87.3%	2144	(10) 89.0%	1892	(10) 88.6%	1938	(10) 93.3%
Remainder									
159	(7) 3.9%	333	(15) 12.7%	265	(10) 11.0%	243	(12) 11.4%	139	(10) 6.7%
TOTAL									
4109	(17) 100.0%	2616	(25) 100.0%	2409	(20) 100.0%	2135	(22) 100.0%	2077	(20) 100.0%

Outcome for all Diagnoses

The Registry has recorded 4,362 revisions of primary unicompartmental knee replacements.

The main reasons for revision are loosening/lysis (45.3%), progression of disease (26.8%) and pain (10.3%) (Table KP13 and Figure KP10).

The main type of revision is to a total knee replacement (86.0%) (Tables KP14).

The type of prosthesis used is a risk factor for revision. Outcomes of unicompartmental knee prostheses with more than 200 procedures reported to the Registry are presented in Table KP15.

Table KP13: Primary Unicompartmental Knee Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	1978	45.3
Progression Of Disease	1168	26.8
Pain	450	10.3
Infection	177	4.1
Fracture	104	2.4
Bearing Dislocation	89	2.0
Malalignment	51	1.2
Wear Tibial Insert	42	1.0
Instability	40	0.9
Wear Tibial	39	0.9
Other	224	5.1
TOTAL	**4362**	**100.0**

Table KP14: Primary Unicompartmental Knee Replacement by Type of Revision

Type of Revision	Number	Percent
TKR (Tibial/Femoral)	3750	86.0
Uni Insert Only	256	5.9
Uni Tibial Component	176	4.0
Uni Femoral Component	64	1.5
UKR (Uni Tibial/Uni Femoral)	57	1.3
Cement Spacer	36	0.8
Removal of Prostheses	7	0.2
Patella/Trochlear Resurfacing	6	0.1
Reinsertion of Components	5	0.1
Cement Only	2	0.0
Patella Only	2	0.0
Femoral Component*	1	0.0
TOTAL	**4362**	**100.0**

*Bicompartmental Component

Figure KP10: Cumulative Incidence Revision Diagnosis of Primary Unicompartmental Knee Replacement

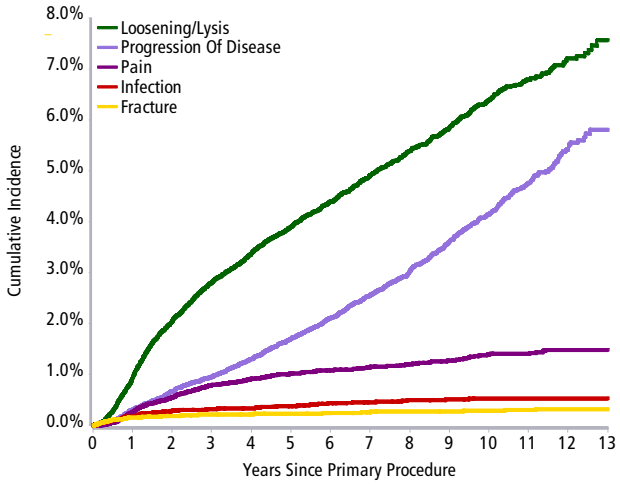


Table KP15: Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Prosthesis Type

Uni Femoral	Uni Tibial	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Allegretto Uni	Allegretto Uni	261	2031	3.1 (2.4, 4.0)	5.7 (4.8, 6.8)	7.9 (6.8, 9.2)	10.2 (8.9, 11.7)	14.7 (13.0, 16.6)	19.7 (16.9, 22.9)
BalanSys Uni	BalanSys Uni Fixed	14	324	2.0 (0.9, 4.4)	2.7 (1.4, 5.4)	4.2 (2.3, 7.6)	5.7 (3.2, 9.8)		
Endo-Model Sled	Endo-Model Sled	117	1108	1.1 (0.6, 1.9)	4.9 (3.8, 6.4)	8.0 (6.4, 9.8)	9.6 (7.9, 11.7)	17.1 (13.5, 21.5)	
Freedom PKR/Active	Freedom PKR/Active	195	1405	1.7 (1.1, 2.5)	7.5 (6.2, 9.1)	13.0 (11.2, 15.1)	17.7 (15.4, 20.3)		
GRU	GRU	171	1968	1.4 (1.0, 2.0)	4.6 (3.7, 5.6)	6.3 (5.3, 7.6)	8.1 (6.9, 9.5)	12.4 (10.6, 14.6)	
Genesis	Genesis	261	1864	2.7 (2.0, 3.5)	8.2 (7.1, 9.6)	10.8 (9.5, 12.4)	13.1 (11.6, 14.8)	17.0 (15.0, 19.2)	
M/G	M/G	207	2135	1.6 (1.1, 2.2)	4.1 (3.4, 5.1)	6.4 (5.4, 7.6)	8.1 (7.0, 9.4)	10.5 (9.2, 12.1)	14.0 (11.8, 16.5)
Oxford	Oxford 3	6	340	2.0 (0.8, 4.8)	2.9 (1.2, 6.7)				
Oxford 3	Oxford	78	1844	3.2 (2.5, 4.2)	5.1 (4.0, 6.4)				
Oxford 3	Oxford 3	1405	11933	2.2 (2.0, 2.5)	5.9 (5.5, 6.4)	8.5 (8.0, 9.1)	11.2 (10.6, 11.8)	14.8 (14.0, 15.6)	18.3 (17.0, 19.7)
Preservation	Preservation Fixed	311	2318	2.4 (1.9, 3.1)	7.1 (6.1, 8.2)	9.5 (8.3, 10.8)	11.9 (10.6, 13.3)	15.8 (14.2, 17.7)	
Preservation	Preservation Mobile	110	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)	27.6 (23.4, 32.5)	
Repicci II	Repicci II	416	2944	1.6 (1.2, 2.1)	4.5 (3.8, 5.3)	7.5 (6.5, 8.5)	10.6 (9.4, 11.9)	17.7 (16.0, 19.4)	
Sigma HP	Sigma HP	14	442	1.6 (0.7, 3.5)	3.6 (2.0, 6.3)	5.5 (2.9, 10.1)			
Uniglide	Uniglide	107	727	4.9 (3.5, 6.8)	11.1 (9.0, 13.7)	13.1 (10.8, 15.9)	15.8 (13.1, 19.0)	19.0 (15.5, 23.2)	
Unix	Unix	300	3583	2.4 (1.9, 2.9)	5.4 (4.7, 6.2)	7.2 (6.4, 8.2)	9.2 (8.1, 10.3)	12.1 (10.7, 13.7)	
ZUK	ZUK	147	3842	1.4 (1.1, 1.8)	3.8 (3.2, 4.6)	4.8 (4.0, 5.7)	5.8 (4.8, 7.0)		
Other (32)		242	2042	3.3 (2.6, 4.2)	8.4 (7.2, 9.8)	10.6 (9.2, 12.2)	14.6 (12.8, 16.7)	20.3 (17.6, 23.3)	
TOTAL		**4362**	**41250**						

Note: Only combinations with over 200 procedures have been listed.

Outcome for Osteoarthritis

The cumulative percent revision at 13 years of primary unicompartmental knee replacement undertaken for osteoarthritis is 19.1% (Table KP16 and Figure KP11).

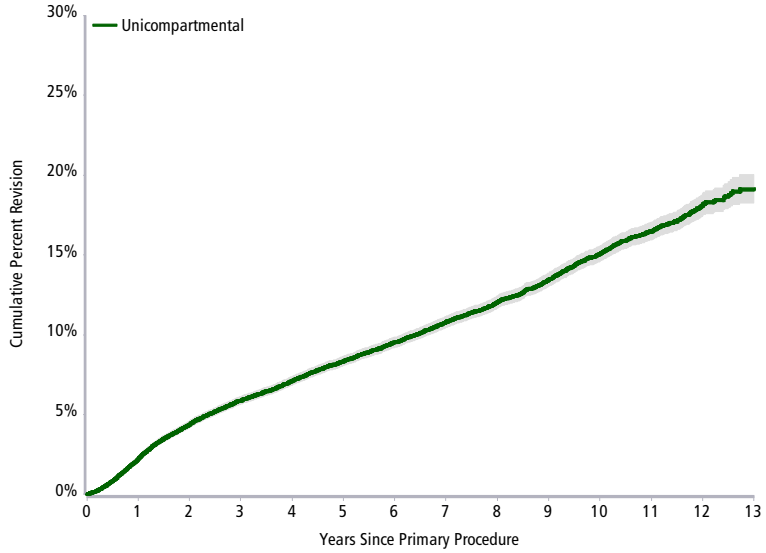
Age is a major factor affecting the outcome of primary unicompartmental knee replacement with the rate of revision decreasing with increasing age (Table KP17 and Figure KP12).

Females have a higher rate of revision, and the effect of age on the rate of revision is evident within both males and females (Table KP18 and Figures KP13-KP15).

Table KP16: 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	13 Yrs
Unicompartmental	4310	40809	2.2 (2.1, 2.4)	5.9 (5.6, 6.1)	8.3 (8.1, 8.6)	10.8 (10.5, 11.2)	15.1 (14.6, 15.5)	19.1 (18.2, 20.0)

Figure KP11: Cumulative Percent Revision of Primary Unicompartmental Knee Replacement (Primary Diagnosis OA)

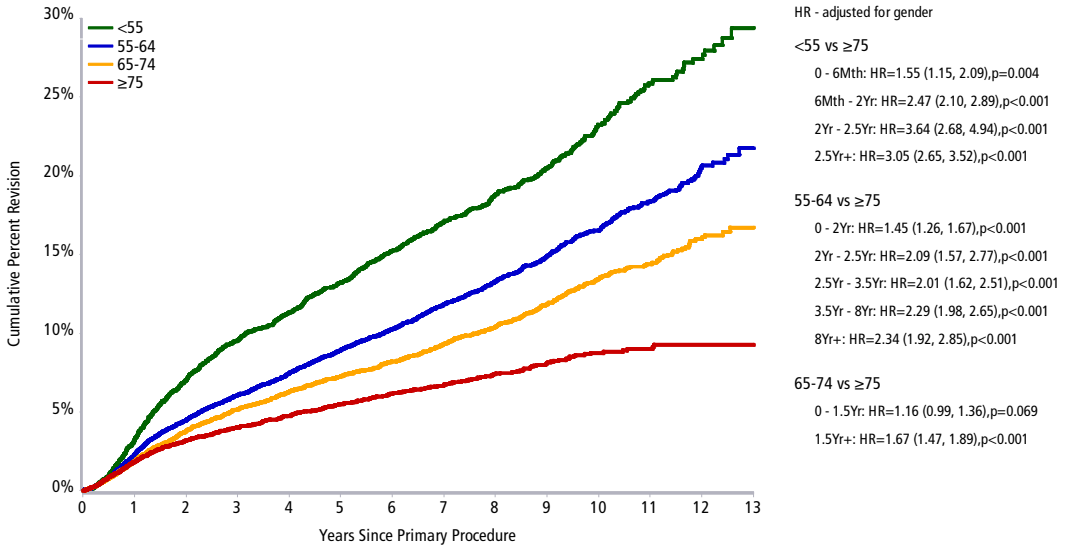


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Unicompartmental	40809	37715	31481	24848	17768	7552	350

Table KP17: 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	13 Yrs
<55	978	5843	3.3 (2.9, 3.8)	9.6 (8.8, 10.4)	13.2 (12.3, 14.2)	17.1 (16.1, 18.3)	23.3 (21.8, 24.8)	29.4 (26.8, 32.1)
55-64	1611	13772	2.3 (2.1, 2.6)	6.1 (5.7, 6.5)	8.9 (8.4, 9.5)	11.8 (11.2, 12.5)	16.5 (15.7, 17.4)	21.7 (20.1, 23.5)
65-74	1219	13018	1.9 (1.7, 2.2)	5.2 (4.8, 5.6)	7.3 (6.8, 7.8)	9.3 (8.8, 9.9)	13.5 (12.7, 14.3)	16.7 (15.4, 18.1)
≥75	502	8176	1.8 (1.6, 2.1)	4.0 (3.6, 4.5)	5.5 (5.0, 6.1)	6.7 (6.1, 7.4)	8.7 (7.9, 9.6)	9.3 (8.4, 10.3)
TOTAL	**4310**	**40809**						

Figure KP12: Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Age (Primary Diagnosis OA)

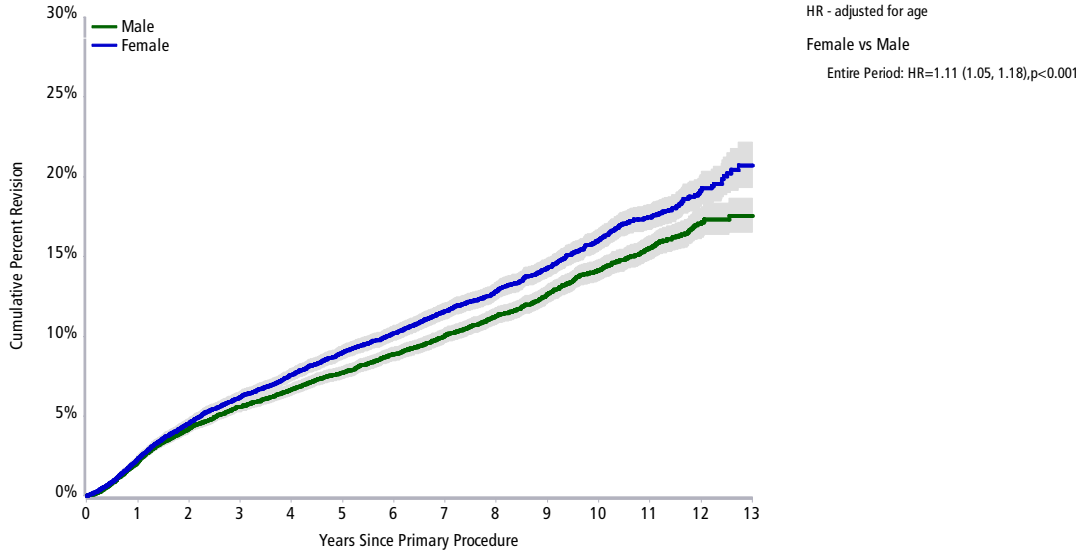


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
<55	5843	5356	4338	3427	2454	1050	56
55-64	13772	12739	10705	8419	6018	2541	114
65-74	13018	12059	10127	8082	5919	2656	132
≥75	8176	7561	6311	4920	3377	1305	48

Table KP18: Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Gender and Age (Primary Diagnosis OA)

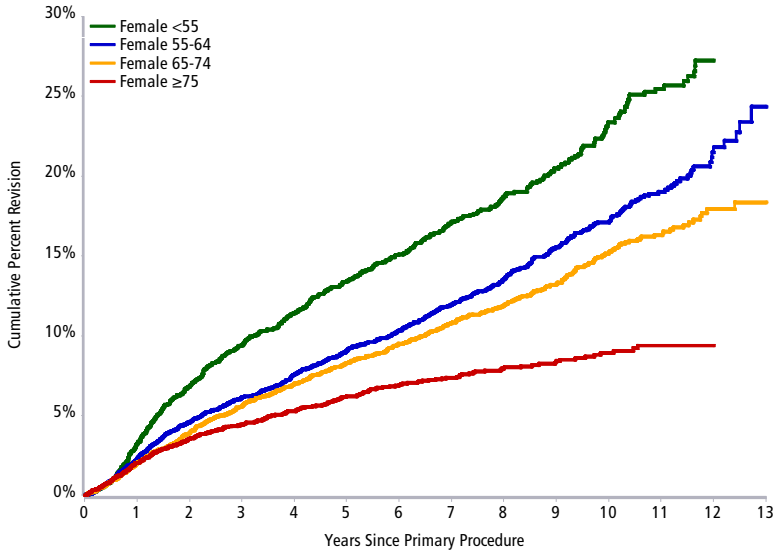
Gender	Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male		**2063**	**21337**	**2.1 (2.0, 2.3)**	**5.6 (5.3, 5.9)**	**7.7 (7.3, 8.1)**	**10.1 (9.6, 10.5)**	**14.1 (13.5, 14.8)**	**17.5 (16.5, 18.6)**
	<55	422	2550	3.4 (2.8, 4.2)	9.8 (8.6, 11.0)	13.0 (11.6, 14.4)	17.1 (15.5, 18.9)	23.1 (21.0, 25.4)	
	55-64	813	7233	2.3 (2.0, 2.7)	6.0 (5.5, 6.6)	8.8 (8.2, 9.6)	11.7 (10.9, 12.6)	15.9 (14.8, 17.1)	19.7 (18.0, 21.4)
	65-74	590	7238	1.8 (1.5, 2.1)	4.8 (4.3, 5.4)	6.4 (5.8, 7.0)	8.1 (7.4, 8.8)	12.0 (11.0, 13.0)	15.3 (13.5, 17.4)
	≥75	238	4316	1.7 (1.3, 2.1)	3.6 (3.1, 4.3)	4.8 (4.2, 5.6)	6.1 (5.3, 7.0)	8.7 (7.5, 10.0)	
Female		**2247**	**19472**	**2.3 (2.1, 2.6)**	**6.2 (5.8, 6.5)**	**9.0 (8.6, 9.4)**	**11.6 (11.1, 12.1)**	**16.0 (15.3, 16.7)**	**20.7 (19.3, 22.2)**
	<55	556	3293	3.2 (2.7, 3.9)	9.4 (8.4, 10.5)	13.4 (12.2, 14.7)	17.1 (15.7, 18.7)	23.4 (21.5, 25.4)	
	55-64	798	6539	2.3 (2.0, 2.7)	6.1 (5.6, 6.8)	9.1 (8.3, 9.8)	12.0 (11.1, 12.9)	17.1 (15.9, 18.4)	24.3 (21.3, 27.8)
	65-74	629	5780	2.1 (1.7, 2.5)	5.6 (5.0, 6.2)	8.3 (7.6, 9.1)	10.8 (9.9, 11.7)	15.2 (14.0, 16.5)	18.4 (16.6, 20.3)
	≥75	264	3860	2.0 (1.6, 2.5)	4.4 (3.8, 5.2)	6.2 (5.4, 7.1)	7.4 (6.5, 8.3)	8.9 (7.9, 10.1)	

Figure KP13: 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	13 Yrs
Male	21337	19601	16166	12649	8979	3819	179
Female	19472	18114	15315	12199	8789	3733	171

Figure KP14: Cumulative Percent Revision of Primary Unicompartmental Knee Replacement for Females by Age (Primary Diagnosis OA)



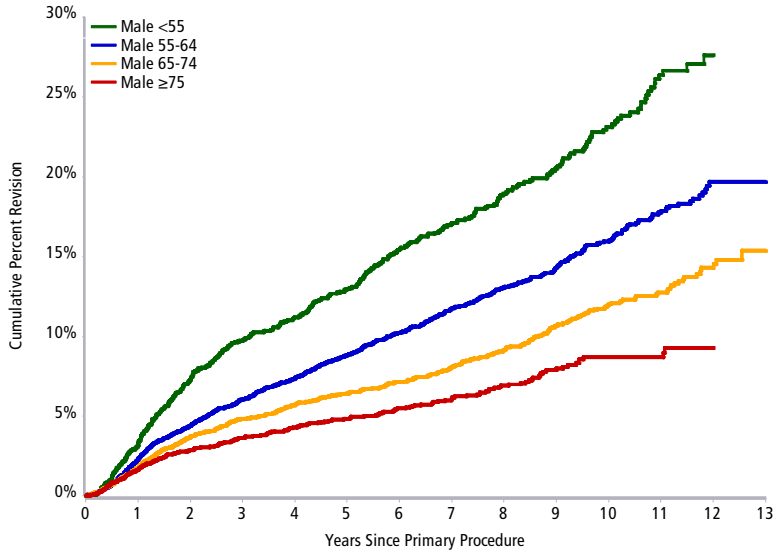
Female <55 vs Female ≥75
0 - 9Mth: HR=1.56 (1.15, 2.13),p=0.004
9Mth - 1.5Yr: HR=2.58 (1.99, 3.34),p<0.001
1.5Yr - 2Yr: HR=2.22 (1.52, 3.23),p<0.001
2Yr+: HR=2.95 (2.47, 3.51),p<0.001

Female 55-64 vs Female ≥75
0 - 3.5Yr: HR=1.45 (1.23, 1.72),p<0.001
3.5Yr - 8Yr: HR=2.22 (1.82, 2.71),p<0.001
8Yr+: HR=2.97 (2.19, 4.04),p<0.001

Female 65-74 vs Female ≥75
0 - 1.5Yr: HR=1.11 (0.89, 1.38),p=0.352
1.5Yr - 8Yr: HR=1.77 (1.49, 2.10),p<0.001
8Yr+: HR=2.17 (1.57, 3.00),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Female	<55	3293	3029	2481	1957	1411	596	36
	55-64	6539	6078	5147	4072	2913	1181	40
	65-74	5780	5393	4601	3698	2720	1231	68
	≥75	3860	3614	3086	2472	1745	725	27

Figure KP15: Cumulative Percent Revision of Primary Unicompartmental Knee Replacement for Males by Age (Primary Diagnosis OA)



Male <55 vs Male ≥75
0 - 1.5Yr: HR=2.50 (2.00, 3.14),p<0.001
1.5Yr+: HR=3.17 (2.65, 3.79),p<0.001

Male 55-64 vs Male ≥75
0 - 2Yr: HR=1.59 (1.33, 1.91),p<0.001
2Yr - 2.5Yr: HR=2.66 (1.86, 3.82),p<0.001
2.5Yr+: HR=2.13 (1.80, 2.52),p<0.001

Male 65-74 vs Male ≥75
Entire Period: HR=1.38 (1.19, 1.61),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male	<55	2550	2327	1857	1470	1043	454	20
	55-64	7233	6661	5558	4347	3105	1360	74
	65-74	7238	6666	5526	4384	3199	1425	64
	≥75	4316	3947	3225	2448	1632	580	21

PRIMARY TOTAL KNEE REPLACEMENT

Classes 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 analyses outcomes 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 prostheses 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 identified 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 396,472 primary total knee procedures reported to the Registry, an additional 44,597 procedures compared to the last report.

Primary total knee replacement continues to increase. In 2013, there were 3.6% more procedures than 2012 and 101.6% more than 2003. As a proportion of all knee replacement procedures, primary total knee replacement increased from 76.7% in 2003 to 87.3% in 2013.

Osteoarthritis is the most common diagnosis for primary total knee replacement (97.4%).

In 2013, primary total knee replacement remains more common in females (56.8%). This proportion has remained relatively stable since 2003 (Figure KT1).

There has been a decrease in the proportion of patients aged 75-84 years from 29.5% in 2003 to 22.4% in 2013. The proportion of patients aged less than 55 years remains small (7.1% in 2013) (Figure KT2).

Figure KT1: Primary Total Knee Replacement by Gender

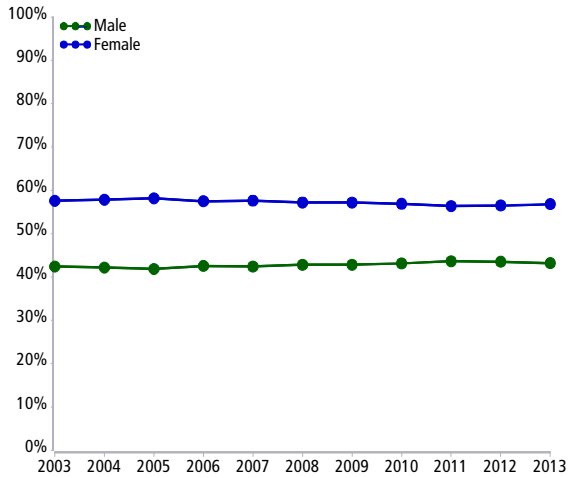
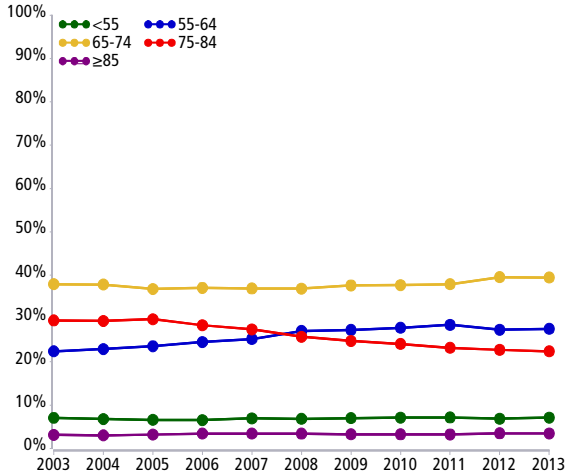
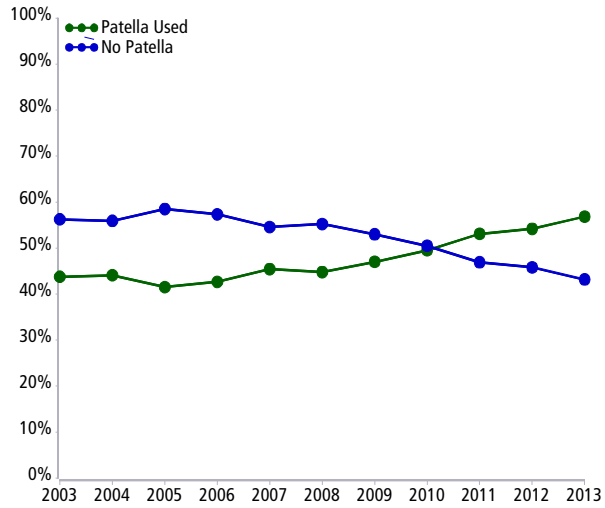


Figure KT2: Primary Total Knee Replacement by Age



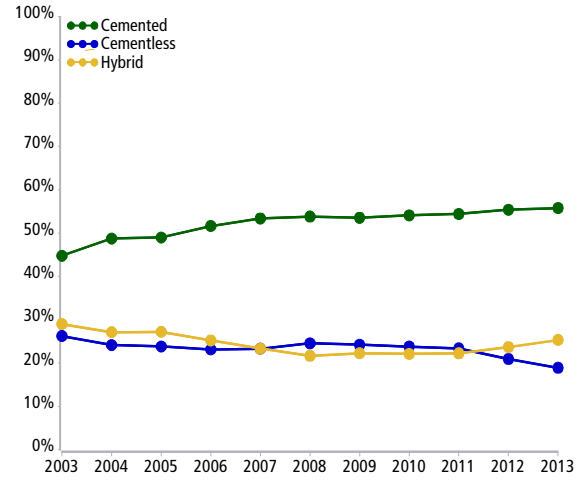
Patella resurfacing in primary total knee replacement continues to increase from a low of 41.5% in 2005 to 56.8% in 2013 (Figure KT3).

Figure KT3: Primary Total Knee Replacement by Patella Usage



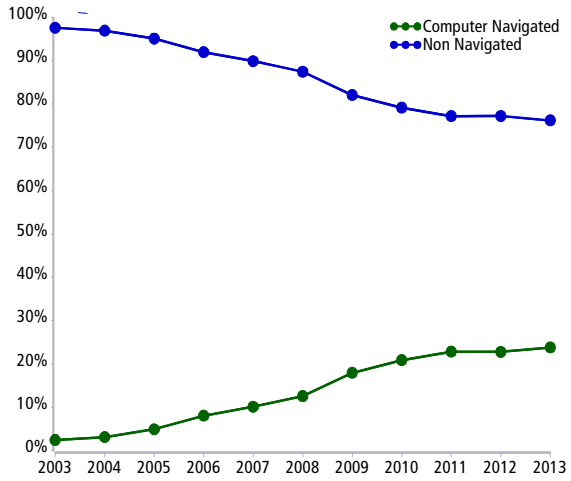
The most common method of fixation is cementing both femoral and tibial components. This has increased from 44.8% in 2003 to 55.8% in 2013. Hybrid fixation has also increased from a low of 21.7% in 2008 to 25.3% in 2013 (Figure KT4).

Figure KT4: Primary Total Knee Replacement by Fixation



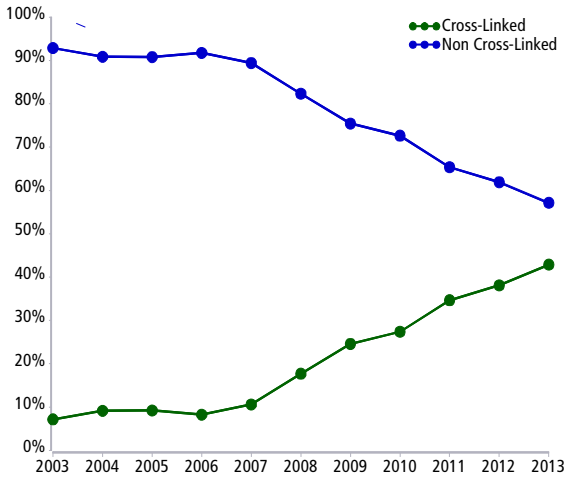
The proportion of primary total knee replacement inserted with computer navigation has increased from 2.4% in 2003 to 23.8% in 2013 (Figure KT5).

Figure KT5: Primary Total Knee Replacement by Computer Navigation



The use of cross-linked polyethylene in primary total knee replacement continues to increase. The proportion of procedures using cross-linked polyethylene was 7.1% in 2003 compared to 42.9% in 2013 (Figure KT6).

Figure KT6: Primary Total Knee Replacement by Type of Polyethylene



Cruciate retaining (CR) and posterior stabilised (PS) prostheses are now reported separately for the majority of total knee prostheses. In 2013, the most commonly used prosthesis was the Triathlon CR (16.7%), followed by Nexgen CR Flex (13.9%) and LCS CR (7.3%) (Table KT1). This has remained stable since 2010. The reporting of the 10 most used systems for cemented, cementless and hybrid primary total knee replacement is based on the femoral prosthesis (Tables KT2-KT4).

Detailed information on demographics of primary total knee replacement is provided in the supplementary report 'Demographics of Knee Arthroplasty' available on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2014.

Table KT1: 10 Most Used Femoral Prostheses in Primary Total Knee Replacement

2003		2010		2011		2012		2013	
N	Model	N	Model	N	Model	N	Model	N	Model
3184	LCS CR	4830	Triathlon CR	6173	Triathlon CR	6840	Triathlon CR	7305	Triathlon CR
2847	Duracon	3801	Nexgen CR Flex	4846	Nexgen CR Flex	5344	Nexgen CR Flex	6095	Nexgen CR Flex
2150	Nexgen CR	3381	LCS CR	3355	LCS CR	3304	LCS CR	3216	LCS CR
1419	PFC Sigma CR	2958	PFC Sigma CR	2875	PFC Sigma CR	2848	PFC Sigma CR	2790	Nexgen LPS Flex
1354	Scorpio CR	2779	Nexgen LPS Flex	2659	Nexgen LPS Flex	2710	Vanguard CR	2654	PFC Sigma CR
1058	Genesis II CR	2103	Vanguard CR	2343	Vanguard CR	2618	Nexgen LPS Flex	2599	Vanguard CR
1002	Natural Knee II	1842	Genesis II CR	1660	Genesis II CR	1763	Genesis II CR	1573	Genesis II CR
902	Nexgen LPS	1747	Genesis II PS	1640	Genesis II Oxinium PS	1671	Genesis II Oxinium PS	1500	Genesis II Oxinium PS
883	Profix	1420	PFC Sigma PS	1529	Genesis II PS	1332	Genesis II PS	1385	Legion Oxinium PS
751	Scorpio PS	1304	Genesis II Oxinium PS	1216	Triathlon PS	1232	PFC Sigma PS	1270	PFC Sigma PS
10 Most Used									
15550	(10) 71.5%	26165	(10) 69.0%	28296	(10) 70.1%	29662	(10) 70.1%	30387	(10) 69.3%
Remainder									
6184	(47) 28.5%	11750	(66) 31.0%	12065	(66) 29.9%	12654	(70) 29.9%	13439	(68) 30.7%
TOTAL									
21734	(57) 100.0%	37915	(76) 100.0%	40361	(76) 100.0%	42316	(80) 100.0%	43826	(78) 100.0%

Table KT2: 10 Most Used Femoral Prostheses in Cemented Primary Total Knee Replacement

2003		2010		2011		2012		2013	
N	Model	N	Model	N	Model	N	Model	N	Model
1214	Duracon	2471	Nexgen LPS Flex	2823	Triathlon CR	3276	Triathlon CR	3354	Triathlon CR
948	LCS CR	2315	Triathlon CR	2395	Nexgen LPS Flex	2227	Nexgen LPS Flex	2373	Nexgen LPS Flex
824	Nexgen LPS	1632	Genesis II PS	1910	Nexgen CR Flex	1911	Nexgen CR Flex	2220	Nexgen CR Flex
761	Nexgen CR	1357	Nexgen CR Flex	1639	Genesis II Oxinium PS	1670	Genesis II Oxinium PS	1500	Genesis II Oxinium PS
690	Nexgen LPS Flex	1272	Genesis II CR	1449	Genesis II PS	1299	Genesis II PS	1383	Legion Oxinium PS
641	Genesis II CR	1270	Genesis II Oxinium PS	1110	Genesis II CR	1188	PFC Sigma CR	1193	Genesis II PS
495	Profix	1196	PFC Sigma PS	1063	PFC Sigma CR	1167	Genesis II CR	1150	Vanguard CR
471	Genesis II Oxinium CR	1051	PFC Sigma CR	1014	PFC Sigma PS	1099	PFC Sigma PS	1069	PFC Sigma CR
471	PFC Sigma PS	842	Vanguard CR	932	LCS CR	1064	Vanguard CR	1065	PFC Sigma PS
419	Genesis II PS	721	LCS CR	892	Vanguard CR	1032	Legion Oxinium PS	983	Genesis II CR
10 Most Used									
6934	(10) 71.3%	14127	(10) 68.9%	15227	(10) 69.3%	15933	(10) 68.0%	16290	(10) 66.6%
Remainder									
2797	(41) 28.7%	6384	(60) 31.1%	6732	(62) 30.7%	7508	(66) 32.0%	8155	(66) 33.4%
TOTAL									
9731	(51) 100.0%	20511	(70) 100.0%	21959	(72) 100.0%	23441	(76) 100.0%	24445	(76) 100.0%

Table KT3: 10 Most Used Femoral Prostheses in Cementless Primary Total Knee Replacement

2003		2010		2011		2012		2013	
N	Model	N	Model	N	Model	N	Model	N	Model
1470	LCS CR	1861	LCS CR	1720	Triathlon CR	1707	Triathlon CR	1703	Triathlon CR
790	Nexgen CR	1381	Triathlon CR	1583	LCS CR	1667	Nexgen CR Flex	1699	Nexgen CR Flex
499	Natural Knee II	1260	Nexgen CR Flex	1580	Nexgen CR Flex	1454	LCS CR	1463	LCS CR
483	Active Knee	628	RBK	674	RBK	571	RBK	430	RBK
476	Duracon	563	PFC Sigma CR	496	Vanguard CR	457	Vanguard CR	405	Vanguard CR
320	Scorpio CR	388	Active Knee	491	Active Knee	378	PFC Sigma CR	354	PFC Sigma CR
314	PFC Sigma CR	348	Vanguard CR	478	PFC Sigma CR	375	Active Knee	238	Nexgen LPS Flex
302	RBK	219	Triathlon PS	231	Scorpio NRG CR	292	Nexgen LPS Flex	237	Score
187	Profix	214	Scorpio NRG CR	204	Score	195	Score	235	ACS
180	Scorpio PS	196	Nexgen LPS Flex	198	Nexgen LPS Flex	195	Scorpio NRG CR	229	Active Knee
10 Most Used									
5021	(10) 88.1%	7058	(10) 78.2%	7655	(10) 81.2%	7291	(10) 82.3%	6993	(10) 84.4%
Remainder									
681	(14) 11.9%	1966	(28) 21.8%	1776	(24) 18.8%	1563	(27) 17.7%	1290	(24) 15.6%
TOTAL									
5702	(24) 100.0%	9024	(38) 100.0%	9431	(34) 100.0%	8854	(37) 100.0%	8283	(34) 100.0%

Table KT4: 10 Most Used Femoral Prostheses in Hybrid Primary Total Knee Replacement

2003		2010		2011		2012		2013	
N	Model	N	Model	N	Model	N	Model	N	Model
1157	Duracon	1344	PFC Sigma CR	1630	Triathlon CR	1857	Triathlon CR	2248	Triathlon CR
766	LCS CR	1184	Nexgen CR Flex	1356	Nexgen CR Flex	1766	Nexgen CR Flex	2176	Nexgen CR Flex
764	PFC Sigma CR	1134	Triathlon CR	1334	PFC Sigma CR	1282	PFC Sigma CR	1231	PFC Sigma CR
737	Scorpio CR	913	Vanguard CR	955	Vanguard CR	1189	Vanguard CR	1044	Vanguard CR
599	Nexgen CR	799	LCS CR	840	LCS CR	843	LCS CR	865	LCS CR
364	Genesis II CR	505	Genesis II CR	476	Genesis II CR	523	Genesis II CR	536	Genesis II CR
255	Maxim	392	Scorpio CR	435	Scorpio CR	313	Scorpio CR	344	Scorpio CR
248	Natural Knee II	224	PFC Sigma PS	347	Triathlon PS	311	Triathlon PS	313	Triathlon PS
204	AGC	210	Triathlon PS	164	Nexgen CR	253	Natural Knee Flex	205	PFC Sigma PS
204	Scorpio PS	170	Natural Knee Flex	161	RBK	191	Legion CR	194	Active Knee
10 Most Used									
5298	(10) 84.1%	6875	(10) 82.0%	7698	(10) 85.8%	8528	(10) 85.1%	9156	(10) 82.5%
Remainder									
1003	(28) 15.9%	1505	(39) 18.0%	1273	(39) 14.2%	1493	(36) 14.9%	1942	(36) 17.5%
TOTAL									
6301	(38) 100.0%	8380	(49) 100.0%	8971	(49) 100.0%	10021	(46) 100.0%	11098	(46) 100.0%

Outcome for all Diagnoses

Primary Diagnosis

The four most common primary diagnoses are osteoarthritis, rheumatoid arthritis, other inflammatory arthritis and osteonecrosis. Rheumatoid arthritis has a lower rate of revision compared to osteoarthritis after nine months. Osteoarthritis has a lower rate of revision compared to other inflammatory arthritis in the first three months only. There is no difference in the rate of revision between osteoarthritis and osteonecrosis (Table KT5 and Figure KT7).

Reason for Revision

Loosening/lysis (29.1%) is the main reason for revision, followed by infection (22.2%), patellofemoral pain (12.1%), pain (9.2%) and instability (6.1%) (Table KT6).

The Registry combines loosening and lysis as a single diagnosis. This is because when lysis occurs it may be in association with loosening. Loosening/lysis accounts for 29.1% of revision procedures; lysis not associated with loosening has occurred in 1.8% with 26.5% of revision procedures undertaken for loosening not associated with lysis. In 0.8% of revision procedures both loosening and lysis have been reported.

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.

The five most common reasons for revision are shown on Figure KT8. Initially infection is the most common reason for revision. Loosening/lysis exceeds infection to become the most common reason after three years**.** The remaining reasons for revision have a lower incidence than both infection and loosening/lysis.

Type of Revision

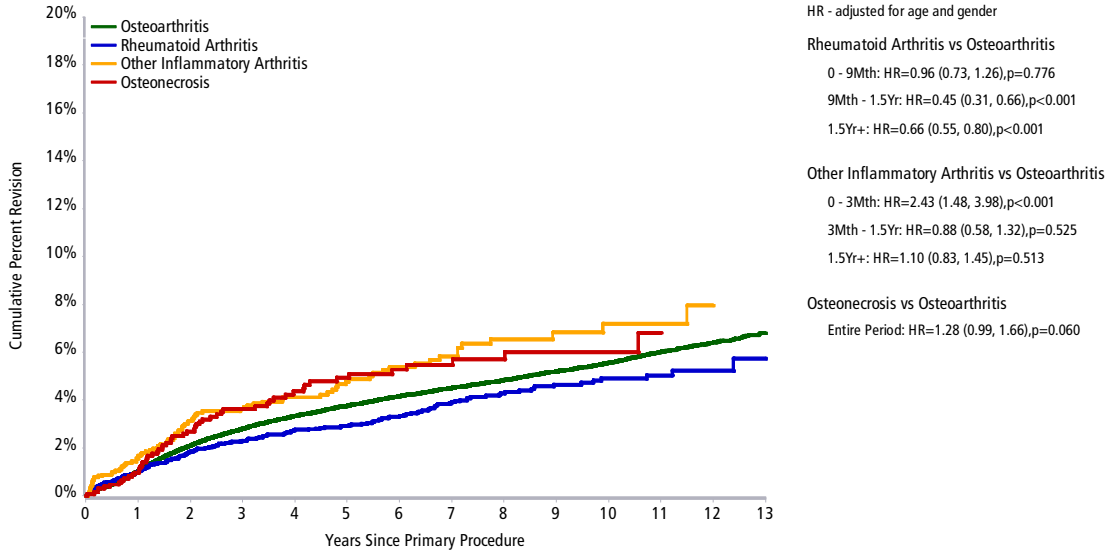
The most common types of revision are replacement of both the femoral and tibial prostheses (25.3%), patella only replacement (21.1%) and insert only exchange (20.6%) (Table KT7).

Table KT5: 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	13 Yrs
Osteoarthritis	13277	386242	1.0 (1.0, 1.1)	2.8 (2.7, 2.9)	3.8 (3.7, 3.8)	4.5 (4.4, 4.6)	5.6 (5.4, 5.7)	6.8 (6.6, 7.0)
Rheumatoid Arthritis	199	6089	1.0 (0.8, 1.3)	2.3 (1.9, 2.7)	2.9 (2.5, 3.4)	3.9 (3.4, 4.5)	4.9 (4.2, 5.7)	5.7 (4.5, 7.2)
Other Inflammatory Arthritis	88	1955	1.7 (1.2, 2.4)	3.6 (2.8, 4.6)	4.8 (3.8, 6.0)	5.8 (4.7, 7.3)	7.2 (5.7, 9.1)	
Osteonecrosis	57	1316	1.0 (0.6, 1.7)	3.6 (2.7, 4.9)	4.9 (3.7, 6.5)	5.5 (4.2, 7.2)	6.0 (4.6, 7.9)	
Other (5)	67	870	1.8 (1.1, 3.0)	7.3 (5.5, 9.6)	10.0 (7.7, 12.9)	12.2 (9.4, 15.9)	15.5 (11.6, 20.6)	
TOTAL	**13688**	**396472**						

Note: Only Primary Diagnoses with over 500 procedures have been listed.

Figure KT7: Cumulative Percent Revision of Primary Total Knee Replacement by Primary Diagnosis



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Osteoarthritis	386242	336702	245413	169367	107475	39239	2405
Rheumatoid Arthritis	6089	5512	4333	3303	2296	974	84
Other Inflammatory Arthritis	1955	1679	1219	841	558	245	23
Osteonecrosis	1316	1148	864	602	403	153	4

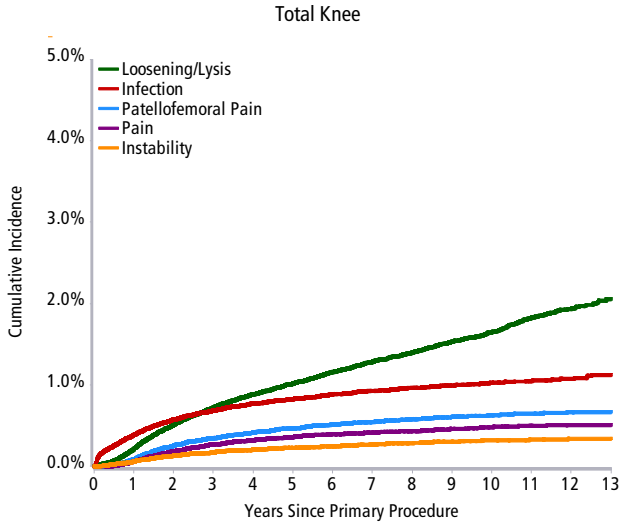
Table KT6: Primary Total Knee Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	3990	29.1
Infection	3038	22.2
Patellofemoral Pain	1657	12.1
Pain	1258	9.2
Instability	833	6.1
Arthrofibrosis	487	3.6
Patella Erosion	423	3.1
Fracture	356	2.6
Malalignment	312	2.3
Metal Related Pathology	245	1.8
Wear Tibial Insert	217	1.6
Incorrect Sizing	188	1.4
Other	684	5.0
TOTAL	**13688**	**100.0**

Table KT7: Primary Total Knee Replacement by Type of Revision

Type of Revision	Number	Percent
TKR (Tibial/Femoral)	3467	25.3
Patella Only	2887	21.1
Insert Only	2826	20.6
Tibial Component	1480	10.8
Insert/Patella	1231	9.0
Femoral Component	874	6.4
Cement Spacer	794	5.8
Removal of Prostheses	73	0.5
Minor Components	37	0.3
Reinsertion of Components	8	0.1
Cement Only	7	0.1
Total Femoral	3	0.0
Patella/Trochlear Resurfacing	1	0.0
TOTAL	**13688**	**100.0**

Figure KT8: Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement



Prostheses Types

There are 467 femoral and tibial prostheses combinations for primary total knee replacement recorded by the Registry, 94 more than 2012. This increase is partly due to femoral components being separated into CR and PS. The cumulative percent revision of the 117 combinations with more than 400 procedures per combination are listed in Tables KT8 – KT10. Although the listed combinations are a small proportion of all possible combinations, they represent 94.5% of all primary total knee replacement. The 'Other' group is the combined outcome of the remaining 350 prostheses combinations with less than 400 procedures per combination.

There are 34 combinations of primary total knee replacement with hybrid fixation with more than 400 procedures. The PFC Sigma CR/PFC Sigma has the lowest 13 year cumulative percent revision (4.4%) (Table KT8).

There are 34 cementless femoral and tibial prostheses combinations with more than 400 procedures. Of those with a 13 year cumulative percent revision, the Nexgen CR/Nexgen is the lowest at 3.8% (Table KT9).

There are 49 cemented total femoral and tibial prostheses combinations with more than 400 procedures. Of those with a 13 year cumulative percent revision, the Genesis II CR/Genesis II is the lowest at 4.6%. The Nexgen CR/Nexgen is the lowest at 10 years (2.7%) (Table KT10).

The Nexgen CR/Nexgen has the lowest 10 year cumulative percent revision of all combinations with 10 year follow up regardless of fixation (3.2%, 2.9% and 2.7% respectively) (Tables KT8-10).

Table KT8: 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	13 Yrs
AGC	AGC	46	1566	0.6 (0.3, 1.1)	1.5 (1.0, 2.3)	2.1 (1.5, 3.0)	2.7 (2.0, 3.7)	3.5 (2.6, 4.8)	6.1 (3.4, 10.9)
Active Knee	Active Knee	53	1535	0.6 (0.3, 1.2)	2.6 (1.8, 3.6)	3.3 (2.4, 4.5)	4.0 (3.0, 5.3)	6.1 (4.4, 8.4)	
Duracon	Duracon	357	7969	1.2 (1.0, 1.5)	2.7 (2.4, 3.1)	3.5 (3.1, 3.9)	4.1 (3.7, 4.6)	4.9 (4.4, 5.4)	5.7 (5.1, 6.5)
Genesis II CR	Genesis II	185	5717	0.9 (0.7, 1.2)	2.6 (2.2, 3.1)	3.5 (3.0, 4.1)	4.0 (3.4, 4.6)	4.6 (3.9, 5.4)	4.9 (4.1, 5.9)
Genesis II PS	Genesis II	43	687	1.8 (1.0, 3.1)	4.6 (3.2, 6.5)	5.6 (4.1, 7.7)	6.6 (4.9, 8.9)	7.4 (5.4, 9.9)	
LCS CR	LCS	121	2361	1.0 (0.7, 1.5)	2.6 (2.1, 3.4)	3.7 (3.0, 4.5)	4.7 (3.9, 5.6)	5.3 (4.4, 6.3)	6.1 (5.1, 7.3)
LCS CR	MBT	155	6419	0.7 (0.5, 1.0)	2.1 (1.7, 2.5)	2.8 (2.4, 3.3)	3.2 (2.7, 3.8)	4.9 (3.8, 6.3)	
LCS CR	MBT Duofix	18	521	2.4 (1.3, 4.3)	4.7 (2.9, 7.4)	4.7 (2.9, 7.4)			
LCS Duofix	MBT	62	822	1.5 (0.8, 2.6)	5.5 (4.1, 7.3)	7.2 (5.6, 9.2)	8.7 (6.7, 11.4)		
Legion CR	Genesis II	8	508	0.9 (0.3, 2.5)	2.2 (1.1, 4.5)				
Maxim	Maxim	78	1416	0.8 (0.4, 1.4)	2.7 (1.9, 3.7)	3.9 (3.0, 5.1)	4.8 (3.8, 6.1)	7.1 (5.6, 9.1)	
Natural Knee Flex	Natural Knee II	8	947	0.5 (0.2, 1.3)	1.1 (0.6, 2.2)	1.1 (0.6, 2.2)			
Natural Knee II	Natural Knee II	68	1884	1.2 (0.8, 1.9)	2.3 (1.7, 3.1)	2.7 (2.0, 3.6)	3.1 (2.4, 4.1)	4.5 (3.5, 5.9)	
Nexgen CR	Nexgen	99	3740	0.4 (0.3, 0.7)	1.6 (1.3, 2.1)	2.2 (1.7, 2.7)	2.4 (2.0, 3.0)	3.2 (2.6, 4.0)	5.3 (3.5, 7.9)
Nexgen CR Flex	Nexgen	146	10201	0.7 (0.6, 0.9)	1.6 (1.4, 1.9)	1.9 (1.6, 2.3)	2.0 (1.7, 2.4)		
Nexgen CR Flex	Nexgen TM CR	13	730	0.6 (0.2, 1.5)	1.4 (0.8, 2.6)	1.5 (0.9, 2.8)	2.1 (1.2, 3.7)		
Nexgen LPS	Nexgen	41	956	0.4 (0.2, 1.1)	2.6 (1.7, 3.8)	4.3 (3.1, 5.9)	5.1 (3.8, 6.9)	5.1 (3.8, 6.9)	
Nexgen LPS Flex	Nexgen	13	449	2.0 (0.9, 4.2)	5.1 (2.9, 8.9)				
Nexgen LPS Flex	Nexgen TM LPS	13	493	0.6 (0.2, 1.9)	1.9 (1.0, 3.5)	2.1 (1.1, 3.8)	3.0 (1.6, 5.4)		
PFC Sigma CR	MBT	145	3259	1.4 (1.0, 1.8)	3.5 (2.9, 4.2)	4.5 (3.8, 5.3)	5.3 (4.5, 6.2)	5.5 (4.6, 6.5)	
PFC Sigma CR	PFC Sigma	216	9473	0.6 (0.5, 0.8)	2.0 (1.7, 2.3)	2.6 (2.3, 3.0)	3.0 (2.6, 3.5)	4.0 (3.4, 4.7)	4.4 (3.7, 5.3)
PFC Sigma PS	MBT Duofix	97	1547	1.7 (1.2, 2.5)	5.2 (4.2, 6.5)	7.1 (5.8, 8.6)	7.5 (6.1, 9.1)	7.5 (6.1, 9.1)	
Profix	Profix	33	769	0.8 (0.4, 1.7)	2.6 (1.6, 4.0)	3.9 (2.7, 5.6)	4.6 (3.3, 6.4)	4.9 (3.5, 6.8)	
Profix	Profix Mobile	49	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)	9.1 (6.8, 12.0)	
RBK	RBK	31	1046	0.9 (0.5, 1.8)	3.0 (2.0, 4.4)	4.6 (3.1, 6.7)	5.0 (3.4, 7.3)	5.0 (3.4, 7.3)	
Scorpio CR	Scorpio+	103	1897	1.0 (0.6, 1.6)	2.9 (2.2, 3.7)	4.0 (3.2, 5.1)	5.4 (4.4, 6.7)	6.7 (5.5, 8.3)	
Scorpio CR	Series 7000	177	5440	0.7 (0.5, 1.0)	2.0 (1.7, 2.5)	2.9 (2.5, 3.5)	3.5 (3.0, 4.1)	4.4 (3.8, 5.2)	5.6 (4.5, 7.0)
Scorpio NRG CR	Series 7000	12	582	0.4 (0.1, 1.4)	2.1 (1.0, 4.3)	3.0 (1.6, 5.7)			
Scorpio PS	Scorpio+	38	906	1.0 (0.5, 1.9)	2.7 (1.8, 4.0)	3.5 (2.5, 5.0)	3.8 (2.7, 5.3)	5.2 (3.7, 7.3)	
Scorpio PS	Series 7000	73	1066	1.1 (0.6, 2.0)	4.3 (3.2, 5.7)	5.9 (4.6, 7.5)	6.7 (5.3, 8.4)	8.1 (6.3, 10.4)	9.2 (7.0, 12.0)
Triathlon CR	Triathlon	110	8635	0.5 (0.4, 0.7)	1.7 (1.4, 2.1)	2.4 (1.9, 3.0)	2.8 (2.2, 3.7)		
Triathlon PS	Triathlon	37	1514	2.0 (1.4, 2.9)	3.0 (2.1, 4.2)	3.3 (2.3, 4.6)			
Vanguard CR	Maxim	106	3903	1.1 (0.8, 1.5)	2.9 (2.3, 3.6)	4.5 (3.6, 5.6)	5.7 (4.1, 8.0)		
Vanguard CR	Vanguard	29	1786	0.6 (0.3, 1.2)	2.3 (1.6, 3.4)	2.8 (1.9, 4.2)			
Other (114)		466	7090	2.1 (1.8, 2.5)	5.6 (5.1, 6.3)	6.8 (6.2, 7.5)	8.0 (7.3, 8.8)	10.1 (9.1, 11.1)	10.9 (9.8, 12.1)
TOTAL		**3249**	**98426**						

Note: Only combinations with over 400 procedures have been listed.

Table KT9: 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	13 Yrs
ACS	ACS	15	473	2.4 (1.2, 4.8)					
Active Knee	Active Knee	263	4663	1.3 (1.0, 1.7)	3.6 (3.1, 4.2)	5.0 (4.3, 5.7)	6.1 (5.4, 7.0)	8.7 (7.6, 10.0)	
Advantim	Advantim	33	1245	0.8 (0.4, 1.5)	2.3 (1.5, 3.4)	2.8 (2.0, 4.1)	3.3 (2.3, 4.7)	4.2 (2.8, 6.1)	4.2 (2.8, 6.1)
Columbus	Columbus	44	498	3.0 (1.8, 5.0)	7.1 (5.1, 9.8)	9.2 (6.8, 12.6)	11.9 (8.5, 16.3)		
Duracon	Duracon	164	3530	1.1 (0.8, 1.5)	2.7 (2.2, 3.3)	3.6 (3.0, 4.3)	4.3 (3.6, 5.0)	5.1 (4.4, 6.0)	6.6 (5.1, 8.6)
Genesis II CR	Profix Mobile	23	505	1.4 (0.7, 2.9)	2.0 (1.1, 3.7)	3.1 (1.9, 5.0)	3.5 (2.2, 5.6)	4.5 (2.9, 6.9)	5.9 (3.8, 8.9)
LCS CR	LCS	137	2333	1.4 (1.0, 2.0)	3.4 (2.7, 4.2)	4.2 (3.5, 5.2)	4.8 (4.0, 5.7)	5.9 (4.9, 6.9)	7.0 (5.9, 8.4)
LCS CR	MBT	182	5766	1.1 (0.9, 1.5)	3.3 (2.8, 3.9)	4.3 (3.7, 5.1)	5.2 (4.5, 6.1)	6.0 (5.0, 7.1)	
LCS CR	MBT Duofix	441	10681	1.2 (1.0, 1.5)	3.2 (2.8, 3.5)	4.0 (3.6, 4.4)	4.6 (4.2, 5.1)	5.3 (4.8, 5.8)	
LCS Duofix	MBT Duofix	401	3648	1.6 (1.2, 2.1)	6.2 (5.4, 7.0)	10.0 (9.1, 11.0)	12.4 (11.3, 13.7)		
Maxim	Maxim	27	602	1.7 (0.9, 3.1)	3.0 (1.9, 4.8)	3.4 (2.2, 5.2)	3.4 (2.2, 5.2)	4.7 (3.2, 6.8)	
Natural Knee Flex	Natural Knee II	19	849	1.2 (0.7, 2.3)	2.3 (1.4, 3.7)	2.8 (1.8, 4.4)			
Natural Knee II	Natural Knee II	179	2780	0.9 (0.6, 1.4)	2.3 (1.8, 2.9)	3.6 (3.0, 4.4)	4.8 (4.0, 5.7)	8.2 (7.0, 9.7)	
Nexgen CR	Nexgen	88	3332	0.5 (0.3, 0.8)	1.6 (1.3, 2.1)	2.0 (1.6, 2.6)	2.4 (1.9, 3.0)	2.9 (2.4, 3.6)	3.8 (2.5, 5.8)
Nexgen CR	Nexgen TM CR	35	607	1.6 (0.8, 3.0)	5.2 (3.6, 7.5)	6.5 (4.6, 9.0)	6.8 (4.9, 9.5)	7.3 (5.2, 10.2)	
Nexgen CR Flex	Nexgen	101	4585	1.1 (0.8, 1.4)	2.2 (1.8, 2.7)	2.7 (2.2, 3.3)	3.0 (2.4, 3.7)		
Nexgen CR Flex	Nexgen TM CR	115	6586	0.5 (0.4, 0.7)	1.9 (1.5, 2.3)	2.5 (2.0, 3.0)	2.8 (2.2, 3.4)		
Nexgen LPS	Nexgen TM LPS	20	838	1.1 (0.6, 2.2)	1.7 (1.0, 3.0)	3.3 (2.1, 5.1)	3.3 (2.1, 5.1)		
Nexgen LPS Flex	Nexgen TM LPS	11	694	0.7 (0.3, 1.8)	1.9 (1.0, 3.5)				
PFC Sigma CR	AMK Duofix	46	1909	0.7 (0.4, 1.2)	1.5 (1.1, 2.3)	2.5 (1.8, 3.4)	3.0 (2.2, 4.0)	3.6 (2.6, 5.0)	
PFC Sigma CR	MBT	49	979	2.4 (1.5, 3.7)	5.7 (4.2, 7.8)	6.7 (5.0, 9.1)	7.5 (5.6, 10.1)	8.4 (6.2, 11.3)	
PFC Sigma CR	MBT Duofix	88	2011	1.4 (1.0, 2.0)	3.3 (2.6, 4.2)	4.5 (3.7, 5.6)	4.8 (3.9, 6.0)	5.4 (4.2, 7.0)	
Profix	Profix	79	1488	1.1 (0.7, 1.8)	3.5 (2.7, 4.6)	4.7 (3.7, 6.0)	5.9 (4.7, 7.4)	6.5 (5.1, 8.1)	
RBK	RBK	202	5285	1.4 (1.1, 1.8)	3.3 (2.8, 3.8)	4.2 (3.7, 4.9)	5.1 (4.4, 5.9)	5.8 (4.9, 6.9)	
Score	Score	47	1181	1.3 (0.7, 2.2)	4.9 (3.6, 6.7)	6.5 (4.9, 8.8)			
Scorpio CR	Series 7000	149	3078	1.2 (0.9, 1.7)	3.2 (2.6, 3.9)	4.4 (3.7, 5.3)	5.0 (4.2, 6.0)	7.1 (5.9, 8.6)	
Scorpio NRG CR	Series 7000	22	1358	0.6 (0.3, 1.3)	1.6 (1.0, 2.6)	2.3 (1.4, 3.6)			
Scorpio NRG PS	Series 7000	54	818	1.4 (0.8, 2.5)	6.5 (4.9, 8.6)	8.5 (6.5, 11.1)			
Scorpio PS	Series 7000	40	568	2.5 (1.5, 4.1)	5.3 (3.8, 7.5)	6.1 (4.4, 8.4)	6.9 (5.0, 9.3)	7.1 (5.2, 9.6)	
Triathlon CR	Triathlon	151	9025	0.8 (0.6, 1.0)	1.9 (1.6, 2.3)	2.6 (2.2, 3.2)	3.4 (2.4, 4.7)		
Triathlon PS	Triathlon	42	947	2.2 (1.4, 3.3)	4.1 (2.9, 5.6)	5.2 (3.8, 7.0)			
Vanguard CR	Maxim	26	580	1.0 (0.5, 2.3)	3.8 (2.5, 5.8)	5.0 (3.4, 7.4)	5.8 (3.8, 8.8)		
Vanguard CR	Regenerex	26	786	1.4 (0.7, 2.5)	4.2 (2.9, 6.2)				
Vanguard CR	Vanguard	13	769	1.1 (0.5, 2.4)	2.7 (1.5, 4.8)				
Other (68)		501	5978	2.7 (2.3, 3.2)	7.3 (6.6, 8.0)	9.0 (8.2, 9.8)	10.6 (9.7, 11.6)	11.8 (10.7, 12.9)	
TOTAL		**3833**	**90975**						

Note: Only combinations with over 400 procedures have been listed.

Table KT10: Cumulative Percent Revision of Primary Total Knee Replacement with Cement Fixation

Femoral Component	Tibial Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
AGC	AGC	146	3451	0.6 (0.4, 0.9)	2.4 (1.9, 2.9)	3.5 (2.9, 4.2)	4.2 (3.5, 5.0)	5.4 (4.6, 6.5)	6.5 (5.3, 8.0)
Active Knee	Active Knee	27	1077	0.8 (0.4, 1.6)	2.5 (1.6, 3.9)	3.6 (2.3, 5.5)	4.9 (3.0, 7.9)		
Advance	Advance II	48	896	1.4 (0.8, 2.5)	4.2 (3.0, 5.8)	5.1 (3.7, 7.0)	6.6 (4.9, 8.8)	8.1 (6.0, 10.9)	
BalanSys	BalanSys	16	898	0.3 (0.1, 1.0)	1.8 (1.0, 3.4)	2.6 (1.4, 4.6)	3.1 (1.7, 5.6)	4.8 (2.6, 8.8)	
Duracon	Duracon	377	8971	1.0 (0.8, 1.2)	2.4 (2.1, 2.7)	3.3 (2.9, 3.6)	3.8 (3.4, 4.2)	4.8 (4.4, 5.4)	6.4 (5.5, 7.5)
Evolis	Evolis	6	599	0.4 (0.1, 1.5)	1.1 (0.5, 2.7)	1.5 (0.6, 3.3)			
Genesis II CR	Genesis II	338	11253	0.9 (0.7, 1.1)	2.5 (2.2, 2.8)	3.2 (2.9, 3.6)	4.0 (3.6, 4.5)	4.3 (3.8, 4.8)	4.6 (4.0, 5.3)
Genesis II CR	Profix Mobile	24	490	1.7 (0.9, 3.4)	3.2 (1.9, 5.4)	5.0 (3.2, 7.7)	5.9 (3.9, 9.0)	8.0 (5.0, 12.8)	
Genesis II Oxinium CR	Genesis II	234	5924	1.1 (0.9, 1.4)	2.8 (2.4, 3.2)	3.6 (3.1, 4.2)	4.6 (4.0, 5.3)	6.1 (5.2, 7.2)	
Genesis II Oxinium PS	Genesis II	493	11510	1.6 (1.4, 1.8)	3.9 (3.5, 4.3)	5.4 (5.0, 6.0)	6.3 (5.7, 6.9)	7.8 (6.8, 9.0)	
Genesis II PS	Genesis II	419	12395	1.3 (1.1, 1.5)	3.0 (2.7, 3.3)	4.0 (3.6, 4.4)	4.5 (4.0, 5.0)	5.4 (4.7, 6.1)	6.9 (5.0, 9.7)
Journey	Journey	161	3132	1.4 (1.0, 1.9)	4.6 (3.9, 5.5)	6.3 (5.4, 7.5)	8.2 (6.9, 9.9)		
Kinemax Plus	Kinemax Plus	88	1826	0.9 (0.6, 1.5)	2.4 (1.8, 3.3)	3.0 (2.3, 3.9)	3.9 (3.1, 4.9)	4.5 (3.6, 5.7)	8.1 (5.6, 11.6)
LCS CR	LCS	269	3936	1.0 (0.7, 1.4)	3.8 (3.2, 4.4)	5.0 (4.4, 5.8)	6.1 (5.3, 6.9)	7.1 (6.3, 8.0)	8.1 (7.2, 9.2)
LCS CR	MBT	224	8058	0.7 (0.5, 0.9)	2.2 (1.9, 2.6)	3.2 (2.7, 3.7)	4.1 (3.6, 4.7)	5.4 (4.6, 6.4)	
LCS PS	MBT	26	452	1.5 (0.7, 3.3)	6.2 (4.2, 9.3)				
Legion CR	Genesis II	15	573	2.0 (1.1, 3.7)	2.7 (1.5, 4.8)				
Legion Oxinium CR	Genesis II	19	1537	0.8 (0.4, 1.5)	1.8 (1.1, 2.9)	2.3 (1.3, 4.2)			
Legion Oxinium PS	Genesis II	80	4020	1.2 (0.9, 1.7)	3.2 (2.5, 4.1)	3.8 (2.9, 5.1)			
Legion PS	Genesis II	19	2008	0.7 (0.4, 1.2)	1.2 (0.7, 2.0)				
Maxim	Maxim	33	499	1.2 (0.5, 2.7)	2.6 (1.5, 4.5)	4.7 (3.2, 7.1)	5.2 (3.6, 7.7)	7.0 (4.8, 10.1)	
Natural Knee Flex	Natural Knee II	15	787	0.8 (0.4, 1.8)	2.5 (1.5, 4.3)	3.4 (1.8, 6.4)			
Natural Knee II	Natural Knee II	43	1678	0.4 (0.2, 0.8)	1.3 (0.8, 2.0)	1.9 (1.3, 2.8)	2.9 (2.1, 4.0)	3.8 (2.7, 5.3)	
Nexgen CR	Nexgen	97	3535	0.4 (0.3, 0.7)	1.3 (1.0, 1.8)	1.7 (1.3, 2.2)	2.0 (1.6, 2.6)	2.7 (2.2, 3.4)	5.5 (3.9, 7.6)
Nexgen CR Flex	Natural Knee II	3	581	0.3 (0.1, 1.4)	0.6 (0.2, 2.0)				
Nexgen CR Flex	Nexgen	152	11390	0.6 (0.5, 0.8)	1.3 (1.1, 1.6)	1.9 (1.6, 2.3)	2.2 (1.8, 2.6)		
Nexgen LCCK	Nexgen	19	449	1.9 (1.0, 3.8)	3.8 (2.2, 6.3)	5.4 (3.3, 8.9)	5.4 (3.3, 8.9)		
Nexgen LPS	Nexgen	193	5118	1.0 (0.7, 1.3)	2.2 (1.8, 2.7)	2.9 (2.4, 3.4)	3.7 (3.2, 4.3)	4.7 (4.1, 5.4)	5.6 (4.7, 6.7)
Nexgen LPS Flex	Nexgen	637	21737	0.9 (0.8, 1.0)	2.4 (2.2, 2.6)	3.3 (3.0, 3.6)	4.2 (3.8, 4.5)	5.3 (4.8, 5.8)	
Optetrak-PS	Optetrak	133	2078	1.6 (1.1, 2.2)	5.0 (4.1, 6.1)	6.9 (5.8, 8.3)	8.4 (7.0, 10.0)	10.4 (8.3, 13.1)	
Optetrak-PS	Optetrak-RBK	32	567	2.0 (1.1, 3.6)	4.8 (3.3, 7.1)	6.6 (4.6, 9.4)	7.4 (5.1, 10.7)		
PFC Sigma CR	MBT	20	1061	0.6 (0.3, 1.3)	1.4 (0.8, 2.4)	1.8 (1.1, 3.0)	2.3 (1.4, 3.7)	3.0 (1.7, 5.2)	
PFC Sigma CR	PFC Sigma	219	9584	0.8 (0.7, 1.0)	1.9 (1.6, 2.2)	2.4 (2.1, 2.8)	3.0 (2.6, 3.5)	4.0 (3.3, 4.8)	
PFC Sigma PS	MBT	159	5219	0.8 (0.6, 1.0)	2.6 (2.2, 3.2)	3.5 (3.0, 4.1)	4.2 (3.5, 5.0)	4.7 (3.9, 5.8)	
PFC Sigma PS	PFC Sigma	171	6238	1.1 (0.8, 1.4)	2.4 (2.0, 2.8)	2.9 (2.5, 3.4)	3.1 (2.7, 3.7)	4.2 (3.5, 5.2)	
Profix	Profix	133	3285	1.1 (0.8, 1.5)	2.6 (2.1, 3.2)	3.2 (2.7, 3.9)	4.0 (3.4, 4.8)	4.8 (4.0, 5.7)	4.9 (4.1, 5.9)
Profix Oxinium	Profix	76	999	1.9 (1.2, 3.0)	5.1 (3.9, 6.7)	6.9 (5.4, 8.7)	7.9 (6.3, 9.8)	8.5 (6.8, 10.6)	
RBK	RBK	53	1890	0.9 (0.5, 1.4)	2.7 (2.0, 3.7)	3.4 (2.5, 4.5)	3.5 (2.6, 4.7)	5.2 (3.4, 8.1)	
Scorpio CR	Series 7000	77	1757	0.9 (0.5, 1.4)	2.3 (1.7, 3.1)	3.0 (2.3, 3.9)	4.1 (3.2, 5.2)	5.1 (4.0, 6.4)	6.4 (4.8, 8.4)
Scorpio NRG CR	Series 7000	16	964	0.8 (0.4, 1.6)	1.4 (0.8, 2.5)	1.8 (1.1, 3.0)			
Scorpio NRG PS	Series 7000	43	2416	0.6 (0.4, 1.0)	1.9 (1.4, 2.6)	2.6 (1.9, 3.6)			
Scorpio PS	Scorpio	29	510	1.2 (0.5, 2.6)	3.8 (2.5, 5.9)	4.4 (2.9, 6.7)	5.4 (3.7, 7.8)	6.7 (4.6, 9.7)	
Scorpio PS	Scorpio+	53	900	1.2 (0.7, 2.2)	4.0 (2.9, 5.5)	5.7 (4.3, 7.4)	6.2 (4.7, 8.0)	6.4 (4.9, 8.4)	
Scorpio PS	Series 7000	131	3057	1.1 (0.8, 1.5)	2.9 (2.3, 3.6)	3.9 (3.2, 4.7)	4.9 (4.1, 5.9)	7.1 (5.7, 8.8)	
Triathlon CR	Triathlon	304	16914	0.8 (0.7, 1.0)	2.1 (1.9, 2.4)	2.8 (2.4, 3.1)	3.1 (2.7, 3.6)		
Triathlon PS	Triathlon	122	4118	1.6 (1.2, 2.0)	3.1 (2.6, 3.8)	3.9 (3.2, 4.8)	4.7 (3.7, 5.8)		
Vanguard CR	Maxim	75	4447	0.6 (0.4, 0.9)	2.1 (1.7, 2.8)	2.9 (2.3, 3.8)	3.4 (2.5, 4.5)		
Vanguard CR	Vanguard	7	681	0.5 (0.2, 1.6)	1.6 (0.7, 3.4)	1.6 (0.7, 3.4)			
Vanguard PS	Maxim	118	2692	1.9 (1.4, 2.5)	5.0 (4.1, 6.0)	6.0 (5.0, 7.3)	7.4 (5.6, 9.6)		
Other (168)		414	8914	1.4 (1.1, 1.7)	3.9 (3.4, 4.4)	5.6 (5.0, 6.2)	7.0 (6.3, 7.7)	8.5 (7.6, 9.4)	9.5 (8.5, 10.6)
TOTAL		**6606**	**207071**						

Note: Some cementless components have been cemented.
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 13 years, the cumulative percent revision of primary total knee replacement undertaken for osteoarthritis is 6.8% (Table KT11 and Figure KT9).

Age and Gender

Age is a major factor affecting the outcome of primary total knee replacement. The rate of revision increases with decreasing age, and this difference increases with time. After four years, those aged less than 55 years have over 4.5 times the rate of revision compared to those aged 75 years or older (Table KT12 and Figure KT10).

Males have a higher rate of revision compared to females (Table KT13 and Figure KT11).

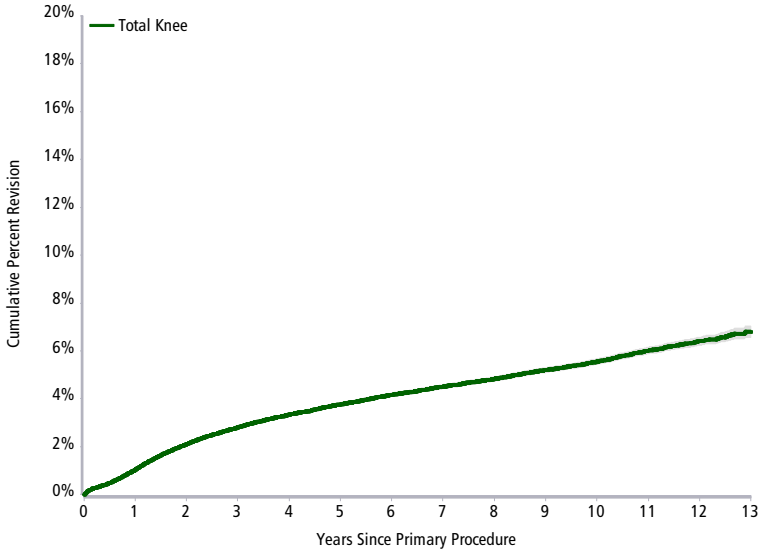
Loosening/lysis is the most common reason for revision in both males and females. Males have a higher incidence of revision for surgeon reported infection than females, with a 13 year cumulative incidence of 1.5% and 0.8% respectively (Figure KT12).

Age related differences in outcome are evident within both males and females (Table KT13 and Figures KT13 and KT14).

Table KT11: 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	13 Yrs
Total Knee	13277	386242	1.0 (1.0, 1.1)	2.8 (2.7, 2.9)	3.8 (3.7, 3.8)	4.5 (4.4, 4.6)	5.6 (5.4, 5.7)	6.8 (6.6, 7.0)

Figure KT9: Cumulative Percent Revision of Primary Total Knee Replacement (Primary Diagnosis OA)

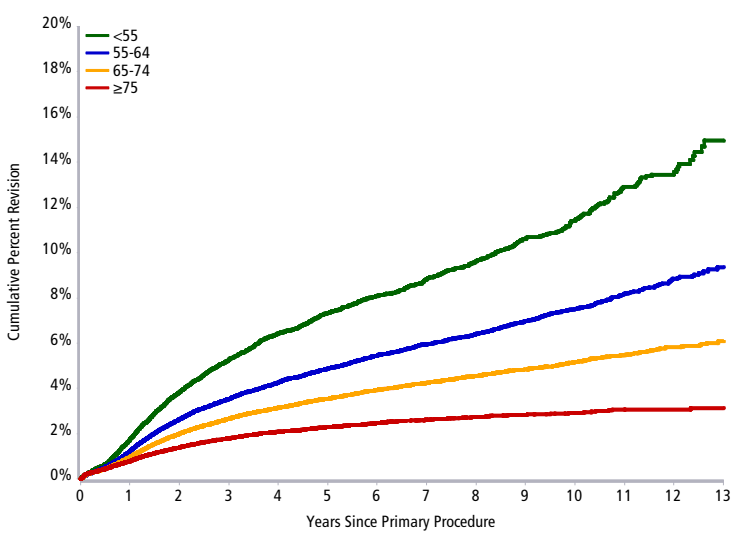


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Total Knee	386242	336702	245413	169367	107475	39239	2405

Table KT12: 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	13 Yrs
<55	1758	25466	1.8 (1.6, 2.0)	5.3 (5.0, 5.6)	7.3 (7.0, 7.7)	8.8 (8.4, 9.3)	11.4 (10.8, 12.1)	14.9 (13.7, 16.3)
55-64	4450	99739	1.2 (1.2, 1.3)	3.5 (3.4, 3.7)	4.9 (4.7, 5.0)	6.0 (5.8, 6.1)	7.5 (7.3, 7.8)	9.4 (8.8, 9.9)
65-74	4780	147445	1.0 (0.9, 1.0)	2.7 (2.6, 2.8)	3.5 (3.4, 3.7)	4.2 (4.1, 4.4)	5.2 (5.0, 5.3)	6.1 (5.8, 6.4)
≥75	2289	113592	0.8 (0.7, 0.8)	1.8 (1.7, 1.9)	2.3 (2.2, 2.4)	2.6 (2.5, 2.7)	2.9 (2.8, 3.1)	3.1 (2.9, 3.4)
TOTAL	**13277**	**386242**						

Figure KT10: Cumulative Percent Revision of Primary Total Knee Replacement by Age (Primary Diagnosis OA)



HR - adjusted for gender

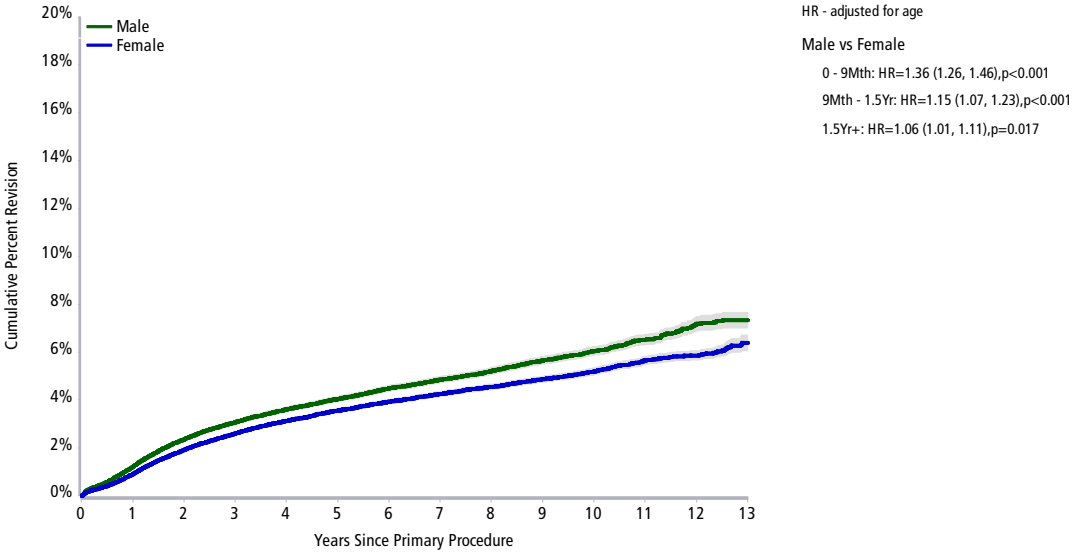
<55 vs ≥75	0 - 1Mth: HR=1.16 (0.85, 1.58),p=0.336
	1Mth - 6Mth: HR=1.71 (1.40, 2.10),p<0.001
	6Mth - 9Mth: HR=3.03 (2.48, 3.71),p<0.001
	9Mth - 4Yr: HR=3.59 (3.31, 3.88),p<0.001
	4Yr - 7Yr: HR=4.76 (4.07, 5.56),p<0.001
	7Yr+: HR=7.83 (6.41, 9.58),p<0.001
55-64 vs ≥75	0 - 1Mth: HR=0.89 (0.73, 1.09),p=0.275
	1Mth - 3Mth: HR=1.13 (0.92, 1.38),p=0.246
	3Mth - 9Mth: HR=1.80 (1.60, 2.02),p<0.001
	9Mth - 3.5Yr: HR=2.27 (2.13, 2.43),p<0.001
	3.5Yr - 5Yr: HR=2.84 (2.49, 3.23),p<0.001
	5Yr - 7Yr: HR=3.59 (3.06, 4.21),p<0.001
	7Yr+: HR=4.31 (3.61, 5.13),p<0.001
65-74 vs ≥75	0 - 6Mth: HR=1.03 (0.92, 1.16),p=0.555
	6Mth - 4Yr: HR=1.63 (1.54, 1.73),p<0.001
	4Yr - 5Yr: HR=1.93 (1.63, 2.28),p<0.001
	5Yr+: HR=2.36 (2.06, 2.72),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
<55	25466	22048	15947	11059	7228	2924	188
55-64	99739	86470	62024	42162	26750	10147	658
65-74	147445	128410	93692	65521	42689	16502	1115
≥75	113592	99774	73750	50625	30808	9666	444

Table KT13: Cumulative Percent Revision of Primary Total Knee Replacement by Gender and Age (Primary Diagnosis OA)

Gender by Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male	**6178**	**167089**	**1.2 (1.2, 1.3)**	**3.1 (3.0, 3.2)**	**4.0 (3.9, 4.1)**	**4.8 (4.7, 5.0)**	**6.0 (5.9, 6.2)**	**7.3 (7.0, 7.7)**
<55	778	10998	2.1 (1.9, 2.4)	5.6 (5.1, 6.1)	7.3 (6.7, 7.9)	8.8 (8.2, 9.5)	11.4 (10.5, 12.3)	14.1 (12.6, 15.7)
55-64	2185	45317	1.4 (1.3, 1.5)	3.8 (3.6, 4.0)	5.2 (5.0, 5.4)	6.4 (6.1, 6.7)	8.1 (7.7, 8.5)	9.9 (9.3, 10.7)
65-74	2230	65439	1.1 (1.1, 1.2)	2.9 (2.7, 3.0)	3.8 (3.6, 3.9)	4.5 (4.3, 4.7)	5.5 (5.2, 5.7)	6.4 (6.0, 6.9)
≥75	985	45335	0.9 (0.8, 1.0)	2.0 (1.8, 2.1)	2.5 (2.3, 2.6)	2.8 (2.6, 3.0)	3.2 (3.0, 3.5)	3.6 (3.2, 4.2)
Female	**7099**	**219153**	**0.9 (0.9, 1.0)**	**2.6 (2.5, 2.7)**	**3.6 (3.5, 3.7)**	**4.2 (4.1, 4.4)**	**5.2 (5.1, 5.3)**	**6.4 (6.1, 6.7)**
<55	980	14468	1.5 (1.3, 1.7)	5.0 (4.6, 5.4)	7.4 (6.9, 7.9)	8.8 (8.2, 9.4)	11.5 (10.7, 12.3)	15.7 (13.8, 17.8)
55-64	2265	54422	1.1 (1.0, 1.2)	3.3 (3.1, 3.5)	4.6 (4.4, 4.8)	5.6 (5.4, 5.9)	7.0 (6.7, 7.4)	8.9 (8.1, 9.8)
65-74	2550	82006	0.8 (0.8, 0.9)	2.5 (2.4, 2.6)	3.4 (3.2, 3.5)	4.1 (3.9, 4.2)	4.9 (4.7, 5.1)	5.8 (5.4, 6.2)
≥75	1304	68257	0.7 (0.6, 0.8)	1.7 (1.6, 1.8)	2.2 (2.1, 2.3)	2.5 (2.3, 2.6)	2.7 (2.6, 2.9)	2.8 (2.7, 3.0)

Figure KT11: Cumulative Percent Revision of Primary Total Knee Replacement by Gender (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male	167089	145007	104408	71161	44509	16079	997
Female	219153	191695	141005	98206	62966	23160	1408

Figure KT12: Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by Gender (Primary Diagnosis OA)

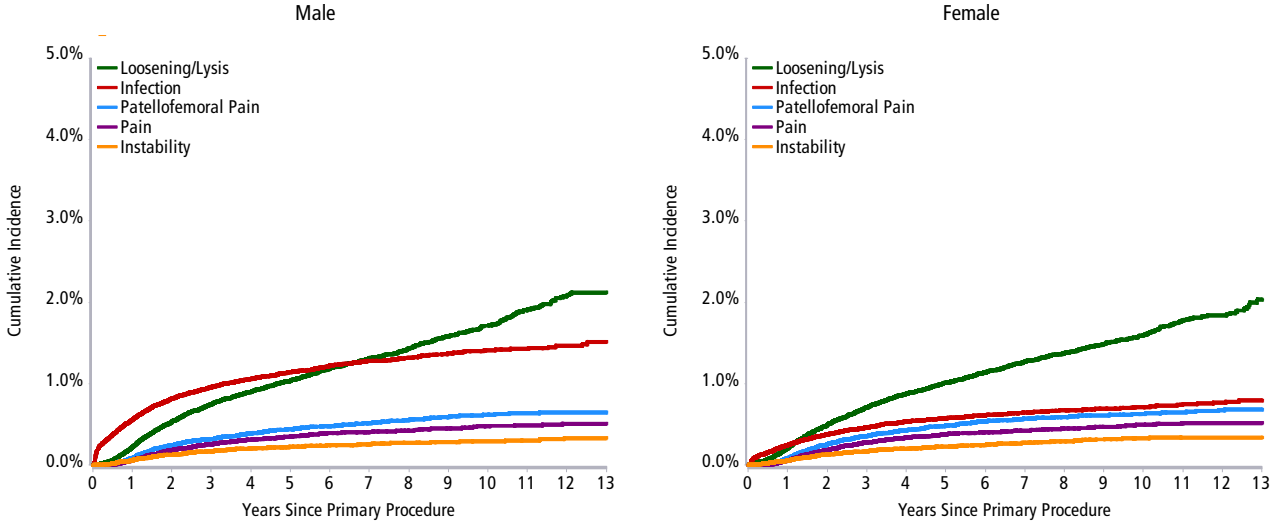
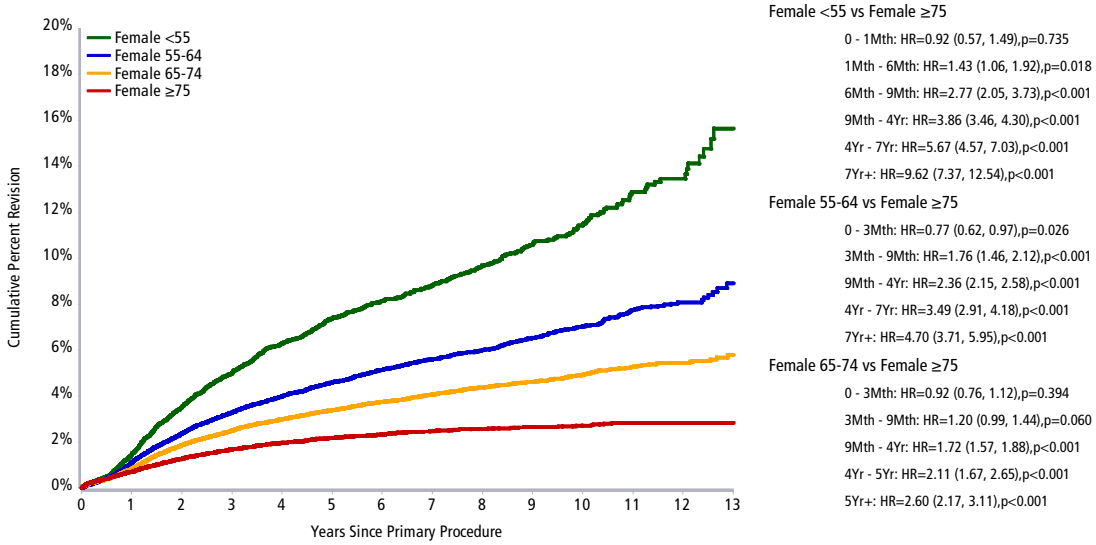
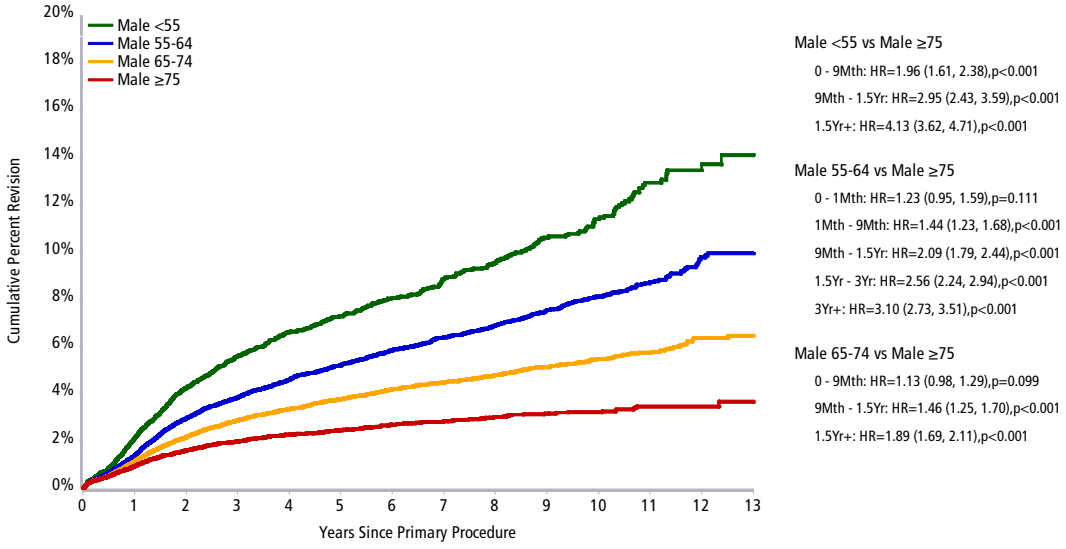


Figure KT13: Cumulative Percent Revision of Primary Total Knee Replacement for Females by Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Female	<55	14468	12511	9038	6225	4025	1594	102
	55-64	54422	47180	33934	23189	14767	5600	346
	65-74	82006	71672	52766	37241	24598	9619	679
	≥75	68257	60332	45267	31551	19576	6347	281

Figure KT14: Cumulative Percent Revision of Primary Total Knee Replacement for Males by Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male	<55	10998	9537	6909	4834	3203	1330	86
	55-64	45317	39290	28090	18973	11983	4547	312
	65-74	65439	56738	40926	28280	18091	6883	436
	≥75	45335	39442	28483	19074	11232	3319	163

Outcome for Osteoarthritis - Prostheses 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 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 over the entire period and rotating-sliding after two years (Table KT14 and Figure KT15).

Within the fixed bearing group, all-polyethylene tibial prostheses have a higher rate of revision compared to moulded non-modular tibial prostheses. There is no difference when comparing all-polyethylene and fixed modular tibial prostheses (Table KT15 and Figure KT16).

The Registry has information on only 1,233 all-polyethylene tibial prostheses. The rate of revision varies depending on the prosthesis used. Two all-polyethylene tibial prostheses have a higher rate of revision compared to all other prostheses in this group (Table KT15). When these two prostheses are excluded, there is no difference in the revision rate of all-polyethylene tibial prostheses compared to moulded non-modular tibial prostheses

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.

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.

Minimally stabilised prostheses are used more commonly than posterior stabilised prostheses. In procedures using either minimally stabilised or posterior stabililised, minimally stabilised account for 72.9%. The use of posterior stabilised peaked in 2008 (33.0%). Since that time it has decreased to 28.5% in 2013 (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 0.3% of primary procedures (Table KT16). They are usually used in complex clinical situations and have therefore not been included in any comparative outcome analysis for primary total knee replacement.

Posterior stabilised prostheses have a higher rate of revision compared to minimally stabilised (Table KT16 and Figure KT18).

Fixation

The outcome 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 KT17 and Figure KT19).

Computer Navigation

There have been 53,928 knee replacement procedures reported to the Registry that have used computer navigation. In 2013, computer navigation was used in 23.8% of all primary total knee replacements. There was no difference overall in the rate of revision between non navigated and navigated knee replacement after 10 years. However there was a difference in the rate of revision for patients aged less than 65 years. In this group there is a reduction in the rate of revision for navigated knee replacement for loosening/lysis (Table KT18 and Figures KT20 - KT22).

Image Derived Instrumentation

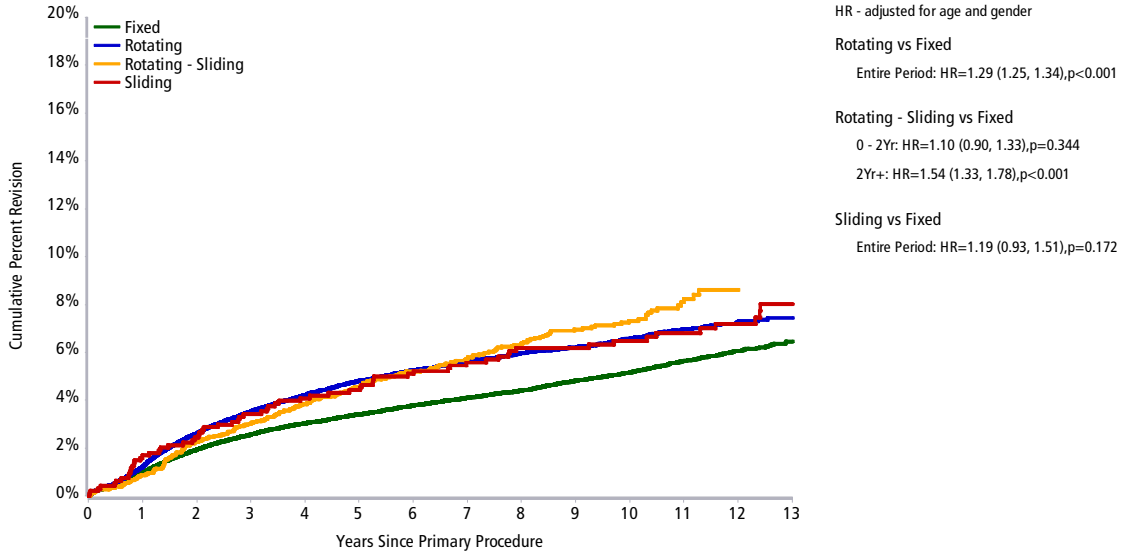
This year the Registry is reporting on Image Derived Instrumentation (IDI) for the first time. The Registry has recorded 8,178 primary total knee procedures undertaken using IDI since 2009. In 2013, IDI was used in 6.7% of all primary total knee procedures. Of those undertaken for osteoarthritis, there is no difference in the rate of revision at three years between procedures with or without IDI usage (Table KT19 and Figure KT23).

Table KT14: 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	13 Yrs
Fixed	9059	294730	1.0 (0.9, 1.0)	2.6 (2.5, 2.6)	3.4 (3.3, 3.5)	4.1 (4.0, 4.2)	5.2 (5.0, 5.3)	6.5 (6.2, 6.7)
Rotating	3853	85712	1.2 (1.2, 1.3)	3.5 (3.4, 3.7)	4.8 (4.6, 5.0)	5.6 (5.5, 5.8)	6.6 (6.3, 6.8)	7.4 (7.1, 7.8)
Rotating - Sliding	295	4712	0.9 (0.6, 1.2)	3.0 (2.6, 3.6)	4.5 (4.0, 5.2)	5.8 (5.1, 6.5)	7.3 (6.5, 8.2)	
Sliding	65	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)	6.5 (5.0, 8.3)	8.0 (6.3, 10.2)
TOTAL	**13272**	**386102**						

Note: Excluding 140 procedures with unknown bearing mobility

Figure KT15: Cumulative Percent Revision of Primary Total Knee Replacement by Bearing Mobility (Primary Diagnosis OA)

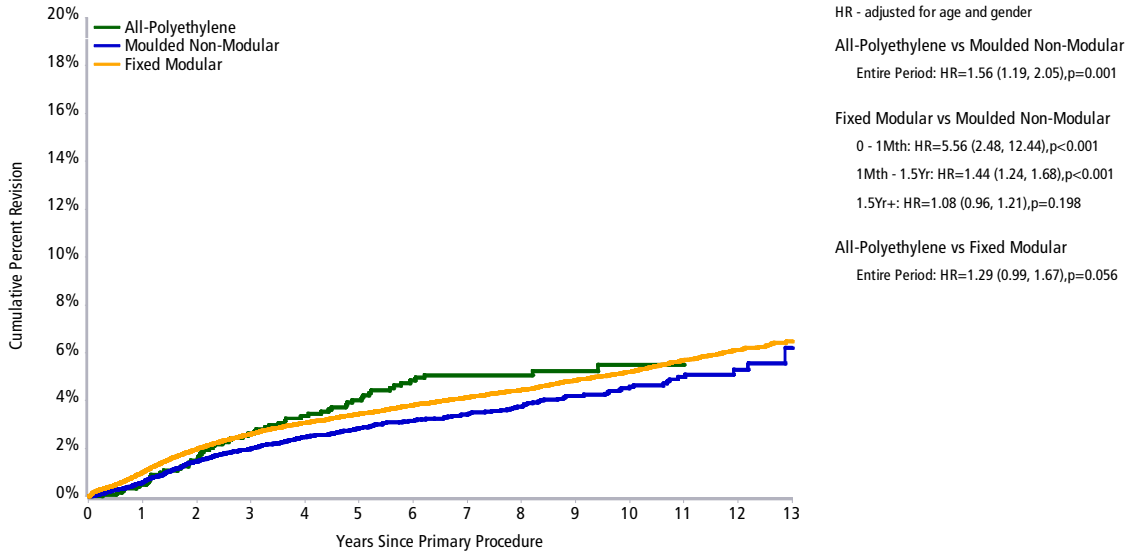


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Fixed	294730	254282	180663	121931	76808	27667	1689
Rotating	85712	76796	59541	42692	26867	9648	508
Rotating - Sliding	4712	4564	4221	3813	2942	1288	8
Sliding	948	925	883	846	788	615	198

Table KT15: Cumulative Percent Revision of Primary Total Knee Replacement by Fixed Bearing Type (Primary Diagnosis OA)

Fixed Bearing	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
All-Polyethylene	58	1233	0.5 (0.2, 1.1)	2.6 (1.9, 3.7)	4.0 (3.0, 5.3)	5.1 (3.9, 6.5)	5.5 (4.2, 7.1)	
Optetrak-PS	10	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)		
Scorpio	37	694	0.6 (0.2, 1.5)	2.8 (1.8, 4.4)	4.4 (3.1, 6.2)	5.4 (3.9, 7.4)	6.0 (4.3, 8.2)	
Other	11	487	0.4 (0.1, 1.7)	1.1 (0.5, 2.6)	1.9 (0.9, 3.7)	2.8 (1.6, 5.1)	2.8 (1.6, 5.1)	
Moulded Non-Modular	471	18077	0.6 (0.5, 0.7)	2.0 (1.8, 2.2)	2.8 (2.6, 3.1)	3.4 (3.1, 3.8)	4.6 (4.1, 5.1)	6.2 (4.8, 7.9)
Fixed Modular	8530	275420	1.0 (1.0, 1.1)	2.6 (2.5, 2.7)	3.4 (3.4, 3.5)	4.1 (4.0, 4.2)	5.2 (5.1, 5.3)	6.5 (6.2, 6.8)
TOTAL	**9059**	**294730**						

Figure KT16: Cumulative Percent Revision of Primary Total Knee Replacement by Fixed Bearing Type (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
All-Polyethylene	1233	1204	1095	967	764	251	3
Moulded Non-Modular	18077	16156	11755	7902	4676	1567	128
Fixed Modular	275420	236922	167813	113062	71368	25849	1558

Figure KT17: Proportion of Primary Total Knee Replacements by Stability (Primary Diagnosis OA)

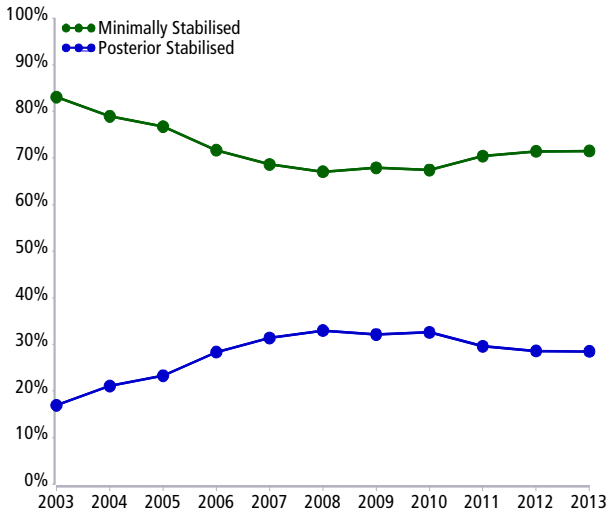
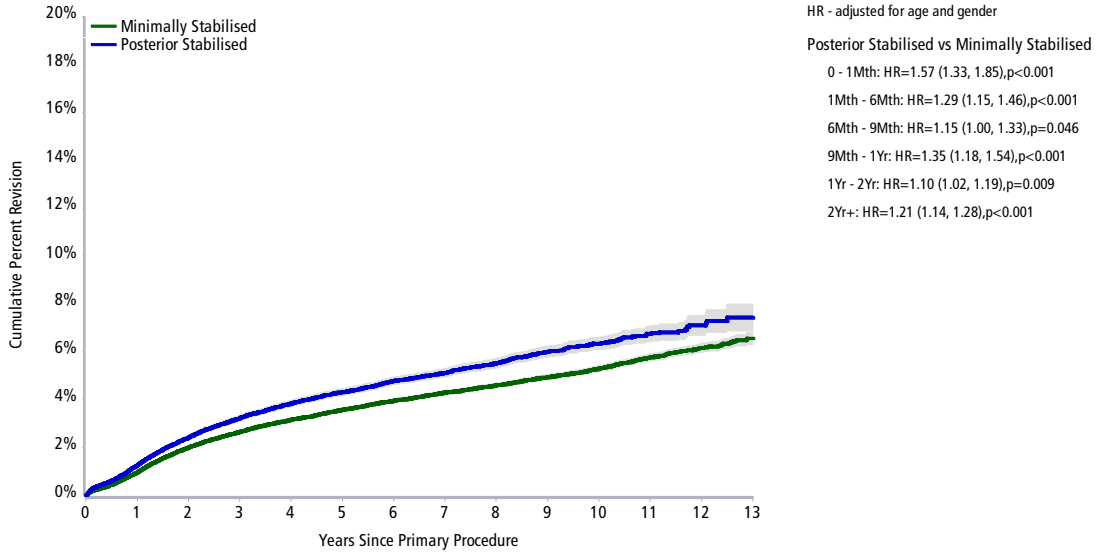


Table KT16: Cumulative Percent Revision of Primary Total Knee Replacement by Stability (Primary Diagnosis OA)

Stability	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Minimally Stabilised	9361	280723	1.0 (0.9, 1.0)	2.6 (2.6, 2.7)	3.6 (3.5, 3.6)	4.3 (4.2, 4.4)	5.3 (5.2, 5.4)	6.5 (6.3, 6.8)
Posterior Stabilised	3857	104149	1.3 (1.2, 1.3)	3.2 (3.1, 3.3)	4.3 (4.2, 4.4)	5.1 (4.9, 5.3)	6.3 (6.1, 6.6)	7.4 (6.9, 8.0)
Fully Stabilised	33	830	2.2 (1.3, 3.6)	4.1 (2.7, 6.1)	5.0 (3.4, 7.4)	6.5 (4.4, 9.5)	8.2 (5.4, 12.5)	
Hinged	21	401	1.6 (0.7, 3.6)	4.8 (2.9, 8.0)	6.0 (3.7, 9.7)	8.0 (4.9, 13.0)		
TOTAL	**13272**	**386103**						

Note: Excluding 139 procedures with unknown stability

Figure KT18: Cumulative Percent Revision of Primary Total Knee Replacement by Stability (Primary Diagnosis OA)



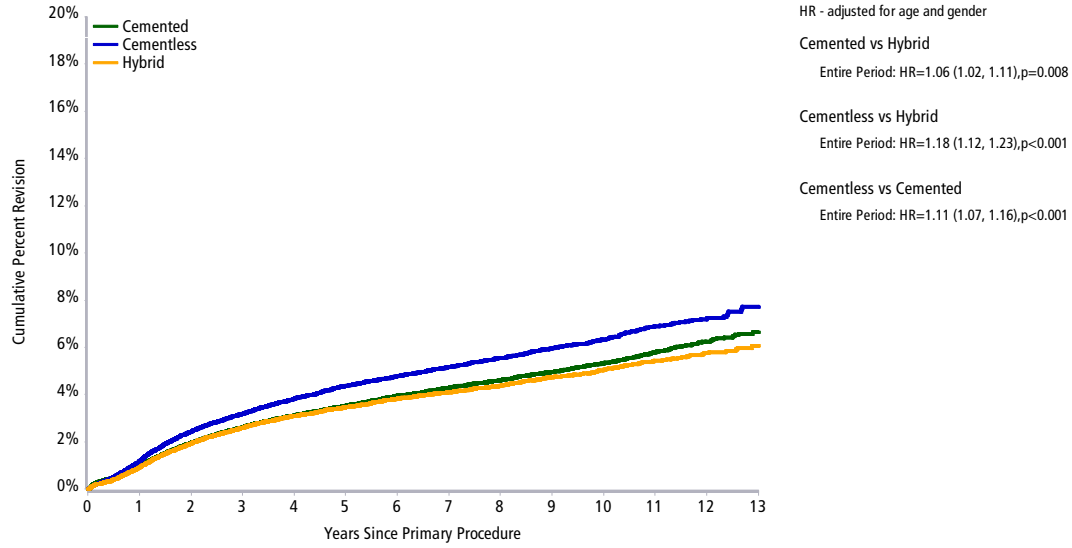
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Minimally Stabilised	280723	245627	180833	128666	85759	33562	2149
Posterior Stabilised	104149	90056	63918	40293	21450	5584	252

Table KT17: 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	13 Yrs
Cemented	6353	200477	1.0 (1.0, 1.0)	2.6 (2.5, 2.7)	3.5 (3.4, 3.6)	4.3 (4.2, 4.4)	5.3 (5.2, 5.5)	6.6 (6.3, 7.0)
Cementless	3631	89099	1.2 (1.1, 1.3)	3.2 (3.1, 3.3)	4.4 (4.2, 4.5)	5.2 (5.0, 5.4)	6.3 (6.1, 6.6)	7.7 (7.2, 8.2)
Hybrid	3100	96248	0.9 (0.9, 1.0)	2.6 (2.5, 2.7)	3.5 (3.3, 3.6)	4.1 (4.0, 4.3)	5.0 (4.8, 5.3)	6.1 (5.7, 6.5)
TOTAL	**13084**	**385824**						

Note: Excluding cementless Genesis Oxinium and Profix Oxinium femoral prostheses

Figure KT19: Cumulative Percent Revision of Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cemented	200477	173276	123862	83440	50768	17366	1071
Cementless	89099	79338	58980	40757	26056	9736	558
Hybrid	96248	83732	62340	44950	30443	11961	776

Table KT18: Cumulative Percent Revision of Primary Total Knee Replacement by Computer Navigation and Age (Primary Diagnosis OA)

Navigation by Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Computer Navigated	**1341**	**53928**	**1.0 (0.9, 1.1)**	**2.8 (2.6, 2.9)**	**3.7 (3.5, 4.0)**	**4.5 (4.2, 4.8)**	**5.5 (4.8, 6.4)**	
Age <65	612	19086	1.1 (1.0, 1.3)	3.5 (3.2, 3.8)	4.9 (4.5, 5.4)	6.0 (5.5, 6.6)	7.5 (6.3, 8.9)	
Age ≥65	729	34842	0.9 (0.8, 1.0)	2.4 (2.2, 2.6)	3.1 (2.8, 3.3)	3.7 (3.4, 4.0)	4.4 (3.6, 5.4)	
Non Navigated	**11936**	**332314**	**1.1 (1.0, 1.1)**	**2.8 (2.7, 2.9)**	**3.8 (3.7, 3.8)**	**4.5 (4.4, 4.6)**	**5.6 (5.4, 5.7)**	**6.8 (6.6, 7.0)**
Age <65	5596	106119	1.4 (1.3, 1.5)	4.0 (3.8, 4.1)	5.5 (5.3, 5.6)	6.6 (6.4, 6.8)	8.4 (8.2, 8.7)	10.7 (10.2, 11.2)
Age ≥65	6340	226195	0.9 (0.9, 0.9)	2.3 (2.2, 2.3)	3.0 (2.9, 3.1)	3.5 (3.4, 3.6)	4.2 (4.1, 4.3)	4.9 (4.7, 5.1)
TOTAL	**13277**	**386242**						

Figure KT20: Cumulative Percent Revision of Primary Total Knee Replacement by Computer Navigation (Primary Diagnosis OA)

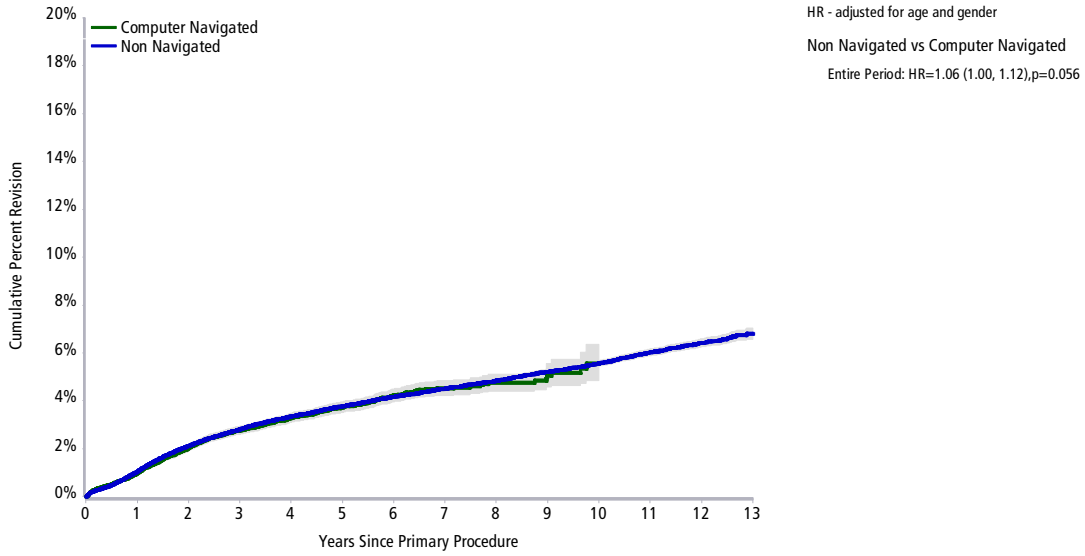


Figure KT21: Cumulative Percent Revision of Primary Total Knee Replacement by Computer Navigation and Age (Primary Diagnosis OA)

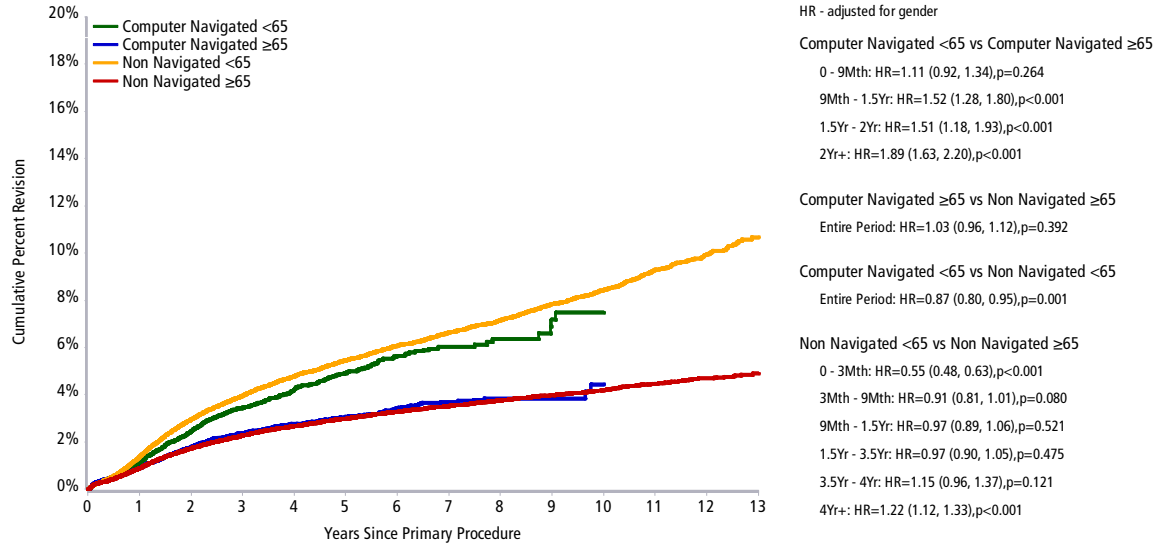
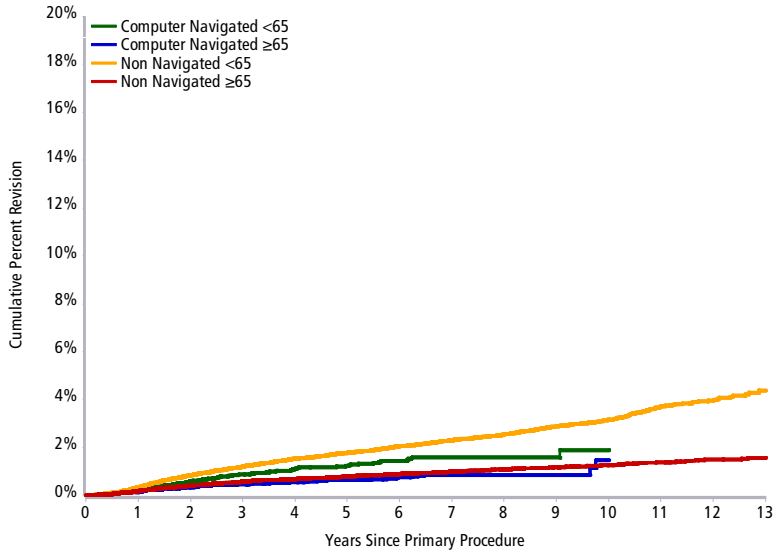


Figure KT22: Cumulative Percent Revision for Loosening/Lysis of Primary Total Knee Replacement by Navigation and Age (Primary Diagnosis OA)



HR - adjusted for gender

Computer Navigated <65 vs Computer Navigated ≥65

Entire Period: HR=1.84 (1.46, 2.31),p<0.001

Computer Navigated ≥65 vs Non Navigated ≥65

Entire Period: HR=0.83 (0.70, 0.99),p=0.036

Computer Navigated <65 vs Non Navigated <65

Entire Period: HR=0.69 (0.58, 0.81),p<0.001

Non Navigated <65 vs Non Navigated ≥65

0 - 1Mth: HR=0.85 (0.48, 1.49),p=0.561

1Mth - 6Mth: HR=2.20 (1.67, 2.91),p<0.001

6Mth - 9Mth: HR=1.89 (1.46, 2.44),p<0.001

9Mth - 2.5Yr: HR=2.19 (1.97, 2.42),p<0.001

2.5Yr - 3Yr: HR=2.00 (1.57, 2.54),p<0.001

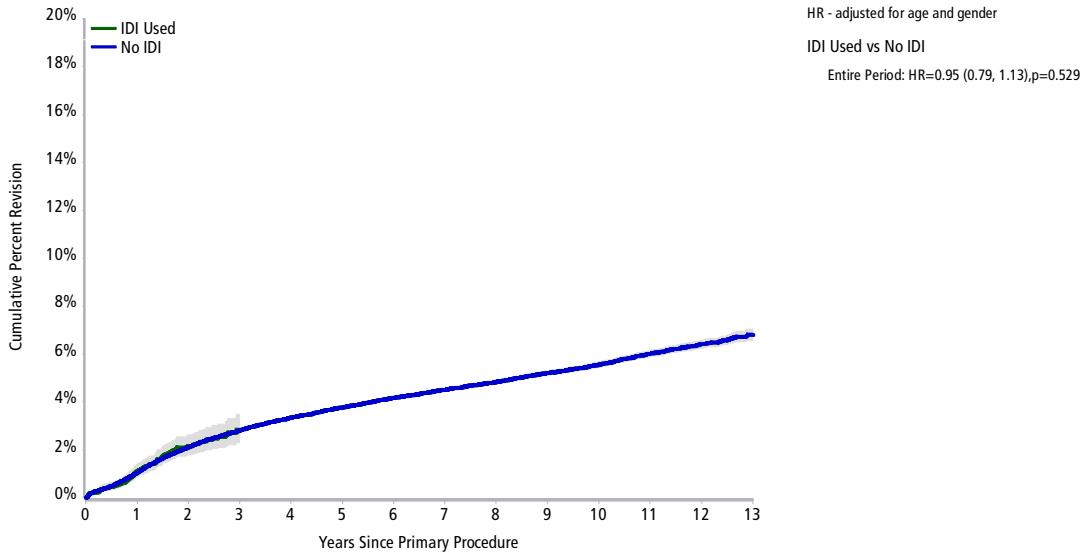
3Yr+: HR=2.87 (2.59, 3.17),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Computer Navigated	**53928**	**42985**	**23738**	**10245**	**3808**	**362**	**0**
Age <65	19086	15392	8458	3607	1336	116	0
Age ≥65	34842	27593	15280	6638	2472	246	0
Non Navigated	**332314**	**293717**	**221675**	**159122**	**103667**	**38877**	**2405**
Age <65	106119	93126	69513	49614	32642	12955	846
Age ≥65	226195	200591	152162	109508	71025	25922	1559

Table KT19: 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	13 Yrs
IDI Used	127	8033	1.1 (0.9, 1.4)	2.8 (2.3, 3.5)				
No IDI	13150	378209	1.0 (1.0, 1.1)	2.8 (2.7, 2.9)	3.8 (3.7, 3.8)	4.5 (4.4, 4.6)	5.6 (5.4, 5.7)	6.8 (6.6, 7.0)
TOTAL	**13277**	**386242**						

Figure KT23: 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	13 Yrs
IDI Used	8033	5067	789	0	0	0	0
No IDI	378209	331635	244624	169367	107475	39239	2405

Bearing Surface

There are two tibial bearing surfaces used in primary total knee replacement, cross-linked and non cross-linked polyethylene. Cross-linked polyethylene (XLPE) has been classified as ultra high molecular weight polyethylene that has been irradiated by high dose (≥50kGy) Gamma or electron beam radiation. Cross-linked polyethylene also includes 470 procedures that have cross-linked polyethylene with the addition of an antioxidant.

Prostheses using cross-linked polyethylene have a lower rate of revision compared to prostheses using non cross-linked polyethylene (Table KT20 and Figure KT24). At 10 years, there is a difference in the cumulative incidence for loosening/lysis; 0.8% for cross-linked polyethylene compared to 1.7% for non cross-linked polyethylene (Figure KT25).

In primary total knee replacement, cross-linked polyethylene is used less frequently than non cross-linked polyethylene and there is considerable prostheses variation in its use. Consequently, any observed difference in revision rate may be confounded by prostheses type. For this reason, subsequent analysis has been limited to specific prostheses that have both cross-linked and non-cross-linked polyethylene options. The criteria for inclusion were a minimum of 2,500 procedures in at least one of the polyethylene groups and a follow up time of five or more years. Four primary total knee prostheses fulfilled these criteria; Natural Knee II, Triathlon, Nexgen and Scorpio NRG/Series 7000. The analysis for each of these prostheses includes age, reasons for revision and stability of the prostheses.

Prosthesis Specific Analysis

The analysis for the Natural Knee II only includes minimally stabilised prostheses as the posterior stabilised option has been rarely used. The Registry has 10 year follow up for both types of polyethylene. Cross-linked polyethylene was used in 53.7% of procedures and has a lower rate of revision after 3.5 years (Table KT21 and Figure KT26). 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 KT21 and Figure KT28). The 10 year cumulative incidence of revision for loosening/lysis is 1.0% for cross-linked polyethylene and 3.6% for non cross-linked polyethylene and this difference occurs after 4.5 years (Figures KT27 and KT29).

The Triathlon knee has seven year follow up and cross-linked polyethylene was used in 72.1% of procedures. There is no difference in rate of revision within minimally and posterior stabilised Triathlon prostheses when comparing cross-linked and non cross-linked polyethylene (Table KT22 and Figure KT30). Age has no effect on this outcome (Tables KT23 and KT24 and Figures KT31 and KT33). There is no difference in the reasons for revision between cross-linked and non cross-linked polyethylene except for minimally stabilised prostheses used in those less than 65 years. In this age group non cross-linked polyethylene has a higher rate of revision for infection. The clinical significance of this is uncertain (Figures KT32 and KT34).

The Nexgen has 10 year follow up for both cross-linked and non cross-linked polyethylene for the minimally stabilised and seven year follow up for the posterior stabilised prostheses.

Cross-linked polyethylene was used in 75.7% of minimally stabilised Nexgen CR and CR Flex knees and has a lower rate of revision after 2.5 years (Table KT25 and Figure KT35). When comparing age groups, this difference is only evident in those aged less than 65 years (Table KT26 and Figure KT36). For those aged less than 65 years, cross-linked polyethylene has a lower rate of revision for loosening/lysis compared to non cross-linked polyethylene. The 10 year cumulative incidence is 1.2% and 2.0% respectively (Figure KT37).

Cross-linked polyethylene was used in 30.3% of posterior stabilised Nexgen LPS and LPS Flex knees. There is no difference in the rate of revision when comparing cross-linked and non cross-linked polyethylene (Table KT25 and Figure KT35). There is also no age related difference and no difference in the reasons for revision (Table KT27 and Figures KT38 and KT39).

The Scorpio NRG/Series 7000 knee has five year follow up and cross-linked polyethylene was used in 85.5% of procedures. There is no difference in rate of revision within minimally and posterior stabilised Scorpio NRG/Series 7000 prostheses when comparing cross-linked and non cross-linked polyethylene (Table KT28 and Figure KT40). Age also has no effect on this outcome and there is no difference in the reasons for revision between cross-linked and non cross-linked polyethylene (Tables KT29 and KT30 and Figures KT41-44).

There is prostheses variation in the effect that cross-linked polyethylene has on the rate of revision following primary total knee replacement. A lower rate of revision has been identified for the two minimally stabilised knees 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. No difference is identified with either minimally or posterior stabilised for the Triathlon and Scorpio NRG/Series 7000, or the posterior stabilised Nexgen. Each of these prostheses has a follow up time of seven years or less.

Table KT20: Cumulative Percent Revision of Primary Total Knee Replacement by Polyethylene Bearing Surface (Primary Diagnosis OA)

Polyethylene	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cross-Linked	1450	83890	0.9 (0.8, 0.9)	2.0 (1.9, 2.2)	2.6 (2.4, 2.7)	2.9 (2.7, 3.0)	3.5 (3.2, 3.8)	
Non Cross-Linked	11822	302214	1.1 (1.1, 1.1)	3.0 (2.9, 3.0)	4.0 (3.9, 4.1)	4.8 (4.7, 4.9)	5.8 (5.7, 6.0)	7.1 (6.8, 7.3)
TOTAL	**13272**	**386104**						

Note: Cross-linked polyethylene includes 459 procedures using cross-linked polyethylene with Vitamin-E.
Excluding 138 procedures with unknown bearing surface

Figure KT24: Cumulative Percent Revision of Primary Total Knee Replacement by Polyethylene Bearing Surface (Primary Diagnosis OA)

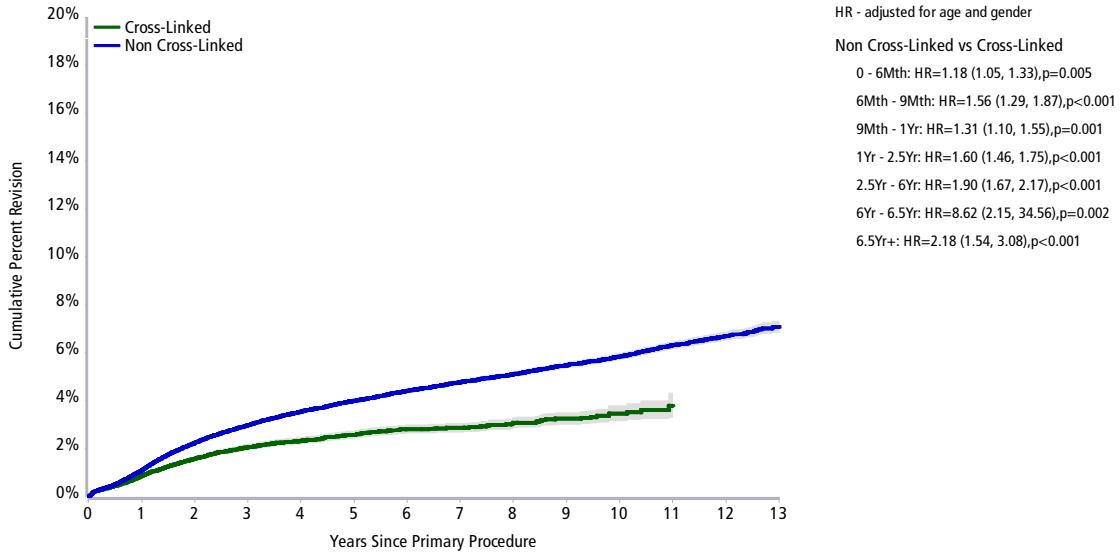
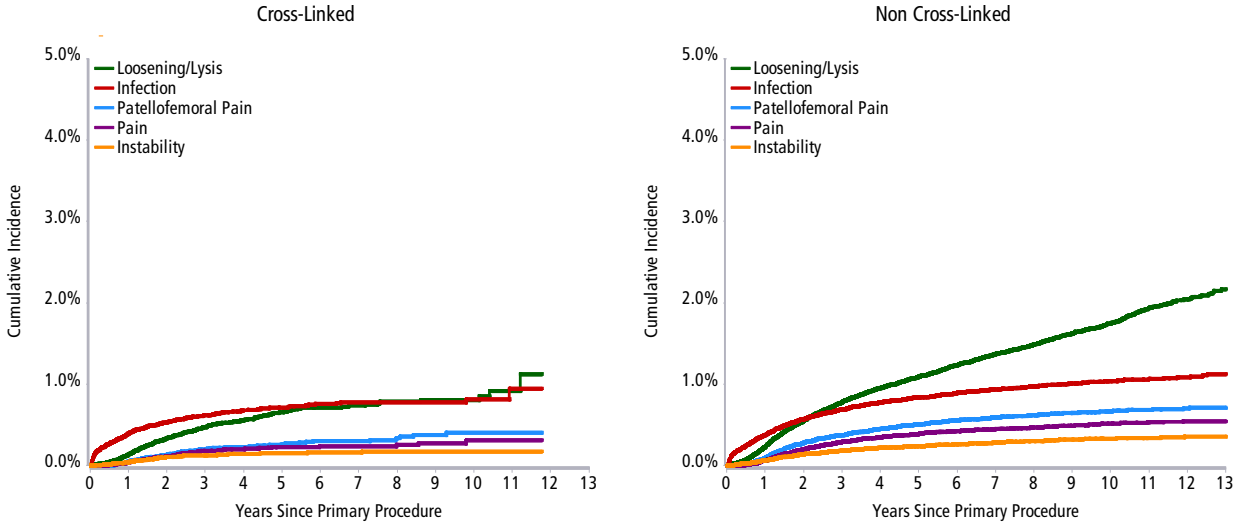


Figure KT25: Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by Polyethylene Bearing Surface (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cross-Linked	83890	64425	34126	15849	7436	1607	0
Non Cross-Linked	302214	272143	211182	153433	99969	37611	2403

Table KT21: Cumulative Percent Revision of Minimally Stabilised Natural Knee II/Natural Knee II Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

Polyethylene by Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cross-Linked	**93**	**3312**	**1.0 (0.7, 1.4)**	**2.1 (1.6, 2.7)**	**2.8 (2.2, 3.5)**	**3.1 (2.5, 3.8)**	**3.8 (3.0, 4.7)**	
Age <65	51	1026	1.5 (0.9, 2.5)	3.5 (2.5, 4.9)	4.8 (3.6, 6.4)	5.3 (4.0, 7.0)	6.0 (4.5, 7.9)	
Age ≥65	42	2286	0.7 (0.4, 1.2)	1.4 (1.0, 2.1)	1.8 (1.3, 2.5)	2.1 (1.5, 2.9)	2.7 (1.9, 3.9)	
Non Cross-Linked	**190**	**2860**	**0.8 (0.5, 1.2)**	**2.0 (1.5, 2.5)**	**3.0 (2.4, 3.7)**	**4.3 (3.6, 5.2)**	**7.4 (6.3, 8.5)**	**9.9 (8.5, 11.6)**
Age <65	97	766	1.0 (0.5, 2.1)	3.0 (2.0, 4.5)	4.6 (3.4, 6.4)	7.0 (5.3, 9.0)	12.9 (10.6, 15.8)	
Age ≥65	93	2094	0.7 (0.4, 1.2)	1.6 (1.1, 2.2)	2.4 (1.8, 3.2)	3.2 (2.5, 4.2)	4.9 (3.9, 6.1)	
TOTAL	**283**	**6172**						

Figure KT26: Cumulative Percent Revision of Minimally Stabilised Natural Knee II/Natural Knee II Primary Total Knee Replacement by Polyethylene Bearing Surface (Primary Diagnosis OA)

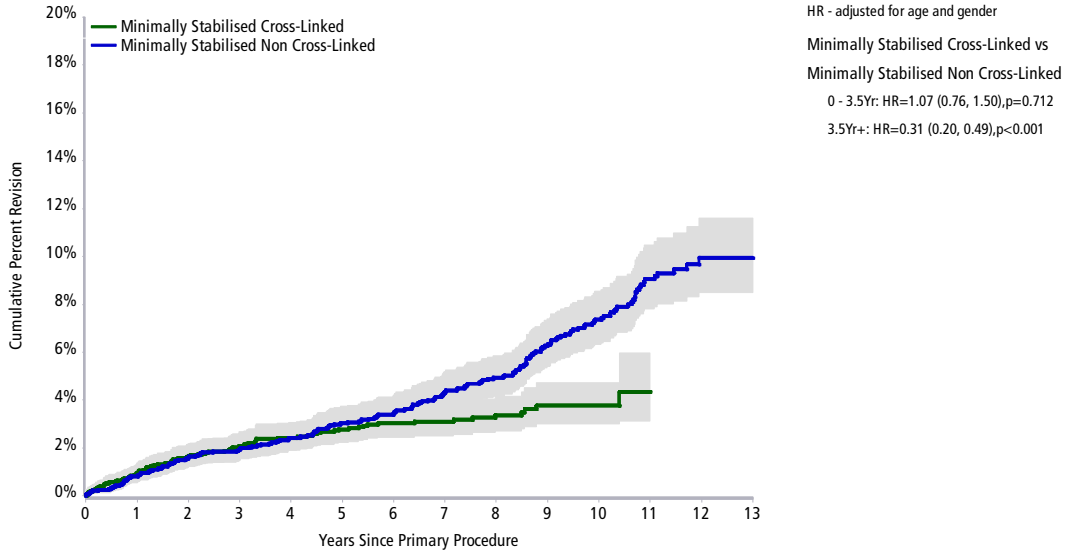
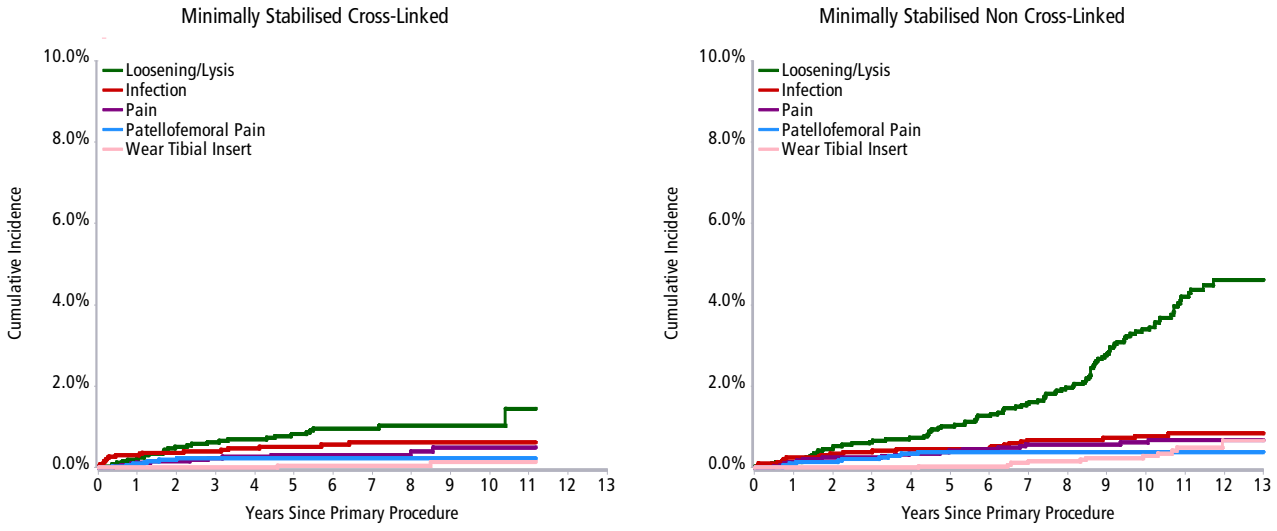


Figure KT27: Cumulative Incidence Revision Diagnosis of Minimally Stabilised Natural Knee II/Natural Knee II Primary Total Knee Replacement by Polyethylene Bearing Surface (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cross-Linked	**3312**	**3083**	**2554**	**2032**	**1304**	**294**	**0**
<65	1026	963	820	665	456	111	0
≥65	2286	2120	1734	1367	848	183	0
Non Cross-Linked	**2860**	**2801**	**2654**	**2467**	**2091**	**1286**	**58**
<65	766	754	730	703	620	422	28
≥65	2094	2047	1924	1764	1471	864	30

Figure KT28: Cumulative Percent Revision of Minimally Stabilised Natural Knee II/Natural Knee II Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

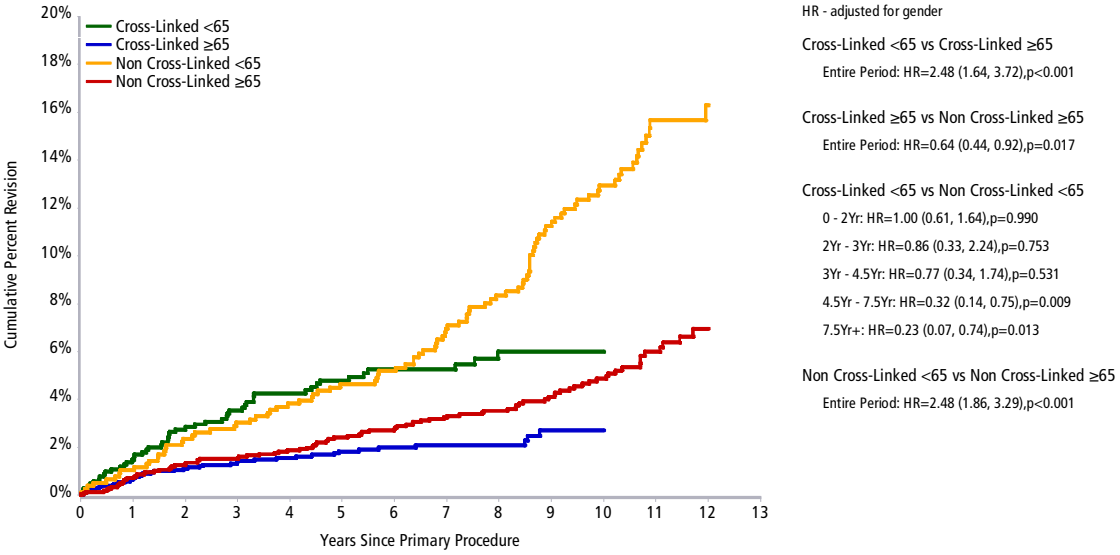


Figure KT29: Cumulative Incidence Revision Diagnosis of Minimally Stabilised Natural Knee II/Natural Knee II Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

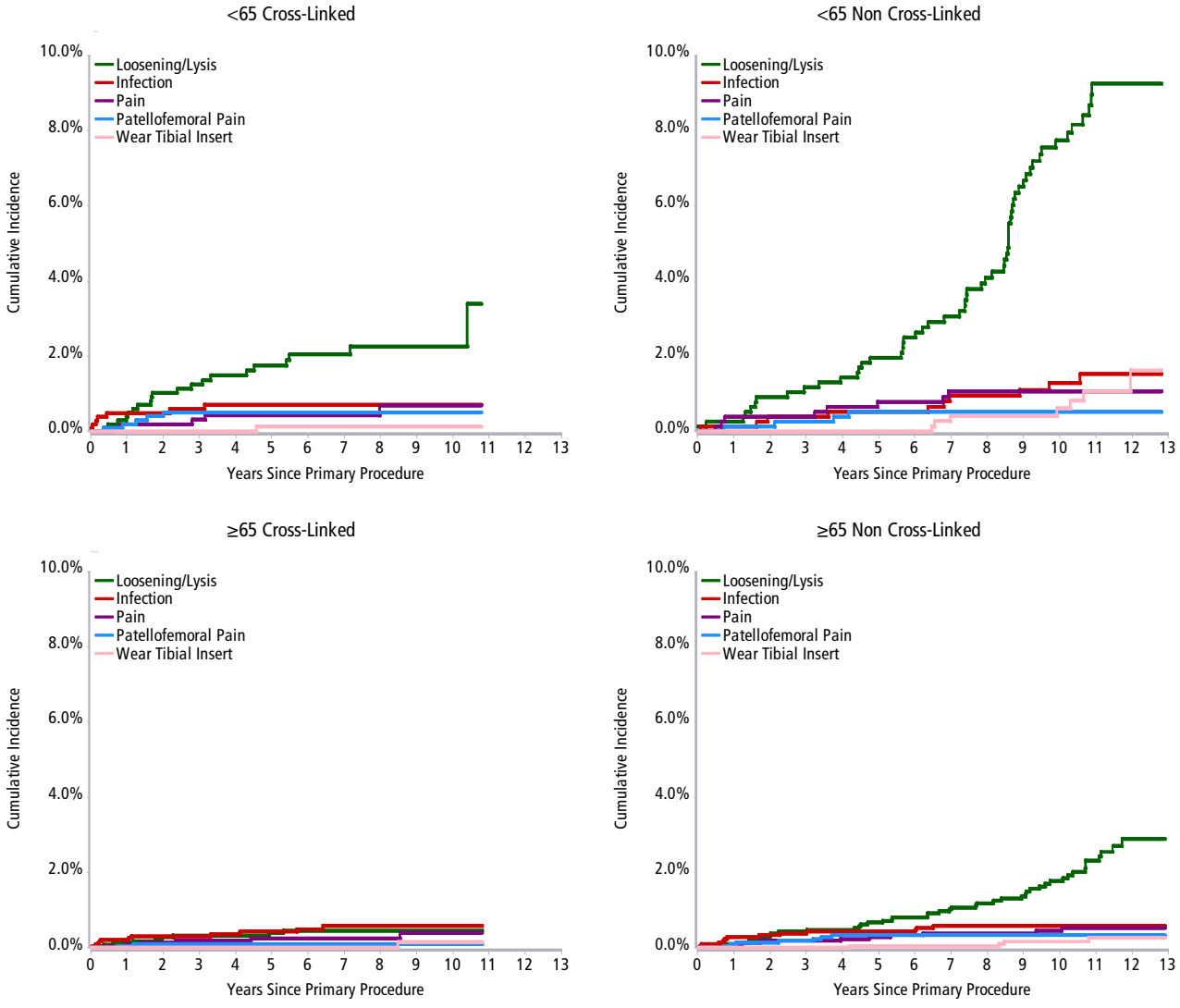
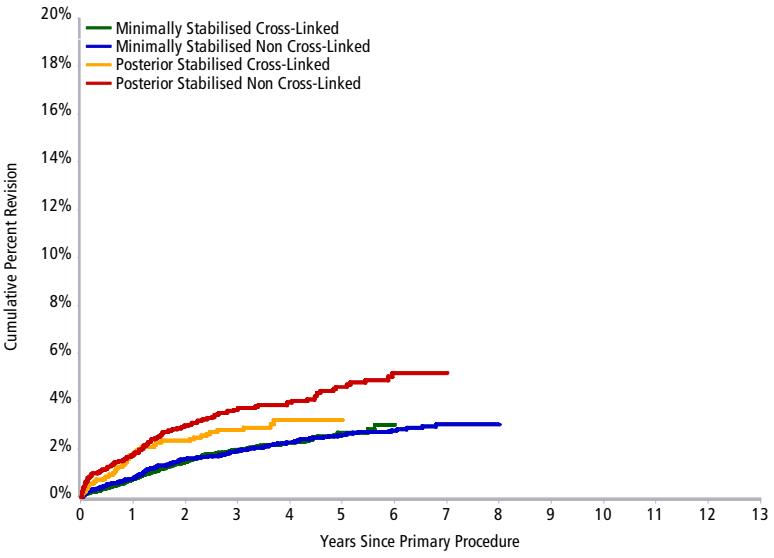


Table KT22: Cumulative Percent Revision of Triathlon/Triathlon Primary Total Knee Replacement by Stability and Polyethylene Bearing Surface (Primary Diagnosis OA)

Stability by Polyethylene	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Minimally Stabilised	**551**	**33899**	**0.8 (0.7, 0.9)**	**1.9 (1.8, 2.1)**	**2.6 (2.4, 2.9)**	**3.1 (2.7, 3.5)**		
Cross-Linked	369	25839	0.7 (0.6, 0.9)	2.0 (1.8, 2.2)	2.7 (2.3, 3.1)			
Non Cross-Linked	182	8060	0.8 (0.6, 1.0)	1.9 (1.6, 2.3)	2.6 (2.2, 3.0)	3.0 (2.6, 3.5)		
Posterior Stabilised	**198**	**6331**	**1.8 (1.5, 2.2)**	**3.3 (2.9, 3.8)**	**4.2 (3.6, 4.8)**	**4.7 (4.0, 5.6)**		
Cross-Linked	72	3149	1.8 (1.4, 2.4)	2.8 (2.2, 3.5)	3.2 (2.5, 4.1)			
Non Cross-Linked	126	3182	1.8 (1.4, 2.3)	3.7 (3.0, 4.4)	4.6 (3.8, 5.5)	5.2 (4.3, 6.3)		
TOTAL	**749**	**40230**						

Note: The minimally stabilised group includes Triathlon CR/Triathlon prosthesis combination.
The posterior stabilised group includes Triathlon PS/Triathlon prosthesis combination.

Figure KT30: Cumulative Percent Revision of Triathlon/Triathlon Primary Total Knee Replacement by Polyethylene Bearing Surface and Stability (Primary Diagnosis OA)



HR - adjusted for age and gender

Minimally Stabilised Cross-Linked vs
Minimally Stabilised Non Cross-Linked
Entire Period: HR=0.98 (0.82, 1.18),p=0.857

Minimally Stabilised Non Cross-Linked vs
Posterior Stabilised Non Cross-Linked
0 - 3Mth: HR=0.27 (0.17, 0.41),p<0.001
3Mth - 2Yr: HR=0.63 (0.46, 0.86),p=0.003
2Yr+: HR=0.66 (0.45, 0.95),p=0.027

Minimally Stabilised Cross-Linked vs
Posterior Stabilised Cross-Linked
0 - 6Mth: HR=0.45 (0.32, 0.63),p<0.001
6Mth - 1Yr: HR=0.70 (0.47, 1.04),p=0.075
1Yr - 1.5Yr: HR=0.65 (0.44, 0.95),p=0.028
1.5Yr+: HR=0.93 (0.67, 1.30),p=0.679

Posterior Stabilised Cross-Linked vs
Posterior Stabilised Non Cross-Linked
Entire Period: HR=0.79 (0.59, 1.05),p=0.106

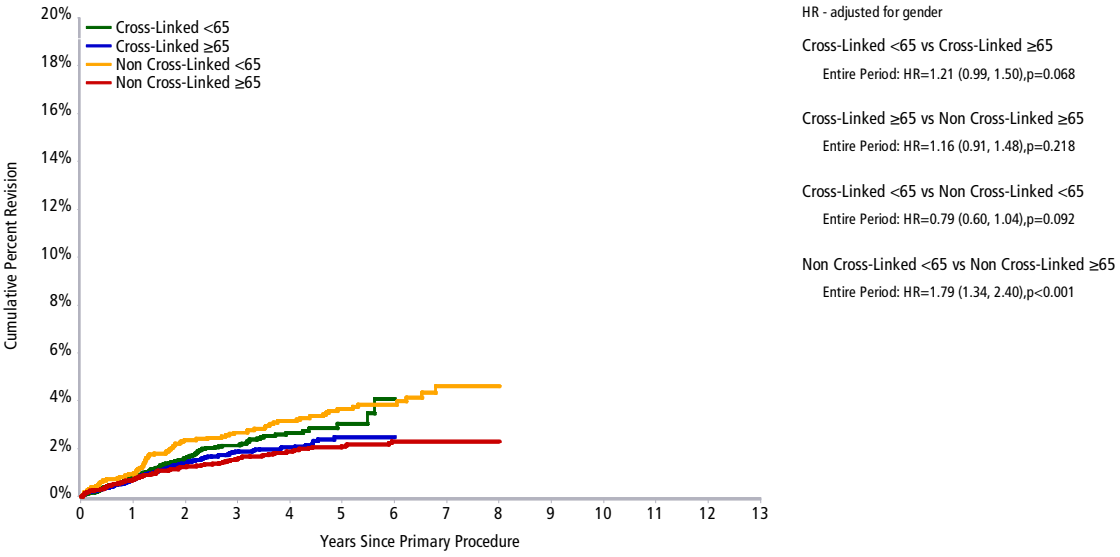
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Minimally Stabilised		**33899**	**26317**	**13297**	**5004**	**869**	**0**	**0**
	Cross-Linked	25839	18964	7621	1273	0	0	0
	Non Cross-Linked	8060	7353	5676	3731	869	0	0
Posterior Stabilised		**6331**	**5260**	**3016**	**1291**	**177**	**0**	**0**
	Cross-Linked	3149	2391	906	199	0	0	0
	Non Cross-Linked	3182	2869	2110	1092	177	0	0

Table KT23: Cumulative Percent Revision of Triathlon CR/Triathlon Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

Polyethylene	Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cross-Linked		**369**	**25839**	**0.7 (0.6, 0.9)**	**2.0 (1.8, 2.2)**	**2.7 (2.3, 3.1)**			
	<65	143	8805	0.8 (0.6, 1.1)	2.1 (1.8, 2.5)	3.0 (2.4, 3.8)			
	≥65	226	17034	0.7 (0.6, 0.9)	1.9 (1.6, 2.1)	2.5 (2.1, 3.0)			
Non Cross-Linked		**182**	**8060**	**0.8 (0.6, 1.0)**	**1.9 (1.6, 2.3)**	**2.6 (2.2, 3.0)**	**3.0 (2.6, 3.5)**		
	<65	82	2536	1.0 (0.7, 1.4)	2.7 (2.1, 3.4)	3.7 (2.9, 4.6)	4.6 (3.6, 5.9)		
	≥65	100	5524	0.7 (0.5, 1.0)	1.6 (1.3, 2.0)	2.1 (1.7, 2.6)	2.3 (1.9, 2.8)		
TOTAL		**551**	**33899**						

Note: The stability of a procedure is based on the knee insert used

Figure KT31: Cumulative Percent Revision of Triathlon CR/Triathlon Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cross-Linked		**25839**	**18964**	**7621**	**1273**	**0**	**0**	**0**
	<65	8805	6492	2596	440	0	0	0
	≥65	17034	12472	5025	833	0	0	0
Non Cross-Linked		**8060**	**7353**	**5676**	**3731**	**869**	**0**	**0**
	<65	2536	2324	1765	1167	274	0	0
	≥65	5524	5029	3911	2564	595	0	0

Figure KT32: Cumulative Incidence Revision Diagnosis of Triathlon CR/Triathlon Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

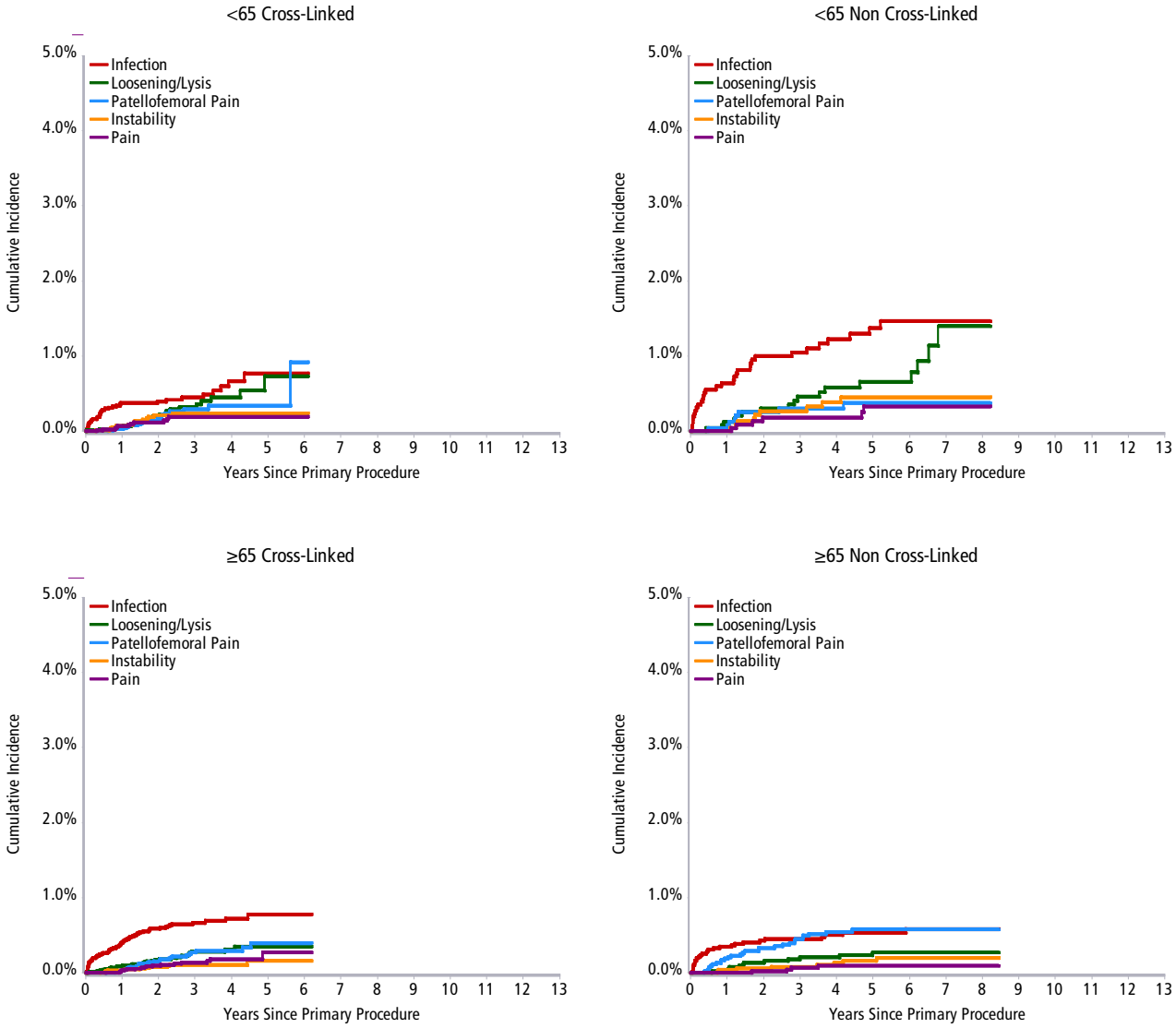
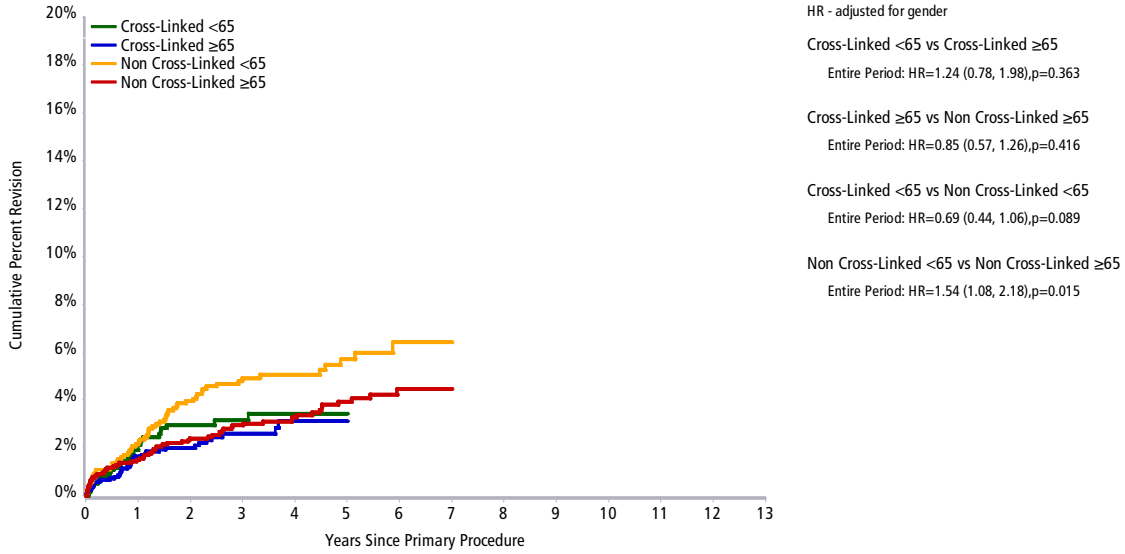


Table KT24: Cumulative Percent Revision of Triathlon PS/Triathlon Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

Polyethylene	Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cross-Linked		**72**	**3149**	**1.8 (1.4, 2.4)**	**2.8 (2.2, 3.5)**	**3.2 (2.5, 4.1)**			
	<65	31	1155	2.1 (1.4, 3.2)	3.1 (2.2, 4.5)	3.4 (2.4, 4.9)			
	≥65	41	1994	1.6 (1.1, 2.4)	2.6 (1.9, 3.6)	3.1 (2.2, 4.4)			
Non Cross-Linked		**126**	**3182**	**1.8 (1.4, 2.3)**	**3.7 (3.0, 4.4)**	**4.6 (3.8, 5.5)**	**5.2 (4.3, 6.3)**		
	<65	60	1191	2.3 (1.5, 3.3)	4.9 (3.8, 6.4)	5.7 (4.4, 7.4)	6.4 (4.8, 8.5)		
	≥65	66	1991	1.5 (1.0, 2.1)	2.9 (2.2, 3.8)	3.9 (3.0, 5.1)	4.5 (3.4, 5.8)		
TOTAL		**198**	**6331**						

Note: The stability of a procedure is based on the knee insert used

Figure KT33: Cumulative Percent Revision of Triathlon PS/Triathlon Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cross-Linked		**3149**	**2391**	**906**	**199**	**0**	**0**	**0**
	<65	1155	893	359	97	0	0	0
	≥65	1994	1498	547	102	0	0	0
Non Cross-Linked		**3182**	**2869**	**2110**	**1092**	**177**	**0**	**0**
	<65	1191	1072	788	377	52	0	0
	≥65	1991	1797	1322	715	125	0	0

Figure KT34: Cumulative Incidence Revision Diagnosis of Triathlon PS/Triathlon Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

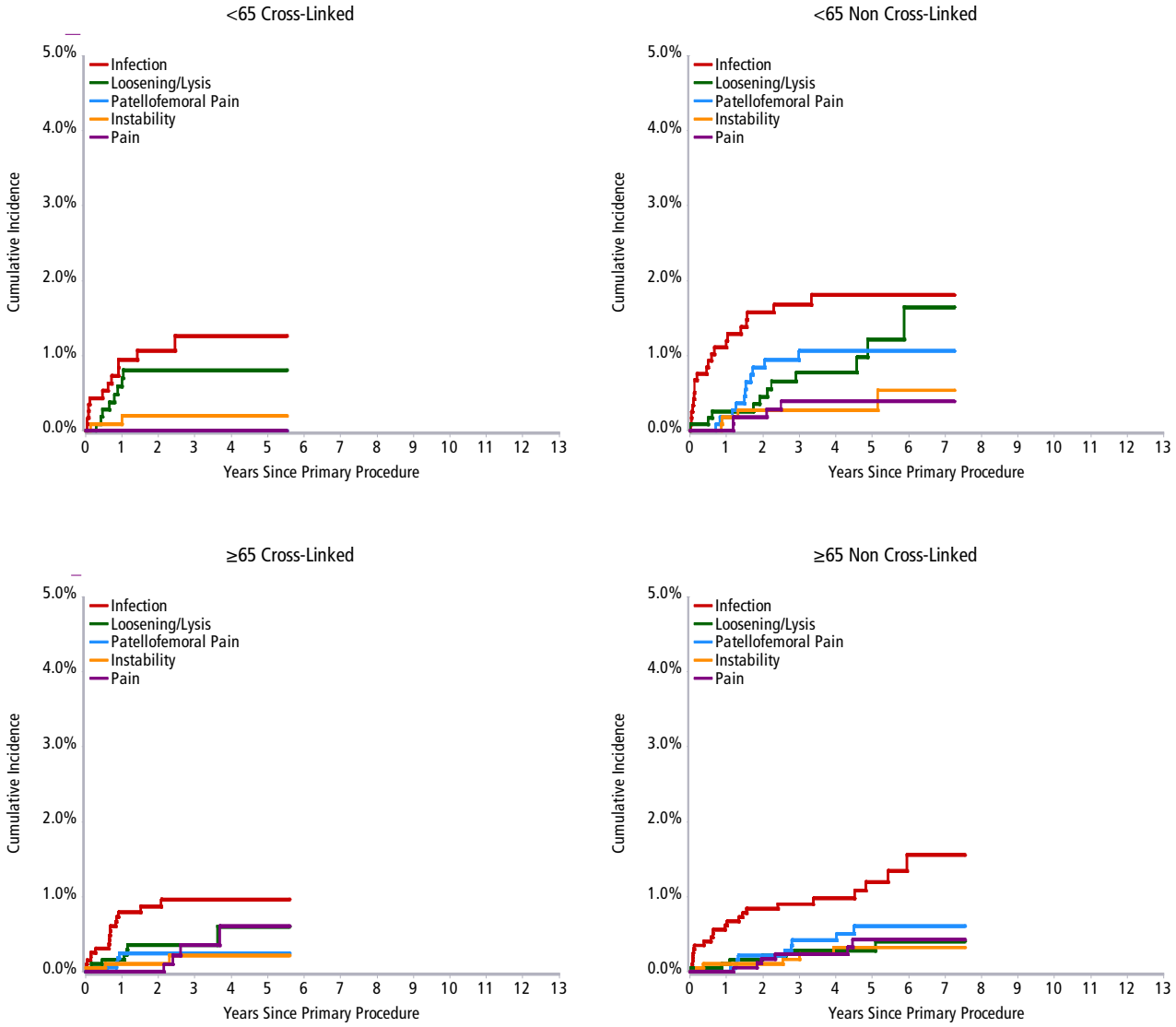
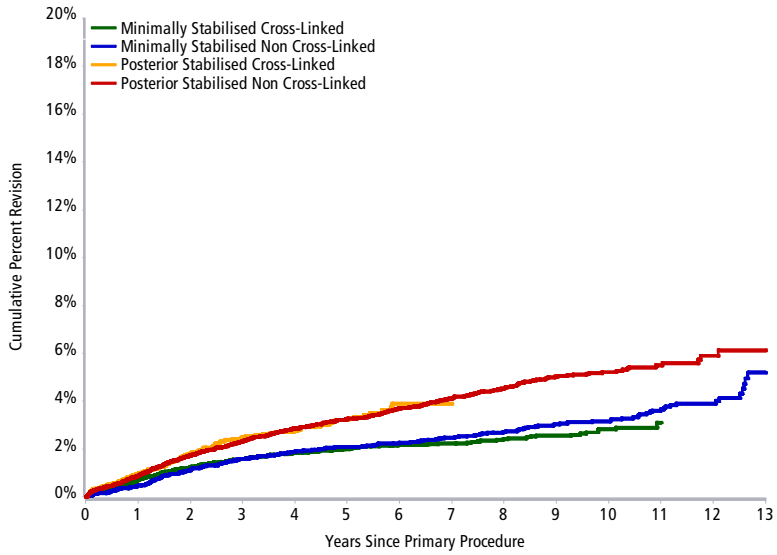


Table KT25: Cumulative Percent Revision of Nexgen/Nexgen Primary Total Knee Replacement by Stability and Polyethylene Bearing Surface (Primary Diagnosis OA)

Stability	Polyethylene	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Minimally Stabilised		**661**	**35928**	**0.7 (0.6, 0.8)**	**1.6 (1.5, 1.7)**	**2.0 (1.9, 2.2)**	**2.3 (2.1, 2.5)**	**2.9 (2.7, 3.2)**	**4.9 (4.0, 6.1)**
	Cross-Linked	437	27193	0.7 (0.6, 0.8)	1.6 (1.4, 1.8)	2.0 (1.8, 2.2)	2.2 (2.0, 2.5)	2.8 (2.5, 3.2)	
	Non Cross-Linked	224	8735	0.5 (0.3, 0.6)	1.6 (1.3, 1.9)	2.1 (1.8, 2.4)	2.5 (2.1, 2.9)	3.2 (2.7, 3.7)	5.2 (4.2, 6.5)
Posterior Stabilised		**865**	**27645**	**0.9 (0.8, 1.0)**	**2.4 (2.2, 2.6)**	**3.3 (3.0, 3.5)**	**4.1 (3.8, 4.4)**	**5.2 (4.8, 5.7)**	**6.1 (5.4, 7.0)**
	Cross-Linked	184	8364	1.0 (0.8, 1.2)	2.5 (2.1, 2.9)	3.2 (2.7, 3.8)	3.9 (3.2, 4.7)		
	Non Cross-Linked	681	19281	0.9 (0.8, 1.0)	2.3 (2.1, 2.6)	3.3 (3.0, 3.5)	4.1 (3.8, 4.5)	5.2 (4.8, 5.7)	6.1 (5.4, 7.0)
TOTAL		**1526**	**63573**						

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 KT35: Cumulative Percent Revision of Nexgen/Nexgen Primary Total Knee Replacement by Polyethylene Bearing Surface and Stability (Primary Diagnosis OA)



HR - adjusted for age and gender

Minimally Stabilised Cross-Linked vs
Minimally Stabilised Non Cross-Linked
0 - 1Yr: HR=1.14 (0.91, 1.42),p=0.268
1Yr - 2.5Yr: HR=0.84 (0.67, 1.06),p=0.137
2.5Yr+: HR=0.62 (0.49, 0.78),p<0.001

Minimally Stabilised Non Cross-Linked vs
Posterior Stabilised Non Cross-Linked
Entire Period: HR=0.68 (0.59, 0.80),p<0.001

Minimally Stabilised Cross-Linked vs
Posterior Stabilised Cross-Linked
Entire Period: HR=0.61 (0.51, 0.72),p<0.001

Posterior Stabilised Cross-Linked vs
Posterior Stabilised Non Cross-Linked
Entire Period: HR=0.94 (0.80, 1.11),p=0.455

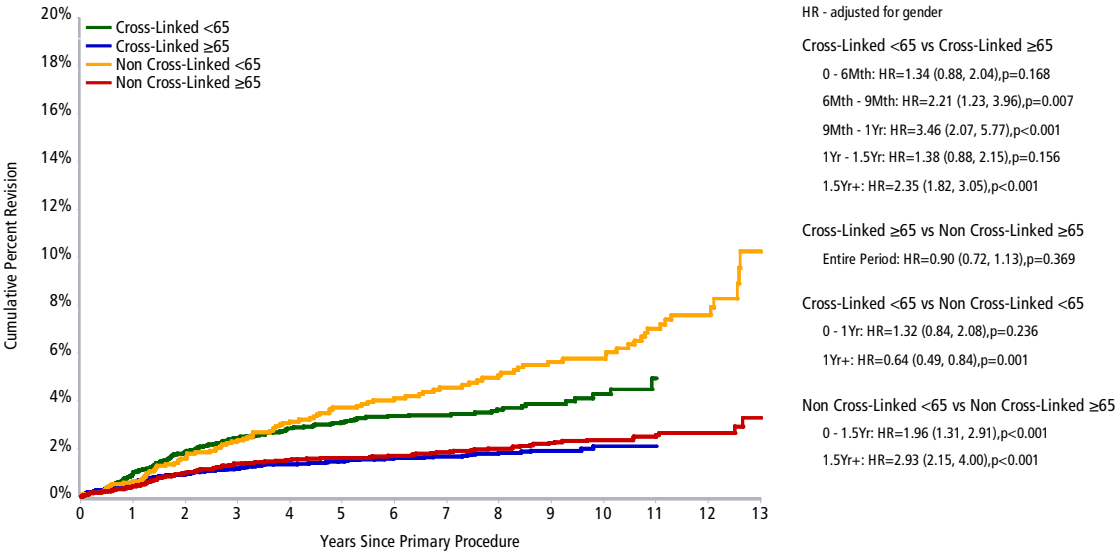
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Minimally Stabilised		**35928**	**30277**	**21332**	**15251**	**10345**	**3804**	**235**
	Cross-Linked	27193	22152	14547	9734	6042	1306	0
	Non Cross-Linked	8735	8125	6785	5517	4303	2498	235
Posterior Stabilised		**27645**	**24366**	**18460**	**12664**	**7773**	**2236**	**80**
	Cross-Linked	8364	6654	3993	1497	70	0	0
	Non Cross-Linked	19281	17712	14467	11167	7703	2236	80

Table KT26: Cumulative Percent Revision of Minimally Stabilised Nexgen Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

Polyethylene	Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cross-Linked		**437**	**27193**	**0.7 (0.6, 0.8)**	**1.6 (1.4, 1.8)**	**2.0 (1.8, 2.2)**	**2.2 (2.0, 2.5)**	**2.8 (2.5, 3.2)**	
	<65	216	9000	1.0 (0.8, 1.3)	2.4 (2.1, 2.8)	3.1 (2.7, 3.6)	3.4 (2.9, 3.9)	4.3 (3.6, 5.1)	
	≥65	221	18193	0.6 (0.5, 0.7)	1.2 (1.0, 1.4)	1.5 (1.3, 1.7)	1.7 (1.4, 1.9)	2.1 (1.7, 2.5)	
Non Cross-Linked		**224**	**8735**	**0.5 (0.3, 0.6)**	**1.6 (1.3, 1.9)**	**2.1 (1.8, 2.4)**	**2.5 (2.1, 2.9)**	**3.2 (2.7, 3.7)**	**5.2 (4.2, 6.5)**
	<65	99	1968	0.6 (0.4, 1.1)	2.4 (1.7, 3.2)	3.7 (2.9, 4.7)	4.6 (3.6, 5.7)	5.8 (4.6, 7.1)	10.2 (7.7, 13.5)
	≥65	125	6767	0.4 (0.3, 0.6)	1.4 (1.1, 1.7)	1.6 (1.3, 2.0)	1.8 (1.5, 2.2)	2.4 (2.0, 2.9)	3.3 (2.4, 4.5)
TOTAL		**661**	**35928**						

Note: The minimally stabilised Nexgen includes Nexgen CR/Nexgen and Nexgen CR Flex/Nexgen prosthesis combinations.

Figure KT36: Cumulative Percent Revision of Minimally Stabilised Nexgen Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cross-Linked		**27193**	**22152**	**14547**	**9734**	**6042**	**1306**	**0**
	<65	9000	7209	4704	3131	1937	501	0
	≥65	18193	14943	9843	6603	4105	805	0
Non Cross-Linked		**8735**	**8125**	**6785**	**5517**	**4303**	**2498**	**235**
	<65	1968	1857	1557	1274	1016	651	79
	≥65	6767	6268	5228	4243	3287	1847	156

Figure KT37: Cumulative Incidence Revision Diagnosis of Minimally Stabilised Nexgen Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

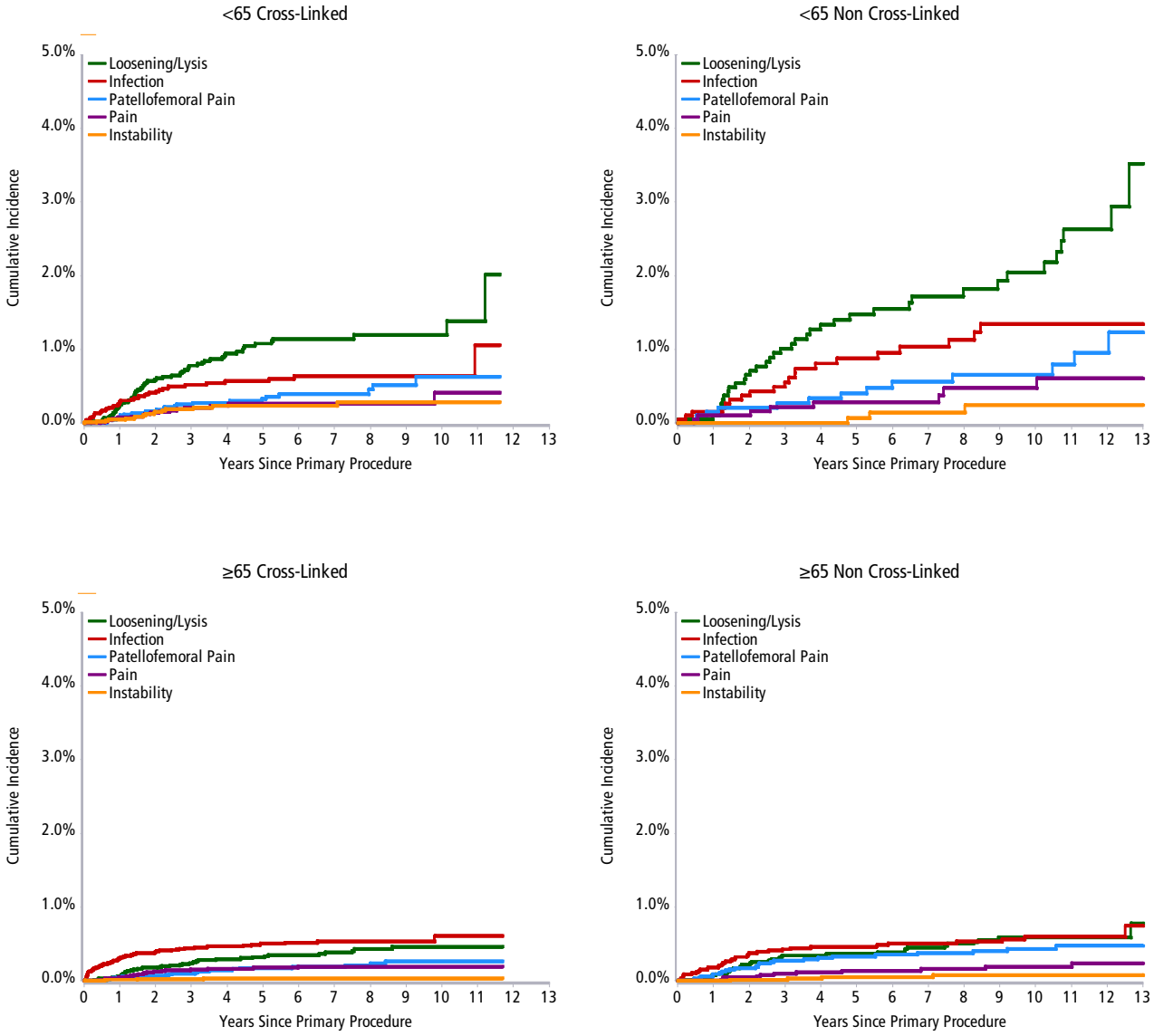
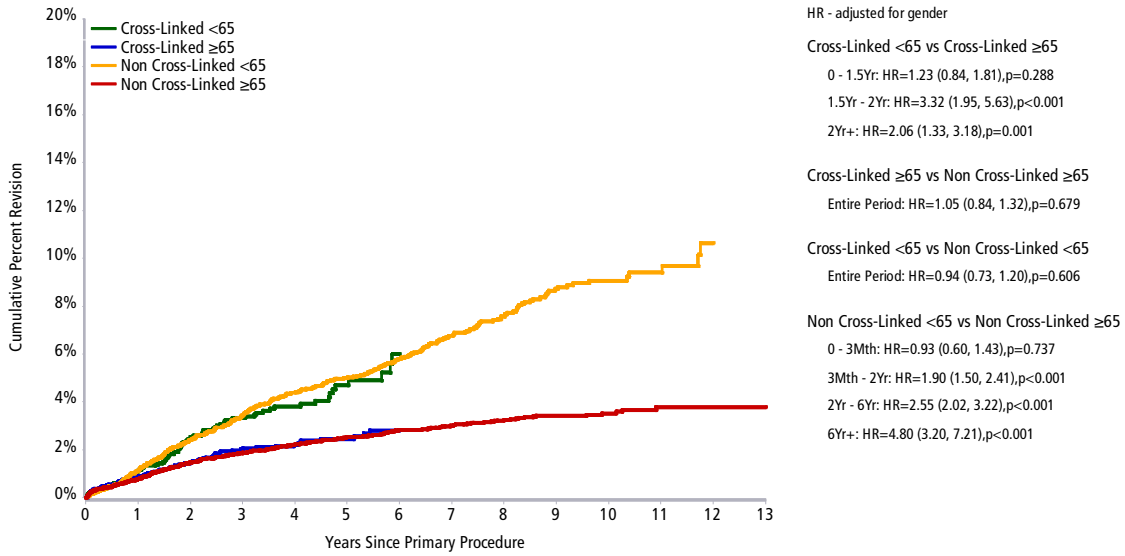


Table KT27: Cumulative Percent Revision of Posterior Stabilised Nexgen Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

Polyethylene	Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cross-Linked		**184**	**8364**	**1.0 (0.8, 1.2)**	**2.5 (2.1, 2.9)**	**3.2 (2.7, 3.8)**	**3.9 (3.2, 4.7)**		
	<65	86	2814	1.2 (0.8, 1.7)	3.3 (2.6, 4.2)	4.7 (3.7, 6.0)			
	≥65	98	5550	0.9 (0.7, 1.2)	2.1 (1.7, 2.6)	2.5 (2.0, 3.0)			
Non Cross-Linked		**681**	**19281**	**0.9 (0.8, 1.0)**	**2.3 (2.1, 2.6)**	**3.3 (3.0, 3.5)**	**4.1 (3.8, 4.5)**	**5.2 (4.8, 5.7)**	**6.1 (5.4, 7.0)**
	<65	332	5523	1.1 (0.9, 1.4)	3.4 (3.0, 4.0)	5.0 (4.4, 5.7)	6.8 (6.0, 7.6)	9.1 (8.1, 10.2)	
	≥65	349	13758	0.8 (0.6, 0.9)	1.9 (1.6, 2.1)	2.5 (2.3, 2.8)	3.0 (2.7, 3.4)	3.5 (3.1, 4.0)	3.8 (3.3, 4.3)
TOTAL		**865**	**27645**						

Note: The posterior stabilised Nexgen includes Nexgen LPS/Nexgen and Nexgen LPS Flex/Nexgen prosthesis combinations.

Figure KT38: Cumulative Percent Revision of Posterior Stabilised Nexgen Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cross-Linked	**8364**	**6654**	**3993**	**1497**	**70**	**0**	**0**
<65	2814	2250	1354	496	32	0	0
≥65	5550	4404	2639	1001	38	0	0
Non Cross-Linked	**19281**	**17712**	**14467**	**11167**	**7703**	**2236**	**80**
<65	5523	5084	4185	3302	2351	706	25
≥65	13758	12628	10282	7865	5352	1530	55

Figure KT39: Cumulative Incidence Revision Diagnosis of Posterior Stabilised Nexgen Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

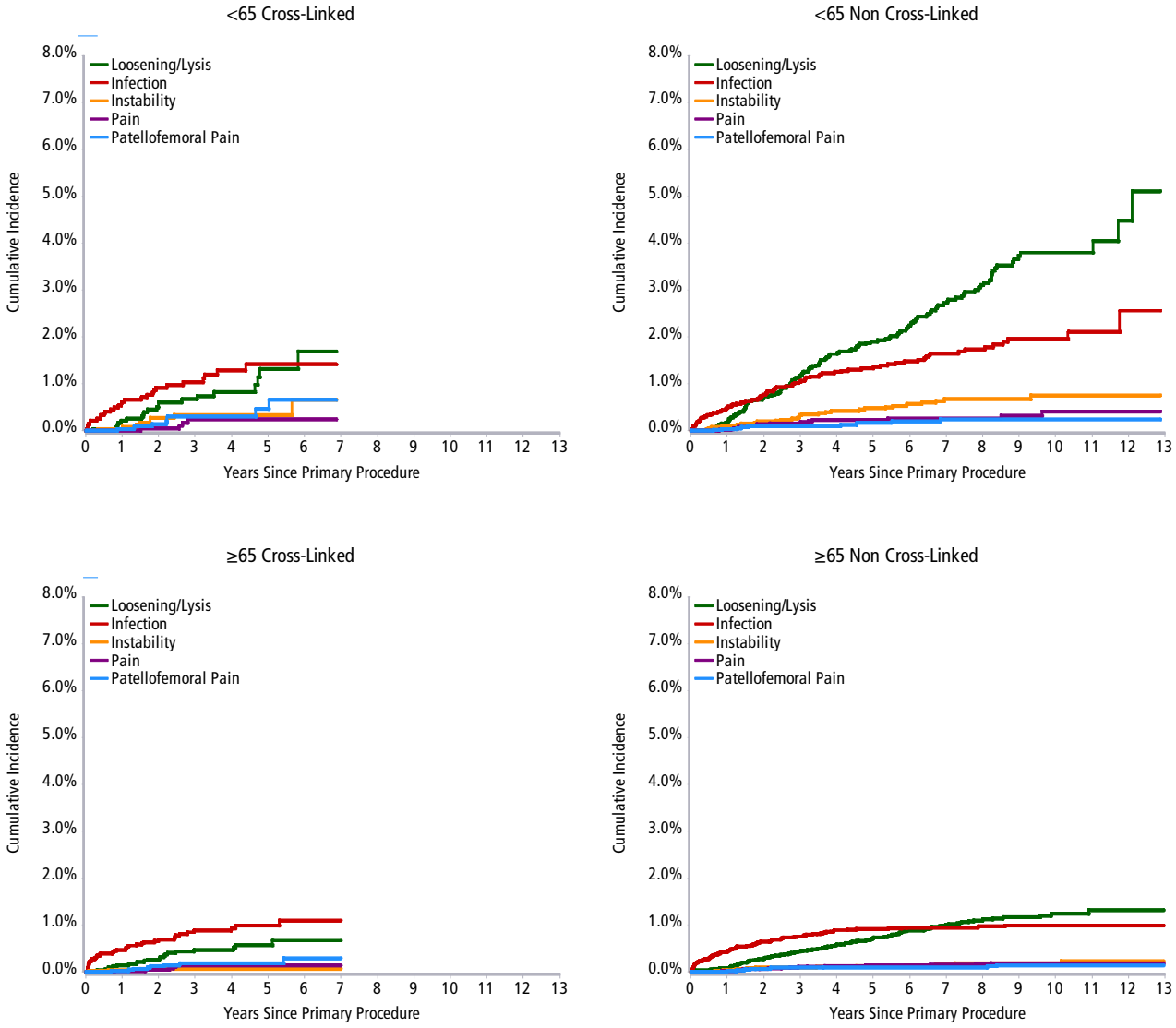
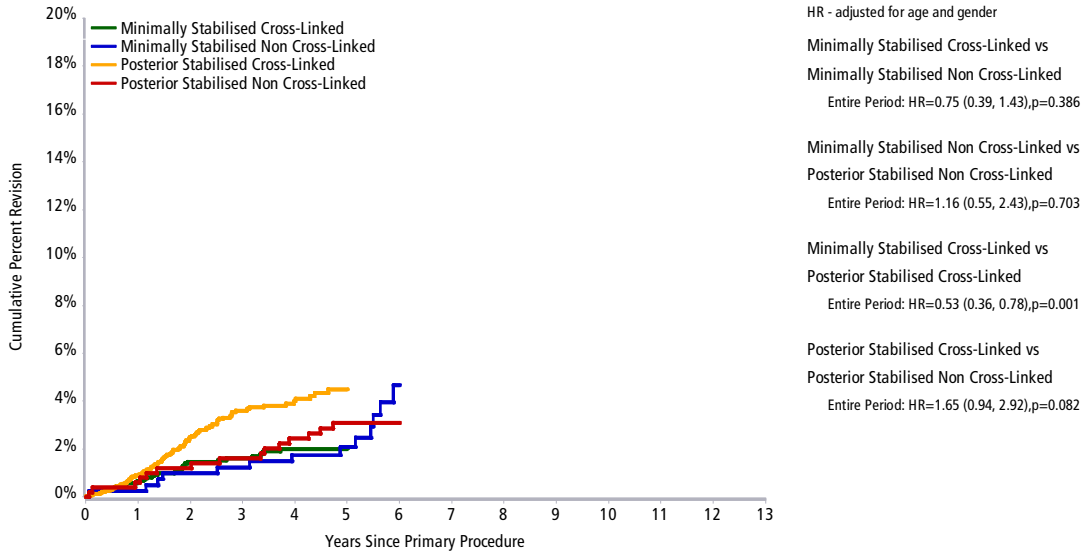


Table KT28: Cumulative Percent Revision of Scorpio NRG/Series 7000 Primary Total Knee Replacement by Stability and Polyethylene Bearing Surface (Primary Diagnosis OA)

Stability	Polyethylene	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Minimally Stabilised		**48**	**2860**	**0.6 (0.4, 1.0)**	**1.6 (1.1, 2.2)**	**2.1 (1.6, 3.0)**			
	Cross-Linked	35	2454	0.7 (0.4, 1.1)	1.6 (1.1, 2.3)	2.0 (1.4, 2.8)			
	Non Cross-Linked	13	406	0.2 (0.0, 1.7)	1.2 (0.5, 3.0)	2.1 (1.0, 4.2)			
Posterior Stabilised		**107**	**3414**	**0.8 (0.6, 1.2)**	**3.2 (2.6, 4.0)**	**4.3 (3.5, 5.2)**			
	Cross-Linked	92	2910	0.9 (0.6, 1.3)	3.6 (2.9, 4.5)	4.5 (3.6, 5.6)			
	Non Cross-Linked	15	504	0.6 (0.2, 1.8)	1.6 (0.8, 3.2)	3.1 (1.9, 5.1)			
TOTAL		**155**	**6274**						

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 KT40: Cumulative Percent Revision of Scorpio NRG/Series 7000 Primary Total Knee Replacement by Polyethylene Bearing Surface and Stability (Primary Diagnosis OA)



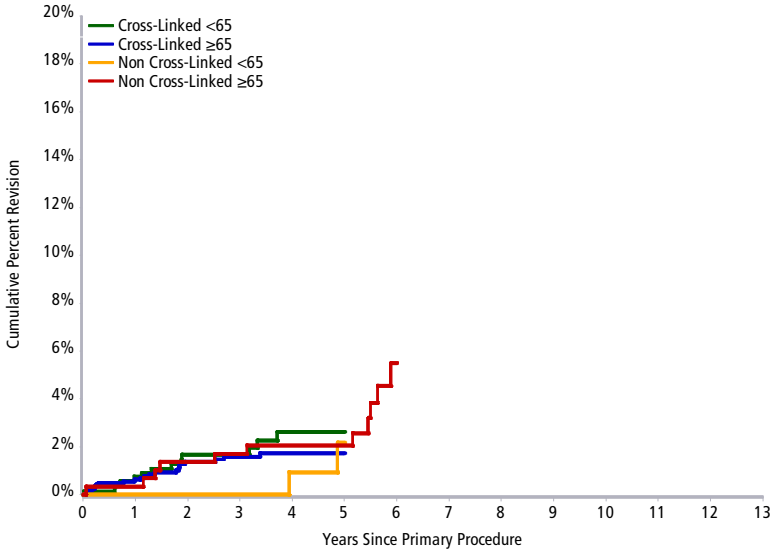
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Minimally Stabilised		**2860**	**2376**	**1543**	**543**	**4**	**0**	**0**
	Cross-Linked	2454	1974	1150	271	0	0	0
	Non Cross-Linked	406	402	393	272	4	0	0
Posterior Stabilised		**3414**	**3003**	**2004**	**844**	**4**	**0**	**0**
	Cross-Linked	2910	2507	1526	419	0	0	0
	Non Cross-Linked	504	496	478	425	4	0	0

Table KT29: Cumulative Percent Revision of Scorpio NRG CR/Series 7000 Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

Polyethylene	Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cross-Linked		**35**	**2454**	**0.7 (0.4, 1.1)**	**1.6 (1.1, 2.3)**	**2.0 (1.4, 2.8)**			
	<65	13	757	0.7 (0.3, 1.8)	1.7 (0.9, 3.1)	2.6 (1.5, 4.6)			
	≥65	22	1697	0.6 (0.3, 1.2)	1.6 (1.0, 2.5)	1.7 (1.1, 2.7)			
Non Cross-Linked		**13**	**406**	**0.2 (0.0, 1.7)**	**1.2 (0.5, 3.0)**	**2.1 (1.0, 4.2)**			
	<65	2	111	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	2.2 (0.5, 8.5)			
	≥65	11	295	0.3 (0.0, 2.4)	1.7 (0.7, 4.0)	2.1 (0.9, 4.5)			
TOTAL		**48**	**2860**						

Note: The stability of a procedure is based on the knee insert used

Figure KT41: Cumulative Percent Revision of Scorpio NRG CR/Series 7000 Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)



HR - adjusted for gender

Cross-Linked <65 vs Cross-Linked ≥65

Entire Period: HR=1.27 (0.64, 2.52),p=0.494

Cross-Linked ≥65 vs Non Cross-Linked ≥65

Entire Period: HR=0.71 (0.33, 1.56),p=0.396

Cross-Linked <65 vs Non Cross-Linked <65

Entire Period: HR=1.86 (0.41, 8.43),p=0.423

Non Cross-Linked <65 vs Non Cross-Linked ≥65

Entire Period: HR=0.49 (0.11, 2.20),p=0.350

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cross-Linked		**2454**	**1974**	**1150**	**271**	**0**	**0**	**0**
	<65	757	608	360	88	0	0	0
	≥65	1697	1366	790	183	0	0	0
Non Cross-Linked		**406**	**402**	**393**	**272**	**4**	**0**	**0**
	<65	111	110	108	75	2	0	0
	≥65	295	292	285	197	2	0	0

Figure KT42: Cumulative Incidence Revision Diagnosis of Scorpio NRG CR/Series 7000 Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

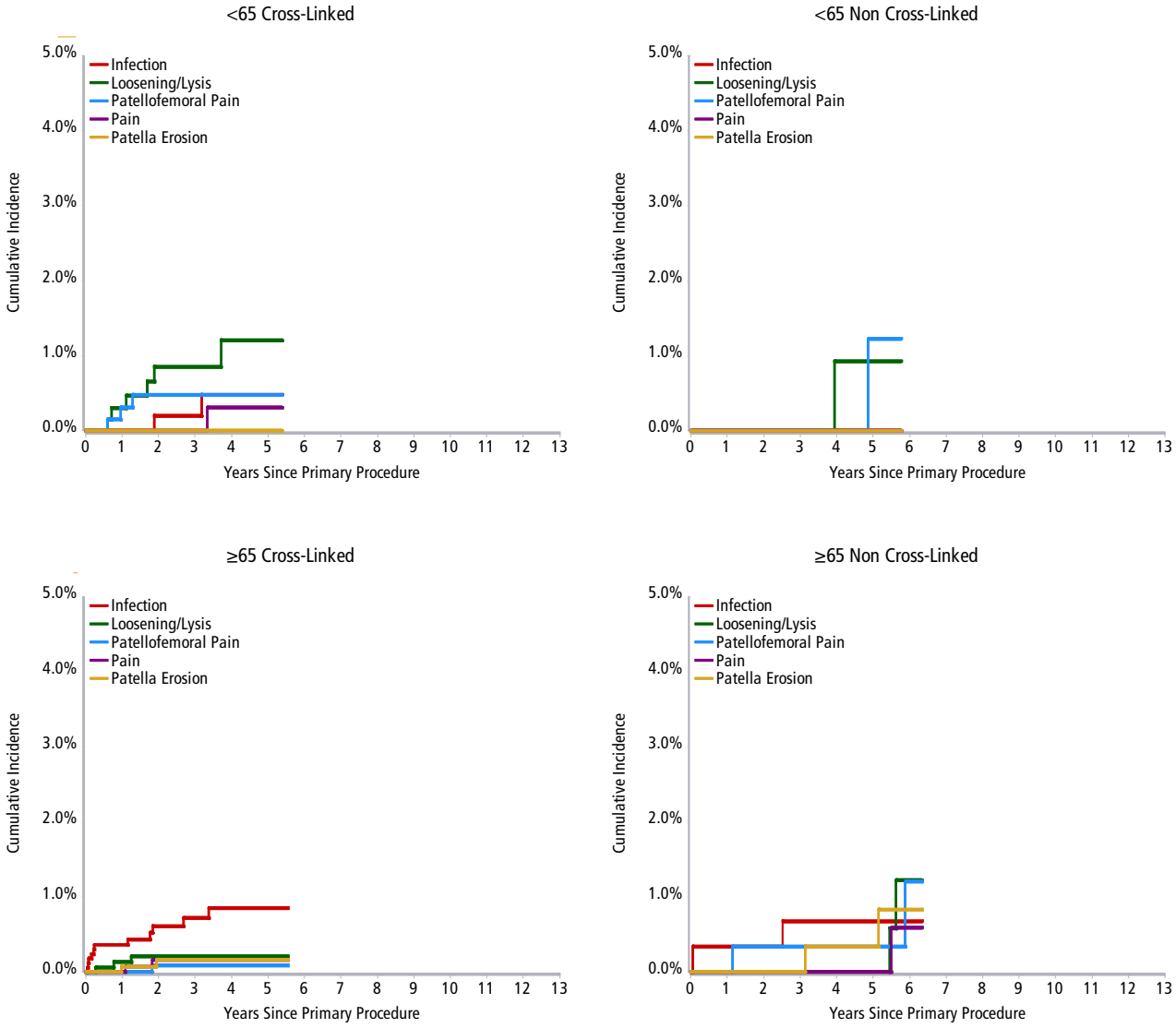
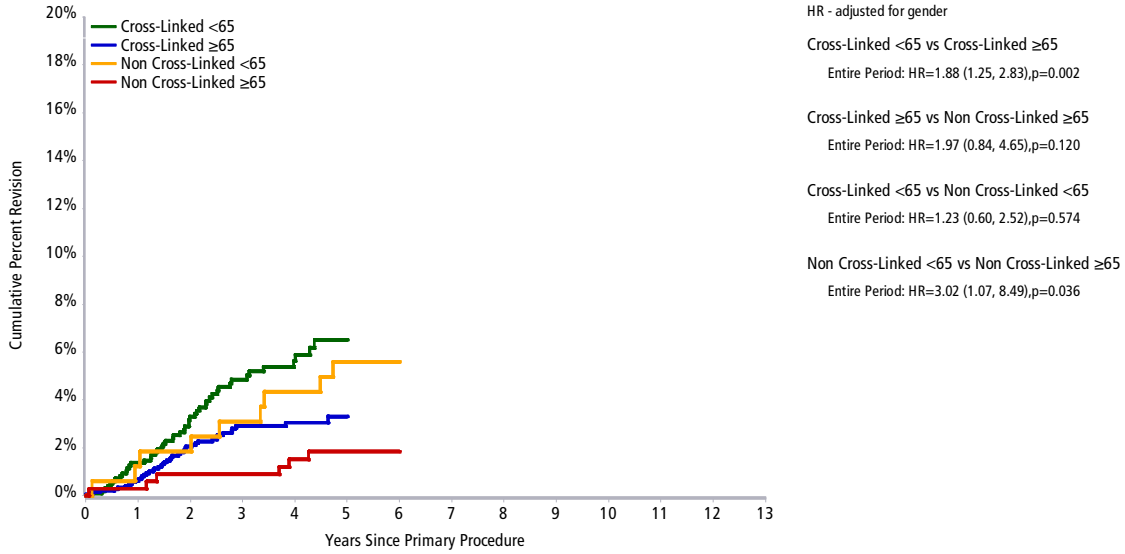


Table KT30: Cumulative Percent Revision of Scorpio NRG PS/Series 7000 Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

Polyethylene	Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cross-Linked		**92**	**2910**	**0.9 (0.6, 1.3)**	**3.6 (2.9, 4.5)**	**4.5 (3.6, 5.6)**			
	<65	48	1016	1.4 (0.8, 2.3)	4.8 (3.6, 6.6)	6.5 (4.8, 8.7)			
	≥65	44	1894	0.6 (0.3, 1.1)	2.9 (2.1, 3.9)	3.3 (2.4, 4.5)			
Non Cross-Linked		**15**	**504**	**0.6 (0.2, 1.8)**	**1.6 (0.8, 3.2)**	**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, 10.5)			
	≥65	6	341	0.3 (0.0, 2.1)	0.9 (0.3, 2.7)	1.8 (0.8, 4.0)			
TOTAL		**107**	**3414**						

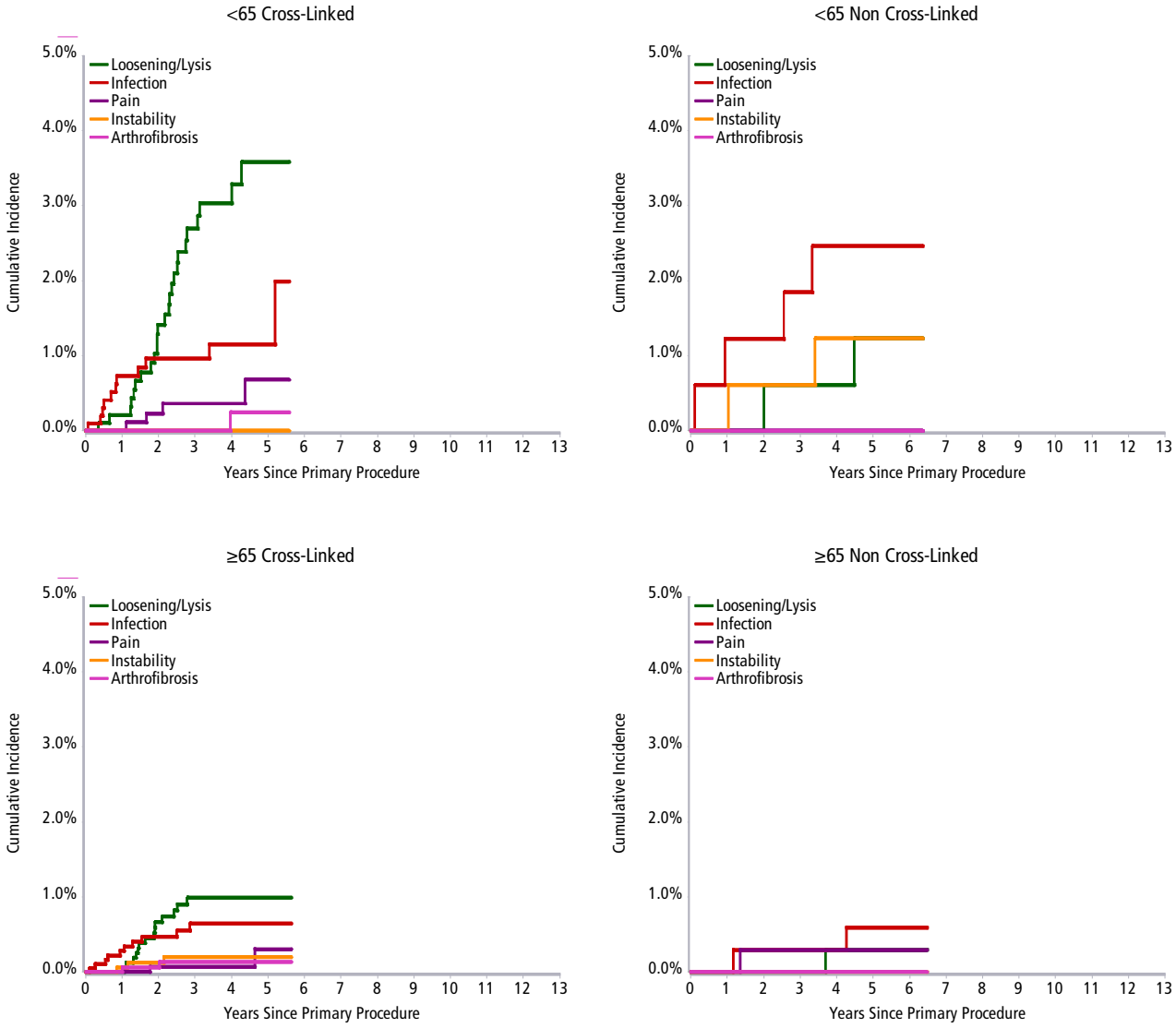
Note: The stability of a procedure is based on the knee insert used

Figure KT43: Cumulative Percent Revision of Scorpio NRG PS/Series 7000 Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cross-Linked	**2910**	**2507**	**1526**	**419**	**0**	**0**	**0**
<65	1016	900	565	161	0	0	0
≥65	1894	1607	961	258	0	0	0
Non Cross-Linked	**504**	**496**	**478**	**425**	**4**	**0**	**0**
<65	163	160	156	145	0	0	0
≥65	341	336	322	280	4	0	0

Figure KT44: Cumulative Incidence Revision Diagnosis of Scorpio NRG PS/Series 7000 Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)



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 prostheses selection. For many prostheses the only source of outcomes data are registry reports.

It is evident from registry data that most prostheses have comparable 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:

(i) the revision rate (per 100 component years) exceeds twice that for the group, and
(ii) the Poisson probability of observing that number of revisions, given the rate of the group is significant ($p<0.05$), and

either

(iii) there are at least 10 primary procedures for that component,

or

(iv) 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 the combination 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.

Stage 2

In Stage 2, the AOANJRR Director and Deputy Directors in conjunction with DMAC staff, review the identified prostheses and undertake further investigation. This includes examining for 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 prostheses combination progress 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 specialists from the Australian Orthopaedic Association Arthroplasty Society. The panel meets with Registry staff at a two-day 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 being used and are identified for the first time.

The second group is prostheses that are being re-identified but are still used. This listing identifies that the prosthesis continues to have a higher than anticipated rate of revision but it also 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. 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 newly identified prostheses which are no longer used in Australia.

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. Registries monitor 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, 12 independent arthroplasty specialists together with the Chairman of the AOANJRR Committee, AOANJRR Director, three Deputy Directors and Assistant Deputy Director attended the two day Surgeon Review Workshop.

Only prostheses identified for the first time or prostheses that are not re-identified are discussed in the following text.

Analyses for all prostheses identified as having a higher than anticipated rate of revision are available on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2014.

Primary Partial Hip Replacement

Unipolar Modular

The Femoral Head (JRI)/Furlong LOL is being identified for the first time this year. This combination has been used in 78 procedures and has a five year cumulative percent revision of 14.5%. There have been nine revisions, three revised to a THR, four involving revision to the acetabular component or femoral component only and two involving head exchange only. Loosening/lysis (33.3%), infection (33.3%) and prosthesis dislocation (22.2%) are the main reasons for revision. The Femoral Head (JRI)/Furlong LOL combination was used in seven procedures in 2013.

Analyses for all prostheses identified as having a higher than anticipated rate of revision are available on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2014.

Table IP1: Revision Rate of Individual Unipolar Modular Hip Prostheses Identified as having a Higher than Anticipated Revision Rate

Head/Femoral	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Newly Identified				
Femoral Head (JRI)/Furlong LOL	78	197	4.57	Entire Period: HR=3.51 (1.82, 6.77),p<0.001

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 Revision Rate

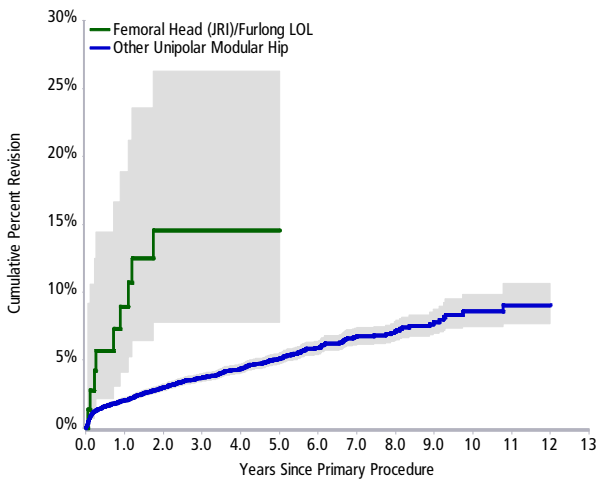
CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	13 Yrs
Newly Identified					
Femoral Head (JRI)/Furlong LOL	8.9 (4.1, 18.9)	14.5 (7.8, 26.3)	14.5 (7.8, 26.3)		

Table IP3: Yearly Usage of Individual Unipolar Modular Hip Prostheses Identified as having a Higher than Anticipated Revision Rate

Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Newly Identified												
Femoral Head (JRI)/Furlong LOL						12	18	10	13	10	8	7

Figure IP1: Cumulative Percent Revision of Individual Unipolar Modular Hip Prostheses Newly Identified

Newly Identified



Bipolar

There is one prosthesis being identified for the first time and one combination being re-identified.

The Synergy femoral component is being identified for the first time. This prosthesis has been used in 54 procedures and has nearly three times the rate of revision compared to all other bipolar hip replacements. Of the eight revisions, seven involved revision of a major component.

Although previously identified in 2012, the Tandem/Basis was not identified to have a higher rate of revision in last year's report. In 2013, there were 24 more procedures and two further revisions. This year the Tandem/Basis has been re-identified as having a higher rate of revision compared to all other bipolar hip replacements. The main reasons for revision are loosening/lysis (50%) and infection (37.5%).

The UHR/Omnifit has previously been identified. This year the Registry is only identifying the UHR/Omnifit (cementless) combination, which has not been used since 2008.

Analyses for all prostheses identified as having a higher than anticipated rate of revision are available on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2014.

Table IP4: Revision Rate of Individual Bipolar Hip Prostheses Identified as having a Higher than Anticipated Revision Rate

Bipolar Head/Femoral	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Newly Identified				
**Synergy	54	305	2.63	Entire Period: HR=2.88 (1.43, 5.81),p=0.003
Re-Identified and still used				
Tandem/Basis	107	267	2.99	Entire Period: HR=2.25 (1.12, 4.54),p=0.023
Identified and no longer used				
UHR/ABGII	177	784	2.04	Entire Period: HR=2.43 (1.47, 4.00),p<0.001
UHR/Omnifit (Cementless)	40	200	3.50	Entire Period: HR=3.81 (1.80, 8.05),p<0.001

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 Revision Rate

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	13 Yrs
Newly Identified					
**Synergy	7.5 (2.9, 18.7)	9.7 (4.2, 21.9)	12.5 (5.7, 26.0)	18.7 (9.6, 34.7)	
Re-Identified and still used					
Tandem/Basis	2.4 (0.6, 9.3)				
Identified and no longer used					
UHR/ABGII	4.4 (2.1, 8.9)	5.1 (2.6, 10.1)	10.2 (5.9, 17.3)		
UHR/Omnifit (Cementless)	18.3 (9.1, 34.6)	18.3 (9.1, 34.6)	18.3 (9.1, 34.6)	18.3 (9.1, 34.6)	

Note: All Components have been compared to all other Bipolar Hip components.
** Femoral Component

Table IP6: Yearly Usage of Individual Bipolar Hip Prostheses Identified as having a Higher than Anticipated Revision Rate

Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Newly Identified												
**Synergy	12	13	9	10	3	2	1	1		1		2
Re-Identified and still used												
Tandem/Basis				10	13	9	11	4	7	8	21	24
Identified and no longer used												
UHR/ABGII	25	25	36	34	10	15	20	7	5			
UHR/Omnifit (Cementless)	11	10	7	5	4	1	2					

Note: All Components have been compared to all other Bipolar Hip components.
** Femoral Component

Figure IP2: Cumulative Percent Revision of Individual Bipolar Hip Prostheses Newly Identified

Newly Identified

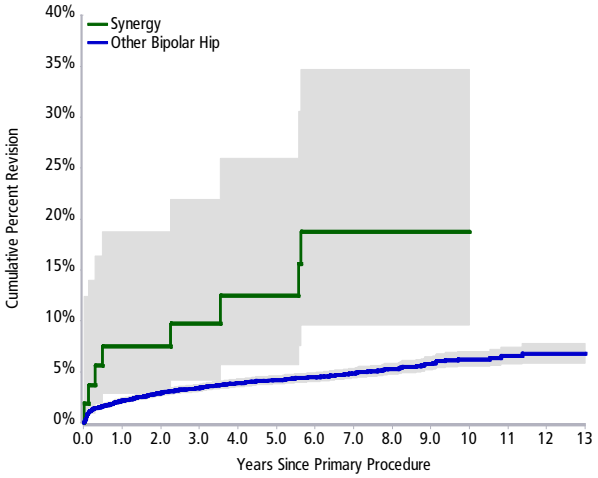
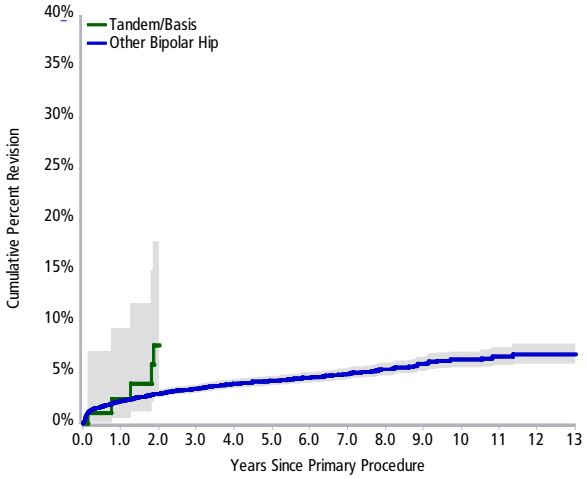


Figure IP3: Cumulative Percent Revision of Individual Bipolar Hip Prostheses Re-identified and still used

Re-identified and still used



Primary Total Hip Replacement

Total Conventional

This year, large head metal/metal bearings have been removed from the comparator group for all total conventional hip investigations. This class of prostheses has a revision rate that is higher than any other and the revision rate continues to increase. Continued inclusion in the comparator group reduces the capacity of the Registry to identify prostheses with a higher than anticipated rate of revision.

There are eight primary total conventional hip prostheses and prostheses combinations identified for the first time.

Corail/Trabecular Metal Shell has been used in 76 procedures since 2007. The cumulative percent revision at three years is 11.0 %. The main reasons for revision are loosening/lysis (50.0%), prosthesis dislocation (25.0%) and infection (25.0%). There were eight revisions, three femoral only, two acetabular only and two head/insert revisions.

CPT/Fitmore is a hybrid combination used in 146 procedures since 2004. The cumulative percent revision at three years is 5.4%. The main reasons for revision are loosening/lysis (37.5%) and infection (25.0%). There were eight revisions, three femoral only and two femoral/acetabular revisions.

Taperloc/M2a is a cementless combination with metal/metal bearing surface used in 518 procedures since 2002. The cumulative percent revision at 10 years is 13.3%. The main reasons for revision are loosening/lysis (43.1%), metal related pathology (21.6%) and infection (11.8%). Of the 51 revisions, 64.7% were acetabular only and 19.6% femoral/acetabular revisions.

Emperion is a cementless stem used in 381 procedures since 2005. The cumulative percent revision at five years is 5.3%. The main reasons for revision are infection (36.8%) and fracture (21.1%). There were 19 revisions, eight femoral and five head/insert revisions.

Deltalox is a cementless acetabular prosthesis used in 213 procedures since 2010. The cumulative percent revision at one year is 5.9%. The main reasons for revision are dislocation (36.8%), loosening/lysis (26.3%) and fracture (15.8%). There were 19 revisions, 31.6% femoral only, 21.1% head only and 21.1% acetabular only.

The Friendly Hip/Cup (Exactech), Integrale (exch neck)/Cera Fit and VerSys/Durom combinations have been identified for the first time and are no longer used.

The Continuum and the ML Taper Kinectiv have been identified in combination since 2011. As an individual prosthesis the Continuum was first identified in 2012 and the ML Taper Kinectiv in 2013. Because both were identified as individual components in 2013 it was unnecessary for the Registry to identify them in combination in last year's report. This year the Continuum and ML Taper Kinectiv are only identified as individual prostheses. The Continuum has a higher than anticipated rate of revision for the first three months and after this there is no difference in the rate of revision. The most common reason for revision is dislocation (41.3%).

Analyses for all prostheses identified as having a higher than anticipated rate of revision are available on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2014.

Table IP7: Revision Rate of Individual Total Conventional Hip Prostheses Identified as having a Higher than Anticipated Revision Rate

Femoral/Acetabular	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Newly Identified				
Corail/Trabecular Metal (Shell)	76	211	3.80	Entire Period: HR=4.47 (2.24, 8.94),p<0.001
CPT/Fitmore	146	488	1.64	Entire Period: HR=2.21 (1.11, 4.42),p=0.024
Taperloc/M2a	518	3676	1.39	0 - 1.5Yr: HR=1.11 (0.61, 2.01),p=0.728 1.5Yr+: HR=3.15 (2.31, 4.30),p<0.001
*Emperion	381	1164	1.63	Entire Period: HR=1.90 (1.21, 2.98),p=0.005
**DeltaLox	213	405	4.69	Entire Period: HR=4.45 (2.84, 6.98),p<0.001
Re-Identified and still used				
CPT/Low Profile Cup	122	393	2.29	Entire Period: HR=3.01 (1.57, 5.79),p<0.001
ML Taper/Fitmore	144	611	1.47	Entire Period: HR=2.15 (1.12, 4.13),p=0.021
*CBH Stem	273	1006	2.29	Entire Period: HR=3.01 (2.00, 4.52),p<0.001
*Excia (cementless)	189	400	2.75	Entire Period: HR=2.80 (1.55, 5.05),p<0.001
*Furlong	430	1625	1.29	Entire Period: HR=1.71 (1.12, 2.63),p=0.013
*Metha	169	370	4.32	Entire Period: HR=4.29 (2.62, 7.00),p<0.001
*ML Taper Kinectiv	2497	6054	1.40	Entire Period: HR=1.50 (1.21, 1.86),p<0.001
*MSA	217	513	3.90	Entire Period: HR=3.90 (2.52, 6.06),p<0.001
*Novation	355	507	3.55	Entire Period: HR=2.88 (1.81, 4.58),p<0.001
*Taper Fit	417	2260	1.50	0 - 2Yr: HR=1.11 (0.58, 2.14),p=0.752 2Yr+: HR=3.87 (2.61, 5.73),p<0.001
*Trabecular Metal	1428	4129	1.57	0 - 1Mth: HR=2.83 (1.91, 4.20),p<0.001 1Mth+: HR=1.52 (1.11, 2.07),p=0.008
*UniSyn	393	2060	1.50	Entire Period: HR=2.27 (1.60, 3.23),p<0.001
**BHR	2981	16916	1.30	0 - 2Wk: HR=0.86 (0.41, 1.82),p=0.698 2Wk - 1Mth: HR=0.18 (0.05, 0.73),p=0.016 1Mth - 3Mth: HR=1.32 (0.80, 2.16),p=0.272 3Mth - 1.5Yr: HR=0.79 (0.51, 1.21),p=0.272 1.5Yr+: HR=3.24 (2.78, 3.78),p<0.001
**Continuum	5356	9961	1.51	0 - 3Mth: HR=1.78 (1.45, 2.19),p<0.001 3Mth+: HR=1.05 (0.81, 1.37),p=0.698
**Cormet	803	4723	1.44	0 - 1.5Yr: HR=1.09 (0.68, 1.76),p=0.721 1.5Yr - 2Yr: HR=0.51 (0.07, 3.66),p=0.506 2Yr+: HR=3.77 (2.85, 4.98),p<0.001
**Fin II	1917	6680	1.23	Entire Period: HR=1.60 (1.29, 1.99),p<0.001
**Plasmacup	360	975	2.46	Entire Period: HR=2.81 (1.88, 4.19),p<0.001
**Procotyl L	743	1970	2.08	Entire Period: HR=2.32 (1.70, 3.15),p<0.001
**SeleXys	391	1177	2.80	Entire Period: HR=3.41 (2.42, 4.80),p<0.001
Identified and no longer used				
+Friendly Hip/Cup (Exactech)	97	675	1.63	Entire Period: HR=2.74 (1.52, 4.95),p<0.001
+Integrale (exch neck)/Cera Fit	75	365	1.64	Entire Period: HR=2.45 (1.11, 5.45),p=0.027
+VerSys/Durom	75	465	1.94	Entire Period: HR=2.99 (1.56, 5.75), p=0.001
Alloclassic/Durom	623	3893	1.70	0 - 1.5Yr: HR=0.91 (0.50, 1.64),p=0.743 1.5Yr+: HR=4.32 (3.31, 5.65),p<0.001
Anca_Fit/Pinnacle	101	578	2.08	Entire Period: HR=3.34 (1.90, 5.88),p<0.001
Apex/Trilogy	108	390	2.05	Entire Period: HR=2.58 (1.29, 5.17),p=0.007
Charnley/Duraloc	180	1590	2.01	0 - 3.5Yr: HR=1.24 (0.56, 2.76),p=0.599 3.5Yr - 4Yr: HR=14.63 (5.47, 39.18),p<0.001 4Yr+: HR=5.26 (3.45, 8.00),p<0.001
Elite Plus/Apollo	52	474	2.53	Entire Period: HR=4.29 (2.44, 7.56),p<0.001
Elite Plus/Charnley LPW	89	725	1.93	Entire Period: HR=3.09 (1.83, 5.22),p<0.001
F2L/Delta PF	107	745	2.01	Entire Period: HR=3.36 (2.03, 5.58), p<0.001
H Moos/Mueller	19	127	6.31	Entire Period: HR=9.82 (4.91, 19.62),p<0.001

Identified and no longer used				
S-Rom/Duraloc	168	1540	1.69	Entire Period: HR=2.74 (1.87, 4.03),p<0.001
Secur-Fit Plus/Secur-Fit	197	1715	1.17	Entire Period: HR=1.95 (1.25, 3.02),p=0.002
*ABGII (Exch Neck)	246	867	4.96	0 - 1Mth: HR=4.00 (1.79, 8.91),p<0.001 1Mth - 2.5Yr: HR=3.47 (2.06, 5.87),p<0.001 2.5Yr - 4Yr: HR=12.25 (6.57, 22.84),p<0.001 4Yr - 5.5Yr: HR=26.35 (13.13, 52.91),p<0.001 5.5Yr - 6Yr: HR=117.7 (37.62, 368.6),p<0.001 6Yr+: HR=3580 (848.9, 15100),p<0.001
*Adapter (cemented)	148	755	3.18	0 – 6Mth: HR=2.33 (0.84, 5.93),p=0.109 6Mth+: HR=6.58 (4.24, 10.20),p<0.001
*Adapter (cementless)	742	3512	2.59	0 - 2Wk: HR=4.12 (2.05, 8.27),p<0.001 2Wk - 1Mth: HR=1.92 (0.80, 4.62),p=0.146 1Mth - 6Mth: HR=0.86 (0.32, 2.30),p=0.767 6Mth - 3Yr: HR=3.53 (2.49, 5.00),p<0.001 3Yr+: HR=7.44 (5.48, 10.10),p<0.001
*Edinburgh	138	637	2.20	Entire Period: HR=3.40 (2.01, 5.74),p<0.001
*K2	601	2154	2.46	Entire Period: HR=3.18 (2.43, 4.17),p<0.001
*LYDERIC II	164	1135	1.23	Entire Period: HR=2.09 (1.24, 3.54),p=0.005
*Margron	688	5660	1.78	Entire Period: HR=2.96 (2.44, 3.61),p<0.001
*Mayo	168	1078	1.21	Entire Period: HR=1.94 (1.13, 3.34),p=0.017
*Profemur Z	186	1283	1.71	Entire Period: HR=2.85 (1.88, 4.33),p<0.001
**2000 Plus	135	694	1.73	Entire Period: HR=2.63 (1.49, 4.63),p<0.001
**Adept	121	572	2.27	Entire Period: HR=3.19 (1.85, 5.49),p<0.001
**Artek	179	1745	3.21	0 - 1.5Yr: HR=2.01 (0.96, 4.21),p=0.065 1.5Yr+: HR=6.42 (4.84, 8.52),p<0.001
**ASR	4421	24222	5.97	0 – 2Wk: HR=1.32 (0.80, 2.16), p=0.277 2Wk – 1Mth: HR=0.25 (0.09, 0.67), p=0.005 1Mth – 9Mth: HR=1.12 (0.83, 1.53), p=0.453 9Mth – 1Yr: HR=2.74 (1.75, 4.30), p<0.001 1Yr – 2Yr: HR=4.41 (3.63, 5.34), p<0.001 2Yr – 3Yr: HR=11.38 (9.82, 13.18), p<0.001 3Yr – 5 Yr:HR=19.45 (17.66, 21.43), p<0.001 5Yr – 7Yr:HR=19.84 (17.61, 22.36), p<0.001 7Yr – 8Yr: HR=15.06 (11.11, 20.41), p<0.001 8Yr+: HR=6.07 (2.87, 12.85), p<0.001
**Bionik	608	3089	2.98	0 - 3Mth: HR=1.80 (0.99, 3.25),p=0.052 3Mth - 3Yr: HR=3.82 (2.73, 5.36),p<0.001 3Yr+: HR=8.72 (6.53, 11.65),p<0.001
**ExpanSys	71	492	2.03	Entire Period: HR=3.42 (1.84, 6.34),p<0.001
**Hedrocel	46	412	1.94	Entire Period: HR=3.19 (1.60, 6.38),p=0.001
**Icon	400	2062	2.33	Entire Period: HR=3.44 (2.59, 4.57),p<0.001
**Inter-Op	33	298	3.02	Entire Period: HR=4.98 (2.59, 9.57),p<0.001
**MBA	124	887	1.80	Entire Period: HR=3.06 (1.87, 5.00),p<0.001
**Mitch TRH	732	3682	1.68	0 - 3Mth: HR=0.66 (0.27, 1.58),p=0.348 3Mth - 2Yr: HR=2.17 (1.37, 3.45),p=0.001 2Yr+: HR=4.23 (3.09, 5.81),p<0.001
**SPH-Blind	952	8414	1.15	0 - 1Mth: HR=2.71 (1.66, 4.43),p<0.001 1Mth+: HR=1.83 (1.47, 2.28),p<0.001

Note: All Components have been compared to all other Total Conventional Hip component, excluding metal/metal bearings with head size >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 Revision Rate

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	13 Yrs
Newly Identified					
Corail/Trabecular Metal (Shell)	5.5 (2.1, 13.9)	11.0 (5.3, 22.0)			
CPT/Fitmore	4.4 (2.0, 9.5)	5.4 (2.6, 11.0)			
Taperloc/M2a	1.7 (0.9, 3.3)	4.3 (2.9, 6.5)	7.3 (5.3, 9.9)	13.3 (9.9, 17.7)	
*Emperion	3.8 (2.3, 6.4)	5.3 (3.4, 8.4)	5.3 (3.4, 8.4)		
**DeltaLox	5.9 (3.4, 10.1)				
Re-Identified and still used					
CPT/Low Profile Cup	4.3 (1.8, 10.1)	6.9 (3.3, 14.4)			
ML Taper/Fitmore	4.4 (2.0, 9.5)	7.1 (3.8, 13.4)	7.1 (3.8, 13.4)		
*CBH Stem	4.1 (2.3, 7.3)	8.2 (5.3, 12.5)	10.4 (6.7, 15.9)		
*Excia (cementless)	4.5 (2.2, 8.7)	6.2 (3.3, 11.5)			
*Furlong	2.6 (1.5, 4.7)	4.8 (3.0, 7.5)	5.6 (3.6, 8.7)		
*Metha	9.3 (5.6, 15.2)	10.8 (6.7, 17.1)			
*ML Taper Kinectiv	2.4 (1.8, 3.1)	3.6 (2.8, 4.5)			
*MSA	5.8 (3.4, 10.0)	10.0 (6.5, 15.4)			
*Novation	4.6 (2.8, 7.6)				
*Taper Fit	1.2 (0.5, 2.9)	3.4 (2.0, 6.0)	7.2 (4.8, 10.8)		
*Trabecular Metal	3.3 (2.5, 4.4)	4.4 (3.4, 5.7)	5.8 (4.4, 7.7)		
*UniSyn	3.6 (2.2, 6.0)	6.2 (4.2, 9.2)	7.7 (5.3, 11.1)		
**BHR	1.1 (0.8, 1.6)	3.2 (2.6, 3.9)	6.0 (5.1, 7.0)	11.7 (9.7, 14.0)	
**Continuum	2.5 (2.1, 2.9)	3.4 (2.9, 4.0)			
**Cormet	1.4 (0.8, 2.5)	3.4 (2.3, 4.9)	5.5 (4.0, 7.4)	16.2 (11.9, 21.7)	
**Fin II	2.8 (2.1, 3.7)	3.9 (3.1, 5.0)	5.4 (4.2, 6.8)		
**Plasmacup	5.5 (3.5, 8.6)	7.4 (4.9, 10.9)	8.6 (5.5, 13.1)		
**Procotyl L	4.1 (2.9, 5.8)	5.7 (4.2, 7.7)			
**SeleXys	4.9 (3.1, 7.6)	9.1 (6.4, 13.0)	12.2 (8.5, 17.3)		

Identified and no longer used				
+Friendly Hip/Cup (Exactech)	2.1 (0.5, 8.0)	3.2 (1.0, 9.5)	6.5 (3.0, 14.0)	15.2 (8.4, 26.4)
+Integrale (exch neck)/Cera Fit	1.3 (0.2, 9.1)	2.7 (0.7, 10.5)	7.4 (3.1, 17.1)	
+VerSys/Durom	2.7 (0.7, 10.2)	6.7 (2.8, 15.3)	9.5 (4.6, 18.9)	
Alloclassic/Durom	1.3 (0.7, 2.6)	4.9 (3.5, 7.0)	6.9 (5.1, 9.3)	
Anca_Fit/Pinnacle	5.0 (2.1, 11.5)	8.0 (4.1, 15.4)	11.1 (6.3, 19.1)	
Apex/Trilogy	4.6 (2.0, 10.8)	7.4 (3.8, 14.3)		
Charnley/Duraloc	0.6 (0.1, 3.9)	2.9 (1.2, 6.7)	9.4 (5.9, 14.9)	18.5 (13.2, 25.6)
Elite Plus/Apollo	2.0 (0.3, 13.4)	4.0 (1.0, 15.1)	12.1 (5.6, 25.0)	23.3 (13.5, 38.2)
Elite Plus/Charnley LPW	1.2 (0.2, 8.2)	6.1 (2.6, 14.1)	11.3 (6.1, 20.7)	18.4 (11.0, 30.0)
F2L/Delta PF	5.6 (2.6, 12.1)	10.3 (5.9, 17.9)	12.3 (7.3, 20.2)	
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)
S-Rom/Duraloc	3.0 (1.3, 7.1)	4.9 (2.5, 9.6)	5.6 (2.9, 10.4)	15.4 (10.2, 22.8)
Secur-Fit Plus/Secur-Fit	3.1 (1.4, 6.7)	7.3 (4.4, 11.9)	7.8 (4.8, 12.6)	10.1 (6.5, 15.3)
*ABGII (Exch Neck)	4.1 (2.2, 7.5)	10.4 (7.1, 15.2)		
*Adapter (cemented)	4.1 (1.9, 8.9)	9.1 (5.4, 15.2)	16.6 (11.2, 24.1)	
*Adapter (cementless)	3.3 (2.2, 4.8)	6.8 (5.2, 8.9)	12.1 (9.7, 15.0)	
*Edinburgh	6.0 (3.1, 11.7)	9.6 (5.6, 16.4)	12.0 (7.2, 19.7)	
*K2	5.2 (3.7, 7.3)	7.6 (5.7, 10.0)	10.4 (7.8, 13.9)	
*LYDERIC II	3.1 (1.3, 7.2)	5.7 (3.0, 10.6)	7.1 (4.0, 12.5)	
*Margron	5.8 (4.3, 7.9)	8.4 (6.5, 10.8)	10.2 (8.2, 12.8)	15.5 (12.9, 18.7)
*Mayo	3.0 (1.3, 7.0)	6.6 (3.7, 11.6)	6.6 (3.7, 11.6)	
*Profemur Z	6.0 (3.4, 10.5)	10.4 (6.7, 15.8)	10.9 (7.2, 16.4)	
**2000 Plus	3.0 (1.1, 7.8)	6.8 (3.6, 12.7)	8.9 (5.0, 15.6)	
**Adept	4.1 (1.7, 9.6)	8.4 (4.6, 15.0)	8.4 (4.6, 15.0)	
**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)	24.1 (22.8, 25.4)	
**Bionik	3.6 (2.4, 5.5)	7.6 (5.7, 10.0)	14.2 (11.5, 17.4)	
**ExpanSys	2.8 (0.7, 10.8)	5.7 (2.2, 14.4)	10.2 (5.0, 20.2)	
**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, 11.0)	12.4 (9.3, 16.4)	
**Inter-Op	12.1 (4.7, 29.1)	15.2 (6.6, 32.6)	21.4 (10.8, 39.8)	28.3 (15.8, 47.4)
**MBA	4.0 (1.7, 9.4)	8.2 (4.5, 14.8)	10.2 (5.9, 17.2)	
**Mitch TRH	1.5 (0.8, 2.7)	4.6 (3.3, 6.4)	8.1 (6.2, 10.5)	
**SPH-Blind	3.8 (2.8, 5.2)	5.8 (4.5, 7.5)	7.3 (5.8, 9.2)	10.4 (8.5, 12.6)

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 Revision Rate

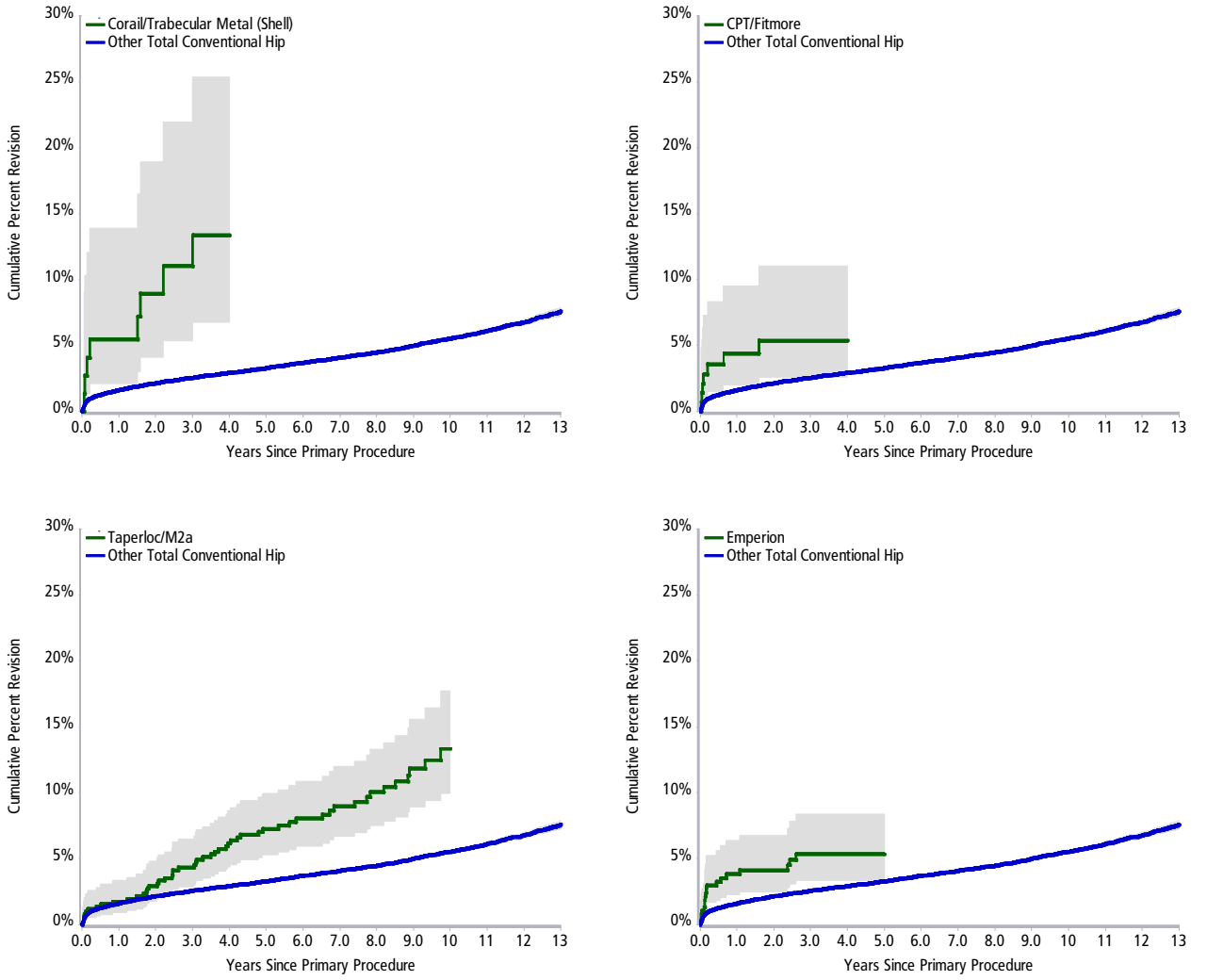
Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Newly Identified												
Corail/Trabecular Metal (Shell)						5	10	17	20	8	8	8
CPT/Fitmore			19	6	6	4	16	12	15	24	14	30
Taperloc/M2a	18	79	113	74	38	43	76	51	23	2		1
*Emperion				1	13	21	26	65	87	72	44	52
**DeltaLox									32	85	72	24
Re-Identified and still used												
CPT/Low Profile Cup			15	9	8	7	7	6	9	16	26	19
ML Taper/Fitmore				7	11	24	70	3		3	5	21
*CBH Stem			12	7	14	37	28	27	45	53	43	7
*Excia (cementless)							6	34	8	47	58	36
*Furlong	27	4			1	35	80	73	61	59	53	37
*Metha								20	53	33	27	36
*ML Taper Kinectiv							36	341	647	576	514	383
*MSA						2	3	11	58	76	46	21
*Novation								4	32	53	130	136
*Taper Fit	30	34	65	50	66	26	18	6	8	16	55	43
*Trabecular Metal					6	101	147	198	242	272	276	186
*UniSyn	1	15	40	74	32	37	46	47	36	23	19	23
**BHR	39	66	127	288	550	581	476	404	276	134	27	13
**Continuum								175	1117	1245	1332	1487
**Cormet	9	53	74	103	115	72	129	124	93	26	4	1
**Fin II				39	127	175	251	269	318	287	205	246
**Plasmacup				10	16	13	7	54	60	59	76	65
**Procotyl L							8	32	268	342	67	26
**SeleXys					35	41	27	21	53	70	88	56
Identified and no longer used												
+Friendly Hip/Cup (Exactech)	8	16	18	16	19	12	2	6				
+Integrale (exch neck)/Cera Fit						8	29	38				
+VerSys/Durom			1	14	19	20	17	4				
Alloclassic/Durom		3	51	151	139	113	112	46	7	1		
Anca_Fit/Pinnacle					30	55	16					
Apex/Trilogy							17	39	30	22		
Charnley/Duraloc	107	33	19	20	1							
Elite Plus/Apollo	42	10										
Elite Plus/Charnley LPW	74	15										
F2L/Delta PF			1	5	8	1						
H Moos/Mueller	19											
S-Rom/Duraloc	93	33	28	3	3	1	4	3				
Secur-Fit Plus/Secur-Fit	101	27	21	26	22							
*ABGII (Exch Neck)						10	39	69	58	63	7	
*Adapter (cemented)				7	41	52	33	8	7			
*Adapter (cementless)				19	140	131	122	158	113	59		
*Edinburgh				20	37	29	18	23	10	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			
*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	583	959	1186	1179	430				
**Bionik				11	147	136	138	134	38	4		

Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
**ExpanSys		1	7	24	30	8	1					
**Hedrocel	37	9										
**Icon			3	40	79	84	68	78	37	11		
**Inter-Op	33											
**MBA	49	29	19	11	9	5	2					
**Mitch TRH					45	274	164	130	82	37		
**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 Individual Total Conventional Hip Prostheses Newly Identified

Newly Identified



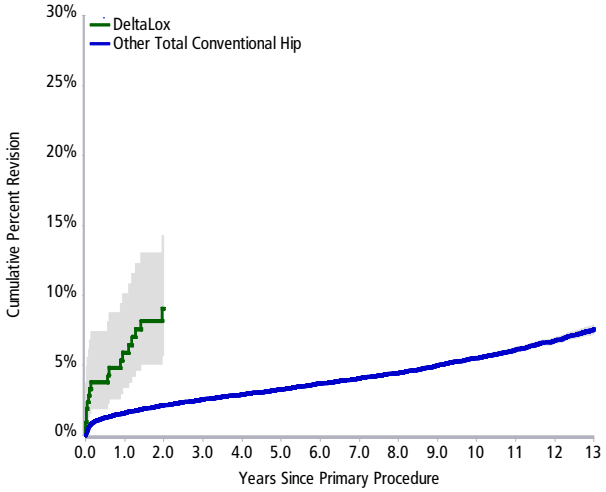
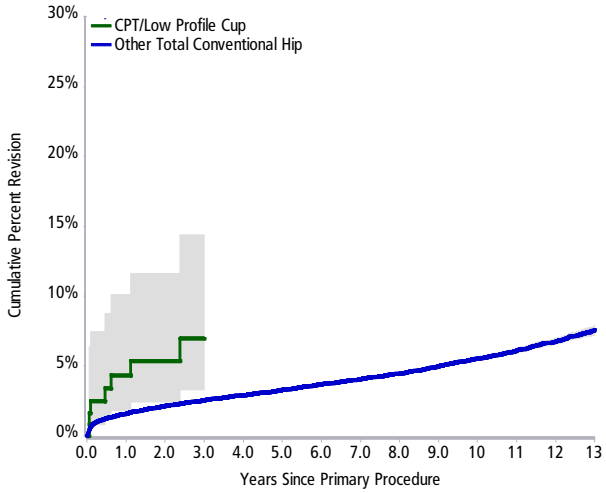
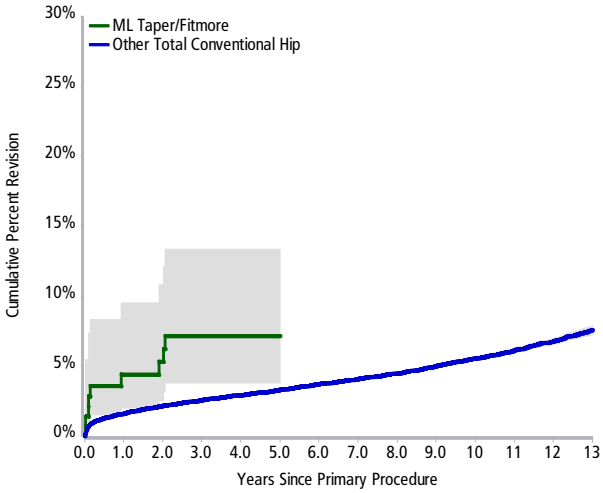
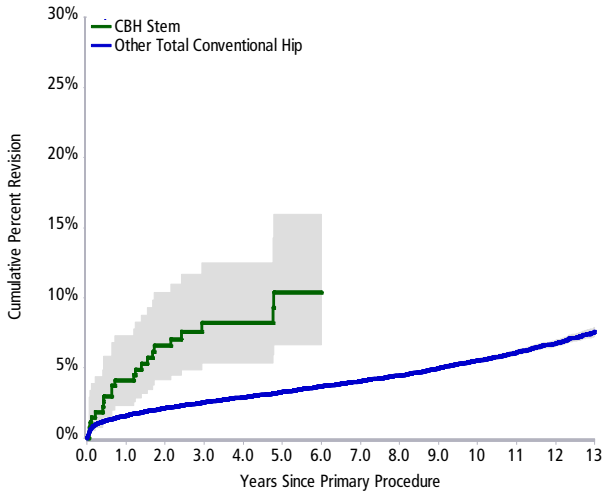

DeltaLox
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10
11
12
13
Years Since Primary Procedure

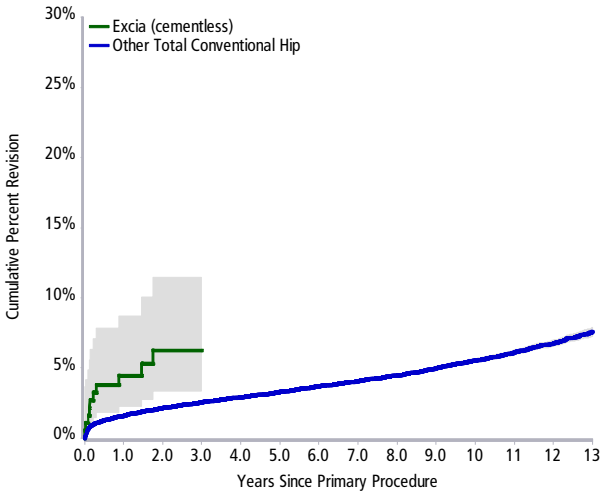
Figure IP5: Cumulative Percent Revision of Individual Total Conventional Hip Prostheses Re-identified and still used

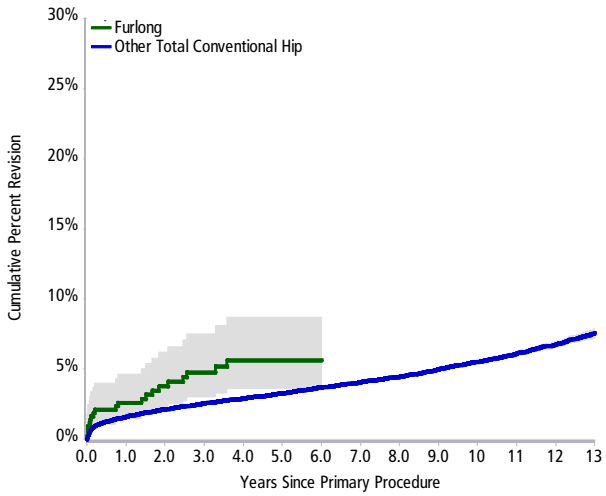
Re-identified and still used

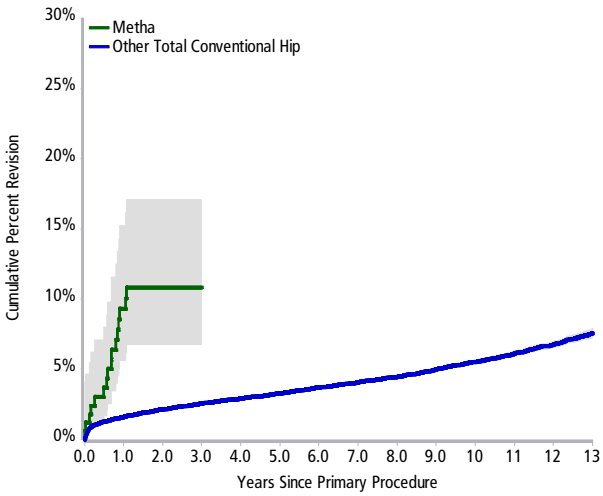


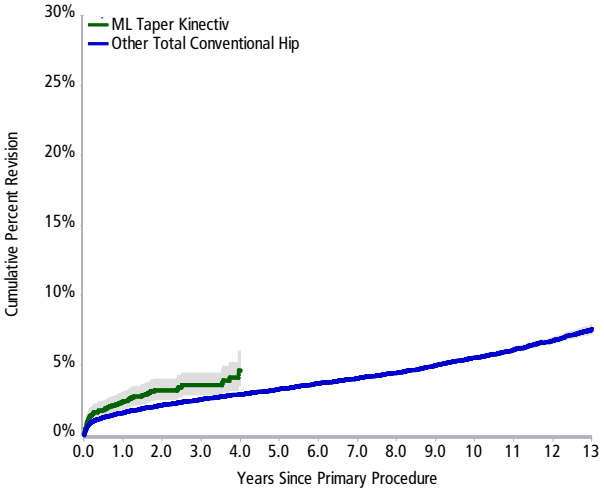


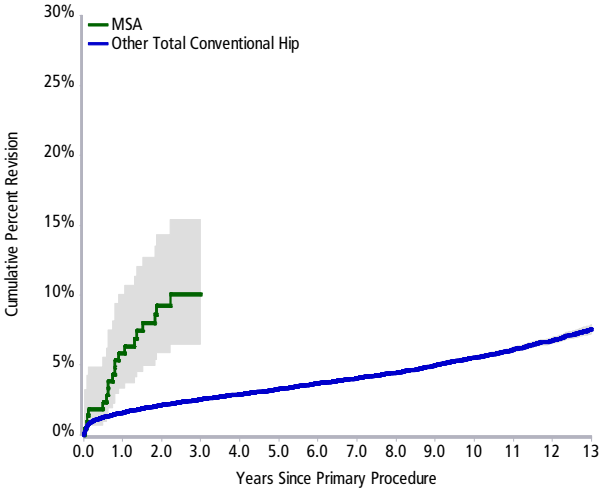


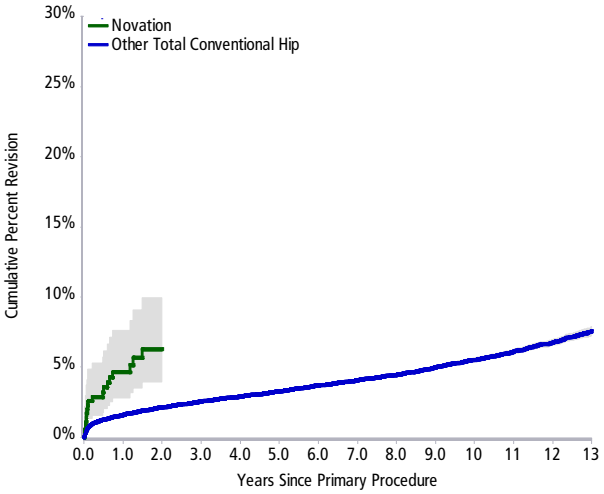


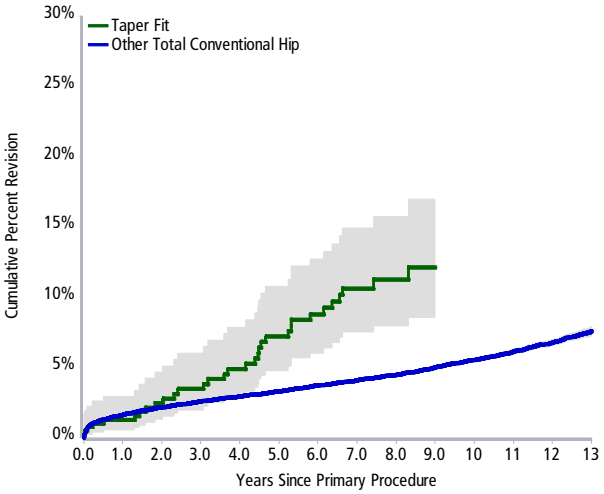


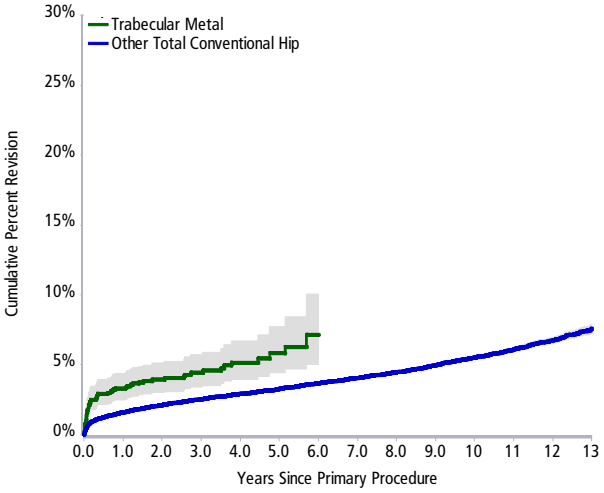


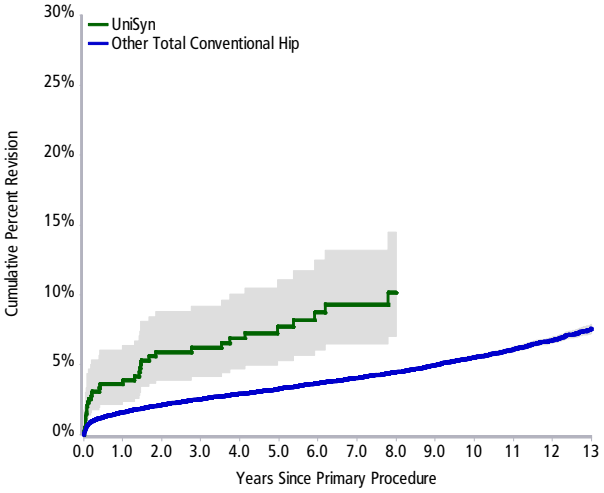

ML Taper Kinectiv
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12 13
Years Since Primary Procedure

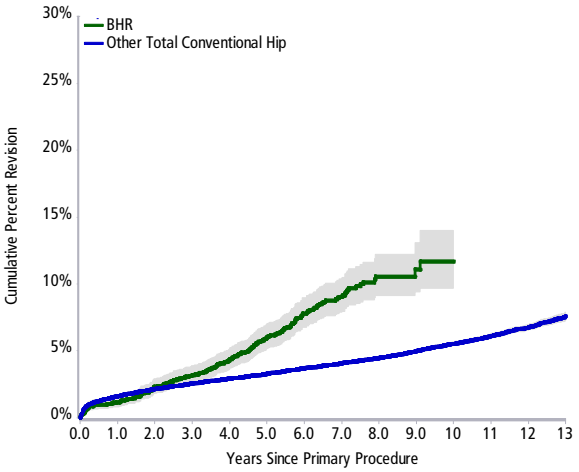

MSA
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12 13
Years Since Primary Procedure

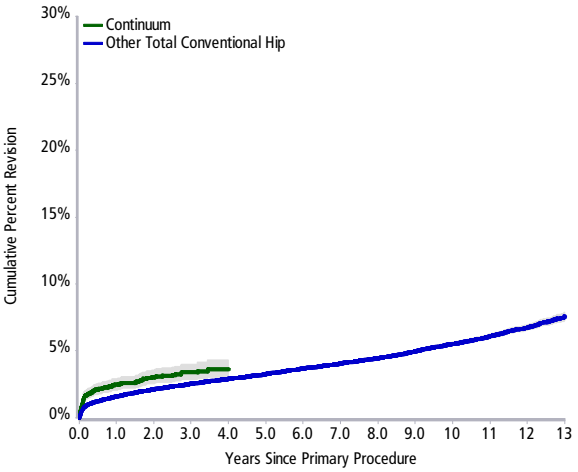

Novation
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12 13
Years Since Primary Procedure

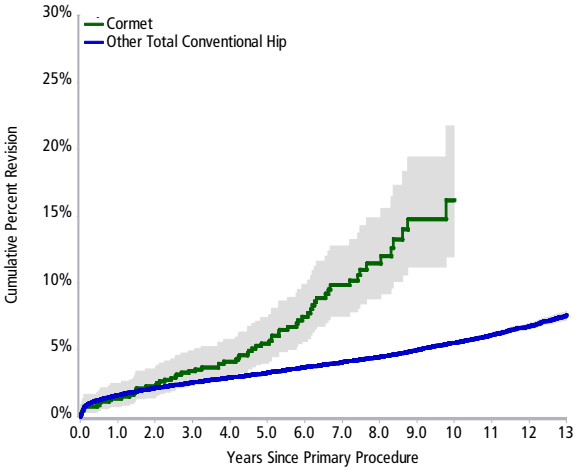

Taper Fit
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12 13
Years Since Primary Procedure

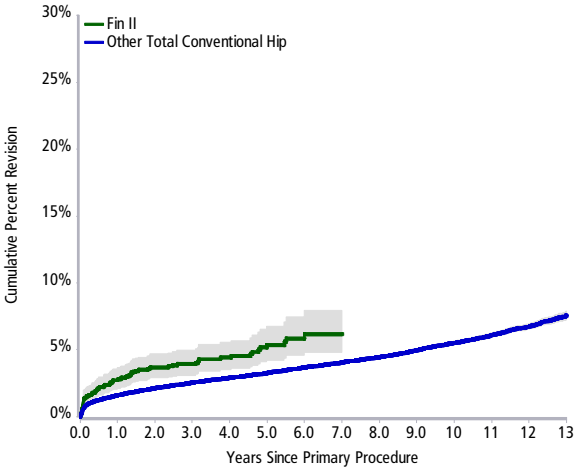

Trabecular Metal
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12 13
Years Since Primary Procedure

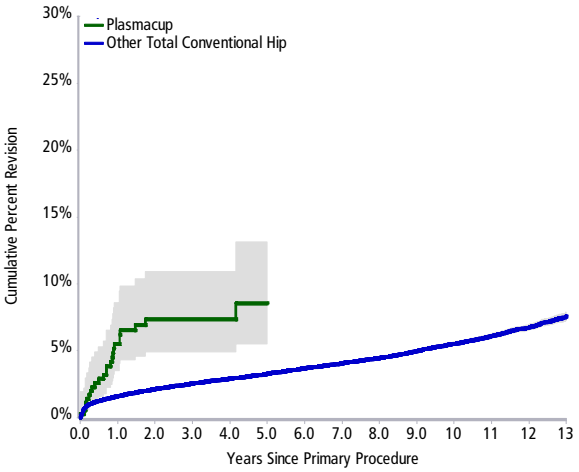

UniSyn
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12 13
Years Since Primary Procedure

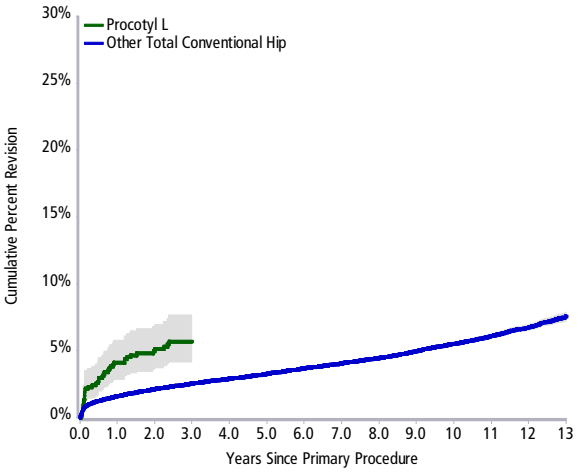

BHR
Other Total Conventional Hip
Cumulative Percent Revision
Years Since Primary Procedure

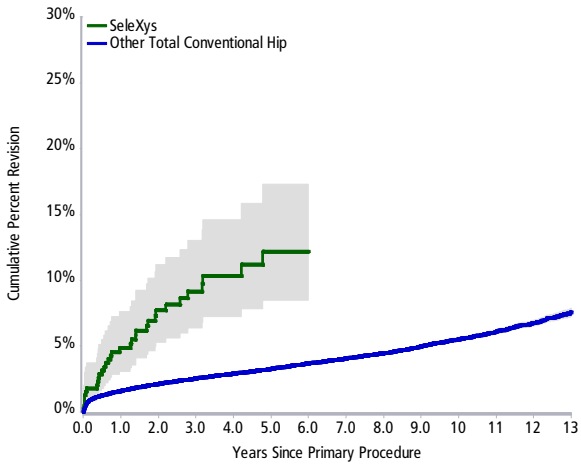

Continuum
Other Total Conventional Hip
Cumulative Percent Revision
Years Since Primary Procedure


Cormet
Other Total Conventional Hip
Cumulative Percent Revision
Years Since Primary Procedure


Fin II
Other Total Conventional Hip
Cumulative Percent Revision
Years Since Primary Procedure


Plasmacup
Other Total Conventional Hip
Cumulative Percent Revision
Years Since Primary Procedure


Procotyl L
Other Total Conventional Hip
Cumulative Percent Revision
Years Since Primary Procedure


SeleXys
Other Total Conventional Hip
Cumulative Percent Revision
Years Since Primary Procedure

Total Resurfacing

There are no total resurfacing prostheses being identified for the first time this year.

The Cormet/Cormet combination was identified for the first time last year. In 2013, there were four more procedures and 12 further revisions.

Table IP10: Revision Rate of Individual Total Resurfacing Hip Prostheses Identified as having a Higher than Anticipated Revision Rate

Resurfacing Head/Acetabular	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Re-Identified and still used				
Cormet/Cormet	626	4071	2.16	0 - 1.5Yr: HR=1.16 (0.71, 1.89),p=0.551
				1.5Yr+: HR=2.46 (1.93, 3.14),p<0.001
Identified and no longer used				
ASR/ASR	1167	7735	3.67	0 - 3Mth: HR=1.78 (1.09, 2.93),p=0.022
				3Mth - 3Yr: HR=2.41 (1.85, 3.15),p<0.001
				3Yr - 4Yr: HR=4.65 (3.13, 6.91),p<0.001
				4Yr - 4.5Yr: HR=6.63 (4.14, 10.60),p<0.001
				4.5Yr - 5Yr: HR=8.98 (5.51, 14.64),p<0.001
				5Yr+: HR=5.97 (4.76, 7.49),p<0.001
Bionik/Bionik	200	1016	3.35	Entire Period: HR=3.36 (2.39, 4.73),p<0.001
Durom/Durom	847	6015	1.28	0 - 4.5Yr: HR=1.71 (1.31, 2.22),p<0.001
				4.5Yr+: HR=0.66 (0.40, 1.09),p=0.101
Recap/Recap	195	1092	2.02	Entire Period: HR=1.96 (1.29, 3.00),p=0.001
*Cormet 2000 HAP	95	860	2.21	Entire Period: HR=2.35 (1.50, 3.70),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 Revision Rate

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	13 Yrs
Re-Identified and still used					
Cormet/Cormet	2.1 (1.2, 3.6)	5.7 (4.1, 7.8)	10.1 (7.9, 12.8)	18.7 (14.9, 23.4)	
Identified and no longer used					
ASR/ASR	3.4 (2.5, 4.6)	7.2 (5.9, 8.8)	15.3 (13.3, 17.5)		
Bionik/Bionik	3.5 (1.7, 7.2)	12.0 (8.2, 17.4)	16.7 (12.1, 22.9)		
Durom/Durom	3.2 (2.2, 4.6)	5.4 (4.1, 7.2)	7.6 (6.0, 9.6)	10.3 (8.2, 12.9)	
Recap/Recap	5.1 (2.8, 9.3)	8.7 (5.5, 13.7)	10.4 (6.8, 15.7)		
*Cormet 2000 HAP	6.3 (2.9, 13.5)	8.4 (4.3, 16.1)	9.5 (5.0, 17.4)	20.3 (13.4, 30.0)	

Note: All Components have been compared to all other Total Resurfacing Hip components.
* Resurfacing Head Component

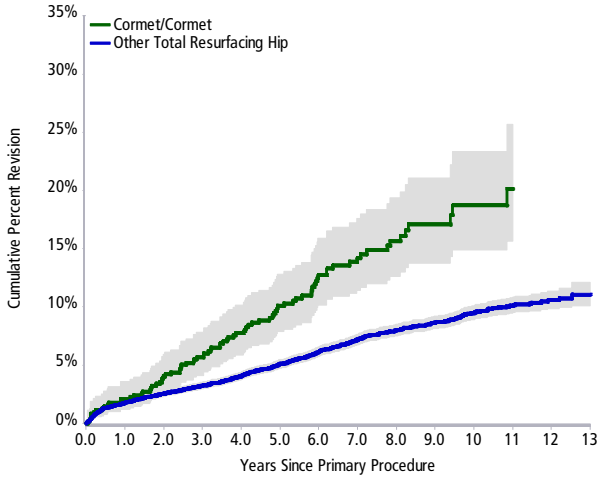
Table IP12: Yearly Usage of Individual Total Resurfacing Hip Prostheses Identified as having a Higher than Anticipated Revision Rate

Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Re-Identified and still used												
Cormet/Cormet	62	42	50	85	74	76	94	75	50	10	4	4
Identified and no longer used												
ASR/ASR		43	165	302	257	176	133	91				
Bionik/Bionik				12	33	33	46	54	20	2		
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: All Components have been compared to all other Total Resurfacing Hip components.
* Resurfacing Head Component

Figure IP6: Cumulative Percent Revision of Individual Total Resurfacing Hip Prostheses Re-identified and still used

Re-identified and still used



Primary Partial Knee Replacement

Patella/Trochlear

There are no patella/trochlear prostheses being identified for the first time.

Table IP13: Revision Rate of Individual Patella/Trochlear Knee Prostheses Identified as having a Higher than Anticipated Revision Rate

Patella/Trochlear	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Re-Identified and still used				
PFC Sigma/Sigma HP	87	215	5.58	Entire Period: HR=1.97 (1.11, 3.52),p=0.021
**Vanguard	41	94	8.52	Entire Period: HR=2.74 (1.35, 5.53),p=0.005
Identified and no longer used				
**LCS	413	2592	4.98	Entire Period: HR=1.75 (1.41, 2.16),p<0.001

Note: All Components have been compared to all other Patella/Trochlear Knee components.
** Trochlear Component

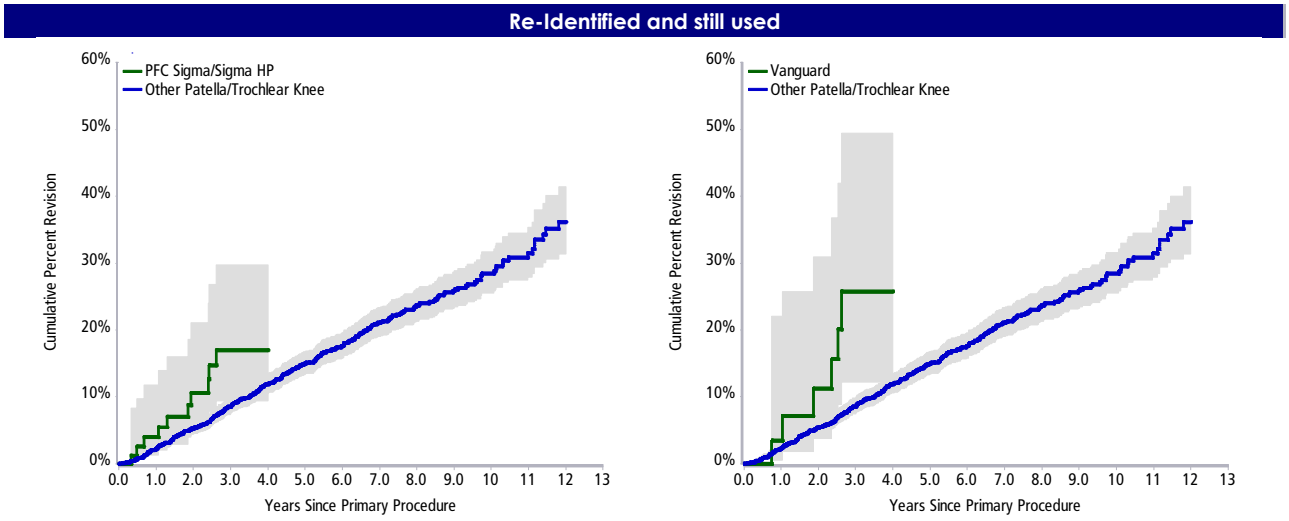
Table IP14: Cumulative Percent Revision of Individual Patella/Trochlear Knee Prostheses Identified as having a Higher than Anticipated Revision Rate

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	13 Yrs
Re-Identified and still used					
PFC Sigma/Sigma HP	3.9 (1.3, 11.8)	17.0 (9.4, 29.7)			
**Vanguard	3.4 (0.5, 22.1)	25.8 (12.2, 49.4)			
Identified and no longer used					
**LCS	3.9 (2.4, 6.2)	11.9 (9.1, 15.4)	20.7 (17.1, 25.0)		

Table IP15: Yearly Usage of Individual Patella/Trochlear Knee Prostheses Identified as having a Higher than Anticipated Revision Rate

Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Re-Identified and still used												
PFC Sigma/Sigma HP						14	6	5	16	15	12	19
**Vanguard						4	5	2	1	12	3	14
Identified and no longer used												
**LCS	26	56	68	47	65	64	60	27				

Figure IP7: Cumulative Percent Revision of Individual Patella/Trochlear Knee Prostheses Re-identified and still used



Unicompartmental

No new unicompartmental knee prostheses have been identified as having a higher than anticipated rate of revision.

Table IP16: Revision Rate of Individual Unicompartmental Knee Prostheses Identified as having a Higher than Anticipated Revision Rate

Femoral/Tibial	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Re-Identified and still used				
GMK-UNI/GMK-UNI	59	101	6.96	Entire Period: HR=3.65 (1.74, 7.65),p<0.001
Uniglide/Uniglide	727	4216	2.54	0 - 1.5Yr: HR=2.02 (1.53, 2.67),p<0.001
				1.5Yr+: HR=1.12 (0.86, 1.46),p=0.389
Identified and no longer used				
Advance/Advance	37	227	6.60	Entire Period: HR=4.24 (2.56, 7.04),p<0.001
BalanSys Uni/BalanSys Uni Mobile	199	1295	2.86	0 - 6Mth: HR=4.63 (2.30, 9.33),p<0.001
				6Mth+: HR=1.40 (0.97, 2.01),p=0.072
Eius/Eius	142	1008	2.98	Entire Period: HR=1.44 (1.01, 2.07),p=0.046
**Preservation Mobile	400	3303	3.33	0 - 1.5Yr: HR=2.24 (1.60, 3.13),p<0.001
				1.5Yr - 3Yr: HR=2.66 (1.81, 3.90),p<0.001
				3Yr+: HR=1.30 (0.98, 1.74),p=0.069

Note: All Components have been compared to all other Unicompartmental Knee components.
** Unicompartmental Tibial Component

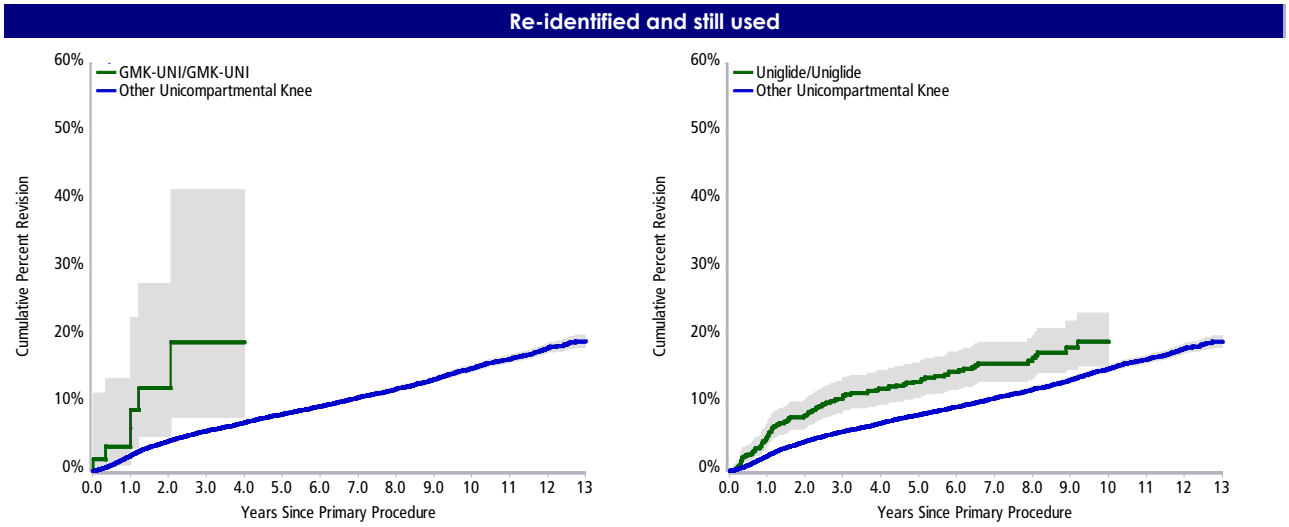
Table IP17: Cumulative Percent Revision of Individual Unicompartmental Knee Prostheses Identified as having a Higher than Anticipated Revision Rate

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	13 Yrs
Re-Identified and still used					
GMK-UNI/GMK-UNI	8.9 (3.4, 22.6)	18.9 (7.9, 41.4)			
Uniglide/Uniglide	4.9 (3.5, 6.8)	11.1 (9.0, 13.7)	13.1 (10.8, 15.9)	19.0 (15.5, 23.2)	
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)	42.2 (27.9, 60.2)	
BalanSys Uni/BalanSys Uni Mobile	7.0 (4.2, 11.6)	13.1 (9.1, 18.6)	14.7 (10.4, 20.4)		
Eius/Eius	4.9 (2.4, 10.1)	12.8 (8.2, 19.5)	17.8 (12.4, 25.3)		
**Preservation Mobile	5.3 (3.5, 7.9)	15.5 (12.3, 19.5)	19.1 (15.6, 23.3)	27.6 (23.4, 32.5)	

Table IP18: Yearly Usage of Individual Unicompartmental Knee Prostheses Identified as having a Higher than Anticipated Revision Rate

Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Re-Identified and still used												
GMK-UNI/GMK-UNI							5	10	2		20	22
Uniglide/Uniglide		80	66	123	84	107	93	61	30	38	25	20
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			
Eius/Eius	10	21	27	37	21	9	8	7	2			
**Preservation Mobile	164	121	59	26	17	13						

Figure IP8: Cumulative Percent Revision of Individual Unicompartmental Knee Prostheses Re-identified and still used



Primary Total Knee Replacement

There are six total knee prostheses combinations and one femoral prosthesis being identified for the first time.

Genesis II CR (cementless)/Profix Mobile (cemented) combination has been used in 241 procedures since 2000. It has a 10 year cumulative percent revision of 13.0%. The main reasons for revision are loosening/lysis (44.0%) and infection (24.0%). There were 25 revisions, most of which were major.

Genesis II Oxinium PS (cemented)/Genesis II (cementless) combination has been used in 56 procedures since 2007 with no procedures recorded since 2012. It has a five year cumulative percent revision of 31.0%. The main reason for revision is loosening/lysis (82.4%). There were 17 revisions, 15 of which were major. Most major revisions were tibial only (76.5%).

GMK Primary (cementless)/GMK Primary (cementless) combination has been used in 306 procedures since 2010. It has a one year cumulative percent revision of 3.0%. The main reasons for revision are loosening/lysis (42.9%) and infection (28.6%). There were seven revisions, three of which were major.

Optetrak CR (cemented)/Optetrak (cemented) combination has been used in 68 procedures since 2001. It has a 10 year cumulative percent revision of 11.9%. The main reason for revision is loosening/lysis (66.7%). There were 6 revisions, 3 of which were major.

Scorpio NRG PS (cementless)/Series 7000 (cementless) combination has been used in 850 procedures since 2007. It has a five year cumulative percent revision of 8.4%. The main reasons for revision are loosening/lysis (46.4%), infection (21.4%) and pain (10.7%). There were 56 revisions, 22 of which were major.

Vanguard PS/Maxim combination has been used in 3,064 procedures since 2005. It has a five year cumulative percent revision of 5.8%. There were 128 revisions, 68 of which were major.

LCS PS femoral component, first recorded in 2008, has been used in 597 procedures and has a three year cumulative percent revision of 7.5%. The main reasons for revision are patellofemoral pain (35.7%) and pain (19.0%). There were 42 revisions, 31 of which were minor.

In the 2013 Annual Report the analysis of the Score/Score knee included both cementless and cemented prostheses. Only the cementless prosthesis has a higher than anticipated rate of revision. It has been used in 1,182 procedures since 2005 and has a five year cumulative percent revision of 6.5%. The main reasons for revision are loosening/lysis (17.0%), infection (19.1%) and patellofemoral pain (14.9%). There were 47 revisions, 26 of which were major.

As a consequence of reporting CR and PS femoral prostheses separately, two previously identified prostheses are now reported differently.

1. Genesis II Oxinium (cementless)/Genesis II is now reported as Genesis II Oxinium CR (cementless)/Genesis II.
2. Genesis II Oxinium (cementless)/Profix Mobile is now reported as Genesis II Oxinium CR (cementless)/Profix Mobile.

In previous years, the Vanguard/Regenerex combination was identified as having higher than anticipated rate of revision. Separate reporting of Vanguard CR and Vanguard PS has identified Vanguard PS/Regenerex as having a higher than anticipated rate of revision but Vanguard CR/Regenerex does not.

Analyses for all prostheses identified as having a higher than anticipated rate of revision are available on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2014.

Table IP19: Revision Rate of Individual Total Knee Prostheses Identified as having a Higher than Anticipated Revision Rate

Femoral/Tibial	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Newly Identified				
Genesis II CR (cementless)/Profix Mobile (cemented)	241	1759	1.42	Entire Period: HR=2.40 (1.62, 3.55),p<0.001
GMK Primary (cementless)/GMK Primary (cementless)	306	269	2.60	Entire Period: HR=2.44 (1.17, 5.11),p=0.017
Optetrak-CR (cemented)/Optetrak (cemented)	68	366	1.64	Entire Period: HR=2.57 (1.16, 5.71),p=0.020
Scorpio NRG PS (cementless)/Series 7000 (cementless)	850	3073	1.82	Entire Period: HR=1.84 (1.42, 2.40),p<0.001
Vanguard PS/Maxim	3064	9070	1.41	Entire Period: HR=1.61 (1.35, 1.92),p<0.001
*LCS PS	597	1695	2.48	Entire Period: HR=2.74 (2.03, 3.71),p<0.001
Re-Identified and still used				
ACS/ACS	1142	1267	2.37	Entire Period: HR=2.29 (1.60, 3.28),p<0.001
Advance/Advance	473	1808	1.44	Entire Period: HR=1.69 (1.15, 2.48),p=0.007
Columbus/Columbus	979	3847	1.74	Entire Period: HR=2.26 (1.78, 2.87),p<0.001
E.Motion/E.Motion	575	886	2.48	Entire Period: HR=2.49 (1.64, 3.78),p<0.001
Genesis II CR (cementless)/Genesis II (cementless)	378	1325	1.51	Entire Period: HR=1.67 (1.08, 2.59),p=0.022
Journey/Journey	3134	11457	1.41	0 - 3Mth: HR=0.30 (0.10, 0.93),p=0.037 3Mth - 9Mth: HR=1.46 (0.94, 2.27),p=0.090 9Mth - 1.5Yr: HR=2.02 (1.53, 2.66),p<0.001 1.5Yr+: HR=1.86 (1.51, 2.30),p<0.001
Optetrak-PS/Optetrak	2252	11641	1.29	Entire Period: HR=1.81 (1.54, 2.13),p<0.001
Optetrak-PS/Optetrak-RBK	749	3326	1.68	Entire Period: HR=2.25 (1.73, 2.92),p<0.001
Score (cementless)/Score (cementless)	1182	3170	1.48	Entire Period: HR=1.38 (1.04, 1.84),p=0.027
Trekking/Trekking	373	578	2.77	0 - 1Yr: HR=3.73 (2.16, 6.43),p<0.001 1Yr+: HR=1.03 (0.33, 3.20),p=0.956
Vanguard PS/Regenerex	221	605	1.98	0 - 1Yr: HR=3.63 (1.89, 6.97),p<0.001 1Yr+: HR=0.77 (0.25, 2.40),p=0.656
Identified and no longer used				
+Genesis II Oxinium PS (cemented)/Genesis II (cementless)	56	176	9.65	Entire Period: HR=8.96 (5.57, 14.42),p<0.001
AMK/AMK	203	2027	1.13	Entire Period: HR=2.06 (1.37, 3.11),p<0.001
Buechel-Pappas/Buechel-Pappas	470	2020	1.68	Entire Period: HR=1.96 (1.40, 2.75),p<0.001
Eska RP/Eska RP	40	219	3.65	Entire Period: HR=5.69 (2.85, 11.38),p<0.001
Gemini MK II/Gemini MK II	21	171	4.09	Entire Period: HR=6.38 (3.04, 13.37),p<0.001
Genesis (cemented)/Genesis (cemented)	62	535	1.68	Entire Period: HR=3.08 (1.60, 5.93),p<0.001
Genesis II Oxinium CR (cementless)/Genesis II	110	708	6.07	Entire Period: HR=8.57 (6.35, 11.55),p<0.001
Genesis II Oxinium CR (cementless)/Profix Mobile	88	441	12.26	Entire Period: HR=16.11 (12.33, 21.05),p<0.001
Genesis II Oxinium PS (cemented)/Genesis II (Keel)	269	1621	3.33	Entire Period: HR=4.66 (3.57, 6.09),p<0.001
HLS Noetos/HLS Noetos	293	1309	1.99	Entire Period: HR=2.50 (1.70, 3.67),p<0.001
IB II/IB II	199	1958	1.58	0 - 2Yr: HR=0.79 (0.25, 2.45),p=0.682 2Yr - 2.5Yr: HR=4.41 (1.42, 13.70),p=0.010 2.5Yr+: HR=4.49 (3.03, 6.66),p<0.001
Interax/Interax	52	462	2.16	0 - 3.5Yr: HR=1.38 (0.34, 5.51),p=0.651 3.5Yr+: HR=7.84 (3.92, 15.70),p<0.001
Optetrak-PS/Optetrak-PS	55	344	3.48	Entire Period: HR=5.76 (3.27, 10.14),p<0.001
Profix Oxinium (cemented)/Profix Mobile	228	2004	1.20	Entire Period: HR=1.70 (1.14, 2.53),p=0.009
Profix Oxinium (cementless)/Profix Mobile	158	989	7.08	Entire Period: HR=10.47 (8.28, 13.24),p<0.001
Profix Oxinium (cementless)/Profix	75	498	6.22	Entire Period: HR=8.63 (6.07, 12.26),p<0.001
Profix/Profix Mobile	1005	7998	1.16	0 - 2.5Yr: HR=2.45 (1.90, 3.16),p<0.001 2.5Yr+: HR=1.31 (0.93, 1.84),p=0.123
Rotaglide Plus/Rotaglide Plus	631	5219	1.09	0 - 1.5Yr: HR=1.17 (0.67, 2.07),p=0.578 1.5Yr+: HR=2.09 (1.56, 2.80),p<0.001
SAL/SAL	56	560	1.61	0 - 8.5Yr: HR=1.36 (0.51, 3.63),p=0.536 8.5Yr+: HR=8.66 (3.59, 20.85),p<0.001
Trac/Trac	138	1314	1.60	Entire Period: HR=2.63 (1.71, 4.03),p<0.001
*LCS Duofix	4867	26813	1.93	0 - 2Yr: HR=1.71 (1.47, 1.99),p<0.001 2Yr+: HR=3.74 (3.35, 4.18),p<0.001
*Renasys	121	832	1.56	Entire Period: HR=2.42 (1.41, 4.16),p=0.001

Note: ** Tibial Component * Femoral Component
+ Newly identified and no longer used

Table IP20: Cumulative Percent Revision of Individual Total Knee Prostheses Identified as having a Higher than Anticipated Revision Rate

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	13 Yrs
Newly Identified					
Genesis II CR (cementless)/Profix Mobile (cemented)	3.1 (1.5, 6.4)	8.0 (5.0, 12.6)	9.6 (6.3, 14.5)	13.0 (8.9, 18.8)	
GMK Primary (cementless)/GMK Primary (cementless)	3.0 (1.2, 7.3)				
Optetrak-CR (cemented)/Optetrak (cemented)	0.0 (0.0, 0.0)	7.2 (2.8, 18.2)	11.9 (5.5, 24.8)	11.9 (5.5, 24.8)	
Scorpio NRG PS (cementless)/Series 7000 (cementless)	1.4 (0.8, 2.4)	6.5 (4.9, 8.5)	8.4 (6.4, 10.9)		
Vanguard PS/Maxim	1.8 (1.4, 2.4)	4.7 (3.9, 5.7)	5.8 (4.8, 7.0)		
*LCS PS	2.2 (1.3, 3.8)	7.5 (5.5, 10.2)			
Re-Identified and still used					
ACS/ACS	2.2 (1.4, 3.6)				
Advance/Advance	2.6 (1.5, 4.5)	4.9 (3.3, 7.4)	4.9 (3.3, 7.4)		
Columbus/Columbus	2.1 (1.4, 3.2)	6.1 (4.7, 7.9)	8.0 (6.2, 10.2)		
E.Motion/E.Motion	2.7 (1.5, 4.6)	7.5 (4.5, 12.3)			
Genesis II CR (cementless)/Genesis II (cementless)	1.7 (0.8, 3.7)	6.6 (4.1, 10.3)	6.6 (4.1, 10.3)		
Journey/Journey	1.4 (1.0, 1.9)	4.6 (3.8, 5.5)	6.3 (5.4, 7.5)		
Optetrak-PS/Optetrak	1.5 (1.1, 2.1)	5.0 (4.2, 6.1)	6.9 (5.9, 8.2)	10.3 (8.5, 12.5)	
Optetrak-PS/Optetrak-RBK	2.6 (1.7, 4.1)	6.5 (4.9, 8.7)	8.3 (6.4, 10.7)		
Score (cementless)/Score (cementless)	1.3 (0.7, 2.2)	4.9 (3.6, 6.6)	6.5 (4.9, 8.8)		
Trekking/Trekking	4.0 (2.4, 6.9)				
Vanguard PS/Regenerex	4.2 (2.2, 7.9)	6.1 (3.5, 10.5)			
Identified and no longer used					
+Genesis II Oxinium PS (cemented)/Genesis II (cementless)	19.6 (11.4, 32.7)	26.9 (17.2, 40.6)	31.0 (20.5, 45.2)		
AMK/AMK	1.0 (0.2, 3.9)	5.0 (2.7, 9.1)	6.6 (3.9, 11.1)	11.3 (7.5, 16.9)	12.2 (8.2, 18.0)
Buechel-Pappas/Buechel-Pappas	1.9 (1.0, 3.7)	5.6 (3.9, 8.2)	8.4 (5.9, 11.9)		
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 (cemented)/Genesis (cemented)	0.0 (0.0, 0.0)	6.7 (2.6, 16.8)	10.0 (4.6, 20.9)	16.6 (8.8, 30.1)	
Genesis II Oxinium CR (cementless)/Genesis II	11.0 (6.4, 18.6)	38.3 (29.8, 48.2)	39.3 (30.7, 49.2)	40.3 (31.7, 50.2)	
Genesis II Oxinium CR (cementless)/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 (cemented)/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 (1.9, 6.3)	8.1 (5.5, 12.0)	9.7 (6.7, 14.1)		
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)	32.4 (17.1, 55.8)
Optetrak-PS/Optetrak-PS	1.8 (0.3, 12.2)	16.4 (8.9, 29.1)	20.0 (11.6, 33.3)		
Profix Oxinium (cemented)/Profix Mobile	1.8 (0.7, 4.6)	6.3 (3.8, 10.4)	8.6 (5.6, 13.1)	11.0 (7.5, 15.9)	
Profix Oxinium (cementless)/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 (cementless)/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)	9.8 (8.1, 12.0)	
Rotaglide Plus/Rotaglide Plus	0.8 (0.3, 1.9)	4.1 (2.8, 6.0)	5.8 (4.2, 8.0)	10.6 (8.2, 13.6)	
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, 10.4)		
*Renasys	2.5 (0.8, 7.5)	4.2 (1.8, 9.8)	8.5 (4.6, 15.1)		

Note: ** Tibial Component
* Femoral Component
+ Newly identified and no longer used

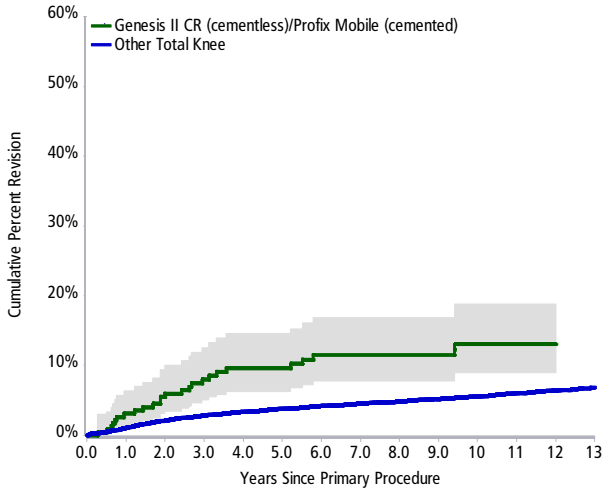
Table IP21: Yearly Usage of Individual Total Knee Prostheses Identified as having a Higher than Anticipated Revision Rate

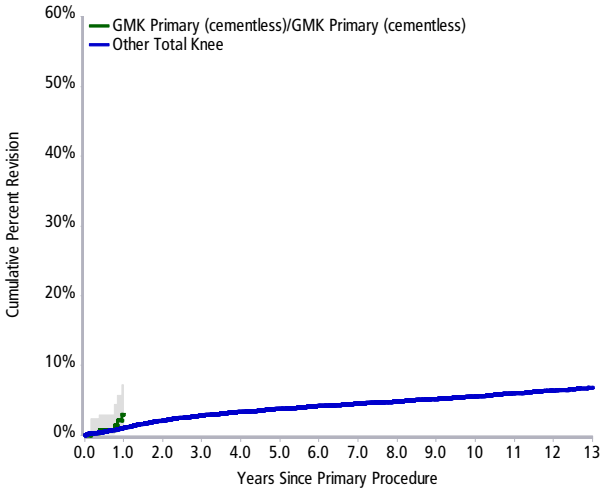
Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Newly Identified												
Genesis II CR (cementless)/Profix Mobile (cemented)	126	26	10	4	2	5	12	6	9	17	2	22
GMK Primary (cementless)/GMK Primary (cementless)									3	3	110	190
Optetrak-CR (cemented)/Optetrak (cemented)	7	7	6	2	9	7	7	4		5	6	8
Scorpio NRG PS (cementless)/Series 7000 (cementless)						76	185	171	166	114	67	71
Vanguard PS/Maxim				22	82	146	318	424	479	600	559	434
*LCS PS							8	157	203	109	51	69
Re-Identified and still used												
ACS/ACS										181	402	559
Advance/Advance	54		8	12	16	2	5	43	115	138	73	7
Columbus/Columbus				49	92	89	148	156	134	136	106	69
E.Motion/E.Motion								12	87	114	129	233
Genesis II CR (cementless)/Genesis II (cementless)	20	11	3		16	29	34	28	53	61	68	55
Journey/Journey					134	337	594	597	464	333	341	334
Optetrak-PS/Optetrak	126	130	155	252	253	216	168	202	198	202	200	150
Optetrak-PS/Optetrak-RBK				1	81	173	166	119	82	40	38	49
Score (cementless)/Score (cementless)				1		11	135	212	187	204	194	238
Trekking/Trekking									35	102	132	104
Vanguard PS/Regenerex								4	121	54	27	15
Identified and no longer used												
+Genesis II Oxinium PS (cemented)/Genesis II (cementless)						4	4	11	35	1	1	
AMK/AMK	200	2	1									
Buechel-Pappas/Buechel-Pappas				1	39	51	84	100	147	44	4	
Eska RP/Eska RP				9	24	5		2				
Gemini MK II/Gemini MK II	14	7										
Genesis (cemented)/Genesis (cemented)	45	6	3	8								
Genesis II Oxinium CR (cementless)/Genesis II	4	106										
Genesis II Oxinium CR (cementless)/Profix Mobile	22	66										
Genesis II Oxinium PS (cemented)/Genesis II (Keel)				19	123	127						
HLS Noetos/HLS Noetos			2	2	47	45	45	56	48	28	20	
IB II/IB II	187	12										
Interax/Interax	52											
Optetrak-PS/Optetrak-PS			8	14	18	15						
Profix Oxinium (cemented)/Profix Mobile	72	31	91	24	3	4	1	2				
Profix Oxinium (cementless)/Profix Mobile	63	95										
Profix Oxinium (cementless)/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	1637	1532	854	1			
*Renasys				51	53	3	14					

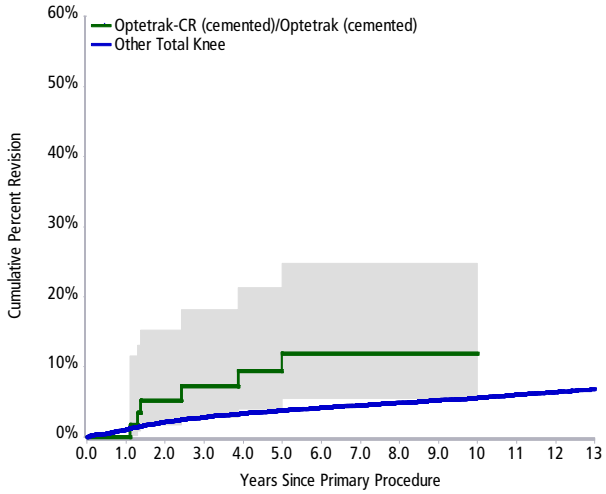
Note: ** Tibial Component
* Femoral Component
+ Newly identified and no longer used

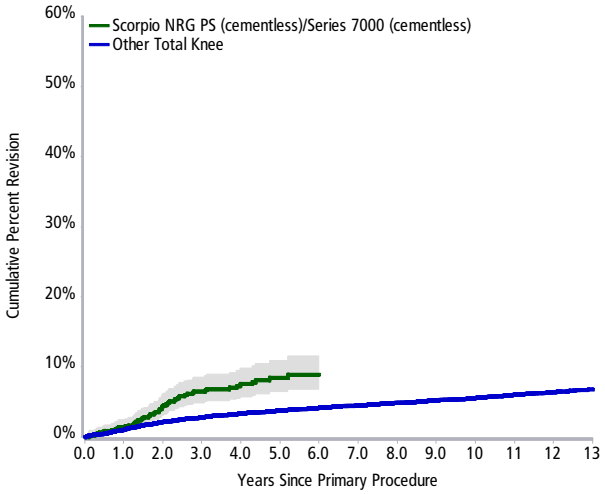
Figure IP9: Cumulative Percent Revision of Individual Total Knee Prostheses Newly Identified

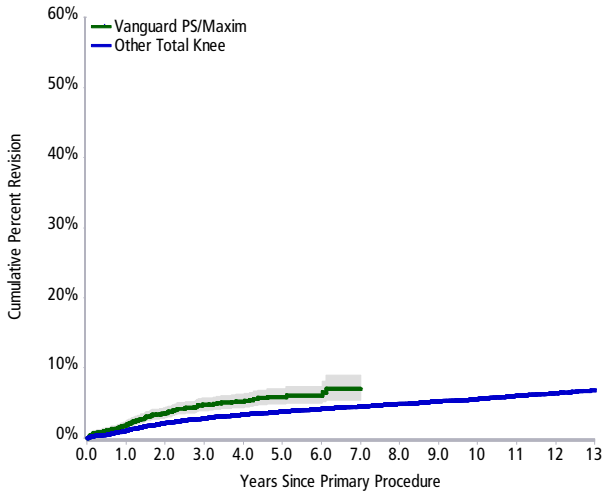
Newly Identified











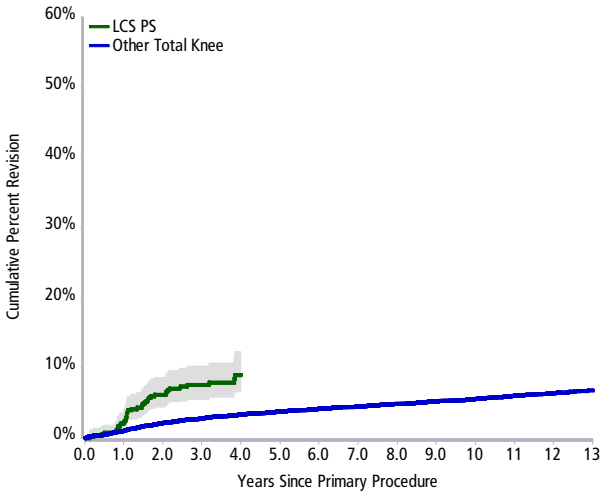
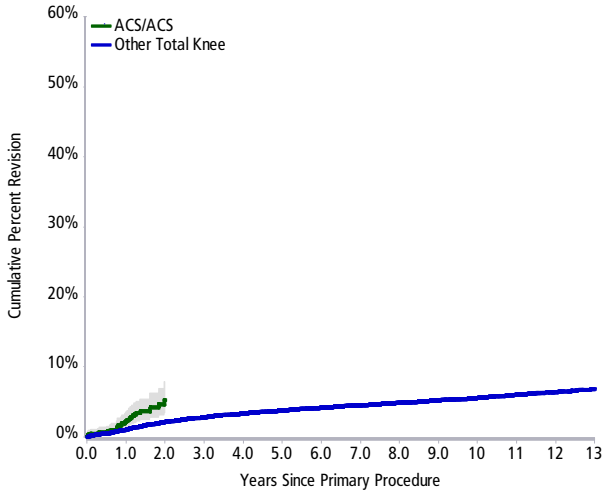
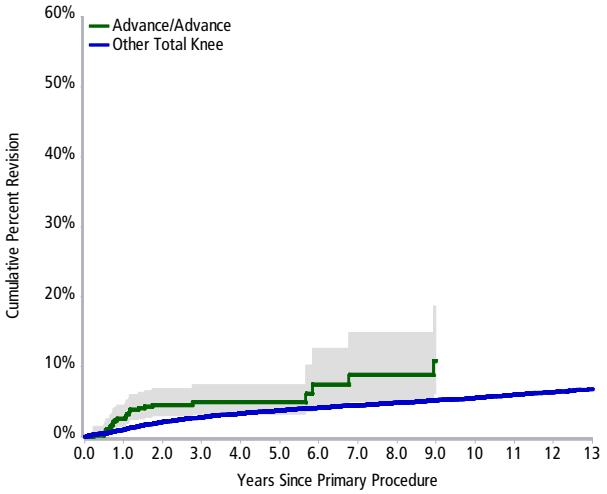
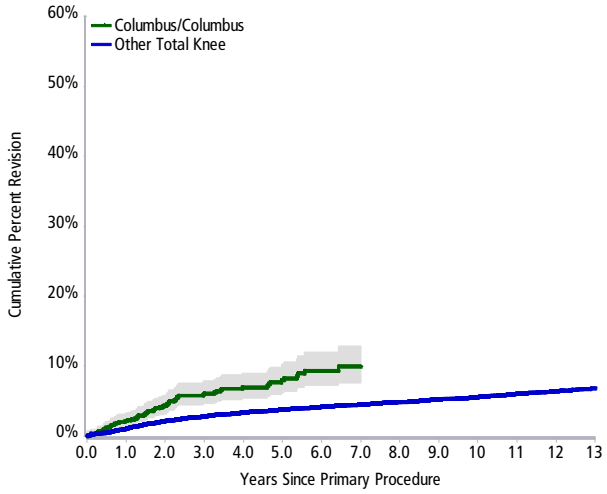


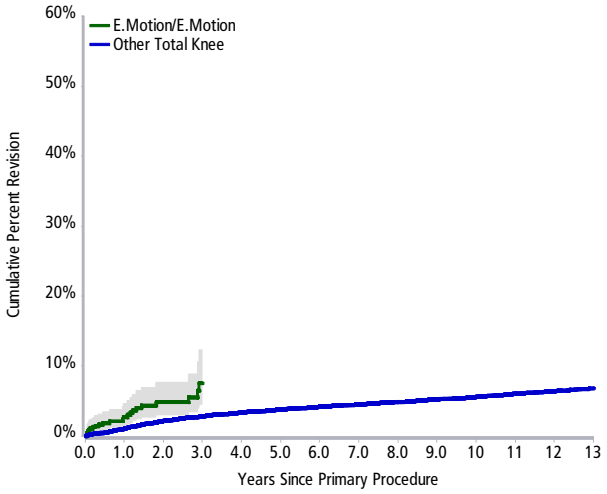
Figure IP10: Cumulative Percent Revision of Individual Total Knee Prostheses Re-identified and still used

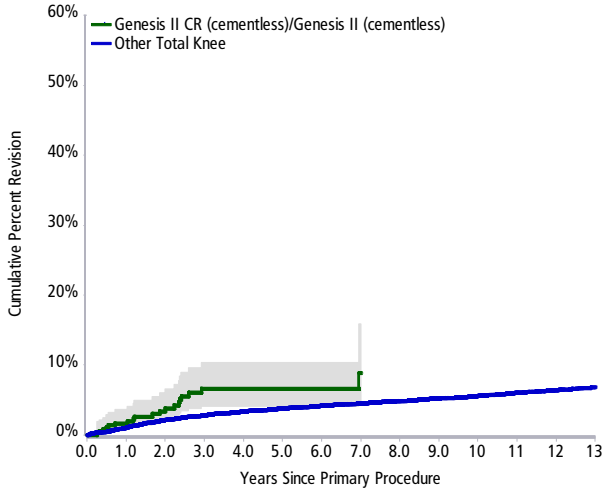
Re-identified and still used

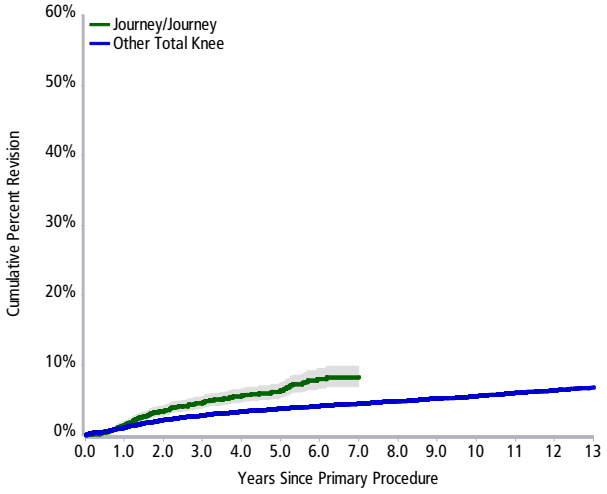


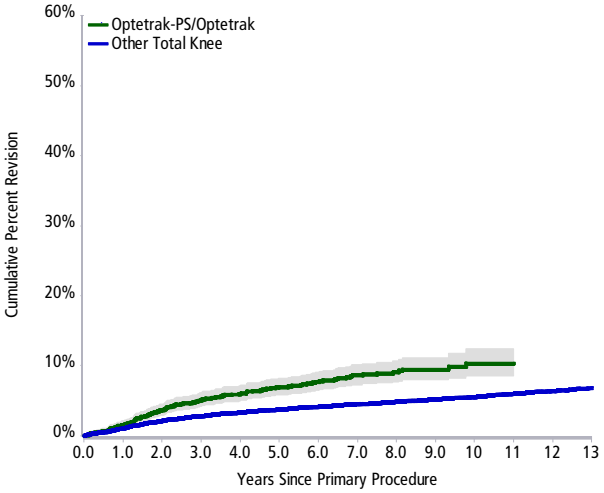


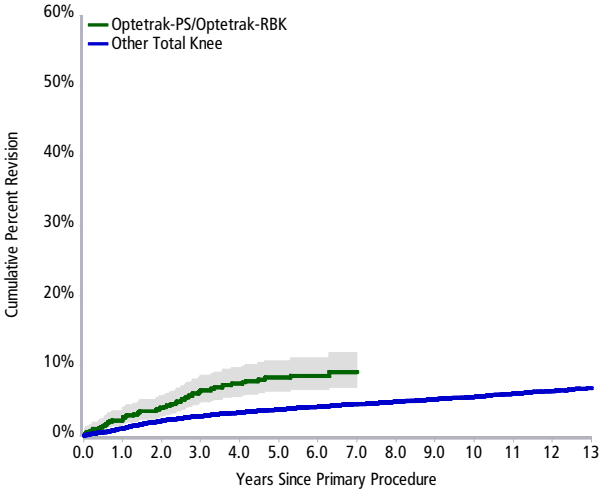


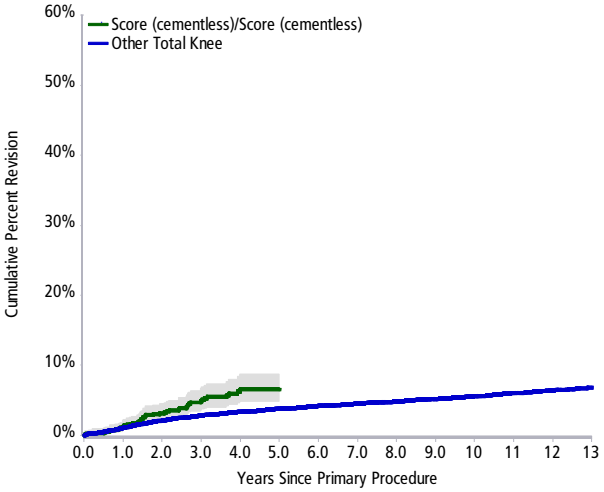


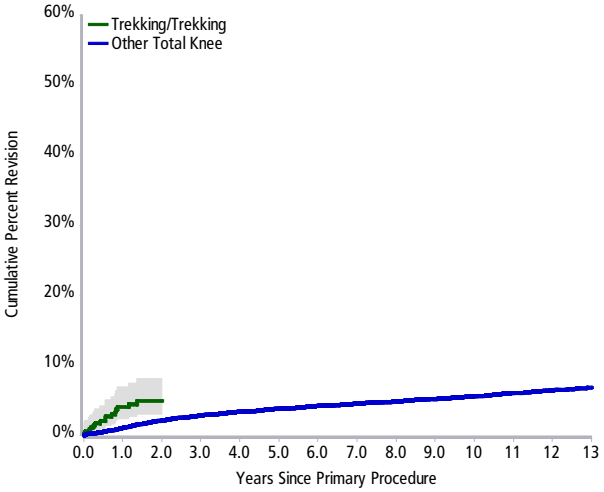


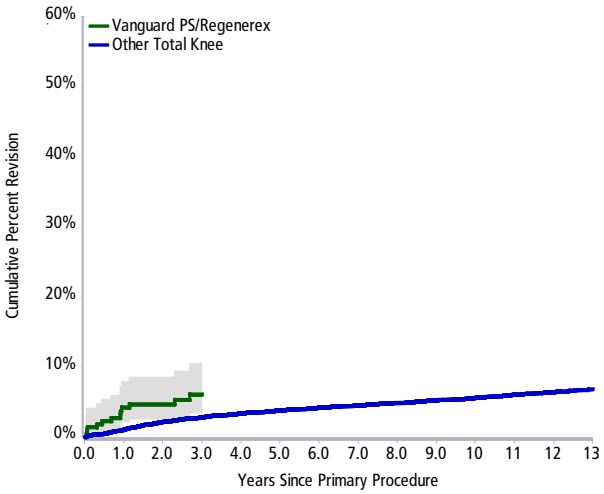



Optetrak-PS/Optetrak
Other Total Knee
Cumulative Percent Revision
60%
50%
40%
30%
20%
10%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12 13
Years Since Primary Procedure


Optetrak-PS/Optetrak-RBK
Other Total Knee
Cumulative Percent Revision
60%
50%
40%
30%
20%
10%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12 13
Years Since Primary Procedure


Score (cementless)/Score (cementless)
Other Total Knee
Cumulative Percent Revision
60%
50%
40%
30%
20%
10%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12 13
Years Since Primary Procedure


Trekking/Trekking
Other Total Knee
Cumulative Percent Revision
60%
50%
40%
30%
20%
10%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12 13
Years Since Primary Procedure


Vanguard PS/Regenerex
Other Total Knee
Cumulative Percent Revision
60%
50%
40%
30%
20%
10%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12 13
Years Since Primary Procedure

APPENDICES

APPENDIX 1

Participating Hospitals & Coordinators

VICTORIA

PUBLIC HOSPITALS

Austin Health	R Kentish/K Morris/B 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	Dusk Gronow
Goulburn Valley Health	Fiona Moncrieff/Cara Disint
Hamilton Base Hospital	Rosalie Broadfoot
Kerang District Health	Margie Christian
Kyabram & District Health Services	Lynda Walker
Latrobe Regional Hospital	Simone Lovison
Maroondah Hospital	Brooke Retallack/Satish Singh
Mildura Base Hospital	Katrina Allen
Monash Medical Centre, Clayton	Candice Brown
Monash Medical Centre, Moorabbin	Carol Jackson/ Lisa Mason
Northeast Health Service	Lynn Reid/Larissa Laverty
Peninsula Health Service, Frankston	Donna Anderson
Portland District Health	Angela Hand
Sandringham & District Memorial	Eileen Dalach
Seymour District Memorial Hospital	Karen Lamaro
South West Healthcare	Tony Kelly
St Vincent's Public Hospital	Shazeli Osman/Stacy Turner
Stawell Regional Health	Chris Gillmartin/Barb Savage
Sunshine Hospital	Cassandra Mules
Swan Hill District Hospital	Helen Wilkins
The Alfred	Caroline McMurray
The Geelong Hospital, Barwon Health	Michelle Quinn
The Northern Hospital	Siew Perry
The Royal Children's Hospital	Sonia Mouat
The Royal Melbourne Hospital	Leah Gourley
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	Brooke Mackay
Cabrini Private Hospital, Malvern	Brooke Mackay
Como Private Hospital	Gillian Wilson/Nicole Groves
Cotham Private Hospital	Kristin James
Epworth Hospital	Lynne Moyes
Epworth Eastern Hospital	Kylie Longley/Janine Cope
Epworth Freemason Hospital	Claudia Nozzolillo
Essendon Private Hospital	Chan Leong
Geelong Private Hospital	Wilna Steyn
Glenferrie Private Hospital	Samantha Jervois
John Fawkner Hospital	Belinda Emmett
Knox Private Hospital	Laura Tilley
Latrobe Private Hospital	Jenny Telfer
Linacre Private Hospital	Melissa Dillon/Denise 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
Mountain District Hospital	Rosslyn Martin
Northpark Private Hospital	Debbie Carlisle
Peninsula Private Hospital	Ruth Honan
Ringwood Private Hospital	Carol Burns
Shepparton Private Hospital	Niki Miller
South Eastern Private Hospital	Sharyn Dorward
St John of God Ballarat Hospital	Dorcas Jerera
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	Naomi Carter/Deanna Delle-virgini
St Vincent's Private Kew	Sue Ziduinas
The Avenue Hospital	Annellen Watson
The Melbourne East Private	Sarah Bridges
The Valley Private Hospital	Anthony Puzon
Wangaratta Private Hospital	Janet McKie
Warringal Hospital	Marilyn Dey
Waverley Private Hospital	Rebecca Juzva
Western Private Hospital	Rachel Cassar

NEW SOUTH WALES

PUBLIC HOSPITALS

Albury Base Hospital	Elwyn Black
Armidale Hospital	Cheryl Fardon
Bankstown/Lidcombe Hospital	John Mati/Karen Och
Bathurst Base Hospital	Kylie Peers
Bega District Hospital	Lena Lee
Blacktown Hospital	Diane Barben/June Tsang
Bowral and District Hospital	Barbara Wise
Broken Hill Health Service	Sue Beahl/Brock Roberts
Campbelltown Hospital	Susan Birch
Canterbury Hospital	Jenny Cubit
Coffs Harbour Health Campus	Eric Dorman
Concord Repatriation Hospital	David Debello
Dubbo Base Hospital	Cathy Chapman
Fairfield Hospital	Michael Ashby
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/Ken Schilling
Lismore Base Hospital	Glen Nettle
Liverpool Health Service	John Murphy
Maitland Hospital	Karen Cheers
Manly District Hospital	Heather Liddle/Maryanne Howell
Manning Rural Referral Hospital	Grahame Cooke
Mona Vale Hospital	Estelle vont Takach
Mt Druitt Hospital	Lydia Baldock
Murwillumbah District Hospital	Lynne Penglase
Nepean Hospital	Debbie Dobbs
Orange Health Service	Teresa Luczak
Port Macquarie Base Hospital	Pam Campbell/Joanne 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 Group Hospital	Leanne McTavish
St George Hospital	Simon Cheng
St Vincent's Public Hospital	Mary Therese Butler/Lee Black
Sutherland Hospital	Sara Hogan
Tamworth Base Hospital	Laura Spence
The Prince of Wales Hospital	Frances O'Brien/Cristina Castillo
The Tweed Hospital	Amanda Budd/Neroli Prestage
Wagga Wagga Base Hospital	Alison Giese/Melissa O'Reilly
Westmead Hospital	Michelle Ward
Wollongong Hospital	Carol Jackson
Wyong Hospital	Marilyn Randall

PRIVATE HOSPITALS

Albury Wodonga Private Hospital	Beverly Francis
Armidale Private Hospital	Cheryl Constance
Baringa Private Hospital	Lesley Berry
Bathurst Private Hospital	Diane Carter
Berkeley Vale Private Hospital	Michelle Turner
Brisbane Waters Private Hospital	Janis Livingstone
Calvary Health Care Riverina	Annette Somerville
Campbelltown Private Hospital	Yvonne Quinn
Castle Hill Hospital	Kathryn O'Connor
Dalcross Adventist Hospital	Anne Carroll/Kerrie Legg
Delmar Private Hospital	S Chote/C Byrne /G McCulloch
Dubbo Private Hospital	Sallie Cross
Dudley Private Hospital	James Bird/Michele Englart
Figtree Private Hospital	Mandy Holmes/Kim Dyer
Forster Private Hospital	Jenny Bullivant
Gosford Private Hospital	Claire Monger
Hawkesbury Health Service	Megan McVIcar
Holroyd Private Hospital	Marta Zajkowska
Hunters Hill Private	Jenny May
Hunter Valley Private	Renae Ross
Insight Clinic Private Hospital	Debbie van de Stadt
Kareena Private Hospital	Martile Horn
Lake Macquarie Private Hospital	Robert Reddie
Lingard Private Hospital	Ian Jones/Nicole Garland
Maitland Private Hospital	Martine Mead
Macquarie University Hospital	Simmy Masuku
Mayo Private Hospital	Suzanne Cini
National Day Surgery Sydney	Stephanie Schofield/Kerry Gardner
Nepean Private Hospital	Yann Letertre
Newcastle Private Hospital	Darren Fogarty
North Shore Private Hospital	Satheesh Jose
Norwest Private Hospital	Lucy Richardson
Nowra Private Hospital	Linda Wright
Port Macquarie Private Hospital	Tresna Bell
Shellharbour Private Hospital	Liz Quennel
Southern Highlands Hospital	Lynne Byrne
St George Private & Medical Centre	Michele McKenna
St Luke's Care	Tanja Radic
St Vincent's Private Darlinghurst	F Crawford/ V Law/D Christofferson
St Vincent's Private Lismore	Janelle Hospers
Strathfield Private Hospital	Maria Read/Kristy Farrugia
Sydney Adventist Hospital	Jill Parker/Melissa Ng
Sydney Private Hospital	Katie Wylie
Sydney South West Private	Julienne James
Tamara Private Hospital	Kris Wall
The Mater Hospital	Namor Guerrero
The Prince of Wales Private	Ellaine Lamasan
Waratah Private Hospital	Leigh Browne
Toronto Private Hospital	Stephanie Keys
Warners Bay Private Hospital	Annette Harrison
Westmead Private Hospital	K O'Shaughnessy/F Tacardon

QUEENSLAND

PUBLIC HOSPITALS

Bundaberg Base Hospital	Kerrie Skilton/Janice Larsen
Cairns Base Hospital	Sharon Ryrie
Gold Coast University Hospital	Karen Morton
Gold Coast Hospital, Robina Campus	Annemarie Brooks/Helen McGuire
Hervey Bay Hospital	Michelle Alcorn
Ipswich Hospital	Ross Howells/Jannah O'Sullivan
Logan Hospital	Denise Maher
Mackay Base Hospital	Renee Hutchinson/Beth Keogh
Maryborough Hospital	H Zillman/B Christiansen
Mater Misericordiae Public Adult's	Vivian Li
Mater Misericordiae Public Children's	Craig Steains
Nambour General Hospital	Kay Friend/Fiona Tognolini
The Prince Charles Hospital	Sue Grice/Louise Tuppin/Rose Seddon
Princess Alexandra Hospital	Jo-Anne de Plater
Queen Elizabeth II Jubilee Hospital	Donna Cal
Redcliffe Hospital	Gemma van Fleet/Kerrie Williamson
Redland Public Hospital	Sara Mackenzie
Rockhampton Base Hospital	Dennis Cedo
Royal Brisbane & Women's	Elaine Hausler/Anna Dowe
Royal Children's Hospital	Noelle Coleman
Toowoomba Hospital	Amanda Lostroh/Freya Chadwick
Townsville Hospital	Tara Cudmore

PRIVATE HOSPITALS

Allamanda Private Hospital	Kathryn Schott
Brisbane Private Hospital	Julie Oddy
Cairns Private Hospital	Louisa Smit
Friendly Society's Hospital	Joanne Peterson/Karen Smith
Greenslopes Private Hospital	Kelly Williams
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	James Turner
Mater Misericordiae Gladstone	Alison Drinkwater
Mater Misericordiae Mackay	Therese Rankine
Mater Misericordiae Rockhampton	Michelle Havik/Tim Harkin
Mater Misericordiae Private Hospital	Melissa Gordon
Mater Private Hospital Redland	Merryl Hoey
Nambour Selangor Private Hospital	Simon Pfeiffer
Noosa Hospital	Janet McMeekin
North West Private Hospital	Teressa Auckland/David Campbell
Peninsula Private Hospital	Lesley Henderson
Pindara Private Hospital	Michael Young
St Andrew's Private Hospital	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	Paul Treadwell
Sunshine Coast University Private	Selena Byrne
The Sunshine Coast Hospital	Phil Hall
Wesley Hospital	Carole Gregory

SOUTH AUSTRALIA

PUBLIC HOSPITALS

Clare Hospital and Health Services	Libby Hoffmann
Flinders Medical Centre	Jo Drabsch/Lyn Healey
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	Carol Dawson
Port Augusta	Leann Cutler
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 Health Care Adelaide	Maria Young
Calvary Wakefield Hospital	Michelle Ireland
Flinders Private Hospital	Marcus Ender
Glenelg Community Hospital	Nicole Russell-Higgins
North Eastern Community Hospital	Anne Sciacca
Parkwynd Private Hospital	Helen Madigan
Sportsmed SA	Magi Odgaard/Kathleen Eneny
St Andrew's Private Hospital	H Crosby/L White
Stirling & District Hospital	Nick Clarke/Tanya Hanlon
The Memorial Hospital	Josie Emery/Jo Ohlson/Julia Castro
Western Hospital	Sharon Bradley

WESTERN AUSTRALIA

PUBLIC HOSPITALS

Albany Regional Hospital	Heather Watson
Armadale Health Service	Eleri Griffiths/Deb Carkeek
Bunbury Regional Hospital	Anthea Amonini
Freemantle Hospital	Steven Johnson
Geraldton Hospital	Vicki Richards
Kaleeya Hospital	Elsy Jiji
Kalgoorlie Regional Hospital	Nicole Hintz
Osborne Park Hospital	Jenny Misiewicz
Rockingham General Hospital	Carol Beaney
Royal Perth Hospital, Shenton Park	Christopher Sheen
Royal Perth Hospital, Wellington St	Carmel McCormack
Sir Charles Gairdner Hospital	Angela Bibb

PRIVATE HOSPITALS

Bethesda Hospital	Melanie Owen
Hollywood Private Hospital	Judith Corbett
Joondalup Health Campus	J Holland/T Rankin/E Yates
Mercy Hospital Mt Lawley	Greg Cox/Stuart Meek
Mount Hospital	Jacqui McDonald
Peel Health Campus	Jan Birmingham
South Perth Hospital	Alice Gill
St John of God Health Care Bunbury	Alison Hawkes
St John of God Health Care Geraldton	Kristie Hutton
St John of God Health Care Murdoch	Keely Seidel
St John of God Health Care Subiaco	Andrew Grimm
Waikiki Private Hospital	Bill Muir

TASMANIA

PUBLIC HOSPITALS

Launceston General Hospital	E Davidson/M Postmus
North West Regional, Burnie Campus	B Kerr/ R Dicker
Royal Hobart Hospital	Carolynne Douglas

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 Ramsley
Hobart Private Hospital	Saman Borazjani/Janine Dohnt
North-West Private Hospital	Roz Watkins/Kylie Smith

AUSTRALIAN CAPITAL TERRITORY

PUBLIC HOSPITALS

The Canberra Hospital	Helen Boyd/Milton Jamieson

PRIVATE HOSPITALS

Calvary John James Hospital	Megan Hassall
The National Capital Private	M Leibhardt/G Palada
Calvary Health Care ACT	Tina Forshaw
Canberra Private Hospital	M Gower/L Tuohy/A Glyde/S Tyrrell

NORTHERN TERRITORY

PUBLIC HOSPITALS

Alice Springs Hospital	Debra Mullan/John Egana
Royal Darwin Hospital	Tanya Anderson

PRIVATE HOSPITALS

Darwin Private Hospital	Vanessa Frewin/Bev Hinchcliffe

APPENDIX 2

Glossary of Statistical Terms

Adjustment: The process of re-estimating a crude measure, such as a rate or rate ratio, to minimise the effects of a difference in the distribution of a characteristic, such as age, between groups being compared on that measure. Adjustment may be carried out in the context of a modelling procedure, for example, linear or proportional hazards regression models, or by standardising the data set against a reference population with a known age distribution, for example, the World Standard Population or the Australian population defined by the Australian Bureau of Statistics Census in a specified year.

Censoring: When the outcome of interest is the time to a defined event, for example, revision of a prosthesis, the event may not occur during the available period of observation. For example, the Registry analyses its data on prosthesis revision for the period ending 31 December each year, and many prostheses will not have been revised by that time. Unless the prosthesis was revised prior to 31 December the outcome is unknown. For the majority, we only know that up until 31 December they had not yet been revised. The times to revision for these prostheses are said to have been censored at 31 December. Statistical methods exist to ensure that censored data are not ignored in analysis, rather information on survival up until the time of censoring is used to give the best possible estimates of survival or revision probabilities.

Chi-Square Test ($\chi 2$) Test: Any test whose statistic has a chi-square distribution under the null hypothesis is called a chi-square test. A common example is a test for association between two categorical variables whose data are arrayed in a cross-classification table of counts (Pearson's chi-square test). This can be generalised to many situations where the distribution of observed data is being compared to an expected theoretical distribution.

Competing Risk: Any event that changes the probability of occurrence of another event is known as a competing risk for the other event. For example, death is a competing risk for revision because the probability of revision after death cannot be assumed to be the same as the probability of revision before death. Another example is that if interest centres on specific causes of revision, then each cause (infection, loosening etc) is a competing risk for each other cause. Treating a competing risk event as a right censoring will bias the estimation of the risk of the event of interest.

Confidence Interval: A set of values for a summary measure, such as a rate or rate ratio, constructed so the set has a specified probability of including the true value of the measure. The specified probability is called the confidence interval, the end points are called lower and upper confidence limits; 95% confidence intervals are most common.

Cox Model or Proportional Hazards Model: A statistical model that relates the hazard for an individual at any time *t* to an (unspecified) baseline hazard and a set of predictor variables, such as treatment type, age, gender etc. The Cox model produces hazard ratios that allow comparisons between groups of the rate of the event of interest. The main assumption of a Cox model is that the ratio of hazards between, say, two 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 death, at a point in time, *t*. This is sometimes called the 'force of mortality'. 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):

1. 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.

2. 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 (31/12/2013) 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

1. A primary total hip procedure performed on 1/1/2013 was revised on 1/7/2013. 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.
2. A patient with a primary procedure on 1/1/2013 died without being revised on 1/4/2013. This procedure contributes 0.25 component years.
3. A primary procedure occurs on 1/1/2013 and has not been revised. This procedure contributes 1 component year (as observation time is censored at 31/12/2013).

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 biased 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	Tumour	*Dominant diagnosis independent of prosthesis/surgery*
2	Infection	
3	Leg Length Discrepancy	*Surgical procedure*
4	Incorrect Sizing	
5	Malposition	
6	Metal Related Pathology	*Reaction to prosthesis*
7	Loosening/Lysis	
8	Wear Hip Insert	*Wear and implant breakage*
9	Wear Acetabular Cup/Shell	
10	Wear Head	
11	Implant Breakage Head	
12	Implant Breakage Stem	
13	Implant Breakage Hip Insert	
14	Implant Breakage Acetabular Cup/Shell	
15	Prosthesis Dislocation	*Stability of prosthesis*
16	Instability	
17	Fracture (Femur/Acetabular/Neck/Periprosthetic)	*Fracture of bone*
18	Chondrolysis/Acetabular Erosion	*Progression of disease on non-operated part of joint*
19	Progression of Disease	
20	Synovitis	*New diseases occurring in association with joint replacement*
21	Osteonecrosis/AVN	
22	Heterotopic Bone	
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	Patella Dislocation	
18	Prosthesis Dislocation	
19	Instability	
20	Patella 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*

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 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 enquires, 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 Data Management & Analysis Centre (DMAC), University of Adelaide undertakes data entry, validation and analysis and provides secure data storage. DMAC was established in 1993. Professor John Lynch is the Director of DMAC. The centre staff include data managers, database programmers, statisticians and data assistants. It is engaged in an increasing variety of work, including clinical trials, pharmacoepidemiological studies, consultations and cohort studies.

The list of personnel with access to identified Registry information is as follows:

Director, Professor Stephen Graves
Deputy Director, Mr David Davidson
Deputy Director, Professor Richard de Steiger
Deputy Director, Mr Peter Lewis
Assistant Deputy Director, Mr James Stoney
Coordinator, Ms Ann Tomkins
Assistant Coordinator, Ms Robyn Vial
DMAC staff including data managers, data assistants, statisticians and programmers.

Declaration of the project as a Quality Assurance Activity ensures that Registry and DMAC staff are bound to maintain confidentiality. Confidentiality not only applies to individual patients but also includes surgeons and hospitals.

DMAC has security systems to restrict access to DMAC 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 DMAC. After a period of time the forms are scanned and electronically stored. As with all data these are securely stored. All data are 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 and for a further five years in August 2011. 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. Joint replacement 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 who 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 database.

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 will produce 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 Ann Tomkins, Registry Coordinator on 1800 068 419 *(freecall)*. A decision on whether or not you wish to be involved in the Registry does not affect your treatment in any way.

If you have any questions, concerns or require further information on the National Joint Replacement Registry please do not hesitate to contact the Registry Coordinator.

Concerns or complaints related to the data collection process may be directed to the Registry 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

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.

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 patella resurfacing
49530-00	Revision of total arthroplasty of knee with bone graft to femur
49530-01	Revision of total arthroplasty of knee with bone graft to tibia
49533-00	Revision of total arthroplasty of knee with bone graft to femur and tibia
49554-00	Revision of total arthroplasty of knee with anatomic specific allograft
90562-00	Patella resurfacing