Hip and Knee Arthroplasty

ANNUAL REPORT 2015

AOA
AUSTRALIAN ORTHOPAEDIC ASSOCIATION

National Joint Replacement Registry

AUSTRALIAN ORTHOPAEDIC ASSOCIATION
NATIONAL JOINT REPLACEMENT REGISTRY

ANNUAL REPORT

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The AOANJRR is funded by the Commonwealth Government

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ISSN 1445-3657

Suggested citation:
Australian Orthopaedic Association National Joint Replacement Registry. Annual Report. Adelaide:AOA; 2015

Australian Orthopaedic Association
National Joint Replacement Registry

ANNUAL REPORT
2015

Hip and Knee Arthroplasty
September 1999 to December 2014

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EXECUTIVE SUMMARY

This summary gives an overview of the 2015 Annual Report. It is based on an analysis of 988,667 primary and revision hip and knee replacement procedures reported to the Registry up to the end of 2014.

For the first time the AOANJRR is producing a printed report on shoulder arthroplasty. This involved analysing 27,236 primary and revision shoulder arthroplasty procedures reported to the Registry up to the end of 2014.

The number of hip and knee replacement procedures undertaken each year in Australia continues to increase. In 2014, there were 5.4% more procedures reported to the Registry (6.3% for hips and 4.7% for knees) compared to the previous year. Most procedures were undertaken in the private sector (59.7% for hips and 70.3% for knees in 2014).

The proportion of revision procedures continues to decline. Revision hip replacement has decreased from 12.9% of all hip procedures in 2003 to 10.2% in 2014. Revision knee replacement has decreased from a peak of 8.8% in 2004 to 7.7% in 2014,

Each year the AOANJRR Annual Report sets out to provide new information as well as update and expand on data provided in previous reports.

The outcome of revision hip and knee replacement surgery is a major focus for this year's report. The Registry has for many years presented data on the outcome of revision hip and knee replacement. This was initially presented within the published report but in recent years the data has been available as a supplementary report updated each year and available from the AOANJRR website. In this year's report a more detailed analysis on the outcome of revision surgery is being presented.

One of the difficulties in presenting data on the outcome of revision surgery in a clear and concise way is a lack of standardised terminology. In addition, commonly used terms such as re-revision are poorly defined and lack specificity. The Registry has previously developed terminology defining class and type of revision. This year it has also introduced a simple numerical approach to describe successive revisions and how they relate to previous procedures.

The 1st revision is the revision of a primary procedure. The outcome of a primary procedure is the rate of first revision. The 2nd revision is the revision of a 1st revision. The outcome of 1st revisions is the rate of 2nd revision and so on. The 10 year cumulative percent revision of a 1st revision hip replacement (i.e. the rate of 2nd revision) is 21.6%. The outcome of 1st revision of a primary total knee replacement (TKR) is similar. The 10 year cumulative percent revision of a 1st revision knee replacement is 22.6%.

Dislocation following 1st revision is the most common reason for a 2nd revision hip replacement (31.1%), followed by loosening/lysis (27.8%) and infection (21.6%). Loosening/Lysis is the most common reason for a 2nd revision knee (38.3%), followed by infection (25.6%), pain (8.4%) and instability (8.1%).

The outcome of 1st revision procedures is affected by the class of revision and time to 1st revision. Revisions can be regarded as minor or major (partial or total). A full description on class of revision can be found on pages 41 and 132.

Minor 1st revision hip replacements have a higher rate of 2nd revision. This difference, however, is evident only if the 1st revision is undertaken within five years of the primary procedure. The class of revision does not affect the outcome of 1st revision hips undertaken more than five years after the primary procedure.

Younger patients (aged less than or equal to 70 years) have a higher rate of 2nd revision hip replacement. The outcome of the 1st revision is not affected by the type of fixation used in the primary hip procedure.

The impact of using large head (>32mm) metal/metal bearing in 1st revision hip procedures was also assessed. This is associated with a higher revision rate irrespective of the bearing used in the primary procedure.

The outcome of revising a large head metal/metal primary is not only improved by using a different bearing in the 1st revision but the rate of 2nd revision is lower than primary procedures where large head metal/metal bearings were not used either in the primary or the 1st revision procedure.

The outcome of 1st revision knee replacement is also affected by class of revision and time to 1st revision. Unlike revision hip replacements minor 1st revision knee procedures undertaken within 5 years of the primary have a lower rate of 2nd revision compared to the other two classes of revision. There is no difference in the outcome of 1st revision knee replacement based on class if they are undertaken more than five years after the primary.

Younger patients (aged less than or equal to 70 years) have a higher rate of 2nd revision knee replacement. The outcome of the 1st revision is lower if the primary knee replacement is cemented but this difference is evident

only for 1st revisions undertaken within 5 years of the primary procedure.

Additional new data presented on primary hip replacement includes information on the outcome of mini femoral stems as well as constrained and dual mobility acetabular components.

The Registry defines a mini stem as a short cementless femoral stem where fixation is entirely metaphyseal and may enable femoral neck sparing. Currently mini femoral stems are not commonly used. They represent less than one percent of all total conventional hip procedures. There is no difference in the rate of revision between total conventional hip replacements undertaken for osteoarthritis using mini stems compared to total conventional hip replacements using other stems. There are, however, differences in the reasons for revision. The cumulative incidence for loosening/lysis for mini stems is over twice that of other femoral stems. In addition, when a mini stem is used a subsequent revision is more likely to involve replacement of the femoral stem. The outcome on eight mini stems is reported. The rate of revision varies depending on the mini stem prosthesis used.

The proportion of constrained acetabular prostheses used for reasons other than osteoarthritis is higher compared to other acetabular prostheses. Despite this, there is no difference in the rate of revision when a constrained acetabular prosthesis is used. This is with follow up of 10 years. Younger patients (≤70 years) with a constrained acetabular prostheses have a higher rate of revision. The outcome is better if the constrained acetabular prosthesis is cemented. When total hip replacement is used for the management of fractured neck of femur, a constrained acetabular prosthesis is associated with a significantly lower rate of revision.

Similar to constrained acetabular prostheses the proportion of dual mobility acetabular prostheses used for diagnoses other than osteoarthritis is higher compared to other acetabular prostheses. At five years, there is no difference in the revision rate of dual mobility acetabular prostheses compared to other acetabular prostheses. This is true for both the diagnoses of osteoarthritis and fractured neck of femur.

This report also contains new data on primary knee replacement. The outcome of lateral unicompartmental knee replacement is presented for the first time. At 10 years, there is no difference in the rate of revision of lateral compared to medial unicompartmental knee replacement.

The effect of fixation on the outcome of minimally stabilised and posterior stabilised primary total knee replacement is also presented for the first time. The lowest rate of revision for minimally stabilised primary total knee replacements is achieved if the tibial component is cemented. This is regardless of the type of fixation used for the femoral component. The lowest rate of revision for posteriorly stabilised knee replacement is associated with cementing both tibial and femoral components.

The bulk of this year's report, as has been the case in other years, is to provide updated information on the outcome of joint replacement in Australia.

The Registry continues to highlight 10 year revision rates of prostheses combinations used in primary total conventional hip and primary total knee replacement. This important milestone is a useful time period to benchmark the comparative performance associated with the use of these prostheses. To be included in the analysis a prosthesis combination must have at least 350 procedures reported to the Registry and have a minimum follow up of ten years.

There are 59 femoral stem and acetabular component combinations with a 10 year cumulative percent ranging from 2.0% to 12.6%. The 10 year cumulative percent revision (for any reason) is less than 5.0% for 47.5% of the combinations. There are 43 total knee combinations with a 10 year cumulative percent revision ranging from 2.6% to 11.2%. The 10 year cumulative percent revision (for any reason) is less than 5.0% for 30.2% of the combinations.

This year the Registry is reporting on 13 year cumulative percent revision rates for partial hip replacement. This particular class of prosthesis is used mainly for arthroplasty treatment of fractured neck of femur. Bipolar hip replacement has the lowest rate of revision compared to both unipolar monoblock and unipolar modular prostheses.

The different types of prostheses used and the effect of age, gender and fixation for each of the three classes of partial hip are detailed in the report.

There has been a significant change in the use of partial hip replacement since the Registry commenced data collection. In 2003 unipolar monoblock prostheses were the most common class of partial hip replacement (55.6%) followed by bipolar (29.7%) and unipolar modular (14.7%). Since that time, unipolar monoblock procedures have decreased in use by 60.1% and their current use is largely limited to the elderly. In 2014, this class of prosthesis was used in 1,128 procedures and 62.6% were in patients 85 years and older.

Unipolar modular is the most common class of partial hip replacement in Australia. Although its use has increased by over 400% since 2003, in recent years the rate of increase has slowed. In 2014, there were 3,539 procedures reported. This is an increase of 2.8% compared to 2013.

Bipolar prostheses use decreased between 2003 and 2010. Since that time, its use has increased. In 2014 there were 1,360 procedures reported. This is an increase of 21.7% compared to 2013 but it is still 1.7% less than in 2003.

This year the Registry is reporting on the outcome of 329,240 primary total hip replacement procedures. Cumulative percent revision rates up to 14 years are provided for many of the analyses and different types of prosthesis presented in this section of the report.

Although the number of conventional primary total hip replacement procedures has increased by 72.5% since 2003, this is not due to increased use in younger patients. The proportion of patients aged less than 65 years of age has not changed since 2003.

A large number of different femoral stem and acetabular components continue to be used. In 2014 there were 116 individual stems and 87 individual acetabular components used in primary conventional total hip replacement.

There were 209 new femoral and acetabular prostheses combinations used in 2014. The Registry now has data on 2,571 femoral stem and acetabular prostheses combinations used in primary total conventional hip replacement.

As was the case last year, large head (>32mm) metal/metal bearings have been excluded from any comparative analysis undertaken for primary total conventional hip replacement. This is due to its high rate of revision compared to other bearings and because it is no longer used. The outcomes for individual large head metal/metal prostheses are reported in the appropriate tables and an analysis of large head metal/metal bearing is provided as a supplementary report on the AOANJRR website.

Outcomes of different types of prostheses used and the effect of diagnosis, age, gender, fixation and bearing surface are detailed in the report.

The Registry is again reporting the increased rate of revision for exchangeable neck prostheses. The higher rate of revision for exchangeable neck prostheses with a mixed stem/neck metal combination (titanium/cobalt chrome) is again highlighted.

The use of primary total resurfacing hip replacement continues to decline. There were only 384 procedures reported in 2014, which represents 0.9% of hip replacement procedures. This is 7.2% less than 2013 and 79.7% less than its peak use in 2005.

Partial knee replacement, in particular unicompartmental knee replacement, is another prosthesis class where the Registry has reported a major decline in use. Last year it was identified that the decline had plateaued. In 2014, the use of unicompartmental knee replacement increased by 4.6% which is almost the same as the overall increase in knee replacement procedures in 2014. As a percentage of all knee replacement, unicompartmental has decreased from 14.5% in 2003 to 4.2% in 2014.

Patella/trochlear replacement is the second most common partial knee replacement. There has been little change in its use over the last five years with only 244 procedures undertaken in 2014.

The outcomes of three different partial knee procedures: partial resurfacing, patella/trochlear and unicompartmental knee replacement are reported in a similar manner to previous years.

The Registry is reporting on the outcome of 443,948 primary total knee replacement procedures. Cumulative percent revision rates up to 14 years are provided for many of the analyses and different prostheses in this section of the report.

The use of primary total knee replacement has increased by 115.1% since 2003. As a proportion of all knee replacement procedures, primary total knee replacement increased from 76.7% in 2003 to 87.7% in 2014.

The use of both patella resurfacing and cement fixation continues to increase. Patella resurfacing was undertaken in 59.3% of primary total knee replacements in 2014 and cement fixation in 58.6%.

The number of different types of knee prostheses used during 2014 has changed little in the last five years. It is however 40% higher than was used in 2003. 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 mobile compared to fixed and posterior compared to minimally stabilised designs.

The Registry continues to report on the outcome of cross-linked polyethylene in primary total knee replacement. This includes both an overall analysis as well as an individual prosthesis comparison of cross-linked and non cross-linked polyethylene for those prostheses with sufficient procedures and follow up. The benefit of cross-linked polyethylene is variable.

Outcomes related to the use of computer assisted surgery and image derived instrumentation in primary total knee replacement is again reported.

An important role of arthroplasty registries is to provide comparative data on the outcome of different prostheses. By comparing outcomes, it is possible to identify prostheses that have higher than anticipated

rates of revision. Since the Registry commenced data collection it has continued to develop and modify its approach to identifying these prostheses. The current three stage process was introduced in 2007. This year the Registry has made a minor modification. The purpose of this change is to simplify the reporting of an individual prosthesis and to avoid identifying the same prosthesis in multiple combinations when it may be more appropriate to identify it individually.

This year the Registry has identified 118 prostheses or prostheses combinations (71 hip and 47 knee). There were 10 total conventional hip prostheses and no total knee prostheses identified for the first time. Detailed analyses of all identified prostheses and prostheses combinations are available as a supplementary report on the AOANJRR website.

This year the Registry is publishing 14 supplementary reports covering a number of different topics. These reports are available on the AOANJRR website aoanjrr.dmac.adelaide.edu.au/annual-reports-2015.

INTRODUCTION

The 2015 Hip and Knee Arthroplasty Report is based on the analysis of 988,667 primary and revision hip and knee procedures recorded by the Registry with a procedure date up to and including 31 December 2014. This is an increase of 97,460 procedures compared to the 2014 Annual Report.

For the first time the AOANJRR is producing a printed report on Shoulder Arthroplasty. In addition, there are 14 supplementary reports that complete the AOANJRR Annual Report for 2015.

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 and Ceramic Bearing Surface in Total Conventional Hip Arthroplasty
9. The Outcome of Classes of Hip and Knee Prostheses No Longer Used
10. Demographics and Outcome of Elbow and Wrist Arthroplasty
11. Demographics and Outcome of Ankle Arthroplasty
12. Demographics of Spinal Disc Arthroplasty
13. Investigations of Prostheses with Higher than Anticipated Rates of Revision
14. Analysis of State and Territory Health Data – All Arthroplasty 1993/1994 – 2013/2014

These reports are available on the AOANJRR website aoanjrr.dmac.adelaide.edu.au/annual-reports-2015.

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 2014, the number of hip replacement procedures increased by 6.3% and the number of knee procedures by 4.7% compared to the previous year. Since 2003, the first year of complete national data collection, the number of hip procedures has increased by 58.6% and the number of knee procedures by 88.3%. 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 – 2013/2014'.

There are many factors known to influence the outcome of joint replacement surgery. Some of these include age, gender, diagnosis of patients and the type of prosthesis and surgical technique 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 of which 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 a 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 for 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 the 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 (245 in 2014). These ad hoc reports are specific analyses requested by surgeons, hospitals, academic institutions, Government and government agencies as well as orthopaedic companies.

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

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

The percentage of revision hip procedures has declined from a peak of 12.9% in 2003 to 10.2% in 2014, equating to 1,155 less hip revisions in 2014. The percentage of revision knee procedures has declined from a peak of 8.8% in 2004 to 7.7% in 2014, equating to 596 less knee revisions in 2014.

The reduction in revision surgery has been brought about due to increased use of the type and class of prostheses shown to have better outcomes and a decline in use 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 Manager and an Administration Assistant 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. A part-time Research Coordinator is also employed by the AOA and is responsible for coordinating the research and publications activity of the AOANJRR.

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 2013/14 financial year, the Registry received 757 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.

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

In previous annual reports, the Registry has reported the revisions per 100 observed component years. This statistic provides a good estimate of the overall rate of revision however, it does not allow for changes in the rate of revision over time. A more informative estimate of the rate of revision over time is the cumulative percent revision. As the Registry is now reporting 14 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 rates of revision. For each model the assumption of proportional hazards is checked analytically. If the interaction between the predictor and the log of time is statistically significant in the standard Cox model, then a time varying model is estimated. Time points are iteratively chosen until the assumption of proportionality is met, then the hazard ratios are calculated for each selected time period. If no time period is specified, then the hazard ratio is over the entire follow up period. All tests are two-tailed at the 5% level of significance.

The cumulative percent revision (CPR) is displayed until the number at risk for the group reaches 40, unless the initial number for the group is less than 100, in which case the 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. Cumulative incidence revision diagnosis graphs deal with the competing risks of reasons for revision, highlighting the differences between groups in the pattern of revision over time. They also provide important insight into different mechanisms of failure.

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

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

Report Review Prior to Publication

Members of the AOA and Arthroplasty Society were invited to attend a two-day workshop to review, comment and provide advice on all sections of the report. The workshop was held in Adelaide on the weekend of 8 and 9 August 2015. Following the workshop the report was provided to the AOA Board for consideration and final approval prior to publication.

Presentation of 2015 Annual Report

The new chapter in the 2015 Annual Report is on 'Revision Hip and Knee Replacement'.

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 chapter 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.

[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.

REVISION JOINT REPLACEMENT

Introduction

The Registry defines a revision as a re-operation of a previous hip or knee replacement where one or more of the prosthetic components are replaced, removed, or one or more components are added.

Since 2006, the AOANJRR has published information on revision hip and knee replacement including demographics and outcomes. This year the Registry provides a more detailed analysis on the outcome of revision surgery.

To fully understand the outcome of an initial revision procedure, it is necessary to know the details of the primary procedure. This analysis reports the outcome of all initial revisions of primary procedures reported to the Registry.

Terminology

Reporting the outcome of revision procedures has the potential to be confusing. This is in part related to a lack of standardised terminology. To minimise confusion, the Registry has used a numerical approach to describe revision procedures.

The 1st revision is the revision of a primary procedure. The 2nd revision is the revision of the 1st revision and so on. Non specific terms such as re-revision have been avoided.

Approach to Analysis

There have been 97,537 revision procedures reported to the Registry. These may be revisions of primary procedures or subsequent revisions of previous revision procedures i.e the 1st, 2nd, 3rd etc. If the primary procedure was undertaken prior to the commencement of data collection, then the Registry is unable to establish the chronology of the initial or any reported subsequent revisions.

This chapter reports the outcome of the 1st revision. It is implicit in the analysis of the outcome of the 1st revision procedure that the Registry also has information on the primary procedure. In order to limit potential confounding due to the original primary diagnosis, this analysis is limited to 1st revision procedures where the primary procedure was undertaken for osteoarthritis.

It is the Registry's view that outcomes of revision for infection should be considered separately from aseptic revisions. For this reason, 1st revisions undertaken for infection have been excluded from the analysis.

In order to determine if the outcome is dependant on time to 1st revision, two different time periods are compared. The two periods are within five years (≤5 years) or more than five years (>5 years) after the primary procedure. A particular focus of this analysis is to determine if outcome varies by class and type of revision. The Registry defines three classes of revision: minor, major partial and major total (refer to revision definitions on pages 41 and 132). The type of revision refers to the different components and component combinations that have been removed or exchanged.

Revision of Total Conventional Hip Replacement

The Registry has information on 11,320 1st revisions where the primary diagnosis was osteoarthritis. There were 1,810 procedures excluded where the 1st revision was for infection. There were also a small number of procedures (36) excluded where a minor or major total conventional hip prostheses was not inserted. This analysis includes 9,474 1st revision procedures. The cumulative percent revision of the 1st revisions at 10 years is 21.6% (Table RH1 and Figure RH1).

The most common reasons for 2nd revision are prosthesis dislocation (31.1%), loosening/lysis (27.8%), infection (21.6%) and peri-prosthetic fracture (7.4%) (Table RH2 and Figure RH2). The types of 2nd revision are listed in Table RH3. Acetabular only revisions are the most common (28.4%), followed by head/insert (21.1%), femoral component (19.3%) and THR (13.9%). Cement spacer and removal of prosthesis account for 9.0%.

The outcome by class of the 1st revision is listed in Table RH4. Minor revisions have an increased rate of revision compared to both major partial and major total revisions (Table RH4 and Figure RH3). There are two types of minor revision, femoral head or head/insert. Both of these minor revisions have a higher rate of 2nd revision when compared to procedures where both the femoral and acetabular components are revised (Table RH5 and Figure RH4).

Outcome based on Time to 1st Revision

This analysis compares the outcome of the 1st revision within five years (≤5 years) with those undertaken more than five years (>5 years) after the primary procedure.

Consistent with analyses presented in this report, large head metal on metal bearing surfaces used in primary conventional THR have been excluded from this analysis.

There were 5,329 revisions of known primary procedures performed ≤5 years and 1,929 revisions of known primary procedures performed >5 years. The rate of 2nd revision is higher when the 1st revision is undertaken within five years of the primary procedure. The cumulative percent revision at seven years of the ≤5 year group is 18.6% compared to 13.8% for the >5 years (Table RH6 and Figure RH5).

Minor revisions undertaken ≤5 years have an increased rate of 2nd revision compared to minor revisions undertaken >5 years after the primary procedure, 21.0% compared to 12.5% at five years (Table RH7 and Figure RH8). In addition, minor revisions undertaken ≤5 years have a higher rate of 2nd revision than both major partial and major total. The cumulative percent revision at seven years is 22.3% compared to 17.3% and 15.3% respectively (Table RH7 and Figure RH6). There is no difference in the rate of 2nd revision comparing the different classes of 1st revision performed >5 years (Figure RH7).

Major partial revisions undertaken ≤5 years after the primary procedure have an increased rate of 2nd revision. This is only evident after the first year (Figure RH9). No difference was observed for major total revisions based on time period after the primary procedure (Figure RH10).

Age at Primary Conventional THR

To determine the effect of age at the time of the primary procedure on the outcome of the 1st revision, two different age groups were compared; ≤70 years and >70 years. The younger age group had a higher rate of 2nd revision at both time periods (Table RH8 and Figure RH11).

Prosthesis Fixation of Primary Conventional THR

Fixation in the primary procedure did not affect the outcome of the 1st revision. This was true for 1st revisions undertaken either ≤5 years or >5 years (Table RH9, Figure RH12 and Figure RH13). Regardless of the fixation used, the rate of 2nd revision was always higher in the ≤5 year group (Figure RH14, Figure RH15 and Figure RH16).

Use of Large Head Metal on Metal Bearings in Primary and Revision THR

This is a specific analysis to examine the outcome when large head metal/metal bearing surfaces are used in the primary or 1st revision procedure.

The type of bearing surface used for the primary procedures does not affect the outcome of the 1st revision (Table RH10 and Figure RH17).

To determine if the outcome of the 1st revision varies depending on the combination of bearing surface used in both the primary and the 1st revision procedure, four groups were compared. These were:

- Large head metal/metal bearing surface used in both primary and 1st revision procedures.
- Large head metal/metal bearing surface used in the primary procedure and a different bearing surface used in the 1st revision.
- Other bearing surface used in the primary procedure and a large head metal/metal used in the 1st revision.
- Other bearing surface used in both the primary and 1st revision procedures.

If a large head metal/metal bearing was used in the 1st revision, the rate of 2nd revision is increased irrespective of the bearing used in the primary procedure.

Procedures that did not use a large head metal/metal bearing in the 1st revision had a lower rate of 2nd revision. The rate of 2nd revision was lowest when a large head metal/metal bearing was used in the primary procedure with another bearing surface in the 1st revision (Table RH11 and Figure RH18).

Conclusion

Minor revisions have a higher rate of 2nd revision compared to other revision classes. This difference is evident only if the 1st revision was undertaken within five years of the primary procedure.

Patients aged less than or equal to 70 years had a higher rate of 2nd revision compared to older patients.

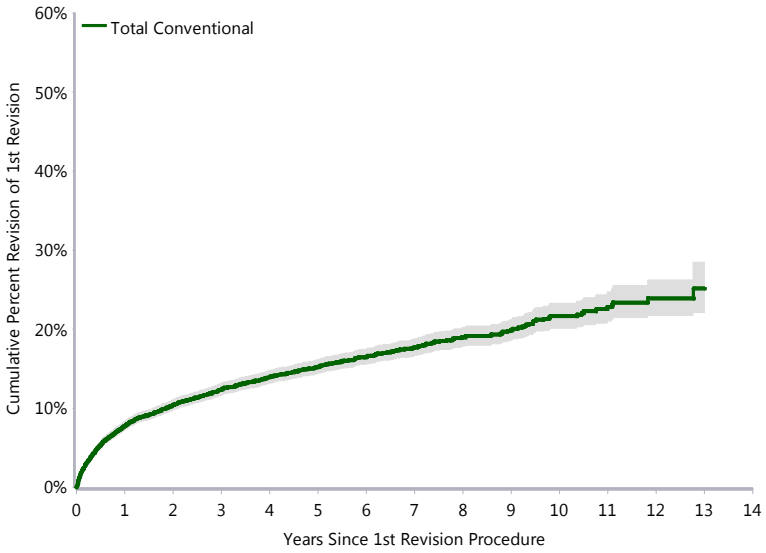
The method of fixation used in the primary procedure does not affect the outcome of the 1st revision.

Using a large head metal/metal bearing in the 1st revision increases the rate of 2nd revision.

Table RH1 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement (Primary Diagnosis OA, excluding 1st Revision for Infection)

Revision of Primary	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Total Conventional	1239	9474	7.8 (7.3, 8.4)	12.4 (11.7, 13.2)	15.2 (14.4, 16.1)	17.7 (16.7, 18.8)	21.6 (20.1, 23.3)	
TOTAL	**1239**	**9474**						

Figure RH1 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement (Primary Diagnosis OA, excluding 1st Revision for Infection)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Total Conventional	9474	7422	4733	2565	1449	471	10

Table RH2 Primary Total Conventional Hip Replacement by Reason for 2nd Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)

Reason for 2nd Revision	Number	Percent
Prosthesis Dislocation	385	31.1
Loosening/Lysis	345	27.8
Infection	268	21.6
Fracture	92	7.4
Metal Related Pathology	43	3.5
Pain	21	1.7
Implant Breakage Acetabular	14	1.1
Instability	14	1.1
Malposition	13	1.0
Leg Length Discrepancy	7	0.6
Implant Breakage Stem	6	0.5
Implant Breakage Acetabular Insert	6	0.5
Wear Acetabular Insert	3	0.2
Wear Acetabulum	3	0.2
Heterotopic Bone	3	0.2
Implant Breakage Head	2	0.2
Synovitis	1	0.1
Tumour	1	0.1
Incorrect Sizing	1	0.1
Other	11	0.9
TOTAL	**1239**	**100.0**

Table RH3 Primary Total Conventional Hip Replacement by Type of 2nd Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)

Type of 2nd Revision	Number	Percent
Acetabular Component	352	28.4
Head/Insert	261	21.1
Femoral Component	239	19.3
THR (Femoral/Acetabular)	172	13.9
Cement Spacer	102	8.2
Head Only	51	4.1
Insert Only	18	1.5
Minor Components	18	1.5
Removal of Prostheses	10	0.8
Head/Neck/Insert	8	0.6
Head/Neck	6	0.5
Reinsertion of Components	1	0.1
Bipolar Only	1	0.1
TOTAL	**1239**	**100.0**

Figure RH2 Cumulative Incidence 2nd Revision Diagnosis of 1st Revision of Primary Total Conventional Hip Replacement (Primary Diagnosis OA, excluding 1st Revision for Infection)

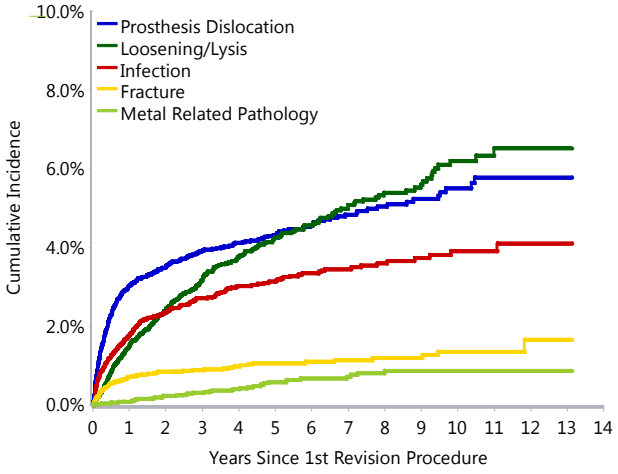
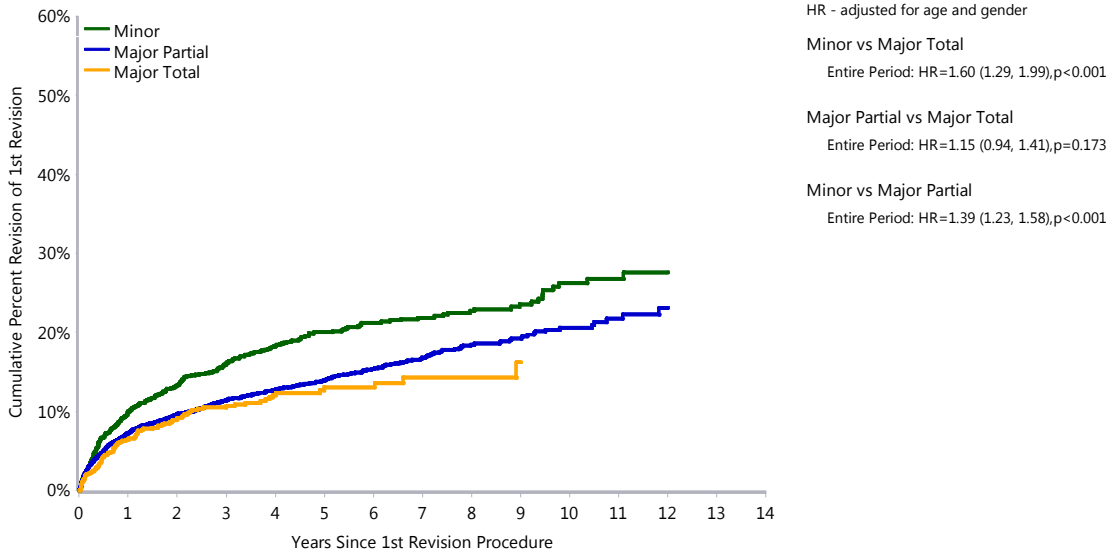


Table RH4 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement by Class of 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)

Class of 1st Revision	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minor	364	2121	10.0 (8.8, 11.4)	16.2 (14.5, 18.0)	20.0 (18.1, 22.1)	21.9 (19.8, 24.2)	26.2 (23.3, 29.5)	
Major Partial	768	6323	7.3 (6.6, 8.0)	11.4 (10.6, 12.3)	13.9 (12.9, 15.0)	16.8 (15.5, 18.2)	20.6 (18.8, 22.6)	
Major Total	107	1030	6.5 (5.1, 8.2)	10.7 (8.8, 13.0)	13.1 (10.7, 15.9)	14.3 (11.5, 17.6)		
TOTAL	**1239**	**9474**						

Figure RH3 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement by Class of 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)



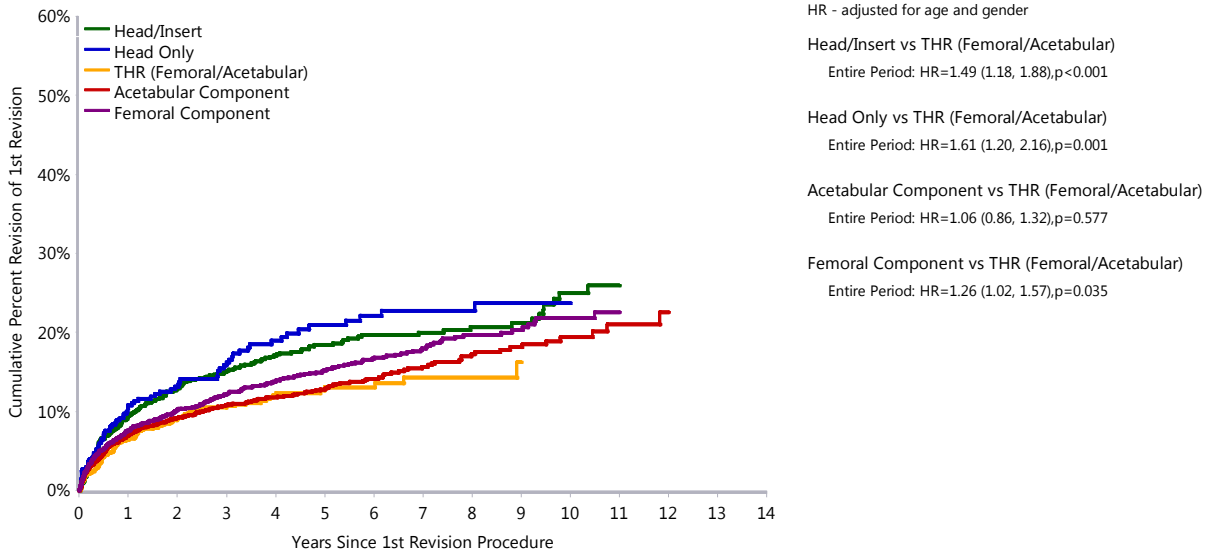
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minor	2121	1614	1076	659	421	156	5
Major Partial	6323	5002	3161	1676	923	288	5
Major Total	1030	806	496	230	105	27	0

Table RH5 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement by Type of 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)

1st Revision of Primary	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Head/Insert	214	1346	9.5 (8.0, 11.2)	15.1 (13.2, 17.4)	18.4 (16.1, 21.0)	20.0 (17.5, 22.8)	25.0 (21.2, 29.4)	
Head Only	76	409	10.8 (8.1, 14.3)	16.2 (12.8, 20.5)	20.9 (16.8, 25.9)	22.8 (18.3, 28.1)	23.7 (19.0, 29.4)	
THR (Femoral/Acetabular)	107	1030	6.5 (5.1, 8.2)	10.7 (8.8, 13.0)	13.1 (10.7, 15.9)	14.3 (11.5, 17.6)		
Acetabular Component	392	3454	7.0 (6.2, 7.9)	10.8 (9.7, 12.0)	12.8 (11.5, 14.2)	15.7 (14.0, 17.6)	19.4 (16.9, 22.3)	
Femoral Component	374	2863	7.6 (6.6, 8.6)	12.2 (10.9, 13.6)	15.2 (13.7, 16.9)	18.0 (16.2, 20.0)	21.8 (19.3, 24.7)	
TOTAL	**1163**	**9102**						

Note: Only the outcome of the five most common types of 1st revision have been listed.

Figure RH4 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement by Type of 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)



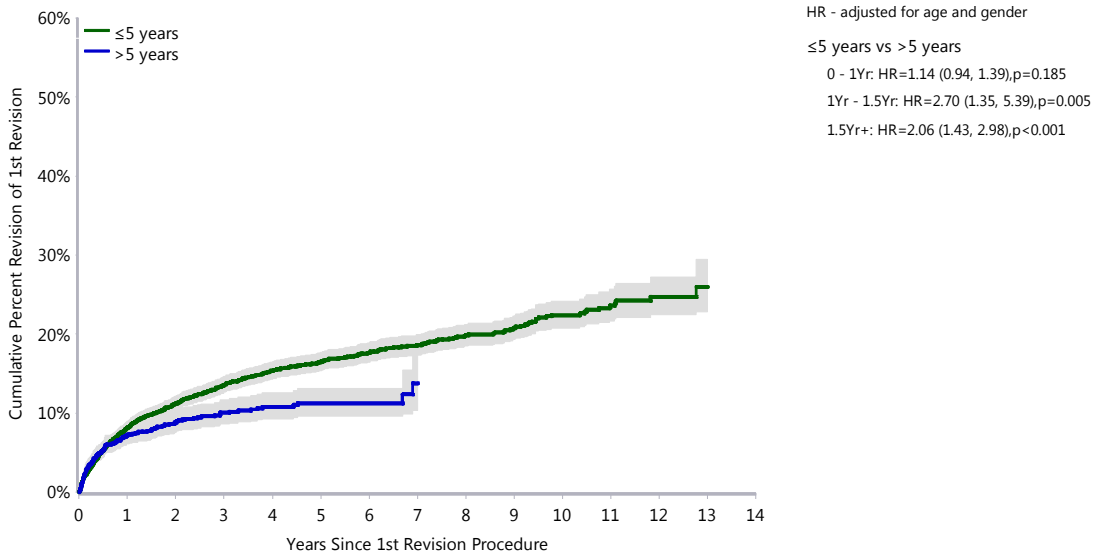
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Head/Insert	1346	1023	684	426	268	94	2
Head Only	409	325	232	144	99	40	1
THR (Femoral/Acetabular)	1030	806	496	230	105	27	0
Acetabular Component	3454	2812	1743	773	430	146	4
Femoral Component	2863	2185	1413	899	490	140	1

Table RH6 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement by Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)

Time to 1st Revision	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
≤5 years	807	5329	8.2 (7.4, 9.0)	13.6 (12.6, 14.6)	16.5 (15.4, 17.7)	18.6 (17.4, 19.9)	22.4 (20.8, 24.2)	
>5 years	170	1929	7.3 (6.1, 8.6)	10.1 (8.6, 11.7)	11.3 (9.6, 13.2)	13.8 (10.4, 18.1)		
TOTAL	**977**	**7258**						

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

Figure RH5 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement by Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
≤5 years	5329	4232	2948	1977	1281	456	10
>5 years	1929	1381	740	294	59	0	0

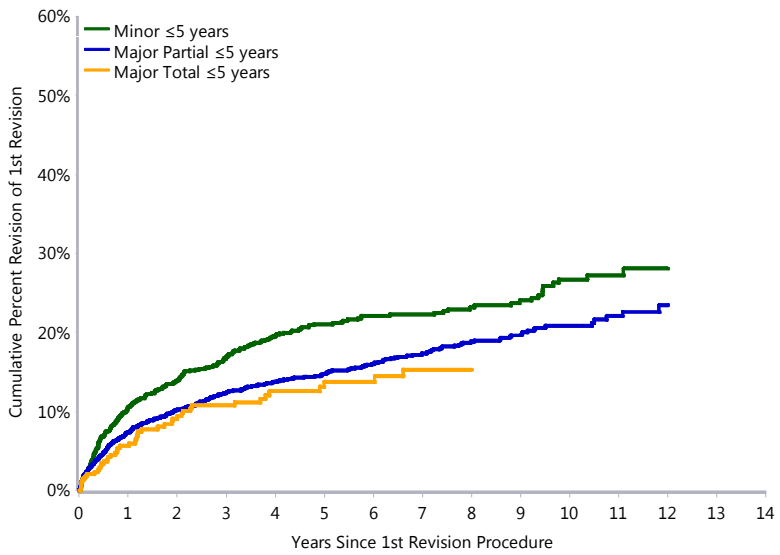
Note: All primary procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table RH7 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement by Class of 1st Revision and Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)

Class of 1st Revision	Time to 1st Revision	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minor	≤5 years	290	1536	10.6 (9.1, 12.3)	17.0 (15.1, 19.1)	21.0 (18.8, 23.5)	22.3 (19.9, 24.8)	26.7 (23.6, 30.2)	
	>5 years	38	413	6.7 (4.6, 9.8)	11.4 (8.2, 15.7)	12.5 (8.9, 17.4)			
Major Partial	≤5 years	470	3402	7.4 (6.5, 8.3)	12.4 (11.3, 13.7)	14.8 (13.4, 16.2)	17.3 (15.8, 19.0)	20.9 (18.9, 23.0)	
	>5 years	108	1198	7.7 (6.3, 9.4)	9.9 (8.2, 12.0)	11.5 (9.4, 14.0)	13.1 (9.8, 17.6)		
Major Total	≤5 years	47	391	5.7 (3.7, 8.6)	10.8 (7.9, 14.6)	13.7 (10.3, 18.3)	15.3 (11.4, 20.3)		
	>5 years	24	318	6.4 (4.1, 9.8)	8.8 (6.0, 13.0)	8.8 (6.0, 13.0)			
TOTAL		**977**	**7258**						

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

Figure RH6 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement by Class of 1st Revision for those Revised ≤5 years since Primary Procedure (Primary Diagnosis OA, excluding 1st Revision for Infection)



HR - adjusted for age and gender

Minor ≤5 years vs Major Total ≤5 years
Entire Period: HR=1.62 (1.19, 2.20),p=0.002

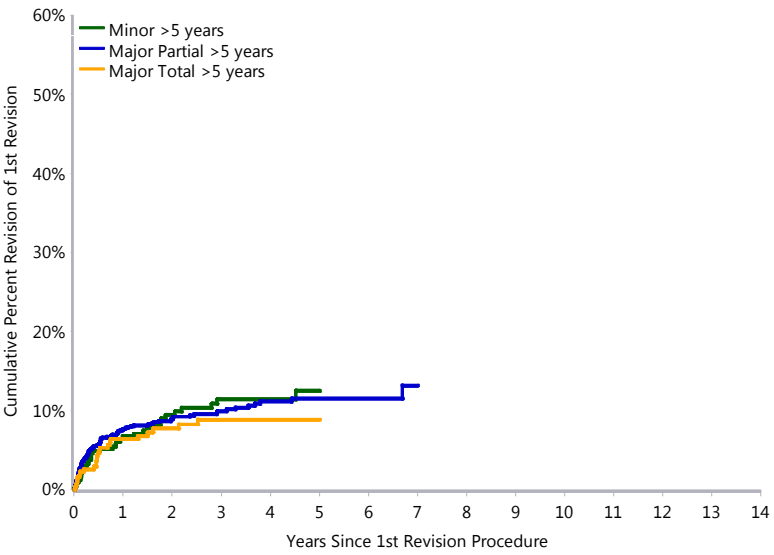
Major Partial ≤5 years vs Major Total ≤5 years
Entire Period: HR=1.18 (0.88, 1.60),p=0.275

Minor ≤5 years vs Major Partial ≤5 years
Entire Period: HR=1.37 (1.18, 1.58),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minor	≤5 years	1536	1197	848	557	391	156	5
Major Partial	≤5 years	3402	2717	1871	1275	802	273	5
Major Total	≤5 years	391	318	229	145	88	27	0

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

Figure RH7 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement by Class of 1st Revision for those Revised >5 years since Primary Procedure (Primary Diagnosis OA, excluding 1st Revision for Infection)



HR - adjusted for age and gender

Minor >5 years vs Major Total >5 years
Entire Period: HR=1.23 (0.74, 2.05),p=0.428

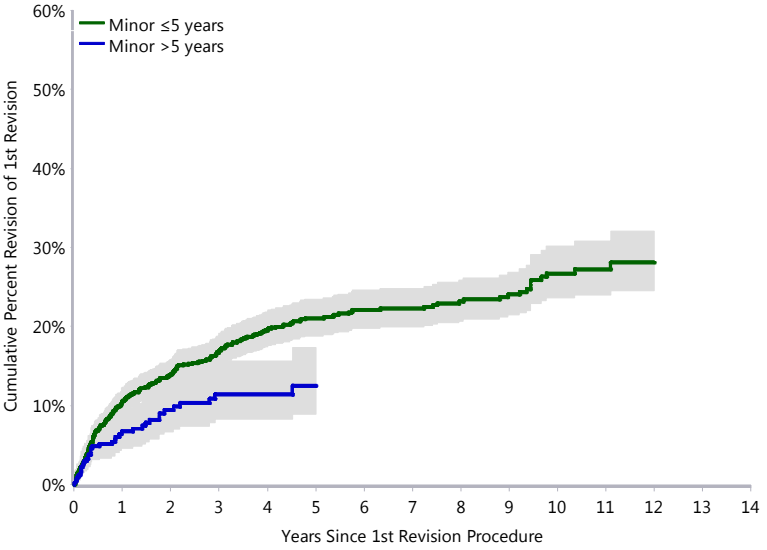
Major Partial >5 years vs Major Total >5 years
Entire Period: HR=1.22 (0.78, 1.90),p=0.375

Minor >5 years vs Major Partial >5 years
Entire Period: HR=1.01 (0.69, 1.46),p=0.974

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minor	>5 years	413	285	157	61	12	0	0
Major Partial	>5 years	1198	858	459	181	40	0	0
Major Total	>5 years	318	238	124	52	7	0	0

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

Figure RH8 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement with Minor Revision by Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)



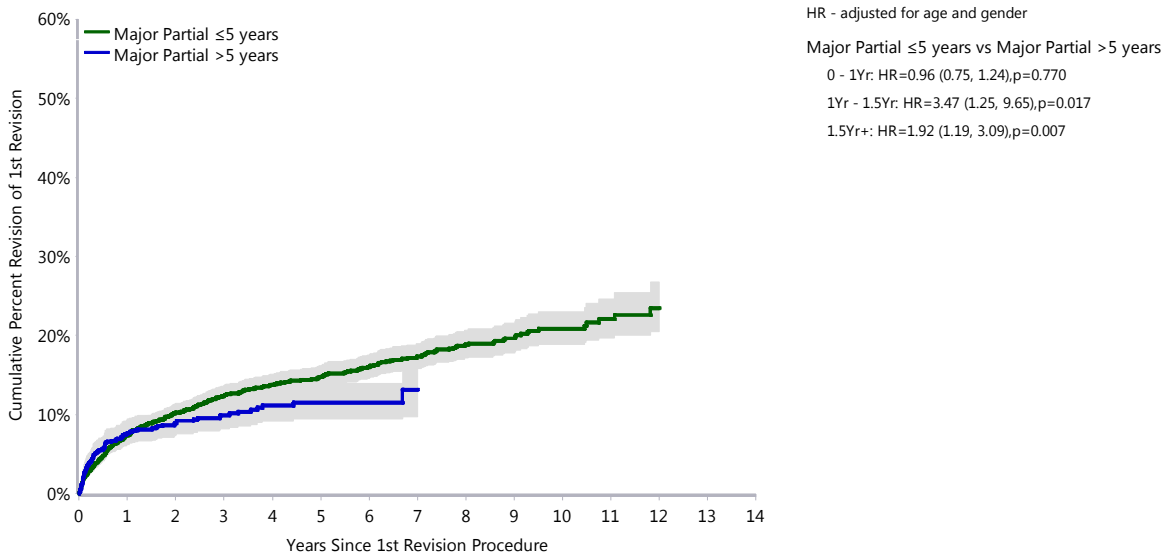
HR - adjusted for age and gender

Minor ≤5 years vs Minor >5 years
Entire Period: HR=1.70 (1.21, 2.39),p=0.002

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minor	≤5 years	1536	1197	848	557	391	156	5
	>5 years	413	285	157	61	12	0	0

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

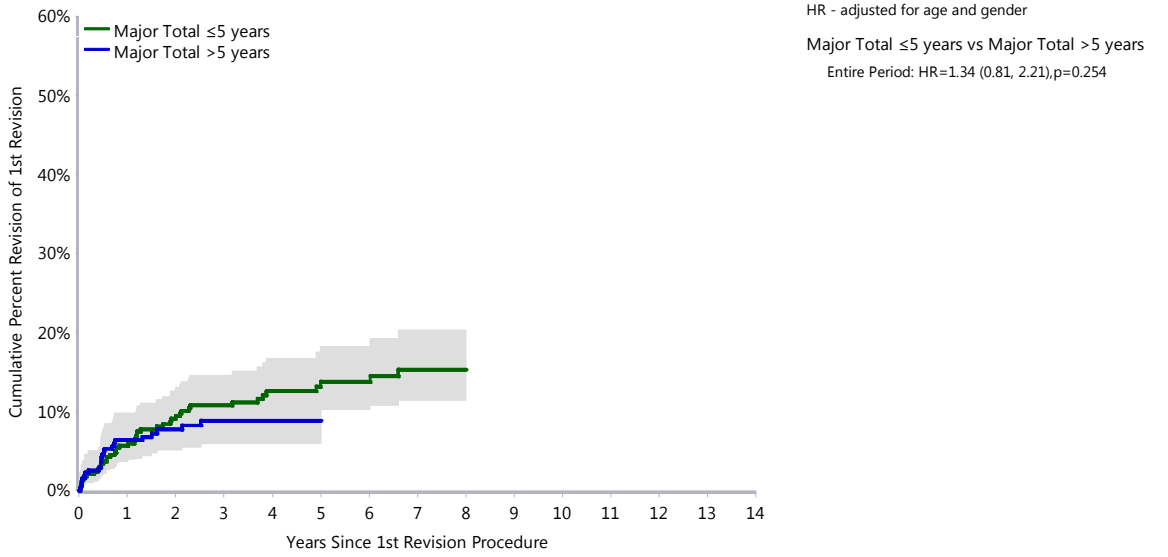
Figure RH9 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement with Major Partial Revision by Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Major Partial	≤5 years	3402	2717	1871	1275	802	273	5
	>5 years	1198	858	459	181	40	0	0

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

Figure RH10 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement with Major Total Revision by Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Major Total	≤5 years	391	318	229	145	88	27	0
	>5 years	318	238	124	52	7	0	0

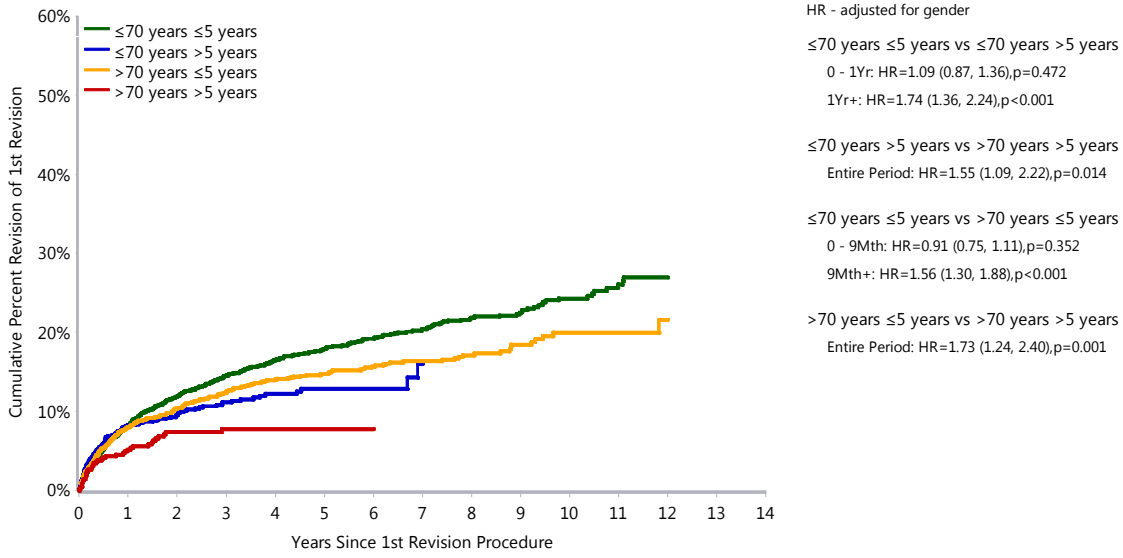
Note: All primary procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table RH8 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement by Age at Primary Procedure and Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)

Age at Primary	Time to 1st Revision	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
≤70 years	≤5 years	484	2888	8.3 (7.3, 9.4)	14.6 (13.2, 16.0)	17.9 (16.4, 19.6)	20.4 (18.7, 22.3)	24.3 (22.1, 26.7)	
	>5 years	130	1282	8.3 (6.8, 10.0)	11.2 (9.4, 13.3)	12.8 (10.7, 15.3)	16.0 (11.8, 21.6)		
>70 years	≤5 years	323	2441	8.0 (7.0, 9.2)	12.5 (11.1, 14.0)	14.8 (13.2, 16.5)	16.3 (14.6, 18.2)	20.0 (17.5, 22.8)	
	>5 years	40	647	5.2 (3.6, 7.3)	7.8 (5.7, 10.5)	7.8 (5.7, 10.5)			
TOTAL		**977**	**7258**						

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

Figure RH11 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement by Age at Primary Procedure and Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
≤70 years	≤5 years	2888	2305	1619	1117	771	299	9
	>5 years	1282	932	516	206	46	0	0
>70 years	≤5 years	2441	1927	1329	860	510	157	1
	>5 years	647	449	224	88	13	0	0

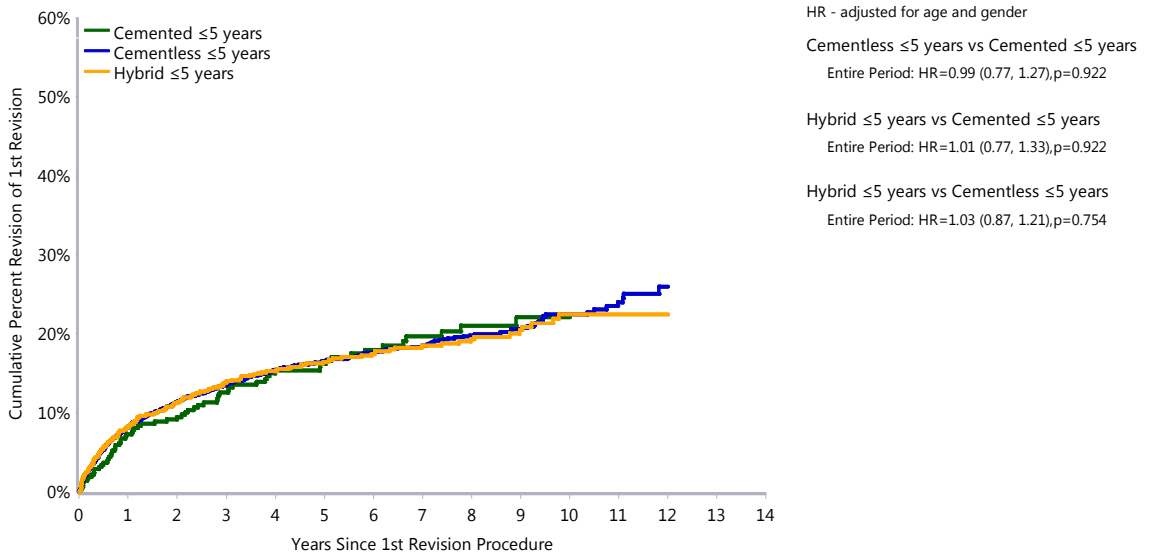
Note: All primary procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table RH9 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement by Primary Procedure Fixation and Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)

Fixation of Primary	Time to 1st Revision	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cemented	≤5 years	68	420	7.3 (5.1, 10.3)	12.6 (9.6, 16.4)	16.2 (12.7, 20.6)	19.7 (15.6, 24.7)	22.1 (17.4, 27.9)	
	>5 years	26	346	6.1 (4.0, 9.3)	8.5 (5.8, 12.5)	9.1 (6.2, 13.3)			
Cementless	≤5 years	536	3557	8.2 (7.4, 9.2)	13.6 (12.4, 14.9)	16.6 (15.2, 18.0)	18.5 (17.0, 20.1)	22.4 (20.4, 24.7)	
	>5 years	85	969	7.1 (5.5, 9.0)	9.9 (7.9, 12.2)	11.8 (9.4, 14.9)			
Hybrid	≤5 years	203	1352	8.3 (6.9, 9.9)	14.0 (12.1, 16.2)	16.4 (14.3, 18.8)	18.5 (16.1, 21.1)	22.5 (19.2, 26.1)	
	>5 years	59	614	8.3 (6.3, 10.8)	11.3 (8.8, 14.5)	11.8 (9.1, 15.1)			
TOTAL		**977**	**7258**						

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

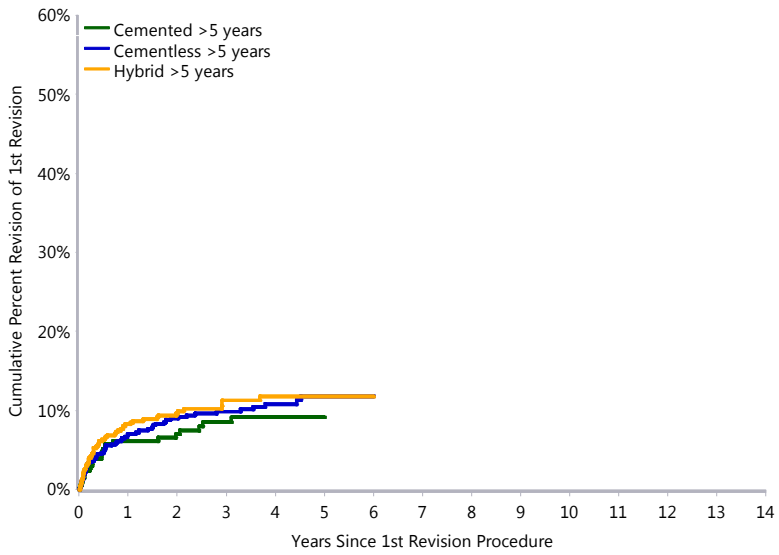
Figure RH12 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement by Primary Procedure Fixation for those Revised ≤5 years since Primary Procedure (Primary Diagnosis OA, excluding 1st Revision for Infection)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cemented	≤5 years	420	348	268	195	128	51	1
Cementless	≤5 years	3557	2816	1931	1261	805	279	7
Hybrid	≤5 years	1352	1068	749	521	348	126	2

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

Figure RH13 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement by Primary Procedure Fixation for those Revised >5 years since Primary Procedure (Primary Diagnosis OA, excluding 1st Revision for Infection)



HR - adjusted for age and gender

Cementless >5 years vs Cemented >5 years

Entire Period: HR=1.13 (0.72, 1.76),p=0.590

Hybrid >5 years vs Cemented >5 years

Entire Period: HR=1.30 (0.82, 2.07),p=0.258

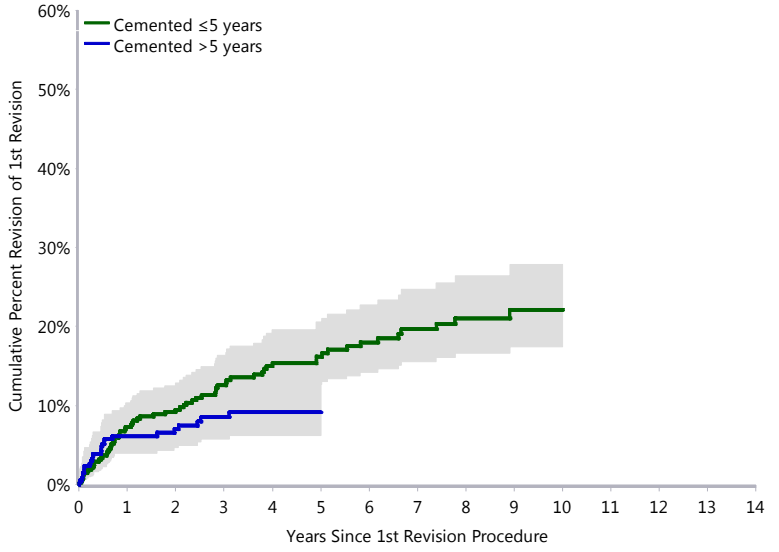
Hybrid >5 years vs Cementless >5 years

Entire Period: HR=1.15 (0.82, 1.62),p=0.404

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cemented	>5 years	346	266	150	59	7	0	0
Cementless	>5 years	969	668	347	141	32	0	0
Hybrid	>5 years	614	447	243	94	20	0	0

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

Figure RH14 Cumulative Percent Revision of 1st Revision of Cemented Primary Total Conventional Hip Replacement by Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)



HR - adjusted for age and gender

Cemented ≤5 years vs Cemented >5 years

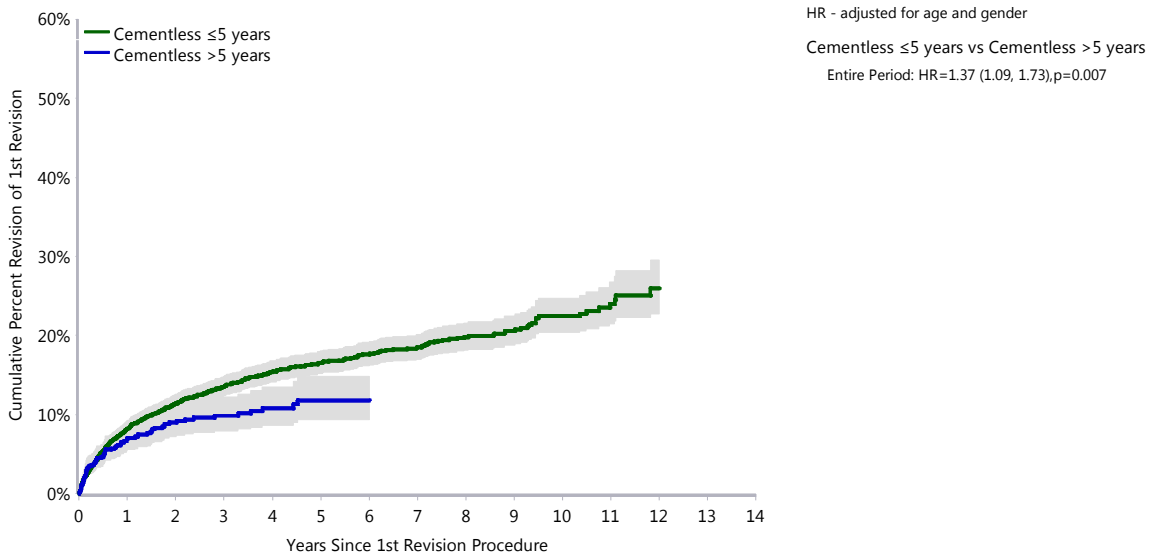
0 - 6Mth: HR=0.79 (0.39, 1.60),p=0.519

6Mth+: HR=3.55 (1.73, 7.31),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cemented	≤5 years	420	348	268	195	128	51	1
	>5 years	346	266	150	59	7	0	0

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

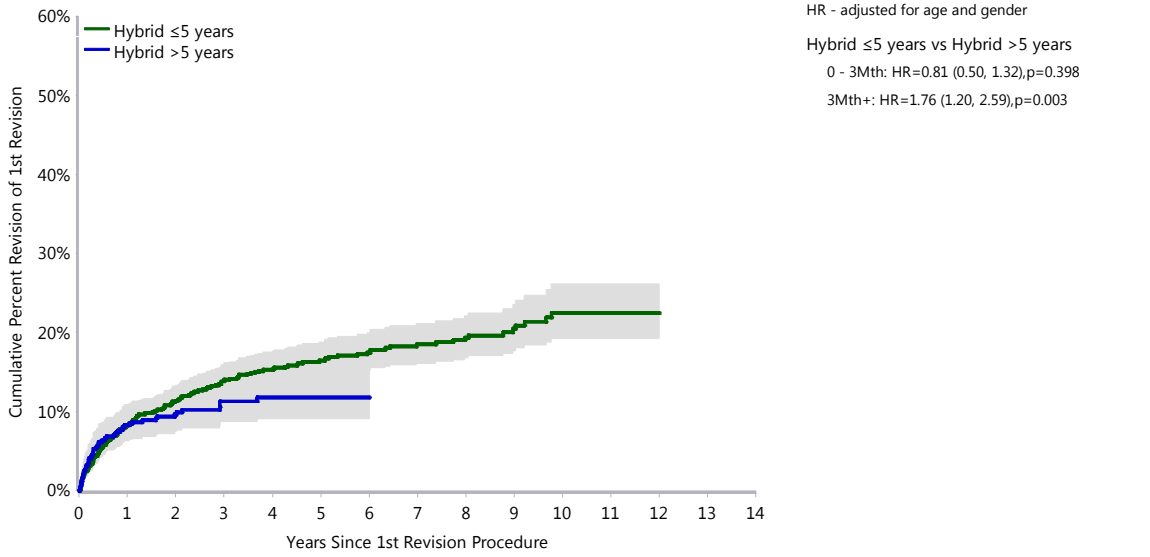
Figure RH15 Cumulative Percent Revision of 1st Revision of Cementless Primary Total Conventional Hip Replacement by Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cementless	≤5 years	3557	2816	1931	1261	805	279	7
	>5 years	969	668	347	141	32	0	0

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

Figure RH16 Cumulative Percent Revision of 1st Revision of Hybrid Primary Total Conventional Hip Replacement by Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Hybrid	≤5 years	1352	1068	749	521	348	126	2
	>5 years	614	447	243	94	20	0	0

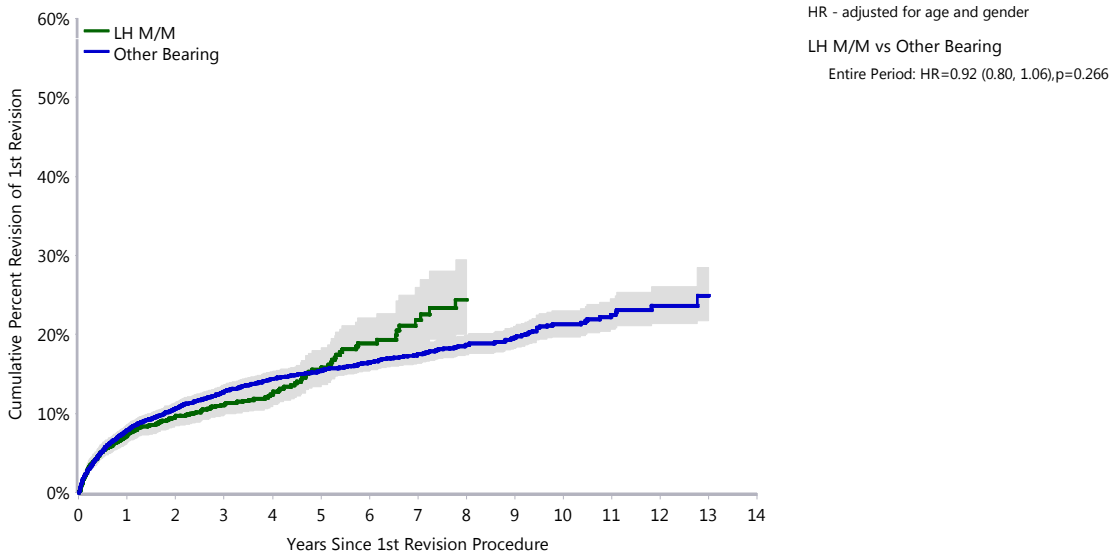
Note: All primary procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table RH10 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement by Bearing Surface used in Primary Procedure (Primary Diagnosis OA, excluding 1st Revision for Infection)

Bearing Surface in Primary	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
LH M/M	262	2216	7.3 (6.3, 8.5)	11.1 (9.8, 12.6)	15.6 (13.4, 18.0)	21.8 (18.3, 26.0)		
Other Bearing	975	7249	7.9 (7.3, 8.6)	12.8 (12.0, 13.7)	15.4 (14.5, 16.4)	17.5 (16.4, 18.7)	21.3 (19.7, 23.0)	
TOTAL	**1237**	**9465**						

Note: Nine procedures of unknown bearing surface have been excluded.

Figure RH17 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement by Bearing Surface used in Primary Procedure (Primary Diagnosis OA, excluding 1st Revision for Infection)



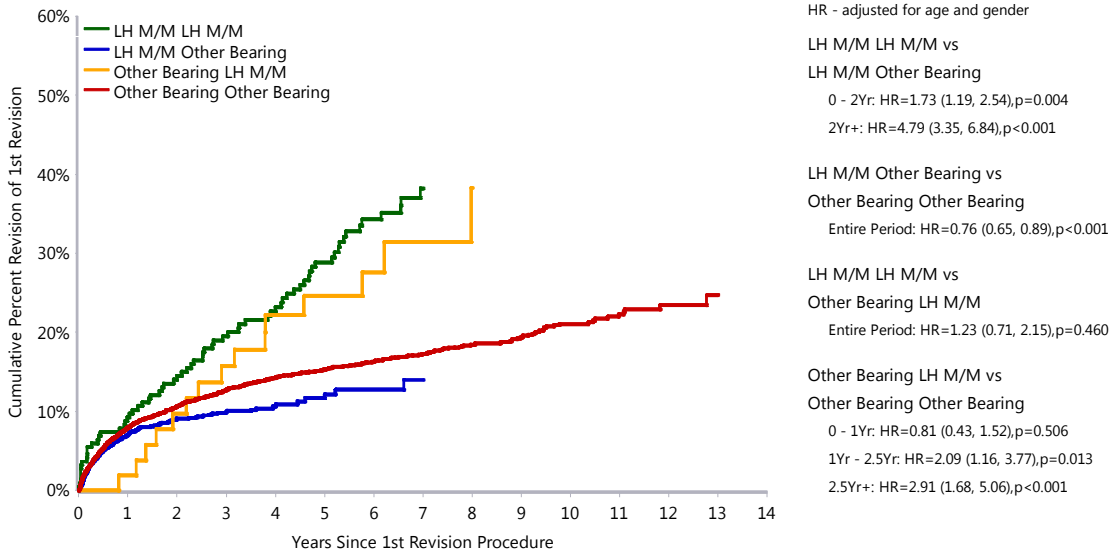
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
LH M/M	2216	1809	1045	294	109	15	0
Other Bearing	7249	5607	3684	2268	1338	455	10

Table RH11 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement by Bearing Surface used in Primary and Revision Procedure (Primary Diagnosis OA, excluding 1st Revision for Infection)

Bearing Surface in Primary	Bearing Surface in Revision	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
LH M/M	LH M/M	72	219	9.2 (6.1, 14.0)	19.5 (14.7, 25.5)	28.9 (23.1, 35.7)	38.2 (31.2, 46.2)		
	Other Bearing	190	1997	7.1 (6.0, 8.4)	9.9 (8.6, 11.4)	11.7 (9.9, 13.8)	14.0 (10.9, 17.8)		
Other Bearing	LH M/M	15	53	1.9 (0.3, 12.6)	15.7 (8.2, 29.0)	24.6 (14.7, 39.4)	31.4 (19.5, 48.1)		
	Other Bearing	960	7196	8.0 (7.3, 8.6)	12.8 (11.9, 13.6)	15.3 (14.4, 16.3)	17.3 (16.2, 18.5)	21.1 (19.5, 22.8)	
TOTAL		**1237**	**9465**						

Note: 9 primary procedures with unknown bearing surface have been excluded.

Figure RH18 Cumulative Percent Revision of 1st Revision of Primary Total Conventional Hip Replacement by Bearing Surface used in Primary and Revision Procedure (Primary Diagnosis OA, excluding 1st Revision for Infection)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
LH M/M	LH M/M	219	192	158	117	53	3	0
	Other Bearing	1997	1617	887	177	56	12	0
Other Bearing	LH M/M	53	51	41	28	17	1	0
	Other Bearing	7196	5556	3643	2240	1321	454	10

Revision of Total Knee Replacement

The Registry has information on 15,232 1st revisions where the primary diagnosis was osteoarthritis. There were 3,394 procedures excluded where the 1st revision was for infection. There were also a small number of procedures (106) excluded where minor or major total knee prostheses were not inserted. This analysis includes 11,732 1st revision procedures. The cumulative percent revision of the 1st revision at 10 years is 22.6% (Table RK1 and Figure RK1).

The most common reasons for 2nd revision are loosening/lysis (38.3%), infection (25.6%), pain (8.4%) and instability (8.1%) (Table RK2 and Figure RK2). The types of 2nd revision are listed in Table RK3. Revision of both the tibial and femoral components is the most common (44.2%) followed by insert only (17.7%), tibial component only (9.2%), cement spacer (8.7%) and patella only (8.1%) (Table RK3).

The outcome by class of the 1st revision is listed in Table RK4. Minor revisions have a higher rate of 2nd revision compared to major revisions in the first nine months. Major partial revisions have a higher rate of revision compared to minor revisions over the entire period. Major partial revisions have a higher rate of revision compared to major total revisions in the first year (Figure RK3).

Revising the patella alone has the same rate of 2nd revision as revision of the insert and patella. The cumulative percent revision at 10 years is 18.5% and 21.4% respectively. An insert only revision has the highest rate of 2nd revision (29.7%) but this is only significant in the first 1.5 years (Table RK5 and Figure RK4).

Outcome based on Time to 1st Revision

As with revision hip replacement, further analysis has been undertaken related to time to 1st revision within five years (≤5 years) and more than five years (>5 years).

There were 9,428 1st revisions of primary procedures performed ≤5 years and 2,304 1st revisions undertaken >5 years. The cumulative percent revision at seven years for the ≤5 year group is 20.1% compared to 10.1% for the >5 year group (Table RK6 and Figure RK5).

For the time period ≤5 years major partial revisions have a higher rate of 2nd revision compared to major revisions but this difference is only evident for the first year. Minor revisions have a lower rate of 2nd revision compared to major total after 2.5 years. There is no difference between minor and major partial revisions (Figure RK6).

For the time period >5 years there is no difference in the rate of 2nd revision for minor, major partial or major total revision (Figure RK7).

Each class of revision has a higher rate of 2nd revision if the 1st revision is undertaken within five years of the primary procedure (Table RK7 and Figure RK6 - Figure RK10).

Age at Primary TKR

To determine the effect of age at the time of the primary procedure on the outcome of 1st revision, two different age groups were compared ≤70 years and > 70 years of age. Patients aged >70 years of age and a 1st revision undertaken five years after the primary procedure had the lowest rate of 2nd revision (Table RK8 and Figure RK11).

Prosthesis Fixation of Primary TKR

The effect of the type of fixation used in the primary procedure was also analysed. Fixation of the primary only affects the outcome of the 1st revision if that revision is undertaken ≤5 years after the primary. Cemented primary procedures have the lowest rate of 2nd revision. After three months there is no difference in the rate of 2nd revision between cementless and hybrid primary procedures. For the time period >5 years, fixation of the primary procedure does not have an effect on the outcome of 1st revision (Table RK9, Figure RK12 and Figure RK13).

The rate of 2nd revision is always higher for 1st revisions undertaken ≤5 years regardless of the method of the fixation used in primary TKR (Figure RK14, Figure RK15 and Figure RK16).

Conclusion

For 1st revisions undertaken within five years of the primary, minor revisions have the lowest rate of 2nd revision compared to the other two classes of revision. Major partial revisions have a higher rate of 2nd revision compared to major total revision but this is only evident in the first year. There is no difference in the outcome of of 1st revision between classes if those 1st revisions were undertaken more than five years after the primary procedure.

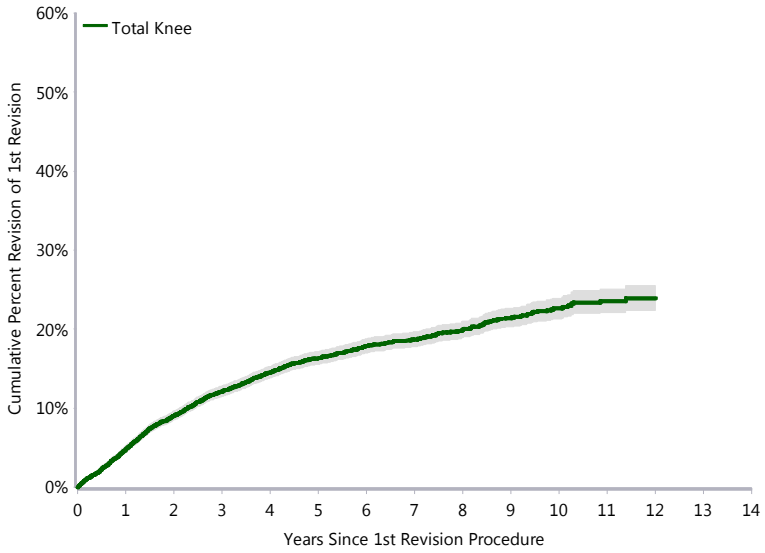
Patients aged less than or equal to 70 years have a higher rate of 2nd revision compared to older patients.

Cemented primary procedures have a lower rate of 2nd revision compared to other methods of fixation when the 1st revision is undertaken within five years of the primary procedure. The method of primary fixation does not have an effect on the outcome of the 1st revision after five years.

Table RK1 Cumulative Percent Revision of 1st Revision of Primary Total Knee Replacement (Primary Diagnosis OA, excluding 1st Revision for Infection)

Revision of Primary	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Total Knee	1598	11732	4.8 (4.4, 5.2)	12.1 (11.5, 12.8)	16.3 (15.5, 17.2)	18.7 (17.8, 19.6)	22.6 (21.3, 23.9)	
TOTAL	**1598**	**11732**						

Figure RK1 Cumulative Percent Revision of 1st Revision of Primary Total Knee Replacement (Primary Diagnosis OA, excluding 1st Revision for Infection)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Total Knee	11732	9721	6374	3845	2174	657	6

Table RK2 Primary Total Knee Replacement by Reason for 2nd Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)

Reason for 2nd Revision	Number	Percent
Loosening/Lysis	612	38.3
Infection	409	25.6
Pain	134	8.4
Instability	130	8.1
Arthrofibrosis	56	3.5
Malalignment	44	2.8
Patellofemoral Pain	32	2.0
Metal Related Pathology	24	1.5
Prosthesis Dislocation	20	1.3
Fracture	19	1.2
Incorrect Sizing	18	1.1
Wear Tibial Insert	17	1.1
Patella Maltracking	11	0.7
Patella Erosion	10	0.6
Implant Breakage Tibial	8	0.5
Bearing Dislocation	7	0.4
Implant Breakage Tibial Insert	6	0.4
Implant Breakage Patella	6	0.4
Synovitis	6	0.4
Implant Breakage Femoral	6	0.4
Wear Patella	3	0.2
Heterotopic Bone	3	0.2
Wear Tibial	2	0.1
Osteonecrosis	2	0.1
Patella Dislocation	1	0.1
Wear Femoral	1	0.1
Other	10	0.6
TOTAL	**1597**	**100.0**

Table RK3 Primary Total Knee Replacement by Type of 2nd Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)

Type of 2nd Revision	Number	Percent
TKR (Tibial/Femoral)	706	44.2
Insert Only	282	17.7
Tibial Component	147	9.2
Cement Spacer	139	8.7
Patella Only	129	8.1
Femoral Component	122	7.6
Insert/Patella	49	3.1
Removal of Prostheses	14	0.9
Minor Components	8	0.5
Cement Only	1	0.1
TOTAL	**1597**	**100.0**

Figure RK2 Cumulative Incidence 2nd Revision Diagnosis of 1st Revision of Primary Total Knee Replacement (Primary Diagnosis OA, excluding 1st Revision for Infection)

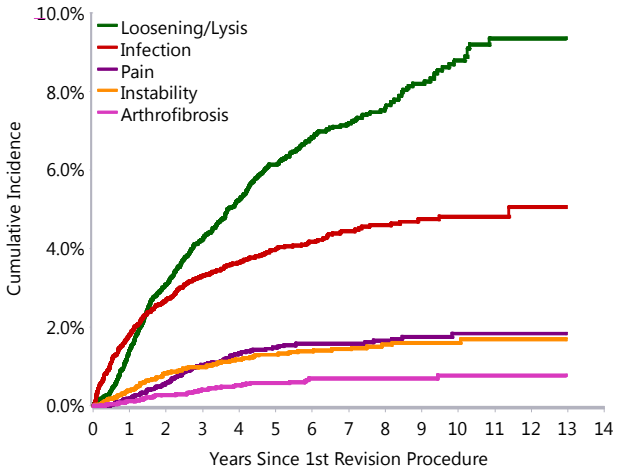
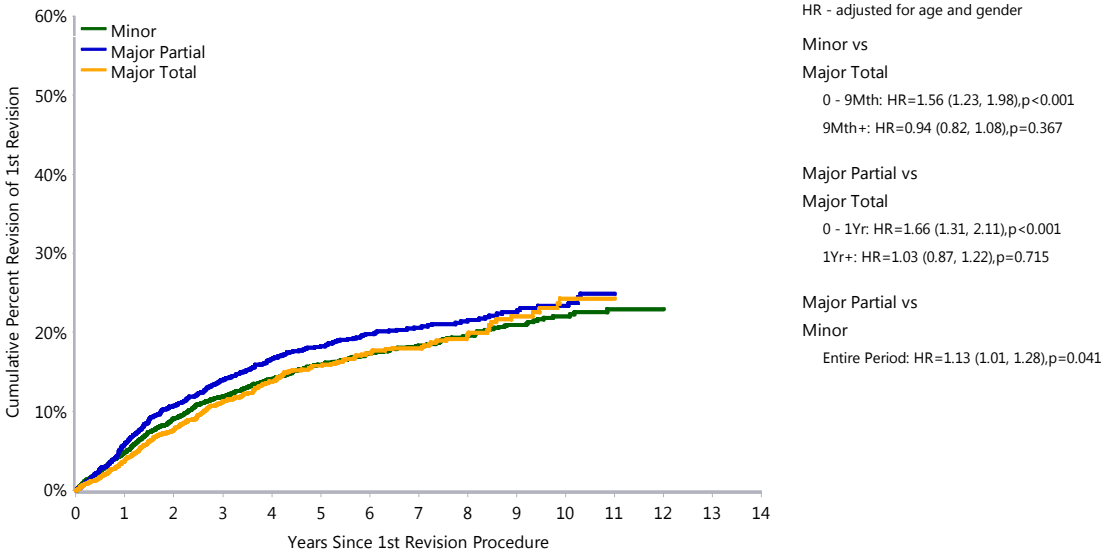


Table RK4 Cumulative Percent Revision of 1st Revision of Primary Total Knee Replacement by Class of 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)

Class of 1st Revision	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minor	828	6220	4.8 (4.3, 5.4)	11.9 (11.0, 12.8)	15.9 (14.8, 17.0)	18.3 (17.1, 19.6)	22.0 (20.3, 23.9)	
Major Partial	382	2341	6.0 (5.1, 7.1)	14.0 (12.5, 15.6)	18.2 (16.5, 20.1)	20.6 (18.7, 22.7)	23.3 (21.0, 25.9)	
Major Total	388	3171	3.8 (3.2, 4.6)	11.3 (10.1, 12.6)	15.8 (14.2, 17.5)	18.0 (16.2, 19.9)	24.3 (21.1, 27.9)	
TOTAL	**1598**	**11732**						

Figure RK3 Cumulative Percent Revision of 1st Revision of Primary Total Knee Replacement by Class of 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)



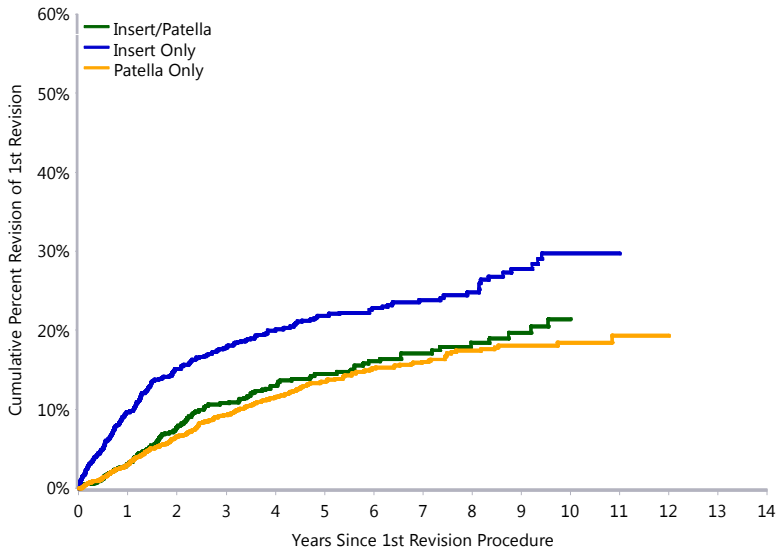
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minor	6220	5129	3382	2057	1133	328	4
Major Partial	2341	1978	1360	914	576	213	1
Major Total	3171	2614	1632	874	465	116	1

Table RK5 Cumulative Percent Revision of 1st Revision of Primary Total Knee Replacement by Type of 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)

Type of 1st Revision	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Insert/Patella	158	1390	3.0 (2.2, 4.1)	10.8 (9.0, 12.8)	14.5 (12.3, 17.0)	17.1 (14.5, 20.1)	21.4 (17.5, 26.0)	
Insert Only	306	1596	9.7 (8.3, 11.3)	17.8 (15.9, 19.9)	21.8 (19.6, 24.3)	23.8 (21.4, 26.5)	29.7 (25.9, 33.9)	
Patella Only	359	3217	3.0 (2.5, 3.7)	9.3 (8.2, 10.5)	13.5 (12.1, 15.0)	16.0 (14.4, 17.8)	18.5 (16.4, 20.7)	
TKR (Tibial/Femoral)	388	3171	3.8 (3.2, 4.6)	11.3 (10.1, 12.6)	15.8 (14.2, 17.5)	18.0 (16.2, 19.9)	24.3 (21.1, 27.9)	
Tibial Component	226	1519	5.6 (4.5, 6.9)	13.2 (11.5, 15.2)	17.3 (15.2, 19.6)	19.5 (17.1, 22.1)	22.2 (19.2, 25.5)	
Femoral Component	155	820	6.9 (5.3, 8.9)	15.4 (13.0, 18.3)	19.8 (16.9, 23.1)	22.5 (19.3, 26.1)	25.2 (21.6, 29.3)	
TOTAL	**1592**	**11713**						

Note: Only the outcome of the six most common types of 1st revision have been listed.

Figure RK4 Cumulative Percent Revision of 1st Revision of Primary Total Knee Replacement by Type of 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)



HR - adjusted for age and gender

Insert/Patella vs Patella Only

Entire Period: HR=1.07 (0.88, 1.29),p=0.508

Insert Only vs Patella Only

0 - 2Wk: HR=22.93 (5.27, 99.87),p<0.001

2Wk - 1.5Yr: HR=2.57 (2.09, 3.17),p<0.001

1.5Yr+: HR=1.03 (0.82, 1.30),p=0.777

Insert Only vs Insert/Patella

0 - 3Mth: HR=4.37 (2.78, 6.87),p<0.001

3Mth - 1.5Yr: HR=2.27 (1.76, 2.92),p<0.001

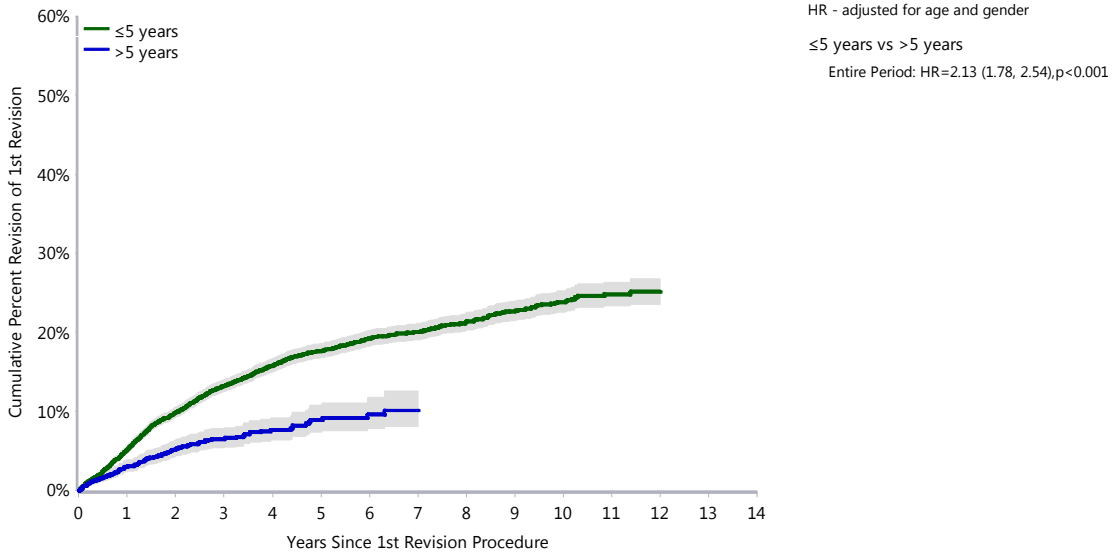
1.5Yr+: HR=0.97 (0.75, 1.25),p=0.814

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Insert/Patella	1390	1140	689	370	215	64	1
Insert Only	1596	1259	819	543	296	79	1
Patella Only	3217	2718	1864	1136	617	182	2

Table RK6 Cumulative Percent Revision of 1st Revision of Primary Total Knee Replacement by Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)

Time to 1st Revision	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
≤5 years	1465	9428	5.2 (4.8, 5.7)	13.2 (12.5, 14.0)	17.7 (16.8, 18.6)	20.1 (19.1, 21.1)	23.9 (22.5, 25.2)	
>5 years	133	2304	3.0 (2.4, 3.8)	6.5 (5.4, 7.8)	8.9 (7.3, 10.8)	10.1 (8.1, 12.6)		
TOTAL	**1598**	**11732**						

Figure RK5 Cumulative Percent Revision of 1st Revision of Primary Total Knee Replacement by Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)

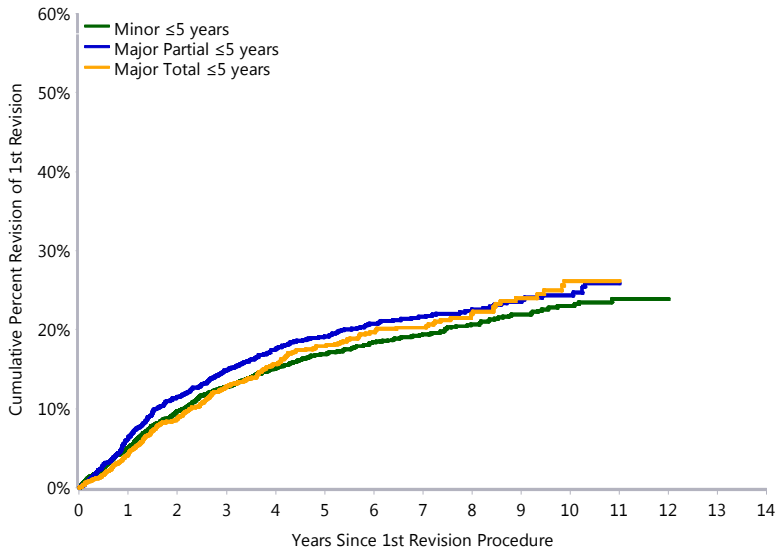


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
≤5 years	9428	7967	5497	3489	2088	657	6
>5 years	2304	1754	877	356	86	0	0

Table RK7 Cumulative Percent Revision of 1st Revision of Known Primary Total Knee Replacement by Class of 1st Revision and Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)

Class of 1st Revision	Time to 1st Revision	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minor	≤5 years	762	5151	5.1 (4.5, 5.7)	12.7 (11.8, 13.8)	16.9 (15.8, 18.2)	19.4 (18.1, 20.8)	23.0 (21.2, 24.9)	
	>5 years	66	1069	3.5 (2.5, 4.9)	6.7 (5.2, 8.7)	9.2 (7.0, 12.1)	10.6 (7.8, 14.3)		
Major Partial	≤5 years	365	2048	6.5 (5.5, 7.7)	14.9 (13.3, 16.6)	19.2 (17.3, 21.2)	21.6 (19.6, 23.8)	24.3 (21.9, 26.9)	
	>5 years	17	293	2.7 (1.3, 5.5)	6.4 (3.8, 10.8)	10.1 (6.0, 17.0)			
Major Total	≤5 years	338	2229	4.3 (3.5, 5.3)	12.8 (11.4, 14.5)	17.9 (16.1, 19.9)	20.3 (18.2, 22.5)	26.2 (22.9, 29.9)	
	>5 years	50	942	2.6 (1.7, 3.9)	6.4 (4.7, 8.6)	8.2 (6.0, 11.1)			
TOTAL		**1598**	**11732**						

Figure RK6 Cumulative Percent Revision of 1st Revision of Primary Total Knee Replacement by Class of 1st Revision for those Revised ≤5 years since Primary Procedure (Primary Diagnosis OA, excluding 1st Revision for Infection)



HR - adjusted for age and gender

Major Partial ≤5 years vs Minor ≤5 years

Entire Period: HR=1.13 (1.00, 1.28),p=0.057

Major Total ≤5 years vs Minor ≤5 years

0 - 2.5Yr: HR=0.90 (0.77, 1.05),p=0.185

2.5Yr+: HR=1.31 (1.06, 1.60),p=0.011

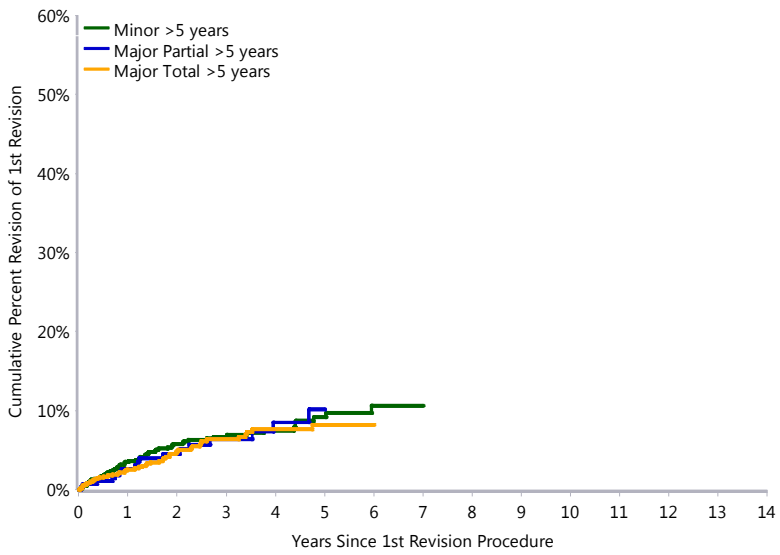
Major Partial ≤5 years vs Major Total ≤5 years

0 - 1Yr: HR=1.59 (1.23, 2.06),p<0.001

1Yr+: HR=0.94 (0.79, 1.12),p=0.495

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minor	≤5 years	5151	4314	2966	1889	1091	328	4
Major Partial	≤5 years	2048	1746	1239	869	566	213	1
Major Total	≤5 years	2229	1907	1292	731	431	116	1

Figure RK7 Cumulative Percent Revision of 1st Revision of Primary Total Knee Replacement by Class of 1st Revision for those Revised >5 years since Primary Procedure (Primary Diagnosis OA, excluding 1st Revision for Infection)



HR - adjusted for age and gender

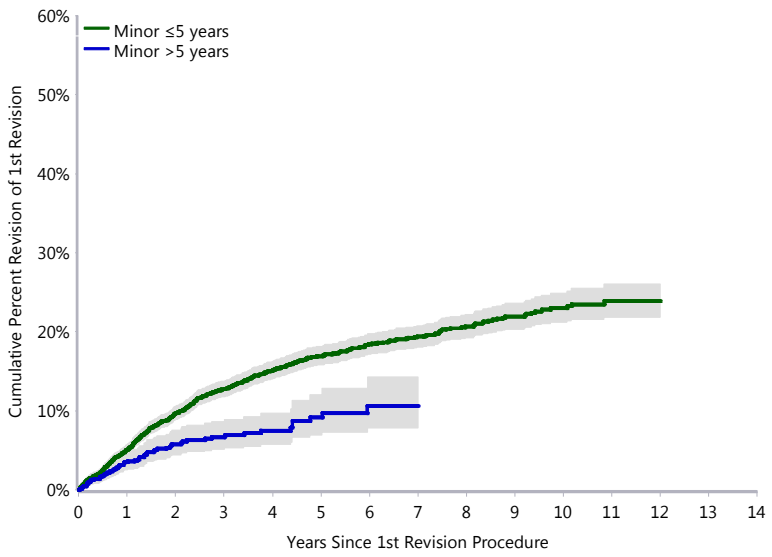
Minor >5 years vs Major Total >5 years
Entire Period: HR=1.20 (0.83, 1.73),p=0.329

Major Partial >5 years vs Major Total >5 years
Entire Period: HR=1.02 (0.59, 1.78),p=0.930

Minor >5 years vs Major Partial >5 years
Entire Period: HR=1.17 (0.69, 2.00),p=0.560

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minor	>5 years	1069	815	416	168	42	0	0
Major Partial	>5 years	293	232	121	45	10	0	0
Major Total	>5 years	942	707	340	143	34	0	0

Figure RK8 Cumulative Percent Revision of 1st Revision of Primary Total Knee Replacement for Minor Revision by Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)

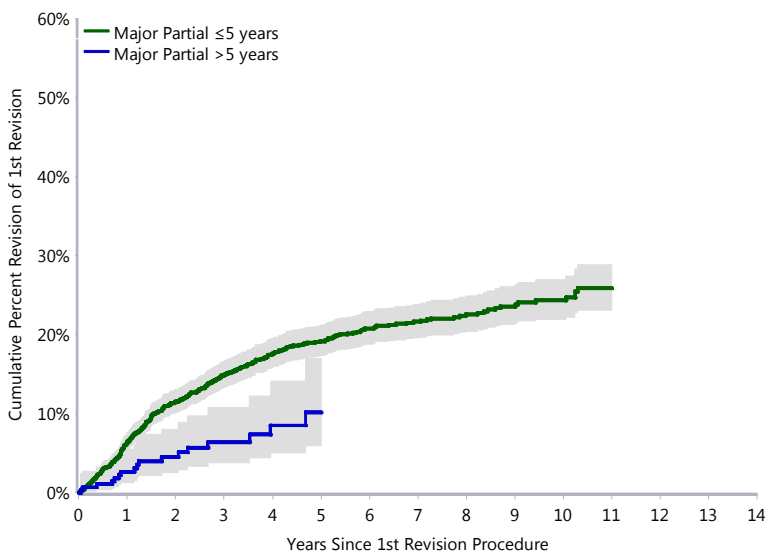


HR - adjusted for age and gender

Minor ≤5 years vs Minor >5 years
Entire Period: HR=1.90 (1.48, 2.45),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minor	≤5 years	5151	4314	2966	1889	1091	328	4
	>5 years	1069	815	416	168	42	0	0

Figure RK9 Cumulative Percent Revision of 1st Revision of Primary Total Knee Replacement for Major Partial Revision by Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)



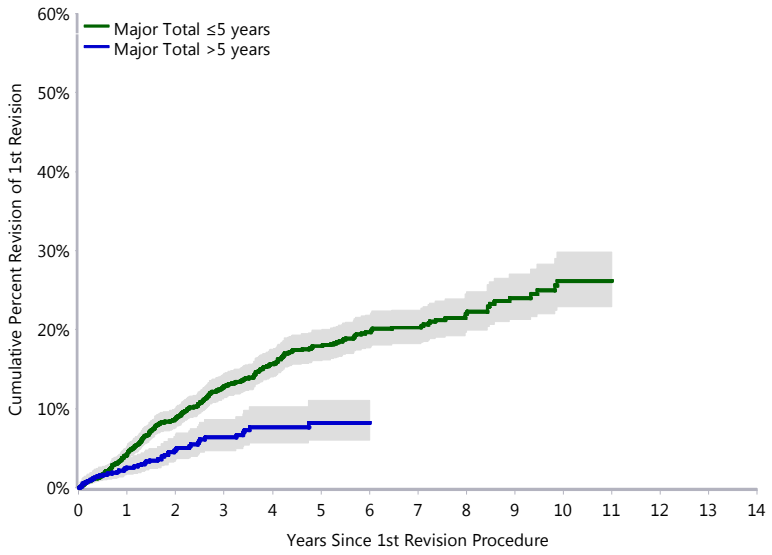
HR - adjusted for age and gender

Major Partial ≤5 years vs Major Partial >5 years

Entire Period: HR=2.53 (1.56, 4.13),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Major Partial	≤5 years	2048	1746	1239	869	566	213	1
	>5 years	293	232	121	45	10	0	0

Figure RK10 Cumulative Percent Revision of 1st Revision of Primary Total Knee Replacement for Major Total Revision by Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)



HR - adjusted for age and gender

Major Total ≤5 years vs Major Total >5 years

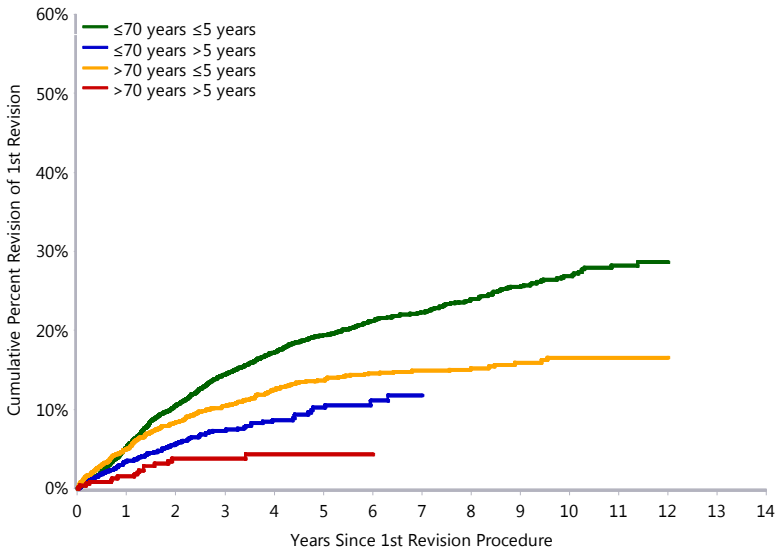
Entire Period: HR=2.21 (1.64, 2.99),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Major Total	≤5 years	2229	1907	1292	731	431	116	1
	>5 years	942	707	340	143	34	0	0

Table RK8 Cumulative Percent Revision of 1st Revision of Primary Total Knee Replacement by Age at Primary Procedure and Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)

Age at Primary	Time to 1st Revision	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
≤70 years	≤5 years	1130	6579	5.3 (4.8, 5.9)	14.4 (13.5, 15.4)	19.4 (18.3, 20.5)	22.3 (21.1, 23.6)	26.9 (25.2, 28.6)	
	>5 years	117	1798	3.4 (2.7, 4.4)	7.3 (6.0, 8.9)	10.2 (8.3, 12.5)	11.8 (9.3, 14.9)		
>70 years	≤5 years	335	2849	5.0 (4.3, 5.9)	10.5 (9.3, 11.7)	13.7 (12.3, 15.2)	14.9 (13.4, 16.5)	16.6 (14.7, 18.7)	
	>5 years	16	506	1.5 (0.7, 3.2)	3.8 (2.3, 6.2)	4.3 (2.6, 7.1)			
TOTAL		**1598**	**11732**						

Figure RK11 Cumulative Percent Revision of 1st Revision of Primary Total Knee Replacement by Age at Primary Procedure and Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)



HR - adjusted for gender

≤70 years ≤5 years vs ≤70 years >5 years
- 0 - 9Mth: HR=1.28 (1.00, 1.64),p=0.054
- 9Mth - 1Yr: HR=2.33 (1.54, 3.52),p<0.001
- 1Yr - 1.5Yr: HR=2.34 (1.71, 3.20),p<0.001
- 1.5Yr+: HR=2.49 (1.97, 3.15),p<0.001

≤70 years >5 years vs >70 years >5 years
- Entire Period: HR=2.11 (1.25, 3.56),p=0.005

≤70 years ≤5 years vs >70 years ≤5 years
- 0 - 2Wk: HR=0.25 (0.10, 0.60),p=0.002
- 2Wk - 3Mth: HR=0.77 (0.54, 1.10),p=0.153
- 3Mth - 6Mth: HR=0.93 (0.64, 1.36),p=0.717
- 6Mth - 9Mth: HR=1.32 (0.91, 1.91),p=0.141
- 9Mth - 2.5Yr: HR=1.57 (1.32, 1.88),p<0.001
- 2.5Yr+: HR=2.00 (1.61, 2.47),p<0.001

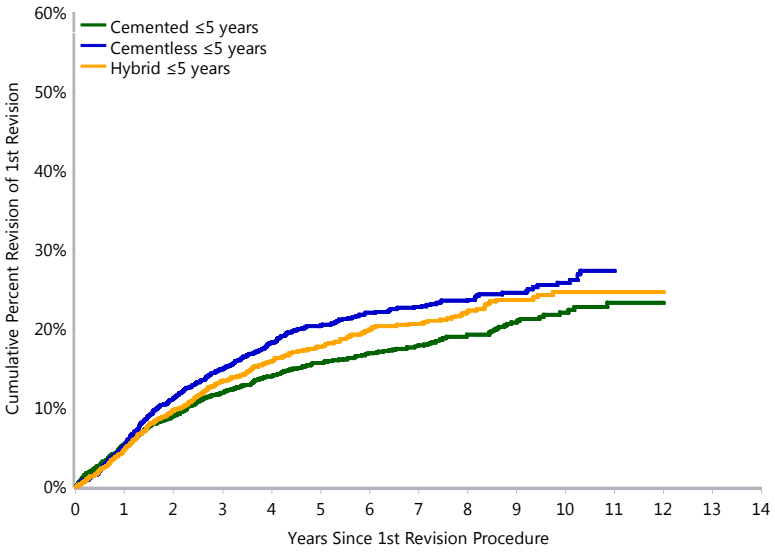
>70 years ≤5 years vs >70 years >5 years
- Entire Period: HR=3.01 (1.82, 4.97),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
≤70 years	≤5 years	6579	5555	3771	2400	1453	459	4
	>5 years	1798	1364	666	275	64	0	0
>70 years	≤5 years	2849	2412	1726	1089	635	198	2
	>5 years	506	390	211	81	22	0	0

Table RK9 Cumulative Percent Revision of 1st Revision of Primary Total Knee Replacement by Primary Procedure Fixation and Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)

Fixation of Primary	Time to 1st Revision	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cemented	≤5 years	574	4201	5.3 (4.7, 6.1)	11.9 (10.9, 13.0)	15.7 (14.4, 17.0)	17.9 (16.4, 19.4)	22.0 (20.0, 24.3)	
	>5 years	60	1073	3.0 (2.1, 4.3)	6.2 (4.7, 8.2)	8.2 (6.1, 10.8)	10.8 (7.6, 15.2)		
Cementless	≤5 years	515	2948	5.4 (4.6, 6.3)	14.9 (13.6, 16.4)	20.4 (18.7, 22.2)	22.7 (20.9, 24.7)	25.8 (23.5, 28.3)	
	>5 years	37	650	3.7 (2.5, 5.6)	6.3 (4.5, 8.9)	8.4 (5.9, 12.0)			
Hybrid	≤5 years	376	2279	4.8 (4.0, 5.8)	13.4 (12.0, 15.0)	17.7 (16.0, 19.6)	20.6 (18.7, 22.7)	24.6 (22.1, 27.3)	
	>5 years	36	581	2.3 (1.3, 4.0)	7.3 (5.2, 10.3)	10.7 (7.4, 15.2)			
TOTAL		**1598**	**11732**						

Figure RK12 Cumulative Percent Revision of 1st Revision of Primary Total Knee Replacement by Primary Procedure Fixation for those Revised ≤5 Years since Primary Procedure (Primary Diagnosis OA, excluding 1st Revision for Infection)



HR - adjusted for age and gender

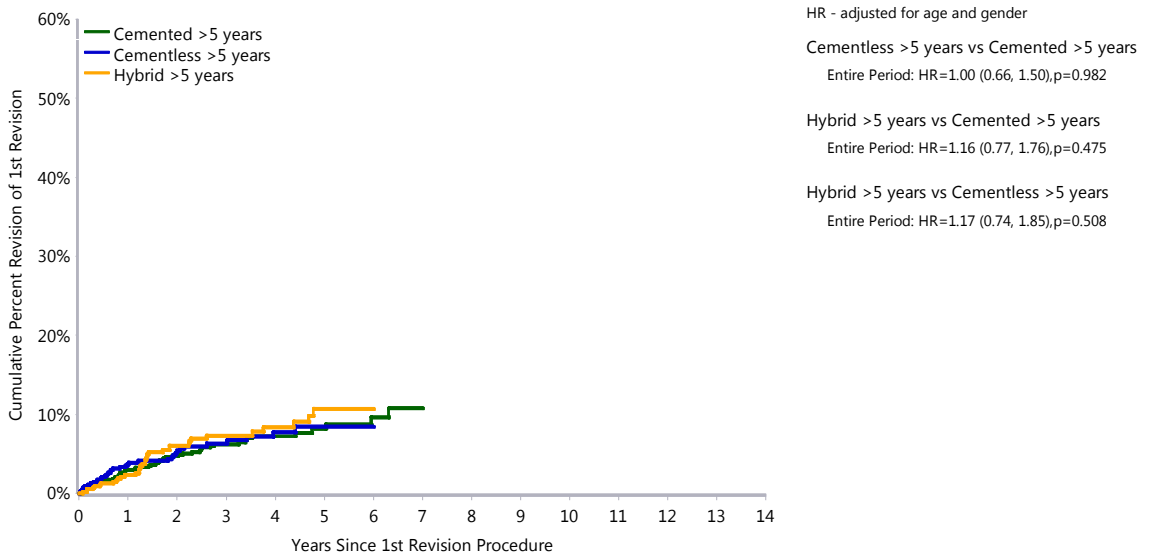
Cementless ≤5 years vs Cemented ≤5 years
- 0 - 3Mth: HR=0.47 (0.30, 0.74),p=0.001
- 3Mth - 1.5Yr: HR=1.31 (1.09, 1.57),p=0.004
- 1.5Yr+: HR=1.30 (1.10, 1.53),p=0.001

Hybrid ≤5 years vs Cemented ≤5 years
- 0 - 3Mth: HR=0.59 (0.37, 0.93),p=0.023
- 3Mth - 2Yr: HR=1.16 (0.96, 1.39),p=0.127
- 2Yr - 2.5Yr: HR=1.04 (0.69, 1.56),p=0.843
- 2.5Yr+: HR=1.27 (1.03, 1.57),p=0.025

Cementless ≤5 years vs Hybrid ≤5 years
- Entire Period: HR=1.08 (0.94, 1.23),p=0.260

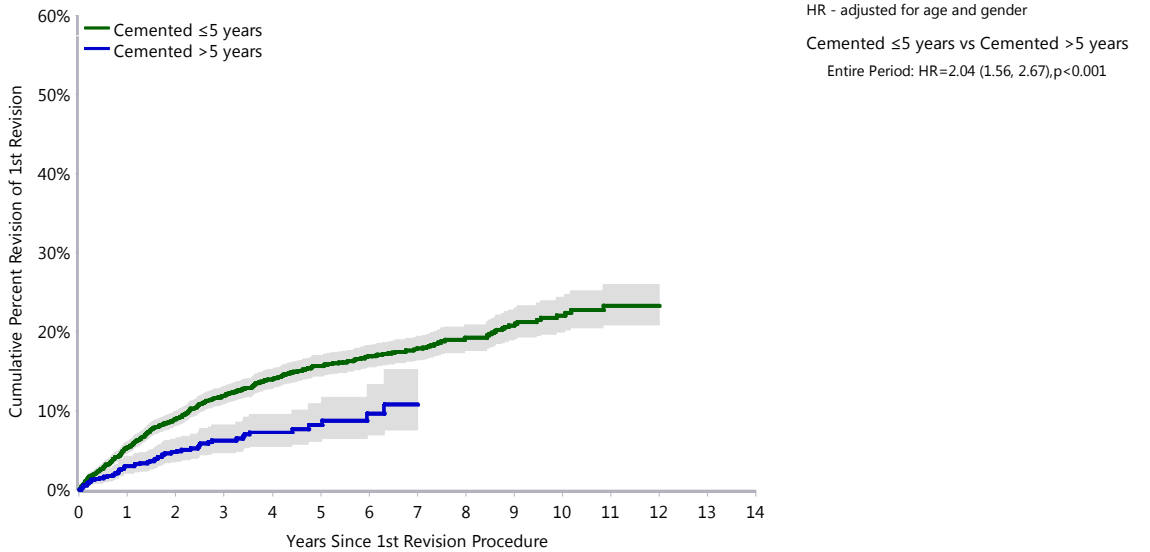
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cemented	≤5 years	4201	3489	2414	1544	848	245	1
Cementless	≤5 years	2948	2536	1663	979	634	218	2
Hybrid	≤5 years	2279	1942	1420	966	606	194	3

Figure RK13 Cumulative Percent Revision of 1st Revision of Primary Total Knee Replacement by Primary Procedure Fixation for those Revised >5 Years since Primary Procedure (Primary Diagnosis OA, excluding 1st Revision for Infection)



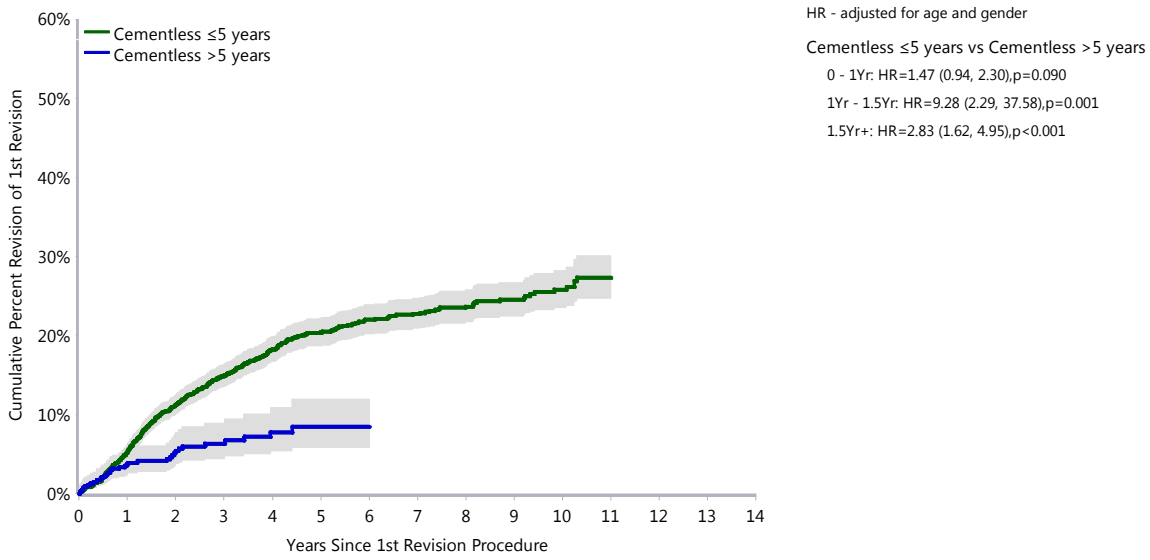
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cemented	>5 years	1073	816	416	163	43	0	0
Cementless	>5 years	650	498	236	99	16	0	0
Hybrid	>5 years	581	440	225	94	27	0	0

Figure RK14 Cumulative Percent Revision of 1st Revision of Cemented Primary Total Knee Replacement by Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)



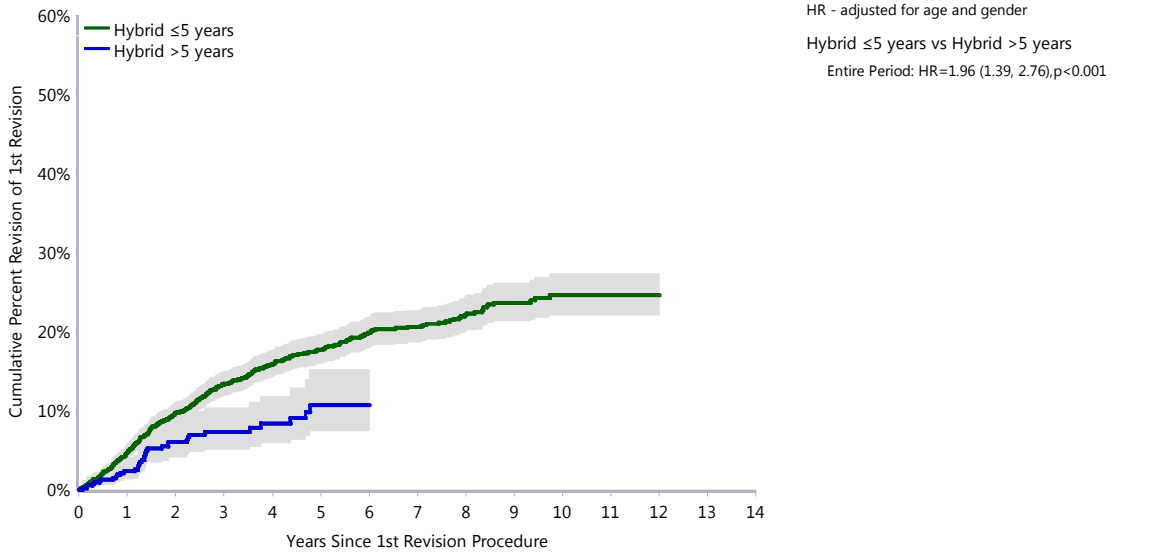
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cemented	≤5 years	4201	3489	2414	1544	848	245	1
	>5 years	1073	816	416	163	43	0	0

Figure RK15 Cumulative Percent Revision of 1st Revision of Cementless Primary Total Knee Replacement by Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cementless	≤5 years	2948	2536	1663	979	634	218	2
	>5 years	650	498	236	99	16	0	0

Figure RK16 Cumulative Percent Revision of 1st Revision of Hybrid Primary Total Knee Replacement by Time to 1st Revision (Primary Diagnosis OA, excluding 1st Revision for Infection)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Hybrid	≤5 years	2279	1942	1420	966	606	194	3
	>5 years	581	440	225	94	27	0	0

TEN YEAR PROSTHESES OUTCOMES

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. This outcome is widely regarded as an important milestone in assessing the performance of prostheses.

Hip Replacement

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

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

There are 59 femoral and acetabular combinations with 10 year outcome data. This is one more than last year. These prosthesis combinations account for 61.0% of all primary total conventional hip procedures. Of these, 22 combinations were not used in 2014, accounting 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 2.0% to 12.6%. There are 28 (47.5%) hip prosthesis combinations with a 10 year cumulative percent revision (for any reason) of less than 5.0% (Table TY1).

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

				Type of Revision						
Femoral Stem	Acetabular Combination	N Revised	N Total	THR	Femoral	Acetabular	Other	1 Yr	5 Yrs	10 Yrs
ABGII	ABGII	196	2736	27	90	49	30	1.8 (1.3, 2.3)	4.1 (3.4, 4.9)	6.8 (5.9, 7.9)
ABGII	ABGII (Shell/Insert)	49	821	10	28	7	4	1.5 (0.8, 2.6)	2.9 (1.9, 4.3)	7.4 (5.5, 9.8)
ABGII	Trident (Shell)	141	2283	6	81	20	34	2.4 (1.9, 3.1)	4.8 (3.9, 5.8)	8.1 (6.7, 9.7)
Accolade I	Trident (Shell)	336	8319	37	127	70	102	1.6 (1.4, 1.9)	3.8 (3.4, 4.2)	5.4 (4.8, 6.1)
Alloclassic	**Allofit**	**169**	**4699**	**19**	**60**	**35**	**55**	**1.2 (0.9, 1.5)**	**2.7 (2.2, 3.2)**	**4.7 (4.0, 5.6)**
Alloclassic	Fitmore	91	1595	12	47	12	20	2.8 (2.1, 3.7)	5.2 (4.1, 6.4)	6.8 (5.6, 8.4)
Alloclassic	**Metasul***	**19**	**371**	**3**	**2**	**9**	**5**	**0.8 (0.3, 2.5)**	**3.6 (2.1, 6.1)**	**4.9 (3.1, 7.8)**
C-Stem	Duraloc*	64	894	8	15	10	31	2.0 (1.3, 3.2)	3.8 (2.7, 5.3)	7.4 (5.7, 9.6)
C-Stem	Elite Plus LPW*	17	367	7	4	6	.	0.6 (0.1, 2.2)	2.7 (1.4, 5.0)	5.4 (3.3, 9.1)
CLS	Allofit	38	760	3	21	9	5	1.3 (0.7, 2.5)	3.8 (2.6, 5.5)	6.2 (4.4, 8.6)
CLS	Fitmore	33	618	2	16	6	9	1.6 (0.9, 3.0)	4.4 (3.0, 6.5)	5.8 (4.0, 8.2)
CPCS	Reflection (Cup)	37	651	10	2	15	10	0.6 (0.2, 1.7)	2.8 (1.7, 4.6)	8.4 (5.7, 12.3)
CPCS	**Reflection (Shell)**	**58**	**2456**	**5**	**21**	**10**	**22**	**0.8 (0.5, 1.3)**	**1.6 (1.2, 2.3)**	**4.3 (3.1, 6.0)**
CPT	**Trilogy**	**191**	**6132**	**21**	**53**	**29**	**88**	**1.4 (1.2, 1.8)**	**3.0 (2.6, 3.5)**	**4.7 (3.9, 5.5)**
CPT	**ZCA**	**23**	**712**	**9**	**4**	**5**	**5**	**0.4 (0.1, 1.3)**	**2.1 (1.2, 3.7)**	**4.6 (2.9, 7.2)**
Charnley	Charnley Ogee*	49	630	28	6	3	12	1.1 (0.5, 2.3)	4.9 (3.5, 7.0)	8.4 (6.3, 11.2)
Charnley	Charnley*	34	563	26	5	3	.	0.5 (0.2, 1.7)	2.2 (1.3, 3.9)	7.0 (4.7, 10.2)
Charnley	Vitalock*	32	370	4	15	2	11	1.9 (0.9, 3.9)	4.4 (2.7, 7.1)	8.0 (5.5, 11.4)
Citation	**Trident (Shell)***	**39**	**1035**	**3**	**7**	**10**	**19**	**1.7 (1.1, 2.8)**	**3.2 (2.3, 4.5)**	**4.1 (3.0, 5.6)**
Citation	**Vitalock***	**26**	**508**	**2**	**4**	**8**	**12**	**0.4 (0.1, 1.6)**	**2.0 (1.1, 3.7)**	**4.8 (3.2, 7.3)**
Corail	Duraloc*	51	1267	4	23	9	15	1.0 (0.6, 1.8)	2.4 (1.7, 3.4)	5.0 (3.7, 6.8)
Corail	Pinnacle	581	24617	57	176	94	254	1.5 (1.4, 1.7)	3.0 (2.7, 3.2)	5.3 (4.3, 6.5)
Corail	Pinnacle^{MoM}*	76	880	9	24	16	27	2.3 (1.5, 3.5)	6.2 (4.7, 8.0)	12.6 (9.6, 16.4)
Elite Plus	Duraloc*	85	953	13	49	5	18	1.6 (1.0, 2.6)	5.1 (3.9, 6.8)	8.8 (7.0, 11.0)
Epoch	**Trilogy***	**40**	**990**	**.**	**9**	**7**	**24**	**2.4 (1.6, 3.6)**	**3.5 (2.5, 4.9)**	**4.7 (3.4, 6.6)**
Exeter	Contemporary*	33	427	8	6	12	7	1.9 (1.0, 3.8)	4.2 (2.6, 6.6)	6.0 (4.0, 8.9)
Exeter	**Vitalock***	**54**	**1076**	**6**	**10**	**22**	**16**	**1.4 (0.8, 2.3)**	**2.3 (1.5, 3.4)**	**4.6 (3.4, 6.1)**
Exeter V40	**ABGII**	**31**	**954**	**7**	**11**	**7**	**6**	**0.8 (0.4, 1.7)**	**1.7 (1.0, 2.7)**	**3.3 (2.3, 4.8)**

Femoral Stem	Acetabular Combination	N Revised	N Total	Type of Revision				1 Yr	5 Yrs	10 Yrs
				THR	Femoral	Acetabular	Other			
Exeter V40	Contemporary	180	4179	39	30	86	25	1.3 (1.0, 1.7)	3.2 (2.6, 3.8)	5.9 (5.0, 7.0)
Exeter V40	**Exeter Contemporary**	**91**	**2694**	**25**	**23**	**26**	**17**	**1.4 (1.0, 1.9)**	**2.9 (2.3, 3.6)**	**4.5 (3.6, 5.6)**
Exeter V40	**Exeter***	**60**	**1526**	**9**	**13**	**24**	**14**	**0.9 (0.5, 1.5)**	**2.8 (2.1, 3.8)**	**4.3 (3.3, 5.7)**
Exeter V40	**Mallory-Head**	**28**	**1238**	**3**	**17**	**1**	**7**	**0.5 (0.2, 1.1)**	**1.0 (0.6, 1.8)**	**3.2 (2.1, 4.8)**
Exeter V40	**Trident (Shell)**	**803**	**36808**	**100**	**230**	**127**	**346**	**1.0 (0.9, 1.1)**	**2.2 (2.0, 2.4)**	**3.9 (3.6, 4.3)**
Exeter V40	Trilogy	17	516	2	5	2	8	1.9 (1.1, 3.6)	2.6 (1.5, 4.4)	5.0 (2.8, 8.7)
Exeter V40	**Vitalock***	**60**	**1795**	**14**	**18**	**15**	**13**	**0.8 (0.5, 1.4)**	**2.3 (1.7, 3.1)**	**3.2 (2.4, 4.1)**
F2L	SPH-Blind*	47	571	4	17	13	13	2.8 (1.7, 4.5)	6.1 (4.4, 8.4)	7.6 (5.7, 10.2)
MS 30	**Allofit**	**40**	**1363**	**5**	**11**	**13**	**11**	**1.3 (0.8, 2.0)**	**2.2 (1.5, 3.2)**	**3.5 (2.5, 4.9)**
MS 30	**Fitmore**	**11**	**466**	**.**	**1**	**4**	**6**	**0.0 (0.0, 0.0)**	**1.3 (0.5, 3.1)**	**2.4 (1.2, 4.8)**
MS 30	**Low Profile Cup**	**11**	**569**	**4**	**2**	**4**	**1**	**0.4 (0.1, 1.4)**	**1.0 (0.4, 2.4)**	**2.5 (1.3, 4.7)**
Mallory-Head	Mallory-Head	129	2761	11	11	40	67	1.8 (1.4, 2.4)	3.0 (2.4, 3.7)	5.0 (4.1, 6.1)
Meridian	Vitalock*	23	354	2	2	9	10	0.9 (0.3, 2.6)	3.5 (2.0, 6.1)	6.1 (3.9, 9.2)
Natural Hip	**Allofit**	**10**	**529**	**.**	**3**	**3**	**4**	**0.8 (0.3, 2.0)**	**1.2 (0.5, 2.6)**	**2.0 (1.1, 3.9)**
Natural Hip	**Fitmore***	**28**	**882**	**2**	**3**	**9**	**14**	**0.5 (0.2, 1.2)**	**2.0 (1.3, 3.2)**	**3.8 (2.6, 5.6)**
Omnifit	Secur-Fit*	72	716	6	20	17	29	2.4 (1.5, 3.8)	6.2 (4.6, 8.2)	10.0 (7.9, 12.6)
Omnifit	**Trident (Shell)**	**109**	**3365**	**11**	**26**	**19**	**53**	**1.6 (1.2, 2.1)**	**3.0 (2.5, 3.7)**	**3.8 (3.2, 4.7)**
S-Rom	**Duraloc Option***	**24**	**524**	**4**	**9**	**4**	**7**	**1.7 (0.9, 3.3)**	**3.3 (2.1, 5.2)**	**4.6 (3.1, 6.8)**
S-Rom	**Pinnacle**	**70**	**2010**	**8**	**40**	**6**	**16**	**2.1 (1.6, 2.9)**	**3.5 (2.7, 4.5)**	**4.3 (3.3, 5.5)**
SL-Plus	EP-Fit Plus	91	2035	5	41	18	27	1.6 (1.1, 2.2)	3.6 (2.8, 4.5)	6.0 (4.7, 7.7)
Secur-Fit	**Trident (Shell)**	**226**	**7598**	**20**	**94**	**44**	**68**	**1.5 (1.2, 1.8)**	**3.0 (2.6, 3.5)**	**4.1 (3.5, 4.7)**
Secur-Fit Plus	**Trident (Shell)**	**137**	**5027**	**10**	**37**	**30**	**60**	**1.1 (0.8, 1.4)**	**2.2 (1.8, 2.6)**	**3.2 (2.7, 3.9)**
Spectron EF	Reflection (Cup)	85	1384	28	10	38	9	0.9 (0.6, 1.6)	2.9 (2.1, 3.9)	7.9 (6.3, 10.0)
Spectron EF	Reflection (Shell)	201	4519	40	63	32	66	1.0 (0.8, 1.3)	2.7 (2.2, 3.2)	5.6 (4.8, 6.6)
Stability	Duraloc*	41	374	1	9	13	18	0.5 (0.1, 2.1)	2.2 (1.1, 4.3)	8.9 (6.3, 12.5)
Summit	**Pinnacle**	**60**	**3486**	**4**	**13**	**13**	**30**	**0.9 (0.7, 1.3)**	**1.7 (1.3, 2.3)**	**2.9 (2.1, 4.1)**
Summit	Pinnacle^{MoM}*	42	730	2	4	7	29	1.4 (0.7, 2.5)	3.3 (2.2, 4.9)	7.4 (5.4, 10.1)
Synergy	**Reflection (Shell)**	**258**	**7134**	**23**	**49**	**86**	**100**	**1.5 (1.2, 1.8)**	**2.6 (2.2, 3.0)**	**4.0 (3.5, 4.5)**
Taperloc	M2a^{MoM}*	49	471	10	2	35	2	1.5 (0.7, 3.1)	6.9 (5.0, 9.7)	12.6 (9.6, 16.5)
Taperloc	Mallory-Head	50	1316	4	10	17	19	1.7 (1.1, 2.6)	3.0 (2.1, 4.2)	5.1 (3.8, 6.9)
VerSys	**Trilogy**	**182**	**4248**	**11**	**64**	**33**	**74**	**2.4 (2.0, 2.9)**	**3.6 (3.1, 4.2)**	**4.7 (4.1, 5.5)**
TOTAL		**5828**	**68872**	**753**	**1793**	**1278**	**2004**			

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 2014

Knee Replacement

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

There are 43 total knee replacement combinations with 10 year outcome data. This is two more than last year.

The listed prostheses most often represent a family of devices that have a range of different femoral and tibial components combined with different tibial inserts listed under one prosthesis name. However, prosthesis types are separated as to whether they are minimally or posteriorly stabilised. These prosthesis combinations account for 71.1% of all primary total knee replacement procedures. Of these, 13 combinations were not used in 2014, accounting for 9.4% of all primary total knee procedures.

The 10 year cumulative percent revision ranges from 2.6% to 11.2%. There are 13 knee prosthesis combinations (30.2%) with a 10 year cumulative percent revision (for any reason) of less than 5.0% (Table TY2).

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

Femoral Component	Tibial Component	N Revised	N Total	Type of Revision				1 Yr	5 Yrs	10 Yrs
				TKR	Femoral	Tibial	Other			
AGC	**AGC**	**205**	**4973**	**70**	**4**	**22**	**109**	**0.5 (0.4, 0.8)**	**3.1 (2.6, 3.6)**	**4.8 (4.2, 5.6)**
Active Knee	Active Knee	385	7607	109	23	30	223	1.1 (0.9, 1.4)	4.6 (4.1, 5.1)	7.6 (6.8, 8.4)
Advance	Advance II	91	1558	28	2	13	48	1.6 (1.1, 2.4)	5.2 (4.1, 6.5)	7.3 (5.9, 9.0)
Advantim	**Advantim**	**47**	**1452**	**19**	**3**	**3**	**22**	**0.7 (0.4, 1.3)**	**2.9 (2.1, 4.0)**	**4.5 (3.3, 6.1)**
BalanSys	**BalanSys**	**19**	**1259**	**6**	**1**	**2**	**10**	**0.3 (0.1, 0.8)**	**2.5 (1.4, 4.2)**	**4.4 (2.4, 7.7)**
Duracon	**Duracon***	**925**	**19829**	**214**	**29**	**63**	**619**	**1.1 (1.0, 1.3)**	**3.4 (3.2, 3.7)**	**4.9 (4.6, 5.3)**
Genesis II CR	**Genesis II**	**606**	**18354**	**120**	**42**	**38**	**406**	**0.9 (0.8, 1.1)**	**3.4 (3.2, 3.8)**	**4.6 (4.2, 5.0)**
Genesis II CR	Profix Mobile*	82	1209	30	9	7	36	1.9 (1.3, 2.9)	5.4 (4.2, 6.9)	7.3 (5.8, 9.2)
Genesis II Oxinium CR Cted	Genesis II	279	6395	46	23	20	190	1.1 (0.8, 1.4)	3.8 (3.3, 4.3)	6.4 (5.6, 7.4)
Genesis II Oxinium PS Cted	Genesis II	582	12724	64	20	107	391	1.6 (1.4, 1.9)	5.4 (4.9, 5.9)	7.9 (7.0, 8.9)
Genesis II PS	Genesis II	528	14280	80	24	37	387	1.3 (1.1, 1.5)	4.0 (3.6, 4.4)	5.7 (5.2, 6.4)
Kinemax Plus	**Kinemax Plus***	**98**	**1815**	**51**	**3**	**5**	**39**	**0.9 (0.6, 1.5)**	**3.2 (2.4, 4.1)**	**4.6 (3.7, 5.8)**
LCS CR	LCS	528	8284	207	23	81	217	1.1 (0.9, 1.3)	4.4 (4.0, 4.9)	6.2 (5.7, 6.8)
LCS CR	MBT	655	21973	207	26	92	330	0.8 (0.7, 1.0)	3.5 (3.2, 3.8)	5.1 (4.7, 5.7)
LCS CR	MBT Duofix	511	11838	139	24	35	313	1.3 (1.1, 1.5)	4.1 (3.8, 4.5)	5.6 (5.1, 6.1)
MBK (Zimmer)	Nexgen*	28	448	15	1	1	11	0.9 (0.3, 2.4)	4.1 (2.6, 6.5)	5.9 (4.0, 8.6)
Maxim	Maxim*	144	2447	34	12	12	86	1.1 (0.7, 1.6)	4.0 (3.3, 4.8)	6.1 (5.2, 7.3)
Natural Knee II	Natural Knee II	315	6391	111	8	57	139	0.9 (0.7, 1.2)	2.9 (2.5, 3.4)	5.8 (5.1, 6.6)
Nexgen CR	**Nexgen**	**287**	**10501**	**89**	**11**	**29**	**158**	**0.5 (0.4, 0.6)**	**2.0 (1.7, 2.3)**	**3.0 (2.6, 3.3)**
Nexgen CR	Nexgen TM CR	42	752	14	3	8	17	1.4 (0.7, 2.5)	5.9 (4.3, 8.0)	6.9 (5.0, 9.3)
Nexgen CR Flex	**Nexgen**	**514**	**31027**	**91**	**42**	**66**	**315**	**0.8 (0.7, 0.9)**	**2.2 (2.0, 2.4)**	**2.9 (2.6, 3.3)**
Nexgen CR Flex	**Nexgen TM CR**	**146**	**8127**	**41**	**12**	**18**	**75**	**0.5 (0.4, 0.7)**	**2.2 (1.9, 2.6)**	**2.6 (2.2, 3.1)**
Nexgen LPS	Nexgen	254	6169	59	16	29	150	0.9 (0.7, 1.2)	3.2 (2.8, 3.7)	5.1 (4.5, 5.8)
Nexgen LPS Flex	Nexgen	733	24490	166	35	140	392	0.9 (0.8, 1.0)	3.3 (3.0, 3.5)	5.2 (4.8, 5.7)
Optetrak-CR	Optetrak	24	528	3	2	3	16	1.3 (0.6, 2.9)	5.1 (3.3, 7.7)	6.1 (4.1, 9.0)
Optetrak-PS	Optetrak	158	2322	46	5	25	82	1.4 (1.0, 2.0)	6.7 (5.6, 7.9)	9.9 (8.3, 11.7)
PFC Sigma CR	**AMK Duofix***	**48**	**1890**	**16**	**.**	**1**	**31**	**0.6 (0.4, 1.1)**	**2.4 (1.8, 3.3)**	**3.2 (2.4, 4.4)**
PFC Sigma CR	MBT	228	5413	30	25	40	133	1.3 (1.1, 1.7)	4.2 (3.7, 4.9)	5.3 (4.6, 6.1)
PFC Sigma CR	MBT Duofix	96	2234	13	13	2	68	1.4 (1.0, 2.0)	4.3 (3.5, 5.4)	5.4 (4.3, 6.8)
PFC Sigma CR	**PFC Sigma**	**482**	**20559**	**98**	**39**	**40**	**305**	**0.7 (0.6, 0.8)**	**2.5 (2.2, 2.7)**	**3.7 (3.3, 4.2)**
PFC Sigma PS	**MBT**	**183**	**5862**	**49**	**9**	**13**	**112**	**0.8 (0.6, 1.0)**	**3.5 (3.0, 4.1)**	**4.4 (3.7, 5.3)**
PFC Sigma PS	MBT Duofix	110	1626	17	2	4	87	1.8 (1.2, 2.6)	7.3 (6.1, 8.8)	8.1 (6.8, 9.7)
PFC Sigma PS	**PFC Sigma**	**206**	**6481**	**62**	**7**	**18**	**119**	**1.1 (0.9, 1.4)**	**3.1 (2.7, 3.6)**	**4.5 (3.8, 5.3)**
Profix	Profix Mobile*	98	986	28	6	5	59	2.3 (1.6, 3.5)	8.2 (6.6, 10.1)	9.9 (8.1, 12.1)
Profix	Profix*	246	5370	49	13	17	167	1.0 (0.8, 1.4)	3.7 (3.2, 4.3)	5.2 (4.5, 5.8)
Profix Oxinium Cted	Profix*	86	1049	17	4	14	51	2.1 (1.4, 3.2)	7.0 (5.6, 8.8)	8.6 (7.0, 10.6)
RBK	RBK	320	8702	110	9	33	168	1.2 (1.0, 1.5)	4.0 (3.5, 4.5)	5.5 (4.8, 6.3)
Rotaglide Plus	Rotaglide Plus*	62	616	23	1	5	33	0.8 (0.3, 2.0)	5.8 (4.1, 8.0)	11.2 (8.8, 14.2)
Scorpio CR	Scorpio+*	138	2448	33	10	18	77	0.9 (0.6, 1.4)	4.0 (3.3, 4.9)	6.3 (5.3, 7.4)
Scorpio CR	Series 7000	426	10472	101	21	37	267	0.9 (0.8, 1.1)	3.4 (3.1, 3.8)	5.2 (4.7, 5.7)
Scorpio PS	Scorpio*	30	524	8	.	8	14	1.2 (0.5, 2.6)	4.5 (3.0, 6.7)	6.5 (4.5, 9.2)
Scorpio PS	Scorpio+*	124	2036	31	12	8	73	1.4 (1.0, 2.1)	5.0 (4.1, 6.0)	6.8 (5.6, 8.1)
Scorpio PS	Series 7000	263	4592	82	5	56	120	1.3 (1.0, 1.7)	4.6 (4.0, 5.3)	7.1 (6.2, 8.1)
TOTAL		**11332**	**307612**	**2826**	**579**	**1262**	**6665**			

Note: Only prosthesis combinations with over 350 procedures have been listed.
* denotes prosthesis combinations with no reported use in Primary Total Knee Procedures in 2014

HIP REPLACEMENT

Categories of Hip Replacement

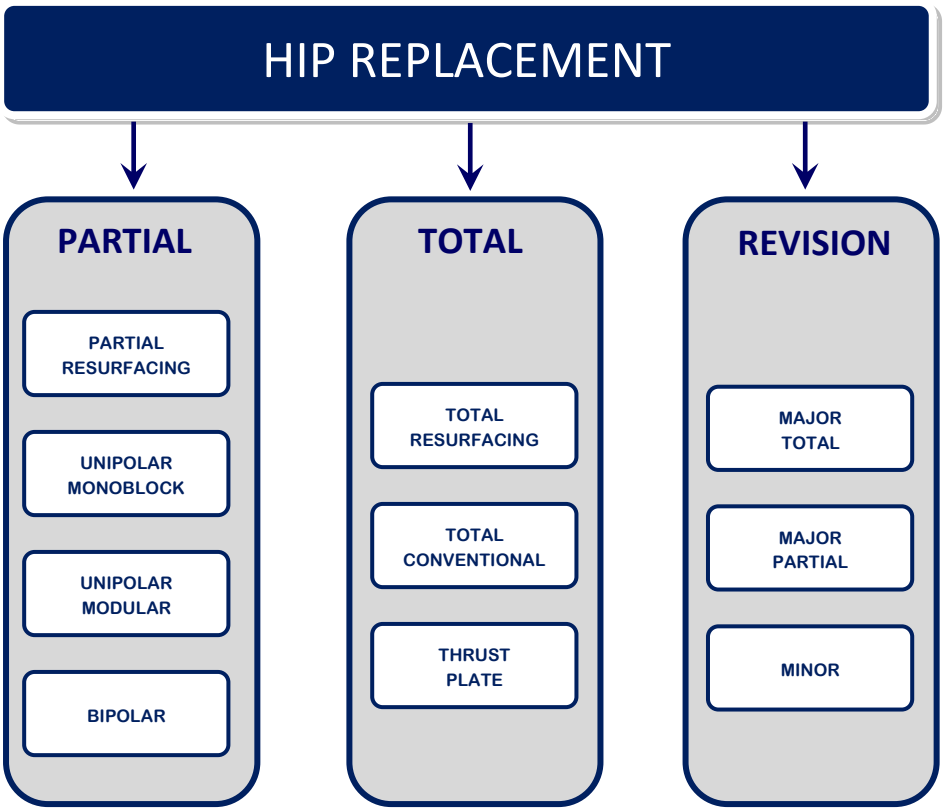
The Registry groups hip replacement into three broad categories; primary partial, primary total and revision hip replacement.

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 demographics of each category of hip replacement is available in the supplementary report Demographics of Hip Arthroplasty' on the AOANJRR website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2015



Use of Hip Replacement

This report analyses 453,950 hip replacements reported to the Registry with a procedure date up to and including 31 December 2014. This is an additional 43,183 hip procedures compared to the number reported last year. When considering all hip procedures currently recorded by the Registry, primary partial hips account for 15.7% of all hip replacements, primary total hips 72.5% and revision hip replacement 11.8% (Table H1).

Table H1 Number of Hip Replacements

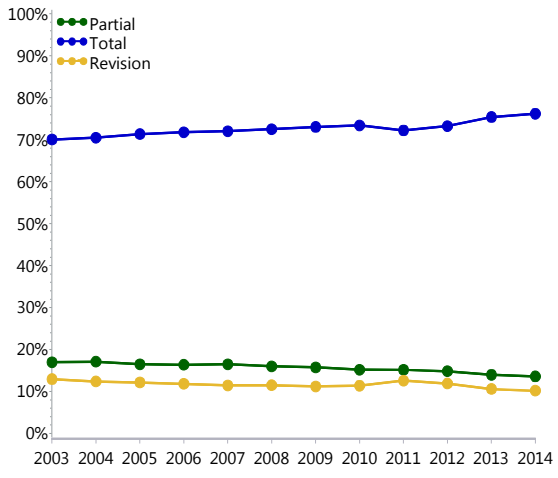
Hip Category	Number	Percent
Partial	71241	15.7
Total	329240	72.5
Revision	53469	11.8
TOTAL	**453950**	**100.0**

The number of hip replacement procedures undertaken in 2014 was 58.6% higher than undertaken in 2003. The corresponding increase in primary total hip replacement was 72.5%, primary partial 26.8% and revision hip replacement 25.1%.

The number of hip replacements undertaken in 2014 increased by 2,515 (6.3%) compared to 2013. During this time, the use of primary total hip replacement increased by 7.5%, accounting for 76.2% of all hip replacement procedures in 2014. Primary partial hip replacement increased by 3.3%, accounting for 13.6% of hip procedures in 2014.

The proportion of revision hip procedures has declined from a peak of 12.9% in 2003 to 10.2% in 2014. This equates to 1,155 less revision procedures in 2014 than would have been expected if the proportion of revision procedures had remained at 12.9% (Figure H1).

Figure H1 Proportion of Hip Replacement



Public and Private Sector

More than half of all hip replacement procedures reported to the Registry are undertaken in private hospitals (59.1% in 2014).

There were 24,929 private sector hip replacements reported in 2014, an increase of 5.8% compared to 2013. In the public sector, there were 17,264 hip replacements, an increase of 7.1% compared to 2013 (Figure H2).

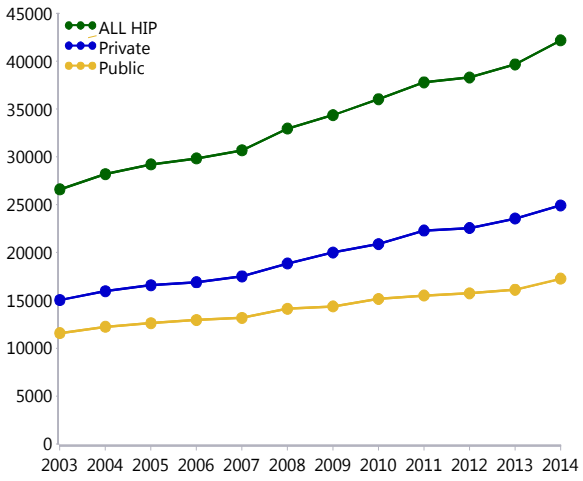
Since 2003, hip replacement in the private sector has increased by 65.8% compared to 49.2% in the public sector.

Primary partial hip replacement has increased in the public sector since 2013 (4.0%) and decreased in the private sector (0.7%). In 2014, there were 4,875 primary partial hip replacements reported in the public sector and 859 in the private sector. Since 2003, primary partial hip replacement has increased in the public sector by 35.8% compared to a decrease of 7.6% in the private sector.

In 2014, 21,602 private sector primary total hip replacements were reported, an increase of 7.0% compared to 2013. In the public sector, there were 10,550 primary total hip replacements, an increase of 8.3% compared to 2013. Since 2003, primary total hip replacement has increased in the private sector by 79.5% compared to an increase of 59.7% in the public sector.

There were 2,468 revision hip replacements reported in the private sector in 2014, a decrease of 1.8% compared to 2013. In the public sector, there were 1,839 revision hip replacements, an increase of 8.6% compared to 2013. Since 2003, revision hip replacement in the private sector has increased by 19.2% compared to 33.8% in the public sector.

Figure H2 Hip Replacement by Hospital 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.

Table HP1 Primary Partial Hip Replacement by Class

Partial Hip Class	Number	Percent
Partial Resurfacing	14	0.0
Unipolar Monoblock	26759	37.6
Unipolar Modular	29411	41.3
Bipolar	15057	21.1
TOTAL	**71241**	**100.0**

Use of Partial Hip Replacement

The most common class of primary partial hip replacement is unipolar modular. This accounts for 41.3% of all partial hip procedures followed by unipolar monoblock (37.6%) and bipolar (21.1%) (Table HP1). Partial resurfacing has only been used in 14 procedures, six of which have been revised. The last procedure was recorded in 2009. Partial hip resurfacing is not presented in detail in this report.

Detailed information on Partial Resurfacing is available in the supplementary report 'The Outcome of Classes of Hip and Knee Prostheses No Longer Used' on the AOANJRR website aoanjrr.dmac.adelaide.edu.au/annual-reports-2015.

Fractured neck of femur is the principal diagnosis for all primary partial hip replacement with the exception of partial resurfacing.

The outcome of primary partial hip replacement varies depending on the class. At 13 years, bipolar has the lowest cumulative percent revision followed by unipolar monoblock and unipolar modular (Table HP2 and Figure HP1). This difference is most apparent in those aged less than 75 years (Table HP3 and Figure HP2).

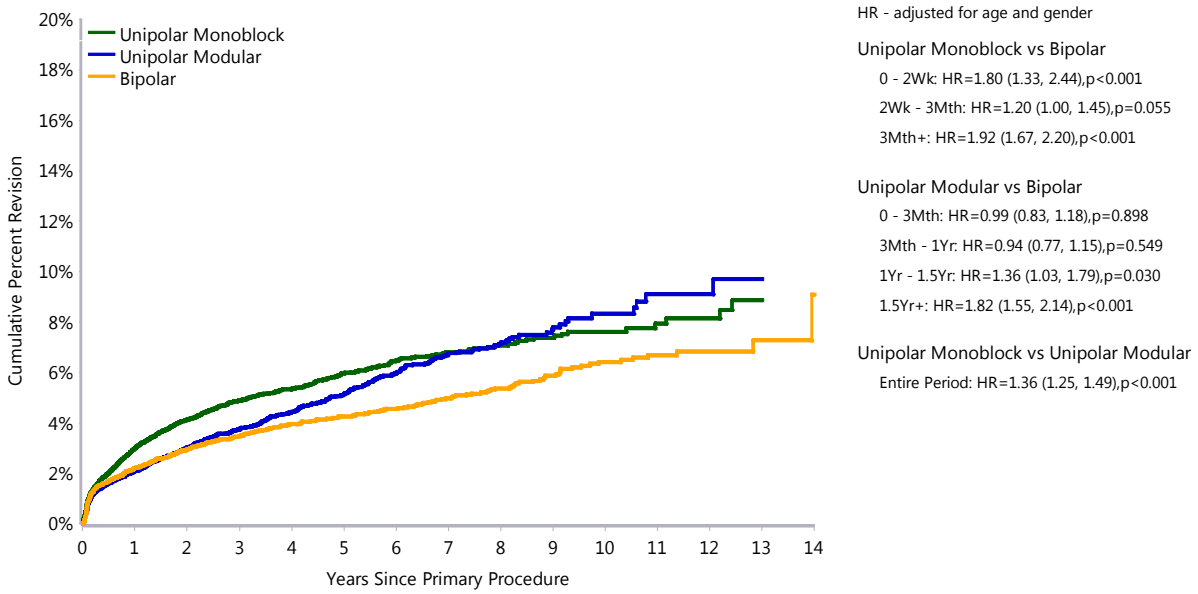
Partial hip replacement is associated with a high mortality rate. The mortality data are detailed in Table HP4. The prosthesis class variation is almost certainly due to patient selection.

Detailed demographic information on primary partial hip replacement is available in the supplementary report 'Demographics of Hip Arthroplasty' on the AOANJRR website aoanjrr.dmac.adelaide.edu.au/annual-reports-2015.

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

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Unipolar Monoblock	1013	26759	3.0 (2.8, 3.3)	4.9 (4.6, 5.2)	6.0 (5.6, 6.4)	6.8 (6.3, 7.3)	7.6 (7.0, 8.3)	8.9 (7.6, 10.3)
Unipolar Modular	996	29411	2.1 (1.9, 2.3)	3.8 (3.5, 4.0)	5.1 (4.8, 5.5)	6.8 (6.3, 7.3)	8.3 (7.5, 9.3)	9.7 (8.1, 11.6)
Bipolar	521	15057	2.2 (2.0, 2.5)	3.5 (3.1, 3.8)	4.3 (3.9, 4.7)	5.0 (4.5, 5.5)	6.4 (5.7, 7.1)	7.3 (6.2, 8.6)
TOTAL	**2530**	**71227**						

Figure HP1 Cumulative Percent Revision of Primary Partial Hip Replacement by Class

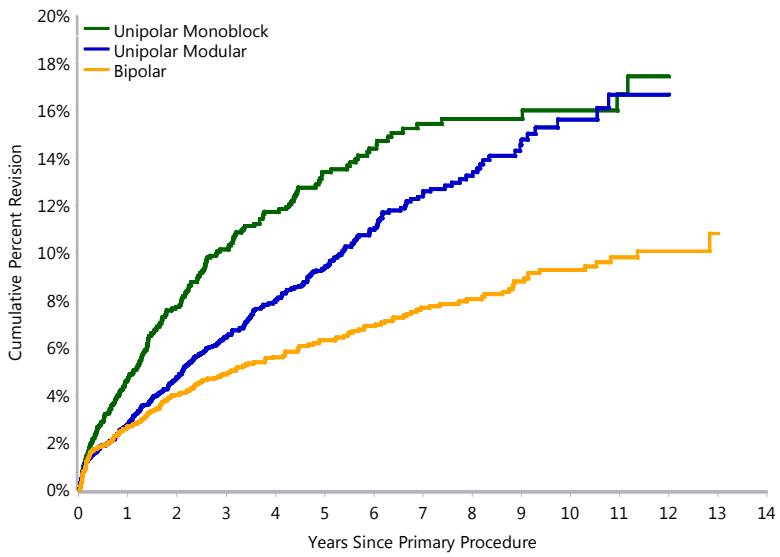


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Unipolar Monoblock	26759	15998	9043	4795	2502	824	154
Unipolar Modular	29411	19586	10875	5416	2382	499	70
Bipolar	15057	10654	7021	4658	2977	1265	172

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

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Unipolar Monoblock	218	2343	4.7 (3.8, 5.8)	10.2 (8.8, 11.7)	13.4 (11.7, 15.4)	15.5 (13.5, 17.7)	16.0 (13.9, 18.4)	
Unipolar Modular	375	5215	2.8 (2.3, 3.3)	6.5 (5.7, 7.3)	9.4 (8.4, 10.5)	12.6 (11.3, 14.1)	15.6 (13.7, 17.8)	
Bipolar	203	3510	2.7 (2.2, 3.3)	4.9 (4.1, 5.8)	6.3 (5.4, 7.4)	7.7 (6.6, 8.9)	9.3 (8.0, 10.8)	10.8 (8.9, 13.2)
TOTAL	**796**	**11068**						

Figure HP2 Cumulative Percent Revision of Primary Partial Hip Replacement for Patients Ages <75 Years by Class



HR - adjusted for age and gender

Unipolar Monoblock vs Bipolar

Entire Period: HR=2.10 (1.72, 2.55),p<0.001

Unipolar Modular vs Bipolar

0 - 3Mth: HR=1.17 (0.85, 1.62),p=0.332

3Mth - 1.5Yr: HR=1.22 (0.92, 1.61),p=0.177

1.5Yr - 2.5Yr: HR=1.48 (1.03, 2.13),p=0.035

2.5Yr+: HR=2.19 (1.70, 2.83),p<0.001

Unipolar Monoblock vs Unipolar Modular

Entire Period: HR=1.39 (1.17, 1.64),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Unipolar Monoblock	2343	1563	1027	666	425	176	37
Unipolar Modular	5215	3800	2474	1526	811	223	36
Bipolar	3510	2649	1939	1495	1102	614	101

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

Hip Class	N Deceased	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Unipolar Monoblock	20840	26073	36.1 (35.5, 36.6)	59.6 (58.9, 60.2)	75.4 (74.8, 75.9)	84.7 (84.2, 85.2)	92.3 (91.9, 92.7)	95.2 (94.8, 95.6)
Unipolar Modular	14552	28565	23.0 (22.5, 23.5)	42.1 (41.4, 42.7)	57.4 (56.7, 58.1)	69.0 (68.2, 69.8)	79.8 (78.8, 80.8)	85.9 (84.4, 87.3)
Bipolar	8614	14693	20.9 (20.3, 21.6)	38.3 (37.5, 39.1)	52.3 (51.4, 53.3)	63.9 (62.9, 64.8)	75.6 (74.7, 76.5)	83.3 (82.1, 84.4)
TOTAL	**44006**	**69331**						

Unipolar Monoblock

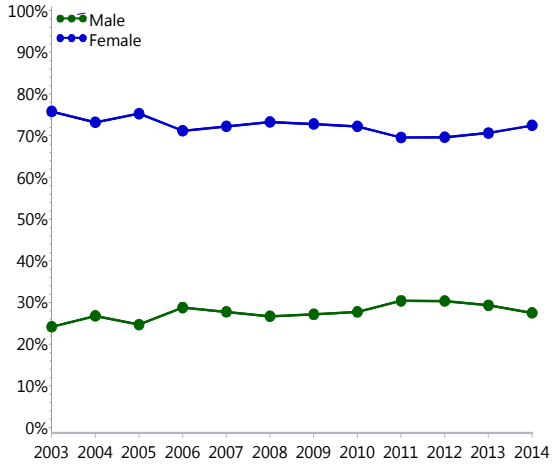
Demographics

There have been 26,759 unipolar monoblock procedures reported to the Registry. This is an additional 1,128 procedures compared to the previous report.

The use of monoblock hip replacement in Australia continues to decline. The number of procedures reported in 2014 was 12.6% less than 2013 and 60.1% less than 2003.

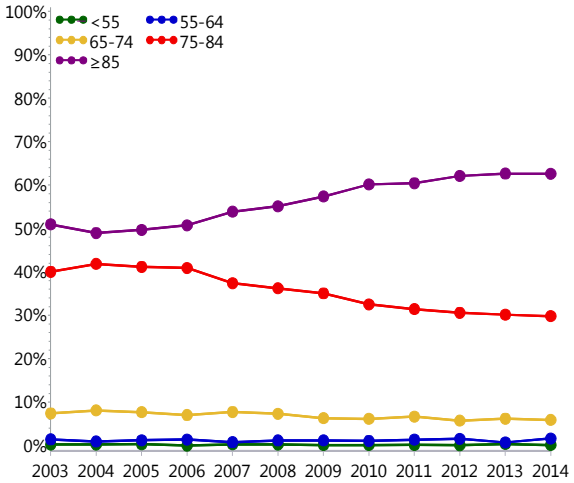
Fractured neck of femur is the principal diagnosis for primary unipolar monoblock hip replacement (97.6%).

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 2014 (Figure HP3 and Figure 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 2014, the use of the Austin-Moore type decreased by 19.1% compared to 2013 and 76.2% compared to 2003. The Thompson type decreased by 19.1% compared to 2013 and 51.7% compared to 2003. In 2014, the use of the ETS increased by 10.9% compared to 2013 and accounted for 27.4% of all monoblock prostheses (Table HP5).

Table HP5 Most Used Monoblock Prostheses in Primary Unipolar Monoblock Hip Replacement

2003		2011		2012		2013		2014	
N	Model	N	Model	N	Model	N	Model	N	Model
1988	Austin-Moore Type	770	Austin-Moore Type	743	Austin-Moore Type	586	Austin-Moore Type	474	Austin-Moore Type
526	Thompson Type	380	Thompson Type	324	Thompson Type	314	Thompson Type	275	ETS
		336	ETS	313	ETS	248	ETS	254	Thompson Type
Most Used									
2514	(2) 100.0%	1486	(3) 100.0%	1380	(3) 100.0%	1148	(3) 100.0%	1003	(3) 100.0%

Outcome for Fractured Neck of Femur

The cumulative percent revision at 13 years for unipolar monoblock when undertaken for fractured neck of femur is 8.9% (Table HP6 and Figure HP5).

The main reason for revision is loosening/lysis (45.3%), followed by fracture (19.9%) and prosthesis dislocation (11.1%) (Table HP7). The majority of unipolar monoblock hip replacements are revised to a total hip replacement (60.7%). Revision to another unipolar hip replacement (femoral component only) has occurred in 18.1% of revisions (Table HP8).

Age and femoral stem fixation are risk factors for revision. The rate of revision decreases with increasing age (Table HP9 and Figure HP6). There is no difference in the outcome between males and females (Table HP10 and Figure HP7).

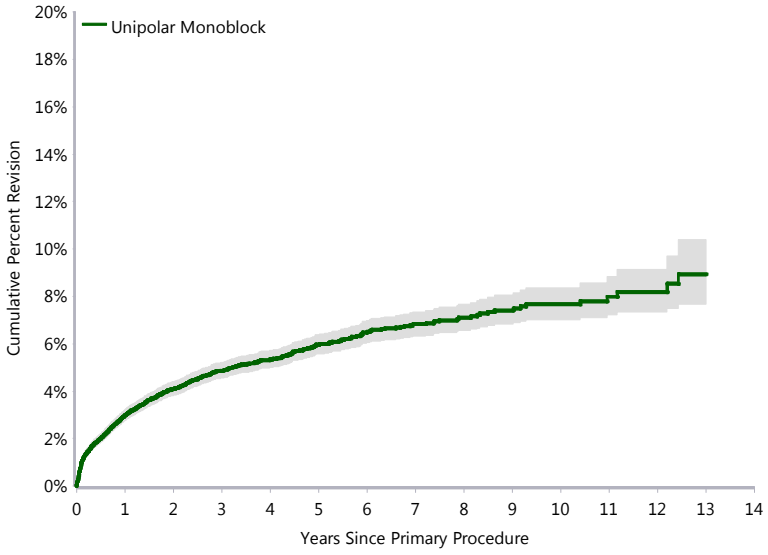
In the first one and a half years, cementless fixation has a higher rate of revision, with no difference after this time (Table HP11 and Figure HP8).

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 cementless 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 HP11 and Figure HP9).

Table HP6 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	987	26110	3.0 (2.8, 3.2)	4.9 (4.5, 5.2)	6.0 (5.6, 6.4)	6.8 (6.3, 7.3)	7.7 (7.0, 8.4)	8.9 (7.7, 10.4)

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	26110	15647	8838	4678	2438	807	149

Table HP7 Primary Unipolar Monoblock Hip Replacement by Reason for Revision (Primary Diagnosis Fractured NOF)

Reason for Revision	Number	Percent
Loosening/Lysis	447	45.3
Fracture	196	19.9
Prosthesis Dislocation	110	11.1
Infection	98	9.9
Pain	71	7.2
Chondrolysis/Acetab. Erosion	42	4.3
Malposition	11	1.1
Other	12	1.2
TOTAL	**987**	**100.0**

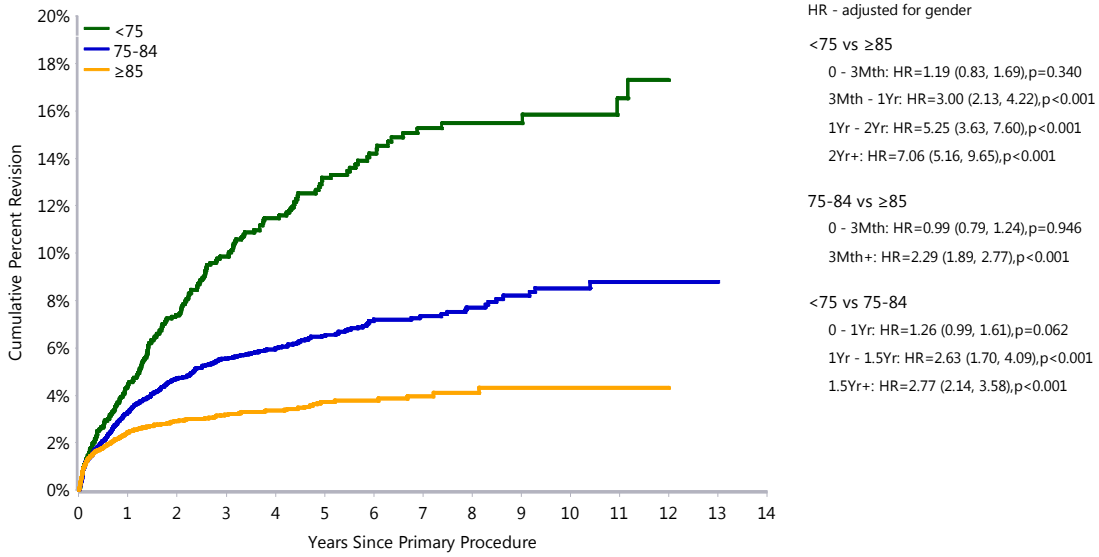
Table HP8 Primary Unipolar Monoblock Hip Replacement by Type of Revision (Primary Diagnosis Fractured NOF)

Type of Revision	Number	Percent
THR (Femoral/Acetabular)	599	60.7
Femoral Component	179	18.1
Bipolar Head and Femoral	94	9.5
Removal of Prostheses	49	5.0
Cement Spacer	41	4.2
Minor Components	16	1.6
Reinsertion of Components	5	0.5
Insert Only	1	0.1
Cement Only	1	0.1
Other	2	0.2
TOTAL	**987**	**100.0**

Table HP9 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	208	2270	4.4 (3.6, 5.5)	9.9 (8.5, 11.5)	13.2 (11.4, 15.1)	15.3 (13.3, 17.5)	15.8 (13.7, 18.3)	
75-84	447	9911	3.3 (2.9, 3.7)	5.6 (5.0, 6.1)	6.5 (5.9, 7.2)	7.3 (6.6, 8.1)	8.5 (7.5, 9.6)	8.8 (7.7, 10.0)
≥85	332	13929	2.4 (2.2, 2.7)	3.2 (2.8, 3.6)	3.7 (3.3, 4.2)	4.0 (3.5, 4.5)	4.3 (3.6, 5.1)	
TOTAL	**987**	**26110**						

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

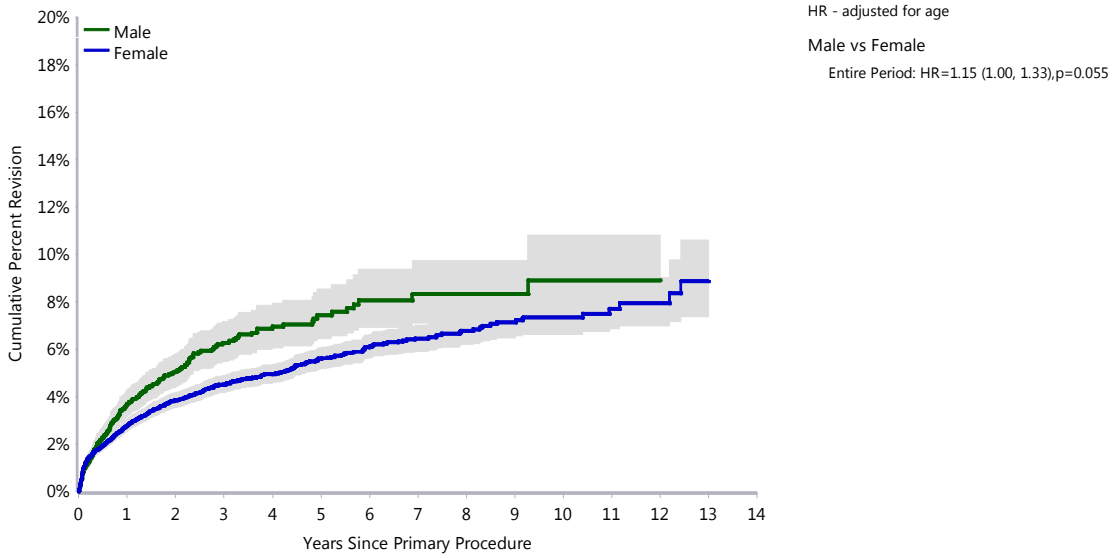


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
<75	2270	1530	1009	655	418	174	37
75-84	9911	6382	3872	2245	1236	424	78
≥85	13929	7735	3957	1778	784	209	34

Table HP10 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	256	6973	3.7 (3.2, 4.3)	6.3 (5.5, 7.2)	7.4 (6.4, 8.5)	8.3 (7.1, 9.7)	8.9 (7.3, 10.8)	
Female	731	19137	2.8 (2.5, 3.1)	4.5 (4.2, 4.9)	5.6 (5.2, 6.1)	6.4 (5.9, 7.0)	7.3 (6.6, 8.1)	8.9 (7.4, 10.6)
TOTAL	**987**	**26110**						

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

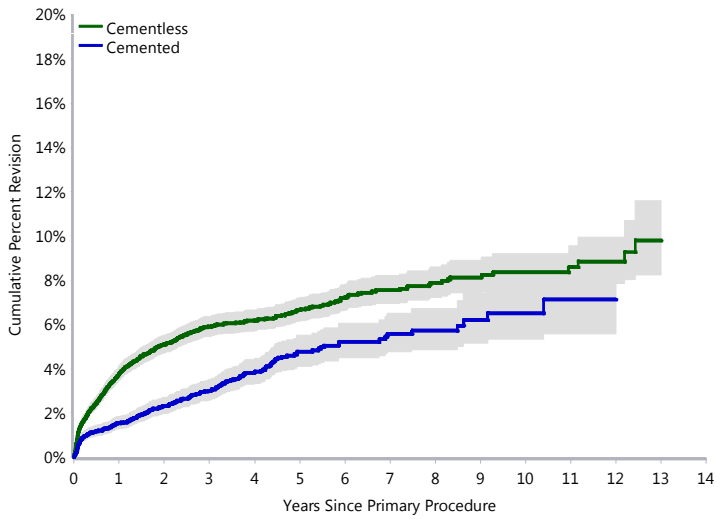


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male	6973	3264	1487	687	352	117	28
Female	19137	12383	7351	3991	2086	690	121

Table HP11 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	**749**	**16931**	**3.8 (3.5, 4.1)**	**5.9 (5.5, 6.4)**	**6.7 (6.2, 7.2)**	**7.5 (6.9, 8.2)**	**8.4 (7.6, 9.2)**	**9.8 (8.2, 11.6)**
Austin-Moore Cementless	702	16381	3.7 (3.4, 4.0)	5.8 (5.3, 6.2)	6.4 (5.9, 7.0)	7.3 (6.7, 8.0)	8.0 (7.3, 8.9)	
Thompson Cementless	47	550	6.7 (4.7, 9.5)	9.6 (7.0, 13.1)	12.8 (9.3, 17.5)	13.7 (9.9, 18.7)		
Cemented	**238**	**9179**	**1.5 (1.3, 1.8)**	**3.0 (2.6, 3.5)**	**4.8 (4.1, 5.5)**	**5.6 (4.8, 6.5)**	**6.5 (5.3, 7.9)**	
Austin-Moore Cemented	16	882	1.2 (0.6, 2.5)	3.1 (1.8, 5.4)	4.3 (2.5, 7.7)	4.3 (2.5, 7.7)		
ETS Cemented	55	2485	1.5 (1.0, 2.1)	2.6 (1.9, 3.5)	3.8 (2.7, 5.2)	5.7 (3.8, 8.4)		
Thompson Cemented	167	5812	1.6 (1.3, 2.0)	3.2 (2.7, 3.8)	5.2 (4.4, 6.2)	5.8 (4.8, 6.9)	6.9 (5.6, 8.6)	
TOTAL	**987**	**26110**						

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



HR - adjusted for age and gender

Cementless vs Cemented

0 - 3Mth: HR=1.91 (1.48, 2.45),p<0.001

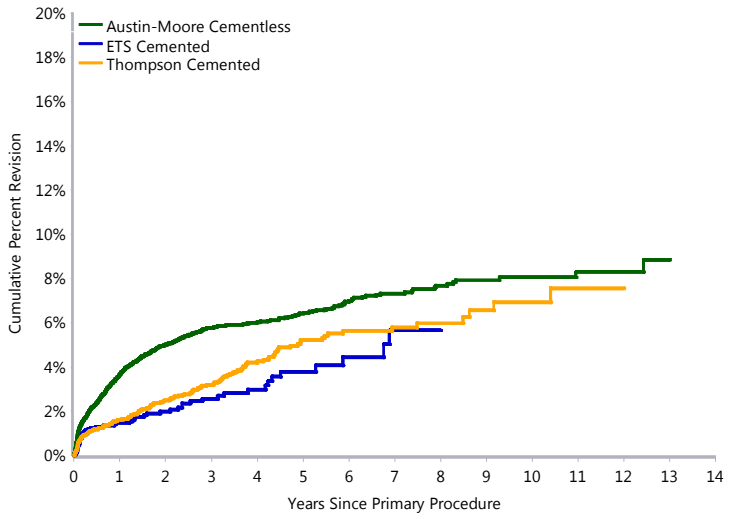
3Mth - 9Mth: HR=4.30 (2.78, 6.64),p<0.001

9Mth - 1.5Yr: HR=2.35 (1.62, 3.40),p<0.001

1.5Yr+: HR=0.94 (0.73, 1.20),p=0.606

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cementless	16931	9928	5685	3108	1669	610	114
Cemented	9179	5719	3153	1570	769	197	35

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



HR - adjusted for age and gender

Austin-Moore Cementless vs ETS Cemented

Entire Period: HR=2.08 (1.58, 2.74),p<0.001

Thompson Cemented vs ETS Cemented

Entire Period: HR=1.30 (0.96, 1.77),p=0.089

Austin-Moore Cementless vs Thompson Cemented

0 - 3Mth: HR=1.70 (1.29, 2.23),p<0.001

3Mth - 9Mth: HR=3.57 (2.29, 5.56),p<0.001

9Mth - 1Yr: HR=2.87 (1.50, 5.49),p=0.001

1Yr - 1.5Yr: HR=1.90 (1.16, 3.10),p=0.010

1.5Yr - 2.5Yr: HR=1.46 (0.93, 2.28),p=0.097

2.5Yr+: HR=0.60 (0.43, 0.84),p=0.002

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Austin-Moore Cementless	16381	9585	5483	3001	1611	588	107
ETS Cemented	2485	1536	827	371	141	8	0
Thompson Cemented	5812	3717	2101	1091	577	182	34

Unipolar Modular

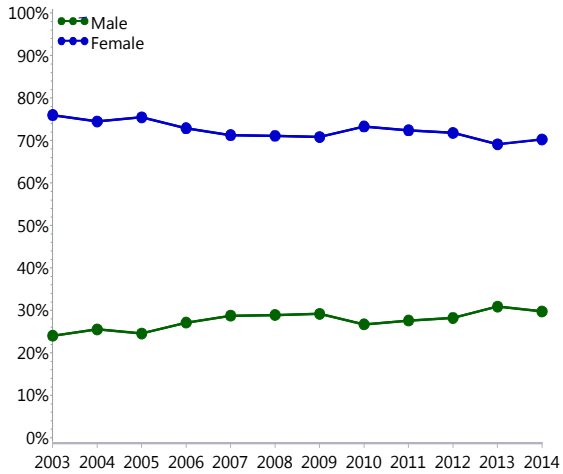
Demographics

There have been 29,411 unipolar modular procedures reported to the Registry. This is an additional 3,539 procedures compared to the previous report.

In 2014, the number of unipolar modular procedures increased by 2.8% compared to 2013 and 412.5% since 2003.

Fractured neck of femur is the principal diagnosis for primary unipolar modular hip replacement (94.4%).

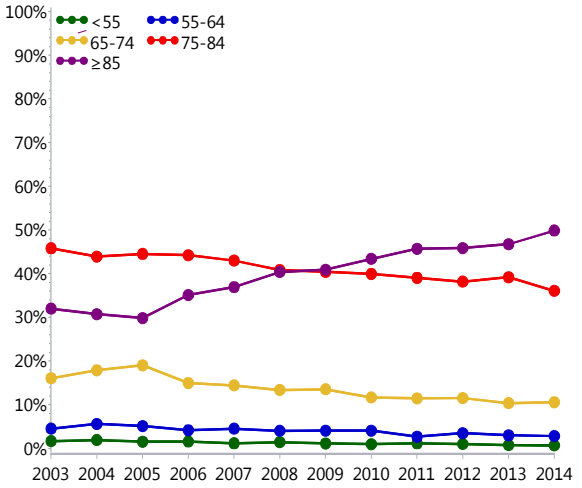
Figure HP10 Primary Unipolar Modular Hip Replacement by Gender



The majority of patients are female (71.8%) and aged 75 years or older (82.3%). The proportion of patients aged 85 years or older has increased from 32.0% in 2003 to 49.9% in 2014 (Figure HP10 and Figure HP11).

Overall, there have been 191 unipolar modular head and stem combinations recorded by the Registry. The 10 most frequently used unipolar modular head prostheses and femoral stems are listed in Table HP12 and Table HP13.

Figure HP11 Primary Unipolar Modular Hip Replacement by Age



In 2014, 16 different unipolar modular head prostheses were used. The Unitrax head was the most frequent (46.5%). The 10 most used unipolar modular head prostheses account for 99.6% of all primary unipolar modular hip procedures.

There were 46 different stem prostheses used in 2014, an increase from 36 in 2013. The most frequently used stem in 2014 was the Exeter V40 stem (44.9%). The 10 most used femoral stems account for 93.2% of all primary unipolar modular hip procedures.

Table HP12 10 Most Used Unipolar Head Prostheses in Primary Unipolar Modular Hip Replacement

2003		2011		2012		2013		2014	
N	Model	N	Model	N	Model	N	Model	N	Model
217	Unipolar (Zimmer)	1319	Unitrax	1339	Unitrax	1466	Unitrax	1588	Unitrax
193	Unitrax	773	Unipolar (S&N)	947	Unipolar (S&N)	957	Unipolar (S&N)	943	Unipolar (S&N)
127	Unipolar (S&N)	627	Unipolar (Zimmer)	534	Unipolar (Zimmer)	572	Unipolar (Zimmer)	527	Unipolar (Zimmer)
64	Unipolar (Mathys)	153	Metasul	155	Metasul	124	Cathcart	159	Cathcart
46	Elite	146	Cathcart	113	Cathcart	71	Unipolar (Corin)	57	Pharo
16	Ultima	115	U2	92	U2	52	Metasul	52	Unipolar (Corin)
1	Metasul	73	Unipolar (Corin)	62	Unipolar (Corin)	27	Pharo	35	Unipolar (JRI)
1	Optimom	42	Unipolar (Lima)	27	Unipolar (Lima)	17	Unipolar (Lima)	24	Unipolar (Lima)
1	Unipolar (Sulzer)	25	Conserve	16	Pharo	8	FMP	13	FMP
		13	Femoral (JRI)	11	Conserve	8	Femoral (JRI)	3	Endo II
10 Most Used									
666	(9) 100.0%	3286	(10) 99.1%	3296	(10) 99.4%	3302	(10) 99.4%	3401	(10) 99.6%
Remainder									
0	(0) 0%	29	(12) 0.9%	21	(10) 0.6%	19	(8) 0.6%	12	(6) 0.4%
TOTAL									
666	(9) 100.0%	3315	(22) 100.0%	3317	(20) 100.0%	3321	(18) 100.0%	3413	(16) 100.0%

Table HP13 10 Most Used Femoral Stem Prostheses in Primary Unipolar Modular Hip Replacement

2003		2011		2012		2013		2014	
N	Model	N	Model	N	Model	N	Model	N	Model
180	Exeter V40	1265	Exeter V40	1299	Exeter V40	1428	Exeter V40	1534	Exeter V40
111	Alloclassic	582	CPT	583	CPT	566	CPT	556	CPCS
91	CPT	332	CPCS	480	CPCS	515	CPCS	476	CPT
70	Spectron EF	277	Spectron EF	239	Spectron EF	181	SL-Plus	183	Spectron EF
49	Fullfix	163	Alloclassic	158	SL-Plus	178	Spectron EF	122	SL-Plus
38	SL-Plus	130	Corail	92	E2	80	Corail	86	C-Stem AMT
33	Elite Plus	113	E2	91	Corail	69	Metafix	73	Corail
18	Basis	81	SL-Plus	69	Alloclassic	55	Basis	56	Pharo
15	CCA	58	Basis	57	Metafix	45	C-Stem AMT	52	Metafix
15	Thompson Modular	52	Metafix	40	Basis	42	Alloclassic	44	Omnifit
10 Most Used									
620	(10) 93.1%	3053	(10) 92.1%	3108	(10) 93.7%	3159	(10) 95.1%	3182	(10) 93.2%
Remainder									
46	(13) 6.9%	262	(42) 7.9%	209	(42) 6.3%	162	(26) 4.9%	231	(36) 6.8%
TOTAL									
666	(23) 100.0%	3315	(52) 100.0%	3317	(52) 100.0%	3321	(36) 100.0%	3413	(46) 100.0%

Outcome for all Diagnoses

The Registry has recorded 996 revisions of primary unipolar modular hip replacement.

The main reasons for revision are prosthesis dislocation (20.0%), infection (18.7%), fracture (15.8%) and loosening/lysis (15.5%) (Table HP14).

The majority of revisions are acetabular only revisions (45.1%), followed by THR (femoral/acetabular) revisions (18.6%) (Table HP15).

The cumulative percent revision of unipolar modular stem/head prostheses with more than 100 procedures are detailed in Table HP16.

Table HP14 Primary Unipolar Modular Hip Replacement by Reason for Revision

Reason for Revision	Number	Percent
Prosthesis Dislocation	199	20.0
Infection	186	18.7
Fracture	157	15.8
Loosening/Lysis	154	15.5
Chondrolysis/Acetab. Erosion	133	13.4
Pain	127	12.8
Malposition	3	0.3
Other	37	3.7
TOTAL	**996**	**100.0**

Table HP15 Primary Unipolar Modular Hip Replacement by Type of Revision

Type of Revision	Number	Percent
Acetabular Component	449	45.1
THR (Femoral/Acetabular)	185	18.6
Femoral Component	124	12.4
Head Only	111	11.1
Cement Spacer	41	4.1
Minor Components	32	3.2
Bipolar Head and Femoral	23	2.3
Removal of Prostheses	22	2.2
Bipolar Only	5	0.5
Reinsertion of Components	3	0.3
Cement Only	1	0.1
TOTAL	**996**	**100.0**

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

Table HP16 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	C-Stem AMT	3	183	2.1 (0.7, 6.3)					
Cathcart	Corail	62	1151	3.9 (2.8, 5.3)	6.2 (4.7, 8.1)	7.2 (5.5, 9.5)	10.2 (7.4, 13.9)		
Endo II	Taperloc	5	101	5.2 (2.2, 12.0)	5.2 (2.2, 12.0)				
Femoral (JRI)	Furlong LOL	10	109	8.4 (4.0, 16.9)					
Metasul	Alloclassic	13	343	2.5 (1.3, 5.0)	3.8 (2.1, 6.7)	4.6 (2.5, 8.4)			
Metasul	CPT	3	215	1.6 (0.5, 4.9)	1.6 (0.5, 4.9)				
Pharo	Pharo	3	116	1.9 (0.5, 7.3)					
U2	E2	2	230	0.0 (0.0, 0.0)	2.2 (0.5, 9.2)				
Ultima	Thompson Modular	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	10	347	2.2 (1.0, 4.7)	2.9 (1.3, 6.1)				
Unipolar (Corin)	Taper Fit	17	306	2.2 (1.0, 4.8)	5.7 (3.3, 9.7)	7.3 (4.4, 12.1)	8.5 (5.0, 14.0)		
Unipolar (Corin)	Tri-Fit	8	288	1.5 (0.6, 4.0)	2.7 (1.2, 5.9)	2.7 (1.2, 5.9)	4.9 (2.3, 10.5)		
Unipolar (Mathys)	CCA	9	357	1.0 (0.3, 3.0)	2.6 (1.2, 5.3)	2.6 (1.2, 5.3)	3.5 (1.7, 7.4)		
Unipolar (Mathys)	Fullfix	8	226	1.5 (0.5, 4.7)	2.7 (1.1, 6.5)	2.7 (1.1, 6.5)	6.1 (3.0, 12.5)		
Unipolar (Plus)	SL-Plus	8	193	2.2 (0.8, 5.8)	3.6 (1.6, 8.0)	4.6 (2.2, 9.6)	6.1 (2.9, 12.5)		
Unipolar (S&N)	Basis	23	559	2.1 (1.1, 3.8)	3.4 (2.0, 5.8)	7.5 (4.8, 11.6)	8.2 (5.3, 12.6)		
Unipolar (S&N)	CPCS	94	3587	1.9 (1.5, 2.5)	3.2 (2.6, 4.0)	4.1 (3.3, 5.2)	5.3 (4.0, 7.0)		
Unipolar (S&N)	Platform	5	110	4.1 (1.5, 10.5)	4.1 (1.5, 10.5)	4.1 (1.5, 10.5)			
Unipolar (S&N)	SL-Plus	34	953	2.2 (1.4, 3.5)	4.5 (3.1, 6.7)	5.1 (3.4, 7.6)	6.7 (4.3, 10.3)		
Unipolar (S&N)	Spectron EF	78	2562	1.6 (1.1, 2.2)	3.0 (2.3, 3.9)	4.1 (3.2, 5.3)	5.3 (4.0, 6.9)	8.3 (5.8, 11.8)	
Unipolar (Zimmer)	Alloclassic	54	1167	3.1 (2.2, 4.4)	4.4 (3.3, 5.9)	5.8 (4.4, 7.7)	6.9 (5.1, 9.2)	6.9 (5.1, 9.2)	
Unipolar (Zimmer)	CPT	130	4122	1.9 (1.5, 2.4)	3.6 (3.0, 4.4)	5.0 (4.1, 6.2)	6.7 (5.3, 8.4)	7.5 (5.6, 10.2)	
Unipolar (Zimmer)	VerSys	3	166	2.6 (0.8, 8.1)	2.6 (0.8, 8.1)				
Unitrax	Accolade I	7	123	0.9 (0.1, 6.0)	6.8 (3.1, 14.5)				
Unitrax	Exeter V40	326	10228	1.8 (1.5, 2.1)	3.6 (3.1, 4.0)	5.4 (4.7, 6.1)	7.2 (6.2, 8.3)	9.6 (7.9, 11.8)	
Unitrax	Omnifit	7	245	2.9 (1.3, 6.4)	3.6 (1.7, 7.5)				
Other (165)		73	1291	3.9 (2.9, 5.2)	6.1 (4.7, 7.9)	7.9 (6.1, 10.1)	10.4 (7.9, 13.5)		
TOTAL		**996**	**29411**						

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

Outcome for Fractured Neck of Femur

The cumulative percent revision at 13 years for unipolar modular hip replacement when undertaken for fractured neck of femur is 9.5% (Table HP17 and Figure HP12).

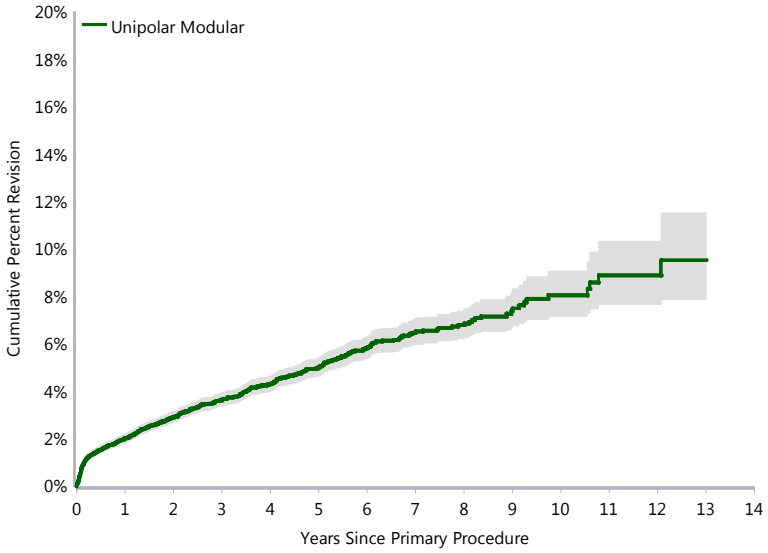
Age, gender and femoral stem fixation are risk factors for revision. The rate of revision decreases with increasing age (Table HP18 and Figure HP13). Males have a higher rate of revision in the first 1.5 years (Table HP19 and Figure HP14).

Cementless fixation has a higher rate of revision in the first nine months, with no difference after this time (Table HP20 and Figure HP15). The cumulative incidence of revision for loosening/lysis and fracture is higher for cementless compared to cemented fixation (Figure HP16).

Table HP17 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	912	27760	2.0 (1.8, 2.2)	3.6 (3.4, 3.9)	5.0 (4.7, 5.4)	6.5 (6.0, 7.1)	8.1 (7.2, 9.1)	9.5 (7.9, 11.5)

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

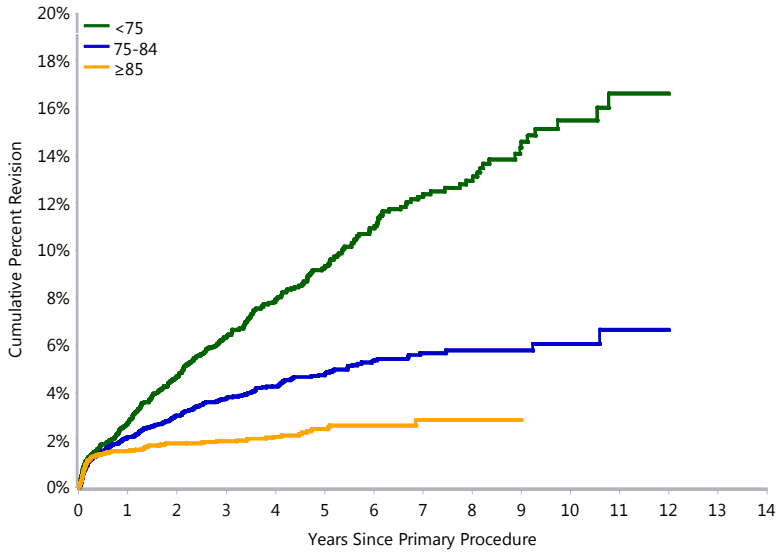


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Unipolar Modular	27760	18557	10255	5072	2221	469	65

Table HP18 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	345	4794	2.7 (2.3, 3.3)	6.4 (5.6, 7.2)	9.3 (8.3, 10.4)	12.4 (11.0, 13.9)	15.5 (13.5, 17.7)	
75-84	374	11226	2.1 (1.9, 2.4)	3.7 (3.4, 4.2)	4.8 (4.3, 5.3)	5.7 (5.0, 6.4)	6.1 (5.2, 7.0)	
≥85	193	11740	1.5 (1.3, 1.8)	2.0 (1.7, 2.3)	2.5 (2.1, 2.9)	2.9 (2.3, 3.6)		
TOTAL	**912**	**27760**						

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=1.06 (0.78, 1.43),p=0.708

3Mth - 2Yr: HR=5.61 (4.07, 7.73),p<0.001

2Yr+: HR=9.51 (6.77, 13.36),p<0.001

75-84 vs ≥85

0 - 3Mth: HR=0.92 (0.72, 1.18),p=0.522

3Mth+: HR=3.22 (2.42, 4.28),p<0.001

<75 vs 75-84

0 - 1.5Yr: HR=1.43 (1.17, 1.74),p<0.001

1.5Yr - 4.5Yr: HR=2.34 (1.81, 3.03),p<0.001

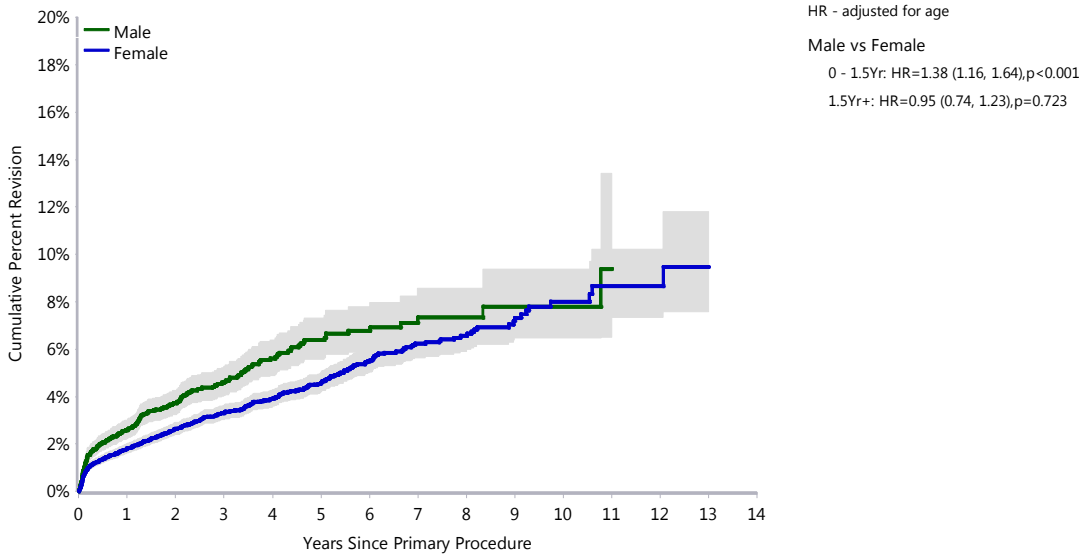
4.5Yr+: HR=4.03 (2.61, 6.24),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
<75	4794	3565	2316	1419	752	209	33
75-84	11226	8005	4677	2420	1093	224	28
≥85	11740	6987	3262	1233	376	36	4

Table HP19 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	277	7822	2.6 (2.2, 3.0)	4.6 (4.1, 5.3)	6.4 (5.6, 7.3)	7.3 (6.3, 8.6)	7.8 (6.5, 9.4)	
Female	635	19938	1.8 (1.6, 2.0)	3.3 (3.0, 3.6)	4.6 (4.2, 5.0)	6.2 (5.6, 6.9)	8.0 (7.0, 9.2)	9.5 (7.6, 11.8)
TOTAL	**912**	**27760**						

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

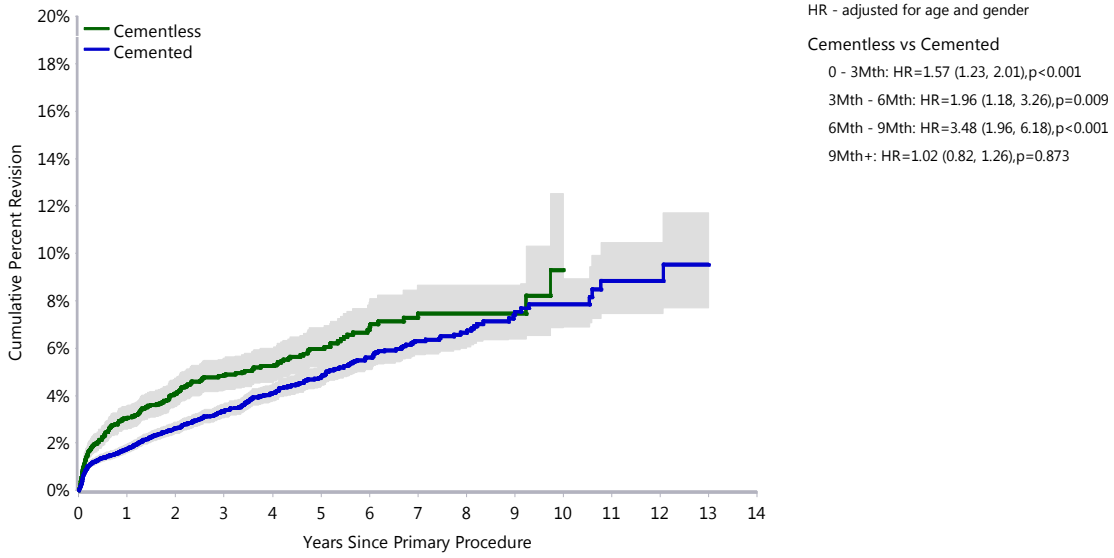


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male	7822	4516	2205	1036	403	86	13
Female	19938	14041	8050	4036	1818	383	52

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

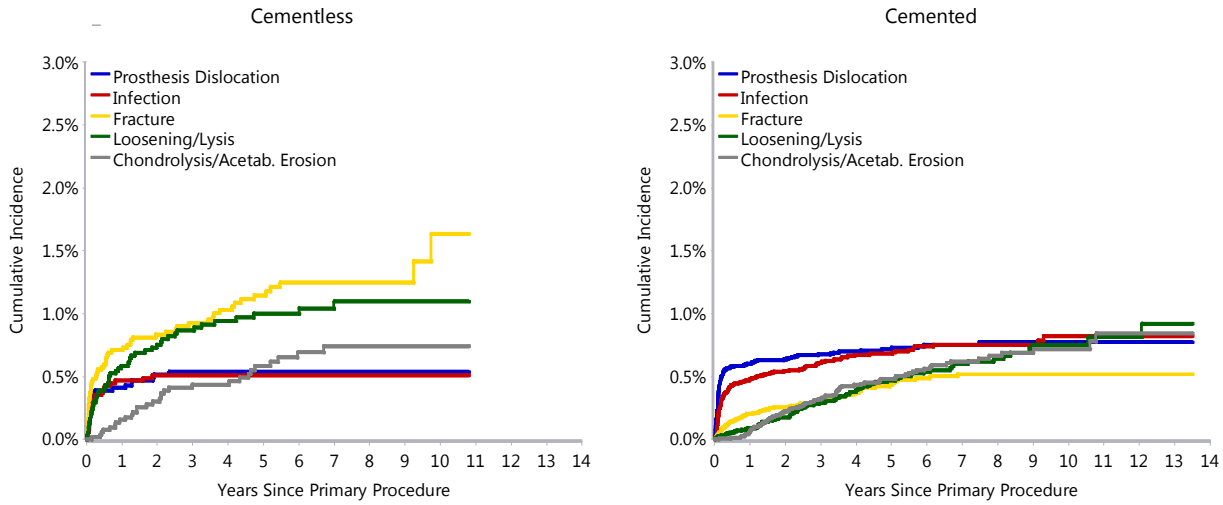
Femoral Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cementless	239	5435	3.0 (2.6, 3.6)	4.9 (4.2, 5.6)	6.0 (5.2, 6.9)	7.4 (6.4, 8.7)	9.3 (6.9, 12.5)	
Cemented	673	22325	1.8 (1.6, 2.0)	3.3 (3.1, 3.6)	4.8 (4.4, 5.2)	6.3 (5.7, 7.0)	7.8 (6.9, 8.9)	9.5 (7.7, 11.7)
TOTAL	**912**	**27760**						

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	5435	3773	2314	1250	529	75	3
Cemented	22325	14784	7941	3822	1692	394	62

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



Bipolar

Demographics

There have been 15,057 bipolar procedures reported to the Registry. This is an additional 1,360 procedures compared to the previous report.

There has been an increase in the number of bipolar procedures undertaken each year since 2010, with 21.7% more procedures in 2014 compared to 2013. However, the total number of bipolar procedures has decreased by 1.7% since 2003.

Fractured neck of femur is the principal diagnosis for bipolar hip replacement (90.3%).

The majority of patients are female (72.3%) and aged 75 years or older (76.7%). The proportion of patients aged 85 years or older has increased from 26.0% in 2003 to 50.0% in 2014 (Figure HP17 and Figure HP18).

Figure HP17 Primary Bipolar Hip Replacement by Gender

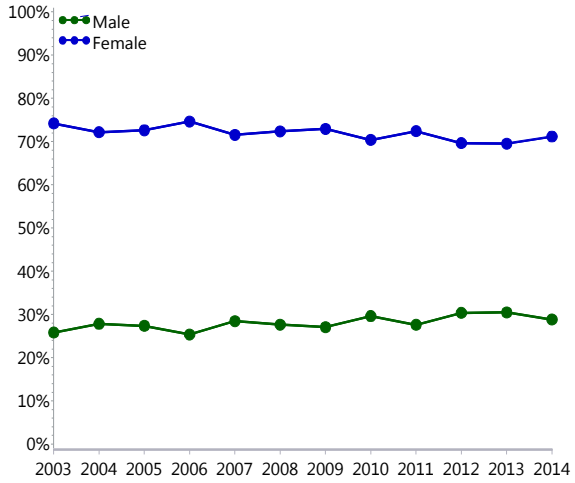
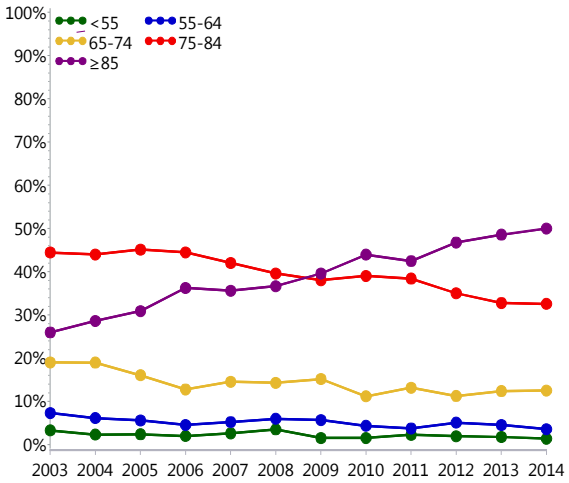


Figure HP18 Primary Bipolar Hip Replacement by Age



Overall, there have been 245 bipolar head and stem combinations reported to the Registry. In 2014, there were 14 different bipolar head and 47 different stem prostheses used.

In 2014, the UHR remains the most frequently used bipolar head (57.2%) and the Exeter V40 the most frequently used femoral stem (53.9%). The 10 most used bipolar head prostheses account for 99.3% of all bipolar hip procedures. The 10 most used femoral stems account for 88.9% of all bipolar hip procedures (Table HP21 and Table HP22).

Table HP21 10 Most Used Bipolar Head Prostheses in Primary Bipolar Hip Replacement

2003		2011		2012		2013		2014	
N	Model	N	Model	N	Model	N	Model	N	Model
760	UHR	433	UHR	523	UHR	592	UHR	754	UHR
140	Hastings	138	Multipolar Bipolar	147	Tandem	153	Tandem	199	Multipolar Bipolar
115	Convene	113	Tandem	104	Multipolar Bipolar	128	Multipolar Bipolar	113	Tandem
91	Bipolar (Zimmer)	71	Self-Centering	57	Self-Centering	45	Bipolar (Lima)	86	Self-Centering
87	Self-Centering	57	Hastings	40	Bipolar (Lima)	38	Hastings	58	Bipolar (Medacta)
59	Multipolar Bipolar	31	Bipolar (Lima)	35	Hastings	35	Self-Centering	33	Hastings
39	Bipolar (Mathys)	30	Bipolar (Medacta)	27	Bipolar (Medacta)	34	Bipolar (Medacta)	27	Bipolar (Lima)
19	Bipolar (Lima)	25	Ringloc	23	Moonstone	22	Ringloc	22	Ringloc
19	Ringloc	23	Moonstone	17	Ringloc	8	Moonstone	13	AcuMatch L-Series
5	UHL	8	Bipolar (ISP)	3	Bipolar (Eska)	8	Pharo	4	Gladiator
10 Most Used									
1334	(10) 99.5%	929	(10) 99.4%	976	(10) 98.8%	1063	(10) 98.2%	1309	(10) 99.3%
Remainder									
7	(2) 0.5%	6	(3) 0.6%	12	(5) 1.2%	20	(7) 1.8%	9	(4) 0.7%
TOTAL									
1341	(12) 100.0%	935	(13) 100.0%	988	(15) 100.0%	1083	(17) 100.0%	1318	(14) 100.0%

Table HP22 10 Most Used Femoral Stem Prostheses in Primary Bipolar Hip Replacement

2003		2011		2012		2013		2014	
N	Model	N	Model	N	Model	N	Model	N	Model
630	Exeter V40	413	Exeter V40	458	Exeter V40	573	Exeter V40	710	Exeter V40
94	Elite Plus	85	CPT	95	CPCS	114	CPCS	164	CPT
75	Alloclassic	77	CPCS	66	Corail	104	CPT	86	Corail
65	CPCS	57	Corail	63	CPT	55	Corail	83	CPCS
61	C-Stem	28	Accolade I	53	Accolade I	28	Quadra-C	37	Accolade I
59	Omnifit	25	Quadra-C	27	C2	25	C2	25	Quadra-C
33	VerSys	22	Spectron EF	21	Basis	24	Basis	22	X-Acta
26	ABGII	21	Summit	21	Quadra-C	19	H-Max	17	H-Max
25	CCA	19	Alloclassic	19	Alloclassic	15	Accolade I	15	Alloclassic
25	Spectron EF	17	Hyperion	18	Hyperion	14	Alloclassic	13	C-Stem AMT
10 Most Used									
1093	(10) 81.5%	764	(10) 81.7%	841	(10) 85.1%	971	(10) 89.7%	1172	(10) 88.9%
Remainder									
248	(46) 18.5%	171	(34) 18.3%	147	(30) 14.9%	112	(33) 10.3%	146	(37) 11.1%
TOTAL									
1341	(56) 100.0%	935	(44) 100.0%	988	(40) 100.0%	1083	(43) 100.0%	1318	(47) 100.0%

Outcome for all Diagnoses

The Registry has recorded 521 revisions of primary bipolar hip replacement.

The main reasons for revision are fracture (23.8%), loosening/lysis (19.4%), infection (19.2%) and prosthesis dislocation (18.4%) (Table HP23).

The majority of revisions are acetabular only revisions (36.3%), followed by THR (femoral/acetabular) revisions (22.8%) and bipolar head and femoral revisions (13.4%) (Table HP24).

The cumulative percent revision of bipolar stem/head prosthesis combinations with more than 100 procedures are detailed in Table HP25.

Table HP23 Primary Bipolar Hip Replacement by Reason for Revision

Reason for Revision	Number	Percent
Fracture	124	23.8
Loosening/Lysis	101	19.4
Infection	100	19.2
Prosthesis Dislocation	96	18.4
Pain	41	7.9
Chondrolysis/Acetab. Erosion	38	7.3
Malposition	2	0.4
Other	19	3.6
TOTAL	**521**	**100.0**

Table HP24 Primary Bipolar Hip Replacement by Type of Revision

Type of Revision	Number	Percent
Acetabular Component	189	36.3
THR (Femoral/Acetabular)	119	22.8
Bipolar Head and Femoral	70	13.4
Bipolar Only	50	9.6
Femoral Component	29	5.6
Cement Spacer	28	5.4
Head Only	15	2.9
Removal of Prostheses	12	2.3
Minor Components	9	1.7
TOTAL	**521**	**100.0**

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

Table HP25 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 (Medacta)	Quadra-C	3	109	3.5 (1.1, 10.7)					
Bipolar (Zimmer)	Alloclassic	13	358	0.9 (0.3, 2.8)	2.3 (1.1, 4.9)	2.8 (1.4, 5.4)	3.4 (1.7, 6.6)	7.2 (4.0, 13.0)	
Centrax	Exeter	7	200	2.1 (0.8, 5.5)	2.8 (1.2, 6.5)	2.8 (1.2, 6.5)	2.8 (1.2, 6.5)	3.9 (1.7, 9.0)	
Convene	CPCS	16	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)	6.7 (4.0, 11.0)	
Convene	Spectron EF	8	123	2.6 (0.9, 8.0)	3.8 (1.4, 10.1)	6.6 (2.9, 14.4)	6.6 (2.9, 14.4)		
Hastings	C-Stem	10	208	2.5 (1.1, 5.9)	5.7 (3.1, 10.3)	5.7 (3.1, 10.3)	5.7 (3.1, 10.3)		
Hastings	Charnley	5	118	0.0 (0.0, 0.0)	2.6 (0.7, 10.1)	5.9 (2.2, 15.0)			
Hastings	Corail	13	355	3.3 (1.9, 6.0)	3.8 (2.2, 6.7)	3.8 (2.2, 6.7)	3.8 (2.2, 6.7)		
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	101	2.5 (0.6, 9.8)	2.5 (0.6, 9.8)				
Multipolar Bipolar	Alloclassic	6	156	3.5 (1.5, 8.3)	3.5 (1.5, 8.3)				
Multipolar Bipolar	CPT	20	685	2.8 (1.7, 4.6)	3.7 (2.3, 5.8)	3.7 (2.3, 5.8)	3.7 (2.3, 5.8)		
Multipolar Bipolar	VerSys	2	204	0.0 (0.0, 0.0)	1.8 (0.4, 6.9)	1.8 (0.4, 6.9)	1.8 (0.4, 6.9)		
Multipolar Bipolar	VerSys Heritage	10	275	1.7 (0.6, 4.5)	3.2 (1.5, 6.7)	4.0 (2.0, 8.1)	4.0 (2.0, 8.1)		
Ringloc	Mallory-Head	2	102	1.3 (0.2, 8.8)	1.3 (0.2, 8.8)				
Self-Centering	C-Stem	3	110	0.0 (0.0, 0.0)	1.2 (0.2, 8.2)	1.2 (0.2, 8.2)			
Self-Centering	Corail	10	290	3.5 (1.8, 6.6)	3.5 (1.8, 6.6)	3.5 (1.8, 6.6)			
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	10	113	2.1 (0.5, 8.0)					
Tandem	CPCS	25	1039	1.6 (1.0, 2.8)	2.9 (1.9, 4.4)	3.2 (2.1, 4.9)	4.2 (2.6, 6.6)		
Tandem	Spectron EF	6	150	2.2 (0.7, 6.7)	4.3 (1.8, 10.1)	5.7 (2.5, 12.5)			
UHR	ABGII	19	177	4.4 (2.1, 8.9)	5.1 (2.6, 10.1)	11.0 (6.5, 18.1)	13.9 (8.5, 22.4)		
UHR	Accolade I	12	287	3.1 (1.6, 6.2)	5.0 (2.7, 8.9)	5.0 (2.7, 8.9)			
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	169	6297	1.9 (1.6, 2.3)	2.9 (2.4, 3.4)	3.5 (3.0, 4.1)	4.1 (3.4, 4.9)	4.7 (3.9, 5.7)	
UHR	GMRS	7	105	3.1 (1.0, 9.4)	4.8 (1.8, 12.7)				
UHR	Omnifit	21	365	5.0 (3.2, 8.0)	5.4 (3.4, 8.4)	5.8 (3.7, 9.0)	7.1 (4.6, 10.9)	7.1 (4.6, 10.9)	
Other (218)		94	2043	2.9 (2.2, 3.8)	4.8 (3.8, 6.0)	5.4 (4.3, 6.7)	6.1 (4.9, 7.6)	8.3 (6.5, 10.6)	10.0 (6.8, 14.7)
TOTAL		**521**	**15057**						

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 6.9% (Table HP26 and Figure HP19).

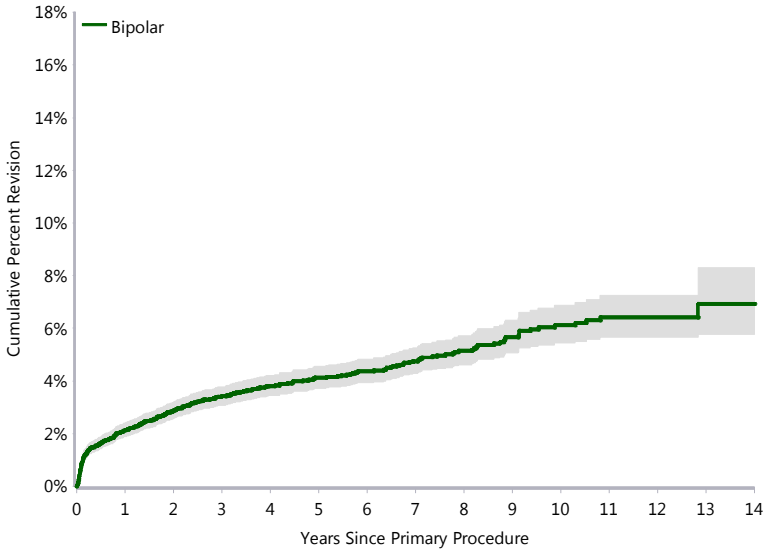
Age and femoral stem fixation are risk factors for revision. Patients aged less than 75 years have a higher rate of revision compared to the two older age groups (Table HP27 and Figure HP20). There is no difference in outcome between males and females (Table HP28 and Figure HP21).

Cementless fixation has a higher rate of revision compared to cemented fixation (Table HP29 and Figure HP22). The cumulative incidence of fracture for cementless fixation is higher than that for cemented fixation and continues to increase as time progresses (Figure HP23).

Table HP26 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	454	13598	2.1 (1.9, 2.4)	3.4 (3.1, 3.8)	4.1 (3.7, 4.6)	4.8 (4.3, 5.3)	6.1 (5.4, 6.9)	6.9 (5.8, 8.3)

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

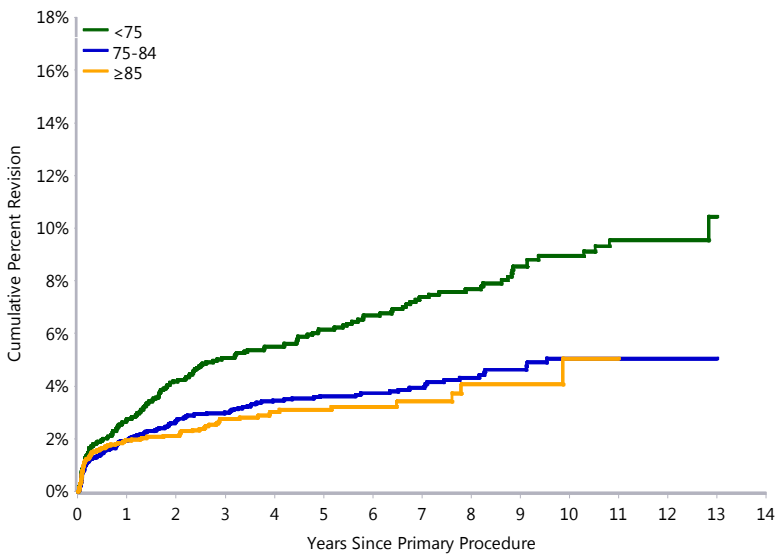


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Bipolar	13598	9713	6414	4262	2737	1155	153

Table HP27 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	170	2900	2.8 (2.2, 3.5)	5.1 (4.3, 6.1)	6.2 (5.2, 7.3)	7.4 (6.3, 8.7)	8.9 (7.6, 10.5)	10.4 (8.3, 13.0)
75-84	172	5626	2.0 (1.6, 2.4)	3.0 (2.5, 3.5)	3.6 (3.1, 4.3)	3.9 (3.3, 4.6)	5.1 (4.2, 6.1)	5.1 (4.2, 6.1)
≥85	112	5072	1.9 (1.6, 2.4)	2.7 (2.2, 3.4)	3.1 (2.5, 3.8)	3.4 (2.7, 4.3)	5.1 (3.2, 7.9)	
TOTAL	**454**	**13598**						

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



HR - adjusted for gender

<75 vs ≥85

0 - 1Yr: HR=1.46 (1.08, 1.98),p=0.014

1Yr - 1.5Yr: HR=2.82 (1.40, 5.68),p=0.003

1.5Yr+: HR=2.45 (1.72, 3.48),p<0.001

75-84 vs ≥85

Entire Period: HR=1.10 (0.87, 1.40),p=0.422

<75 vs 75-84

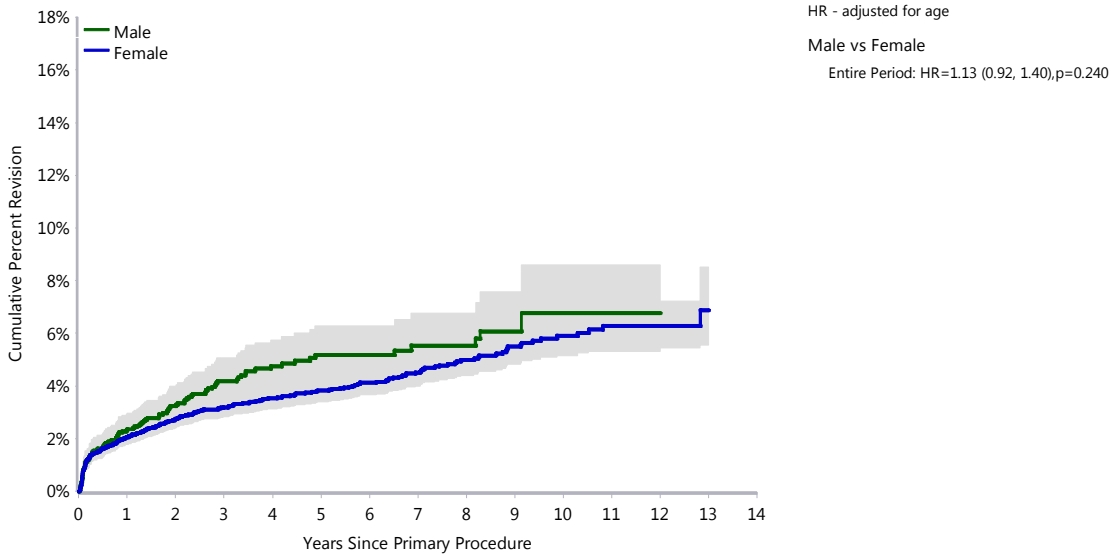
Entire Period: HR=1.72 (1.39, 2.13),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
<75	2900	2279	1693	1330	995	550	86
75-84	5626	4265	3002	2057	1328	516	65
≥85	5072	3169	1719	875	414	89	2

Table HP28 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	122	3683	2.4 (1.9, 3.0)	4.2 (3.4, 5.1)	5.2 (4.3, 6.3)	5.5 (4.5, 6.8)	6.8 (5.3, 8.6)	
Female	332	9915	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 (5.2, 6.7)	6.9 (5.5, 8.5)
TOTAL	**454**	**13598**						

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

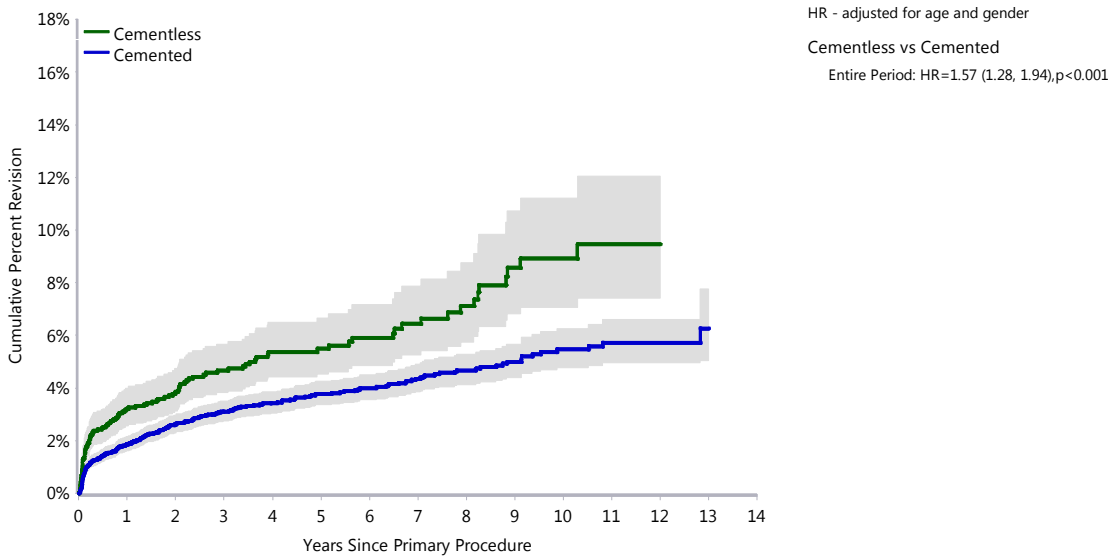


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Male	3683	2329	1326	794	489	204	22
Female	9915	7384	5088	3468	2248	951	131

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

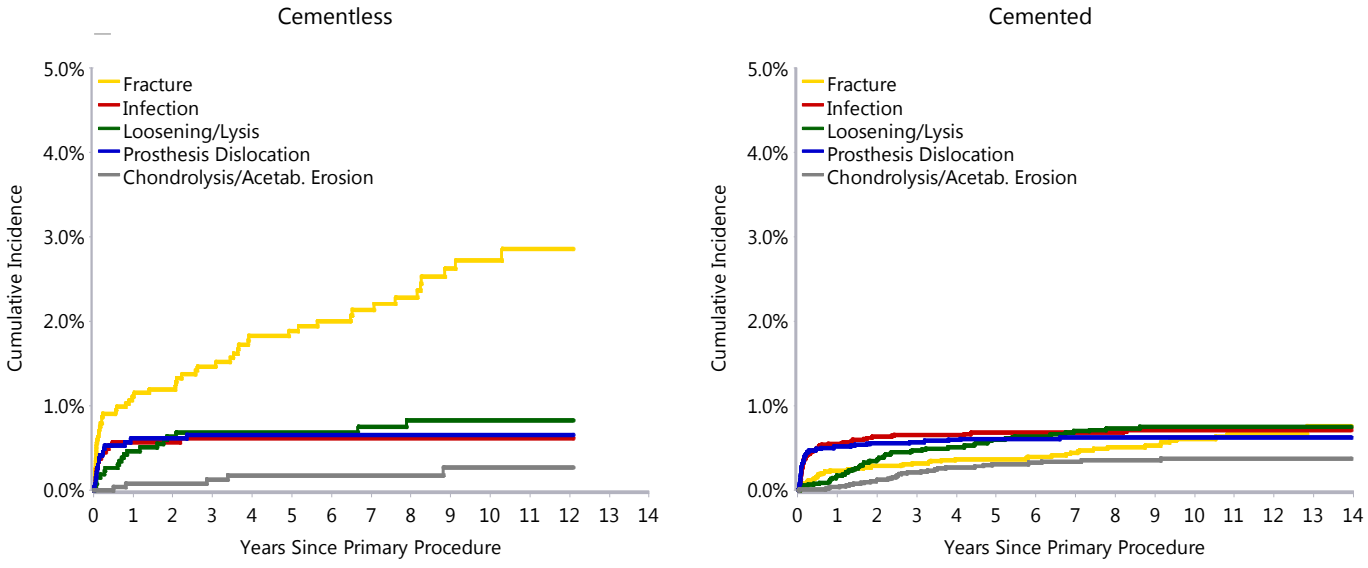
Femoral Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cementless	124	2658	3.2 (2.6, 4.0)	4.7 (3.8, 5.7)	5.5 (4.5, 6.7)	6.4 (5.3, 7.9)	8.9 (7.1, 11.2)	
Cemented	330	10940	1.9 (1.6, 2.2)	3.1 (2.8, 3.5)	3.8 (3.4, 4.3)	4.4 (3.9, 4.9)	5.5 (4.8, 6.3)	6.3 (5.1, 7.8)
TOTAL	**454**	**13598**						

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



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	13 Yrs
Cementless	2658	1878	1208	765	477	187	11
Cemented	10940	7835	5206	3497	2260	968	142

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.

Detailed information on Thrust Plate is available in the supplementary report 'The Outcome of Classes of Hip and Knee Prostheses No Longer Used' on the AOANJRR website aoanjrr.dmac.adelaide.edu.au/annual-reports-2015.

Use of Total Hip Replacement

The Registry has recorded 329,240 primary total hip replacement procedures. Of these, total conventional is the most common class (95.0%), followed by total resurfacing (4.9%). The Registry has recorded only a small number of thrust plate procedures and there have been no procedures recorded since 2012 (Table HT1).

Table HT1 Total Hip Replacement by Class

Total Hip Class	Number	Percent
Total Conventional	312828	95.0
Total Resurfacing	16154	4.9
Thrust Plate	258	0.1
TOTAL	**329240**	**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 14 years (Table HT2).

Detailed demographic information on primary total hip replacement is available in the supplementary report 'Demographics of Hip Arthroplasty' on the AOANJRR website aoanjrr.dmac.adelaide.edu.au/annual-reports-2015.

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	14 Yrs
Total Conventional	13222	312828	1.6 (1.6, 1.7)	2.8 (2.7, 2.8)	3.9 (3.9, 4.0)	5.2 (5.1, 5.3)	6.8 (6.7, 6.9)	9.5 (9.2, 9.9)
Total Resurfacing	1307	16154	1.8 (1.6, 2.0)	3.3 (3.1, 3.6)	5.2 (4.9, 5.6)	7.3 (6.9, 7.7)	10.0 (9.4, 10.5)	13.0 (11.5, 14.5)
Thrust Plate	15	258	0.8 (0.2, 3.1)	1.2 (0.4, 3.6)	4.1 (2.2, 7.5)	4.6 (2.6, 8.2)	6.9 (4.0, 11.7)	
TOTAL	**14544**	**329240**						

Primary Total Conventional Hip Replacement

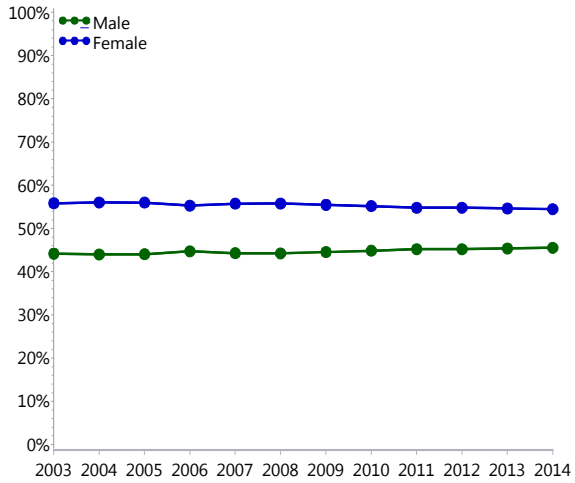
Demographics

There have been 312,828 total conventional hip procedures reported to the Registry, an additional 32,306 procedures compared to the previous report.

Osteoarthritis is the principal diagnosis (88.5%), followed by fractured neck of femur (4.1%), osteonecrosis (3.4%), developmental dysplasia (1.3%) and rheumatoid arthritis (1.1%).

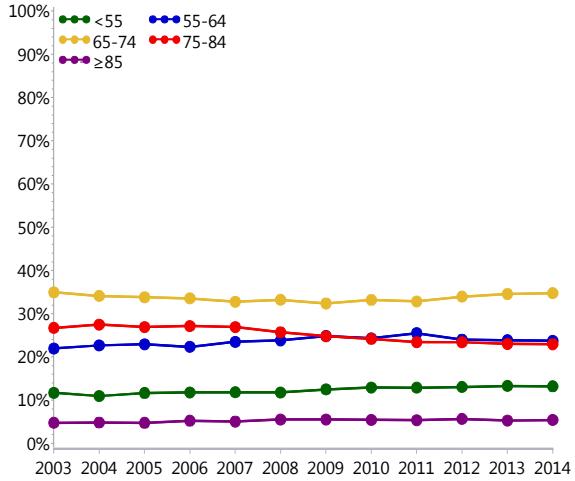
Total conventional hip replacement is more common in females (55.2%). This proportion has remained stable since 2003 (Figure HT1).

Figure HT1 Primary Total Conventional Hip Replacement by Gender



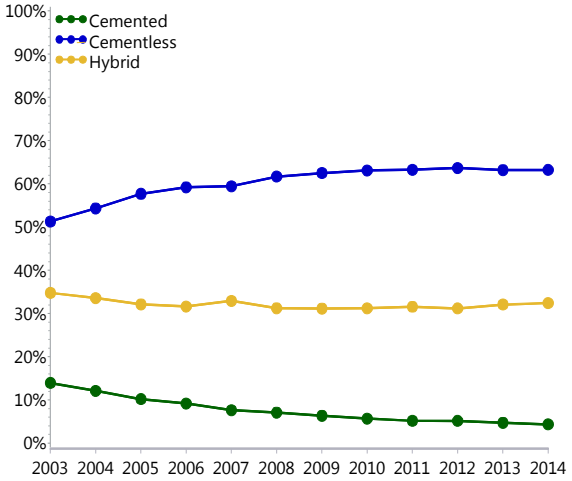
There has been minimal change in the proportion of patients aged 55-64 years (21.9% in 2003 to 23.7% in 2014) and younger than 55 years (11.7% in 2003 to 13.2% in 2014) (Figure HT2).

Figure HT2 Primary Total Conventional Hip Replacement by Age



The use of cementless fixation has increased from 51.3% in 2003 to 63.2% in 2014. Cement fixation has declined from 13.9% to 4.4% and hybrid fixation from 34.8% to 32.4% over the same period (Figure HT3).

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 2014, 67.3% 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 Table HT5 and Table HT6. In 2014, the 10 most used cemented stems accounted for 95.3% of procedures compared to 66.2% of cementless stems.

The Trident, Pinnacle and R3 remain the most frequently used acetabular prostheses for total conventional hip replacement. In 2014, 79.4% of total conventional hip procedures used acetabular components from the 10 most used list (Table HT4). Nine of the acetabular components in this list are cementless prostheses. The 10 most used cemented and cementless acetabular prostheses are listed separately in Table HT7 and Table HT8.

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

2003		2011		2012		2013		2014	
N	Model	N	Model	N	Model	N	Model	N	Model
3901	Exeter V40	6170	Exeter V40	6249	Exeter V40	6922	Exeter V40	7311	Exeter V40
1029	ABGII	4290	Corail	4440	Corail	4659	Corail	4971	Corail
1000	Synergy	1426	Quadra-H	1917	Quadra-H	2257	Quadra-H	2866	Quadra-H
819	Alloclassic	1241	CPT	1294	CPT	1460	CPT	1543	CPT
809	VerSys	1119	Secur-Fit	1082	Secur-Fit	1049	Polarstem	1180	Polarstem
780	Spectron EF	870	Synergy	770	Synergy	811	Secur-Fit	831	Anthology
713	Secur-Fit Plus	823	Accolade I	734	Polarstem	783	CPCS	711	CPCS
618	Omnifit	689	Anthology	680	Anthology	764	Accolade I	708	Taperloc
565	C-Stem	637	CPCS	657	CPCS	731	Synergy	707	Secur-Fit
485	S-Rom	576	M/L Taper Kinectiv	655	Accolade I	642	Anthology	566	Synergy
10 Most Used									
10719	(10) 62.8%	17841	(10) 66.8%	18478	(10) 66.9%	20078	(10) 68.0%	21394	(10) 67.3%
Remainder									
6354	(73) 37.2%	8852	(105) 33.2%	9128	(96) 33.1%	9439	(109) 32.0%	10385	(106) 32.7%
TOTAL									
17073	(83) 100.0%	26693	(115) 100.0%	27606	(106) 100.0%	29517	(119) 100.0%	31779	(116) 100.0%

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

2003		2011		2012		2013		2014	
N	Model	N	Model	N	Model	N	Model	N	Model
3986	Trident (Shell)	6222	Trident (Shell)	6201	Trident (Shell)	7011	Trident (Shell)	7251	Trident (Shell)
1748	Reflection (Shell)	5122	Pinnacle	5481	Pinnacle	5640	Pinnacle	6069	Pinnacle
1524	Trilogy	2659	R3	3023	R3	3336	R3	3392	R3
955	Vitalock	1410	Versafitcup CC	1837	Versafitcup CC	2132	Versafitcup CC	2773	Versafitcup CC
907	Duraloc	1317	Trilogy	1332	Continuum	1504	Continuum	1475	Continuum
827	ABGII	1245	Continuum	1126	Trilogy	1020	Trilogy	1299	Trinity
793	Allofit	775	Trident/Tritanium (Shell)	675	Allofit	776	Trinity	1084	Trilogy
729	Mallory-Head	749	Allofit	674	Trident/Tritanium (Shell)	643	Allofit	647	Exeter X3 Rimfit
539	Contemporary	684	DeltaMotion	597	DeltaMotion	625	Trident/Tritanium (Shell)	643	Trident/Tritanium (Shell)
537	Pinnacle	596	Reflection (Shell)	577	Exceed	563	Delta-TT	608	Allofit
10 Most Used									
12545	(10) 73.5%	20779	(10) 77.8%	21523	(10) 78.0%	23250	(10) 78.8%	25241	(10) 79.4%
Remainder									
4528	(68) 26.5%	5914	(71) 22.2%	6083	(61) 22.0%	6267	(69) 21.2%	6538	(77) 20.6%
TOTAL									
17073	(78) 100.0%	26693	(81) 100.0%	27606	(71) 100.0%	29517	(79) 100.0%	31779	(87) 100.0%

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

2003		2011		2012		2013		2014	
N	Model	N	Model	N	Model	N	Model	N	Model
3901	Exeter V40	6169	Exeter V40	6249	Exeter V40	6922	Exeter V40	7311	Exeter V40
780	Spectron EF	1241	CPT	1294	CPT	1460	CPT	1543	CPT
565	C-Stem	637	CPCS	657	CPCS	782	CPCS	710	CPCS
477	CPT	497	Spectron EF	426	Spectron EF	324	C-Stem AMT	370	C-Stem AMT
445	Elite Plus	305	C-Stem AMT	381	C-Stem AMT	316	Spectron EF	273	Spectron EF
358	MS 30	159	Omnifit	194	MS 30	245	Omnifit	235	MS 30
339	Omnifit	131	MS 30	172	Omnifit	164	MS 30	189	Quadra-C
321	Charnley	107	C-Stem	115	Quadra-C	118	Quadra-C	179	Omnifit
244	CPCS	104	E2	94	C-Stem	106	C-Stem	153	Evolve
123	Exeter	62	Quadra-C	89	E2	74	Absolut	114	Absolut
10 Most Used									
7553	(10) 91.5%	9412	(10) 96.6%	9671	(10) 97.0%	10511	(10) 97.1%	11077	(10) 95.3%
Remainder									
702	(37) 8.5%	332	(28) 3.4%	300	(29) 3.0%	315	(38) 2.9%	550	(36) 4.7%
TOTAL									
8255	(47) 100.0%	9744	(38) 100.0%	9971	(39) 100.0%	10826	(48) 100.0%	11627	(46) 100.0%

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

2003		2011		2012		2013		2014	
N	Model	N	Model	N	Model	N	Model	N	Model
1027	ABGII	4289	Corail	4439	Corail	4659	Corail	4969	Corail
979	Synergy	1424	Quadra-H	1917	Quadra-H	2256	Quadra-H	2865	Quadra-H
819	Alloclassic	1119	Secur-Fit	1082	Secur-Fit	1048	Polarstem	1180	Polarstem
739	VerSys	870	Synergy	770	Synergy	811	Secur-Fit	830	Anthology
712	Secur-Fit Plus	823	Accolade I	734	Polarstem	764	Accolade I	708	Taperloc
484	S-Rom	689	Anthology	679	Anthology	729	Synergy	706	Secur-Fit
482	Secur-Fit	576	M/L Taper Kinectiv	653	Accolade I	642	Anthology	566	Synergy
375	Corail	560	Alloclassic	631	Taperloc	604	Taperloc	528	M/L Taper
333	Accolade I	505	Taperloc	515	M/L Taper Kinectiv	448	Alloclassic	517	Accolade II
329	Mallory-Head	423	Summit	470	Alloclassic	433	Summit	473	Summit
10 Most Used									
6279	(10) 71.2%	11278	(10) 66.5%	11890	(10) 67.4%	12394	(10) 66.3%	13342	(10) 66.2%
Remainder									
2539	(48) 28.8%	5671	(85) 33.5%	5745	(73) 32.6%	6297	(81) 33.7%	6810	(80) 33.8%
TOTAL									
8818	(58) 100.0%	16949	(95) 100.0%	17635	(83) 100.0%	18691	(91) 100.0%	20152	(90) 100.0%

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

2003		2011		2012		2013		2014	
N	Model	N	Model	N	Model	N	Model	N	Model
539	Contemporary	338	Exeter X3 Rimfit	502	Exeter X3 Rimfit	542	Exeter X3 Rimfit	647	Exeter X3 Rimfit
256	Exeter	282	Contemporary	276	Contemporary	222	Contemporary	231	Contemporary
250	Reflection (Cup)	206	Exeter Contemporary	123	Marathon	130	Marathon	130	Marathon
227	Exeter Contemporary	138	Marathon	112	Brunswick	111	Brunswick	98	ZCA
199	Charnley Ogee	122	Brunswick	112	Exeter Contemporary	108	Exeter Contemporary	74	Reflection (Cup)
149	Elite Plus LPW	94	Reflection (Cup)	98	Reflection (Cup)	96	ZCA	58	Exeter Contemporary
130	Low Profile Cup	88	ZCA	94	ZCA	81	Reflection (Cup)	37	Brunswick
110	Elite Plus Ogee	31	CCB	46	Low Profile Cup	28	Low Profile Cup	21	Trabecular Metal (Shell)
102	Charnley	29	Low Profile Cup	30	Polarcup	19	CCB	18	CCB
90	ZCA	18	Polarcup	24	CCB	19	Trabecular Metal (Shell)	18	Low Profile Cup
10 Most Used									
2052	(10) 84.1%	1346	(10) 93.4%	1417	(10) 95.4%	1356	(10) 94.7%	1332	(10) 92.2%
Remainder									
388	(34) 15.9%	95	(26) 6.6%	69	(22) 4.6%	76	(24) 5.3%	112	(29) 7.8%
TOTAL									
2440	(44) 100.0%	1441	(36) 100.0%	1486	(32) 100.0%	1432	(34) 100.0%	1444	(39) 100.0%

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

2003		2011		2012		2013		2014	
N	Model	N	Model	N	Model	N	Model	N	Model
3983	Trident (Shell)	6205	Trident (Shell)	6193	Trident (Shell)	7003	Trident (Shell)	7241	Trident (Shell)
1742	Reflection (Shell)	5118	Pinnacle	5480	Pinnacle	5639	Pinnacle	6068	Pinnacle
1524	Trilogy	2655	R3	3019	R3	3334	R3	3389	R3
954	Vitalock	1410	Versafitcup CC	1837	Versafitcup CC	2130	Versafitcup CC	2773	Versafitcup CC
902	Duraloc	1313	Trilogy	1330	Continuum	1502	Continuum	1469	Continuum
826	ABGII	1242	Continuum	1124	Trilogy	1019	Trilogy	1299	Trinity
786	Allofit	772	Trident/Tritanium (Shell)	675	Allofit	776	Trinity	1084	Trilogy
728	Mallory-Head	749	Allofit	673	Trident/Tritanium (Shell)	643	Allofit	641	Trident/Tritanium (Shell)
536	Pinnacle	684	DeltaMotion	597	DeltaMotion	620	Trident/Tritanium (Shell)	607	Allofit
520	Fitmore	590	Reflection (Shell)	577	Exceed	563	Delta-TT	449	Reflection (Shell)
10 Most Used									
12501	(10) 85.4%	20738	(10) 82.1%	21505	(10) 82.3%	23229	(10) 82.7%	25020	(10) 82.5%
Remainder									
2132	(41) 14.6%	4514	(50) 17.9%	4615	(42) 17.7%	4856	(52) 17.3%	5315	(53) 17.5%
TOTAL									
14633	(51) 100.0%	25252	(60) 100.0%	26120	(52) 100.0%	28085	(62) 100.0%	30335	(63) 100.0%

Outcome for all Diagnoses

When procedures with large head metal/metal bearings are included the 14 year cumulative percent revision for primary total conventional hip replacement is 9.5% (Table HT2).

Large head metal/metal bearings are now rarely used (5 BMHR in 2014) and has been excluded. This group of 16,296 procedures (5.2%) has a high revision rate (22.4% at 10 years). In addition, it was used more frequently in younger patients and with cementless fixation. Consequently, its inclusion would have a disproportionate effect on analysis based on fixation and age compared to the more standard bearings currently used.

Primary Diagnosis

The number of total conventional hip procedures included in the analysis is 296,532. 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.

Osteoarthritis has a lower rate of revision compared to fractured neck of femur, osteonecrosis and rheumatoid arthritis as well as developmental dysplasia in the first month only (Figure HT4).

Reason for Revision

The most common reasons for revision of primary total conventional hip replacement are loosening/lysis (28.0%), followed by prosthesis dislocation (24.2%), fracture (18.2%) and infection (17.3%) (Table HT10).

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

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 28.0% of revision procedures, lysis not associated with loosening has occurred in 2.1% with 24.7% of revision procedures undertaken for loosening not associated with lysis. In 1.3% 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

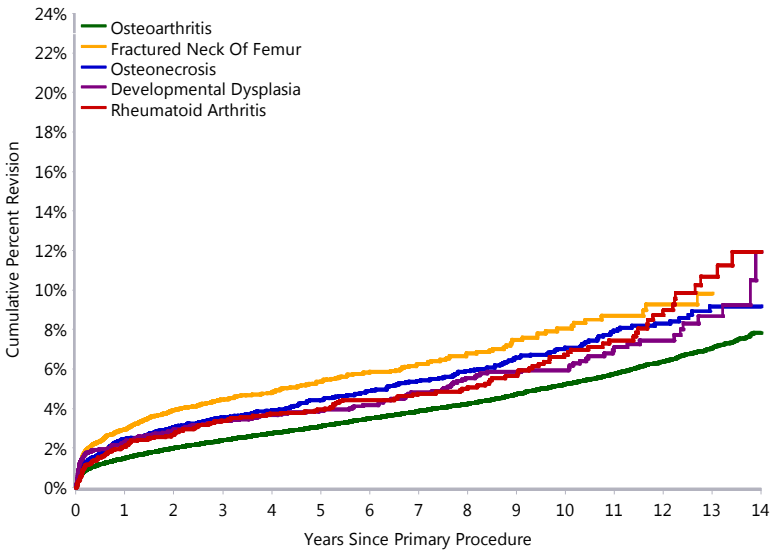
The five most common types of revision recorded by the Registry are femoral only (31.4%), acetabular only (22.7%), head and insert (19.1%), THR (femoral/acetabular) (12.0%) and head only (5.1%) (Table HT11).

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	14 Yrs
Osteoarthritis	8837	262454	1.5 (1.5, 1.5)	2.4 (2.3, 2.5)	3.1 (3.0, 3.2)	3.9 (3.8, 4.0)	5.2 (5.1, 5.4)	7.8 (7.5, 8.2)
Fractured Neck Of Femur	564	12243	2.9 (2.6, 3.3)	4.5 (4.1, 4.9)	5.4 (4.9, 5.9)	6.3 (5.7, 6.9)	8.0 (7.1, 9.1)	
Osteonecrosis	480	9955	2.5 (2.2, 2.8)	3.6 (3.2, 4.0)	4.4 (4.0, 4.9)	5.4 (4.9, 5.9)	7.1 (6.4, 7.8)	9.2 (8.0, 10.5)
Developmental Dysplasia	174	3646	2.3 (1.9, 2.9)	3.4 (2.8, 4.0)	3.9 (3.3, 4.6)	4.8 (4.1, 5.7)	5.9 (5.0, 7.0)	11.9 (8.4, 16.8)
Rheumatoid Arthritis	167	3250	2.1 (1.6, 2.6)	3.4 (2.8, 4.1)	3.9 (3.3, 4.7)	4.8 (4.0, 5.7)	6.7 (5.6, 8.0)	11.9 (9.4, 15.1)
Other (6)	242	4984	3.1 (2.6, 3.6)	4.7 (4.0, 5.4)	5.5 (4.7, 6.3)	6.3 (5.4, 7.3)	8.6 (7.3, 10.1)	
TOTAL	**10464**	**296532**						

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

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



HR - adjusted for age and gender

Fractured Neck Of Femur vs Osteoarthritis
Entire Period: HR=1.82 (1.67, 1.98),p<0.001

Osteonecrosis vs Osteoarthritis
0 - 6Mth: HR=1.43 (1.23, 1.67),p<0.001
6Mth - 9Mth: HR=2.65 (1.94, 3.63),p<0.001
9Mth+: HR=1.24 (1.09, 1.40),p<0.001

Developmental Dysplasia vs Osteoarthritis
0 - 2Wk: HR=2.54 (1.69, 3.82),p<0.001
2Wk - 1Mth: HR=1.87 (1.24, 2.80),p=0.002
1Mth - 3Mth: HR=1.20 (0.74, 1.95),p=0.450
3Mth+: HR=1.05 (0.87, 1.27),p=0.623

Rheumatoid Arthritis vs Osteoarthritis
Entire Period: HR=1.33 (1.14, 1.55),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Osteoarthritis	262454	228197	171156	121748	83162	40035	1914
Fractured Neck Of Femur	12243	9480	6130	3554	1914	659	22
Osteonecrosis	9955	8626	6525	4778	3339	1699	96
Developmental Dysplasia	3646	3195	2499	1911	1422	866	48
Rheumatoid Arthritis	3250	2933	2367	1822	1368	736	61

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	2935	28.0
Prosthesis Dislocation	2528	24.2
Fracture	1907	18.2
Infection	1811	17.3
Pain	191	1.8
Leg Length Discrepancy	145	1.4
Malposition	125	1.2
Implant Breakage Stem	99	0.9
Instability	94	0.9
Implant Breakage Acetabular Insert	81	0.8
Implant Breakage Acetabular	79	0.8
Incorrect Sizing	79	0.8
Wear Acetabular Insert	77	0.7
Metal Related Pathology	74	0.7
Implant Breakage Head	30	0.3
Other	209	2.0
TOTAL	**10464**	**100.0**

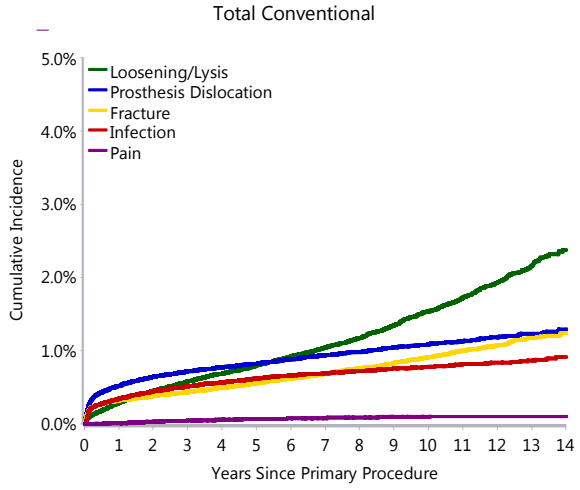
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT11 Primary Total Conventional Hip Replacement by Type of Revision

Type of Revision	Number	Percent
Femoral Component	3283	31.4
Acetabular Component	2378	22.7
Head/Insert	2001	19.1
THR (Femoral/Acetabular)	1255	12.0
Head Only	532	5.1
Cement Spacer	484	4.6
Minor Components	188	1.8
Insert Only	134	1.3
Removal of Prostheses	70	0.7
Head/Neck/Insert	64	0.6
Head/Neck	52	0.5
Reinsertion of Components	10	0.1
Neck Only	4	0.0
Total Femoral	3	0.0
Bipolar Only	3	0.0
Neck/Insert	1	0.0
Saddle	1	0.0
Bipolar Head and Femoral	1	0.0
TOTAL	**10464**	**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 2,571 different stem and acetabular combinations for primary total conventional hip replacement recorded by the Registry. This includes metal/metal prostheses with head size larger than 32mm. The cumulative percent revision of the 97 prosthesis combinations with more than 500 procedures is listed in Table HT12 – Table HT14. Although the listed combinations are a small proportion of the possible combinations, they represent 78.9% of all primary total conventional hip replacements.

The 'Other' group is the combined outcome of all prosthesis combinations with less than 500 procedures. This group accounts for 21.1% 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 MS 30/Low Profile Cup has the lowest 10 year cumulative percent revision of 2.8%. Three other combinations have a cumulative percent revision of less than 5.0% at 10 years (Table HT12).

There are 61 cementless total conventional stem and acetabular combinations listed. The Summit/Pinnacle has the lowest 10 year cumulative percent revision of 2.6%. Nine other combinations have a cumulative percent revision of less than 5.0% at 10 years (Table HT13).

There are 26 combinations of total conventional hip replacement with hybrid fixation. The MS 30/Fitmore has the lowest cumulative percent revision at 10 years (2.4%). Ten 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	14 Yrs
CPCS	Reflection (Cup)	44	823	1.1 (0.6, 2.2)	2.4 (1.5, 3.8)	3.3 (2.2, 5.0)	4.0 (2.7, 5.9)	8.3 (5.8, 11.8)	
CPT	ZCA	28	823	0.5 (0.2, 1.3)	2.1 (1.3, 3.5)	2.7 (1.7, 4.2)	3.2 (2.0, 5.0)	4.9 (3.2, 7.4)	
Charnley	Charnley	34	591	0.5 (0.2, 1.6)	1.0 (0.5, 2.3)	2.2 (1.2, 3.8)	3.4 (2.1, 5.4)	6.7 (4.6, 9.8)	
Charnley	Charnley Ogee	54	709	1.0 (0.5, 2.1)	3.0 (1.9, 4.5)	4.8 (3.4, 6.7)	6.6 (4.9, 8.8)	8.3 (6.3, 11.0)	
Exeter V40	Contemporary	226	5131	1.6 (1.3, 2.0)	2.8 (2.4, 3.3)	3.4 (2.9, 4.0)	4.3 (3.7, 5.0)	6.3 (5.5, 7.3)	
Exeter V40	Exeter	75	1712	0.8 (0.5, 1.4)	1.9 (1.3, 2.7)	3.1 (2.3, 4.0)	3.9 (3.0, 5.0)	4.9 (3.8, 6.2)	
Exeter V40	Exeter Contemporary	108	3139	1.4 (1.0, 1.8)	2.3 (1.8, 2.9)	2.9 (2.4, 3.6)	3.8 (3.1, 4.7)	4.5 (3.7, 5.5)	
Exeter V40	Exeter X3 Rimfit	33	2052	1.2 (0.8, 1.8)	2.4 (1.6, 3.5)				
MS 30	Low Profile Cup	15	690	0.6 (0.2, 1.6)	0.8 (0.3, 1.8)	1.1 (0.5, 2.4)	1.6 (0.8, 3.0)	2.8 (1.6, 4.9)	
Spectron EF	Reflection (Cup)	93	1639	1.0 (0.6, 1.6)	1.6 (1.1, 2.4)	2.7 (2.0, 3.7)	4.0 (3.1, 5.3)	7.8 (6.2, 9.8)	
Other (394)		437	8740	1.5 (1.3, 1.8)	2.5 (2.2, 2.9)	3.7 (3.3, 4.2)	4.7 (4.2, 5.3)	6.6 (5.9, 7.3)	11.3 (9.9, 12.8)
TOTAL		**1147**	**26049**						

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

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	14 Yrs
ABGII	ABGII	211	2944	1.8 (1.4, 2.4)	3.1 (2.5, 3.8)	4.1 (3.5, 4.9)	5.3 (4.5, 6.2)	6.7 (5.8, 7.8)	11.1 (9.1, 13.5)
ABGII	ABGII (Shell/Insert)	53	870	1.5 (0.9, 2.6)	2.3 (1.5, 3.6)	3.0 (2.0, 4.4)	4.5 (3.2, 6.2)	7.7 (5.8, 10.1)	
ABGII	Trident (Shell)	157	2409	2.6 (2.1, 3.4)	4.2 (3.5, 5.1)	5.2 (4.3, 6.2)	6.2 (5.2, 7.3)	8.4 (7.0, 10.0)	
Accolade I	Trident (Shell)	366	9017	1.6 (1.4, 1.9)	2.9 (2.6, 3.3)	3.8 (3.4, 4.2)	4.6 (4.1, 5.1)	5.5 (4.8, 6.2)	
Accolade I	Trident/Tritanium (Shell)	20	726	1.4 (0.8, 2.6)	2.7 (1.7, 4.3)				
Accolade II	Trident (Shell)	6	584	1.5 (0.6, 3.5)					
Alloclassic	Allofit	213	5457	1.4 (1.1, 1.8)	2.3 (1.9, 2.7)	3.0 (2.5, 3.5)	3.6 (3.1, 4.2)	5.2 (4.4, 6.0)	
Alloclassic	Durom^{MoM}	68	621	1.3 (0.7, 2.6)	5.0 (3.5, 7.0)	6.9 (5.1, 9.2)	10.4 (8.1, 13.3)		
Alloclassic	Fitmore	102	1765	2.8 (2.1, 3.7)	4.1 (3.3, 5.2)	5.1 (4.2, 6.3)	5.7 (4.7, 7.0)	6.9 (5.7, 8.4)	
Alloclassic	Trabecular Metal (Shell)	36	1037	2.3 (1.6, 3.5)	3.1 (2.1, 4.3)	3.9 (2.8, 5.5)	3.9 (2.8, 5.5)		
Alloclassic	Trilogy	10	850	0.6 (0.3, 1.5)	0.7 (0.3, 1.6)	1.1 (0.5, 2.1)	1.7 (0.8, 3.3)		
Anthology	R3	79	4042	1.7 (1.3, 2.1)	2.0 (1.6, 2.5)	2.3 (1.8, 2.9)			
Anthology	Reflection (Shell)	19	920	1.5 (0.9, 2.6)	1.8 (1.1, 2.9)	2.0 (1.3, 3.2)	2.2 (1.4, 3.5)		
Apex	Fin II	34	1000	1.8 (1.2, 2.9)	2.4 (1.6, 3.6)	3.8 (2.6, 5.5)	4.6 (3.2, 6.7)		
Avenir	Continuum	8	572	1.4 (0.7, 2.9)	1.4 (0.7, 2.9)				
CLS	Allofit	42	818	1.5 (0.9, 2.6)	3.4 (2.3, 5.0)	3.7 (2.6, 5.4)	5.2 (3.8, 7.2)	6.3 (4.6, 8.6)	
CLS	Fitmore	36	674	1.8 (1.0, 3.1)	3.8 (2.6, 5.6)	4.4 (3.0, 6.3)	4.8 (3.4, 6.9)	5.6 (4.0, 7.9)	
Citation	Trident (Shell)	45	1147	1.7 (1.1, 2.7)	2.5 (1.7, 3.5)	3.2 (2.3, 4.4)	3.5 (2.6, 4.8)	4.2 (3.1, 5.7)	
Citation	Vitalock	37	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)	6.6 (4.7, 9.2)	9.3 (5.9, 14.5)
Corail	ASR^{MoM}	1090	2901	2.2 (1.7, 2.8)	11.1 (10.0, 12.4)	26.8 (25.1, 28.4)	38.7 (36.8, 40.6)		
Corail	DeltaMotion	9	763	0.8 (0.4, 1.8)	1.3 (0.6, 2.6)				
Corail	Duraloc	64	1433	1.4 (0.9, 2.2)	2.2 (1.5, 3.1)	2.8 (2.1, 3.9)	4.0 (3.0, 5.2)	5.7 (4.4, 7.6)	
Corail	Pinnacle	672	26938	1.7 (1.5, 1.8)	2.5 (2.3, 2.7)	3.1 (2.9, 3.4)	3.7 (3.3, 4.0)	5.4 (4.5, 6.5)	
Corail	Pinnacle^{MoM}	82	966	2.2 (1.4, 3.3)	3.7 (2.6, 5.1)	5.9 (4.6, 7.7)	9.6 (7.7, 12.1)	13.4 (10.2, 17.6)	
Epoch	Trilogy	41	1020	2.5 (1.7, 3.6)	3.4 (2.4, 4.7)	3.6 (2.6, 4.9)	4.1 (3.0, 5.6)	4.4 (3.2, 5.9)	
F2L	SPH-Blind	50	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-TT	12	704	1.2 (0.6, 2.4)	2.6 (1.4, 4.8)				
M/L Taper	Allofit	11	506	1.7 (0.9, 3.4)	2.2 (1.2, 4.2)	2.7 (1.5, 4.9)			
M/L Taper	Continuum	19	821	2.0 (1.2, 3.2)	3.0 (1.8, 4.9)				
M/L Taper	Trilogy	17	637	1.4 (0.7, 2.7)	1.6 (0.9, 3.0)	2.5 (1.4, 4.4)	4.2 (2.5, 7.0)		
M/LTaper Kinectiv	Continuum	50	1659	2.1 (1.5, 3.0)	3.3 (2.5, 4.4)				
Mallory-Head	Mallory-Head	142	2856	1.8 (1.4, 2.4)	2.3 (1.8, 2.9)	3.1 (2.5, 3.8)	3.9 (3.2, 4.7)	5.3 (4.4, 6.4)	10.1 (8.1, 12.7)
Metafix	Trinity	24	1035	2.1 (1.4, 3.2)	2.9 (1.8, 4.5)				
Nanos	R3	5	627	0.7 (0.3, 1.8)	0.9 (0.4, 2.2)				
Natural Hip	Fitmore	33	889	1.0 (0.5, 1.9)	1.6 (0.9, 2.7)	2.4 (1.6, 3.7)	2.9 (1.9, 4.2)	4.4 (3.1, 6.2)	
Omnifit	Secur-Fit	58	508	3.2 (1.9, 5.1)	5.0 (3.4, 7.3)	6.6 (4.7, 9.2)	8.2 (6.1, 11.0)	10.9 (8.4, 14.1)	
Omnifit	Trident (Shell)	62	1271	1.9 (1.3, 2.8)	3.2 (2.3, 4.3)	4.1 (3.1, 5.4)	4.7 (3.6, 6.1)	5.4 (4.2, 6.9)	
Polarstem	R3	70	3097	2.0 (1.5, 2.6)	3.2 (2.4, 4.1)	3.2 (2.4, 4.1)			
Quadra-H	Versafitcup CC	195	8900	1.7 (1.5, 2.0)	2.7 (2.3, 3.1)	3.1 (2.6, 3.7)	5.7 (3.1, 10.6)		
S-Rom	Duraloc Option	32	666	1.5 (0.8, 2.8)	2.4 (1.5, 3.9)	3.4 (2.2, 5.0)	4.0 (2.7, 5.8)	4.7 (3.3, 6.6)	
S-Rom	Pinnacle	105	2777	2.3 (1.8, 2.9)	3.5 (2.9, 4.3)	3.9 (3.2, 4.7)	4.3 (3.5, 5.3)	5.0 (4.0, 6.4)	
SL-Plus	EP-Fit Plus	99	2257	1.7 (1.2, 2.3)	2.7 (2.1, 3.5)	3.5 (2.8, 4.4)	4.3 (3.5, 5.3)	5.8 (4.6, 7.4)	
SL-Plus	R3	42	1320	2.0 (1.4, 3.0)	3.4 (2.5, 4.6)	3.8 (2.8, 5.1)			
Secur-Fit	DeltaMotion	13	728	0.7 (0.3, 1.7)	1.9 (1.1, 3.3)	1.9 (1.1, 3.3)			
Secur-Fit	Trident (Shell)	251	8237	1.6 (1.3, 1.9)	2.5 (2.2, 2.9)	3.1 (2.7, 3.5)	3.8 (3.3, 4.3)	4.1 (3.6, 4.7)	
Secur-Fit Plus	Trident (Shell)	160	5447	1.2 (0.9, 1.5)	1.9 (1.5, 2.3)	2.3 (1.9, 2.8)	2.6 (2.2, 3.1)	3.5 (3.0, 4.1)	4.3 (3.6, 5.2)
Summit	ASR^{MoM}	399	1118	1.2 (0.7, 2.0)	6.5 (5.2, 8.1)	19.7 (17.5, 22.2)	32.4 (29.7, 35.4)		
Summit	Pinnacle	64	3695	1.0 (0.7, 1.4)	1.5 (1.1, 2.0)	1.8 (1.3, 2.3)	2.6 (1.9, 3.4)	2.6 (1.9, 3.4)	
Summit	Pinnacle^{MoM}	45	784	1.5 (0.9, 2.7)	2.2 (1.4, 3.5)	3.3 (2.2, 4.8)	4.9 (3.5, 6.8)	7.4 (5.5, 10.0)	
Synergy	BHR^{MoM}	63	817	1.6 (0.9, 2.7)	3.1 (2.1, 4.5)	4.7 (3.4, 6.4)	7.4 (5.7, 9.6)		
Synergy	R3	87	3587	1.7 (1.4, 2.2)	2.5 (2.0, 3.1)	3.0 (2.4, 3.7)			
Synergy	Reflection (Shell)	293	7731	1.6 (1.3, 1.9)	2.4 (2.1, 2.8)	2.7 (2.4, 3.1)	3.1 (2.8, 3.6)	4.2 (3.7, 4.7)	6.3 (5.2, 7.7)
Taperloc	Exceed	40	1793	1.4 (0.9, 2.1)	2.4 (1.8, 3.4)	2.8 (2.0, 3.8)			
Taperloc	M2a^{MoM}	53	512	1.8 (0.9, 3.4)	4.4 (2.9, 6.5)	7.4 (5.4, 10.1)	9.0 (6.7, 11.9)	12.6 (9.6, 16.3)	
Taperloc	Mallory-Head	52	1415	1.7 (1.2, 2.6)	2.4 (1.7, 3.4)	2.9 (2.1, 4.1)	4.2 (3.1, 5.7)	4.8 (3.5, 6.4)	

Femoral Component	Acetabular Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Taperloc	Recap[MoM]	42	500	2.4 (1.4, 4.2)	4.3 (2.8, 6.5)	6.2 (4.4, 8.8)	8.6 (6.3, 11.7)		
Trabecular Metal	Continuum	33	603	4.7 (3.3, 6.8)	6.0 (4.3, 8.3)				
Tri-Fit TS	Trinity	4	717	0.7 (0.3, 2.0)					
Tri-Lock	DeltaMotion	5	724	0.6 (0.2, 1.5)	0.6 (0.2, 1.5)				
VerSys	Trilogy	188	4303	2.4 (2.0, 2.9)	3.2 (2.7, 3.8)	3.7 (3.2, 4.3)	4.2 (3.6, 4.8)	4.8 (4.1, 5.6)	
twinSys	RM Cup	15	527	2.8 (1.7, 4.7)	3.3 (1.9, 5.6)				
Other (1250)		2363	40590	2.2 (2.1, 2.4)	3.9 (3.7, 4.1)	5.4 (5.2, 5.7)	7.3 (6.9, 7.6)	9.4 (9.0, 9.8)	12.4 (11.6, 13.3)
TOTAL		**8696**	**185001**						

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

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

Femoral Component	Acetabular Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
C-Stem	Duraloc	72	981	2.4 (1.6, 3.5)	3.1 (2.2, 4.4)	4.0 (2.9, 5.5)	5.2 (3.9, 6.8)	7.7 (6.0, 9.9)	
C-Stem	Pinnacle	24	754	1.9 (1.1, 3.2)	2.6 (1.6, 4.1)	2.8 (1.8, 4.4)	4.9 (3.1, 7.6)	4.9 (3.1, 7.6)	
C-Stem AMT	Pinnacle	23	1414	0.7 (0.4, 1.3)	1.9 (1.2, 3.0)	2.3 (1.5, 3.7)	3.4 (2.0, 5.7)		
CPCS	R3	61	2611	1.9 (1.4, 2.5)	2.5 (2.0, 3.3)	3.0 (2.2, 3.9)			
CPCS	Reflection (Shell)	74	2813	0.9 (0.6, 1.4)	1.3 (0.9, 1.8)	1.7 (1.3, 2.3)	2.6 (2.0, 3.4)	4.6 (3.4, 6.2)	
CPT	Allofit	18	945	1.2 (0.7, 2.2)	1.6 (1.0, 2.7)	2.5 (1.6, 4.1)	2.5 (1.6, 4.1)		
CPT	Continuum	57	1857	2.7 (2.0, 3.5)	3.5 (2.7, 4.6)				
CPT	Trabecular Metal (Shell)	52	1271	2.1 (1.5, 3.1)	3.6 (2.6, 4.9)	4.7 (3.5, 6.2)	5.5 (4.1, 7.4)		
CPT	Trilogy	228	6818	1.6 (1.3, 1.9)	2.5 (2.1, 2.9)	3.2 (2.8, 3.7)	3.8 (3.3, 4.4)	5.0 (4.3, 5.8)	
Elite Plus	Duraloc	103	1078	2.0 (1.3, 3.0)	3.6 (2.7, 5.0)	5.4 (4.2, 7.0)	7.3 (5.8, 9.1)	9.7 (8.0, 11.9)	13.6 (11.0, 16.8)
Exeter	Vitalock	65	1218	1.6 (1.0, 2.5)	2.3 (1.6, 3.4)	2.5 (1.8, 3.6)	3.3 (2.4, 4.5)	4.8 (3.6, 6.2)	6.5 (5.0, 8.3)
Exeter V40	ABGII	39	1071	1.1 (0.6, 2.0)	1.4 (0.9, 2.4)	2.1 (1.3, 3.1)	3.1 (2.2, 4.5)	3.6 (2.5, 5.0)	
Exeter V40	Hemispherical	23	690	2.2 (1.3, 3.6)	3.2 (2.1, 4.9)	3.4 (2.2, 5.1)	3.4 (2.2, 5.1)		
Exeter V40	Mallory-Head	28	1296	0.5 (0.2, 1.1)	0.8 (0.4, 1.5)	0.9 (0.5, 1.7)	1.7 (1.1, 2.8)	3.0 (2.0, 4.6)	
Exeter V40	Pinnacle	25	1205	1.2 (0.7, 2.1)	2.0 (1.3, 3.1)	2.4 (1.6, 3.6)	3.2 (2.0, 5.0)		
Exeter V40	R3	31	1239	1.3 (0.8, 2.1)	2.4 (1.6, 3.6)	4.0 (2.7, 5.9)			
Exeter V40	Trident (Shell)	983	41949	1.2 (1.1, 1.3)	1.8 (1.7, 2.0)	2.4 (2.2, 2.6)	3.0 (2.8, 3.2)	4.2 (3.9, 4.6)	
Exeter V40	Trident/Tritanium (Shell)	34	2017	1.3 (0.9, 2.0)	1.9 (1.3, 2.7)	2.5 (1.7, 3.7)			
Exeter V40	Trilogy	19	605	1.7 (0.9, 3.1)	2.4 (1.4, 4.0)	2.6 (1.6, 4.3)	2.9 (1.8, 4.7)	4.8 (2.8, 8.2)	
Exeter V40	Vitalock	69	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)	3.3 (2.6, 4.3)	
MS 30	Allofit	45	1454	1.3 (0.8, 2.0)	1.8 (1.2, 2.7)	2.3 (1.6, 3.3)	3.2 (2.3, 4.4)	3.9 (2.9, 5.4)	
MS 30	Fitmore	12	531	0.2 (0.0, 1.3)	0.8 (0.3, 2.2)	1.4 (0.6, 3.0)	2.0 (1.0, 4.0)	2.4 (1.2, 4.5)	
Omnifit	Trident (Shell)	75	2503	1.7 (1.3, 2.3)	2.7 (2.1, 3.5)	3.0 (2.4, 3.8)	3.3 (2.6, 4.1)	3.6 (2.8, 4.6)	
Spectron EF	BHR[MoM]	44	532	0.8 (0.3, 2.0)	2.9 (1.8, 4.8)	6.6 (4.7, 9.2)	8.8 (6.4, 11.9)		
Spectron EF	R3	35	1349	1.6 (1.0, 2.4)	2.7 (1.9, 3.8)	3.3 (2.3, 4.7)			
Spectron EF	Reflection (Shell)	225	5075	1.1 (0.8, 1.4)	1.9 (1.6, 2.4)	2.7 (2.3, 3.2)	3.6 (3.1, 4.2)	5.7 (4.9, 6.6)	9.9 (8.1, 12.1)
Other (830)		915	16543	1.9 (1.7, 2.1)	3.2 (2.9, 3.5)	4.6 (4.3, 5.0)	5.9 (5.5, 6.3)	7.8 (7.3, 8.4)	10.4 (9.5, 11.4)
TOTAL		**3379**	**101778**						

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

Outcome for Osteoarthritis - Patient Characteristics

The outcome has been analysed excluding all procedures using metal/metal bearing surface with femoral head size larger than 32mm. The 14 year cumulative percent revision of primary total conventional hip replacement undertaken for osteoarthritis is 7.8% 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 years 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 14 years is 8.5% for males and 7.3% 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. After three months, females aged less than 55 years have almost twice the rate of revision compared to females 75 years or older (Table HT17 and Figure HT9).

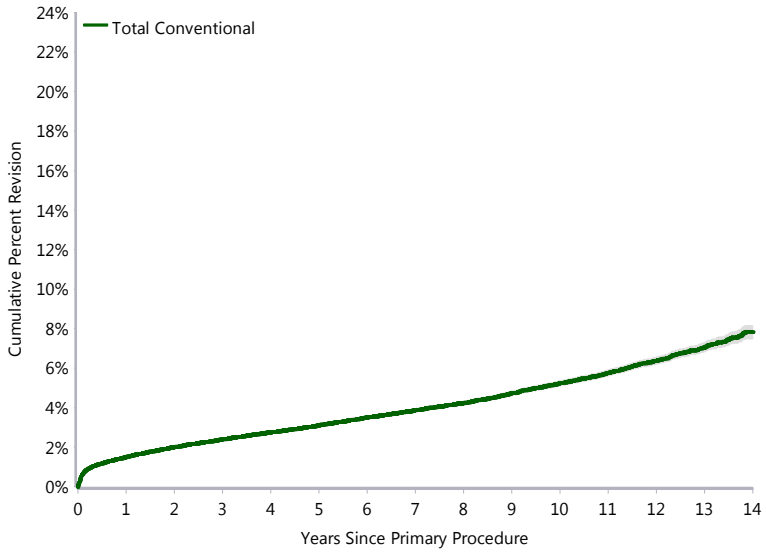
The relationship between revision rate and age for males is not as apparent. Males aged 75 years or older have a higher rate of revision initially. After 1.5 years, there is no difference (Table HT17 and Figure HT10).

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

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Total Conventional	8837	262454	1.5 (1.5, 1.5)	2.4 (2.3, 2.5)	3.1 (3.0, 3.2)	3.9 (3.8, 4.0)	5.2 (5.1, 5.4)	7.8 (7.5, 8.2)

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	14 Yrs
Total Conventional	262454	228197	171156	121748	83162	40035	1914

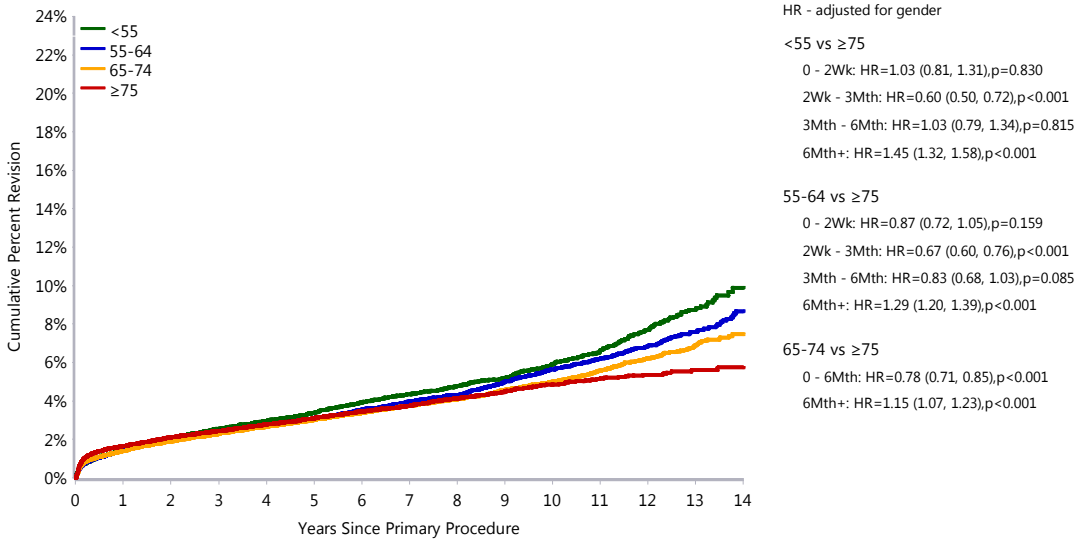
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

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	14 Yrs
<55	1049	27318	1.5 (1.3, 1.6)	2.6 (2.4, 2.8)	3.4 (3.2, 3.7)	4.3 (4.1, 4.7)	5.9 (5.5, 6.4)	9.9 (8.9, 11.0)
55-64	2211	62084	1.4 (1.4, 1.5)	2.4 (2.3, 2.5)	3.1 (3.0, 3.3)	4.0 (3.8, 4.2)	5.6 (5.4, 5.9)	8.7 (8.0, 9.4)
65-74	3092	93130	1.4 (1.3, 1.5)	2.3 (2.2, 2.4)	3.0 (2.9, 3.2)	3.7 (3.6, 3.9)	5.0 (4.8, 5.2)	7.5 (7.0, 8.0)
≥75	2485	79922	1.7 (1.6, 1.7)	2.4 (2.3, 2.6)	3.1 (3.0, 3.2)	3.8 (3.6, 3.9)	4.9 (4.6, 5.1)	5.7 (5.3, 6.2)
TOTAL	**8837**	**262454**						

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)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
<55	27318	23482	17259	12081	8686	4901	306
55-64	62084	54174	40968	29227	20542	10765	626
65-74	93130	81228	61477	44757	31441	15590	735
≥75	79922	69313	51452	35683	22493	8779	247

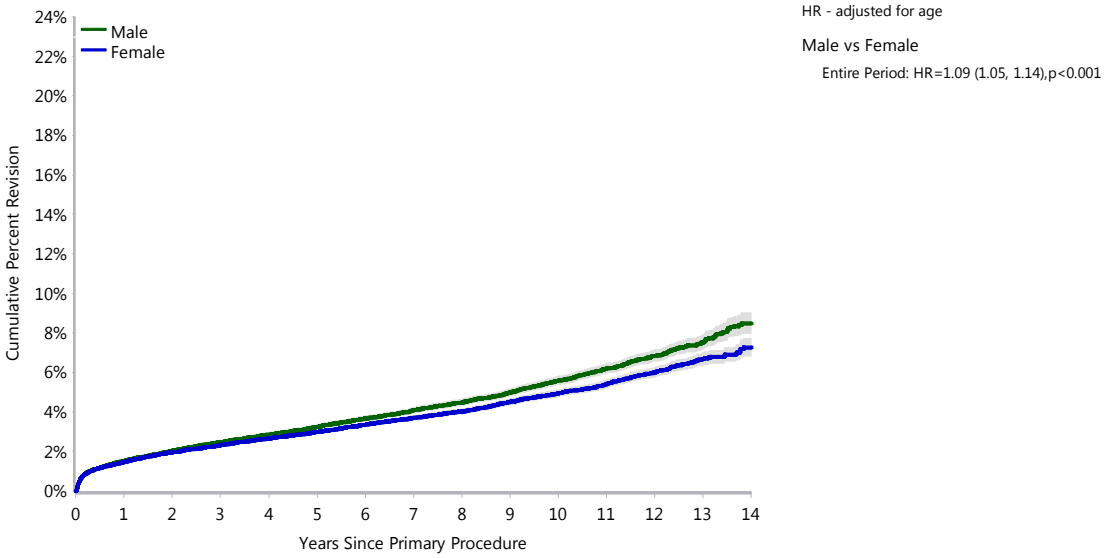
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

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

Gender	Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Male		**4180**	**119257**	**1.5 (1.5, 1.6)**	**2.5 (2.4, 2.6)**	**3.2 (3.1, 3.4)**	**4.1 (3.9, 4.2)**	**5.6 (5.4, 5.8)**	**8.5 (8.0, 9.0)**
	<55	506	14726	1.3 (1.1, 1.5)	2.3 (2.0, 2.6)	3.1 (2.7, 3.4)	3.9 (3.5, 4.3)	5.4 (4.9, 6.0)	8.8 (7.7, 10.2)
	55-64	1108	30431	1.5 (1.4, 1.7)	2.5 (2.3, 2.7)	3.2 (2.9, 3.4)	4.1 (3.8, 4.4)	5.7 (5.3, 6.1)	9.4 (8.3, 10.5)
	65-74	1461	43115	1.4 (1.2, 1.5)	2.3 (2.1, 2.4)	3.1 (2.9, 3.3)	3.9 (3.7, 4.1)	5.3 (5.0, 5.6)	7.9 (7.2, 8.7)
	≥75	1105	30985	1.9 (1.8, 2.1)	2.9 (2.7, 3.1)	3.7 (3.5, 3.9)	4.5 (4.2, 4.8)	5.9 (5.5, 6.4)	6.6 (6.0, 7.2)
Female		**4657**	**143197**	**1.5 (1.4, 1.5)**	**2.3 (2.2, 2.4)**	**3.0 (2.9, 3.1)**	**3.7 (3.6, 3.8)**	**4.9 (4.8, 5.1)**	**7.3 (6.8, 7.7)**
	<55	543	12592	1.7 (1.5, 1.9)	2.9 (2.6, 3.2)	3.8 (3.4, 4.2)	4.9 (4.4, 5.3)	6.5 (5.9, 7.2)	11.2 (9.4, 13.3)
	55-64	1103	31653	1.4 (1.3, 1.5)	2.4 (2.2, 2.5)	3.1 (2.9, 3.3)	3.9 (3.7, 4.2)	5.6 (5.2, 6.0)	7.9 (7.1, 8.9)
	65-74	1631	50015	1.5 (1.4, 1.6)	2.3 (2.2, 2.5)	3.0 (2.8, 3.2)	3.6 (3.4, 3.8)	4.7 (4.5, 5.0)	7.1 (6.5, 7.8)
	≥75	1380	48937	1.5 (1.4, 1.6)	2.2 (2.1, 2.3)	2.7 (2.6, 2.9)	3.3 (3.1, 3.5)	4.2 (4.0, 4.5)	5.2 (4.7, 5.9)
TOTAL		**8837**	**262454**						

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

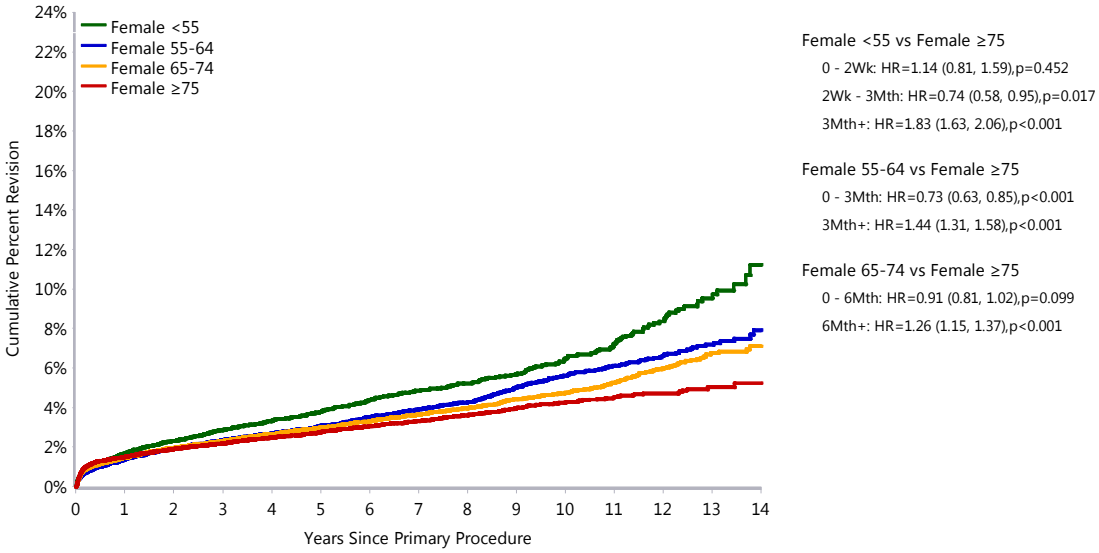
Figure HT8 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Gender (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Male	119257	103087	76231	53550	36570	17858	876
Female	143197	125110	94925	68198	46592	22177	1038

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

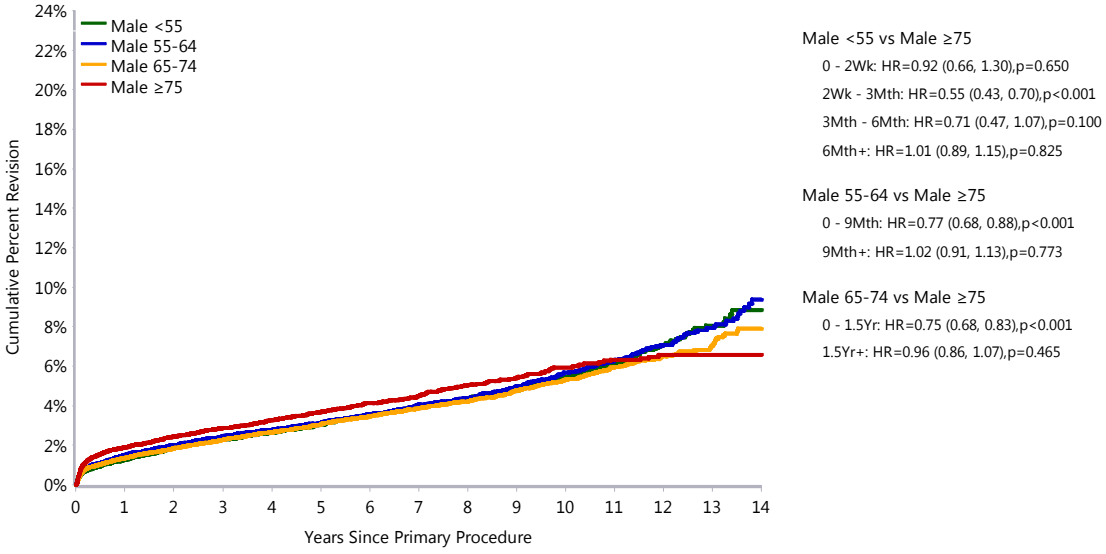
Figure HT9 Cumulative Percent Revision of Primary Total Conventional Hip Replacement for Females by Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Female	<55	12592	10893	8192	5842	4131	2238	121
	55-64	31653	27767	21228	15267	10582	5362	322
	65-74	50015	43576	33099	24244	17067	8537	409
	≥75	48937	42874	32406	22845	14812	6040	186

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	14 Yrs
Male	<55	14726	12589	9067	6239	4555	2663	185
	55-64	30431	26407	19740	13960	9960	5403	304
	65-74	43115	37652	28378	20513	14374	7053	326
	≥75	30985	26439	19046	12838	7681	2739	61

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

Outcome for Osteoarthritis - Prosthesis Characteristics

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

Fixation

Hybrid fixation has a lower rate of revision compared to cemented fixation after six months and cementless fixation up to three years. Cementless fixation has a higher rate of revision compared to cemented fixation in the first three months, but after three years the rate of revision is lower for cementless fixation. The cumulative percent revision at 14 years is 7.1% for hybrid, 7.6% for cementless and 10.1% for cemented fixation (Table HT18 and Figure HT11).

For all age groups cementless fixation initially has a higher rate of revision. For patients aged 75 years or more, cementless fixation continues to have a higher rate of revision over the entire period. However, for patients aged less than 75 years, cementless fixation has a lower rate of revision at later time periods than cemented or hybrid fixation (Table HT19, Figure HT12 and Figure 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).

Mini Stems

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

There have been 1,778 procedures using a mini stem undertaken for osteoarthritis. This represents less than one percent of all total conventional hip procedures. There is no difference in the outcome when a mini stem is used. The 10 year cumulative percent revision for total hip replacement using a mini stem compared to other femoral stems is 7.1% and 5.2% respectively (Table HT20 and Figure HT16).

The cumulative incidence of loosening/lysis for procedures using a mini stem is over twice that of other femoral stems at 10 years (3.9% and 1.5% respectively) (Figure HT17). The types of revision are presented in Table HT21.

The Registry has information on 10 different mini stem prostheses. Revision rates vary depending on the type of prosthesis (Table HT22).

Femoral Stems with Exchangeable Necks

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

The Registry has recorded 9,289 procedures using femoral stems with exchangeable necks undertaken for osteoarthritis. The proportion of procedures using exchangeable necks peaked in 2010 at 6.6% of all primary total conventional hip procedures. This proportion continues to decrease, with 2.1% of all procedures using a stem with an exchangeable neck in 2014.

Femoral stems with exchangeable necks have twice the rate of revision compared to fixed stems. The cumulative percent revision at 10 years is 9.7% for stems with exchangeable necks compared to 5.1% for fixed neck stems (Table HT23 and Figure HT18). The increase in the rate of revision is due to a higher cumulative incidence of loosening/lysis (2.8% at 10 years compared to 1.5% for fixed femoral neck), dislocation (1.8% compared to 1.0%) and fracture (1.4% compared to 0.9%) (Figure HT19). Of the revisions for femoral stems with exchangeable necks, 2.4% are for implant breakage of the femoral component compared to 0.8% for fixed neck stems. The higher rate of revision when using stems with exchangeable necks is evident for all bearing surfaces (Table HT24 and Figure HT20).

The Registry has undertaken an analysis to determine whether the stem/neck metal combination has an effect on the rate of revision. As in last year's report only the two principal combinations were included in the analysis (Titanium stem/Titanium neck and Titanium stem/Cobalt Chrome neck). The Titanium/Cobalt Chrome combination has a higher rate of revision compared to the Titanium/Titanium combination (Table HT25 and Figure HT21). The reason for this difference is a higher cumulative incidence for each of the five main reasons for revision with the exception of infection. Metal related pathology is the second most common reason for revision with the Titanium/Cobalt Chrome combination. In the Titanium/Titanium combination metal related pathology is the lowest of the five main reasons for revision (Figure HT22).

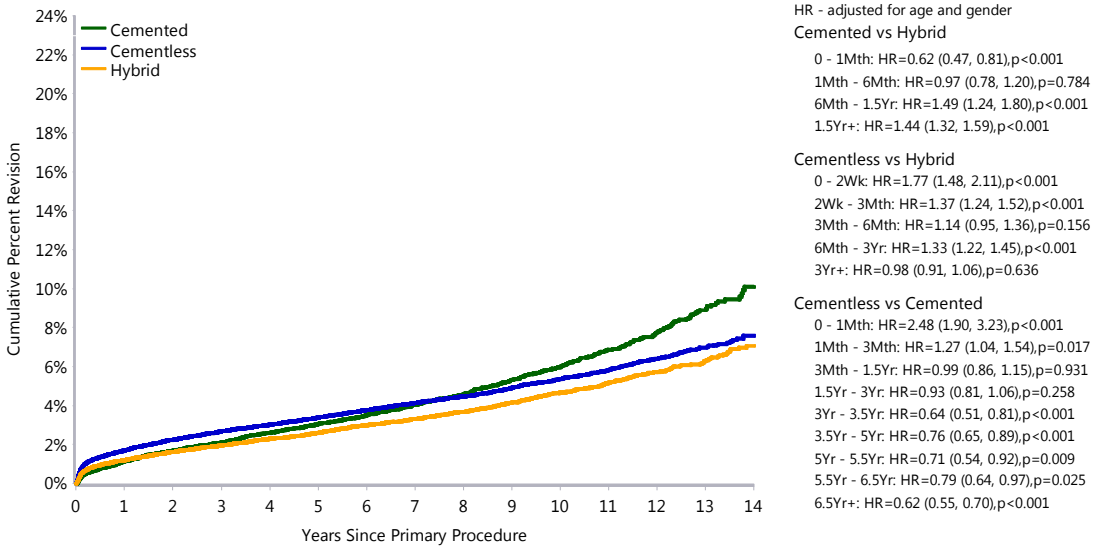
There are six exchangeable femoral neck prostheses with a cumulative percent revision at seven or more years. All have a higher cumulative percent revision than fixed neck stems (Table HT26).

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	14 Yrs
Cemented	929	20694	1.1 (1.0, 1.3)	2.1 (1.9, 2.3)	3.1 (2.8, 3.3)	4.0 (3.7, 4.4)	6.0 (5.6, 6.4)	10.1 (9.1, 11.2)
Cementless	5362	155063	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)	7.6 (7.1, 8.1)
Hybrid	2546	86697	1.2 (1.1, 1.3)	2.0 (1.9, 2.1)	2.6 (2.5, 2.7)	3.3 (3.2, 3.5)	4.7 (4.5, 4.9)	7.1 (6.5, 7.6)
TOTAL	**8837**	**262454**						

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)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cemented	20694	19080	16043	12982	9879	5402	369
Cementless	155063	133238	97330	66831	44602	21190	801
Hybrid	86697	75879	57783	41935	28681	13443	744

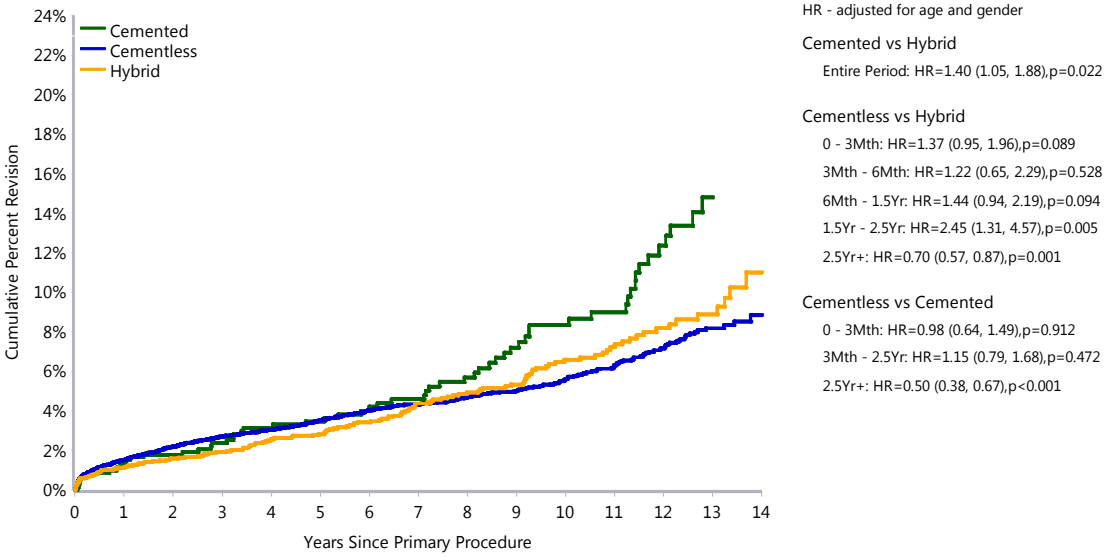
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

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

Age	Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
<55		**1049**	**27318**	**1.5 (1.3, 1.6)**	**2.6 (2.4, 2.8)**	**3.4 (3.2, 3.7)**	**4.3 (4.1, 4.7)**	**5.9 (5.5, 6.4)**	**9.9 (8.9, 11.0)**
	Cemented	62	820	1.4 (0.8, 2.5)	2.4 (1.5, 3.7)	3.5 (2.4, 5.1)	4.6 (3.2, 6.5)	8.3 (6.2, 11.1)	
	Cementless	813	21949	1.5 (1.4, 1.7)	2.7 (2.5, 2.9)	3.5 (3.2, 3.8)	4.3 (4.0, 4.7)	5.6 (5.2, 6.1)	8.8 (7.8, 10.1)
	Hybrid	174	4549	1.1 (0.9, 1.5)	1.9 (1.5, 2.4)	2.8 (2.3, 3.4)	4.4 (3.6, 5.2)	6.6 (5.5, 7.8)	11.0 (8.6, 14.0)
55-64		**2211**	**62084**	**1.4 (1.4, 1.5)**	**2.4 (2.3, 2.5)**	**3.1 (3.0, 3.3)**	**4.0 (3.8, 4.2)**	**5.6 (5.4, 5.9)**	**8.7 (8.0, 9.4)**
	Cemented	180	2571	1.4 (1.0, 2.0)	2.9 (2.3, 3.7)	4.1 (3.4, 5.0)	5.3 (4.4, 6.4)	8.5 (7.3, 10.0)	14.3 (11.6, 17.6)
	Cementless	1523	45134	1.5 (1.4, 1.7)	2.5 (2.3, 2.7)	3.1 (3.0, 3.3)	3.9 (3.7, 4.2)	5.3 (5.0, 5.7)	7.6 (6.8, 8.5)
	Hybrid	508	14379	1.2 (1.0, 1.4)	2.0 (1.8, 2.3)	2.8 (2.5, 3.1)	3.7 (3.4, 4.2)	5.7 (5.1, 6.3)	9.2 (8.0, 10.7)
65-74		**3092**	**93130**	**1.4 (1.3, 1.5)**	**2.3 (2.2, 2.4)**	**3.0 (2.9, 3.2)**	**3.7 (3.6, 3.9)**	**5.0 (4.8, 5.2)**	**7.5 (7.0, 8.0)**
	Cemented	378	6992	1.1 (0.9, 1.4)	2.2 (1.8, 2.5)	3.1 (2.7, 3.6)	4.4 (3.9, 5.0)	6.5 (5.8, 7.2)	11.2 (9.7, 13.0)
	Cementless	1777	54848	1.6 (1.5, 1.7)	2.5 (2.4, 2.7)	3.2 (3.1, 3.4)	3.9 (3.7, 4.1)	4.9 (4.7, 5.2)	6.7 (6.1, 7.4)
	Hybrid	937	31290	1.2 (1.0, 1.3)	1.9 (1.8, 2.1)	2.6 (2.4, 2.8)	3.2 (3.0, 3.5)	4.5 (4.2, 4.8)	6.5 (5.9, 7.3)
≥75		**2485**	**79922**	**1.7 (1.6, 1.7)**	**2.4 (2.3, 2.6)**	**3.1 (3.0, 3.2)**	**3.8 (3.6, 3.9)**	**4.9 (4.6, 5.1)**	**5.7 (5.3, 6.2)**
	Cemented	309	10311	1.1 (0.9, 1.3)	1.9 (1.6, 2.1)	2.7 (2.4, 3.1)	3.3 (2.9, 3.7)	4.3 (3.8, 4.9)	5.1 (4.4, 5.9)
	Cementless	1249	33132	2.3 (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, 6.4)	
	Hybrid	927	36479	1.3 (1.2, 1.4)	2.0 (1.8, 2.1)	2.5 (2.3, 2.7)	3.1 (2.9, 3.3)	4.0 (3.7, 4.4)	5.1 (4.4, 5.9)
TOTAL		**8837**	**262454**						

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

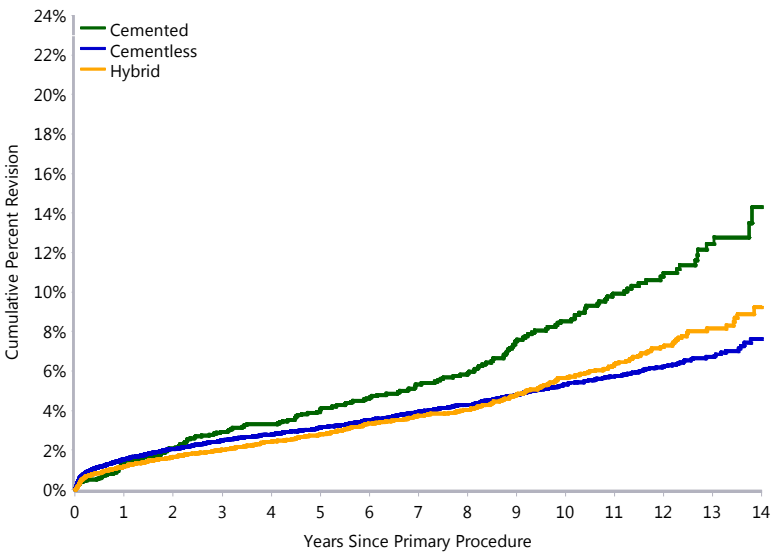
Figure HT12 Cumulative Percent Revision of Primary Total Conventional Hip Replacement for Patients Aged <55 Years by Fixation (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cemented	820	752	644	557	452	283	28
Cementless	21949	18847	13731	9437	6715	3755	195
Hybrid	4549	3883	2884	2087	1519	863	83

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=1.50 (1.26, 1.78),p<0.001

Cementless vs Hybrid

0 - 2Wk: HR=2.41 (1.53, 3.80),p<0.001
2Wk - 3Mth: HR=1.24 (0.97, 1.58),p=0.082
3Mth - 1.5Yr: HR=1.18 (0.97, 1.45),p=0.101
1.5Yr - 7Yr: HR=0.93 (0.80, 1.09),p=0.355
7Yr+: HR=0.66 (0.54, 0.81),p<0.001

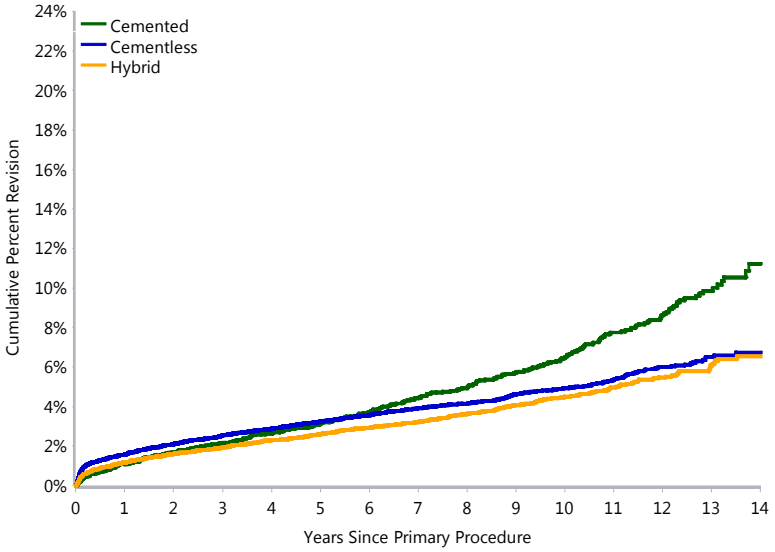
Cemented vs Cementless

0 - 9Mth: HR=0.59 (0.38, 0.92),p=0.019
9Mth - 1Yr: HR=3.60 (2.11, 6.13),p<0.001
1Yr - 1.5Yr: HR=0.81 (0.36, 1.83),p=0.613
1.5Yr - 2.5Yr: HR=2.31 (1.50, 3.57),p<0.001
2.5Yr - 3Yr: HR=1.15 (0.47, 2.84),p=0.761
3Yr+: HR=2.03 (1.66, 2.50),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cemented	2571	2403	2084	1756	1414	888	76
Cementless	45134	39107	29126	20313	14007	7200	338
Hybrid	14379	12664	9758	7158	5121	2677	212

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

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



HR - adjusted for age and gender

Cemented vs Hybrid

0 - 1Mth: HR=0.51 (0.30, 0.86),p=0.011
1Mth - 6Mth: HR=1.05 (0.73, 1.51),p=0.801
6Mth - 1.5Yr: HR=1.37 (1.02, 1.85),p=0.038
1.5Yr - 2Yr: HR=1.15 (0.67, 1.96),p=0.616
2Yr - 4Yr: HR=1.36 (1.03, 1.81),p=0.032
4Yr+: HR=1.99 (1.69, 2.34),p<0.001

Cementless vs Hybrid

0 - 3Mth: HR=1.60 (1.37, 1.87),p<0.001
3Mth+: HR=1.05 (0.96, 1.15),p=0.283

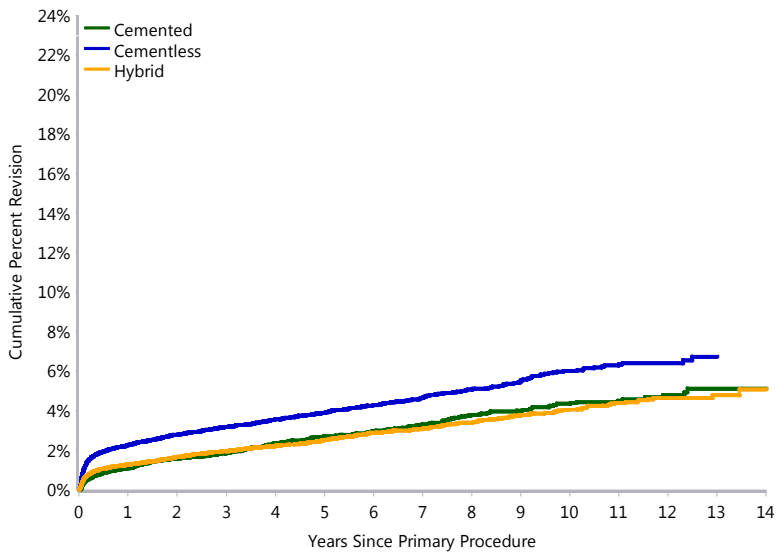
Cementless vs Cemented

0 - 1Mth: HR=3.21 (1.92, 5.38),p<0.001
1Mth - 3Mth: HR=1.51 (1.02, 2.24),p=0.038
3Mth - 6Mth: HR=0.92 (0.60, 1.43),p=0.722
6Mth - 1.5Yr: HR=0.72 (0.59, 0.89),p=0.001
1.5Yr - 3Yr: HR=0.80 (0.64, 0.99),p=0.038
3Yr - 9Yr: HR=0.59 (0.50, 0.69),p<0.001
9Yr+: HR=0.48 (0.37, 0.63),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cemented	6992	6528	5662	4772	3865	2314	170
Cementless	54848	47069	34338	23810	15956	7455	229
Hybrid	31290	27631	21477	16175	11620	5821	336

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=5.11 (2.51, 10.41),p<0.001

2Wk - 3Mth: HR=1.82 (1.52, 2.19),p<0.001

3Mth+: HR=1.19 (1.04, 1.37),p=0.012

Hybrid vs Cemented

0 - 2Wk: HR=2.74 (1.32, 5.66),p=0.006

2Wk+: HR=0.91 (0.80, 1.04),p=0.155

Cementless vs Hybrid

0 - 3Mth: HR=1.89 (1.64, 2.18),p<0.001

3Mth+: HR=1.34 (1.20, 1.49),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cemented	10311	9397	7653	5897	4148	1917	95
Cementless	33132	28215	20135	13271	7924	2780	39
Hybrid	36479	31701	23664	16515	10421	4082	113

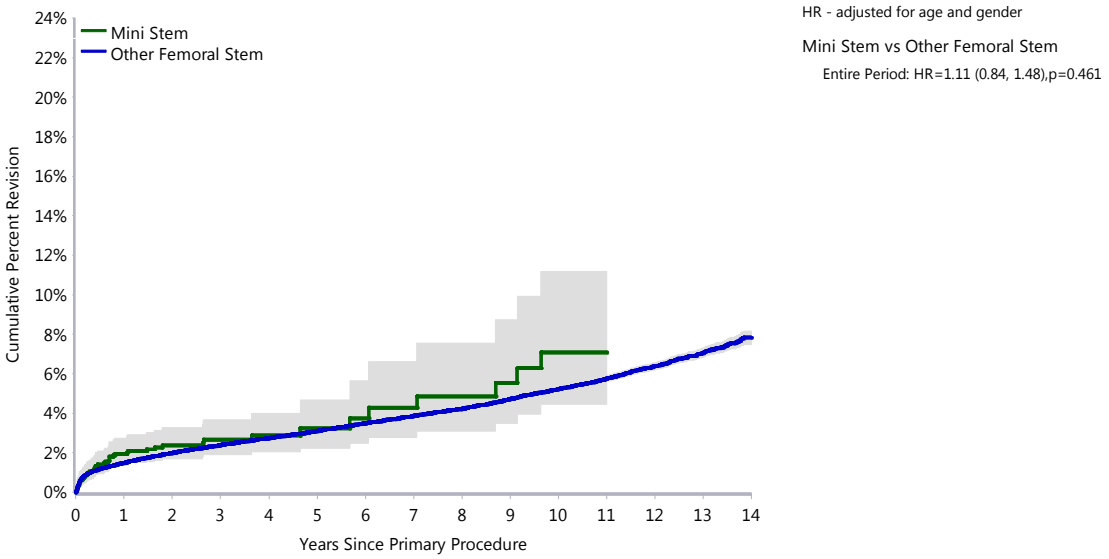
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

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

Stem Type	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Mini Stem	47	1778	1.9 (1.4, 2.7)	2.6 (1.9, 3.7)	3.2 (2.2, 4.7)	4.3 (2.8, 6.6)	7.1 (4.4, 11.2)	
Other Femoral Stem	8790	260676	1.5 (1.4, 1.5)	2.4 (2.3, 2.5)	3.1 (3.0, 3.2)	3.9 (3.8, 4.0)	5.2 (5.1, 5.4)	7.8 (7.5, 8.2)
TOTAL	**8837**	**262454**						

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

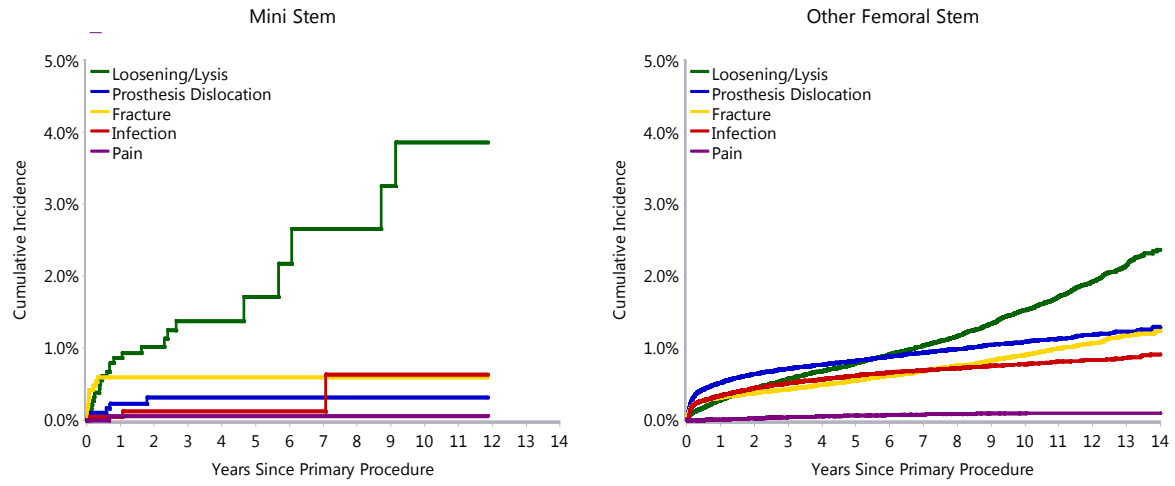
Figure HT16 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Stem Type (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Mini Stem	1778	1331	599	233	167	104	1
Other Femoral Stem	260676	226866	170557	121515	82995	39931	1913

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

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



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

Table HT21 Primary Total Conventional Hip Replacement by Type of Revision and Stem Type (Primary Diagnosis OA)

	Mini Stem			Other Femoral Stem		
Type of Revision	Number	% Primaries Revised	% Revisions	Number	% Primaries Revised	% Revisions
Femoral Component	25	1.4	53.2	2780	1.1	31.6
Acetabular Component	11	0.6	23.4	1948	0.7	22.2
Head/Insert	3	0.2	6.4	1688	0.6	19.2
THR (Femoral/Acetabular)	3	0.2	6.4	1063	0.4	12.1
Head Only	3	0.2	6.4	448	0.2	5.1
Cement Spacer	1	0.1	2.1	412	0.2	4.7
Minor Components	1	0.1	2.1	159	0.1	1.8
Insert Only				114	0.0	1.3
Removal of Prostheses				60	0.0	0.7
Head/Neck/Insert				59	0.0	0.7
Head/Neck				45	0.0	0.5
Reinsertion of Components				6	0.0	0.1
Neck Only				3	0.0	0.0
Bipolar Only				2	0.0	0.0
Neck/Insert				1	0.0	0.0
Saddle				1	0.0	0.0
Total Femoral				1	0.0	0.0
N Revision	**47**	**2.6**	**100.0**	**8790**	**3.4**	**100.0**
N Primary	**1778**			**260676**		

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

Table HT22 Cumulative Percent Revision of Primary Total Conventional Hip Replacement using a Mini Stem by Prosthesis (Primary Diagnosis OA)

Femoral Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
C.F.P.	9	123	4.1 (1.7, 9.5)	4.1 (1.7, 9.5)	4.9 (2.2, 10.6)	5.8 (2.8, 11.7)	7.9 (4.2, 14.7)	
Mallory-Head	3	74	2.8 (0.7, 10.8)	6.3 (1.8, 20.4)				
Mayo	6	96	2.1 (0.5, 8.1)	4.2 (1.6, 10.8)	4.2 (1.6, 10.8)	5.7 (2.4, 13.4)	7.9 (3.5, 17.4)	
Metha	4	100	3.3 (1.1, 9.8)	4.6 (1.7, 11.7)				
MiniHip	11	461	2.2 (1.2, 4.3)	3.2 (1.7, 5.8)				
Nanos	5	629	0.7 (0.3, 1.8)	0.9 (0.4, 2.2)				
Silent	2	50	4.0 (1.0, 15.1)	4.0 (1.0, 15.1)				
Taperloc Microplasty	5	230	1.9 (0.7, 5.1)	1.9 (0.7, 5.1)				
Other (2)	2	15	6.7 (1.0, 38.7)	6.7 (1.0, 38.7)	6.7 (1.0, 38.7)	6.7 (1.0, 38.7)		
TOTAL	**47**	**1778**						

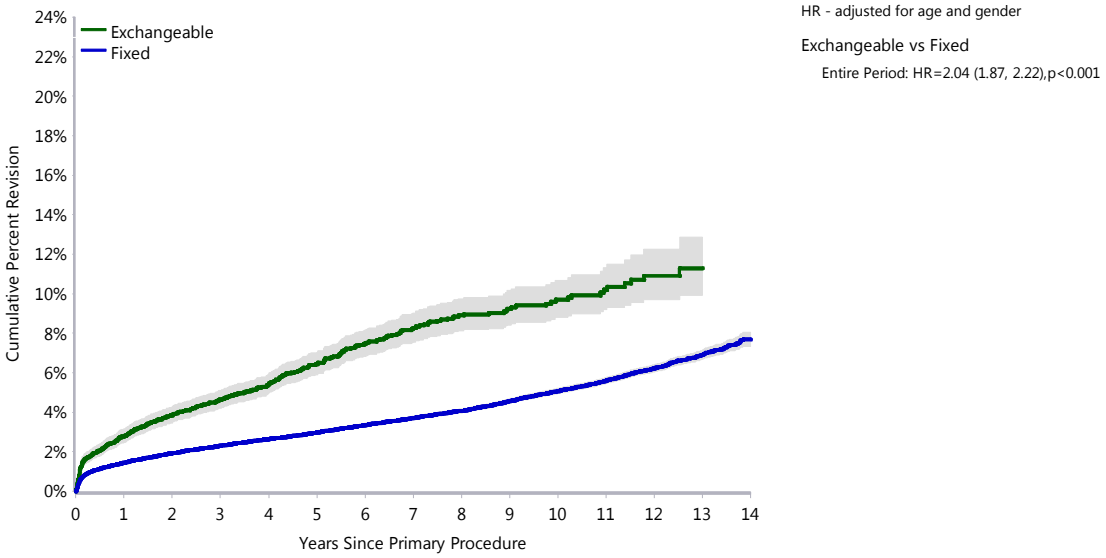
Note: Only prostheses with over 50 procedures have been listed.
All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT23 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	14 Yrs
Exchangeable	581	9289	2.8 (2.5, 3.2)	4.6 (4.2, 5.1)	6.4 (5.9, 7.0)	8.3 (7.6, 9.0)	9.7 (8.8, 10.7)	
Fixed	8256	253165	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 (4.9, 5.2)	7.7 (7.3, 8.0)
TOTAL	**8837**	**262454**						

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

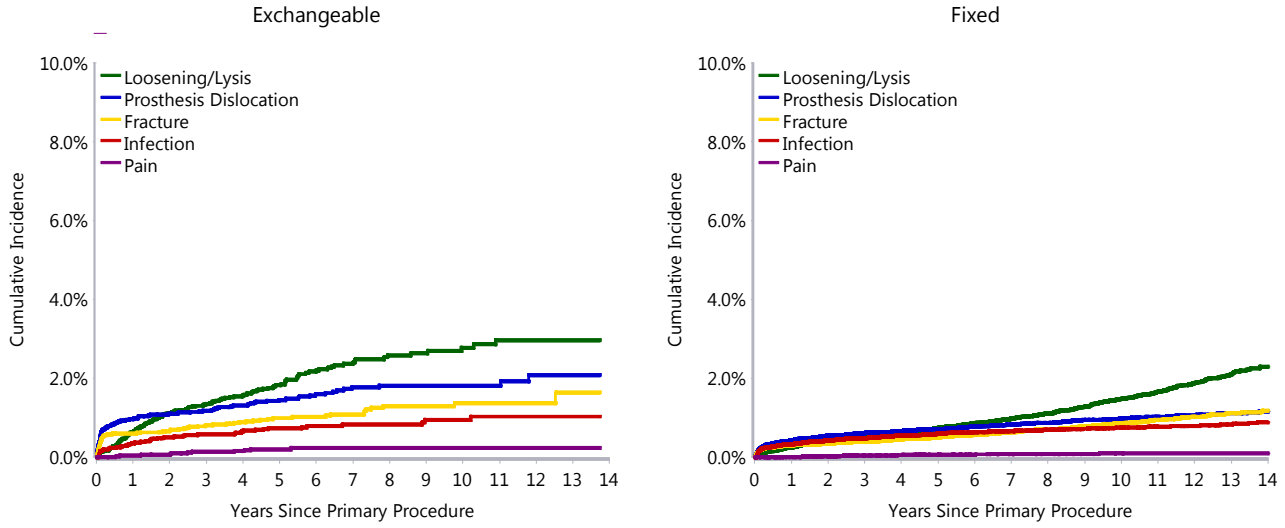
Figure HT18 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Type of Femoral Neck (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Exchangeable	9289	8369	6503	3593	2044	887	25
Fixed	253165	219828	164653	118155	81118	39148	1889

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

Figure HT19 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement by Type of Femoral Neck (Primary Diagnosis OA)



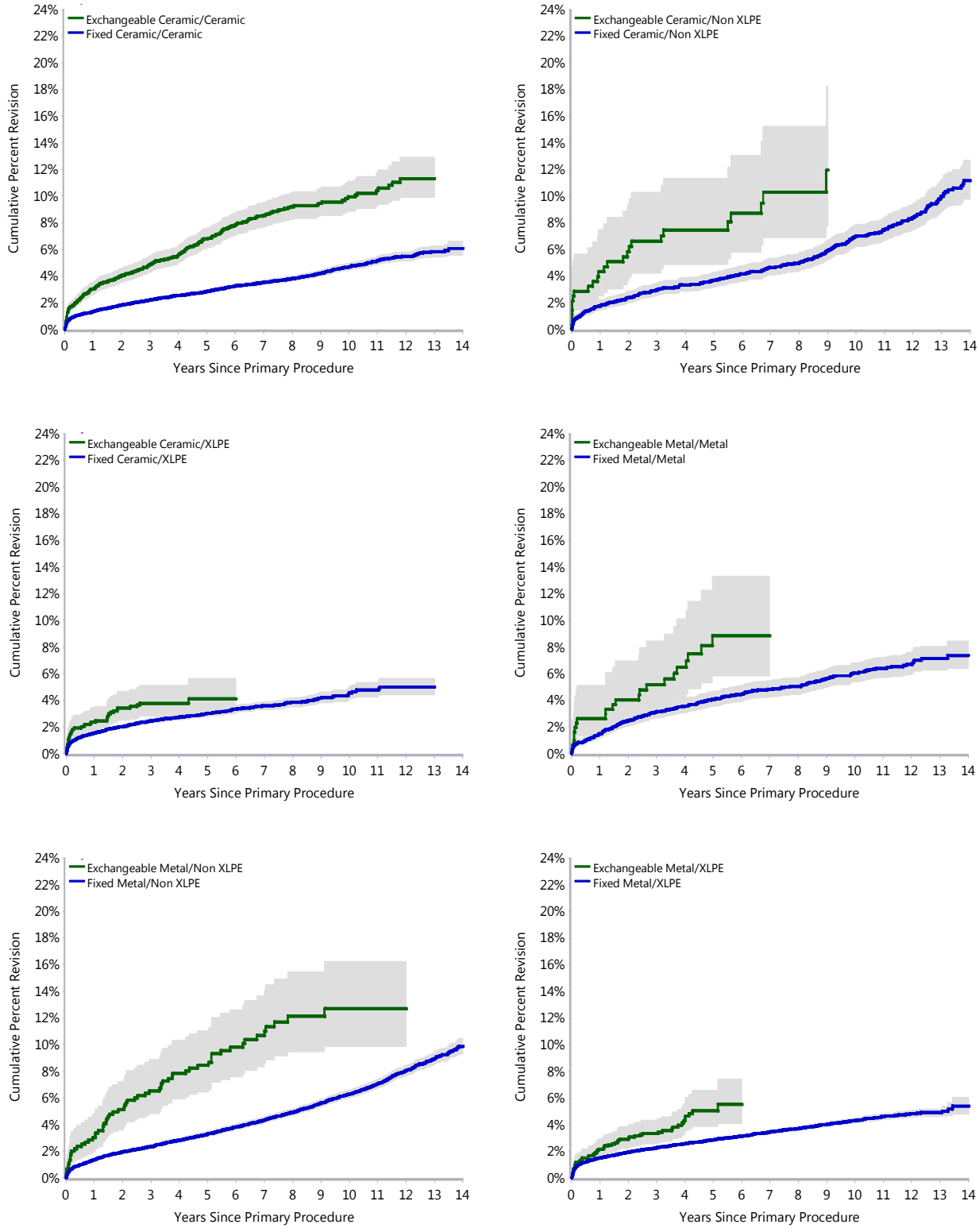
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT24 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Bearing Surface and Type of Femoral Neck (Primary Diagnosis OA)

Bearing Surface	Femoral Neck	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Ceramic/Ceramic	Exchangeable	364	5146	3.0 (2.6, 3.5)	4.9 (4.3, 5.5)	6.8 (6.0, 7.6)	8.5 (7.7, 9.5)	9.9 (8.9, 11.1)	
Ceramic/Ceramic	Fixed	1745	59968	1.3 (1.2, 1.4)	2.2 (2.1, 2.3)	2.8 (2.7, 3.0)	3.5 (3.3, 3.7)	4.7 (4.4, 4.9)	6.1 (5.5, 6.6)
Ceramic/Non XLPE	Exchangeable	26	280	4.3 (2.5, 7.5)	6.6 (4.2, 10.3)	7.4 (4.9, 11.3)	10.3 (6.9, 15.2)		
Ceramic/Non XLPE	Fixed	324	4993	1.8 (1.4, 2.2)	3.0 (2.5, 3.5)	3.7 (3.2, 4.3)	4.6 (4.0, 5.3)	7.0 (6.2, 7.9)	11.1 (9.8, 12.7)
Ceramic/XLPE	Exchangeable	41	1171	2.4 (1.6, 3.4)	3.8 (2.8, 5.1)	4.1 (3.0, 5.6)			
Ceramic/XLPE	Fixed	734	29664	1.5 (1.4, 1.7)	2.4 (2.3, 2.6)	3.0 (2.8, 3.3)	3.6 (3.3, 3.9)	4.6 (4.1, 5.1)	
Metal/Metal	Exchangeable	23	308	2.6 (1.3, 5.1)	5.2 (3.1, 8.4)	8.8 (5.8, 13.3)	8.8 (5.8, 13.3)		
Metal/Metal	Fixed	275	4821	1.5 (1.2, 1.9)	3.1 (2.7, 3.7)	4.1 (3.6, 4.7)	4.8 (4.2, 5.5)	6.1 (5.4, 6.8)	7.4 (6.4, 8.5)
Metal/Non XLPE	Exchangeable	62	601	3.0 (1.9, 4.8)	6.5 (4.8, 8.9)	8.4 (6.4, 11.0)	11.0 (8.6, 14.1)	12.7 (9.9, 16.2)	
Metal/Non XLPE	Fixed	1929	33413	1.4 (1.2, 1.5)	2.4 (2.2, 2.5)	3.3 (3.1, 3.5)	4.3 (4.1, 4.6)	6.3 (6.0, 6.6)	9.9 (9.3, 10.5)
Metal/XLPE	Exchangeable	65	1766	2.1 (1.5, 2.9)	3.3 (2.5, 4.3)	5.0 (3.8, 6.6)			
Metal/XLPE	Fixed	2897	105459	1.5 (1.4, 1.6)	2.3 (2.2, 2.4)	2.9 (2.7, 3.0)	3.4 (3.3, 3.6)	4.3 (4.1, 4.5)	5.4 (4.8, 6.1)
Other (5)	Exchangeable	0	6	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)				
Other (5)	Fixed	341	14605	1.5 (1.3, 1.7)	2.1 (1.8, 2.3)	2.4 (2.1, 2.7)	2.9 (2.6, 3.3)	3.8 (3.3, 4.4)	
TOTAL		**8826**	**262201**						

Note: 253 procedures with unknown bearing surface have been excluded
All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

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



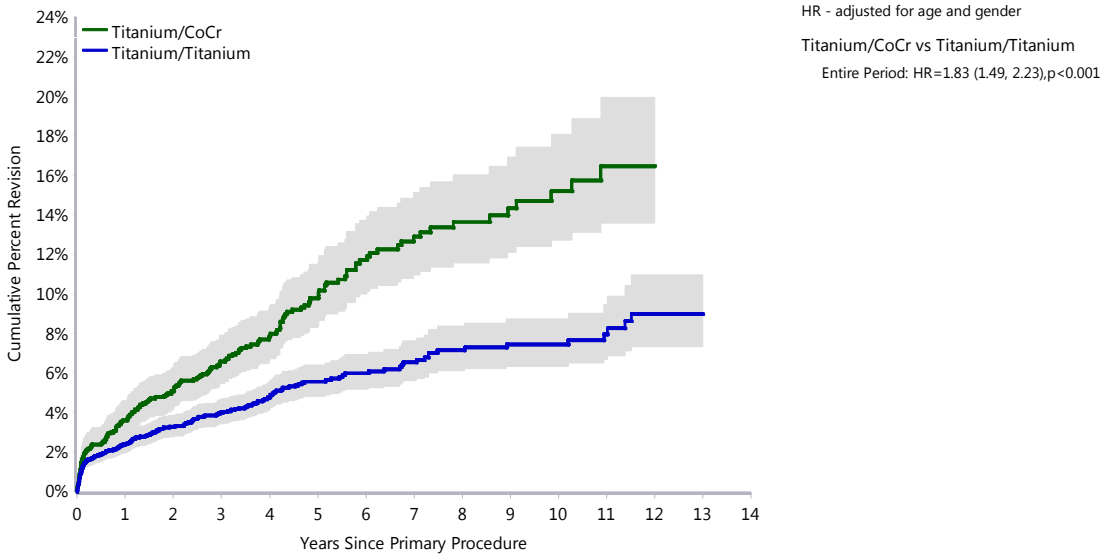
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT25 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	14 Yrs
Titanium/CoCr	168	1673	3.6 (2.8, 4.6)	6.6 (5.5, 7.9)	9.8 (8.3, 11.5)	12.9 (11.0, 15.1)	15.2 (12.7, 18.1)	
Titanium/Titanium	217	4430	2.4 (2.0, 2.9)	4.0 (3.4, 4.7)	5.6 (4.8, 6.4)	6.5 (5.6, 7.6)	7.4 (6.3, 8.7)	
TOTAL	**385**	**6103**						

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

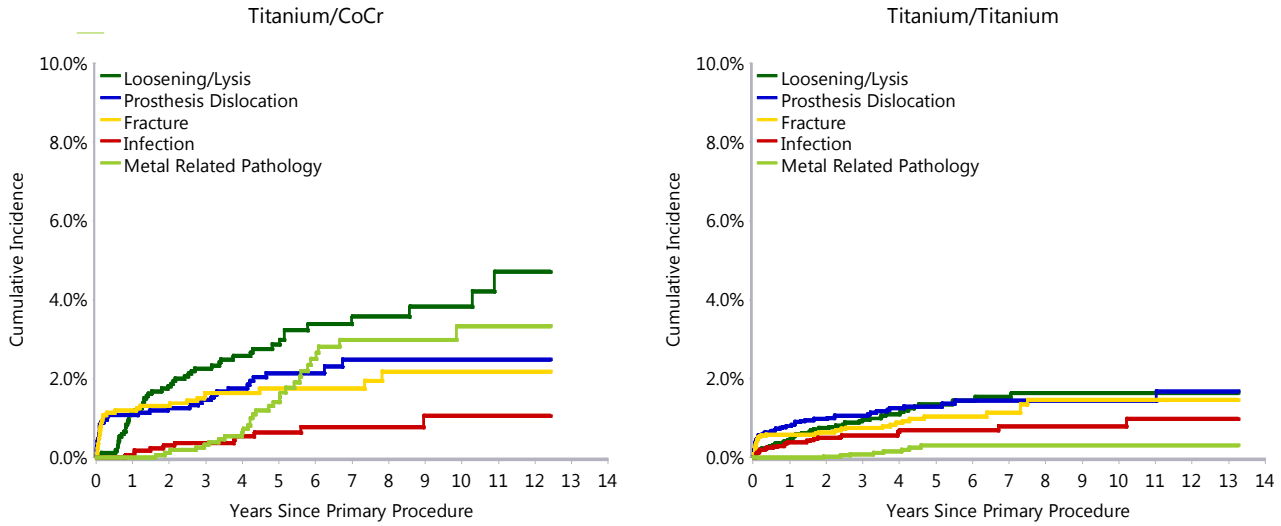
Figure HT21 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Stem/Neck Material (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Titanium/CoCr	1673	1589	1303	706	391	168	0
Titanium/Titanium	4430	3895	2846	1279	795	441	10

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

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



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

Table HT26 Cumulative Percent Revision of Primary Total Conventional Hip Replacement using an Exchangeable Femoral Neck by Prosthesis Type (Primary Diagnosis OA)

Femoral Neck	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
ABGII	46	228	4.0 (2.1, 7.5)	10.2 (6.9, 15.0)	18.3 (13.4, 24.7)			
Adapter	40	374	3.8 (2.2, 6.3)	7.3 (5.1, 10.5)	10.1 (7.3, 13.8)	13.3 (9.7, 18.2)		
Apex	105	2163	2.7 (2.1, 3.5)	4.1 (3.3, 5.0)	5.1 (4.2, 6.3)	6.3 (5.1, 7.8)		
F2L	62	687	3.2 (2.1, 4.8)	5.4 (4.0, 7.4)	6.8 (5.1, 9.0)	7.6 (5.8, 9.9)	8.6 (6.7, 11.0)	
Femoral Neck (Amplitude)	14	442	0.9 (0.3, 2.4)	2.4 (1.2, 4.8)	5.4 (3.0, 9.5)			
H-Max	0	68	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	95	2575	2.2 (1.7, 2.8)	3.4 (2.8, 4.3)	5.1 (4.1, 6.4)			
MBA	47	630	2.1 (1.2, 3.5)	4.2 (2.8, 6.1)	6.1 (4.4, 8.4)	7.1 (5.2, 9.7)	9.7 (7.2, 13.1)	
MSA	17	174	7.6 (4.5, 12.7)	9.5 (5.9, 15.0)				
Margron	76	552	5.3 (3.7, 7.5)	7.3 (5.4, 9.9)	9.4 (7.2, 12.2)	12.5 (10.0, 15.6)	14.3 (11.5, 17.6)	
Metha	11	84	10.7 (5.7, 19.6)	11.9 (6.6, 21.0)	15.6 (8.2, 28.3)			
Profemur	52	932	3.0 (2.1, 4.3)	4.7 (3.5, 6.3)	5.5 (4.2, 7.3)	6.7 (4.9, 9.0)		
R120	5	171	1.2 (0.3, 4.6)	2.6 (1.0, 6.8)	2.6 (1.0, 6.8)			
Other (5)	5	99	1.0 (0.1, 7.0)	3.3 (1.1, 10.0)	5.9 (2.5, 13.8)	5.9 (2.5, 13.8)		
TOTAL	**581**	**9289**						

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.

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 14 year cumulative percent revision, the lowest is metal femoral heads with cross-linked polyethylene (5.4%). (Table HT27).

When using cross-linked polyethylene with either metal or ceramic femoral heads, there is no difference in the rate of revision (Table HT27 and Figure HT23). Although ceramicised metal femoral heads have a lower rate of revision compared to metal/cross-linked polyethylene 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 14 years (11.4% and 9.9% respectively) (Table HT27 and Figure HT23).

The Registry has information on two types of ceramic and metal bearings. These have been used in small numbers (300 ceramic/metal and 7 metal/ceramic).

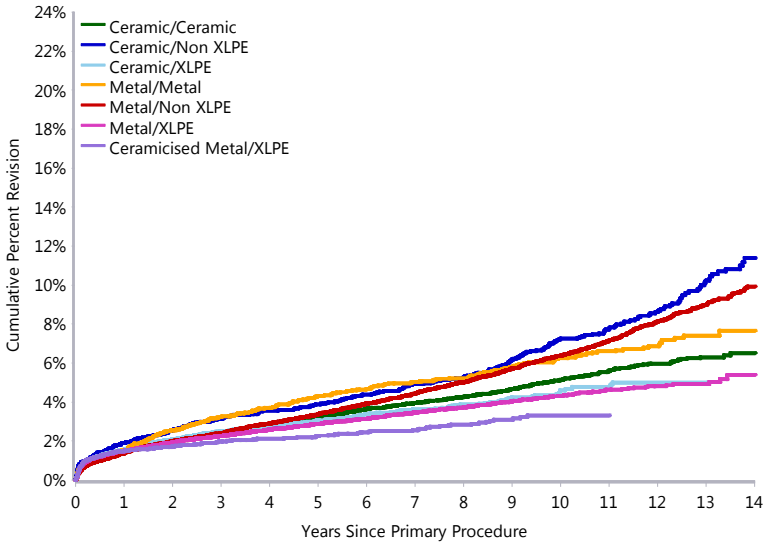
A supplementary report on the analysis of metal/metal and metal and ceramic bearing surfaces is available on the AOANJRR website aoanjrr.dmac.adelaide.edu.au/annual-reports-2015.

Table HT27 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	14 Yrs
Ceramic/Ceramic	2109	65114	1.5 (1.4, 1.6)	2.4 (2.3, 2.6)	3.2 (3.0, 3.3)	4.0 (3.8, 4.2)	5.1 (4.9, 5.4)	6.5 (6.0, 7.0)
Ceramic/Non XLPE	350	5273	1.9 (1.6, 2.3)	3.2 (2.7, 3.7)	3.9 (3.4, 4.5)	4.9 (4.3, 5.6)	7.3 (6.5, 8.1)	11.4 (10.0, 12.9)
Ceramic/XLPE	775	30835	1.6 (1.4, 1.7)	2.5 (2.3, 2.7)	3.1 (2.8, 3.3)	3.6 (3.3, 3.9)	4.6 (4.1, 5.1)	
Ceramic/Metal	15	300	1.7 (0.7, 4.0)	3.7 (2.1, 6.6)	4.1 (2.3, 7.1)			
Metal/Metal	298	5129	1.5 (1.2, 1.9)	3.3 (2.8, 3.8)	4.3 (3.8, 4.9)	5.0 (4.4, 5.7)	6.3 (5.6, 7.0)	7.7 (6.7, 8.8)
Metal/Non XLPE	1991	34014	1.4 (1.3, 1.5)	2.4 (2.3, 2.6)	3.4 (3.2, 3.6)	4.5 (4.2, 4.7)	6.4 (6.1, 6.7)	9.9 (9.4, 10.5)
Metal/XLPE	2962	107225	1.5 (1.4, 1.6)	2.3 (2.2, 2.4)	2.9 (2.8, 3.0)	3.5 (3.3, 3.6)	4.3 (4.1, 4.5)	5.4 (4.8, 6.1)
Ceramicised Metal/Non XLPE	27	287	1.8 (0.7, 4.2)	4.0 (2.2, 7.1)	4.4 (2.5, 7.6)	7.9 (5.2, 12.1)	11.2 (7.7, 16.2)	
Ceramicised Metal/XLPE	299	14016	1.5 (1.3, 1.7)	2.0 (1.7, 2.2)	2.3 (2.0, 2.6)	2.6 (2.3, 2.9)	3.3 (2.9, 3.9)	
TOTAL	**8826**	**262193**						

Note: 253 procedures with unknown bearing surface, one procedure with Ceramicised Metal/Ceramic bearing surface and 7 procedures with Metal/Ceramic bearing surface have been excluded
All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Figure HT23 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Bearing Surface (Primary Diagnosis OA)



HR – adjusted for age and gender

Ceramic/Ceramic vs Metal/XLPE	Entire Period: HR=1.08 (1.02, 1.14),p=0.013
Ceramic/Non XLPE vs Metal/XLPE	0 - 1Yr: HR=1.31 (1.07, 1.60),p=0.009
	1Yr - 3Yr: HR=1.50 (1.15, 1.95),p=0.002
	3Yr - 5Yr: HR=1.14 (0.79, 1.65),p=0.477
	5Yr - 7Yr: HR=1.66 (1.19, 2.31),p=0.002
	7Yr - 9Yr: HR=2.05 (1.47, 2.87),p<0.001
	9Yr - 11Yr: HR=2.40 (1.70, 3.38),p<0.001
	11Yr+: HR=4.74 (3.21, 7.00),p<0.001
Ceramic/XLPE vs Metal/XLPE	Entire Period: HR=1.04 (0.96, 1.12),p=0.375
Metal/Metal vs Metal/XLPE	Entire Period: HR=1.36 (1.21, 1.54),p<0.001
Metal/Non XLPE vs Metal/XLPE	0 - 1Mth: HR=0.77 (0.64, 0.91),p=0.002
	1Mth - 3Mth: HR=0.99 (0.82, 1.21),p=0.950
	3Mth - 6Mth: HR=0.99 (0.77, 1.28),p=0.964
	6Mth - 1Yr: HR=1.39 (1.15, 1.68),p<0.001
	1Yr - 3Yr: HR=1.26 (1.11, 1.42),p<0.001
	3Yr - 5Yr: HR=1.55 (1.34, 1.78),p<0.001
	5Yr - 7Yr: HR=1.76 (1.51, 2.04),p<0.001
	7Yr - 9Yr: HR=2.13 (1.80, 2.53),p<0.001
	9Yr - 11Yr: HR=2.14 (1.75, 2.61),p<0.001
	11Yr+: HR=3.53 (2.62, 4.75),p<0.001
Ceramicised Metal/XLPE vs Metal/XLPE	0 - 1Yr: HR=1.03 (0.89, 1.19),p=0.671
	1Yr+: HR=0.54 (0.44, 0.67),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Ceramic/Ceramic	65114	56824	41560	28289	18897	9189	268
Ceramic/Non XLPE	5273	4846	4255	3759	3270	2272	327
Ceramic/ XLPE	30835	23805	14797	8528	4737	1527	17
Metal/Metal	5129	4961	4684	4285	3543	2126	88
Metal/Non XLPE	34014	32622	29942	26387	21884	13709	1107
Metal/ XLPE	107225	92580	67229	44874	27380	10279	104
Ceramicised Metal/ XLPE	14016	11824	8003	5102	3157	791	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 152,076 procedures reported to the Registry. This includes 3,332 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, this is only evident after six months (Table HT28 and Figure HT24). The difference increases with time and at 14 years the cumulative percent revision is 5.2% and 10.2% respectively. The cumulative incidence of loosening/lysis and prosthesis dislocation is 3.6% and 1.6% at 14 years for non cross-linked compared to 1.1% and 1.3% for cross-linked polyethylene bearings respectively (Figure HT25).

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. There is no difference between head sizes less than 32mm and greater than 32mm (Table HT28, Figure HT26 and Figure HT27).

Head sizes of 32mm or greater were used in 70.7% of cross-linked polyethylene procedures and only 11.3% 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. The lower cumulative incidence of loosening/lysis when cross-linked polyethylene is used is evident within each head size group (Figure HT28).

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 HT29). This difference is evident after three months for a ceramic head, six months for a metal head and 1.5 years for a ceramicised metal head (data not shown).

Prosthesis Specific

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

The Allofit Shell has a 10 year follow up with an insert using both types of polyethylene. Cross-linked polyethylene is used in 89.1% of Allofit Shell total conventional hip procedures. Cross-linked polyethylene has a lower rate of revision than non cross-linked polyethylene (Table HT29 and Figure HT30).

The Duraloc Shell has a 10 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. Cross-linked polyethylene has a lower rate of revision compared to non cross-linked polyethylene (Table HT29 and Figure HT31).

The Reflection Cup has a 10 year follow up for both types of polyethylene. Cross-linked polyethylene has been used in 49.9% of Reflection Cup total conventional hip procedures. After five years, cross-linked polyethylene has a lower rate of revision than non cross-linked polyethylene (Table HT29 and Figure HT32).

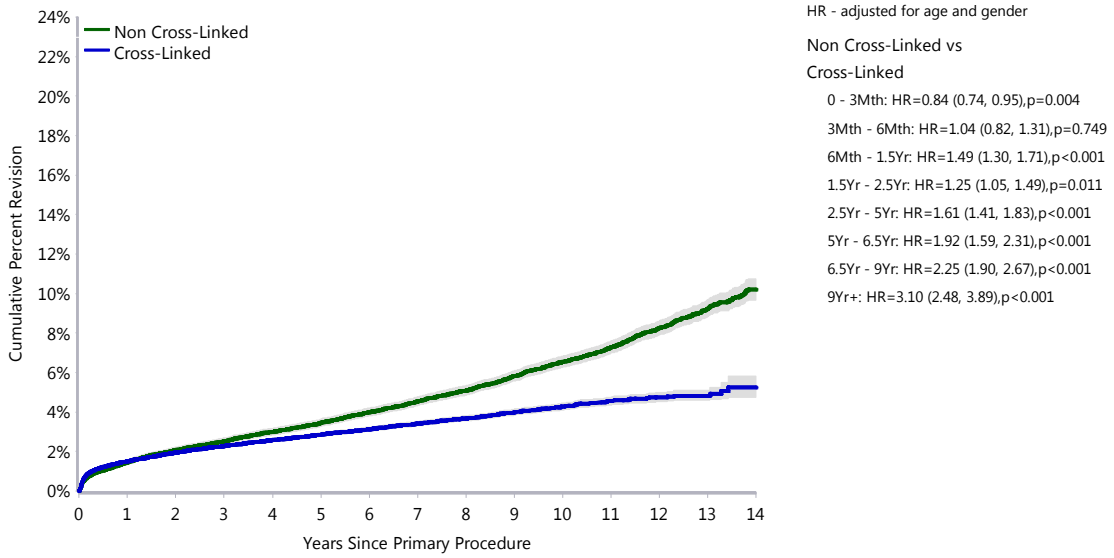
The Reflection Shell has a 10 year follow up with an insert using both types of polyethylene. Cross-linked polyethylene is used in 83.1% of Reflection Shell total conventional hip procedures. Cross-linked polyethylene has a lower rate of revision after three months compared to non cross-linked polyethylene (Table HT29 and Figure HT33).

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 HT29 and Figure HT34). This is the only acetabular prosthesis where cross-linked polyethylene does not demonstrate a lower rate of revision compared to non cross-linked.

Table HT28 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	14 Yrs
Non Cross-Linked		**2368**	**39574**	**1.5 (1.3, 1.6)**	**2.5 (2.4, 2.7)**	**3.5 (3.3, 3.7)**	**4.5 (4.3, 4.8)**	**6.5 (6.3, 6.8)**	**10.2 (9.7, 10.8)**
	<32mm	2182	35093	1.4 (1.3, 1.6)	2.5 (2.3, 2.6)	3.4 (3.2, 3.6)	4.5 (4.2, 4.7)	6.5 (6.2, 6.8)	10.2 (9.6, 10.7)
	32mm	165	4208	1.5 (1.2, 1.9)	2.9 (2.4, 3.5)	3.7 (3.1, 4.4)	5.0 (4.2, 5.9)	5.7 (4.8, 6.9)	
	>32mm	21	273	4.1 (2.3, 7.3)	6.9 (4.3, 10.9)	9.0 (5.8, 13.9)			
Cross-Linked		**4036**	**152076**	**1.5 (1.5, 1.6)**	**2.3 (2.2, 2.4)**	**2.9 (2.8, 3.0)**	**3.4 (3.3, 3.5)**	**4.3 (4.1, 4.5)**	**5.2 (4.7, 5.8)**
	<32mm	1509	44544	1.5 (1.4, 1.6)	2.3 (2.2, 2.5)	2.9 (2.7, 3.1)	3.5 (3.3, 3.7)	4.4 (4.1, 4.6)	5.3 (4.8, 5.9)
	32mm	1378	60701	1.5 (1.4, 1.6)	2.2 (2.1, 2.3)	2.6 (2.4, 2.7)	3.1 (3.0, 3.3)	3.9 (3.6, 4.2)	
	>32mm	1149	46831	1.6 (1.5, 1.7)	2.4 (2.2, 2.5)	3.2 (3.0, 3.4)	3.6 (3.4, 3.9)	4.6 (4.1, 5.3)	
TOTAL		**6404**	**191650**						

Figure HT24 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	14 Yrs
Non Cross-Linked	39574	37739	34450	30378	25345	16076	1434
Cross-Linked	152076	128209	90029	58504	35274	12597	121

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

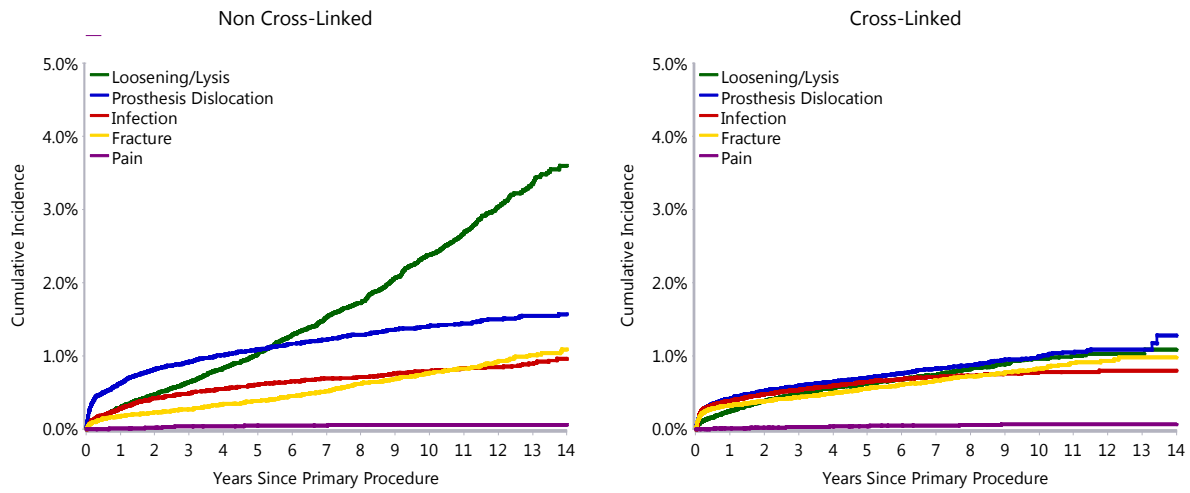
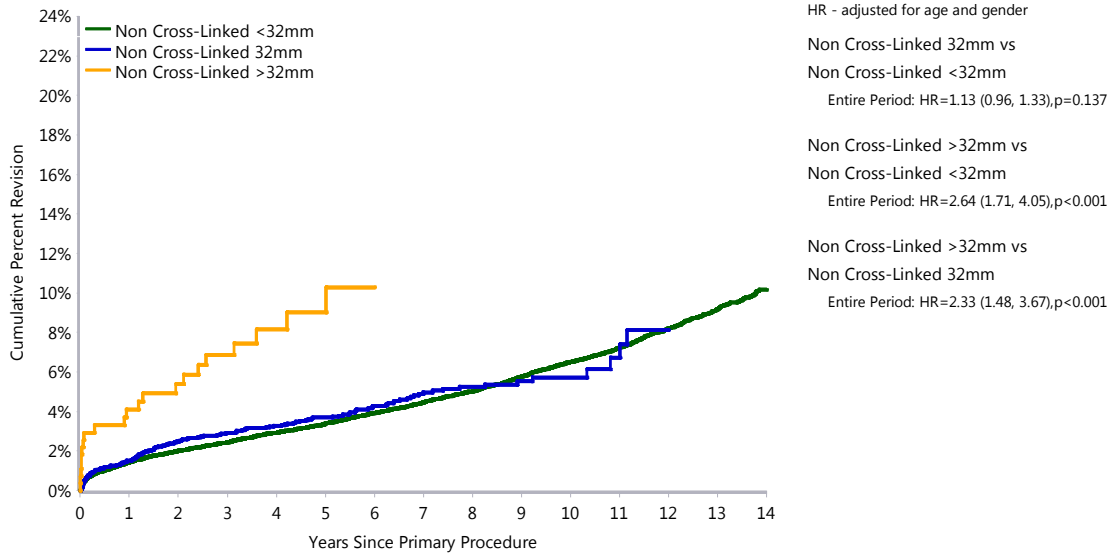
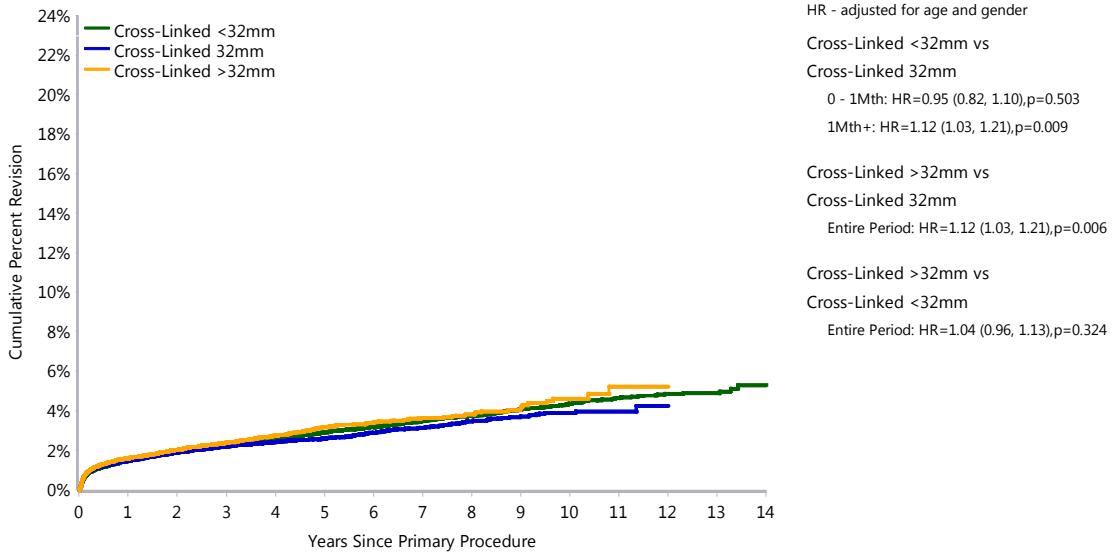


Figure HT26 Cumulative Percent Revision of Primary Total Conventional Hip Replacement using Non Cross-linked Polyethylene by Head Size (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Non Cross-Linked	<32mm	35093	33683	31276	28257	24081	15785	1431
Non Cross-Linked	32mm	4208	3815	3008	2049	1228	287	3
Non Cross-Linked	>32mm	273	241	166	72	36	4	0

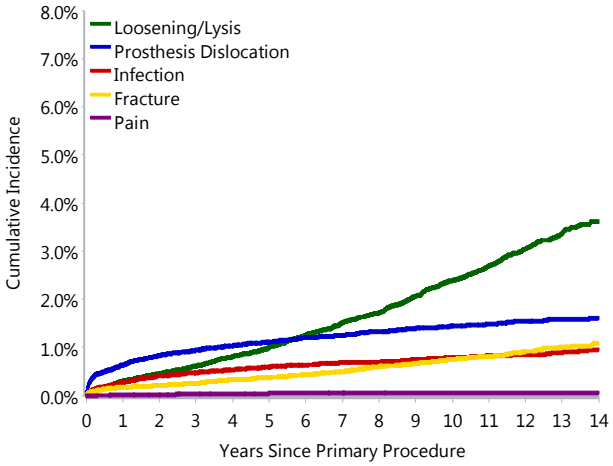
Figure HT27 Cumulative Percent Revision of Primary Total Conventional Hip Replacement using Cross-linked Polyethylene by Head Size (Primary Diagnosis OA)



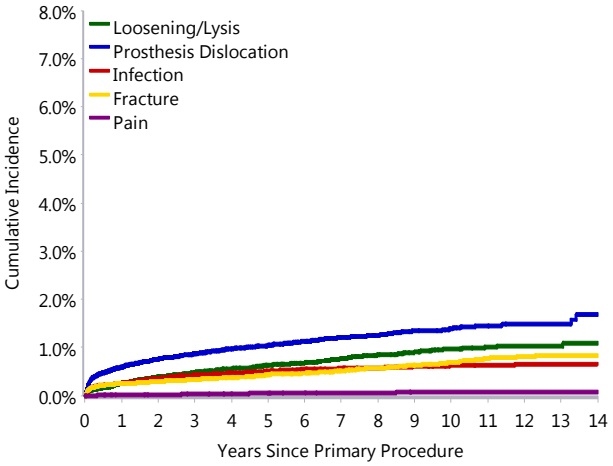
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cross-Linked	<32mm	44544	41255	35174	28740	22150	10461	120
Cross-Linked	32mm	60701	49226	31585	18125	8960	1555	1
Cross-Linked	>32mm	46831	37728	23270	11639	4164	581	0

Figure HT28 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement by Type of Polyethylene and Head Size (Primary Diagnosis OA)

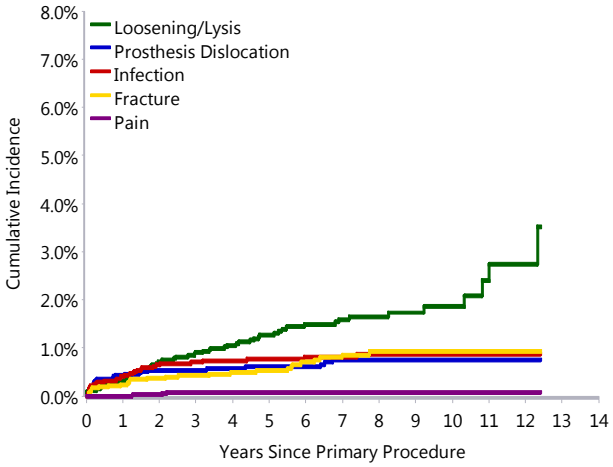
<32mm Non Cross-Linked



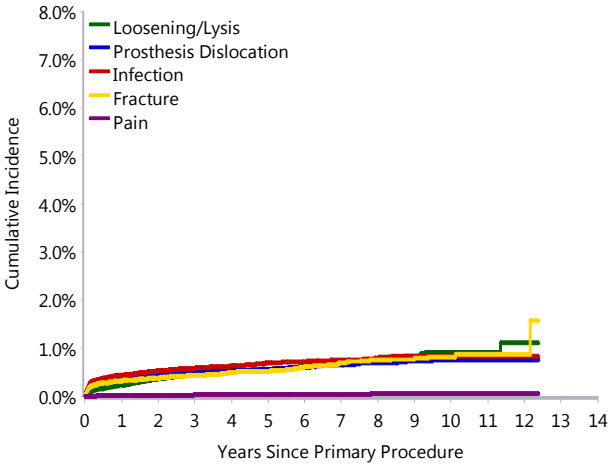
<32mm Cross-Linked



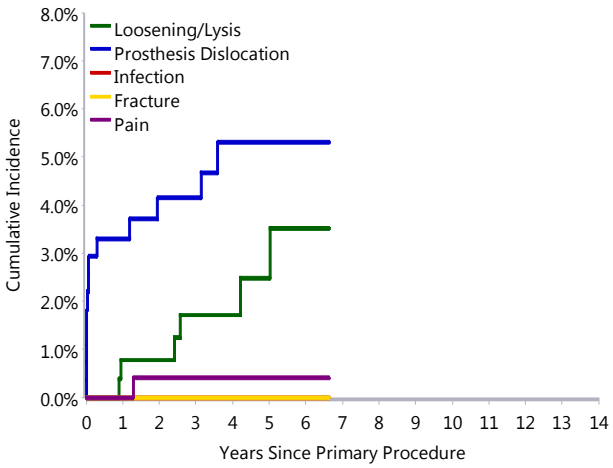
32mm Non Cross-Linked



32mm Cross-Linked



>32mm Non Cross-Linked



>32mm Cross-Linked

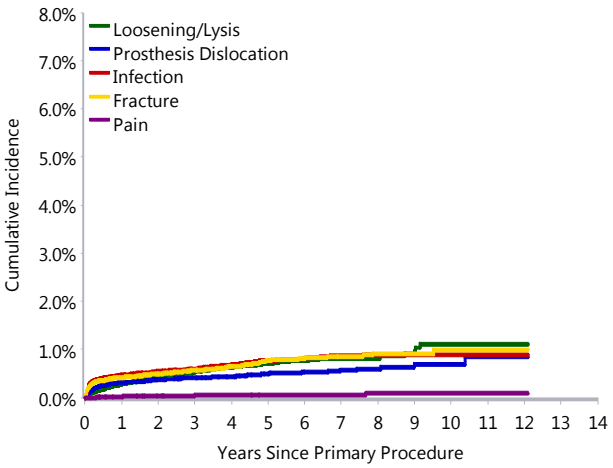
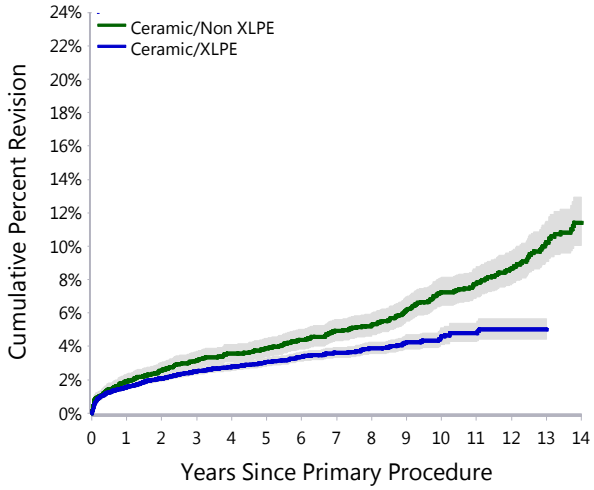
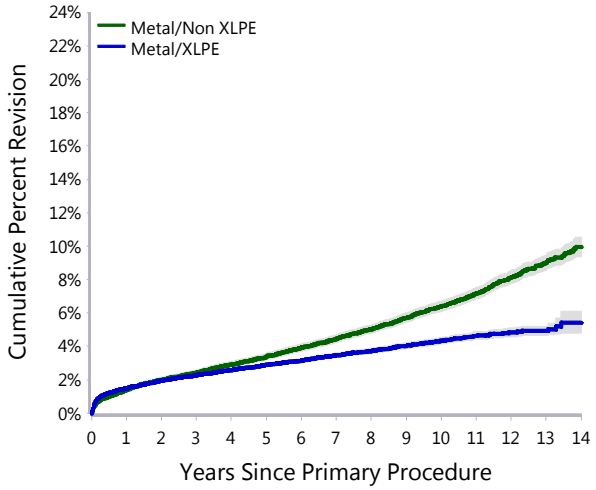


Figure HT29 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Head Surface and Type of Polyethylene (Primary Diagnosis OA)





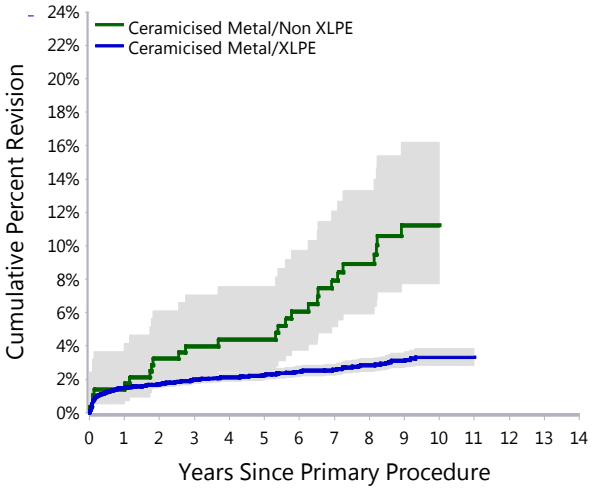
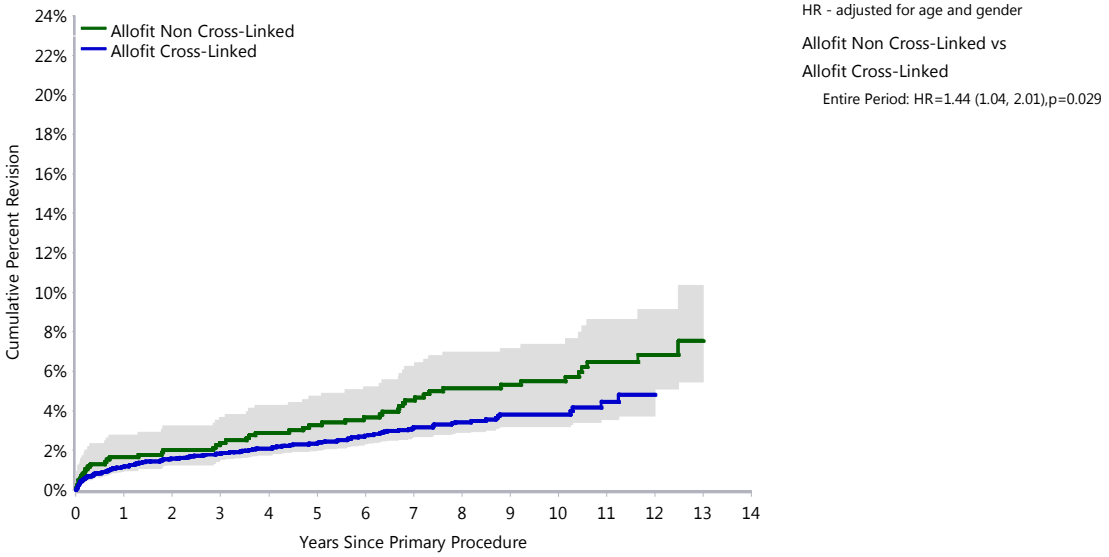


Table HT29 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Prosthesis Type and Type of Polyethylene (Primary Diagnosis OA)

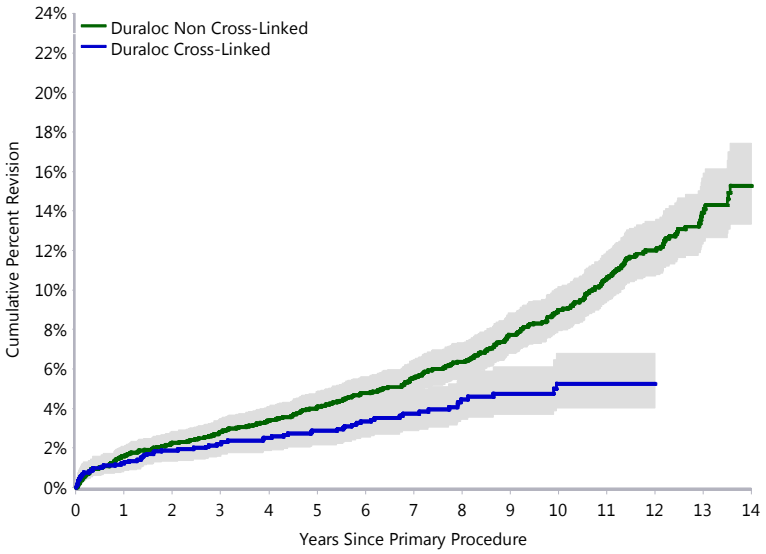
Acetabular Component	Type of Polyethylene	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Allofit		**225**	**7792**	**1.2 (1.0, 1.5)**	**1.9 (1.6, 2.3)**	**2.5 (2.1, 2.9)**	**3.4 (2.9, 3.9)**	**4.1 (3.6, 4.8)**	
	Non Cross-Linked	48	848	1.7 (1.0, 2.8)	2.4 (1.5, 3.7)	3.3 (2.3, 4.7)	4.5 (3.3, 6.2)	5.5 (4.1, 7.4)	
	Cross-Linked	177	6944	1.2 (1.0, 1.5)	1.8 (1.5, 2.2)	2.4 (2.0, 2.8)	3.2 (2.7, 3.7)	3.8 (3.2, 4.5)	
Duraloc		**367**	**4710**	**1.5 (1.2, 1.9)**	**2.6 (2.2, 3.1)**	**3.6 (3.1, 4.2)**	**5.0 (4.3, 5.6)**	**8.0 (7.1, 8.9)**	**13.8 (12.0, 15.8)**
	Non Cross-Linked	299	2994	1.6 (1.2, 2.1)	2.8 (2.3, 3.5)	4.1 (3.4, 4.8)	5.6 (4.8, 6.5)	9.0 (7.9, 10.2)	15.3 (13.3, 17.4)
	Cross-Linked	68	1716	1.3 (0.9, 2.0)	2.2 (1.6, 3.0)	2.9 (2.2, 3.8)	3.7 (2.9, 4.8)	5.2 (4.0, 6.8)	
Reflection (Cup)		**134**	**2151**	**0.8 (0.5, 1.3)**	**1.7 (1.2, 2.4)**	**2.9 (2.2, 3.8)**	**4.4 (3.5, 5.5)**	**8.4 (7.0, 10.2)**	
	Non Cross-Linked	111	1078	0.6 (0.3, 1.2)	1.9 (1.3, 3.0)	3.3 (2.3, 4.6)	5.5 (4.2, 7.1)	11.0 (9.0, 13.5)	
	Cross-Linked	23	1073	1.1 (0.6, 1.9)	1.4 (0.8, 2.3)	2.5 (1.6, 3.7)	2.6 (1.7, 4.0)	2.6 (1.7, 4.0)	
Reflection (Shell)		**508**	**13759**	**1.2 (1.0, 1.4)**	**1.9 (1.7, 2.1)**	**2.4 (2.1, 2.7)**	**3.1 (2.8, 3.5)**	**4.8 (4.3, 5.3)**	**9.2 (7.6, 10.9)**
	Non Cross-Linked	228	2321	1.6 (1.2, 2.2)	3.2 (2.6, 4.0)	4.3 (3.5, 5.2)	6.1 (5.1, 7.2)	9.5 (8.3, 10.9)	15.3 (13.1, 17.7)
	Cross-Linked	280	11438	1.1 (0.9, 1.3)	1.6 (1.4, 1.9)	2.0 (1.7, 2.2)	2.4 (2.1, 2.8)	3.2 (2.8, 3.6)	
Vitalock		**219**	**4619**	**1.0 (0.8, 1.4)**	**1.9 (1.5, 2.3)**	**2.5 (2.1, 3.0)**	**3.1 (2.7, 3.7)**	**4.5 (3.9, 5.2)**	**6.5 (5.5, 7.6)**
	Non Cross-Linked	181	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)	4.6 (3.9, 5.4)	6.6 (5.6, 7.8)
	Cross-Linked	38	1050	0.7 (0.3, 1.4)	1.6 (1.0, 2.5)	2.4 (1.6, 3.5)	3.0 (2.1, 4.3)	3.9 (2.8, 5.4)	
TOTAL		**1453**	**33031**						

Figure HT30 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	14 Yrs
Allofit	Non Cross-Linked	848	828	793	736	641	446	7
Allofit	Cross-Linked	6944	6244	4916	3503	2105	635	0

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



HR - adjusted for age and gender

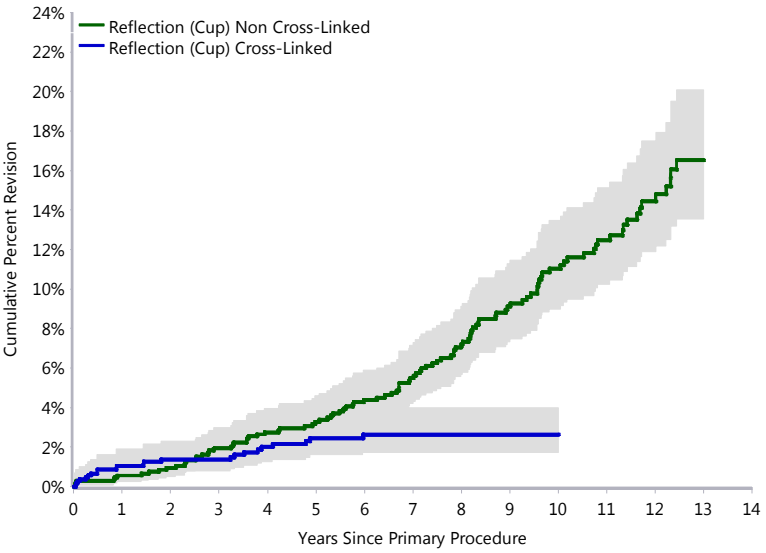
Duraloc Non Cross-Linked vs Duraloc Cross-Linked

0 - 8Yr: HR=1.40 (1.05, 1.87),p=0.021

8Yr+: HR=4.92 (2.01, 12.06),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Duraloc	Non Cross-Linked	2994	2915	2743	2568	2342	1721	112
Duraloc	Cross-Linked	1716	1668	1559	1319	894	386	0

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



HR - adjusted for age and gender

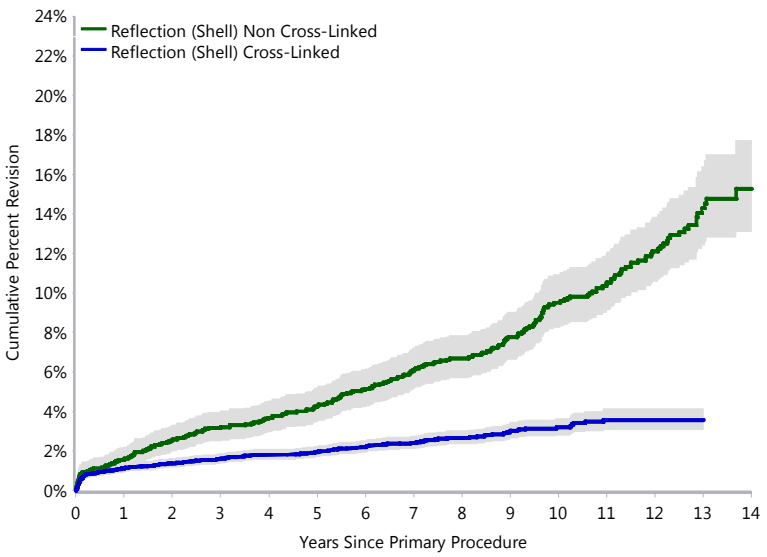
Reflection (Cup) Non Cross-Linked vs Reflection (Cup) Cross-Linked

0 - 5Yr: HR=1.25 (0.73, 2.14),p=0.423

5Yr+: HR=27.76 (3.85, 200.2),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Reflection (Cup)	Non Cross-Linked	1078	1051	974	895	758	467	36
Reflection (Cup)	Cross-Linked	1073	991	816	619	394	132	0

Figure HT33 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=1.50 (0.90, 2.50),p=0.121

1Mth - 3Mth: HR=0.60 (0.21, 1.70),p=0.336

3Mth - 3.5Yr: HR=2.59 (1.85, 3.63),p<0.001

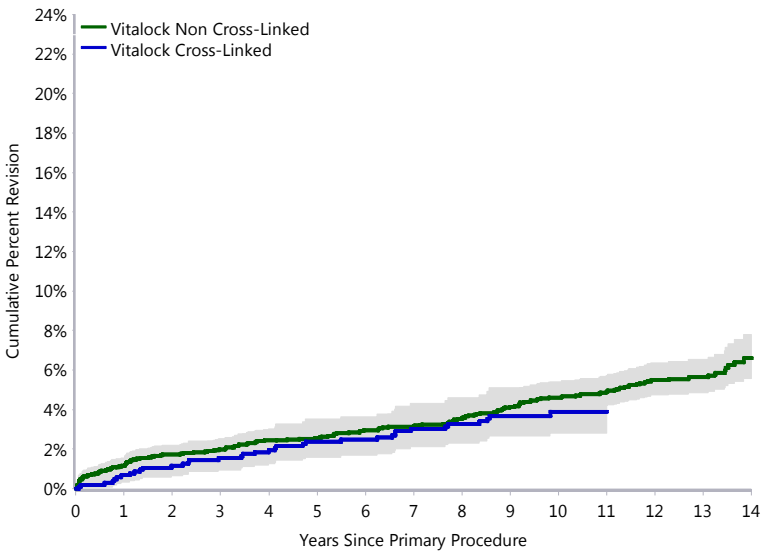
3.5Yr - 4Yr: HR=5.88 (2.04, 16.94),p=0.001

4Yr - 10Yr: HR=4.21 (3.12, 5.68),p<0.001

10Yr+: HR=5.75 (2.40, 13.73),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Reflection (Shell)	Non Cross-Linked	2321	2241	2115	1964	1754	1194	113
Reflection (Shell)	Cross-Linked	11438	10750	9504	8043	5981	1983	6

Figure HT34 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=1.12 (0.79, 1.60),p=0.518

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Vitalock	Non Cross-Linked	3569	3477	3330	3161	2956	2473	392
Vitalock	Cross-Linked	1050	1032	985	936	861	428	0

Constrained Acetabular Prosthesis

This year, for the first time, the Registry is reporting on the use of constrained acetabular components.

Constrained acetabular prostheses have a mechanism to lock the femoral head into the acetabular component. Although often considered 'revision' components, there have been 1,789 constrained acetabular prostheses used for primary total conventional hip replacement. Of these, 611 are constrained acetabular inserts and 1,178 constrained cups.

If all primary diagnoses are considered, there is no difference in the rate of revision when constrained prostheses are compared to other acetabular prostheses (Table HT30 and Figure HT35).

Compared to other acetabular prostheses, constrained acetabular prostheses are used more commonly for fractured neck of femur, tumour, failed internal fixation and fracture/dislocation (Table HT31).

For a primary diagnosis of osteoarthritis, there is also no difference in the rate of revision of constrained acetabular prostheses compared to other acetabular prostheses (Table HT32 and Figure HT36). There is also no gender difference (Table HT33 and Figure HT37).

Age is a risk factor for revision. For a primary diagnosis of osteoarthritis, patients aged ≤70 years have a higher rate of revision compared to those aged >70 years (Table HT34 and Figure HT38). There is no difference in the rate of revision for fixation (Table HT35 and Figure HT39). Constrained prostheses show no difference in the rate of revision for loosening/lysis or dislocation.

When used for fractured neck of femur, constrained prostheses have a lower rate of revision compared to other acetabular prostheses (Table HT36 and Figure HT40).

Dual Mobility Acetabular Prosthesis

The Registry is also reporting on the outcome of dual mobility acetabular prostheses for the first time. Dual mobility prostheses have a femoral head which moves within a polyethylene component which also moves within a fixed acetabular shell.

There have been 1,702 primary total conventional hip replacements using dual mobility prostheses.

If all primary diagnoses are considered, there is no difference in the rate of revision of dual mobility prostheses when compared to other acetabular prostheses (Table HT37 and Figure HT41). Compared to other acetabular prostheses, dual mobility acetabular prostheses are used more frequently for fractured neck of femur, tumour and failed internal fixation (Table HT38).

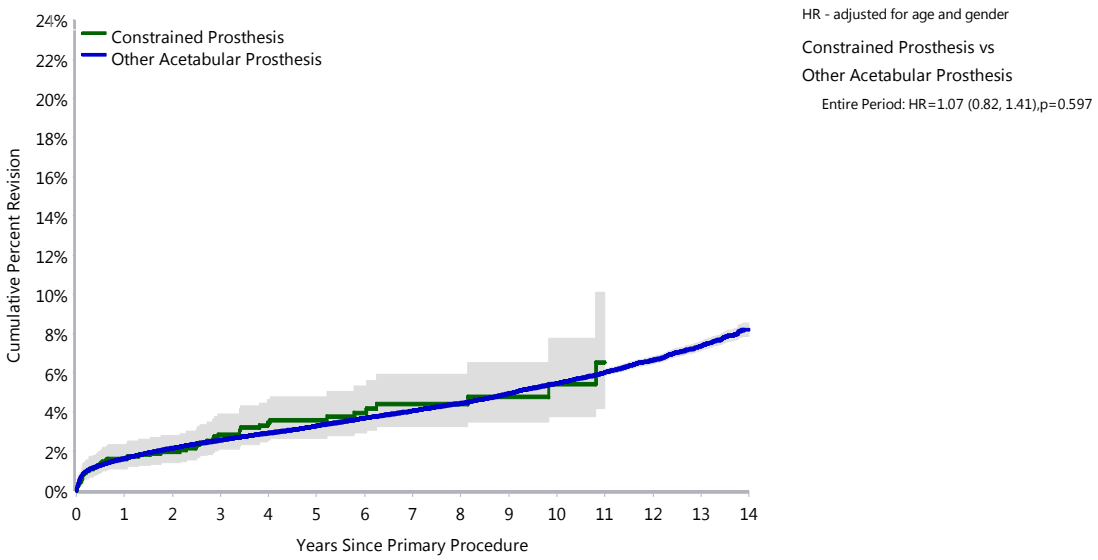
For osteoarthritis or for fractured neck of femur, there is no difference in the rate of revision when dual mobility prostheses are compared to other acetabular prostheses (Table HT39 and Figure HT42, Table HT40 and Figure HT43).

Table HT30 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Type (All Diagnoses)

Acetabular Type	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Constrained Prosthesis	54	1789	1.6 (1.1, 2.3)	2.8 (2.1, 3.9)	3.6 (2.7, 4.8)	4.4 (3.3, 5.9)	5.4 (3.8, 7.8)	
Other Acetabular Prosthesis	10410	294743	1.6 (1.6, 1.7)	2.6 (2.5, 2.6)	3.3 (3.2, 3.4)	4.1 (4.0, 4.2)	5.5 (5.3, 5.6)	8.2 (7.9, 8.5)
TOTAL	**10464**	**296532**						

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

Figure HT35 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Type (All Diagnoses)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Constrained Prosthesis	1789	1432	929	567	350	133	4
Other Acetabular Prosthesis	294743	254544	190060	134753	91862	44355	2169

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

Table HT31 Primary Total Conventional Hip Replacement by Primary Diagnosis and Acetabular Type

	Constrained Prosthesis		Other Acetabular Prosthesis	
Diagnosis	N	Col%	N	Col%
Osteoarthritis	728	40.7	261726	88.8
Fractured Neck Of Femur	642	35.9	11601	3.9
Osteonecrosis	68	3.8	9887	3.4
Developmental Dysplasia	14	0.8	3632	1.2
Rheumatoid Arthritis	21	1.2	3229	1.1
Tumour	187	10.5	1514	0.5
Failed Internal Fixation	95	5.3	1283	0.4
Other Inflammatory Arthritis	5	0.3	1346	0.5
Fracture/Dislocation	21	1.2	306	0.1
Arthrodesis Takedown	6	0.3	100	0.0
Other	2	0.1	119	0.0
TOTAL	**1789**	**100.0**	**294743**	**100.0**

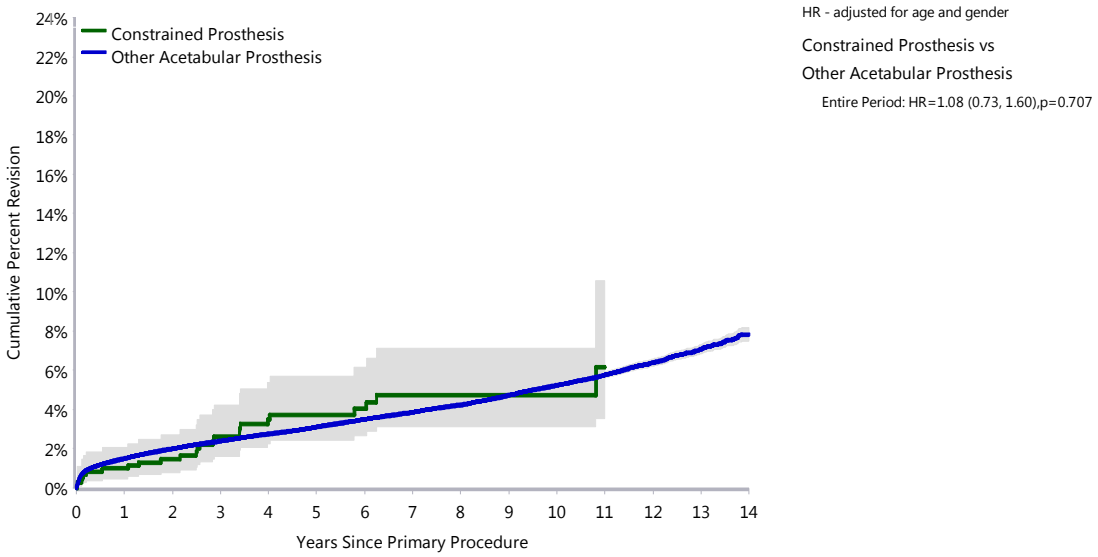
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT32 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Type (Primary Diagnosis OA)

Model	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Constrained Prosthesis	25	728	1.0 (0.5, 2.1)	2.6 (1.6, 4.2)	3.7 (2.4, 5.7)	4.7 (3.1, 7.1)	4.7 (3.1, 7.1)	
Other Acetabular Prosthesis	8812	261726	1.5 (1.5, 1.5)	2.4 (2.3, 2.5)	3.1 (3.0, 3.2)	3.9 (3.8, 4.0)	5.2 (5.1, 5.4)	7.8 (7.5, 8.2)
TOTAL	**8837**	**262454**						

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

Figure HT36 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Type (Primary Diagnosis OA)



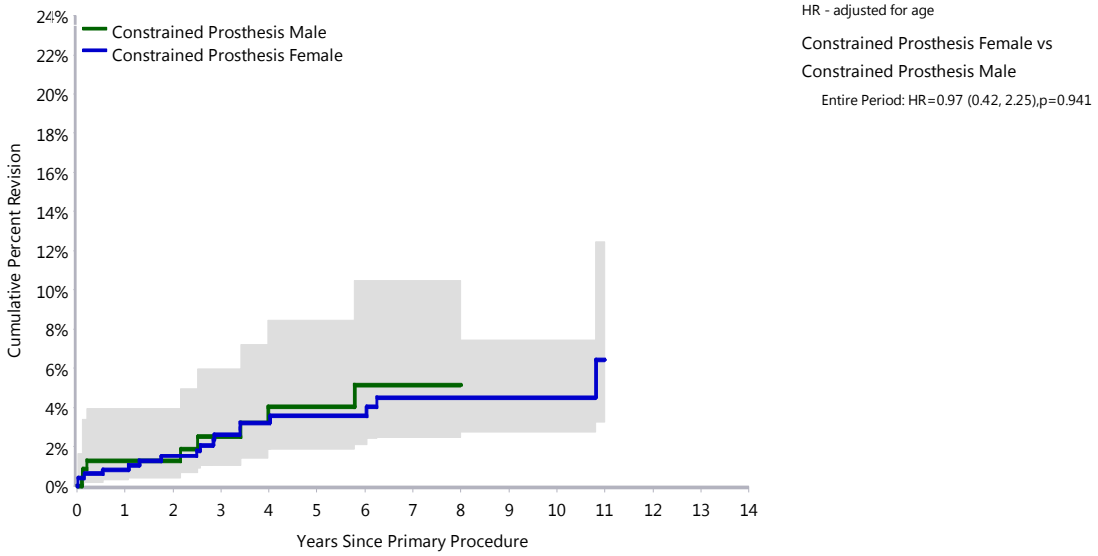
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Constrained Prosthesis	728	647	485	337	228	102	2
Other Acetabular Prosthesis	261726	227550	170671	121411	82934	39933	1912

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

Table HT33 Cumulative Percent Revision of Constrained Primary Total Conventional Hip Replacement by Gender (Primary Diagnosis OA)

Gender	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Male	8	237	1.3 (0.4, 4.0)	2.5 (1.0, 6.0)	4.0 (1.9, 8.5)	5.2 (2.5, 10.5)		
Female	17	491	0.8 (0.3, 2.2)	2.6 (1.5, 4.7)	3.6 (2.1, 6.0)	4.5 (2.7, 7.4)	4.5 (2.7, 7.4)	
TOTAL	**25**	**728**						

Figure HT37 Cumulative Percent Revision of Constrained Primary Total Conventional Hip Replacement by Gender (Primary Diagnosis OA)

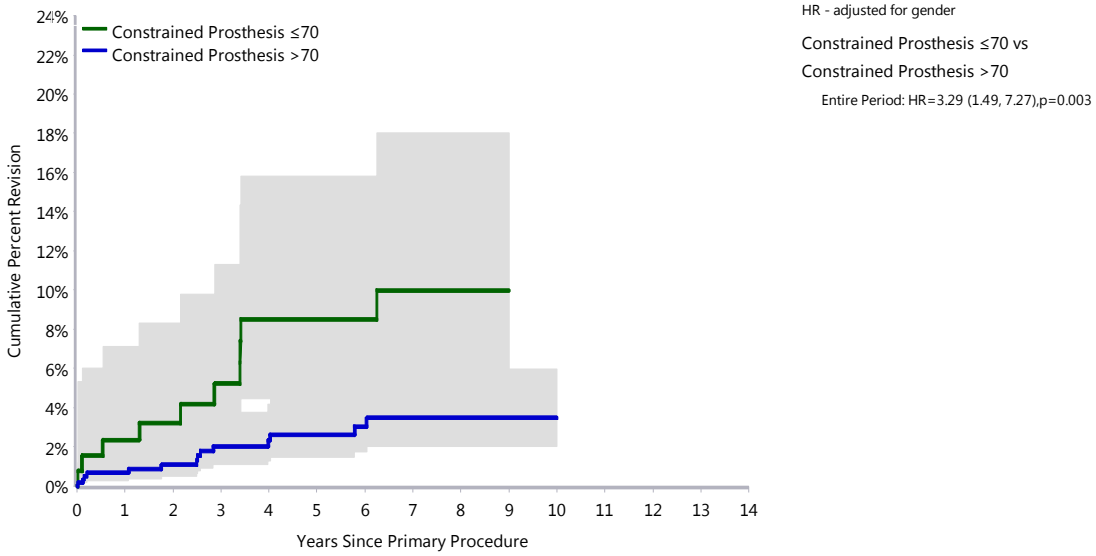


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Male	237	203	140	100	57	26	0
Female	491	444	345	237	171	76	2

Table HT34 Cumulative Percent Revision of Constrained Primary Total Conventional Hip Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
≤70	11	130	2.4 (0.8, 7.1)	5.2 (2.4, 11.3)	8.5 (4.5, 15.8)	10.0 (5.4, 18.0)		
>70	14	598	0.7 (0.3, 1.8)	2.0 (1.1, 3.8)	2.6 (1.5, 4.6)	3.5 (2.0, 6.0)	3.5 (2.0, 6.0)	
TOTAL	**25**	**728**						

Figure HT38 Cumulative Percent Revision of Constrained Primary Total Conventional Hip Replacement by Age (Primary Diagnosis OA)

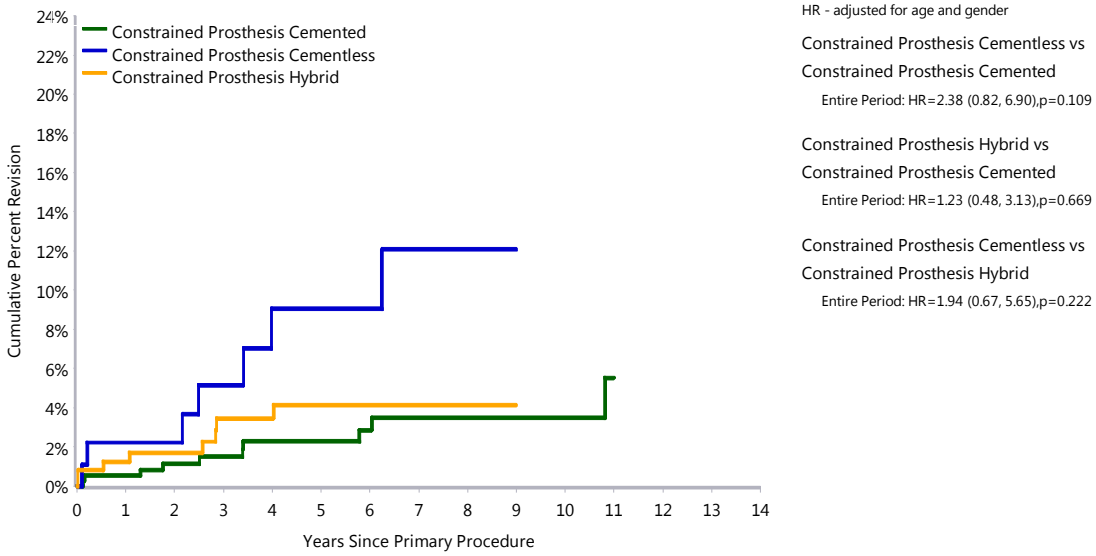


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	14 Yrs
≤70	130	117	88	76	27	0
>70	598	530	397	261	75	2

Table HT35 Cumulative Percent Revision of Constrained Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis OA)

Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cemented	10	388	0.5 (0.1, 2.1)	1.5 (0.6, 3.6)	2.3 (1.1, 4.8)	3.5 (1.8, 6.8)	3.5 (1.8, 6.8)	
Cementless	7	92	2.2 (0.6, 8.6)	5.2 (1.9, 13.3)	9.0 (4.1, 19.5)	12.1 (5.6, 24.9)		
Hybrid	8	248	1.2 (0.4, 3.8)	3.5 (1.6, 7.2)	4.1 (2.1, 8.2)	4.1 (2.1, 8.2)		
TOTAL	**25**	**728**						

Figure HT39 Cumulative Percent Revision of Constrained Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis OA)



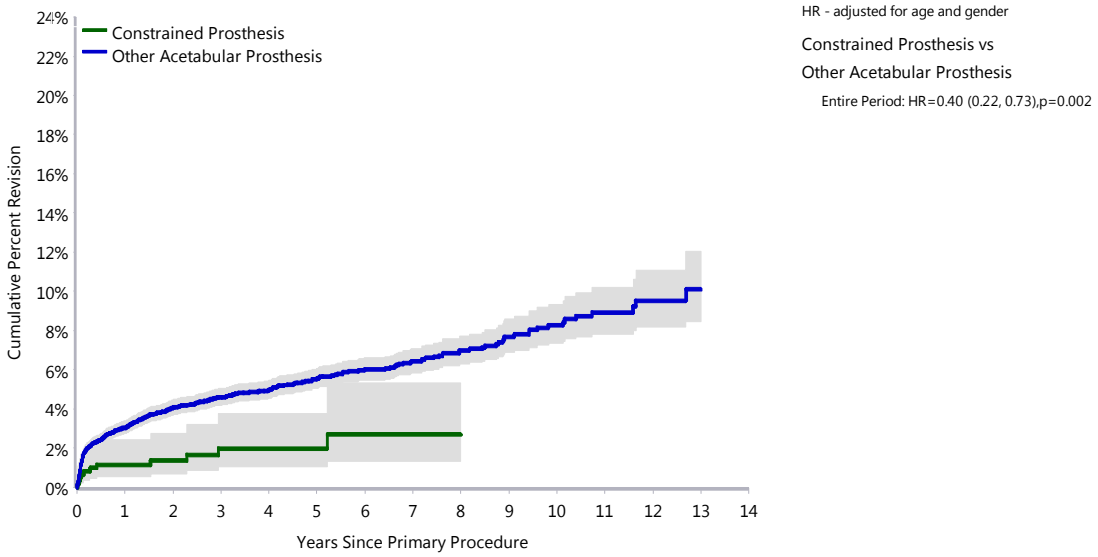
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cemented	388	352	269	184	130	66	0
Cementless	92	78	57	37	24	7	0
Hybrid	248	217	159	116	74	29	2

Table HT36 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Type (Primary Diagnosis Fractured NOF)

Acetabular Type	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Constrained Prosthesis	11	642	1.2 (0.6, 2.4)	2.0 (1.1, 3.8)	2.0 (1.1, 3.8)	2.7 (1.3, 5.3)		
Other Acetabular Prosthesis	553	11601	3.0 (2.7, 3.4)	4.6 (4.2, 5.0)	5.5 (5.1, 6.1)	6.4 (5.8, 7.1)	8.3 (7.3, 9.3)	
TOTAL	**564**	**12243**						

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

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



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Constrained Prosthesis	642	495	295	150	77	16	1
Other Acetabular Prosthesis	11601	8985	5835	3404	1837	643	21

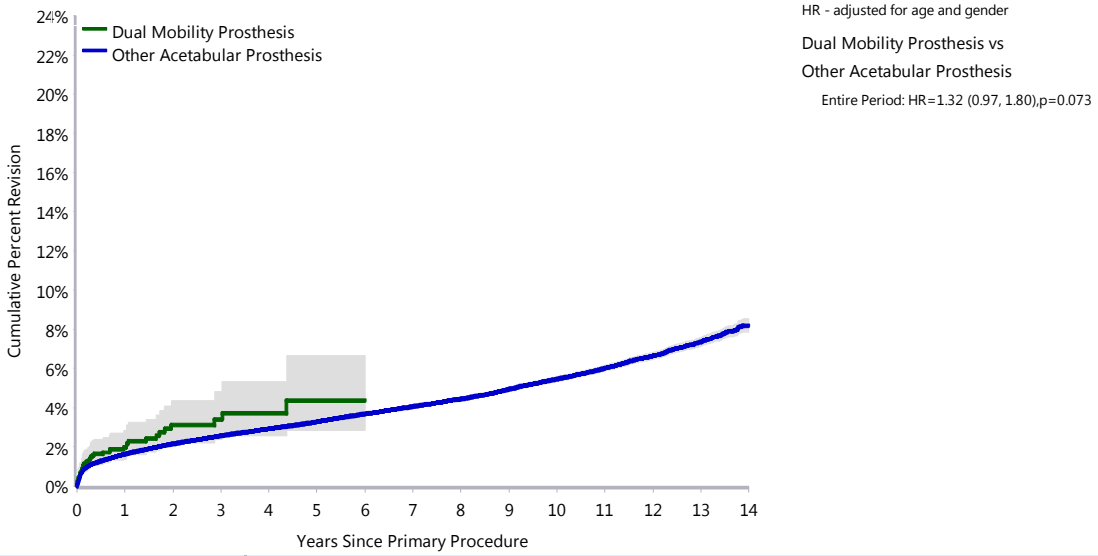
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT37 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Mobility (All Diagnoses)

Acetabular Mobility	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Dual Mobility Prosthesis	41	1702	2.0 (1.4, 2.8)	3.4 (2.4, 4.8)	4.4 (2.9, 6.7)			
Other Acetabular Prosthesis	10423	294830	1.6 (1.6, 1.7)	2.6 (2.5, 2.6)	3.3 (3.2, 3.4)	4.1 (4.0, 4.2)	5.5 (5.3, 5.6)	8.2 (7.9, 8.5)
TOTAL	**10464**	**296532**						

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

Figure HT41 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Mobility (All Diagnoses)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Dual Mobility Prosthesis	1702	974	310	105	22	0	0
Other Acetabular Prosthesis	294830	255002	190679	135215	92190	44488	2173

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

Table HT38 Primary Total Conventional Hip Replacement by Primary Diagnosis and Acetabular Mobility

	Dual Mobility Prosthesis		Other Acetabular Prosthesis	
Diagnosis	N	Col%	N	Col%
Osteoarthritis	1007	59.2	261447	88.7
Fractured Neck Of Femur	443	26.0	11800	4.0
Osteonecrosis	68	4.0	9887	3.4
Developmental Dysplasia	30	1.8	3616	1.2
Rheumatoid Arthritis	8	0.5	3242	1.1
Tumour	65	3.8	1636	0.6
Failed Internal Fixation	51	3.0	1327	0.5
Other Inflammatory Arthritis	5	0.3	1346	0.5
Fracture/Dislocation	18	1.1	309	0.1
Arthrodesis Takedown	6	0.4	100	0.0
Other	1	0.1	120	0.0
TOTAL	**1702**	**100.0**	**294830**	**100.0**

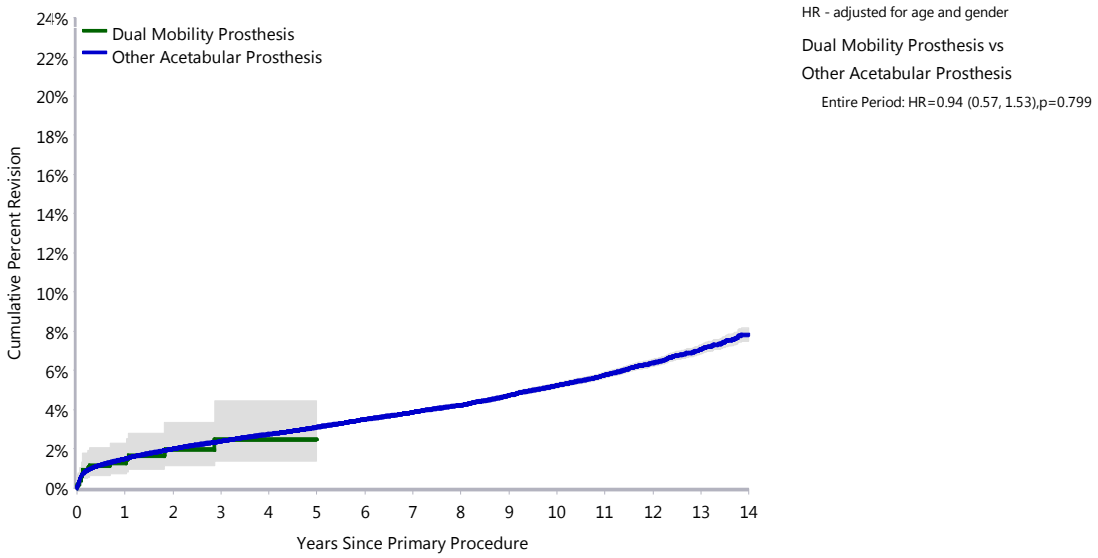
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT39 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Mobility (Primary Diagnosis OA)

Acetabular Mobility	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Dual Mobility Prosthesis	16	1007	1.3 (0.7, 2.3)	2.5 (1.4, 4.5)	2.5 (1.4, 4.5)			
Other Acetabular Prosthesis	8821	261447	1.5 (1.5, 1.5)	2.4 (2.3, 2.5)	3.1 (3.0, 3.2)	3.9 (3.8, 4.0)	5.2 (5.1, 5.4)	7.8 (7.5, 8.2)
TOTAL	**8837**	**262454**						

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

Figure HT42 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Mobility (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Dual Mobility Prosthesis	1007	579	172	47	12	0	0
Other Acetabular Prosthesis	261447	227618	170984	121701	83150	40035	1914

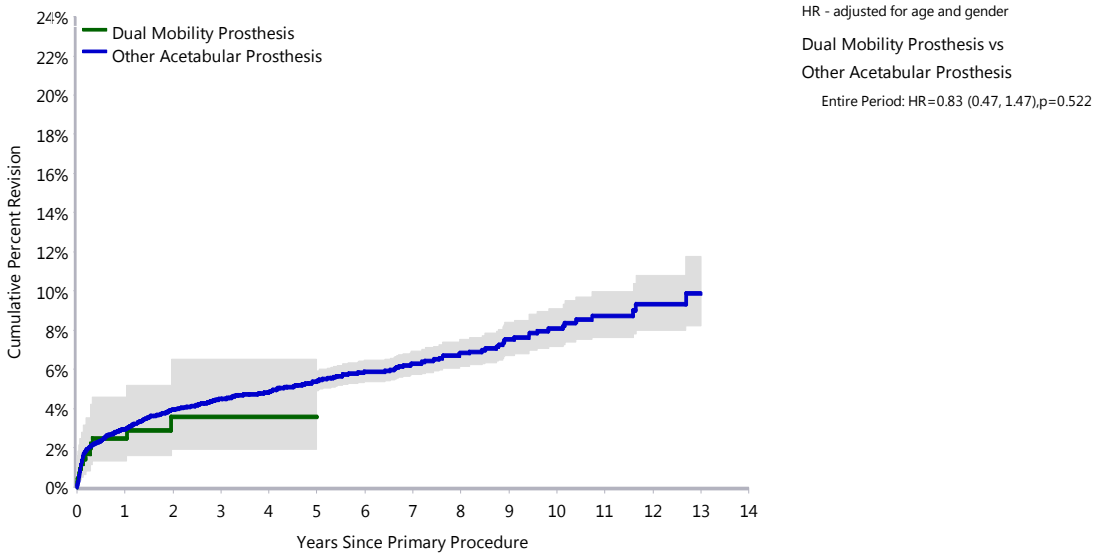
Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

Table HT40 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Mobility (Primary Diagnosis Fractured NOF)

Acetabular Mobility	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Dual Mobility Prosthesis	12	443	2.5 (1.3, 4.6)	3.6 (1.9, 6.5)	3.6 (1.9, 6.5)			
Other Acetabular Prosthesis	552	11800	3.0 (2.7, 3.3)	4.5 (4.1, 4.9)	5.4 (4.9, 5.9)	6.3 (5.7, 6.9)	8.1 (7.2, 9.1)	
TOTAL	**564**	**12243**						

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

Figure HT43 Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Acetabular Mobility (Primary Diagnosis Fractured NOF)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Dual Mobility Prosthesis	443	255	87	42	9	0	0
Other Acetabular Prosthesis	11800	9225	6043	3512	1905	659	22

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

Ceramic/Ceramic Bearing

Ceramic/ceramic bearings have been used in 65,114 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 or larger head size is five years compared to over 10 years follow up for the other three head sizes. Head size 32mm has a lower rate of revision compared to head sizes 28mm or less. There is no difference when head size 32mm is compared to the 36-38mm head size group. Head sizes 40mm or larger have a lower rate of revision compared to 32mm (Table HT41 and Figure HT44). Head sizes 28mm or less have a higher rate of revision for prosthesis dislocation compared to the other head size groups. At one year, the cumulative incidence of dislocation is 0.9% for head sizes 28mm or less compared to 0.4% for 32mm, 0.3% for 36-38mm and 0.2% for head sizes 40mm or larger (Figure HT45).

Fixation

The majority of procedures using ceramic/ceramic bearing surfaces are cementless (85.1%). Hybrid fixation accounts for 14.9%. Hybrid fixation has a lower rate of revision compared to cementless fixation over the entire period (Table HT42 and Figure HT46).

When using cementless fixation, head sizes 40mm or larger have 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 HT43 and Figure HT47). For hybrid fixation, head sizes 28mm or less have a higher rate of revision compared to 32mm over the entire period. Head size 32mm shows no difference compared to 36-38mm and 40mm or greater head size groups (Table HT44 and Figure HT48).

Table HT41 Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)

Bearing Surface	Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Ceramic/Ceramic	≤28mm	408	6535	2.1 (1.7, 2.4)	3.4 (3.0, 3.9)	4.3 (3.8, 4.8)	5.1 (4.6, 5.7)	6.6 (6.0, 7.3)	8.3 (7.4, 9.3)
	32mm	864	24538	1.5 (1.3, 1.6)	2.4 (2.2, 2.6)	3.1 (2.8, 3.3)	3.8 (3.6, 4.1)	4.8 (4.4, 5.1)	6.0 (5.3, 6.6)
	36-38mm	756	29034	1.4 (1.3, 1.5)	2.4 (2.2, 2.6)	3.2 (2.9, 3.4)	3.9 (3.6, 4.2)	5.3 (4.7, 5.9)	
	≥40mm	81	5007	1.1 (0.8, 1.4)	1.7 (1.4, 2.2)	2.3 (1.8, 2.9)			
TOTAL	.	2109	65114						

Figure HT44 Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)

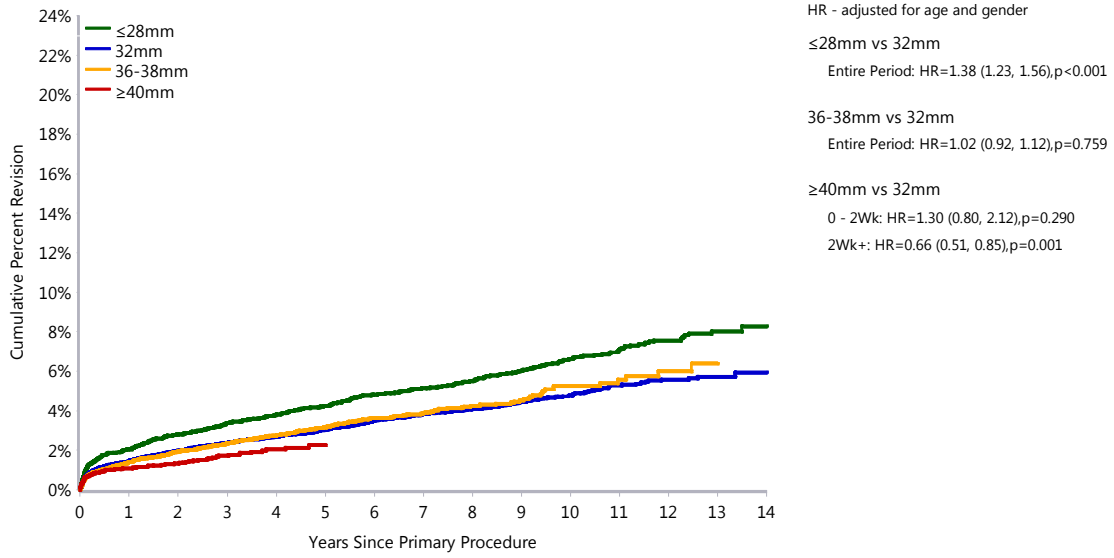
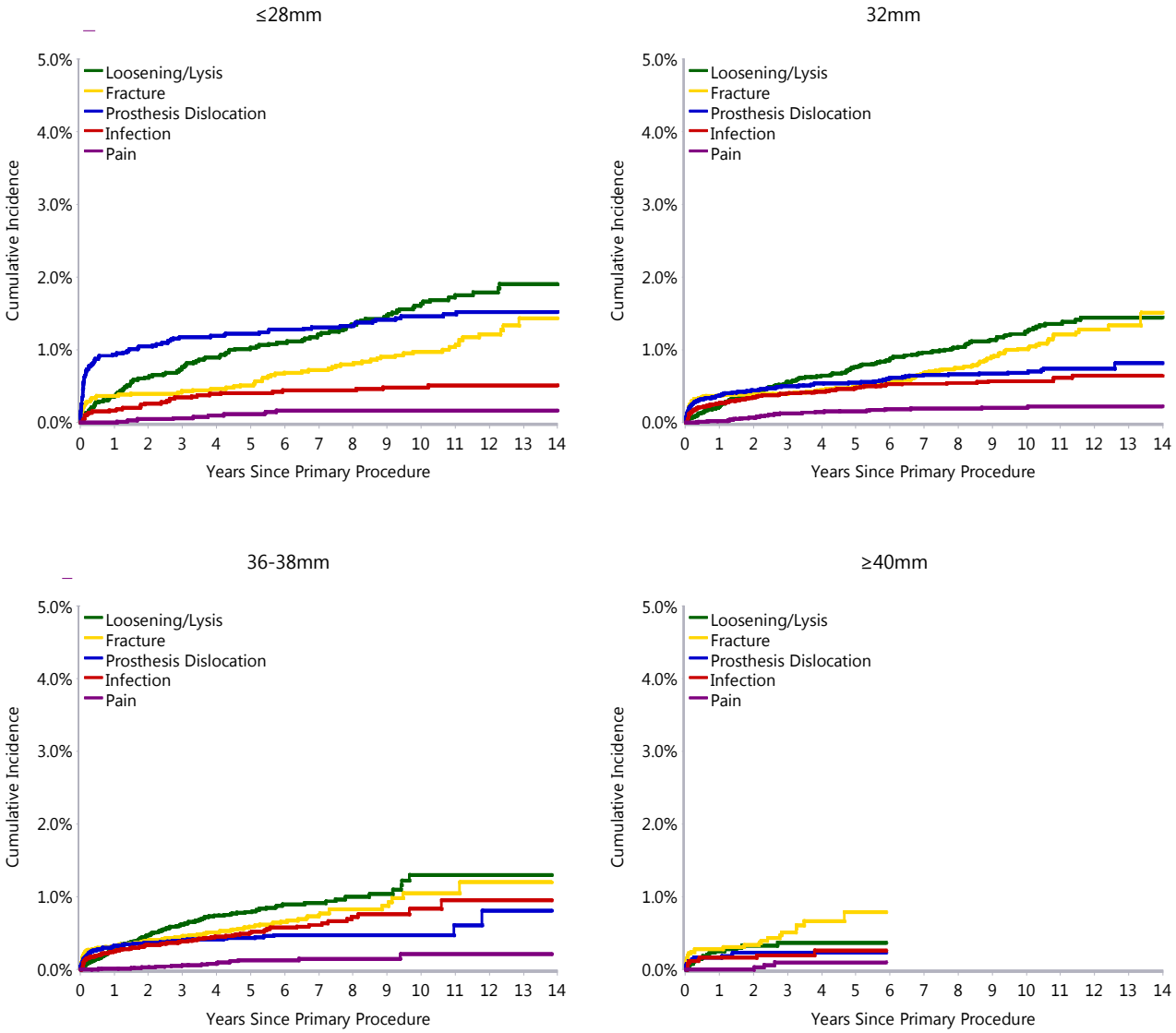


Figure HT45 Cumulative Incidence Revision Diagnosis of Ceramic/Ceramic Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)



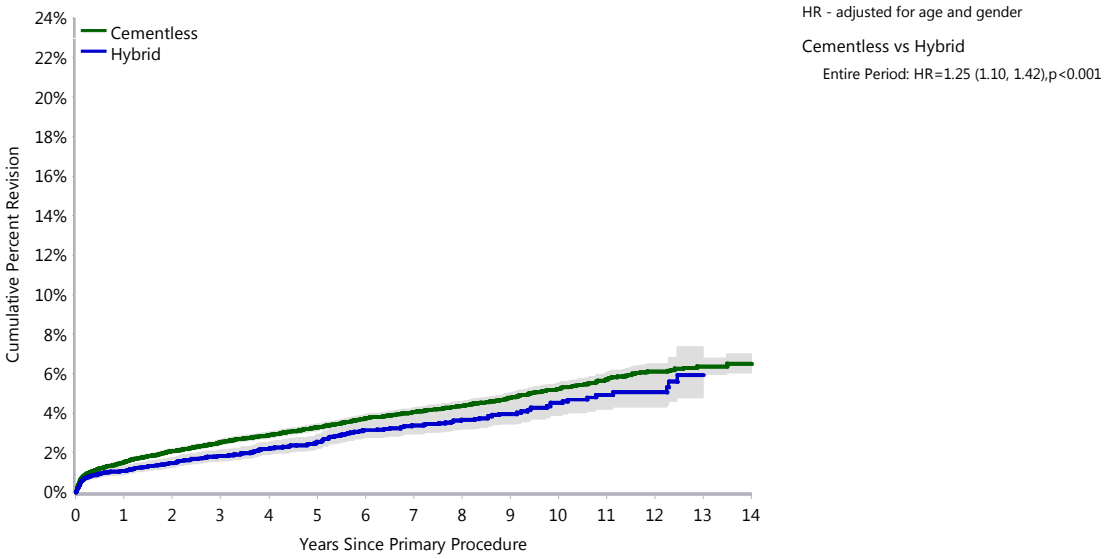
Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
≤28mm	6535	6244	5824	5343	4727	3204	144
32mm	24538	22418	18386	14090	10358	5041	106
36-38mm	29034	24028	15139	8363	3812	944	18
≥40mm	5007	4134	2211	493	0	0	0

Table HT42 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	14 Yrs
Cementless	1839	55411	1.5 (1.4, 1.6)	2.5 (2.4, 2.7)	3.3 (3.1, 3.5)	4.1 (3.9, 4.3)	5.2 (5.0, 5.5)	6.5 (6.0, 7.0)
Hybrid	267	9677	1.1 (0.9, 1.3)	1.8 (1.6, 2.2)	2.6 (2.2, 2.9)	3.4 (3.0, 3.9)	4.5 (3.9, 5.2)	
TOTAL	**2106**	**65088**						

Note: 26 procedures with cemented fixation have been excluded

Figure HT46 Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis OA)

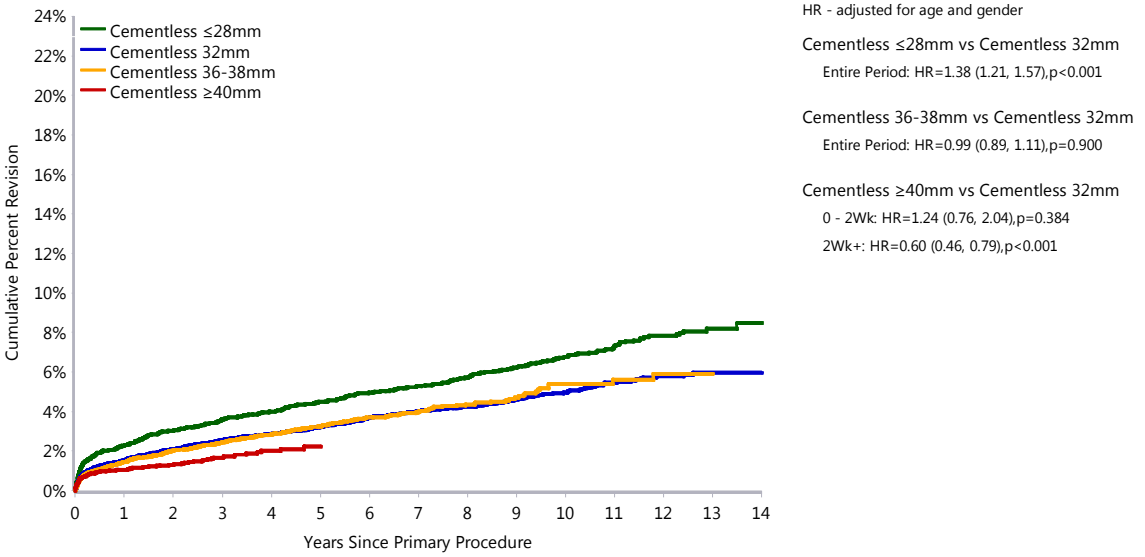


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cementless	55411	48124	34964	23605	15961	8030	262
Hybrid	9677	8675	6573	4666	2923	1157	6

Table HT43 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	14 Yrs
Cementless	≤28mm	341	5143	2.3 (1.9, 2.7)	3.6 (3.1, 4.2)	4.5 (3.9, 5.1)	5.3 (4.7, 5.9)	6.8 (6.1, 7.6)	8.5 (7.5, 9.6)
	32mm	727	19281	1.6 (1.4, 1.7)	2.6 (2.3, 2.8)	3.2 (3.0, 3.5)	4.0 (3.7, 4.3)	5.0 (4.6, 5.4)	6.0 (5.4, 6.5)
	36-38mm	693	26065	1.5 (1.3, 1.6)	2.4 (2.2, 2.7)	3.2 (3.0, 3.5)	4.0 (3.6, 4.4)	5.4 (4.7, 6.1)	
	≥40mm	78	4922	1.1 (0.8, 1.4)	1.7 (1.3, 2.1)	2.2 (1.7, 2.9)			
TOTAL		**1839**	**55411**						

Figure HT47 Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement with Cementless Fixation by Head Size (Primary Diagnosis OA)

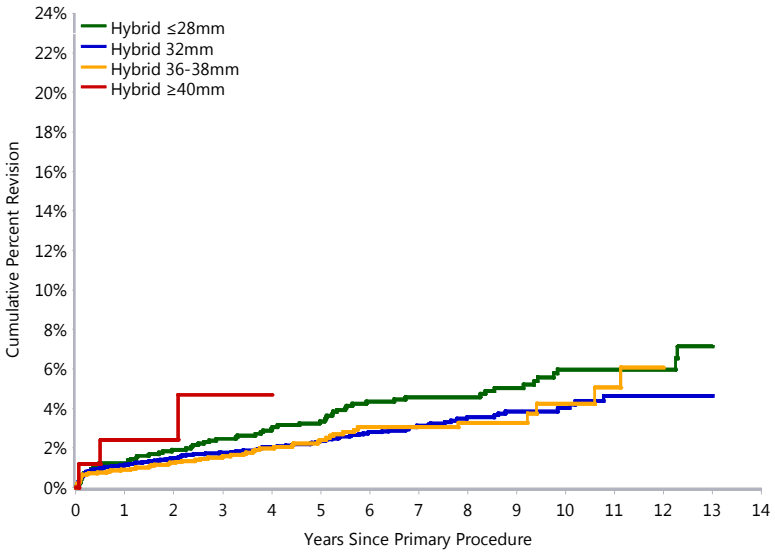


Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cementless	≤28mm	5143	4907	4624	4340	3949	2765	138
	32mm	19281	17633	14615	11438	8751	4474	106
	36-38mm	26065	21524	13543	7337	3261	791	18
	≥40mm	4922	4060	2182	490	0	0	0

Table HT44 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	14 Yrs
Hybrid	≤28mm	65	1386	1.2 (0.8, 2.0)	2.5 (1.8, 3.5)	3.4 (2.5, 4.5)	4.6 (3.5, 5.9)	6.0 (4.6, 7.7)	
	32mm	136	5242	1.1 (0.9, 1.5)	1.8 (1.4, 2.2)	2.4 (2.0, 2.9)	3.1 (2.6, 3.8)	4.0 (3.3, 4.9)	
	36-38mm	63	2964	0.9 (0.6, 1.3)	1.6 (1.2, 2.2)	2.4 (1.8, 3.2)	3.0 (2.3, 4.0)	4.2 (2.9, 6.2)	
	≥40mm	3	85	2.4 (0.6, 9.4)	4.7 (1.4, 14.6)				
TOTAL		**267**	**9677**						

Figure HT48 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=1.44 (1.06, 1.95),p=0.019

Hybrid 36-38mm vs Hybrid 32mm

Entire Period: HR=0.95 (0.70, 1.29),p=0.731

Hybrid ≥40mm vs Hybrid 32mm

Entire Period: HR=2.20 (0.70, 6.92),p=0.178

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Hybrid	≤28mm	1386	1331	1195	1000	775	439	6
	32mm	5242	4771	3757	2641	1600	565	0
	36-38mm	2964	2499	1592	1022	548	153	0
	≥40mm	85	74	29	3	0	0	0

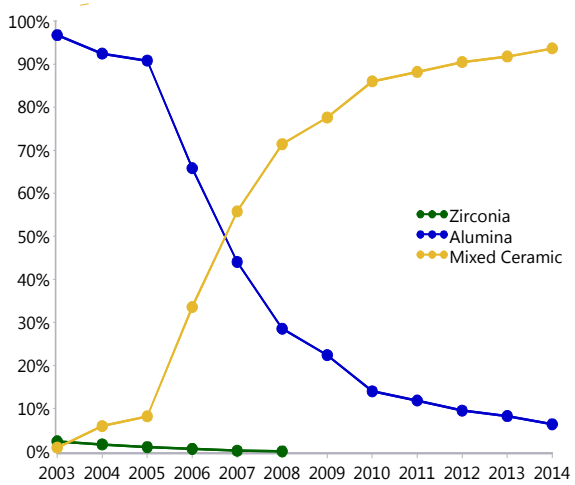
Ceramic Types

There are three types of ceramic femoral heads. They are Zirconia, Alumina, and Zirconia/Alumina combination, referred to as Mixed Ceramic.

Use

When the Registry commenced data collection Alumina was the most common type of ceramic femoral head used. The use of Mixed Ceramic in Australia was first reported in 2003 and within four years its use exceeded Alumina. In 2014, 93.7% of ceramic femoral heads used were Mixed Ceramic; the remaining femoral heads were Alumina. Zirconia femoral heads have only been reported in small numbers and their use ceased in 2008 (Figure HT49).

Figure HT49 Primary Total Conventional Hip Replacement with Ceramic Femoral Head by Ceramic Type



Ceramic femoral heads have been used in 101,537 primary total conventional hip replacements undertaken for osteoarthritis. The proportion of procedures with Zirconia femoral heads is 1.2%, Alumina 33.0% and Mixed Ceramic 65.8% (Table HT45).

When the outcome of the different ceramics is compared, Zirconia has a higher rate of revision than both Alumina and Mixed Ceramic femoral heads. Alumina has a higher rate of revision after three months compared to Mixed Ceramic. At 10 years, the cumulative percent revision for Zirconia is 8.2%, Alumina 5.4% and 4.8% for Mixed Ceramic (Table HT45 and Figure HT50). This difference is due to an increased rate of revision for loosening/lysis and dislocation in the Zirconia group (Figure HT51).

There are a number of potential confounders that may be contributing to this result. These include femoral head size, bearing surface and the type of femoral and acetabular prostheses used.

Head Size

Four head sizes were compared (≤28mm, 32mm, 36-38mm and ≥40mm).

Almost all Zirconia femoral heads used were 28mm or less. Only a small number of procedures (10) used one other head size (32mm). The cumulative percent revision at 10 years for head sizes 28mm or less is 8.2% (Table HT46).

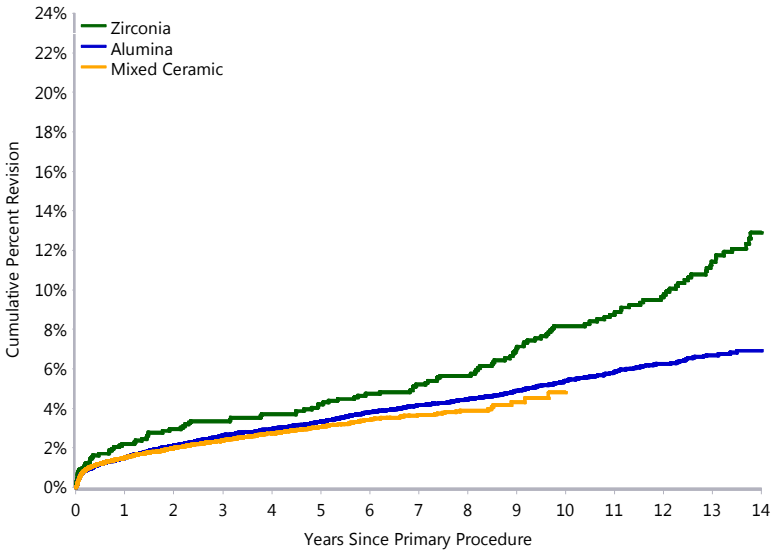
The most common Alumina femoral head size is 32mm (51.0%) followed by 28mm or less (32.4%) and 36-38mm (16.5%). Only a small proportion of Alumina femoral heads with a head size 40mm or larger have been used (0.1%). Head sizes 32mm have a lower rate of revision compared to both 28mm or less and 36-38mm. The cumulative percent revision at 10 years is 6.2% for 28mm or less, 4.6% for 32mm and 6.1% for 36-38mm (Table HT46 and Figure HT52).

The most used Mixed Ceramic femoral head size is 36-38mm (56.0%), followed by 32mm (30.4%) and 40mm or larger (8.1%). Head sizes 28mm or less accounted for only 5.5%. Head sizes 40mm or larger have a lower rate of revision compared to both 28mm or less and 32mm over the entire period and 36-38mm after six months. The cumulative percent revision at seven years is 4.1% for 28mm or less and 3.7% for both 32mm and 36-38mm. Head sizes of 40mm or larger have a shorter follow up and the cumulative percent revision at five years is 2.3% (Table HT46 and Figure HT53).

Table HT45 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	14 Yrs
Zirconia	126	1228	2.2 (1.5, 3.2)	3.4 (2.5, 4.5)	4.2 (3.2, 5.5)	5.2 (4.1, 6.6)	8.2 (6.7, 9.9)	12.9 (10.8, 15.4)
Alumina	1563	33497	1.5 (1.4, 1.7)	2.6 (2.5, 2.8)	3.3 (3.1, 3.5)	4.2 (3.9, 4.4)	5.4 (5.1, 5.7)	6.9 (6.5, 7.4)
Mixed Ceramic	1561	66812	1.5 (1.4, 1.6)	2.4 (2.3, 2.5)	3.1 (2.9, 3.2)	3.7 (3.4, 3.9)	4.8 (4.0, 5.7)	
TOTAL	**3250**	**101537**						

Figure HT50 Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Ceramic Femoral Head by Ceramic Type (Primary Diagnosis OA)



HR - adjusted for age and gender

Zirconia vs Mixed Ceramic

0 - 3Mth: HR=1.23 (0.73, 2.05),p=0.435

3Mth - 1.5Yr: HR=1.99 (1.26, 3.14),p=0.003

1.5Yr - 2Yr: HR=0.76 (0.19, 3.06),p=0.696

2Yr - 4.5Yr: HR=1.06 (0.58, 1.94),p=0.840

4.5Yr - 5Yr: HR=2.10 (0.77, 5.73),p=0.149

5Yr - 6Yr: HR=1.35 (0.60, 3.07),p=0.466

6Yr+: HR=2.78 (2.11, 3.67),p<0.001

Alumina vs Mixed Ceramic

0 - 3Mth: HR=0.93 (0.81, 1.07),p=0.301

3Mth+: HR=1.19 (1.08, 1.31),p<0.001

Zirconia vs Alumina

Entire Period: HR=1.65 (1.37, 1.99),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Zirconia	1228	1192	1156	1096	1037	847	210
Alumina	33497	31899	28919	25523	21343	11895	403
Mixed Ceramic	66812	52691	30834	14139	4547	249	0

Figure HT51 Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement with Ceramic Femoral Head by Ceramic Type (Primary Diagnosis OA)

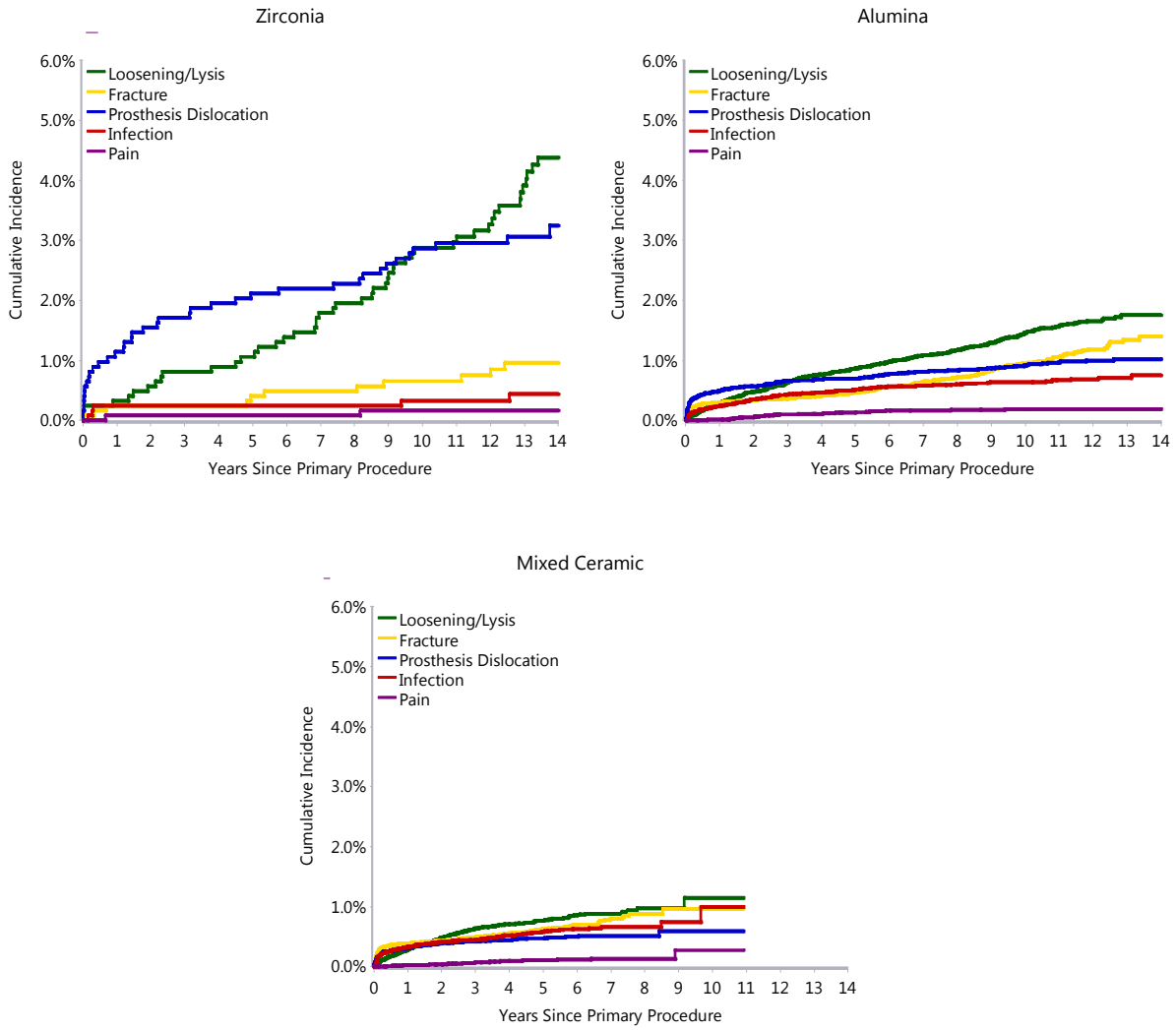
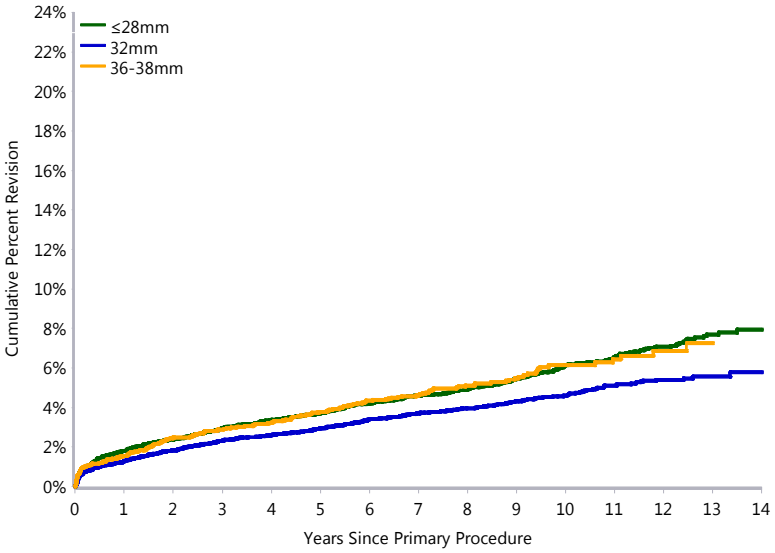


Table HT46 Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Ceramic Femoral Head by Ceramic Type and Head Size (Primary Diagnosis OA)

Ceramic Type	Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Zirconia	≤28mm	126	1218	2.2 (1.5, 3.2)	3.4 (2.5, 4.6)	4.2 (3.2, 5.6)	5.2 (4.1, 6.7)	8.2 (6.7, 10.0)	12.9 (10.8, 15.4)
	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	645	10840	1.8 (1.6, 2.1)	3.0 (2.7, 3.3)	3.7 (3.4, 4.1)	4.6 (4.2, 5.0)	6.2 (5.7, 6.7)	7.9 (7.2, 8.7)
	32mm	674	17083	1.3 (1.1, 1.5)	2.3 (2.1, 2.6)	3.0 (2.7, 3.2)	3.7 (3.4, 4.0)	4.6 (4.3, 5.0)	5.8 (5.2, 6.5)
	36-38mm	242	5528	1.5 (1.3, 1.9)	2.9 (2.5, 3.4)	3.8 (3.3, 4.4)	4.6 (4.1, 5.3)	6.1 (5.3, 7.1)	
	≥40mm	2	46	4.3 (1.1, 16.3)					
Mixed Ceramic	≤28mm	115	3685	1.7 (1.4, 2.2)	2.9 (2.4, 3.6)	3.5 (2.9, 4.3)	4.1 (3.3, 5.0)	5.7 (4.3, 7.4)	
	32mm	489	20326	1.6 (1.5, 1.8)	2.4 (2.2, 2.7)	3.0 (2.7, 3.3)	3.7 (3.3, 4.2)		
	36-38mm	865	37378	1.5 (1.4, 1.6)	2.4 (2.2, 2.6)	3.2 (2.9, 3.4)	3.7 (3.4, 4.0)	4.8 (3.5, 6.5)	
	≥40mm	92	5423	1.2 (0.9, 1.5)	1.8 (1.5, 2.3)	2.3 (1.8, 2.9)			
TOTAL		**3250**	**101537**						

Figure HT52 Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Alumina Femoral Head by Head Size (Primary Diagnosis OA)



HR - adjusted for age and gender

≤28mm vs 32mm

Entire Period: HR=1.31 (1.17, 1.46),p<0.001

36-38mm vs 32mm

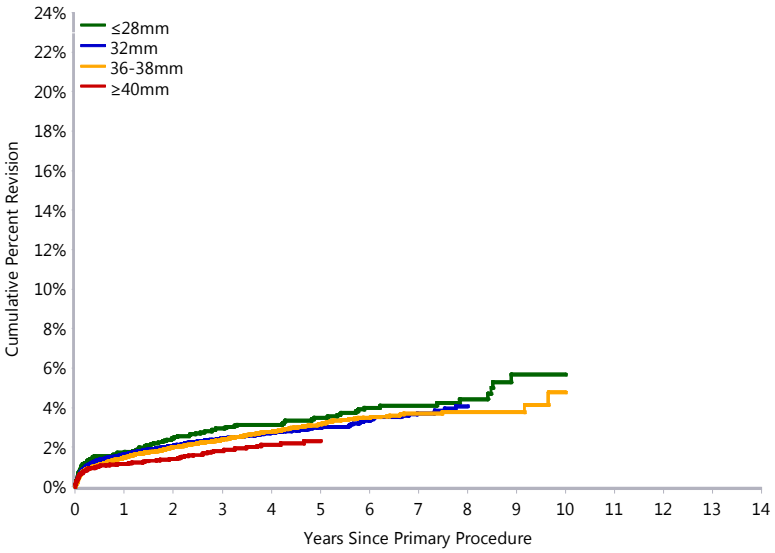
Entire Period: HR=1.29 (1.11, 1.50),p<0.001

≤28mm vs 36-38mm

Entire Period: HR=1.02 (0.87, 1.19),p=0.832

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
≤28mm	10840	10502	9940	9240	8326	5688	280
32mm	17083	16292	14712	12719	10616	5340	105
36-38mm	5528	5062	4263	3563	2401	867	18

Figure HT53 Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Mixed Ceramic Femoral Head by Head Size (Primary Diagnosis OA)



HR - adjusted for age and gender

≤28mm vs ≥40mm

Entire Period: HR=1.60 (1.21, 2.11),p=0.001

32mm vs ≥40mm

Entire Period: HR=1.35 (1.08, 1.70),p=0.008

36-38mm vs ≥40mm

0 - 6Mth: HR=1.11 (0.87, 1.40),p=0.400

6Mth+: HR=1.59 (1.25, 2.03),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
≤28mm	3685	2959	1945	1280	736	149	0
32mm	20326	15904	9651	4855	1695	2	0
36-38mm	37378	29344	16815	7497	2116	98	0
≥40mm	5423	4484	2423	507	0	0	0

Primary Total Resurfacing Hip Replacement

Demographics

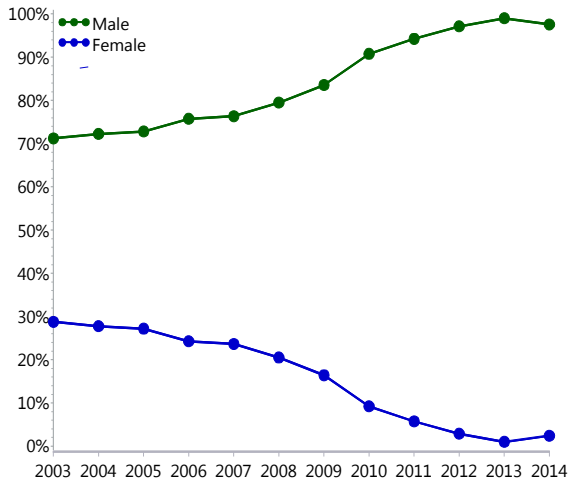
There have been 16,154 total resurfacing hip replacement procedures reported to the Registry, an additional 384 procedures compared to the last report.

The use of resurfacing hip replacement in Australia has been declining since 2005. In 2014, the number of total resurfacing procedures is 7.2% less than in 2013 and 79.7% less than 2005. Resurfacing hip replacement represents 0.9% of hip replacements performed in 2014.

The principal diagnosis is osteoarthritis (95.2%), followed by developmental dysplasia (2.4%) and osteonecrosis (1.6%) (Table HT48).

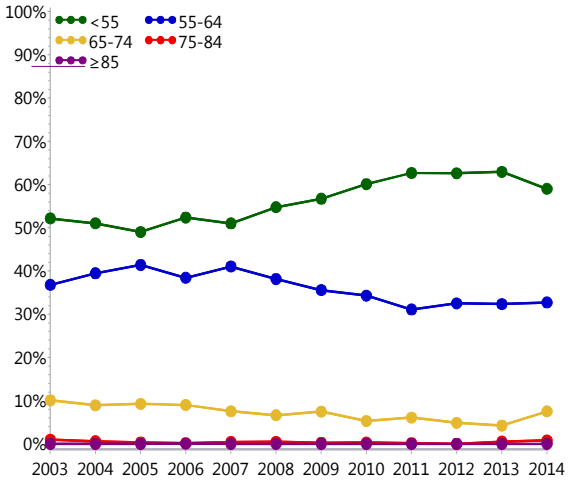
In 2014, 97.6% of resurfacing hip replacements were undertaken in males (Figure HT54).

Figure HT54 Primary Total Resurfacing Hip Replacement by Gender



The age of patients receiving total resurfacing hip replacment has changed over the past 10 years. The proportion of those aged less than 55 years has increased from 52.2% in 2003 to 59.0% in 2014. Over the same period, the proportion of patients aged 65 years or older has declined from 11.1% to 8.3% (Figure HT55).

Figure HT55 Primary Total Resurfacing Hip Replacement by Age



All total resurfacing procedures in 2014 used hybrid fixation.

There were only two resurfacing prostheses used in 2014 with the BHR accounting for 75.3% of procedures (Table HT47).

Table HT47 Most Used Resurfacing Heads in Primary Total Resurfacing Hip Replacement

2003		2011		2012		2013		2014	
N	Model	N	Model	N	Model	N	Model	N	Model
1359	BHR	445	BHR	341	BHR	267	BHR	281	BHR
58	Durom	93	Mitch TRH	90	Adept	126	Adept	92	Adept
43	ASR	27	Adept	10	Mitch TRH	5	Icon		
42	Cormet	10	Cormet	7	ACCIS	4	Cormet		
38	Cormet 2000 HAP	10	Durom	4	Cormet				
7	Conserve Plus	3	Recap						
		2	ACCIS						
		2	Bionik						
Most Used									
1547	(6) 100.0%	592	(8) 100.0%	452	(5) 100.0%	402	(4) 100.0%	373	(2) 100.0%

Outcome for all Diagnoses

Primary Diagnosis

The outcomes for osteoarthritis, developmental dysplasia and osteonecrosis are listed in Table HT48. 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 HT56).

Reasons for Revision

The main reasons for revision of primary total resurfacing hip replacement are loosening/lysis (32.5%), metal related pathology (26.7%) and fracture (19.7%) (Table HT49).

The five most common reasons for revision are shown in Figure HT57. The cumulative incidence of fracture increases rapidly in the first year, after this time the incidence increases at a slower rate. Loosening/lysis shows a linear increase and at five years exceeds fracture to have the highest cumulative incidence. The cumulative incidence of metal related pathology continues to increase to be the second most common reason for revision after six years.

Type of Revision

The main types of revision of total resurfacing hip replacement are total hip replacement (66.2%), femoral only (27.2%) and acetabular only (3.7%) (Table HT50). 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

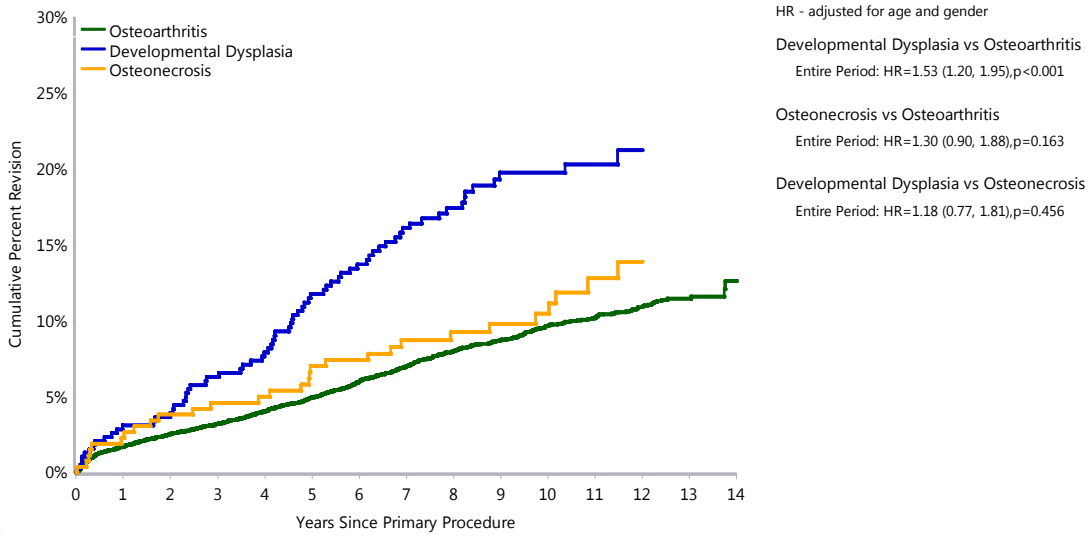
The cumulative percent revision of total resurfacing hip prostheses combinations with more than 100 procedures are listed in Table HT51. The Adept (3.5%), Mitch TRH (3.7%) and BHR (4.9%) have the lowest cumulative percent revision at seven years. Of the four prostheses with 10 year data, the BHR resurfacing prosthesis has the lowest cumulative percent revision (7.0%).

Table HT48 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	14 Yrs
Osteoarthritis	1191	15379	1.7 (1.5, 1.9)	3.2 (2.9, 3.5)	4.9 (4.6, 5.3)	7.0 (6.6, 7.4)	9.7 (9.1, 10.2)	12.6 (11.1, 14.3)
Developmental Dysplasia	72	386	3.1 (1.8, 5.4)	6.3 (4.3, 9.3)	11.8 (8.9, 15.5)	16.1 (12.7, 20.3)	19.8 (15.9, 24.4)	
Osteonecrosis	30	265	2.3 (1.0, 5.0)	4.6 (2.6, 7.9)	7.0 (4.5, 10.9)	8.7 (5.8, 13.0)	10.5 (7.1, 15.2)	
Other (6)	14	124	2.4 (0.8, 7.4)	5.0 (2.3, 10.8)	9.5 (5.3, 16.4)	10.4 (6.0, 17.6)	13.3 (7.9, 21.8)	
TOTAL	**1307**	**16154**						

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

Figure HT56 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	14 Yrs
Osteoarthritis	15379	14738	13625	11838	9124	4416	79
Developmental Dysplasia	386	369	352	319	271	154	4
Osteonecrosis	265	255	243	230	194	129	6

Table HT49 Primary Total Resurfacing Hip Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	425	32.5
Metal Related Pathology	349	26.7
Fracture	257	19.7
Infection	85	6.5
Pain	76	5.8
Osteonecrosis	35	2.7
Prosthesis Dislocation	23	1.8
Malposition	19	1.5
Other	38	2.9
TOTAL	**1307**	**100.0**

Table HT50 Primary Total Resurfacing Hip Replacement by Type of Revision

Type of Revision	Number	Percent
THR (Femoral/Acetabular)	865	66.2
Femoral Component	356	27.2
Acetabular Component	49	3.7
Cement Spacer	30	2.3
Removal of Prostheses	5	0.4
Bipolar Head and Femoral	2	0.2
TOTAL	**1307**	**100.0**

Figure HT57 Cumulative Incidence Revision Diagnosis of Primary Total Resurfacing Hip Replacement

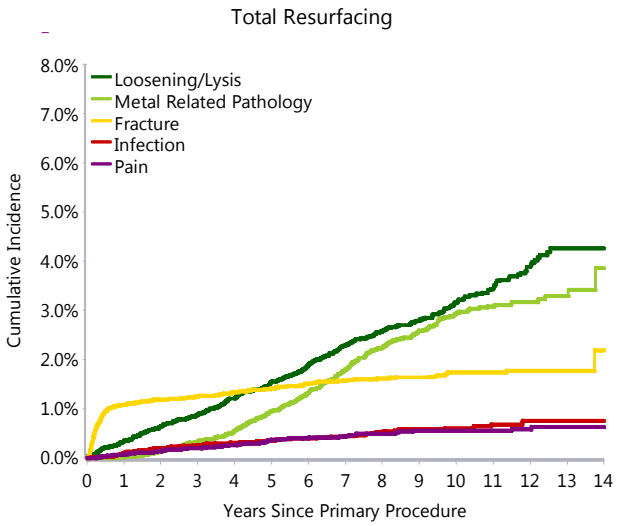


Table HT51 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Prosthesis Type

Head Component	Acetabular Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
ASR	ASR	313	1168	3.4 (2.5, 4.6)	7.2 (5.9, 8.8)	15.2 (13.3, 17.4)	23.1 (20.7, 25.7)	30.8 (27.7, 34.0)	
Adept	Adept	21	750	1.2 (0.6, 2.3)	1.8 (1.0, 3.1)	2.5 (1.5, 4.1)	3.5 (2.1, 5.7)		
BHR	BHR	653	11038	1.4 (1.2, 1.6)	2.4 (2.2, 2.8)	3.5 (3.2, 3.9)	4.9 (4.5, 5.4)	7.0 (6.4, 7.6)	9.8 (8.3, 11.5)
Bionik	Bionik	42	200	3.5 (1.7, 7.2)	12.0 (8.2, 17.4)	17.3 (12.7, 23.4)	19.9 (14.9, 26.4)		
Cormet	Cormet	92	626	2.1 (1.2, 3.6)	5.6 (4.1, 7.8)	9.7 (7.6, 12.4)	13.6 (11.0, 16.7)	16.8 (13.6, 20.7)	
Durom	Durom	84	847	3.2 (2.2, 4.6)	5.4 (4.1, 7.2)	7.5 (5.9, 9.5)	8.7 (7.0, 10.8)	11.0 (8.9, 13.6)	
Icon	Icon	11	118	1.7 (0.4, 6.6)	4.2 (1.8, 9.9)	6.0 (2.9, 12.3)	7.9 (4.2, 14.7)		
Mitch TRH	Mitch TRH	35	1024	1.2 (0.7, 2.1)	2.1 (1.4, 3.2)	2.7 (1.8, 3.9)	3.7 (2.6, 5.3)		
Recap	Recap	24	195	5.1 (2.8, 9.3)	8.7 (5.5, 13.7)	10.3 (6.8, 15.5)	12.2 (8.1, 18.1)		
Other (8)		32	188	5.3 (2.9, 9.7)	7.5 (4.5, 12.3)	9.7 (6.2, 15.0)	12.1 (8.1, 17.8)	17.3 (12.4, 23.9)	
TOTAL		**1307**	**16154**						

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

Outcome for Osteoarthritis

The cumulative percent revision at 14 years for primary total resurfacing hip replacement undertaken for osteoarthritis is 12.6% (Table HT52 and Figure HT58).

Age and Gender

Patients aged 65 years or older have a higher rate of revision compared to patients aged less than 55 years and 55-64 years for the first six months only. After six months, patients 65 years or older have a lower rate of revision (Table HT53 and Figure HT59).

Females have a higher rate of revision compared to males. After two and a half years, the rate of revision is over two times higher for females compared to males (Table HT54 and Figure HT60). While there is no age related difference in the rate of revision for females (Table HT54 and Figure HT61), 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. (Table HT54 and Figure HT62).

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 HT55 and Figure HT63).

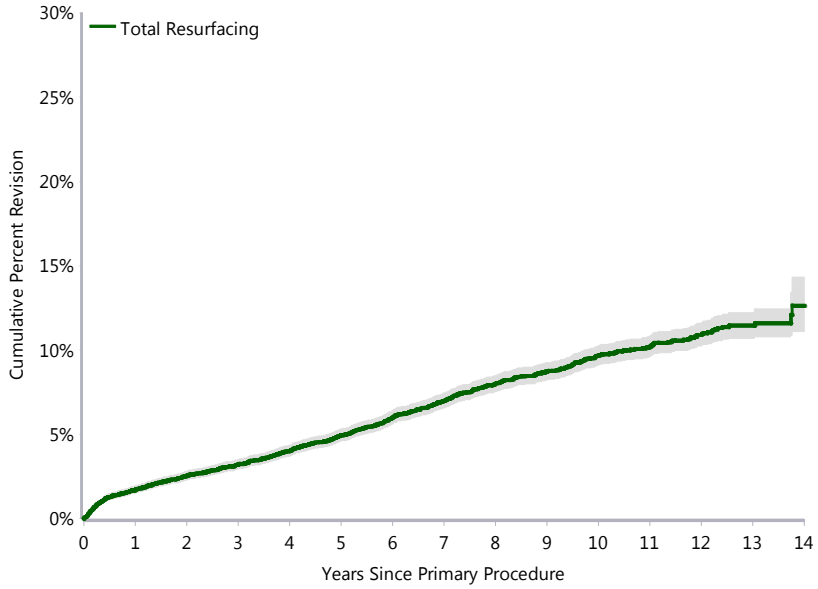
The reason for revision varies with head size. Head sizes less than 50mm have a higher cumulative incidence of loosening/lysis, metal related pathology, fracture, infection and pain compared to head sizes 50mm or larger (Figure HT64).

This effect of femoral component head size is evident within both males and females (Table HT56 and Figure HT65).

Table HT52 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement (Primary Diagnosis OA)

Hip Type	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Total Resurfacing	1191	15379	1.7 (1.5, 1.9)	3.2 (2.9, 3.5)	4.9 (4.6, 5.3)	7.0 (6.6, 7.4)	9.7 (9.1, 10.2)	12.6 (11.1, 14.3)
TOTAL	**1191**	**15379**						

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

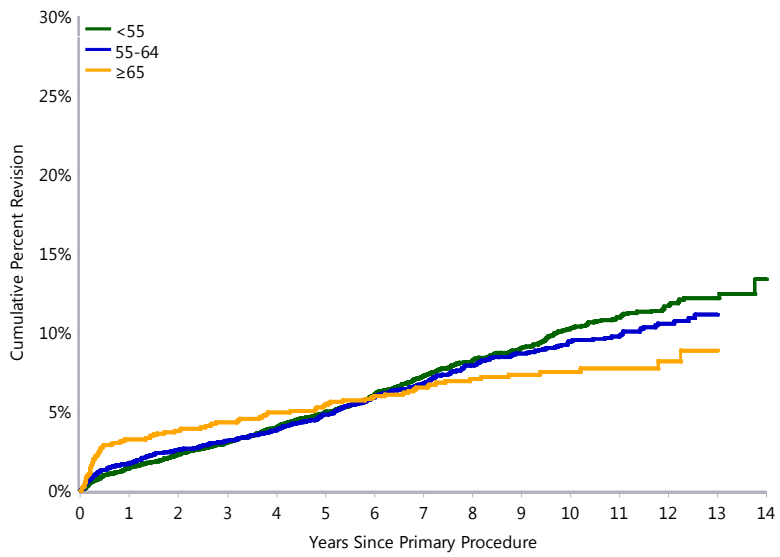


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Total Resurfacing	15379	14738	13625	11838	9124	4416	79

Table HT53 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	14 Yrs
<55	641	8082	1.4 (1.2, 1.7)	3.1 (2.7, 3.5)	5.0 (4.5, 5.5)	7.3 (6.7, 7.9)	10.3 (9.5, 11.1)	13.4 (11.4, 15.7)
55-64	456	5925	1.8 (1.4, 2.1)	3.2 (2.7, 3.6)	4.8 (4.3, 5.4)	6.8 (6.1, 7.5)	9.4 (8.6, 10.4)	
≥65	94	1372	3.2 (2.4, 4.3)	4.3 (3.3, 5.5)	5.5 (4.4, 6.8)	6.5 (5.3, 8.0)	7.5 (6.1, 9.2)	
TOTAL	**1191**	**15379**						

Figure HT59 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Age (Primary Diagnosis OA)



HR - adjusted for gender

55-64 vs <55

0 - 1.5Yr: HR=1.28 (1.02, 1.61),p=0.036

1.5Yr+: HR=0.88 (0.76, 1.01),p=0.070

≥65 vs <55

0 - 6Mth: HR=3.37 (2.33, 4.88),p<0.001

6Mth+: HR=0.67 (0.51, 0.88),p=0.004

≥65 vs 55-64

0 - 6Mth: HR=2.60 (1.80, 3.77),p<0.001

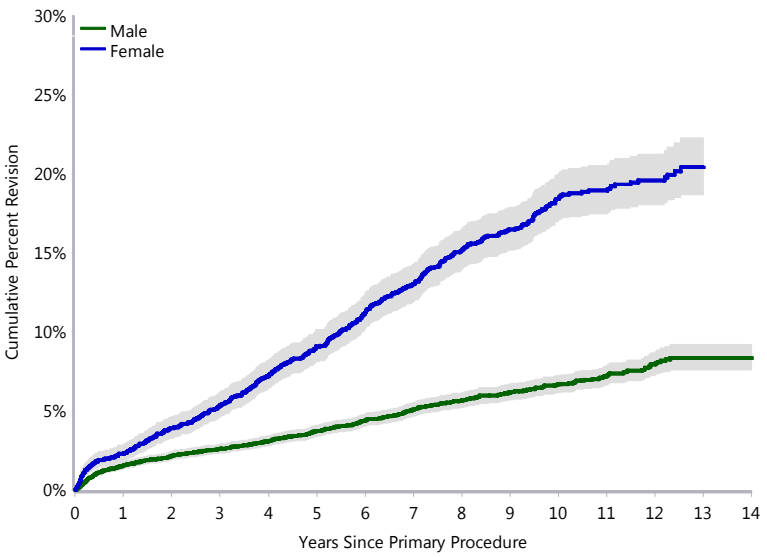
6Mth+: HR=0.73 (0.55, 0.97),p=0.027

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
<55	8082	7754	7092	6038	4576	2268	52
55-64	5925	5692	5313	4697	3667	1716	24
≥65	1372	1292	1220	1103	881	432	3

Table HT54 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender and Age (Primary Diagnosis OA)

Gender	Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Male		**651**	**12126**	**1.6 (1.4, 1.8)**	**2.6 (2.3, 2.9)**	**3.7 (3.4, 4.1)**	**5.1 (4.7, 5.5)**	**6.7 (6.2, 7.2)**	**8.4 (7.6, 9.2)**
	<55	322	6212	1.2 (1.0, 1.5)	2.4 (2.0, 2.8)	3.5 (3.0, 4.0)	5.0 (4.5, 5.7)	6.8 (6.0, 7.6)	
	55-64	253	4674	1.6 (1.3, 2.0)	2.5 (2.1, 3.0)	3.7 (3.1, 4.3)	4.9 (4.3, 5.7)	6.6 (5.8, 7.6)	
	≥65	76	1240	3.2 (2.3, 4.3)	4.1 (3.1, 5.4)	5.1 (4.0, 6.5)	6.1 (4.8, 7.6)	6.6 (5.3, 8.3)	
Female		**540**	**3253**	**2.3 (1.8, 2.9)**	**5.4 (4.6, 6.2)**	**9.1 (8.1, 10.1)**	**13.0 (11.9, 14.3)**	**18.4 (17.0, 20.0)**	
	<55	319	1870	2.1 (1.6, 2.9)	5.2 (4.2, 6.3)	9.3 (8.1, 10.7)	13.4 (11.9, 15.1)	19.1 (17.2, 21.2)	
	55-64	203	1251	2.4 (1.7, 3.4)	5.6 (4.5, 7.1)	8.8 (7.4, 10.5)	12.8 (11.0, 14.8)	17.9 (15.7, 20.3)	
	≥65	18	132	3.8 (1.6, 8.9)	6.1 (3.1, 11.8)	8.4 (4.8, 14.7)	10.1 (6.0, 16.8)	14.6 (9.2, 22.7)	
TOTAL		**1191**	**15379**						

Figure HT60 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender (Primary Diagnosis OA)



HR - adjusted for age

Female vs Male

0 - 3Mth: HR=2.04 (1.42, 2.94),p<0.001

3Mth - 6Mth: HR=1.19 (0.69, 2.06),p=0.532

6Mth - 1.5Yr: HR=1.60 (1.11, 2.33),p=0.012

1.5Yr - 2.5Yr: HR=2.81 (1.90, 4.15),p<0.001

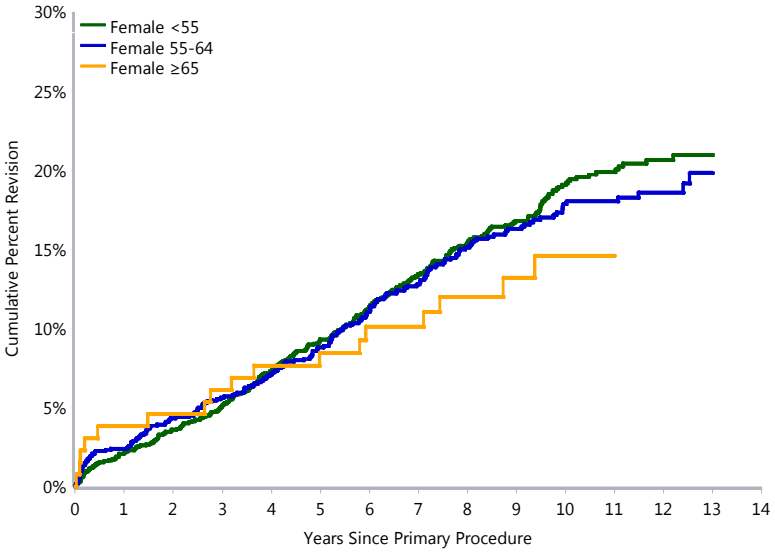
2.5Yr - 6Yr: HR=3.51 (2.89, 4.27),p<0.001

6Yr - 6.5Yr: HR=4.37 (2.50, 7.63),p<0.001

6.5Yr+: HR=2.88 (2.30, 3.60),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Male	12126	11572	10580	9024	6819	3234	56
Female	3253	3166	3045	2814	2305	1182	23

Figure HT61 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement for Females by Age (Primary Diagnosis OA)



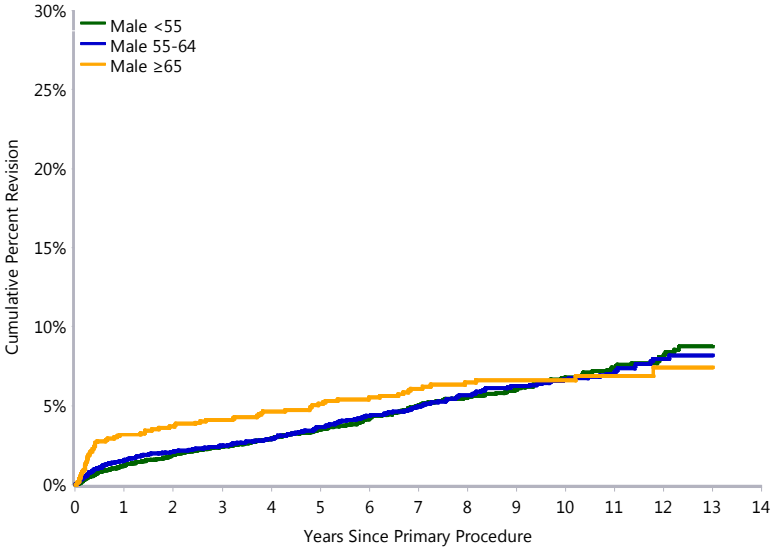
Female 55-64 vs Female <55
Entire Period: HR=0.94 (0.79, 1.12),p=0.492

Female ≥65 vs Female <55
0 - 3Mth: HR=2.29 (0.82, 6.41),p=0.113
3Mth+: HR=0.66 (0.39, 1.12),p=0.126

Female ≥65 vs Female 55-64
Entire Period: HR=0.83 (0.51, 1.35),p=0.454

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Female	<55	1870	1825	1756	1613	1306	656	16
	55-64	1251	1215	1167	1085	901	472	7
	≥65	132	126	122	116	98	54	0

Figure HT62 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement for Males by Age (Primary Diagnosis OA)



Male 55-64 vs Male <55
Entire Period: HR=1.00 (0.85, 1.18),p=0.997

Male ≥65 vs Male <55
0 - 6Mth: HR=2.98 (2.01, 4.42),p<0.001
6Mth+: HR=0.73 (0.53, 1.01),p=0.054

Male ≥65 vs Male 55-64
0 - 6Mth: HR=2.98 (2.00, 4.44),p<0.001
6Mth+: HR=0.73 (0.52, 1.01),p=0.057

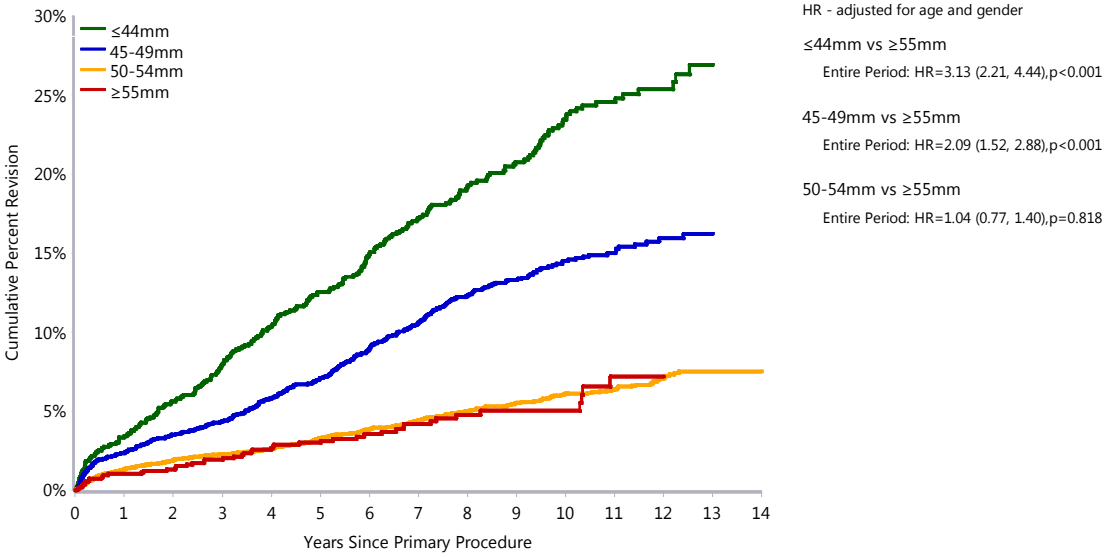
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Male	<55	6212	5929	5336	4425	3270	1612	36
	55-64	4674	4477	4146	3612	2766	1244	17
	≥65	1240	1166	1098	987	783	378	3

Table HT55 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	14 Yrs
≤44mm	260	1195	3.4 (2.5, 4.6)	8.0 (6.6, 9.7)	12.5 (10.8, 14.5)	17.2 (15.1, 19.5)	23.4 (20.9, 26.2)	
45-49mm	422	3562	2.4 (1.9, 2.9)	4.4 (3.7, 5.1)	7.1 (6.3, 8.0)	10.6 (9.6, 11.7)	14.5 (13.2, 15.9)	
50-54mm	463	9540	1.3 (1.1, 1.6)	2.3 (2.0, 2.6)	3.3 (3.0, 3.7)	4.4 (4.0, 4.9)	6.1 (5.5, 6.7)	7.5 (6.7, 8.4)
≥55mm	46	1081	1.0 (0.6, 1.8)	1.9 (1.2, 3.0)	3.0 (2.1, 4.3)	4.2 (3.0, 5.8)	5.0 (3.7, 6.8)	
TOTAL	**1191**	**15378**						

Note: Excludes one procedure with unknown head size.

Figure HT63 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	14 Yrs
≤44mm	1195	1151	1088	995	808	436	9
45-49mm	3562	3417	3197	2838	2137	980	13
50-54mm	9540	9145	8390	7217	5635	2785	52
≥55mm	1081	1024	949	787	544	215	5

Figure HT64 Cumulative Incidence Revision Diagnosis of Primary Total Resurfacing Hip Replacement by Head Size (Primary Diagnosis OA)

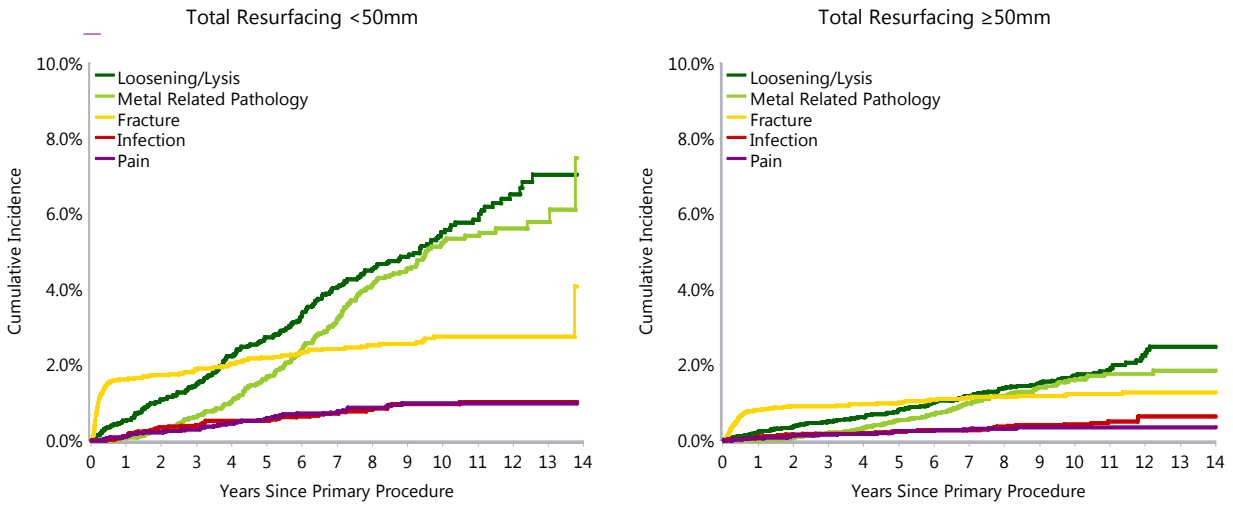
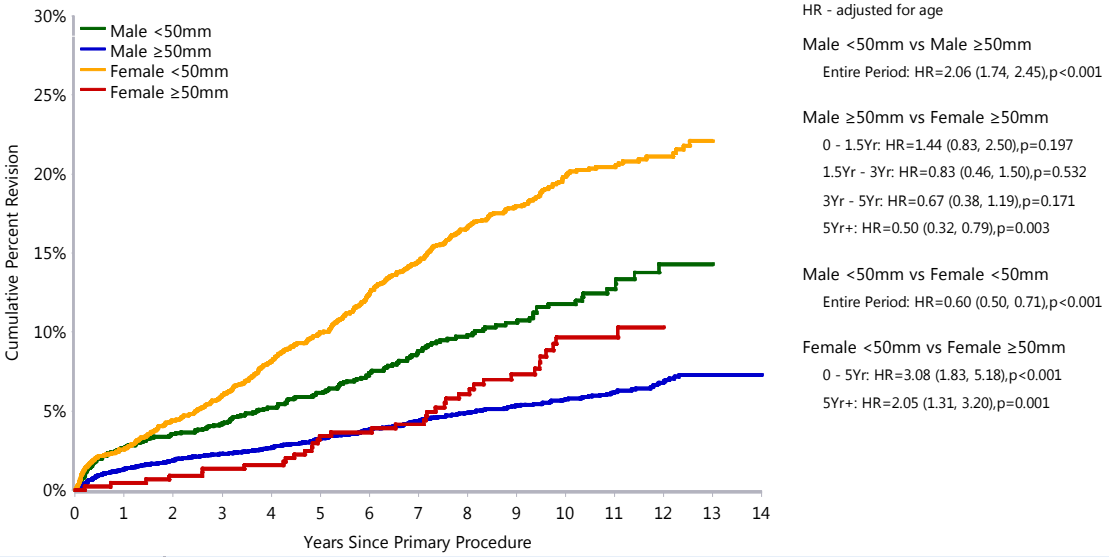


Table HT56 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender and Head Size (Primary Diagnosis OA)

Gender by Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Male	**651**	**12125**	**1.6 (1.4, 1.8)**	**2.6 (2.3, 2.9)**	**3.7 (3.4, 4.1)**	**5.1 (4.7, 5.5)**	**6.7 (6.2, 7.2)**	**8.4 (7.6, 9.2)**
<50mm	178	1953	2.7 (2.1, 3.5)	4.2 (3.4, 5.2)	6.1 (5.1, 7.3)	8.8 (7.5, 10.3)	11.8 (10.1, 13.7)	
≥50mm	473	10172	1.3 (1.1, 1.6)	2.3 (2.0, 2.6)	3.3 (2.9, 3.6)	4.4 (4.0, 4.8)	5.7 (5.2, 6.3)	7.3 (6.5, 8.2)
Female	**540**	**3253**	**2.3 (1.8, 2.9)**	**5.4 (4.6, 6.2)**	**9.1 (8.1, 10.1)**	**13.0 (11.9, 14.3)**	**18.4 (17.0, 20.0)**	
<50mm	504	2804	2.6 (2.1, 3.3)	6.0 (5.2, 7.0)	10.0 (8.9, 11.2)	14.5 (13.2, 15.9)	19.8 (18.3, 21.5)	
≥50mm	36	449	0.4 (0.1, 1.8)	1.3 (0.6, 3.0)	3.4 (2.1, 5.6)	4.2 (2.6, 6.5)	9.7 (7.0, 13.3)	
TOTAL	**1191**	**15378**						

Note: Excludes one male procedure with unknown head size.

Figure HT65 Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender and Head Size (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Male	<50mm	1953	1848	1676	1431	1001	437	3
	≥50mm	10172	9723	8903	7592	5818	2797	53
Female	<50mm	2804	2720	2609	2402	1944	979	19
	≥50mm	449	446	436	412	361	203	4

KNEE REPLACEMENT

Categories of Knee Replacement

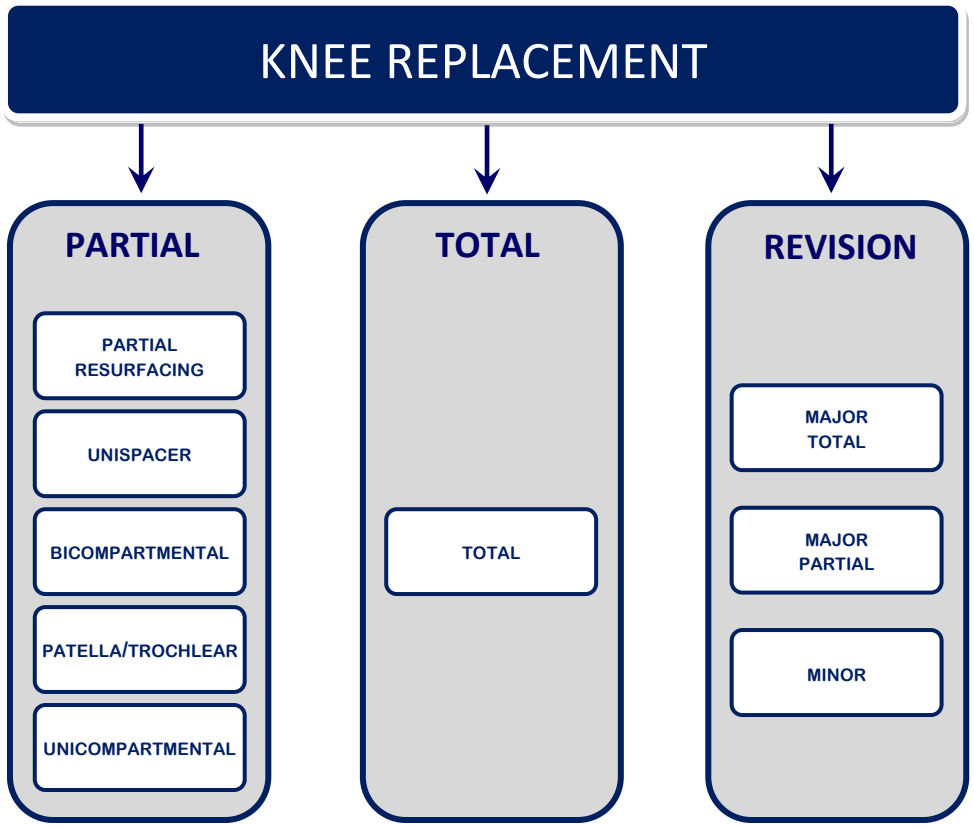
The Registry groups knee replacement into three broad categories: primary partial, primary total and revision knee replacement.

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 demographic information on knee replacement is availble in the supplementary report 'Demographics of Knee Arthroplasty' on the AOANJRR website aoanjrr.dmac.adelaide.edu.au/annual-reports-2015



Use of Knee Replacement

This report analyses 534,717 knee replacements reported to the Registry with a procedure date up to and including 31 December 2014. This is an additional 54,277 knee procedures compared to the number reported last year. When considering all knee procedures currently recorded by the Registry, primary partial knees account for 8.7%, primary total knees 83.0% and revision knee replacement 8.2% (Table K1).

Table K1 Number of Knee Replacements

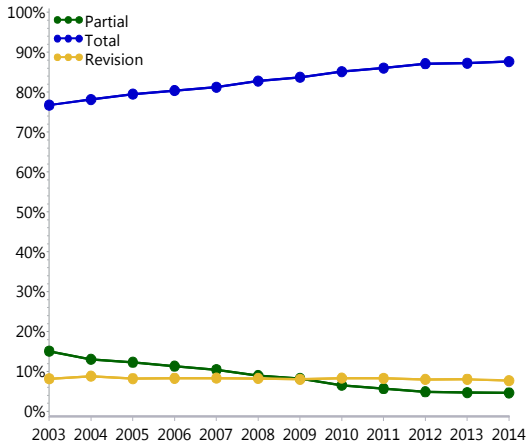
Knee Category	Number	Percent
Partial	46701	8.7
Total	443948	83.0
Revision	44068	8.2
TOTAL	**534717**	**100.0**

In 2014, the number of knee replacements undertaken increased by 2,395 (4.7%) compared to 2013. During the last year, primary partial and primary total knee replacement increased by 3.2% and 5.2% respectively. There was a slight increase in revision knee replacement (0.1%).

Since 2003, the number of knee replacement procedures undertaken per year has increased by 88.3%. Primary total knee replacement has increased by 115.1% and revision knee replacement by 77.3%. Primary partial knee replacement has decreased by 42.1%.

In 2014, primary total knee replacement accounted for 87.7% of all knee replacement procedures. This has increased from 76.7% in 2003. Primary partial knee replacement decreased from 15.1% in 2003 to 4.6% in 2014. The proportion of revision knee procedures has declined from a peak of 8.8% in 2004 to 7.7% in 2014. This equates to 596 less revision procedures in 2014 than would have been expected if the proportion of revision procedures had remained at 8.8% (Figure K1).

Figure K1 Proportion of Knee Replacements

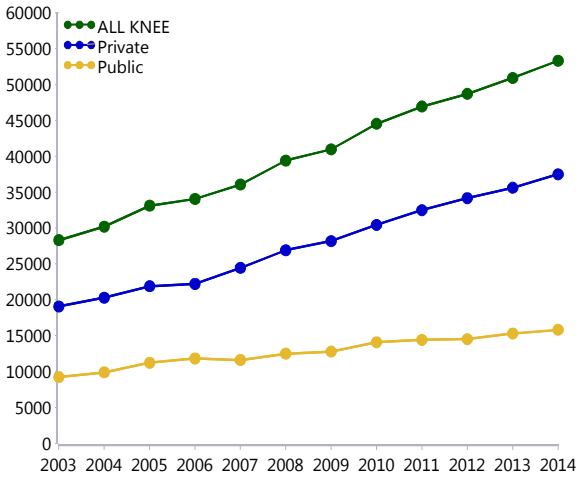


Public and Private Sector

In 2014, 70.3% of all knee replacement procedures reported to the Registry were undertaken in private hospitals.

In the last year, there was an increase in the number of knee replacements recorded in both the private and public sector. The private sector recorded 37,501 procedures, an increase of 5.3%, and the public sector recorded 15,821 procedures, an increase of 3.3% compared to 2013 (Figure K2).

Figure K2 Knee Replacement by Hospital Sector



Since 2003, knee replacement has increased by 96.5% in the private sector compared to 71.2% in the public sector.

There were 2,105 primary partial knee replacements reported for the private sector in 2014, an increase of 4.1% compared to 2013 and a decrease of 38.3% since 2003. In the public sector, there were 370 partial knee replacements, a decrease of 1.3% compared to 2013 and a decrease of 57.1% since 2003.

In 2014, 32,551 primary total knee replacements were reported in the private sector, an increase of 5.9% compared to 2013. In the public sector in 2014, there were 14,192 primary total knee replacements, an increase of 3.8% compared to 2013. Since 2003, primary total knee replacement has increased by 131.3% in the private sector compared to 85.2% in the public sector.

There were 2,845 private sector revision knee replacements reported in 2014. This is an increase of 0.2% compared to 2013. In the public sector, there were 1,259 revision knee replacements, a decrease of 0.1% compared to 2013. Since 2003, revision knee replacement has increased by 78.1% in the private sector compared to 75.3% 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.

Detailed information on demographics of each class of primary partial knee replacement is available in the supplementary report 'Demographics of Knee Arthroplasty' on the AOANJRR website aoanjrr.dmac.adelaide.edu.au/annual-reports-2015

Use of Partial Knee Replacement

Unicompartmental knee remains the most common primary partial knee replacement, accounting for 93.2% of all partial knee replacement procedures. The second most common is patella/trochlear replacement (5.9%). The three remaining partial knee procedures are reported in small numbers (partial resurfacing, unispacer and bicompartmental knee replacement) (Table KP1).

The unispacer procedure has not been used since 2005 and has the highest revision rate of any class of partial knee replacement. Bicompartmental knee replacement has not been used since July 2012. Both of these classes of partial knee replacement are not presented in detail in this report.

Detailed information on Unispacer and Bicompartmental Knee Replacement is available in the supplementary report 'The Outcome of Classes of Hip and Knee Prostheses No Longer Used' on the AOANJRR website aoanjrr.dmac.adelaide.edu.au/annual-reports-2015.

Table KP1 Partial Knee Replacement by Class

Partial Knee Class	Number	Percent
Partial Resurfacing	214	0.5
Unispacer	40	0.1
Bicompartmental	165	0.4
Patella/Trochlear	2739	5.9
Unicompartmental	43543	93.2
TOTAL	**46701**	**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).

Table KP2 Cumulative Percent Revision of Primary Partial Knee Replacement by Class

Partial Knee Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Partial Resurfacing	58	214	5.9 (3.4, 10.1)	17.1 (12.5, 23.3)	24.8 (19.1, 31.9)	32.8 (26.0, 40.8)		
Unispacer	31	40	42.5 (29.0, 59.2)	67.5 (53.0, 81.2)	67.5 (53.0, 81.2)	75.0 (61.0, 87.0)	77.5 (63.7, 88.8)	
Bicompartmental	22	165	6.1 (3.3, 11.0)	11.1 (7.1, 17.0)	13.9 (9.3, 20.3)			
Patella/Trochlear	444	2739	2.3 (1.8, 3.0)	8.6 (7.5, 9.8)	14.5 (13.0, 16.1)	20.0 (18.1, 22.0)	27.0 (24.5, 29.8)	
Unicompartmental	4874	43543	2.2 (2.1, 2.4)	5.8 (5.6, 6.1)	8.3 (8.0, 8.6)	10.8 (10.4, 11.1)	15.0 (14.6, 15.4)	20.5 (19.5, 21.5)
TOTAL	**5429**	**46701**						

Partial Resurfacing

The Registry has recorded 214 partial resurfacing procedures, an additional 17 procedures compared to the number reported last year.

The most common reason for undertaking a partial resurfacing procedure is osteoarthritis (86.9%). The majority of partial resurfacing procedures were undertaken on patients aged less than 55 years (69.6%) and 50.5% were females.

In 2014, the number of partial resurfacings decreased by 39.1% compared to 2013. Of these, 28.6% were undertaken in patients aged 55 years or older and 71.4% were female.

All recorded partial resurfacing procedures use the 'Hemicap' range of prostheses.

Of the 214 procedures, 161 have one cap implanted, 48 have two and five procedures have three caps implanted. Of those with one cap implanted, there were 134 femoral, 10 patella, eight trochlear, seven tibial and two unknown. When two caps were implanted, there were 45 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 resurfaced the patella, trochlear, femoral and tibial articular surfaces.

There are 71 procedures that involve resurfacing of the patella/trochlear joint either on one side (21) or both sides (50). The five year cumulative percent revision for one side is 20.6% and 42.9% when both sides are resurfaced.

The main reasons for revision are progression of disease (56.9%), loosening/lysis (15.5%) and pain (8.6%).

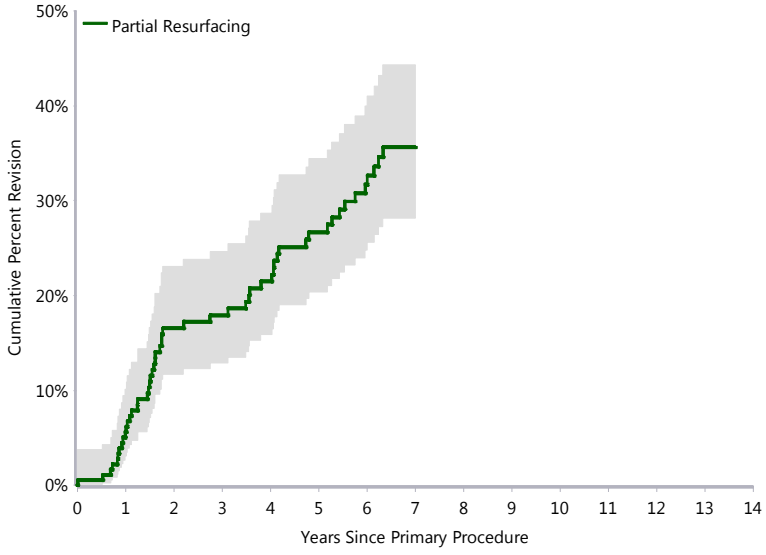
Most primary partial resurfacings are revised to either total knee replacement (53.4%) or unicompartmental (24.1%). The remainder include revision to a patella/trochlear (6.9%), addition of another resurfacing component (6.9%), patella only (6.9%), or removal of the prosthesis (1.7%).

The cumulative percent revision of partial resurfacing procedures undertaken for osteoarthritis is 5.6% at one year and 35.6% at seven years (Table KP3 and Figure KP1).

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	14 Yrs
Partial Resurfacing	54	186	5.6 (3.0, 10.1)	17.9 (12.9, 24.7)	26.7 (20.4, 34.4)	35.6 (28.2, 44.3)		
TOTAL	**54**	**186**						

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	14 Yrs
Partial Resurfacing	186	166	117	95	54	0	0

Patella/Trochlear

Demographics

There have been 2,739 patella/trochlear knee replacements reported to the Registry. This is an additional 244 procedures compared to the previous report.

The principal diagnosis for patella/trochlear procedures is osteoarthritis (98.9%). This procedure is most frequently undertaken in females (76.8%) and patients less than 65 years of age (68.6%) (Figure KP2 and Figure KP3).

Figure KP2 Primary Patella/Trochlear Knee Replacement by Gender

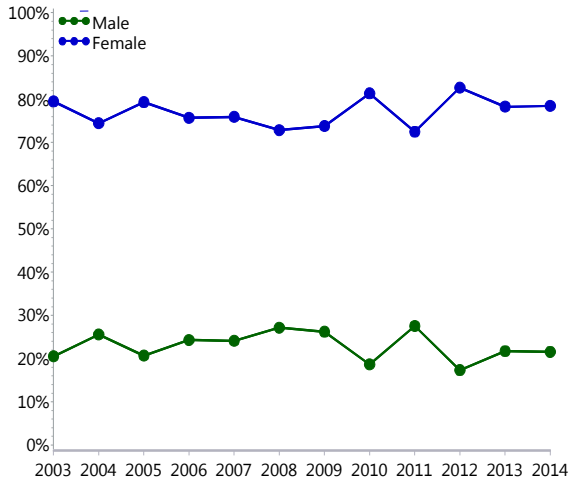
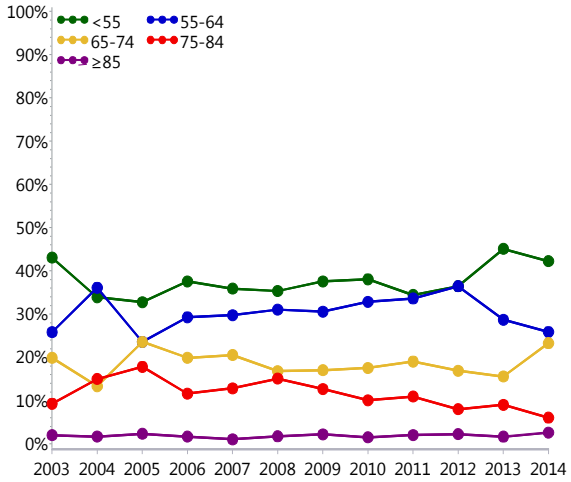


Figure KP3 Primary Patella/Trochlear Knee Replacement by Age



In 2014, the four most common resurfacing trochlear prostheses were the Gender Solutions, Avon, RBK and Journey (previously reported as Competitor). The Gender Solutions prosthesis was first reported in 2009 and since 2010 it has remained the most frequently used prosthesis in this class (Table KP4).

Table KP4 Most Used Resurfacing Trochlear Prostheses in Primary Patella/Trochlear Knee Replacement

2003		2011		2012		2013		2014	
N	Model	N	Model	N	Model	N	Model	N	Model
56	LCS	73	Gender Solutions	84	Gender Solutions	93	Gender Solutions	115	Gender Solutions
43	Avon	65	Journey	46	Journey	47	RBK	40	Avon
29	Lubinus	43	RBK	41	Avon	41	Journey	36	RBK
13	Themis	38	Avon	39	RBK	26	Avon	32	Journey
9	MOD III	15	Sigma HP	12	Sigma HP	20	Sigma HP	7	Sigma HP
1	RBK	13	Vanguard	3	Vanguard	14	Vanguard	1	HLS Kneetec
						3	HLS Kneetec	1	Vanguard
Most Used									
151	(6) 100.0%	247	(6) 100.0%	225	(6) 100.0%	244	(7) 100.0%	232	(7) 100.0%

Outcome for all Diagnoses

The Registry has recorded 444 revisions of primary patella/trochlear knee replacement.

The most common reason for revision is progression of disease (44.8%), followed by loosening/lysis (19.8%) and pain (12.6%) (Table KP5).

A primary patella/trochlear procedure is usually revised to a total knee replacement (82.9%) (Table KP6).

The outcomes of patella/trochlear prosthesis combinations with more than 20 procedures are presented in Table KP7.

Table KP5 Primary Patella/Trochlear Knee Replacement by Reason for Revision

Reason for Revision	Number	Percent
Progression Of Disease	199	44.8
Loosening/Lysis	88	19.8
Pain	56	12.6
Implant Breakage Patella	19	4.3
Wear Patella	16	3.6
Malalignment	13	2.9
Infection	13	2.9
Other	40	9.0
TOTAL	**444**	**100.0**

Table KP6 Primary Patella/Trochlear Knee Replacement by Type of Revision

Type of Revision	Number	Percent
TKR (Tibial/Femoral)	368	82.9
Patella Only	49	11.0
Patella/Trochlear Resurfacing	18	4.1
UKR (Uni Tibial/Uni Femoral)	5	1.1
Removal of Prostheses	2	0.5
Cement Spacer	2	0.5
TOTAL	**444**	**100.0**

Table KP7 Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement by Prosthesis Type

Resurfacing Trochlear	Patella	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Avon	Avon	43	323	0.7 (0.2, 2.7)	7.3 (4.8, 11.1)	12.8 (9.2, 17.6)	17.2 (12.6, 23.3)		
Avon	Kinemax Plus	71	307	2.0 (0.9, 4.3)	4.9 (3.0, 8.0)	12.1 (8.9, 16.4)	18.3 (14.3, 23.4)	23.2 (18.5, 29.0)	
Avon	Triathlon	1	43	0.0 (0.0, 0.0)	3.7 (0.5, 23.5)				
Gender Solutions	Natural Knee Flex	3	22	0.0 (0.0, 0.0)	18.3 (6.1, 47.3)				
Gender Solutions	Nexgen	18	464	2.1 (1.1, 4.2)	6.0 (3.8, 9.5)				
Journey	Genesis II	27	359	1.5 (0.6, 3.5)	6.1 (3.9, 9.5)	10.3 (6.9, 15.2)			
LCS	LCS	128	395	3.5 (2.1, 5.9)	11.7 (8.9, 15.3)	20.9 (17.2, 25.3)	28.1 (23.8, 33.0)	38.8 (32.9, 45.3)	
Lubinus	Duracon	22	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)	23.6 (15.3, 35.2)	
Lubinus	Lubinus	16	39	5.1 (1.3, 19.0)	18.1 (9.1, 34.3)	20.9 (11.0, 37.6)	29.4 (17.4, 46.9)	35.3 (22.2, 53.0)	
MOD III	MOD III	20	63	4.8 (1.6, 14.0)	14.3 (7.7, 25.7)	17.5 (10.1, 29.4)	19.2 (11.4, 31.4)	26.4 (17.1, 39.6)	42.4 (28.0, 60.3)
RBK	RBK	47	403	2.4 (1.2, 4.5)	8.7 (6.1, 12.4)	13.4 (9.9, 17.9)	17.7 (13.2, 23.6)		
Sigma HP	PFC Sigma	15	95	4.5 (1.7, 11.7)	17.3 (10.3, 28.2)	26.1 (14.7, 43.7)			
Themis	Themis	7	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)	17.0 (8.0, 34.2)	
Vanguard	Series A	7	39	2.6 (0.4, 17.2)	17.9 (7.6, 38.6)	41.3 (18.8, 74.5)			
Other (24)		19	72	4.2 (1.4, 12.5)	13.5 (7.2, 24.3)	15.3 (8.5, 26.7)	27.7 (17.2, 42.6)	36.0 (22.8, 53.6)	
TOTAL		**444**	**2739**						

Note: Only combinations with over 20 procedures have been listed.

Outcome for Osteoarthritis

The cumulative percent revision for primary patella/trochlear knee replacement undertaken for osteoarthritis is 14.5% at five years and 27.0% at 10 years (Table KP8 and Figure KP4).

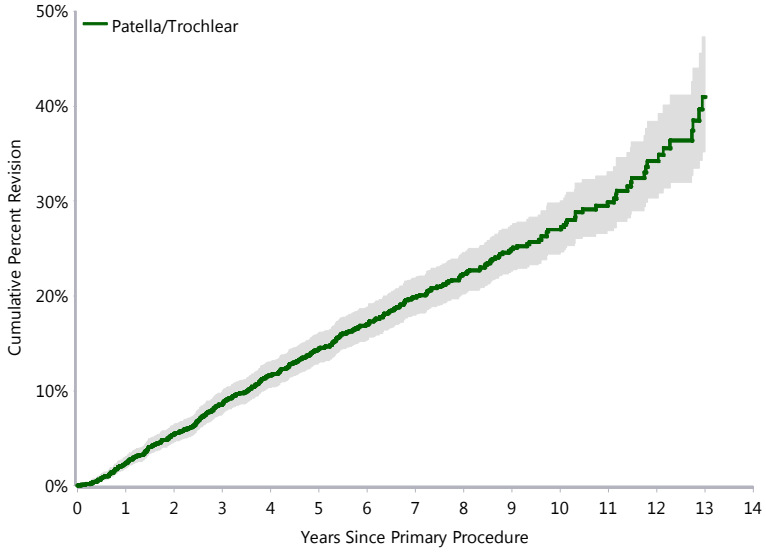
Age and gender are risk factors for revision. Patients younger than 65 years of age have a higher rate of revision than patients 65 years or older (Table KP9 and Figure KP5).

Males have a higher rate of revision than females (Table KP10 and Figure KP6).

Table KP8 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	14 Yrs
Patella/Trochlear	437	2709	2.3 (1.8, 3.0)	8.6 (7.5, 9.8)	14.5 (13.0, 16.1)	19.9 (18.0, 21.9)	27.0 (24.4, 29.8)	
TOTAL	**437**	**2709**						

Figure KP4 Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement (Primary Diagnosis OA)

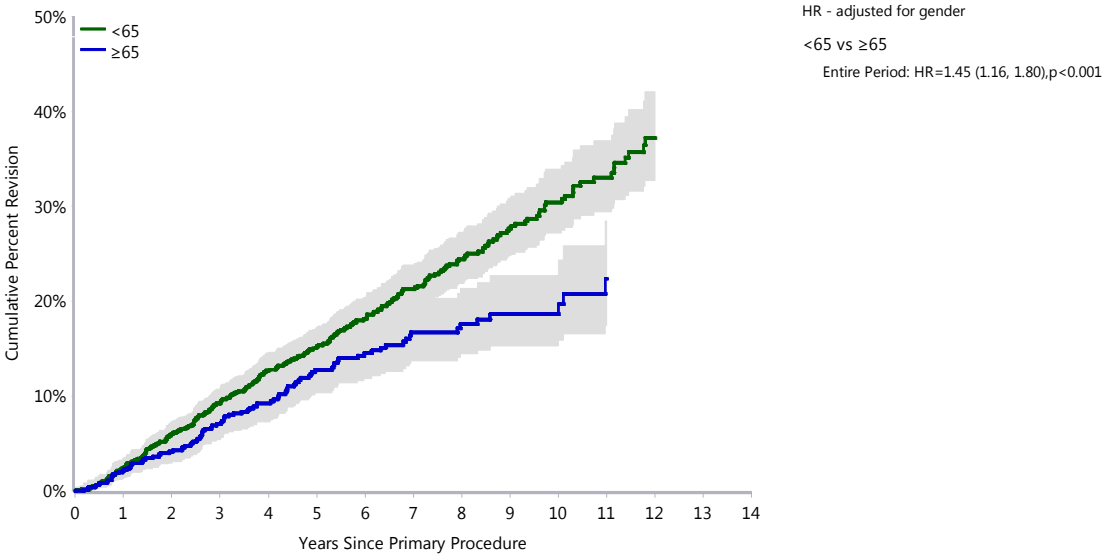


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Patella/Trochlear	2709	2411	1796	1213	770	301	16

Table KP9 Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
<65	332	1853	2.5 (1.8, 3.3)	9.3 (7.9, 10.8)	15.2 (13.4, 17.2)	21.3 (19.0, 23.8)	30.4 (27.2, 34.0)	
≥65	105	856	2.1 (1.3, 3.4)	7.0 (5.4, 9.2)	12.8 (10.3, 15.7)	16.7 (13.7, 20.3)	18.6 (15.2, 22.7)	
TOTAL	**437**	**2709**						

Figure KP5 Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement by Age (Primary Diagnosis OA)

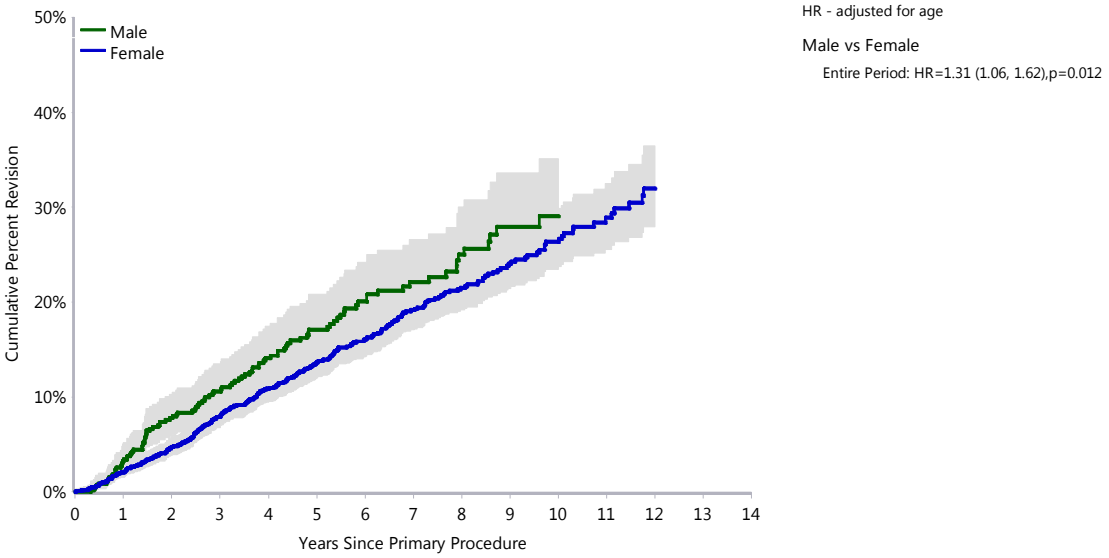


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
<65	1853	1652	1224	826	522	225	15
≥65	856	759	572	387	248	76	1

Table KP10 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	14 Yrs
Male	118	629	3.4 (2.2, 5.2)	10.6 (8.3, 13.5)	17.1 (14.0, 20.8)	22.1 (18.3, 26.6)	29.0 (23.8, 35.1)	
Female	319	2080	2.0 (1.5, 2.8)	8.0 (6.8, 9.3)	13.7 (12.0, 15.5)	19.2 (17.1, 21.5)	26.3 (23.5, 29.5)	
TOTAL	**437**	**2709**						

Figure KP6 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	14 Yrs
Male	629	557	419	281	160	57	4
Female	2080	1854	1377	932	610	244	12

Unicompartmental

Demographics

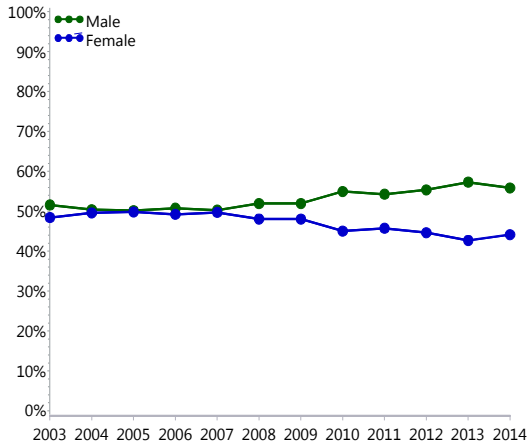
This year the Registry is reporting on 43,543 unicompartmental knee procedures, an additional 2,293 procedures compared to the last report.

The use of unicompartmental knee replacement increased by 4.6% in 2014 compared to 2013, however its usage has decreased by 45.8% since 2003. As a percentage of all knee replacement, unicompartmental has decreased from 14.5% in 2003 to 4.2% in 2014.

Osteoarthritis is the principal diagnosis, accounting for 99.0% of primary unicompartmental knee replacement.

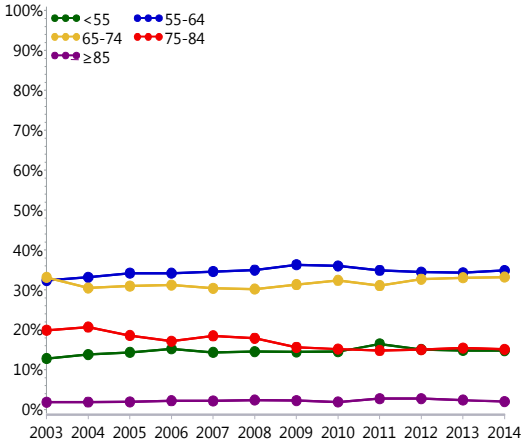
There continues to be a higher proportion of males undergoing unicompartmental knee replacement. This proportion has increased by 5.6% since 2007 (Figure KP7).

Figure KP7 Primary Unicompartmental Knee Replacement by Gender



Unicompartmental knee replacement is most frequently undertaken in patients aged between 55 and 74 years (65.7%). The age distribution has remained relatively stable since 2003 (Figure KP8).

Figure KP8 Primary Unicompartmental Knee Replacement by Age



In 2014, the 10 most used tibial prostheses accounted for 94.8% of all unicompartmental procedures. The ZUK, Oxford and Oxford 3 remain the most used prostheses in 2014. The Oxford is a cementless unicompartmental knee prosthesis introduced in 2007 and reported separately from the Oxford 3 (Table KP11).

Table KP11 10 Most Used Tibial Prostheses in Primary Unicompartmental Knee Replacement

2003		2011		2012		2013		2014	
N	Model	N	Model	N	Model	N	Model	N	Model
1366	Oxford 3	514	ZUK	490	ZUK	576	ZUK	660	ZUK
444	Repicci II	513	Oxford 3	419	Oxford	492	Oxford	650	Oxford
373	Preservation Fixed	371	Oxford	390	Oxford 3	388	Oxford 3	376	Oxford 3
353	M/G	291	Unix	208	Unix	167	Unix	128	Sigma HP
336	Allegretto Uni	108	Sigma HP	90	Repicci II	96	Sigma HP	92	Unix
321	GRU	75	Freedom PKR/Active	69	Sigma HP	67	Repicci II	52	Journey Deuce
275	Genesis	72	Repicci II	68	Freedom PKR/Active	64	Journey Deuce	50	Freedom PKR/Active
260	Unix	71	Journey	64	Journey Deuce	63	Freedom PKR/Active	45	Endo-Model Sled
121	Preservation Mobile	69	GRU	55	GRU	37	Endo-Model Sled	33	Repicci II
101	Endo-Model Sled	61	Genesis	46	Journey	36	BalanSys Uni Fixed	28	BalanSys Uni Fixed
10 Most Used									
3950	(10) 96.1%	2145	(10) 89.0%	1899	(10) 88.6%	1986	(10) 93.2%	2114	(10) 94.8%
Remainder									
159	(7) 3.9%	265	(10) 11.0%	245	(12) 11.4%	145	(9) 6.8%	115	(10) 5.2%
TOTAL									
4109	(17) 100.0%	2410	(20) 100.0%	2144	(22) 100.0%	2131	(19) 100.0%	2229	(20) 100.0%

Outcome for all Diagnoses

The Registry has recorded 4,874 revisions of primary unicompartmental knee replacements.

The main reasons for revision are loosening/lysis (44.0%), progression of disease (28.4%) and pain (9.9%) (Table KP12 and Figure KP9).

The main type of revision is to a total knee replacement (86.4%) (Table KP13).

The outcome of unicompartmental knee prosthesis combinations with more than 200 procedures reported to the Registry are presented in Table KP14.

Table KP12 Primary Unicompartmental Knee Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	2143	44.0
Progression Of Disease	1384	28.4
Pain	482	9.9
Infection	200	4.1
Fracture	112	2.3
Bearing Dislocation	102	2.1
Wear Tibial Insert	54	1.1
Malalignment	54	1.1
Instability	47	1.0
Wear Tibial	44	0.9
Other	252	5.2
TOTAL	**4874**	**100.0**

Table KP13 Primary Unicompartmental Knee Replacement by Type of Revision

Type of Revision	Number	Percent
TKR (Tibial/Femoral)	4212	86.4
Uni Insert Only	286	5.9
Uni Tibial Component	185	3.8
Uni Femoral Component	66	1.4
UKR (Uni Tibial/Uni Femoral)	60	1.2
Cement Spacer	40	0.8
Removal of Prostheses	7	0.1
Reinsertion of Components	6	0.1
Patella/Trochlear Resurfacing	6	0.1
Cement Only	2	0.0
Patella Only	2	0.0
Femoral Component*	2	0.0
TOTAL	**4874**	**100.0**

*Bicompartmental Component

Figure KP9 Cumulative Incidence Revision Diagnosis of Primary Unicompartmental Knee Replacement

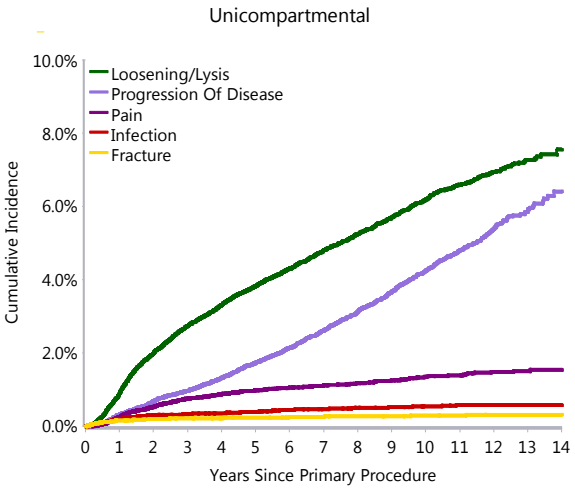


Table KP14 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Prosthesis Type

Uni Femoral	Uni Tibial	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Allegretto Uni	Allegretto Uni	283	2034	3.2 (2.5, 4.0)	5.8 (4.9, 6.9)	8.1 (6.9, 9.4)	10.3 (9.0, 11.8)	14.8 (13.2, 16.7)	20.2 (17.1, 23.9)
BalanSys Uni	BalanSys Uni Fixed	17	352	1.8 (0.8, 4.0)	2.8 (1.5, 5.3)	4.1 (2.3, 7.2)	5.3 (3.1, 9.0)		
Endo-Model Sled	Endo-Model Sled	127	1153	1.1 (0.6, 1.9)	4.8 (3.7, 6.3)	7.8 (6.3, 9.6)	9.7 (8.0, 11.8)	15.3 (12.7, 18.4)	
Freedom PKR/Active	Freedom PKR/Active	224	1456	1.7 (1.1, 2.5)	7.4 (6.1, 8.9)	12.9 (11.2, 14.9)	17.3 (15.2, 19.7)		
GRU	GRU	204	1991	1.4 (0.9, 2.0)	4.5 (3.7, 5.5)	6.2 (5.2, 7.4)	8.5 (7.3, 9.9)	13.3 (11.6, 15.3)	
Genesis	Genesis	277	1864	2.7 (2.0, 3.5)	8.3 (7.1, 9.6)	11.0 (9.7, 12.5)	13.1 (11.6, 14.8)	16.6 (14.8, 18.6)	
Journey	Journey	14	222	0.9 (0.2, 3.7)	6.7 (3.8, 11.6)				
Journey	Journey Deuce	7	201	2.5 (0.9, 6.5)	5.3 (2.2, 12.4)	5.3 (2.2, 12.4)			
M/G	M/G	228	2135	1.6 (1.1, 2.2)	4.1 (3.4, 5.1)	6.4 (5.5, 7.6)	8.2 (7.0, 9.4)	10.5 (9.1, 12.0)	
Oxford	Oxford 3	9	656	1.1 (0.5, 2.5)	1.9 (0.9, 3.9)				
Oxford 3	Oxford	115	2485	3.1 (2.5, 4.0)	5.2 (4.2, 6.3)	7.8 (6.3, 9.7)			
Oxford 3	Oxford 3	1558	12003	2.2 (2.0, 2.5)	5.9 (5.5, 6.4)	8.6 (8.1, 9.1)	11.2 (10.6, 11.8)	15.0 (14.2, 15.7)	20.5 (19.0, 22.0)
Preservation	Preservation Fixed	330	2318	2.4 (1.9, 3.1)	7.1 (6.1, 8.2)	9.5 (8.3, 10.7)	11.8 (10.5, 13.2)	15.4 (13.8, 17.1)	
Preservation	Preservation Mobile	117	400	5.3 (3.5, 7.9)	15.5 (12.3, 19.5)	19.1 (15.6, 23.3)	21.7 (17.9, 26.1)	27.1 (23.0, 31.9)	
Repicci II	Repicci II	461	2980	1.6 (1.2, 2.2)	4.5 (3.8, 5.4)	7.5 (6.6, 8.6)	10.7 (9.6, 11.9)	17.7 (16.2, 19.4)	
Sigma HP	Sigma HP	19	571	1.2 (0.5, 2.7)	3.6 (2.1, 5.9)	5.1 (3.1, 8.4)			
Uniglide	Uniglide	117	737	4.9 (3.6, 6.8)	10.9 (8.8, 13.4)	13.0 (10.7, 15.7)	16.0 (13.4, 19.1)	19.5 (16.3, 23.2)	
Unix	Unix	335	3682	2.4 (2.0, 3.0)	5.4 (4.7, 6.2)	7.2 (6.4, 8.1)	9.1 (8.1, 10.2)	12.1 (10.8, 13.6)	
ZUK	ZUK	177	4494	1.4 (1.1, 1.8)	3.7 (3.1, 4.3)	4.8 (4.1, 5.6)	5.6 (4.8, 6.6)		
Other (30)		255	1809	3.6 (2.8, 4.6)	8.6 (7.3, 10.0)	11.1 (9.7, 12.8)	15.0 (13.2, 17.0)	20.2 (17.8, 22.9)	
TOTAL		**4874**	**43543**						

Note: Only combinations with over 200 procedures have been listed.

Outcome for Osteoarthritis

The cumulative percent revision at 14 years of primary unicompartmental knee replacement undertaken for osteoarthritis is 20.5% (Table KP15 and Figure KP10).

Age is a major factor affecting the outcome of primary unicompartmental knee replacement with the rate of revision decreasing with increasing age (Table KP16 and Figure KP11).

Females have a higher rate of revision, and the effect of age on the rate of revision is evident in both males and females (Table KP17 and Figure KP12 - Figure KP14).

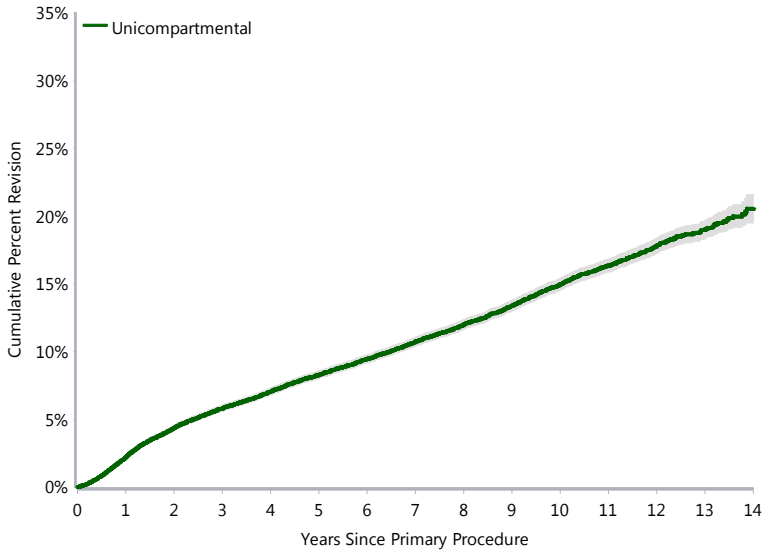
Comparison of Medial and Lateral Unicompartmental Knee Replacement

For the first time, the Registry is reporting the outcome of medial and lateral unicompartmental knees. The Registry has information on 1,807 lateral procedures undertaken for osteoarthritis. There is no difference in the rate of revision when compared to medial unicompartmental knee replacement (Table KP18 and Figure KP15).

Table KP15 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	14 Yrs
Unicompartmental	4816	43087	2.2 (2.1, 2.4)	5.8 (5.6, 6.1)	8.3 (8.0, 8.6)	10.7 (10.4, 11.1)	15.0 (14.5, 15.4)	20.5 (19.5, 21.6)
TOTAL	**4816**	**43087**						

Figure KP10 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement (Primary Diagnosis OA)

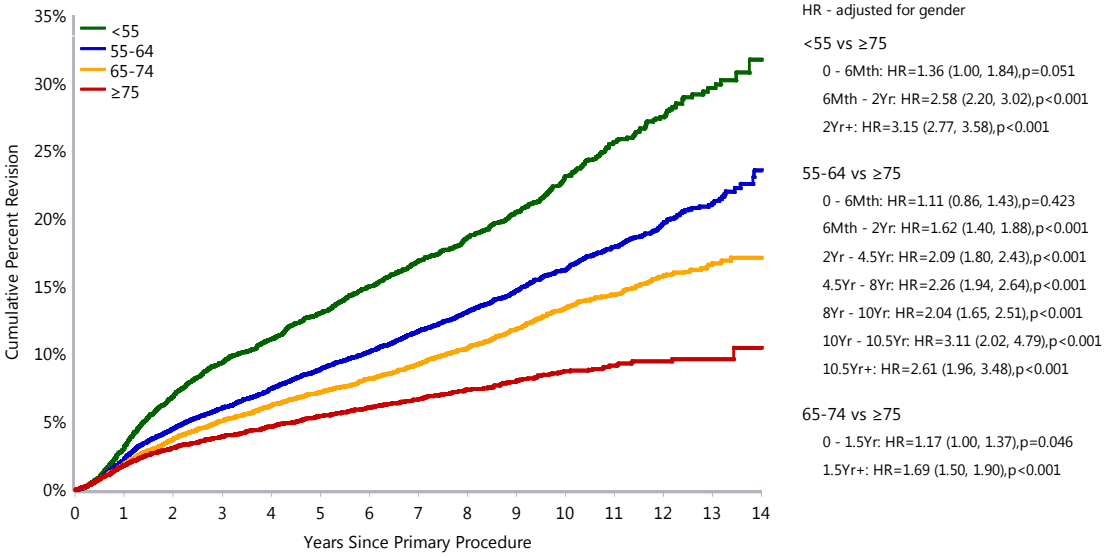


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Unicompartmental	43087	39782	33709	27542	20655	10194	327

Table KP16 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	14 Yrs
<55	1100	6182	3.2 (2.8, 3.7)	9.4 (8.7, 10.2)	13.1 (12.2, 14.0)	17.0 (15.9, 18.0)	23.2 (21.8, 24.6)	31.8 (28.9, 34.9)
55-64	1806	14567	2.3 (2.1, 2.6)	6.1 (5.7, 6.5)	8.9 (8.4, 9.4)	11.7 (11.1, 12.3)	16.2 (15.5, 17.0)	23.6 (21.6, 25.8)
65-74	1366	13771	1.9 (1.7, 2.2)	5.1 (4.7, 5.5)	7.2 (6.8, 7.7)	9.3 (8.8, 9.9)	13.4 (12.7, 14.2)	17.1 (16.0, 18.4)
≥75	544	8567	1.8 (1.5, 2.1)	3.9 (3.5, 4.4)	5.4 (5.0, 6.0)	6.7 (6.1, 7.3)	8.8 (8.0, 9.6)	10.5 (8.8, 12.5)
TOTAL	**4816**	**43087**						

Figure KP11 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Age (Primary Diagnosis OA)

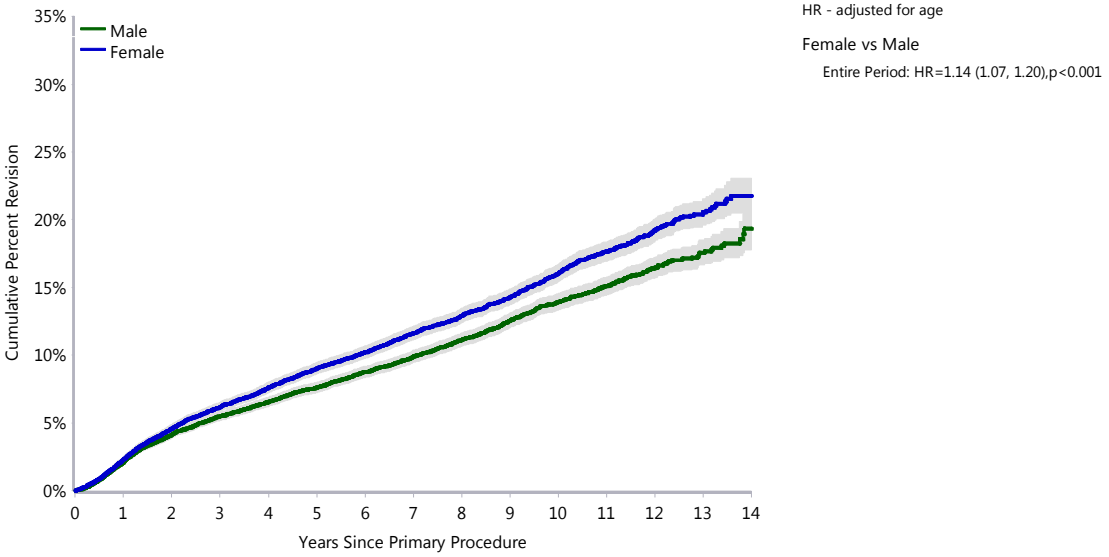


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
<55	6182	5663	4706	3810	2870	1422	53
55-64	14567	13448	11495	9432	7059	3517	107
65-74	13771	12745	10824	8923	6822	3501	126
≥75	8567	7926	6684	5377	3904	1754	41

Table KP17 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Gender and Age (Primary Diagnosis OA)

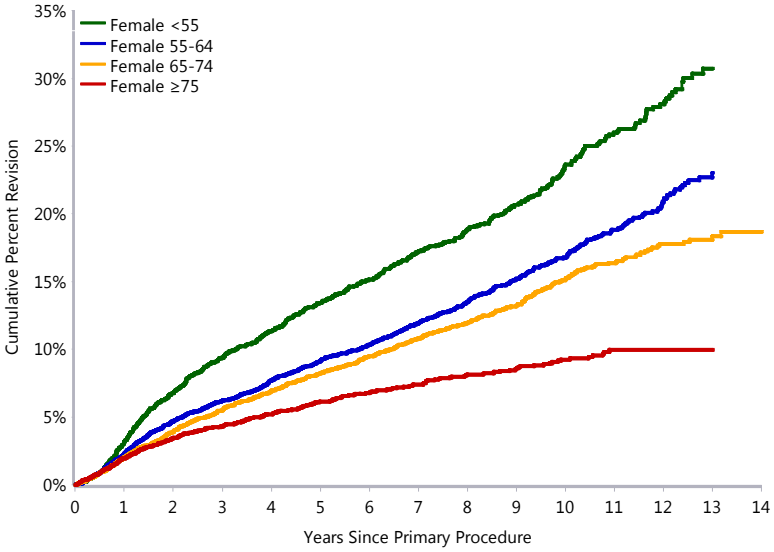
Gender	Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Male		**2283**	**22613**	**2.1 (1.9, 2.3)**	**5.5 (5.2, 5.8)**	**7.6 (7.2, 8.0)**	**9.9 (9.5, 10.4)**	**13.9 (13.3, 14.5)**	**19.3 (17.8, 21.0)**
	<55	462	2700	3.3 (2.7, 4.1)	9.4 (8.3, 10.7)	12.5 (11.3, 14.0)	16.5 (15.0, 18.2)	22.5 (20.5, 24.7)	
	55-64	902	7696	2.3 (2.0, 2.7)	5.9 (5.4, 6.5)	8.7 (8.1, 9.4)	11.5 (10.7, 12.4)	15.7 (14.7, 16.8)	21.9 (19.1, 25.0)
	65-74	664	7682	1.8 (1.5, 2.1)	4.8 (4.3, 5.3)	6.4 (5.8, 7.0)	8.0 (7.4, 8.7)	11.9 (11.0, 12.9)	15.8 (14.2, 17.7)
	≥75	255	4535	1.7 (1.3, 2.1)	3.6 (3.0, 4.2)	4.8 (4.2, 5.5)	6.0 (5.3, 6.9)	8.3 (7.3, 9.5)	
Female		**2533**	**20474**	**2.3 (2.1, 2.5)**	**6.2 (5.8, 6.5)**	**9.0 (8.6, 9.4)**	**11.6 (11.1, 12.1)**	**16.0 (15.4, 16.7)**	**21.8 (20.5, 23.1)**
	<55	638	3482	3.2 (2.6, 3.8)	9.4 (8.4, 10.4)	13.4 (12.3, 14.7)	17.3 (15.9, 18.7)	23.6 (21.9, 25.5)	
	55-64	904	6871	2.3 (2.0, 2.7)	6.2 (5.7, 6.9)	9.2 (8.4, 9.9)	11.9 (11.1, 12.8)	16.8 (15.7, 17.9)	
	65-74	702	6089	2.1 (1.7, 2.5)	5.5 (5.0, 6.1)	8.3 (7.5, 9.0)	10.8 (10.0, 11.7)	15.2 (14.1, 16.3)	18.7 (17.1, 20.4)
	≥75	289	4032	2.0 (1.6, 2.4)	4.3 (3.7, 5.0)	6.1 (5.4, 7.0)	7.4 (6.6, 8.4)	9.3 (8.2, 10.4)	
TOTAL		**4816**	**43087**						

Figure KP12 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Gender (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Male	22613	20783	17375	14046	10434	5122	167
Female	20474	18999	16334	13496	10221	5072	160

Figure KP13 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement for Females by Age (Primary Diagnosis OA)



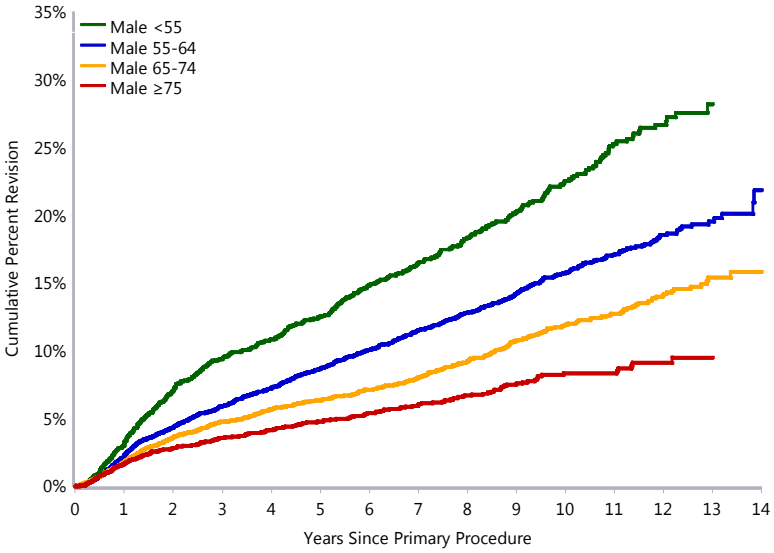
Female <55 vs Female ≥75
- 0 - 9Mth: HR=1.58 (1.17, 2.14),p=0.002
- 9Mth - 1.5Yr: HR=2.55 (1.98, 3.28),p<0.001
- 1.5Yr - 2Yr: HR=2.07 (1.43, 2.98),p<0.001
- 2Yr - 8Yr: HR=2.63 (2.20, 3.14),p<0.001
- 8Yr+: HR=5.98 (3.75, 9.54),p<0.001

Female 55-64 vs Female ≥75
- 0 - 3.5Yr: HR=1.45 (1.24, 1.70),p<0.001
- 3.5Yr - 8Yr: HR=1.95 (1.61, 2.36),p<0.001
- 8Yr+: HR=4.48 (2.84, 7.05),p<0.001

Female 65-74 vs Female ≥75
- 0 - 1.5Yr: HR=1.13 (0.91, 1.40),p=0.279
- 1.5Yr - 8Yr: HR=1.63 (1.38, 1.92),p<0.001
- 8Yr+: HR=3.28 (2.06, 5.22),p<0.001

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Female	<55	3482	3199	2660	2171	1654	822	34
	55-64	6871	6388	5510	4557	3418	1668	36
	65-74	6089	5655	4897	4085	3136	1616	66
	≥75	4032	3757	3267	2683	2013	966	24

Figure KP14 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, 3.12),p<0.001
- 1.5Yr+: HR=3.15 (2.66, 3.74),p<0.001

Male 55-64 vs Male ≥75
- 0 - 2Yr: HR=1.64 (1.37, 1.96),p<0.001
- 2Yr - 2.5Yr: HR=2.56 (1.80, 3.64),p<0.001
- 2.5Yr+: HR=2.12 (1.80, 2.49),p<0.001

Male 65-74 vs Male ≥75
- Entire Period: HR=1.43 (1.23, 1.65),p<0.001

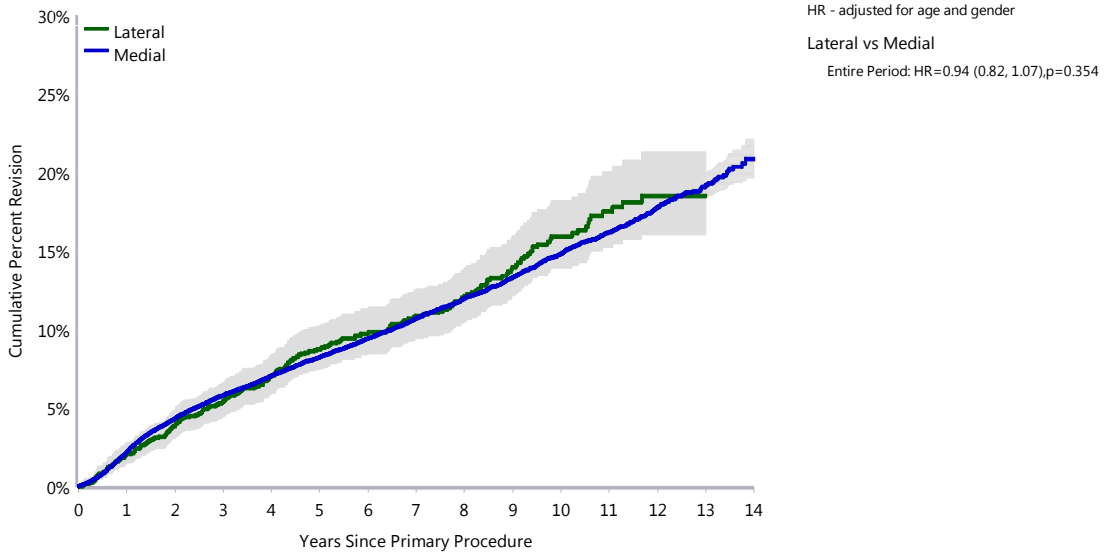
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Male	<55	2700	2464	2046	1639	1216	600	19
	55-64	7696	7060	5985	4875	3641	1849	71
	65-74	7682	7090	5927	4838	3686	1885	60
	≥75	4535	4169	3417	2694	1891	788	17

Table KP18 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Position (Primary Diagnosis OA)

Position	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Lateral	217	1807	2.0 (1.5, 2.8)	5.4 (4.4, 6.6)	8.7 (7.5, 10.2)	10.9 (9.4, 12.6)	15.9 (13.9, 18.2)	
Medial	4117	37454	2.2 (2.0, 2.3)	5.8 (5.6, 6.0)	8.2 (7.9, 8.5)	10.7 (10.3, 11.1)	14.8 (14.3, 15.3)	20.8 (19.7, 22.1)
TOTAL	**4334**	**39261**						

Note: Analysis excludes 3,826 primary unicompartmental knee procedures with unknown/missing position.

Figure KP15 Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Position (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Lateral	1807	1694	1490	1250	957	455	18
Medial	37454	34879	29345	23804	17596	8247	236

PRIMARY TOTAL KNEE REPLACEMENT

Class of Total Knee Replacement

The Registry defines a total knee replacement as a replacement of the entire femorotibial articulation using a single femoral and a single tibial prosthesis. This may or may not be combined with a patella replacement.

In this report, the Registry reports the outcome of total knee replacement based on specific patient and prosthesis characteristics. In addition, it presents the outcome for different types of total knee prostheses.

Individual prostheses are usually available as part of a knee system. The Registry subdivides knee systems into specific prosthesis types based on distinguishing prosthesis characteristics. The initial characteristic used to subdivide is the method of fixation. Further subdivision of specific knee systems is based on additional prosthesis characteristics. These include mobility, stability and flexion capacity. This further system subdivision, however, is not uniformly applied to all knee systems at this time.

High use prosthesis systems are more likely to be subdivided if there are specific reasons to do so. These may include differences or potential differences in outcome between prostheses with different characteristics within a single system.

Low use systems are unlikely to be subdivided because of small numbers or insufficient follow up. The exception is if the system is identified as having a higher than anticipated rate of revision. The Registry then undertakes catalogue range specific analysis to determine if the higher than anticipated rate of revision is associated with specific prosthesis characteristics.

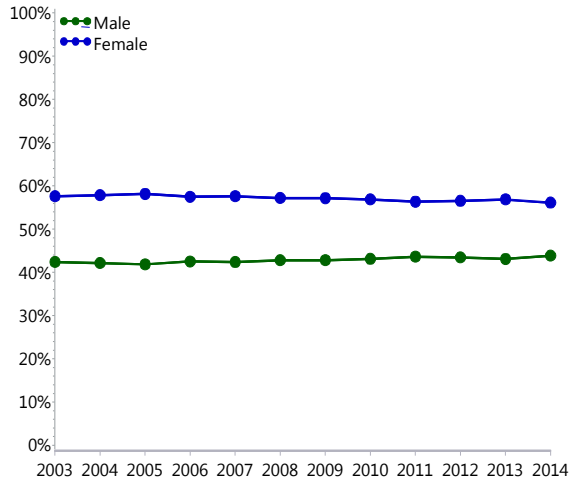
To enable the Registry to undertake range specific analysis uniformly across all knee systems it is necessary to link the different catalogue ranges to the specific prosthesis characteristics. This is an ongoing process.

Demographics

There have been 443,948 primary total knee procedures reported to the Registry, an additional 47,476 procedures compared to the last report.

Primary total knee replacement continues to increase. In 2014, there were 5.2% more procedures than 2013 and 115.1% more than 2003. As a proportion of all knee replacement procedures, primary total knee replacement increased from 76.7% in 2003 to 87.7% in 2014.

Figure KT1 Primary Total Knee Replacement by Gender

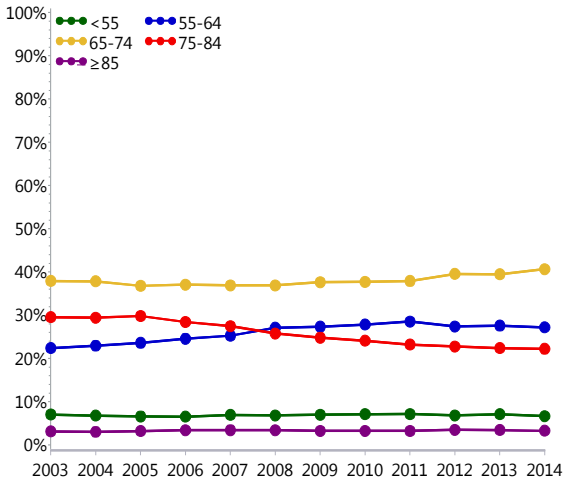


Osteoarthritis is the most common diagnosis for primary total knee replacement (97.5%).

In 2014, primary total knee replacement remains more common in females (56.1%). This proportion has remained constant since 2003 (Figure KT1).

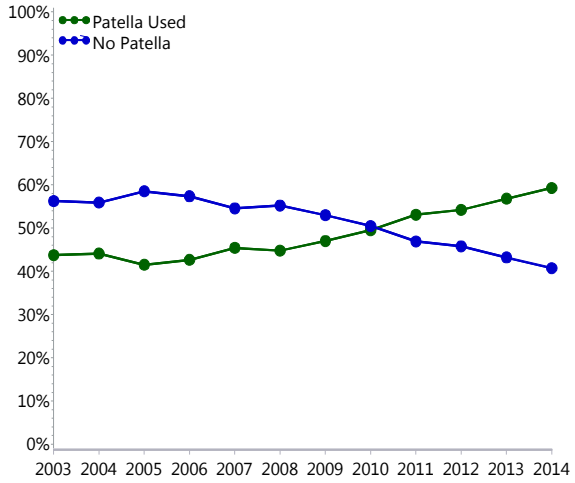
There has been a decrease in the proportion of patients aged 75-84 years from 29.5% in 2003 to 22.2% in 2014. The proportion of patients aged less than 55 years remains small (6.7% in 2014) (Figure KT2).

Figure KT2 Primary Total Knee Replacement by Age



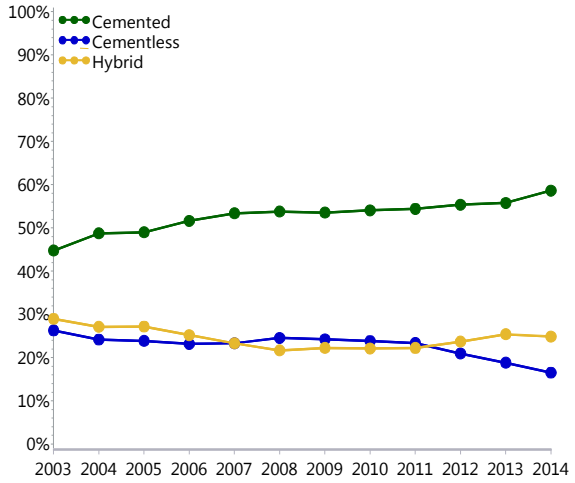
Patella resurfacing in primary total knee replacement continues to increase from a low of 41.5% in 2005 to 59.3% in 2014 (Figure KT3).

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 58.6% in 2014. Hybrid fixation has also increased from a low of 21.7% in 2008 to 24.9% in 2014. The use of cementless fixation has decreased from a peak of 23.4% in 2011 to 16.5% in 2014 (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 26.8% in 2014 (Figure KT5).

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 49.2% in 2014 (Figure KT6).

Figure KT5 Primary Total Knee Replacement by Computer Navigation

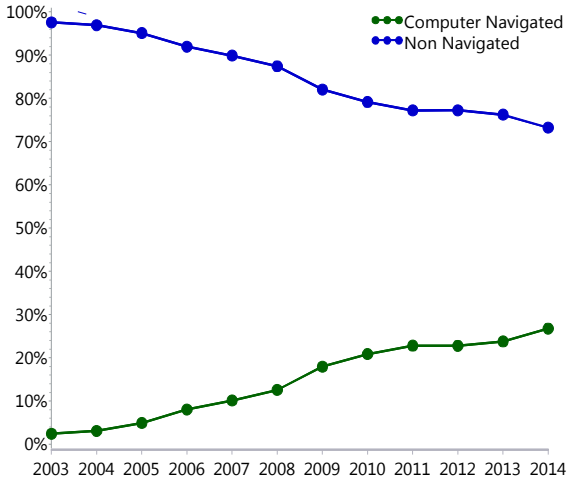
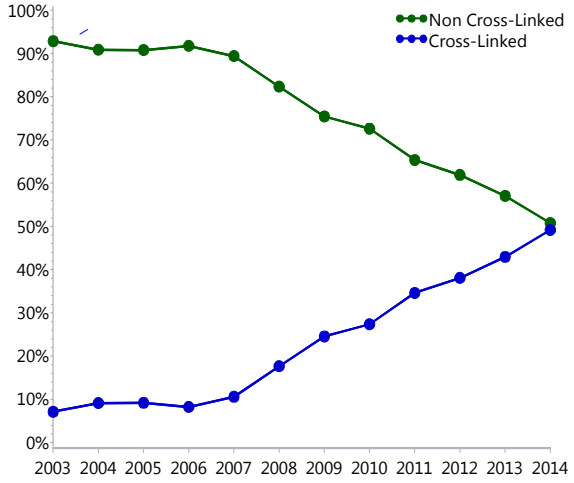


Figure KT6 Primary Total Knee Replacement by Type of Polyethylene



Cruciate retaining (CR) and posterior stabilised (PS) prostheses are now reported separately for the majority of total knee prostheses. In 2014, the most commonly used femoral prosthesis was the Triathlon CR (17.2%), followed by Nexgen CR Flex (13.5%) and LCS CR (6.8%) (Table KT1). The reporting of the 10 most used systems for cemented, cementless and hybrid primary total knee replacement is based on the femoral prosthesis (Table KT2 - Table KT4).

Detailed demographic information on primary total knee replacement is available in the supplementary report 'Demographics of Knee Arthroplasty' on the AOANJRR website aoanjrr.dmac.adelaide.edu.au/annual-reports-2015.

Table KT1 10 Most Used Femoral Prostheses in Primary Total Knee Replacement

2003		2011		2012		2013		2014	
N	Model	N	Model	N	Model	N	Model	N	Model
3184	LCS CR	6176	Triathlon CR	6857	Triathlon CR	7393	Triathlon CR	8017	Triathlon CR
2847	Duracon	4849	Nexgen CR Flex	5356	Nexgen CR Flex	6170	Nexgen CR Flex	6308	Nexgen CR Flex
2150	Nexgen CR	3358	LCS CR	3313	LCS CR	3256	LCS CR	3174	LCS CR
1419	PFC Sigma CR	2876	PFC Sigma CR	2855	PFC Sigma CR	2809	Nexgen LPS Flex	2957	Vanguard CR
1354	Scorpio CR	2663	Nexgen LPS Flex	2724	Vanguard CR	2698	PFC Sigma CR	2874	Nexgen LPS Flex
1058	Genesis II CR	2344	Vanguard CR	2623	Nexgen LPS Flex	2654	Vanguard CR	2256	PFC Sigma CR
1002	Natural Knee II	1661	Genesis II CR	1763	Genesis II CR	1593	Genesis II CR	2005	Legion Oxinium PS
902	Nexgen LPS	1640	Genesis II Oxinium PS	1671	Genesis II Oxinium PS	1534	Genesis II Oxinium PS	1486	Genesis II CR
883	Profix	1529	Genesis II PS	1338	Genesis II PS	1388	Legion Oxinium PS	1391	Genesis II Oxinium PS
751	Scorpio PS	1216	Triathlon PS	1236	PFC Sigma PS	1291	PFC Sigma PS	1243	Genesis II PS
10 Most Used									
15550	(10) 71.5%	28312	(10) 70.1%	29736	(10) 70.1%	30786	(10) 69.3%	31711	(10) 67.8%
Remainder									
6184	(47) 28.5%	12068	(65) 29.9%	12689	(69) 29.9%	13643	(73) 30.7%	15032	(70) 32.2%
TOTAL									
21734	(57) 100.0%	40380	(75) 100.0%	42425	(79) 100.0%	44429	(83) 100.0%	46743	(80) 100.0%

Table KT2 10 Most Used Femoral Prostheses in Cemented Primary Total Knee Replacement

2003		2011		2012		2013		2014	
N	Model	N	Model	N	Model	N	Model	N	Model
1214	Duracon	2824	Triathlon CR	3285	Triathlon CR	3388	Triathlon CR	4019	Triathlon CR
948	LCS CR	2399	Nexgen LPS Flex	2228	Nexgen LPS Flex	2385	Nexgen LPS Flex	2526	Nexgen LPS Flex
824	Nexgen LPS	1911	Nexgen CR Flex	1916	Nexgen CR Flex	2263	Nexgen CR Flex	2329	Nexgen CR Flex
761	Nexgen CR	1639	Genesis II Oxinium PS	1670	Genesis II Oxinium PS	1534	Genesis II Oxin PS	2005	Legion Oxinium PS
690	Nexgen LPS Flex	1449	Genesis II PS	1305	Genesis II PS	1386	Legion Oxinium PS	1391	Genesis II Oxinium PS
641	Genesis II CR	1111	Genesis II CR	1192	PFC Sigma CR	1204	Genesis II PS	1268	Vanguard CR
495	Profix	1063	PFC Sigma CR	1167	Genesis II CR	1170	Vanguard CR	1214	Genesis II PS
471	Genesis II Oxinium CR	1015	PFC Sigma PS	1103	PFC Sigma PS	1090	PFC Sigma CR	1004	PFC Sigma CR
471	PFC Sigma PS	933	LCS CR	1067	Vanguard CR	1087	PFC Sigma PS	929	Genesis II CR
419	Genesis II PS	893	Vanguard CR	1031	Legion Oxinium PS	994	Genesis II CR	922	PFC Sigma PS
10 Most Used									
6934	(10) 71.3%	15237	(10) 69.4%	15964	(10) 68.0%	16501	(10) 66.6%	17607	(10) 64.2%
Remainder									
2794	(41) 28.7%	6732	(61) 30.6%	7524	(65) 32.0%	8282	(70) 33.4%	9798	(68) 35.8%
TOTAL									
9728	(51) 100.0%	21969	(71) 100.0%	23488	(75) 100.0%	24783	(80) 100.0%	27405	(78) 100.0%

Table KT3 10 Most Used Femoral Prostheses in Cementless Primary Total Knee Replacement

2003		2011		2012		2013		2014	
N	Model	N	Model	N	Model	N	Model	N	Model
1470	LCS CR	1722	Triathlon CR	1714	Triathlon CR	1725	Triathlon CR	1643	Nexgen CR Flex
793	Nexgen CR	1584	LCS CR	1670	Nexgen CR Flex	1707	Nexgen CR Flex	1610	Triathlon CR
500	Natural Knee II	1581	Nexgen CR Flex	1460	LCS CR	1476	LCS CR	1411	LCS CR
487	Active Knee	674	RBK	574	RBK	436	RBK	404	Vanguard CR
476	Duracon	496	Vanguard CR	458	Vanguard CR	412	Vanguard CR	368	RBK
320	Scorpio CR	492	Active Knee	378	PFC Sigma CR	354	PFC Sigma CR	268	Score
314	PFC Sigma CR	478	PFC Sigma CR	375	Active Knee	247	ACS	248	Scorpio NRG CR
303	RBK	231	Scorpio NRG CR	294	Nexgen LPS Flex	242	Nexgen LPS Flex	237	PFC Sigma CR
187	Profix	204	Score	196	Score	237	Score	203	Nexgen LPS Flex
181	Scorpio PS	199	Nexgen LPS Flex	195	Scorpio NRG CR	229	Active Knee	174	GMK Primary
10 Most Used									
5031	(10) 88.1%	7661	(10) 81.2%	7314	(10) 82.3%	7065	(10) 84.5%	6566	(10) 85.1%
Remainder									
681	(14) 11.9%	1778	(23) 18.8%	1571	(26) 17.7%	1298	(23) 15.5%	1154	(22) 14.9%
TOTAL									
5712	(24) 100.0%	9439	(33) 100.0%	8885	(36) 100.0%	8363	(33) 100.0%	7720	(32) 100.0%

Table KT4 10 Most Used Femoral Prostheses in Hybrid Primary Total Knee Replacement

2003		2011		2012		2013		2014	
N	Model	N	Model	N	Model	N	Model	N	Model
1157	Duracon	**1630**	Triathlon CR	1858	Triathlon CR	2280	Triathlon CR	2388	Triathlon CR
766	LCS CR	1357	Nexgen CR Flex	1770	Nexgen CR Flex	2200	Nexgen CR Flex	2336	Nexgen CR Flex
764	PFC Sigma CR	1335	PFC Sigma CR	1285	PFC Sigma CR	1254	PFC Sigma CR	1285	Vanguard CR
737	Scorpio CR	955	Vanguard CR	1199	Vanguard CR	1072	Vanguard CR	1015	PFC Sigma CR
596	Nexgen CR	841	LCS CR	844	LCS CR	887	LCS CR	863	LCS CR
364	Genesis II CR	476	Genesis II CR	523	Genesis II CR	544	Genesis II CR	500	Genesis II CR
255	Maxim	435	Scorpio CR	316	Scorpio CR	351	Scorpio CR	375	Scorpio CR
247	Natural Knee II	348	Triathlon PS	311	Triathlon PS	319	Triathlon PS	287	Triathlon PS
204	AGC	164	Nexgen CR	262	Natural Knee Flex	204	PFC Sigma PS	286	Legion CR
203	Scorpio PS	161	RBK	191	Legion CR	196	Active Knee	282	ACS
10 Most Used									
5293	(10) 84.1%	7702	(10) 85.8%	8559	(10) 85.1%	9307	(10) 82.5%	9617	(10) 82.8%
Remainder									
1001	(27) 15.9%	1270	(38) 14.2%	1493	(35) 14.9%	1976	(36) 17.5%	2001	(30) 17.2%
TOTAL									
6294	(37) 100.0%	8972	(48) 100.0%	10052	(45) 100.0%	11283	(46) 100.0%	11618	(40) 100.0%

Outcome for All Diagnoses

Primary Diagnosis

The four most common primary diagnoses are osteoarthritis (97.5%), rheumatoid arthritis (1.5%), other inflammatory arthritis (0.5%) and osteonecrosis (0.3%). Rheumatoid arthritis has a lower rate of revision compared to osteoarthritis after nine months. Osteonecrosis and other inflammatory arthritis have a higher rate of revision compared to osteoarthritis however this is only evident in the first three months for other inflammatory arthritis (Table KT5 and Figure KT7).

Reason for Revision

Loosening/lysis (28.7%) is the main reason for revision, followed by infection (22.4%), patellofemoral pain (12.1%), pain (8.8%) and instability (6.3%) (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 28.7% of revision procedures, lysis not associated with loosening has occurred in 1.9% with 25.8% of revision procedures undertaken for loosening not associated with lysis. In 0.9% 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.

Type of Revision

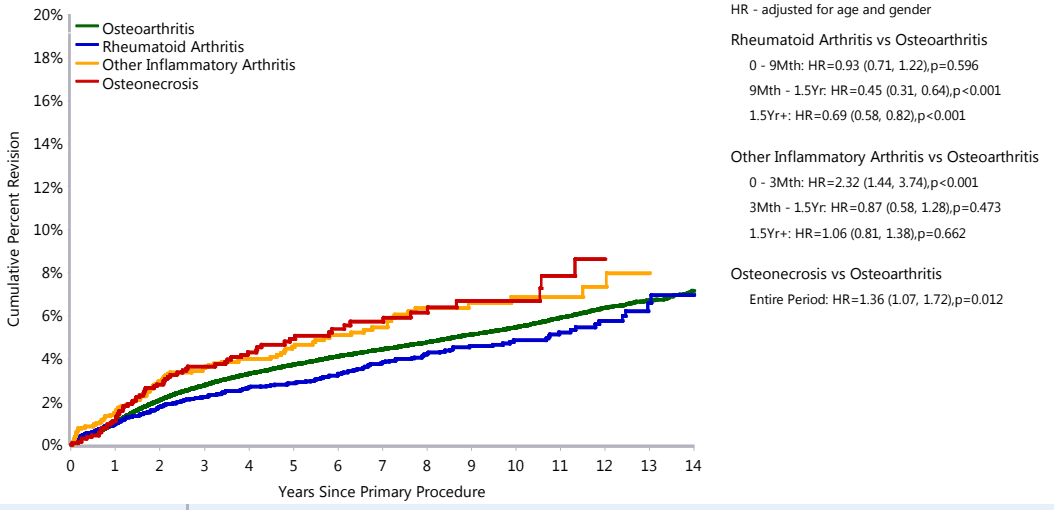
The most common types of revision are replacement of both the femoral and tibial prostheses (25.3%), insert only exchange (21.1%) and patella only replacement (21.0%) (Table KT7).

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	14 Yrs
Osteoarthritis	15232	432833	1.0 (1.0, 1.1)	2.8 (2.7, 2.8)	3.7 (3.7, 3.8)	4.4 (4.4, 4.5)	5.5 (5.4, 5.6)	7.2 (6.9, 7.4)
Rheumatoid Arthritis	223	6550	1.0 (0.8, 1.3)	2.2 (1.9, 2.6)	2.9 (2.5, 3.3)	3.8 (3.3, 4.4)	4.8 (4.2, 5.6)	7.0 (5.6, 8.6)
Other Inflammatory Arthritis	97	2163	1.6 (1.1, 2.2)	3.6 (2.8, 4.5)	4.6 (3.6, 5.7)	5.5 (4.4, 6.8)	6.9 (5.5, 8.6)	
Osteonecrosis	68	1459	1.2 (0.7, 1.9)	3.6 (2.7, 4.8)	4.9 (3.8, 6.4)	5.7 (4.4, 7.4)	6.7 (5.2, 8.6)	
Other (5)	83	943	2.1 (1.3, 3.4)	7.9 (6.1, 10.1)	10.4 (8.2, 13.2)	12.6 (10.0, 16.0)	16.5 (12.7, 21.1)	
TOTAL	**15703**	**443948**						

Note: Only Primary Diagnoses with over 1,000 procedures have been listed.

Figure KT7 Cumulative Percent Revision of Primary Total Knee Replacement by Primary Diagnosis



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Osteoarthritis	432833	379637	282812	199373	131354	55555	2214
Rheumatoid Arthritis	6550	5942	4767	3657	2667	1287	81
Other Inflammatory Arthritis	2163	1910	1401	978	681	312	21
Osteonecrosis	1459	1280	944	693	478	207	4

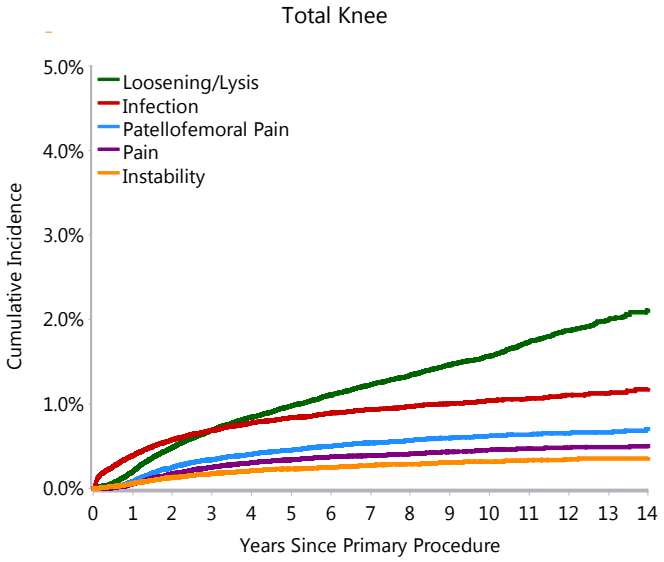
Table KT6 Primary Total Knee Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	4503	28.7
Infection	3522	22.4
Patellofemoral Pain	1894	12.1
Pain	1382	8.8
Instability	982	6.3
Patella Erosion	591	3.8
Arthrofibrosis	559	3.6
Fracture	416	2.6
Malalignment	357	2.3
Metal Related Pathology	267	1.7
Wear Tibial Insert	245	1.6
Incorrect Sizing	204	1.3
Other	781	5.0
TOTAL	**15703**	**100.0**

Table KT7 Primary Total Knee Replacement by Type of Revision

Type of Revision	Number	Percent
TKR (Tibial/Femoral)	3968	25.3
Insert Only	3306	21.1
Patella Only	3305	21.0
Tibial Component	1636	10.4
Insert/Patella	1469	9.4
Femoral Component	972	6.2
Cement Spacer	900	5.7
Removal of Prostheses	86	0.5
Minor Components	39	0.2
Reinsertion of Components	8	0.1
Cement Only	7	0.0
Total Femoral	7	0.0
TOTAL	**15703**	**100.0**

Figure KT8 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement



Prosthesis Types

There are 486 femoral and tibial prosthesis combinations for primary total knee replacement recorded by the Registry, 19 more than 2013. The cumulative percent revision of the 131 combinations with more than 400 procedures per combination are listed in Table KT8 – Table KT10. Although the listed combinations are a small proportion of all possible combinations, they represent 95.2% of all primary total knee replacement. The 'Other' group is the combined outcome of the remaining 355 prosthesis combinations with less than 400 procedures per combination.

There are 57 cemented total femoral and tibial prosthesis combinations with more than 400 procedures. Of those with a 14 year cumulative percent revision, the Nexgen CR/Nexgen is the lowest at 4.5%. (Table KT8).

There are 36 cementless femoral and tibial prostheses combinations with more than 400 procedures. Of those with a 14 year cumulative percent revision, the Nexgen CR/Nexgen is the lowest at 3.4% (Table KT9).

There are 38 combinations of primary total knee replacement with hybrid fixation with more than 400 procedures. The Nexgen CR/Nexgen has the lowest 14 year cumulative percent revision (4.8%) (Table KT10).

Table KT8 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	14 Yrs
AGC	AGC	162	3486	0.6 (0.4, 0.9)	2.5 (2.0, 3.0)	3.5 (2.9, 4.2)	4.2 (3.6, 5.0)	5.4 (4.6, 6.4)	7.5 (6.0, 9.3)
Active Knee	Active Knee	29	1275	0.8 (0.4, 1.5)	2.0 (1.3, 3.1)	3.3 (2.2, 5.0)	4.4 (2.8, 6.9)		
Advance	Advance II	52	918	1.5 (0.9, 2.6)	4.3 (3.1, 5.9)	5.1 (3.8, 6.8)	6.4 (4.8, 8.5)	7.7 (5.8, 10.3)	
Apex Knee PS	Apex Knee	0	522	0.0 (0.0, 0.0)					
Attune CR	Attune	6	975	0.9 (0.4, 2.1)					
Attune PS	Attune	1	709	0.2 (0.0, 1.2)					
BalanSys	BalanSys	17	1132	0.2 (0.1, 0.8)	1.6 (0.9, 2.8)	2.1 (1.2, 3.7)	2.6 (1.4, 4.7)	4.1 (2.2, 7.6)	
Duracon	Duracon	399	8968	1.0 (0.8, 1.2)	2.4 (2.1, 2.8)	3.3 (2.9, 3.7)	3.8 (3.5, 4.3)	4.7 (4.3, 5.3)	6.3 (5.6, 7.1)
E.Motion	E.Motion	14	403	2.1 (1.1, 4.2)	4.0 (2.4, 6.7)				
Evolis	Evolis	10	681	0.3 (0.1, 1.3)	1.3 (0.6, 2.7)	1.9 (1.0, 3.8)			
Evolution	Evolution	1	562	0.0 (0.0, 0.0)					
GMK Primary	GMK Primary	5	448	0.7 (0.2, 2.1)	2.1 (0.7, 6.1)				
GMK Sphere Primary	GMK Primary	6	670	1.1 (0.5, 2.5)					
Genesis II CR	Genesis II	384	12194	0.9 (0.8, 1.1)	2.5 (2.2, 2.8)	3.2 (2.9, 3.6)	4.1 (3.7, 4.5)	4.4 (3.9, 4.9)	5.0 (4.4, 5.8)
Genesis II CR	Profix Mobile	29	490	1.7 (0.8, 3.3)	3.5 (2.1, 5.6)	5.7 (3.8, 8.4)	6.5 (4.4, 9.4)	8.7 (5.8, 12.9)	
Genesis II Oxin CR	Genesis II	273	6378	1.1 (0.8, 1.4)	2.8 (2.4, 3.3)	3.7 (3.3, 4.3)	4.7 (4.1, 5.3)	6.4 (5.5, 7.3)	
Genesis II Oxin PS	Genesis II	578	12930	1.5 (1.3, 1.7)	3.8 (3.5, 4.2)	5.3 (4.8, 5.7)	6.2 (5.7, 6.7)	7.8 (6.9, 8.8)	
Genesis II PS	Genesis II	479	13624	1.3 (1.1, 1.5)	2.9 (2.7, 3.3)	3.9 (3.5, 4.3)	4.6 (4.1, 5.0)	5.4 (4.9, 6.0)	
Journey Oxinium	Journey	188	3029	1.4 (1.0, 1.8)	4.5 (3.8, 5.3)	6.4 (5.5, 7.5)	8.6 (7.3, 10.1)		
Kinemax Plus	Kinemax Plus	97	1826	0.9 (0.6, 1.5)	2.4 (1.8, 3.3)	3.1 (2.4, 4.0)	3.9 (3.1, 5.0)	4.6 (3.7, 5.7)	8.1 (6.2, 10.4)
LCS CR	LCS	288	3936	1.0 (0.7, 1.4)	3.8 (3.2, 4.4)	5.0 (4.4, 5.8)	6.1 (5.4, 6.9)	7.2 (6.4, 8.1)	9.2 (8.1, 10.5)
LCS CR	MBT	258	8964	0.7 (0.5, 0.9)	2.2 (1.9, 2.6)	3.2 (2.8, 3.6)	4.0 (3.5, 4.6)	5.1 (4.4, 5.9)	
LCS PS	MBT	29	490	1.3 (0.6, 2.9)	6.0 (4.1, 8.7)	7.7 (5.3, 11.1)			
Legion CR	Genesis II	17	729	1.5 (0.8, 2.8)	2.4 (1.4, 4.0)	3.9 (2.3, 6.8)			
Legion Oxinium CR	Genesis II	31	1816	0.9 (0.5, 1.5)	2.1 (1.4, 3.1)	2.7 (1.8, 4.1)			
Legion Oxinium PS	Genesis II	128	6011	1.2 (1.0, 1.6)	3.2 (2.7, 3.9)	4.1 (3.3, 5.1)			
Legion PS	Genesis II	35	2608	0.8 (0.5, 1.3)	1.8 (1.3, 2.6)	2.1 (1.4, 3.2)			
Maxim	Maxim	33	498	1.2 (0.5, 2.7)	2.6 (1.5, 4.5)	4.8 (3.2, 7.1)	5.2 (3.6, 7.6)	6.5 (4.5, 9.3)	
Natural Knee Flex	Natural Knee II	17	918	0.7 (0.3, 1.6)	2.3 (1.4, 3.8)	2.7 (1.6, 4.6)			
Natural Knee II	Natural Knee II	47	1750	0.5 (0.2, 0.9)	1.3 (0.9, 2.0)	2.0 (1.4, 2.9)	2.8 (2.1, 3.9)	3.9 (2.8, 5.3)	
Nexgen CR	Nexgen	101	3644	0.5 (0.3, 0.8)	1.4 (1.0, 1.8)	1.8 (1.4, 2.3)	2.1 (1.6, 2.6)	2.7 (2.2, 3.4)	4.5 (3.5, 5.9)
Nexgen CR Flex	Natural Knee II	5	687	0.3 (0.1, 1.2)	0.7 (0.3, 2.0)	0.7 (0.3, 2.0)			

Femoral Component	Tibial Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Nexgen CR Flex	Nexgen	204	13661	0.7 (0.5, 0.8)	1.5 (1.2, 1.7)	2.0 (1.7, 2.3)	2.3 (1.9, 2.6)	2.5 (2.1, 3.0)	
Nexgen LCCK	Nexgen	22	524	2.0 (1.1, 3.7)	3.6 (2.2, 5.8)	5.4 (3.4, 8.4)	5.4 (3.4, 8.4)		
Nexgen LPS	Nexgen	210	5370	1.0 (0.8, 1.3)	2.3 (1.9, 2.7)	2.9 (2.5, 3.4)	3.8 (3.2, 4.4)	4.9 (4.2, 5.6)	5.5 (4.7, 6.3)
Nexgen LPS Flex	Nexgen	734	24280	0.9 (0.8, 1.0)	2.3 (2.1, 2.6)	3.2 (3.0, 3.5)	4.0 (3.7, 4.4)	5.1 (4.7, 5.6)	
Optetrak-PS	Optetrak	145	2195	1.5 (1.1, 2.1)	4.7 (3.9, 5.8)	6.7 (5.6, 7.9)	7.9 (6.7, 9.4)	9.8 (8.1, 11.8)	
Optetrak-PS	Optetrak-RBK	35	663	1.8 (1.0, 3.2)	4.4 (3.0, 6.5)	5.9 (4.1, 8.3)	7.2 (5.0, 10.1)		
PFC Sigma CR	MBT	21	1102	0.7 (0.3, 1.4)	1.4 (0.9, 2.4)	1.8 (1.1, 2.9)	2.2 (1.4, 3.4)	2.6 (1.6, 4.2)	
PFC Sigma CR	PFC Sigma	245	10571	0.8 (0.6, 1.0)	1.9 (1.6, 2.2)	2.4 (2.1, 2.8)	2.9 (2.5, 3.3)	3.6 (3.1, 4.2)	
PFC Sigma PS	MBT	177	5664	0.7 (0.6, 1.0)	2.6 (2.2, 3.0)	3.4 (2.9, 4.0)	4.0 (3.4, 4.7)	4.4 (3.7, 5.2)	
PFC Sigma PS	PFC Sigma	215	6741	1.1 (0.9, 1.4)	2.6 (2.2, 3.0)	3.1 (2.7, 3.6)	3.5 (3.0, 4.0)	4.5 (3.8, 5.3)	
Profix	Profix	135	3285	1.1 (0.8, 1.5)	2.6 (2.1, 3.2)	3.2 (2.6, 3.9)	3.9 (3.3, 4.7)	4.7 (3.9, 5.5)	
Profix Oxinium	Profix	76	999	1.9 (1.2, 3.0)	5.0 (3.8, 6.5)	6.7 (5.3, 8.4)	7.6 (6.1, 9.5)	8.1 (6.5, 10.1)	
RBK	RBK	66	2018	0.9 (0.5, 1.4)	2.6 (1.9, 3.4)	3.5 (2.7, 4.6)	4.0 (3.1, 5.2)	5.5 (4.0, 7.7)	
SAIPH	SAIPH	5	434	0.5 (0.1, 2.1)					
Scorpio CR	Series 7000	81	1767	0.9 (0.5, 1.4)	2.3 (1.7, 3.1)	2.9 (2.2, 3.9)	4.2 (3.3, 5.3)	5.0 (4.0, 6.3)	
Scorpio NRG CR	Series 7000	21	1145	0.6 (0.3, 1.4)	1.2 (0.7, 2.2)	2.0 (1.2, 3.2)			
Scorpio NRG PS	Series 7000	49	2484	0.7 (0.4, 1.1)	1.8 (1.3, 2.4)	2.4 (1.8, 3.2)	2.5 (1.9, 3.4)		
Scorpio PS	Scorpio	30	510	1.2 (0.5, 2.6)	3.8 (2.4, 5.9)	4.4 (2.9, 6.6)	5.3 (3.7, 7.7)	6.6 (4.6, 9.4)	
Scorpio PS	Scorpio+	55	900	1.2 (0.7, 2.2)	4.0 (2.9, 5.5)	5.6 (4.3, 7.4)	6.1 (4.6, 7.9)	6.9 (5.3, 9.1)	
Scorpio PS	Series 7000	150	3140	1.1 (0.8, 1.5)	2.8 (2.3, 3.5)	3.8 (3.2, 4.6)	4.8 (4.0, 5.7)	7.0 (5.8, 8.4)	
Triathlon CR	Triathlon	393	20975	0.8 (0.7, 0.9)	2.1 (1.9, 2.3)	2.7 (2.4, 3.0)	3.0 (2.7, 3.4)		
Triathlon PS	Triathlon	148	5045	1.5 (1.2, 1.9)	3.1 (2.6, 3.7)	3.8 (3.2, 4.5)	4.3 (3.6, 5.2)		
Vanguard CR	Maxim	106	5545	0.6 (0.4, 0.9)	2.3 (1.9, 2.8)	2.9 (2.3, 3.6)	3.5 (2.7, 4.4)		
Vanguard CR	Vanguard	10	872	0.5 (0.2, 1.4)	1.3 (0.6, 2.6)	1.9 (0.9, 4.1)			
Vanguard PS	Maxim	143	3118	1.9 (1.4, 2.4)	4.8 (4.0, 5.7)	6.0 (5.0, 7.1)	7.1 (5.7, 8.9)		
Other (172)		450	8567	1.4 (1.2, 1.7)	3.8 (3.4, 4.3)	5.5 (5.0, 6.1)	6.8 (6.2, 7.5)	8.3 (7.5, 9.2)	9.6 (8.6, 10.7)
TOTAL		**7645**	**234846**						

Note: Some Cementless components have been cemented.
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	14 Yrs
Active Knee	Active Knee	308	4798	1.3 (1.0, 1.7)	3.8 (3.2, 4.4)	5.2 (4.6, 5.9)	6.4 (5.7, 7.2)	8.6 (7.7, 9.7)	
Advance	Advance	23	485	2.1 (1.1, 4.0)	5.3 (3.5, 8.1)	5.7 (3.8, 8.6)			
Advantim	Advantim	44	1253	0.7 (0.4, 1.4)	2.6 (1.8, 3.7)	3.3 (2.4, 4.6)	3.7 (2.7, 5.1)	4.9 (3.5, 6.8)	
Columbus	Columbus	51	500	3.2 (2.0, 5.2)	7.6 (5.5, 10.3)	9.8 (7.4, 13.0)	11.8 (8.9, 15.4)		
Duracon	Duracon	172	3539	1.1 (0.8, 1.4)	2.7 (2.2, 3.3)	3.7 (3.1, 4.4)	4.3 (3.6, 5.0)	5.1 (4.4, 6.0)	6.9 (5.2, 9.1)
GMK Primary	GMK Primary	16	480	2.2 (1.1, 4.4)					
Genesis II CR	Genesis II	21	431	1.5 (0.7, 3.2)	5.4 (3.4, 8.5)	6.0 (3.8, 9.4)	7.6 (4.4, 12.8)		
Genesis II CR	Profix Mobile	29	505	1.4 (0.7, 2.9)	2.0 (1.1, 3.7)	3.0 (1.8, 5.0)	3.5 (2.2, 5.5)	4.3 (2.8, 6.6)	8.4 (5.7, 12.3)
LCS CR	LCS	140	2336	1.4 (1.0, 2.0)	3.4 (2.7, 4.2)	4.2 (3.5, 5.1)	4.8 (4.0, 5.7)	5.9 (5.0, 6.9)	6.9 (5.8, 8.1)
LCS CR	MBT	230	6466	1.2 (0.9, 1.5)	3.4 (2.9, 3.9)	4.4 (3.9, 5.1)	5.2 (4.5, 6.0)	5.9 (5.1, 6.8)	
LCS CR	MBT Duofix	499	11412	1.3 (1.1, 1.5)	3.2 (2.9, 3.6)	4.1 (3.7, 4.5)	4.7 (4.3, 5.2)	5.5 (5.0, 6.1)	
LCS Duofix	MBT Duofix	422	3649	1.6 (1.2, 2.1)	6.2 (5.4, 7.0)	10.1 (9.1, 11.1)	12.0 (10.9, 13.1)		
Maxim	Maxim	31	612	1.6 (0.9, 3.0)	3.0 (1.9, 4.7)	3.3 (2.2, 5.1)	3.3 (2.2, 5.1)	4.8 (3.3, 6.9)	
Natural Knee Flex	Natural Knee II	22	973	1.1 (0.6, 2.0)	2.1 (1.3, 3.4)	2.7 (1.8, 4.2)			
Natural Knee II	Natural Knee II	201	2861	1.0 (0.7, 1.4)	2.3 (1.8, 2.9)	3.5 (2.9, 4.3)	4.6 (3.9, 5.5)	7.8 (6.7, 9.0)	
Nexgen CR	Nexgen	93	3358	0.5 (0.3, 0.9)	1.7 (1.3, 2.2)	2.1 (1.7, 2.7)	2.5 (2.0, 3.1)	3.0 (2.4, 3.6)	3.4 (2.7, 4.2)
Nexgen CR	Nexgen TM CR	39	632	1.5 (0.8, 2.8)	4.9 (3.4, 7.0)	6.8 (5.0, 9.3)	7.2 (5.2, 9.8)	7.6 (5.5, 10.3)	
Nexgen CR Flex	Nexgen	123	5357	1.0 (0.8, 1.4)	2.3 (1.9, 2.8)	2.7 (2.3, 3.3)	3.0 (2.5, 3.6)	3.8 (3.0, 4.8)	
Nexgen CR Flex	Nexgen TM CR	135	7466	0.5 (0.4, 0.7)	1.8 (1.5, 2.2)	2.3 (2.0, 2.8)	2.6 (2.2, 3.1)		
Nexgen LPS	Nexgen TM LPS	21	926	1.0 (0.5, 2.0)	1.6 (0.9, 2.7)	2.8 (1.8, 4.3)	3.2 (2.0, 5.1)		
Nexgen LPS Flex	Nexgen TM LPS	13	786	0.8 (0.4, 1.8)	1.6 (0.9, 2.8)				
PFC Sigma CR	AMK Duofix	49	1911	0.6 (0.4, 1.1)	1.6 (1.1, 2.2)	2.4 (1.8, 3.3)	2.8 (2.1, 3.8)	3.3 (2.4, 4.5)	
PFC Sigma CR	MBT	53	994	2.2 (1.5, 3.4)	4.9 (3.7, 6.6)	5.9 (4.4, 7.9)	6.7 (5.0, 8.9)	7.3 (5.5, 9.7)	
PFC Sigma CR	MBT Duofix	94	2234	1.3 (0.9, 1.9)	3.3 (2.6, 4.2)	4.3 (3.5, 5.3)	4.5 (3.7, 5.6)	5.3 (4.2, 6.7)	
Profix	Profix	84	1488	1.1 (0.7, 1.8)	3.5 (2.6, 4.5)	4.6 (3.6, 5.8)	6.0 (4.8, 7.4)	6.5 (5.3, 8.1)	
RBK	RBK	223	5667	1.4 (1.1, 1.7)	3.1 (2.7, 3.7)	4.1 (3.6, 4.7)	4.8 (4.2, 5.6)	5.6 (4.8, 6.5)	
Score	Score	62	1451	1.2 (0.8, 2.0)	5.0 (3.8, 6.5)	6.5 (5.0, 8.4)			
Scorpio CR	Series 7000	166	3116	1.3 (1.0, 1.8)	3.3 (2.7, 4.0)	4.6 (3.9, 5.5)	5.3 (4.5, 6.2)	7.0 (6.0, 8.3)	
Scorpio NRG CR	Series 7000	30	1609	0.8 (0.4, 1.4)	1.7 (1.1, 2.5)	2.4 (1.6, 3.5)	3.2 (2.1, 4.8)		
Scorpio NRG PS	Series 7000	58	895	1.3 (0.7, 2.3)	6.0 (4.5, 7.9)	7.8 (6.0, 10.1)	8.4 (6.5, 10.8)		
Scorpio PS	Series 7000	44	570	2.5 (1.5, 4.1)	5.3 (3.7, 7.5)	6.2 (4.5, 8.6)	7.0 (5.2, 9.5)	7.8 (5.8, 10.4)	
Triathlon CR	Triathlon	208	10670	1.0 (0.8, 1.2)	2.0 (1.7, 2.3)	2.7 (2.3, 3.1)	3.2 (2.7, 3.8)		
Triathlon PS	Triathlon	45	975	2.2 (1.4, 3.3)	3.9 (2.9, 5.4)	5.0 (3.7, 6.6)	5.0 (3.7, 6.6)		
Vanguard CR	Maxim	30	581	1.2 (0.6, 2.5)	3.9 (2.6, 5.9)	5.5 (3.8, 7.8)	5.9 (4.1, 8.4)		
Vanguard CR	Regenerex	33	948	1.1 (0.6, 2.1)	3.9 (2.7, 5.6)				
Vanguard CR	Vanguard	20	1019	0.9 (0.4, 1.8)	3.1 (1.9, 4.9)	3.1 (1.9, 4.9)			
Other (70)		518	5961	2.7 (2.3, 3.2)	7.3 (6.6, 8.1)	9.1 (8.3, 9.9)	10.5 (9.7, 11.5)	11.7 (10.7, 12.8)	
TOTAL		**4350**	**98914**						

Note: Only combinations with over 400 procedures have been listed.

Table KT10 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	14 Yrs
ACS	ACS Fixed	7	427	2.0 (0.9, 4.4)					
AGC	AGC	49	1602	0.6 (0.3, 1.1)	1.5 (1.0, 2.2)	2.1 (1.4, 3.0)	2.6 (1.9, 3.6)	3.4 (2.5, 4.7)	4.9 (3.4, 7.0)
Active Knee	Active Knee	60	1725	0.6 (0.3, 1.1)	2.4 (1.7, 3.3)	3.2 (2.4, 4.3)	4.2 (3.2, 5.6)	5.6 (4.2, 7.4)	
Advance	Advance II	20	412	1.3 (0.5, 3.0)	2.8 (1.6, 5.1)	3.8 (2.3, 6.3)	4.5 (2.8, 7.3)	5.9 (3.7, 9.1)	
Duracon	Duracon	383	7963	1.2 (1.0, 1.5)	2.7 (2.4, 3.1)	3.5 (3.1, 3.9)	4.2 (3.7, 4.6)	5.0 (4.5, 5.5)	6.8 (5.7, 8.1)
Genesis II CR	Genesis II	217	6223	0.9 (0.7, 1.1)	2.8 (2.4, 3.3)	3.7 (3.2, 4.3)	4.2 (3.7, 4.8)	4.7 (4.1, 5.5)	5.3 (4.5, 6.2)
Genesis II PS	Genesis II	51	691	1.7 (1.0, 3.1)	4.6 (3.3, 6.5)	5.6 (4.1, 7.6)	6.7 (5.0, 9.0)	8.8 (6.7, 11.6)	
LCS CR	LCS	127	2361	1.0 (0.7, 1.5)	2.7 (2.1, 3.4)	3.7 (3.0, 4.6)	4.7 (3.9, 5.7)	5.2 (4.4, 6.3)	7.4 (5.5, 10.0)
LCS CR	MBT	186	7154	0.7 (0.5, 0.9)	2.1 (1.7, 2.5)	2.9 (2.5, 3.4)	3.3 (2.8, 3.9)	4.6 (3.8, 5.6)	
LCS CR	MBT Duofix	22	673	1.8 (1.0, 3.2)	4.4 (2.9, 6.8)	4.8 (3.1, 7.4)	4.8 (3.1, 7.4)		
LCS Duofix	MBT	65	822	1.5 (0.8, 2.6)	5.5 (4.1, 7.3)	7.1 (5.5, 9.1)	8.3 (6.6, 10.6)		
Legion CR	Genesis II	18	796	0.9 (0.4, 2.0)	4.2 (2.5, 7.1)				
Maxim	Maxim	83	1407	0.8 (0.4, 1.4)	2.7 (1.9, 3.7)	3.9 (3.0, 5.1)	4.8 (3.8, 6.1)	6.7 (5.3, 8.3)	
Natural Knee Flex	Natural Knee II	12	1194	0.4 (0.1, 1.0)	1.2 (0.6, 2.2)	1.8 (1.0, 3.5)			
Natural Knee II	Natural Knee II	75	1946	1.3 (0.8, 1.9)	2.3 (1.7, 3.1)	2.7 (2.0, 3.5)	3.0 (2.3, 4.0)	4.1 (3.2, 5.3)	
Nexgen CR	Nexgen	102	3881	0.4 (0.3, 0.7)	1.6 (1.2, 2.0)	2.1 (1.6, 2.6)	2.4 (1.9, 3.0)	3.1 (2.5, 3.8)	4.8 (3.4, 6.8)
Nexgen CR Flex	Nexgen	201	12554	0.8 (0.7, 1.0)	1.8 (1.5, 2.0)	2.1 (1.8, 2.5)	2.2 (1.9, 2.6)	2.7 (2.2, 3.3)	
Nexgen CR Flex	Nexgen TM CR	13	743	0.5 (0.2, 1.4)	1.4 (0.7, 2.5)	1.5 (0.8, 2.7)	1.9 (1.1, 3.3)		
Nexgen LPS	Nexgen	44	964	0.4 (0.2, 1.1)	2.5 (1.7, 3.7)	4.1 (3.0, 5.7)	5.2 (3.8, 6.9)	5.5 (4.1, 7.5)	
Nexgen LPS Flex	Nexgen	17	595	1.8 (1.0, 3.4)	4.1 (2.5, 6.6)				
Nexgen LPS Flex	Nexgen TM LPS	13	496	0.6 (0.2, 1.9)	1.8 (1.0, 3.5)	2.1 (1.1, 3.8)	2.6 (1.5, 4.6)		
Optetrak-CR	Optetrak	20	420	1.3 (0.5, 3.1)	3.3 (1.9, 5.7)	3.9 (2.3, 6.5)	5.7 (3.7, 8.9)	6.4 (4.1, 9.9)	
PFC Sigma CR	MBT	156	3391	1.3 (1.0, 1.7)	3.3 (2.8, 4.0)	4.5 (3.8, 5.3)	5.1 (4.4, 6.0)	5.6 (4.7, 6.6)	
PFC Sigma CR	PFC Sigma	248	10384	0.6 (0.5, 0.8)	2.0 (1.7, 2.3)	2.6 (2.2, 2.9)	2.9 (2.6, 3.4)	3.8 (3.3, 4.4)	4.9 (4.0, 6.1)
PFC Sigma PS	MBT Duofix	109	1657	1.7 (1.2, 2.5)	5.2 (4.2, 6.4)	7.2 (6.0, 8.7)	7.9 (6.5, 9.4)	7.9 (6.5, 9.4)	
Profix	Profix	33	769	0.8 (0.4, 1.7)	2.5 (1.6, 3.9)	3.8 (2.7, 5.5)	4.5 (3.2, 6.3)	4.7 (3.4, 6.6)	
Profix	Profix Mobile	54	592	1.9 (1.0, 3.4)	5.7 (4.1, 7.9)	7.4 (5.6, 9.9)	8.2 (6.2, 10.8)	9.5 (7.3, 12.3)	
RBK	RBK	36	1166	1.0 (0.5, 1.8)	2.8 (1.9, 4.1)	4.3 (3.0, 6.0)	4.6 (3.2, 6.6)	5.1 (3.5, 7.4)	
Scorpio CR	Scorpio+	113	1893	1.0 (0.6, 1.6)	2.8 (2.2, 3.7)	4.1 (3.3, 5.1)	5.5 (4.5, 6.7)	6.7 (5.6, 8.2)	
Scorpio CR	Series 7000	191	5823	0.7 (0.5, 1.0)	2.1 (1.7, 2.5)	2.9 (2.5, 3.4)	3.5 (3.0, 4.0)	4.3 (3.7, 5.0)	5.7 (4.5, 7.2)
Scorpio NRG CR	Series 7000	14	715	0.3 (0.1, 1.1)	1.9 (0.9, 3.6)	2.6 (1.4, 4.8)			
Scorpio PS	Scorpio+	41	905	1.0 (0.5, 1.9)	2.6 (1.7, 3.9)	3.4 (2.4, 4.8)	3.7 (2.6, 5.1)	4.8 (3.4, 6.7)	
Scorpio PS	Series 7000	77	1066	1.1 (0.6, 2.0)	4.3 (3.2, 5.7)	5.7 (4.5, 7.3)	6.4 (5.1, 8.2)	7.7 (6.1, 9.7)	
Triathlon CR	Triathlon	153	11054	0.6 (0.4, 0.7)	1.6 (1.4, 2.0)	2.2 (1.8, 2.6)	2.9 (2.3, 3.7)		
Triathlon PS	Triathlon	44	1807	1.8 (1.2, 2.5)	2.6 (1.9, 3.6)	3.4 (2.4, 4.8)	3.4 (2.4, 4.8)		
Vanguard CR	Maxim	125	4859	0.9 (0.7, 1.3)	2.8 (2.3, 3.4)	4.0 (3.3, 4.8)	4.5 (3.6, 5.5)		
Vanguard CR	Vanguard	39	2151	0.6 (0.3, 1.1)	2.1 (1.5, 2.9)	2.8 (2.0, 3.9)			
Vanguard PS	Maxim	15	442	1.6 (0.7, 3.5)	3.5 (2.0, 6.2)	4.7 (2.7, 8.1)			
Other (113)		475	6465	2.1 (1.8, 2.5)	6.1 (5.5, 6.8)	7.4 (6.7, 8.2)	8.5 (7.7, 9.4)	11.1 (10.0, 12.2)	13.3 (11.6, 15.3)
TOTAL		**3708**	**110188**						

Note: Only combinations with over 400 procedures have been listed.

Outcome for Osteoarthritis - Patient Characteristics

Primary total knee replacement has the lowest rate of revision compared to all other classes of primary knee replacement. At 14 years, the cumulative percent revision of primary total knee replacement undertaken for osteoarthritis is 7.2% (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 three years, those aged less than 55 years have over four 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).

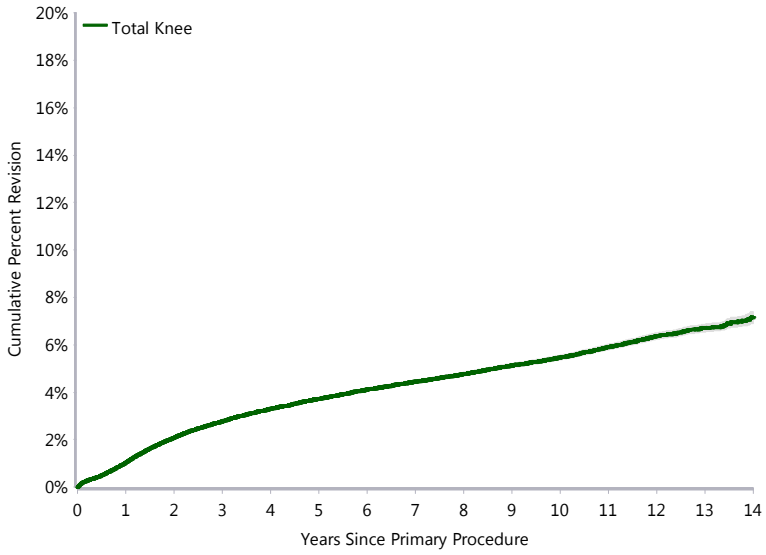
Loosening/lysis is the most common reason for revision in both males and females. Males have a higher incidence of revision for surgeon reported infection than females, with a 14 year cumulative incidence of 1.6% and 0.8% respectively (Figure KT12).

Age related differences in outcome are evident within both males and females (Table KT13, Figure KT13 and Figure 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	14 Yrs
Total Knee	15232	432833	1.0 (1.0, 1.1)	2.8 (2.7, 2.8)	3.7 (3.7, 3.8)	4.4 (4.4, 4.5)	5.5 (5.4, 5.6)	7.2 (6.9, 7.4)
TOTAL	**15232**	**432833**						

Figure KT9 Cumulative Percent Revision of Primary Total Knee Replacement (Primary Diagnosis OA)

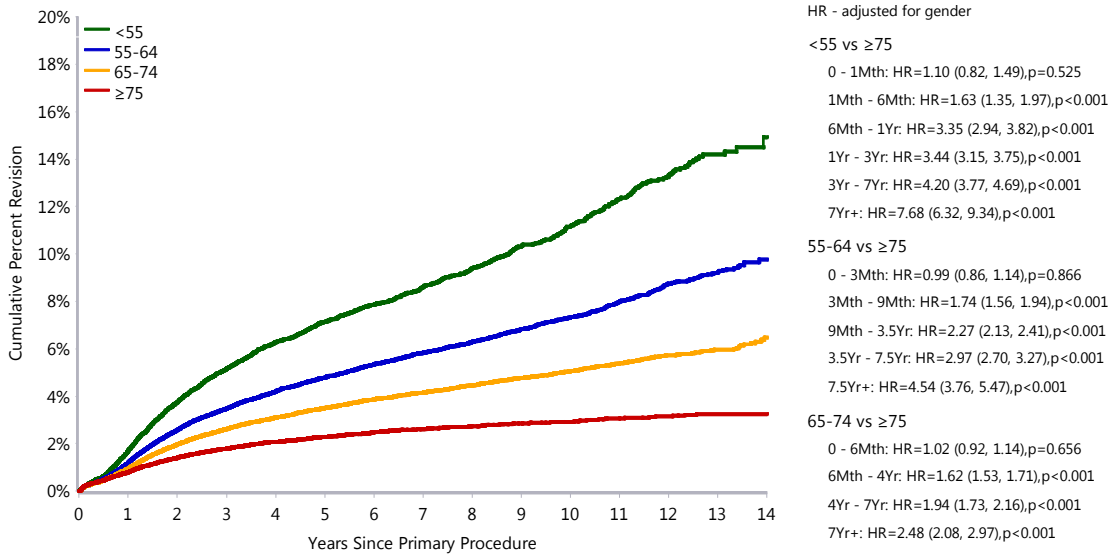


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Total Knee	432833	379637	282812	199373	131354	55555	2214

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	14 Yrs
<55	2016	28486	1.7 (1.6, 1.9)	5.2 (4.9, 5.4)	7.1 (6.8, 7.5)	8.6 (8.2, 9.0)	11.2 (10.6, 11.7)	14.9 (13.7, 16.2)
55-64	5161	112427	1.2 (1.2, 1.3)	3.5 (3.4, 3.6)	4.8 (4.6, 4.9)	5.8 (5.7, 6.0)	7.3 (7.1, 7.6)	9.8 (9.2, 10.3)
65-74	5466	166434	1.0 (0.9, 1.0)	2.6 (2.5, 2.7)	3.5 (3.4, 3.6)	4.2 (4.0, 4.3)	5.0 (4.9, 5.2)	6.5 (6.1, 6.9)
≥75	2589	125486	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, 3.0)	3.3 (3.1, 3.4)
TOTAL	**15232**	**432833**						

Figure KT10 Cumulative Percent Revision of Primary Total Knee Replacement by Age (Primary Diagnosis OA)

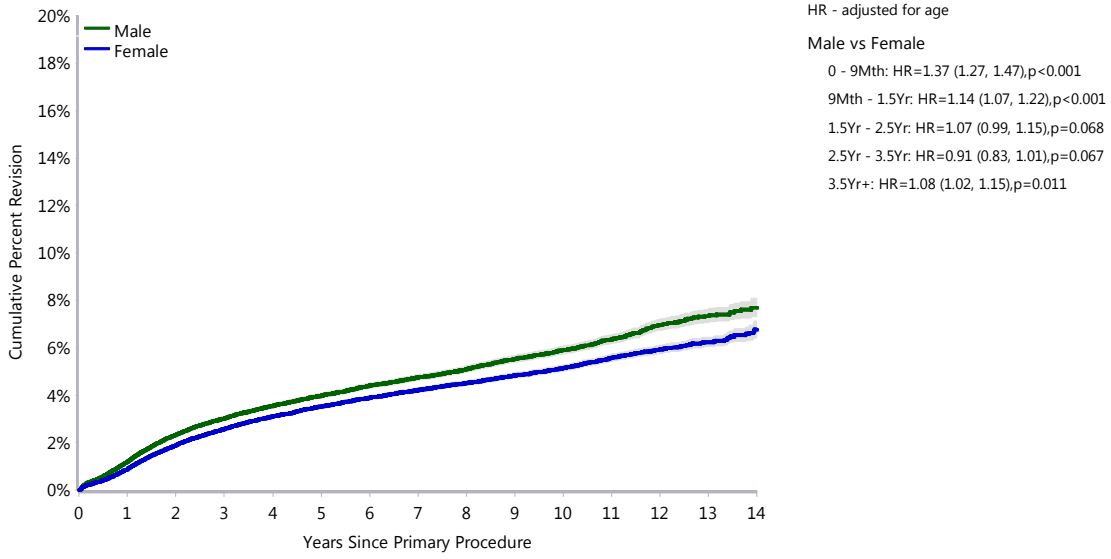


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
<55	28486	24994	18546	13125	8884	4130	185
55-64	112427	98377	72853	50702	33194	14623	632
65-74	166434	145445	108061	77137	51967	23226	1020
≥75	125486	110821	83352	58409	37309	13576	377

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	14 Yrs
Male	**7054**	**187586**	**1.2 (1.2, 1.3)**	**3.0 (2.9, 3.1)**	**4.0 (3.9, 4.1)**	**4.7 (4.6, 4.9)**	**5.9 (5.7, 6.1)**	**7.7 (7.3, 8.1)**
<55	869	12244	2.1 (1.8, 2.3)	5.4 (5.0, 5.8)	7.0 (6.5, 7.5)	8.4 (7.8, 9.1)	11.0 (10.2, 11.8)	13.7 (12.5, 15.0)
55-64	2517	51129	1.4 (1.3, 1.5)	3.8 (3.6, 3.9)	5.1 (4.9, 5.3)	6.2 (5.9, 6.5)	7.8 (7.5, 8.2)	10.5 (9.7, 11.2)
65-74	2550	74008	1.1 (1.1, 1.2)	2.8 (2.7, 3.0)	3.7 (3.6, 3.9)	4.4 (4.2, 4.6)	5.3 (5.1, 5.6)	6.8 (6.2, 7.4)
≥75	1118	50205	0.9 (0.9, 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)	3.7 (3.4, 4.2)
Female	**8178**	**245247**	**0.9 (0.9, 0.9)**	**2.6 (2.5, 2.6)**	**3.5 (3.4, 3.6)**	**4.2 (4.1, 4.3)**	**5.1 (5.0, 5.3)**	**6.8 (6.4, 7.1)**
<55	1147	16242	1.5 (1.3, 1.7)	5.0 (4.6, 5.4)	7.3 (6.8, 7.7)	8.7 (8.2, 9.3)	11.3 (10.6, 12.1)	15.9 (14.0, 18.1)
55-64	2644	61298	1.1 (1.0, 1.2)	3.2 (3.1, 3.4)	4.5 (4.4, 4.7)	5.5 (5.3, 5.8)	6.9 (6.6, 7.2)	9.2 (8.5, 10.0)
65-74	2916	92426	0.8 (0.8, 0.9)	2.5 (2.4, 2.6)	3.3 (3.2, 3.5)	4.0 (3.8, 4.1)	4.8 (4.6, 5.0)	6.2 (5.7, 6.8)
≥75	1471	75281	0.7 (0.6, 0.8)	1.7 (1.6, 1.8)	2.2 (2.0, 2.3)	2.5 (2.3, 2.6)	2.7 (2.6, 2.9)	3.0 (2.8, 3.2)
TOTAL	**15232**	**432833**						

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	14 Yrs
Male	187586	163493	120619	83898	54417	22646	887
Female	245247	216144	162193	115475	76937	32909	1327

Figure KT12 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by Gender (Primary Diagnosis OA)

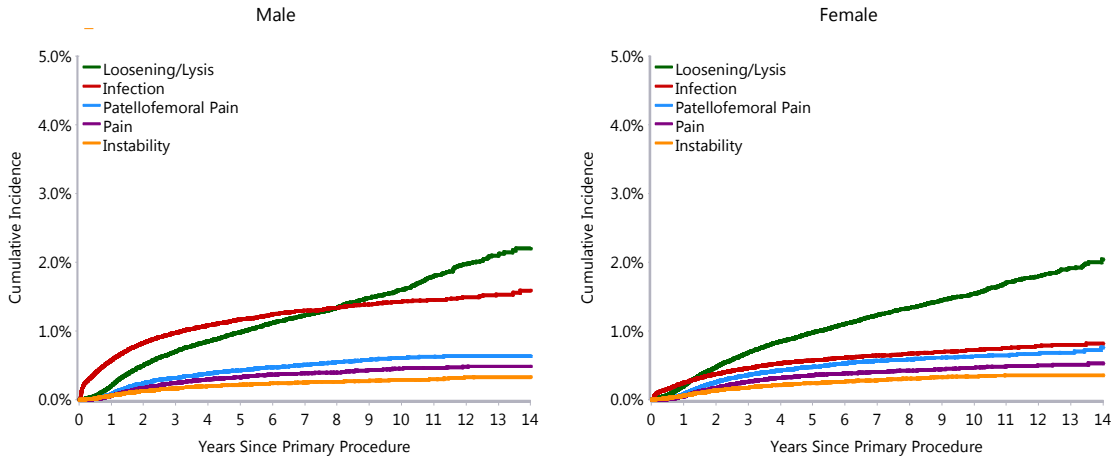
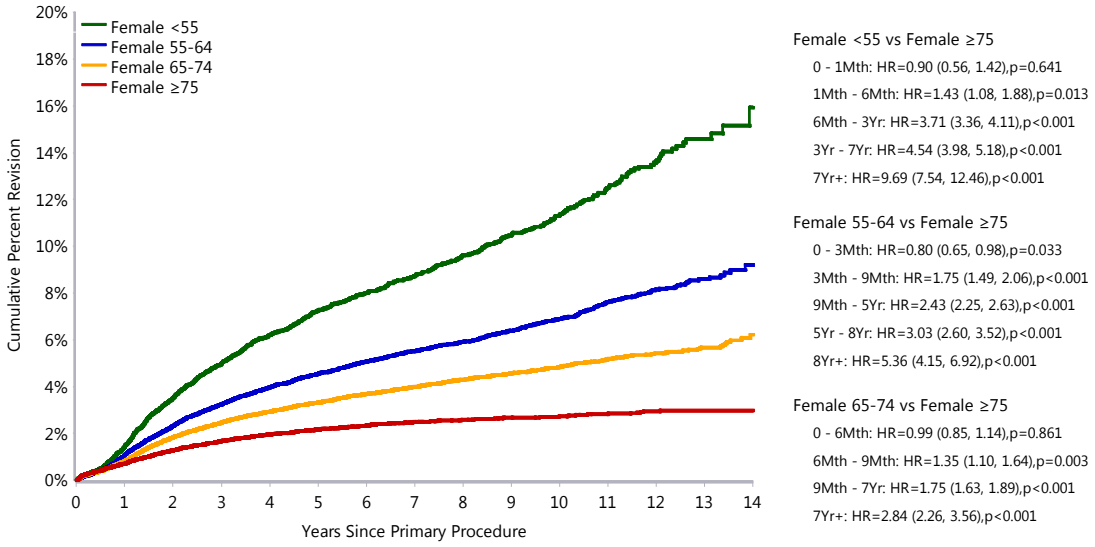
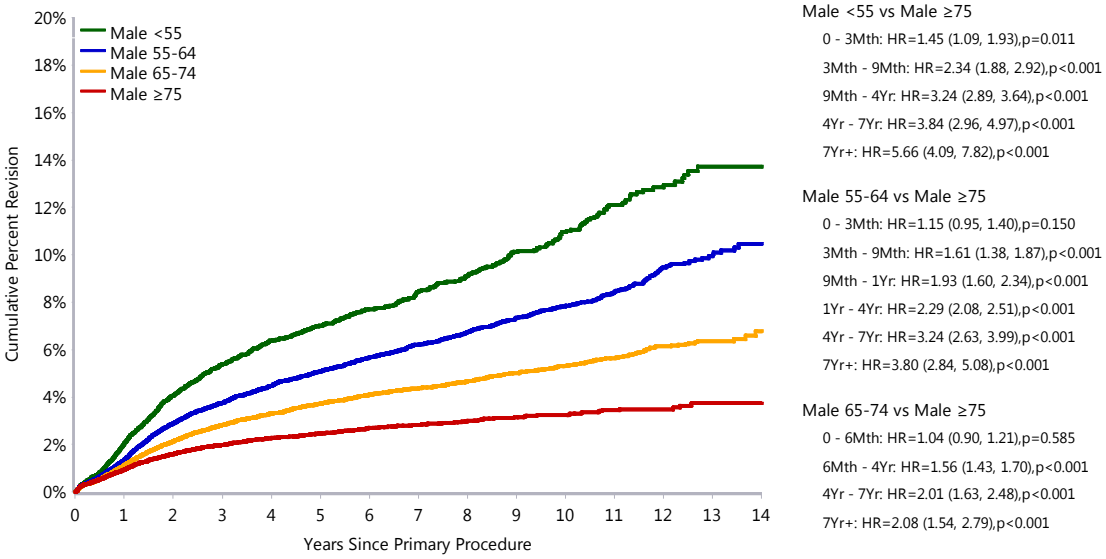


Figure KT13 Cumulative Percent Revision of Primary Total Knee Replacement for Females by Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Female	<55	16242	14249	10499	7398	4990	2293	99
	55-64	61298	53796	39823	27845	18274	8107	336
	65-74	92426	81130	60781	43841	29918	13574	639
	≥75	75281	66969	51090	36391	23755	8935	253

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	14 Yrs
Male	<55	12244	10745	8047	5727	3894	1837	86
	55-64	51129	44581	33030	22857	14920	6516	296
	65-74	74008	64315	47280	33296	22049	9652	381
	≥75	50205	43852	32262	22018	13554	4641	124

Outcome for Osteoarthritis - Prosthesis Characteristics

Fixed and Mobile Bearing

Tibial prostheses are either modular or non-modular. Modular prostheses have a metal baseplate and tibial insert, which may be fixed or mobile. Non-modular are either all-polyethylene or polyethylene moulded to a metal baseplate.

Mobile bearings include inserts that move in one of three ways; rotating, sliding or both rotating and sliding. Fixed bearings include non-modular tibial prostheses as well as fixed inserts that do not move relative to the baseplate.

Fixed bearing prostheses have a lower rate of revision compared to rotating and rotating-sliding after two years. There is no difference between fixed and sliding prostheses (Table KT14 and Figure KT15).

There is no difference when comparing all-polyethylene to fixed modular tibial prostheses (Table KT15 and Figure KT16). All-polyethylene tibial prostheses however have a higher rate of revision compared to moulded non-modular tibial prostheses.

There is variation within the all-polyethylene tibial component group. The Optetrak PS all-polyethylene prosthesis has a cumulative percent revision of 19.4% at seven years (Table KT16).

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 stabilised, minimally stabilised account for 72.8%. The use of posterior stabilised peaked in 2008 (32.9%). Since that time, it has decreased to 28.9% in 2014 (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 0.6% of primary procedures (Table KT17). They are usually used in complex clinical situations and have therefore been excluded from any comparative outcome analysis for primary total knee replacement.

Posterior stabilised prostheses have a higher rate of revision compared to minimally stabilised (Table KT17 and Figure KT18).

Patellar Resurfacing

Resurfacing the patella has a lower rate of revision compared to procedures with no patella resurfacing (Table KT18 and Figure KT19). When resurfacing the patella, the rate of revision is lower for minimally stabilised compared to posterior stabilised prostheses. Posterior stabilised without patellar resurfacing has the highest rate of revision (Table KT19 and Figure KT20).

Outcomes related to the use of patella resurfacing vary depending on the type of prosthesis used. Most have a lower rate of revision when the patella is resurfaced, however some prostheses, for example the Duracon, have no difference in the rate of revision depending on whether the patella is resurfaced or not (Table KT20 and Figure KT21).

Fixation

The rate of revision varies depending on fixation. Hybrid fixation has a lower rate of revision compared to both cemented and cementless fixation. Cemented fixation has a lower rate of revision than cementless fixation (Table KT21 and Figure KT22).

The effect of fixation varies depending on whether the knee replacement is minimally or posteriorly stabilised. With a minimally stabilised prosthesis there is no difference between cemented and hybrid fixation and both have a lower rate of revision compared to cementless fixation (Table KT22 and Figure KT23). When a posterior stabilised knee is used, cement fixation has a lower rate of revision compared to both hybrid and cementless fixation (Table KT23 and Figure KT24).

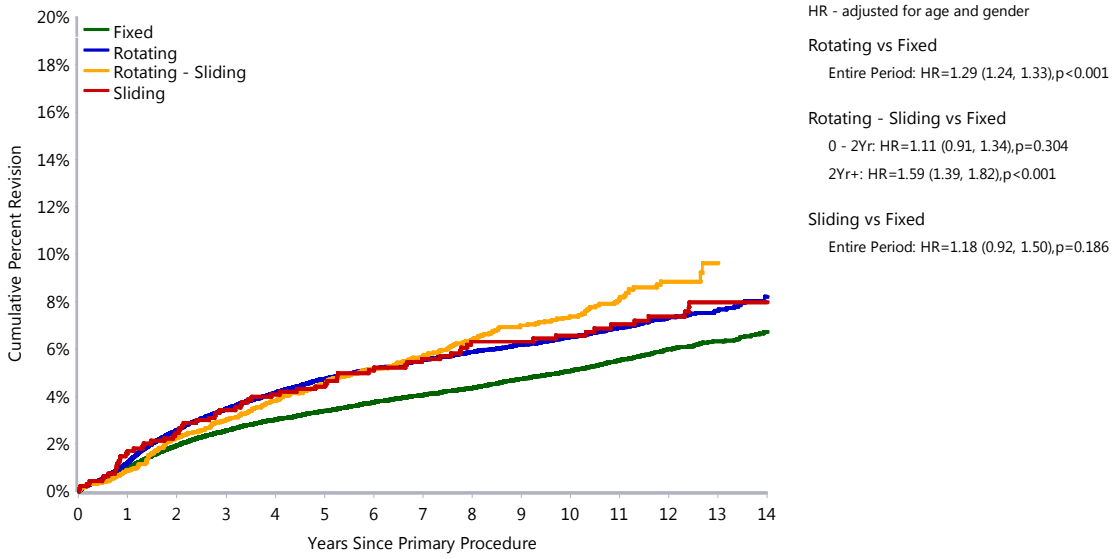
In the minimally stabilised knee these results suggest that the best outcome is achieved if the tibial component is cemented. When a posterior stabilised knee is used, the best outcome is achieved when both the tibial and femoral components are cemented.

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	14 Yrs
Fixed	10535	334019	1.0 (0.9, 1.0)	2.5 (2.5, 2.6)	3.4 (3.3, 3.5)	4.1 (4.0, 4.1)	5.1 (5.0, 5.2)	6.7 (6.4, 7.0)
Rotating	4303	92930	1.2 (1.1, 1.3)	3.5 (3.4, 3.6)	4.7 (4.6, 4.9)	5.5 (5.4, 5.7)	6.5 (6.3, 6.7)	8.2 (7.6, 8.8)
Rotating - Sliding	321	4787	0.9 (0.6, 1.2)	3.0 (2.6, 3.5)	4.5 (3.9, 5.2)	5.7 (5.1, 6.4)	7.4 (6.6, 8.2)	
Sliding	67	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)	6.6 (5.1, 8.4)	8.0 (6.3, 10.1)
TOTAL	**15226**	**432684**						

Note: Excluding 149 procedures with unknown bearing mobility

Figure KT15 Cumulative Percent Revision of Primary Total Knee Replacement by Bearing Mobility (Primary Diagnosis OA)

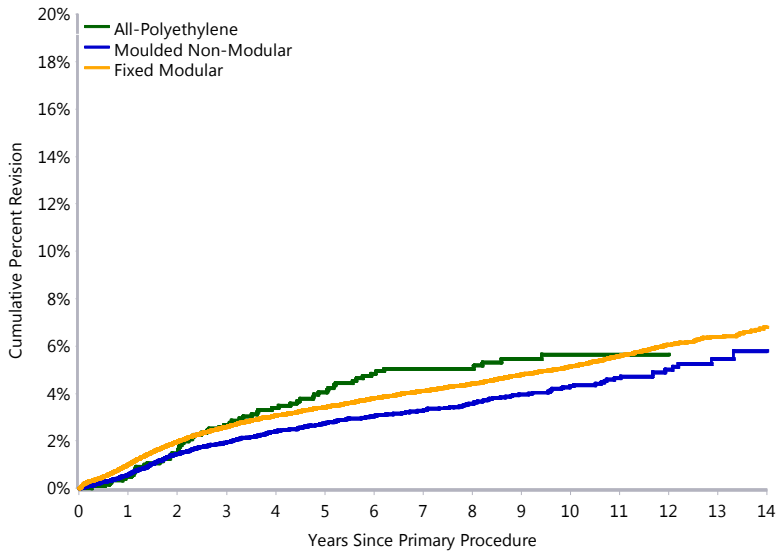


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Fixed	334019	289872	211133	145028	93850	39086	1544
Rotating	92930	84069	66382	49501	33201	14008	475
Rotating - Sliding	4787	4627	4292	3906	3431	1765	7
Sliding	948	925	883	846	794	662	186

Table KT15 Cumulative Percent Revision of Primary Total Knee Replacement by Fixed Bearing Type (Primary Diagnosis OA)

Fixed Bearing Type	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
All-Polyethylene	61	1281	0.5 (0.2, 1.1)	2.7 (1.9, 3.8)	4.0 (3.1, 5.4)	5.0 (3.9, 6.5)	5.6 (4.4, 7.2)	
Moulded Non-Modular	525	19606	0.6 (0.5, 0.7)	1.9 (1.7, 2.2)	2.7 (2.5, 3.0)	3.3 (3.0, 3.6)	4.3 (3.9, 4.8)	5.8 (4.8, 6.9)
Fixed Modular	9949	313132	1.0 (1.0, 1.0)	2.6 (2.5, 2.6)	3.4 (3.3, 3.5)	4.1 (4.0, 4.2)	5.1 (5.0, 5.2)	6.8 (6.5, 7.1)
TOTAL	**10535**	**334019**						

Figure KT16 Cumulative Percent Revision of Primary Total Knee Replacement by Fixed Bearing Type (Primary Diagnosis OA)



HR - adjusted for age and gender

All-Polyethylene vs Moulded Non-Modular

Entire Period: HR=1.60 (1.23, 2.09),p<0.001

Fixed Modular vs Moulded Non-Modular

0 - 1Mth: HR=4.49 (2.23, 9.03),p<0.001

1Mth - 1.5Yr: HR=1.46 (1.26, 1.69),p<0.001

1.5Yr+: HR=1.13 (1.02, 1.26),p=0.021

All-Polyethylene vs Fixed Modular

Entire Period: HR=1.28 (0.99, 1.64),p=0.057

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
All-Polyethylene	1281	1210	1107	1002	830	402	3
Moulded Non-Modular	19606	17851	13533	9449	5880	2166	115
Fixed Modular	313132	270811	196493	134577	87140	36518	1426

Table KT16 Cumulative Percent Revision of All-Polyethylene Primary Total Knee Replacement by Prosthesis Type (Primary Diagnosis OA)

Prosthesis Type	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Scorpio	38	694	0.6 (0.2, 1.5)	2.8 (1.8, 4.4)	4.3 (3.0, 6.2)	5.3 (3.9, 7.4)	6.0 (4.4, 8.2)	
Profix	6	152	0.7 (0.1, 4.6)	2.0 (0.7, 6.2)	3.5 (1.5, 8.2)	4.3 (1.9, 9.3)		
Nexgen	4	146	0.8 (0.1, 5.7)	2.5 (0.8, 7.6)	2.5 (0.8, 7.6)	3.7 (1.4, 9.7)	3.7 (1.4, 9.7)	
Genesis II	1	130	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	1.1 (0.2, 7.5)		
Optetrak-PS	11	52	0.0 (0.0, 0.0)	13.5 (6.7, 26.2)	17.4 (9.4, 30.7)	19.4 (10.9, 33.1)		
Other (5)	1	107	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	1.7 (0.2, 11.2)	1.7 (0.2, 11.2)		
TOTAL	**61**	**1281**						

Note: Only prostheses with over 50 procedures have been listed.

Figure KT17 Primary Total Knee Replacement by Stability (Primary Diagnosis OA)

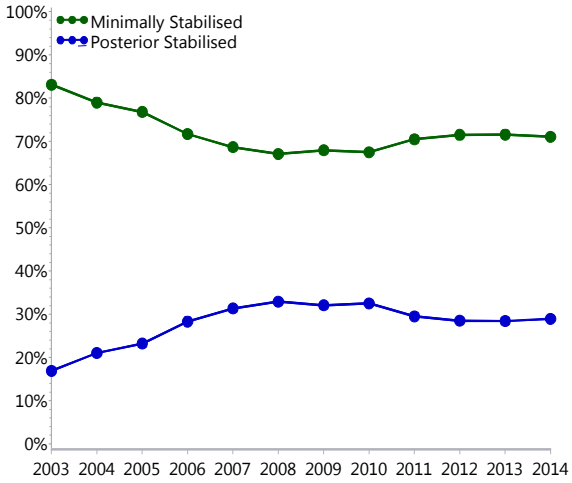
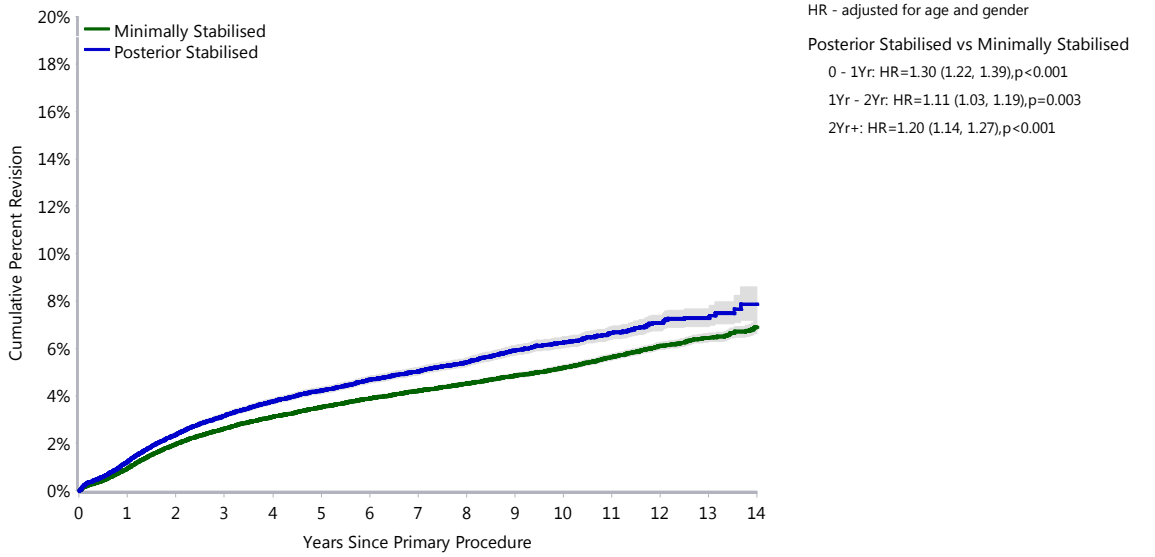


Table KT17 Cumulative Percent Revision of Primary Total Knee Replacement by Stability (Primary Diagnosis OA)

Stability	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minimally Stabilised	10678	313162	0.9 (0.9, 1.0)	2.6 (2.6, 2.7)	3.5 (3.4, 3.6)	4.2 (4.1, 4.3)	5.2 (5.1, 5.3)	6.9 (6.6, 7.2)
Posterior Stabilised	4458	117079	1.2 (1.2, 1.3)	3.2 (3.1, 3.3)	4.2 (4.1, 4.4)	5.0 (4.9, 5.2)	6.3 (6.0, 6.5)	7.9 (7.2, 8.6)
Fully Stabilised	62	1979	2.0 (1.4, 2.8)	3.7 (2.8, 5.0)	5.2 (3.9, 7.0)	6.1 (4.6, 8.2)	7.3 (5.2, 10.2)	
Hinged	28	464	1.8 (0.9, 3.6)	4.8 (3.0, 7.6)	6.7 (4.4, 10.1)	8.2 (5.4, 12.5)		
TOTAL	**15226**	**432684**						

Note: Excluding 149 procedures with unknown stability

Figure KT18 Cumulative Percent Revision of Primary Total Knee Replacement by Stability (Primary Diagnosis OA)

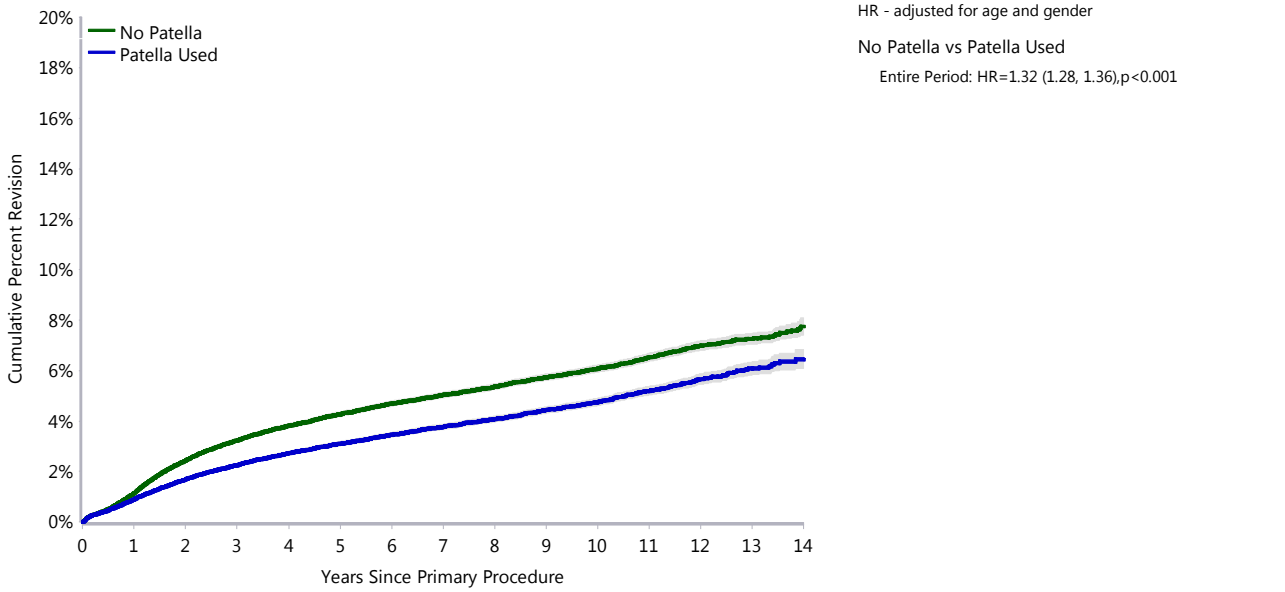


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minimally Stabilised	313162	276063	207121	148994	102177	46430	1981
Posterior Stabilised	117079	101879	74683	49768	28822	8987	228

Table KT18 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	14 Yrs
No Patella	9240	220976	1.2 (1.1, 1.2)	3.2 (3.2, 3.3)	4.3 (4.2, 4.4)	5.0 (4.9, 5.1)	6.1 (5.9, 6.2)	7.7 (7.4, 8.1)
Patella Used	5992	211857	0.9 (0.9, 0.9)	2.3 (2.2, 2.3)	3.1 (3.0, 3.2)	3.8 (3.7, 3.9)	4.7 (4.6, 4.9)	6.4 (6.1, 6.8)
TOTAL	**15232**	**432833**						

Figure KT19 Cumulative Percent Revision of Primary Total Knee Replacement by Patella Usage (Primary Diagnosis OA)

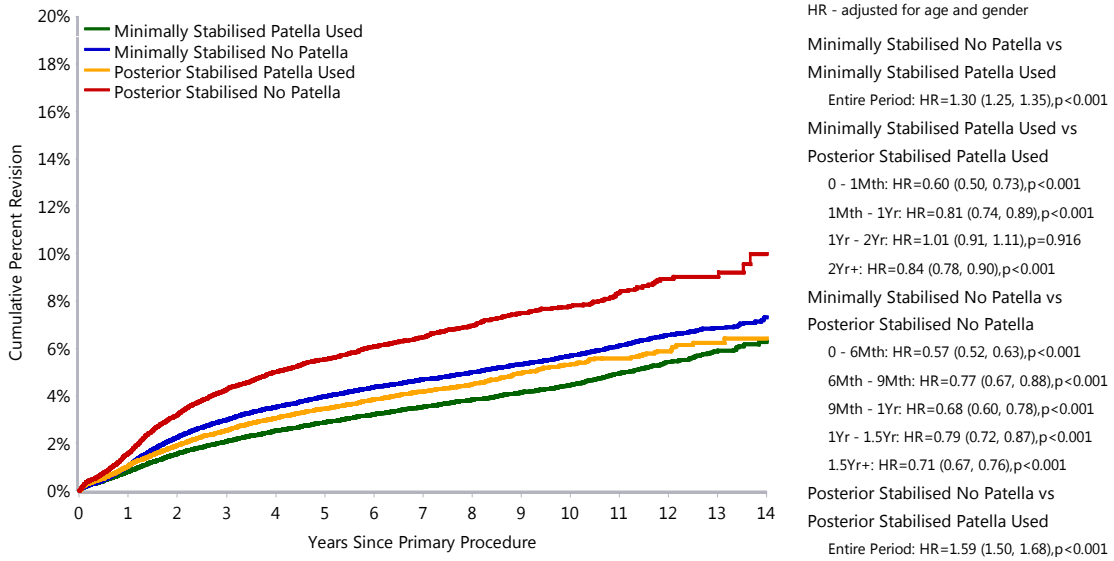


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
No Patella	220976	198070	153063	111381	74338	31541	1507
Patella Used	211857	181567	129749	87992	57016	24014	707

Table KT19 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	14 Yrs
Minimally	No Patella	7029	180378	1.1 (1.0, 1.1)	3.0 (2.9, 3.1)	4.0 (3.9, 4.1)	4.7 (4.6, 4.8)	5.7 (5.5, 5.8)	7.3 (7.0, 7.7)
	Patella Used	3649	132784	0.8 (0.8, 0.9)	2.1 (2.0, 2.2)	2.9 (2.8, 3.0)	3.5 (3.4, 3.7)	4.4 (4.3, 4.6)	6.3 (5.8, 6.7)
Posterior	No Patella	2156	39467	1.6 (1.5, 1.7)	4.3 (4.1, 4.5)	5.5 (5.3, 5.8)	6.5 (6.2, 6.8)	7.8 (7.4, 8.2)	10.0 (8.8, 11.3)
	Patella Used	2302	77612	1.0 (1.0, 1.1)	2.5 (2.4, 2.7)	3.4 (3.3, 3.6)	4.2 (4.0, 4.4)	5.3 (5.1, 5.6)	6.4 (5.8, 7.1)
TOTAL		**15136**	**430241**						

Figure KT20 Cumulative Percent Revision of Primary Total Knee Replacement by Stability and Patella Usage (Primary Diagnosis OA)

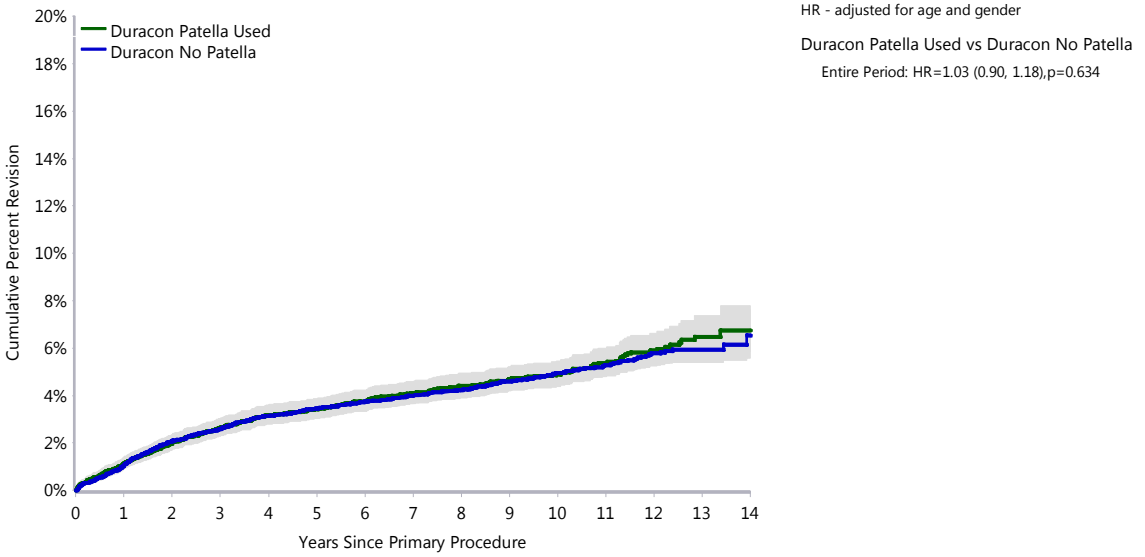


Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minimally	No Patella	180378	161381	123903	90577	62133	27672	1392
	Patella Used	132784	114682	83218	58417	40044	18758	589
Posterior	No Patella	39467	35914	28646	20463	12003	3788	112
	Patella Used	77612	65965	46037	29305	16819	5199	116

Table KT20 Cumulative Percent Revision of Duracon Primary Total Knee Replacement by Patella Usage (Primary Diagnosis OA)

Model	Patella Usage	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Duracon	Patella Used	343	7185	1.1 (0.9, 1.4)	2.6 (2.3, 3.0)	3.4 (3.0, 3.9)	4.1 (3.6, 4.6)	4.9 (4.4, 5.4)	6.7 (5.8, 7.8)
	No Patella	582	12644	1.1 (0.9, 1.3)	2.6 (2.3, 2.9)	3.5 (3.1, 3.8)	4.0 (3.7, 4.4)	4.9 (4.5, 5.4)	6.5 (5.6, 7.6)
TOTAL		**925**	**19829**						

Figure KT21 Cumulative Percent Revision of Duracon Primary Total Knee Replacement by Patella Usage (Primary Diagnosis OA)



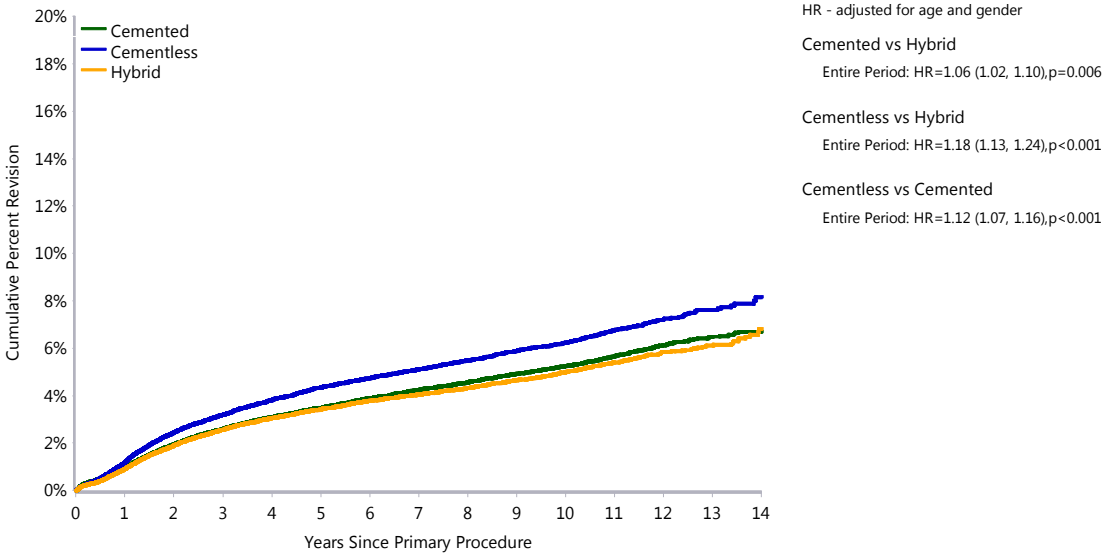
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Duracon	Patella Used	7185	7024	6686	6202	5088	2919	129
	No Patella	12644	12352	11803	11066	9242	4600	220

Table KT21 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	14 Yrs
Cemented	7352	227627	1.0 (0.9, 1.0)	2.6 (2.5, 2.7)	3.5 (3.4, 3.6)	4.2 (4.1, 4.3)	5.2 (5.1, 5.4)	6.7 (6.4, 7.0)
Cementless	4139	96929	1.2 (1.1, 1.3)	3.2 (3.1, 3.3)	4.3 (4.2, 4.5)	5.1 (4.9, 5.3)	6.2 (6.0, 6.4)	8.2 (7.6, 8.8)
Hybrid	3544	107858	0.9 (0.9, 1.0)	2.6 (2.5, 2.7)	3.4 (3.3, 3.5)	4.0 (3.9, 4.2)	5.0 (4.8, 5.2)	6.8 (6.3, 7.4)
TOTAL	**15035**	**432414**						

Note: Excluding cementless Genesis Oxinium and Profix Oxinium femoral prostheses

Figure KT22 Cumulative Percent Revision of Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)



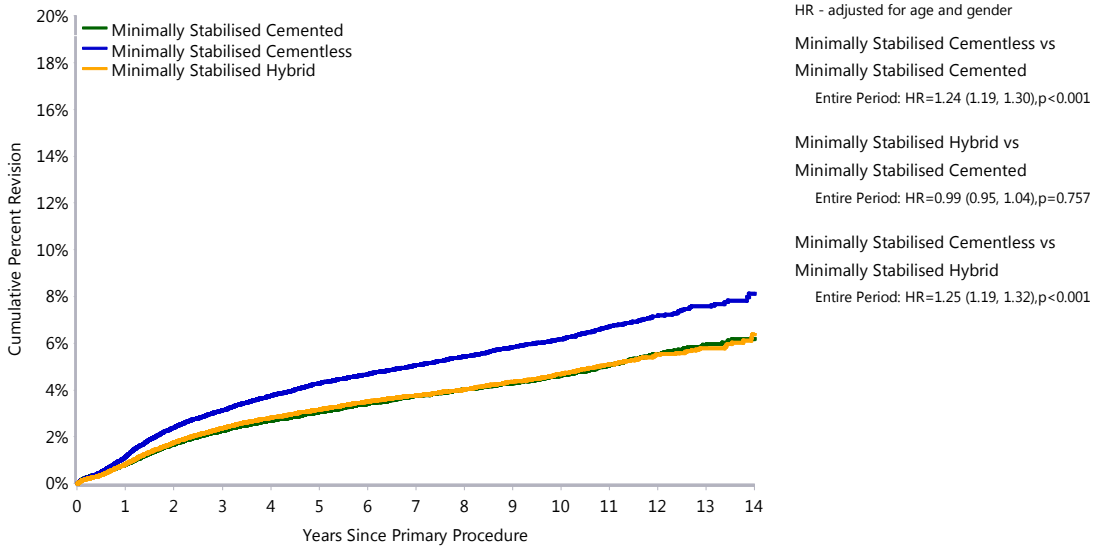
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Cemented	227627	197034	144011	99391	63341	25142	969
Cementless	96929	87587	67888	48155	31744	13844	528
Hybrid	107858	94660	70682	51608	36062	16394	717

Table KT22 Cumulative Percent Revision of Minimally Stabilised Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)

Stability	Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minimally Stabilised	Cemented	3654	124267	0.8 (0.8, 0.9)	2.3 (2.2, 2.3)	3.0 (2.9, 3.2)	3.7 (3.6, 3.9)	4.6 (4.4, 4.8)	6.2 (5.8, 6.5)
	Cementless	3856	90906	1.2 (1.1, 1.2)	3.1 (3.0, 3.3)	4.3 (4.1, 4.4)	5.1 (4.9, 5.2)	6.2 (6.0, 6.4)	8.1 (7.5, 8.7)
	Hybrid	2971	97570	0.8 (0.8, 0.9)	2.4 (2.3, 2.5)	3.2 (3.0, 3.3)	3.8 (3.6, 3.9)	4.7 (4.5, 4.9)	6.4 (5.8, 6.9)
TOTAL		**10481**	**312743**						

Note: Excluding cementless Genesis Oxinium and Profix Oxinium femoral prostheses

Figure KT23 Cumulative Percent Revision of Minimally Stabilised Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)



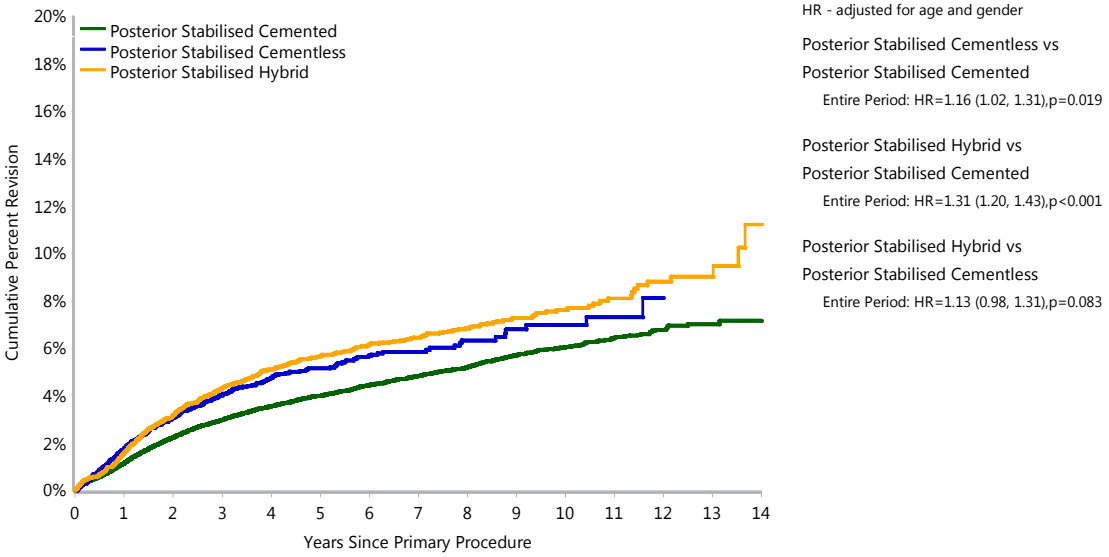
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minimally Stabilised	Cemented	124267	108211	79884	57072	39001	17563	798
	Cementless	90906	82185	63774	45692	30523	13480	523
	Hybrid	97570	85311	63232	46011	32446	15212	660

Table KT23 Cumulative Percent Revision of Posterior Stabilised Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)

Stability	Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Posterior Stabilised	Cemented	3608	100861	1.2 (1.1, 1.2)	3.0 (2.9, 3.1)	4.0 (3.9, 4.1)	4.8 (4.7, 5.0)	6.1 (5.8, 6.3)	7.1 (6.7, 7.6)
	Cementless	281	5996	1.8 (1.5, 2.2)	4.0 (3.5, 4.6)	5.2 (4.6, 5.8)	5.8 (5.2, 6.6)	7.0 (6.0, 8.1)	
	Hybrid	569	10222	1.6 (1.4, 1.9)	4.3 (3.9, 4.8)	5.7 (5.2, 6.2)	6.5 (5.9, 7.0)	7.6 (6.9, 8.4)	11.2 (8.7, 14.4)
TOTAL		**4458**	**117079**						

Note: Excluding cementless Genesis Oxinium and Profix Oxinium femoral prostheses

Figure KT24 Cumulative Percent Revision of Posterior Stabilised Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Posterior Stabilised	Cemented	100861	87212	63184	41759	24029	7465	168
	Cementless	5996	5376	4095	2449	1208	358	3
	Hybrid	10222	9291	7404	5560	3585	1164	57

Computer Navigation

There have been 66,336 primary total knee replacements reported to the Registry that have used computer navigation. In 2014, computer navigation was used in 26.8% of all primary total knee replacement There is a difference in the rate of revision for patients aged less than 65 years when comparing navigated and non navigated procedures (Table KT24 and Figure KT25). There is a reduction in the rate of revision for navigated knee replacement for loosening/lysis in both age groups (Figure KT26).

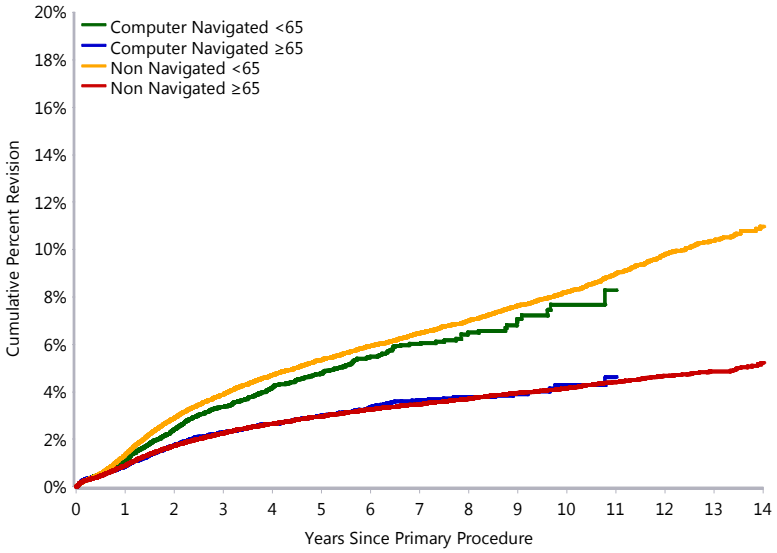
Image Derived Instrumentation (IDI)

The Registry has recorded 11,188 primary total knee procedures undertaken using IDI since 2009. In 2014, IDI was used in 6.8% of all primary total knee procedures. Of those undertaken for osteoarthritis, there is no difference in the rate of revision between procedures with or without IDI usage (Table KT25 and Figure KT27).

Table KT24 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	14 Yrs
Computer Navigated	**1707**	**66336**	**0.9 (0.9, 1.0)**	**2.7 (2.5, 2.8)**	**3.6 (3.5, 3.8)**	**4.5 (4.3, 4.8)**	**5.5 (5.0, 6.1)**	
<65	790	23360	1.1 (1.0, 1.3)	3.4 (3.1, 3.7)	4.8 (4.4, 5.2)	6.0 (5.5, 6.5)	7.7 (6.7, 8.8)	
≥65	917	42976	0.9 (0.8, 1.0)	2.3 (2.1, 2.5)	3.0 (2.8, 3.2)	3.7 (3.4, 4.0)	4.3 (3.8, 4.9)	
Non Navigated	**13525**	**366497**	**1.0 (1.0, 1.1)**	**2.8 (2.7, 2.8)**	**3.7 (3.7, 3.8)**	**4.4 (4.4, 4.5)**	**5.5 (5.4, 5.6)**	**7.2 (6.9, 7.4)**
<65	6387	117553	1.4 (1.3, 1.4)	3.9 (3.8, 4.0)	5.3 (5.2, 5.5)	6.5 (6.3, 6.6)	8.2 (8.0, 8.4)	11.0 (10.5, 11.5)
≥65	7138	248944	0.9 (0.9, 0.9)	2.3 (2.2, 2.3)	3.0 (2.9, 3.0)	3.5 (3.4, 3.6)	4.1 (4.0, 4.3)	5.2 (4.9, 5.5)
TOTAL	**15232**	**432833**						

Figure KT25 Cumulative Percent Revision of Primary Total Knee Replacement by Computer Navigation and Age (Primary Diagnosis OA)



HR - adjusted for gender

Computer Navigated <65 vs Computer Navigated ≥65

0 - 9Mth: HR=1.11 (0.94, 1.32),p=0.208

9Mth - 2Yr: HR=1.54 (1.34, 1.76),p<0.001

2Yr+: HR=1.95 (1.71, 2.22),p<0.001

Computer Navigated ≥65 vs Non Navigated ≥65

Entire Period: HR=1.02 (0.95, 1.09),p=0.666

Computer Navigated <65 vs Non Navigated <65

Entire Period: HR=0.88 (0.82, 0.95),p=0.001

Non Navigated <65 vs Non Navigated ≥65

0 - 3Mth: HR=1.06 (0.94, 1.19),p=0.348

3Mth - 9Mth: HR=1.58 (1.43, 1.74),p<0.001

9Mth - 1.5Yr: HR=1.85 (1.73, 1.99),p<0.001

1.5Yr - 2.5Yr: HR=1.95 (1.81, 2.11),p<0.001

2.5Yr - 3.5Yr: HR=1.86 (1.69, 2.05),p<0.001

3.5Yr - 4Yr: HR=2.29 (1.95, 2.69),p<0.001

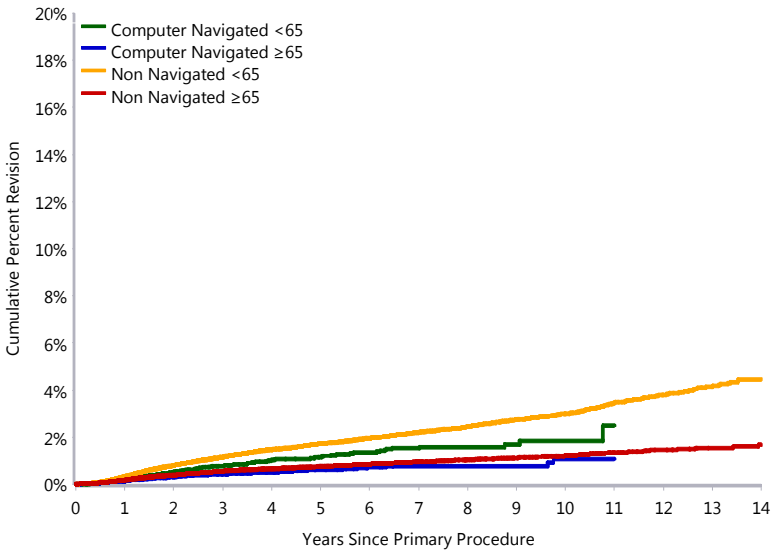
4Yr - 4.5Yr: HR=2.05 (1.72, 2.44),p<0.001

4.5Yr - 5Yr: HR=2.20 (1.83, 2.65),p<0.001

5Yr - 6.5Yr: HR=2.19 (1.93, 2.48),p<0.001

6.5Yr+: HR=2.69 (2.44, 2.96),p<0.001

Figure KT26 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
0 - 1.5Yr: HR=1.54 (1.16, 2.03),p=0.002
1.5Yr+: HR=2.17 (1.71, 2.76),p<0.001

Computer Navigated ≥65 vs
Non Navigated ≥65
Entire Period: HR=0.80 (0.69, 0.94),p=0.005

Computer Navigated <65 vs
Non Navigated <65
Entire Period: HR=0.66 (0.57, 0.77),p<0.001

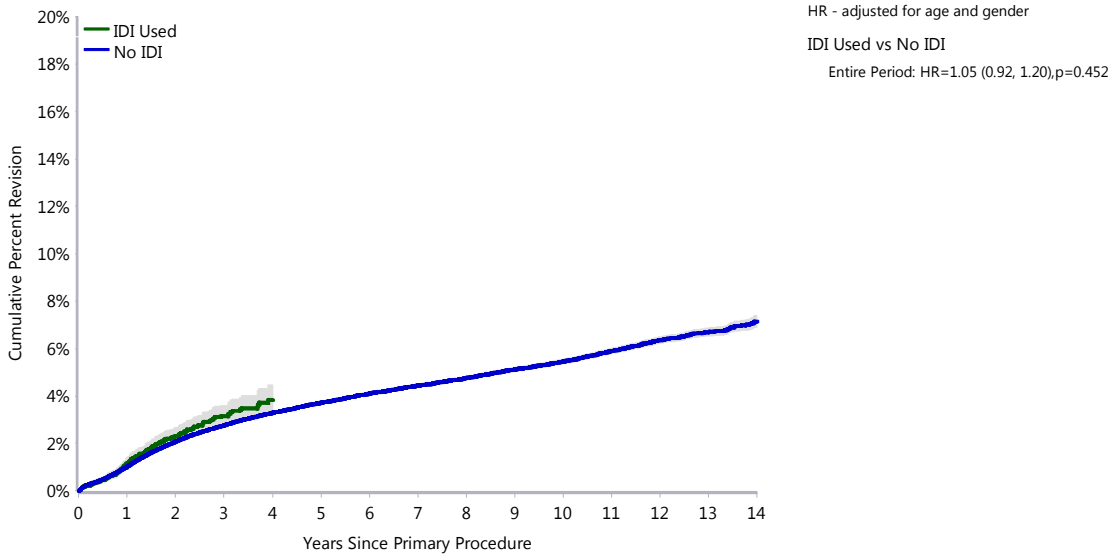
Non Navigated <65 vs
Non Navigated ≥65
0 - 1Mth: HR=0.83 (0.48, 1.44),p=0.501
1Mth - 6Mth: HR=2.00 (1.53, 2.61),p<0.001
6Mth - 9Mth: HR=1.85 (1.44, 2.36),p<0.001
9Mth - 3Yr: HR=2.18 (1.99, 2.39),p<0.001
3Yr+: HR=2.84 (2.58, 3.11),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Computer Navigated	**66336**	**53189**	**32327**	**15620**	**6217**	**854**	**0**
<65	23360	18871	11725	5617	2203	321	0
≥65	42976	34318	20602	10003	4014	533	0
Non Navigated	**366497**	**326448**	**250485**	**183753**	**125137**	**54701**	**2214**
<65	117553	104500	79674	58210	39875	18432	817
≥65	248944	221948	170811	125543	85262	36269	1397

Table KT25 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	14 Yrs
IDI Used	232	11188	1.2 (1.0, 1.4)	3.1 (2.7, 3.6)				
No IDI	15000	421645	1.0 (1.0, 1.1)	2.8 (2.7, 2.8)	3.7 (3.6, 3.8)	4.4 (4.4, 4.5)	5.5 (5.4, 5.6)	7.1 (6.9, 7.4)
TOTAL	**15232**	**432833**						

Figure KT27 Cumulative Percent Revision of Primary Total Knee Replacement by IDI Usage (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
IDI Used	11188	7930	2698	28	0	0	0
No IDI	421645	371707	280114	199345	131354	55555	2214

Bearing Surface

There are two tibial bearing surfaces used in primary total knee replacement, non cross-linked and 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 2,223 procedures that have used cross-linked polyethylene with the addition of an antioxidant.

Prostheses using cross-linked polyethylene have a cumulative percent revision of 3.6% at 10 years compared to 5.8% for non cross-linked polyethylene (Table KT26 and Figure KT28). At 10 years, there is a difference in the cumulative incidence of revision for loosening/lysis, 0.8% for cross-linked polyethylene compared to 1.7% for non cross-linked polyethylene (Figure KT29).

In primary total knee replacement, cross-linked polyethylene is used less frequently than non cross-linked polyethylene and there is considerable prosthesis variation in its use. Consequently, any observed difference in the rate of revision may be confounded by prosthesis type. For this reason, subsequent analysis has been limited to specific prostheses that have both cross-linked and non-cross-linked polyethylene options. The criteria for inclusion are a minimum of 2,500 procedures in at least one of the polyethylene groups and a follow up time of five or more years for both groups. 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 prosthesis.

Prosthesis Specific Analysis

Natural Knee II

The analysis for the Natural Knee II only includes minimally stabilised prostheses as the posterior stabilised option has rarely been used. The Registry has 10 year follow up for both types of polyethylene. Cross-linked polyethylene is used in 55.2% of procedures and has a lower rate of revision after 3.5 years (Table KT27 and Figure KT30). This difference is evident regardless of age, however the difference occurs later and is of greater magnitude for those aged less than 65 years (Table KT27 and Figure KT32). The 10 year cumulative incidence for loosening/lysis is 1.0% for cross-linked polyethylene and 3.2% for non cross-linked polyethylene and this difference occurs after 4.5 years (Figure KT31 and Figure KT33).

Triathlon

The minimally stabilised Triathlon knee has a seven year follow up for both the cross-linked and non cross-linked polyethylene and five year follow up for the posterior stabilised prosthesis.

Cross-linked polyethylene is used in 79.6% of minimally stabilised Triathlon knees. There is no difference in the rate of revision when comparing cross-linked and non cross-linked polyethylene (Table KT28 and Figure KT34). Age has no effect on this outcome (Table KT29 and Figure KT35). There is no difference in the reasons for revision between cross-linked and non cross-linked polyethylene except in those aged less than 65 years. In this age group non cross-linked polyethylene has a higher rate of revision for infection (Figure KT36).

Cross-linked polyethylene is used in 54.0% of posterior stabilised Triathlon knees and has a lower rate of revision (Table KT28 and Figure KT34). When comparing age groups there is a lower rate of revision for cross-linked in patients aged less than 65 years compared to non cross-linked polyethylene (Table KT30 and Figure KT37). There is no difference in the reasons for revision between cross-linked and non cross-linked polyethylene (Figure KT38).

Nexgen

The minimally stabilised Nexgen knee has a 10 year follow up for both cross-linked and non cross-linked polyethylene and seven year follow up for the posterior stabilised prostheses.

Cross-linked polyethylene is used in 78.3% of minimally stabilised Nexgen CR and CR Flex knees and has a lower rate of revision after one year (Table KT31 and Figure KT39). When comparing age groups, this difference is only evident in those aged less than 65 years (Table KT32 and Figure KT40). 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 1.9% respectively (Figure KT41).

Cross-linked polyethylene is used in 34.5% 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 KT31 and Figure KT39). There is also no age related difference and no difference in the reasons for revision (Table KT33, Figure KT42 and Figure KT43).

Scorpio NRG/Series 7000

The Scorpio NRG/Series 7000 knee has a five year follow up and cross-linked polyethylene was used in 87.0% of procedures. There is no difference in the rate of revision within minimally and posterior stabilised Scorpio NRG/Series 7000 prostheses when comparing cross-linked and non cross-linked polyethylene (Table KT34 and Figure KT44). 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 (Table KT35, Table KT36, and Figure KT45 - Figure KT48).

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. There is a lower rate of revision for posterior stabilised Triathlon when using cross-linked polyethylene. No difference is identified with either minimally or posterior stabilised Scorpio NRG/Series 7000, the minimally stabilised Triathlon or the posterior stabilised Nexgen. Each of these prostheses has a follow up time of seven years or less.

Table KT26 Cumulative Percent Revision of Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA)

Polyethylene Type	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Non Cross-Linked	13271	325896	1.1 (1.0, 1.1)	2.9 (2.9, 3.0)	4.0 (3.9, 4.0)	4.7 (4.6, 4.8)	5.8 (5.7, 5.9)	7.5 (7.2, 7.7)
Cross-Linked	1943	104566	0.9 (0.8, 0.9)	2.1 (2.0, 2.2)	2.6 (2.5, 2.8)	3.0 (2.8, 3.2)	3.6 (3.3, 3.8)	
TOTAL	**15214**	**430462**						

Note: Including 2223 procedures using cross-linked polyethylene with Antioxidant
Excluding 148 procedures with unknown bearing surface

Figure KT28 Cumulative Percent Revision of Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA)

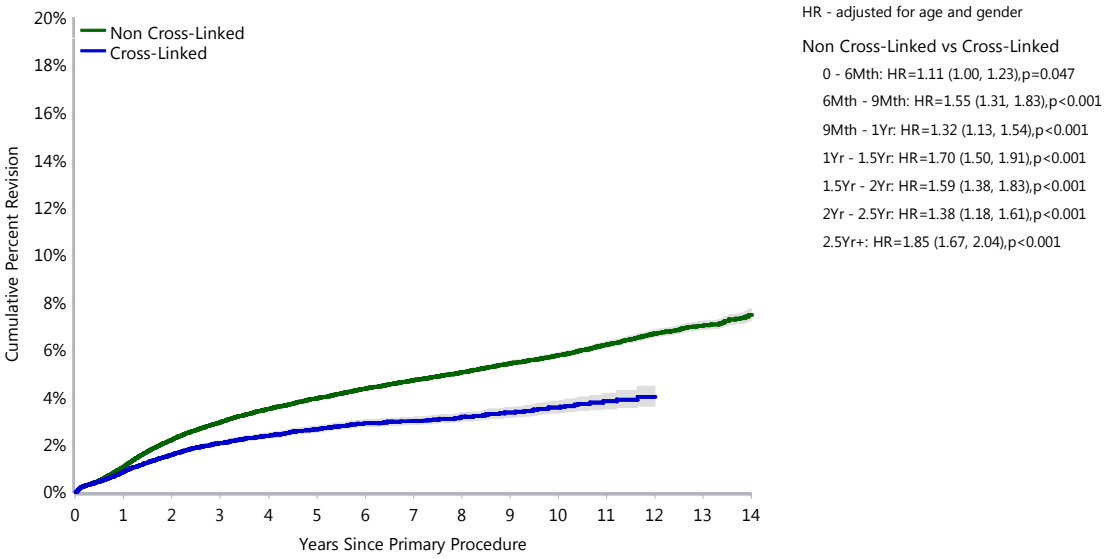
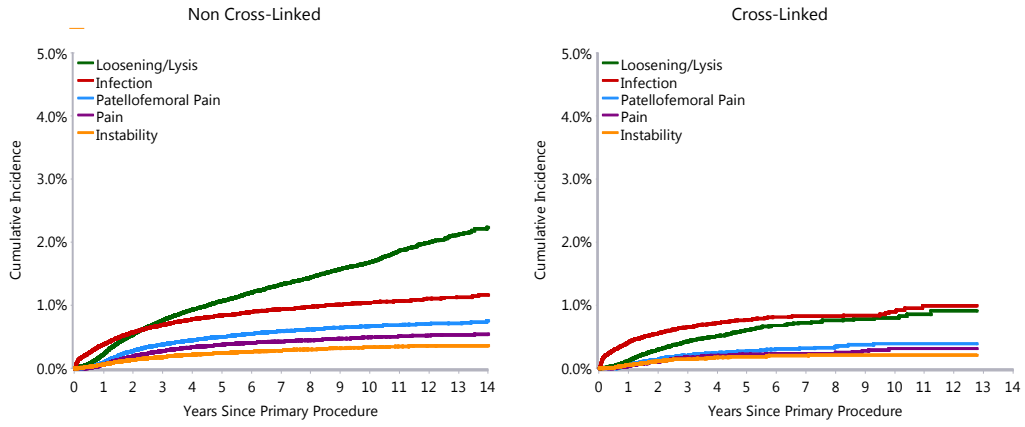


Figure KT29 Cumulative Incidence Revision Diagnosis of Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Non Cross-Linked	325896	296593	235568	175940	121280	52415	2212
Cross-Linked	104566	82382	47012	23341	9996	3106	0

Table KT27 Cumulative Percent Revision of Minimally Stabilised Natural Knee II/Natural Knee II Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

Polyethylene by Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Non Cross-Linked	**213**	**2861**	**0.8 (0.5, 1.2)**	**2.0 (1.5, 2.5)**	**3.0 (2.4, 3.7)**	**4.3 (3.6, 5.1)**	**7.1 (6.1, 8.2)**	**12.6 (10.0, 15.8)**
<65	110	766	1.0 (0.5, 2.1)	3.0 (2.0, 4.5)	4.6 (3.3, 6.4)	6.8 (5.2, 8.9)	12.4 (10.1, 15.1)	
≥65	103	2095	0.7 (0.4, 1.2)	1.6 (1.1, 2.2)	2.4 (1.8, 3.2)	3.3 (2.6, 4.2)	4.7 (3.8, 5.9)	
Cross-Linked	**101**	**3524**	**1.0 (0.7, 1.4)**	**2.1 (1.6, 2.6)**	**2.8 (2.2, 3.4)**	**3.0 (2.5, 3.7)**	**3.7 (3.0, 4.6)**	
<65	56	1076	1.7 (1.1, 2.7)	3.6 (2.6, 5.0)	4.8 (3.6, 6.3)	5.2 (3.9, 6.8)	6.1 (4.6, 8.0)	
≥65	45	2448	0.7 (0.4, 1.2)	1.4 (1.0, 2.0)	1.8 (1.3, 2.5)	2.0 (1.5, 2.8)	2.6 (1.9, 3.6)	
TOTAL	**314**	**6385**						

Figure KT30 Cumulative Percent Revision of Minimally Stabilised Natural Knee II/Natural Knee II Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA)

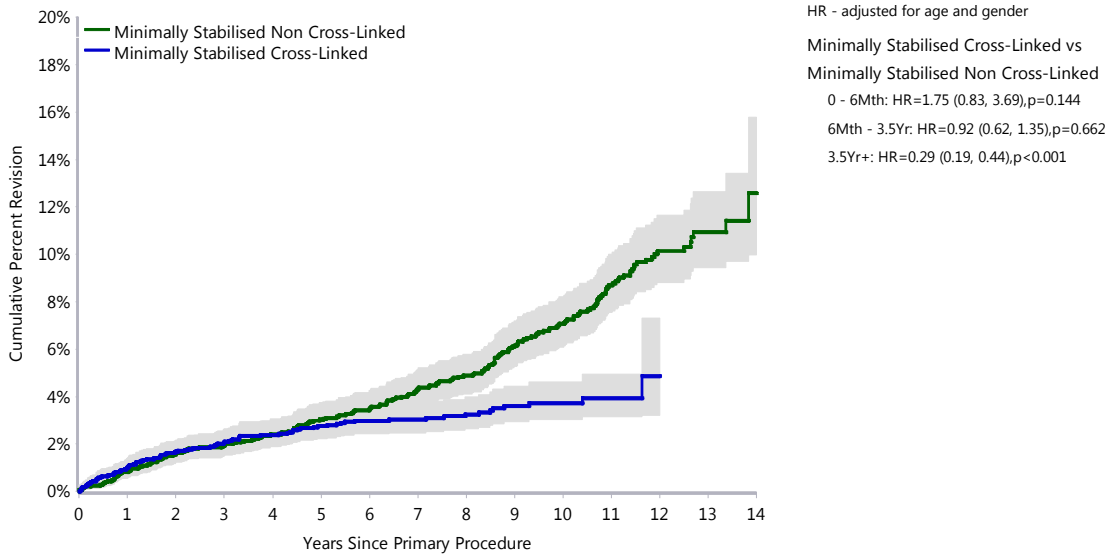
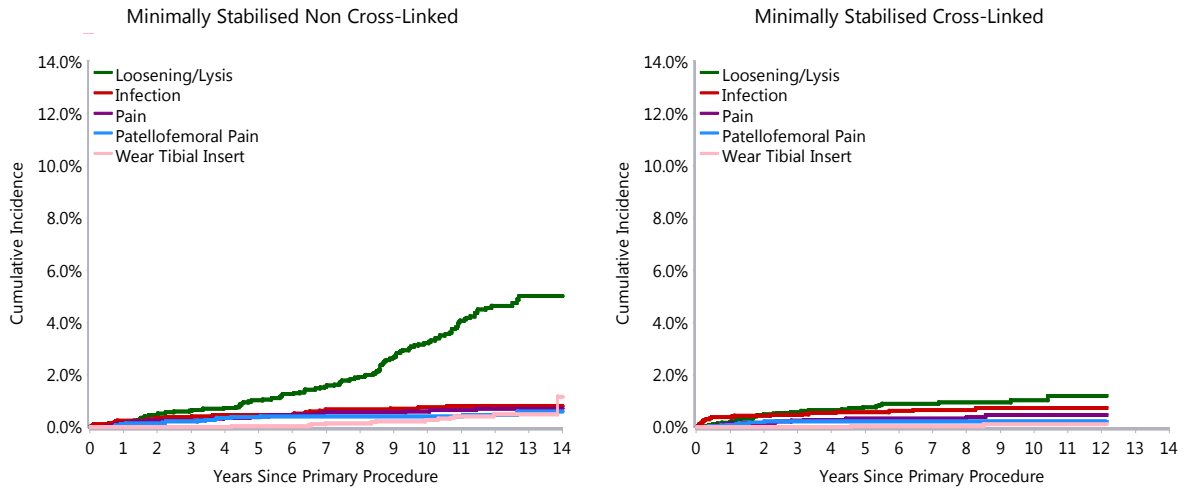
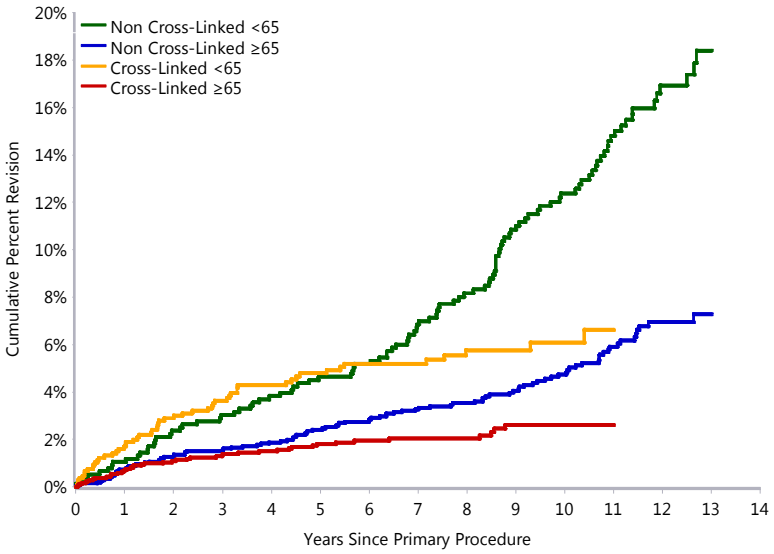


Figure KT31 Cumulative Incidence Revision Diagnosis of Minimally Stabilised Natural Knee II/Natural Knee II Primary Total Knee Replacement by Polyethylene Type (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Non Cross-Linked	**2861**	**2803**	**2659**	**2483**	**2220**	**1475**	**57**
<65	766	755	731	707	657	486	28
≥65	2095	2048	1928	1776	1563	989	29
Cross-Linked	**3524**	**3253**	**2767**	**2218**	**1599**	**574**	**0**
<65	1076	1009	892	723	547	217	0
≥65	2448	2244	1875	1495	1052	357	0

Figure KT32 Cumulative Percent Revision of Minimally Stabilised Natural Knee II/Natural Knee II Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)



HR - adjusted for gender

Cross-Linked <65 vs Cross-Linked ≥65

Entire Period: HR=2.58 (1.74, 3.83),p<0.001

Cross-Linked ≥65 vs Non Cross-Linked ≥65

Entire Period: HR=0.60 (0.42, 0.85),p=0.004

Cross-Linked <65 vs Non Cross-Linked <65

0 - 2Yr: HR=1.06 (0.66, 1.70),p=0.823

2Yr - 3Yr: HR=0.80 (0.31, 2.09),p=0.650

3Yr - 4.5Yr: HR=0.68 (0.30, 1.52),p=0.344

4.5Yr - 7.5Yr: HR=0.28 (0.12, 0.66),p=0.003

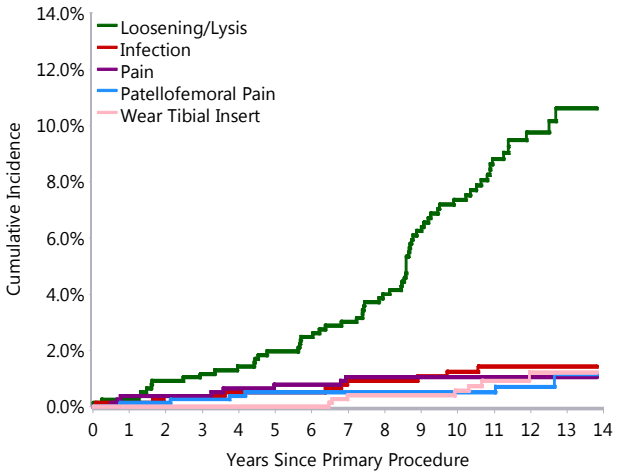
7.5Yr+: HR=0.24 (0.10, 0.59),p=0.002

Non Cross-Linked <65 vs Non Cross-Linked ≥65

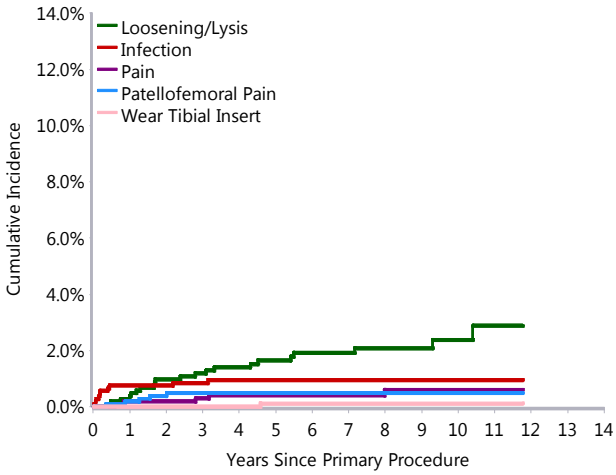
Entire Period: HR=2.46 (1.88, 3.22),p<0.001

Figure KT33 Cumulative Incidence Revision Diagnosis of Minimally Stabilised Natural Knee II/Natural Knee II Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

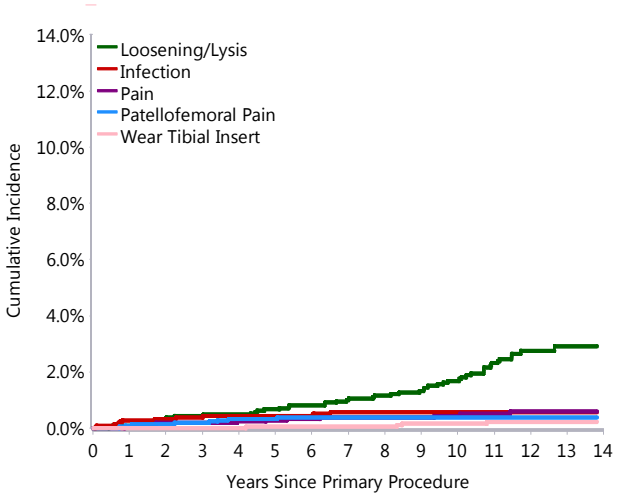
<65 Non Cross-Linked



<65 Cross-Linked



≥65 Non Cross-Linked



≥65 Cross-Linked

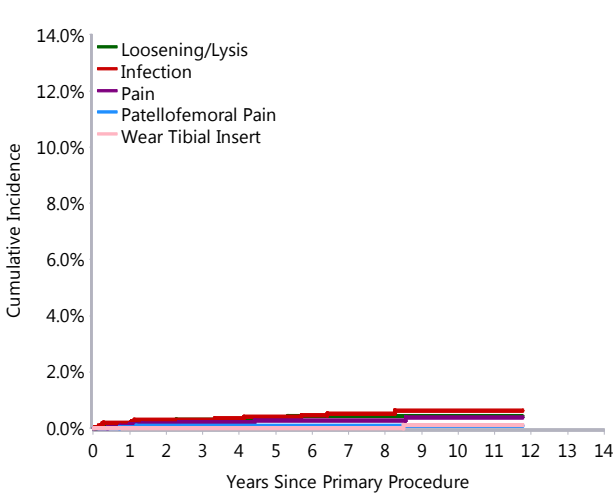
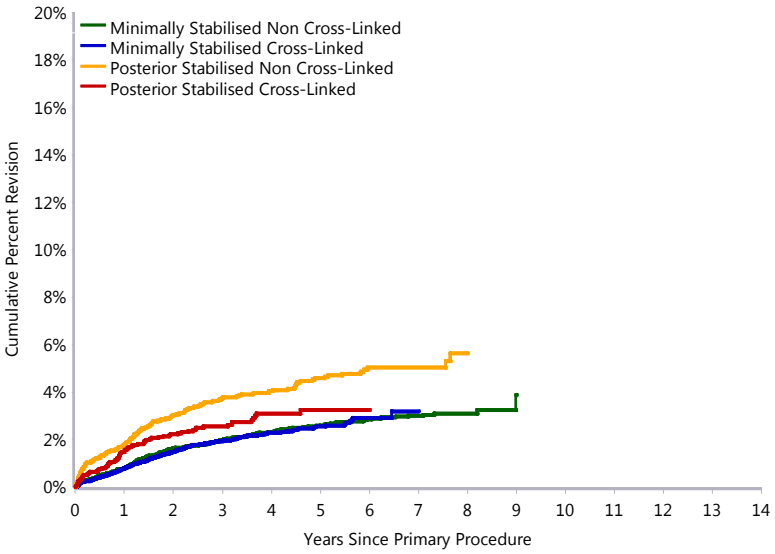


Table KT28 Cumulative Percent Revision of Triathlon/Triathlon Primary Total Knee Replacement by Stability and Polyethylene Type (Primary Diagnosis OA)

Stability by Polyethylene	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minimally Stabilised	**736**	**41868**	**0.8 (0.7, 0.9)**	**1.9 (1.8, 2.1)**	**2.6 (2.4, 2.8)**	**3.0 (2.7, 3.3)**		
Non Cross-Linked	210	8548	0.8 (0.6, 1.0)	2.0 (1.7, 2.3)	2.6 (2.2, 3.0)	3.0 (2.6, 3.4)		
Cross-Linked	526	33320	0.8 (0.7, 0.9)	1.9 (1.8, 2.1)	2.6 (2.3, 2.8)	3.2 (2.7, 3.8)		
Posterior Stabilised	**233**	**7498**	**1.7 (1.4, 2.0)**	**3.2 (2.8, 3.6)**	**4.0 (3.5, 4.6)**	**4.4 (3.8, 5.0)**		
Non Cross-Linked	143	3448	1.8 (1.4, 2.3)	3.7 (3.1, 4.5)	4.6 (3.9, 5.4)	5.0 (4.2, 5.9)		
Cross-Linked	90	4050	1.6 (1.2, 2.0)	2.5 (2.0, 3.2)	3.2 (2.6, 4.1)			
TOTAL	**969**	**49366**						

Note: The minimally stabilised group includes Triathlon CR/Triathlon prosthesis combination.
The posterior stabilised group includes Triathlon PS/Triathlon prosthesis combination.

Figure KT34 Cumulative Percent Revision of Triathlon/Triathlon Primary Total Knee Replacement by Stability and Polyethylene Type (Primary Diagnosis OA)



HR - adjusted for age and gender

Minimally Stabilised Non Cross-Linked vs Minimally Stabilised Cross-Linked
Entire Period: HR=1.03 (0.87, 1.21),p=0.743

Minimally Stabilised Cross-Linked vs Posterior Stabilised Cross-Linked
0 - 1Yr: HR=0.52 (0.39, 0.69),p<0.001
1Yr+: HR=1.09 (0.76, 1.55),p=0.646

Minimally Stabilised Non Cross-Linked vs Posterior Stabilised Non Cross-Linked
0 - 3Mth: HR=0.32 (0.19, 0.52),p<0.001
3Mth+: HR=0.64 (0.51, 0.80),p<0.001

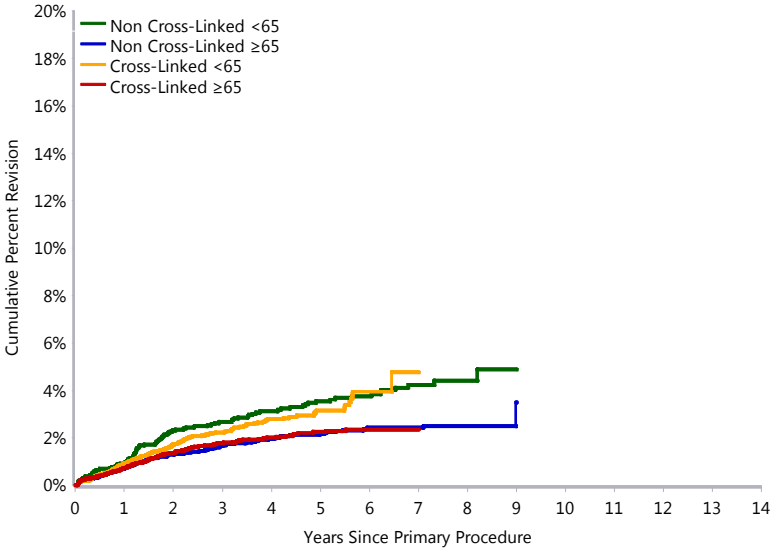
Posterior Stabilised Non Cross-Linked vs Posterior Stabilised Cross-Linked
Entire Period: HR=1.41 (1.08, 1.84),p=0.011

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minimally Stabilised	**41868**	**33505**	**19058**	**8420**	**2399**	**4**	**0**
Non Cross-Linked	8548	7940	6436	4693	2237	4	0
Cross-Linked	33320	25565	12622	3727	162	0	0
Posterior Stabilised	**7498**	**6189**	**4120**	**2048**	**614**	**0**	**0**
Non Cross-Linked	3448	3108	2525	1565	578	0	0
Cross-Linked	4050	3081	1595	483	36	0	0

Table KT29 Cumulative Percent Revision of Triathlon CR/Triathlon Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

Polyethylene by Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Non Cross-Linked	**210**	**8548**	**0.8 (0.6, 1.0)**	**2.0 (1.7, 2.3)**	**2.6 (2.2, 3.0)**	**3.0 (2.6, 3.4)**		
<65	92	2685	1.0 (0.6, 1.4)	2.7 (2.1, 3.4)	3.5 (2.9, 4.4)	4.2 (3.4, 5.2)		
≥65	118	5863	0.7 (0.5, 1.0)	1.7 (1.4, 2.1)	2.1 (1.8, 2.6)	2.4 (2.0, 2.9)		
Cross-Linked	**526**	**33320**	**0.8 (0.7, 0.9)**	**1.9 (1.8, 2.1)**	**2.6 (2.3, 2.8)**	**3.2 (2.7, 3.8)**		
<65	216	11232	0.9 (0.8, 1.1)	2.2 (1.9, 2.6)	3.1 (2.7, 3.7)	4.8 (3.6, 6.4)		
≥65	310	22088	0.7 (0.6, 0.9)	1.8 (1.6, 2.0)	2.2 (2.0, 2.5)	2.4 (2.0, 2.7)		
TOTAL	**736**	**41868**						

Figure KT35 Cumulative Percent Revision of Triathlon CR/Triathlon Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)



HR - adjusted for gender

Non Cross-Linked <65 vs Non Cross-Linked ≥65

Entire Period: HR=1.69 (1.29, 2.22),p<0.001

Non Cross-Linked ≥65 vs Cross-Linked ≥65

Entire Period: HR=0.94 (0.76, 1.17),p=0.586

Non Cross-Linked <65 vs Cross-Linked <65

Entire Period: HR=1.14 (0.89, 1.46),p=0.305

Cross-Linked <65 vs Cross-Linked ≥65

0 - 1.5Yr: HR=1.25 (1.01, 1.54),p=0.040

1.5Yr+: HR=1.51 (1.16, 1.98),p=0.002

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Non Cross-Linked	**8548**	**7940**	**6436**	**4693**	**2237**	**4**	**0**
<65	2685	2510	2044	1456	717	3	0
≥65	5863	5430	4392	3237	1520	1	0
Cross-Linked	**33320**	**25565**	**12622**	**3727**	**162**	**0**	**0**
<65	11232	8729	4381	1307	54	0	0
≥65	22088	16836	8241	2420	108	0	0

Figure KT36 Cumulative Incidence Revision Diagnosis of Triathlon CR/Triathlon Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

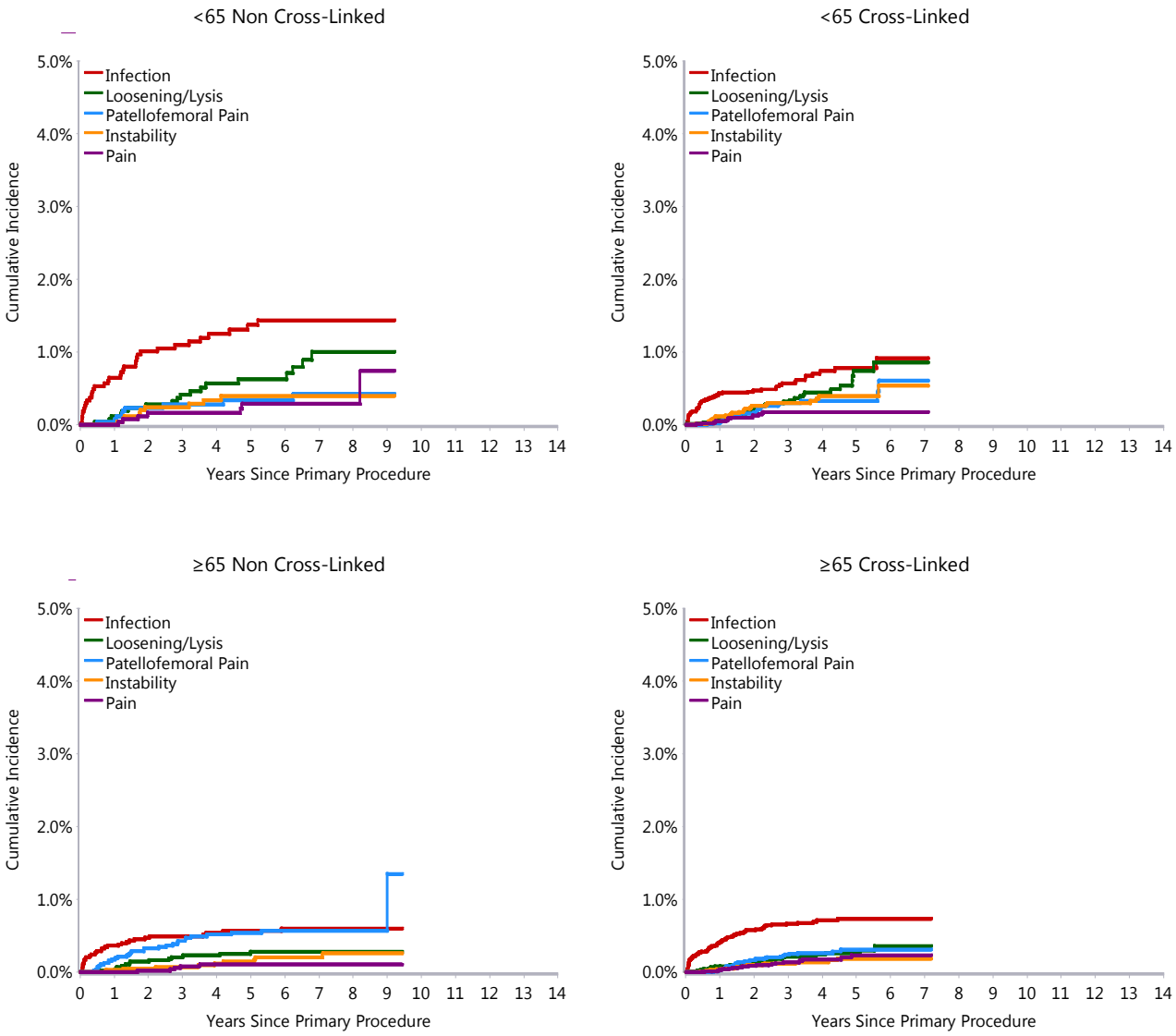
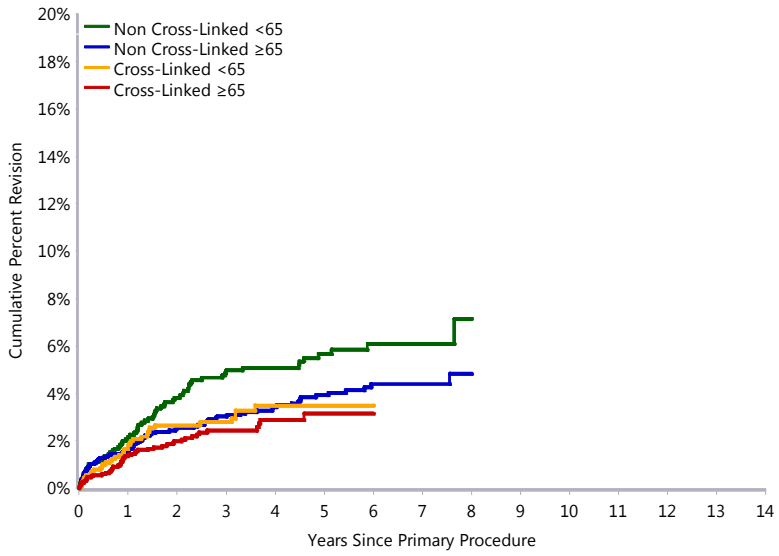


Table KT30 Cumulative Percent Revision of Triathlon PS/Triathlon Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

Polyethylene by Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Non Cross-Linked	**143**	**3448**	**1.8 (1.4, 2.3)**	**3.7 (3.1, 4.5)**	**4.6 (3.9, 5.4)**	**5.0 (4.2, 5.9)**		
<65	66	1283	2.2 (1.5, 3.1)	5.0 (3.9, 6.4)	5.7 (4.4, 7.2)	6.1 (4.7, 7.8)		
≥65	77	2165	1.6 (1.1, 2.2)	3.0 (2.3, 3.9)	3.9 (3.1, 4.9)	4.4 (3.5, 5.5)		
Cross-Linked	**90**	**4050**	**1.6 (1.2, 2.0)**	**2.5 (2.0, 3.2)**	**3.2 (2.6, 4.1)**			
<65	38	1455	1.8 (1.2, 2.7)	2.8 (2.0, 3.9)	3.5 (2.5, 4.8)			
≥65	52	2595	1.4 (1.0, 2.0)	2.4 (1.8, 3.2)	3.1 (2.3, 4.3)			
TOTAL	**233**	**7498**						

Figure KT37 Cumulative Percent Revision of Triathlon PS/Triathlon Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)



HR - adjusted for gender

Non Cross-Linked <65 vs Non Cross-Linked ≥65
Entire Period: HR=1.44 (1.04, 2.01),p=0.028

Non Cross-Linked ≥65 vs Cross-Linked ≥65
Entire Period: HR=1.32 (0.93, 1.89),p=0.121

Non Cross-Linked <65 vs Cross-Linked <65
Entire Period: HR=1.55 (1.04, 2.32),p=0.031

Cross-Linked <65 vs Cross-Linked ≥65
Entire Period: HR=1.23 (0.81, 1.87),p=0.327

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Non Cross-Linked	**3448**	**3108**	**2525**	**1565**	**578**	**0**	**0**
<65	1283	1163	943	564	199	0	0
≥65	2165	1945	1582	1001	379	0	0
Cross-Linked	**4050**	**3081**	**1595**	**483**	**36**	**0**	**0**
<65	1455	1135	625	215	17	0	0
≥65	2595	1946	970	268	19	0	0

Figure KT38 Cumulative Incidence Revision Diagnosis of Triathlon PS/Triathlon Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

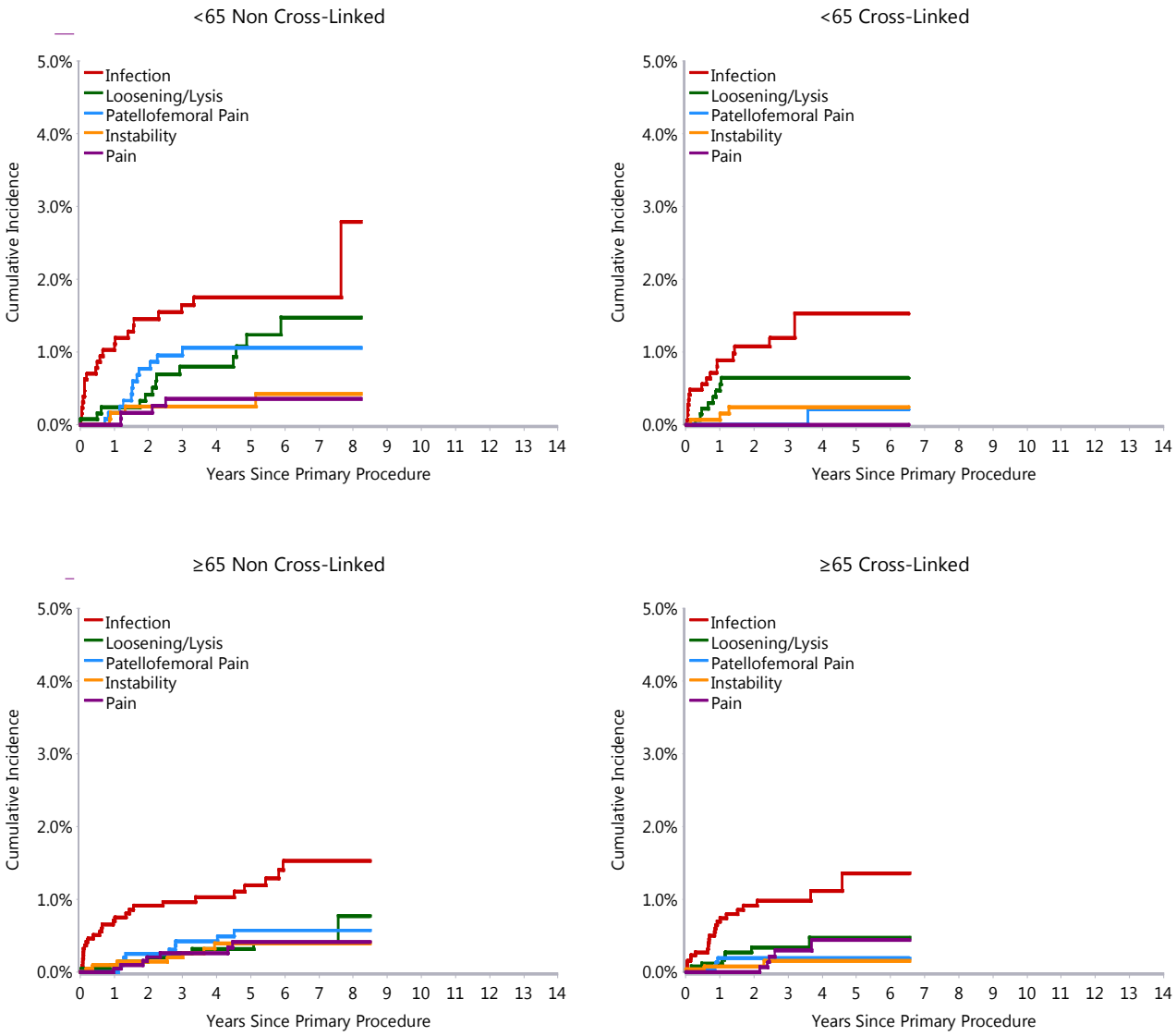
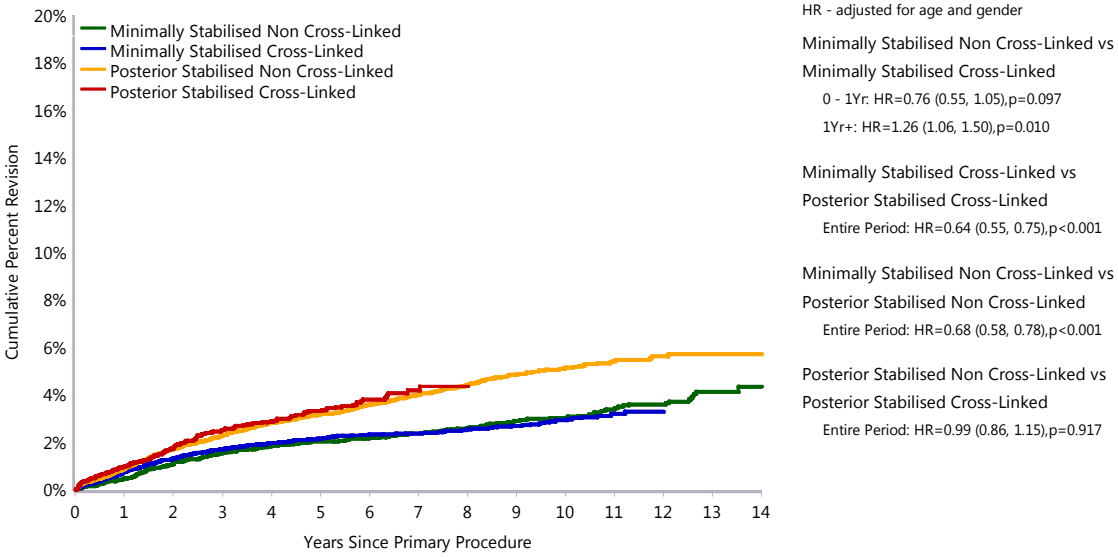


Table KT31 Cumulative Percent Revision of Nexgen/Nexgen Primary Total Knee Replacement by Stability and Polyethylene Type (Primary Diagnosis OA)

Stability by Polyethylene	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minimally Stabilised	**800**	**41504**	**0.7 (0.6, 0.8)**	**1.7 (1.5, 1.8)**	**2.1 (2.0, 2.3)**	**2.4 (2.2, 2.6)**	**3.0 (2.8, 3.2)**	**4.2 (3.6, 4.9)**
Non Cross-Linked	231	9003	0.5 (0.4, 0.6)	1.5 (1.3, 1.8)	2.0 (1.7, 2.4)	2.4 (2.1, 2.8)	3.0 (2.6, 3.5)	4.3 (3.6, 5.2)
Cross-Linked	569	32501	0.8 (0.7, 0.9)	1.7 (1.6, 1.9)	2.2 (2.0, 2.4)	2.4 (2.2, 2.6)	2.9 (2.7, 3.3)	
Posterior Stabilised	**986**	**30634**	**0.9 (0.8, 1.0)**	**2.4 (2.2, 2.5)**	**3.2 (3.0, 3.5)**	**4.1 (3.8, 4.3)**	**5.2 (4.8, 5.6)**	**5.8 (5.3, 6.3)**
Non Cross-Linked	739	20057	0.9 (0.8, 1.0)	2.3 (2.1, 2.5)	3.2 (2.9, 3.5)	4.0 (3.7, 4.3)	5.2 (4.8, 5.6)	5.7 (5.2, 6.3)
Cross-Linked	247	10577	1.0 (0.8, 1.2)	2.5 (2.2, 2.9)	3.3 (2.9, 3.8)	4.2 (3.6, 4.9)		
TOTAL	**1786**	**72138**						

Note: The minimally stabilised Nexgen includes Nexgen CR/Nexgen and Nexgen CR Flex/Nexgen prosthesis combinations.
The posterior stabilised Nexgen includes Nexgen LPS/Nexgen and Nexgen LPS Flex/Nexgen prosthesis combinations

Figure KT39 Cumulative Percent Revision of Nexgen/Nexgen Primary Total Knee Replacement by Stability and Polyethylene Type (Primary Diagnosis OA)

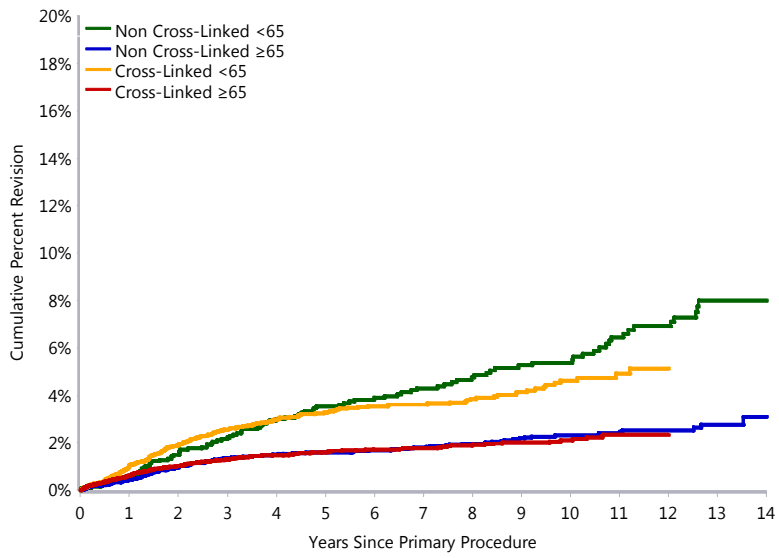


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minimally Stabilised	**41504**	**35482**	**25039**	**17618**	**12203**	**5463**	**215**
Non Cross-Linked	9003	8602	7283	5981	4695	2941	215
Cross-Linked	32501	26880	17756	11637	7508	2522	0
Posterior Stabilised	**30634**	**27176**	**20956**	**15001**	**9748**	**3633**	**74**
Non Cross-Linked	20057	18940	15720	12378	9172	3633	74
Cross-Linked	10577	8236	5236	2623	576	0	0

Table KT32 Cumulative Percent Revision of Minimally Stabilised Nexgen Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

Polyethylene by Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Non Cross-Linked	**231**	**9003**	**0.5 (0.4, 0.6)**	**1.5 (1.3, 1.8)**	**2.0 (1.7, 2.4)**	**2.4 (2.1, 2.8)**	**3.0 (2.6, 3.5)**	**4.3 (3.6, 5.2)**
<65	100	2040	0.6 (0.3, 1.1)	2.2 (1.6, 3.0)	3.5 (2.8, 4.5)	4.3 (3.4, 5.4)	5.4 (4.3, 6.7)	8.0 (6.4, 9.9)
≥65	131	6963	0.4 (0.3, 0.6)	1.4 (1.1, 1.7)	1.6 (1.3, 1.9)	1.8 (1.5, 2.2)	2.3 (1.9, 2.8)	3.1 (2.3, 4.1)
Cross-Linked	**569**	**32501**	**0.8 (0.7, 0.9)**	**1.7 (1.6, 1.9)**	**2.2 (2.0, 2.4)**	**2.4 (2.2, 2.6)**	**2.9 (2.7, 3.3)**	
<65	282	10829	1.1 (0.9, 1.3)	2.6 (2.2, 2.9)	3.3 (2.9, 3.7)	3.6 (3.2, 4.1)	4.6 (4.0, 5.3)	
≥65	287	21672	0.6 (0.5, 0.7)	1.3 (1.1, 1.5)	1.6 (1.4, 1.8)	1.8 (1.6, 2.0)	2.1 (1.8, 2.4)	
TOTAL	**800**	**41504**						

Figure KT40 Cumulative Percent Revision of Minimally Stabilised Nexgen Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)



HR - adjusted for gender

Non Cross-Linked <65 vs Non Cross-Linked ≥65

0 - 3Yr: HR=1.66 (1.17, 2.36),p=0.004

3Yr+: HR=3.90 (2.79, 5.45),p<0.001

Non Cross-Linked ≥65 vs Cross-Linked ≥65

Entire Period: HR=1.01 (0.82, 1.24),p=0.924

Non Cross-Linked <65 vs Cross-Linked <65

0 - 1.5Yr: HR=0.81 (0.53, 1.24),p=0.324

1.5Yr+: HR=1.46 (1.11, 1.92),p=0.007

Cross-Linked <65 vs Cross-Linked ≥65

0 - 1.5Yr: HR=1.67 (1.35, 2.07),p<0.001

1.5Yr+: HR=2.46 (1.94, 3.12),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Non Cross-Linked	**9003**	**8602**	**7283**	**5981**	**4695**	**2941**	**215**
<65	2040	1952	1680	1402	1116	759	77
≥65	6963	6650	5603	4579	3579	2182	138
Cross-Linked	**32501**	**26880**	**17756**	**11637**	**7508**	**2522**	**0**
<65	10829	8906	5748	3799	2477	927	0
≥65	21672	17974	12008	7838	5031	1595	0

Figure KT41 Cumulative Incidence Revision Diagnosis of Minimally Stabilised Nexgen Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

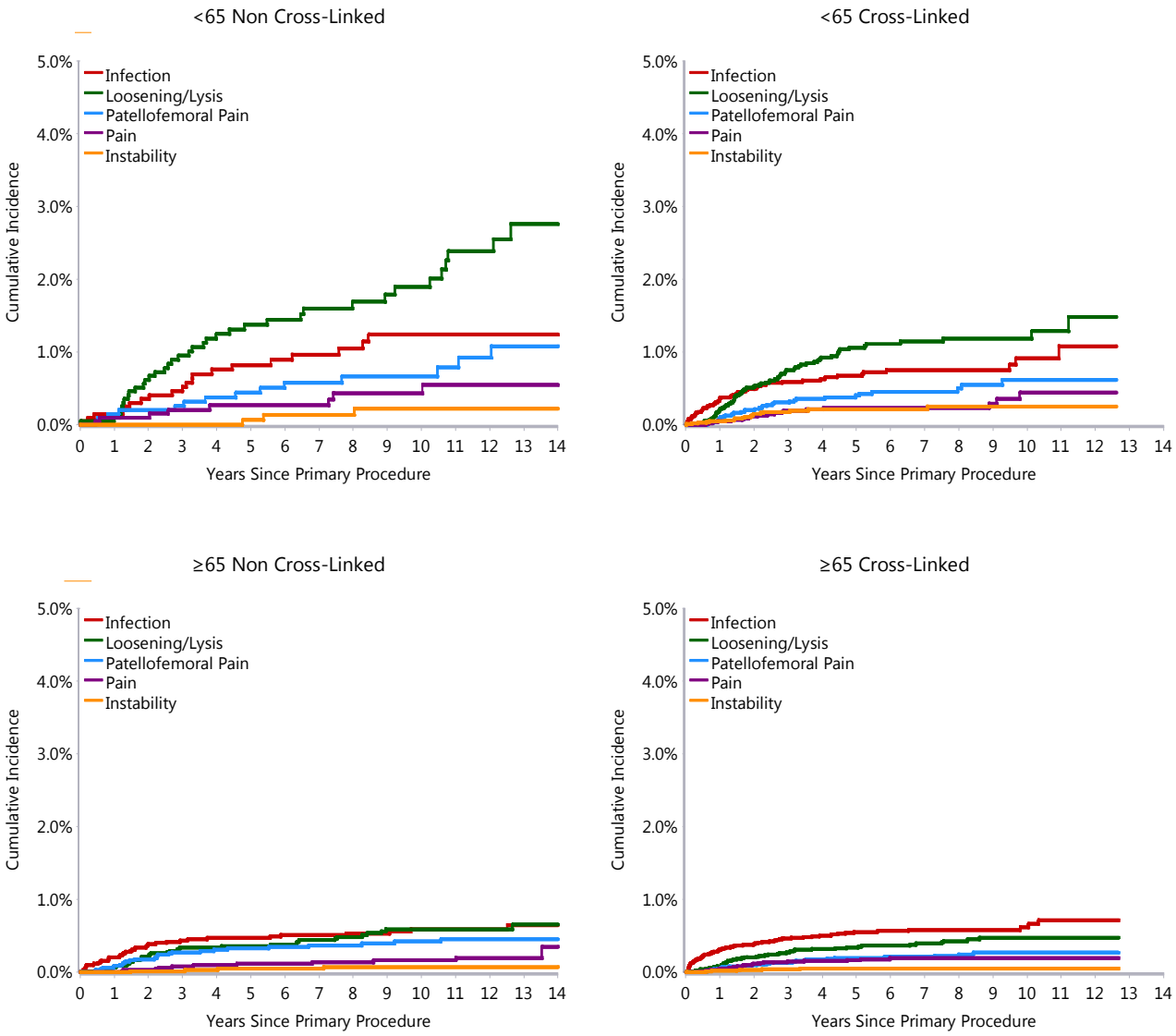


Table KT33 Cumulative Percent Revision of Posterior Stabilised Nexgen Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

Polyethylene by Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Non Cross-Linked	**739**	**20057**	**0.9 (0.8, 1.0)**	**2.3 (2.1, 2.5)**	**3.2 (2.9, 3.5)**	**4.0 (3.7, 4.3)**	**5.2 (4.8, 5.6)**	**5.7 (5.2, 6.3)**
<65	359	5742	1.1 (0.9, 1.4)	3.4 (2.9, 3.9)	4.9 (4.3, 5.5)	6.5 (5.8, 7.3)	8.8 (7.9, 9.8)	
≥65	380	14315	0.8 (0.7, 0.9)	1.8 (1.6, 2.1)	2.5 (2.2, 2.8)	2.9 (2.6, 3.3)	3.6 (3.2, 4.0)	3.8 (3.4, 4.3)
Cross-Linked	**247**	**10577**	**1.0 (0.8, 1.2)**	**2.5 (2.2, 2.9)**	**3.3 (2.9, 3.8)**	**4.2 (3.6, 4.9)**		
<65	113	3567	1.0 (0.7, 1.5)	3.4 (2.8, 4.2)	4.7 (3.9, 5.7)	6.2 (4.9, 7.7)		
≥65	134	7010	1.0 (0.8, 1.2)	2.1 (1.7, 2.5)	2.6 (2.2, 3.1)	3.2 (2.5, 3.9)		
TOTAL	**986**	**30634**						

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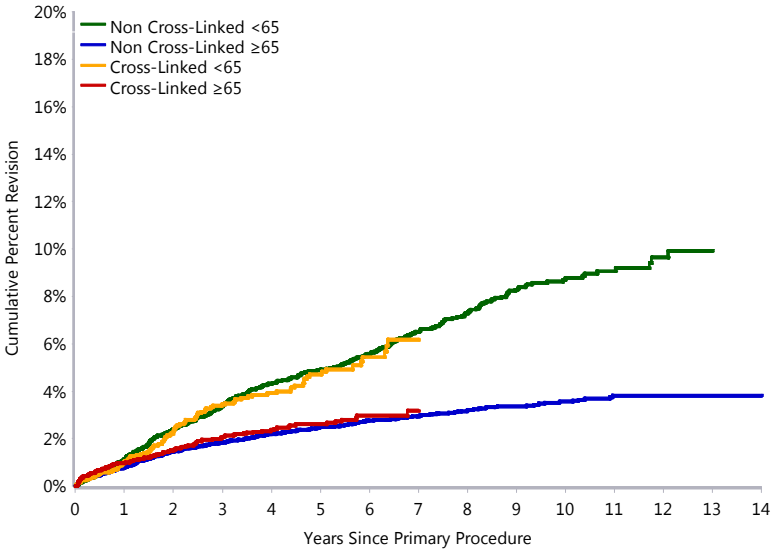
Figure KT42 Cumulative Percent Revision of Posterior Stabilised Nexgen Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)



HR - adjusted for gender

Non Cross-Linked <65 vs Non Cross-Linked ≥65

0 - 3Mth: HR=0.78 (0.46, 1.34),p=0.375

3Mth - 2Yr: HR=1.93 (1.53, 2.43),p<0.001

2Yr - 6Yr: HR=2.49 (1.99, 3.12),p<0.001

6Yr+: HR=4.11 (2.91, 5.80),p<0.001

Non Cross-Linked ≥65 vs Cross-Linked ≥65

Entire Period: HR=0.91 (0.75, 1.11),p=0.360

Non Cross-Linked <65 vs Cross-Linked <65

Entire Period: HR=1.10 (0.88, 1.36),p=0.410

Cross-Linked <65 vs Cross-Linked ≥65

0 - 6Mth: HR=0.71 (0.46, 1.10),p=0.121

6Mth+: HR=2.11 (1.59, 2.79),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Non Cross-Linked	**20057**	**18940**	**15720**	**12378**	**9172**	**3633**	**74**
<65	5742	5440	4578	3681	2793	1191	25
≥65	14315	13500	11142	8697	6379	2442	49
Cross-Linked	**10577**	**8236**	**5236**	**2623**	**576**	**0**	**0**
<65	3567	2784	1812	900	194	0	0
≥65	7010	5452	3424	1723	382	0	0

Figure KT43 Cumulative Incidence Revision Diagnosis of Posterior Stabilised Nexgen Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

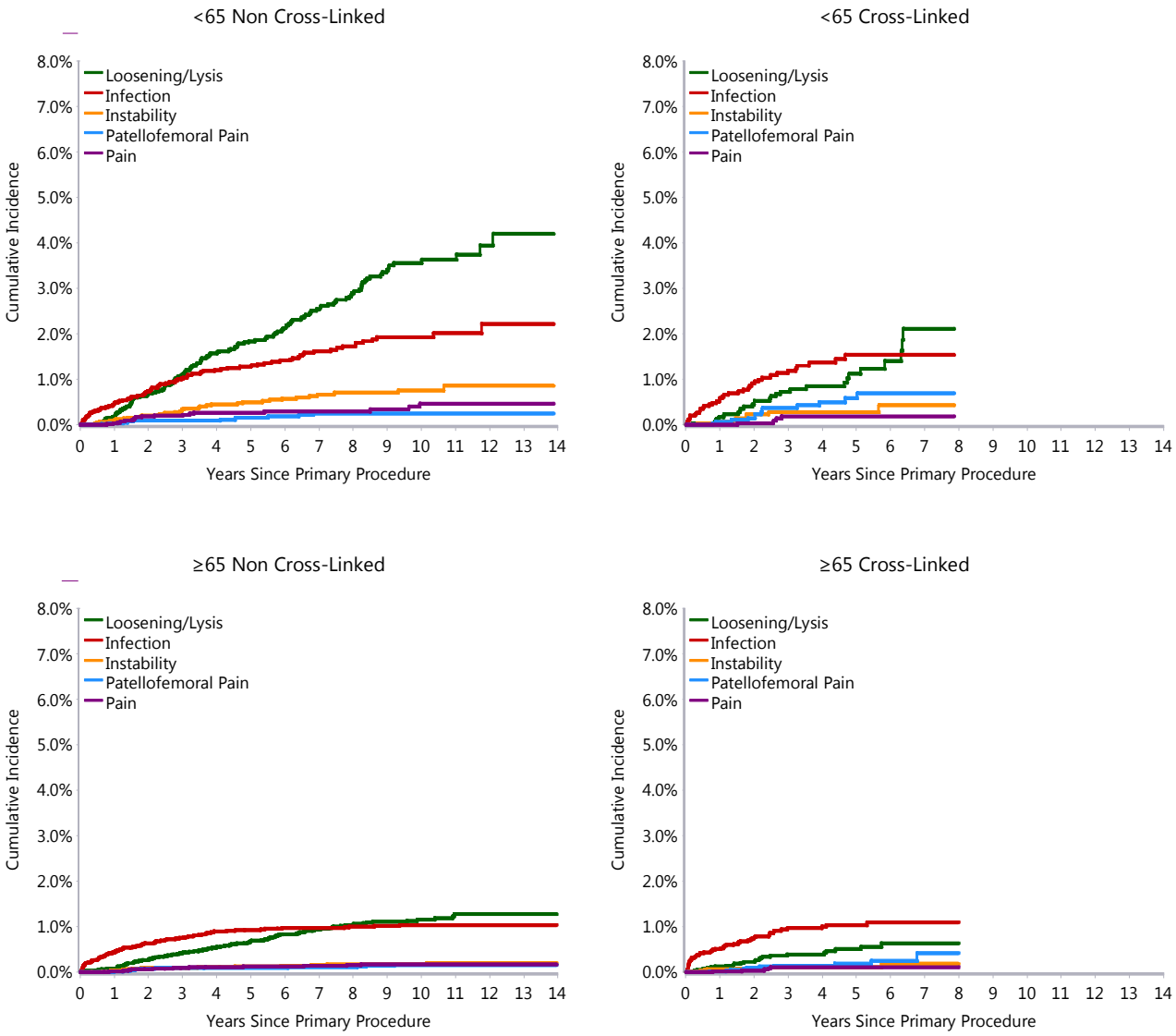
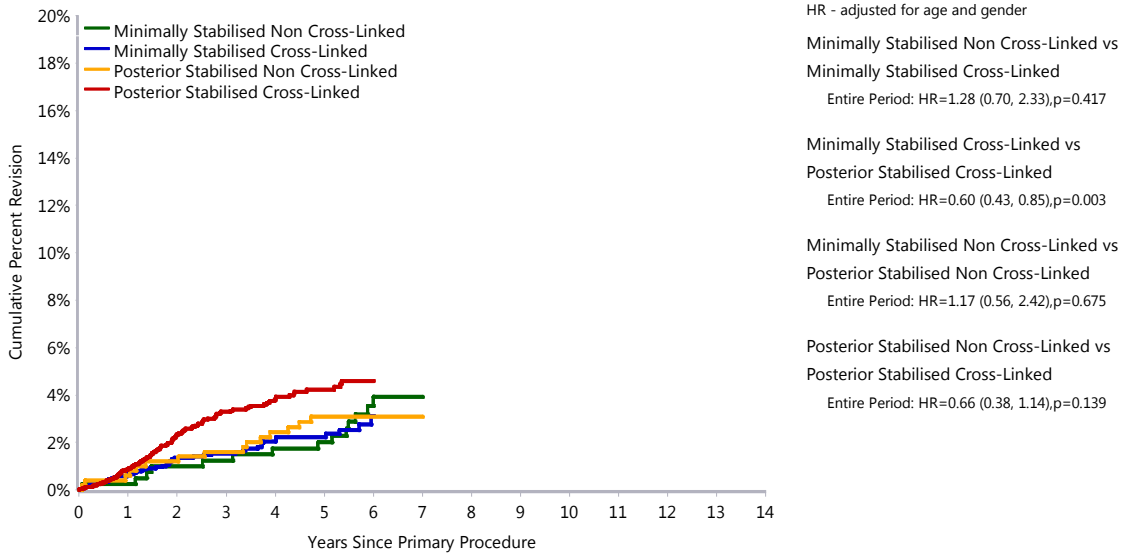


Table KT34 Cumulative Percent Revision of Scorpio NRG/Series 7000 Primary Total Knee Replacement by Stability and Polyethylene Type (Primary Diagnosis OA)

Stability by Polyethylene	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minimally Stabilised	**63**	**3421**	**0.6 (0.4, 0.9)**	**1.5 (1.1, 2.0)**	**2.2 (1.7, 2.9)**	**3.5 (2.6, 4.7)**		
Non Cross-Linked	14	406	0.2 (0.0, 1.7)	1.2 (0.5, 3.0)	2.0 (1.0, 4.0)	3.9 (2.3, 6.6)		
Cross-Linked	49	3015	0.7 (0.4, 1.0)	1.5 (1.1, 2.1)	2.2 (1.6, 3.0)			
Posterior Stabilised	**120**	**3561**	**0.8 (0.6, 1.2)**	**3.0 (2.5, 3.7)**	**4.1 (3.4, 4.9)**	**4.3 (3.6, 5.2)**		
Non Cross-Linked	15	504	0.6 (0.2, 1.8)	1.6 (0.8, 3.2)	3.1 (1.9, 5.1)	3.1 (1.9, 5.1)		
Cross-Linked	105	3057	0.9 (0.6, 1.3)	3.3 (2.7, 4.1)	4.2 (3.5, 5.1)			
TOTAL	**183**	**6982**						

Note: The minimally stabilised group includes Scorpio NRG CR/Series 7000 prosthesis combination.
The posterior stabilised group includes Scorpio NRG PS/Series 7000 prosthesis combination.

Figure KT44 Cumulative Percent Revision of Scorpio NRG/Series 7000 Primary Total Knee Replacement by Stability and Polyethylene Type (Primary Diagnosis OA)

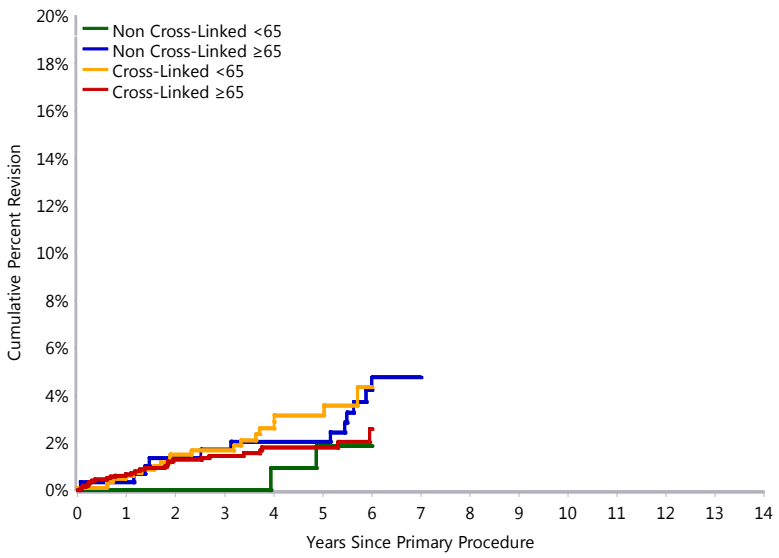


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Minimally Stabilised	**3421**	**2828**	**1932**	**1114**	**103**	**0**	**0**
Non Cross-Linked	406	402	396	372	103	0	0
Cross-Linked	3015	2426	1536	742	0	0	0
Posterior Stabilised	**3561**	**3352**	**2474**	**1401**	**228**	**0**	**0**
Non Cross-Linked	504	496	480	444	228	0	0
Cross-Linked	3057	2856	1994	957	0	0	0

Table KT35 Cumulative Percent Revision of Scorpio NRG CR/Series 7000 Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

Polyethylene by Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Non Cross-Linked	**14**	**406**	**0.2 (0.0, 1.7)**	**1.2 (0.5, 3.0)**	**2.0 (1.0, 4.0)**	**3.9 (2.3, 6.6)**		
<65	2	111	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	1.9 (0.5, 7.2)			
≥65	12	295	0.3 (0.0, 2.4)	1.7 (0.7, 4.0)	2.0 (0.9, 4.5)	4.8 (2.7, 8.3)		
Cross-Linked	**49**	**3015**	**0.7 (0.4, 1.0)**	**1.5 (1.1, 2.1)**	**2.2 (1.6, 3.0)**			
<65	20	948	0.6 (0.2, 1.4)	1.7 (0.9, 2.9)	3.2 (2.0, 5.1)			
≥65	29	2067	0.7 (0.4, 1.2)	1.5 (1.0, 2.2)	1.8 (1.2, 2.6)			
TOTAL	**63**	**3421**						

Figure KT45 Cumulative Percent Revision of Scorpio NRG CR/Series 7000 Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)



HR - adjusted for gender

Non Cross-Linked <65 vs Non Cross-Linked ≥65
Entire Period: HR=0.42 (0.09, 1.89),p=0.259

Non Cross-Linked ≥65 vs Cross-Linked ≥65
Entire Period: HR=1.52 (0.76, 3.03),p=0.233

Non Cross-Linked <65 vs Cross-Linked <65
Entire Period: HR=0.44 (0.10, 1.88),p=0.265

Cross-Linked <65 vs Cross-Linked ≥65
Entire Period: HR=1.48 (0.83, 2.61),p=0.180

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Non Cross-Linked	**406**	**402**	**396**	**372**	**103**	**0**	**0**
<65	111	110	110	105	31	0	0
≥65	295	292	286	267	72	0	0
Cross-Linked	**3015**	**2426**	**1536**	**742**	**0**	**0**	**0**
<65	948	753	479	235	0	0	0
≥65	2067	1673	1057	507	0	0	0

Figure KT46 Cumulative Incidence Revision Diagnosis of Scorpio NRG CR/Series 7000 Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

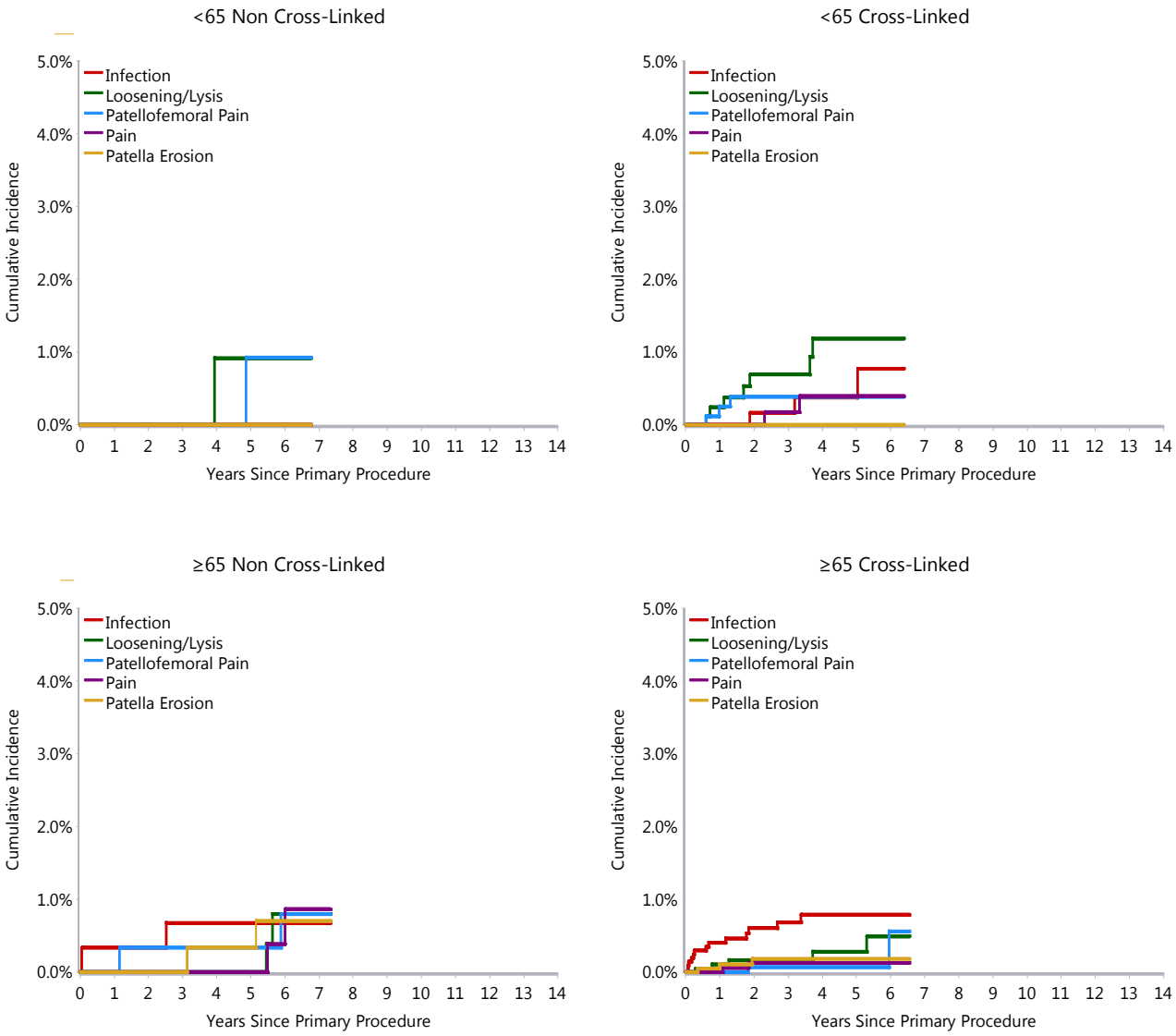
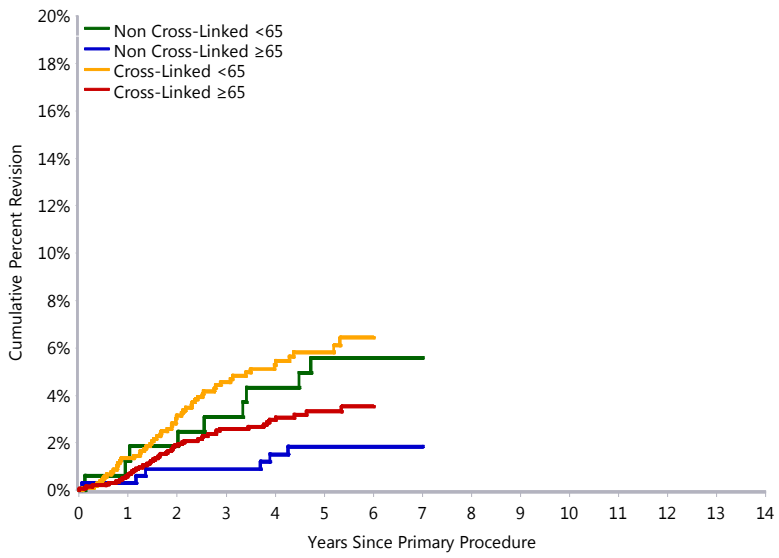


Table KT36 Cumulative Percent Revision of Scorpio NRG PS/Series 7000 Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)

Polyethylene by Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Non Cross-Linked	**15**	**504**	**0.6 (0.2, 1.8)**	**1.6 (0.8, 3.2)**	**3.1 (1.9, 5.1)**	**3.1 (1.9, 5.1)**		
<65	9	163	1.2 (0.3, 4.8)	3.1 (1.3, 7.3)	5.6 (2.9, 10.4)	5.6 (2.9, 10.4)		
≥65	6	341	0.3 (0.0, 2.1)	0.9 (0.3, 2.7)	1.8 (0.8, 4.0)	1.8 (0.8, 4.0)		
Cross-Linked	**105**	**3057**	**0.9 (0.6, 1.3)**	**3.3 (2.7, 4.1)**	**4.2 (3.5, 5.1)**			
<65	53	1071	1.3 (0.8, 2.3)	4.6 (3.4, 6.1)	5.8 (4.4, 7.6)			
≥65	52	1986	0.6 (0.4, 1.1)	2.6 (1.9, 3.5)	3.3 (2.5, 4.4)			
TOTAL	**120**	**3561**						

Figure KT47 Cumulative Percent Revision of Scorpio NRG PS/Series 7000 Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)



HR - adjusted for gender

Non Cross-Linked <65 vs Non Cross-Linked ≥65
Entire Period: HR=3.01 (1.07, 8.47),p=0.036

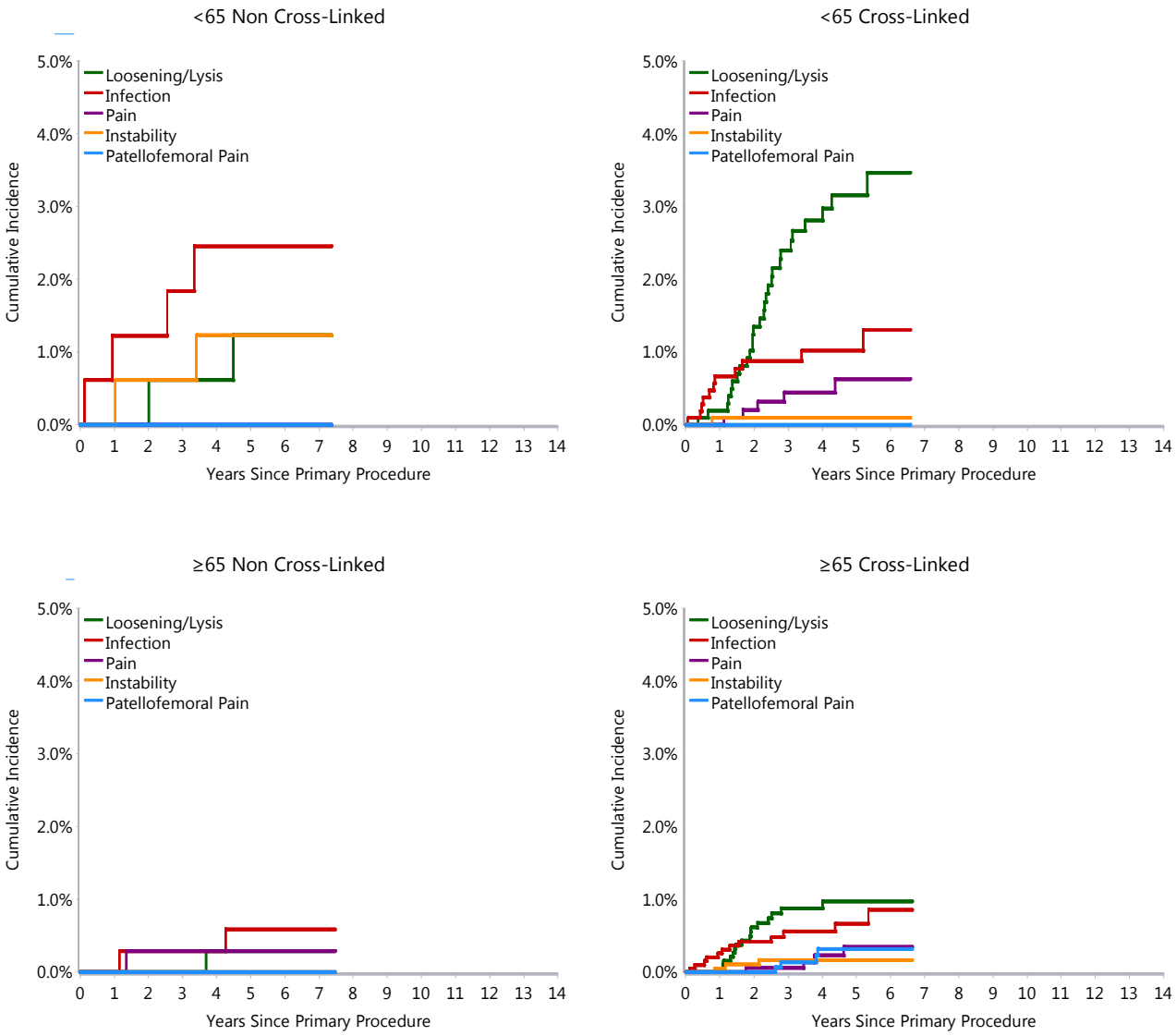
Non Cross-Linked ≥65 vs Cross-Linked ≥65
Entire Period: HR=0.52 (0.22, 1.21),p=0.130

Non Cross-Linked <65 vs Cross-Linked <65
Entire Period: HR=0.88 (0.43, 1.78),p=0.716

Cross-Linked <65 vs Cross-Linked ≥65
Entire Period: HR=1.79 (1.22, 2.62),p=0.002

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
Non Cross-Linked	**504**	**496**	**480**	**444**	**228**	**0**	**0**
<65	163	160	157	151	92	0	0
≥65	341	336	323	293	136	0	0
Cross-Linked	**3057**	**2856**	**1994**	**957**	**0**	**0**	**0**
<65	1071	1000	730	368	0	0	0
≥65	1986	1856	1264	589	0	0	0

Figure KT48 Cumulative Incidence Revision Diagnosis of Scorpio NRG PS/Series 7000 Primary Total Knee Replacement by Polyethylene Type and Age (Primary Diagnosis OA)



PROSTHESES WITH HIGHER THAN ANTICIPATED RATES OF REVISION

Introduction

A unique and important function of registries is that they are able to provide population based data on the comparative outcome of individual prostheses in a community. Outcomes data are necessary to enable an evidence-based approach to prosthesis selection. For many prostheses, the only source of outcomes data are registry reports.

It is evident from Registry data that most prostheses have similar outcomes. A number, however, have revision rates that are statistically higher than other prostheses in the same class. The Registry identifies these as 'prostheses with a higher than anticipated rate of revision'.

The Registry has developed a standardised three-stage approach to identify prostheses that are outliers with respect to revision rate. The comparator group includes all other prostheses within the same class regardless of their rate of revision. This is a more pragmatic approach than comparing to a select group of prostheses with the lowest revision rates.

Stage 1

The first stage is a screening test to identify prostheses that differ significantly from the combined revisions per 100 observed component years of all other prostheses in the same class. It is an automated analysis that identifies prostheses based on set criteria. These include:

(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 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.

This year the Registry has made a minor change in the approach to the identification of a prosthesis. If a prosthesis is identified in more than two combinations in Stage 1, an additional analysis of the individual prosthesis is undertaken for review at Stage 2, regardless of whether the individual prosthesis was identified in Stage 1. The purpose of this change is to simplify the reporting of an individual prosthesis and to avoid identifying the same prosthesis in multiple combinations when it may be more appropriate to identify it individually.

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 prosthesis 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 surgeons from the Australian Orthopaedic Association and 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 identified for the first time and are still used.

The second group is 'Re-identified and still used'. This listing identifies the prostheses which continue to have a higher than anticipated rate of revision and provides information on its continued use. Most identified or re-identified prostheses decline in use. This is usually evident only after the first year because almost a full year of use has occurred prior to identification in the Annual Report.

Prostheses that have a higher rate of revision but are no longer used in Australia make up the third group, 'Identified and no longer used'. These are listed to provide ongoing information on the rate of revision. This also enables comparison of other prostheses to the discontinued group. This group may include prostheses that are no longer used in Australia that are identified for the first time.

The Registry does not make a recommendation or otherwise on the continued use of identified prostheses. Identification is made to ensure that prostheses with a higher rate of revision compared to others in the same class are highlighted.

On occasion, a prosthesis previously identified no longer meets the criteria for inclusion. In this situation, the prosthesis is not subsequently re-identified. 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 and three Deputy Directors 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-2015.

Primary Partial Hip Replacement

Unipolar Modular

There are no unipolar modular prostheses being identified for the first time this year.

Table IP1 Revision Rate of Individual Unipolar Modular Hip Prostheses Identified as having a Higher than Anticipated Revision Rate

Head/Femoral	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Re-Identified and still used				
Femoral Head (JRI)/Furlong LOL	109	242	4.13	Entire Period: HR=3.10 (1.66, 5.77),p<0.001

Note: All Components have been compared to all other Unipolar Modular Hip components.

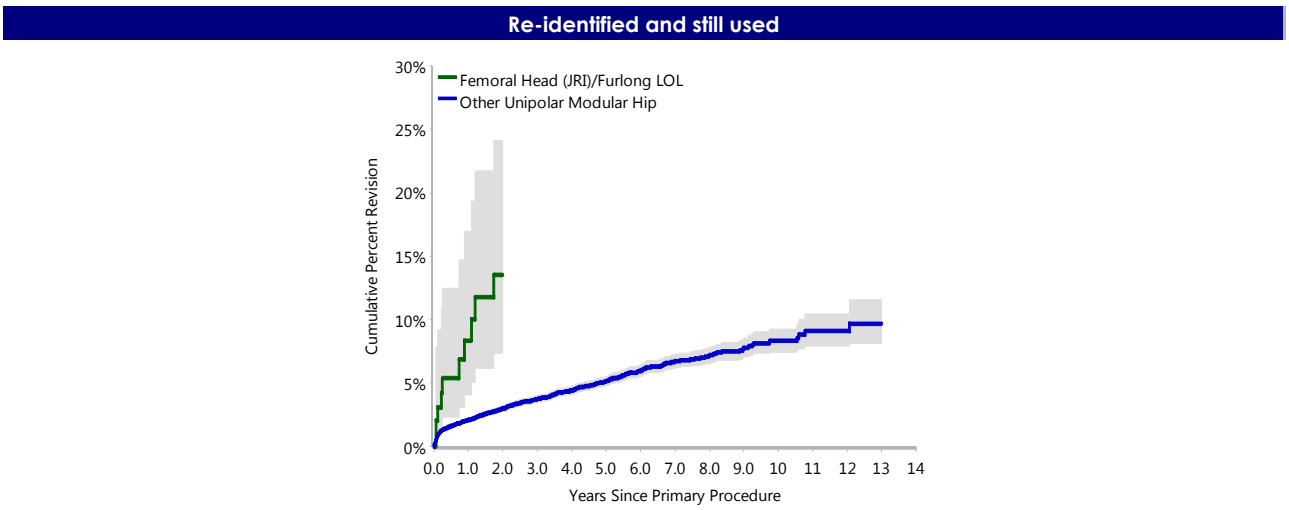
Table IP2 Cumulative Percent Revision of Individual Unipolar Modular Hip Prostheses Identified as having a Higher than Anticipated Revision Rate

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	13 Yrs
Re-Identified and still used					
Femoral Head (JRI)/Furlong LOL	8.4 (4.0, 16.9)				

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	2014
Re-Identified and still used													
Femoral Head (JRI)/Furlong LOL						12	18	10	13	10	8	7	31

Figure IP1 Cumulative Percent Revision of Individual Unipolar Modular Hip Prostheses Re-identified and still used



Bipolar

There are no bipolar prostheses being identified for the first time this year.

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
Re-Identified and still used				
Tandem/Basis	113	332	3.01	0 - 1.5Yr: HR=0.99 (0.32, 3.10),p=0.992 1.5Yr+: HR=6.11 (2.86, 13.06),p<0.001
Identified and no longer used				
UHR/ABGII	177	831	2.29	Entire Period: HR=2.79 (1.76, 4.41),p<0.001
UHR/Omnifit (cementless)	40	212	3.30	Entire Period: HR=3.68 (1.74, 7.76),p<0.001
**Synergy	54	324	2.47	Entire Period: HR=2.74 (1.36, 5.52),p=0.004

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
Re-Identified and still used					
Tandem/Basis	2.1 (0.5, 8.0)				
Identified and no longer used					
UHR/ABGII	4.4 (2.1, 8.9)	5.1 (2.6, 10.1)	11.0 (6.5, 18.1)		
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)	
**Synergy	7.5 (2.9, 18.7)	9.7 (4.2, 21.9)	12.5 (5.7, 26.0)	18.5 (9.5, 34.3)	

Note: ** Femoral Component

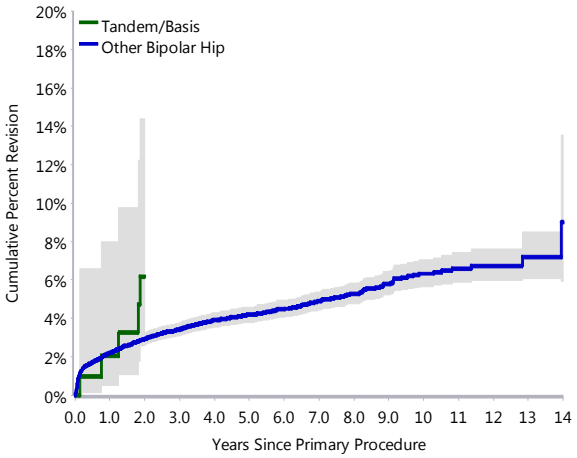
Table IP6 Yearly Usage of Individual Bipolar Hip Prostheses Identified as having a Higher than Anticipated Revision Rate

Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Re-Identified and still used													
Tandem/Basis				10	13	9	11	4	7	8	21	24	6
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						
**Synergy	12	13	9	10	3	2	1	1		1		2	

Note: ** Femoral Component

Figure IP2 Cumulative Percent Revision of Individual Bipolar Hip Prostheses Re-identified and still used

Re-identified and still used



Primary Total Hip Replacement

Total Conventional

Large head metal/metal bearings have been removed from the comparator group for all primary total conventional hip investigations.

There is one combination, M/L Taper/Fitmore that is no longer identified. This combination is still used. There have been 48 additional procedures and no further revisions.

There are 10 primary total conventional hip prostheses and prosthesis combinations identified for the first time.

The Metafix/Trinity combination has been used in 1,035 procedures since 2010. The cumulative percent revision at three years is 2.9%. The combination has a higher cumulative percent revision in the first two weeks and after this time there is no difference. Of the 24 revisions, 13 were femoral only and five were acetabular only revisions. The main reasons for revision are fracture (37.5%) and loosening/lysis (33.3%).

The Profemur L/Dynasty combination has been used in 193 procedures since 2013. The combination has a higher rate of revision for the entire period compared to other total conventional hip procedures. All six revisions were major, three femoral only, two acetabular only and one femoral/acetabular. The main reason for revision is loosening/lysis (50.0%).

The Taperloc Microplasty/Regenerex combination has been used in 43 procedures since 2010. The cumulative percent revision is 9.9% at one year. There were four revisions, three of which were major, one femoral only and two acetabular only. The main reason for revision is prosthesis dislocation (50.0%).

The Delta-One-TT acetabular prosthesis has been used in 69 procedures since 2010. The cumulative percent revision at one year is 2.9%. There were four revisions, all of which were acetabular only. The main reasons for revision are prosthesis dislocation (50.0%) and loosening/lysis (50.0%).

The Furlong acetabular prosthesis has been used in 490 procedures since 2000. The cumulative percent revision at five years is 6.1%. Of the 26 revisions, 14 were acetabular or femoral only and two were femoral/acetabular. The main reasons for revision are prosthesis dislocation (38.5%) and loosening/lysis (26.9%).

The Anatomic II/Duraloc Option combination and the Profemur TL/Dynasty combination are identified for the first time and are no longer used.

Three prostheses that have previously been identified in combination with another prosthesis are identified for the first time as an individual prosthesis. This is due to the modification of the criteria for identification of an individual prosthesis that has been implemented this year (refer to Introduction of this chapter).

The Duraloc acetabular prosthesis, Durom acetabular prosthesis and Elite Plus femoral prosthesis have been identified individually for the first time under the new identification criteria. None of these prostheses are currently used. As they are now identified individually, the following combinations are no longer listed:

- Charnley/Duraloc
- S-Rom/Duraloc
- Alloclassic/Durom
- Versys/Durom
- Elite Plus/Apollo
- Elite Plus/Charnley LPW

The Apex femoral stem has previously been identified in combination with the Trilogy acetabular component. This year, the Apex femoral stem was also identified in Stage 1 in combination with a number of other different acetabular prostheses. The panel recommended that the Apex femoral stem should be identified in combination with the Icon and SPH Blind acetabular prostheses. As both the Icon and SPH Blind are already reported individually in the 'Identified and no longer used' group, it was felt uneccessary to provide separate analyses of the Apex femoral stem in combination with these two acetabular prostheses.

This year the Registry has separated femoral prostheses which have both fixed and modular neck designs. As a result, only the Metha (exch neck) is identified as having a higher than anticipated rate of revision. This stem is no longer used. The fixed neck Metha stem does not have a higher rate of revision and is no longer identified.

Last year the Registry newly identified the Taperloc/M2a combination for the first time. The M2a can be used with different bearing surfaces. This year, only procedures using the Taperloc/M2a combination with a metal on metal bearing surface have been included in the analysis. This bearing surface is no longer used and therefore this combination is now listed in the section 'Identified and no longer used'.

The Integrale (exch neck)/Cerafit combination is no longer identified. This combination is no longer used and there have been no additional revision procedures recorded.

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				
Metafix/Trinity	1035	1709	1.40	0 - 2Wk: HR=2.84 (1.42, 5.70),p=0.003 2Wk+: HR=0.94 (0.58, 1.54),p=0.813
Profemur L/Dynasty	193	97	6.16	Entire Period: HR=2.58 (1.16, 5.72),p=0.019
Taperloc Microplasty/Regenerex	43	122	3.28	Entire Period: HR=3.92 (1.47, 10.45),p=0.006
**Delta-One-TT	69	85	4.69	Entire Period: HR=3.42 (1.29, 9.09),p=0.013
**Furlong	490	1704	1.53	Entire Period: HR=1.93 (1.31, 2.83),p<0.001
Re-Identified and still used				
Corail/Trabecular Metal (Shell)	82	270	3.33	Entire Period: HR=4.20 (2.19, 8.08),p<0.001
CPT/Fitmore	176	619	1.45	Entire Period: HR=1.97 (1.03, 3.79),p=0.041
CPT/Low Profile Cup	129	482	2.07	Entire Period: HR=2.88 (1.55, 5.35),p<0.001
*Emperion	420	1532	1.70	Entire Period: HR=2.13 (1.45, 3.13),p<0.001
*Excia (cementless)	208	584	2.57	Entire Period: HR=2.98 (1.80, 4.95),p<0.001
*Furlong	463	1997	1.20	Entire Period: HR=1.68 (1.13, 2.51),p=0.010
*ML Taper Kinectiv	2843	8557	1.26	Entire Period: HR=1.50 (1.24, 1.81),p<0.001
*MSA	224	707	3.25	Entire Period: HR=3.72 (2.47, 5.60),p<0.001
*Novation	577	947	2.43	Entire Period: HR=2.12 (1.41, 3.20),p<0.001
*Taper Fit	529	2605	1.50	0 - 3Mth: HR=0.94 (0.39, 2.26),p=0.890 3Mth - 2Yr: HR=1.32 (0.59, 2.93),p=0.502 2Yr+: HR=3.78 (2.61, 5.48),p<0.001
*Trabecular Metal	1648	5533	1.48	0 - 1Mth: HR=2.66 (1.83, 3.86),p<0.001 1Mth+: HR=1.60 (1.23, 2.09),p<0.001
*UniSyn	422	2392	1.55	Entire Period: HR=2.37 (1.71, 3.27),p<0.001
**BHR	2986	19350	1.30	0 - 2Wk: HR=0.84 (0.40, 1.77),p=0.645 2Wk - 1Mth: HR=0.18 (0.04, 0.71),p=0.014 1Mth - 3Mth: HR=1.27 (0.77, 2.08),p=0.346 3Mth - 1.5Yr: HR=0.79 (0.51, 1.21),p=0.276 1.5Yr+: HR=3.20 (2.78, 3.69),p<0.001
**Continuum	6848	15718	1.30	0 - 3Mth: HR=1.73 (1.44, 2.08),p<0.001 3Mth+: HR=1.03 (0.83, 1.28),p=0.791
**DeltaLox	222	597	3.35	Entire Period: HR=3.82 (2.46, 5.91),p<0.001
**Fin II	2014	8406	1.09	Entire Period: HR=1.52 (1.24, 1.87),p<0.001
**Plasmacup	409	1326	2.11	Entire Period: HR=2.60 (1.80, 3.77),p<0.001
**Procotyl L	862	2697	1.67	Entire Period: HR=2.04 (1.52, 2.73),p<0.001
**seleXys	420	1526	2.36	Entire Period: HR=3.08 (2.22, 4.27),p<0.001

Identified and no longer used				
+Anatomic II/Duraloc Option	60	430	1.63	Entire Period: HR=2.71 (1.29, 5.68),p=0.008
+Profemur TL/Dynasty	56	164	2.44	Entire Period: HR=2.77 (1.04, 7.39),p=0.041
+*Elite Plus	2841	25268	0.81	0 - 1Mth: HR=0.28 (0.12, 0.68),p=0.004 1Mth+: HR=1.55 (1.35, 1.78),p<0.001
+**Duraloc	5354	46333	0.96	0 - 3Mth: HR=0.89 (0.67, 1.17),p=0.398 3Mth - 2.5Yr: HR=1.34 (1.09, 1.65),p=0.006 2.5Yr - 3Yr: HR=1.76 (1.08, 2.86),p=0.022 3Yr - 5.5Yr: HR=1.45 (1.12, 1.88),p=0.004 5.5Yr+: HR=2.45 (2.13, 2.81),p<0.001
+**Durom	1245	8971	1.29	0 - 1.5Yr: HR=0.77 (0.49, 1.20),p=0.245 1.5Yr+: HR=3.15 (2.58, 3.86),p<0.001
Anca-Fit/Pinnacle	101	649	2.00	Entire Period: HR=3.36 (1.95, 5.78),p<0.001
Apex/Trilogy	108	488	1.64	Entire Period: HR=2.28 (1.14, 4.56),p=0.019
Friendly Hip/Cup (Exactech)	97	738	1.63	Entire Period: HR=2.79 (1.59, 4.92),p<0.001
F2L/Delta-PF	107	819	1.95	Entire Period: HR=3.31 (2.03, 5.40),p<0.001
H Moos/Mueller	19	131	6.87	Entire Period: HR=10.78 (5.62, 20.67),p<0.001
Secur-Fit Plus/Secur-Fit	197	1850	1.08	Entire Period: HR=1.81 (1.17, 2.80),p=0.008
Taperloc/M2a MoM	515	4076	1.32	Entire Period: HR=2.20 (1.69, 2.88),p<0.001
*ABGII (exch neck)	246	1056	4.64	0 - 1Mth: HR=3.89 (1.75, 8.67),p<0.001 1Mth - 2.5Yr: HR=3.44 (2.03, 5.81),p<0.001 2.5Yr - 4Yr: HR=10.17 (5.62, 18.42),p<0.001 4Yr+: HR=24.28 (15.24, 38.68),p<0.001
*Adapter (cemented)	148	839	3.22	0 - 6Mth: HR=1.80 (0.45, 7.22),p=0.404 6Mth+: HR=5.27 (2.92, 9.50),p<0.001
*Adapter (cementless)	744	4067	2.56	0 - 2Wk: HR=4.02 (2.00, 8.06),p<0.001 2Wk - 1Mth: HR=1.85 (0.77, 4.46),p=0.168 1Mth - 6Mth: HR=0.84 (0.32, 2.24),p=0.729 6Mth - 3Yr: HR=3.52 (2.48, 4.98),p<0.001 3Yr+: HR=7.16 (5.48, 9.35),p<0.001
*CBH Stem	273	1227	2.12	Entire Period: HR=3.01 (2.05, 4.43),p<0.001
*Edinburgh	138	709	2.12	Entire Period: HR=3.40 (2.05, 5.64),p<0.001
*K2	601	2657	2.15	Entire Period: HR=3.05 (2.35, 3.95),p<0.001
*LYDERIC II	164	1199	1.25	Entire Period: HR=2.15 (1.30, 3.57),p=0.003
*Margron	688	6136	1.66	Entire Period: HR=2.77 (2.28, 3.37),p<0.001
*Mayo	168	1207	1.08	Entire Period: HR=1.78 (1.03, 3.07),p=0.037
*Metha (exch neck)	88	343	3.79	Entire Period: HR=4.96 (2.89, 8.53),p<0.001
*Profemur Z	186	1407	1.56	Entire Period: HR=2.64 (1.74, 4.01),p<0.001
**2000 Plus	135	793	1.76	Entire Period: HR=2.82 (1.67, 4.76),p<0.001
**Adept	121	670	2.09	Entire Period: HR=3.09 (1.83, 5.22),p<0.001
**Artek	179	1840	3.26	0 - 1.5Yr: HR=1.97 (0.94, 4.14),p=0.072 1.5Yr+: HR=6.44 (4.91, 8.46),p<0.001
**ASR	4421	26686	6.06	0 - 1Mth: HR=0.69 (0.45, 1.08),p=0.102 1Mth - 9Mth: HR=1.11 (0.82, 1.50),p=0.506 9Mth - 1.5Yr: HR=3.47 (2.72, 4.42),p<0.001 1.5Yr - 2Yr: HR=5.95 (4.59, 7.72),p<0.001 2Yr - 3Yr: HR=12.66 (10.92, 14.68),p<0.001 3Yr - 5Yr: HR=23.08 (20.93, 25.44),p<0.001 5Yr - 5.5Yr: HR=27.39 (22.64, 33.13),p<0.001 5.5Yr - 6Yr: HR=22.71 (18.34, 28.13),p<0.001 6Yr - 8.5Yr: HR=16.82 (14.66, 19.31),p<0.001 8.5Yr+: HR=8.55 (5.57, 13.13),p<0.001

**Bionik	608	3513	2.99	0 - 3Mth: HR=1.74 (0.96, 3.15),p=0.065 3Mth - 3Yr: HR=3.85 (2.75, 5.40),p<0.001 3Yr+: HR=8.54 (6.61, 11.03),p<0.001
**Cormet	803	5360	1.44	0 - 1.5Yr: HR=1.07 (0.67, 1.73),p=0.767 1.5Yr - 2Yr: HR=0.51 (0.07, 3.62),p=0.499 2Yr+: HR=3.69 (2.86, 4.78),p<0.001
**ExpanSys	71	542	1.84	Entire Period: HR=3.15 (1.70, 5.86),p<0.001
**Hedrocel	46	438	2.05	Entire Period: HR=3.38 (1.76, 6.49),p<0.001
**Icon	401	2365	2.49	0 - 2.5Yr: HR=2.53 (1.70, 3.78),p<0.001 2.5Yr+: HR=5.94 (4.25, 8.29),p<0.001
**Inter-Op	33	311	2.89	Entire Period: HR=4.76 (2.48, 9.15),p<0.001
**MBA	124	934	1.71	Entire Period: HR=2.93 (1.80, 4.79),p<0.001
**Mitch TRH	732	4292	1.63	0 - 3Mth: HR=0.64 (0.26, 1.53),p=0.313 3Mth - 2Yr: HR=2.18 (1.37, 3.47),p<0.001 2Yr+: HR=4.05 (3.04, 5.41),p<0.001
**SPH-Blind	952	9061	1.09	0 - 1Mth: HR=2.63 (1.61, 4.31),p<0.001 1Mth+: HR=1.74 (1.40, 2.16),p<0.001

Note: All Components have been compared to all other Total Conventional Hip components, 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	14 Yrs
Newly Identified					
Metafix/Trinity	2.1 (1.4, 3.2)	2.9 (1.8, 4.5)			
Profemur L/Dynasty					
Taperloc Microplasty/Regenerex	9.9 (3.8, 24.3)	9.9 (3.8, 24.3)			
**Delta-One-TT	2.9 (0.7, 11.1)				
**Furlong	3.8 (2.4, 5.9)	5.4 (3.7, 8.0)	6.1 (4.1, 9.3)		
Re-Identified and still used					
Corail/Trabecular Metal (Shell)	9.8 (4.7, 19.6)	14.2 (7.5, 26.2)			
CPT/Fitmore	3.5 (1.6, 7.7)	4.4 (2.1, 9.1)	6.3 (2.9, 13.6)		
CPT/Low Profile Cup	4.7 (2.2, 10.2)	6.8 (3.4, 13.2)			
*Emperion	3.9 (2.4, 6.3)	5.2 (3.4, 7.9)	7.2 (4.7, 10.9)		
*Excia (cementless)	5.4 (3.0, 9.5)	6.5 (3.8, 11.0)			
*Furlong	2.9 (1.7, 4.9)	4.7 (3.1, 7.2)	5.9 (3.9, 8.8)		
*ML Taper Kinectiv	2.3 (1.8, 3.0)	3.6 (3.0, 4.4)	5.1 (4.2, 6.3)		
*MSA	5.9 (3.5, 9.9)	9.4 (6.1, 14.1)			
*Novation	3.7 (2.4, 5.7)	5.1 (3.3, 7.7)			
*Taper Fit	1.4 (0.7, 2.9)	3.3 (2.0, 5.6)	6.9 (4.6, 10.3)	15.1 (10.7, 21.2)	
*Trabecular Metal	3.4 (2.6, 4.4)	4.6 (3.7, 5.8)	5.7 (4.5, 7.2)		
*UniSyn	3.6 (2.2, 5.9)	6.4 (4.3, 9.3)	7.4 (5.1, 10.5)		
**BHR	1.1 (0.8, 1.6)	3.1 (2.6, 3.8)	6.0 (5.2, 7.0)	11.9 (10.2, 13.8)	
**Continuum	2.5 (2.1, 2.9)	3.4 (3.0, 3.9)	3.8 (3.2, 4.4)		
**DeltaLox	5.9 (3.5, 10.0)	9.0 (5.8, 13.8)			
**Fin II	2.7 (2.1, 3.5)	3.7 (2.9, 4.6)	5.1 (4.1, 6.4)		
**Plasmacup	5.2 (3.4, 7.9)	6.6 (4.5, 9.6)	8.2 (5.5, 12.3)		
**Procotyl L	3.9 (2.8, 5.4)	5.3 (3.9, 7.1)			
**seleXys	4.7 (3.0, 7.2)	8.0 (5.7, 11.3)	10.8 (7.6, 15.0)		

Identified and no longer used					
+Anatomic II/Duraloc Option	1.7 (0.2, 11.2)	6.7 (2.6, 16.8)	10.1 (4.7, 21.1)		
+Profemur TL/Dynasty	3.6 (0.9, 13.5)	5.8 (1.9, 17.1)			
+**Elite Plus	1.5 (1.1, 2.0)	2.8 (2.3, 3.5)	4.2 (3.5, 5.1)	7.7 (6.6, 8.8)	10.8 (9.2, 12.8)
+**Duraloc	1.8 (1.5, 2.2)	3.0 (2.6, 3.5)	4.0 (3.5, 4.6)	8.6 (7.8, 9.6)	14.3 (12.6, 16.1)
+**Durom	1.1 (0.7, 1.9)	3.6 (2.7, 4.8)	5.3 (4.2, 6.7)	12.7 (9.8, 16.5)	
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)	7.4 (3.8, 14.3)		
Friendly Hip/Cup (Exactech)	2.1 (0.5, 8.0)	3.2 (1.0, 9.5)	6.5 (3.0, 14.0)	15.0 (8.7, 25.1)	
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)	
Secur-Fit Plus/Secur-Fit	3.1 (1.4, 6.7)	7.3 (4.4, 11.9)	7.8 (4.8, 12.6)	10.1 (6.5, 15.3)	
Taperloc/M2a MoM	1.8 (0.9, 3.3)	4.3 (2.9, 6.5)	7.4 (5.4, 10.1)	12.8 (9.8, 16.5)	
*ABGII (exch neck)	4.1 (2.2, 7.5)	10.3 (7.1, 14.9)	18.2 (13.5, 24.2)		
*Adapter (cemented)	4.1 (1.9, 8.9)	9.1 (5.4, 15.2)	17.0 (11.6, 24.6)		
*Adapter (cementless)	3.2 (2.2, 4.8)	6.7 (5.1, 8.8)	11.6 (9.4, 14.3)		
*CBH Stem	4.1 (2.3, 7.2)	7.6 (5.0, 11.6)	9.9 (6.6, 14.9)		
*Edinburgh	6.0 (3.1, 11.7)	9.6 (5.6, 16.4)	12.6 (7.8, 20.2)		
*K2	5.2 (3.7, 7.3)	7.5 (5.7, 10.0)	9.9 (7.6, 12.7)		
*LYDERIC II	3.1 (1.3, 7.2)	5.7 (3.0, 10.6)	7.1 (4.0, 12.5)	13.2 (7.6, 22.3)	
*Margron	5.8 (4.3, 7.9)	8.4 (6.5, 10.8)	10.2 (8.2, 12.8)	15.1 (12.6, 18.2)	
*Mayo	3.0 (1.3, 7.0)	6.6 (3.7, 11.6)	6.6 (3.7, 11.6)		
*Metha (exch neck)	12.5 (7.1, 21.4)	13.6 (8.0, 22.8)	17.2 (9.7, 29.7)		
*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)	8.5 (4.8, 14.9)		
**Adept	4.1 (1.7, 9.6)	8.4 (4.6, 15.0)	9.4 (5.3, 16.4)		
**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 (22.9, 25.5)	47.6 (44.3, 51.0)	
**Bionik	3.6 (2.4, 5.5)	7.6 (5.7, 10.0)	14.1 (11.5, 17.2)		
**Cormet	1.4 (0.8, 2.5)	3.4 (2.3, 4.9)	5.2 (3.8, 7.0)	16.3 (12.6, 20.9)	
**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, 10.9)	12.5 (9.6, 16.3)		
**Inter-Op	12.1 (4.7, 29.1)	15.2 (6.6, 32.6)	21.4 (10.8, 39.8)	28.3 (15.8, 47.4)	
**MBA	4.0 (1.7, 9.4)	8.2 (4.5, 14.8)	10.2 (5.9, 17.2)	16.4 (10.1, 26.1)	
**Mitch TRH	1.5 (0.8, 2.7)	4.6 (3.3, 6.4)	7.6 (5.9, 9.9)		
**SPH-Blind	3.8 (2.8, 5.2)	5.8 (4.5, 7.5)	7.3 (5.8, 9.2)	10.3 (8.5, 12.5)	

Note: **Acetabular Component
* Femoral 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

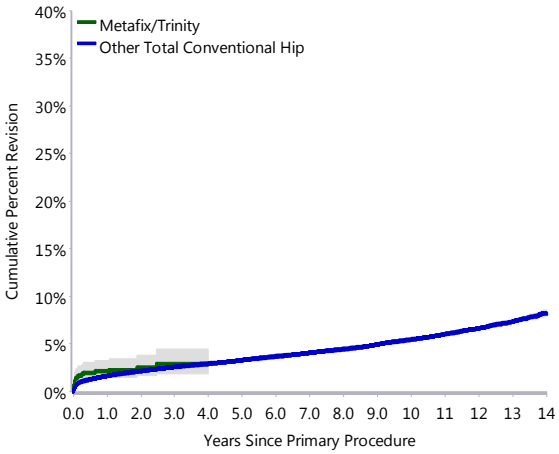
Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Newly Identified													
Metafix/Trinity									52	114	223	292	354
Profemur L/Dynasty												23	170
Taperloc Microplasty/Regenerex									12	14	12	2	3
**Delta-One-TT									4	7	6	15	37
**Furlong	27	4				4	7	61	90	84	73	76	64
Re-Identified and still used													
Corail/Trabecular Metal (Shell)						5	10	17	20	8	8	8	6
CPT/Fitmore			19	6	6	4	16	12	15	24	14	30	30
CPT/Low Profile Cup			15	9	8	7	7	6	9	16	26	20	6
*Emperion				1	13	21	26	65	87	72	44	53	38
*Excia (cementless)							6	34	8	47	58	38	17
*Furlong	27	4			1	35	80	73	61	59	53	37	33
*ML Taper Kinectiv							36	341	647	576	515	384	344
*MSA						2	3	11	58	76	46	21	7
*Novation								4	32	53	130	137	221
*Taper Fit	30	34	65	50	66	26	18	6	8	17	55	45	109
*Trabecular Metal					6	101	147	198	242	272	276	186	220
*UniSyn	1	14	41	74	32	38	46	48	36	23	19	23	27
**BHR	39	66	127	288	550	581	476	404	276	134	27	13	5
**Continuum								175	1117	1245	1332	1504	1475
**DeltaLox									32	86	72	24	8
**Fin II				39	127	175	251	269	318	287	205	247	96
**Plasmacup				10	16	13	7	54	60	59	77	69	44
**Procotyl L							8	32	268	342	67	26	119
**seleXys					35	41	27	21	53	70	89	57	27

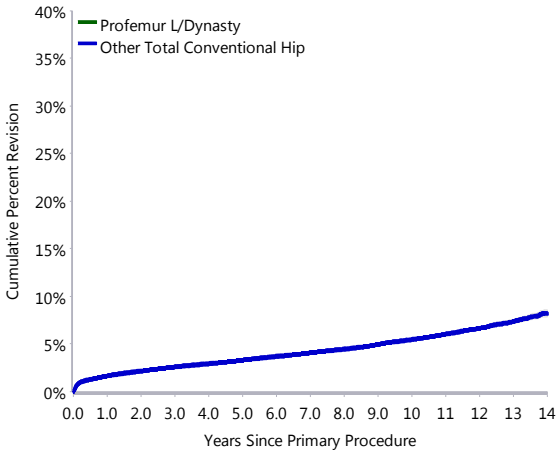
Identified and no longer used												
+Anatomic II/Duraloc Option				4	33	23						
+Profemur TL/Dynasty										29	27	
+**Elite Plus	1609	445	353	249	112	46	26			1		
+**Duraloc	2147	907	631	448	301	253	293	187	82	84	18	3
+**Durom		5	79	265	322	257	218	85	13	1		
Anca-Fit/Pinnacle					30	55	16					
Apex/Trilogy							17	39	30	22		
Friendly Hip/Cup (Exactech)	8	16	18	16	19	12	2	6				
F2L/Delta-PF			7	62	28	10						
H Moos/Mueller	19											
Secur-Fit Plus/Secur-Fit	101	27	21	26	22							
Taperloc/M2a MoM	18	79	113	74	38	43	76	49	23	2		
*ABGII (exch neck)						10	39	69	58	63	7	
*Adapter (cemented)				7	41	52	33	8	7			
*Adapter (cementless)				19	140	131	122	158	113	60		1
*CBH Stem			12	7	14	37	28	27	45	53	43	7
*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			
*Metha (exch neck)								20	53	15		
*Profemur Z			41	79	56	6	1	2	1			
**2000 Plus				11	23	42	14	18	25	2		
**Adept					19	20	29	30	11	12		
**Artek	179											
**ASR			84	584	958	1186	1179	430				
**Bionik				11	147	136	138	134	38	4		
**Cormet	9	53	74	103	114	73	129	124	93	26	4	1
**ExpanSys		1	7	24	30	8	1					
**Hedrocel	37	9										
**Icon			3	40	80	84	68	78	37	11		
**Inter-Op	33											
**MBA	49	29	19	11	9	5	2					
**Mitch TRH					45	274	164	130	82	37		
**SPH-Blind	376	262	205	41	49	19						

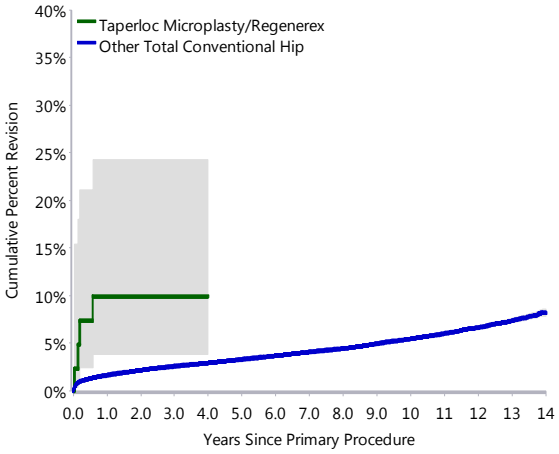
Note: * Femoral Component
** Acetabular Component
+ Newly identified and no longer used

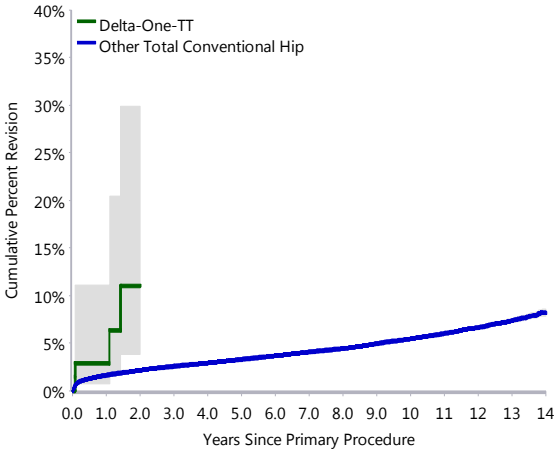
Figure IP3 Cumulative Percent Revision of Individual Total Conventional Hip Prostheses Newly Identified

Newly Identified









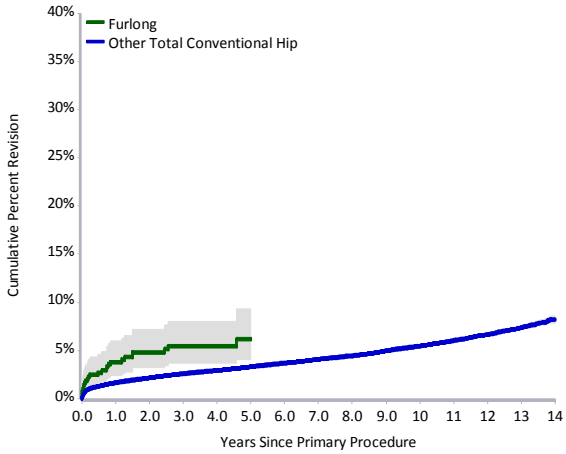
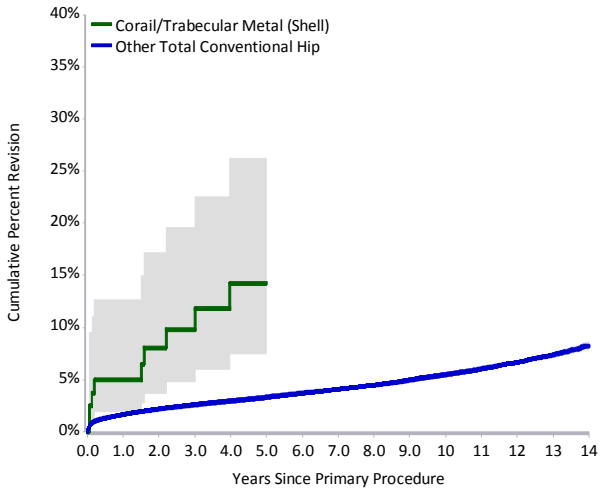
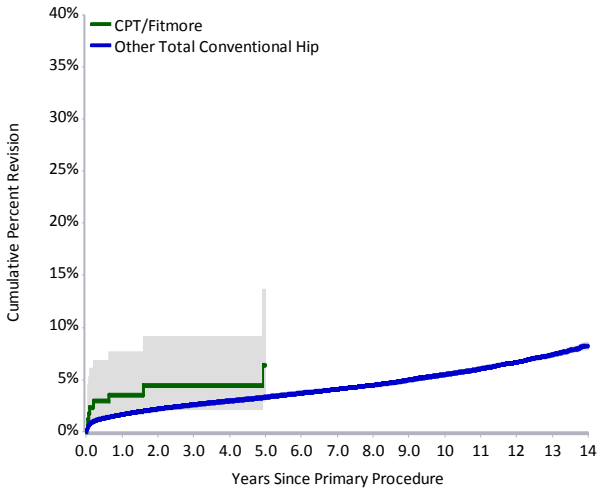
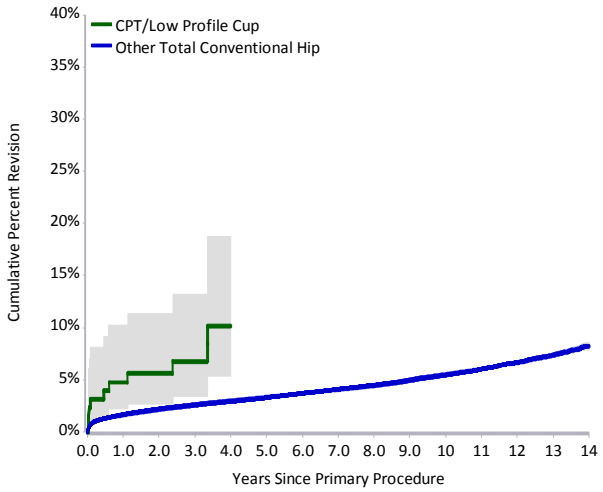


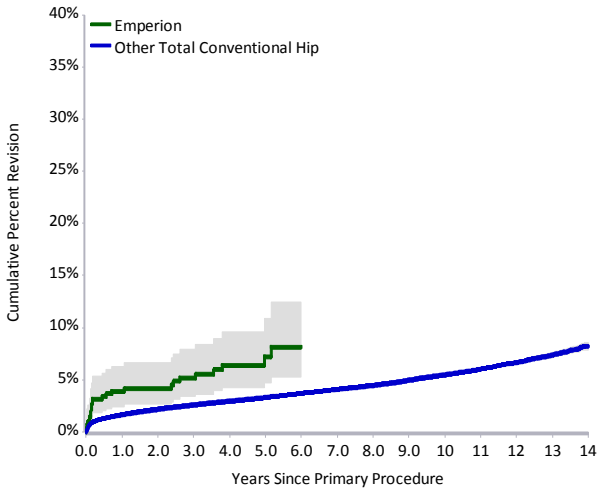
Figure IP4 Cumulative Percent Revision of Individual Total Conventional Hip Prostheses Re-identified and still used

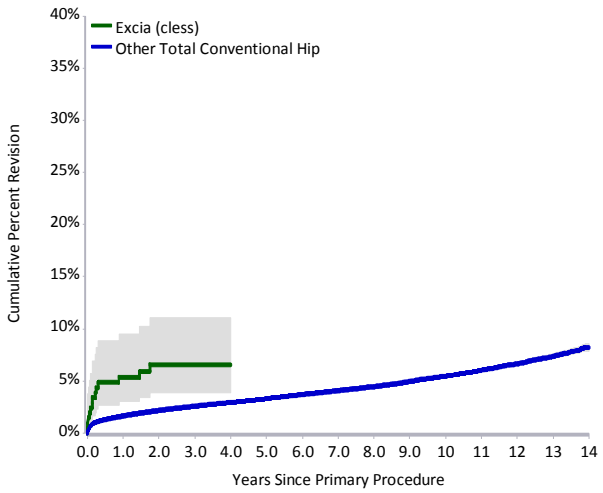
Re-identified and still used

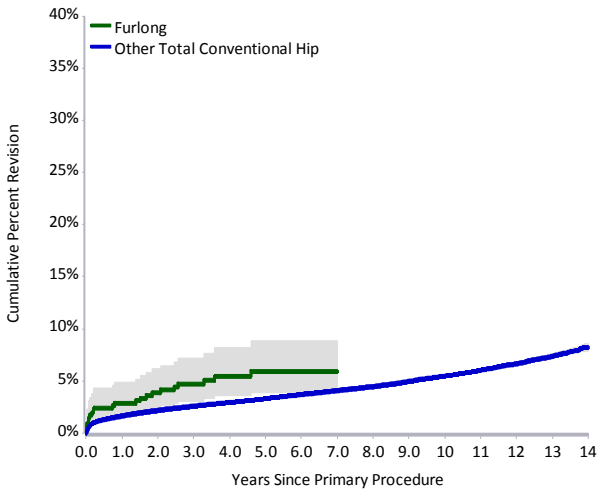


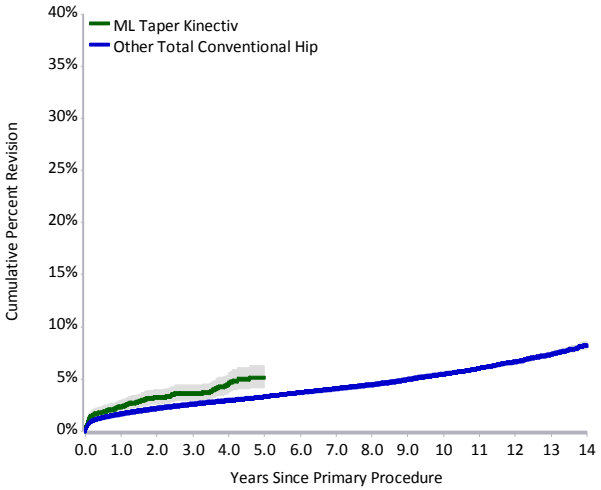


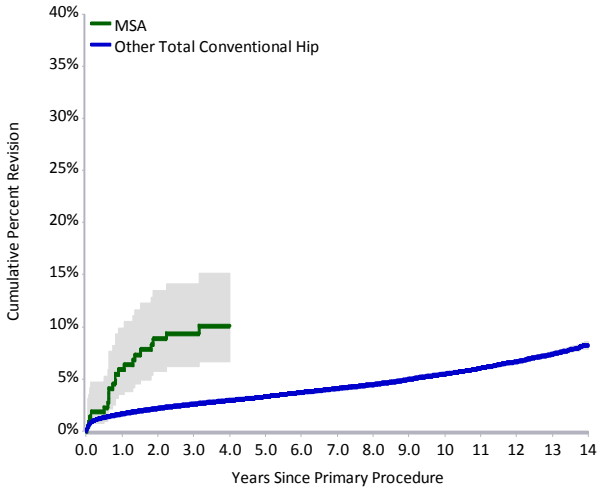


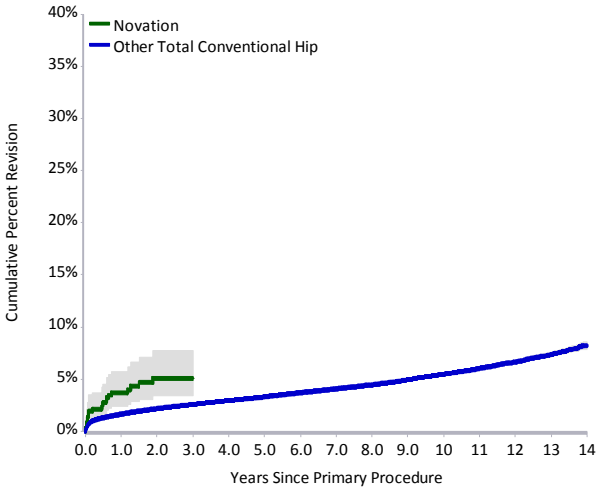


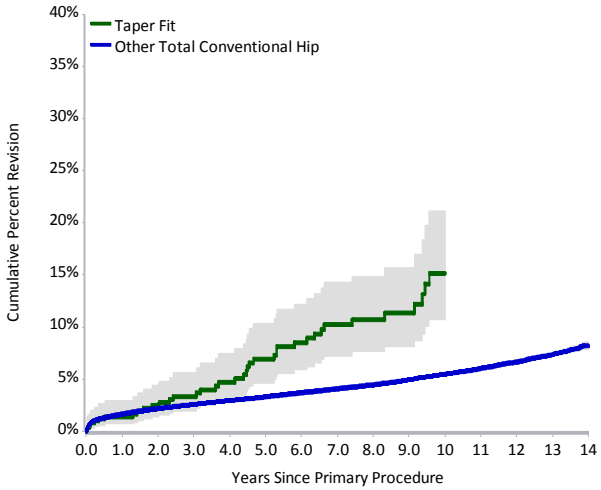


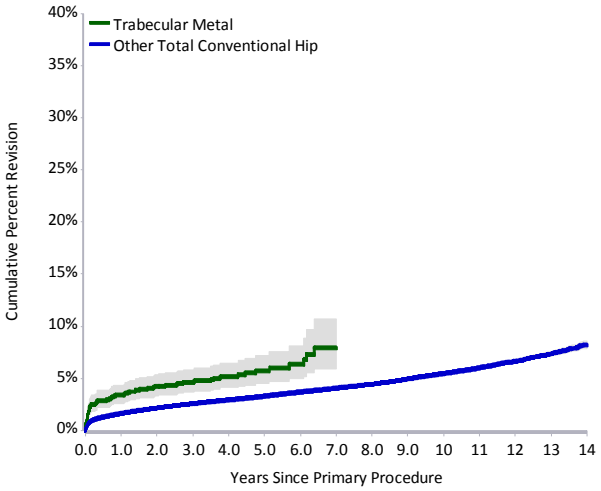


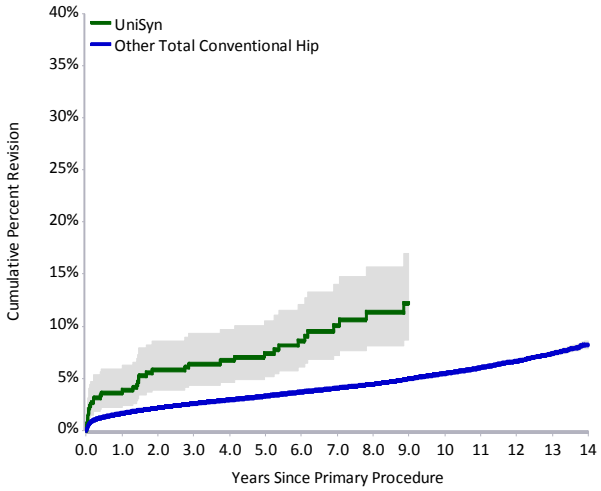

ML Taper Kinectiv
Other Total Conventional Hip
Cumulative Percent Revision
40%
35%
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12 13 14
Years Since Primary Procedure

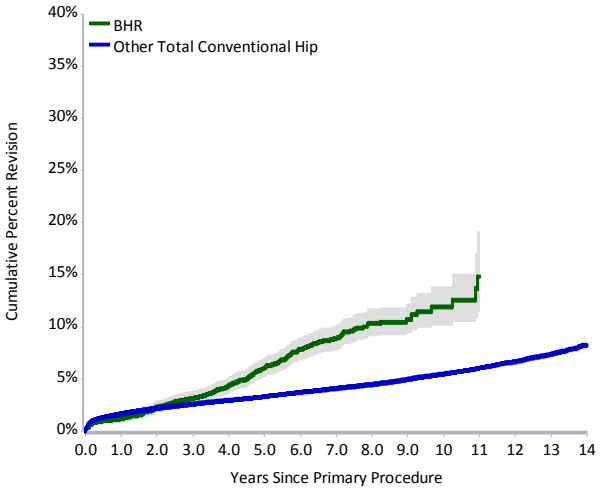

MSA
Other Total Conventional Hip
Cumulative Percent Revision
40%
35%
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12 13 14
Years Since Primary Procedure

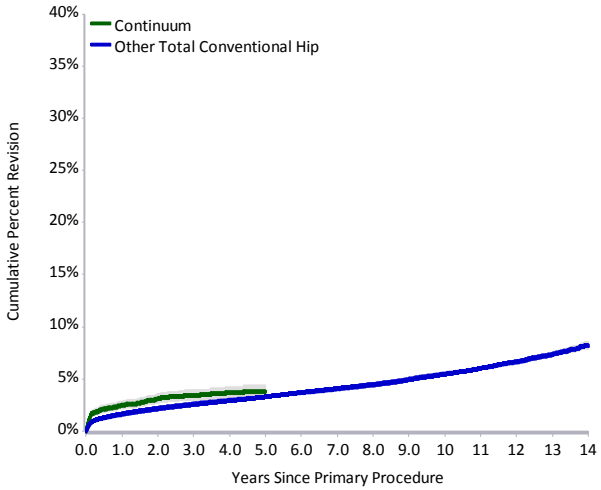

Novation
Other Total Conventional Hip
Cumulative Percent Revision
40%
35%
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12 13 14
Years Since Primary Procedure

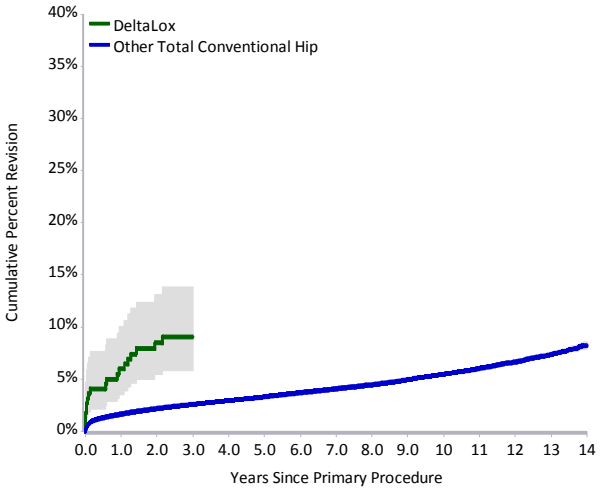

Taper Fit
Other Total Conventional Hip
Cumulative Percent Revision
40%
35%
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12 13 14
Years Since Primary Procedure

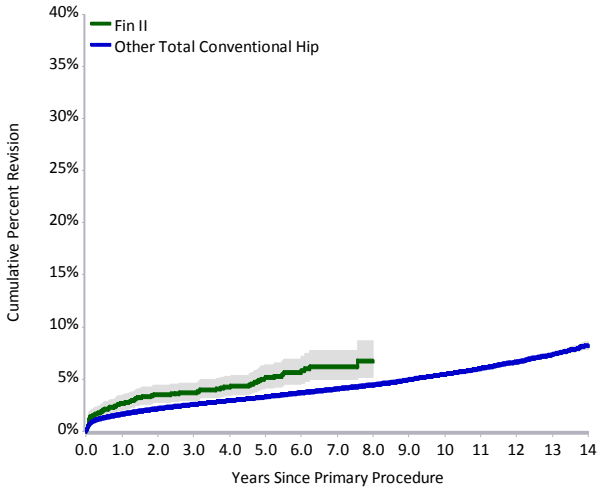

Trabecular Metal
Other Total Conventional Hip
Cumulative Percent Revision
40%
35%
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12 13 14
Years Since Primary Procedure

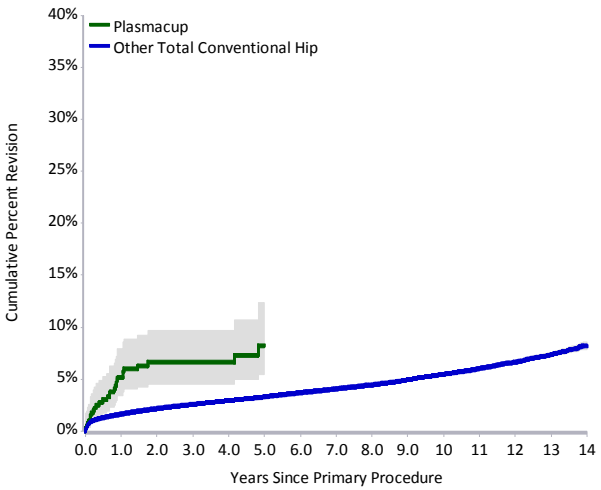

UniSyn
Other Total Conventional Hip
Cumulative Percent Revision
40%
35%
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12 13 14
Years Since Primary Procedure

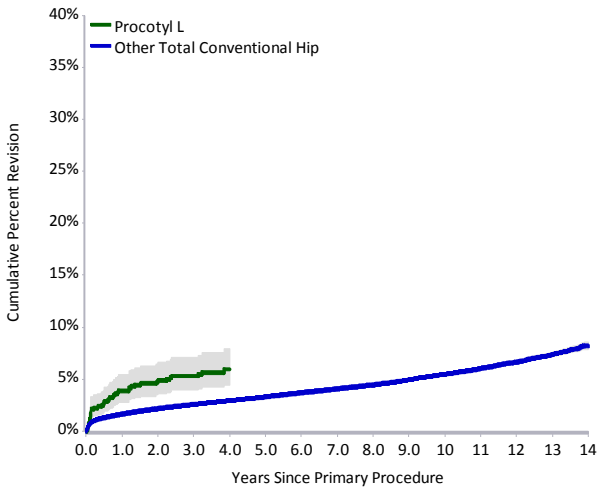

BHR
Other Total Conventional Hip
Cumulative Percent Revision
40%
35%
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12 13 14
Years Since Primary Procedure

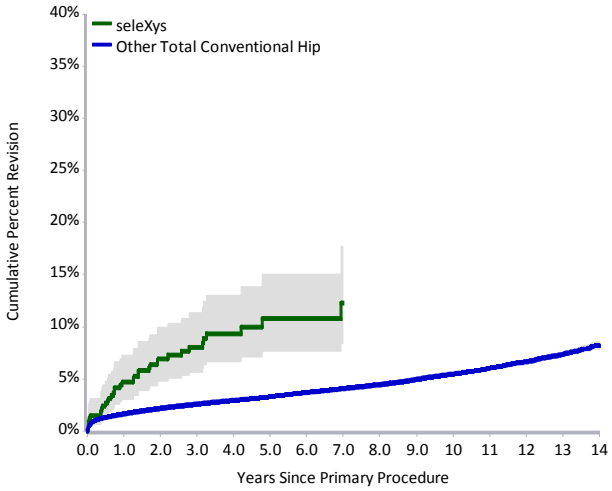

Continuum
Other Total Conventional Hip
Cumulative Percent Revision
40%
35%
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12 13 14
Years Since Primary Procedure


DeltaLox
Other Total Conventional Hip
Cumulative Percent Revision
40%
35%
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 14
Years Since Primary Procedure


Fin II
Other Total Conventional Hip
Cumulative Percent Revision
40%
35%
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 14
Years Since Primary Procedure


Plasmacup
Other Total Conventional Hip
Cumulative Percent Revision
40%
35%
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 14
Years Since Primary Procedure


Procotyl L
Other Total Conventional Hip
Cumulative Percent Revision
40%
35%
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 14
Years Since Primary Procedure


seleXys
Other Total Conventional Hip
Cumulative Percent Revision
40%
35%
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 14
Years Since Primary Procedure

Total Resurfacing

There are no total resurfacing prostheses identified for the first time this year.

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
Identified and no longer used				
ASR/ASR	1168	8585	3.65	0 - 3Mth: HR=1.77 (1.08, 2.91),p=0.024 3Mth - 3Yr: HR=2.40 (1.84, 3.14),p<0.001 3Yr - 4Yr: HR=4.76 (3.21, 7.07),p<0.001 4Yr - 4.5Yr: HR=6.83 (4.28, 10.91),p<0.001 4.5Yr - 5Yr: HR=8.72 (5.42, 14.04),p<0.001 5Yr+: HR=5.42 (4.44, 6.62),p<0.001
Bionik/Bionik	200	1176	3.57	Entire Period: HR=3.65 (2.68, 4.97),p<0.001
Cormet/Cormet	626	4584	2.01	Entire Period: HR=1.89 (1.53, 2.33),p<0.001
Durom/Durom	847	6760	1.24	0 - 4.5Yr: HR=1.71 (1.32, 2.23),p<0.001 4.5Yr+: HR=0.74 (0.48, 1.12),p=0.149
Recap/Recap	195	1258	1.91	Entire Period: HR=1.87 (1.25, 2.80),p=0.002
*Cormet 2000 HAP	95	932	2.15	Entire Period: HR=2.29 (1.47, 3.56),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	14 Yrs
Identified and no longer used					
ASR/ASR	3.4 (2.5, 4.6)	7.2 (5.9, 8.8)	15.2 (13.3, 17.4)	30.8 (27.7, 34.0)	
Bionik/Bionik	3.5 (1.7, 7.2)	12.0 (8.2, 17.4)	17.3 (12.7, 23.4)		
Cormet/Cormet	2.1 (1.2, 3.6)	5.6 (4.1, 7.8)	9.7 (7.6, 12.4)	16.8 (13.6, 20.7)	
Durom/Durom	3.2 (2.2, 4.6)	5.4 (4.1, 7.2)	7.5 (5.9, 9.5)	11.0 (8.9, 13.6)	
Recap/Recap	5.1 (2.8, 9.3)	8.7 (5.5, 13.7)	10.3 (6.8, 15.5)		
*Cormet 2000 HAP	6.3 (2.9, 13.5)	8.4 (4.3, 16.1)	9.5 (5.0, 17.4)	20.0 (13.3, 29.6)	

Note: * Resurfacing Head Component

Table IP12 Yearly Usage of Individual Total Resurfacing Hip Prostheses Identified as having a Higher than Anticipated Revision Rate

Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Identified and no longer used													
ASR/ASR		43	165	302	258	176	133	91					
Bionik/Bionik				12	33	33	46	54	20	2			
Cormet/Cormet	62	42	50	85	74	76	94	75	50	10	4	4	
Durom/Durom		58	166	207	143	105	88	46	24	10			
Recap/Recap			27	14	9	42	46	38	16	3			
*Cormet 2000 HAP	18	38	39										

Note: * Resurfacing Head Component

Primary Partial Knee Replacement

Patella/Trochlear

There are no patella/trochlear prostheses identified for the first time this year.

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	95	287	5.23	Entire Period: HR=1.82 (1.09, 3.06),p=0.023
**Vanguard	43	130	6.14	Entire Period: HR=2.02 (1.00, 4.07),p=0.049
Identified and no longer used				
**LCS	413	2839	4.75	Entire Period: HR=1.72 (1.41, 2.12),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	14 Yrs
Re-Identified and still used					
PFC Sigma/Sigma HP	4.5 (1.7, 11.7)	17.3 (10.3, 28.2)	26.1 (14.7, 43.7)		
**Vanguard	2.4 (0.3, 15.7)	19.2 (8.9, 38.4)	35.3 (17.5, 62.7)		
Identified and no longer used					
**LCS	3.9 (2.4, 6.2)	11.9 (9.1, 15.4)	20.7 (17.1, 25.0)	39.5 (33.6, 46.0)	

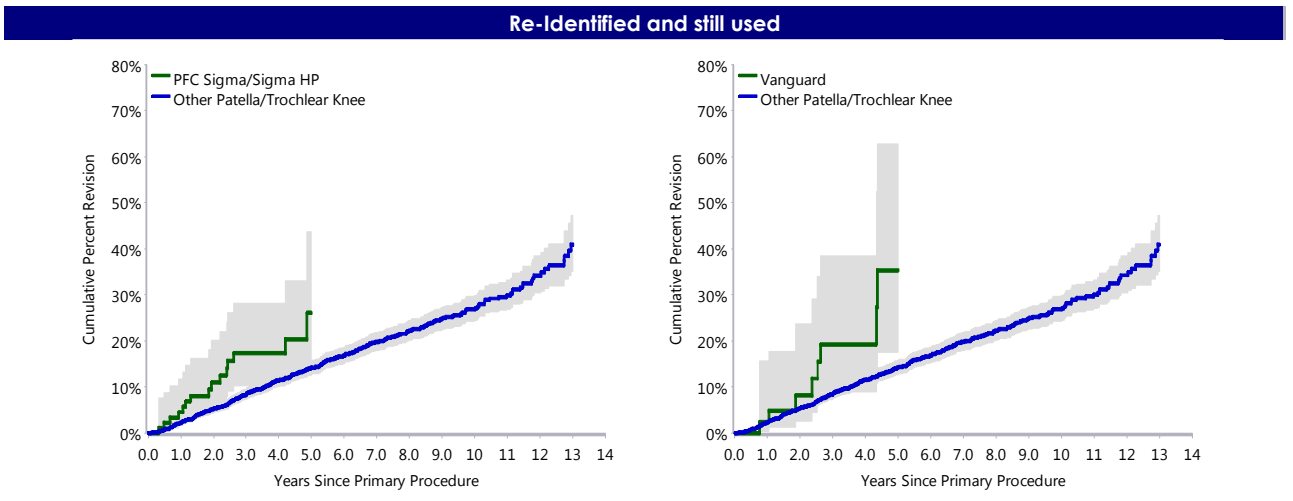
Note: ** Trochlear Component

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	2014
Re-Identified and still used													
PFC Sigma/Sigma HP						14	6	5	16	15	12	20	7
**Vanguard						4	5	2	1	13	3	14	1
Identified and no longer used													
**LCS	26	56	68	47	65	64	60	27					

Note: ** Trochlear Component

Figure IP5 Cumulative Percent Revision of Individual Patella/Trochlear Knee Prostheses Re-identified and still used



Unicompartmental

There are no unicompartmental knee prostheses identified for the first time this year.

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	74	158	6.95	Entire Period: HR=3.57 (1.97, 6.45),p<0.001
Uniglide/Uniglide	737	4790	2.44	0 - 1.5Yr: HR=2.03 (1.54, 2.68),p<0.001 1.5Yr+: HR=1.11 (0.87, 1.42),p=0.405
Identified and no longer used				
Advance/Advance	37	245	6.12	Entire Period: HR=3.95 (2.38, 6.56),p<0.001
BalanSys Uni/BalanSys Uni Mobile	199	1442	2.77	0 - 6Mth: HR=4.59 (2.28, 9.24),p<0.001 6Mth+: HR=1.39 (0.98, 1.96),p=0.065
Eius/Eius	142	1109	2.98	Entire Period: HR=1.45 (1.03, 2.04),p=0.034
**Preservation Mobile	400	3557	3.29	0 - 1.5Yr: HR=2.25 (1.61, 3.15),p<0.001 1.5Yr+: HR=1.60 (1.29, 2.00),p<0.001

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	14 Yrs
Re-Identified and still used					
GMK-UNI/GMK-UNI	7.8 (3.3, 17.7)	19.6 (10.7, 34.4)	26.3 (13.7, 47.0)		
Uniglide/Uniglide	4.9 (3.6, 6.8)	10.9 (8.8, 13.4)	13.0 (10.7, 15.7)	19.5 (16.3, 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)	41.8 (27.6, 59.6)	
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, 25.2)	24.1 (17.2, 33.0)	
**Preservation Mobile	5.3 (3.5, 7.9)	15.5 (12.3, 19.5)	19.1 (15.6, 23.3)	27.1 (23.0, 31.9)	

Note: ** Unicompartmental Tibial Component

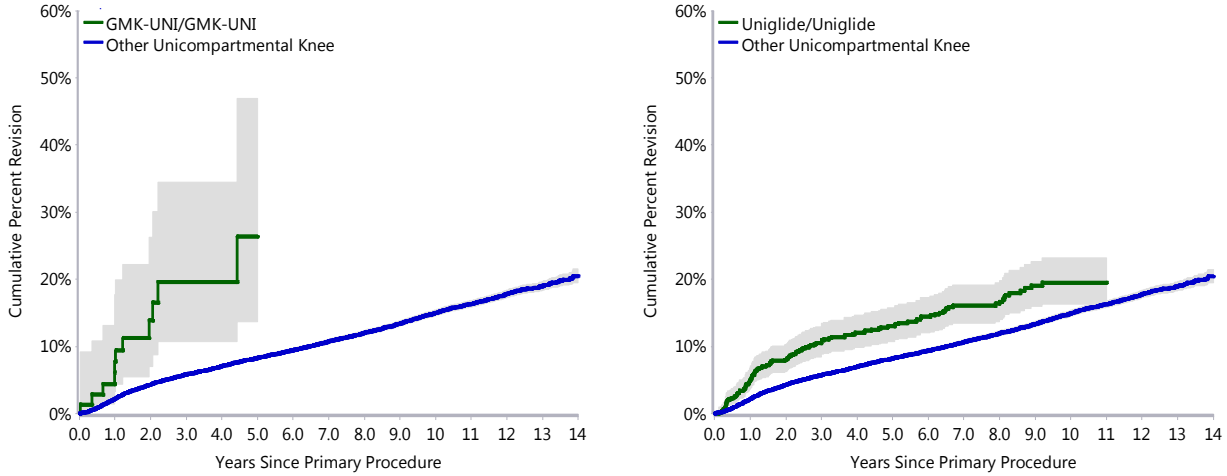
Table IP18 Yearly Usage of Individual Unicompartmental Knee Prostheses Identified as having a Higher than Anticipated Revision Rate

Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Re-Identified and still used													
GMK-UNI/GMK-UNI							5	10	2		21	22	14
Uniglide/Uniglide		80	66	123	84	107	93	61	30	38	25	22	8
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							

Note: ** Unicompartmental Tibial Component

Figure IP6 Cumulative Percent Revision of Individual Unicompartmental Knee Prostheses Re-identified and still used

Re-identified and still used



Primary Total Knee Replacement

There are no total knee prostheses identified for the first time this year.

In previous years, the ACS/ACS combination has been identified as having a higher than anticipated rate of revision. This year, this combination is reported separately by bearing mobility, ACS Fixed and ACS Mobile. Both have a higher than anticipated rate of revision.

This year the Registry has separated the Journey Oxinium from other Journey knees. As a result only the Journey Oxinium is identified as having a higher than anticipated rate of revision. This prosthesis is no longer used.

The Optetrak-CR (cemented)/Optetrak (cemented) combination is no longer identified. This was newly identified last year and there have been an additional 43 procedures and no further revisions. It no longer has a higher than anticipated rate of revision.

The Genesis II CR (cementless)/ Genesis II (cementless) is no longer identified. There have been an additional 57 procedures and one further revision. It no longer has a higher than anticipated rate of revision.

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-2015.

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
Re-Identified and still used				
ACS/ACS Fixed	968	1233	2.11	Entire Period: HR=1.97 (1.34, 2.89),p<0.001
ACS/ACS Mobile	797	1457	2.06	Entire Period: HR=2.18 (1.53, 3.12),p<0.001
Advance/Advance	566	2266	1.37	Entire Period: HR=1.69 (1.18, 2.40),p=0.003
Buechel-Pappas/Buechel-Pappas	478	2436	1.48	Entire Period: HR=1.89 (1.36, 2.62),p<0.001
Columbus/Columbus	1016	4696	1.66	Entire Period: HR=2.31 (1.85, 2.88),p<0.001
E.Motion/E.Motion	684	1474	2.37	Entire Period: HR=2.45 (1.76, 3.42),p<0.001
GMK Primary (cless)/GMK Primary (cless)	482	658	2.43	Entire Period: HR=2.36 (1.45, 3.85),p<0.001
Optetrak-PS/Optetrak	2369	13554	1.20	Entire Period: HR=1.76 (1.51, 2.05),p<0.001
Optetrak-PS/Optetrak-RBK	845	3983	1.51	Entire Period: HR=2.15 (1.67, 2.77),p<0.001
Score (cless)/Score (cless)	1433	4389	1.39	Entire Period: HR=1.39 (1.08, 1.79),p=0.009
Scorpio NRG PS (cless)/Series 7000 (cless)	924	3862	1.58	Entire Period: HR=1.73 (1.34, 2.22),p<0.001
Trekking/Trekking	485	991	1.92	0 - 1.5Yr: HR=2.34 (1.44, 3.81),p<0.001 1.5Yr+: HR=0.90 (0.29, 2.81),p=0.862
Vanguard PS/Maxim	3577	12108	1.31	Entire Period: HR=1.59 (1.36, 1.86),p<0.001
Vanguard PS/Regenerex	241	818	1.47	0 - 1Yr: HR=3.41 (1.77, 6.56),p<0.001 1Yr+: HR=0.59 (0.19, 1.82),p=0.356
*LCS PS	636	2245	2.14	Entire Period: HR=2.59 (1.95, 3.44),p<0.001

Identified and no longer used				
AMK/AMK	203	2119	1.09	Entire Period: HR=2.00 (1.33, 3.02),p<0.001
Eska RP/Eska RP	40	242	3.31	Entire Period: HR=5.48 (2.74, 10.96),p<0.001
Gemini MK II/Gemini MK II	21	179	3.91	Entire Period: HR=6.26 (2.98, 13.13),p<0.001
Genesis (ctd)/Genesis (ctd)	62	562	1.60	Entire Period: HR=3.01 (1.57, 5.79),p<0.001
Genesis II CR (class)/Profix Mobile (ctd)	241	1930	1.30	Entire Period: HR=2.22 (1.50, 3.29),p<0.001
Genesis II Oxinium CR (class)/Genesis II	110	744	6.05	0 - 1Yr: HR=10.19 (5.91, 17.56),p<0.001 1Yr - 1.5Yr: HR=17.90 (9.90, 32.36),p<0.001 1.5Yr - 2.5Yr: HR=20.40 (12.28, 33.89),p<0.001 2.5Yr+: HR=2.41 (1.08, 5.37),p=0.031
Genesis II Oxinium CR (class)/Profix Mobile	88	470	11.70	0 - 6Mth: HR=7.74 (2.90, 20.64),p<0.001 6Mth - 9Mth: HR=46.24 (25.54, 83.73),p<0.001 9Mth - 1.5Yr: HR=32.08 (20.89, 49.27),p<0.001 1.5Yr - 2Yr: HR=26.76 (12.74, 56.22),p<0.001 2Yr+: HR=6.73 (3.82, 11.85),p<0.001
Genesis II Oxinium PS (ctd)/Genesis II (class)	56	214	7.94	Entire Period: HR=8.28 (5.15, 13.29),p<0.001
Genesis II Oxinium PS (ctd)/Genesis II (keel)	269	1818	3.14	Entire Period: HR=4.70 (3.62, 6.10),p<0.001
HLS Noetos/HLS Noetos	294	1549	1.87	Entire Period: HR=2.54 (1.77, 3.66),p<0.001
IB II/IB II	199	2062	1.50	0 - 2Yr: HR=0.80 (0.26, 2.49),p=0.703 2Yr - 2.5Yr: HR=4.42 (1.43, 13.74),p=0.010 2.5Yr+: HR=4.24 (2.86, 6.28),p<0.001
Interax/Interax	52	474	2.32	0 - 3.5Yr: HR=1.40 (0.35, 5.60),p=0.634 3.5Yr+: HR=8.57 (4.46, 16.45),p<0.001
Journey Oxinium/Journey	3030	13703	1.37	0 - 3Mth: HR=0.30 (0.10, 0.94),p=0.039 3Mth - 1.5Yr: HR=1.79 (1.42, 2.25),p<0.001 1.5Yr - 2Yr: HR=1.46 (0.93, 2.29),p=0.102 2Yr+: HR=2.13 (1.74, 2.62),p<0.001
Optetrak-PS/Optetrak-PS	55	376	3.46	Entire Period: HR=6.02 (3.50, 10.37),p<0.001
Profix Oxinium (ctd)/Profix Mobile	228	2168	1.11	Entire Period: HR=1.63 (1.09, 2.43),p=0.016
Profix Oxinium (class)/Profix Mobile	158	1049	6.67	Entire Period: HR=10.21 (8.07, 12.91),p<0.001
Profix Oxinium (class)/Profix	75	533	5.82	Entire Period: HR=8.32 (5.85, 11.83),p<0.001
Profix/Profix Mobile	1005	8676	1.16	Entire Period: HR=1.96 (1.61, 2.38),p<0.001
Rotaglide Plus/Rotaglide Plus	631	5619	1.14	0 - 1.5Yr: HR=1.19 (0.68, 2.10),p=0.540 1.5Yr - 2Yr: HR=2.90 (1.45, 5.81),p=0.002 2Yr+: HR=2.19 (1.63, 2.94),p<0.001
SAL/SAL	56	591	1.52	0 - 8.5Yr: HR=1.39 (0.52, 3.70),p=0.512 8.5Yr+: HR=6.99 (2.90, 16.84),p<0.001
Trac/Trac	138	1376	1.67	Entire Period: HR=2.81 (1.87, 4.24),p<0.001
*LCS Duofix	4866	30680	1.78	0 - 2Yr: HR=1.74 (1.50, 2.01),p<0.001 2Yr+: HR=3.56 (3.20, 3.95),p<0.001
*Renasys	121	927	1.40	Entire Period: HR=2.30 (1.34, 3.96),p=0.002

Note: All Components have been compared to all other Total Knee components.
* Femoral Component

Table IP20 Cumulative Percent Revision of Individual Total Knee Prostheses Identified as having a Higher than Anticipated Revision Rate

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	14 Yrs
Re-Identified and still used					
ACS/ACS Fixed	2.0 (1.2, 3.3)	5.3 (3.4, 8.2)			
ACS/ACS Mobile	2.2 (1.3, 3.7)	5.1 (3.4, 7.6)			
Advance/Advance	2.4 (1.3, 4.1)	5.2 (3.6, 7.7)	6.3 (4.2, 9.4)	11.8 (7.2, 19.2)	
Buechel-Pappas/Buechel-Pappas	1.9 (1.0, 3.7)	5.6 (3.8, 8.1)	8.0 (5.8, 11.1)		
Columbus/Columbus	2.1 (1.4, 3.2)	6.4 (5.0, 8.2)	8.3 (6.6, 10.4)		
E.Motion/E.Motion	3.0 (1.9, 4.6)	7.3 (5.1, 10.3)			
GMK Primary (cless)/GMK Primary (cless)	2.2 (1.1, 4.3)				
Optetrak-PS/Optetrak	1.5 (1.1, 2.1)	4.8 (4.0, 5.8)	6.7 (5.7, 7.9)	9.8 (8.3, 11.6)	
Optetrak-PS/Optetrak-RBK	2.4 (1.5, 3.8)	6.1 (4.6, 8.1)	7.6 (5.9, 9.9)		
Score (cless)/Score (cless)	1.2 (0.7, 1.9)	4.9 (3.7, 6.5)	6.4 (5.0, 8.3)		
Scorpio NRG PS (cless)/Series 7000 (cless)	1.2 (0.7, 2.2)	6.2 (4.7, 8.1)	7.9 (6.2, 10.1)		
Trekking/Trekking	3.0 (1.7, 5.1)	4.7 (2.9, 7.5)			
Vanguard PS/Maxim	1.8 (1.4, 2.3)	4.7 (4.0, 5.5)	5.8 (5.0, 6.9)		
Vanguard PS/Regenerex	3.9 (2.1, 7.4)	5.4 (3.1, 9.3)			
*LCS PS	2.0 (1.1, 3.5)	7.2 (5.3, 9.6)	9.6 (7.2, 12.7)		
Identified and no longer used					
AMK/AMK	1.0 (0.2, 3.9)	5.0 (2.7, 9.1)	6.6 (3.9, 11.1)	11.3 (7.5, 16.9)	13.5 (9.0, 20.0)
Eska RP/Eska RP	7.5 (2.5, 21.5)	12.7 (5.5, 27.9)	18.2 (9.1, 34.5)		
Gemini MK II/Gemini MK II	9.5 (2.5, 33.0)	14.3 (4.8, 38.0)	23.8 (10.7, 48.1)	23.8 (10.7, 48.1)	
Genesis (ctd)/Genesis (ctd)	0.0 (0.0, 0.0)	6.7 (2.6, 16.8)	10.0 (4.6, 20.9)	16.1 (8.6, 28.9)	
Genesis II CR (cless)/Profix Mobile (ctd)	2.9 (1.4, 6.1)	7.6 (4.8, 12.0)	9.1 (6.0, 13.8)	12.4 (8.5, 18.0)	
Genesis II Oxinium CR (cless)/Genesis II	11.9 (7.1, 19.7)	39.2 (30.7, 49.1)	40.2 (31.6, 50.1)	41.2 (32.5, 51.2)	
Genesis II Oxinium CR (cless)/Profix Mobile	24.0 (16.3, 34.4)	52.8 (42.8, 63.5)	57.4 (47.4, 67.9)	61.1 (51.0, 71.3)	
Genesis II Oxinium PS (ctd)/Genesis II (cless)	19.6 (11.4, 32.7)	26.8 (17.1, 40.4)	30.5 (20.2, 44.4)		
Genesis II Oxinium PS (ctd)/Genesis II (keel)	4.5 (2.6, 7.7)	14.5 (10.8, 19.3)	18.7 (14.5, 23.9)		
HLS Noetos/HLS Noetos	3.4 (1.8, 6.2)	8.3 (5.6, 12.1)	10.0 (7.0, 14.2)		
IB II/IB II	0.0 (0.0, 0.0)	3.6 (1.7, 7.3)	7.8 (4.8, 12.7)	15.4 (10.9, 21.5)	
Interax/Interax	0.0 (0.0, 0.0)	2.0 (0.3, 13.4)	8.3 (3.2, 20.7)	13.0 (6.0, 26.8)	
Journey Oxinium/Journey	1.4 (1.0, 1.8)	4.5 (3.8, 5.3)	6.4 (5.5, 7.5)		
Optetrak-PS/Optetrak-PS	1.8 (0.3, 12.2)	16.4 (8.9, 29.1)	20.0 (11.6, 33.3)		
Profix Oxinium (ctd)/Profix Mobile	1.8 (0.7, 4.6)	6.3 (3.8, 10.4)	8.6 (5.5, 13.1)	10.9 (7.5, 15.9)	
Profix Oxinium (cless)/Profix Mobile	9.0 (5.4, 14.6)	40.2 (32.9, 48.3)	41.5 (34.2, 49.7)	46.0 (38.4, 54.3)	
Profix Oxinium (cless)/Profix	13.3 (7.4, 23.4)	36.1 (26.4, 48.1)	37.5 (27.6, 49.5)	42.0 (31.7, 54.2)	
Profix/Profix Mobile	2.3 (1.5, 3.4)	6.4 (5.0, 8.1)	8.2 (6.6, 10.1)	10.1 (8.3, 12.2)	
Rotaglide Plus/Rotaglide Plus	0.8 (0.3, 1.9)	4.1 (2.8, 6.0)	5.8 (4.2, 8.0)	11.1 (8.7, 14.1)	
SAL/SAL	0.0 (0.0, 0.0)	1.9 (0.3, 12.6)	1.9 (0.3, 12.6)	14.8 (7.3, 28.6)	
Trac/Trac	2.2 (0.7, 6.6)	5.9 (3.0, 11.4)	9.0 (5.2, 15.2)	15.1 (9.9, 22.7)	
*LCS Duofix	1.5 (1.2, 1.9)	5.9 (5.3, 6.6)	9.6 (8.8, 10.5)		
*Renasys	2.5 (0.8, 7.5)	4.2 (1.8, 9.8)	8.5 (4.6, 15.1)		

Note: * Femoral Component

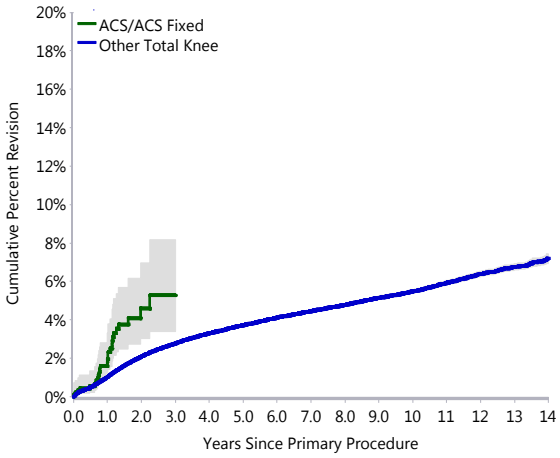
Table IP21 Yearly Usage of Individual Total Knee Prostheses Identified as having a Higher than Anticipated Revision Rate

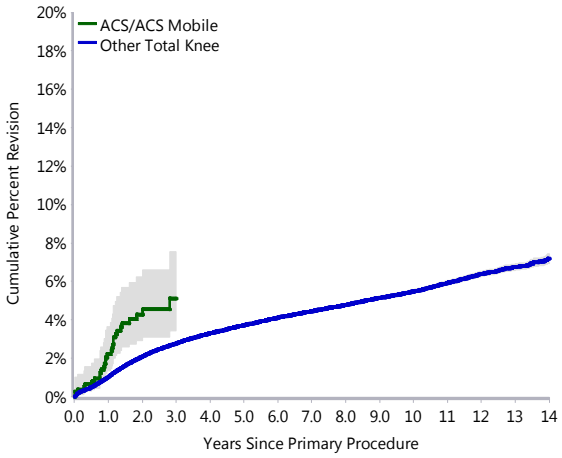
Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Re-Identified and still used													
ACS/ACS Fixed										49	151	354	414
ACS/ACS Mobile										132	251	218	196
Advance/Advance	54		8	12	16	2	5	43	115	138	74	7	92
Buechel-Pappas/Buechel-Pappas				1	39	51	84	100	148	44	4		7
Columbus/Columbus				49	92	89	148	156	134	136	108	69	35
E.Motion/E.Motion								12	87	114	129	236	106
GMK Primary (class)/GMK Primary (class)									3	3	110	192	174
Optetrak-PS/Optetrak	126	130	155	252	253	216	168	202	198	202	200	150	117
Optetrak-PS/Optetrak-RBK				1	81	173	166	119	82	40	37	50	96
Score (class)/Score (class)				1		11	135	212	187	204	195	238	250
Scorpio NRG PS (class)/Series 7000 (class)						76	185	171	166	114	68	71	73
Trekking/Trekking									35	102	133	107	108
Vanguard PS/Maxim				22	82	146	318	424	479	600	561	442	503
Vanguard PS/Regenerex								4	121	54	27	15	20
*LCS PS							8	157	203	109	51	69	39
Identified and no longer used													
AMK/AMK	200	2	1										
Eska RP/Eska RP				9	24	5		2					
Gemini MK II/Gemini MK II	14	7											
Genesis (ctd)/Genesis (ctd)	45	6	3	8									
Genesis II CR (class)/Profix Mobile (ctd)	126	26	10	4	2	5	12	6	9	17	2	22	
Genesis II Oxinium CR (class)/Genesis II	4	106											
Genesis II Oxinium CR (class)/Profix Mobile	22	66											
Genesis II Oxinium PS (ctd)/Genesis II (class)						4	4	11	35	1	1		
Genesis II Oxinium PS (ctd)/Genesis II (keel)				19	123	127							
HLS Noetos/HLS Noetos			2	2	47	45	45	56	48	28	20	1	
IB II/IB II	187	12											
Interax/Interax	52												
Journey Oxinium/Journey					134	337	541	555	464	333	341	325	
Optetrak-PS/Optetrak-PS			8	14	18	15							
Profix Oxinium (ctd)/Profix Mobile	72	31	91	24	3	4	1	2					
Profix Oxinium (class)/Profix Mobile	63	95											
Profix Oxinium (class)/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	1531	854	1				
*Renasys				51	53	3	14						

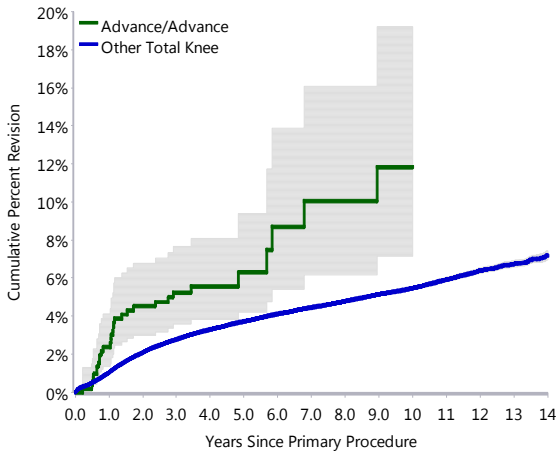
Note: * Femoral Component

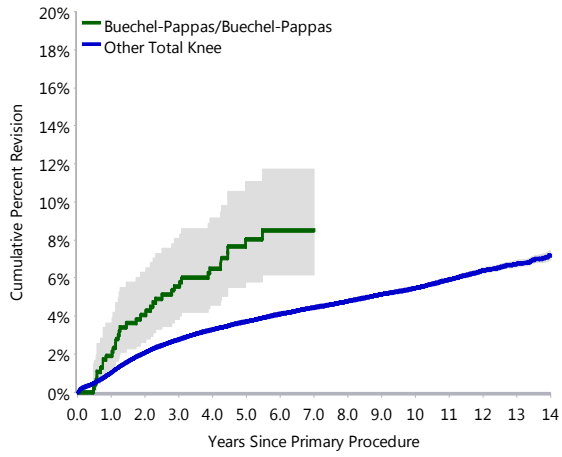
Figure IP7 Cumulative Percent Revision of Individual Total Knee Prostheses Re-identified and still used

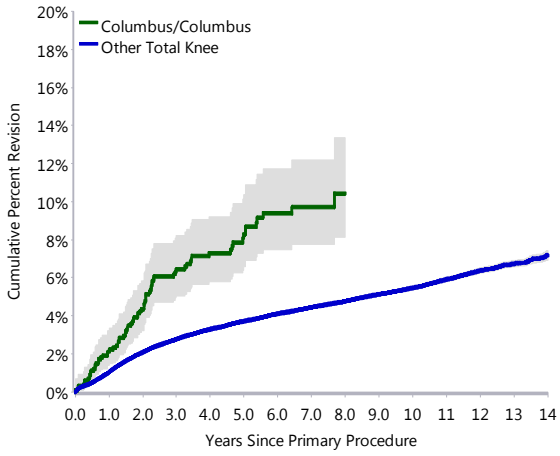
Re-identified and still used

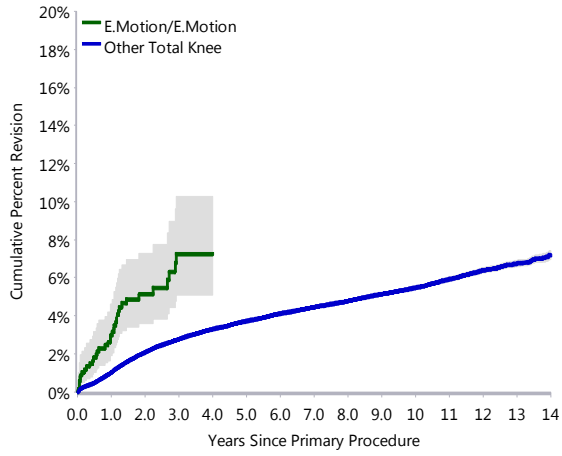


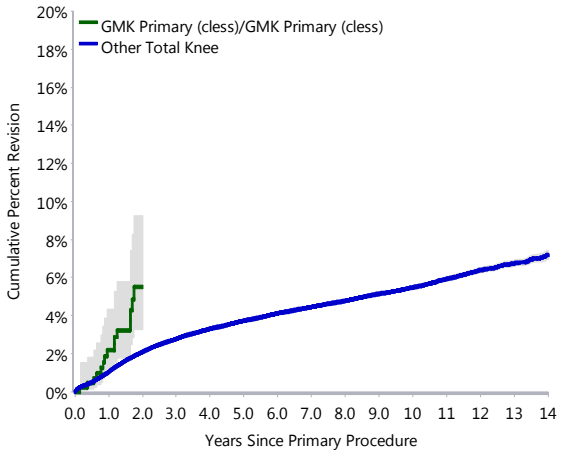


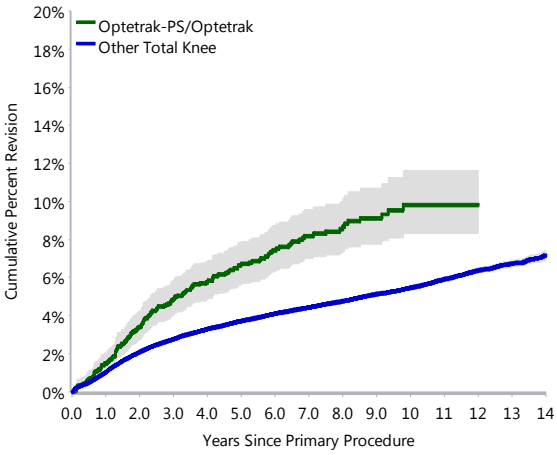


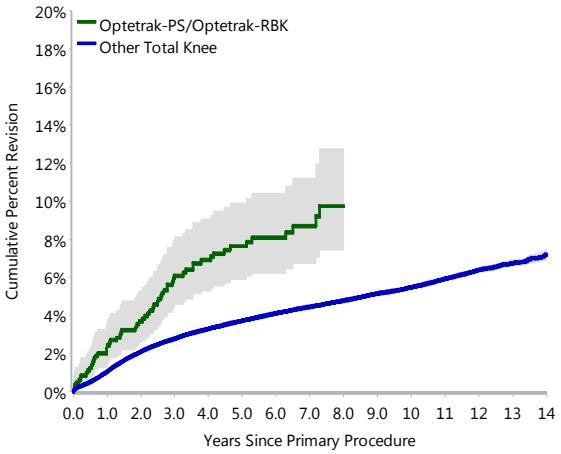


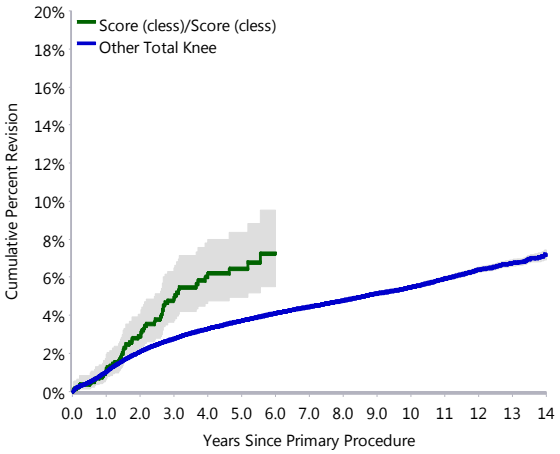


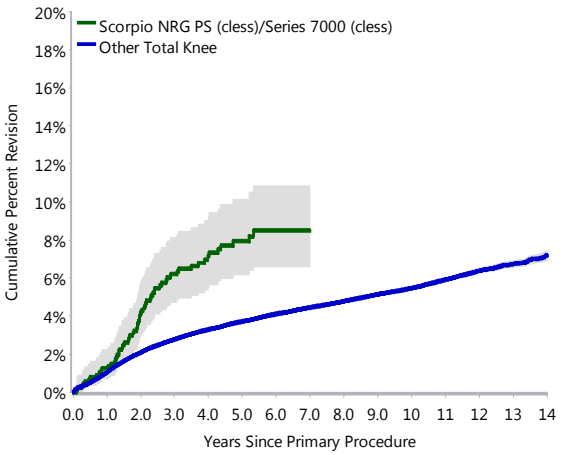


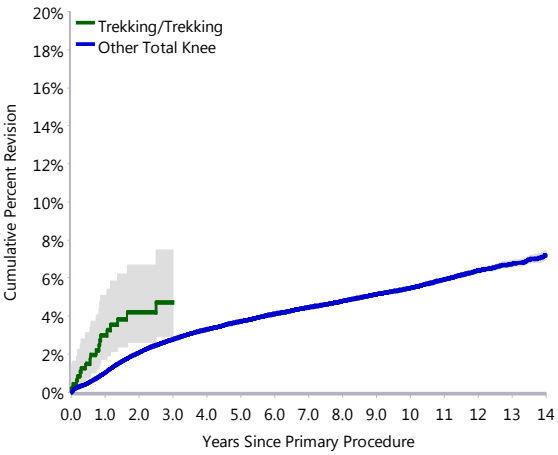

GMK Primary (class)/GMK Primary (class)
Other Total Knee
Cumulative Percent Revision
Years Since Primary Procedure

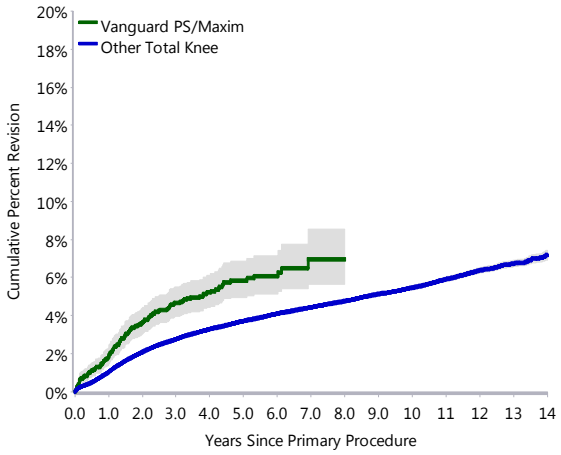

Optetrak-PS/Optetrak
Other Total Knee
Cumulative Percent Revision
Years Since Primary Procedure

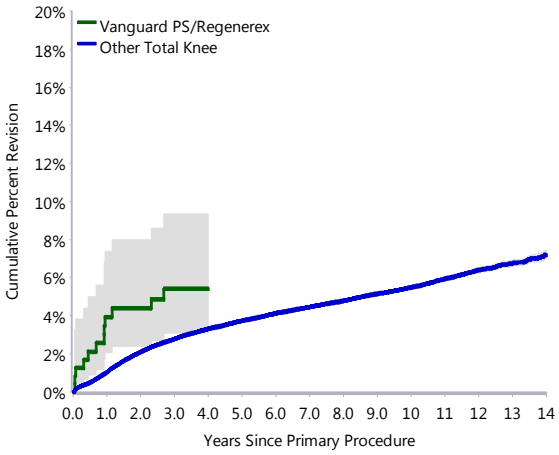

Optetrak-PS/Optetrak-RBK
Other Total Knee
Cumulative Percent Revision
Years Since Primary Procedure

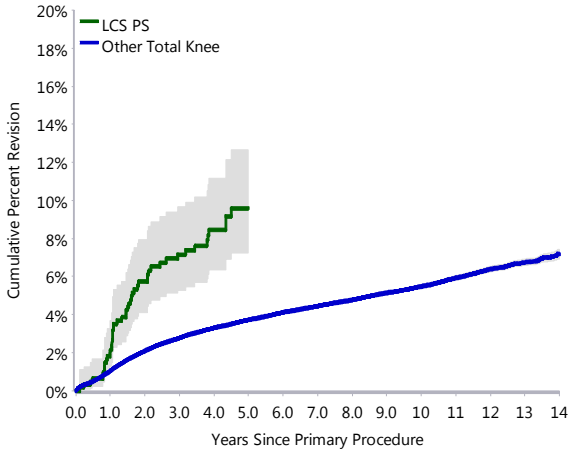

Score (class)/Score (class)
Other Total Knee
Cumulative Percent Revision
Years Since Primary Procedure


Scorpio NRG PS (class)/Series 7000 (class)
Other Total Knee
Cumulative Percent Revision
Years Since Primary Procedure


Trekking/Trekking
Other Total Knee
Cumulative Percent Revision
Years Since Primary Procedure


Vanguard PS/Maxim
Other Total Knee
Cumulative Percent Revision
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
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 14
Years Since Primary Procedure


Vanguard PS/Regenerex
Other Total Knee
Cumulative Percent Revision
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
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 14
Years Since Primary Procedure


LCS PS
Other Total Knee
Cumulative Percent Revision
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
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 14
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	Satish Singh
Mildura Base Hospital	Katrina Allen
Monash Medical Centre, Clayton	Candice Brown
Monash Medical Centre, Moorabbin	Carol Jackson/Lisa Mason
Northeast Health Wangaratta	Lynn Reid/Larissa Laverty
Peninsula Health Service, Frankston	Donna Anderson
Portland Hospital	Julie Sealey
Sandringham & District Memorial	Rebecca Harouche
Seymour District Memorial Hospital	Karen Lamaro
South West Healthcare	Tony Kelly
St Vincent's Public Hospital	Shazeli Osman/Ridwan Khaan
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	Candice Dawson
West Gippsland Healthcare Group	Stefanie Backman/Bernie Norman
West Wimmera Health Service	Sharon Sanderson/Christine Dufty
Western Hospital	Vicki Mahaljcek/Cassandra Mules
Williamstown Hospital	Paul Buso/Maureen Clark
Wimmera Health Care Group	Maree Markby

PRIVATE HOSPITALS

Beleura Private Hospital	Jean Leyland
Bellbird Private Hospital	Belinda Van Denberg
Cabrini Private Hospital, Brighton	Jodie Reynolds
Cabrini Private Hospital, Malvern	Jodie Reynolds
Como Private Hospital	Gillian Wilson/Nicole Groves
Cotham Private Hospital	Marianne Westley
Epworth Hospital	Lynne Moyes
Epworth Eastern Hospital	Kylie Longley/Janine Cope
Epworth Freemason Hospital	Claudia Nozzolillo
Essendon Private Hospital	Elaine Jordan
Geelong Private Hospital	Wilna Steyn
Glenferrie Private Hospital	Samantha Jervois
John Fawkner Hospital	Belinda Emmett
Knox Private Hospital	Bronwyn Hawkins/Laura Tilley
Linacre Private Hospital	Melissa Dillon/Denice Tyler
Maryvale Private Hospital	Glenda Chambers
Masada Private Hospital	Anna Bonato/Lisa Butler
Melbourne Private Hospital	Karen Grant/Tracey Perkins
Mildura Private Hospital	Kylie Fisher
Mitcham Private Hospital	Julie Nankivell/Joshie Lonthyil
Northpark Private Hospital	Esther Nielsen
Peninsula Private Hospital	Ruth Honan
Ringwood Private Hospital	Carol Burns
Shepparton Private Hospital	Niki Miller
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 Dellevirgini
St Vincent's Private Kew	Sue Ziduinas/Nicole Campbell
The Avenue Hospital	Annellen Watson
The Bays	Romany Goonan
The Melbourne East Private	Jay Phillpotts
The Valley Private Hospital	Anthony Puzon
Wangaratta Private Hospital	Janet McKie
Warringal Hospital	Marilyn Dey
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 Cubitt
Coffs Harbour Health Campus	Annie Fitzgerald
Concord Repatriation Hospital	David Debello
Dubbo Base Hospital	Kathy Chapman
Fairfield Hospital	Caroline Youkhana
Gosford Hospital	Kirstie Brown/Toni Hoad
Goulburn Base Hospital	Karen Goode/Debbie Hay
Grafton Base Hospital	Anthony Corkett
Hornsby & Ku-Ring-Gai Hospital	Bessie Chu
Inst Rheum & Orthopaedic Surgery	Maria Hatziandreou/Elena Katz
John Hunter Hospital	Felicia Bristow/Ken Shilling
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	Bronwyn Friend
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/Jo Atkins
Royal Newcastle Centre	Graham Cutler
Royal North Shore Hospital	Kay Crawford
Royal Prince Alfred Hospital	Lisa Hatton/Jennifer Wilkie
Ryde Hospital	Karen Jones
Shoalhaven Group Hospital	Leanne McTavish
St George Hospital	Simon Cheng
St Vincent's Public Hospital	Mary Theresa Butler/Lee Black
Sutherland Hospital	Sara Hogan
Tamworth Base Hospital	David Marsh
The Children's Hospital Westmead	Ariella Galstaun
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	Katherine Latter
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	Sandy Chote/Kathy Byrne
Dubbo Private Hospital	Sallie Cross
Dudley Private Hospital	James Bird/Michele Englart
East Sydney Private	Sussan Nguyen
Figtree Private Hospital	Mandy Holmes/Kim Dyer
Forster Private Hospital	Jenny Bullivant
Gosford Private Hospital	Claire Monger
Hawkesbury Health Service	Sharon Garden
Holroyd Private Hospital	Marta Zajkowska
Hospital for Specialist Surgery	Radha Reddy
Hunters Hill Private	Jenny May
Hunter Valley Private	Renae Ross
Hurstville Private	Priscilla Thanjan
Insight Clinic Private Hospital	Debbie van de Stadt
Kareena Private Hospital	Martile Horn
Lake Macquarie Private Hospital	Robert Reddie/Fiona Lindsay
Lingard Private Hospital	Nicole Garland
Maitland Private Hospital	Martine Mead
Macquarie University Hospital	Simmy Masuku
Mayo Private Hospital	Suzanne Cini
National Day Surgery Sydney	Stephanie Schofield/Kerry Gardner
Nepean Private Hospital	Jane Telfer
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	Stefanie Wells
Southern Highlands Hospital	Lynne Byrne
St George Private & Medical Centre	Donna Reichel
St Luke's Care	Tanja Radic
St Vincent's Private Darlinghurst	F Crawford/ V Law/D Christofferson
St Vincent's Private Lismore	Janelle Hospers/Maria Read
Strathfield Private Hospital	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 Perez/Paula Civit Diez
Toronto Private Hospital	Stephanie Keys
Waratah Private Hospital	Leigh Browne
Warners Bay Private Hospital	Annette Harrison
Westmead Private Hospital	K O'Shaughnessy/F Tacardon

QUEENSLAND

PUBLIC HOSPITALS

Bundaberg Base Hospital	D Norman/A Drinkwater/J 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
Nambour General Hospital	Kay Friend/Fiona Tognolini
Prince Charles Hospital	Louise Tuppin/Rose Seddon
Princess Alexandra Hospital	Jo-Anne de Plater/Anna McBride
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
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	Karen Smith
Greenslopes Private Hospital	Kelly Williams/Rhonda Griffin
Hervey Bay Surgical Centre	Margo Christensen
Hillcrest Rockhampton Private	Lyn Martin
Holy Spirit Northside Hospital	Lexie Shannon
John Flynn Hospital	Paula Archer
Mater Health Services North Qld	Jo Humphreys/Anjela Hunt
Mater Misericordiae Bundaberg	James Turner
Mater Misericordiae Gladstone	Saroj Saini
Mater Misericordiae Mackay	Judith McDonald
Mater Misericordiae Rockhampton	Michelle Havik/Tim Harkin
Mater Misericordiae Private Hospital	Justine Jones
Mater Private Hospital Redland	Merryl Hoey
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/Esther Moire
St Andrew's Private Hospital, Ipswitch	Mel Grant
St Andrew's Hospital, Toowoomba	Jeff van Leeuwen
St Andrew's War Memorial Hospital	Wendy Smith
St Stephen's Private Hospital	Wendy Simmers
St Vincent's Hospital, Toowoomba	Judy Plotecki
Sunnybank Private Hospital	Judith Aslette
Sunshine Coast University Private	Lynette Whiting
The Sunshine Coast Hospital	Phil Hall
Wesley Hospital	Carole Gregory/Kalpana Patel

SOUTH AUSTRALIA

PUBLIC HOSPITALS

Clare Hospital and Health Services	Libby Hoffman
Flinders Medical Centre	L Healey/J Platten/A Ware
Gawler Health Service	Sharon Mewett
Lyell McEwin Hospital	Fiona Brinkies
Modbury Public Hospital	Lisa Pearson
Mt Barker DSM Hospital	Emma Crowder
Mt Gambier Regional Hospital	Kylie Duncan
Murray Bridge Soldiers Memorial	Janine Colwell
Naracoorte Health Service	Trina Berry
Noarlunga Hospital	Carole Dawson
Port Augusta	Paola Williams
Port Lincoln Hospital	Christine Weber
Port Pirie Hospital	Sue Wilkinson
Queen Elizabeth Hospital	Renae Wauchope
Repatriation General Hospital	Joy Telfer/Elspeth Raymond
Riverland Regional Hospital	Leanne Zerna
Royal Adelaide Hospital	Lisa Lewington
South Coast District Hospital	Anne Price/Gail Mogg
Whyalla Health Service	Michael Prunty
Women's and Children's Hospital	Margaret Betterman

PRIVATE HOSPITALS

Ashford Community Hospital	Lisa Kowalik
Burnside War Memorial Hospital	Brooke Drechsler
Calvary Central Districts Hospital	Adele Alves
Calvary North Adelaide Hospital	Maria Young
Calvary Wakefield Hospital	Michelle Ireland/Ingrid Snowball
Flinders Private Hospital	Marcus Ender
Glenelg Community Hospital	N Russell-Higgins/VLawrence
North Eastern Community Hospital	Anne Sciacca
Parkwynd Private Hospital	Helen Madigan
Sportsmed SA	K Stapleton/F Penning/ S Smith/M Odgaaı
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	Elsy Jiji
Fiona Stanley	Jarrod Duncan/Sasha Rademakers
Geraldton Hospital	Vicki Richards
Kalgoorlie Regional Hospital	Nicole Hintz
Osborne Park Hospital	Jenny Misiewicz
Rockingham General Hospital	Carol Beaney
Royal Perth Hospital, Wellington St	Carmel McCormack
Sir Charles Gairdner Hospital	Angela Bibb

PRIVATE HOSPITALS

Bethesda Hospital	H Hanekom/H Collis/J Fitzroy
Hollywood Private Hospital	Martin Coulter
Joondalup Health Campus	D Crowley/J Holland/T Rankin/E Yates
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	Karen Merefield
St John of God Health Care Murdoch	C Sheen/L Green/C O'Neill
St John of God Mt Lawley	Greg Cox/Stuart Meek
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
Calvary Health Care ACT	Tina Forshaw

PRIVATE HOSPITALS

Calvary John James Hospital	Thomas Abraham
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
Royal Darwin Hospital	Tanya Anderson

PRIVATE HOSPITALS

Darwin Private Hospital	Beverley 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 groups that we wish to compare does not vary over time. If the hazard for prosthesis Model A is twice that of prosthesis Model B at three years, it will also be twice at four years, and so on. This is referred to as the 'proportional hazards assumption'. If the hazard ratio is not proportional over the entire time of observation, then a time varying model is used, which estimates a separate hazard ratio within each pre-defined time period. Within each time period, the hazards are proportional. The Registry uses a set algorithm which iteratively chooses time points until the assumption of proportional hazards is met for each time period. The time points are selected based on where the greatest change in hazard occurs between the two comparison groups, weighted by the number of events in that time period.

Cumulative Incidence Function: An estimator of the actual probability of revision in the presence of a competing risk. In these circumstances, the Kaplan-Meier estimate, which treats competing risks as censored, overestimates the true probability. In the competing risks paradigm, patients who have already had a revision or died are excluded from the set at risk of being revised. Under Kaplan-Meier only patients who have already been revised are excluded from the risk set; dead patients are analysed as though they are still at risk of revision.

Cumulative Percent Revision: otherwise known as the 'cumulative failure rate'. This is defined as 100 x [1- S(*t*)] where S(*t*) is the survivorship probability estimated by the Kaplan-Meier method (see survival curve, below). The cumulative percent revision gives the percent of procedures revised up until time *t*, and allows for right censoring due to death (but see Cumulative Incidence Function above) or closure of the database for analysis.

Hazard Ratio: A hazard is an estimate of the instantaneous risk of occurrence of an event, for example revision, at a point in time, *t*. A hazard ratio results from dividing one group's hazard by another's to give a comparative measure of the instantaneous risk of experiencing the event of interest. In this report, hazard ratios are adjusted for age and gender as

appropriate. Hazard ratios are either for the entire survivorship period (if proportional; see "Cox Model or Proportional Hazards Model" section above) or for specific time periods (if the hazard for the entire survivorship period is not proportional).

For example, a comparison of Primary Total Conventional Hip Replacement for a Primary Diagnosis of Avascular Necrosis (AVN), Developmental Dysplasia of the Hip (DDH) and Osteoarthritis (OA):

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 (31/12/2014) 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 1/1/2014 was revised on 1/7/2014. 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 1/1/2014 died without being revised on 1/4/2014. This procedure contributes 0.25 component years.
3. A primary procedure occurs on 1/1/2014 and has not been revised. This procedure contributes 1 component year (as observation time is censored at 31/12/2014).

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 2	Tumour Infection	*Dominant diagnosis independent of prosthesis/surgery*
3 4 5	Leg Length Discrepancy Incorrect Sizing Malposition	*Surgical procedure*
6 7	Metal Related Pathology Loosening/Lysis	*Reaction to prosthesis*
8 9 10 11 12 13 14	Wear Hip Insert Wear Acetabular Cup/Shell Wear Head Implant Breakage Head Implant Breakage Stem Implant Breakage Hip Insert Implant Breakage Acetabular Cup/Shell	*Wear and implant breakage*
15 16	Prosthesis Dislocation Instability	*Stability of prosthesis*
17	Fracture (Femur/Acetabular/Neck/Periprosthetic)	*Fracture of bone*
18 19	Chondrolysis/Acetabular Erosion Progression of Disease	*Progression of disease on non-operated part of joint*
20 21 22	Synovitis Osteonecrosis/AVN Heterotopic Bone	*New diseases occurring in association with joint replacement*
23	Pain	*Pain*
24	Other	*Remaining diagnoses*

Diagnosis Hierarchy for Revision Knee Replacement

Rank	Diagnosis	Category
1	Tumour	*Dominant diagnosis independent of prosthesis/surgery*
2	Infection	
3	Incorrect Side	*Surgical procedure*
4	Incorrect Sizing	
5	Malalignment	
6	Metal Related Pathology	*Reaction to prosthesis*
7	Loosening/Lysis	
8	Wear Knee Insert	*Wear and implant breakage*
9	Wear Tibial Tray	
10	Wear Femoral	
11	Wear Patella	
12	Implant Breakage Femoral	
13	Implant Breakage Knee Insert	
14	Implant Breakage Tibial Tray	
15	Implant Breakage Patella	
16	Bearing Dislocation	*Stability of prosthesis/knee*
17	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. Associate Professor Tracy Merlin is Managing 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
Manager, Ms Ann Tomkins
Research Coordinator, Dr Sophia Rainbird
Administration Assistant, Ms Rychelle Morris
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