Hip and Knee Arthroplasty

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AUSTRALIAN ORTHOPAEDIC ASSOCIATION

National Joint Replacement Registry

AUSTRALIAN ORTHOPAEDIC ASSOCIATION NATIONAL JOINT REPLACEMENT REGISTRY

ANNUAL REPORT

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EXECUTIVE SUMMARY

This summary gives an overview of the 2012 Annual Report outlining additions to the Registry analysis as well as highlighting major findings.

One of the most notable findings in this report has been the large increase in revision hip procedures reported to the Registry in 2011. In 2010, revision procedures represented 11.3% of all hip replacements. In 2011, this increased to 12.5%. The major reason for this increase was the high number of revisions being undertaken for the ASR, in particular the ASR XL used in primary total conventional hip replacement. Last year there were 573 revision procedures reported for this prosthesis, this accounted for almost all of the increase in revision hip procedures.

It was the AOANJRR that first raised concern about the ASR. It was removed from the Australian market in 2009. The AOANJRR had for a number of years prior, identified both the ASR XL conventional hip and the ASR resurfacing prostheses as having a higher than anticipated rate of revision. This identification resulted in a major decline in the use of these prostheses in Australia. This decline was the reason the company gave for removing the ASR from the Australian market, well ahead of the subsequent worldwide withdrawal in 2010.

It is likely that this prosthesis, as well as other large head (>32mm) Metal on Metal devices identified by the Registry as having an increased rate of revision, will continue to contribute to an overall increase in the revision burden for hip replacement in Australia for the next few years.

The other major area of concern in hip replacement is the use of femoral stems with exchangeable necks. The Registry has highlighted for a number of years that these devices, when used in primary total conventional hip replacement, have an increased rate of revision compared to procedures using fixed neck stems. This difference is again highlighted in this report.

The number of hip and knee replacement procedures undertaken each year continues to increase. In 2011, the number of procedures undertaken increased by 4.3% compared to 2010 (4.0% for hips and 4.5% for knees). Most procedures were undertaken in the private sector (59.3% for hips and 69.4% for knees in 2011).

Partial hip replacement is mainly used for the treatment of fractured neck of femur. The change in use of different classes of partial hip replacement previously reported, in particular the declining use of the Austin Moore type prosthesis, has continued in 2011. Bipolar partial hip replacements are revised less frequently than other partial hips and the use of cement fixation reduces the rate of revision regardless of the class of partial hip replacement.

There has been a reduction in the use of new hip prostheses and prostheses combinations being used in Australia. In 2010 there were 330 new combinations used. This reduced to 97 in 2011.

The lower revision rate of modified polyethylene compared to non-modified is again highlighted. It remains the case that large head sizes (>32 mm) have the same outcome as smaller head sizes when used with modified polyethylene.

The use of primary total resurfacing hip replacement continues to decline, reducing by 39.7% in 2011 compared to 2010. It accounted for only 1.6% of all hip procedures in 2011. A higher proportion of resurfacing procedures are undertaken in younger males. The Registry has previously identified that this patient population has the best outcome for this procedure.

The findings for knee replacement reported this year are similar to last year's report.

Unicompartmental knee replacement is by far the most common partial knee replacement. Its use has been declining for a number of years and this has continued in 2011, reducing by a further 9.0% compared to 2010. It has a higher rate of revision than primary total knee replacement.

In 2011, the Registry reported for the first time on ten year outcomes for both hip and knee replacement. This year the Registry presents data on an increased number of prostheses combinations that have reached this milestone. At ten years, 44.0% of all primary total hip and 24.2% all primary total knee prostheses combinations have greater than 95% survivorship.

An entirely new area of analysis for the Registry included in this Report examines the effect of the average number of procedures performed by a surgeon each year on the outcome of both primary total hip and primary total knee replacement. Four groups of surgeons were identified, surgeons averaging 10 or less procedures per year, more than ten but less than or equal to 25, more than 25 but less than or equal to 70 and more than 70.

Comparing outcomes of the four groups demonstrated a relationship between the number of procedures a surgeon averages and the subsequent rate of revision. In general, the group of surgeons averaging more than 70 procedures per year have the best outcome. There is however, a complex interaction between the average number of procedures performed and the prostheses used.

In primary total conventional hip replacement, a prosthesis combination known to have a low rate of revision improves the outcome regardless of how many procedures a surgeon undertakes. Conversely, a prosthesis known to have a high rate of revision continues to have a high rate even when undertaken by surgeons averaging a higher number of procedures per year. The Registry was also able to identify that there is variation in the rate of revision for surgeons in each of the four groups, including those averaging more than 70 procedures per year. In this group, the variation appears to be related to prosthesis choice. Surgeons identified as having higher rates of revision compared to other surgeons used a higher proportion of prostheses known to have higher than anticipated rates of revision.

Similar results were found when analysing the effect on the outcome of primary total knee replacement. As a group, surgeons averaging more than 70 procedures had the lowest rate of revision. There was improvement in outcome when a prosthesis known to have a low rate of revision was used, however this was not uniform across all groups. When a prosthesis known to have a higher than anticipated rate of revision was used, the revision rate was high regardless of how many procedures a surgeon averaged. As was the case with primary total hip replacement, there was variation between surgeons within a group. In the group of surgeons averaging more than 70 procedures this variation could be partly, but not entirely, explained by prostheses selection. Therefore it is likely that other factors may also be contributing to this difference.

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

This year the Registry has identified 90 prostheses or prostheses combinations (54 hip and 36 knee). Of these, ten hip and four knee prostheses are reported for the first time. Two of the knees reported for the first time are no longer used. Detailed analyses of all identified prostheses and prostheses combinations are available as a supplementary report on the Registry website.

As in previous years, the Registry also publishes a number of supplementary reports covering a range of topics. This year 11 supplementary reports will be available on the Registry website.
www.dmac.adelaide.edu.au/aoanjrr/publications.jsp.

INTRODUCTION

The 2012 Hip and Knee Arthroplasty Report is based on the analysis of 713,077 primary and revision hip and knee procedures recorded by the Registry with a procedure date up to and including 31 December 2011. This is an increase of 84,984 procedures compared to the 2011 Annual Report.

In addition, there are 11 supplementary reports that complete the AOANJRR Annual Report for 2012.

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. Demographics of Shoulder, Elbow and Wrist Arthroplasty
7. Outcome of Shoulder Arthroplasty
8. Demographics and Outcome of Ankle Arthroplasty
9. Demographics of Spinal Disc Arthroplasty
10. Investigations of Prostheses with Higher than Anticipated Rates of Revision
11. Analysis of State and Territory Health Data – All Arthroplasty 1993/1994 – 2010/2011

These reports are available on the Registry website *www.dmac.adelaide.edu.au/aoanjrr/publications.jsp*.

Data are submitted to the Registry by all hospitals (public and private) undertaking joint replacement. Currently there are 299 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 2011, the number of hip replacement procedures increased by 4.0% compared to the year prior and the number of knees by 4.5%. Since 2003, the first year of complete national data collection by the Registry, the number of hip procedures has increased by 39.2% and the number of knee procedures by 63.5%.

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 – 2010/2011'.

There are many factors known to influence the outcome of joint replacement surgery. Some of these include age, gender and diagnosis of patients, the type of prosthesis and surgical techniques used. Superimposed on this is the rapid rate of change in medical technology. There is continual development and use of new types of prostheses and surgical techniques; for many the outcome remains uncertain.

The Australian Orthopaedic Association (AOA) recognised the need to establish a National Joint Replacement Registry (NJRR) in 1993. At that time, the outcome of joint replacement in Australia was unknown. It was not apparent who was receiving joint replacement or the types of prostheses and techniques used to implant them.

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

In 1998, the Commonwealth Department of Health and Ageing (DOHA) 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 and Ageing continues to provide funding to maintain the Registry. In June 2009, Federal Parliament passed legislation to enable the government to cost recover this funding from the orthopaedic industry.

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

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

Aims

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

Benefits

Information obtained by the analysis of Registry data is used to benefit the community. The Registry releases this information through publicly available annual and supplementary reports, journal publications and ad hoc reports (195 in 2011). These ad hoc reports are specific analyses requested by surgeons, hospitals, academic institutions, Government and government agencies as well as orthopaedic companies.

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

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

The percentage of revision hip replacement decreased from 12.9% in 2003 to 11.3% in 2010, however this has increased in 2011 to 12.5%. Revisions of the ASR XL prosthesis accounted for almost all of this increase, with 573 revisions of known ASR primary procedures being reported in 2011.

The percentage of revision knee procedures has declined from a peak of 8.8% in 2004 to 8.1% in 2011, equating to 334 less knee revisions in 2011.

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

Governance

The NJRR 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 NJRR policies. The NJRR Committee reports to the Board. Members include the Chairman, NJRR Director, two NJRR Deputy Directors, an orthopaedic surgeon from each state and the ACT and a representative from each of the AOA specialty arthroplasty groups and the Neurosurgical Society of Australasia. A complete list of the current NJRR Committee is provided on the inside front cover of this report.

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

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

In 2009, the Commonwealth established the NJRR Consultative Committee. This was a restructure of the previous Registry Advisory Committee. The NJRR 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 and Ageing
- NJRR Director

a representative of

- Department of Health and Ageing
- Australian Orthopaedic Association
- Consumer's Health Forum
- Therapeutic Goods Administration
- Prostheses and Devices Committee
- Australian Health Industries Association
- 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 monthly. Examples of Registry data forms are available on the website *www.dmac.adelaide.edu.au/aoanjrr/documentation.jsp*.

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 no hospital is 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 2010/11 financial year, the Registry received almost 1,200 more procedures than were provided in the various health department data files. The Registry accepts that these additional notifications are valid.

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 obtain procedure details from individual hospitals for these data.

Initial validation resulted in over 93.9% of Registry records verified against health department data. Following the retrieval of unreported records and checking of unmatched data, 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.

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

The cumulative percent revision is displayed graphically 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 graph is extended 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. However, analytical comparisons of revision rates using the proportional hazards model are based on all available data (*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*).

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. In the 2010 Annual Report, the Registry introduced revision diagnosis cumulative incidence graphs to deal with the competing risks of reasons for revision. Revision diagnosis cumulative incidence graphs are useful when making comparisons between groups as the differences in the pattern of revision over time is highlighted and provides 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 its class. The Registry refers to this group as 'prostheses with a higher than anticipated rate of revision'. A three-stage approach has been developed and is outlined in detail in the relevant section.

Report Review Prior to Publication

Members of the AOA Arthroplasty Society were invited to attend a two-day workshop to review, comment and provide advice on all sections of the report. The workshop for this report was held in Adelaide on the weekend of 28 and 29 July 2012. Following the workshop the report is provided to the AOA Board for consideration and final approval prior to publication.

Presentation of 2012 Annual Report

This year, for the first time, the Registry is reporting surgeon specific effect on the outcome of primary conventional total hip and primary total knee replacement. This analysis examined the relationship between the number of procedures undertaken by a surgeon and the revision rate.

In the 2011 Annual Report, ten year outcomes of hip and knee prostheses were reported for the first time. This analysis has been repeated and includes additional prosthesis combinations compared to last year's report.

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

Detailed analyses of prostheses or combinations of prostheses that have been 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.

SURGEON EFFECT ON THE OUTCOME OF HIP AND KNEE ARTHROPLASTY

Introduction

Patient, surgeon and prosthesis factors may affect the outcome of hip and knee replacement. The relative importance of each of these elements is yet to be established. For the first time the Registry has undertaken an analysis to determine if the rate of revision is related to the number of procedures performed by a surgeon, whether this relationship is different for hip and knee replacement and if it varies depending on the type of prostheses used.

The Registry anonymously analysed data using surgeon code for individual surgeons who have operated since 2003. Different groups of surgeons were compared based on the average number of procedures undertaken per year.

Four groups of surgeons were identified:

- ≤10 – an average of less than or equal to 10 procedures per year
- >10-≤25 – an average of more than 10 but less than or equal to 25 procedures per year
- >25-≤70 – an average of more than 25 but less than or equal to 70 procedures per year
- >70 – an average of more than 70 procedures per year

Primary Conventional Total Hip Replacement

Outcome and Number of Procedures

Almost half the surgeons in this analysis undertaking primary total conventional hip replacement for osteoarthritis did on average ten or less procedures per year (44.9%). A similar number did between ten and 70 procedures per year (>10-≤25 (23.6%), >25-≤70 (26.8%)). A small number of surgeons averaged more than 70 (4.6%) procedures per year (Table SE1).

There is a difference in outcome based on the average number of procedures undertaken each year. Surgeons averaging 70 or less procedures per year have a higher rate of revision compared to those averaging greater than 70 procedures. This difference is evident for up to four years for surgeons averaging less than or equal to ten procedures per year and for a shorter period for those averaging >10-≤25 (first 3 months) and >25-≤70 (first 1.5 years). After these times there is no difference except after 5.5 years there is an increased rate of revision in the >70 procedures per year group compared to >25-≤70 procedures per year.

The reason for this is unknown (Tables SE2 and SE3 and Figure SE1).

Specific Hip Prostheses and Number of Procedures

In an attempt to determine if the outcome varied depending on the type of prostheses used, the analysis was repeated using two different high use prostheses. The first was the Exeter V40/Trident combination, which is the most commonly implanted stem and acetabular combination and has a cumulative percent revision of less than 5.0% at ten years. There have been 14,611 procedures undertaken for osteoarthritis reported with surgeon code to the end of 2011 using this combination.

The second prosthesis was the ASR XL acetabular component which has been used with a variety of stems. This prosthesis was selected because it has been used in large numbers and is a prostheses that has been identified by the Registry as having a higher than anticipated rate of revision. There were 2,379 procedures available for analysis using this prosthesis.

This analysis confirmed the relationship between the number of procedures a surgeon performs and the rate of revision.

The analysis of the Exeter V40/Trident combination showed that surgeons undertaking more than 70 procedures per year had a lower rate of revision compared to surgeons undertaking >10-≤25 and >25-≤70 procedures per year. There are insufficient data to compare to ≤10 procedures per year. The higher rate of revision after 5.5 years for the >70 group compared to the >25-≤70 group evident when all prostheses were used, was not apparent in this analysis. The Exeter V40/Trident combination for all four groups had a lower rate of revision compared to all other prostheses combined (Tables SE4 and SE5 and Figure SE2).

In contrast, the rate of revision for the ASR XL prosthesis was higher for all groups, although the ≤10 group had a higher rate of revision than the other groups (Tables SE6 and SE7 and Figure SE3).

This may indicate that surgeons undertaking a large number of procedures do not improve the outcome of a prosthesis that has been identified as having a higher than anticipated rate of revision.

Surgeon Variation

Further analysis was undertaken to assess variation in surgeon performance. The number of surgeon outliers in each of the four groups were identified. An outlier was defined as a surgeon who had at least twice the revisions per 100 observed years compared to all other surgeons in the group and the Poisson probability of observing that number of revisions, given the rate of the group, was significant ($p<0.05$). Only procedures undertaken for osteoarthritis were included.

The percentage of surgeons undertaking total hip replacement identified as outliers was 7.26%. This percentage increased as the average number of procedures increased. The highest percentage of outlier surgeons occurred in the >70 group with five of the 40 (12.5%) surgeons identified as outliers (Table SE8). The prosthesis use for each of the five surgeons was assessed. All five had used prostheses that the Registry has identified as having a higher than anticipated rate of revision. This analysis would indicate that it is likely that prosthesis selection is a factor in these surgeons being identified as outliers

Table SE1: Numbers of Surgeons per Group Undertaking Primary Total Conventional Hip Replacement

Average Number per Year	Number	%
≤10	390	44.9
>10-≤25	205	23.6
>25-≤70	233	26.8
>70	40	4.6
TOTAL	**868**	**100.0**

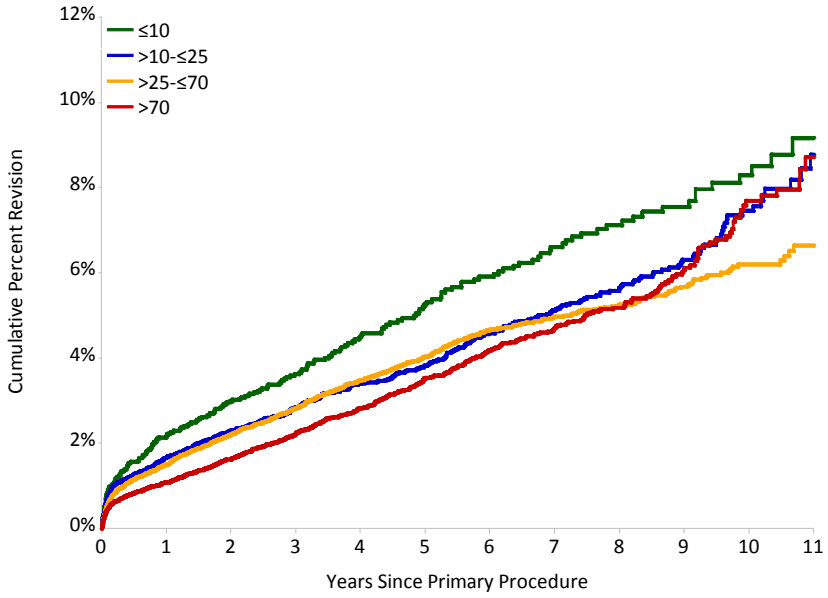
Table SE2: Revision Rates of Primary Total Conventional Hip Replacement by Average Number of Procedures Performed per Year (Primary Diagnosis OA)

Average Number per Year	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
≤10	234	5150	21565	1.09 (0.95, 1.23)
>10-≤25	620	18932	68828	0.90 (0.83, 0.97)
>25-≤70	1637	56068	185976	0.88 (0.84, 0.92)
>70	814	28941	107839	0.75 (0.70, 0.81)
TOTAL	**3305**	**109091**	**384207**	**0.86 (0.83, 0.89)**

Table SE3: Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Average Number of Procedures Performed per Year (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
≤10	2.2 (1.8, 2.6)	3.6 (3.1, 4.2)	5.3 (4.5, 6.1)	8.3 (7.1, 9.7)	9.2 (7.7, 10.9)
>10-≤25	1.7 (1.5, 1.9)	2.8 (2.6, 3.1)	3.8 (3.5, 4.2)	7.4 (6.6, 8.4)	8.8 (7.5, 10.2)
>25-≤70	1.5 (1.4, 1.6)	2.8 (2.7, 3.0)	4.0 (3.8, 4.3)	6.2 (5.7, 6.7)	6.6 (6.0, 7.3)
>70	1.1 (1.0, 1.2)	2.2 (2.0, 2.4)	3.5 (3.2, 3.8)	7.7 (6.8, 8.6)	8.7 (7.5, 10.1)

Figure SE1: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Average Number of Procedures Performed per Year (Primary Diagnosis OA)



HR - adjusted for age and gender

≤10 vs >70

0 - 1Mth: HR=2.00 (1.42, 2.80),p<0.001

1Mth - 3.5Yr: HR=1.54 (1.27, 1.87),p<0.001

3.5Yr - 4Yr: HR=2.11 (1.13, 3.97),p=0.019

4Yr+: HR=1.05 (0.79, 1.40),p=0.751

>10-≤25 vs >70

0 - 3Mth: HR=1.67 (1.37, 2.03),p<0.001

3Mth+: HR=1.05 (0.93, 1.19),p=0.413

>25-≤70 vs >70

0 - 1Mth: HR=1.27 (1.04, 1.54),p=0.018

1Mth - 3Mth: HR=1.65 (1.31, 2.07),p<0.001

3Mth - 1.5Yr: HR=1.25 (1.08, 1.45),p=0.003

1.5Yr - 2Yr: HR=1.21 (0.93, 1.58),p=0.162

2Yr - 5.5Yr: HR=1.12 (0.97, 1.29),p=0.113

5.5Yr+: HR=0.59 (0.47, 0.75),p<0.001

Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
≤10	5150	4212	2693	1723	453	150
>10-≤25	18932	14937	8765	5401	837	274
>25-≤70	56068	44119	23783	13378	1582	423
>70	28941	23680	14450	8670	877	276

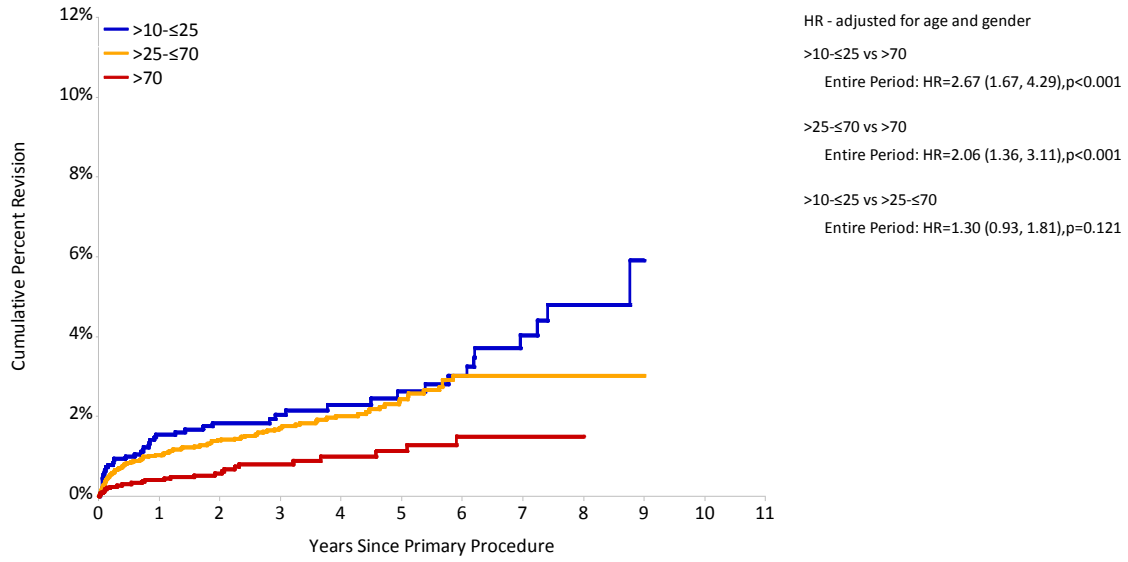
Table SE4: Revision Rates of Exeter V40/Trident Primary Total Conventional Hip Replacement by Average Number of Procedures per Year (Primary Diagnosis OA)

Average Number per Year	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
≤10	6	524	1510	0.40 (0.15, 0.86)
>10-≤25	48	2072	6843	0.70 (0.52, 0.93)
>25-≤70	138	8553	24012	0.57 (0.48, 0.68)
>70	27	3462	9749	0.28 (0.18, 0.40)
TOTAL	**219**	**14611**	**42115**	**0.52 (0.45, 0.59)**

Table SE5: Yearly Cumulative Percent Revision of Exeter V40/Trident Primary Total Conventional Hip Replacement by Average Number of Procedures per Year (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
≤10	1.1 (0.4, 2.5)	1.1 (0.4, 2.5)	2.1 (0.7, 6.2)		
>10-≤25	1.5 (1.1, 2.2)	2.0 (1.5, 2.9)	2.6 (1.9, 3.7)		
>25-≤70	1.0 (0.8, 1.3)	1.7 (1.4, 2.1)	2.4 (2.0, 3.0)		
>70	0.4 (0.2, 0.7)	0.8 (0.5, 1.2)	1.1 (0.7, 1.8)		

Figure SE2: Cumulative Percent Revision of Exeter V40/Trident Primary Total Conventional Hip Replacement by Average Number of Procedures per Year (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
>10-≤25	2072	1550	886	563	14	0
>25-≤70	8553	6539	3206	1420	37	0
>10-25	3462	2678	1261	638	7	0

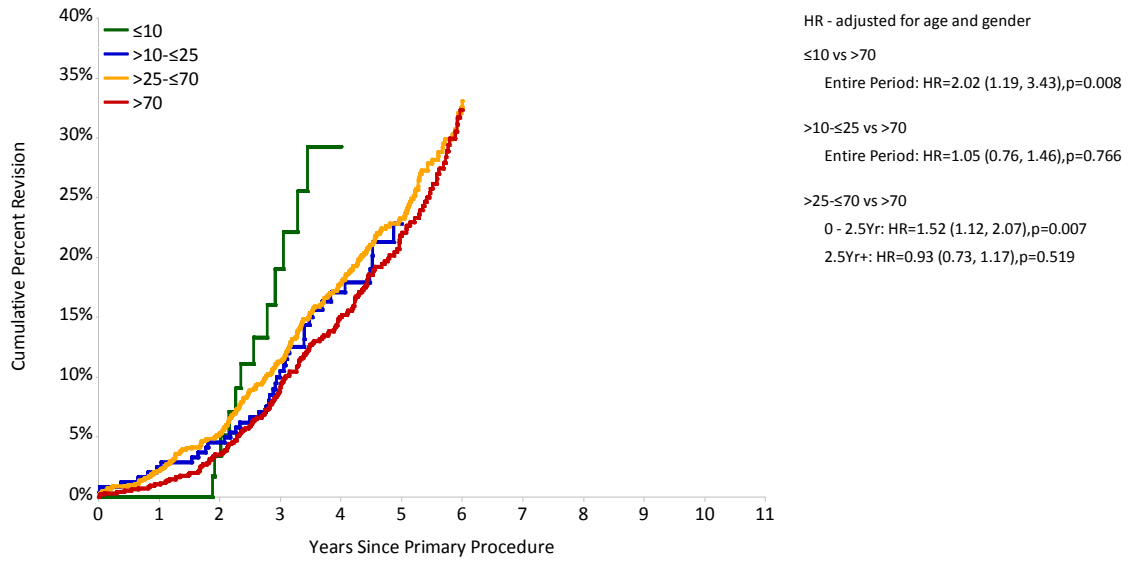
Table SE6: Revision Rates of ASR Primary Total Conventional Hip Replacement by Average Number of Procedures per Year (Primary Diagnosis OA)

Average Number per Year	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
≤10	15	58	190	7.91 (4.43, 13.05)
>10-≤25	44	242	926	4.75 (3.45, 6.38)
>25-≤70	236	1120	4484	5.26 (4.61, 5.98)
>70	195	959	3985	4.89 (4.23, 5.63)
TOTAL	**490**	**2379**	**9586**	**5.11 (4.67, 5.59)**

Table SE7: Yearly Cumulative Percent Revision of ASR Primary Total Conventional Hip Replacement by Average Number of Procedures per Year (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
≤10	0.0 (0.0, 0.0)	19.0 (10.2, 34.0)			
>10-≤25	2.5 (1.1, 5.4)	10.5 (7.2, 15.3)	22.8 (16.7, 30.7)		
>25-≤70	2.2 (1.5, 3.2)	11.3 (9.5, 13.3)	23.3 (20.5, 26.4)		
>70	1.0 (0.6, 1.9)	9.2 (7.5, 11.2)	21.8 (18.8, 25.3)		

Figure SE3: Cumulative Percent Revision of ASR Primary Total Conventional Hip Replacement by Average Number of Procedures per Year (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
≤10	58	58	26	5	0	0
>10-≤25	242	235	178	46	0	0
>25-≤70	1120	1081	825	337	0	0
>70	959	945	769	283	0	0

Table SE8: Number of Outlier Surgeons per Group Undertaking Primary Total Conventional Hip Replacement

Average Number per year	Number of Outlier Surgeons	% of Group
≤10	17	4.36
>10-≤25	17	8.29
>25-≤70	24	10.30
>70	5	12.50
TOTAL	**63**	**7.26**

Primary Total Knee Replacement

Outcome and Number of Procedures

A similar analysis was performed for primary total knee replacement using the same four surgeon groups.

Almost 40% of surgeons undertaking primary total knee replacement were in the ≤10 group (37.6%). Of the three remaining groups, 21.1% were in the >10-≤25 group, 32.4% >25-≤70 group and 8.9% >70 group (Table SE9).

There is a difference in outcome based on the average number of procedures undertaken each year. Surgeons averaging 70 or less procedures per year have a higher rate of revision compared to surgeons in >70 group (Tables SE10 and SE11 and Figure SE4). The rate of revision increases with decreasing number of procedures performed, however the revision rate in the ≤10 group is not significantly different from the >10-≤25 group (data not shown).

Specific Knee Prostheses and Number of Procedures

In an attempt to determine if the outcome varied depending on the type of prostheses used, the analysis was repeated using two different high use prostheses.

The first prosthesis was the Genesis II with 13,734 procedures undertaken for osteoarthritis reported with surgeon code to the end of 2011. No difference in the rate of revision was identified with the exception of the ≤10 group compared to the >70 group (Tables SE12 and SE13 and Figure SE5).

The second prosthesis was the LCS Duofix. This prosthesis was selected because it has been used in large numbers and has been identified as having a higher than anticipated rate of revision. The LCS Duofix was recalled in October 2010. There were 2,614 procedures available for analysis using this prosthesis.

The revision rate for this prosthesis was high for all groups although the >10-≤25 group had a higher rate of revision than the other groups (Tables SE14 and SE15 and Figure SE6). There are insufficient data for the ≤10 group for a comparison to be made. As with the ASR XL analysis, these results suggest that surgeons undertaking a large number of procedures do not improve the outcome of a prosthesis that has been identified as having a higher rate of revision.

Surgeon Variation

Further analysis was undertaken to assess variation in surgeon performance. An identical approach to the hip analysis was used.

The percentage of all surgeons undertaking total knee replacement identified as outliers was 8.7%. When the different groups were compared, the percentage of surgeons identified as outliers increased as the average number of procedures increased, with the exception of the >70 group. This group had a percentage that was higher than the first two groups, but less than the >25-≤70 group (Table SE16). Ten of the 83 (12.1%) surgeons in the >70 group were identified as outliers. Three of the outlier surgeons used prostheses that have been identified as having a higher than anticipated rate of revision.

As with hip replacement, not all surgeons averaging more than 70 procedures per year have similar outcomes. The difference is influenced by prostheses choice for some, but for others there are other unidentified factors contributing to the observed surgeon variation.

Table SE9: Number of Surgeons per Group undertaking Primary Total Knee Replacement

Average Number per Year	Number	%
≤10	350	37.6
>10-≤25	197	21.1
>25-≤70	302	32.4
>70	83	8.9
TOTAL	**932**	**100.0**

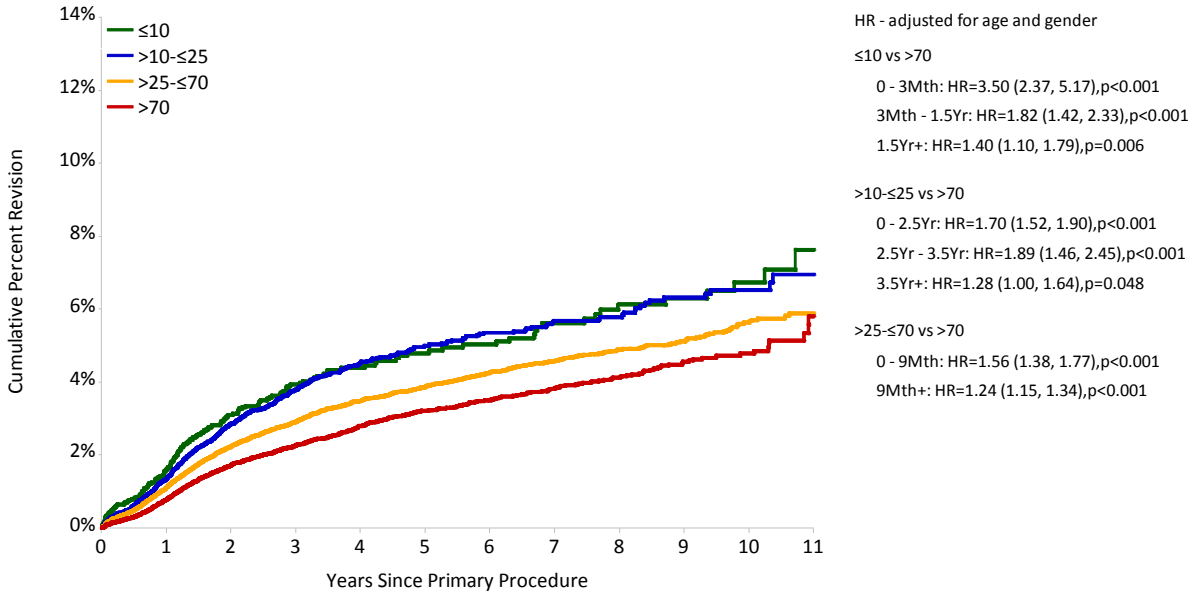
Table SE10: Revision Rates of Primary Total Knee Replacement by Average Number of Procedures Performed per Year (Primary Diagnosis OA)

Average Number per Year	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
≤10	167	4440	16916	0.99 (0.84, 1.15)
>10-≤25	582	17697	56626	1.03 (0.95, 1.11)
>25-≤70	2382	88172	295267	0.81 (0.77, 0.84)
>70	1237	57583	189015	0.65 (0.62, 0.69)
TOTAL	**4368**	**167892**	**557824**	**0.78 (0.76, 0.81)**

Table SE11: Yearly Cumulative Percent Revision of Primary Total Knee Replacement by Average Number of Procedures Performed per Year (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
≤10	1.6 (1.3, 2.0)	3.9 (3.3, 4.6)	4.8 (4.1, 5.7)	6.7 (5.6, 8.1)	7.6 (6.0, 9.6)
>10-≤25	1.3 (1.2, 1.5)	3.8 (3.5, 4.2)	5.0 (4.6, 5.5)	6.5 (5.8, 7.3)	6.9 (6.1, 7.9)
>25-≤70	1.1 (1.0, 1.2)	2.9 (2.8, 3.0)	3.9 (3.7, 4.0)	5.6 (5.3, 6.0)	5.9 (5.5, 6.3)
>70	0.8 (0.7, 0.9)	2.3 (2.1, 2.4)	3.2 (3.0, 3.4)	4.8 (4.4, 5.2)	5.8 (4.9, 6.8)

Figure SE4: Cumulative Percent Revision of Primary Total Knee Replacement by Average Number of Procedures Performed per Year (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
≤10	4440	3485	2078	1280	340	113
>10-≤25	17697	13621	7148	3801	586	204
>25-≤70	88172	69241	37879	21467	2597	745
>70	57583	45780	24802	13251	1352	372

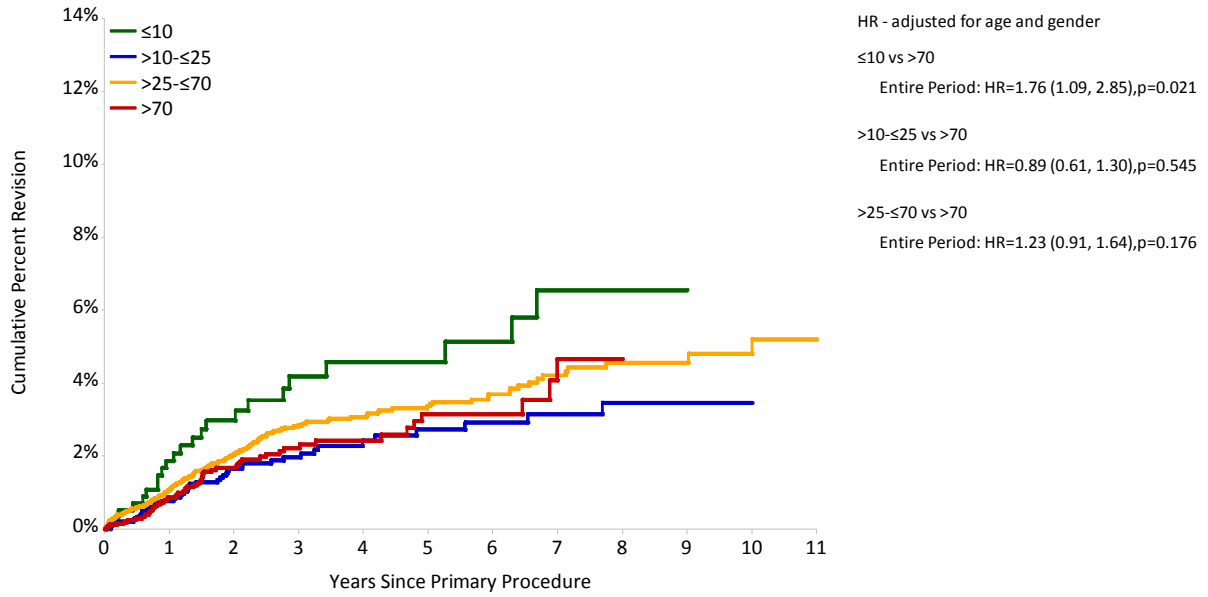
Table SE12: Revision Rates of Genesis II/Genesis II Primary Total Knee Replacement by Average Number of Procedures Performed per Year (Primary Diagnosis OA)

Average Number per Year	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
≤10	23	607	2239	1.03 (0.65, 1.54)
>10-≤25	47	2600	8587	0.55 (0.40, 0.73)
>25-≤70	175	7223	23374	0.75 (0.64, 0.87)
>70	60	3304	8565	0.70 (0.53, 0.90)
TOTAL	**305**	**13734**	**42765**	**0.71 (0.64, 0.80)**

Table SE13: Yearly Cumulative Percent Revision of Genesis II/Genesis II Primary Total Knee Replacement by Average Number of Procedures Performed per Year (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
≤10	1.9 (1.0, 3.5)	4.2 (2.7, 6.6)	4.6 (2.9, 7.1)		
>10-≤25	0.8 (0.5, 1.2)	2.0 (1.4, 2.7)	2.7 (2.0, 3.8)	3.5 (2.4, 4.9)	
>25-≤70	1.1 (0.9, 1.4)	2.8 (2.4, 3.4)	3.4 (2.9, 4.0)	4.8 (3.9, 5.9)	5.2 (4.1, 6.6)
>70	0.9 (0.6, 1.3)	2.2 (1.7, 3.0)	3.2 (2.3, 4.3)		

Figure SE5: Cumulative Percent Revision of Genesis II/Genesis II Primary Total Knee Replacement by Average Number of Procedures Performed per Year (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
≤10	607	481	274	181	28	5
>10-≤25	2600	2053	1030	566	124	37
>25-≤70	7223	5562	2890	1679	236	71
>70	3304	2551	1029	483	16	0

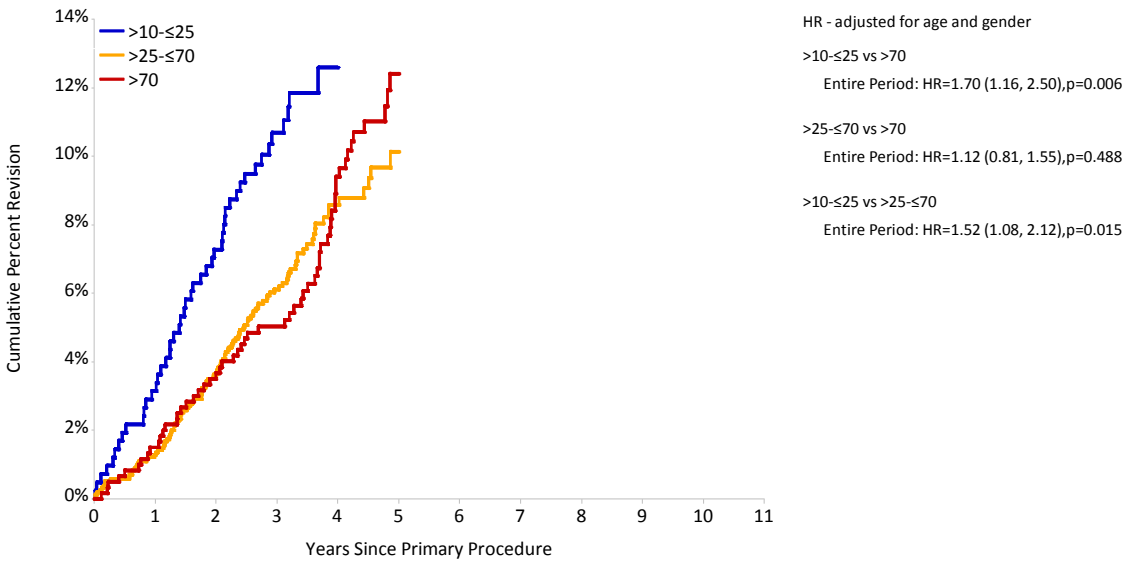
Table SE14: Revision Rates of LCS Duofix Primary Total Knee Replacement by Average Number of Procedures Performed per Year (Primary Diagnosis OA)

Average Number per Year	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
≤10	1	38	125	0.80 (0.02, 4.46)
>10-≤25	49	416	1364	3.59 (2.66, 4.75)
>25-≤70	117	1558	5432	2.15 (1.78, 2.58)
>70	59	602	2462	2.40 (1.82, 3.09)
TOTAL	**226**	**2614**	**9383**	**2.41 (2.10, 2.74)**

Table SE15: Yearly Cumulative Percent Revision of LCS Duofix Primary Total Knee Replacement by Average Number of Procedures Performed per Year (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
≤10	2.6 (0.4, 17.2)	2.6 (0.4, 17.2)			
>10-≤25	3.1 (1.8, 5.3)	10.7 (8.0, 14.1)			
>25-≤70	1.3 (0.8, 2.0)	6.1 (5.0, 7.5)	10.1 (8.2, 12.5)		
>70	1.5 (0.8, 2.9)	5.0 (3.5, 7.1)	12.4 (9.6, 16.0)		

Figure SE6: Cumulative Percent Revision of LCS Duofix Primary Total Knee Replacement by Average Number of Procedures Performed per Year (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
>10-≤25	416	399	260	22	0	0
>25-≤70	1558	1527	1024	161	0	0
>70	602	591	492	139	0	0

Table SE16: Number of Outlier Surgeons per Group Undertaking Primary Total Knee Replacement

Average Number per Year	Number of Outlier Surgeons	% of Group
≤10	12	3.43
>10-≤25	18	9.14
>25-≤70	41	13.58
>70	10	12.05
TOTAL	**81**	**8.69**

Conclusion

The Registry has identified that the average number of procedures a surgeon undertakes per year has an effect on the outcome of both hip and knee replacement surgery. When the influence of the average number of surgeon procedures is assessed for commonly used prostheses, with outcomes that are regarded as satisfactory compared to those known to have a higher rate of revision, this effect is still evident.

It is apparent however that the choice of prosthesis is a very important determinate in the final outcome. This analysis also showed that there remains considerable variation between individual surgeons averaging the same number of procedures per year. This is evident for all groups including surgeons averaging the highest number of procedures per year. Prostheses selection and surgeon experience may contribute to this difference.

TEN YEAR PROSTHESES OUTCOMES

In 2011, the Registry reported ten year outcomes for the first time. Outcomes at this time are widely regarded as an important milestone in assessing the performance of prostheses. In the UK, the National Institute for Clinical Excellence (NICE) implemented prosthetic hip replacement guidelines focusing on ten year outcomes as the benchmark for assessing prosthesis performance. It recommended that surgeons use prostheses with a cumulative percent revision of less than 10.0% at ten years.

This year the Registry is reporting ten year survivorship data on an increased number of hip and knee prostheses.

Hip Replacement

The Registry is reporting the ten year cumulative percent revision for femoral stem and acetabular prostheses combinations used in primary conventional hip replacement. A combination was included when the Registry recorded more than 350 procedures. This year the Registry is reporting on the outcomes of 50 femoral and acetabular combinations, which is 13 more than last year.

In 2011, the Registry also reported the outcome of individual femoral stem and acetabular prostheses. Outcomes for these individual prostheses varied depending on the other components they were combined with. For this reason, this year the Registry has only considered the outcome of combinations.

The cumulative percent revision at ten years for the femoral stem and acetabular component combinations ranged from 2.2% to 9.8% (Table TY1).

Almost 2,000 different combinations of femoral stem and acetabular components have been reported to the Registry. There are 50 combinations that have ten year cumulative percent revision, accounting for 49.9% of all primary total conventional hip procedures. Of these combinations, 17 are no longer used. These account for 5.4% of all primary total conventional hip procedures.

All of the combinations with ten year outcomes are consistent with current NICE guidelines. It is apparent that there is the potential for considerable variation in revision rates within the NICE criteria. In the 2011 report the Registry identified that many of the femoral stems, acetabular prostheses and combinations with a ten year cumulative percent revision greater than 7.5% had been identified by the Registry as having a higher than anticipated rate of revision, either individually or in combination with other prostheses.

When assessing the outcome of hip prostheses it is important to consider which combinations of femoral and acetabular components have the lowest rate of revision. Of the 50 combinations reported this year, 44.0% have less than 5.0% revision for any reason at ten years. This is a large number of prostheses with follow up of ten or more years. Perhaps a new benchmark for a successful outcome should be considered.

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

Femoral Stem	Acetabular Combination	N Revised	N Total	1 Yr CPR	5 Yrs CPR	10 Yrs CPR
ABGII	ABGII	145	2683	1.8 (1.3, 2.3)	4.2 (3.5, 5.1)	6.7 (5.7, 8.0)
ABGII	Trident	91	2026	2.1 (1.5, 2.8)	4.5 (3.6, 5.6)	7.1 (5.3, 9.5)
Accolade	Trident	240	7374	1.6 (1.3, 1.9)	3.9 (3.4, 4.5)	5.4 (4.2, 7.0)
Alloclassic	Allofit	123	4252	1.2 (0.9, 1.6)	2.9 (2.4, 3.5)	5.3 (4.0, 7.1)
Alloclassic	Fitmore	72	1385	2.6 (1.9, 3.7)	4.9 (3.9, 6.3)	6.9 (5.2, 9.1)
Alloclassic	Metasul*	15	371	0.8 (0.3, 2.5)	3.6 (2.1, 6.1)	4.6 (2.7, 7.6)
C-Stem	Duraloc*	46	894	2.0 (1.3, 3.2)	3.6 (2.6, 5.1)	9.2 (6.4, 13.0)
C-Stem	Elite Plus LPW*	12	367	0.6 (0.1, 2.2)	2.4 (1.2, 4.8)	7.8 (3.4, 17.1)
CLS	Allofit	25	659	1.3 (0.6, 2.5)	3.3 (2.1, 5.1)	6.1 (3.8, 9.7)
CLS	Fitmore	23	533	1.5 (0.8, 3.0)	3.9 (2.5, 6.1)	4.8 (3.2, 7.2)
CPCS	Reflection (Shell)	35	2073	0.8 (0.5, 1.3)	1.6 (1.1, 2.3)	4.0 (2.3, 6.8)
CPT	Trilogy	121	4497	1.3 (1.0, 1.7)	2.7 (2.2, 3.3)	5.1 (3.9, 6.7)
CPT	ZCA	15	582	0.4 (0.1, 1.4)	1.9 (1.0, 3.7)	5.1 (2.9, 9.1)
Charnley	Charnley Ogee*	40	630	1.1 (0.5, 2.3)	5.2 (3.6, 7.4)	8.4 (5.8, 12.1)
Charnley	Charnley*	22	563	0.5 (0.2, 1.7)	2.4 (1.3, 4.3)	6.8 (4.3, 10.6)
Charnley	Vitalock*	25	370	1.9 (0.9, 3.9)	4.4 (2.7, 7.1)	7.4 (5.0, 10.9)
Citation	Trident	33	1074	1.7 (1.1, 2.7)	3.2 (2.3, 4.6)	4.2 (2.8, 6.3)
Citation	Vitalock*	16	508	0.4 (0.1, 1.6)	2.0 (1.1, 3.7)	4.1 (2.5, 6.8)
Corail	Duraloc	35	1246	1.1 (0.6, 1.8)	2.6 (1.7, 3.7)	4.5 (3.0, 6.6)
Elite Plus	Duraloc*	70	953	1.6 (1.0, 2.6)	5.1 (3.9, 6.8)	8.9 (7.0, 11.3)
Epoch	Trilogy	32	978	2.3 (1.5, 3.4)	3.0 (2.1, 4.4)	7.4 (3.2, 16.6)
Exeter	Contemporary*	24	426	1.9 (1.0, 3.8)	4.2 (2.6, 6.6)	6.0 (4.0, 9.0)
Exeter	Vitalock*	43	1076	1.4 (0.8, 2.3)	2.3 (1.5, 3.4)	4.3 (3.2, 5.8)
Exeter V40	ABGII	24	920	0.9 (0.4, 1.8)	1.7 (1.1, 2.9)	3.0 (2.0, 4.4)
Exeter V40	Contemporary	118	3682	1.2 (0.9, 1.7)	3.0 (2.4, 3.6)	5.1 (4.1, 6.4)
Exeter V40	Exeter Contemporary	70	2457	1.3 (0.9, 1.9)	2.9 (2.3, 3.8)	6.0 (4.0, 8.9)
Exeter V40	Exeter*	43	1526	0.9 (0.5, 1.5)	2.7 (1.9, 3.7)	3.9 (2.8, 5.4)
Exeter V40	Mallory-Head	19	1022	0.5 (0.2, 1.2)	1.2 (0.7, 2.3)	4.0 (2.3, 7.0)
Exeter V40	Trident	503	25378	1.1 (0.9, 1.2)	2.3 (2.1, 2.6)	4.5 (3.6, 5.7)
Exeter V40	Trilogy	13	468	2.0 (1.0, 3.7)	2.7 (1.5, 4.7)	3.2 (1.8, 5.5)
Exeter V40	Vitalock*	52	1795	0.8 (0.5, 1.4)	2.3 (1.7, 3.1)	3.2 (2.4, 4.2)
F2L	SPH-Blind*	42	570	2.8 (1.7, 4.6)	6.1 (4.4, 8.4)	7.6 (5.6, 10.2)
MS 30	Allofit	27	1119	1.4 (0.8, 2.3)	2.3 (1.5, 3.5)	3.0 (2.0, 4.5)
MS 30	Fitmore	6	392	0.0 (0.0, 0.0)	1.0 (0.3, 3.1)	2.3 (1.0, 5.1)
MS 30	Low Profile Cup	9	542	0.4 (0.1, 1.5)	1.1 (0.4, 2.6)	2.2 (1.1, 4.6)
Mallory-Head	Mallory-Head	90	2427	1.9 (1.4, 2.6)	3.0 (2.4, 3.8)	5.5 (4.3, 7.0)
Meridian	Vitalock*	19	354	0.9 (0.3, 2.6)	3.5 (2.0, 6.1)	6.3 (4.0, 9.9)
Natural Hip	Allofit	8	492	0.8 (0.3, 2.2)	1.3 (0.6, 2.9)	2.2 (1.1, 4.6)
Natural Hip	Fitmore	20	880	0.5 (0.2, 1.2)	1.9 (1.2, 3.2)	3.2 (2.0, 5.2)
Omnifit	Secur-Fit*	61	716	2.4 (1.5, 3.8)	6.2 (4.6, 8.3)	9.8 (7.6, 12.5)
Omnifit	Trident	87	2812	1.7 (1.2, 2.2)	3.1 (2.5, 3.8)	3.8 (3.0, 4.7)
S-Rom	Duraloc Option*	22	524	1.7 (0.9, 3.3)	3.3 (2.1, 5.2)	5.2 (3.3, 8.3)
Secur-Fit	Trident	129	5441	1.2 (0.9, 1.5)	2.7 (2.2, 3.3)	4.0 (3.2, 5.0)
Secur-Fit Plus	Trident	103	4557	1.1 (0.9, 1.5)	2.2 (1.8, 2.8)	3.1 (2.5, 3.8)
Spectron EF	Reflection (Cup)	58	1321	0.9 (0.5, 1.6)	2.6 (1.9, 3.8)	9.4 (6.9, 12.6)
Spectron EF	Reflection (Shell)	156	4200	1.0 (0.7, 1.4)	2.9 (2.4, 3.5)	7.0 (5.7, 8.5)
Stability	Duraloc*	25	373	0.5 (0.1, 2.1)	2.2 (1.1, 4.3)	9.1 (5.9, 13.9)
Synergy	Reflection (Shell)	211	6752	1.4 (1.2, 1.8)	2.5 (2.2, 2.9)	5.5 (4.4, 6.8)
Taperloc	Mallory-Head	32	904	1.5 (0.9, 2.5)	2.9 (1.9, 4.4)	5.2 (3.5, 7.5)
VerSys	Trilogy	157	4367	2.2 (1.8, 2.7)	3.4 (2.9, 4.0)	4.3 (3.6, 5.0)
TOTAL		**3407**	**111511**			

Note: Only prosthesis combinations with over 350 procedures have been listed.
* denotes prosthesis combinations that have not had any reported use in Primary Total Conventional Hip Procedures in 2011

Knee Replacement

There are 33 total knee replacement combinations with over 350 procedures that have ten year outcome data. 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.

The cumulative percent revision at ten years ranges from 2.4% to 11.6% (Table TY2). This group of knee prostheses accounts for 72.4% of all primary total knee replacements reported to the Registry. There are seven knees with a cumulative percent revision at ten years of over 7.5%. Four of these prostheses have previously been identified by the Registry as having a higher than anticipated rate of revision. Of the 33 knees being reported eight (24.2%) have a cumulative percent revision of less than 5.0% at ten years.

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

Femoral Component	Tibial Component	N Revised	N Total	1 Yr CPR	5 Yrs CPR	10 Yrs CPR
AGC	AGC	161	4595	0.6 (0.4, 0.9)	3.2 (2.7, 3.8)	4.9 (4.2, 5.9)
AMK	AMK*	33	402	1.5 (0.7, 3.4)	5.9 (4.0, 8.8)	8.8 (6.3, 12.3)
Active Knee	Active Knee	215	5809	1.0 (0.8, 1.3)	4.0 (3.5, 4.7)	6.7 (5.6, 8.0)
Advance	Advance	88	1688	1.8 (1.2, 2.6)	5.8 (4.7, 7.3)	8.0 (6.4, 9.9)
Advantim	Advantim	20	1155	0.7 (0.4, 1.5)	1.9 (1.2, 3.1)	2.5 (1.5, 4.0)
BalanSys	BalanSys	15	556	0.6 (0.2, 1.8)	4.4 (2.5, 7.7)	6.3 (3.5, 11.1)
Duracon	Duracon	747	19820	1.1 (1.0, 1.2)	3.4 (3.1, 3.7)	4.7 (4.4, 5.1)
Genesis II	Genesis II	751	25242	1.1 (1.0, 1.3)	3.7 (3.4, 4.0)	4.8 (4.4, 5.3)
Genesis II	Mobile Bearing Knee	61	1109	2.0 (1.3, 3.0)	5.2 (4.0, 6.9)	7.6 (5.8, 9.8)
Genesis II Oxinium Cted	Genesis II	508	15372	1.4 (1.2, 1.6)	4.6 (4.2, 5.0)	7.3 (5.7, 9.4)
Genesis II Oxinium Cted	Mobile Bearing Knee	18	365	0.6 (0.1, 2.2)	4.6 (2.9, 7.5)	6.5 (3.8, 11.1)
Kinemax Plus	Kinemax Plus*	73	1815	0.9 (0.6, 1.5)	3.1 (2.4, 4.1)	4.8 (3.8, 6.1)
LCS	LCS	460	8267	1.1 (0.9, 1.3)	4.4 (4.0, 4.9)	6.2 (5.7, 6.9)
LCS	MBT	1089	29518	1.1 (1.0, 1.2)	4.7 (4.4, 5.0)	6.3 (5.6, 7.1)
MBK (Zimmer)	Nexgen*	24	444	0.9 (0.3, 2.4)	3.9 (2.5, 6.2)	5.5 (3.7, 8.1)
Maxim	Maxim*	112	2448	1.1 (0.7, 1.6)	4.0 (3.3, 4.9)	5.4 (4.5, 6.6)
Natural Knee II	Natural Knee II	223	5786	0.9 (0.7, 1.1)	3.0 (2.6, 3.5)	6.8 (5.7, 8.0)
Nexgen CR	Nexgen	224	9711	0.5 (0.3, 0.6)	1.9 (1.7, 2.2)	2.9 (2.5, 3.3)
Nexgen LPS	Nexgen	200	5468	0.9 (0.7, 1.2)	3.2 (2.7, 3.7)	5.2 (4.4, 6.0)
Nexgen LPS Flex	Nexgen	446	16779	0.9 (0.8, 1.1)	3.5 (3.2, 3.9)	6.0 (4.9, 7.2)
Optetrak-CR	Optetrak	22	391	1.3 (0.6, 3.2)	5.4 (3.4, 8.3)	6.9 (4.5, 10.4)
Optetrak-PS	Optetrak	113	1857	1.5 (1.1, 2.3)	7.2 (5.9, 8.7)	11.6 (7.6, 17.3)
PFC Sigma	AMK	30	1649	0.6 (0.3, 1.2)	2.4 (1.7, 3.4)	2.4 (1.7, 3.4)
PFC Sigma	MBT	428	12022	1.3 (1.1, 1.5)	4.5 (4.1, 5.0)	5.4 (4.8, 6.0)
PFC Sigma	PFC Sigma	430	19217	0.9 (0.8, 1.0)	2.7 (2.4, 2.9)	4.7 (4.0, 5.6)
Profix	Mobile Bearing Knee*	85	986	2.3 (1.6, 3.5)	8.3 (6.7, 10.2)	9.1 (7.4, 11.1)
Profix	Profix	205	5285	1.1 (0.8, 1.4)	3.7 (3.2, 4.3)	5.1 (4.4, 5.9)
Profix Oxinium Cted	Profix	70	1003	2.1 (1.3, 3.2)	7.0 (5.5, 8.8)	9.7 (7.0, 13.4)
RBK	RBK	198	6346	1.2 (1.0, 1.5)	4.2 (3.6, 4.9)	5.1 (4.3, 6.1)
Rotaglide Plus	Rotaglide Plus*	48	616	0.8 (0.3, 2.0)	5.8 (4.2, 8.0)	10.1 (7.3, 13.7)
Scorpio	Scorpio	44	822	1.1 (0.6, 2.1)	5.0 (3.6, 6.8)	6.0 (4.5, 8.0)
Scorpio	Scorpio Plus	205	4437	1.2 (0.9, 1.5)	4.3 (3.7, 5.0)	6.5 (5.4, 7.9)
Scorpio	Series 7000	507	13350	1.0 (0.9, 1.2)	3.8 (3.4, 4.1)	5.8 (5.2, 6.5)
TOTAL		**7853**	**224330**			

Note: Only prosthesis combinations with over 350 procedures have been listed.
* denotes prosthesis combinations that have not had any reported use in Total Knee Procedures in 2011

HIP REPLACEMENT

Categories of Hip Replacement

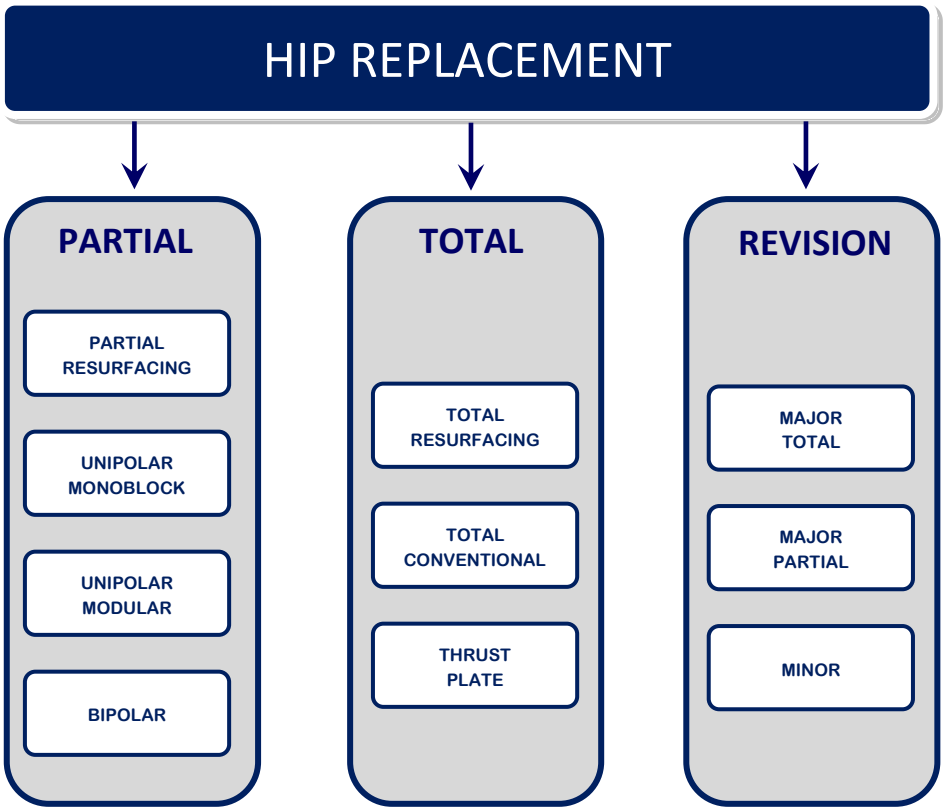
The Registry groups hip replacement into three broad categories; primary partial, primary total and revision hip replacement.

A primary replacement is the 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 hips 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. These are defined in the chapter on revision outcomes.



Use of Hip Replacement

This report analyses 332,351 hip replacements reported to the Registry with a procedure date up to and including 31 December 2011. This is an additional 38,022 hip procedures compared to the number reported last year. When considering all hip procedures currently recorded by the Registry, primary partial hips account for 16.1% of all hip replacements, primary total hips 71.8% and revision hip replacement 12.1% (Table H1).

Table H1: Number of Hip Replacements

Hip Category	Number	Percent
Primary Partial Hip	53699	16.1
Primary Total Hip	238492	71.8
Revision Hip	40160	12.1
TOTAL	**332351**	**100.0**

The number of hip replacements undertaken in 2011 increased by 1,419 (4.0%) compared to 2010. During the last 12 months the use of primary partial increased by 3.4%, primary total increased by 2.3% and revision hip replacement increased by 15.8% (Figure H1).

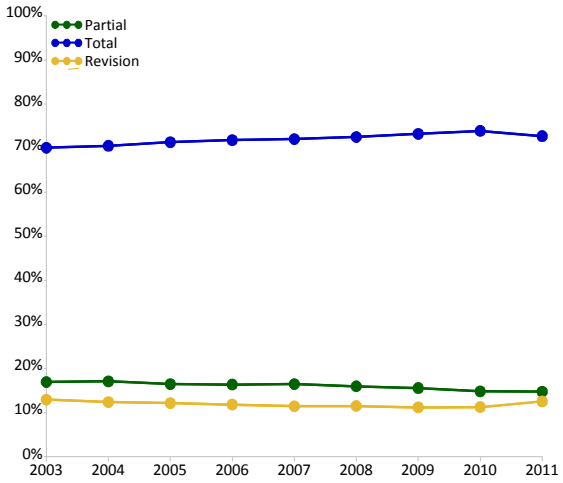
The number of hip replacement procedures undertaken in 2011 was 39.2% higher than undertaken in 2003. The corresponding increase in primary total hip replacement was 44.4%, primary partial 21.1% and revision hip replacement 34.9%.

Primary total hip replacement accounted for 72.7% of all hip replacement procedures in 2011, a decline from 2010. Primary partial hip replacement remains at 14.8% (Figure H1).

In 2011, there was an increase in the number of revision hip procedures being reported to the Registry compared to 2010 (4,646 in 2011 and 4,013 in 2010). As a percentage of all hip replacement, revisions have increased from 11.3% in 2010 to 12.5% in 2011. Revisions of the ASR XL prosthesis accounted for almost all of this increase, with 573 revisions of known ASR primary procedures being reported in 2011. This prosthesis was withdrawn from the Australian market in 2009 following identification of a higher than anticipated rate of revision by the Registry.

The ASR XL prosthesis has the potential to contribute to an increased rate of revision in Australia for the foreseeable future (Figure H1).

Figure H1: Proportion of Hip Replacements



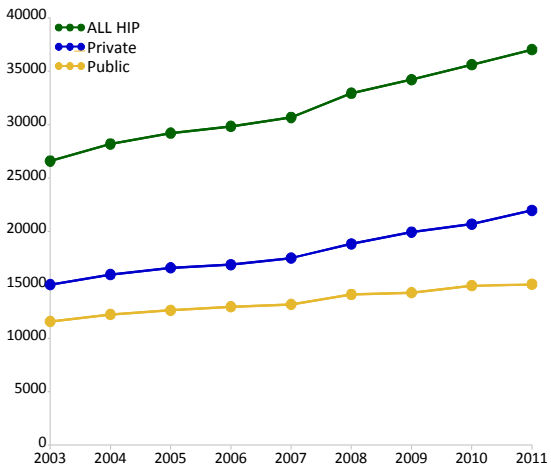
Detailed information on the demographics of each category of hip replacement is provided in the supplementary report 'Demographics of Hip Arthroplasty' available on the Registry website, www.dmac.adelaide.edu.au/aoanjrr/publications.jsp.

Public and Private Sector

More than half of all hip replacement procedures reported to the Registry have been undertaken in private hospitals (59.3% in 2011).

There were 21,972 private sector hip replacements reported for 2011, an increase of 6.2% compared to 2010. In the public sector, there were 15,059 hip replacements, an increase of 0.9% compared to 2010.

Figure H2: Hip Replacement by Hospital Sector



Since 2003, hip replacement in the private sector has increased by 46.2% compared to 30.2% in the public sector (Figure H2).

There were 4,518 public sector primary partial hip replacements reported for 2011, an increase of 3.8% compared to 2010. In the private sector, there were 946 partial hip replacements, an increase of 1.4% compared to 2010. Since 2003, primary partial hip replacement in the public sector has increased by 25.9% compared to an increase of 2.6% in the private sector.

In 2011, 17,959 private sector primary total hip replacements were reported, an increase of 3.4% compared to 2010. In the public sector, there were 8,962 primary total hip replacements, an increase of 0.2% compared to 2010. Since 2003, primary total hip replacement in the private sector has increased by 49.2% compared to 35.7% in the public sector.

There were 3,067 private sector revision hip replacements reported for 2011, a large increase of 28.6% compared to 2010. In the public sector, there were 1,579 revision hip replacements, a decrease of 3.1% compared to 2010. Since 2003, revision hip replacement in the private sector has increased by 48.2% compared to 14.9% in the public sector.

PRIMARY PARTIAL HIP REPLACEMENT

Classes of Partial Hip Replacement

The Registry identifies four classes of primary partial hip replacement. These are defined by the type of prostheses used.

1. **Partial resurfacing** involves the use of one or more button prostheses to replace part of the natural articulating surface on one or both sides of the hip joint.
2. **Unipolar monoblock** involves the use of a femoral stem prosthesis with a fixed large head that replaces the natural femoral head.
3. **Unipolar modular** involves the use of a femoral stem and exchangeable large head prosthesis that replaces the natural femoral head.
4. **Bipolar** involves the use of a femoral stem and standard head prosthesis that articulates with a non-fixed component that replaces the natural femoral head.

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

Table HP1: Partial Hip Replacement by Class

Partial Hip Class	Number	Percent
Partial Resurfacing	14	0.0
Unipolar Monoblock	22929	42.7
Unipolar Modular	19157	35.7
Bipolar	11599	21.6
TOTAL	**53699**	**100.0**

Use of Partial Hip Replacement

The most common class of primary partial hip replacement is unipolar monoblock. This accounts for 42.7% of all partial hip procedures, followed by unipolar modular (35.7%) and bipolar (21.6%). Partial resurfacing prostheses are rarely used (Table HP1).

Fractured neck of femur is the principal diagnosis for all primary partial hip replacement with the exception of partial resurfacing. This diagnosis accounts for 97.5% of unipolar monoblock, 93.5% of unipolar modular and 89.4% of bipolar hip replacements.

The outcome of primary partial hip replacement varies depending on the class. At ten years, bipolar has the lowest cumulative percent revision followed by unipolar monoblock and unipolar modular (Tables HP2 and HP3). This difference is most apparent in the less than 75 year age group (Tables HP5 and HP6 and Figure HP1).

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

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

Table HP2: Revision Rates of Primary Partial Hip Replacement by Class

Hip Class	N Revised	N Deceased	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Unipolar Monoblock	855	16555	22929	55623	1.54 (1.44, 1.64)
Unipolar Modular	597	7837	19157	44317	1.35 (1.24, 1.46)
Bipolar	381	5976	11599	40791	0.93 (0.84, 1.03)
TOTAL	**1833**	**30368**	**53685**	**140731**	**1.30 (1.24, 1.36)**

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

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Unipolar Monoblock	3.0 (2.8, 3.3)	4.9 (4.6, 5.3)	6.1 (5.6, 6.5)	7.8 (7.0, 8.7)	7.8 (7.0, 8.7)
Unipolar Modular	2.0 (1.8, 2.3)	3.8 (3.5, 4.2)	5.3 (4.8, 5.8)	8.8 (7.3, 10.7)	
Bipolar	2.1 (1.9, 2.4)	3.4 (3.1, 3.8)	4.2 (3.8, 4.7)	5.9 (5.1, 6.9)	6.9 (5.1, 9.4)

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

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Unipolar Monoblock	34.6 (34.0, 35.3)	58.0 (57.3, 58.7)	73.7 (73.0, 74.3)	91.4 (90.8, 92.0)	92.7 (91.9, 93.4)
Unipolar Modular	21.6 (21.0, 22.2)	39.6 (38.8, 40.4)	54.3 (53.4, 55.3)	75.9 (73.9, 77.7)	
Bipolar	19.8 (19.1, 20.6)	36.5 (35.5, 37.4)	50.3 (49.3, 51.3)	72.7 (71.3, 74.1)	75.4 (73.5, 77.3)

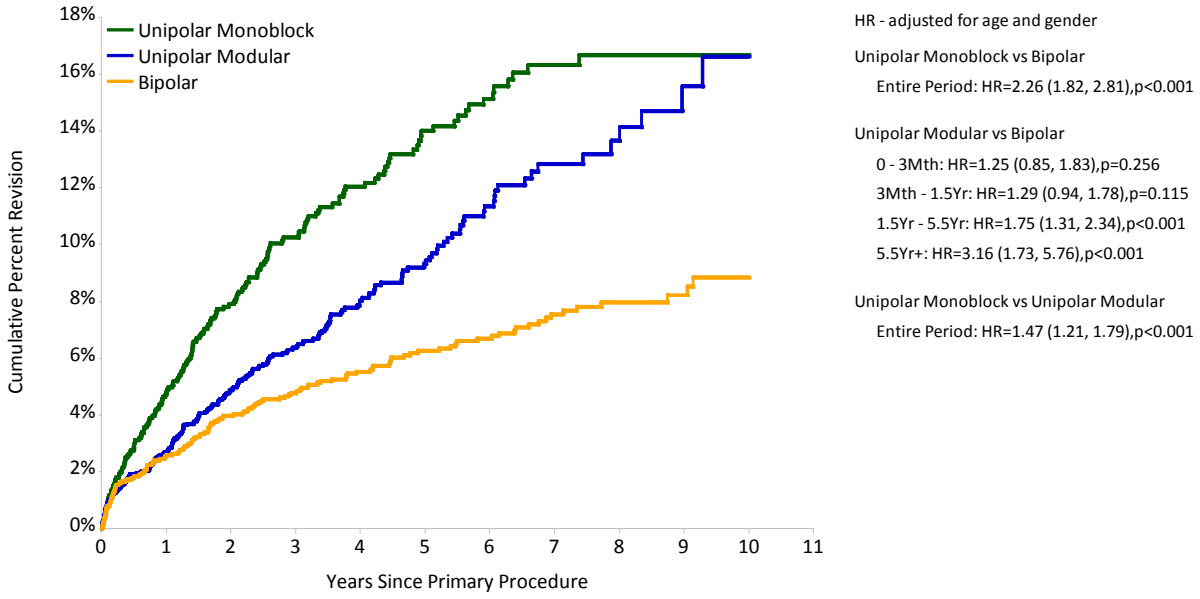
Table HP5: Revision Rates of Primary Partial Hip Replacement in Patients <75 Years by Class

Hip Class	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Unipolar Monoblock	190	2064	6463	2.94 (2.54, 3.39)
Unipolar Modular	232	3706	10735	2.16 (1.89, 2.46)
Bipolar	153	2887	12329	1.24 (1.05, 1.45)
TOTAL	**575**	**8657**	**29527**	**1.95 (1.79, 2.11)**

Table HP6: Yearly Cumulative Percent Revision of Primary Partial Hip Replacement in Patients <75 Years by Class

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Unipolar Monoblock	4.8 (3.8, 5.9)	10.2 (8.8, 12.0)	14.0 (12.1, 16.2)	16.7 (14.3, 19.4)	
Unipolar Modular	2.7 (2.2, 3.3)	6.4 (5.5, 7.4)	9.3 (8.1, 10.8)	16.6 (13.3, 20.7)	
Bipolar	2.6 (2.0, 3.3)	4.8 (4.0, 5.7)	6.3 (5.3, 7.4)	8.8 (7.3, 10.6)	

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Unipolar Monoblock	2064	1383	870	511	59	18
Unipolar Modular	3706	2628	1488	745	46	16
Bipolar	2887	2194	1625	1173	132	38

Partial Resurfacing

The Registry has recorded 14 partial resurfacing procedures. There have been no new procedures recorded since 2009. Osteonecrosis was the principal diagnosis (50%) and 11 patients were male. Thirteen procedures involved replacing part of the femoral articular surface. One resurfacing prosthesis was used on the acetabular surface

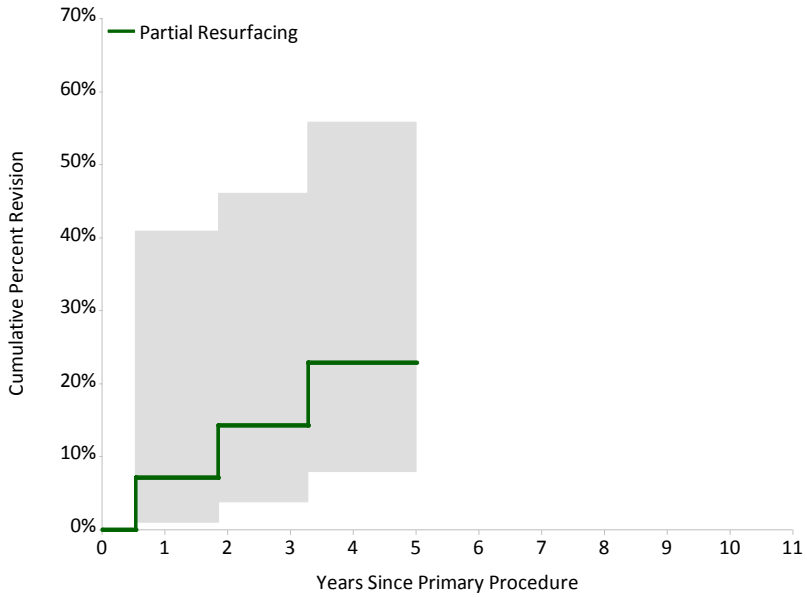
The cumulative percent revision is 7.1% at one year and 22.9% at five years (Table HP7 and Figure HP2).

Of the three revisions, two were for loosening/lysis and one for prosthesis dislocation. All were revised to a total hip replacement.

Table HP7: Yearly Cumulative Percent Revision of Primary Partial Resurfacing Hip Replacement

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Partial Resurfacing	7.1 (1.0, 40.9)	14.3 (3.8, 46.1)	22.9 (7.9, 55.8)		

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Partial Resurfacing	14	13	10	3	0	0

Unipolar Monoblock

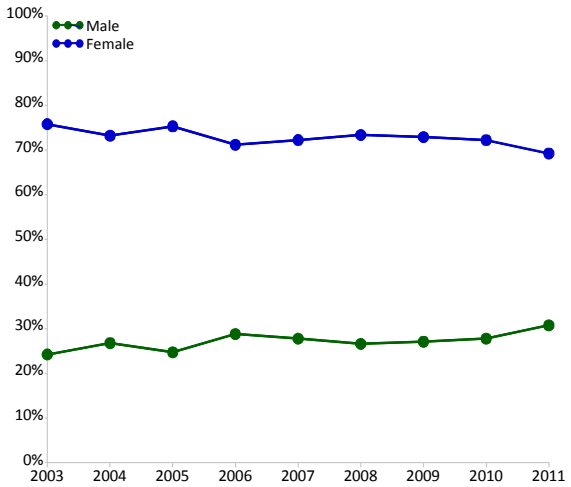
Demographics

There have been 22,929 unipolar monoblock procedures reported to the Registry; an additional 1,501 procedures compared to the last report.

The use of all monoblock hip replacement in Australia continues to decline. The number of procedures reported in 2011 was 10.6% less than 2010 and 46.5% less than 2003.

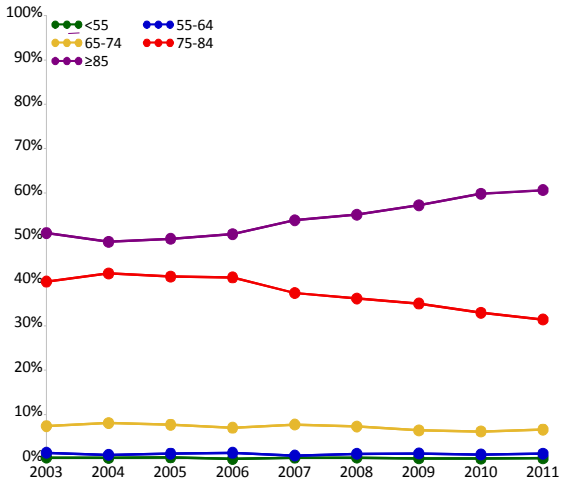
Fractured neck of femur is the principal diagnosis for unipolar monoblock hip replacement (97.5%).

Figure HP3: Primary Unipolar Monoblock Hip Replacement by Gender



Most patients are female (73.7%) and the majority of patients are aged 75 years or older (91.0%). The proportion of patients aged 85 years or older has increased from 51.0% in 2003 to 60.6% in 2011 (Figures HP3 and HP4).

Figure HP4: Primary Unipolar Monoblock Hip Replacement by Age



The three types of unipolar monoblock prostheses are the Austin Moore type, Thompson type and Exeter Trauma Stem (ETS). The use of the Austin-Moore type decreased by 17.7% in 2011 compared to 2010 and 67.0% since 2003. The Thompson type decreased by 21.5% compared to 2010 and 31.2% since 2003. The use of the ETS increased 32.9% in 2011 and accounted for 24.3% of all monoblock prostheses (Table HP8).

Table HP8: Most Used Monoblock Prostheses in Primary Unipolar Monoblock Hip Replacement

2003		2008		2009		2010		2011	
N	Model	N	Model	N	Model	N	Model	N	Model
1988	Austin-Moore	1157	Austin-Moore	1000	Austin-Moore	798	Austin-Moore	657	Austin-Moore
526	Thompson	408	Thompson	400	Thompson	461	Thompson	362	Thompson
		254	ETS	250	ETS	246	ETS	327	ETS
Most Used									
2514	(2) 100.0%	1819	(3) 100.0%	1650	(3) 100.0%	1505	(3) 100.0%	1346	(3) 100.0%

Outcome

The cumulative percent revision at eleven years for this procedure when undertaken for fractured neck of femur is 7.9% (Table HP9 and Figure HP5).

The main reasons for revision of unipolar monoblock hip replacement are loosening/lysis (48.2%) and fracture (18.4%). The majority of unipolar monoblock hip replacements are revised to a total hip replacement (62%) (Tables HP10 and HP11).

Age and fixation of the femoral stem are risk factors for revision. The rate of revision decreases with increasing age (Tables HP12 and HP13 and Figure HP6). This is evident in both males and females.

There is no difference in the outcome of primary unipolar monoblock hip replacement between males and females (Tables HP14 and HP15 and Figure HP7).

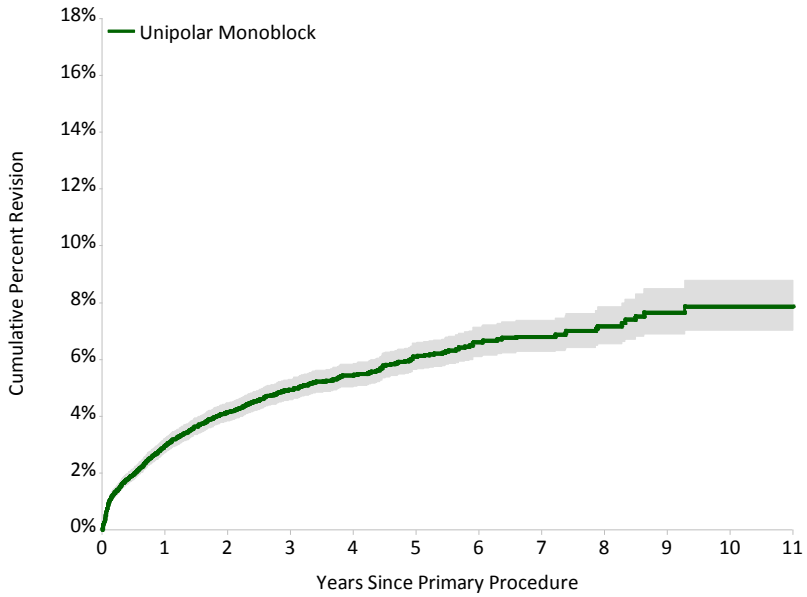
In the first one and a half years, cementless fixation has a higher rate of revision. There is no difference after this time (Tables HP16 and HP17 and Figure HP8). Although the Thompson type prosthesis is intended to be used with cement, the Registry does have outcome data when it is used without cement. The seven year cumulative percent revision with cement is 5.6% and without is 11.5% (Tables HP18 and HP19).

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

Table HP9: Yearly Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement (Primary Diagnosis Fractured NOF)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Unipolar Monoblock	3.0 (2.7, 3.2)	4.9 (4.6, 5.3)	6.1 (5.6, 6.6)	7.9 (7.0, 8.8)	7.9 (7.0, 8.8)

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Unipolar Monoblock	22347	13352	7229	3628	254	60

Table HP10: Primary Unipolar Monoblock Hip Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	412	48.2
Fracture	157	18.4
Prosthesis Dislocation	92	10.8
Infection	82	9.6
Pain	60	7.0
Chondrolysis/Acetab. Erosion	32	3.7
Malposition	9	1.1
Other	11	1.3
TOTAL	**855**	**100.0**

Table HP11: Primary Unipolar Monoblock Hip Replacement by Type of Revision

Type of Revision	Number	Percent
THR (Femoral/Acetabular)	530	62.0
Femoral Component	153	17.9
Bipolar Head and Femoral	88	10.3
Removal of Prostheses	34	4.0
Cement Spacer	33	3.9
Minor Components	9	1.1
Reinsertion of Components	4	0.5
Incomplete	1	0.1
Bipolar Only	1	0.1
Insert Only	1	0.1
Cement Only	1	0.1
TOTAL	**855**	**100.0**

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

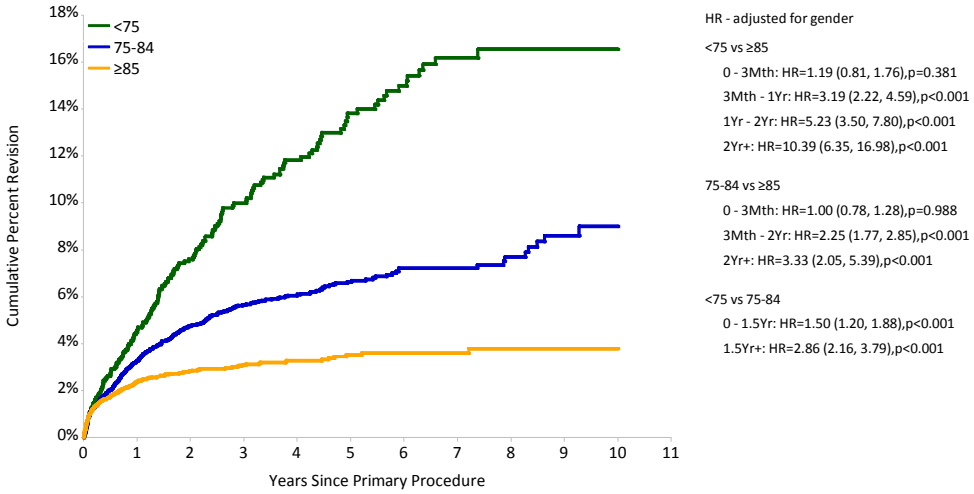
Table HP12: Revision Rates of Primary Unipolar Monoblock Hip Replacement by Age (Primary Diagnosis Fractured NOF)

Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
<75	182	1996	6336	2.87 (2.47, 3.32)
75-84	388	8767	24001	1.62 (1.46, 1.79)
≥85	263	11584	23984	1.10 (0.97, 1.24)
TOTAL	**833**	**22347**	**54321**	**1.53 (1.43, 1.64)**

Table HP13: Yearly Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement by Age (Primary Diagnosis Fractured NOF)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
<75	4.5 (3.6, 5.7)	10.0 (8.5, 11.7)	13.8 (11.9, 16.0)	16.6 (14.2, 19.3)	
75-84	3.3 (2.9, 3.7)	5.7 (5.1, 6.3)	6.6 (6.0, 7.4)	9.0 (7.6, 10.6)	
≥85	2.4 (2.1, 2.7)	3.1 (2.7, 3.5)	3.5 (3.1, 4.0)	3.8 (3.2, 4.5)	

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
<75	1996	1352	855	501	59	18
75-84	8767	5619	3228	1770	133	31
≥85	11584	6381	3146	1357	62	11

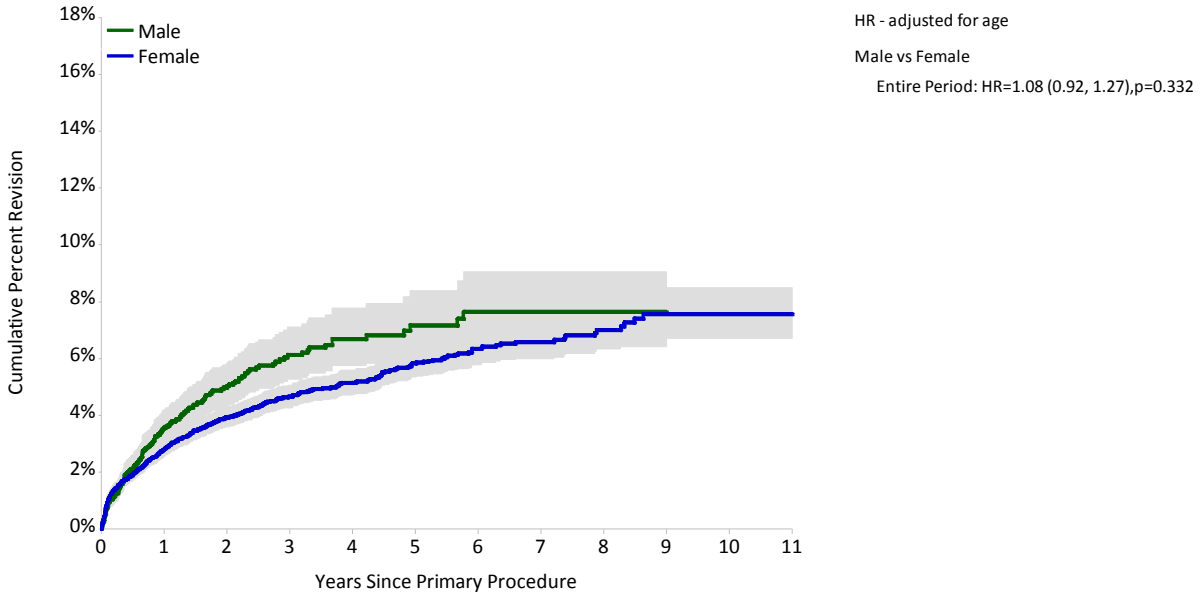
Table HP14: Revision Rates of Primary Unipolar Monoblock Hip Replacement by Gender (Primary Diagnosis Fractured NOF)

Gender	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	203	5875	9923	2.05 (1.77, 2.35)
Female	630	16472	44398	1.42 (1.31, 1.53)
TOTAL	**833**	**22347**	**54321**	**1.53 (1.43, 1.64)**

Table HP15: Yearly Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement by Gender (Primary Diagnosis Fractured NOF)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	3.6 (3.0, 4.2)	6.1 (5.3, 7.1)	7.2 (6.1, 8.4)		
Female	2.8 (2.5, 3.1)	4.6 (4.3, 5.1)	5.8 (5.3, 6.3)	7.6 (6.7, 8.5)	7.6 (6.7, 8.5)

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	5875	2699	1169	513	33	11
Female	16472	10653	6060	3115	221	49

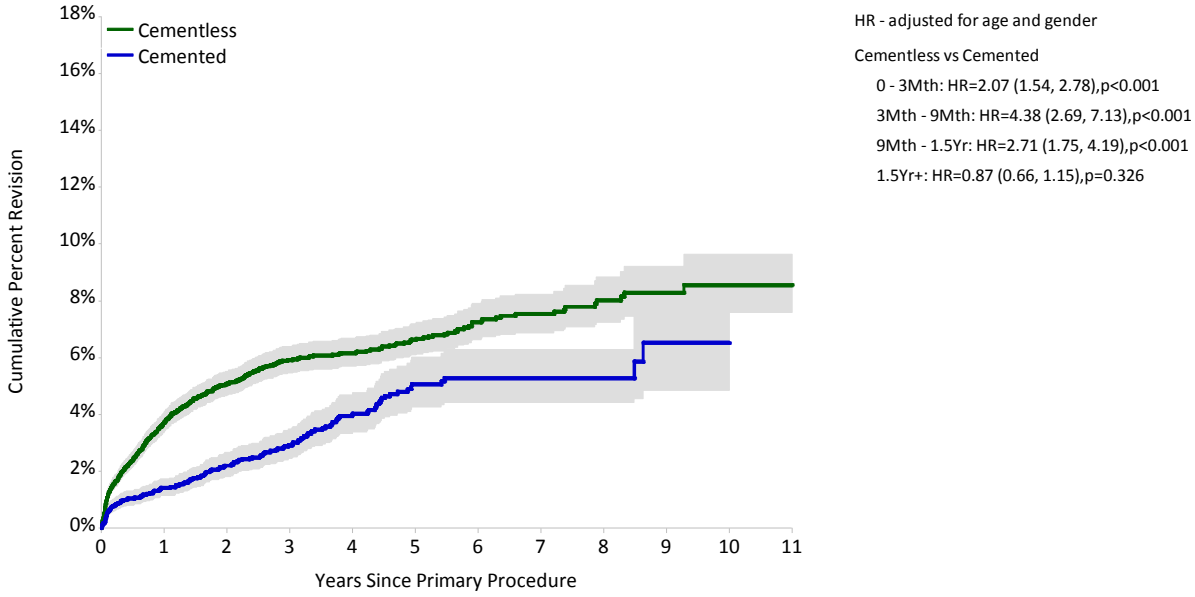
Table HP16: Revision Rates of Primary Unipolar Monoblock Hip Replacement by Femoral Fixation (Primary Diagnosis Fractured NOF)

Femoral Fixation	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Cementless	660	15131	37315	1.77 (1.64, 1.91)
Cemented	173	7216	17006	1.02 (0.87, 1.18)
TOTAL	**833**	**22347**	**54321**	**1.53 (1.43, 1.64)**

Table HP17: Yearly Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement by Femoral Fixation (Primary Diagnosis Fractured NOF)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Cementless	3.7 (3.4, 4.1)	5.9 (5.4, 6.4)	6.6 (6.1, 7.2)	8.6 (7.6, 9.6)	8.6 (7.6, 9.6)
Cemented	1.4 (1.1, 1.7)	2.9 (2.4, 3.5)	5.1 (4.3, 6.0)	6.5 (4.8, 8.8)	

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Cementless	15131	8941	4944	2562	196	46
Cemented	7216	4411	2285	1066	58	14

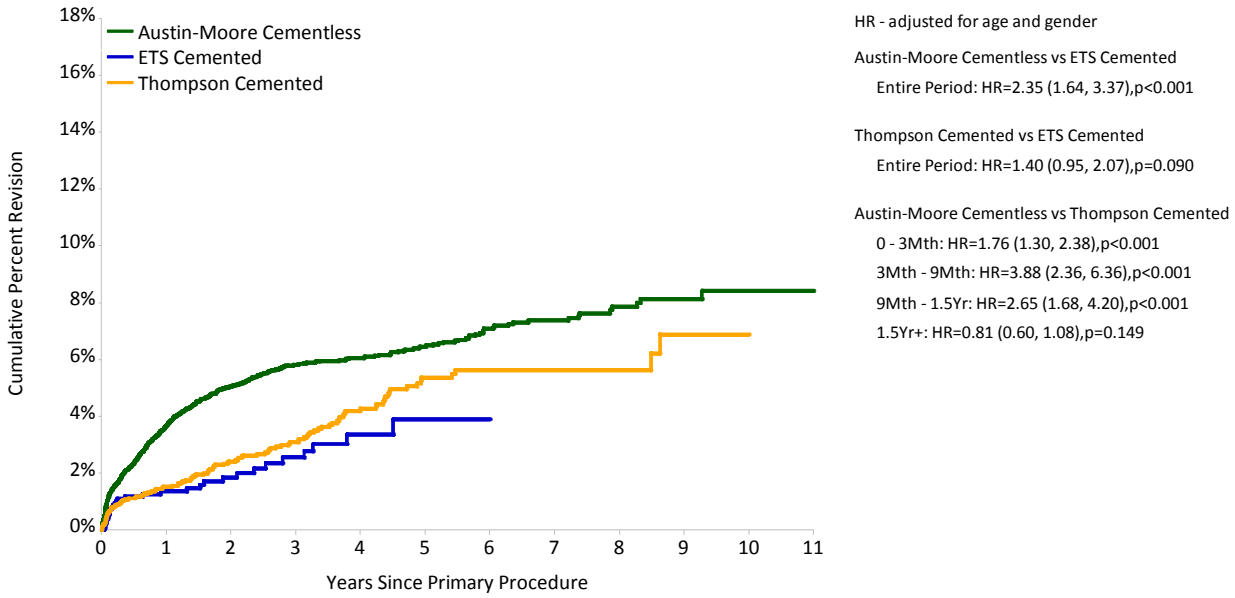
Table HP18: Revision Rates of Primary Unipolar Monoblock Hip Replacement

Unipolar Monoblock	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Austin-Moore Type Cemented	11	674	1342	0.82 (0.41, 1.47)
Austin-Moore Type Cementless	642	14999	36905	1.74 (1.61, 1.88)
ETS Cemented	31	1671	3264	0.95 (0.65, 1.35)
Thompson Type Cemented	136	5075	12827	1.06 (0.89, 1.25)
Thompson Type Cementless	35	510	1285	2.72 (1.90, 3.79)
TOTAL	**855**	**22929**	**55623**	**1.54 (1.44, 1.64)**

Table HP19: Yearly Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Austin-Moore Type Cemented	1.0 (0.4, 2.5)	2.7 (1.3, 5.5)	4.4 (2.2, 8.6)		
Austin-Moore Type Cementless	3.7 (3.3, 4.0)	5.8 (5.4, 6.3)	6.5 (5.9, 7.0)	8.4 (7.4, 9.5)	8.4 (7.4, 9.5)
ETS Cemented	1.4 (0.9, 2.1)	2.5 (1.7, 3.8)	3.9 (2.5, 6.0)		
Thompson Type Cemented	1.5 (1.2, 1.9)	3.1 (2.5, 3.8)	5.4 (4.4, 6.5)	6.9 (5.1, 9.2)	
Thompson Type Cementless	6.3 (4.3, 9.1)	9.0 (6.3, 12.7)	11.5 (8.0, 16.5)		

Figure HP9: Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Austin-Moore Cementless	14999	8844	4897	2540	191	43
ETS Cemented	1671	973	446	132	0	0
Thompson Cemented	5075	3197	1718	877	59	14

Unipolar Modular

Demographics

There have been 19,157 unipolar modular procedures reported to the Registry, an additional 3,416 procedures compared to the previous report.

The number of unipolar modular procedures reported in 2011 was 9.0% more than 2010 and 382.0% more than 2003.

Fractured neck of femur is the principal diagnosis for unipolar modular hip replacement (93.6%).

Most patients are female (72.4%) and the majority of patients are aged 75 years or older (80.6%). The proportion of patients aged 85 years or older has increased from 32.0% in 2003 to 45.8% in 2011 (Figures HP10 and HP11).

Figure HP11: Primary Unipolar Modular Hip Replacement by Age

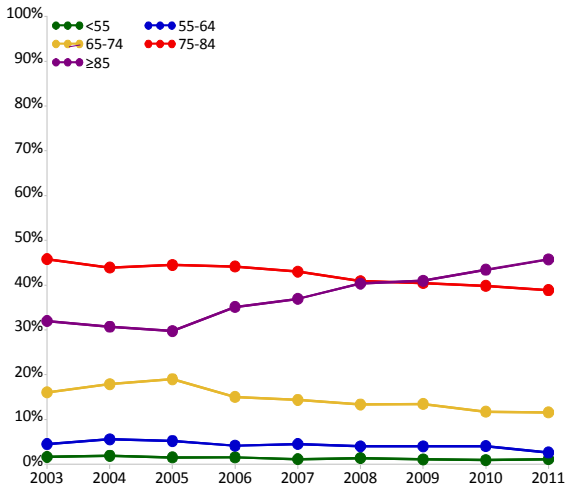
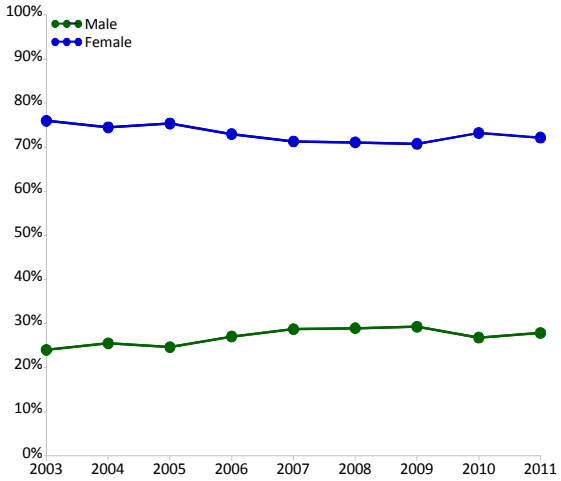


Figure HP10: Primary Unipolar Modular Hip Replacement by Gender



There were 23 different unipolar modular head prostheses and 49 different stem prostheses used in 2011. Overall there have been 179 unipolar modular head and stem combinations recorded by the Registry. The ten most frequently used unipolar modular head prostheses and femoral stems are listed in Tables HP20 and HP21.

In 2011, the Unitrax head was the most frequently used unipolar modular head (39.8%). The Exeter V40 was the most frequently used stem (38.1%).

The ten most used unipolar modular head prostheses account for 98.0% of all unipolar modular hip procedures. The ten most used femoral stems account for 92.0% of all unipolar modular hip procedures (Tables HP20 and HP21).

Table HP20: Ten Most Used Unipolar Head Prostheses in Primary Unipolar Modular Hip Replacement

2003		2008		2009		2010		2011	
N	Model	N	Model	N	Model	N	Model	N	Model
193	Unitrax	803	Unipolar (S&N)	942	Unitrax	1151	Unitrax	1278	Unitrax
99	Unipolar (CPulse)	762	Unitrax	918	Unipolar (S&N)	722	Unipolar (S&N)	723	Unipolar (S&N)
89	Unipolar (S&N)	375	VerSys Endo	393	VerSys Endo	495	VerSys Endo	544	VerSys Endo
75	VerSys Endo	187	Cathcart	216	Cathcart	175	Cathcart	145	Metasul
64	Hemi (Mathys)	145	Unipolar (Corin)	119	Unipolar (Zimmer)	101	Unipolar (Zimmer)	135	Cathcart
46	Elite	121	Unipolar (Zimmer)	105	Unipolar (Corin)	79	Unipolar (Corin)	114	U2
38	Unipolar (Plus)	95	Unipolar (Plus)	85	Metasul	62	Metasul	72	Unipolar (Zimmer)
28	Unipolar (Zimmer)	29	Metasul	64	Unipolar (Plus)	52	Unipolar (Plus)	68	Unipolar (Corin)
16	Ultima	18	Hemi (Mathys)	16	Endo II	22	U2	41	Unipolar (Lima)
15	Unipolar (Protek)	15	Femoral (JRI)	6	Furlong LOL	21	Conserve	27	Unipolar (Plus)
Ten Most Used									
663	(10) 99.5%	2550	(10) 98.5%	2864	(10) 99.1%	2880	(10) 97.8%	3147	(10) 98.0%
Remainder									
3	(3) 0.5%	40	(11) 1.5%	27	(11) 0.9%	65	(13) 2.2%	63	(13) 2.0%
TOTAL									
666	(13) 100.0%	2590	(21) 100.0%	2891	(21) 100.0%	2945	(23) 100.0%	3210	(23) 100.0%

Table HP21: Ten Most Used Femoral Stem Prostheses in Primary Unipolar Modular Hip Replacement

2003		2008		2009		2010		2011	
N	Model	N	Model	N	Model	N	Model	N	Model
180	Exeter V40	732	Exeter V40	921	Exeter V40	1101	Exeter V40	1224	Exeter V40
111	Alloclassic	360	CPCS	458	CPCS	495	CPT	574	CPT
91	CPT	344	CPT	374	CPT	323	CPCS	317	CPCS
70	Spectron EF	314	Spectron EF	335	Spectron EF	270	Spectron EF	269	Spectron EF
49	Fullfix Stem	182	Corail	205	Corail	156	Corail	153	Alloclassic
38	SL-Plus	156	Alloclassic	202	Alloclassic	144	Alloclassic	121	Corail
33	Elite Plus	100	SL-Plus	97	SL-Plus	80	SL-Plus	111	E2
18	Basis	71	Taper Fit	59	Basis	62	Basis	80	SL-Plus
15	CCA	68	Trifit	53	Metafix	54	Metafix	58	Basis
15	Thompson Modular Stem	48	Basis	45	Taper Fit	38	Omnifit	47	Metafix
Ten Most Used									
620	(10) 93.1%	2375	(10) 91.7%	2749	(10) 95.1%	2723	(10) 92.5%	2954	(10) 92.0%
Remainder									
46	(12) 6.9%	215	(27) 8.3%	142	(34) 4.9%	222	(39) 7.5%	256	(39) 8.0%
TOTAL									
666	(22) 100.0%	2590	(37) 100.0%	2891	(44) 100.0%	2945	(49) 100.0%	3210	(49) 100.0%

Outcome

The cumulative percent revision at ten years for this procedure when undertaken for fractured neck of femur is 8.7% (Table HP22 and Figure HP12).

The main reasons for revision are prosthesis dislocation (19.6%), infection (18.1%), loosening/lysis (17.4%), and fracture (16.4%). The majority of revisions of primary unipolar modular are acetabular only revisions (46.2%), followed by THR (femoral/acetabular) revisions (20.4%) (Tables HP23 and HP24).

Age, gender and fixation of the femoral stem are all risk factors for revision. The rate of revision decreases with increasing age (Tables HP25 and HP26 and Figure HP13). This is evident in both males and females. Males have a significantly higher rate of revision in the first one and a half years, after this time there is no difference (Tables HP27 and HP28 and Figure HP14).

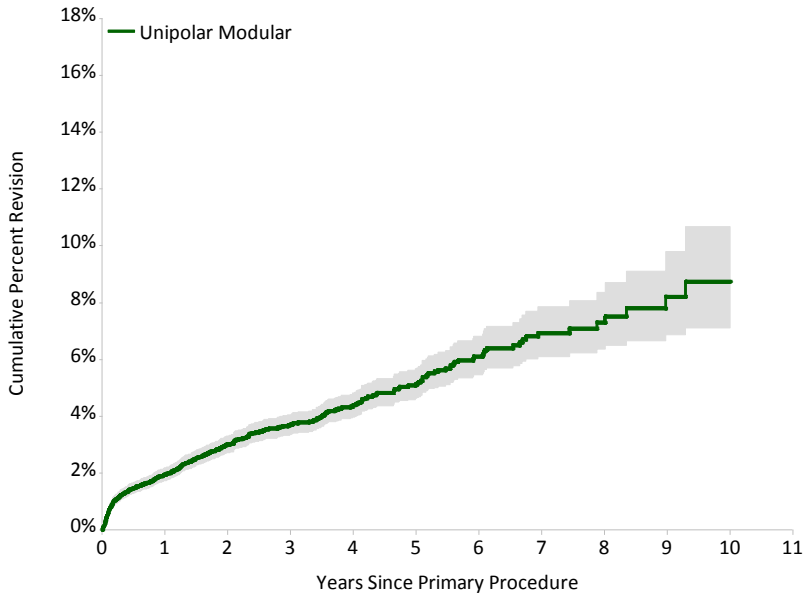
Cementless fixation has a higher rate of revision in the first nine months, after this time there is no difference in the rate of revision compared to cemented stems (Tables HP29 and HP30 and Figures HP15 and HP16).

The revisions per 100 observed component years and yearly cumulative percent revision of individual combinations of unipolar modular stem/head prostheses with 100 or more procedures are detailed in Tables HP31 and HP32.

Table HP22: Yearly Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement (Primary Diagnosis Fractured NOF)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Unipolar Modular	1.9 (1.7, 2.2)	3.7 (3.4, 4.1)	5.1 (4.6, 5.7)	8.7 (7.1, 10.7)	

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Unipolar Modular	17921	11440	5521	2228	100	27

Table HP23: Primary Unipolar Modular Hip Replacement by Reason for Revision

Reason for Revision	Number	Percent
Prosthesis Dislocation	117	19.6
Infection	108	18.1
Loosening/Lysis	104	17.4
Fracture	98	16.4
Pain	84	14.1
Chondrolysis/Acetab. Erosion	64	10.7
Malposition	1	0.2
Other	21	3.5
TOTAL	**597**	**100.0**

Table HP24: Primary Unipolar Modular Hip Replacement by Type of Revision

Type of Revision	Number	Percent
Acetabular Component	276	46.2
THR (Femoral/Acetabular)	122	20.4
Femoral Component	74	12.4
Head Only	54	9.0
Cement Spacer	23	3.9
Minor Components	21	3.5
Bipolar Head and Femoral	13	2.2
Removal of Prostheses	10	1.7
Bipolar Only	2	0.3
Cement Only	1	0.2
Reinsertion of Components	1	0.2
TOTAL	**597**	**100.0**

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

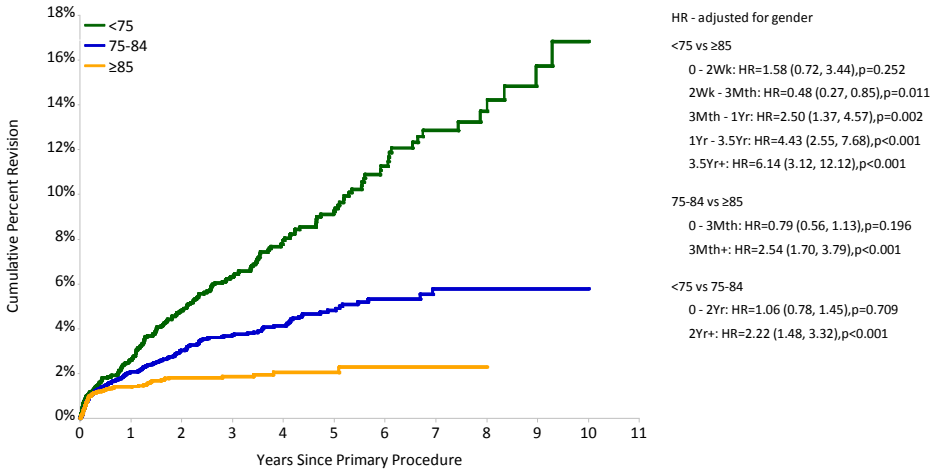
Table HP25: Revision Rates of Primary Unipolar Modular Hip Replacement by Age (Primary Diagnosis Fractured NOF)

Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
<75	213	3372	9960	2.14 (1.86, 2.45)
75-84	226	7493	18845	1.20 (1.05, 1.37)
≥85	102	7056	12652	0.81 (0.66, 0.98)
TOTAL	**541**	**17921**	**41457**	**1.30 (1.20, 1.42)**

Table HP26: Yearly Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement by Age (Primary Diagnosis Fractured NOF)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
<75	2.6 (2.1, 3.2)	6.3 (5.4, 7.4)	9.2 (7.9, 10.7)	16.8 (13.3, 21.1)	
75-84	2.1 (1.7, 2.5)	3.7 (3.2, 4.3)	4.8 (4.2, 5.6)	5.8 (4.8, 6.9)	
≥85	1.4 (1.1, 1.7)	1.9 (1.5, 2.3)	2.0 (1.6, 2.6)		

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
<75	3372	2439	1375	695	43	16
75-84	7493	5054	2575	1097	50	10
≥85	7056	3947	1571	436	7	1

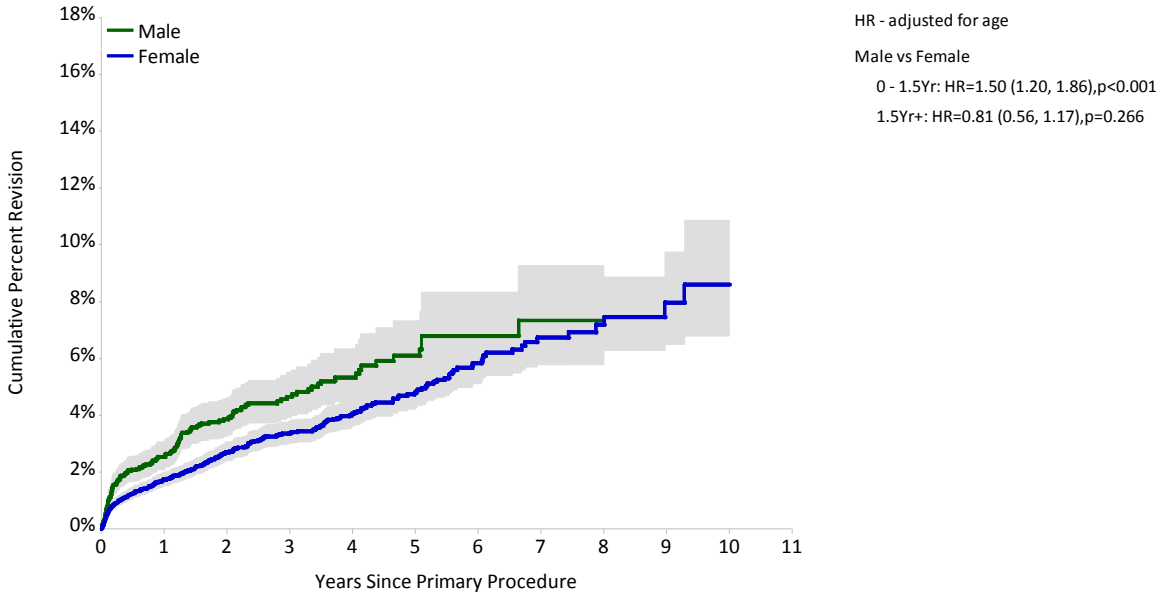
Table HP27: Revision Rates of Primary Unipolar Modular Hip Replacement by Gender (Primary Diagnosis Fractured NOF)

Gender	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	165	4924	9388	1.76 (1.50, 2.05)
Female	376	12997	32069	1.17 (1.06, 1.30)
TOTAL	**541**	**17921**	**41457**	**1.30 (1.20, 1.42)**

Table HP28: Yearly Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement by Gender (Primary Diagnosis Fractured NOF)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	2.5 (2.1, 3.1)	4.6 (3.9, 5.5)	6.1 (5.0, 7.3)		
Female	1.7 (1.5, 2.0)	3.4 (3.0, 3.8)	4.8 (4.2, 5.4)	8.6 (6.8, 10.9)	

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	4924	2720	1179	416	18	5
Female	12997	8720	4342	1812	82	22

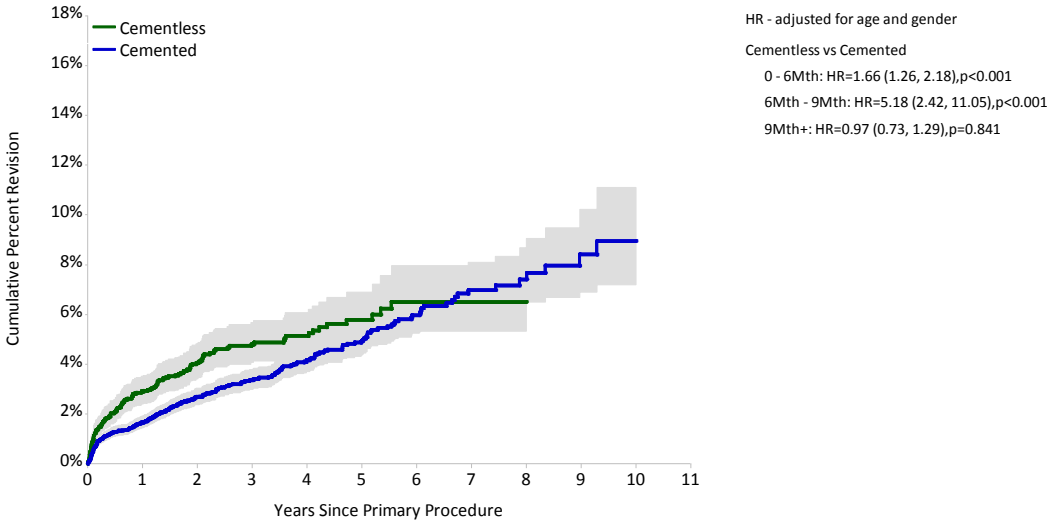
Table HP29: Revision Rates of Primary Unipolar Modular Hip Replacement by Femoral Fixation (Primary Diagnosis Fractured NOF)

Femoral Fixation	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Cementless	155	4025	9631	1.61 (1.37, 1.88)
Cemented	386	13896	31825	1.21 (1.09, 1.34)
TOTAL	**541**	**17921**	**41457**	**1.30 (1.20, 1.42)**

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

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Cementless	2.9 (2.4, 3.5)	4.8 (4.1, 5.7)	5.8 (4.8, 6.9)		
Cemented	1.7 (1.4, 1.9)	3.4 (3.0, 3.8)	4.9 (4.4, 5.6)	8.9 (7.2, 11.1)	

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Cementless	4025	2712	1367	490	3	0
Cemented	13896	8728	4154	1738	97	27

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

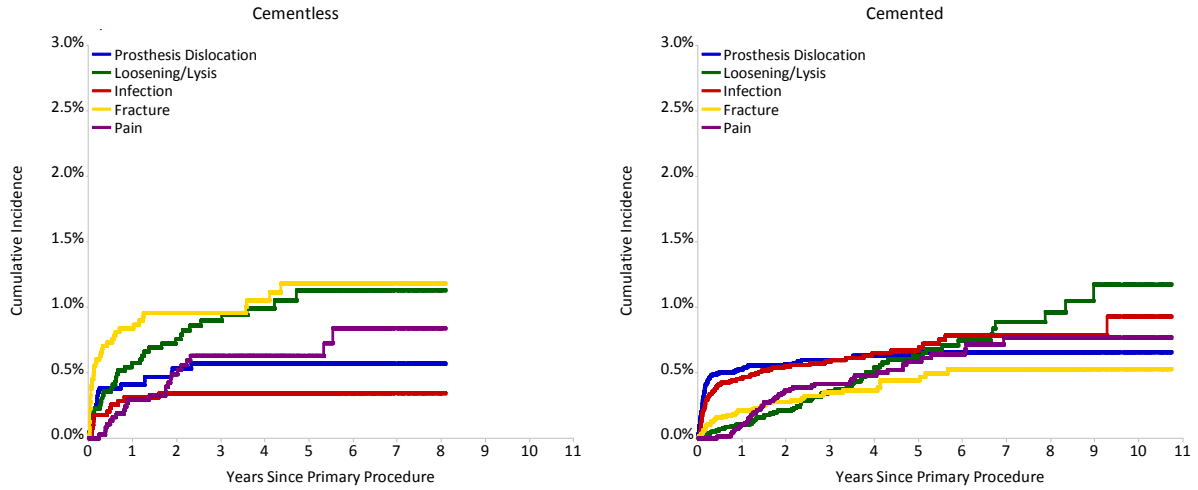


Table HP31: Revision Rates of Primary Unipolar Modular Hip Replacement

Unipolar Head	Femoral Component	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Cathcart	Corail	38	884	1704	2.23 (1.58, 3.06)
Hemi Head (Mathys)	CCA	8	357	1452	0.55 (0.24, 1.09)
Hemi Head (Mathys)	Fullfix Stem	6	226	872	0.69 (0.25, 1.50)
Metasul	Alloclassic	7	273	432	1.62 (0.65, 3.34)
U2	E2	0	128	64	0.00 (0.00, 5.74)
Ultima	Thompson Modular Stem	1	133	616	0.16 (0.00, 0.90)
Unipolar Head (CPulse)	Alloclassic	16	275	1090	1.47 (0.84, 2.38)
Unipolar Head (Corin)	Metafix	0	160	199	0.00 (0.00, 1.85)
Unipolar Head (Corin)	Taper Fit	14	298	722	1.94 (1.06, 3.25)
Unipolar Head (Corin)	Trifit	6	288	818	0.73 (0.27, 1.60)
Unipolar Head (Plus)	SL-Plus	21	541	1679	1.25 (0.77, 1.91)
Unipolar Head (S&N)	Basis	13	438	1124	1.16 (0.62, 1.98)
Unipolar Head (S&N)	CPCS	52	1985	3851	1.35 (1.01, 1.77)
Unipolar Head (S&N)	Platform	4	107	253	1.58 (0.43, 4.06)
Unipolar Head (S&N)	SL-Plus	1	141	133	0.75 (0.02, 4.18)
Unipolar Head (S&N)	Spectron EF	51	1945	4773	1.07 (0.80, 1.40)
Unipolar Head (Zimmer)	Alloclassic	27	725	1881	1.44 (0.95, 2.09)
Unipolar Head (Zimmer)	CPT	8	159	901	0.89 (0.38, 1.75)
Unitrax	Accolade	6	109	301	2.00 (0.73, 4.35)
Unitrax	Exeter V40	174	5902	12709	1.37 (1.17, 1.59)
Unitrax	Omnifit	4	139	281	1.42 (0.39, 3.65)
VerSys Endo	CPT	70	2465	4989	1.40 (1.09, 1.77)
VerSys Endo	VerSys	6	155	356	1.69 (0.62, 3.67)
Other (156)		64	1324	3118	2.05 (1.58, 2.62)
TOTAL		**597**	**19157**	**44317**	**1.35 (1.24, 1.46)**

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

Table HP32: Yearly Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement

Unipolar Head	Femoral Component	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Cathcart	Corail	3.9 (2.7, 5.6)	6.1 (4.4, 8.5)			
Hemi Head (Mathys)	CCA	1.0 (0.3, 3.0)	2.6 (1.2, 5.3)	2.6 (1.2, 5.3)		
Hemi Head (Mathys)	Fullfix Stem	1.5 (0.5, 4.7)	2.7 (1.1, 6.5)	2.7 (1.1, 6.5)		
Metasul	Alloclassic	1.6 (0.6, 4.3)				
Ultima	Thompson Modular Stem	0.8 (0.1, 5.5)	0.8 (0.1, 5.5)	0.8 (0.1, 5.5)		
Unipolar Head (CPulse)	Alloclassic	3.8 (2.0, 7.2)	5.3 (3.0, 9.1)	7.3 (4.4, 11.9)		
Unipolar Head (Corin)	Metafix	0.0 (0.0, 0.0)				
Unipolar Head (Corin)	Taper Fit	2.3 (1.0, 5.0)	6.5 (3.8, 11.2)			
Unipolar Head (Corin)	Trifit	1.5 (0.6, 4.0)	2.6 (1.2, 5.9)	2.6 (1.2, 5.9)		
Unipolar Head (Plus)	SL-Plus	2.0 (1.1, 3.6)	4.3 (2.7, 6.8)	5.7 (3.5, 9.2)		
Unipolar Head (S&N)	Basis	1.4 (0.6, 3.4)	3.0 (1.5, 6.2)	6.3 (3.4, 11.4)		
Unipolar Head (S&N)	CPCS	2.0 (1.4, 2.7)	3.5 (2.6, 4.7)	4.7 (3.2, 7.0)		
Unipolar Head (S&N)	Platform	4.2 (1.6, 10.8)	4.2 (1.6, 10.8)			
Unipolar Head (S&N)	SL-Plus	0.8 (0.1, 5.8)				
Unipolar Head (S&N)	Spectron EF	1.5 (1.0, 2.3)	3.2 (2.3, 4.4)	4.2 (3.1, 5.7)		
Unipolar Head (Zimmer)	Alloclassic	2.8 (1.8, 4.5)	4.0 (2.7, 6.0)	5.1 (3.3, 7.8)		
Unipolar Head (Zimmer)	CPT	0.7 (0.1, 4.9)	3.0 (1.1, 7.9)	5.1 (2.3, 11.1)		
Unitrax	Accolade	1.0 (0.1, 6.6)	8.0 (3.6, 17.1)			
Unitrax	Exeter V40	1.7 (1.4, 2.1)	3.5 (2.9, 4.1)	5.6 (4.6, 6.7)		
Unitrax	Omnifit	3.6 (1.3, 9.5)				
VerSys Endo	CPT	1.8 (1.3, 2.5)	3.7 (2.9, 4.9)	5.4 (3.9, 7.5)		
VerSys Endo	VerSys	3.5 (1.3, 9.3)	3.5 (1.3, 9.3)			
Other (156)		3.9 (2.9, 5.2)	5.7 (4.3, 7.5)	7.4 (5.6, 9.8)		

Note: The U2/E2 combination is not listed as it does not have one year follow up.

Bipolar

Demographics

There have been 11,599 bipolar procedures reported to the Registry, an additional 946 procedures compared to the last report.

The number of bipolar procedures undertaken in 2011 was 8.9% more than 2010 but 31.8% less than 2003.

Fractured neck of femur is the principal diagnosis for bipolar hip replacement (89.5%).

Most patients are female (72.9%) and aged 75 years or older (75.2%). The proportion of patients aged 85 years or older has increased from 25.8% in 2003 to 42.3% in 2011 (Figures HP17 and HP18).

Figure HP17: Primary Bipolar Hip Replacement by Gender

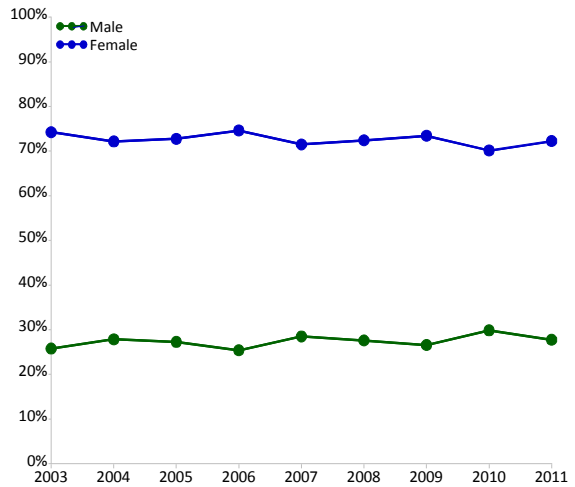
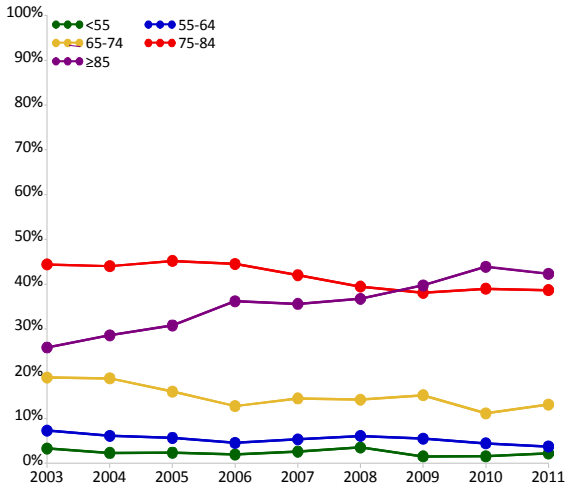


Figure HP18: Primary Bipolar Hip Replacement by Age



There were 13 different bipolar head prostheses and 42 different stem prostheses used in 2011. Overall there have been 217 bipolar head and stem combinations reported to the Registry (Tables HP33 and HP34).

In 2011, the UHR remains the most frequently used bipolar head (45.8%) and the Exeter V40 remains the most frequently used stem (43.9%), however there has been a small decrease in the use of these prostheses as an overall percentage compared to 2010.

The ten most used bipolar head prostheses account for 99.3% of all bipolar hip procedures. The ten most used femoral stems account for 82.5% of all bipolar hip procedures (Tables HP33 and HP34).

Table HP33: Ten Most Used Bipolar Head Prostheses in Primary Bipolar Hip Replacement

2003		2008		2009		2010		2011	
N	Model	N	Model	N	Model	N	Model	N	Model
750	UHR	470	UHR	410	UHR	453	UHR	416	UHR
140	Hastings	130	Tandem	123	Tandem	124	Tandem	132	Multipolar Bipolar
115	Convene	118	Multipolar Bipolar	114	Multipolar Bipolar	98	Multipolar Bipolar	113	Tandem
91	Bipolar (CPulse)	72	Hastings	64	Hastings	71	Hastings	70	Self-Centering
87	Self-Centering	36	Self-Centering	30	Self-Centering	35	Self-Centering	55	Hastings
59	Multipolar Bipolar	17	Ringloc	16	Bipolar (Medacta)	13	Ringloc	31	Bipolar (Lima)
39	Bipolar (Mathys)	8	UHL	11	Ringloc	12	Bipolar (Medacta)	29	Bipolar (Medacta)
19	Bipolar (Lima)	1	Bipolar (Lima)	6	UHL	10	Moonstone	25	Ringloc
19	Ringloc			5	Bipolar (Eska)	5	Bipolar (Lima)	23	Moonstone
5	UHL			3	Moonstone	5	UHL	8	Bipolar (ISP)
Ten Most Used									
1324	(10) 99.5%	852	(8) 100.0%	782	(10) 99.9%	826	(10) 99.0%	902	(10) 99.3%
Remainder									
7	(2) 0.5%	0	(0) 0%	1	(1) 0.1%	8	(4) 1.0%	6	(3) 0.7%
TOTAL									
1331	(12) 100.0%	852	(8) 100.0%	783	(11) 100.0%	834	(14) 100.0%	908	(13) 100.0%

Table HP34: Ten Most Used Femoral Stem Prostheses in Primary Bipolar Hip Replacement

2003		2008		2009		2010		2011	
N	Model	N	Model	N	Model	N	Model	N	Model
622	Exeter V40	381	Exeter V40	338	Exeter V40	402	Exeter V40	399	Exeter V40
94	Elite Plus	78	CPCS	83	CPCS	91	CPCS	83	CPT
75	Alloclassic	65	VerSys	46	CPT	57	Corail	77	CPCS
65	CPCS	54	Corail	44	VerSys	53	CPT	55	Corail
61	C-Stem	35	Accolade	43	Corail	33	VerSys	27	Accolade
59	Omnifit	33	CPT	41	Accolade	31	Accolade	24	Quadra-C
45	VerSys	23	Spectron EF	26	C-Stem	14	Spectron EF	24	VerSys
26	ABGII	20	ABGII	22	Spectron EF	13	C-Stem	22	Spectron EF
25	CCA	17	Alloclassic	12	GMRS	13	HACTIV	21	Summit
25	Spectron EF	17	GMRS	11	Alloclassic	11	GMRS	17	HACTIV
Ten Most Used									
1097	(10) 82.4%	723	(10) 84.9%	666	(10) 85.1%	718	(10) 86.1%	749	(10) 82.5%
Remainder									
234	(45) 17.6%	129	(25) 15.1%	117	(28) 14.9%	116	(36) 13.9%	159	(32) 17.5%
TOTAL									
1331	(55) 100.0%	852	(35) 100.0%	783	(38) 100.0%	834	(46) 100.0%	908	(42) 100.0%

Outcome

The cumulative percent revision at 11 years for this procedure when undertaken for fractured neck of femur is 6.4% (Table HP35 and Figure HP19).

The main reasons for revision of bipolar hip replacement are fracture (22.3%), loosening/lysis (21.8%), infection (17.8%) and prosthesis dislocation (17.8%). The majority of revisions of primary bipolar are acetabular only revisions (37.3%), followed by THR (femoral/acetabular) revisions (24.1%) and bipolar head and femoral revisions (13.4%) (Tables HP36 and HP37).

Age and fixation of the femoral stem are risk factors for revision (Figures HP20, HP22 and HP23).

There is a higher rate of revision in patients less than 75 years of age. Compared to patients 85 years or older however this is only evident after six months. There is no difference in the rate of revision between the two older age groups (75-84 and ≥85 years) (Tables HP38 and HP39 and Figure HP20).

There is no difference in the rate of revision between males and females (Tables HP40 and HP41 and Figure HP21).

Bipolar hip replacement has a higher rate of revision in the first three months when cementless stems are used. This is mainly due to an increased incidence of femoral fracture (1.0% at three months for cementless stems compared to 0.1% for cemented stems). There is no difference in the rate of revision after three months (Tables HP42 and HP43 and Figures HP22 and HP23).

The revisions per 100 observed component years and yearly cumulative percent revision of individual combinations of bipolar stem/head prostheses with 100 or more procedures are detailed in Tables HP44 and HP45.

Table HP35: Yearly Cumulative Percent Revision of Primary Bipolar Hip Replacement (Primary Diagnosis Fractured NOF)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Bipolar	2.1 (1.8, 2.4)	3.4 (3.0, 3.8)	4.1 (3.7, 4.6)	5.4 (4.6, 6.2)	6.4 (4.5, 9.1)

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

Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Bipolar	10375	7590	5107	3253	234	65

Table HP36: Primary Bipolar Hip Replacement by Reason for Revision

Reason for Revision	Number	Percent
Fracture	85	22.3
Loosening/Lysis	83	21.8
Prosthesis Dislocation	68	17.8
Infection	68	17.8
Pain	35	9.2
Chondrolysis/Acetab. Erosion	26	6.8
Malposition	2	0.5
Other	14	3.7
TOTAL	**381**	**100.0**

Table HP37: Primary Bipolar Hip Replacement by Type of Revision

Type of Revision	Number	Percent
Acetabular Component	142	37.3
THR (Femoral/Acetabular)	92	24.1
Bipolar Head and Femoral	51	13.4
Bipolar Only	34	8.9
Femoral Component	20	5.2
Cement Spacer	20	5.2
Head Only	11	2.9
Minor Components	7	1.8
Removal of Prostheses	4	1.0
TOTAL	**381**	**100.0**

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

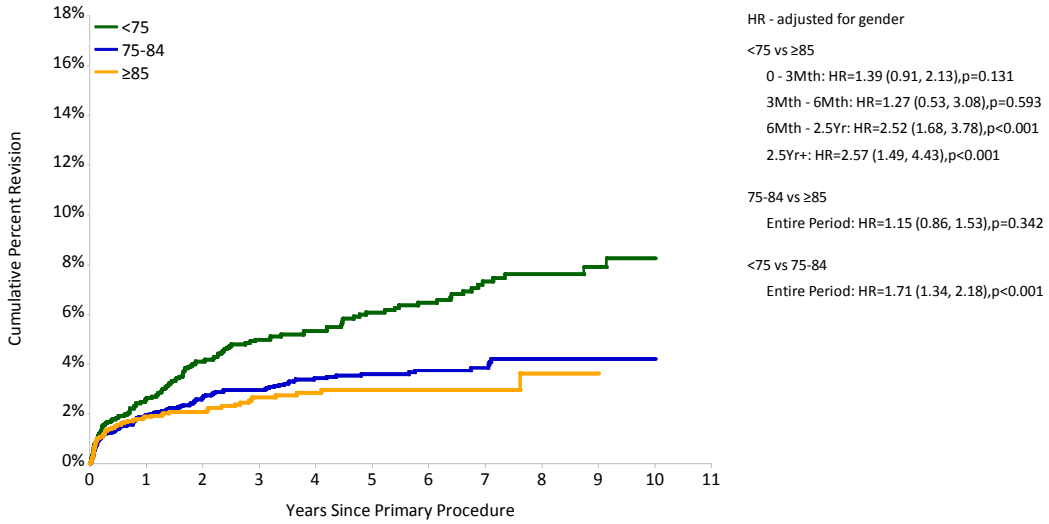
Table HP38: Revision Rates of Primary Bipolar Hip Replacement by Age (Primary Diagnosis Fractured NOF)

Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
<75	128	2364	10770	1.19 (0.99, 1.41)
75-84	131	4538	17335	0.76 (0.63, 0.90)
≥85	73	3473	8962	0.81 (0.64, 1.02)
TOTAL	**332**	**10375**	**37067**	**0.90 (0.80, 1.00)**

Table HP39: Yearly Cumulative Percent Revision of Primary Bipolar Hip Replacement by Age (Primary Diagnosis Fractured NOF)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
<75	2.6 (2.0, 3.4)	5.0 (4.1, 6.0)	6.1 (5.1, 7.3)	8.3 (6.8, 10.1)	
75-84	1.9 (1.6, 2.4)	3.0 (2.5, 3.6)	3.6 (3.0, 4.3)	4.2 (3.5, 5.1)	
≥85	1.9 (1.4, 2.4)	2.7 (2.1, 3.4)	3.0 (2.3, 3.8)		

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
<75	2364	1880	1424	1049	115	33
75-84	4538	3475	2433	1598	113	30
≥85	3473	2235	1250	606	6	2

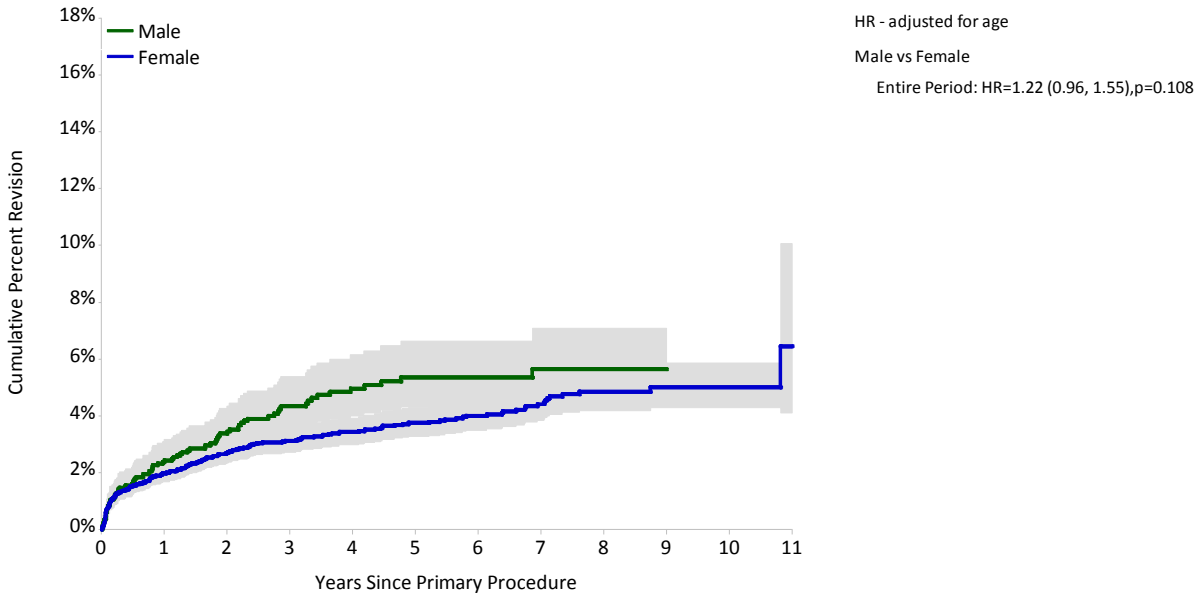
Table HP40: Revision Rates of Primary Bipolar Hip Replacement by Gender (Primary Diagnosis Fractured NOF)

Gender	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	93	2737	7856	1.18 (0.96, 1.45)
Female	239	7638	29210	0.82 (0.72, 0.93)
TOTAL	**332**	**10375**	**37067**	**0.90 (0.80, 1.00)**

Table HP41: Yearly Cumulative Percent Revision of Primary Bipolar Hip Replacement by Gender (Primary Diagnosis Fractured NOF)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	2.4 (1.9, 3.2)	4.3 (3.5, 5.4)	5.4 (4.3, 6.6)		
Female	2.0 (1.7, 2.3)	3.1 (2.7, 3.6)	3.7 (3.3, 4.3)	5.0 (4.3, 5.8)	6.4 (4.1, 10.1)

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	2737	1777	1044	610	36	16
Female	7638	5813	4063	2643	198	49

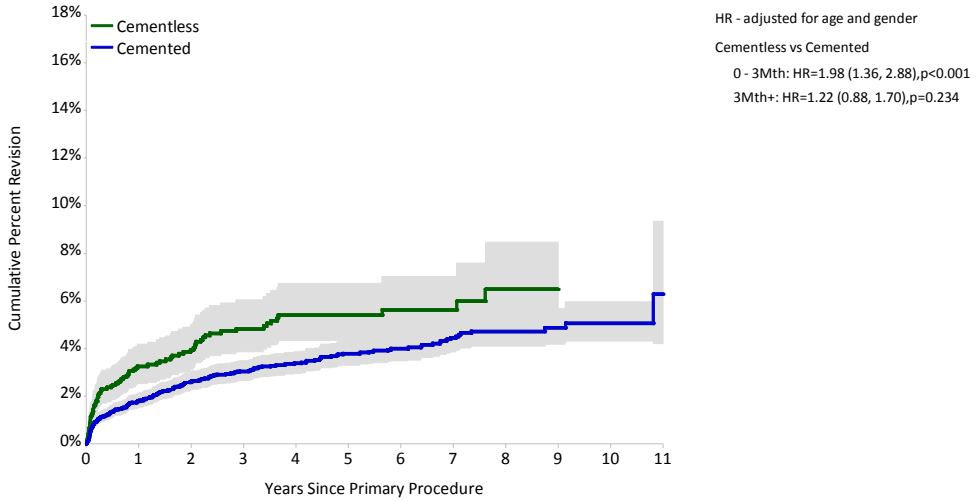
Table HP42: Revision Rates of Primary Bipolar Hip Replacement by Femoral Fixation (Primary Diagnosis Fractured NOF)

Femoral Fixation	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Cementless	85	2005	6558	1.30 (1.04, 1.60)
Cemented	247	8370	30509	0.81 (0.71, 0.92)
TOTAL	**332**	**10375**	**37067**	**0.90 (0.80, 1.00)**

Table HP43: Yearly Cumulative Percent Revision of Primary Bipolar Hip Replacement by Femoral Fixation (Primary Diagnosis Fractured NOF)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Cementless	3.3 (2.5, 4.2)	4.8 (3.9, 6.0)	5.4 (4.3, 6.7)		
Cemented	1.8 (1.5, 2.1)	3.0 (2.7, 3.5)	3.8 (3.3, 4.3)	5.1 (4.3, 6.0)	6.3 (4.2, 9.3)

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Cementless	2005	1422	938	552	18	8
Cemented	8370	6168	4169	2701	216	57

Figure HP23: Revision Diagnosis Cumulative Incidence of Primary Bipolar Hip Replacement by Femoral Fixation (Primary Diagnosis FNOF)

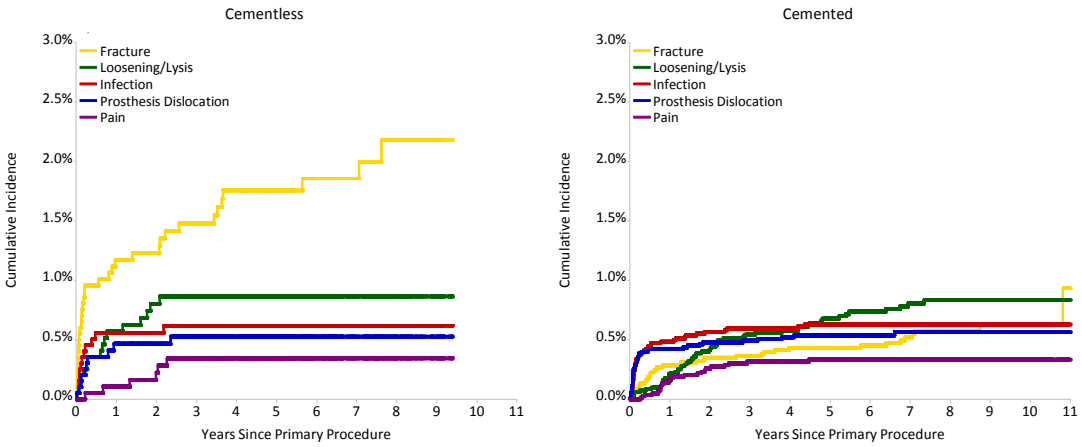


Table HP44: Revision Rates of Primary Bipolar Hip Replacement

Bipolar Head	Femoral Component	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Bipolar Head (CPulse)	Alloclassic	8	307	1493	0.54 (0.23, 1.06)
Centrax	Exeter	7	200	1184	0.59 (0.24, 1.22)
Convene	CPCS	16	345	1498	1.07 (0.61, 1.73)
Convene	Spectron EF	7	123	598	1.17 (0.47, 2.41)
Hastings	C-Stem	9	201	837	1.07 (0.49, 2.04)
Hastings	Charnley	5	105	366	1.36 (0.44, 3.19)
Hastings	Corail	10	277	786	1.27 (0.61, 2.34)
Hastings	Elite Plus	14	298	1480	0.95 (0.52, 1.59)
Multipolar Bipolar	Alloclassic	3	104	274	1.09 (0.23, 3.19)
Multipolar Bipolar	CPT	9	351	714	1.26 (0.58, 2.39)
Multipolar Bipolar	VerSys	10	446	1289	0.78 (0.37, 1.43)
Self-Centering	C-Stem	2	105	440	0.45 (0.06, 1.64)
Self-Centering	Corail	6	163	433	1.39 (0.51, 3.02)
Self-Centering	Elite Plus	3	238	1116	0.27 (0.06, 0.79)
Tandem	CPCS	19	743	1819	1.04 (0.63, 1.63)
Tandem	Spectron EF	4	127	281	1.42 (0.39, 3.65)
UHR	ABGII	11	177	668	1.65 (0.82, 2.95)
UHR	Accolade	9	189	416	2.17 (0.99, 4.11)
UHR	Exeter	8	202	1175	0.68 (0.29, 1.34)
UHR	Exeter V40	118	4527	15293	0.77 (0.64, 0.92)
UHR	Omnifit	21	354	1617	1.30 (0.80, 1.98)
Other (196)		82	2017	7013	1.17 (0.93, 1.45)
TOTAL		**381**	**11599**	**40791**	**0.93 (0.84, 1.03)**

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

Table HP45: Yearly Cumulative Percent Revision of Primary Bipolar Hip Replacement

Bipolar Head	Femoral Component	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Bipolar Head (CPulse)	Alloclassic	1.1 (0.3, 3.3)	2.7 (1.3, 5.6)	3.2 (1.6, 6.3)		
Centrax	Exeter	2.1 (0.8, 5.5)	2.8 (1.2, 6.5)	2.8 (1.2, 6.5)	3.9 (1.7, 9.0)	
Convene	CPCS	2.2 (1.1, 4.6)	3.3 (1.8, 6.1)	5.2 (3.1, 8.8)		
Convene	Spectron EF	2.6 (0.9, 8.0)	3.8 (1.4, 10.1)	6.6 (3.0, 14.4)		
Hastings	C-Stem	2.6 (1.1, 6.1)	5.4 (2.8, 10.3)	5.4 (2.8, 10.3)		
Hastings	Charnley	0.0 (0.0, 0.0)	3.0 (0.8, 11.5)			
Hastings	Corail	3.2 (1.6, 6.3)	3.9 (2.0, 7.6)	3.9 (2.0, 7.6)		
Hastings	Elite Plus	1.9 (0.8, 4.6)	4.3 (2.3, 7.9)	5.4 (3.1, 9.5)		
Multipolar Bipolar	Alloclassic	2.2 (0.6, 8.6)	2.2 (0.6, 8.6)			
Multipolar Bipolar	CPT	2.7 (1.3, 5.3)	3.3 (1.7, 6.4)			
Multipolar Bipolar	VerSys	1.1 (0.4, 2.9)	2.9 (1.5, 5.6)	3.6 (1.9, 6.8)		
Self-Centering	C-Stem	0.0 (0.0, 0.0)	1.2 (0.2, 8.4)	1.2 (0.2, 8.4)		
Self-Centering	Corail	3.9 (1.8, 8.5)	3.9 (1.8, 8.5)			
Self-Centering	Elite Plus	0.0 (0.0, 0.0)	0.6 (0.1, 3.9)	1.3 (0.3, 5.2)		
Tandem	CPCS	1.8 (1.0, 3.3)	3.4 (2.1, 5.5)	3.9 (2.4, 6.3)		
Tandem	Spectron EF	1.7 (0.4, 6.6)	4.7 (1.7, 12.6)			
UHR	ABGII	4.4 (2.1, 8.9)	5.2 (2.6, 10.1)	8.3 (4.6, 14.8)		
UHR	Accolade	3.6 (1.6, 7.9)	6.7 (3.4, 12.8)			
UHR	Exeter	1.6 (0.5, 5.0)	3.5 (1.6, 7.7)	5.0 (2.5, 9.8)		
UHR	Exeter V40	1.8 (1.4, 2.2)	2.6 (2.2, 3.2)	3.4 (2.8, 4.2)		
UHR	Omnifit	5.2 (3.3, 8.2)	5.6 (3.5, 8.7)	6.0 (3.9, 9.3)		
Other (196)		2.8 (2.1, 3.6)	4.7 (3.7, 5.9)	5.3 (4.2, 6.6)	8.0 (5.7, 11.2)	

PRIMARY TOTAL HIP REPLACEMENT

Classes of Total Hip Replacement

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

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

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

3. **Thrust plate** includes acetabular replacement combined with resection of the femoral head and replacement with a femoral component that has a lateral fixation plate and femoral head prosthesis.

Use of Total Hip Replacement

Total conventional is the most common primary total hip replacement (93.7%), followed by total resurfacing (6.2%). The Registry has recorded only a small number of thrust plate procedures (Table HT1).

Table HT1: Total Hip Replacement by Class

Total Hip Class	Number	Percent
Total Conventional	223339	93.7
Total Resurfacing	14901	6.2
Thrust Plate	252	0.1
TOTAL	**238492**	**100.0**

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

At 11 years, total conventional hip replacement has a lower cumulative percent revision compared to total resurfacing (Tables HT2 and HT3).

Detailed information on the demographics of each class of primary total hip replacement is provided in the supplementary report 'Demographics of Hip Arthroplasty' available on the Registry website, www.dmac.adelaide.edu.au/aoanjrr/publications.jsp.

Table HT2: Revision Rates of Primary Total Hip Replacement by Class

Total Hip Class	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Total Conventional	8105	223339	993697	0.82 (0.80, 0.83)
Total Resurfacing	880	14901	82314	1.07 (1.00, 1.14)
Thrust Plate	9	252	1497	0.60 (0.27, 1.14)
TOTAL	**8994**	**238492**	**1077508**	**0.83 (0.82, 0.85)**

Table HT3: Yearly Cumulative Percent Revision of Primary Total Hip Replacement by Class

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Total Conventional	1.6 (1.5, 1.6)	2.8 (2.7, 2.9)	3.9 (3.8, 4.0)	6.7 (6.5, 6.9)	7.4 (7.1, 7.7)
Total Resurfacing	1.8 (1.6, 2.1)	3.4 (3.1, 3.7)	5.2 (4.9, 5.6)	9.5 (8.7, 10.3)	9.8 (8.9, 10.8)
Thrust Plate	0.8 (0.2, 3.2)	1.3 (0.4, 3.9)	4.1 (2.0, 8.0)		

Primary Total Conventional Hip Replacement

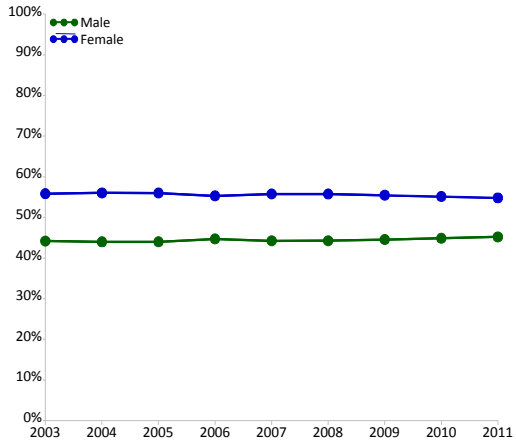
Demographics

There have been 223,339 total conventional procedures reported to the Registry, an additional 26,757 procedures compared to the last report.

Osteoarthritis is the principal diagnosis for total conventional hip replacement (88.4%), followed by fractured neck of femur (3.8%), osteonecrosis (3.6%), developmental dysplasia (1.3%) and rheumatoid arthritis (1.2%).

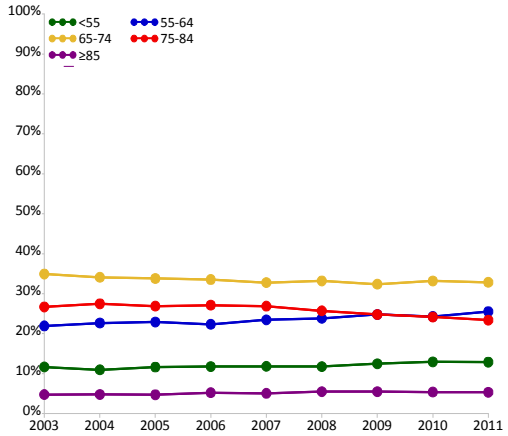
Total conventional hip replacement is more common in females (55.4%). This proportion has remained the same since the registry first received full national data in 2003 (Figure HT1).

Figure HT1: Primary Total Conventional Hip Replacement by Gender



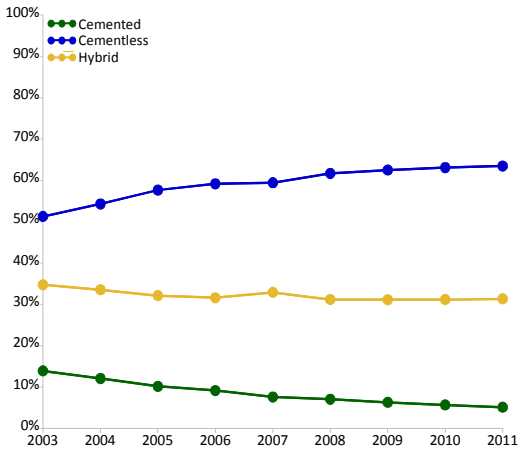
There has been a small increase in the proportion of patients aged 55-64 years (21.9% in 2003 to 25.5% in 2011). There has also been a small increase in the proportion of patients younger than 55 years receiving total conventional hip replacement during this period (11.7% in 2003 and 12.9% in 2011) (Figure HT2).

Figure HT2: Primary Total Conventional Hip Replacement by Age



The use of cementless fixation has increased from 51.3% in 2003 to 63.5% in 2011. During the same period, cemented fixation has declined from 13.9% to 5.1% and hybrid from 34.8% to 31.4% (Figure HT3).

Figure HT3: Primary Total Conventional Hip Replacement by Fixation



The Exeter V40 and Corail remain the most used femoral stems for total conventional hip replacement. The Quadra-H is the third most used stem in 2011 (Table HT4). In 2011, 66.8% of conventional hip replacements used stems that are reported in the ten most used femoral component list. Seven of these are cementless. The ten most used cemented and cementless stems are listed in Tables HT6 and HT7. In 2011, 96.7% of cemented conventional hip replacements used stems that are reported in the ten most used cemented femoral components compared to 66.7% in the cementless group.

The Trident, Pinnacle and R3 remain the most frequently used acetabular prostheses for total conventional hip replacement. For the first time the Delta prosthesis is listed in the ten most used acetabular prostheses. In 2011, 79.6% of conventional hip replacements used acetabular components from the ten most used acetabular component list (Table HT5). All of the acetabular components in this list are cementless prostheses. The ten most used cemented and cementless acetabular prostheses are listed separately in Tables HT8 and HT9.

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

2003		2008		2009		2010		2011	
N	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**
3901	Exeter V40	4887	Exeter V40	5318	Exeter V40	5633	Exeter V40	6066	Exeter V40
1029	ABGII	3160	Corail	3612	Corail	4003	Corail	4237	Corail
1000	Synergy	1184	Accolade	1123	Accolade	1190	CPT	1411	Quadra-H
885	VerSys	1113	Synergy	1048	CPT	1030	Secur-Fit	1216	CPT
819	Alloclassic	1078	Alloclassic	1031	Synergy	974	Quadra-H	1115	Secur-Fit
780	Spectron EF	1070	CPT	921	Secur-Fit	973	Synergy	863	Synergy
713	Secur-Fit Plus	712	Anthology	919	Alloclassic	902	Accolade	810	Accolade
618	Omnifit	695	Spectron EF	740	Spectron EF	754	Anthology	684	Anthology
565	C-Stem	666	SL-Plus	709	CPCS	682	Alloclassic	618	CPCS
484	S-Rom	664	Summit	702	SL-Plus	645	M/L Taper Kinectiv	572	M/L Taper Kinectiv
Ten Most Used									
10794	(10) 63.2%	15229	(10) 68.0%	16123	(10) 67.7%	16786	(10) 66.2%	17592	(10) 66.8%
Remainder									
6279	(69) 36.8%	7176	(101) 32.0%	7691	(103) 32.3%	8556	(103) 33.8%	8733	(101) 33.2%
TOTAL									
17073	(79) 100.0%	22405	(111) 100.0%	23814	(113) 100.0%	25342	(113) 100.0%	26325	(111) 100.0%

Table HT5: Ten Most Used Acetabular Components in Primary Total Conventional Hip Replacement

2003		2008		2009		2010		2011	
N	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**
3986	Trident	5673	Trident	6572	Trident	6750	Trident	6892	Trident
1748	Reflection (Shell)	3268	Pinnacle	4044	Pinnacle	5093	Pinnacle	5067	Pinnacle
1524	Trilogy	1908	R3	2286	R3	2442	R3	2611	R3
955	Vitalock	1639	Trilogy	1418	Trilogy	1215	Trilogy	1400	Versafit
907	Duraloc	1197	Reflection (Shell)	991	Reflection (Shell)	1109	Continuum	1299	Trilogy
827	ABGII	1178	ASR	913	Allofit	812	Reflection (Shell)	1225	Continuum
793	Allofit	955	Allofit	820	Trabecular Metal Shell	807	Versafit	743	Allofit
729	Mallory-Head	618	Trabecular Metal Shell	513	DeltaMotion	791	Allofit	675	DeltaMotion
539	Contemporary	476	BHR	453	Versafit	682	DeltaMotion	588	Reflection (Shell)
537	Pinnacle	427	Contemporary	429	ASR	479	Trabecular Metal Shell	461	Delta
Ten Most Used									
12545	(10) 73.5%	17339	(10) 77.4%	18439	(10) 77.4%	20180	(10) 79.6%	20961	(10) 79.6%
Remainder									
4528	(66) 26.5%	5066	(73) 22.6%	5375	(71) 22.6%	5162	(69) 20.4%	5364	(62) 20.4%
TOTAL									
17073	(76) 100.0%	22405	(83) 100.0%	23814	(81) 100.0%	25342	(79) 100.0%	26325	(72) 100.0%

Table HT6: Ten Most Used Femoral Components in Primary Total Conventional Hip Replacement with Cement Fixation

2003		2008		2009		2010		2011	
N	Model	N	Model	N	Model	N	Model	N	Model
3901	Exeter V40	4887	Exeter V40	5318	Exeter V40	5632	Exeter V40	6065	Exeter V40
780	Spectron EF	1070	CPT	1047	CPT	1189	CPT	1216	CPT
565	C-Stem	694	Spectron EF	740	Spectron EF	640	Spectron EF	618	CPCS
477	CPT	639	CPCS	709	CPCS	624	CPCS	486	Spectron EF
445	Elite Plus	219	MS 30	226	Omnifit	236	Omnifit	304	C-Stem AMT
358	MS 30	181	Omnifit	149	MS 30	216	C-Stem AMT	145	Omnifit
339	Omnifit	162	Charnley	144	C-Stem AMT	179	MS 30	128	MS 30
321	Charnley	129	C-Stem	119	Charnley	158	C-Stem	107	C-Stem
244	CPCS	114	C-Stem AMT	92	C-Stem	59	Charnley	102	E2
146	VerSys	53	R120	27	R120	44	Profemur Xm	60	Quadra-C
Ten Most Used									
7576	(10) 91.8%	8148	(10) 95.7%	8571	(10) 96.9%	8977	(10) 96.8%	9231	(10) 96.7%
Remainder									
679	(36) 8.2%	367	(39) 4.3%	276	(35) 3.1%	294	(32) 3.2%	318	(27) 3.3%
TOTAL									
8255	(46) 100.0%	8515	(49) 100.0%	8847	(45) 100.0%	9271	(42) 100.0%	9549	(37) 100.0%

Table HT7: Ten Most Used Femoral Components in Primary Total Conventional Hip Replacement with Cementless Fixation

2003		2008		2009		2010		2011	
N	Model	N	Model	N	Model	N	Model	N	Model
1027	ABGII	3159	Corail	3611	Corail	4000	Corail	4236	Corail
979	Synergy	1184	Accolade	1121	Accolade	1030	Secur-Fit	1409	Quadra-H
819	Alloclassic	1104	Synergy	1022	Synergy	974	Quadra-H	1115	Secur-Fit
739	VerSys	1078	Alloclassic	921	Secur-Fit	973	Synergy	863	Synergy
712	Secur-Fit Plus	708	Anthology	919	Alloclassic	902	Accolade	810	Accolade
483	S-Rom	665	SL-Plus	702	SL-Plus	752	Anthology	684	Anthology
482	Secur-Fit	644	Summit	692	Anthology	682	Alloclassic	572	M/L Taper Kinectiv
376	Corail	617	Secur-Fit	531	Quadra-H	644	M/L Taper Kinectiv	556	Alloclassic
333	Accolade	451	S-Rom	434	Summit	513	Summit	520	Taperloc
329	Mallory-Head	371	ABGII	385	Taperloc	476	SL-Plus	423	Summit
Ten Most Used									
6279	(10) 71.2%	9981	(10) 71.9%	10338	(10) 69.1%	10946	(10) 68.1%	11188	(10) 66.7%
Remainder									
2539	(46) 28.8%	3909	(75) 28.1%	4629	(78) 30.9%	5125	(85) 31.9%	5588	(81) 33.3%
TOTAL									
8818	(56) 100.0%	13890	(85) 100.0%	14967	(88) 100.0%	16071	(95) 100.0%	16776	(91) 100.0%

Table HT8: Ten Most Used Acetabular Components in Primary Total Conventional Hip Replacement with Cement Fixation

2003		2008		2009		2010		2011	
N	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**
539	Contemporary	427	Contemporary	393	Exeter Contemporary	382	Exeter Contemporary	337	Exeter X3 Rimfit
256	Exeter	357	Exeter Contemporary	348	Contemporary	300	Contemporary	277	Contemporary
250	Reflection (Cup)	214	Reflection (Cup)	146	Reflection (Cup)	142	Marathon	205	Exeter Contemporary
227	Exeter Contemporary	115	Exeter	142	Exeter	128	Reflection (Cup)	138	Marathon
199	Charnley Ogee	89	ZCA	78	Brunswick	123	Exeter	117	Brunswick
149	Elite Plus LPW	79	Charnley	69	ZCA	113	ZCA	92	Reflection (Cup)
130	Low Profile Cup	70	Brunswick	58	CCB	101	Brunswick	87	ZCA
110	Elite Plus Ogee	48	CCB	55	Charnley	47	Exeter X3 Rimfit	30	CCB
102	Charnley	42	Low Profile Cup	43	Marathon	46	CCB	29	Low Profile Cup
90	ZCA	36	Charnley Ogee	30	Charnley Ogee	30	Low Profile Cup	26	Trident
Ten Most Used									
2052	(10) 84.1%	1477	(10) 89.5%	1362	(10) 85.8%	1412	(10) 93.1%	1338	(10) 94.6%
Remainder									
388	(34) 15.9%	174	(31) 10.5%	226	(32) 14.2%	104	(26) 6.9%	77	(21) 5.4%
TOTAL									
2440	(44) 100.0%	1651	(41) 100.0%	1588	(42) 100.0%	1516	(36) 100.0%	1415	(31) 100.0%

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

2003		2008		2009		2010		2011	
N	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**
3983	Trident	5651	Trident	6542	Trident	6731	Trident	6866	Trident
1742	Reflection (Shell)	3266	Pinnacle	4044	Pinnacle	5092	Pinnacle	5063	Pinnacle
1524	Trilogy	1906	R3	2283	R3	2436	R3	2607	R3
954	Vitalock	1631	Trilogy	1410	Trilogy	1215	Trilogy	1400	Versafit
902	Duraloc	1195	Reflection (Shell)	984	Reflection (Shell)	1108	Continuum	1295	Trilogy
826	ABGII	1176	ASR	909	Allofit	807	Versafit	1222	Continuum
786	Allofit	950	Allofit	804	Trabecular Metal Shell	804	Reflection (Shell)	743	Allofit
728	Mallory-Head	607	Trabecular Metal Shell	513	DeltaMotion	790	Allofit	675	DeltaMotion
536	Pinnacle	475	BHR	453	Versafit	682	DeltaMotion	582	Reflection (Shell)
521	Fitmore	413	EPF-Plus	428	ASR	469	Trabecular Metal Shell	459	Delta
Ten Most Used									
12502	(10) 85.4%	17270	(10) 83.2%	18370	(10) 82.7%	20134	(10) 84.5%	20912	(10) 84.0%
Remainder									
2131	(40) 14.6%	3484	(49) 16.8%	3856	(44) 17.3%	3692	(46) 15.5%	3998	(45) 16.0%
TOTAL									
14633	(50) 100.0%	20754	(59) 100.0%	22226	(54) 100.0%	23826	(56) 100.0%	24910	(55) 100.0%

Outcome by Patient Characteristics

The cumulative percent revision at 11 years for primary total conventional hip replacement undertaken for osteoarthritis is 7.2% (Table HT10 and Figure HT4).

Reason for Revision

As a proportion of all revisions, the most common reasons for revision of primary total conventional hip replacement are loosening/lysis (29.0%), followed by prosthesis dislocation (22.9%), infection (15.8%), fracture (14.1%) and metal sensitivity (5.9%) (Table HT11). The term metal sensitivity when used in this report is a diagnosis that encompasses the entire spectrum of surgeon identified metal related pathology. In the last two years metal sensitivity as a reason for revision increased from 1.2% to 5.9%.

The Registry links loosening/lysis as they often occur in association, particularly in late revision, secondary to wear related inflammation. The aetiology of loosening however varies with time. Early revision with a diagnosis of loosening is usually a consequence of not obtaining adequate initial fixation.

The five most common reasons for revision have different rates of incidence. Initially the incidence of revision for dislocation increases rapidly, however, after the first few months it increases at a slower rate. Loosening/lysis shows a linear increase and at three years exceeds dislocation to become the most common reason for revision. In a similar way to dislocation, infection and fracture show a high initial increase in incidence but to a lesser extent. Metal sensitivity is the fifth most common reason for revision. There is an increase in incidence after three years (Figure HT5).

Type of Revision

The type of revision is influenced by the reason for revision. As these change with time, the relative proportion of each type of revision will also change. Currently, the five most common types of revision recorded by the Registry are acetabular only (29.9%), femoral only (26.7%), head and insert (16.0%), THR (femoral/acetabular) (13.0%) and head only (5.0%) (Table HT12). For the first time acetabular only revisions are being reported as the most common type of revision. The increase in this type of revision reflects the increased incidence of revising MoM acetabular components in particular the ASR XL acetabular component**.**

Primary Diagnosis

The outcomes of the five most common primary diagnoses (osteoarthritis, fractured neck of femur, osteonecrosis, developmental dysplasia and rheumatoid arthritis) are listed in Tables HT13 and HT14.

The rate of revision varies depending on the primary diagnosis. Osteoarthritis has a significantly lower rate of revision compared to osteonecrosis, fractured neck of femur and rheumatoid arthritis. Osteoarthritis has a significantly lower rate of revision compared to developmental dysplasia in the first month, but there is no difference after this time (Figure HT6).

Age and Gender

There is a significant difference in the rate of revision with respect to age. After the first six months, patients over the age of 75 have a significantly lower rate of revision than other age groups. In general, the rate of revision decreases with increasing age (Tables HT15 and HT16 and Figure HT7).

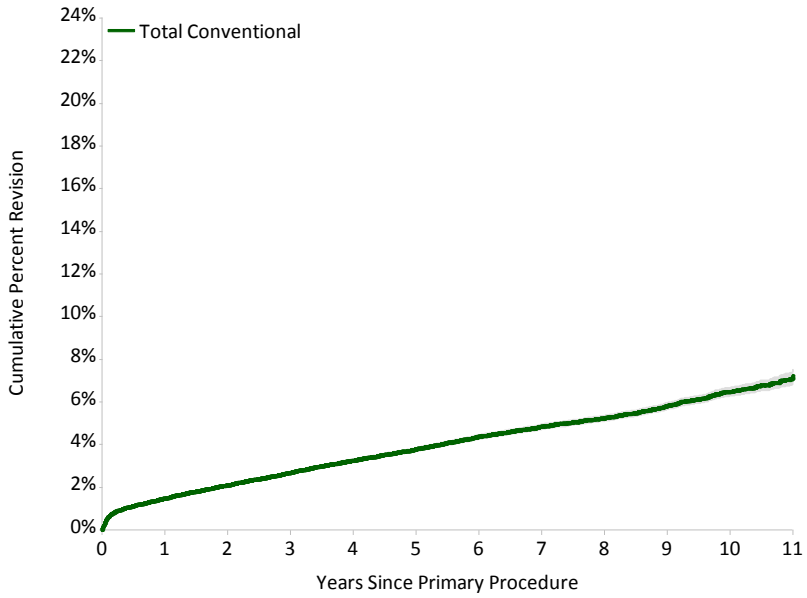
The Registry again identifies a difference in the rate of revision with respect to gender. Although the difference is small, it remains significant (Tables HT17 and HT18 and Figure HT8).

The Registry continues to report a difference in the rate of revision between age within gender. For females, the rate of revision decreases with increasing age. Females under 55 years have a higher cumulative percent revision at 11 years (8.9%) compared to females 75 years or older (4.8%). The relationship between revision rate and age for males is not as apparent although there is a higher cumulative percent revision at 11 years in the two age groups below 65 years compared to the two older age groups (Tables HT19 and HT20 and Figures HT9 and HT10).

Table HT10: Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Total Conventional	1.5 (1.4, 1.5)	2.7 (2.6, 2.8)	3.8 (3.7, 3.9)	6.5 (6.3, 6.7)	7.2 (6.9, 7.5)

Figure HT4: Cumulative Percent Revision of Primary Total Conventional Hip Replacement (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Total Conventional	197346	169404	121247	81142	9251	2343

Table HT11: Primary Total Conventional Hip Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	2350	29.0
Prosthesis Dislocation	1860	22.9
Infection	1283	15.8
Fracture	1140	14.1
Metal Sensitivity	475	5.9
Pain	193	2.4
Leg Length Discrepancy	102	1.3
Malposition	85	1.0
Implant Breakage Acetabular	66	0.8
Implant Breakage Stem	65	0.8
Instability	57	0.7
Incorrect Sizing	54	0.7
Implant Breakage Acetabular Insert	44	0.5
Wear Acetabular Insert	40	0.5
Implant Breakage Head	23	0.3
Other	268	3.3
TOTAL	**8105**	**100.0**

Table HT12: Primary Total Conventional Hip Replacement by Type of Revision

Type of Revision	Number	Percent
Acetabular Component	2426	29.9
Femoral Component	2164	26.7
Head/Insert	1295	16.0
THR (Femoral/Acetabular)	1053	13.0
Head Only	407	5.0
Cement Spacer	378	4.7
Minor Components	119	1.5
Insert Only	93	1.1
Head/Neck/Insert	56	0.7
Head/Neck	50	0.6
Removal of Prostheses	46	0.6
Reinsertion of Components	9	0.1
Bipolar Only	3	0.0
Neck Only	3	0.0
Saddle	2	0.0
Neck/Insert	1	0.0
TOTAL	**8105**	**100.0**

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

Figure HT5: Revision Diagnosis Cumulative Incidence of Primary Total Conventional Hip Replacement (Primary Diagnosis OA)

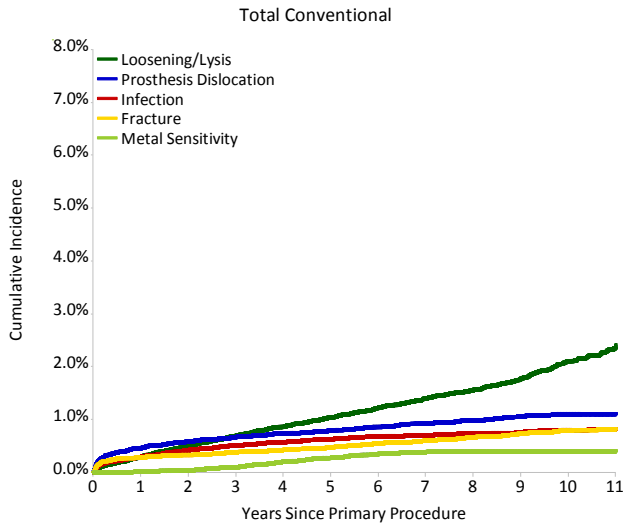


Table HT13: Revision Rates of Primary Total Conventional Hip Replacement by Primary Diagnosis

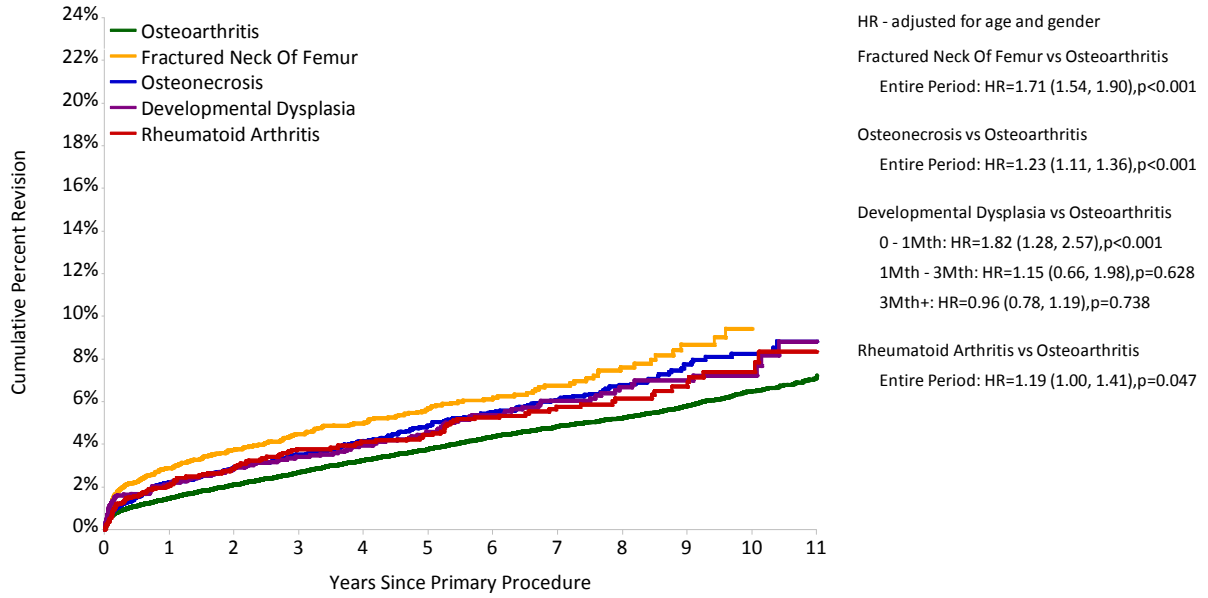
Primary Diagnosis	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Osteoarthritis	6915	197346	887370	0.78 (0.76, 0.80)
Fractured Neck Of Femur	382	8554	27705	1.38 (1.24, 1.52)
Osteonecrosis	373	7993	37103	1.01 (0.91, 1.11)
Developmental Dysplasia	137	2877	14344	0.96 (0.80, 1.13)
Rheumatoid Arthritis	133	2740	14135	0.94 (0.79, 1.12)
Other (6)	165	3829	13040	1.27 (1.08, 1.47)
TOTAL	**8105**	**223339**	**993697**	**0.82 (0.80, 0.83)**

Note: Only Primary Diagnoses with over 2000 procedures have been listed.

Table HT14: Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Primary Diagnosis

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Osteoarthritis	1.5 (1.4, 1.5)	2.7 (2.6, 2.8)	3.8 (3.7, 3.9)	6.5 (6.3, 6.7)	7.2 (6.9, 7.5)
Fractured Neck Of Femur	2.9 (2.5, 3.3)	4.5 (4.0, 5.0)	5.7 (5.1, 6.4)	9.4 (7.8, 11.3)	
Osteonecrosis	2.2 (1.9, 2.6)	3.5 (3.1, 4.0)	4.9 (4.3, 5.4)	8.2 (7.2, 9.4)	8.8 (7.6, 10.2)
Developmental Dysplasia	2.1 (1.7, 2.7)	3.4 (2.8, 4.2)	4.6 (3.8, 5.5)	7.2 (6.0, 8.7)	8.8 (6.8, 11.4)
Rheumatoid Arthritis	2.1 (1.6, 2.7)	3.8 (3.1, 4.6)	4.4 (3.7, 5.4)	7.4 (6.0, 9.1)	8.3 (6.6, 10.5)
Other (6)	2.9 (2.4, 3.5)	4.5 (3.8, 5.3)	5.3 (4.5, 6.3)	7.5 (6.1, 9.2)	7.5 (6.1, 9.2)

Figure HT6: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Primary Diagnosis



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Osteoarthritis	197346	169404	121247	81142	9251	2343
Fractured Neck Of Femur	8554	6518	3869	2010	149	33
Osteonecrosis	7993	6878	5007	3431	458	123
Developmental Dysplasia	2877	2509	1880	1390	214	55
Rheumatoid Arthritis	2740	2427	1885	1387	211	71

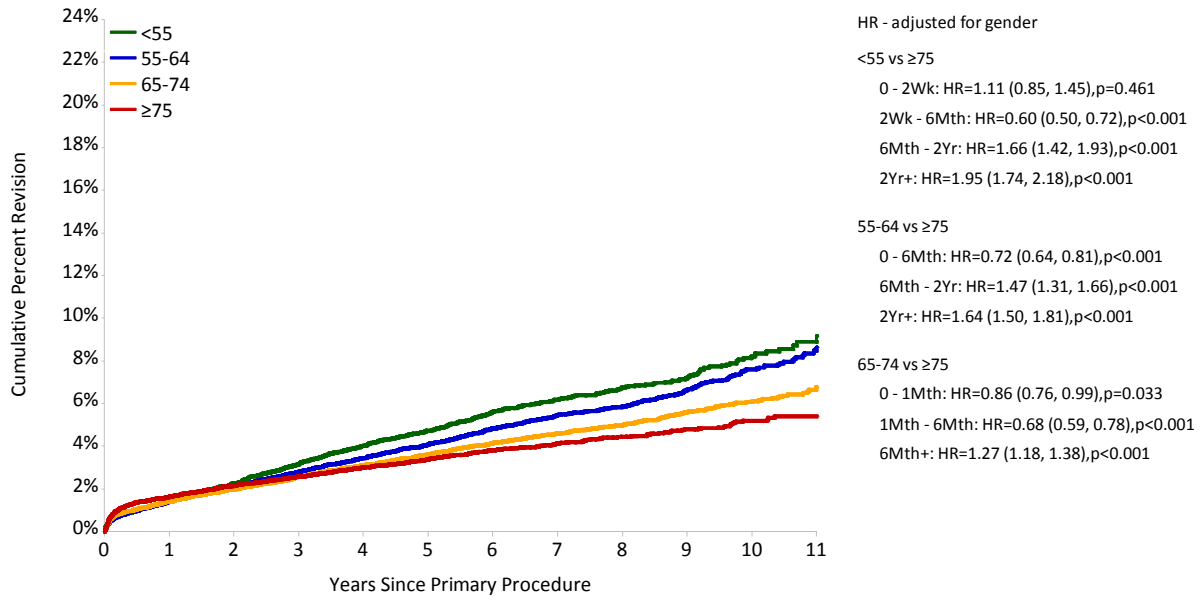
Table HT15: Revision Rates of Primary Total Conventional Hip Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
<55	902	20698	94238	0.96 (0.90, 1.02)
55-64	1825	47273	214153	0.85 (0.81, 0.89)
65-74	2362	69191	321351	0.74 (0.71, 0.77)
≥75	1826	60184	257628	0.71 (0.68, 0.74)
TOTAL	**6915**	**197346**	**887370**	**0.78 (0.76, 0.80)**

Table HT16: Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Age (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
<55	1.4 (1.2, 1.6)	3.2 (2.9, 3.4)	4.7 (4.4, 5.1)	8.2 (7.5, 8.9)	9.2 (8.2, 10.2)
55-64	1.4 (1.3, 1.5)	2.8 (2.6, 3.0)	4.1 (3.9, 4.3)	7.6 (7.1, 8.1)	8.6 (7.9, 9.4)
65-74	1.4 (1.3, 1.5)	2.6 (2.4, 2.7)	3.6 (3.5, 3.8)	6.1 (5.8, 6.4)	6.8 (6.3, 7.3)
≥75	1.6 (1.5, 1.7)	2.6 (2.4, 2.7)	3.4 (3.2, 3.5)	5.2 (4.8, 5.6)	5.4 (5.0, 5.8)

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
<55	20698	17658	12518	8629	1240	346
55-64	47273	40402	28820	19514	2528	690
65-74	69191	59869	43633	29929	3529	888
≥75	60184	51475	36276	23070	1954	419

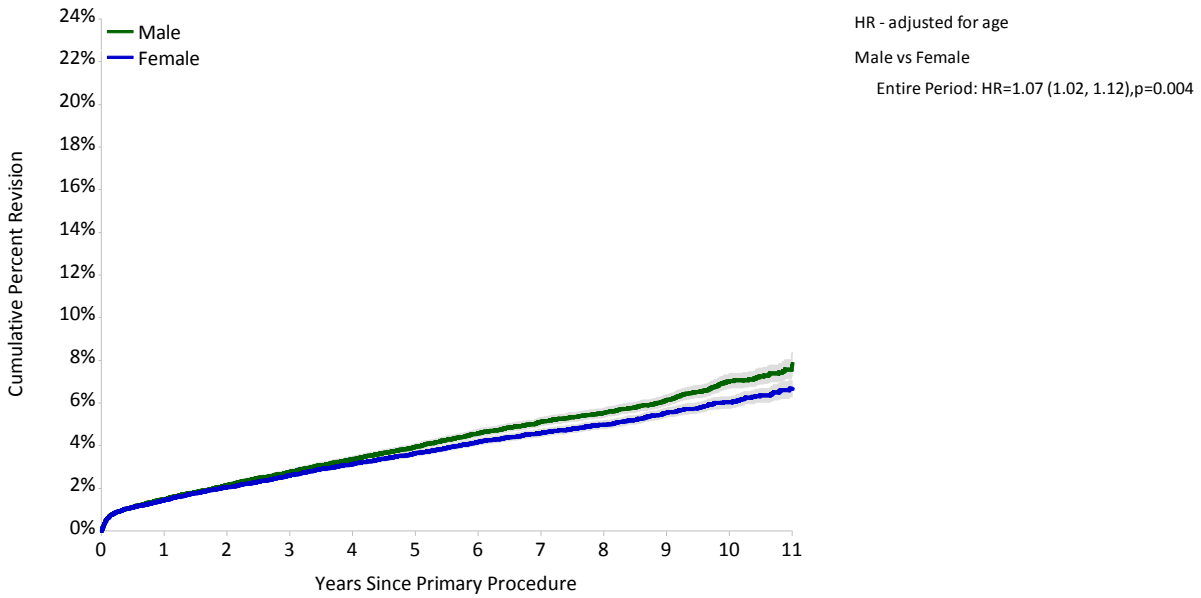
Table HT17: Revision Rates of Primary Total Conventional Hip Replacement by Gender (Primary Diagnosis OA)

Gender	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	3312	90603	403945	0.82 (0.79, 0.85)
Female	3603	106743	483425	0.75 (0.72, 0.77)
TOTAL	**6915**	**197346**	**887370**	**0.78 (0.76, 0.80)**

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

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	1.5 (1.4, 1.6)	2.8 (2.7, 2.9)	3.9 (3.8, 4.1)	7.0 (6.7, 7.4)	7.8 (7.3, 8.4)
Female	1.4 (1.4, 1.5)	2.6 (2.5, 2.7)	3.6 (3.5, 3.8)	6.0 (5.8, 6.3)	6.7 (6.3, 7.1)

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	90603	77456	55076	36740	4323	1082
Female	106743	91948	66171	44402	4928	1261

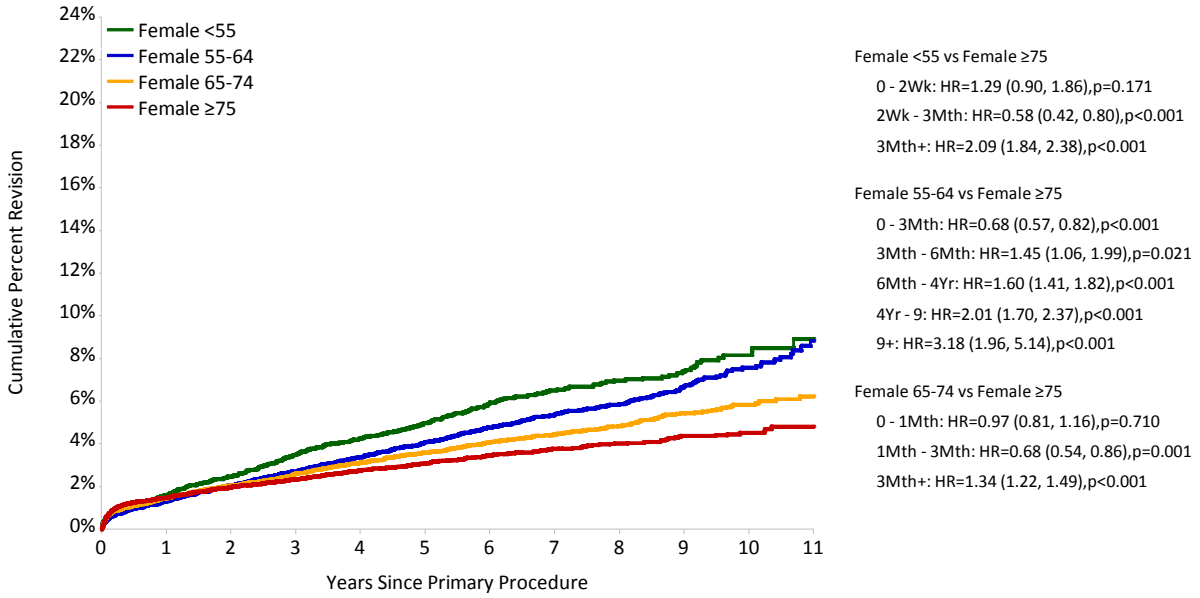
Table HT19: Revision Rates of Primary Total Conventional Hip Replacement by Age and Gender (Primary Diagnosis OA)

Gender	Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	<55	469	11242	51182	0.92 (0.84, 1.00)
	55-64	916	23403	106769	0.86 (0.80, 0.92)
	65-74	1134	32695	151352	0.75 (0.71, 0.79)
	≥75	793	23263	94643	0.84 (0.78, 0.90)
Female	<55	433	9456	43057	1.01 (0.91, 1.10)
	55-64	909	23870	107384	0.85 (0.79, 0.90)
	65-74	1228	36496	169999	0.72 (0.68, 0.76)
	≥75	1033	36921	162985	0.63 (0.60, 0.67)
TOTAL		**6915**	**197346**	**887370**	**0.78 (0.76, 0.80)**

Table HT20: Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Age and Gender (Primary Diagnosis OA)

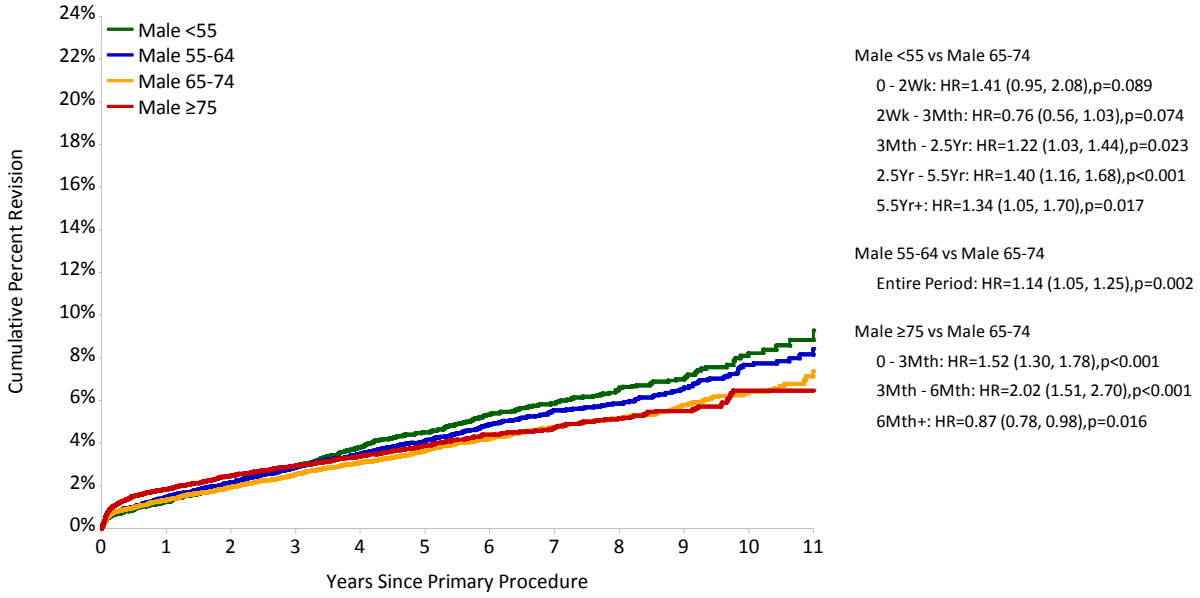
Gender	Age	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	<55	1.2 (1.0, 1.5)	2.9 (2.6, 3.2)	4.5 (4.1, 5.0)	8.2 (7.3, 9.2)	9.3 (7.9, 10.9)
	55-64	1.5 (1.3, 1.6)	2.9 (2.6, 3.1)	4.1 (3.8, 4.4)	7.7 (7.0, 8.4)	8.4 (7.5, 9.5)
	65-74	1.3 (1.2, 1.5)	2.5 (2.4, 2.7)	3.7 (3.4, 3.9)	6.4 (5.9, 6.9)	7.4 (6.5, 8.3)
	≥75	1.8 (1.7, 2.0)	2.9 (2.7, 3.2)	3.9 (3.6, 4.2)	6.5 (5.7, 7.3)	6.5 (5.7, 7.3)
Female	<55	1.6 (1.4, 1.9)	3.5 (3.1, 3.9)	5.0 (4.5, 5.5)	8.1 (7.2, 9.1)	8.9 (7.7, 10.4)
	55-64	1.3 (1.2, 1.5)	2.7 (2.5, 2.9)	4.1 (3.8, 4.4)	7.6 (6.9, 8.2)	8.8 (7.8, 10.0)
	65-74	1.4 (1.3, 1.6)	2.6 (2.4, 2.8)	3.6 (3.4, 3.8)	5.8 (5.4, 6.3)	6.2 (5.7, 6.8)
	≥75	1.5 (1.4, 1.6)	2.3 (2.2, 2.5)	3.1 (2.9, 3.3)	4.5 (4.2, 4.9)	4.8 (4.3, 5.3)

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



Number at Risk		0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Female	<55	9456	8120	5748	3946	529	138
	55-64	23870	20508	14542	9727	1193	352
	65-74	36496	31510	23049	15848	1857	482
	≥75	36921	31810	22832	14881	1349	289

Figure HT10: Cumulative Percent Revision of Primary Total Conventional Hip Replacement for Males by Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	<55	11242	9538	6770	4683	711	208
	55-64	23403	19894	14278	9787	1335	338
	65-74	32695	28359	20584	14081	1672	406
	≥75	23263	19665	13444	8189	605	130

Outcome by Prostheses Characteristics

Fixation

At 11 years, hybrid fixation has the lowest cumulative percent revision of 6.0% compared to cemented (7.2%) and cementless fixation (7.8%) (Tables HT21 and HT22).

Hybrid fixation has a lower rate of revision compared to cementless and this is evident over the entire period. The lower rate of revision for hybrid fixation compared to cemented fixation becomes most evident after 6.5 years. Cementless has a higher rate of revision compared to cemented in the first month but after six years the rate of revision for cemented is significantly higher than cementless (Figure HT11).

There continues to be age related differences in the rate of revision for the different types of fixation. Cementless fixation has a higher rate of revision than hybrid fixation in all age groups however the difference is most apparent in the oldest age group (≥75 years of age). Cementless fixation also has a significantly higher rate of revision compared to cemented fixation in the ≥75 years of age group. There is no difference between hybrid and cemented fixation in this age group after the first three months (Tables HT23 and HT24 and Figures HT12-HT15).

In the under 55 year age group only a small number of procedures using cemented fixation have been performed and there is no difference in the rate of revision compared to either hybrid or cementless fixation (Figure HT12).

Cemented fixation in the 55-64 and 65-74 year age groups has a higher rate of revision compared to hybrid fixation. This becomes evident after the first month for the 65-74 year age group. Cemented fixation also has a higher rate of revision in the 55-64 year age group compared to cementless fixation but this only becomes evident after 6.5 years. There is no difference between cemented and cementless fixation in the 65-74 year age group after the first month (Figures HT13 and HT14).

Femoral Stems with Exchangeable Necks

A femoral stem with an exchangeable neck has a separate neck that connects proximally to the stem. Femoral stems with exchangeable necks were introduced to enable surgeons to have increased choice with respect to determining femoral neck version, offset and length during total hip arthroplasty. The Registry has reported for two years that this group of prostheses has a higher rate of revision compared to femoral stems that have fixed necks.

Femoral stems with exchangeable necks were used in 8,300 primary total conventional hip procedures undertaken for the treatment of osteoarthritis. Outcomes were compared to 189,046 primary total conventional hip procedures using fixed neck femoral stems for the same diagnosis. The cumulative percent revision at ten years for exchangeable neck prostheses is 10.6% compared to 6.3% for fixed femoral stems (adj HR=1.97; 95%CI(1.79, 2.16), p<0.001) (Tables HT25, HT26 and Figure HT16).

The higher rate of revision when exchangeable necks were used was evident for all bearing surfaces with the exception of metal on metal. This is due to a high rate of revision for this bearing surface for both exchangeable and fixed necks. The difference between exchangeable neck and fixed neck prostheses is significant for all bearing surfaces with greater than five year follow up other than metal on metal (Tables HT27 and HT28 and Figure HT17).

Seven exchangeable femoral neck prostheses with over 50 procedures have at least a five year cumulative percent revision reported (Tables HT29 and HT30). All had a higher cumulative percent revision than fixed neck stems. The increase in revision was due to a higher incidence of loosening (3.6% at ten years compared to 2.0% for fixed femoral neck), dislocation (1.8% compared to 1.1%) and infection (1.4% compared to 0.8%) (Figure HT18).

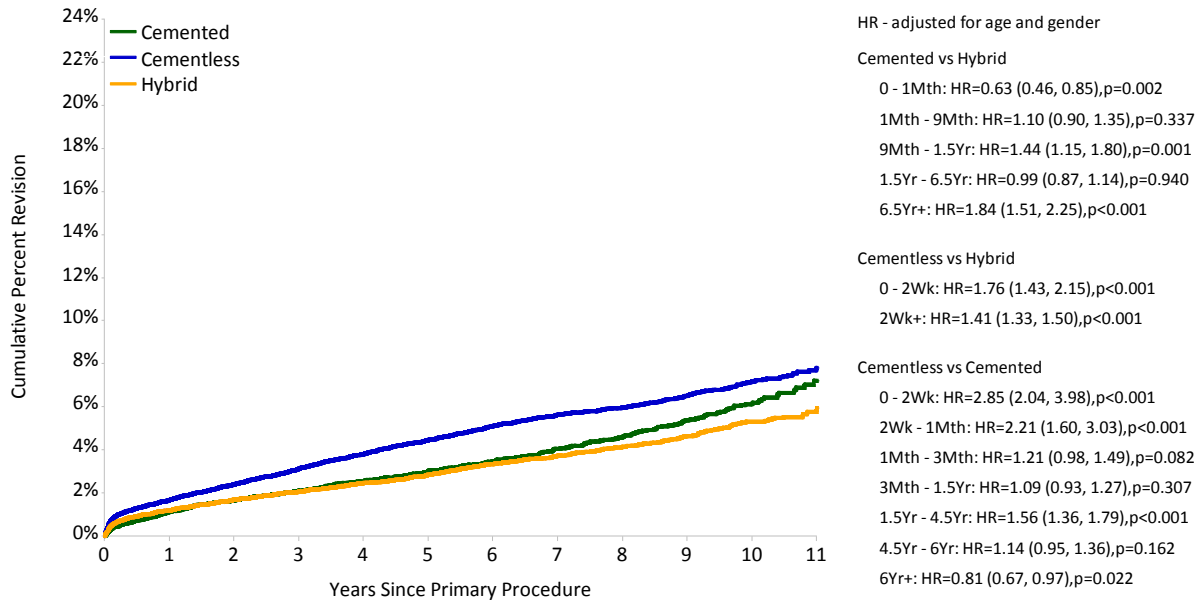
Table HT21: Revision Rates of Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis OA)

Fixation	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Cemented	637	17707	99850	0.64 (0.59, 0.69)
Cementless	4499	115703	492361	0.91 (0.89, 0.94)
Hybrid	1779	63936	295159	0.60 (0.58, 0.63)
TOTAL	**6915**	**197346**	**887370**	**0.78 (0.76, 0.80)**

Table HT22: Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Cemented	1.1 (1.0, 1.3)	2.1 (1.9, 2.3)	3.0 (2.8, 3.3)	6.1 (5.6, 6.7)	7.2 (6.4, 8.1)
Cementless	1.7 (1.6, 1.7)	3.1 (3.0, 3.2)	4.4 (4.3, 4.6)	7.2 (6.9, 7.5)	7.8 (7.3, 8.3)
Hybrid	1.2 (1.1, 1.3)	2.1 (1.9, 2.2)	2.8 (2.7, 3.0)	5.3 (5.0, 5.6)	6.0 (5.4, 6.5)

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Cemented	17707	16150	13116	9999	1733	489
Cementless	115703	97967	67962	43987	4109	941
Hybrid	63936	55287	40169	27156	3409	913

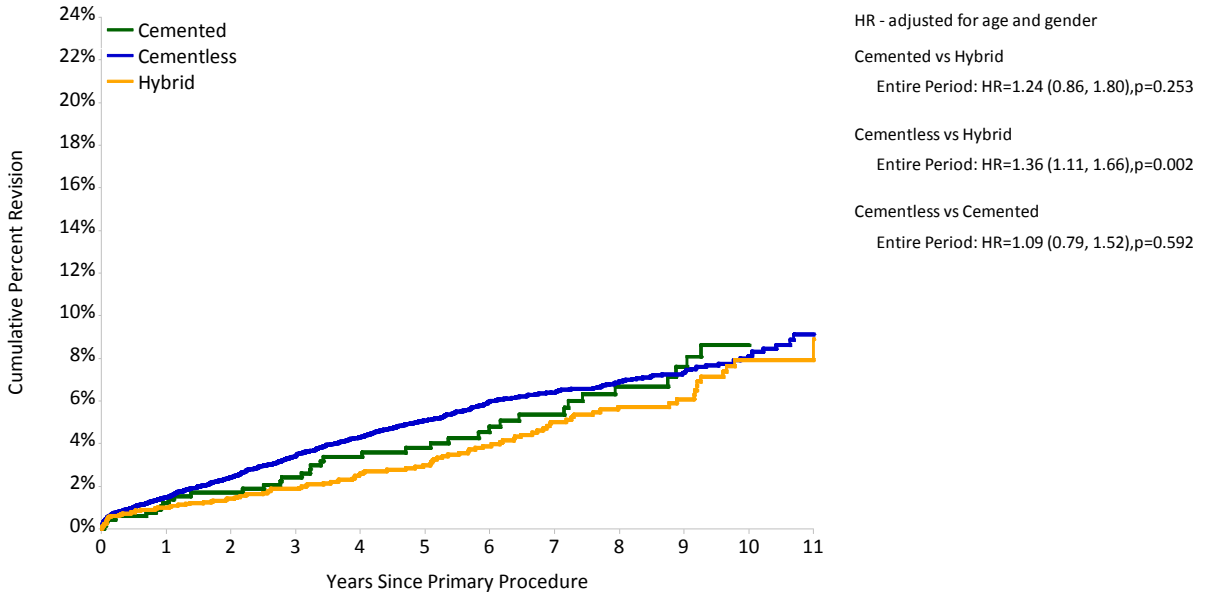
Table HT23: Revision Rates of Primary Total Conventional Hip Replacement by Fixation and Age (Primary Diagnosis OA)

Age	Fixation	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
<55	Cemented	37	684	4192	0.88 (0.62, 1.22)
	Cementless	755	16920	75072	1.01 (0.94, 1.08)
	Hybrid	110	3094	14974	0.73 (0.60, 0.89)
55-64	Cemented	124	2221	13313	0.93 (0.77, 1.11)
	Cementless	1378	34573	151072	0.91 (0.86, 0.96)
	Hybrid	323	10479	49768	0.65 (0.58, 0.72)
65-74	Cemented	255	6067	36795	0.69 (0.61, 0.78)
	Cementless	1419	39862	171285	0.83 (0.79, 0.87)
	Hybrid	688	23262	113270	0.61 (0.56, 0.65)
≥75	Cemented	221	8735	45551	0.49 (0.42, 0.55)
	Cementless	947	24348	94931	1.00 (0.94, 1.06)
	Hybrid	658	27101	117147	0.56 (0.52, 0.61)
TOTAL		**6915**	**197346**	**887370**	**0.78 (0.76, 0.80)**

Table HT24: Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Fixation and Age (Primary Diagnosis OA)

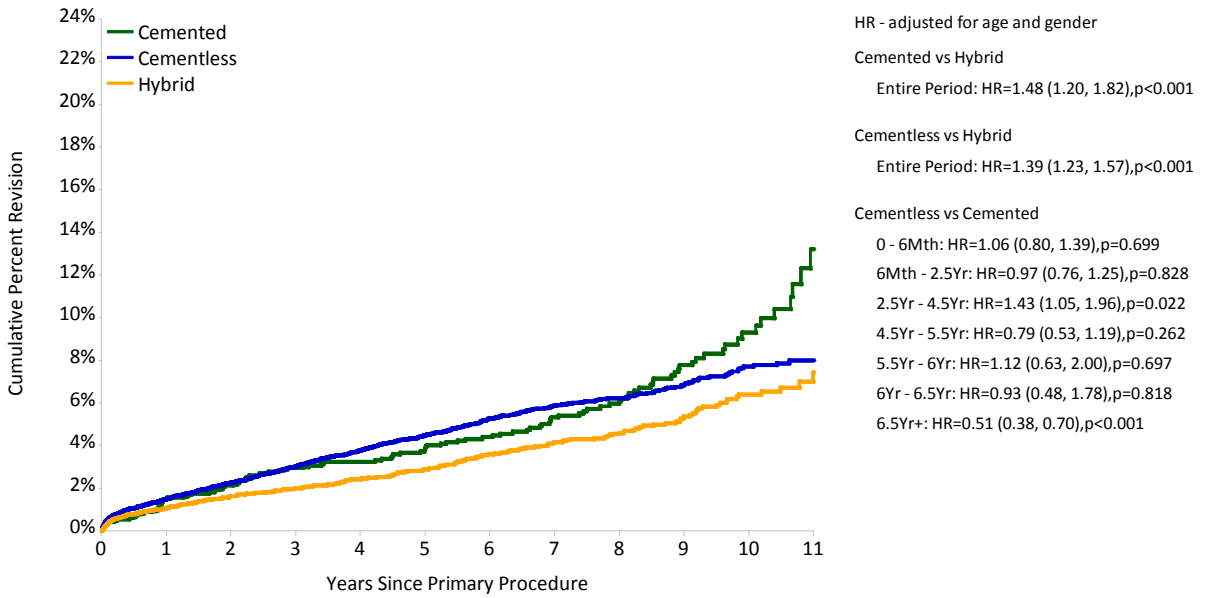
Age	Fixation	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
<55	Cemented	1.2 (0.6, 2.4)	2.4 (1.5, 4.0)	3.8 (2.5, 5.7)	8.6 (6.1, 12.1)	
	Cementless	1.5 (1.3, 1.7)	3.4 (3.1, 3.7)	5.1 (4.7, 5.5)	8.1 (7.4, 8.9)	9.1 (8.0, 10.3)
	Hybrid	1.0 (0.7, 1.4)	1.9 (1.4, 2.5)	3.0 (2.3, 3.8)	7.9 (6.3, 9.9)	8.9 (6.6, 11.8)
55-64	Cemented	1.5 (1.1, 2.1)	2.9 (2.3, 3.8)	3.9 (3.1, 4.9)	9.3 (7.6, 11.4)	13.2 (10.1, 17.2)
	Cementless	1.5 (1.3, 1.6)	3.0 (2.8, 3.2)	4.5 (4.2, 4.7)	7.7 (7.1, 8.3)	8.0 (7.4, 8.7)
	Hybrid	1.1 (0.9, 1.3)	2.0 (1.7, 2.3)	2.9 (2.5, 3.3)	6.4 (5.5, 7.4)	7.4 (6.1, 8.9)
65-74	Cemented	1.1 (0.8, 1.4)	2.2 (1.8, 2.6)	3.2 (2.7, 3.7)	6.6 (5.8, 7.6)	7.4 (6.4, 8.6)
	Cementless	1.5 (1.4, 1.7)	2.9 (2.7, 3.0)	4.1 (3.9, 4.3)	6.4 (6.0, 6.9)	7.4 (6.4, 8.5)
	Hybrid	1.2 (1.1, 1.4)	2.2 (2.0, 2.4)	3.0 (2.7, 3.2)	5.2 (4.7, 5.7)	5.6 (5.0, 6.4)
≥75	Cemented	1.0 (0.8, 1.3)	1.8 (1.5, 2.1)	2.6 (2.2, 3.0)	4.2 (3.5, 5.0)	4.2 (3.5, 5.0)
	Cementless	2.3 (2.1, 2.5)	3.5 (3.2, 3.7)	4.5 (4.2, 4.8)	6.7 (6.0, 7.4)	6.7 (6.0, 7.4)
	Hybrid	1.2 (1.1, 1.4)	2.0 (1.8, 2.2)	2.6 (2.4, 2.9)	4.3 (3.9, 4.9)	4.8 (4.1, 5.5)

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



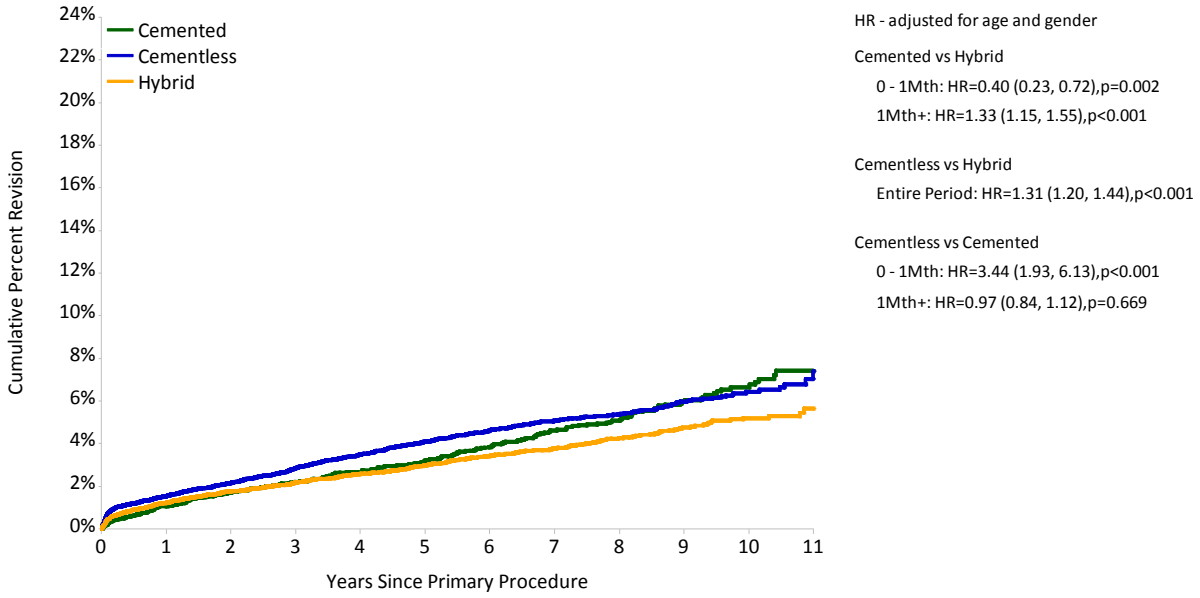
Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Cemented	684	623	526	421	104	31
Cementless	16920	14400	10061	6829	868	219
Hybrid	3094	2635	1931	1379	268	96

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



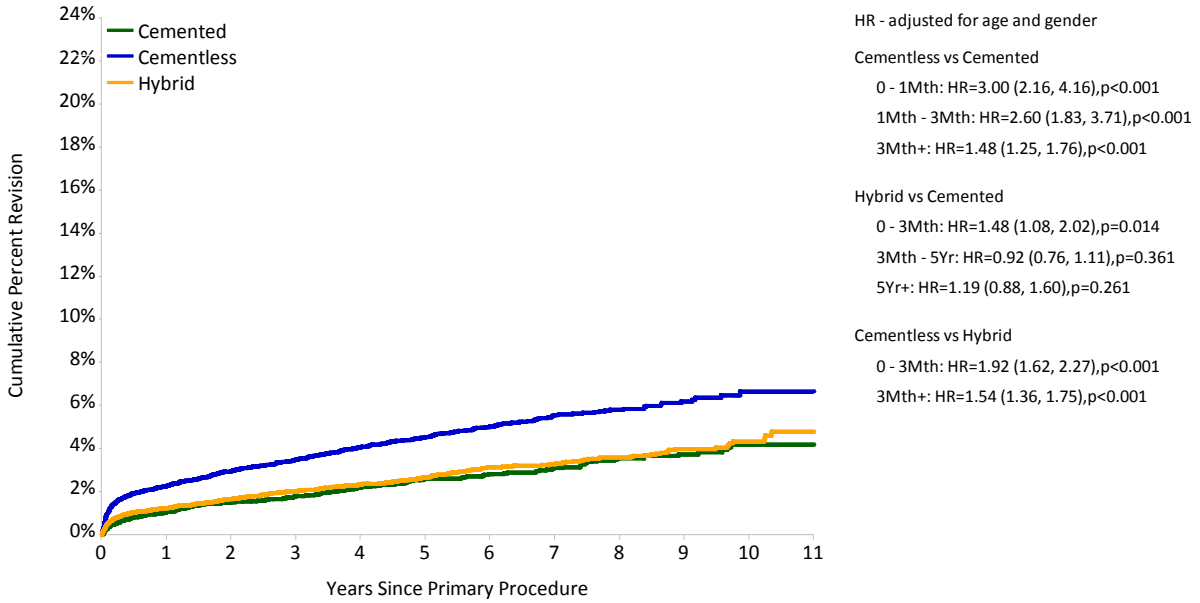
Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Cemented	2221	2015	1667	1336	297	90
Cementless	34573	29351	20577	13603	1466	374
Hybrid	10479	9036	6576	4575	765	226

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Cemented	6067	5604	4697	3785	731	212
Cementless	39862	33902	23714	15411	1343	278
Hybrid	23262	20363	15222	10733	1455	398

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Cemented	8735	7908	6226	4457	601	156
Cementless	24348	20314	13610	8144	432	70
Hybrid	27101	23253	16440	10469	921	193

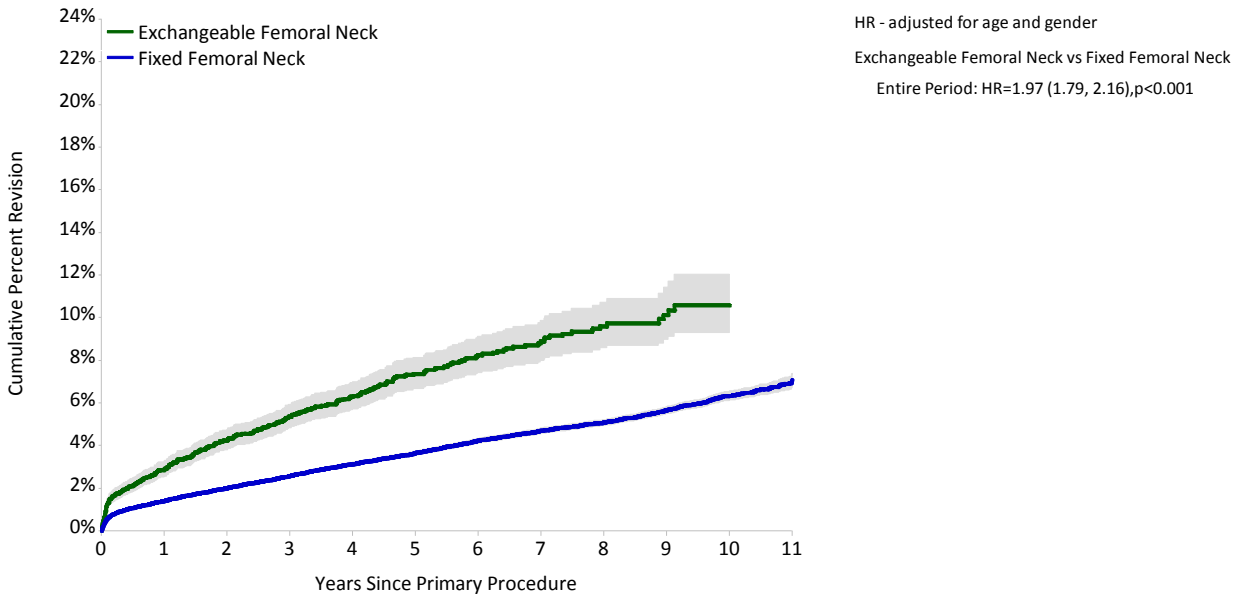
Table HT25: Revision Rates of Primary Total Conventional Hip Replacement by Type of Femoral Neck (Primary Diagnosis OA)

Femoral Neck	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Exchangeable Femoral Neck	459	8300	28043	1.64 (1.49, 1.79)
Fixed Femoral Neck	6456	189046	859327	0.75 (0.73, 0.77)
TOTAL	**6915**	**197346**	**887370**	**0.78 (0.76, 0.80)**

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

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Exchangeable Femoral Neck	2.9 (2.5, 3.3)	5.3 (4.8, 5.9)	7.4 (6.7, 8.1)	10.6 (9.3, 12.0)	
Fixed Femoral Neck	1.4 (1.3, 1.5)	2.6 (2.5, 2.6)	3.6 (3.5, 3.7)	6.3 (6.1, 6.5)	7.1 (6.7, 7.4)

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Exchangeable Femoral Neck	8300	6523	3738	2143	148	32
Fixed Femoral Neck	189046	162881	117509	78999	9103	2311

Table HT27: Revision Rates of Primary Total Conventional Hip Replacement by Type of Femoral Neck and Bearing Surface (Primary Diagnosis OA)

Bearing Surface	Femoral Neck	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Ceramic/Ceramic	Exchangeable	252	4412	17028	1.48 (1.30, 1.67)
	Fixed	1031	38966	166353	0.62 (0.58, 0.66)
Ceramic/Polyethylene	Exchangeable	14	217	735	1.90 (1.04, 3.19)
	Fixed	139	2549	18786	0.74 (0.62, 0.87)
Ceramic/Mod Polyethylene	Exchangeable	24	663	1228	1.96 (1.25, 2.91)
	Fixed	404	16612	60910	0.66 (0.60, 0.73)
Metal/Metal	Exchangeable	83	1322	4391	1.89 (1.51, 2.34)
	Fixed	1534	18008	88629	1.73 (1.65, 1.82)
Metal/Polyethylene	Exchangeable	35	397	1737	2.01 (1.40, 2.80)
	Fixed	831	15965	107063	0.78 (0.72, 0.83)
Metal/Mod Polyethylene	Exchangeable	40	1069	2644	1.51 (1.08, 2.06)
	Fixed	2334	87680	384918	0.61 (0.58, 0.63)
Other (5)	Exchangeable	11	210	240	4.59 (2.29, 8.21)
	Fixed	175	9137	31910	0.55 (0.47, 0.64)
TOTAL		**6907**	**197207**	**886570**	**0.78 (0.76, 0.80)**

Note: Excludes 139 procedures where the bearing surface is yet to be identified.

Table HT28: Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Type of Femoral Neck and Bearing Surface (Primary Diagnosis OA)

Bearing Surface	Femoral Neck	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Ceramic/Ceramic	Exchangeable	3.1 (2.6, 3.7)	5.2 (4.5, 6.0)	6.7 (5.9, 7.7)	9.5 (8.2, 11.1)	
	Fixed	1.3 (1.2, 1.4)	2.3 (2.1, 2.4)	3.0 (2.8, 3.2)	4.8 (4.4, 5.2)	5.3 (4.7, 5.9)
Ceramic/Polyethylene	Exchangeable	4.0 (2.0, 7.9)	6.8 (3.9, 11.9)	7.7 (4.5, 13.1)		
	Fixed	1.6 (1.2, 2.2)	2.6 (2.0, 3.3)	3.3 (2.6, 4.1)	7.8 (6.5, 9.4)	9.2 (7.5, 11.3)
Ceramic/Mod Polyethylene	Exchangeable	2.5 (1.5, 4.1)	5.0 (3.3, 7.7)	5.0 (3.3, 7.7)		
	Fixed	1.3 (1.2, 1.5)	2.3 (2.1, 2.6)	2.9 (2.6, 3.2)	5.3 (4.5, 6.3)	5.6 (4.6, 6.7)
Metal/Metal	Exchangeable	2.1 (1.5, 3.1)	5.4 (4.2, 6.9)	10.2 (8.1, 12.9)		
	Fixed	1.6 (1.4, 1.8)	4.9 (4.6, 5.2)	8.8 (8.3, 9.2)	13.4 (12.6, 14.3)	14.1 (13.1, 15.3)
Metal/Polyethylene	Exchangeable	3.1 (1.8, 5.4)	7.5 (5.2, 10.8)	8.7 (6.1, 12.2)		
	Fixed	1.4 (1.2, 1.6)	2.5 (2.3, 2.8)	3.7 (3.4, 4.0)	7.7 (7.1, 8.3)	8.8 (7.9, 9.7)
Metal/Mod Polyethylene	Exchangeable	2.2 (1.4, 3.3)	3.8 (2.6, 5.6)	6.3 (4.2, 9.5)		
	Fixed	1.4 (1.3, 1.5)	2.2 (2.1, 2.3)	2.8 (2.7, 3.0)	4.6 (4.3, 4.8)	5.0 (4.6, 5.5)
Other (5)	Exchangeable	5.9 (3.2, 10.9)				
	Fixed	1.3 (1.1, 1.6)	1.9 (1.6, 2.2)	2.1 (1.8, 2.5)		

Figure HT17: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Type of Femoral Neck and Bearing Surface (Primary Diagnosis OA)

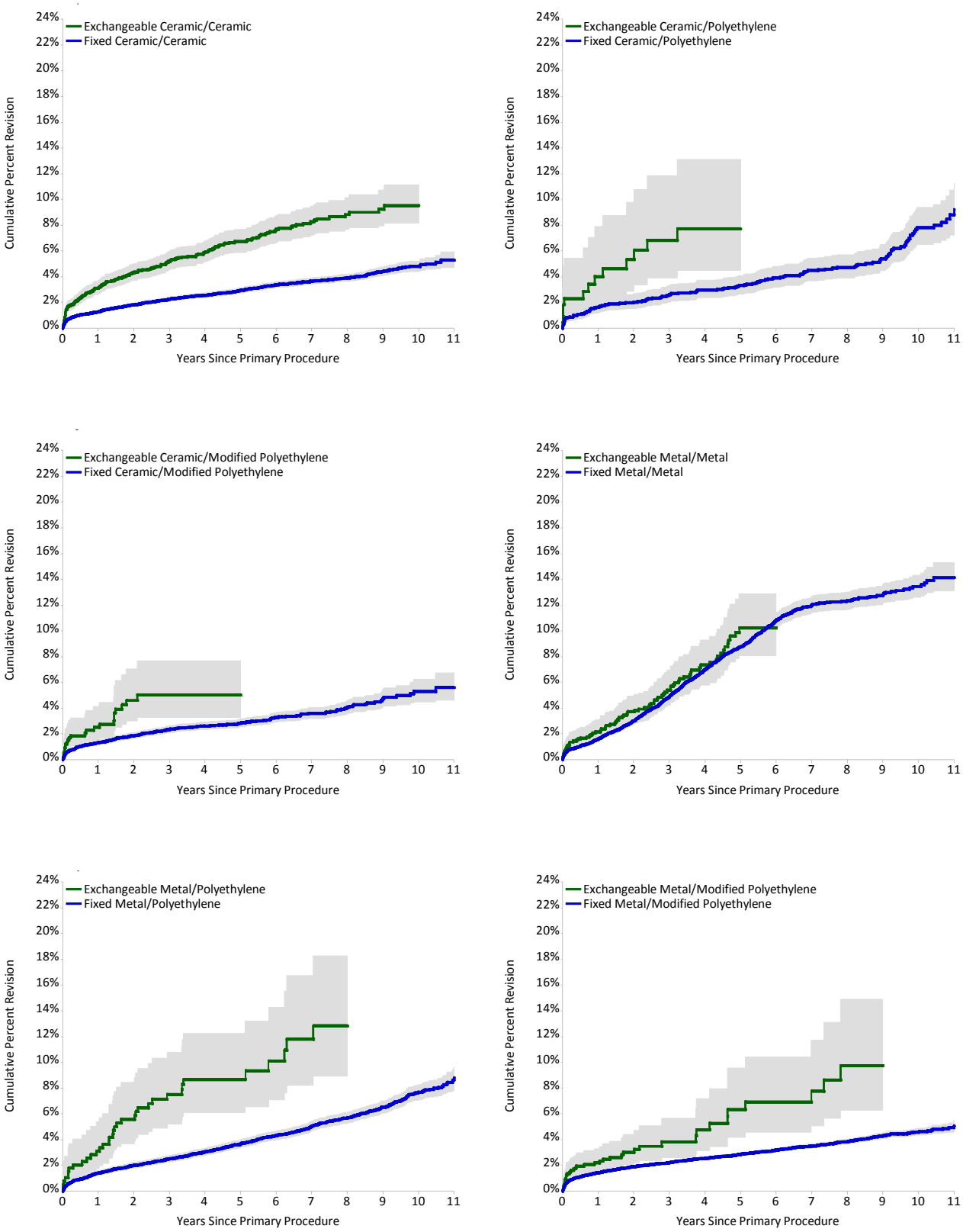


Table HT29: Revision Rates of Primary Total Conventional Hip Replacement using an Exchangeable Femoral Neck by Component Used (Primary Diagnosis OA)

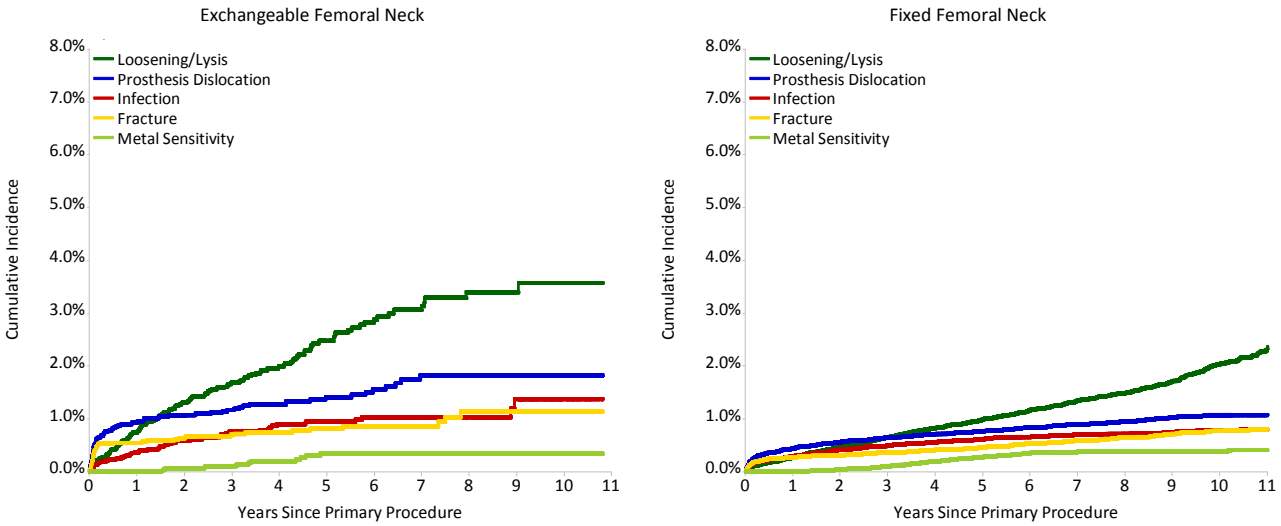
Femoral Neck	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
ABGII	16	223	420	3.81 (2.18, 6.18)
Adapter	64	727	2392	2.68 (2.06, 3.42)
Apex	86	1811	5088	1.69 (1.35, 2.09)
F2L	55	692	5158	1.07 (0.80, 1.39)
Integrale	9	469	1016	0.89 (0.41, 1.68)
M-Cor	2	111	393	0.51 (0.06, 1.84)
M/L Taper Kinectiv	39	1452	1920	2.03 (1.44, 2.78)
MSA	4	144	152	2.64 (0.72, 6.76)
Margron	70	553	3826	1.83 (1.43, 2.31)
Metha	9	84	118	7.61 (3.48, 14.45)
Modular Neck (Group Lepine)	37	557	3034	1.22 (0.86, 1.68)
Profemur	44	980	2610	1.69 (1.22, 2.26)
R120	4	140	387	1.03 (0.28, 2.65)
UniSyn	15	273	1151	1.30 (0.73, 2.15)
Other (9)	5	84	378	1.32 (0.43, 3.09)
TOTAL	**459**	**8300**	**28043**	**1.64 (1.49, 1.79)**

Note: Only Femoral Neck Prostheses with over 50 procedures have been listed.

Table HT30: Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement using an Exchangeable Femoral Neck by Component Used (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
ABGII	3.6 (1.8, 7.1)	10.0 (5.5, 17.6)			
Adapter	3.2 (2.2, 4.8)	7.6 (5.8, 10.1)	12.8 (9.8, 16.5)		
Apex	2.8 (2.1, 3.7)	5.0 (4.0, 6.3)	6.8 (5.3, 8.6)		
F2L	3.2 (2.1, 4.8)	5.5 (4.1, 7.5)	6.9 (5.2, 9.1)	8.3 (6.4, 10.7)	
Integrale	0.9 (0.3, 2.3)	2.8 (1.3, 6.0)			
M-Cor	0.0 (0.0, 0.0)	0.9 (0.1, 6.3)			
M/L Taper Kinectiv	2.4 (1.7, 3.4)				
MSA	1.8 (0.4, 7.2)				
Margron	5.3 (3.7, 7.5)	7.3 (5.4, 9.8)	9.4 (7.2, 12.2)	14.8 (11.7, 18.6)	
Metha	10.2 (5.2, 19.5)				
Modular Neck (Group Lepine)	2.2 (1.2, 3.8)	4.3 (2.9, 6.5)	5.9 (4.1, 8.5)		
Profemur	3.1 (2.2, 4.5)	5.5 (4.0, 7.6)	6.3 (4.6, 8.6)		
R120	1.5 (0.4, 5.7)	3.3 (1.3, 8.7)			
UniSyn	2.9 (1.5, 5.8)	5.0 (2.9, 8.5)	6.3 (3.8, 10.4)		
Other (9)	1.2 (0.2, 8.2)	2.6 (0.7, 10.2)	8.4 (3.5, 19.4)		

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



Bearing Surface

For the past five years the Registry has reported on the outcomes of bearing surfaces. There is information on 11 different bearing surface combinations, though a number have short follow up and only a small number of procedures undertaken. There are now six bearing surfaces with 11 year cumulative percent revision available for analysis.

The bearing surfaces reported include metal and ceramic femoral heads combined with modified (cross-linked) polyethylene and non-modified polyethylene and Metal on Metal (MoM) and Ceramic on Ceramic (CoC). Ceramicised Metal is reported as a separate bearing surface and has a shorter follow up period of eight years. Although it has been combined with both modified and non-modified polyethylene, the numbers used with the latter are small (290) and this combination has not been reported.

Comparison of Bearing Surfaces

Outcome varies depending on the type of bearing surface. MoM has the highest rate of revision of all bearing surfaces (Tables HT31 and HT32 and Figure HT19).

Although Ceramicised Metal on Modified Polyethylene has the lowest reported cumulative percent revision at seven years (2.2 (1.8, 2.7)) this result should be interpreted with caution (Tables HT31 and HT32). It is the Registry's view that this articulation should not be compared to other articulations. It has only been used with a small number of femoral stem and acetabular combinations from a single company, therefore the analysis cannot be corrected for the confounding effect of prosthesis combination.

Metal on Metal

Since 2008, the Registry has identified that Metal on Metal (MoM) bearing surface has a higher rate of revision compared to Metal on Polyethylene (MoP). In 2010, MoM was identified as having a higher rate of revision compared to all other bearing surfaces. It was also in that year that the Registry first identified the important relationship between head size and revision of MoM prostheses (Table HT33 and HT34 and Figures HT20 and HT21).

To further evaluate the effect of head size with MoM bearing surface, analysis was undertaken comparing four head size groups (≤28, 30-32, 36-40, >40mm). There is no difference in the rate of revision for head sizes less than or equal to 28mm and 30-32mm. The two larger head size groups were associated with an increased rate of revision compared to the two groups with head sizes 32mm or less. In particular there has been an increasing rate of revision for head sizes greater than 40mm (Tables HT35 and HT36 and Figure HT22).

For the first time the Registry is reporting a difference in the rate of revision with regard to age. Patients aged less than 75 years of age have a significantly higher rate of revision compared to patients 75 years or older after 4.5 years. (Tables HT37 and HT38 and Figure HT23).

There continues to be an interaction between age and head size. The rate of revision for head sizes greater than 32mm is higher regardless of age. Patients less than 65 years of age with a head size greater than 32mm have a higher rate of revision than patients 65 years of age or older (Tables HT39 and HT40 and Figure HT24).

Females have a higher rate of revision for MoM (Tables HT41 and HT42 and Figure HT25). This difference is related to head size. For head sizes greater than 32mm both males and females have a higher rate of revision however females have the highest rate. There is no gender difference for head sizes less than or equal to 32mm (Tables HT43 and HT44 and Figure HT26).

There are differences in the reasons for revision when MoM and MoP bearing surfaces are compared. The cumulative incidence of reason for revision demonstrates a higher incidence of revision for loosening/lysis, metal sensitivity and infection for the MoM group. The cumulative incidence for these three revision diagnoses for MoM at eleven years is 4.2%, 3.8% and 1.8% respectively compared to MoP 2.2%, 0.0% and 0.7% respectively (Figure HT27). It is uncertain why there is a higher incidence of reported infection. The diagnosis of infection is reported to the Registry at the time of surgery and has not been confirmed by linking to results of microbiological investigation.

The differences in the reasons for revision between MoM and MoP are more evident in the MoM prostheses with a head size greater than 32mm. Metal sensitivity is largely confined to head sizes greater than 32mm. The cumulative incidence of metal sensitivity at ten years is 5.7% for head sizes greater than 32mm and 0.1% for head sizes less than or equal to 32mm. The incidence of metal sensitivity is potentially higher as it is possible that undiagnosed metal sensitivity contributes to the increased rate of loosening/lysis and infection reported in MoM articulations with larger head sizes (Figure HT28). The Registry has also identified that lysis, as the sole diagnosis for revision, is reported with the highest frequency in metal on metal articulations.

In the MoM bearing group the Metasul articulation is the principal recorded femoral head for MoM bearings with a head size of less than or equal to 32mm. It accounts for 85.2% of all the MoM bearings with this head size.

In order to determine if the higher revision rate of MoM articulations with greater than 32mm head sizes is prosthesis specific, the Registry has analysed all prosthesis head/acetabular combinations with head size greater than 32mm with more than 200 procedures. There are 13 combinations that meet these criteria and the cumulative percent revision ranges from 3.6% to 21.9% at five years (Tables HT45 and HT46).

Modified Polyethylene

Modified polyethylene includes all polyethylene that has been cross-linked or has the addition of Vitamin E. Non-modified polyethylene includes all other polyethylene.

Modified polyethylene has a lower rate of revision compared to non-modified polyethylene (Tables HT47 and HT48 and Figure HT29). Modified polyethylene has a cumulative percent revision at 11 years of 5.1% compared to non-modified polyethylene 9.1%. The difference between the two types of polyethylene becomes significant after six months. When modified polyethylene is used there is no difference in outcome when head sizes less than or equal to 32 mm and greater than 32 mm are compared.

There is a significant difference with non-modified polyethylene when head sizes less than or equal to 32mm and greater than 32mm are compared. The larger head sizes however have only been used in small numbers with a shorter follow up (Tables HT49 and HT50 and Figure HT30).

Modified polyethylene and non-modified polyethylene are combined with three different femoral head bearing surfaces, ceramic, metal and ceramicised metal. For the first time the Registry is able to demonstrate a lower rate of revision for all three of these bearing surfaces when comparing modified polyethylene to non-modified polyethylene. When a ceramic head is used there is a significantly lower rate of revision for modified polyethylene compared to non-modified polyethylene (HR=0.75 (0.62, 0.92) p=0.004) (Figure HT31).

When a metal head is used there is a significantly lower rate of revision in the modified polyethylene group after three months. With ceramicised metal there is a significantly lower rate of revision after one month (HR=0.27 (0.16, 0.45) p<0.001) (Figure HT31).

Ceramic on Ceramic Bearing

The analysis on three head sizes for ceramic on ceramic bearing surface is reported, ≤28mm, 32mm and >32mm. There is no difference in the rate of revision between head sizes 32mm and greater than 32mm, however less than or equal to 28mm CoC bearings have a significantly higher rate of revision compared to the other two head sizes (Tables HT51 and HT52 and Figure HT32).

Ceramic and Metal Bearing

The Registry reports data on these relatively new bearing surface combinations. There are two types of ceramic and metal bearing. The Registry has information on 298 ceramic head/metal bearings and 48 metal head/ceramic bearings.

The rate of revision of ceramic head/metal bearing is not different from most other bearings. The cumulative percent revision at three years is 4.1 (2.0, 8.3).

The use of a metal head/ceramic bearing is not an industry recommended combination. Only a small number of procedures have been undertaken using this bearing surface. The cumulative percent revision at five years is 6.3 (2.1, 18.1). Metal head/ceramic bearing has a significantly higher rate of revision when compared to the bearing surface combination of modified polyethylene with metal, ceramic or ceramicised metal femoral heads.

Table HT31: Revision Rates of Primary Total Conventional Hip Replacement by Bearing Surface (Primary Diagnosis OA)

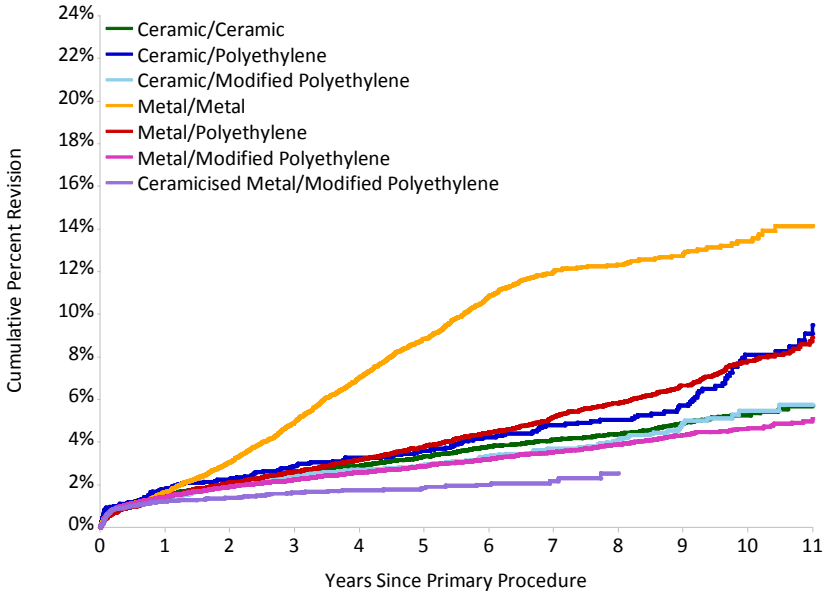
Bearing Surface	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Ceramic/Ceramic	1283	43378	183380	0.70 (0.66, 0.74)
Ceramic/Polyethylene	153	2766	19521	0.78 (0.66, 0.92)
Ceramic/Modified Polyethylene	428	17275	62138	0.69 (0.63, 0.76)
Metal/Metal	1617	19330	93020	1.74 (1.65, 1.83)
Metal/Polyethylene	866	16362	108800	0.80 (0.74, 0.85)
Metal/Modified Polyethylene	2374	88749	387561	0.61 (0.59, 0.64)
Ceramicised Metal/Mod Polyethylene	134	8364	28899	0.46 (0.39, 0.55)
Other (5)	60	1122	4050	1.48 (1.13, 1.91)
TOTAL	**6915**	**197346**	**887370**	**0.78 (0.76, 0.80)**

Note: Only Bearing Surfaces with over 500 procedures have been listed.
Other includes Ceramic/Metal, Metal/Ceramic, Ceramicised Metal/Polyethylene, Ceramicised Metal/Ceramic and Unknown bearing surfaces.

Table HT32: Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Bearing Surface (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Ceramic/Ceramic	1.5 (1.4, 1.6)	2.6 (2.4, 2.7)	3.3 (3.1, 3.5)	5.3 (4.9, 5.7)	5.7 (5.2, 6.3)
Ceramic/Polyethylene	1.8 (1.3, 2.4)	2.9 (2.3, 3.6)	3.6 (2.9, 4.4)	8.1 (6.8, 9.7)	9.5 (7.8, 11.5)
Ceramic/Modified Polyethylene	1.4 (1.2, 1.6)	2.4 (2.2, 2.7)	2.9 (2.6, 3.3)	5.5 (4.6, 6.4)	5.7 (4.8, 6.9)
Metal/Metal	1.6 (1.5, 1.8)	4.9 (4.6, 5.3)	8.8 (8.4, 9.3)	13.4 (12.6, 14.3)	14.1 (13.1, 15.3)
Metal/Polyethylene	1.4 (1.3, 1.6)	2.6 (2.4, 2.9)	3.8 (3.5, 4.1)	7.8 (7.2, 8.4)	8.9 (8.1, 9.8)
Metal/Modified Polyethylene	1.4 (1.3, 1.5)	2.2 (2.1, 2.3)	2.9 (2.7, 3.0)	4.6 (4.4, 4.9)	5.1 (4.7, 5.5)
Ceramicised Metal/Mod Polyethylene	1.2 (1.0, 1.5)	1.6 (1.4, 1.9)	1.9 (1.5, 2.2)		
Other (5)	3.1 (2.2, 4.4)	4.9 (3.7, 6.6)	5.4 (4.0, 7.1)		

Figure HT19: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Bearing Surface (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Ceramic/Ceramic	43378	36056	24418	16419	1620	298
Ceramic/Polyethylene	2766	2515	2300	2027	625	236
Ceramic/Modified Polyethylene	17275	13583	8381	5009	477	151
Metal/Metal	19330	18508	14717	8234	648	123
Metal/Polyethylene	16362	15509	13770	11586	2203	581
Metal/Modified Polyethylene	88749	75744	52790	35049	3644	940
Ceramicised Metal/Mod Polyethylene	8364	6602	4385	2473	0	0

Comparison	Hazard Ratio
Ceramic/Ceramic vs Metal/Modified Polyethylene	Entire Period: HR=1.09 (1.02, 1.17),p=0.012
Ceramic/Polyethylene vs Metal/Modified Polyethylene	Entire Period: HR=1.47 (1.25, 1.73),p<0.001
Ceramic/Modified Polyethylene vs Metal/Modified Polyethylene	Entire Period: HR=1.02 (0.92, 1.13),p=0.683
Metal/Metal vs Metal/Modified Polyethylene	0 - 2Wk: HR=1.36 (1.04, 1.77),p=0.023 2Wk - 6Mth: HR=0.89 (0.75, 1.06),p=0.181 6Mth - 9Mth: HR=1.22 (0.87, 1.70),p=0.245 9Mth - 1.5Yr: HR=2.37 (2.00, 2.79),p<0.001 1.5Yr - 2Yr: HR=3.40 (2.76, 4.18),p<0.001 2Yr - 3Yr: HR=4.91 (4.24, 5.70),p<0.001 3Yr - 6Yr: HR=6.16 (5.52, 6.88),p<0.001 6Yr - 7Yr: HR=3.74 (2.78, 5.02),p<0.001 7Yr+: HR=1.33 (0.93, 1.91),p=0.113
Metal/Polyethylene vs Metal/Modified Polyethylene	0 - 3Mth: HR=0.83 (0.68, 1.00),p=0.054 3Mth - 9Mth: HR=1.30 (1.02, 1.65),p=0.031 9Mth - 3.5Yr: HR=1.41 (1.23, 1.62),p<0.001 3.5Yr - 6.5Yr: HR=1.95 (1.68, 2.27),p<0.001 6.5Yr+: HR=2.24 (1.88, 2.67),p<0.001

Note: HR – adjusted for age and gender

Table HT33: Revision Rates of Primary Total Conventional Hip Replacement by Bearing Surface and Head Size (Primary Diagnosis OA)

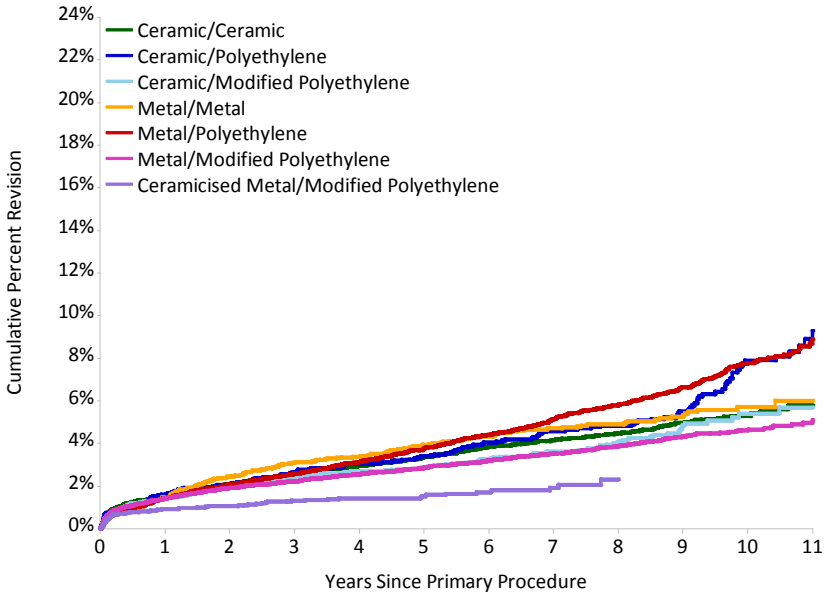
Bearing Surface	Head Size	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Ceramic/Ceramic	≤32mm	890	25359	135342	0.66 (0.62, 0.70)
	>32mm	393	18019	48038	0.82 (0.74, 0.90)
Ceramic/Polyethylene	≤32mm	145	2614	19329	0.75 (0.63, 0.88)
	>32mm	8	152	192	4.16 (1.80, 8.20)
Ceramic/Modified Polyethylene	≤32mm	316	11253	49738	0.64 (0.57, 0.71)
	>32mm	112	6022	12400	0.90 (0.74, 1.09)
Metal/Metal	≤32mm	219	4958	31763	0.69 (0.60, 0.79)
	>32mm	1398	14372	61257	2.28 (2.16, 2.41)
Metal/Polyethylene	≤32mm	856	16072	108151	0.79 (0.74, 0.85)
	>32mm	10	290	648	1.54 (0.74, 2.84)
Metal/Modified Polyethylene	≤32mm	2065	73630	348489	0.59 (0.57, 0.62)
	>32mm	309	15119	39072	0.79 (0.71, 0.88)
Ceramicised Metal/Modified Polyethylene	≤32mm	69	4803	19644	0.35 (0.27, 0.44)
	>32mm	65	3561	9255	0.70 (0.54, 0.90)
Other (4)	≤32mm	26	490	2367	1.10 (0.72, 1.61)
	>32mm	26	493	884	2.94 (1.92, 4.31)
TOTAL		**6907**	**197207**	**886570**	**0.78 (0.76, 0.80)**

Note: Excludes 139 procedures where the bearing surface is yet to be identified

Table HT34: Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Bearing Surface and Head Size (Primary Diagnosis OA)

Bearing Surface	Head Size	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Ceramic/Ceramic	≤32mm	1.5 (1.4, 1.7)	2.6 (2.4, 2.8)	3.4 (3.1, 3.6)	5.3 (4.9, 5.7)	5.8 (5.2, 6.4)
	>32mm	1.4 (1.2, 1.6)	2.5 (2.2, 2.7)	3.3 (2.9, 3.7)	5.3 (4.1, 6.8)	
Ceramic/Polyethylene	≤32mm	1.6 (1.2, 2.2)	2.7 (2.1, 3.4)	3.4 (2.7, 4.2)	7.9 (6.6, 9.5)	9.3 (7.6, 11.4)
	>32mm	5.6 (2.5, 12.1)				
Ceramic/Mod Polyethylene	≤32mm	1.4 (1.2, 1.7)	2.5 (2.2, 2.8)	2.9 (2.6, 3.3)	5.4 (4.6, 6.4)	5.7 (4.7, 6.8)
	>32mm	1.3 (1.0, 1.6)	2.3 (1.9, 2.9)	3.4 (2.6, 4.5)		
Metal/Metal	≤32mm	1.5 (1.2, 1.9)	3.1 (2.7, 3.7)	3.9 (3.4, 4.6)	5.7 (4.9, 6.6)	6.0 (5.1, 7.1)
	>32mm	1.7 (1.5, 1.9)	5.6 (5.2, 6.0)	10.9 (10.3, 11.6)	20.3 (17.6, 23.3)	
Metal/Polyethylene	≤32mm	1.4 (1.3, 1.6)	2.6 (2.3, 2.8)	3.8 (3.5, 4.1)	7.8 (7.2, 8.4)	8.9 (8.0, 9.8)
	>32mm	1.5 (0.6, 4.1)	5.8 (2.9, 11.5)			
Metal/Mod Polyethylene	≤32mm	1.4 (1.3, 1.5)	2.2 (2.1, 2.4)	2.9 (2.7, 3.0)	4.6 (4.4, 4.9)	5.1 (4.7, 5.5)
	>32mm	1.4 (1.3, 1.7)	2.2 (1.9, 2.5)	3.0 (2.6, 3.5)		
Ceramicised Metal/Mod Polyethylene	≤32mm	0.9 (0.7, 1.2)	1.3 (1.0, 1.7)	1.5 (1.2, 2.0)		
	>32mm	1.6 (1.2, 2.1)	2.0 (1.6, 2.6)	2.3 (1.8, 3.1)		
Other (4)	≤32mm	2.1 (1.1, 3.9)	3.5 (2.1, 5.8)	3.8 (2.4, 6.3)		
	>32mm	4.5 (2.9, 6.9)	7.0 (4.5, 10.6)			

Figure HT20: Cumulative Percent Revision of Primary Total Conventional Hip Replacement using ≤32mm Head Size by Bearing Surface (Primary Diagnosis OA)

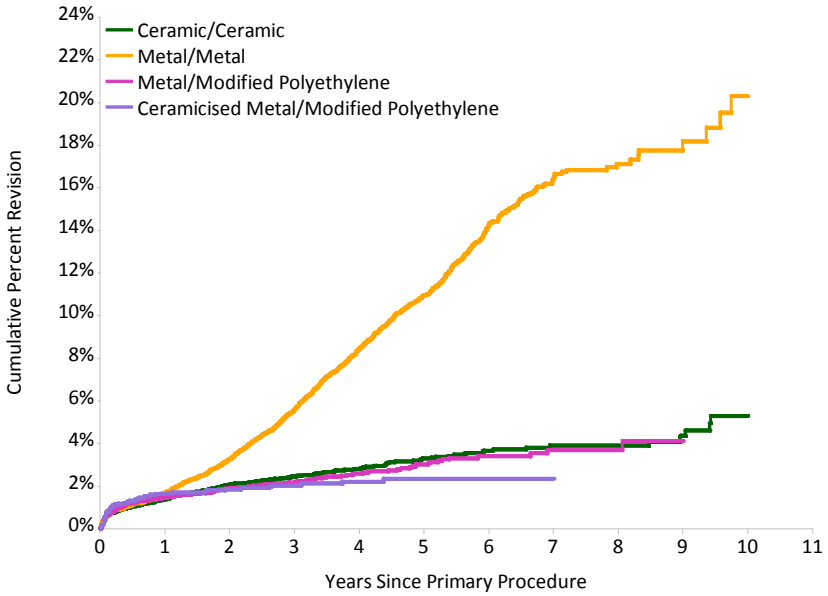


Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Ceramic/Ceramic	25359	22666	18168	13719	1457	278
Ceramic/Polyethylene	2614	2460	2277	2020	625	236
Ceramic/Modified Polyethylene	11253	9396	6839	4703	477	151
Metal/Metal	4958	4758	4173	3307	554	97
Metal/Polyethylene	16072	15322	13681	11561	2203	581
Metal/Modified Polyethylene	73630	64091	47583	33215	3635	940
Ceramicised Metal/Modified Polyethylene	4803	4103	3040	1903	0	0

Comparison	Hazard Ratio
Ceramic/Ceramic vs Metal/Modified Polyethylene	0 - 2Wk: HR=1.29 (1.00, 1.67),p=0.050 2Wk - 3Mth: HR=1.03 (0.87, 1.22),p=0.731 3Mth+: HR=1.12 (1.02, 1.24),p=0.016
Ceramic/Polyethylene vs Metal/Modified Polyethylene	0 - 1Mth: HR=1.34 (0.85, 2.11),p=0.214 1Mth - 3Mth: HR=0.22 (0.05, 0.87),p=0.031 3Mth - 6Mth: HR=0.96 (0.40, 2.33),p=0.933 6Mth+: HR=1.62 (1.34, 1.95),p<0.001
Ceramic/Modified Polyethylene vs Metal/Modified Polyethylene	Entire Period: HR=1.02 (0.90, 1.15),p=0.754
Metal/Metal vs Metal/Modified Polyethylene	Entire Period: HR=1.22 (1.06, 1.41),p=0.005
Metal/Polyethylene vs Metal/Modified Polyethylene	0 - 3Mth: HR=0.81 (0.66, 0.98),p=0.033 3Mth - 9Mth: HR=1.33 (1.04, 1.70),p=0.022 9Mth - 3.5Yr: HR=1.40 (1.21, 1.61),p<0.001 3.5Yr - 6.5Yr: HR=1.98 (1.69, 2.32),p<0.001 6.5Yr+: HR=2.32 (1.94, 2.77),p<0.001

Note: HR – adjusted for age and gender

Figure HT21: Cumulative Percent Revision of Primary Total Conventional Hip Replacement using >32mm Head Size by Bearing Surface (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Ceramic/Ceramic	18019	13390	6250	2700	163	20
Metal/Metal	14372	13750	10544	4927	94	26
Metal/Modified Polyethylene	15119	11653	5207	1834	9	0
Ceramicised Metal/Modified Polyethylene	3561	2499	1345	570	0	0

Note: Only bearing surfaces with at least seven years follow up are displayed in Figure HT21

Comparison	Hazard Ratio
Ceramic/Ceramic vs Metal/Modified Polyethylene	Entire Period: HR=1.06 (0.91, 1.23),p=0.478
Metal/Metal vs Metal/Modified Polyethylene	0 - 2Wk: HR=1.47 (1.03, 2.09),p=0.034 2Wk - 1Mth: HR=0.59 (0.38, 0.90),p=0.014 1Mth - 9Mth: HR=1.13 (0.88, 1.43),p=0.337 9Mth - 2Yr: HR=2.81 (2.26, 3.48),p<0.001 2Yr - 3.5Yr: HR=7.08 (5.47, 9.17),p<0.001 3.5Yr - 5.5Yr: HR=7.23 (5.30, 9.84),p<0.001 5.5Yr+: HR=9.73 (5.71, 16.56),p<0.001

Note: HR – adjusted for age and gender

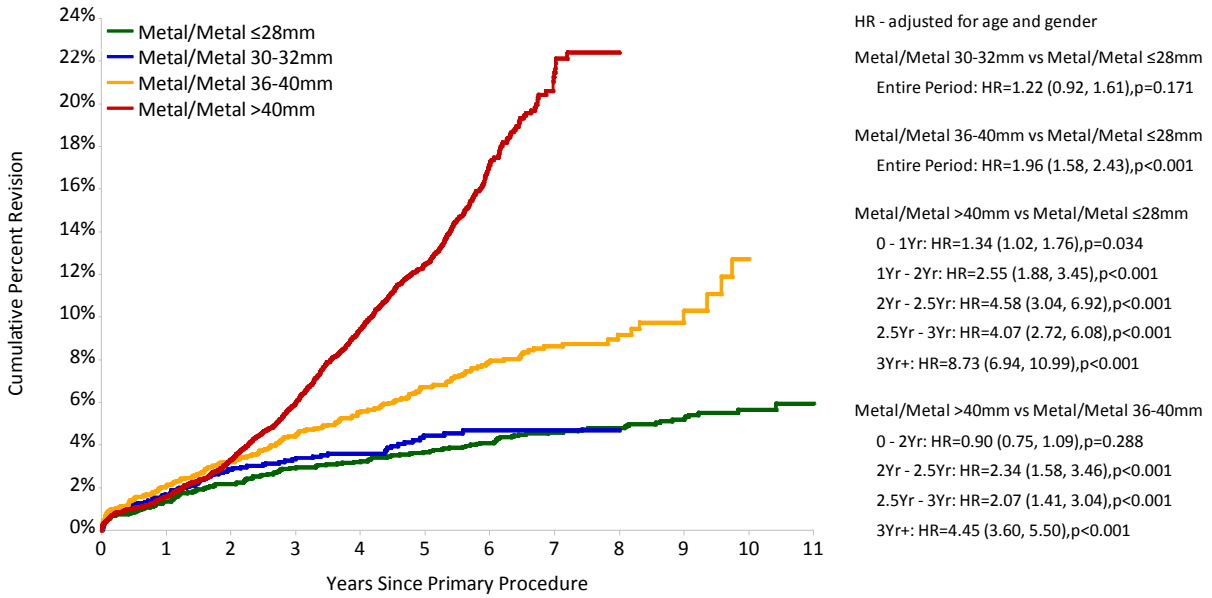
Table HT35: Revision Rates of Metal/Metal Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)

Bearing Surface	Head Size	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Metal/Metal	≤28mm	140	2906	22295	0.63 (0.53, 0.74)
	30-32mm	79	2052	9468	0.83 (0.66, 1.04)
	36-40mm	242	3655	17689	1.37 (1.20, 1.55)
	>40mm	1156	10717	43568	2.65 (2.50, 2.81)
TOTAL		**1617**	**19330**	**93020**	**1.74 (1.65, 1.83)**

Table HT36: Yearly Cumulative Percent Revision of Metal/Metal Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)

Bearing Surface	Head Size	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs
Metal/Metal	≤28mm	1.3 (1.0, 1.8)	2.9 (2.4, 3.6)	3.7 (3.0, 4.4)	4.6 (3.9, 5.4)	5.6 (4.7, 6.7)
	30-32mm	1.7 (1.2, 2.3)	3.4 (2.7, 4.3)	4.4 (3.5, 5.6)	4.7 (3.7, 5.9)	
	36-40mm	2.1 (1.7, 2.6)	4.5 (3.8, 5.2)	6.7 (5.8, 7.7)	8.6 (7.5, 9.9)	12.7 (9.8, 16.4)
	>40mm	1.6 (1.3, 1.8)	6.0 (5.5, 6.5)	12.5 (11.7, 13.2)	21.5 (19.8, 23.3)	

Figure HT22: Cumulative Percent Revision of Metal/Metal Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Metal/Metal	≤28mm	2906	2835	2660	2395	554	97
	30-32mm	2052	1923	1513	912	0	0
	36-40mm	3655	3481	2670	1663	93	26
	>40mm	10717	10269	7874	3264	1	0

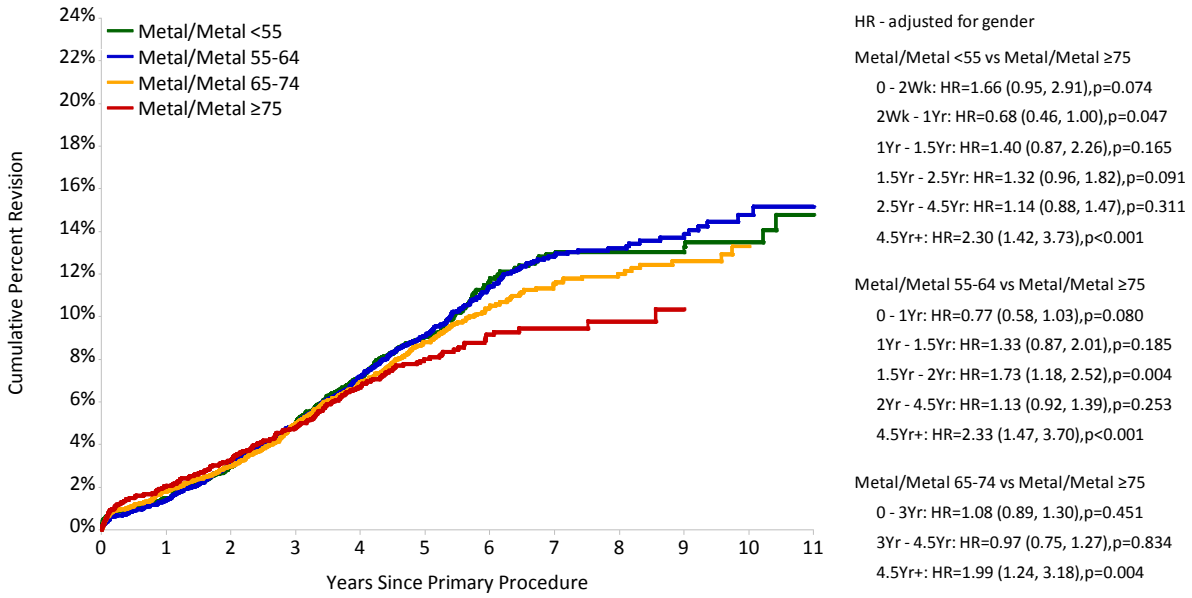
Table HT37: Revision Rates of Metal/Metal Primary Total Conventional Hip Replacement by Age (Primary Diagnosis OA)

Bearing Surface	Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Metal/Metal	<55	335	3796	18685	1.79 (1.61, 2.00)
	55-64	566	6396	31141	1.82 (1.67, 1.97)
	65-74	499	5997	29345	1.70 (1.55, 1.86)
	≥75	217	3141	13849	1.57 (1.37, 1.79)
TOTAL		**1617**	**19330**	**93020**	**1.74 (1.65, 1.83)**

Table HT38: Yearly Cumulative Percent Revision of Metal/Metal Primary Total Conventional Hip Replacement by Age (Primary Diagnosis OA)

Bearing Surface	Age	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Metal/Metal	<55	1.5 (1.1, 1.9)	5.0 (4.3, 5.8)	9.1 (8.1, 10.2)	13.5 (12.0, 15.2)	14.8 (12.6, 17.3)
	55-64	1.4 (1.1, 1.7)	4.9 (4.4, 5.5)	9.1 (8.3, 9.9)	14.8 (13.3, 16.4)	15.1 (13.5, 17.0)
	65-74	1.8 (1.5, 2.2)	5.0 (4.4, 5.6)	8.8 (8.0, 9.7)	13.3 (11.8, 15.0)	
	≥75	2.1 (1.6, 2.6)	4.8 (4.1, 5.6)	8.0 (7.0, 9.2)		

Figure HT23: Cumulative Percent Revision of Metal/Metal Primary Total Conventional Hip Replacement by Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Metal/Metal	<55	3796	3626	2878	1671	197	50
	55-64	6396	6174	4883	2737	231	47
	65-74	5997	5752	4641	2663	188	24
	≥75	3141	2956	2315	1163	32	2

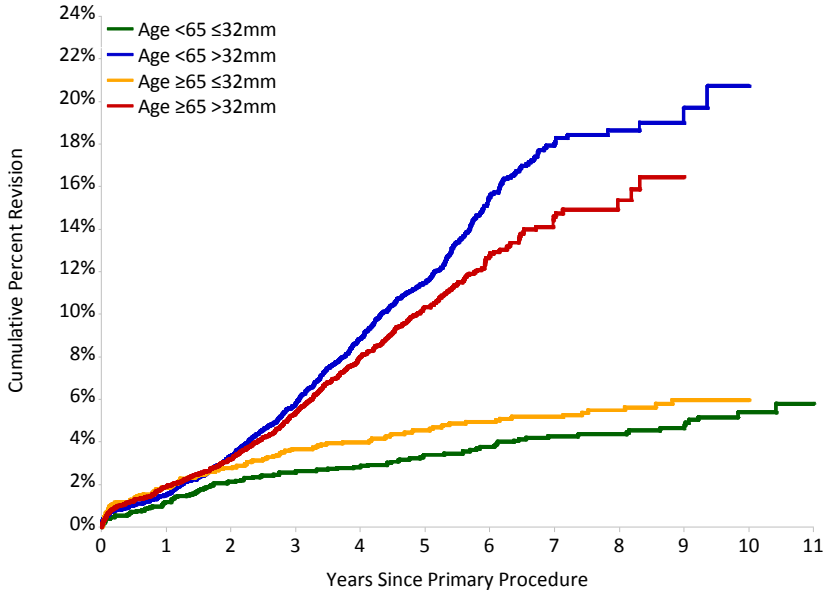
Table HT39: Revision Rates of Metal/Metal Primary Total Conventional Hip Replacement by Age and Head Size (Primary Diagnosis OA)

Head Size	Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
≤32mm	<65	105	2593	17287	0.61 (0.50, 0.74)
	≥65	114	2365	14476	0.79 (0.65, 0.95)
>32mm	<65	796	7599	32539	2.45 (2.28, 2.62)
	≥65	602	6773	28718	2.10 (1.93, 2.27)
TOTAL		**1617**	**19330**	**93020**	**1.74 (1.65, 1.83)**

Table HT40: Yearly Cumulative Percent Revision of Metal/Metal Primary Total Conventional Hip Replacement by Age and Head Size (Primary Diagnosis OA)

Head Size	Age	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
≤32mm	<65	1.2 (0.8, 1.7)	2.6 (2.1, 3.3)	3.4 (2.7, 4.2)	5.4 (4.4, 6.6)	5.8 (4.6, 7.4)
	≥65	1.8 (1.4, 2.5)	3.7 (3.0, 4.5)	4.6 (3.8, 5.5)	6.0 (4.9, 7.2)	
>32mm	<65	1.5 (1.3, 1.8)	5.8 (5.3, 6.4)	11.5 (10.6, 12.4)	20.7 (18.0, 23.8)	
	≥65	1.9 (1.6, 2.3)	5.4 (4.9, 6.0)	10.3 (9.5, 11.2)		

Figure HT24: Cumulative Percent Revision of Metal/Metal Primary Total Conventional Hip Replacement by Age and Head Size (Primary Diagnosis OA)



HR - adjusted for gender

Age <65 ≤32mm vs Age <65 >32mm
- 0 - 2Wk: HR=0.49 (0.20, 1.23),p=0.129
- 2Wk - 2Yr: HR=0.60 (0.44, 0.80),p<0.001
- 2Yr+: HR=0.14 (0.11, 0.19),p<0.001

Age <65 >32mm vs Age ≥65 >32mm
- Entire Period: HR=1.20 (1.07, 1.33),p<0.001

Age <65 ≤32mm vs Age ≥65 ≤32mm
- Entire Period: HR=0.80 (0.61, 1.04),p=0.100

Age ≥65 ≤32mm vs Age ≥65 >32mm
- 0 - 1.5Yr: HR=0.91 (0.69, 1.20),p=0.504
- 1.5Yr - 2Yr: HR=0.50 (0.32, 0.80),p=0.003
- 2Yr - 3Yr: HR=0.38 (0.27, 0.55),p<0.001
- 3Yr - 3.5Yr: HR=0.13 (0.06, 0.28),p<0.001
- 3.5Yr+: HR=0.20 (0.14, 0.27),p<0.001

Number at Risk		0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
≤32mm	<65	2593	2508	2217	1760	371	77
	≥65	2365	2250	1956	1547	183	20
>32mm	<65	7599	7292	5544	2648	57	20
	≥65	6773	6458	5000	2279	37	6

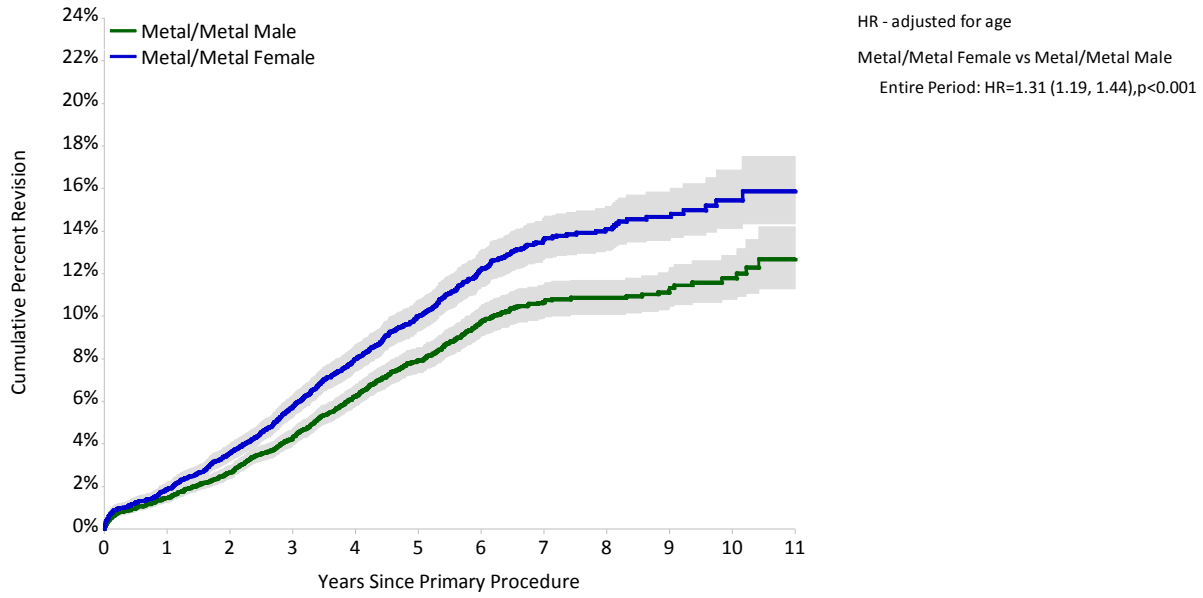
Table HT41: Revision Rates of Metal/Metal Primary Total Conventional Hip Replacement by Gender (Primary Diagnosis OA)

Bearing Surface	Gender	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Metal/Metal	Male	793	10902	51677	1.53 (1.43, 1.65)
	Female	824	8428	41343	1.99 (1.86, 2.13)
TOTAL		**1617**	**19330**	**93020**	**1.74 (1.65, 1.83)**

Table HT42: Yearly Cumulative Percent Revision of Metal/Metal Primary Total Conventional Hip Replacement by Gender (Primary Diagnosis OA)

Bearing Surface	Gender	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Metal/Metal	Male	1.5 (1.3, 1.7)	4.3 (3.9, 4.7)	7.9 (7.3, 8.5)	11.8 (10.8, 12.9)	12.7 (11.3, 14.2)
	Female	1.9 (1.6, 2.2)	5.8 (5.3, 6.3)	10.0 (9.3, 10.7)	15.4 (14.1, 16.9)	15.9 (14.4, 17.5)

Figure HT25: Cumulative Percent Revision of Metal/Metal Primary Total Conventional Hip Replacement by Gender (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Metal/Metal	Male	10902	10403	8149	4491	397	75
	Female	8428	8105	6568	3743	251	48

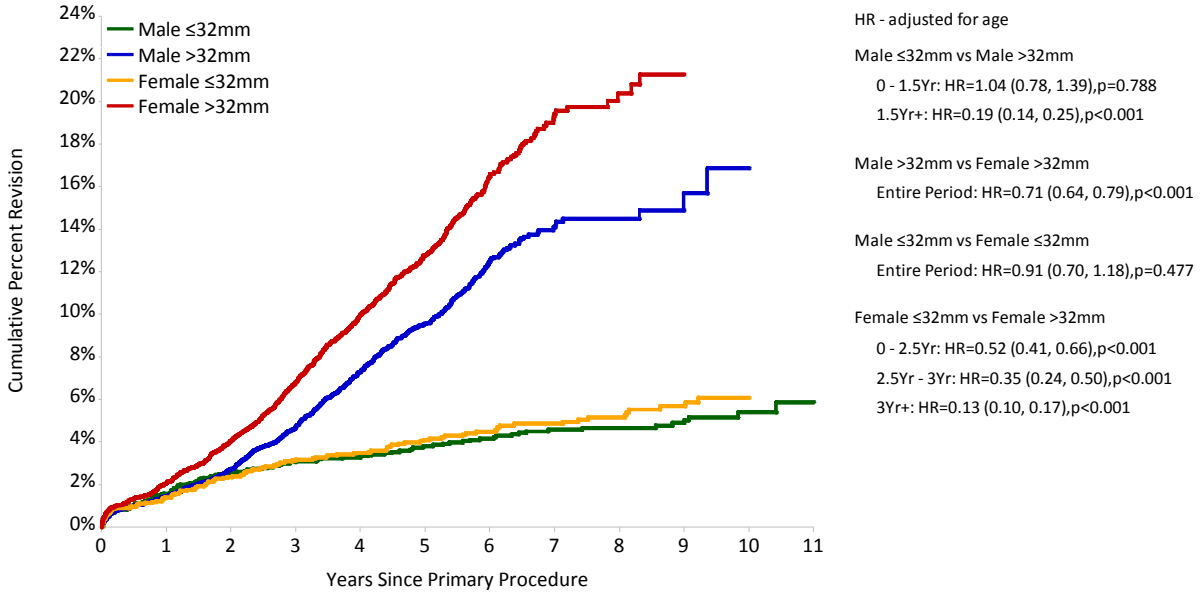
Table HT43: Revision Rates of Metal/Metal Primary Total Conventional Hip Replacement by Gender and Head Size (Primary Diagnosis OA)

Gender	Head Size	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	≤32mm	109	2567	16692	0.65 (0.54, 0.79)
	>32mm	684	8335	34985	1.96 (1.81, 2.11)
Female	≤32mm	110	2391	15071	0.73 (0.60, 0.88)
	>32mm	714	6037	26272	2.72 (2.52, 2.92)
TOTAL		**1617**	**19330**	**93020**	**1.74 (1.65, 1.83)**

Table HT44: Yearly Cumulative Percent Revision of Metal/Metal Primary Total Conventional Hip Replacement by Gender and Head Size (Primary Diagnosis OA)

Gender	Head Size	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	≤32mm	1.6 (1.2, 2.1)	3.1 (2.5, 3.8)	3.8 (3.1, 4.7)	5.4 (4.4, 6.6)	5.9 (4.6, 7.5)
	>32mm	1.4 (1.2, 1.7)	4.7 (4.3, 5.2)	9.5 (8.8, 10.3)	16.9 (14.0, 20.2)	
Female	≤32mm	1.4 (1.0, 1.9)	3.2 (2.5, 4.0)	4.1 (3.3, 5.0)	6.1 (4.9, 7.4)	
	>32mm	2.1 (1.7, 2.5)	6.8 (6.2, 7.5)	12.8 (11.8, 13.8)		

Figure HT26: Cumulative Percent Revision of Metal/Metal Primary Total Conventional Hip Replacement by Gender and Head Size (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	≤32mm	2567	2449	2139	1721	342	60
	>32mm	8335	7954	6010	2770	55	15
Female	≤32mm	2391	2309	2034	1586	212	37
	>32mm	6037	5796	4534	2157	39	11

Figure HT27: Revision Diagnosis Cumulative Incidence of Metal/Metal and Metal/Polyethylene Primary Total Conventional Hip Replacement (Primary Diagnosis OA)

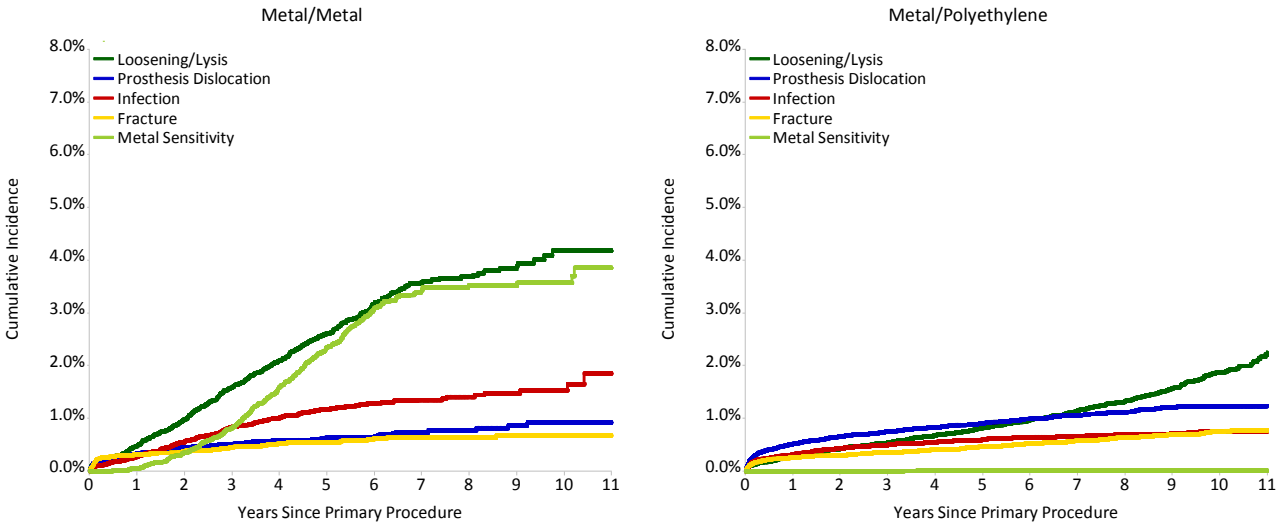


Figure HT28: Revision Diagnosis Cumulative Incidence of Metal/Metal and Metal/Polyethylene Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)

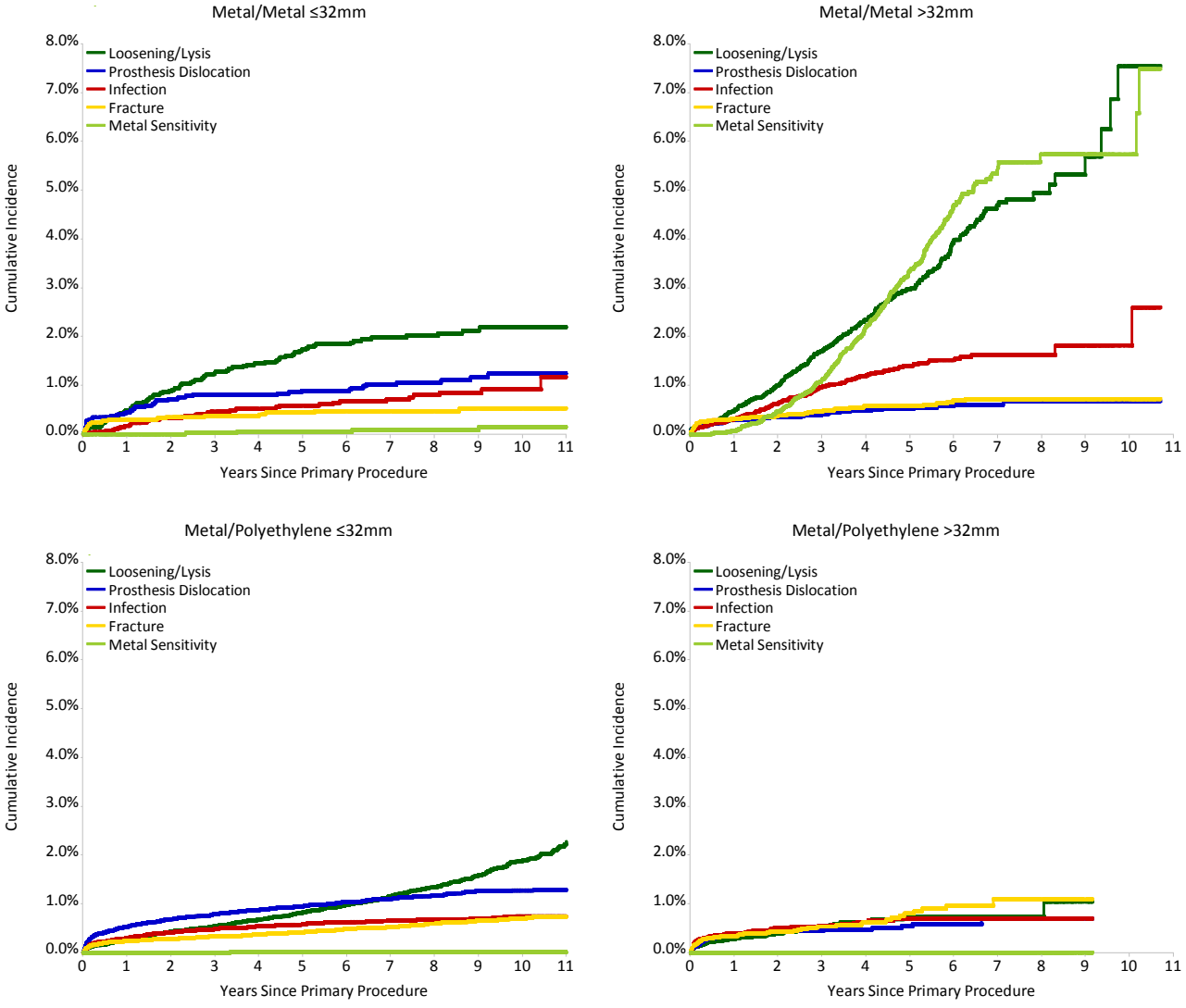


Table HT45: Revision Rates of Metal/Metal Primary Total Conventional Hip Replacement using Head Size >32mm by Prostheses Used (Primary Diagnosis OA)

Head Surface	Acetabular Surface	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
ASR	ASR	821	3978	16568	4.96 (4.62, 5.31)
Articul/Eze	Pinnacle	62	1623	7134	0.87 (0.67, 1.11)
BHR	BHR	109	2215	9468	1.15 (0.95, 1.39)
BHR	R3	30	535	1483	2.02 (1.36, 2.89)
BMHR	BHR	7	241	520	1.34 (0.54, 2.77)
Bionik	Bionik	44	377	1426	3.09 (2.24, 4.14)
Cormet 2000	Cormet	37	639	2706	1.37 (0.96, 1.88)
Icon	Icon	28	341	1224	2.29 (1.52, 3.31)
M2a	M2a	51	781	4696	1.09 (0.81, 1.43)
M2a	Recap	33	924	3697	0.89 (0.61, 1.25)
Metasul	Durom	57	1099	5194	1.10 (0.83, 1.42)
Mitch TRH	Mitch TRH	37	647	2126	1.74 (1.23, 2.40)
S-Rom	Pinnacle	13	283	1842	0.71 (0.38, 1.21)
Other (26)		69	689	3174	2.17 (1.69, 2.75)
TOTAL		**1398**	**14372**	**61257**	**2.28 (2.16, 2.41)**

Note: Only combinations with over 200 procedures have been listed.

Table HT46: Yearly Cumulative Percent Revision of Metal/Metal Primary Total Conventional Hip Replacement using Head Size >32mm by Prostheses Used (Primary Diagnosis OA)

Head Surface	Acetabular Surface	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs
ASR	ASR	1.7 (1.4, 2.2)	9.4 (8.5, 10.4)	21.9 (20.5, 23.5)	44.0 (38.8, 49.6)	
Articul/Eze	Pinnacle	1.9 (1.3, 2.7)	3.0 (2.2, 4.0)	4.2 (3.2, 5.5)	5.6 (4.2, 7.4)	
BHR	BHR	1.0 (0.7, 1.5)	3.2 (2.5, 4.1)	5.5 (4.5, 6.7)	8.6 (6.8, 10.9)	
BHR	R3	2.1 (1.2, 3.7)	5.6 (3.8, 8.1)			
BMHR	BHR	2.2 (0.9, 5.1)	2.7 (1.2, 6.0)			
Bionik	Bionik	3.7 (2.2, 6.2)	8.4 (6.0, 11.8)	15.9 (11.7, 21.3)		
Cormet 2000	Cormet	1.4 (0.7, 2.7)	3.4 (2.2, 5.3)	6.0 (4.1, 8.7)	9.9 (6.8, 14.2)	
Icon	Icon	2.4 (1.2, 4.7)	6.7 (4.3, 10.2)	11.6 (8.0, 16.8)		
M2a	M2a	1.8 (1.1, 3.0)	3.8 (2.6, 5.4)	5.5 (4.1, 7.4)	7.3 (5.5, 9.5)	
M2a	Recap	1.5 (0.9, 2.6)	2.2 (1.5, 3.5)	3.6 (2.4, 5.3)		
Metasul	Durom	1.2 (0.7, 2.0)	3.9 (2.9, 5.3)	5.2 (3.9, 6.7)	6.8 (5.0, 9.2)	
Mitch TRH	Mitch TRH	1.7 (0.9, 3.1)	4.9 (3.4, 7.0)			
S-Rom	Pinnacle	2.1 (1.0, 4.7)	3.6 (1.9, 6.5)	4.0 (2.2, 7.0)	4.4 (2.5, 7.7)	
Other (26)		2.4 (1.4, 3.8)	5.9 (4.3, 8.2)	9.9 (7.5, 13.0)	14.2 (10.9, 18.4)	18.6 (14.2, 24.1)

Note: Only combinations with over 200 procedures have been listed.

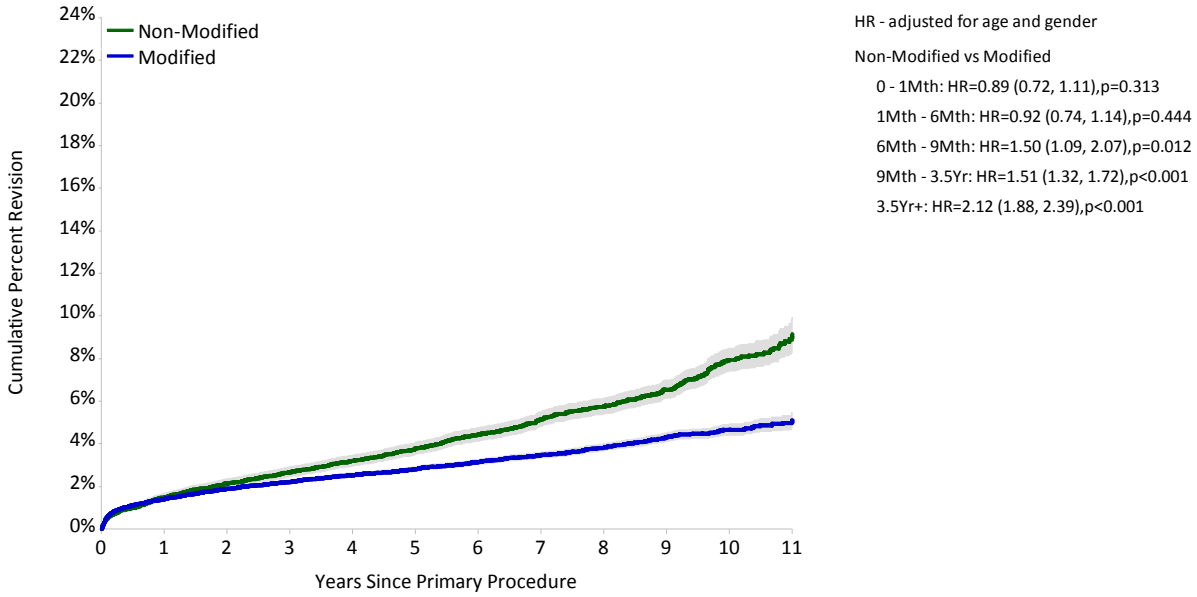
Table HT47: Revision Rates of Primary Total Conventional Hip Replacement by Type of Polyethylene (Primary Diagnosis OA)

Polyethylene Surface	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Non-Modified	1038	19418	129953	0.80 (0.75, 0.85)
Modified	2936	114388	478598	0.61 (0.59, 0.64)
TOTAL	**3974**	**133806**	**608551**	**0.65 (0.63, 0.67)**

Table HT48: Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Type of Polyethylene (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Non-Modified	1.5 (1.3, 1.7)	2.7 (2.4, 2.9)	3.8 (3.5, 4.1)	7.9 (7.4, 8.5)	9.1 (8.4, 10.0)
Modified	1.4 (1.3, 1.5)	2.2 (2.1, 2.3)	2.8 (2.7, 2.9)	4.6 (4.4, 4.9)	5.1 (4.7, 5.5)

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Non-Modified	19418	18293	16309	13812	2828	817
Modified	114388	95929	65556	42531	4121	1091

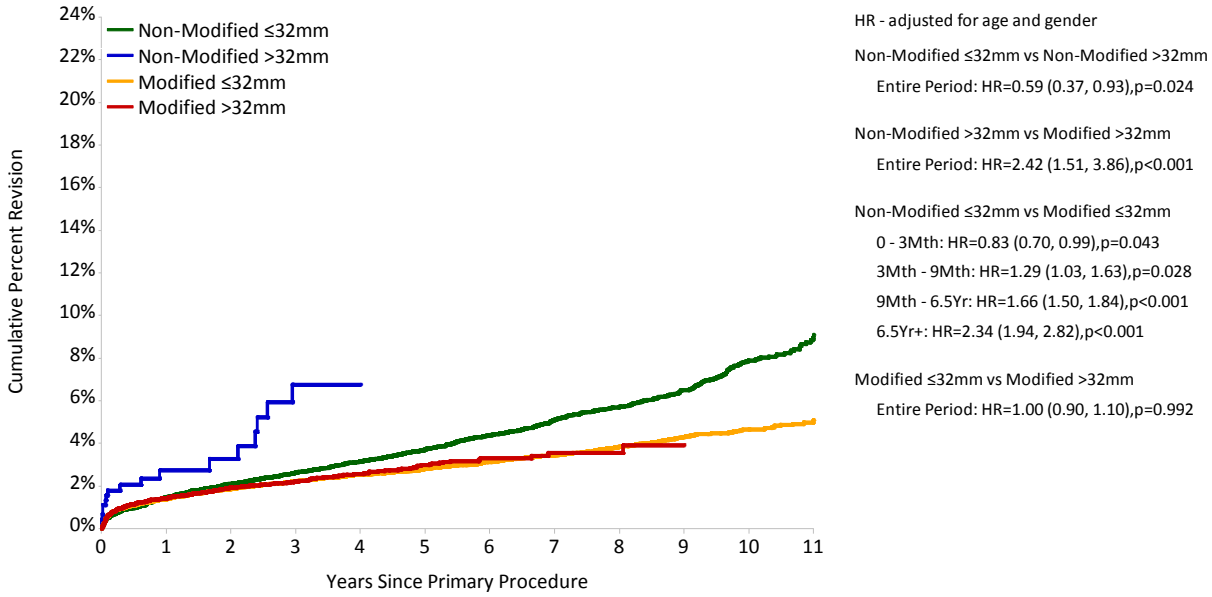
Table HT49: Revision Rates of Primary Total Conventional Hip Replacement by Type of Polyethylene and Head Size (Primary Diagnosis OA)

Polyethylene Surface	Head Size	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Non-Modified	≤32mm	1020	18963	129088	0.79 (0.74, 0.84)
	>32mm	18	455	865	2.08 (1.23, 3.29)
Modified	≤32mm	2450	89686	417870	0.59 (0.56, 0.61)
	>32mm	486	24702	60728	0.80 (0.73, 0.87)
TOTAL		**3974**	**133806**	**608551**	**0.65 (0.63, 0.67)**

Table HT50: Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Type of Polyethylene and Head Size (Primary Diagnosis OA)

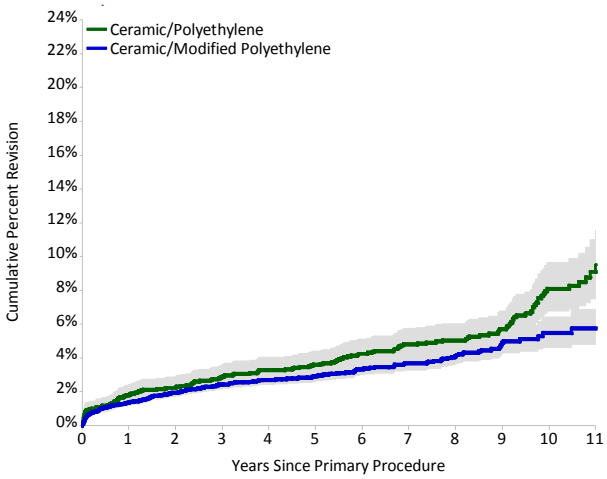
Polyethylene Surface	Head Size	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Non-Modified	≤32mm	1.5 (1.3, 1.6)	2.6 (2.4, 2.9)	3.7 (3.4, 4.0)	7.9 (7.4, 8.5)	9.1 (8.3, 9.9)
	>32mm	2.7 (1.5, 4.9)	6.8 (4.0, 11.3)			
Modified	≤32mm	1.4 (1.3, 1.5)	2.2 (2.1, 2.3)	2.8 (2.7, 2.9)	4.6 (4.4, 4.9)	5.1 (4.7, 5.5)
	>32mm	1.4 (1.3, 1.6)	2.2 (2.0, 2.4)	3.0 (2.7, 3.3)		

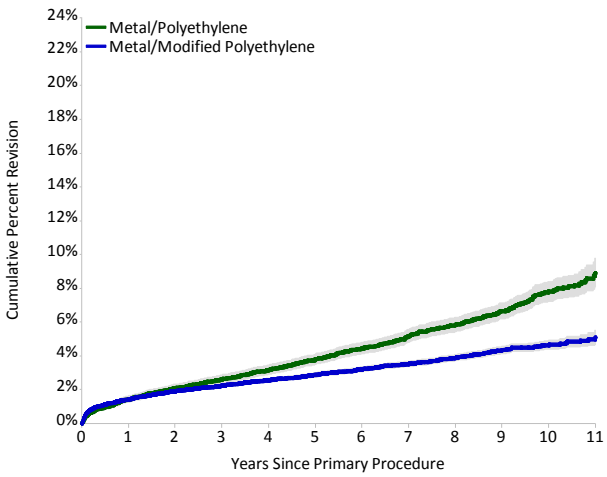
Figure HT30: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Type of Polyethylene and Head Size (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Non-Modified	≤32mm	18963	18042	16194	13780	2828	817
	>32mm	455	251	115	32	0	0
Modified	≤32mm	89686	77590	57462	39821	4112	1091
	>32mm	24702	18339	8094	2710	9	0

Figure HT31: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Head Surface and Type of Polyethylene (Primary Diagnosis OA)





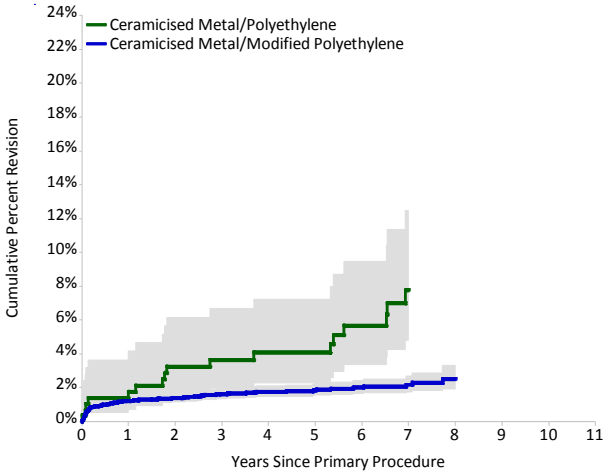


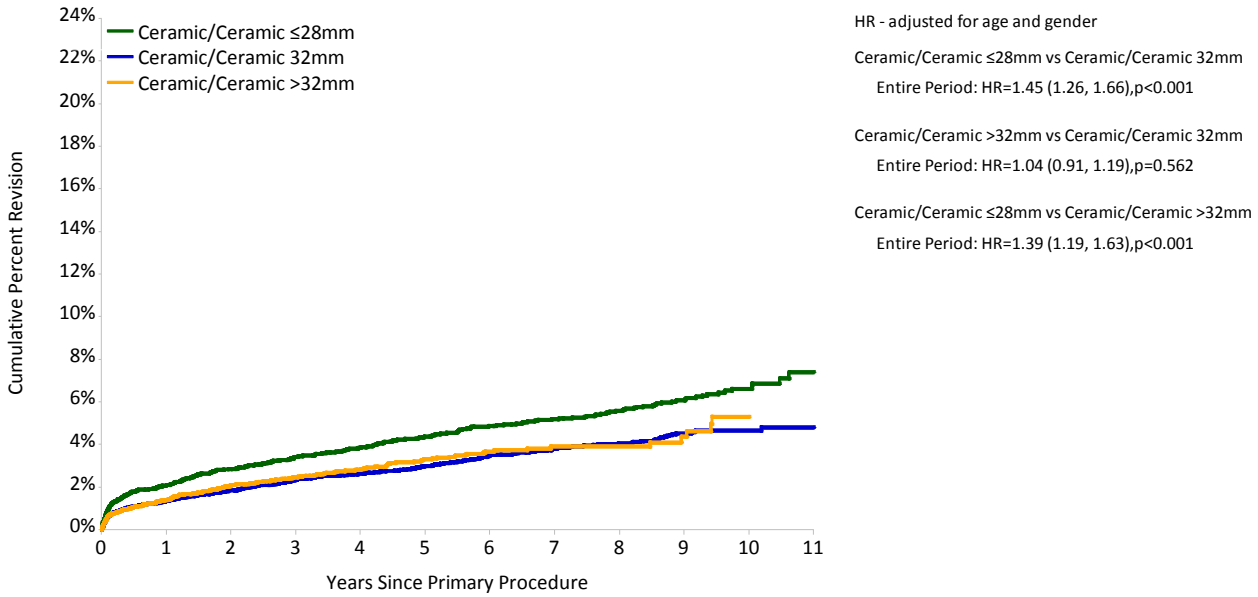
Table HT51: Revision Rates of Ceramic/Ceramic Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)

Bearing Surface	Head Size	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Ceramic/Ceramic	≤28mm	328	6194	42517	0.77 (0.69, 0.86)
	32mm	562	19165	92825	0.61 (0.56, 0.66)
	>32mm	393	18019	48038	0.82 (0.74, 0.90)
TOTAL		**1283**	**43378**	**183380**	**0.70 (0.66, 0.74)**

Table HT52: Yearly Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)

Bearing Surface	Head Size	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Ceramic/Ceramic	≤28mm	2.1 (1.8, 2.5)	3.4 (3.0, 3.9)	4.4 (3.9, 4.9)	6.6 (5.9, 7.4)	7.4 (6.3, 8.6)
	32mm	1.3 (1.2, 1.5)	2.3 (2.1, 2.6)	3.0 (2.7, 3.3)	4.6 (4.2, 5.1)	4.8 (4.3, 5.4)
	>32mm	1.4 (1.2, 1.6)	2.5 (2.2, 2.7)	3.3 (2.9, 3.7)	5.3 (4.1, 6.8)	

Figure HT32: Cumulative Percent Revision 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	10 Yrs	11 Yrs
Ceramic/Ceramic	≤28mm	6194	5891	5391	4604	738	160
	32mm	19165	16775	12777	9115	719	118
	>32mm	18019	13390	6250	2700	163	20

Table HT53: Revision Rates of Primary Total Conventional Hip Replacement using Ceramic and Metal Bearing Surfaces (Primary Diagnosis OA)

Bearing Surface	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Ceramic/Metal	9	298	662	1.36 (0.62, 2.58)
Metal/Ceramic	5	48	353	1.42 (0.46, 3.31)
TOTAL	**14**	**346**	**1015**	**1.38 (0.75, 2.31)**

Table HT54: Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement using Ceramic and Metal Bearing Surfaces (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Ceramic/Metal	1.8 (0.7, 4.2)	4.1 (2.0, 8.3)			
Metal/Ceramic	6.3 (2.1, 18.1)	6.3 (2.1, 18.1)	6.3 (2.1, 18.1)	12.5 (5.2, 28.2)	

Prostheses Types

There are 1,966 different stem and acetabular combinations for primary total conventional hip replacement recorded by the Registry, 97 more than 2010. The revisions per 100 observed component years and yearly cumulative percent revision of the 87 combinations with more than 400 procedures are listed in Tables HT55 – HT60. 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 prostheses combinations with less than 400 procedures. This group has a total of 1,869 stem and acetabular combinations, making up 21.1% of all primary total conventional hip replacement.

There are 11 total conventional stem and acetabular combinations with more than 400 procedures using cement fixation. The revisions per 100 observed component years range from 0.25 to 0.97. The MS30/Low Profile Cup and the Exeter/Exeter have the lowest 11 year cumulative percent revision of 2.2% and 6.7% respectively (Tables HT55 and HT56).

There are 50 cementless total conventional stem and acetabular combinations listed. The revisions per 100 observed component years range from 0.26 to 5.3. Of the six combinations reported with an 11 year cumulative percent revision the Secure-Fit Plus/Trident combination has the lowest cumulative percentage revision (3.4%), followed by the VerSys/Triology (4.7%) (Tables HT57 and HT58).

There are 26 combinations of total conventional hip replacement with hybrid fixation. The revisions per 100 observed component years range from 0.20 to 1.64. The Exeter/Vitalock has the lowest cumulative percent revision at 11 years (4.7%) and there are six other combinations with less than 4.0% cumulative percent revision at ten years (Tables HT59 and HT60).

Table HT55: Revision Rates of Primary Total Conventional Hip Replacement with Cement Fixation

Femoral Component	Acetabular Component	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
CPCS	Reflection (Cup)	21	687	3286	0.64 (0.40, 0.98)
CPT	ZCA	19	663	3673	0.52 (0.31, 0.81)
Charnley	Charnley	22	591	3658	0.60 (0.38, 0.91)
Charnley	Charnley Ogee	44	709	4529	0.97 (0.71, 1.30)
Exeter	Contemporary	28	487	3869	0.72 (0.48, 1.05)
Exeter	Exeter	22	420	3674	0.60 (0.38, 0.91)
Exeter V40	Contemporary	146	4447	21903	0.67 (0.56, 0.78)
Exeter V40	Exeter	53	1711	10021	0.53 (0.40, 0.69)
Exeter V40	Exeter Contemporary	83	2868	11955	0.69 (0.55, 0.86)
MS 30	Low Profile Cup	11	658	4475	0.25 (0.12, 0.44)
Spectron EF	Reflection (Cup)	65	1559	8912	0.73 (0.56, 0.93)
Other (332)		273	7005	35662	0.77 (0.68, 0.86)
TOTAL		**787**	**21805**	**115616**	**0.68 (0.63, 0.73)**

Note: Some cementless components have been cemented
Only combinations with over 400 procedures have been listed.

Table HT56: Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Cement Fixation

Femoral Component	Acetabular Component	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
CPCS	Reflection (Cup)	1.3 (0.7, 2.6)	2.7 (1.6, 4.3)	3.1 (1.9, 4.9)		
CPT	ZCA	0.5 (0.2, 1.4)	2.0 (1.1, 3.7)	2.5 (1.5, 4.3)	5.5 (3.3, 9.1)	
Charnley	Charnley	0.5 (0.2, 1.6)	1.1 (0.5, 2.3)	2.3 (1.3, 4.1)	6.5 (4.1, 10.1)	
Charnley	Charnley Ogee	1.0 (0.5, 2.1)	3.0 (1.9, 4.6)	4.9 (3.5, 7.0)	8.5 (6.0, 11.9)	
Exeter	Contemporary	1.9 (1.0, 3.6)	3.9 (2.5, 6.1)	4.4 (2.9, 6.7)	6.3 (4.4, 9.1)	7.1 (4.8, 10.3)
Exeter	Exeter	1.0 (0.4, 2.6)	1.2 (0.5, 2.9)	2.3 (1.2, 4.4)	5.8 (3.8, 8.9)	6.7 (4.4, 10.0)
Exeter V40	Contemporary	1.4 (1.1, 1.8)	2.6 (2.1, 3.1)	3.2 (2.6, 3.8)	5.5 (4.5, 6.7)	
Exeter V40	Exeter	0.8 (0.5, 1.4)	2.0 (1.4, 2.8)	2.9 (2.1, 3.9)	4.3 (3.3, 5.8)	
Exeter V40	Exeter Contemporary	1.3 (1.0, 1.8)	2.4 (1.9, 3.1)	3.0 (2.4, 3.8)		
MS 30	Low Profile Cup	0.6 (0.2, 1.6)	0.8 (0.3, 1.9)	1.2 (0.6, 2.5)	2.2 (1.1, 4.3)	2.2 (1.1, 4.3)
Spectron EF	Reflection (Cup)	1.0 (0.6, 1.6)	1.7 (1.1, 2.5)	2.5 (1.8, 3.6)	9.3 (7.0, 12.3)	9.9 (7.4, 13.2)
Other (332)		1.4 (1.2, 1.7)	2.4 (2.0, 2.8)	3.7 (3.2, 4.3)	7.2 (6.3, 8.3)	8.6 (7.2, 10.3)

Note: Some cementless components have been cemented
Only combinations with over 400 procedures have been listed.

Table HT57: Revision Rates of Primary Total Conventional Hip Replacement with Cementless Fixation

Femoral Component	Acetabular Component	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
ABGII	ABGII	156	2884	20407	0.76 (0.65, 0.89)
ABGII	ABGII (Shell/Insert)	35	831	4912	0.71 (0.50, 0.99)
ABGII	Trident	104	2148	10504	0.99 (0.81, 1.20)
Accolade	Trident	262	7974	31410	0.83 (0.74, 0.94)
Adapter	Bionik	48	513	1835	2.62 (1.93, 3.47)
Alloclassic	Allofit	154	4912	24462	0.63 (0.53, 0.74)
Alloclassic	Durom	41	621	2892	1.42 (1.02, 1.92)
Alloclassic	Fitmore	79	1543	9128	0.87 (0.69, 1.08)
Alloclassic	Trabecular Metal Shell	23	791	2683	0.86 (0.54, 1.29)
Alloclassic	Trilogy	6	683	2331	0.26 (0.09, 0.56)
Anthology	R3	39	2165	3883	1.00 (0.71, 1.37)
Anthology	Reflection (Shell)	17	873	3153	0.54 (0.31, 0.86)
Apex	Fin II	16	655	1907	0.84 (0.48, 1.36)
CLS	Allofit	29	711	3984	0.73 (0.49, 1.05)
CLS	Fitmore	25	584	3893	0.64 (0.42, 0.95)
Citation	Trident	36	1187	6292	0.57 (0.40, 0.79)
Citation	Vitalock	26	555	4525	0.57 (0.38, 0.84)
Corail	ASR	609	2899	11492	5.30 (4.89, 5.74)
Corail	Duraloc	45	1412	7043	0.64 (0.47, 0.85)
Corail	Pinnacle	332	14961	34674	0.96 (0.86, 1.07)
Epoch	Trilogy	33	1008	4425	0.75 (0.51, 1.05)
F2L	SPH-Blind	45	613	4800	0.94 (0.68, 1.25)
M/L Taper	Trilogy	11	442	1552	0.71 (0.35, 1.27)
M/L Taper Kinectiv	Continuum	22	778	788	2.79 (1.75, 4.22)
Mallory-Head	Mallory-Head	107	2520	15031	0.71 (0.58, 0.86)
Mallory-Head	Recap	9	442	1761	0.51 (0.23, 0.97)
Natural Hip	Fitmore	25	887	5939	0.42 (0.27, 0.62)
Omnifit	Secur-Fit	47	508	3999	1.18 (0.86, 1.56)
Omnifit	Trident	50	1190	7863	0.64 (0.47, 0.84)
Polarstem	R3	15	620	741	2.02 (1.13, 3.34)
Quadra-H	Versafit	50	2636	3464	1.44 (1.07, 1.90)
S-Rom	Duraloc Option	30	666	5430	0.55 (0.37, 0.79)
S-Rom	Pinnacle	82	2479	9856	0.83 (0.66, 1.03)
SL-Plus	EPF-Plus	79	2234	9413	0.84 (0.66, 1.05)
SL-Plus	R3	25	898	1851	1.35 (0.87, 1.99)
Secur-Fit	DeltaMotion	9	577	949	0.95 (0.43, 1.80)
Secur-Fit	Trident	144	5920	25109	0.57 (0.48, 0.68)
Secur-Fit Plus	Trident	120	4941	28358	0.42 (0.35, 0.51)
Stability	Duraloc	29	401	3321	0.87 (0.58, 1.25)
Summit	ASR	210	1118	5188	4.05 (3.52, 4.63)
Summit	Pinnacle	53	3151	11925	0.44 (0.33, 0.58)
Synergy	BHR	33	814	3459	0.95 (0.66, 1.34)
Synergy	R3	50	2335	4534	1.10 (0.82, 1.45)
Synergy	Reflection (Shell)	239	7330	44857	0.53 (0.47, 0.60)
Synergy	Trident	6	409	1492	0.40 (0.15, 0.88)
Taperloc	Exceed	12	857	1254	0.96 (0.49, 1.67)
Taperloc	M2a	29	514	2797	1.04 (0.69, 1.49)
Taperloc	Mallory-Head	33	976	5356	0.62 (0.42, 0.87)
Taperloc	Recap	27	501	2000	1.35 (0.89, 1.96)
VerSys	Trilogy	158	4074	24909	0.63 (0.54, 0.74)
Other (891)		1284	27637	112738	1.14 (1.08, 1.20)
TOTAL		**5148**	**128378**	**546570**	**0.94 (0.92, 0.97)**

Note: Only combinations with over 400 procedures have been listed.

Table HT58: Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Cementless Fixation

Femoral Component	Acetabular Component	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
ABGII	ABGII	1.8 (1.4, 2.4)	3.1 (2.6, 3.9)	4.2 (3.5, 5.1)	6.7 (5.7, 7.9)	7.6 (5.8, 9.8)
ABGII	ABGII (Shell/Insert)	1.6 (0.9, 2.7)	2.6 (1.7, 4.0)	3.5 (2.4, 5.1)		
ABGII	Trident	2.2 (1.7, 2.9)	4.1 (3.3, 5.0)	4.8 (4.0, 5.9)		
Accolade	Trident	1.6 (1.3, 1.9)	2.9 (2.6, 3.4)	3.9 (3.5, 4.5)		
Adapter	Bionik	3.1 (1.9, 5.1)	7.4 (5.4, 10.2)	13.2 (9.7, 17.6)		
Alloclassic	Allofit	1.5 (1.2, 1.9)	2.4 (2.0, 2.9)	3.2 (2.7, 3.8)	5.6 (4.4, 7.3)	
Alloclassic	Durom	1.3 (0.7, 2.6)	5.0 (3.6, 7.1)	6.4 (4.6, 8.8)		
Alloclassic	Fitmore	2.5 (1.8, 3.4)	3.9 (3.0, 5.0)	4.8 (3.8, 6.1)	7.0 (5.4, 9.1)	
Alloclassic	Trabecular Metal Shell	2.3 (1.5, 3.7)	2.9 (1.9, 4.4)	3.2 (2.1, 4.8)		
Alloclassic	Trilogy	0.6 (0.2, 1.7)	0.8 (0.3, 1.9)	1.0 (0.5, 2.3)		
Anthology	R3	1.7 (1.2, 2.3)	2.2 (1.6, 3.0)			
Anthology	Reflection (Shell)	1.2 (0.6, 2.1)	1.5 (0.9, 2.6)	2.4 (1.4, 3.9)		
Apex	Fin II	1.4 (0.7, 2.7)	2.3 (1.3, 4.0)	3.7 (2.0, 6.9)		
CLS	Allofit	1.5 (0.8, 2.7)	2.9 (1.8, 4.5)	3.3 (2.2, 5.0)		
CLS	Fitmore	1.7 (0.9, 3.2)	3.7 (2.4, 5.7)	3.9 (2.6, 6.0)	4.5 (3.0, 6.7)	
Citation	Trident	1.7 (1.1, 2.6)	2.4 (1.7, 3.5)	3.2 (2.3, 4.4)	4.1 (2.7, 6.1)	
Citation	Vitalock	0.5 (0.2, 1.7)	2.2 (1.2, 3.8)	2.8 (1.7, 4.5)	5.9 (4.0, 8.7)	5.9 (4.0, 8.7)
Corail	ASR	2.2 (1.7, 2.8)	10.9 (9.8, 12.1)	24.5 (22.6,		
Corail	Duraloc	1.4 (0.9, 2.2)	2.2 (1.6, 3.2)	3.1 (2.2, 4.2)		
Corail	Pinnacle	1.6 (1.4, 1.8)	2.6 (2.3, 2.9)	3.6 (3.1, 4.1)		
Epoch	Trilogy	2.3 (1.5, 3.4)	3.2 (2.2, 4.5)	3.2 (2.2, 4.5)		
F2L	SPH-Blind	3.1 (2.0, 4.8)	4.9 (3.5, 7.0)	6.1 (4.5, 8.4)	7.5 (5.6, 10.0)	
M/L Taper	Trilogy	1.9 (0.9, 3.7)	2.2 (1.1, 4.2)	2.7 (1.4, 5.0)		
M/L Taper Kinectiv	Continuum	2.5 (1.6, 4.0)				
Mallory-Head	Mallory-Head	2.0 (1.5, 2.6)	2.5 (1.9, 3.2)	3.3 (2.7, 4.2)	6.4 (5.1, 7.9)	6.7 (5.3, 8.3)
Mallory-Head	Recap	1.1 (0.5, 2.7)	1.4 (0.6, 3.0)	1.7 (0.8, 3.6)		
Natural Hip	Fitmore	1.0 (0.5, 1.9)	1.6 (1.0, 2.7)	2.3 (1.5, 3.6)	4.0 (2.6, 6.3)	
Omnifit	Secur-Fit	3.2 (1.9, 5.1)	5.0 (3.4, 7.3)	6.6 (4.8, 9.2)	10.3 (7.7, 13.6)	
Omnifit	Trident	2.0 (1.4, 3.0)	3.0 (2.2, 4.2)	3.9 (2.9, 5.3)	4.9 (3.7, 6.4)	
Polarstem	R3	2.5 (1.5, 4.2)	2.5 (1.5, 4.2)			
Quadra-H	Versafit	1.8 (1.3, 2.4)	2.8 (2.0, 3.9)			
S-Rom	Duraloc Option	1.5 (0.8, 2.8)	2.4 (1.5, 3.9)	3.4 (2.2, 5.0)	5.2 (3.5, 7.7)	
S-Rom	Pinnacle	2.0 (1.5, 2.7)	3.4 (2.7, 4.3)	3.8 (3.0, 4.7)		
SL-Plus	EPF-Plus	1.7 (1.3, 2.4)	2.9 (2.3, 3.8)	3.7 (2.9, 4.6)		
SL-Plus	R3	2.1 (1.3, 3.3)	3.6 (2.4, 5.3)			
Secur-Fit	DeltaMotion	0.9 (0.4, 2.2)				
Secur-Fit	Trident	1.3 (1.0, 1.6)	2.2 (1.8, 2.6)	2.7 (2.3, 3.3)	3.9 (3.1, 4.8)	
Secur-Fit Plus	Trident	1.2 (1.0, 1.6)	2.0 (1.6, 2.4)	2.4 (2.0, 2.9)	3.4 (2.7, 4.2)	3.4 (2.7, 4.2)
Stability	Duraloc	0.7 (0.2, 2.3)	2.3 (1.2, 4.3)	2.5 (1.4, 4.6)	9.6 (6.4, 14.1)	
Summit	ASR	1.2 (0.7, 2.0)	6.1 (4.8, 7.7)	16.4 (14.0,		
Summit	Pinnacle	1.0 (0.7, 1.4)	1.6 (1.2, 2.1)	2.0 (1.5, 2.7)		
Synergy	BHR	1.6 (0.9, 2.8)	2.8 (1.9, 4.2)	3.7 (2.5, 5.3)		
Synergy	R3	1.4 (1.0, 2.0)	2.9 (2.1, 3.8)			
Synergy	Reflection (Shell)	1.5 (1.3, 1.8)	2.3 (2.0, 2.7)	2.7 (2.3, 3.1)	5.8 (4.7, 7.0)	5.8 (4.7, 7.0)
Synergy	Trident	1.0 (0.4, 2.6)	1.4 (0.6, 3.5)	1.4 (0.6, 3.5)		
Taperloc	Exceed	0.9 (0.4, 1.8)	2.1 (1.2, 3.8)			
Taperloc	M2a	1.8 (0.9, 3.4)	3.4 (2.1, 5.4)	5.3 (3.6, 7.9)		
Taperloc	Mallory-Head	1.6 (1.0, 2.6)	2.4 (1.6, 3.7)	2.9 (2.0, 4.3)	4.7 (3.2, 6.7)	
Taperloc	Recap	2.4 (1.4, 4.2)	4.0 (2.6, 6.2)	5.8 (3.9, 8.7)		
VerSys	Trilogy	2.3 (1.9, 2.8)	3.1 (2.6, 3.7)	3.7 (3.1, 4.3)	4.7 (3.9, 5.5)	4.7 (3.9, 5.5)
Other (891)		2.2 (2.0, 2.3)	3.9 (3.7, 4.2)	5.3 (5.0, 5.6)	8.9 (8.3, 9.6)	9.9 (9.0, 10.9)

Note: Only combinations with over 400 procedures have been listed.

Table HT59: Revision Rates of Primary Total Conventional Hip Replacement with Hybrid Fixation

Femoral Component	Acetabular Component	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
C-Stem	Duraloc	53	981	6481	0.82 (0.61, 1.07)
C-Stem	Pinnacle	20	587	2070	0.97 (0.59, 1.49)
C-Stem AMT	Pinnacle	5	668	1356	0.37 (0.12, 0.86)
CPCS	R3	23	1175	2213	1.04 (0.66, 1.56)
CPCS	Reflection (Shell)	50	2378	10122	0.49 (0.37, 0.65)
CPT	Allofit	8	608	1730	0.46 (0.20, 0.91)
CPT	Continuum	8	574	570	1.40 (0.61, 2.76)
CPT	Trabecular Metal Shell	28	902	2723	1.03 (0.68, 1.49)
CPT	Trilogy	146	5017	21867	0.67 (0.56, 0.79)
Elite Plus	Duraloc	86	1078	8095	1.06 (0.85, 1.31)
Exeter	Vitalock	53	1218	11048	0.48 (0.36, 0.63)
Exeter V40	ABGII	31	1035	7508	0.41 (0.28, 0.59)
Exeter V40	Hemispherical	14	528	1791	0.78 (0.43, 1.31)
Exeter V40	Mallory-Head	19	1069	5615	0.34 (0.20, 0.53)
Exeter V40	Pinnacle	14	693	1789	0.78 (0.43, 1.31)
Exeter V40	R3	8	613	1091	0.73 (0.32, 1.44)
Exeter V40	Trident	615	28741	106451	0.58 (0.53, 0.63)
Exeter V40	Trilogy	15	552	2629	0.57 (0.32, 0.94)
Exeter V40	Vitalock	57	1959	14386	0.40 (0.30, 0.51)
MS 30	Allofit	31	1193	6322	0.49 (0.33, 0.70)
MS 30	Fitmore	6	439	2994	0.20 (0.07, 0.44)
Omnifit	Trident	60	1968	10303	0.58 (0.44, 0.75)
Spectron EF	BHR	20	529	1952	1.02 (0.63, 1.58)
Spectron EF	R3	22	817	1339	1.64 (1.03, 2.49)
Spectron EF	Reflection (Shell)	172	4729	26541	0.65 (0.55, 0.75)
VerSys	Trilogy	14	719	4534	0.31 (0.17, 0.52)
Other (656)		592	12386	67991	0.87 (0.80, 0.94)
TOTAL		**2170**	**73156**	**331510**	**0.65 (0.63, 0.68)**

Note: Only combinations with over 400 procedures have been listed.

Table HT60: Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Hybrid Fixation

Femoral Component	Acetabular Component	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
C-Stem	Duraloc	2.4 (1.6, 3.5)	3.1 (2.2, 4.4)	3.8 (2.8, 5.3)	9.3 (6.7, 12.9)	
C-Stem	Pinnacle	2.5 (1.5, 4.2)	3.6 (2.3, 5.8)	3.6 (2.3, 5.8)		
C-Stem AMT	Pinnacle	0.5 (0.2, 1.7)	1.3 (0.5, 3.3)			
CPCS	R3	1.4 (0.9, 2.3)	2.4 (1.5, 3.7)			
CPCS	Reflection (Shell)	1.0 (0.7, 1.5)	1.3 (0.9, 1.9)	1.8 (1.3, 2.5)		
CPT	Allofit	0.9 (0.4, 2.0)	1.4 (0.7, 3.0)	1.8 (0.9, 3.8)		
CPT	Continuum	1.8 (0.9, 3.5)				
CPT	Trabecular Metal Shell	2.0 (1.2, 3.1)	3.1 (2.1, 4.6)	3.9 (2.6, 5.9)		
CPT	Trilogy	1.5 (1.2, 1.8)	2.4 (2.0, 2.9)	3.0 (2.5, 3.6)	5.5 (4.3, 7.0)	
Elite Plus	Duraloc	2.0 (1.3, 3.0)	3.6 (2.7, 5.0)	5.4 (4.2, 7.0)	9.9 (8.0, 12.2)	10.4 (8.3, 13.0)
Exeter	Vitalock	1.6 (1.0, 2.5)	2.3 (1.6, 3.4)	2.5 (1.8, 3.6)	4.6 (3.5, 6.0)	4.7 (3.6, 6.1)
Exeter V40	ABGII	1.2 (0.7, 2.1)	1.5 (0.9, 2.5)	2.2 (1.4, 3.3)	3.3 (2.3, 4.7)	
Exeter V40	Hemispherical	1.8 (1.0, 3.5)	3.2 (1.9, 5.3)	3.2 (1.9, 5.3)		
Exeter V40	Mallory-Head	0.5 (0.2, 1.2)	1.0 (0.5, 1.8)	1.1 (0.6, 2.1)	3.8 (2.2, 6.7)	
Exeter V40	Pinnacle	1.3 (0.6, 2.5)	2.4 (1.4, 4.1)	2.4 (1.4, 4.1)		
Exeter V40	R3	1.1 (0.5, 2.4)	1.9 (0.9, 4.2)			
Exeter V40	Trident	1.2 (1.1, 1.3)	1.9 (1.7, 2.1)	2.5 (2.3, 2.8)	4.7 (3.9, 5.8)	
Exeter V40	Trilogy	1.7 (0.9, 3.2)	2.6 (1.5, 4.4)	2.9 (1.7, 5.0)		
Exeter V40	Vitalock	0.9 (0.6, 1.5)	1.7 (1.2, 2.3)	2.3 (1.7, 3.1)	3.2 (2.5, 4.2)	
MS 30	Allofit	1.4 (0.8, 2.2)	2.0 (1.3, 3.0)	2.5 (1.7, 3.6)		
MS 30	Fitmore	0.0 (0.0, 0.0)	0.3 (0.0, 1.9)	0.9 (0.3, 2.8)	2.1 (0.9, 4.6)	
Omnifit	Trident	1.8 (1.3, 2.5)	2.8 (2.2, 3.7)	3.2 (2.4, 4.1)	3.9 (2.9, 5.0)	
Spectron EF	BHR	0.8 (0.3, 2.1)	2.9 (1.7, 5.0)	6.1 (3.7, 9.8)		
Spectron EF	R3	1.6 (0.9, 2.8)	3.7 (2.4, 5.8)			
Spectron EF	Reflection (Shell)	1.0 (0.8, 1.4)	2.0 (1.6, 2.4)	2.9 (2.4, 3.5)	7.0 (5.8, 8.5)	9.1 (6.9, 12.1)
VerSys	Trilogy	1.1 (0.6, 2.2)	1.6 (0.9, 2.8)	1.6 (0.9, 2.8)	2.4 (1.4, 4.2)	
Other (656)		1.9 (1.6, 2.1)	3.2 (2.9, 3.6)	4.5 (4.1, 5.0)	7.3 (6.7, 8.0)	7.9 (7.1, 8.9)

Note: Only combinations with over 400 procedures have been listed.

Primary Total Resurfacing Hip Replacement

Demographics

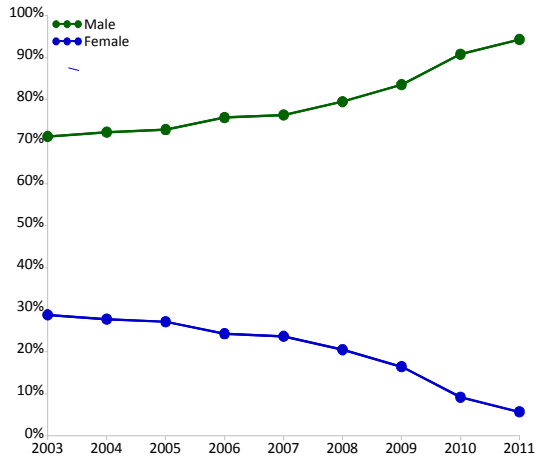
There have been 14,901 total resurfacing procedures reported to the Registry, an additional 603 procedures, compared to the last report.

The use of resurfacing hip replacement in Australia continues to decline. The number of procedures reported in 2011 was 39.7% less than in 2010 and 68.5% less compared to the peak in 2005.

Osteoarthritis is the principal diagnosis for total resurfacing hip replacement (95.0%), followed by developmental dysplasia (2.5%) and osteonecrosis (1.7%).

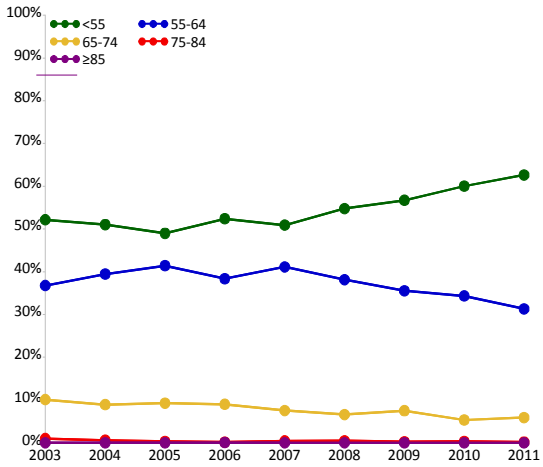
Most patients are male and the proportion of males has increased from 71.2% in 2003 to 94.3% in 2011 (Figure HT33).

Figure HT33: Primary Total Resurfacing Hip Replacement by Gender



There continues to be a shift in the use of primary total resurfacing hip replacement to younger patients. The proportion of patients under the age of 55 years has continued to increase and accounted for 62.6% of all primary total resurfacing procedures in 2011. There has been a corresponding decrease in use for patients aged 55-64 years (Figure HT34).

Figure HT34: Primary Total Resurfacing Hip Replacement by Age



The majority of total resurfacings use hybrid fixation (98.3% in 2011).

The BHR remains the most used resurfacing hip prosthesis in 2011. Although its use has declined in absolute numbers in 2011 the proportion of resurfacing procedures using BHR has increased from 62.6% in 2010 to 75.4% in 2011 (Table HT61).

Table HT61: Ten Most Used Resurfacing Heads in Primary Total Resurfacing Hip Replacement

2003		2008		2009		2010		2011	
N	Model	N	Model	N	Model	N	Model	N	Model
1359	BHR	745	BHR	631	BHR	600	BHR	436	BHR
58	Durom	233	Mitch TRH	196	Mitch TRH	188	Mitch TRH	88	Mitch TRH
43	ASR	133	ASR	91	ASR	53	Adept	27	Adept
42	Cormet	88	Durom	70	Adept	42	Cormet	10	Durom
38	Cormet 2000 HAP	73	Cormet	54	Bionik	24	Durom	8	Cormet
7	Conserve Plus	62	Adept	52	Cormet	17	Bionik	3	Recap
		46	Bionik	46	Durom	16	Recap	2	ACCIS
		46	Recap	45	Recap	10	Icon	2	Bionik
		21	Cormet Bi-Coated	23	Cormet Bi-Coated	8	Cormet Bi-Coated	2	Cormet Bi-Coated
		20	Icon	6	Icon				
Ten Most Used									
1547	(6) 100.0%	1467	(10) 99.9%	1214	(10) 99.9%	958	(9) 100.0%	578	(9) 100.0%
Remainder									
0	(0) 0%	1	(1) 0.1%	1	(1) 0.1%	0	(0) 0%	0	(0) 0%
TOTAL									
1547	(6) 100.0%	1468	(11) 100.0%	1215	(11) 100.0%	958	(9) 100.0%	578	(9) 100.0%

Note: Cormet 2000 HAP Bi-Coated has been reported in the above table as Cormet Bi-Coated

Outcome

The cumulative percent revision at 11 years for primary total resurfacing hip replacement undertaken for osteoarthritis is 9.5% (Table HT62 and Figure HT35).

Reasons for Revision

The main reasons for revision of primary total resurfacing hip replacement are loosening/lysis (33.6%), fracture (25.7%), metal sensitivity (16.6%), infection (7.2%) and pain (6.0%) (Table HT63).

The five most common reasons for revision are shown in Figure HT36. The incidence of revision for fracture increases rapidly in the first year, however after this time the incidence increases at a slower rate. Loosening/lysis shows a linear increase and at just over four years exceeds fracture to become the most common reason for revision. The incidence of revision for metal sensitivity continues to increase.

Type of Revision

The main types of revision of resurfacing hip replacement are total hip replacement (53.3%), isolated femoral (38.5%), and acetabular only (5.2%) (Table HT64). In previous reports the most common type of revision was femoral only revision. This year the Registry is reporting a change. Revision of both the acetabular and femoral components to a total conventional hip replacement is now the most common type of revision for resurfacing hip replacement.

Primary Diagnosis

The outcomes of the three most common primary diagnoses (osteoarthritis, developmental dysplasia and osteonecrosis) are listed in Tables HT65 and HT66. Primary total resurfacing hip replacement for osteoarthritis has a significantly lower rate of revision compared to developmental dysplasia (Figure HT37).

Age and Gender

There is a higher rate of revision for patients 65 years or older for the first six months, after this time there is no difference compared to the other age groups (Tables HT67 and HT68 and Figure HT38).

Females have an increased rate of revision compared to males. After six years, females have over four times the rate of revision compared to males (Tables HT69 and HT70 and Figure HT39). While there is no age related difference in the rate of revision for females (Tables HT71 and HT72 and Figure HT40), there is an age related revision rate associated with males. Males over the age of 65 years have an increased rate of revision compared to males less than 55 years for the first six months and for males between the ages of 55 to 64 years for the first three months only (Tables HT71 and HT72 and Figure HT41).

Head Size

There is a relationship between femoral component head size and the rate of revision. Femoral head sizes of 44mm or less have more than three times the rate of revision compared to head sizes 50-54mm. Head sizes 45-49mm have over twice the rate of revision compared to head sizes 50-54mm (Tables HT73 and HT74 and Figure HT42). The effect of femoral component head size is evident in both males and females. Females have an increased rate of revision independent of head size though this is only apparent in head sizes greater than or equal to 50mm after seven years (Tables HT75, HT76 and Figure HT43).

Revision diagnosis cumulative incidence varies with head size. Head sizes less than 50mm have a higher incidence of the five most common reasons for revision (Figure HT44).

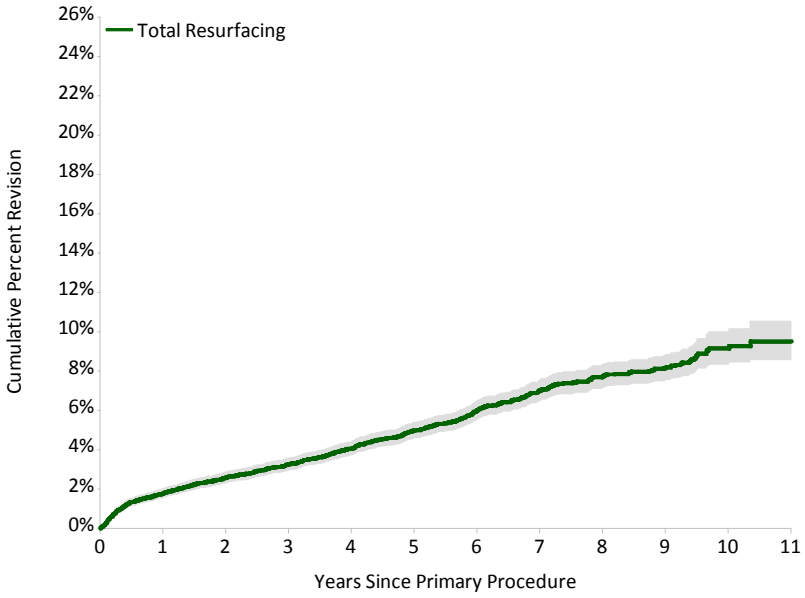
Prosthesis Types

Revisions per 100 observed component years and yearly cumulative percent revision of total resurfacing hip prostheses are listed in Tables HT77 and HT78. There are seven prostheses with over 1,000 observed component years, the ASR, Adept, BHR, Cormet, Cormet 2000 Bi-coated, Durom and Mitch TRH. The BHR resurfacing prosthesis has a cumulative percent revision at 11 years of 7.1%.

Table HT62: Yearly Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Total Resurfacing	1.8 (1.6, 2.0)	3.2 (3.0, 3.6)	5.0 (4.6, 5.4)	9.1 (8.4, 10.0)	9.5 (8.6, 10.5)

Figure HT35: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Total Resurfacing	14151	13315	11019	7963	654	84

Table HT63: Primary Total Resurfacing Hip Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	296	33.6
Fracture	226	25.7
Metal Sensitivity	146	16.6
Infection	63	7.2
Pain	53	6.0
Osteonecrosis	23	2.6
Prosthesis Dislocation	21	2.4
Malposition	16	1.8
Other	36	4.1
TOTAL	**880**	**100.0**

Table HT64: Primary Total Resurfacing Hip Replacement by Type of Revision

Type of Revision	Number	Percent
THR (Femoral/Acetabular)	469	53.3
Femoral Component	339	38.5
Acetabular Component	46	5.2
Cement Spacer	22	2.5
Removal of Prostheses	4	0.5
TOTAL	**880**	**100.0**

Figure HT36: Revision Diagnosis Cumulative Incidence of Primary Total Resurfacing Hip Replacement (Primary Diagnosis OA)

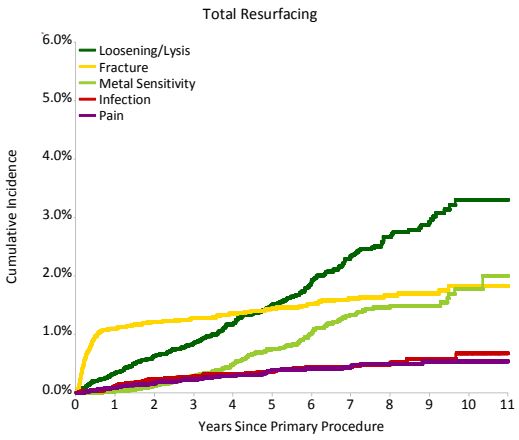


Table HT65: Revision Rates of Primary Total Resurfacing Hip Replacement by Primary Diagnosis

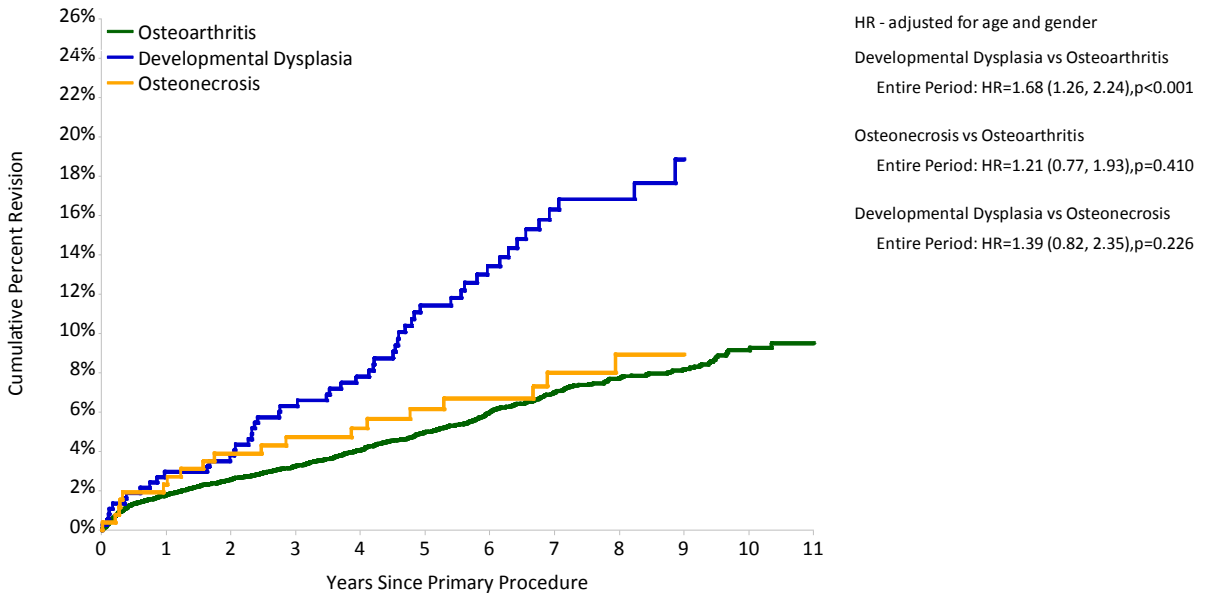
Primary Diagnosis	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Osteoarthritis	795	14151	77557	1.03 (0.96, 1.10)
Developmental Dysplasia	53	373	2326	2.28 (1.71, 2.98)
Osteonecrosis	19	259	1714	1.11 (0.67, 1.73)
Other (6)	13	118	718	1.81 (0.96, 3.10)
TOTAL	**880**	**14901**	**82314**	**1.07 (1.00, 1.14)**

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

Table HT66: Yearly Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Primary Diagnosis

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Osteoarthritis	1.8 (1.6, 2.0)	3.2 (3.0, 3.6)	5.0 (4.6, 5.4)	9.1 (8.4, 10.0)	9.5 (8.6, 10.5)
Developmental Dysplasia	3.0 (1.7, 5.3)	6.3 (4.2, 9.3)	11.4 (8.5, 15.3)		
Osteonecrosis	2.3 (1.0, 5.1)	4.7 (2.7, 8.2)	6.2 (3.7, 10.0)		
Other (6)	2.6 (0.8, 7.7)	5.2 (2.4, 11.3)	10.5 (5.9, 18.2)		

Figure HT37: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Primary Diagnosis



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Osteoarthritis	14151	13315	11019	7963	654	84
Developmental Dysplasia	373	356	322	254	18	4
Osteonecrosis	259	251	228	180	22	6

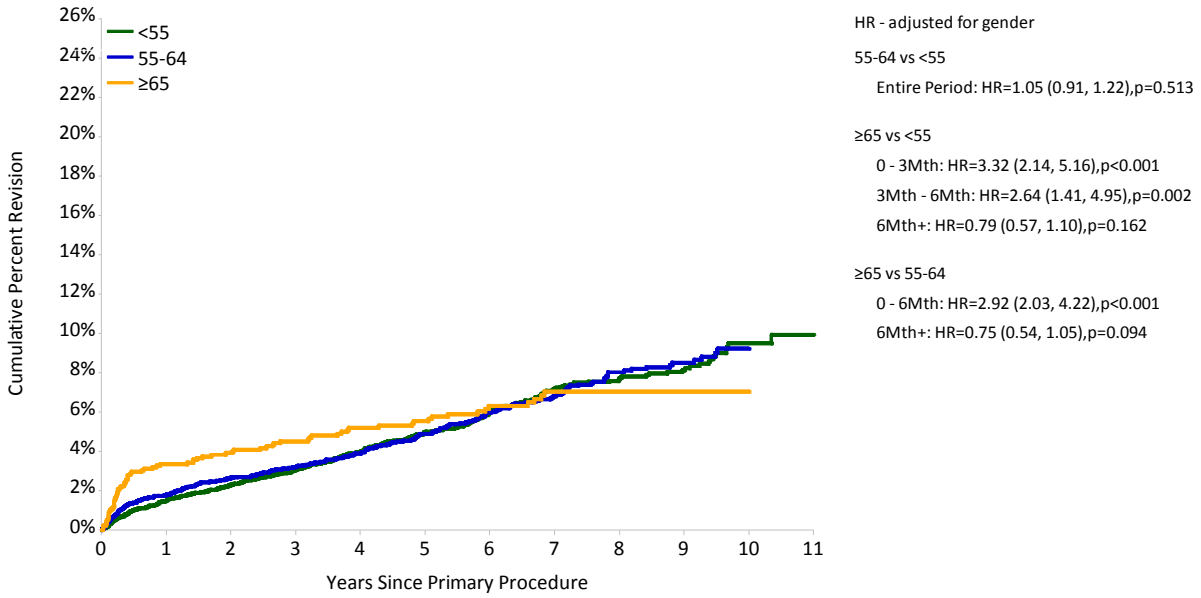
Table HT67: Revision Rates of Primary Total Resurfacing Hip Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
<55	402	7328	39430	1.02 (0.92, 1.12)
55-64	316	5524	30681	1.03 (0.92, 1.15)
≥65	77	1299	7445	1.03 (0.82, 1.29)
TOTAL	**795**	**14151**	**77557**	**1.03 (0.96, 1.10)**

Table HT68: Yearly Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Age (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
<55	1.5 (1.2, 1.8)	3.1 (2.7, 3.5)	5.0 (4.4, 5.6)	9.5 (8.4, 10.8)	9.9 (8.6, 11.5)
55-64	1.8 (1.5, 2.2)	3.2 (2.8, 3.7)	4.9 (4.3, 5.5)	9.2 (8.0, 10.5)	
≥65	3.3 (2.5, 4.5)	4.5 (3.5, 5.8)	5.5 (4.4, 7.0)	7.0 (5.6, 8.8)	

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
<55	7328	6863	5561	3987	348	54
55-64	5524	5237	4412	3170	254	26
≥65	1299	1215	1046	806	52	4

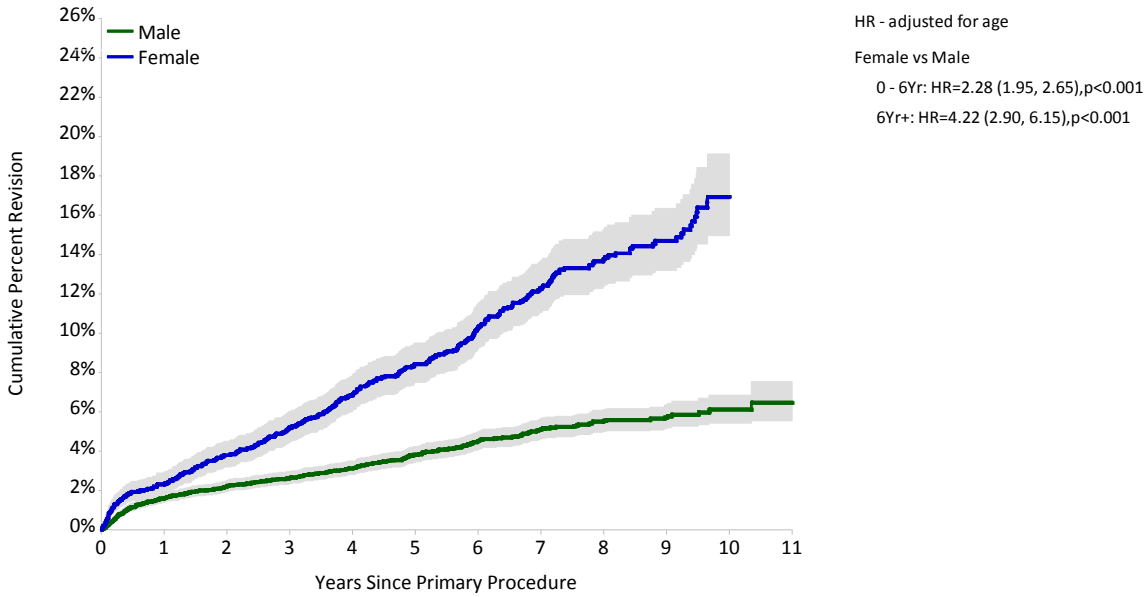
Table HT69: Revision Rates of Primary Total Resurfacing Hip Replacement by Gender (Primary Diagnosis OA)

Gender	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	437	10924	57932	0.75 (0.69, 0.83)
Female	358	3227	19625	1.82 (1.64, 2.02)
TOTAL	**795**	**14151**	**77557**	**1.03 (0.96, 1.10)**

Table HT70: Yearly Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	1.6 (1.4, 1.9)	2.6 (2.3, 3.0)	3.8 (3.4, 4.2)	6.1 (5.4, 6.9)	6.5 (5.5, 7.5)
Female	2.3 (1.9, 2.9)	5.2 (4.5, 6.0)	8.4 (7.5, 9.5)	16.9 (15.0, 19.1)	

Figure HT39: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	10924	10197	8246	5868	453	58
Female	3227	3118	2773	2095	201	26

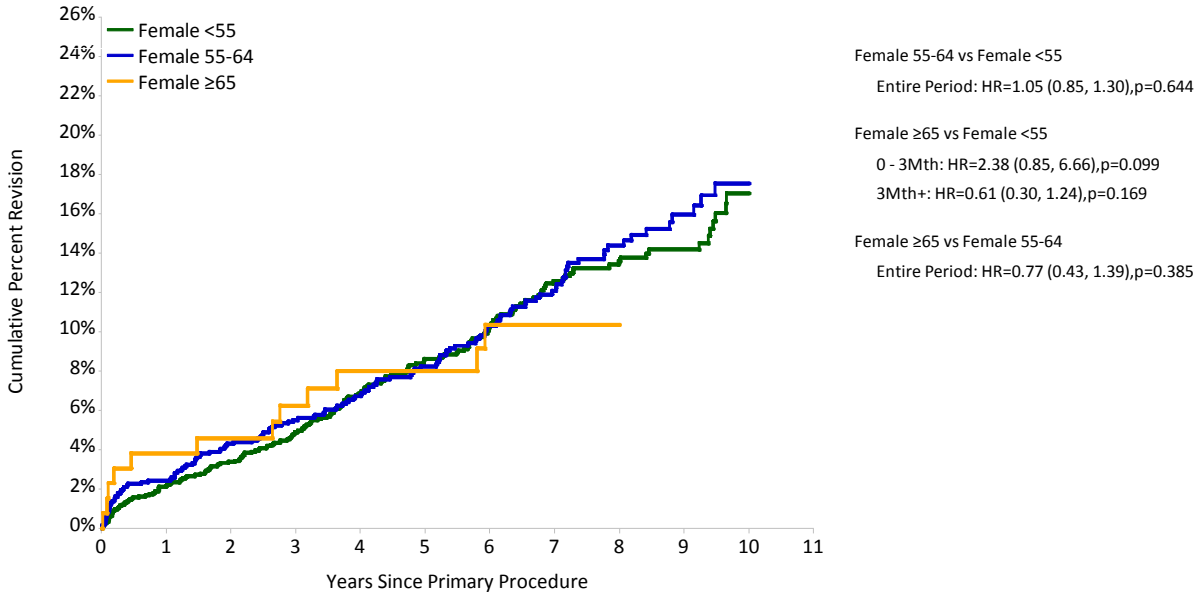
Table HT71: Revision Rates of Primary Total Resurfacing Hip Replacement by Age and Gender (Primary Diagnosis OA)

Gender	Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	<55	201	5476	28267	0.71 (0.62, 0.82)
	55-64	171	4280	23040	0.74 (0.64, 0.86)
	≥65	65	1168	6625	0.98 (0.76, 1.25)
Female	<55	201	1852	11163	1.80 (1.56, 2.07)
	55-64	145	1244	7641	1.90 (1.60, 2.23)
	≥65	12	131	820	1.46 (0.76, 2.56)
TOTAL		**795**	**14151**	**77557**	**1.03 (0.96, 1.10)**

Table HT72: Yearly Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Age and Gender (Primary Diagnosis OA)

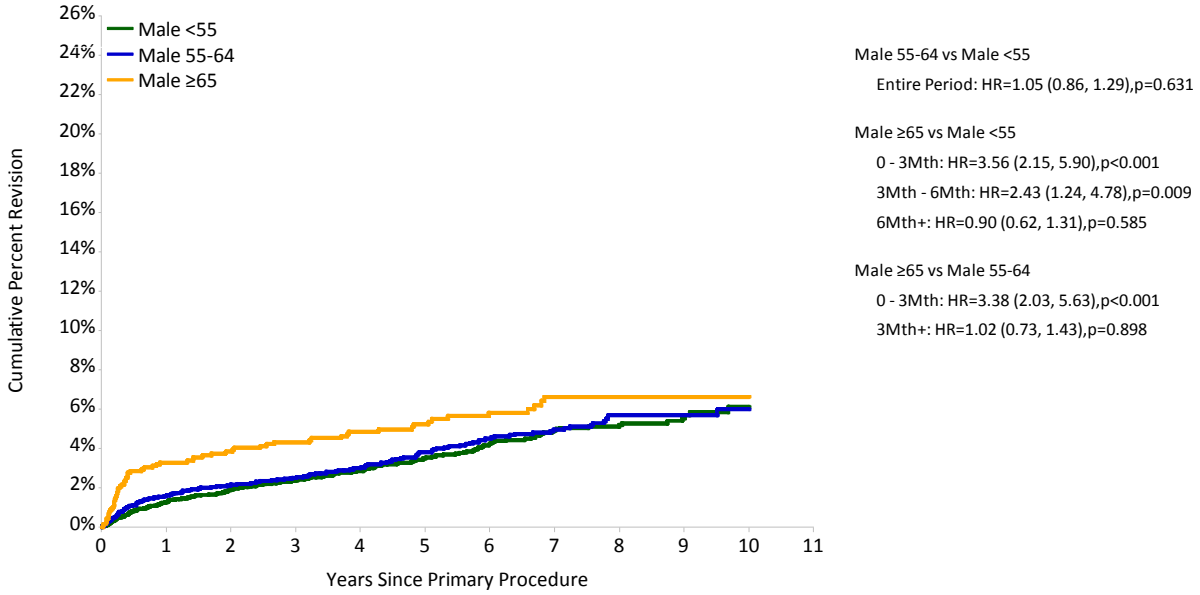
Gender	Age	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	<55	1.3 (1.0, 1.6)	2.4 (2.0, 2.8)	3.5 (3.0, 4.1)	6.1 (5.1, 7.3)	
	55-64	1.6 (1.3, 2.0)	2.5 (2.1, 3.0)	3.8 (3.2, 4.5)	6.0 (5.0, 7.2)	
	≥65	3.3 (2.4, 4.5)	4.3 (3.3, 5.7)	5.2 (4.0, 6.7)	6.6 (5.2, 8.5)	
Female	<55	2.2 (1.6, 2.9)	4.9 (4.0, 6.0)	8.6 (7.4, 10.1)	17.0 (14.4, 20.1)	
	55-64	2.4 (1.7, 3.4)	5.5 (4.4, 6.9)	8.2 (6.8, 10.0)	17.5 (14.6, 21.0)	
	≥65	3.8 (1.6, 8.9)	6.2 (3.2, 12.1)	8.0 (4.4, 14.4)		

Figure HT40: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement for Females by Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Female	<55	1852	1794	1587	1177	111	18
	55-64	1244	1199	1077	827	82	8
	≥65	131	125	109	91	8	0

Figure HT41: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement for Males by Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	<55	5476	5069	3974	2810	237	36
	55-64	4280	4038	3335	2343	172	18
	≥65	1168	1090	937	715	44	4

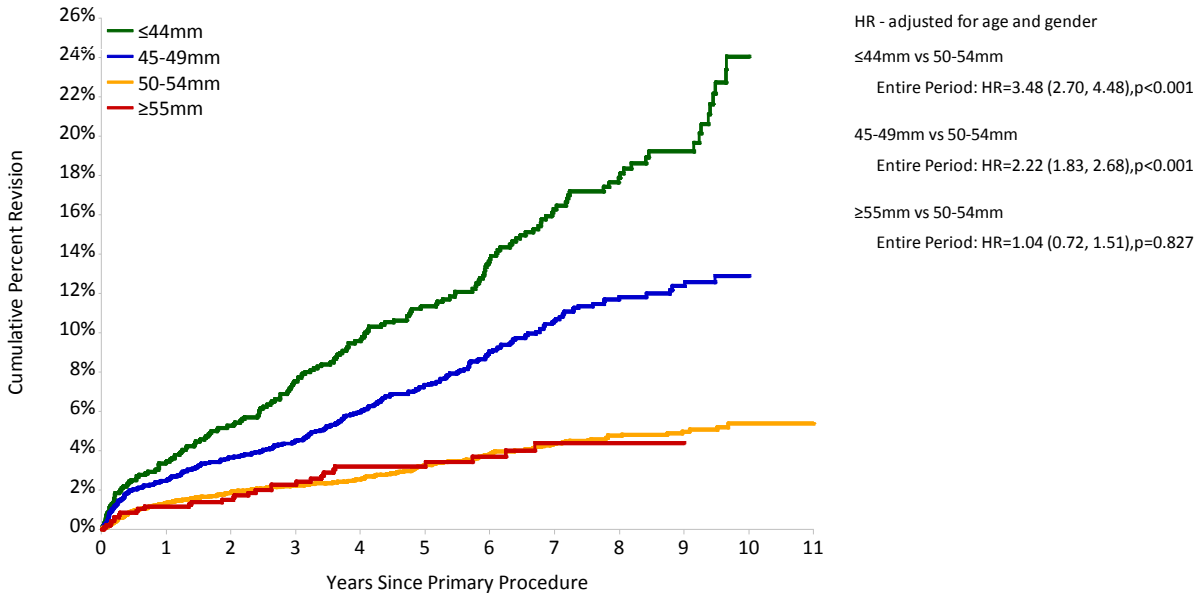
Table HT73: Revision Rates of Primary Total Resurfacing Hip Replacement by Head Size (Primary Diagnosis OA)

Head Size	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
≤44mm	181	1196	7117	2.54 (2.19, 2.94)
45-49mm	282	3355	18321	1.54 (1.36, 1.73)
50-54mm	301	8625	47419	0.63 (0.57, 0.71)
≥55mm	31	975	4699	0.66 (0.45, 0.94)
TOTAL	**795**	**14151**	**77557**	**1.03 (0.96, 1.10)**

Table HT74: Yearly Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Head Size (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
≤44mm	3.4 (2.5, 4.6)	7.5 (6.1, 9.2)	11.3 (9.6, 13.4)	24.0 (20.3, 28.4)	
45-49mm	2.5 (2.0, 3.1)	4.5 (3.8, 5.3)	7.3 (6.4, 8.4)	12.9 (11.3, 14.7)	
50-54mm	1.3 (1.1, 1.6)	2.2 (1.9, 2.6)	3.3 (2.9, 3.7)	5.4 (4.6, 6.2)	5.4 (4.6, 6.2)
≥55mm	1.1 (0.6, 2.1)	2.3 (1.5, 3.5)	3.2 (2.2, 4.7)		

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



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
≤44mm	1196	1134	992	730	82	12
45-49mm	3355	3180	2680	1865	165	13
50-54mm	8625	8090	6668	4929	375	53
≥55mm	975	911	679	439	32	6

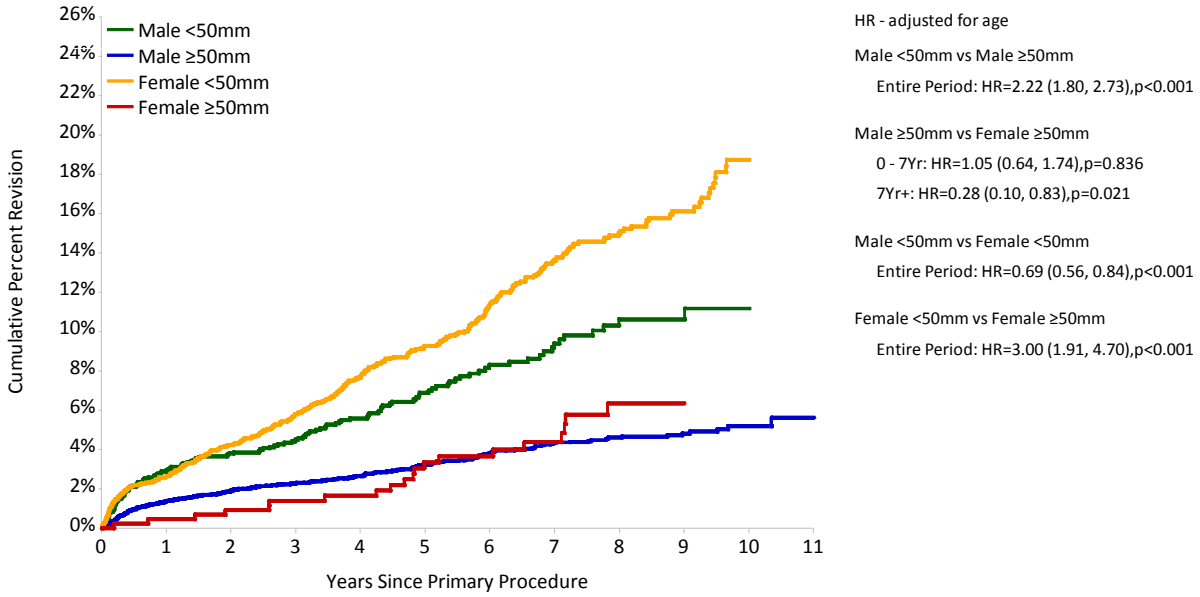
Table HT75: Revision Rates of Primary Total Resurfacing Hip Replacement by Gender and Head Size (Primary Diagnosis OA)

Gender	Head Size	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	<50mm	125	1767	8771	1.43 (1.19, 1.70)
	≥50mm	312	9157	49161	0.63 (0.57, 0.71)
Female	<50mm	338	2784	16667	2.03 (1.82, 2.26)
	≥50mm	20	443	2957	0.68 (0.41, 1.04)
TOTAL		**795**	**14151**	**77557**	**1.03 (0.96, 1.10)**

Table HT76: Yearly Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender and Head Size (Primary Diagnosis OA)

Gender	Head Size	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	<50mm	2.9 (2.2, 3.8)	4.5 (3.6, 5.6)	6.9 (5.7, 8.3)	11.2 (9.1, 13.7)	
	≥50mm	1.4 (1.1, 1.6)	2.3 (2.0, 2.6)	3.2 (2.9, 3.6)	5.2 (4.5, 6.0)	5.6 (4.6, 6.8)
Female	<50mm	2.6 (2.1, 3.3)	5.8 (5.0, 6.7)	9.2 (8.2, 10.5)	18.7 (16.5, 21.2)	
	≥50mm	0.5 (0.1, 1.8)	1.4 (0.6, 3.1)	3.3 (2.0, 5.7)		

Figure HT43: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender and Head Size (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	<50mm	1767	1632	1300	826	76	3
	≥50mm	9157	8565	6946	5042	377	55
Female	<50mm	2784	2682	2372	1769	171	22
	≥50mm	443	436	401	326	30	4

Figure HT44: Revision Diagnosis Cumulative Incidence of Primary Total Resurfacing Hip Replacement by Head Size (Primary Diagnosis OA)

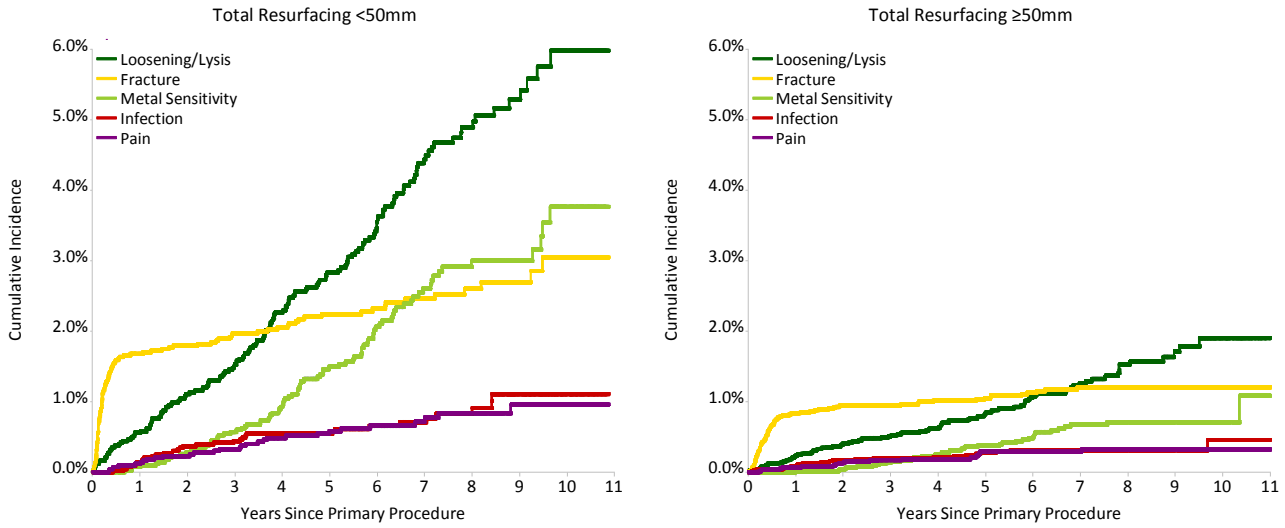


Table HT77: Revision Rates of Primary Total Resurfacing Hip Replacement

Head Component	Acetabular Component	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
ASR	ASR	200	1167	5936	3.37 (2.92, 3.87)
Adept	Adept	11	442	1636	0.67 (0.34, 1.20)
BHR	BHR	447	10133	61083	0.73 (0.67, 0.80)
Bionik	Bionik	23	197	673	3.42 (2.17, 5.13)
Cormet	Cormet	38	371	1863	2.04 (1.44, 2.80)
Cormet 2000 HAP Bi-Coated	Cormet	23	247	1151	2.00 (1.27, 3.00)
Durom	Durom	67	847	4494	1.49 (1.16, 1.89)
Icon	Icon	3	113	511	0.59 (0.12, 1.72)
Mitch TRH	Mitch TRH	22	1009	3017	0.73 (0.46, 1.10)
Recap	Recap	21	195	750	2.80 (1.73, 4.28)
Other (7)		25	180	1200	2.08 (1.35, 3.07)
TOTAL		**880**	**14901**	**82314**	**1.07 (1.00, 1.14)**

Note: Only combinations with over 100 procedures have been listed

Table HT78: Yearly Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement

Head Component	Acetabular Component	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs
ASR	ASR	3.3 (2.5, 4.5)	7.1 (5.8, 8.7)	14.7 (12.7, 17.0)	23.4 (20.2, 26.9)	
Adept	Adept	1.4 (0.6, 3.0)	1.9 (1.0, 3.8)	2.7 (1.4, 5.1)		
BHR	BHR	1.4 (1.2, 1.7)	2.5 (2.2, 2.8)	3.6 (3.2, 4.0)	5.1 (4.6, 5.6)	6.7 (6.0, 7.5)
Bionik	Bionik	3.6 (1.7, 7.3)	10.6 (6.9, 16.2)			
Cormet	Cormet	1.9 (0.9, 3.9)	5.7 (3.6, 8.8)	7.5 (5.0, 11.3)	12.4 (8.7, 17.6)	
Cormet 2000 HAP Bi-Coated	Cormet	2.4 (1.1, 5.4)	4.6 (2.6, 8.1)	9.5 (6.2, 14.5)		
Durom	Durom	3.2 (2.2, 4.6)	5.4 (4.1, 7.2)	7.5 (5.8, 9.6)	9.3 (7.3, 11.9)	
Icon	Icon	0.9 (0.1, 6.1)	1.8 (0.4, 6.9)	2.9 (0.9, 8.9)		
Mitch TRH	Mitch TRH	1.2 (0.7, 2.1)	2.3 (1.5, 3.6)	2.9 (1.8, 4.4)		
Recap	Recap	5.2 (2.8, 9.4)	9.0 (5.7, 14.0)	11.8 (7.6, 18.1)		
Other (7)		5.6 (3.0, 10.1)	7.9 (4.7, 13.0)	10.3 (6.6, 15.8)	12.3 (8.2, 18.2)	

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

KNEE REPLACEMENT

Categories of Knee Replacement

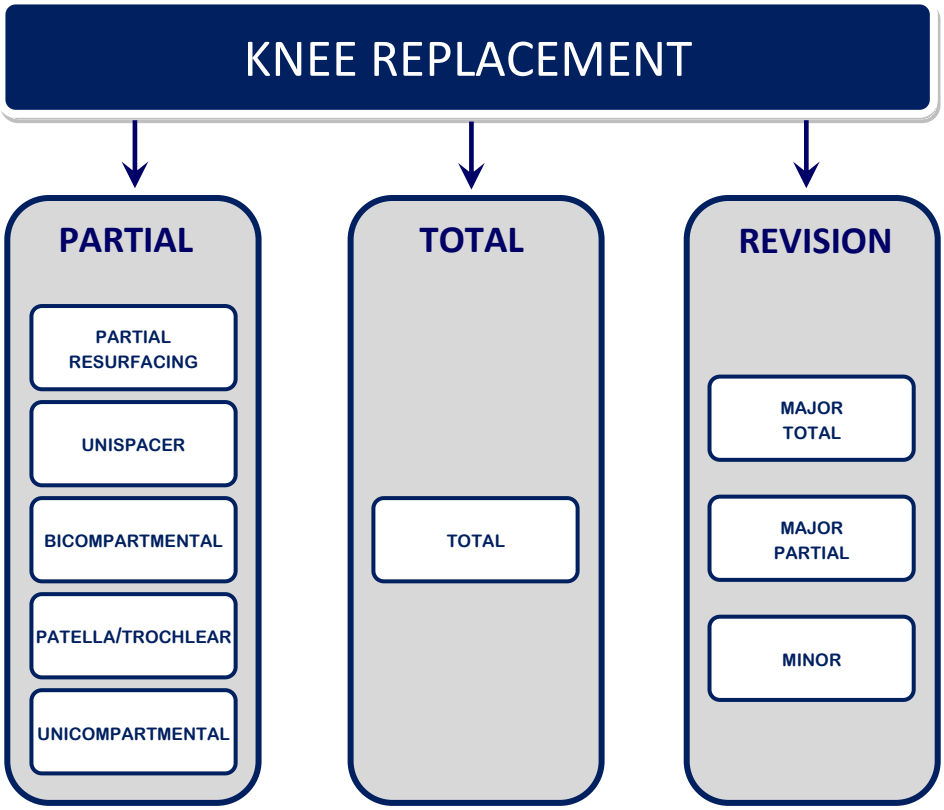
The Registry groups knee replacement into three broad categories, primary partial, primary total and revision knee replacement.

A primary replacement is the 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 chapter on partial knees.

Revision knees 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. These are defined in the revision outcomes chapter.



Use of Knee Replacement

This report analyses 380,726 knee replacements reported to the Registry with a procedure date up to and including 31 December 2011. This is an additional 46,962 knee procedures compared to the number reported last year. When considering all procedures currently recorded by the Registry, primary partial knees account for 10.3% of all knee replacement, primary total knees 81.3% and revision knee replacement 8.3% (Table K1).

Table K1: Number of Knee Replacements

Knee Category	Number	Percent
Primary Partial Knee	39355	10.3
Primary Total Knee	309673	81.3
Revision Knee	31698	8.3
TOTAL	**380726**	**100.0**

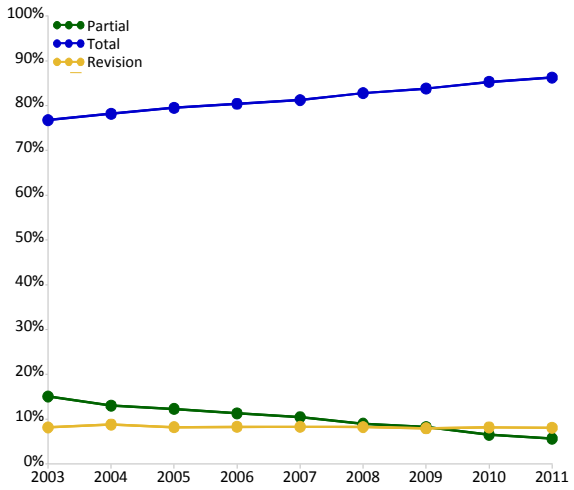
The number of knee replacements undertaken in 2011 increased by 1,988 (4.5%) compared to 2010. During the last 12 months primary partial knees decreased by 9.3%, primary total knees increased by 5.7% and revision knee replacement increased by 3.3%.

Since 2003, the number of knee replacement procedures has increased by 63.5%. Primary total knee replacement has increased by 83.7% and revision knee replacement 61.7%. Primary partial knee replacement has declined by 38.5%.

In 2011, primary total knee replacement accounted for 86.2% of all knee replacement procedures. This has increased from 76.7% in 2003. Primary partial knee replacement decreased from 15.1% in 2003 to 5.7% in 2011 (Figure K1).

The proportion of revision knee procedures has declined from a peak of 8.8% in 2004 to 8.1% in 2011. This equates to 334 less revision procedures in 2011 compared to what would have been the case if the proportion of revision procedures had not declined from 8.8% (Figure K1).

Figure K1: Proportion of Knee Replacements



Detailed information on the demographics of each category of knee replacement is provided in the supplementary report 'Demographics of Knee Arthroplasty' available on the Registry website, www.dmac.adelaide.edu.au/aoanjrr/publications.jsp.

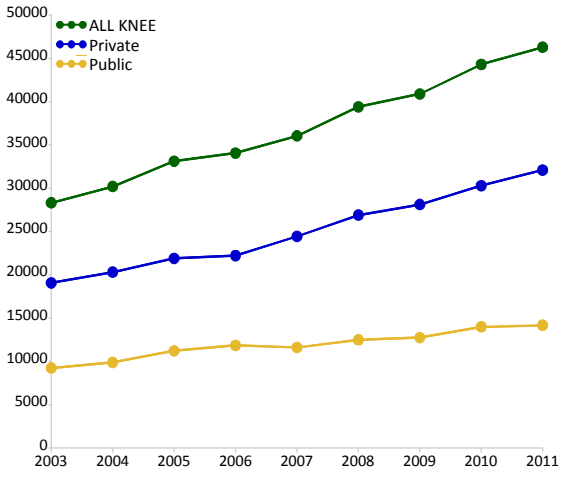
Public and Private Sector

More than two thirds of all knee replacement procedures reported to the Registry have been undertaken in private hospitals (69.4% in 2011).

There were 32,105 private sector knee replacements reported for 2011, an increase of 6.0% compared to 2010. In the public sector there were 14,179 knee replacements, an increase of 1.3% compared to 2010.

Since 2003, knee replacement in the private sector has increased by 68.3% compared to 53.5% in the public sector (Figure K2).

Figure K2: Knee Replacement by Hospital Sector



There were 2,214 private sector primary partial knee replacements reported for 2011, a decrease of 7.9% compared to 2010. In the public sector, there were 410 partial knee replacements, a decrease of 16.2% compared to 2010. Since 2003, primary partial knee replacement in the private sector has decreased by 35.0% compared to 52.4% in the public sector.

In 2011, 27,322 private sector primary total knee replacements were reported, an increase of 7.7% compared to 2010. In the public sector, there were 12,595 primary total knee replacements, an increase of 1.6% compared to 2010. Since 2003, primary total knee replacement in the private sector has increased by 94.2% compared to 64.4% in the public sector.

There were 2,569 private sector revision knee replacements reported for 2011, an increase of 2.1% compared to 2010. In the public sector, there were 1,174 revision knee replacements, an increase of 5.9% compared to 2010. Since 2003, revision knee replacement in the private sector has increased by 60.9% compared to 63.5% 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 prosthesis to replace part of the natural articulating surface on one or more sides of the joint in one or more articular compartments of the knee.
2. **Unispacer** involves the use of a medial or lateral femorotibial compartment articular spacer.
3. **Bicompartmental** involves the replacement of the medial femoral and trochlear articular surface of the knee with a single femoral prosthesis as well as the medial tibial articular surface with a unicompartmental tibial prosthesis. It may also include the use of a patellar prosthesis.
4. **Patella/trochlear** involves the use of a trochlear prosthesis to replace the femoral trochlear articular surface and on most occasions a patellar prosthesis.
5. **Unicompartmental** procedure involves the replacement of the femoral and tibial articular surface of either the medial or lateral femorotibial compartment using unicompartmental femoral and tibial prostheses.

Use of Partial Knee Replacement

The most common primary partial knee is the unicompartmental knee. This accounts for 93.9% of all partial knee replacements. Patella/trochlear replacement (5.1%) is the next most common. The three remaining partial knee procedures (partial resurfacing, unispacer and bicompartmental knee replacement) have been reported in small numbers (Table KP1).

Table KP1: Partial Knee Replacement by Class

Partial Knee Class	Number	Percent
Partial Resurfacing	162	0.4
Unispacer	40	0.1
Bicompartmental	161	0.4
Patella/Trochlear	2021	5.1
Unicompartmental	36971	93.9
TOTAL	**39355**	**100.0**

Osteoarthritis is the principal diagnosis for the five different classes of partial knee replacement. There is considerable variation in the outcome of primary partial knee depending on the class (Tables KP2 and KP3).

Detailed information on the demographics of each class of primary partial knee replacement is provided in the supplementary report 'Demographics of Knee Arthroplasty' available on the Registry website, www.dmac.adelaide.edu.au/aoanjrr/publications.jsp.

Table KP2: Revision Rates of Primary Partial Knee Replacement by Class

Partial Knee Class	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Partial Resurfacing	39	162	572	6.82 (4.85, 9.32)
Unispacer	30	40	121	24.82 (16.75, 35.44)
Bicompartmental	16	161	444	3.61 (2.06, 5.86)
Patella/Trochlear	290	2021	8202	3.54 (3.14, 3.97)
Unicompartmental	3359	36971	193886	1.73 (1.67, 1.79)
TOTAL	**3734**	**39355**	**203224**	**1.84 (1.78, 1.90)**

Table KP3: Yearly Cumulative Percent Revision of Primary Partial Knee Replacement by Class

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Partial Resurfacing	5.7 (3.0, 10.7)	17.2 (12.0, 24.2)	27.6 (20.2, 37.1)		
Unispacer	42.5 (29.0, 59.2)	67.5 (53.0, 81.2)	67.5 (53.0, 81.2)		
Bicompartmental	6.4 (3.5, 11.6)	10.3 (6.3, 16.6)			
Patella/Trochlear	2.3 (1.8, 3.1)	9.4 (8.0, 10.9)	16.3 (14.4, 18.5)	29.9 (26.3, 34.0)	
Unicompartmental	2.2 (2.1, 2.4)	6.0 (5.7, 6.2)	8.5 (8.2, 8.9)	15.2 (14.6, 15.9)	16.3 (15.5, 17.2)

Partial Resurfacing

The Registry has data on 162 procedures. This has increased by 11 procedures compared to the number reported last year.

The most common reason reported for undertaking a partial resurfacing procedure is osteoarthritis (87.0%). The majority of procedures have been on patients aged less than 55 years (75.3%). The procedure has been undertaken more frequently in males (53.1%).

All recorded partial resurfacing procedures used the 'Hemicap' range of prostheses.

Of the 162 procedures 140 had one cap implanted (116 femoral, 9 patellar, 6 tibial, 7 trochlear and 2 unknown). There have been 20 partial resurfacings with two caps implanted (17 femoral/trochlear and patella, 1 femoral and patellar and 2 where both devices were used on the femoral articular surface). Three devices were implanted in two procedures; both had devices to the femoral, patellar and trochlear articular surfaces.

The cumulative percent revision of partial resurfacing procedures undertaken for osteoarthritis is 5.8% at one year and 17.9% at three years (Table KP4 and Figure KP1).

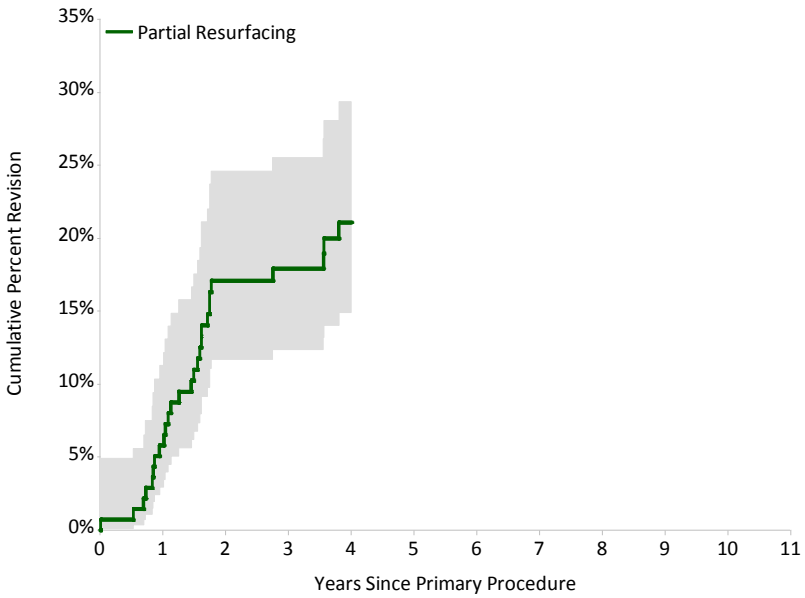
The main reasons for revision are progression of disease (53.8%), loosening (17.9%) and pain (7.7%).

Most primary partial resurfacings are revised to either total knee replacement (51.3%) or unicompartmental (30.8%). A small number were revised to a patella/trochlear (7.7%). The remainder of the revisions involved another resurfacing component (7.7%) or removal of the prosthesis (2.5%).

Table KP4: Yearly Cumulative Percent Revision of Primary Partial Resurfacing Knee Replacement (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Partial Resurfacing	5.8 (2.9, 11.3)	17.9 (12.4, 25.5)			

Figure KP1: Cumulative Percent Revision of Primary Partial Resurfacing Knee Replacement (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Partial Resurfacing	141	129	91	36	0	0

Unispacer

There have only been 40 unispacer procedures reported to the Registry. There have been no additional procedures undertaken in Australia since 2005.

Osteoarthritis was the diagnosis reported for all unispacer knee replacements with 52.5% of procedures performed on males and the majority of patients aged less than 65 years (90.0%).

Two types of unispacer prostheses have been used, UniSpacer (Zimmer) (31) and InterCushion (Advance Biosurfaces Inc.) (9).

All InterCushion prostheses were revised within one and half years, most within a year. The eight year cumulative percent revision of the Zimmer UniSpacer prostheses was 69.0% (52.1, 84.4) (Tables KP5 and KP6 and Figure KP2).

The main reason for revision was pain (23.3%), followed by progression of disease, loosening and synovitis.

Most unispacer procedures were revised to a unicompartmental knee replacement (66.7%) or a total knee (20%). The remainder of the revisions involved a further unispacer replacement.

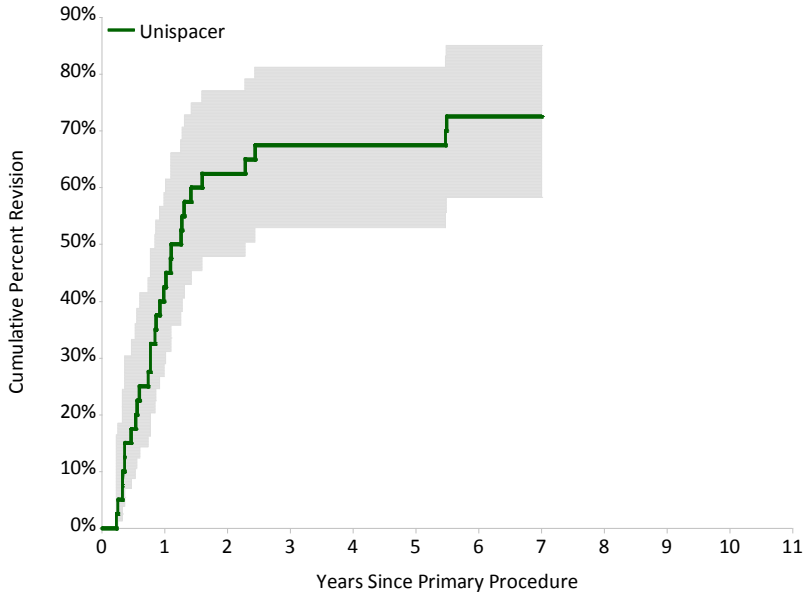
Table KP5: Revision Rates of Primary Unispacer Knee Replacement

Unispacer	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
InterCushion	9	9	8	110.76 (50.64, 210.3)
Unispacer	21	31	113	18.63 (11.53, 28.47)
Primary Unispacer	**30**	**40**	**121**	**24.82 (16.75, 35.44)**

Table KP6: Yearly Cumulative Percent Revision of Primary Unispacer Knee Replacement

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
InterCushion	55.6 (28.1, 86.4)	100.0 (100.0,100.0)			
Unispacer	38.7 (24.2, 58.0)	58.1 (41.7, 75.3)	58.1 (41.7, 75.3)		
Primary Unispacer	42.5 (29.0, 59.2)	67.5 (53.0, 81.2)	67.5 (53.0, 81.2)		

Figure KP2: Cumulative Percent Revision of Primary Unispacer Knee Replacement



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Unispacer	40	23	13	13	0	0

Bicompartmental

The Registry has data on 161 bicompartmental procedures, an additional 11 procedures compared to the last report.

The principal diagnosis for bicompartmental knee replacement is osteoarthritis (96.9%). It is used more frequently in females (60.2%) and 54.7% of patients are aged less than 65 years at the time of surgery.

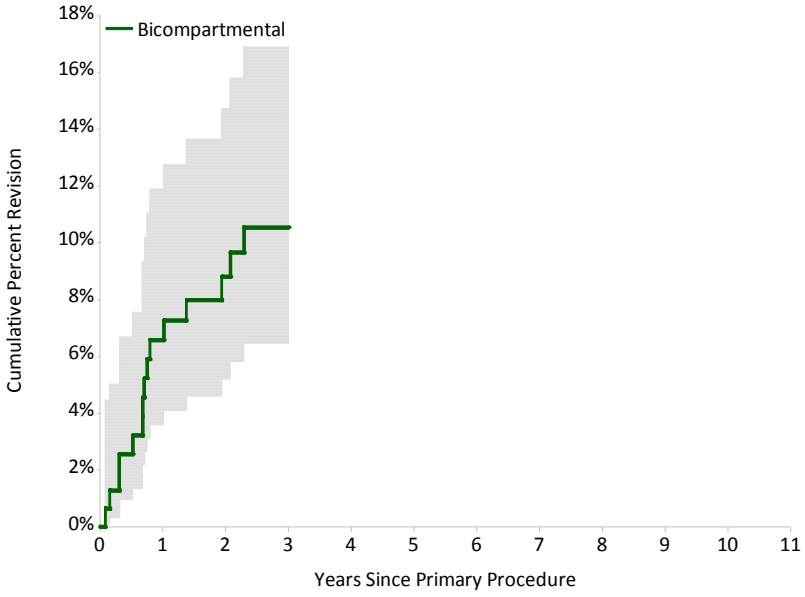
The bicompartmental knee is a single company product. One femoral component, the Journey Deuce, has been combined with two different tibial components the Journey (32.3%) and the Journey Deuce (67.7%). The majority of bicompartmental procedures have been used with a patellar replacement (83.9%).

The cumulative percent revision of bicompartmental knee replacement at one year is 6.6%, and 10.6% at three years (Table KP7 and Figure KP3). The main reasons for revision were patellofemoral pain (31.3%), and pain (18.8%). Eight of the 16 revisions involved the addition of a patellar prosthesis only. Six procedures have been revised to a total knee replacement.

Table KP7: Yearly Cumulative Percent Revision of Primary Bicompartmental Knee Replacement (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Bicompartmental	6.6 (3.6, 11.9)	10.6 (6.5, 17.0)			

Figure KP3: Cumulative Percent Revision of Primary Bicompartmental Knee Replacement (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Bicompartmental	156	137	78	3	0	0

Patella/Trochlear

Demographics

There have been 2,021 patella/trochlear procedures reported to the Registry, an additional 242 procedures compared to the last report.

The principal diagnosis for this procedure is osteoarthritis (98.8%). It is more common in females (75.9%) (Figures KP4). The procedure is most often undertaken on patients less than 65 years of age (67.5%) (Figure KP5).

Figure KP4: Primary Patella/Trochlear Knee Replacement by Gender

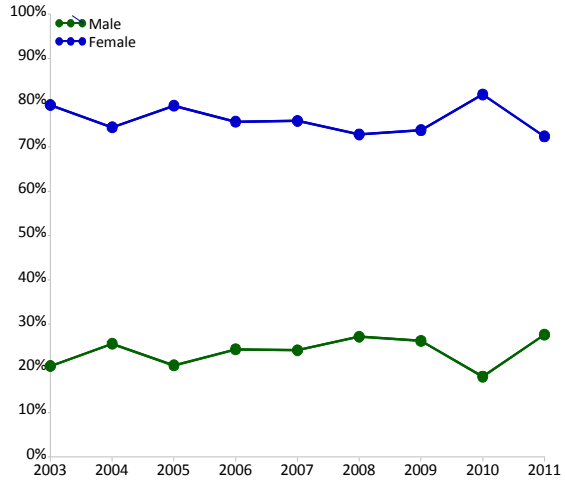
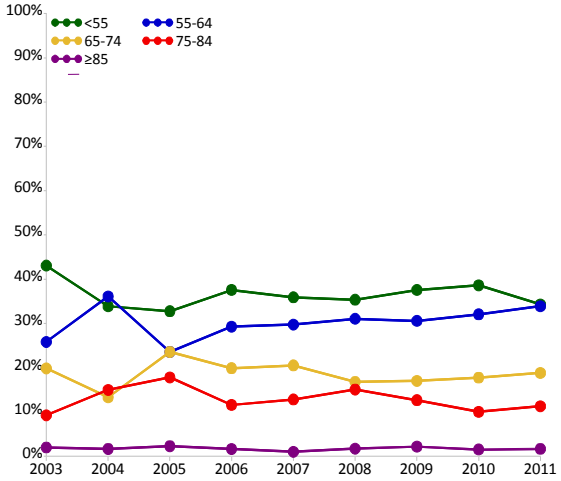


Figure KP5: Primary Patella/Trochlear Knee Replacement by Age



In 2011, six different patellar/trochlear prostheses were used, the four most common were the Gender Solutions, Competitor, RBK, and Avon. The Gender Solutions prosthesis was reported for the first time in 2009 and remains the most frequently used prosthesis in this class (Table KP8).

Table KP8: Most Used Resurfacing Trochlear Prostheses in Primary Patella/Trochlear Knee Replacement

2003		2008		2009		2010		2011	
N	Model	N	Model	N	Model	N	Model	N	Model
56	LCS	66	Avon	56	Avon	79	Gender Solutions	69	Gender Solutions
43	Avon	60	LCS	51	RBK	68	Avon	62	Competitor
29	Lubinus Pat Glide	58	Competitor	43	Competitor	48	RBK	43	RBK
13	Themis	37	RBK	42	Gender Solutions	47	Competitor	38	Avon
9	MOD III	6	Sigma HP	27	LCS	16	Sigma HP	15	Sigma HP
1	RBK	5	Vanguard	5	Sigma HP	1	Vanguard	12	Vanguard
				3	Lubinus Pat Glide				
				2	Vanguard				
Most Used									
151	(6) 100.0%	232	(6) 100.0%	229	(8) 100.0%	259	(6) 100.0%	239	(6) 100.0%

Outcome

The cumulative percent revision at five years for primary patella/trochlear knee replacement undertaken for osteoarthritis is 16.3% and at 10 years is 29.8% (Table KP9 and Figure KP6).

Progression of disease (42.8%) is the most common reason for revision followed by loosening (21.7%) and pain (9.3%) (Table KP10).

When a primary patella/trochlear procedure is revised it is usually revised to a total knee replacement (81.0%) (Table KP11).

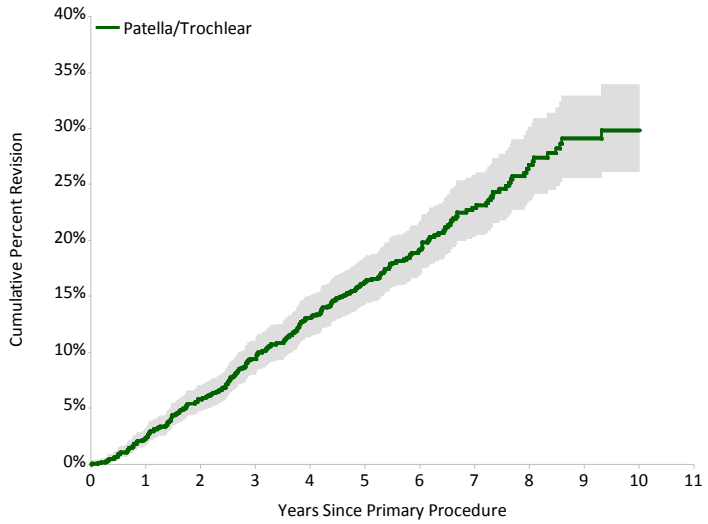
Age is a risk factor for revision. The rate of revision in patients younger than 65 years of age is significantly higher than patients 65 years or older (Tables KP12 and KP13 and Figure KP7). There is no significant gender difference (Tables KP14 and KP15 and Figure KP8).

The outcomes of patella/trochlear prostheses with more than 20 procedures are detailed in Tables KP16 and KP17.

Table KP9: Yearly Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Patella/Trochlear	2.4 (1.8, 3.2)	9.4 (8.1, 11.0)	16.3 (14.4, 18.5)	29.8 (26.1, 33.9)	

Figure KP6: Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Patella/Trochlear	1997	1713	1133	700	58	21

Table KP10: Primary Patella/Trochlear Knee Replacement by Reason for Revision

Reason for Revision	Number	Percent
Progression Of Disease	124	42.8
Loosening/Lysis	63	21.7
Pain	27	9.3
Implant Breakage Patella	14	4.8
Patellofemoral Pain	12	4.1
Infection	11	3.8
Malalignment	8	2.8
Other	31	10.7
TOTAL	**290**	**100.0**

Table KP11: Primary Patella/Trochlear Knee Replacement by Type of Revision

Type of Revision	Number	Percent
TKR (Tibial/Femoral)	235	81.0
Patella Only	39	13.4
Patella/Trochlear Resurfacing	10	3.4
UKR (Uni Tibial/Uni Femoral)	3	1.0
Removal of Prostheses	2	0.7
Cement Spacer	1	0.3
TOTAL	**290**	**100.0**

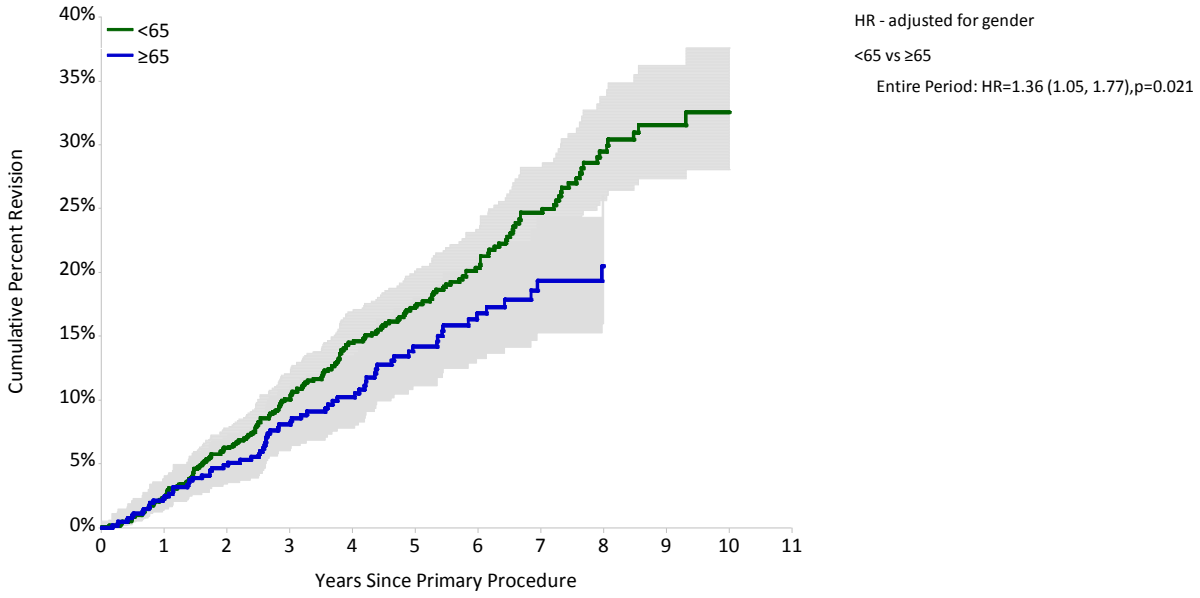
Table KP12: Revision Rates of Patella/Trochlear Knee Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
<65	210	1342	5467	3.84 (3.34, 4.40)
≥65	75	655	2637	2.84 (2.24, 3.57)
TOTAL	**285**	**1997**	**8104**	**3.52 (3.12, 3.95)**

Table KP13: Yearly Cumulative Percent Revision of Patella/Trochlear Knee Replacement by Age (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
<65	2.4 (1.7, 3.4)	10.1 (8.4, 12.1)	17.4 (15.0, 20.1)	32.5 (28.0, 37.6)	
≥65	2.3 (1.4, 3.9)	8.1 (6.0, 10.8)	14.2 (11.1, 18.0)		

Figure KP7: Cumulative Percent Revision of Patella/Trochlear Knee Replacement by Age (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
<65	1342	1151	759	473	43	20
≥65	655	562	374	227	15	1

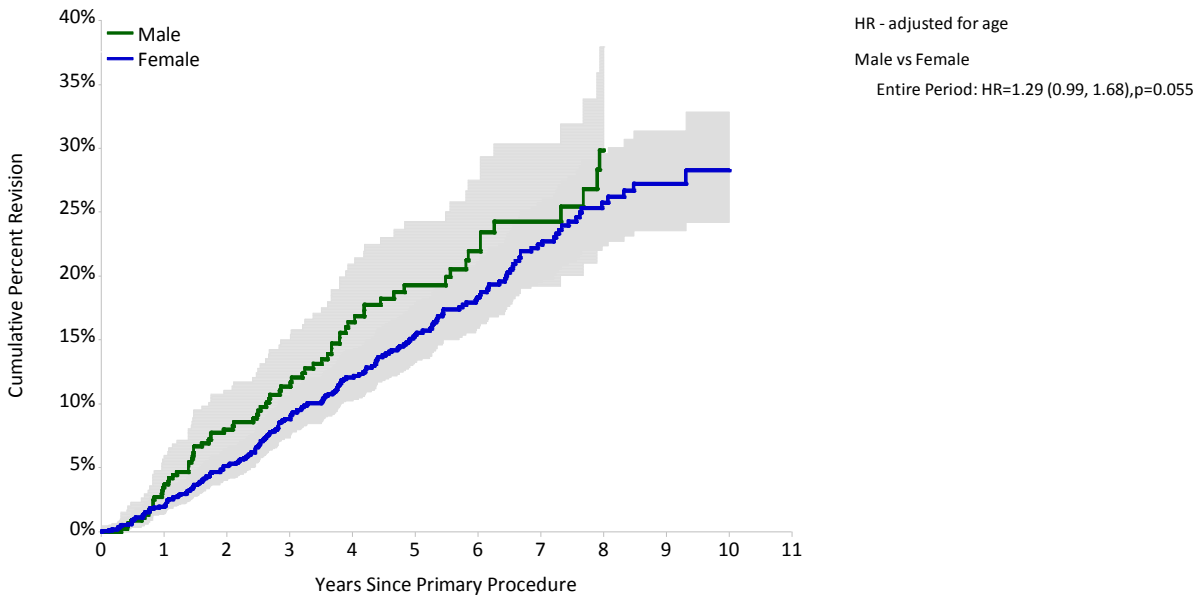
Table KP14: Revision Rates of Patella/Trochlear Knee Replacement by Gender (Primary Diagnosis OA)

Gender	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	77	483	1844	4.18 (3.30, 5.22)
Female	208	1514	6260	3.32 (2.89, 3.81)
TOTAL	**285**	**1997**	**8104**	**3.52 (3.12, 3.95)**

Table KP15: Yearly Cumulative Percent Revision of Patella/Trochlear Knee Replacement by Gender (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	3.7 (2.3, 6.0)	11.4 (8.6, 15.0)	19.3 (15.2, 24.3)		
Female	2.0 (1.4, 2.8)	8.8 (7.3, 10.6)	15.4 (13.3, 17.9)	28.3 (24.2, 32.8)	

Figure KP8: Cumulative Percent Revision of Patella/Trochlear Knee Replacement by Gender (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	483	401	263	148	14	6
Female	1514	1312	870	552	44	15

Table KP16: Revision Rates of Primary Patella/Trochlear Knee Replacement

Resurfacing Trochlear	Patella	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Avon	Avon	22	254	853	2.58 (1.62, 3.90)
Avon	Kinemax Plus	53	304	1851	2.86 (2.14, 3.74)
Competitor	Genesis II	13	237	521	2.50 (1.33, 4.27)
Gender Solutions	Nexgen	3	177	225	1.34 (0.28, 3.90)
LCS	LCS	104	395	1968	5.29 (4.32, 6.40)
Lubinus Pat Glide	Duracon	16	77	504	3.18 (1.82, 5.16)
Lubinus Pat Glide	Lubinus P Glide	12	39	251	4.78 (2.47, 8.35)
MOD III	MOD III	14	63	474	2.95 (1.62, 4.96)
RBK	RBK	28	280	856	3.27 (2.17, 4.73)
Sigma HP	PFC Sigma	7	56	103	6.77 (2.72, 13.96)
Themis	Themis	5	38	260	1.92 (0.62, 4.49)
Vanguard	Series A	1	20	34	2.91 (0.07, 16.21)
Other (25)		12	81	302	3.97 (2.05, 6.94)
TOTAL		**290**	**2021**	**8202**	**3.54 (3.14, 3.97)**

Note: Only combinations with over 20 procedures have been listed.

Table KP17: Yearly Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement

Resurfacing Trochlear	Patella	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Avon	Avon	0.9 (0.2, 3.4)	7.8 (4.7, 12.9)	13.6 (8.7, 20.9)		
Avon	Kinemax Plus	2.0 (0.9, 4.4)	4.8 (2.9, 8.0)	12.5 (9.0, 17.1)		
Competitor	Genesis II	0.6 (0.1, 4.0)	9.1 (5.2, 15.8)			
Gender Solutions	Nexgen	1.6 (0.4, 6.3)				
LCS	LCS	3.5 (2.1, 5.9)	11.7 (8.9, 15.4)	21.8 (17.8, 26.6)		
Lubinus Pat Glide	Duracon	2.6 (0.7, 10.0)	9.2 (4.5, 18.4)	15.9 (9.4, 26.3)		
Lubinus Pat Glide	Lubinus Pat Glide	5.1 (1.3, 19.0)	18.1 (9.1, 34.3)	21.1 (11.1, 37.9)	35.0 (21.3, 54.0)	
MOD III	MOD III	4.8 (1.6, 14.0)	14.3 (7.7, 25.7)	17.6 (10.1, 29.5)	25.5 (15.5, 40.2)	25.5 (15.5, 40.2)
RBK	RBK	2.0 (0.8, 4.7)	11.3 (7.5, 16.8)	15.4 (10.4, 22.5)		
Sigma HP	PFC Sigma	6.3 (2.1, 18.4)	19.7 (8.4, 42.0)			
Themis	Themis	2.6 (0.4, 17.2)	2.6 (0.4, 17.2)	8.0 (2.7, 22.9)		
Vanguard	Series A	0.0 (0.0, 0.0)	14.3 (2.1, 66.6)			
Other (25)		4.2 (1.4, 12.4)	13.1 (6.7, 24.8)	16.3 (8.5, 30.0)		

Unicompartmental

Demographics

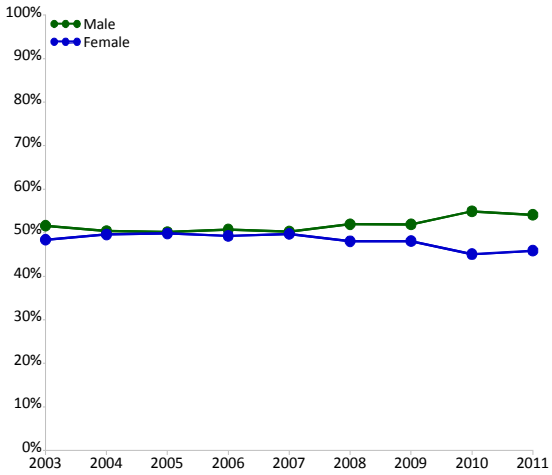
This year the Registry is reporting on 36,971 unicompartmental procedures, an additional 2,416 procedures compared to the last report.

The use of unicompartmental knee replacement continues to decline. The number of procedures reported in 2011 was 9.0% less than 2010 and 42.4% less than 2003. As a percentage of all knee replacement, unicompartmental has decreased from 14.5% in 2003 to 5.1% in 2011.

Osteoarthritis is the principal diagnosis for almost all unicompartmental knee replacements (98.9%).

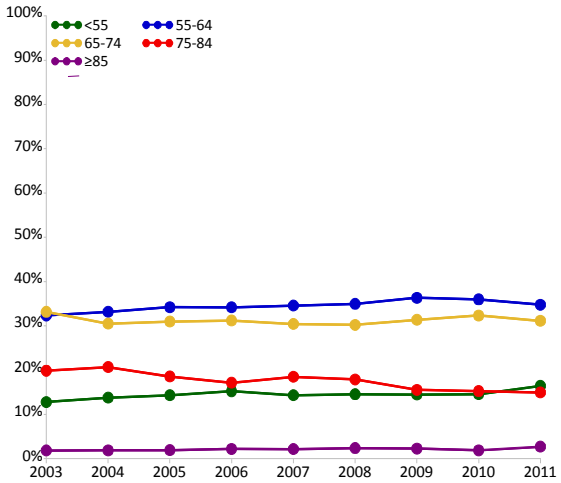
There continues to be a higher proportion of males undergoing unicompartmental knee replacement (54.1% in 2011) (Figure KP9).

Figure KP9: Primary Unicompartmental Knee Replacement by Gender



There has been little change in the age distribution for many years apart from a small decrease in the 75-84 year age group. Unicompartmental knee replacement is most frequently undertaken in the 55-64 and 65-74 age groups (Figure KP10).

Figure KP10: Primary Unicompartmental Knee Replacement by Age



In 2011, the ten most used prostheses accounted for 89.0% of all unicompartmental procedures. This is similar to the proportion reported in recent years but is 7.1% less than 2003. In that year, 17 different prostheses were used compared to 20 in 2011.

The ZUK, Oxford 3 and the Oxford were the most used prostheses in 2011. The Oxford is a cementless unicompartmental knee replacement introduced in 2007 and is reported separately from the Oxford 3. The Journey is listed for the first time in the ten most used prostheses table (Table KP18).

Table KP18: Ten Most Used Tibial Prostheses in Primary Unicompartmental Knee Replacement

2003		2008		2009		2010		2011	
N	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**
1366	Oxford 3	948	Oxford 3	803	Oxford 3	594	Oxford 3	507	ZUK
444	Repicci	500	ZUK	479	ZUK	550	ZUK	503	Oxford 3
373	Pres Fixed	362	Unix	351	Unix	353	Oxford	360	Oxford
352	M/G	211	GRU	226	Oxford	273	Unix	286	Unix
335	Allegretto Uni	180	Pres Fixed	176	Journey Deuce	101	Freedom/Active	107	Sigma HP
321	GRU	162	Freedom/Active	170	Pres Fixed	93	Genesis	75	Freedom/Active
274	Genesis	119	Repicci	149	Freedom/Active	83	Repicci	72	Repicci
260	Unix	117	Genesis	133	Repicci	81	GRU	69	GRU
121	Pres Mobile	102	Allegretto Uni	128	GRU	78	Allegretto Uni	67	Journey
101	Endo-Model Sled	93	AMC	81	Allegretto Uni	64	Sigma HP	61	Genesis
Ten Most Used									
3947	(10) 96.1%	2794	(10) 86.7%	2696	(10) 87.4%	2270	(10) 87.2%	2107	(10) 89.0%
Remainder									
159	(7) 3.9%	430	(17) 13.3%	387	(16) 12.6%	332	(15) 12.8%	260	(10) 11.0%
TOTAL									
4106	(17) 100.0%	3224	(27) 100.0%	3083	(26) 100.0%	2602	(25) 100.0%	2367	(20) 100.0%

Note: Freedom PKR/Active is reported as Freedom/Active, Preservation-Fixed as Pres-Fixed and Preservation-Mobile as Pres-Mobile

Outcome

The cumulative percent revision at 11 years for primary unicompartmental knee replacement undertaken for osteoarthritis is 16.4% (Table KP19 and Figure KP11).

The main reasons for revision are loosening/lysis (47.4%), progression of disease (23.2%) and pain (11.1%). Most are revised to a total knee replacement (84.5%) (Tables KP20 and KP21).

Age, gender and the type of prosthesis affect the rate of revision.

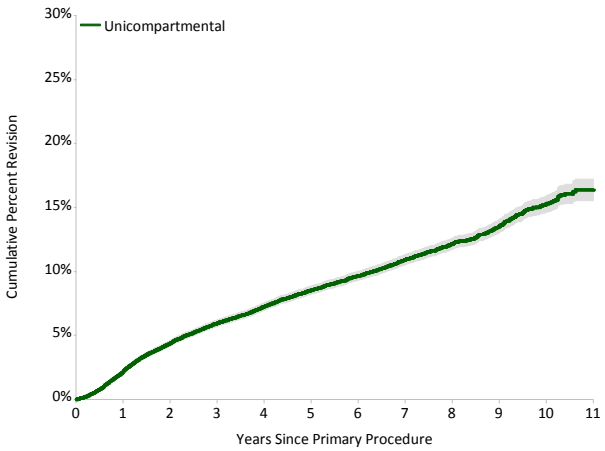
Age is a major factor affecting the outcome of primary unicompartmental knee replacement with the rate of revision decreasing with increasing age (Tables KP22 and KP23 and Figure KP12). Females have a higher rate of revision (Tables KP24 and KP25 and Figure KP13). The effect of age on the rate of revision is evident for both males and females (Tables KP26 and KP27 and Figures KP14 and KP15).

Outcomes of unicompartmental knee prostheses with more than 200 procedures reported to the Registry are presented in Tables KP28 and KP29.

Table KP19: Yearly Cumulative Percent Revision of Primary Unicompartmental Knee Replacement (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Unicompartmental	2.2 (2.1, 2.4)	5.9 (5.7, 6.2)	8.5 (8.2, 8.9)	15.3 (14.6, 15.9)	16.4 (15.6, 17.2)

Figure KP11: Cumulative Percent Revision of Primary Unicompartmental Knee Replacement (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Unicompartmental	36569	33320	26244	18944	2005	406

Table KP20: Primary Unicompartmental Knee Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	1593	47.4
Progression Of Disease	778	23.2
Pain	373	11.1
Infection	145	4.3
Fracture	85	2.5
Bearing Dislocation	65	1.9
Malalignment	42	1.3
Wear Tibial	37	1.1
Instability	28	0.8
Other	213	6.3
TOTAL	**3359**	**100.0**

Table KP21: Primary Unicompartmental Knee Replacement by Type of Revision

Type of Revision	Number	Percent
TKR (Tibial/Femoral)	2840	84.5
Uni Insert Only	205	6.1
Uni Tibial Component	157	4.7
Uni Femoral Component	61	1.8
UKR (Uni Tibial/Uni Femoral)	50	1.5
Cement Spacer	25	0.7
Removal of Prostheses	7	0.2
Patella/Trochlear Resurfacing	6	0.2
Reinsertion of Components	3	0.1
Cement Only	2	0.1
Patella Only	2	0.1
Femoral Component*	1	0.0
TOTAL	**3359**	**100.0**

*Bicompartmental Component

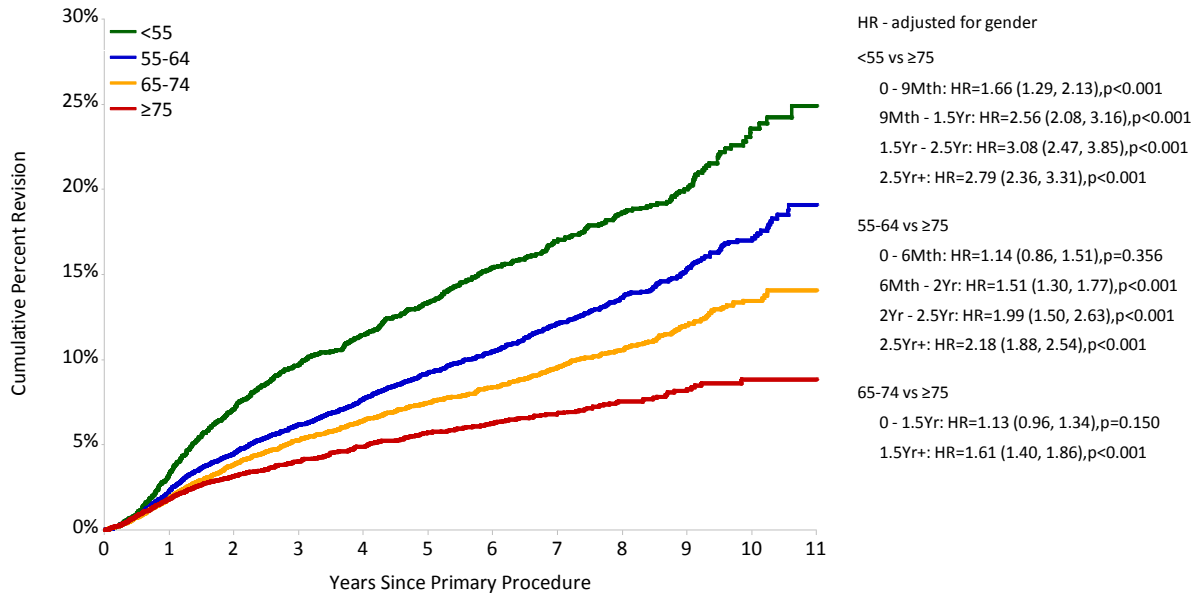
Table KP22: Revision Rates of Primary Unicompartmental Knee Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
<55	733	5215	26351	2.78 (2.58, 2.99)
55-64	1225	12305	63859	1.92 (1.81, 2.03)
65-74	942	11622	62709	1.50 (1.41, 1.60)
≥75	418	7427	38692	1.08 (0.98, 1.19)
TOTAL	**3318**	**36569**	**191612**	**1.73 (1.67, 1.79)**

Table KP23: Yearly Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Age (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
<55	3.3 (2.9, 3.9)	9.7 (8.9, 10.6)	13.4 (12.4, 14.4)	23.6 (21.6, 25.8)	24.9 (22.4, 27.6)
55-64	2.3 (2.1, 2.6)	6.2 (5.7, 6.6)	9.2 (8.7, 9.8)	17.0 (15.9, 18.2)	19.1 (17.5, 20.9)
65-74	1.9 (1.6, 2.1)	5.3 (4.9, 5.7)	7.5 (7.0, 8.0)	13.5 (12.5, 14.5)	14.1 (12.9, 15.3)
≥75	1.8 (1.5, 2.1)	4.0 (3.6, 4.5)	5.7 (5.2, 6.3)	8.8 (7.8, 10.0)	8.8 (7.8, 10.0)

Figure KP12: Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Age (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
<55	5215	4663	3592	2580	292	62
55-64	12305	11205	8772	6294	645	124
65-74	11622	10656	8466	6264	741	153
≥75	7427	6796	5414	3806	327	67

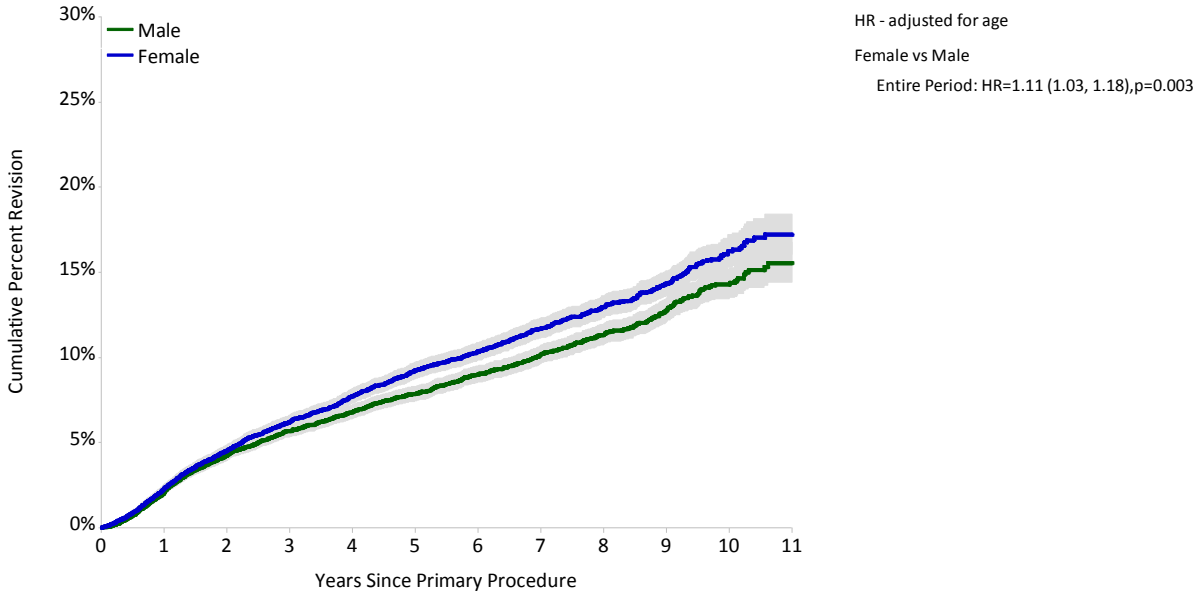
Table KP24: Revision Rates of Primary Unicompartmental Knee Replacement by Gender (Primary Diagnosis OA)

Gender	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	1591	18944	97967	1.62 (1.55, 1.71)
Female	1727	17625	93644	1.84 (1.76, 1.93)
TOTAL	**3318**	**36569**	**191612**	**1.73 (1.67, 1.79)**

Table KP25: Yearly Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Gender (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	2.1 (1.9, 2.3)	5.7 (5.4, 6.1)	7.9 (7.5, 8.3)	14.3 (13.5, 15.2)	15.5 (14.4, 16.8)
Female	2.3 (2.1, 2.6)	6.2 (5.9, 6.6)	9.2 (8.8, 9.7)	16.2 (15.3, 17.2)	17.2 (16.1, 18.4)

Figure KP13: Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Gender (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	18944	17196	13386	9632	1030	202
Female	17625	16124	12858	9312	975	204

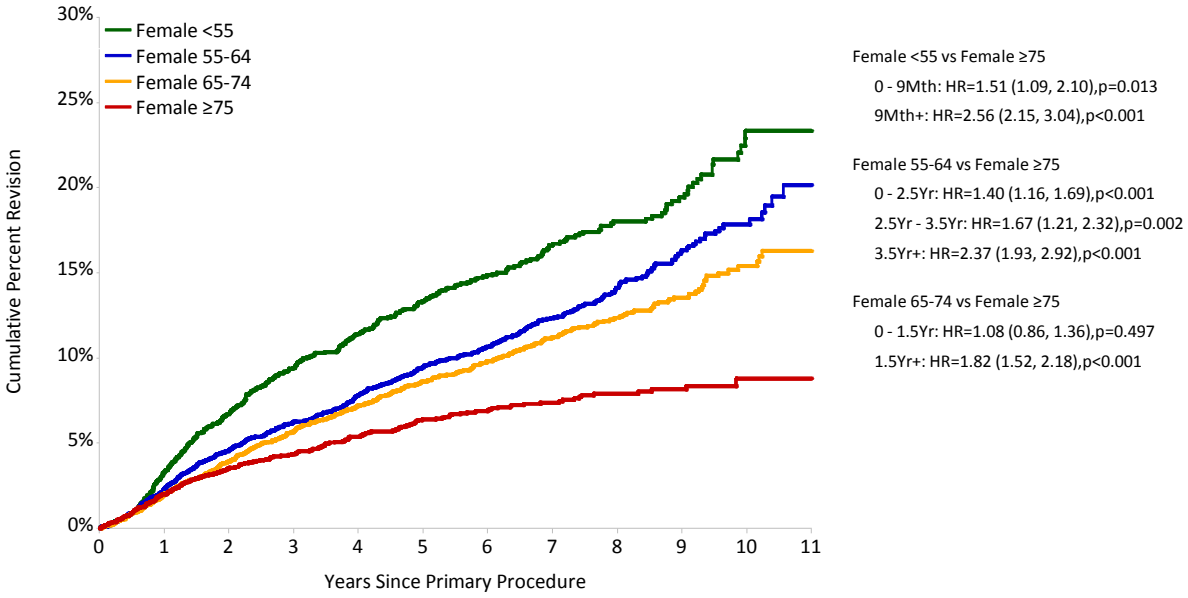
Table KP26: Revision Rates of Primary Unicompartmental Knee Replacement by Gender and Age (Primary Diagnosis OA)

Gender	Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	<55	326	2276	11236	2.90 (2.60, 3.23)
	55-64	618	6411	33213	1.86 (1.72, 2.01)
	65-74	448	6389	34051	1.32 (1.20, 1.44)
	≥75	199	3868	19468	1.02 (0.89, 1.17)
Female	<55	407	2939	15116	2.69 (2.44, 2.97)
	55-64	607	5894	30646	1.98 (1.83, 2.14)
	65-74	494	5233	28659	1.72 (1.58, 1.88)
	≥75	219	3559	19224	1.14 (0.99, 1.30)
TOTAL		**3318**	**36569**	**191612**	**1.73 (1.67, 1.79)**

Table KP27: Yearly Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Gender and Age (Primary Diagnosis OA)

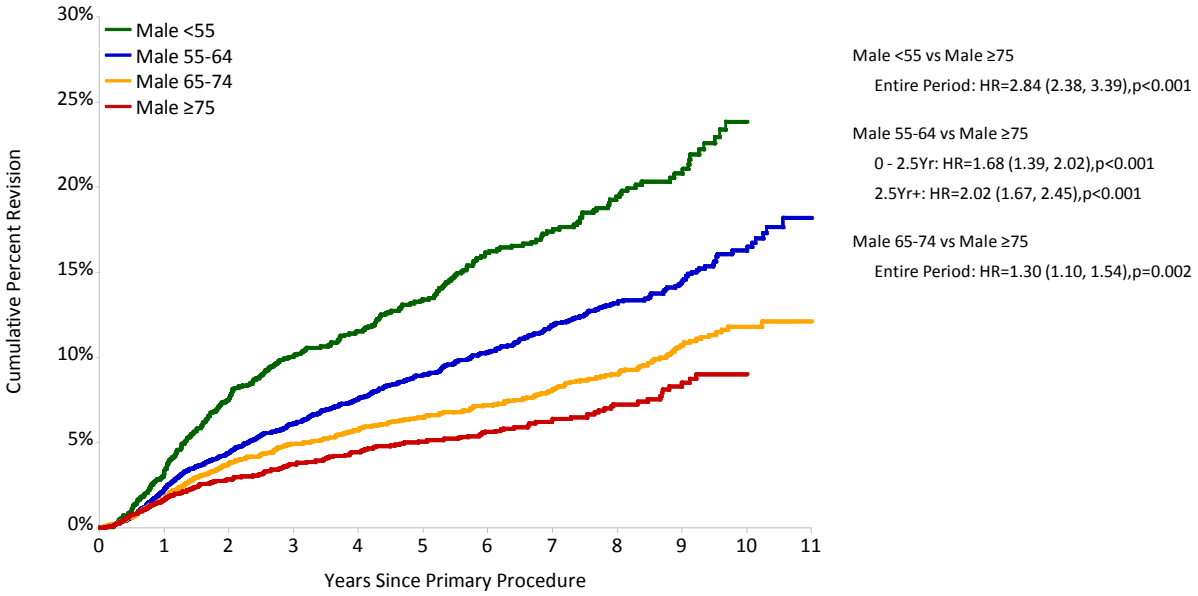
Gender	Age	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	<55	3.4 (2.7, 4.3)	10.1 (8.9, 11.5)	13.4 (11.9, 15.1)	23.9 (21.0, 27.0)	
	55-64	2.3 (1.9, 2.7)	6.1 (5.5, 6.8)	9.0 (8.2, 9.8)	16.3 (14.8, 17.9)	18.2 (16.1, 20.5)
	65-74	1.7 (1.4, 2.1)	4.9 (4.4, 5.5)	6.5 (5.9, 7.2)	11.8 (10.5, 13.2)	12.1 (10.7, 13.7)
	≥75	1.6 (1.3, 2.1)	3.7 (3.1, 4.4)	5.1 (4.3, 5.9)	9.0 (7.5, 10.8)	
Female	<55	3.3 (2.7, 4.0)	9.4 (8.3, 10.6)	13.3 (12.0, 14.8)	23.3 (20.6, 26.3)	23.3 (20.6, 26.3)
	55-64	2.3 (2.0, 2.8)	6.2 (5.6, 6.9)	9.5 (8.7, 10.3)	17.8 (16.2, 19.6)	20.1 (17.6, 23.0)
	65-74	2.0 (1.7, 2.5)	5.7 (5.1, 6.4)	8.6 (7.8, 9.5)	15.4 (13.9, 17.1)	16.3 (14.5, 18.2)
	≥75	2.0 (1.6, 2.5)	4.4 (3.7, 5.1)	6.4 (5.6, 7.3)	8.8 (7.4, 10.4)	8.8 (7.4, 10.4)

Figure KP14: Cumulative Percent Revision of Primary Unicompartmental Knee Replacement for Females by Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Female	<55	2939	2659	2060	1480	178	40
	55-64	5894	5381	4239	3036	271	45
	65-74	5233	4818	3879	2880	350	78
	≥75	3559	3266	2680	1916	176	41

Figure KP15: Cumulative Percent Revision of Primary Unicompartmental Knee Replacement for Males by Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	<55	2276	2004	1532	1100	114	22
	55-64	6411	5824	4533	3258	374	79
	65-74	6389	5838	4587	3384	391	75
	≥75	3868	3530	2734	1890	151	26

Table KP28: Revision Rates of Primary Unicompartmental Knee Replacement by Prostheses Used

Uni Femoral	Uni Tibial	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
AMC	AMC	85	680	3067	2.77 (2.21, 3.43)
Allegretto Uni	Allegretto Uni	216	1987	12907	1.67 (1.46, 1.91)
BalanSys Uni	BalanSys Uni Fixed	12	258	1023	1.17 (0.61, 2.05)
Endo-Model Sled	Endo-Model Sled	87	1032	5212	1.67 (1.34, 2.06)
Freedom PKR/Active	Freedom PKR/Active	133	1274	5071	2.62 (2.20, 3.11)
GRU	GRU	133	1883	9802	1.36 (1.14, 1.61)
Genesis	Genesis	214	1831	10180	2.10 (1.83, 2.40)
M/G	M/G	171	2114	14162	1.21 (1.03, 1.40)
Oxford 3	Oxford	25	944	1217	2.05 (1.33, 3.03)
Oxford 3	Oxford 3	1127	11402	65634	1.72 (1.62, 1.82)
Preservation	Preservation Fixed	247	2317	13564	1.82 (1.60, 2.06)
Preservation	Preservation Mobile	94	400	2750	3.42 (2.76, 4.18)
Repicci	Repicci	311	2789	18168	1.71 (1.53, 1.91)
Sigma HP	Sigma HP	4	277	472	0.85 (0.23, 2.17)
Unix	Unix	221	3209	15289	1.45 (1.26, 1.65)
ZUK	ZUK	88	2839	7752	1.14 (0.91, 1.40)
Other (32)		191	1735	7616	2.51 (2.16, 2.89)
TOTAL		**3359**	**36971**	**193886**	**1.73 (1.67, 1.79)**

Note: Only combinations with over 200 procedures have been listed.

Table KP29: Yearly Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Prostheses Used

Uni Femoral	Uni Tibial	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
AMC	AMC	4.4 (3.1, 6.3)	10.4 (8.2, 13.0)	12.7 (10.2, 15.7)		
Allegretto Uni	Allegretto Uni	3.1 (2.4, 4.0)	5.7 (4.7, 6.8)	8.0 (6.8, 9.4)	15.0 (12.9, 17.3)	17.3 (14.5, 20.5)
BalanSys Uni	BalanSys Uni Fixed	2.5 (1.1, 5.4)	3.4 (1.7, 6.7)	5.6 (3.0, 10.1)		
Endo-Model Sled	Endo-Model Sled	1.2 (0.7, 2.1)	5.2 (4.0, 6.9)	8.2 (6.6, 10.3)		
Freedom PKR/Active	Freedom PKR/Active	1.6 (1.0, 2.4)	7.1 (5.7, 8.8)	13.0 (10.9, 15.4)		
GRU	GRU	1.5 (1.0, 2.1)	4.7 (3.8, 5.8)	6.7 (5.6, 8.1)		
Genesis	Genesis	2.7 (2.1, 3.6)	8.3 (7.1, 9.7)	11.0 (9.6, 12.7)	15.3 (13.1, 17.9)	
M/G	M/G	1.6 (1.1, 2.2)	4.2 (3.4, 5.2)	6.5 (5.5, 7.7)	10.3 (8.7, 12.0)	10.8 (9.0, 13.0)
Oxford 3	Oxford	2.4 (1.5, 3.8)				
Oxford 3	Oxford 3	2.3 (2.0, 2.6)	6.0 (5.6, 6.5)	8.7 (8.2, 9.3)	14.9 (13.9, 15.9)	16.1 (14.9, 17.4)
Preservation	Preservation Fixed	2.4 (1.8, 3.1)	6.9 (6.0, 8.1)	9.3 (8.1, 10.6)	15.2 (12.9, 17.9)	
Preservation	Preservation Mobile	5.3 (3.5, 7.9)	15.5 (12.3, 19.5)	18.9 (15.4, 23.1)		
Repicci	Repicci	1.6 (1.2, 2.1)	4.4 (3.7, 5.3)	7.5 (6.5, 8.6)	17.6 (15.6, 19.8)	
Sigma HP	Sigma HP	1.6 (0.5, 5.0)	2.3 (0.8, 5.9)			
Unix	Unix	2.2 (1.7, 2.7)	5.3 (4.5, 6.2)	6.9 (6.0, 8.0)	12.6 (10.6, 15.0)	
ZUK	ZUK	1.3 (0.9, 1.8)	3.8 (3.0, 4.7)	5.0 (4.0, 6.3)		
Other (32)		3.8 (2.9, 4.8)	8.7 (7.4, 10.3)	11.0 (9.4, 12.9)	21.1 (17.8, 24.8)	21.8 (18.3, 25.8)

Note: Only combinations with over 200 procedures have been listed.

PRIMARY TOTAL KNEE REPLACEMENT

Classes of Total Knee Replacement

The Registry defines a total knee replacement as a replacement of the entire femorotibial articulation using a single femoral and a single tibial prosthesis. This may or may not be combined with a patellar replacement.

In this report, the Registry analyses outcomes based on specific patient and prosthesis characteristics. In addition, it presents the outcome for different types of total knee prostheses.

Individual prostheses are usually available as part of a knee system. The Registry subdivides knee systems into specific prosthesis types based on distinguishing prostheses characteristics. The initial characteristic used to subdivide is the method of fixation. Further subdivision of specific knee systems is based on additional prosthesis characteristics. These include mobility, stability and flexion capacity. This further system subdivision however is not uniformly applied to all knee systems at this time.

High use prostheses systems are more likely to be subdivided if there are specific reasons to do so. These may include differences or potential differences in outcome between prostheses with different characteristics within a single system.

Low use systems are unlikely to be subdivided because of small numbers or insufficient follow up. The exception is if the system is identified as having a higher than anticipated rate of revision. The Registry then undertakes catalogue range specific analysis to determine if the identified higher than anticipated rate of revision is associated with specific prosthesis characteristics.

To enable the Registry to undertake range specific analysis uniformly across all knee systems it is necessary to link the different catalogue ranges to the specific prosthesis characteristics. This is an ongoing process.

Demographics

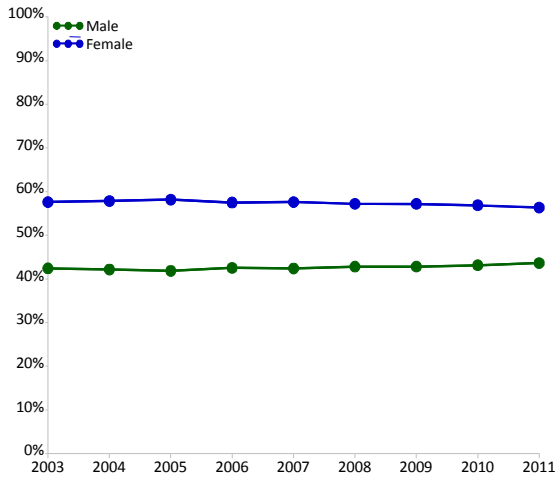
This year the Registry is reporting on 309,673 primary total knee procedures, an additional 40,407 procedures compared to the last report.

The use of primary total knee replacement has increased steadily. In 2011, there were 5.7% more procedures undertaken than 2010 and 83.7% more than 2003. As a proportion of all knee replacement procedures, primary total knee increased from 76.7% in 2003 to 86.2% in 2011.

As with all other types of primary knee replacement, osteoarthritis is the most common diagnosis for primary total knee replacement (97.3%).

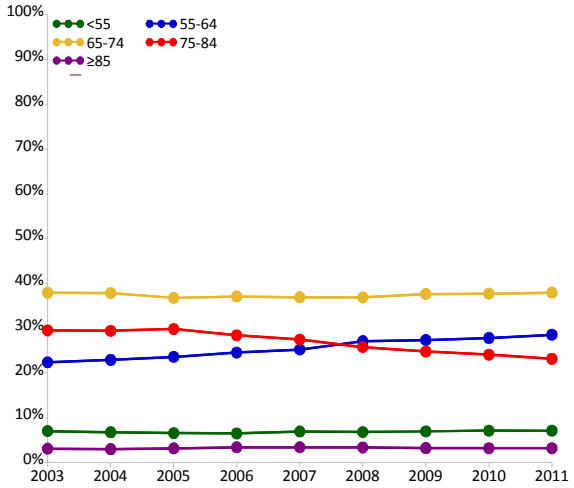
Primary total knee replacement is more common in females (56.4% in 2011). This proportion has remained reasonably constant since 2003 (Figure KT1).

Figure KT1: Primary Total Knee Replacement by Gender



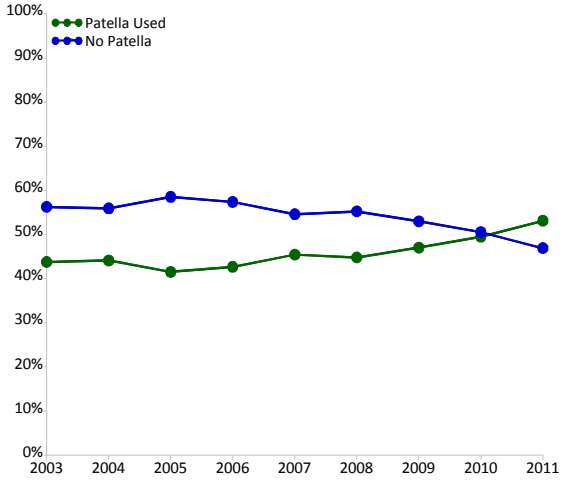
There has been a small increase in the proportion of patients aged 55-64 years (22.4% in 2003 to 28.5% in 2011). The proportion of patients aged 75-84 years has decreased from 29.5% to 23.2% during the same period. The proportion of patients aged less than 55 years is small (7.1% in 2011) and remains unchanged (Figure KT2).

Figure KT2: Primary Total Knee Replacement by Age



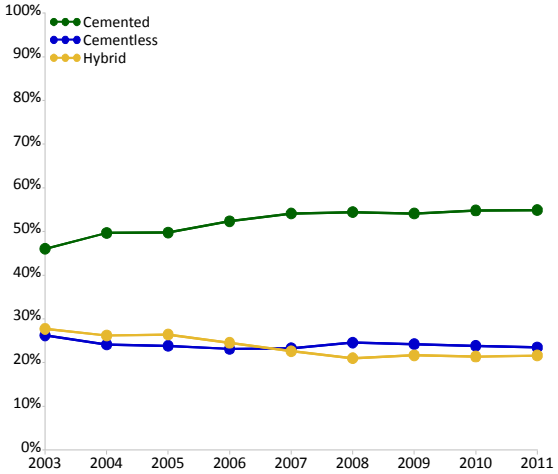
The use of patella resurfacing continues to increase from a low of 41.5% in 2005 to 53.1% in 2011 (Figure KT3).

Figure KT3: Primary Total Knee Replacement by Patella Usage



Cementing both the femoral and tibial components is the most common method of fixation. This has increased from 46.0% in 2003 to 54.9% in 2011 (Figure KT4).

Figure KT4: Primary Total Knee Replacement by Fixation



The reporting of the most used systems for primary total knee replacement is based on the femoral prosthesis used. In 2011, this was the Triathlon (18.3%), followed by Nexgen CR Flex (12.0%) and PFC Sigma (10.0%) (Table KT1). The Triathlon and PFC Sigma systems include a number of different types of femoral prostheses. However, Nexgen femoral prostheses are subdivided into Nexgen CR, Nexgen CR Flex, Nexgen LPS, Nexgen LPS Flex and Nexgen LCCK. In 2011, the use of all Nexgen femoral prostheses combined accounted for 20.6% of all primary total knee replacements.

The ten most used femoral prostheses for cemented, cementless and hybrid primary total knee replacement are listed in Tables KT2-KT4.

Detailed information on the demographics of primary total knee replacement is provided in the supplementary report 'Demographics of Knee Arthroplasty' available on the Registry website, www.dmac.adelaide.edu.au/aoanjrr/publications.jsp.

Table KT1: Ten Most Used Femoral Prostheses in Primary Total Knee Replacement

2003		2008		2009		2010		2011	
N	Model	N	Model	N	Model	N	Model	N	Model
3184	LCS	4049	PFC Sigma	4710	Triathlon	5819	Triathlon	7320	Triathlon
2847	Duracon	3795	LCS	3910	PFC Sigma	4372	PFC Sigma	4805	Nexgen CR Flex
2150	Nexgen CR	3480	Triathlon	3766	LCS	3912	Genesis II	4005	PFC Sigma
2115	Scorpio	3069	Nexgen CR Flex	3404	Nexgen CR Flex	3782	Nexgen CR Flex	3502	Genesis II
1944	PFC Sigma	2603	Genesis II	3198	Genesis II	3590	LCS	3451	LCS
1521	Genesis II	2355	Nexgen LPS Flex	2489	Nexgen LPS Flex	2764	Nexgen LPS Flex	2974	Genesis II Oxinium
1002	Natural Knee II	2097	Genesis II Oxinium	1976	Genesis II Oxinium	2709	Vanguard	2973	Vanguard
902	Nexgen LPS	1393	Duracon	1789	Vanguard	2388	Genesis II Oxinium	2621	Nexgen LPS Flex
883	Profix	1388	Scorpio	1281	Scorpio NRG	1109	Scorpio	1060	RBK
725	Genesis II Oxinium	1259	Vanguard	1176	Scorpio	1017	Scorpio NRG	933	Scorpio NRG
Ten Most Used									
17273 (10)	79.5%	25488 (10)	78.2%	27699 (10)	80.9%	31462 (10)	83.3%	33644 (10)	84.3%
Remainder									
4458 (39)	20.5%	7123 (47)	21.8%	6560 (47)	19.1%	6317 (47)	16.7%	6273 (49)	15.7%
TOTAL									
21731 (49)	100.0%	32611 (57)	100.0%	34259 (57)	100.0%	37779 (57)	100.0%	39917 (59)	100.0%

Table KT2: Ten Most Used Femoral Prostheses in Cemented Primary Total Knee Replacement

2003		2008		2009		2010		2011	
N	Model	N	Model	N	Model	N	Model	N	Model
1250	Duracon	2241	Nexgen LPS Flex	2617	Genesis II	3264	Genesis II	3499	Triathlon
1089	Genesis II	2208	PFC Sigma	2504	Triathlon	2923	Triathlon	2972	Genesis II Oxinium
984	LCS	2090	Genesis II Oxinium	2346	Nexgen LPS Flex	2462	Nexgen LPS Flex	2919	Genesis II
839	PFC Sigma	2024	Genesis II	2023	PFC Sigma	2311	Genesis II Oxinium	2366	Nexgen LPS Flex
828	Nexgen LPS	1960	Triathlon	1961	Genesis II Oxinium	2283	PFC Sigma	2102	PFC Sigma
793	Nexgen CR	1097	Nexgen CR Flex	1081	Nexgen CR Flex	1396	Nexgen CR Flex	1936	Nexgen CR Flex
713	Scorpio	776	LCS	881	Vanguard	1302	Vanguard	1442	Vanguard
690	Nexgen LPS Flex	746	Vanguard	814	LCS	900	LCS	1045	LCS
548	Genesis II Oxinium	674	Duracon	758	Scorpio NRG	548	Scorpio NRG	518	Scorpio NRG
506	Profix	593	Journey	597	Journey	472	Scorpio	321	Journey
Ten Most Used									
8240 (10)	82.4%	14409 (10)	81.2%	15582 (10)	84.0%	17861 (10)	86.3%	19120 (10)	87.2%
Remainder									
1766 (33)	17.6%	3345 (43)	18.8%	2958 (42)	16.0%	2845 (43)	13.7%	2797 (45)	12.8%
TOTAL									
10006 (43)	100.0%	17754 (53)	100.0%	18540 (52)	100.0%	20706 (53)	100.0%	21917 (55)	100.0%

Table KT3: Ten Most Used Femoral Prostheses in Cementless Primary Total Knee Replacement

2003		2008		2009		2010		2011	
N	Model	N	Model	N	Model	N	Model	N	Model
1470	LCS	2317	LCS	2093	LCS	1861	LCS	1907	Triathlon
788	Nexgen CR	1132	Nexgen CR Flex	1288	Triathlon	1596	Triathlon	1578	LCS
500	Scorpio	915	Triathlon	1194	Nexgen CR Flex	1255	Nexgen CR Flex	1563	Nexgen CR Flex
499	Natural Knee II	484	RBK	516	RBK	627	RBK	667	RBK
483	Active Knee	443	PFC Sigma	501	PFC Sigma	564	PFC Sigma	542	Vanguard
476	Duracon	442	Scorpio NRG	388	Scorpio NRG	472	Vanguard	486	Active Knee
314	PFC Sigma	388	Active Knee	311	Active Knee	388	Active Knee	476	PFC Sigma
302	RBK	303	Duracon	212	Score	368	Scorpio NRG	331	Scorpio NRG
187	Profix	217	Scorpio	209	Profix	194	Nexgen LPS Flex	203	Score
141	Maxim	164	Natural Knee II	201	Scorpio	189	Scorpio	197	Nexgen LPS Flex
Ten Most Used									
5160 (10)	90.5%	6805 (10)	84.9%	6913 (10)	83.3%	7514 (10)	83.5%	7950 (10)	84.8%
Remainder									
540 (12)	9.5%	1206 (21)	15.1%	1386 (19)	16.7%	1483 (21)	16.5%	1421 (20)	15.2%
TOTAL									
5700 (22)	100.0%	8011 (31)	100.0%	8299 (29)	100.0%	8997 (31)	100.0%	9371 (30)	100.0%

Table KT4: Ten Most Used Femoral Prostheses in Hybrid Primary Total Knee Replacement

2003		2008		2009		2010		2011	
N	Model	N	Model	N	Model	N	Model	N	Model
1121	Duracon	1398	PFC Sigma	1386	PFC Sigma	1525	PFC Sigma	1914	Triathlon
902	Scorpio	840	Nexgen CR Flex	1129	Nexgen CR Flex	1300	Triathlon	1427	PFC Sigma
791	PFC Sigma	702	LCS	918	Triathlon	1131	Nexgen CR Flex	1306	Nexgen CR Flex
730	LCS	605	Triathlon	859	LCS	935	Vanguard	989	Vanguard
569	Nexgen CR	590	Scorpio	753	Vanguard	829	LCS	828	LCS
377	Genesis II	478	Vanguard	494	Genesis II	511	Genesis II	452	Genesis II
249	Maxim	456	Genesis II	451	Scorpio	448	Scorpio	440	Scorpio
232	Natural Knee II	416	Duracon	225	Duracon	139	RBK	157	RBK
191	AGC	203	Scorpio NRG	143	Nexgen LPS Flex	123	Nexgen CR	156	Nexgen CR
190	Profix	130	Nexgen LPS	135	Scorpio NRG	108	Nexgen LPS Flex	109	Active Knee
Ten Most Used									
5352 (10)	88.8%	5818 (10)	85.0%	6493 (10)	87.5%	7049 (10)	87.3%	7778 (10)	90.1%
Remainder									
673 (25)	11.2%	1028 (31)	15.0%	927 (28)	12.5%	1027 (30)	12.7%	851 (30)	9.9%
TOTAL									
6025 (35)	100.0%	6846 (41)	100.0%	7420 (38)	100.0%	8076 (40)	100.0%	8629 (40)	100.0%

Outcome by Patient Characteristics

Primary total knee replacement has the lowest rate of revision compared to all other primary knee replacement procedures. The cumulative percent revision at 11 years for primary total knee undertaken for osteoarthritis is 6.1% (Table KT5 and Figure KT5).

Reason for Revision

The main reasons for revision are loosening/lysis (30.0%), infection (21.7%), patellofemoral pain (13.6%), pain (9.0%) and instability (5.8%) (Table KT6).

The five most common reasons for revision are shown on the revision diagnosis cumulative incidence graph (Figure KT6). The incidence of revision for infection increases rapidly in the first year, however after this it increases at a slower rate. Loosening/lysis exceeds infection to become the most common reason for revision after two years**.** The remaining reasons for revision have a low incidence.

Type of Revision

The most common types of revision are replacement of both the femoral and tibial prostheses (25.2%), patella only replacement (21.8%) and insert only exchange (19.8%) (Table KT7).

Primary Diagnosis

The four most common primary diagnoses are osteoarthritis, rheumatoid arthritis, other inflammatory arthritis and osteonecrosis (Tables KT 8 and KT9).

Rheumatoid arthritis has the lowest rate of revision. There is no significant difference between osteoarthritis and the other two diagnoses (Tables KT8 and KT9 and Figure KT7).

Age and Gender

Age is a major factor affecting the outcome of primary total knee replacement. The rate of revision decreases with increasing age. The age related difference in the rate of revision increases with time. After three and a half years, those aged less than 55 years have over five times the rate of revision compared to those aged 75 or older (Tables KT10 and KT11 and Figure KT8).

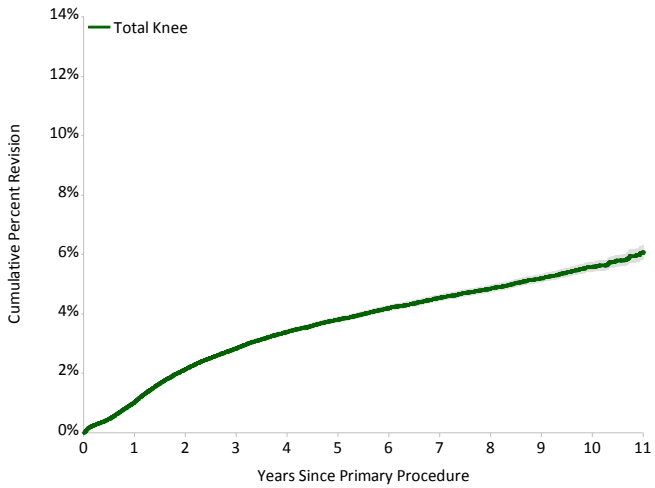
Males have a significantly higher rate of revision (Tables KT12 and KT13 and Figure KT9). Age related differences in outcome are evident for both males and females (Tables K14 and KT15 and Figures KT11 and KT12).

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. At 11 years the cumulative incidence of infection is 1.4% for males and 0.8% for females (Figure KT10).

Table KT5: Yearly Cumulative Percent Revision of Primary Total Knee Replacement (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Total Knee	1.0 (1.0, 1.1)	2.8 (2.8, 2.9)	3.8 (3.7, 3.9)	5.6 (5.4, 5.7)	6.1 (5.8, 6.3)

Figure KT5: Cumulative Percent Revision of Primary Total Knee Replacement (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Total Knee	301276	257003	178977	115592	11407	2777

Table KT6: Primary Total Knee Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	2960	30.0
Infection	2145	21.7
Patellofemoral Pain	1339	13.6
Pain	886	9.0
Instability	577	5.8
Arthrofibrosis	376	3.8
Fracture	234	2.4
Malalignment	213	2.2
Patella Erosion	199	2.0
Incorrect Sizing	148	1.5
Wear Tibial Insert	140	1.4
Metal Sensitivity	130	1.3
Other	533	5.4
TOTAL	**9880**	**100.0**

Table KT7: Primary Total Knee Replacement by Type of Revision

Type of Revision	Number	Percent
TKR (Tibial/Femoral)	2493	25.2
Patella Only	2151	21.8
Insert Only	1956	19.8
Tibial Component	1103	11.2
Insert/Patella	826	8.4
Femoral Component	696	7.0
Cement Spacer	563	5.7
Removal of Prostheses	54	0.5
Minor Components	23	0.2
Cement Only	6	0.1
Reinsertion of Components	6	0.1
Total Femoral	2	0.0
Patella/Trochlear Resurfacing	1	0.0
TOTAL	**9880**	**100.0**

Figure KT6: Revision Diagnosis Cumulative Incidence of Primary Total Knee Replacement

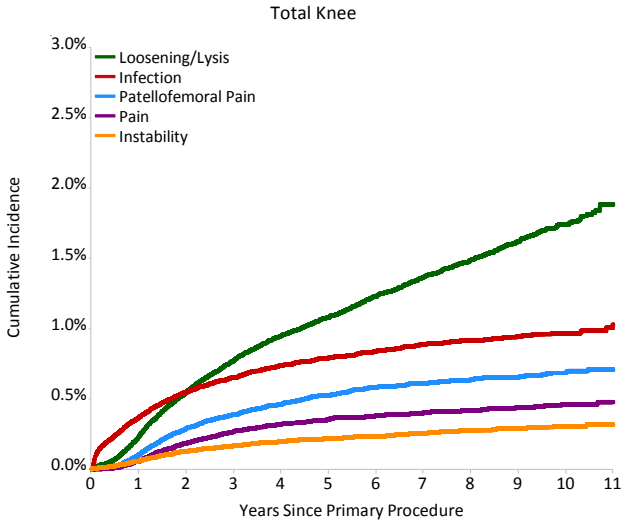


Table KT8: Revision Rates of Primary Total Knee Replacement by Primary Diagnosis

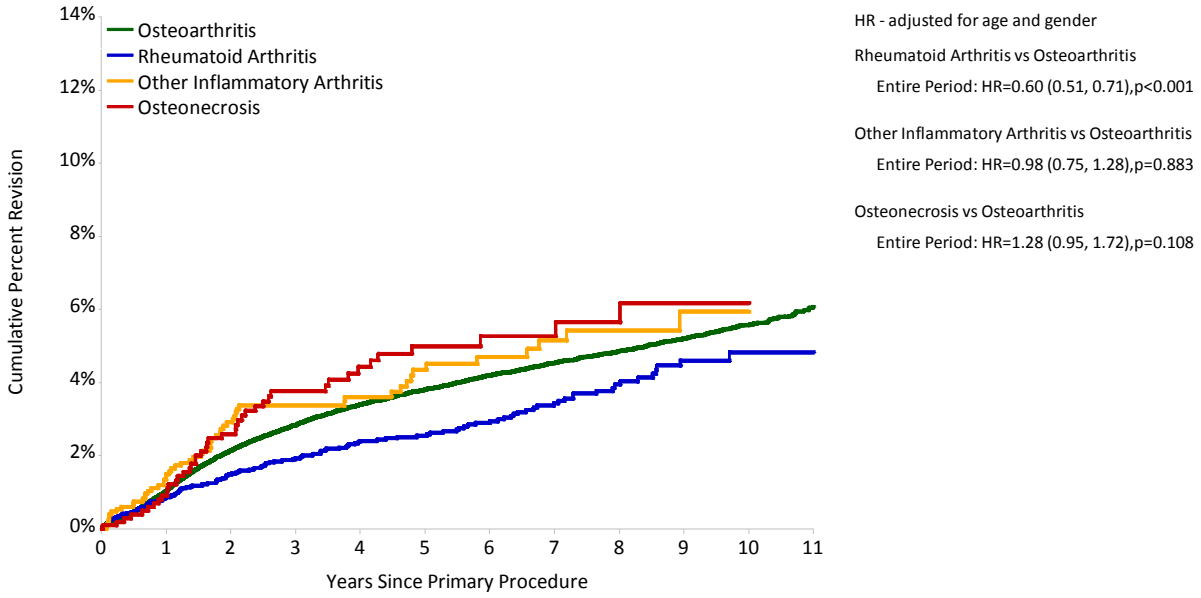
Primary Diagnosis	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Osteoarthritis	9597	301276	1296538	0.74 (0.73, 0.76)
Rheumatoid Arthritis	139	5163	25962	0.54 (0.45, 0.63)
Other Inflammatory Arthritis	56	1515	6806	0.82 (0.62, 1.07)
Osteonecrosis	43	1055	4791	0.90 (0.65, 1.21)
Other (5)	45	664	2249	2.00 (1.46, 2.68)
TOTAL	**9880**	**309673**	**1336347**	**0.74 (0.72, 0.75)**

Note: Only Primary Diagnoses with over 400 procedures have been listed.

Table KT9: Yearly Cumulative Percent Revision of Primary Total Knee Replacement by Primary Diagnosis

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Osteoarthritis	1.0 (1.0, 1.1)	2.8 (2.8, 2.9)	3.8 (3.7, 3.9)	5.6 (5.4, 5.7)	6.1 (5.8, 6.3)
Rheumatoid Arthritis	0.9 (0.6, 1.2)	1.9 (1.6, 2.4)	2.6 (2.1, 3.1)	4.8 (3.9, 5.9)	4.8 (3.9, 5.9)
Other Inflammatory Arthritis	1.5 (1.0, 2.3)	3.4 (2.5, 4.5)	4.4 (3.3, 5.8)	5.9 (4.4, 8.1)	
Osteonecrosis	0.9 (0.5, 1.7)	3.8 (2.7, 5.3)	5.0 (3.7, 6.8)	6.2 (4.4, 8.6)	
Other (5)	1.5 (0.8, 3.0)	6.8 (4.9, 9.6)	10.2 (7.4, 13.9)		

Figure KT7: Cumulative Percent Revision of Primary Total Knee Replacement by Primary Diagnosis



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Osteoarthritis	301276	257003	178977	115592	11407	2777
Rheumatoid Arthritis	5163	4574	3549	2503	312	91
Other Inflammatory Arthritis	1515	1289	904	603	97	27
Osteonecrosis	1055	939	655	436	42	4

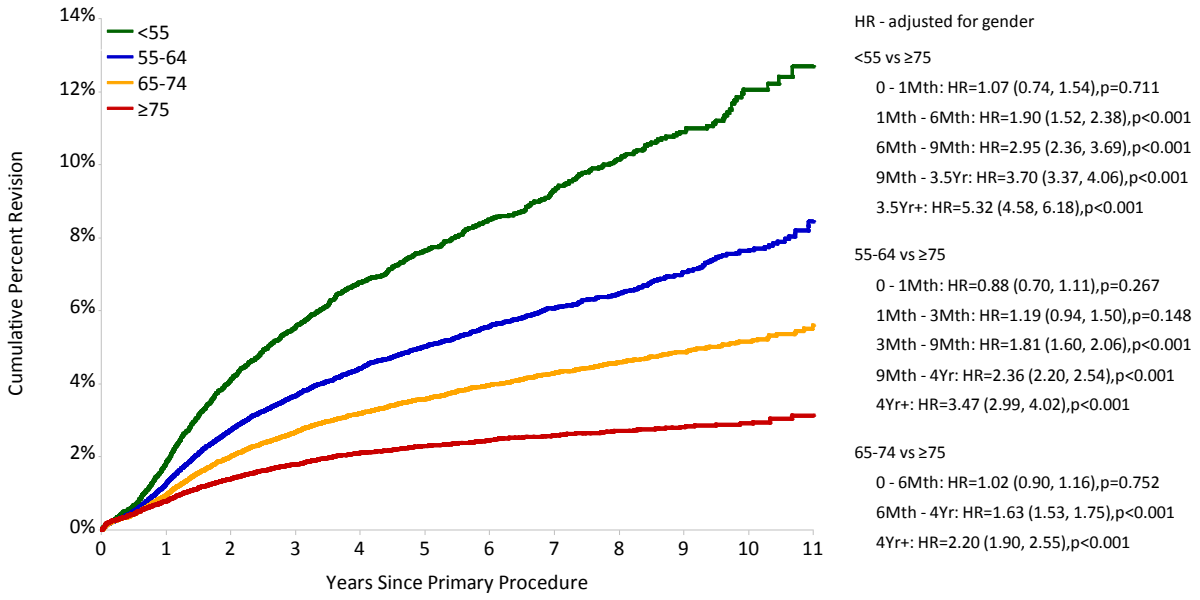
Table KT10: Revision Rates of Primary Total Knee Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
<55	1273	19720	84058	1.51 (1.43, 1.60)
55-64	3133	76339	316928	0.99 (0.95, 1.02)
65-74	3446	113838	500490	0.69 (0.67, 0.71)
≥75	1745	91379	395061	0.44 (0.42, 0.46)
TOTAL	**9597**	**301276**	**1296538**	**0.74 (0.73, 0.76)**

Table KT11: Yearly Cumulative Percent Revision of Primary Total Knee Replacement by Age (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
<55	1.9 (1.7, 2.1)	5.6 (5.2, 5.9)	7.6 (7.2, 8.1)	12.1 (11.2, 13.0)	12.7 (11.6, 13.9)
55-64	1.3 (1.2, 1.4)	3.7 (3.5, 3.8)	5.0 (4.8, 5.2)	7.6 (7.3, 8.0)	8.4 (7.9, 9.1)
65-74	1.0 (0.9, 1.0)	2.7 (2.6, 2.8)	3.6 (3.5, 3.7)	5.2 (4.9, 5.4)	5.6 (5.3, 5.9)
≥75	0.8 (0.7, 0.9)	1.8 (1.7, 1.9)	2.3 (2.2, 2.4)	2.9 (2.7, 3.1)	3.1 (2.9, 3.4)

Figure KT8: Cumulative Percent Revision of Primary Total Knee Replacement by Age (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
<55	19720	16663	11418	7439	803	196
55-64	76339	64110	43375	27561	2799	696
65-74	113838	97343	68311	45113	4912	1242
≥75	91379	78887	55873	35479	2893	643

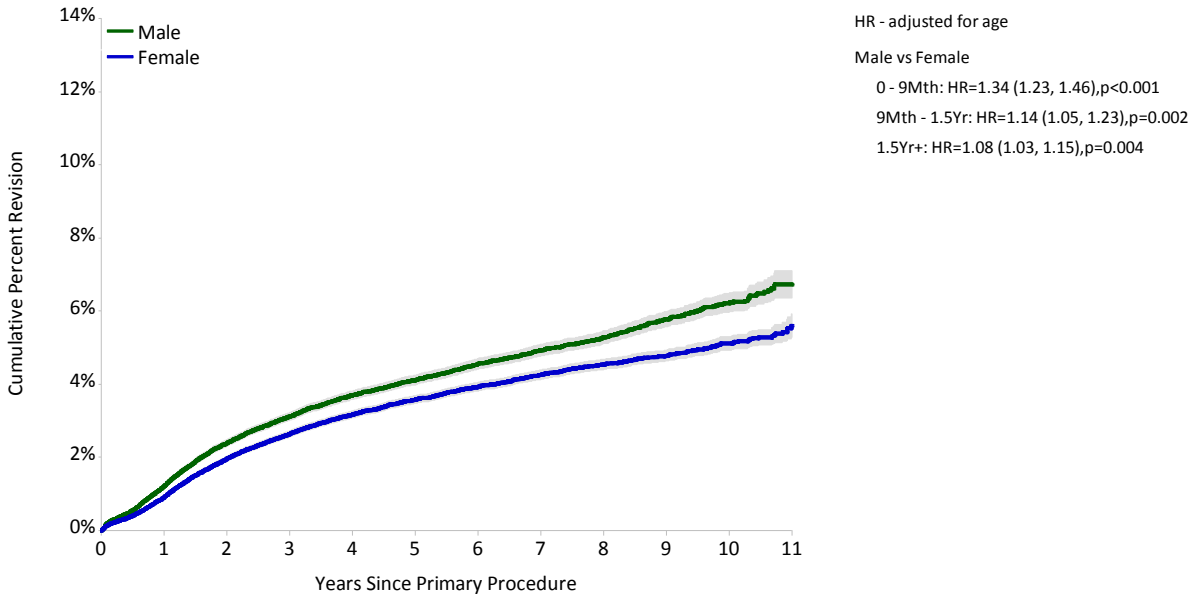
Table KT12: Revision Rates of Primary Total Knee Replacement by Gender (Primary Diagnosis OA)

Gender	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	4500	130099	549826	0.82 (0.79, 0.84)
Female	5097	171177	746712	0.68 (0.66, 0.70)
TOTAL	**9597**	**301276**	**1296538**	**0.74 (0.73, 0.76)**

Table KT13: Yearly Cumulative Percent Revision of Primary Total Knee Replacement by Gender (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	1.2 (1.2, 1.3)	3.1 (3.0, 3.2)	4.1 (4.0, 4.2)	6.2 (6.0, 6.5)	6.7 (6.4, 7.1)
Female	0.9 (0.9, 1.0)	2.6 (2.6, 2.7)	3.6 (3.5, 3.7)	5.1 (4.9, 5.3)	5.6 (5.3, 5.9)

Figure KT9: Cumulative Percent Revision of Primary Total Knee Replacement by Gender (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	130099	110210	75969	48510	4758	1178
Female	171177	146793	103008	67082	6649	1599

Figure KT10: Revision Diagnosis Cumulative Incidence of Primary Total Knee Replacement by Gender

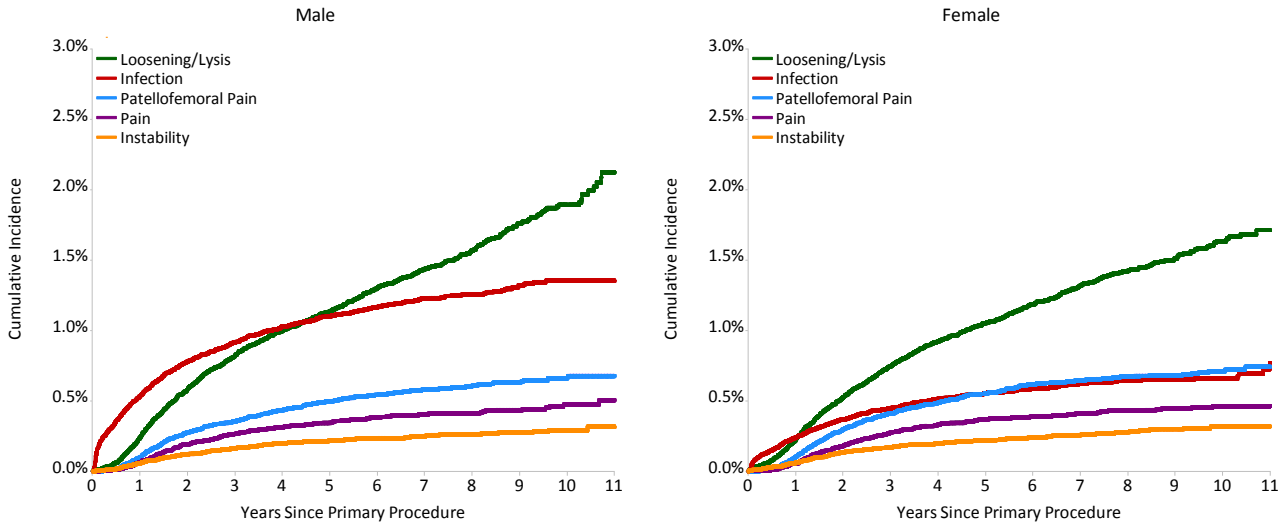


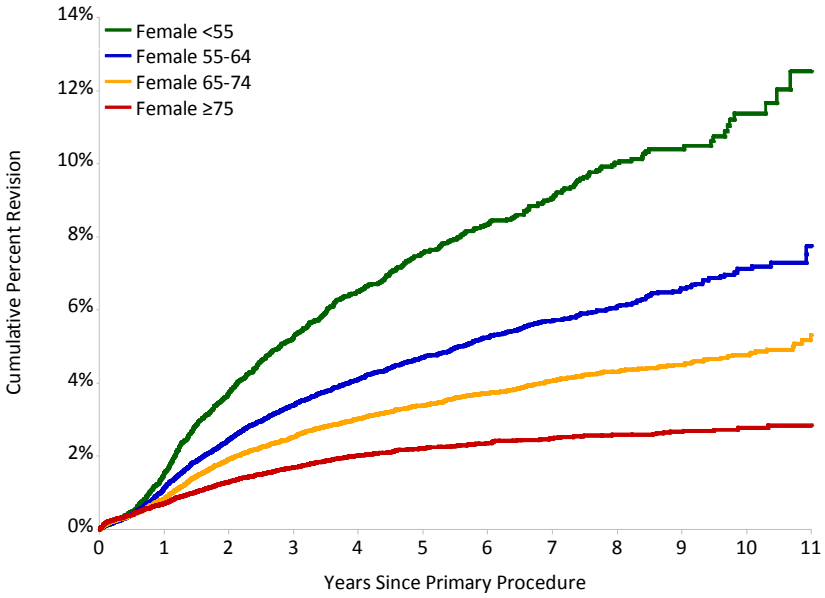
Table KT14: Revision Rates of Primary Total Knee Replacement by Gender and Age (Primary Diagnosis OA)

Gender	Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	<55	587	8609	36976	1.59 (1.46, 1.72)
	55-64	1552	34830	143730	1.08 (1.03, 1.13)
	65-74	1625	50328	217229	0.75 (0.71, 0.79)
	≥75	736	36332	151890	0.48 (0.45, 0.52)
Female	<55	686	11111	47082	1.46 (1.35, 1.57)
	55-64	1581	41509	173198	0.91 (0.87, 0.96)
	65-74	1821	63510	283261	0.64 (0.61, 0.67)
	≥75	1009	55047	243172	0.41 (0.39, 0.44)
TOTAL		**9597**	**301276**	**1296538**	**0.74 (0.73, 0.76)**

Table KT15: Yearly Cumulative Percent Revision of Primary Total Knee Replacement by Gender and Age (Primary Diagnosis OA)

Gender	Age	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	<55	2.3 (2.0, 2.6)	6.0 (5.4, 6.5)	7.7 (7.1, 8.4)	12.9 (11.5, 14.4)	12.9 (11.5, 14.4)
	55-64	1.4 (1.3, 1.6)	4.0 (3.8, 4.2)	5.4 (5.1, 5.7)	8.2 (7.7, 8.8)	9.3 (8.4, 10.2)
	65-74	1.1 (1.0, 1.2)	2.9 (2.7, 3.0)	3.8 (3.6, 4.0)	5.7 (5.3, 6.0)	5.9 (5.5, 6.4)
	≥75	0.9 (0.8, 1.0)	1.9 (1.8, 2.1)	2.4 (2.2, 2.6)	3.1 (2.9, 3.5)	3.6 (3.0, 4.3)
Female	<55	1.6 (1.3, 1.8)	5.2 (4.8, 5.7)	7.6 (7.0, 8.2)	11.4 (10.3, 12.6)	12.5 (10.9, 14.4)
	55-64	1.1 (1.0, 1.3)	3.4 (3.2, 3.6)	4.7 (4.5, 5.0)	7.1 (6.7, 7.6)	7.8 (7.0, 8.6)
	65-74	0.9 (0.8, 0.9)	2.5 (2.4, 2.7)	3.4 (3.2, 3.6)	4.8 (4.5, 5.0)	5.3 (4.8, 5.8)
	≥75	0.7 (0.6, 0.8)	1.7 (1.6, 1.8)	2.2 (2.1, 2.4)	2.8 (2.6, 3.0)	2.8 (2.6, 3.1)

Figure KT11: Cumulative Percent Revision of Primary Total Knee Replacement for Females by Age (Primary Diagnosis OA)



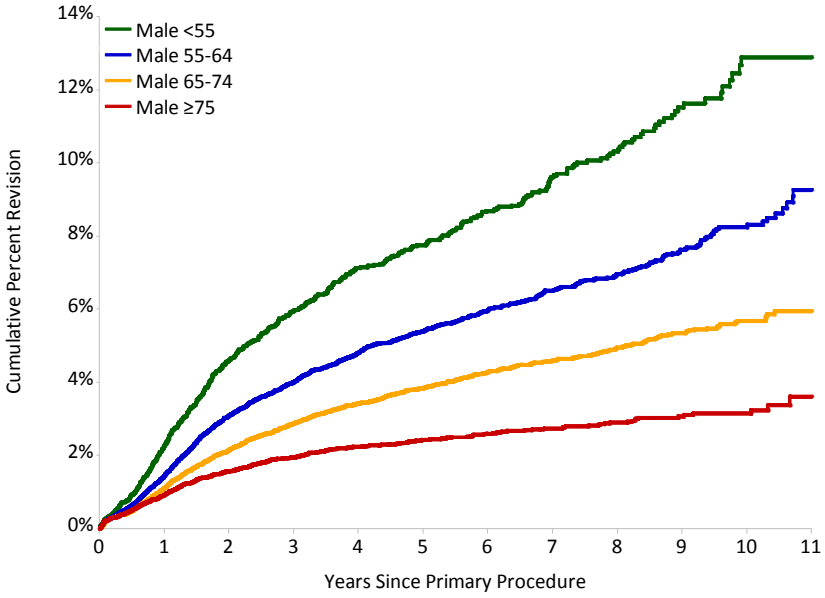
Female <55 vs Female ≥75
0 - 1Mth: HR=0.70 (0.38, 1.30),p=0.258
1Mth - 6Mth: HR=1.51 (1.08, 2.11),p=0.015
6Mth - 9Mth: HR=2.56 (1.83, 3.58),p<0.001
9Mth - 4Yr: HR=4.10 (3.64, 4.63),p<0.001
4Yr+: HR=5.33 (4.37, 6.49),p<0.001

Female 55-64 vs Female ≥75
0 - 3Mth: HR=0.80 (0.61, 1.03),p=0.085
3Mth - 9Mth: HR=1.69 (1.37, 2.08),p<0.001
9Mth - 4Yr: HR=2.47 (2.23, 2.72),p<0.001
4Yr+: HR=3.12 (2.66, 3.65),p<0.001

Female 65-74 vs Female ≥75
0 - 3Mth: HR=0.93 (0.74, 1.16),p=0.495
3Mth - 9Mth: HR=1.17 (0.96, 1.44),p=0.126
9Mth+: HR=1.79 (1.64, 1.96),p<0.001

Number at Risk		0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Female	<55	11111	9432	6438	4127	427	106
	55-64	41509	34962	23742	15137	1493	362
	65-74	63510	54529	38519	25749	2877	736
	≥75	55047	47870	34309	22069	1852	395

Figure KT12: Cumulative Percent Revision of Primary Total Knee Replacement for Males by Age (Primary Diagnosis OA)



Male <55 vs Male ≥75
0 - 1Mth: HR=1.51 (0.96, 2.39),p=0.076
1Mth - 9Mth: HR=2.25 (1.78, 2.84),p<0.001
9Mth - 1.5Yr: HR=3.33 (2.68, 4.14),p<0.001
1.5Yr+: HR=4.45 (3.80, 5.22),p<0.001

Male 55-64 vs Male ≥75
0 - 1Mth: HR=1.15 (0.85, 1.56),p=0.352
1Mth - 6Mth: HR=1.49 (1.20, 1.86),p<0.001
6Mth - 9Mth: HR=1.47 (1.16, 1.86),p=0.001
9Mth - 1.5Yr: HR=2.23 (1.87, 2.65),p<0.001
1.5Yr+: HR=2.97 (2.60, 3.39),p<0.001

Male 65-74 vs Male ≥75
0 - 9Mth: HR=1.07 (0.92, 1.26),p=0.376
9Mth - 1.5Yr: HR=1.51 (1.27, 1.80),p<0.001
1.5Yr+: HR=2.03 (1.78, 2.32),p<0.001

Number at Risk		0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Male	<55	8609	7231	4980	3312	376	90
	55-64	34830	29148	19633	12424	1306	334
	65-74	50328	42814	29792	19364	2035	506
	≥75	36332	31017	21564	13410	1041	248

Outcome by Prosthesis Characteristics

Fixed and Mobile Bearing

Tibial prostheses are either modular or non-modular. Modular prostheses have a metal baseplate and tibial insert. The insert 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 bearings have a lower rate of revision compared to all mobile bearings. This difference is significant for rotating and rotating-sliding bearings (Tables KT16 and KT17 and Figure KT13).

There are also differences within the fixed bearing group. All-polyethylene tibial prostheses have a higher rate of revision compared to both moulded non-modular and fixed modular tibial prostheses (Tables KT18 and KT19 and Figure KT14).

Stability

Stability refers to particular prosthetic features intended to substitute for the intrinsic stability of knee ligaments. The two categories most relevant to primary total knee replacement 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 is defined as a prosthesis with a peg and box design intended to provide additional posterior stability. Alternatively, the additional posterior stability can be provided by a cam and groove design. This design is used less frequently.

Fully stabilised (large peg and box design) and hinged are additional prostheses that provide collateral as well as posterior ligament stability. These prostheses are infrequently used in primary procedures (Table KT20) and if used it is usually in complex clinical situations. Therefore, these prostheses have not been included in any comparative outcome analysis for primary total knee replacement.

Posterior stabilised prostheses have a significantly higher rate of revision compared to minimally stabilised (Tables KT20 and KT21 and Figure KT15).

Patellar Resurfacing

There is an increasing use of patellar resurfacing. In 2003 43.8% of patellae were resurfaced compared to 53.1% in 2011. Resurfacing the patella is associated with a lower rate of revision (Tables KT22 and KT23 and Figure KT16).

The rate of revision when resurfacing the patella varies between minimally and posterior stabilised prostheses. Posterior stabilised without patellar resurfacing has the highest rate of revision (Tables KT24 and KT25 and Figure KT17).

Fixation

The outcome varies depending on fixation. Hybrid fixation has the lowest rate of revision. For the first time the Registry has identified a difference between cemented and cementless fixation. Cementless fixation has a higher rate of revision than cemented (HR=1.05, p=0.045) (Tables KT26 and KT27 and Figure KT18).

Prostheses Types

There are 357 femoral and tibial prostheses combinations for primary total knee replacement recorded by the Registry, 35 more than 2010. The revisions per 100 observed component years and yearly cumulative percent revision of the 83 combinations with more than 400 procedures are listed in Tables KT28 – KT33. Although the listed combinations are a small proportion of the possible combinations, they represent 95.0% of all primary total knee replacements.

The 'Other' group is the combined outcome of all prostheses combinations with less than 400 procedures. This group has 274 combinations and accounts for 5.0% of all primary total knee replacement.

There are 32 cemented total femoral and tibial prostheses combinations with more than 400 procedures. The rate of revision per 100 observed component years varies from 0.31 to 1.79. The Nexgen CR/Nexgen has the lowest cumulative percent revision at 11 years of 4.0% (Tables KT28 and KT29).

There are 27 cementless total femoral and tibial prostheses combinations with more than 400 procedures. The rate of revision per 100 observed component years varies from 0.32 to 2.16 revisions. The Advantim/Advantim has the lowest cumulative percent revision at 11 years of 2.2% (Tables KT30 and KT31).

There are 24 combinations of total knee replacement with hybrid fixation with more than 400 procedures. The rate of revision per 100 observed component years varies from 0.36 to 1.33. The Nexgen CR/Nexgen has the lowest cumulative percent revision at 11 years of 3.1% (Tables KT32 and KT33).

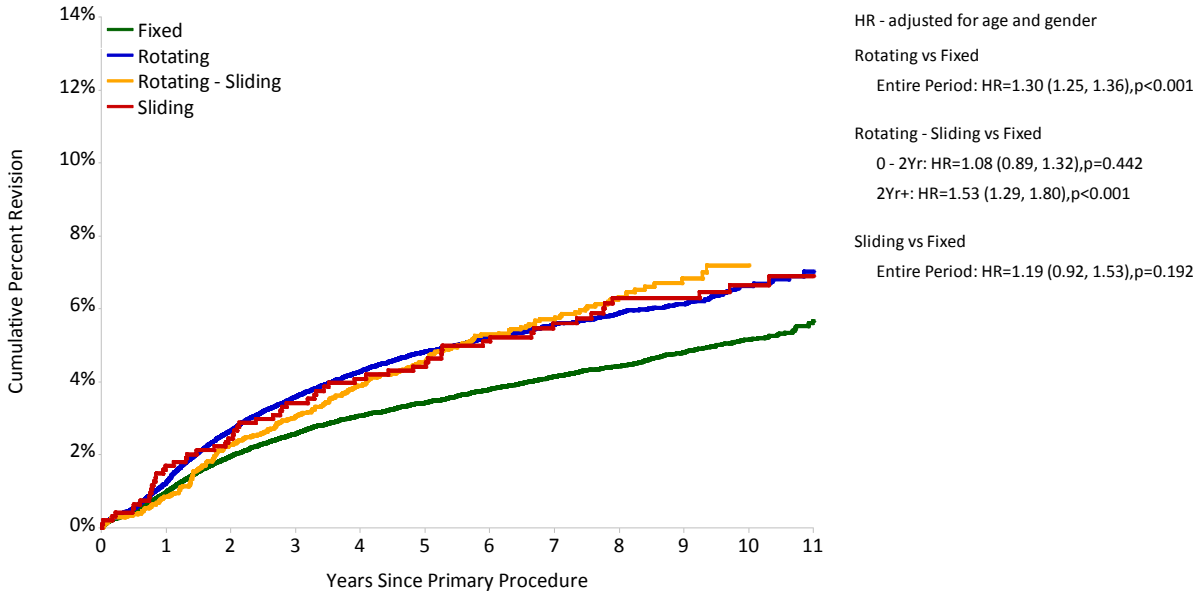
Table KT16: Revision Rates of Primary Total Knee Replacement by Bearing Mobility (Primary Diagnosis OA)

Bearing Mobility	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Fixed	6367	224401	938176	0.68 (0.66, 0.70)
Rotating	2920	71236	320642	0.91 (0.88, 0.94)
Rotating - Sliding	247	4576	28711	0.86 (0.76, 0.97)
Sliding	59	948	8337	0.71 (0.54, 0.91)
Unknown	4	115	673	0.59 (0.16, 1.52)
TOTAL	**9597**	**301276**	**1296538**	**0.74 (0.73, 0.76)**

Table KT17: Yearly Cumulative Percent Revision of Primary Total Knee Replacement by Bearing Mobility (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Fixed	1.0 (0.9, 1.0)	2.6 (2.5, 2.7)	3.4 (3.3, 3.5)	5.1 (5.0, 5.3)	5.7 (5.4, 6.0)
Rotating	1.3 (1.2, 1.3)	3.6 (3.4, 3.7)	4.8 (4.6, 5.0)	6.6 (6.3, 7.0)	7.0 (6.6, 7.5)
Rotating - Sliding	0.8 (0.6, 1.2)	3.1 (2.6, 3.6)	4.5 (4.0, 5.2)	7.2 (6.2, 8.3)	
Sliding	1.7 (1.0, 2.8)	3.4 (2.4, 4.8)	4.4 (3.3, 6.0)	6.7 (5.2, 8.5)	6.9 (5.4, 8.9)

Figure KT13: Cumulative Percent Revision of Primary Total Knee Replacement by Bearing Mobility (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Fixed	224401	188879	128789	82705	8052	1976
Rotating	71236	62672	45169	28843	2733	573
Rotating - Sliding	4576	4417	4046	3133	170	13
Sliding	948	925	883	840	442	213

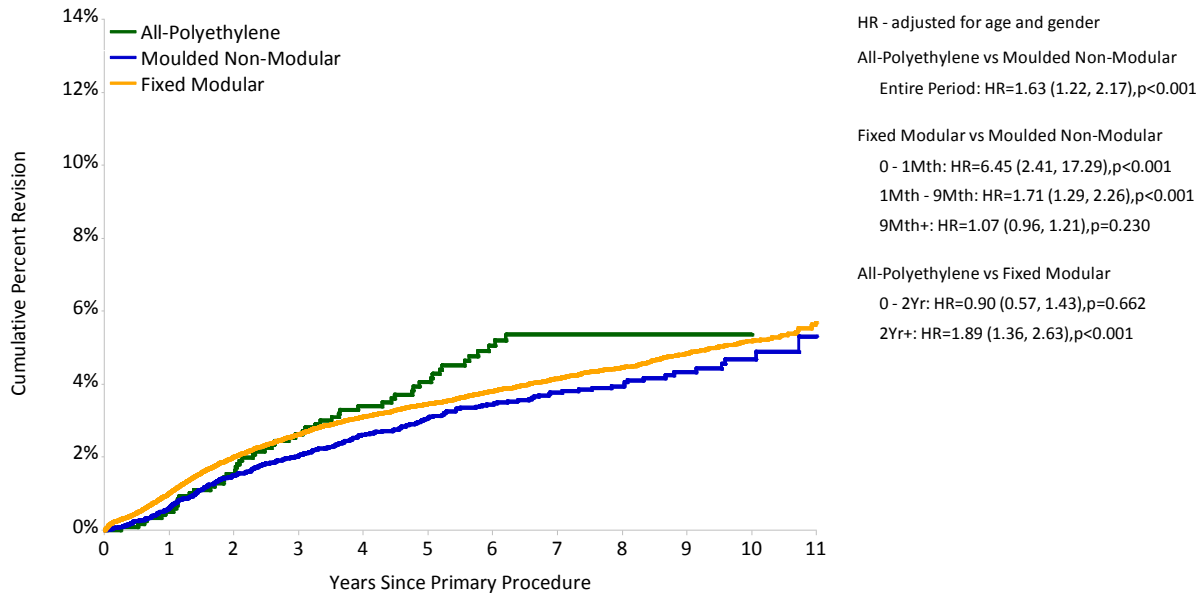
Table KT18: Revision Rates of Primary Total Knee Replacement by Fixed Bearing Type (Primary Diagnosis OA)

Fixed Bearing Type	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
All-Polyethylene	54	1208	7301	0.74 (0.56, 0.97)
Moulded Non-Modular	346	14334	59146	0.58 (0.52, 0.65)
Fixed Modular	5967	208859	871728	0.68 (0.67, 0.70)
TOTAL	**6367**	**224401**	**938176**	**0.68 (0.66, 0.70)**

Table KT19: Yearly Cumulative Percent Revision of Primary Total Knee Replacement by Fixed Bearing Type (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
All-Polyethylene	0.5 (0.2, 1.1)	2.6 (1.8, 3.7)	4.0 (3.0, 5.4)	5.4 (4.1, 7.0)	
Moulded Non-Modular	0.6 (0.5, 0.8)	2.0 (1.8, 2.3)	3.1 (2.7, 3.5)	4.7 (4.0, 5.4)	5.3 (4.3, 6.6)
Fixed Modular	1.0 (1.0, 1.1)	2.6 (2.5, 2.7)	3.4 (3.4, 3.5)	5.2 (5.0, 5.4)	5.7 (5.4, 6.0)

Figure KT14: Cumulative Percent Revision of Primary Total Knee Replacement by Fixed Bearing Type (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
All-Polyethylene	1208	1173	1039	839	42	5
Moulded Non-Modular	14334	12303	8371	5024	506	150
Fixed Modular	208859	175403	119379	76842	7504	1821

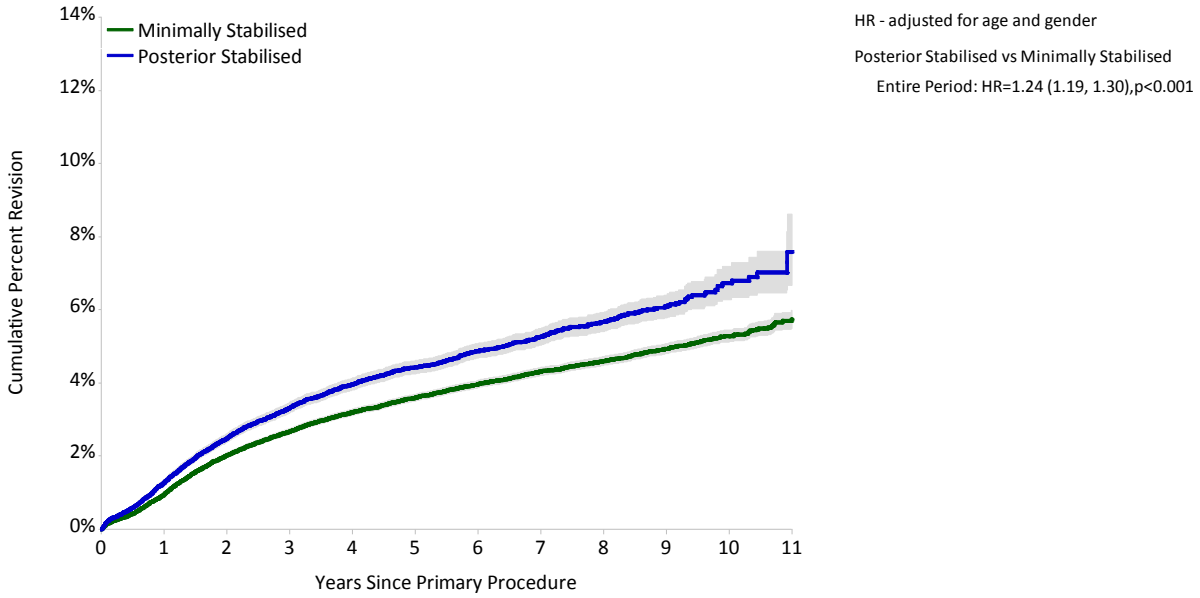
Table KT20: Revision Rates of Primary Total Knee Replacement by Stability (Primary Diagnosis OA)

Stability	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Minimally Stabilised	6815	219130	995731	0.68 (0.67, 0.70)
Posterior Stabilised	2740	81022	296818	0.92 (0.89, 0.96)
Fully Stabilised	24	685	2319	1.03 (0.66, 1.54)
Hinged	14	324	996	1.41 (0.77, 2.36)
Unknown	4	115	673	0.59 (0.16, 1.52)
TOTAL	**9597**	**301276**	**1296538**	**0.74 (0.73, 0.76)**

Table KT21: Yearly Cumulative Percent Revision of Primary Total Knee Replacement by Stability (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Minimally Stabilised	1.0 (0.9, 1.0)	2.7 (2.6, 2.7)	3.6 (3.5, 3.7)	5.3 (5.1, 5.4)	5.7 (5.5, 6.0)
Posterior Stabilised	1.3 (1.2, 1.4)	3.3 (3.2, 3.5)	4.4 (4.2, 4.6)	6.7 (6.3, 7.2)	7.6 (6.7, 8.6)

Figure KT15: Cumulative Percent Revision of Primary Total Knee Replacement by Stability (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Minimally Stabilised	219130	188386	135717	92190	10085	2475
Posterior Stabilised	81022	67708	42749	23088	1290	298

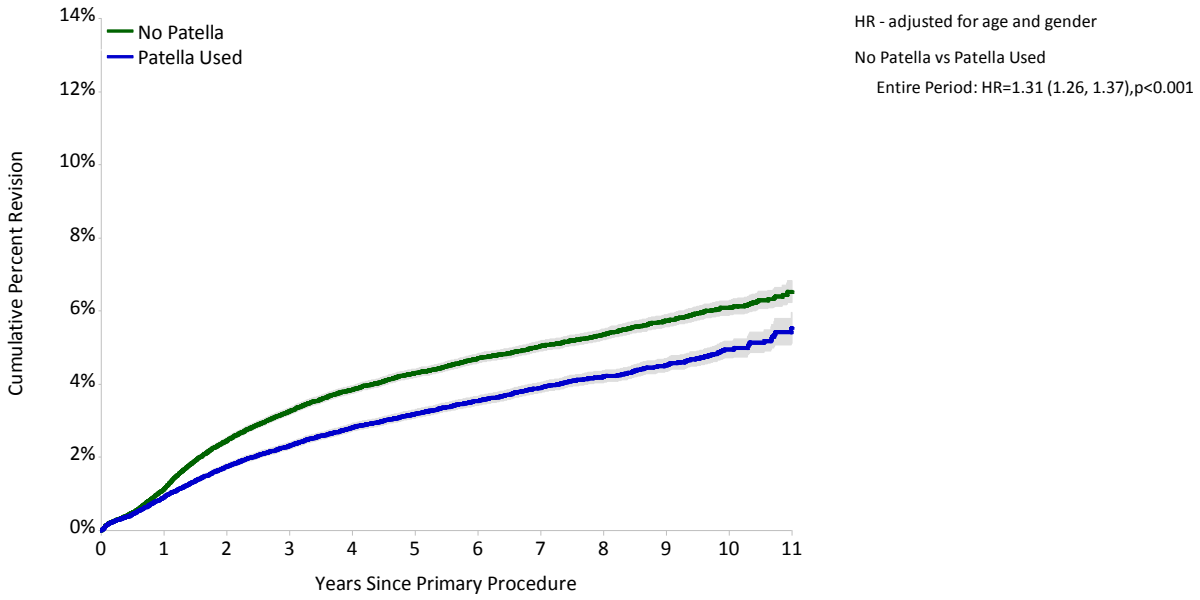
Table KT22: Revision Rates of Primary Total Knee Replacement by Patella Usage (Primary Diagnosis OA)

Patella Usage	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
No Patella	6022	163994	730059	0.82 (0.80, 0.85)
Patella Used	3575	137282	566479	0.63 (0.61, 0.65)
TOTAL	**9597**	**301276**	**1296538**	**0.74 (0.73, 0.76)**

Table KT23: Yearly Cumulative Percent Revision of Primary Total Knee Replacement by Patella Usage (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
No Patella	1.2 (1.1, 1.2)	3.3 (3.2, 3.4)	4.3 (4.2, 4.4)	6.1 (5.9, 6.3)	6.5 (6.2, 6.8)
Patella Used	0.9 (0.9, 1.0)	2.3 (2.2, 2.4)	3.2 (3.1, 3.3)	4.9 (4.7, 5.2)	5.5 (5.1, 6.0)

Figure KT16: Cumulative Percent Revision of Primary Total Knee Replacement by Patella Usage (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
No Patella	163994	142496	101217	66185	6871	1894
Patella Used	137282	114507	77760	49407	4536	883

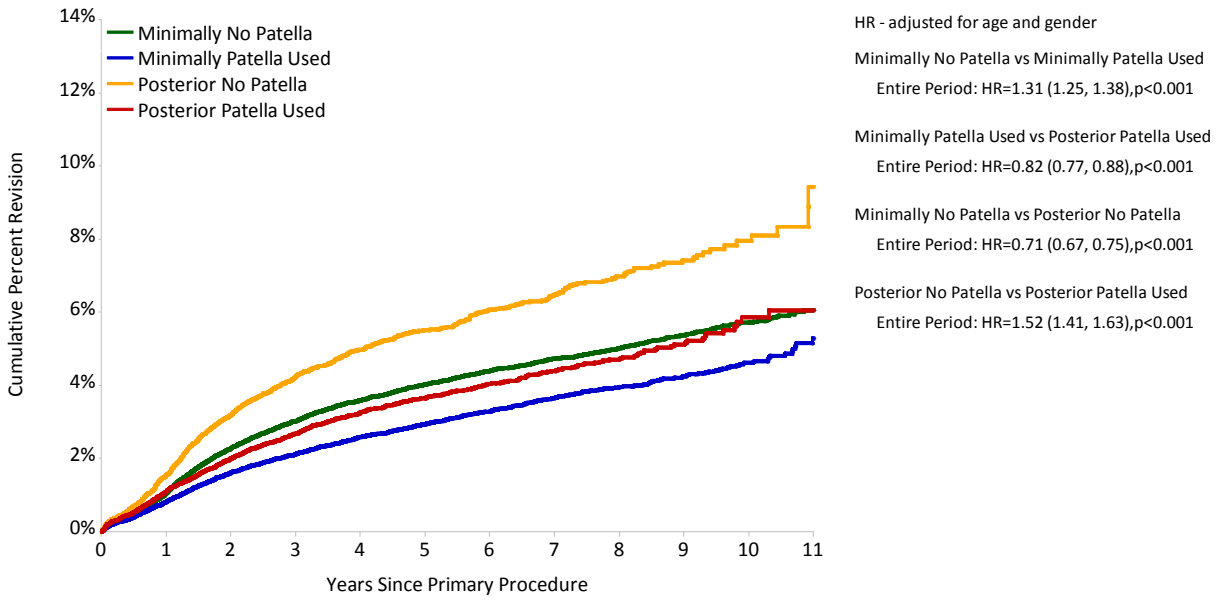
Table KT24: Revision Rates of Primary Total Knee Replacement by Stability and Patella Usage (Primary Diagnosis OA)

Stability	Patella Usage	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Minimally	No Patella	4582	131514	604385	0.76 (0.74, 0.78)
	Patella Used	2233	87616	391346	0.57 (0.55, 0.59)
Posterior	No Patella	1416	31916	123477	1.15 (1.09, 1.21)
	Patella Used	1324	49106	173341	0.76 (0.72, 0.81)
TOTAL		**9555**	**300152**	**1292549**	**0.74 (0.72, 0.75)**

Table KT25: Yearly Cumulative Percent Revision of Primary Total Knee Replacement by Stability and Patella Usage (Primary Diagnosis OA)

Stability	Patella Usage	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Minimally	No Patella	1.1 (1.0, 1.1)	3.0 (2.9, 3.1)	4.0 (3.9, 4.1)	5.7 (5.5, 5.9)	6.1 (5.8, 6.3)
	Patella Used	0.8 (0.8, 0.9)	2.1 (2.0, 2.2)	2.9 (2.8, 3.1)	4.6 (4.4, 4.9)	5.3 (4.8, 5.8)
Posterior	No Patella	1.5 (1.4, 1.7)	4.2 (4.0, 4.5)	5.5 (5.2, 5.8)	7.9 (7.3, 8.6)	9.4 (7.8, 11.3)
	Patella Used	1.1 (1.0, 1.2)	2.7 (2.5, 2.8)	3.6 (3.4, 3.9)	5.9 (5.3, 6.5)	6.0 (5.4, 6.8)

Figure KT17: Cumulative Percent Revision of Primary Total Knee Replacement by Stability and Patella Usage (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Minimally	No Patella	131514	114328	82912	56155	6235	1739
	Patella Used	87616	74058	52805	36035	3850	736
Posterior	No Patella	31916	27701	18014	9843	620	153
	Patella Used	49106	40007	24735	13245	670	145

Table KT26: Revision Rates of Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)

Fixation	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Cemented	4664	156442	650478	0.72 (0.70, 0.74)
Cementless	2533	72074	311055	0.81 (0.78, 0.85)
Hybrid	2210	72341	332821	0.66 (0.64, 0.69)
TOTAL	**9407**	**300857**	**1294354**	**0.73 (0.71, 0.74)**

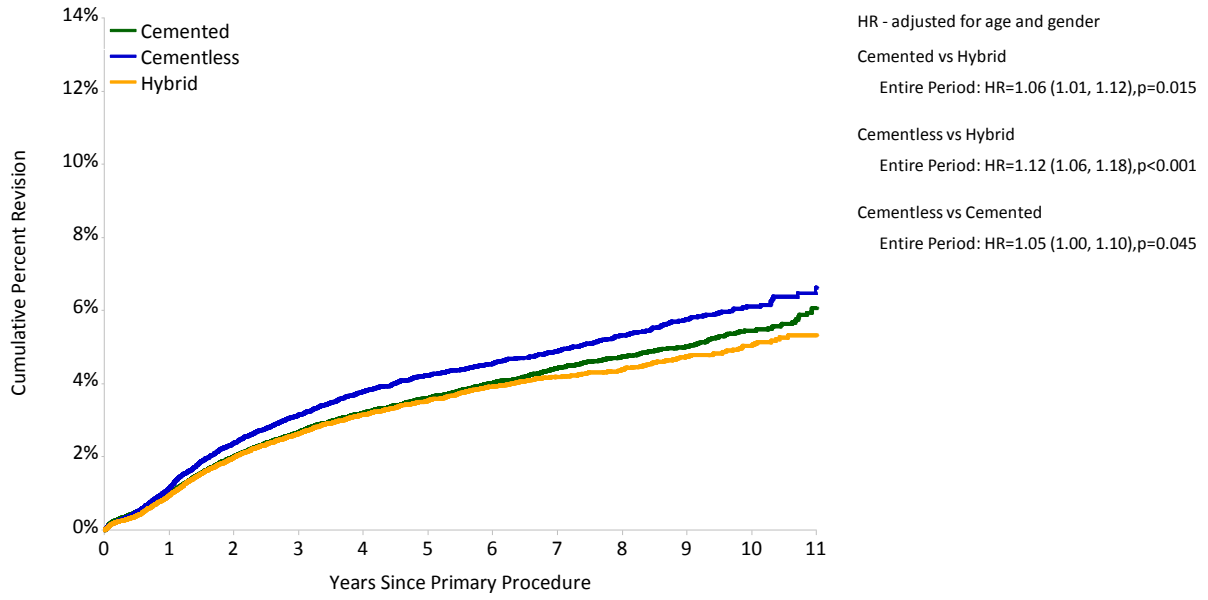
Note: Excluding cementless Genesis Oxinium and Profix Oxinium femoral prostheses

Table KT27: Yearly Cumulative Percent Revision of Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Cemented	1.0 (1.0, 1.1)	2.7 (2.6, 2.8)	3.6 (3.5, 3.7)	5.4 (5.2, 5.7)	6.1 (5.7, 6.4)
Cementless	1.2 (1.1, 1.2)	3.1 (3.0, 3.3)	4.2 (4.0, 4.4)	6.1 (5.8, 6.4)	6.6 (6.1, 7.2)
Hybrid	1.0 (0.9, 1.0)	2.6 (2.5, 2.8)	3.5 (3.4, 3.7)	5.0 (4.8, 5.3)	5.3 (5.0, 5.7)

Note: Excluding cementless Genesis Oxinium and Profix Oxinium femoral prostheses

Figure KT18: Cumulative Percent Revision of Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Cemented	156442	132421	90411	56425	5652	1350
Cementless	72074	61590	42924	27745	2471	626
Hybrid	72341	62636	45411	31202	3284	801

Table KT28: Revision Rates of Primary Total Knee Replacement with Cement Fixation

Femoral Component	Tibial Component	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
AGC	AGC	132	3354	20337	0.65 (0.54, 0.77)
Active Knee	Active Knee	18	716	2073	0.87 (0.51, 1.37)
Advance	Advance	45	791	4190	1.07 (0.78, 1.44)
BalanSys	BalanSys	13	555	2006	0.65 (0.34, 1.11)
Duracon	Duracon	342	9280	58104	0.59 (0.53, 0.65)
Evolis	Evolis	3	406	682	0.44 (0.09, 1.29)
Genesis II	Genesis II	581	20444	81083	0.72 (0.66, 0.78)
Genesis II	Mobile Bearing Knee	20	421	1882	1.06 (0.65, 1.64)
Genesis II Oxinium	Genesis II	501	15519	53253	0.94 (0.86, 1.03)
Journey	Journey	113	2446	6323	1.79 (1.47, 2.15)
Kinemax Plus	Kinemax Plus	72	1827	13344	0.54 (0.42, 0.68)
LCS	LCS	253	4106	32273	0.78 (0.69, 0.89)
LCS	MBT	172	6711	25128	0.68 (0.59, 0.79)
Maxim	Maxim	29	567	3904	0.74 (0.50, 1.07)
Natural Knee II	Natural Knee II	39	1629	8867	0.44 (0.31, 0.60)
Nexgen CR	Nexgen	80	3553	25417	0.31 (0.25, 0.39)
Nexgen CR Flex	Nexgen	98	7660	22489	0.44 (0.35, 0.53)
Nexgen LPS	Nexgen	163	4737	30007	0.54 (0.46, 0.63)
Nexgen LPS Flex	Nexgen	459	17089	61586	0.75 (0.68, 0.82)
Optetrak-PS	Optetrak	105	1760	7232	1.45 (1.19, 1.76)
Optetrak-PS	Optetrak RBK	25	490	1514	1.65 (1.07, 2.44)
PFC Sigma	MBT	131	5321	20173	0.65 (0.54, 0.77)
PFC Sigma	PFC Sigma	286	12715	54125	0.53 (0.47, 0.59)
Profix	Profix	119	3295	19497	0.61 (0.51, 0.73)
Profix Oxinium	Profix	64	954	5107	1.25 (0.97, 1.60)
RBK	RBK	41	1467	5140	0.80 (0.57, 1.08)
Scorpio	Scorpio	43	826	5184	0.83 (0.60, 1.12)
Scorpio	Scorpio+	52	1223	6354	0.82 (0.61, 1.07)
Scorpio	Series 7000	172	4785	24590	0.70 (0.60, 0.81)
Scorpio NRG	Series 7000	26	2555	5587	0.47 (0.30, 0.68)
Triathlon	Triathlon	218	13161	29552	0.74 (0.64, 0.84)
Vanguard	Maxim	99	4495	8948	1.11 (0.90, 1.35)
Other (127)		332	7020	29247	1.14 (1.02, 1.26)
TOTAL		**4846**	**161878**	**675196**	**0.72 (0.70, 0.74)**

Note: Some Cementless components have been cemented.
Only combinations with over 400 procedures have been listed.

Table KT29: Yearly Cumulative Percent Revision of Primary Total Knee Replacement with Cement Fixation

Femoral Component	Tibial Component	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
AGC	AGC	0.6 (0.3, 0.9)	2.4 (1.9, 3.0)	3.6 (3.0, 4.4)	5.6 (4.7, 6.8)	6.6 (5.0, 8.5)
Active Knee	Active Knee	1.1 (0.5, 2.3)	3.1 (1.8, 5.2)	3.6 (2.1, 6.1)		
Advance	Advance	1.7 (1.0, 2.9)	4.8 (3.4, 6.8)	5.8 (4.2, 7.9)	8.5 (6.3, 11.4)	
BalanSys	BalanSys	0.4 (0.1, 1.7)	2.8 (1.5, 5.5)	3.9 (2.1, 7.0)		
Duracon	Duracon	1.0 (0.8, 1.2)	2.5 (2.2, 2.8)	3.3 (3.0, 3.7)	4.9 (4.3, 5.5)	5.2 (4.4, 6.1)
Evolis	Evolis	0.3 (0.0, 2.0)	1.2 (0.4, 3.7)			
Genesis II	Genesis II	1.1 (1.0, 1.3)	2.8 (2.6, 3.1)	3.6 (3.3, 3.9)	4.7 (4.3, 5.2)	5.0 (4.3, 5.8)
Genesis II	Mobile Bearing Knee	1.8 (0.8, 3.6)	3.6 (2.1, 6.2)	5.4 (3.3, 8.7)		
Genesis II Oxinium	Genesis II	1.3 (1.1, 1.5)	3.2 (2.9, 3.6)	4.5 (4.1, 4.9)	7.4 (5.7, 9.6)	
Journey	Journey	1.8 (1.3, 2.4)	5.4 (4.5, 6.6)	7.3 (5.9, 9.1)		
Kinemax Plus	Kinemax Plus	0.9 (0.6, 1.5)	2.5 (1.8, 3.3)	3.1 (2.4, 4.0)	4.7 (3.7, 6.0)	5.2 (3.9, 6.9)
LCS	LCS	1.0 (0.7, 1.4)	3.7 (3.2, 4.4)	5.0 (4.4, 5.7)	6.8 (6.0, 7.8)	7.4 (6.4, 8.6)
LCS	MBT	0.8 (0.6, 1.1)	2.5 (2.1, 2.9)	3.4 (2.9, 4.0)	5.4 (4.2, 6.8)	
Maxim	Maxim	1.2 (0.6, 2.6)	3.0 (1.9, 4.8)	4.9 (3.4, 7.1)		
Natural Knee II	Natural Knee II	0.5 (0.3, 1.0)	1.6 (1.0, 2.3)	2.1 (1.5, 3.0)	3.7 (2.6, 5.2)	
Nexgen CR	Nexgen	0.4 (0.2, 0.7)	1.2 (0.9, 1.7)	1.6 (1.2, 2.1)	2.8 (2.2, 3.6)	4.0 (2.7, 5.8)
Nexgen CR Flex	Nexgen	0.5 (0.4, 0.7)	1.4 (1.1, 1.7)	2.1 (1.6, 2.6)		
Nexgen LPS	Nexgen	1.0 (0.7, 1.3)	2.2 (1.8, 2.7)	2.8 (2.4, 3.4)	4.8 (4.1, 5.7)	4.8 (4.1, 5.7)
Nexgen LPS Flex	Nexgen	0.9 (0.8, 1.1)	2.5 (2.3, 2.8)	3.5 (3.2, 3.9)		
Optetrak-PS	Optetrak	1.6 (1.1, 2.3)	5.1 (4.1, 6.4)	7.2 (5.9, 8.8)		
Optetrak-PS	Optetrak RBK	2.3 (1.3, 4.1)	5.3 (3.4, 8.1)	7.7 (4.9, 11.8)		
PFC Sigma	MBT	0.7 (0.5, 1.0)	2.4 (2.0, 2.9)	3.3 (2.7, 3.9)	4.0 (3.2, 5.0)	
PFC Sigma	PFC Sigma	1.0 (0.8, 1.2)	2.0 (1.8, 2.3)	2.6 (2.3, 2.9)	4.7 (3.8, 5.9)	4.7 (3.8, 5.9)
Profix	Profix	1.1 (0.8, 1.5)	2.6 (2.1, 3.2)	3.3 (2.7, 4.0)	4.8 (3.9, 5.9)	4.8 (3.9, 5.9)
Profix Oxinium	Profix	1.8 (1.1, 2.9)	5.3 (4.0, 7.0)	6.8 (5.3, 8.7)		
RBK	RBK	0.9 (0.5, 1.6)	2.9 (2.1, 4.1)	3.9 (2.8, 5.4)		
Scorpio	Scorpio	1.0 (0.5, 2.0)	3.2 (2.2, 4.7)	4.7 (3.4, 6.5)		
Scorpio	Scorpio+	1.0 (0.6, 1.7)	3.3 (2.4, 4.5)	4.4 (3.3, 5.8)		
Scorpio	Series 7000	1.1 (0.8, 1.4)	2.7 (2.2, 3.2)	3.5 (3.0, 4.2)	5.9 (4.9, 7.1)	6.8 (5.0, 9.3)
Scorpio NRG	Series 7000	0.5 (0.3, 0.9)	1.3 (0.9, 2.0)			
Triathlon	Triathlon	0.9 (0.8, 1.1)	2.2 (1.9, 2.5)	2.9 (2.4, 3.5)		
Vanguard	Maxim	1.3 (1.0, 1.7)	3.3 (2.7, 4.1)	3.9 (3.0, 5.0)		
Other (127)		1.3 (1.0, 1.6)	3.9 (3.4, 4.5)	5.9 (5.3, 6.7)	9.1 (8.0, 10.3)	10.5 (8.9, 12.4)

Note: Some Cementless components have been cemented.
Only combinations with over 400 procedures have been listed.

Table KT30: Revision Rates of Primary Total Knee Replacement with Cementless Fixation

Femoral Component	Tibial Component	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Active Knee	Active Knee	162	4054	18977	0.85 (0.73, 1.00)
Advance	Advance	30	584	2417	1.24 (0.84, 1.77)
Advantim	Advantim	17	984	4924	0.35 (0.20, 0.55)
Columbus	Columbus	25	450	1340	1.87 (1.21, 2.75)
Duracon	Duracon	134	3526	21942	0.61 (0.51, 0.72)
Genesis II	Genesis II	26	564	1513	1.72 (1.12, 2.52)
Genesis II	Mobile Bearing Knee	19	500	3933	0.48 (0.29, 0.75)
LCS	LCS	129	2326	19358	0.67 (0.56, 0.79)
LCS	MBT	768	17550	75021	1.02 (0.95, 1.10)
Maxim	Maxim	26	603	4683	0.56 (0.36, 0.81)
Natural Knee II	Natural Knee II	142	2641	16642	0.85 (0.72, 1.01)
Nexgen CR	Nexgen	74	3266	23210	0.32 (0.25, 0.40)
Nexgen CR	Nexgen CR	30	521	2366	1.27 (0.86, 1.81)
Nexgen CR Flex	Nexgen	56	3248	11778	0.48 (0.36, 0.62)
Nexgen CR Flex	Nexgen CR	61	4532	11772	0.52 (0.40, 0.67)
Nexgen LPS	Nexgen LPS	17	670	1825	0.93 (0.54, 1.49)
PFC Sigma	AMK	30	1663	7783	0.39 (0.26, 0.55)
PFC Sigma	MBT	108	2503	9429	1.15 (0.94, 1.38)
Profix	Profix	61	1446	7337	0.83 (0.64, 1.07)
RBK	RBK	140	4275	16445	0.85 (0.72, 1.00)
Score	Score	22	749	1374	1.60 (1.00, 2.42)
Scorpio	Scorpio+	45	689	4191	1.07 (0.78, 1.44)
Scorpio	Series 7000	148	3331	18446	0.80 (0.68, 0.94)
Scorpio NRG	Series 7000	48	1660	3697	1.30 (0.96, 1.72)
Triathlon	Triathlon	81	6463	12918	0.63 (0.50, 0.78)
Vanguard	Maxim	18	511	1646	1.09 (0.65, 1.73)
Vanguard	Regenerex	15	683	694	2.16 (1.21, 3.56)
Other (54)		281	3736	13443	2.09 (1.85, 2.35)
TOTAL		**2713**	**73728**	**319105**	**0.85 (0.82, 0.88)**

Note: Only combinations with over 400 procedures have been listed.

Table KT31: Yearly Cumulative Percent Revision of Primary Total Knee Replacement with Cementless Fixation

Femoral Component	Tibial Component	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Active Knee	Active Knee	1.0 (0.7, 1.4)	3.1 (2.6, 3.7)	4.2 (3.6, 5.0)		
Advance	Advance	2.4 (1.4, 4.3)	5.4 (3.6, 8.1)	6.9 (4.7, 10.0)		
Advantim	Advantim	0.8 (0.4, 1.6)	1.7 (1.0, 2.9)	2.2 (1.4, 3.6)	2.2 (1.4, 3.6)	2.2 (1.4, 3.6)
Columbus	Columbus	2.8 (1.6, 4.9)	6.5 (4.4, 9.5)	7.0 (4.7, 10.3)		
Duracon	Duracon	1.1 (0.8, 1.5)	2.7 (2.2, 3.3)	3.5 (2.9, 4.2)	4.7 (3.9, 5.7)	5.1 (4.1, 6.5)
Genesis II	Genesis II	1.4 (0.7, 2.9)	6.2 (4.0, 9.4)	7.3 (4.6, 11.5)		
Genesis II	Mobile Bearing Knee	1.4 (0.7, 3.0)	1.9 (1.0, 3.5)	2.9 (1.7, 4.9)	4.8 (3.0, 7.7)	4.8 (3.0, 7.7)
LCS	LCS	1.5 (1.1, 2.1)	3.4 (2.7, 4.2)	4.3 (3.5, 5.2)	6.1 (5.2, 7.3)	6.4 (5.4, 7.7)
LCS	MBT	1.2 (1.1, 1.4)	3.8 (3.5, 4.1)	5.4 (5.0, 5.8)	6.6 (6.1, 7.2)	
Maxim	Maxim	1.7 (0.9, 3.1)	3.0 (1.9, 4.8)	3.4 (2.2, 5.2)	4.6 (3.1, 6.7)	
Natural Knee II	Natural Knee II	1.0 (0.7, 1.5)	2.4 (1.9, 3.1)	3.7 (3.0, 4.6)	9.7 (7.9, 11.8)	
Nexgen CR	Nexgen	0.5 (0.3, 0.9)	1.6 (1.2, 2.1)	1.9 (1.5, 2.5)	2.8 (2.2, 3.5)	2.8 (2.2, 3.5)
Nexgen CR	Nexgen CR	1.6 (0.8, 3.2)	5.8 (3.9, 8.5)	7.1 (5.0, 10.1)		
Nexgen CR Flex	Nexgen	0.9 (0.6, 1.3)	1.8 (1.3, 2.4)	2.2 (1.7, 2.9)		
Nexgen CR Flex	Nexgen CR	0.5 (0.3, 0.7)	1.7 (1.3, 2.2)	2.5 (1.9, 3.3)		
Nexgen LPS	Nexgen LPS	1.5 (0.8, 2.8)	2.2 (1.2, 3.8)	4.7 (2.7, 8.0)		
PFC Sigma	AMK	0.6 (0.3, 1.2)	1.6 (1.0, 2.4)	2.4 (1.6, 3.4)		
PFC Sigma	MBT	1.9 (1.4, 2.5)	4.2 (3.4, 5.2)	5.5 (4.5, 6.7)		
Profix	Profix	1.1 (0.7, 1.9)	3.6 (2.7, 4.7)	4.3 (3.3, 5.6)	5.7 (4.4, 7.5)	
RBK	RBK	1.4 (1.1, 1.8)	3.2 (2.7, 3.9)	4.3 (3.6, 5.1)		
Score	Score	1.3 (0.7, 2.6)	5.4 (3.3, 8.7)			
Scorpio	Scorpio+	1.7 (1.0, 3.1)	4.6 (3.2, 6.4)	5.7 (4.2, 7.7)		
Scorpio	Series 7000	1.3 (1.0, 1.8)	3.2 (2.7, 3.9)	4.3 (3.6, 5.1)	7.3 (5.7, 9.3)	
Scorpio NRG	Series 7000	0.9 (0.6, 1.6)	4.0 (3.0, 5.4)			
Triathlon	Triathlon	0.8 (0.6, 1.1)	1.9 (1.5, 2.3)	2.1 (1.6, 2.7)		
Vanguard	Maxim	1.1 (0.4, 2.5)	3.4 (2.0, 5.7)	4.9 (3.1, 7.8)		
Vanguard	Regenerex	2.1 (1.1, 3.8)				
Other (54)		2.9 (2.4, 3.5)	8.7 (7.7, 9.9)	10.0 (8.9, 11.3)	12.8 (11.1, 14.7)	

Note: Only combinations with over 400 procedures have been listed.

Table KT32: Revision Rates of Primary Total Knee Replacement with Hybrid Fixation

Femoral Component	Tibial Component	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
AGC	AGC	33	1353	8689	0.38 (0.26, 0.53)
Active Knee	Active Knee	38	1199	5569	0.68 (0.48, 0.94)
Duracon	Duracon	293	7655	51443	0.57 (0.51, 0.64)
Genesis II	Genesis II	158	4956	23755	0.67 (0.57, 0.78)
LCS	LCS	101	2183	16828	0.60 (0.49, 0.73)
LCS	MBT	178	6042	22612	0.79 (0.68, 0.91)
Maxim	Maxim	60	1348	8265	0.73 (0.55, 0.93)
Natural Knee II	Natural Knee II	48	1673	10264	0.47 (0.34, 0.62)
Nexgen CR	Nexgen	76	3249	21027	0.36 (0.28, 0.45)
Nexgen CR Flex	Nexgen	73	6069	18138	0.40 (0.32, 0.51)
Nexgen CR Flex	Nexgen CR	11	705	2990	0.37 (0.18, 0.66)
Nexgen LPS	Nexgen	37	867	4402	0.84 (0.59, 1.16)
Nexgen LPS Flex	Nexgen LPS	9	483	1764	0.51 (0.23, 0.97)
PFC Sigma	MBT	196	4406	18772	1.04 (0.90, 1.20)
PFC Sigma	PFC Sigma	156	7028	29006	0.54 (0.46, 0.63)
Profix	Mobile Bearing Knee	41	562	3686	1.11 (0.80, 1.51)
Profix	Profix	29	718	4521	0.64 (0.43, 0.92)
RBK	RBK	20	715	2418	0.83 (0.51, 1.28)
Scorpio	Scorpio+	112	2662	14888	0.75 (0.62, 0.91)
Scorpio	Series 7000	200	5634	31429	0.64 (0.55, 0.73)
Scorpio NRG	Series 7000	14	578	1476	0.95 (0.52, 1.59)
Triathlon	Triathlon	57	5265	9463	0.60 (0.46, 0.78)
Vanguard	Maxim	60	2646	5543	1.08 (0.83, 1.39)
Vanguard	Vanguard	8	930	1641	0.49 (0.21, 0.96)
Other (93)		313	5141	23456	1.33 (1.19, 1.49)
TOTAL		**2321**	**74067**	**342046**	**0.68 (0.65, 0.71)**

Note: Only combinations with over 400 procedures have been listed.

Table KT33: Yearly Cumulative Percent Revision of Primary Total Knee Replacement with Hybrid Fixation

Femoral Component	Tibial Component	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
AGC	AGC	0.7 (0.4, 1.3)	1.7 (1.1, 2.5)	2.3 (1.5, 3.3)	3.3 (2.3, 4.9)	3.3 (2.3, 4.9)
Active Knee	Active Knee	0.7 (0.3, 1.4)	2.6 (1.8, 3.7)	3.2 (2.3, 4.6)		
Duracon	Duracon	1.2 (1.0, 1.4)	2.6 (2.3, 3.0)	3.4 (3.0, 3.8)	4.6 (4.1, 5.2)	4.8 (4.2, 5.5)
Genesis II	Genesis II	1.1 (0.8, 1.4)	2.8 (2.3, 3.3)	3.6 (3.1, 4.3)	4.5 (3.7, 5.3)	4.8 (3.9, 6.1)
LCS	LCS	1.0 (0.6, 1.5)	2.5 (1.9, 3.3)	3.6 (2.8, 4.4)	5.3 (4.3, 6.6)	5.8 (4.5, 7.3)
LCS	MBT	0.9 (0.7, 1.2)	3.0 (2.5, 3.5)	4.0 (3.4, 4.6)		
Maxim	Maxim	0.7 (0.4, 1.4)	2.5 (1.8, 3.5)	3.8 (2.9, 5.1)		
Natural Knee II	Natural Knee II	1.0 (0.6, 1.6)	2.1 (1.5, 2.9)	2.5 (1.8, 3.5)	4.5 (3.1, 6.6)	
Nexgen CR	Nexgen	0.4 (0.2, 0.7)	1.7 (1.3, 2.2)	2.3 (1.8, 2.9)	3.1 (2.4, 3.9)	3.1 (2.4, 3.9)
Nexgen CR Flex	Nexgen	0.7 (0.5, 1.0)	1.4 (1.1, 1.7)	1.7 (1.3, 2.2)		
Nexgen CR Flex	Nexgen CR	0.6 (0.2, 1.5)	1.3 (0.7, 2.5)	1.5 (0.8, 2.8)		
Nexgen LPS	Nexgen	0.5 (0.2, 1.3)	2.9 (1.9, 4.3)	4.9 (3.5, 6.9)		
Nexgen LPS Flex	Nexgen LPS	0.6 (0.2, 1.9)	2.0 (1.0, 3.8)	2.0 (1.0, 3.8)		
PFC Sigma	MBT	1.6 (1.2, 2.0)	4.1 (3.5, 4.7)	5.4 (4.6, 6.2)	6.2 (5.3, 7.3)	
PFC Sigma	PFC Sigma	0.7 (0.5, 1.0)	2.1 (1.8, 2.6)	2.8 (2.4, 3.3)	4.6 (3.6, 6.0)	4.6 (3.6, 6.0)
Profix	Mobile Bearing Knee	1.6 (0.8, 3.1)	5.2 (3.7, 7.5)	6.9 (5.1, 9.4)		
Profix	Profix	0.9 (0.4, 1.9)	2.7 (1.7, 4.2)	3.9 (2.6, 5.7)	5.0 (3.4, 7.5)	
RBK	RBK	0.8 (0.3, 1.8)	3.3 (2.0, 5.5)	4.5 (2.8, 7.2)		
Scorpio	Scorpio+	1.1 (0.7, 1.6)	2.8 (2.2, 3.5)	3.9 (3.2, 4.7)	6.2 (4.8, 8.0)	
Scorpio	Series 7000	0.8 (0.6, 1.1)	2.5 (2.1, 3.0)	3.6 (3.1, 4.2)	5.2 (4.4, 6.1)	5.4 (4.5, 6.5)
Scorpio NRG	Series 7000	0.6 (0.2, 1.8)	2.8 (1.6, 4.9)			
Triathlon	Triathlon	0.5 (0.4, 0.8)	1.7 (1.2, 2.3)	3.1 (2.1, 4.8)		
Vanguard	Maxim	1.3 (0.9, 1.8)	2.9 (2.2, 4.0)	5.3 (3.8, 7.3)		
Vanguard	Vanguard	0.2 (0.1, 0.9)	1.4 (0.7, 3.1)			
Other (93)		2.1 (1.8, 2.6)	5.7 (5.0, 6.5)	6.9 (6.1, 7.8)	9.6 (8.5, 10.9)	10.3 (8.9, 12.1)

Note: Only combinations with over 400 procedures have been listed.

REVISION HIP AND KNEE REPLACEMENT

Classes of Revision Procedures

The Registry defines revision of a joint replacement as any subsequent procedure that involves the insertion, removal and/or replacement of a prosthesis or implant.

Revisions are sub-categorised into three classes, major total, major partial and minor.

1. **Major total revision** is the insertion, removal and/or replacement of all major components.
2. **Major partial revision** is the insertion, removal and/or replacement of one major component.
3. **Minor revision** is the insertion removal and/or replacement of any other prostheses or implant including patellar prostheses in knee replacement.

Major components are prostheses that are fixed to bone. These are the femoral prosthesis and the acetabular shell or cup in hip replacement and the femoral and tibial prostheses in either partial or total knee replacement. Although a patellar prosthesis is fixed to bone it is not considered a major prosthesis.

Different types of major partial and minor revisions are identified based on the specific prostheses or implants used in the revision. These are listed in Tables R1 and R9.

If there is more than one revision then subsequent revisions are identified in sequential order i.e. 2nd 3rd 4th etc. The exception to this is a planned two-stage revision for infection, which is regarded as a single revision.

Approach to Analysis

The purpose of this analysis is to provide information on the outcome of first revision procedures i.e. time from first to second revision (re-revision). To achieve this it is necessary to have a full chronological list of procedures including the primary procedure. This is important as the type of primary procedure as well as the timing and type of first revision are factors that potentially affect the outcome of that revision.

As the Registry has been collecting complete national data since 2003 the full history is not available for many of the revisions reported to the Registry. If the Registry does not have information on preceding procedures it is unable to establish if a reported revision is the first for that joint or a revision of a previous revision. It is also unable to determine the type of primary procedure that subsequently required revision.

To assist in analysis the Registry groups revision procedures into 'All Revisions' and 'Revisions of known Primary Procedures'.

The 'All Revisions' group includes all revision procedures reported to the Registry regardless of whether the Registry has a full chronological history including the primary procedure.

Analysis of this group provides information on the entire revision burden as well as demographic data, the reasons for revision and the types of revision undertaken.

The second group is a subset of the first and only includes the first revision of a Registry recorded primary procedure. This group is referred to as 'Revisions of known Primary Procedures'. The reason the Registry identifies this group is because this is the subset that can be used to determine the outcome of the first revision.

The number and proportion of revision procedures where the Registry has a record of the primary procedure continues to increase. The proportion of revisions being reported with a primary procedure recorded by the Registry will eventually approach 100%.

There are important differences between the two groups.

The 'All Revisions' group covers the full spectrum of revisions including revisions on procedures undertaken prior to the implementation of the Registry i.e. early, mid and late revisions.

As the 'Revisions of known Primary Procedures' group are first revisions of primary procedures recorded by the Registry, they must have occurred a maximum of 11 years or less after the primary. These are therefore largely early to mid term revisions.

First revisions for infection have been excluded from the analysis of the 'Revisions of known Primary Procedures' group. Determining the outcome of these revisions is more complex than revisions undertaken for other reasons. There are many additional factors to consider, e.g. antibiotic treatment, adequacy of debridement, infective organism(s) and revision strategy such as planned multi-staged procedures. The Registry does not have information on some of these factors and therefore meaningful interpretation of any analysis related to infection is difficult.

Revision Hip

Demographics of All Revision

This analysis is of all 40,160 hip revisions reported to the Registry with a procedure date up to and including 31 December 2011. This is an additional 4,780 procedures compared to the last report.

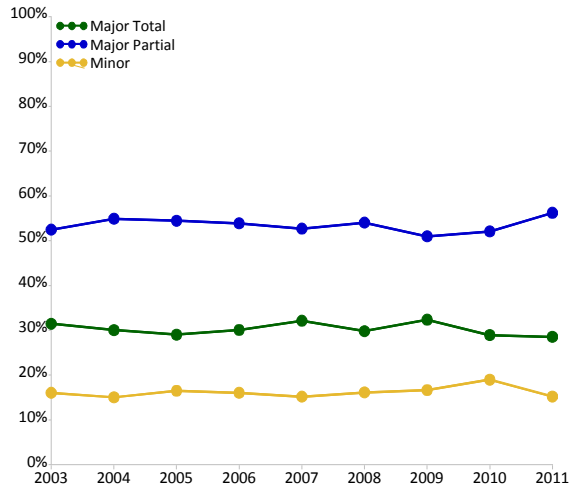
Type of Revision

Most revisions recorded by the Registry are major revisions (84.8%). The most common types of revision are acetabular only (32.4%), THR (femoral/acetabular) (29.8%) and femoral only (17.6%) (Table R1).

Minor revisions account for 15.2% of all hip revisions. The most common is head and insert exchange. This type of revision accounts for 10.5% of all revisions (Table R1).

In 2011 there has been a decrease in the proportion of revisions that are minor revisions (decreased from 19.0% in 2010 to 15.2% in 2011). There has been a corresponding increase in the proportion of major partial revisions (increased from 52.1% in 2010 to 56.2% in 2011) (Figure R1).

Figure R1: Revision Hip Replacement by Class



Reason for Revision

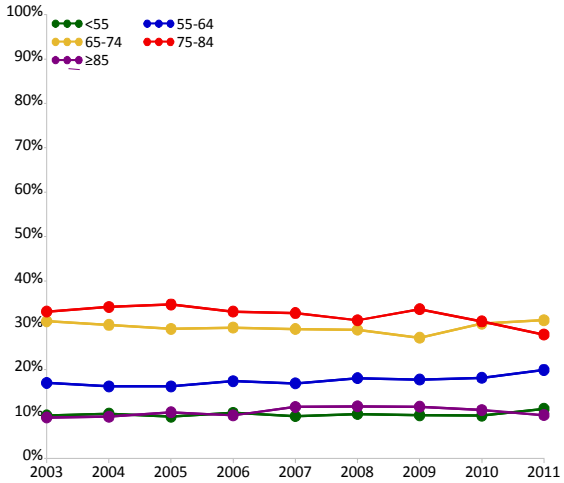
The most common reasons for revision are loosening/lysis (52.2%), dislocation (14.2%), infection (12.5%) and fracture (9.3%) (Table R2).

Age and Gender

There has been little change in the age distribution of revision procedures since 2003 (Figure R2).

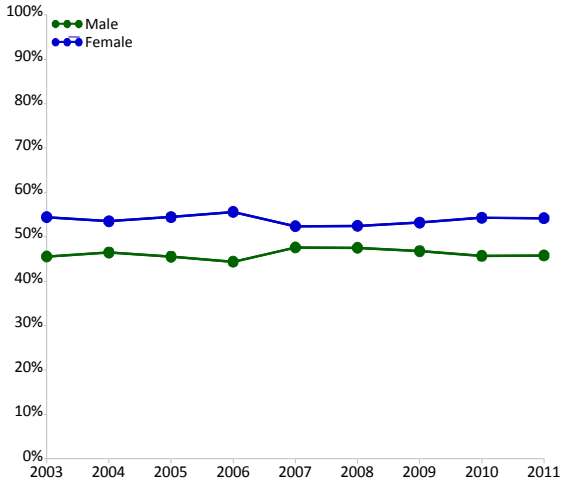
There has been a decrease in the proportion of patients aged over 75 (decreased from 41.8% in 2010 to 37.7% in 2011).

Figure R2: Revision Hip Replacement by Age



Revision hip replacement is more common in females. There has been little change in the proportion of females undergoing revisions (Figure R3).

Figure R3: Revision Hip Replacement by Gender



Detailed information on demographics of revision hip replacement is provided in the supplementary report 'Demographics of Hip Arthroplasty', which is available on the Registry website.
www.dmac.adelaide.edu.au/aoanjrr/publications.jsp.

Demographics of Revisions of Known Primary

This year the Registry is analysing 10,835 first revision procedures where the primary procedure has been recorded by the Registry. This is an additional 2,246 procedures compared to the last report.

Type of Revision

There are differences in the types of revision between the 'Revisions of known Primary Procedures' group and the 'All Revisions' group.

The 'Revisions of known Primary Procedures' group has a smaller proportion of major revisions (80.0%) compared to the 'All Revisions' group (84.8%). There are also less acetabular only and THR (acetabular/femoral) revisions but more femoral only revisions (Table R1).

There is a higher proportion of minor revisions in the 'Revisions of known Primary Procedures' group (20.0% compared to 15.2%) (Table R1).

Reason for Revision

There are also differences in the reason for revision. Loosening/lysis is still the most common reason but the proportion is less in the 'Revisions of known Primary Procedures' group (30.1% compared to 52.2%). Other diagnoses such as dislocation, infection, fracture and pain are more common in the 'Revisions of known Primary Procedures' group (Table R2).

Table R1: Revision Hip Replacement by Type of Revision

	Revision of Known Primary		All Revisions	
Type of Revision	**Number**	**Percent**	**Number**	**Percent**
Major Revision				
Acetabular Component	2895	26.7	13018	32.4
THR (Femoral/Acetabular)	2270	21.0	11962	29.8
Femoral Component	2756	25.4	7081	17.6
Cement Spacer	476	4.4	1272	3.2
Removal of Prostheses	98	0.9	341	0.8
Bipolar Head and Femoral	152	1.4	328	0.8
Reinsertion of Components	14	0.1	30	0.1
Saddle	2	0.0	5	0.0
Thrust Plate	1	0.0	2	0.0
N Major	**8664**	**80.0**	**34039**	**84.8**
Minor Revision				
Head/Insert	1296	12.0	4229	10.5
Head Only	472	4.4	826	2.1
Minor Components	156	1.4	414	1.0
Insert Only	94	0.9	405	1.0
Head/Neck	50	0.5	85	0.2
Head/Neck/Insert	56	0.5	77	0.2
Bipolar Only	40	0.4	72	0.2
Neck Only	3	0.0	7	0.0
Cement Only	2	0.0	3	0.0
Neck/Insert	1	0.0	2	0.0
Incomplete	1	0.0	1	0.0
N Minor	**2171**	**20.0**	**6121**	**15.2**
TOTAL	**10835**	**100.0**	**40160**	**100.0**

Table R2: Revision Hip Replacement by Reason for Revision

Reason for Revision	Revision of Known Primary		All Revisions	
	Number	Percent	Number	Percent
Loosening/Lysis	3256	30.1	20971	52.2
Prosthesis Dislocation	2160	19.9	5720	14.2
Infection	1604	14.8	5015	12.5
Fracture	1708	15.8	3737	9.3
Pain	425	3.9	770	1.9
Metal Sensitivity	623	5.7	750	1.9
Wear Acetabular Insert	41	0.4	639	1.6
Implant Breakage Acetabular	68	0.6	406	1.0
Implant Breakage Stem	74	0.7	345	0.9
Wear Acetabulum	15	0.1	248	0.6
Malposition	114	1.1	176	0.4
Implant Breakage Acetabular Insert	44	0.4	173	0.4
Chondrolysis/Acetab. Erosion	123	1.1	164	0.4
Leg Length Discrepancy	105	1.0	137	0.3
Instability	60	0.6	136	0.3
Incorrect Sizing	62	0.6	76	0.2
Implant Breakage Head	27	0.2	61	0.2
Osteonecrosis	24	0.2	57	0.1
Tumour	22	0.2	51	0.1
Heterotopic Bone	14	0.1	34	0.1
Progression Of Disease	5	0.0	25	0.1
Synovitis	6	0.1	9	0.0
Wear Head	6	0.1	8	0.0
Other	249	2.3	452	1.1
TOTAL	**10835**	**100.0**	**40160**	**100.0**

Outcome of First Revision of Primary Total Conventional Hip Replacement

This analysis examines the rate of subsequent revision following the first revision of a known primary total conventional hip replacement.

There are 5,777 procedures available for analysis. These are obtained by including first revisions of primary total conventional hips undertaken for osteoarthritis and excluding all first revisions with a diagnosis of infection.

Minor revisions have an increased rate of re-revision compared to major partial and major total revisions. There is no difference in the rate of re-revision comparing major partial and major total revisions (Tables R3 and R4 and Figure R4).

The outcomes for the five most common types of first revision procedures are detailed in Tables R5 and R6 are Figure R5.

Table R3: Re-revision Rates of Known Primary Total Conventional Hip Replacement (Primary Diagnosis OA, excluding first revision for Infection)

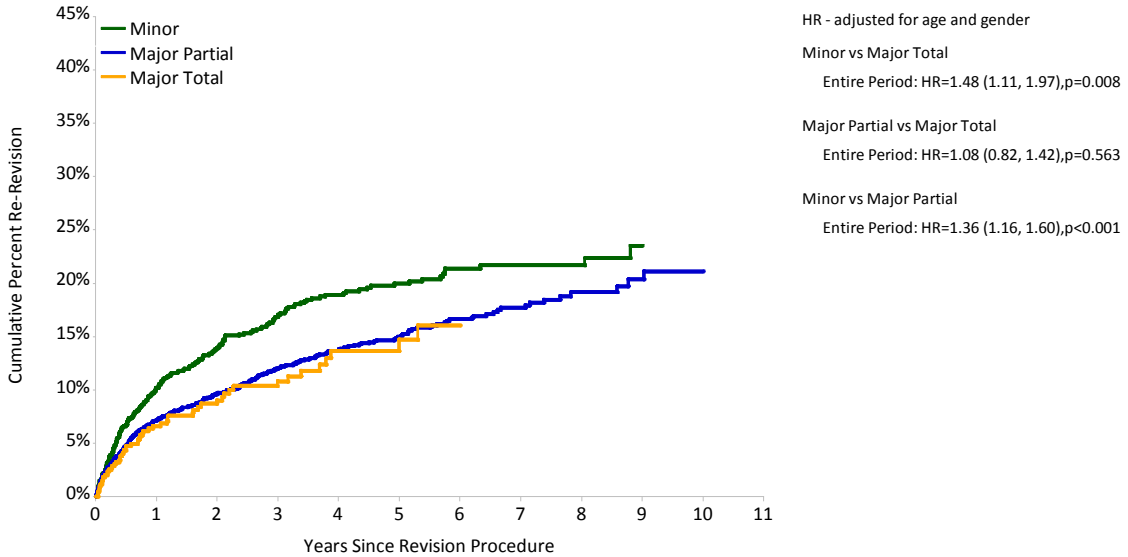
Revision of Primary	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Minor	226	1369	4706	4.80 (4.20, 5.47)
Major Partial	416	3795	10932	3.81 (3.45, 4.19)
Major Total	59	613	1494	3.95 (3.01, 5.09)
All Revision	**701**	**5777**	**17132**	**4.09 (3.79, 4.41)**

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

Table R4: Yearly Cumulative Percent Re-revision of Known Primary Total Conventional Hip Replacement (Primary Diagnosis OA, excluding first revision for Infection)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Minor	10.2 (8.6, 12.0)	17.1 (15.0, 19.4)	20.0 (17.6, 22.6)		
Major Partial	7.2 (6.3, 8.1)	12.0 (10.9, 13.3)	14.9 (13.5, 16.5)	21.1 (18.2, 24.5)	
Major Total	6.6 (4.8, 9.0)	10.8 (8.2, 14.2)	14.7 (10.9, 19.6)		
All Revision	**7.9 (7.1, 8.6)**	**13.2 (12.2, 14.3)**	**16.2 (15.0, 17.5)**	**21.9 (19.5, 24.6)**	

Figure R4: Cumulative Percent Re-revision of Known Primary Total Conventional Hip Replacement (Primary Diagnosis OA, excluding first revision for Infection)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Minor	1369	1033	637	401	23	7
Major Partial	3795	2547	1487	815	46	8
Major Total	613	408	202	80	3	1

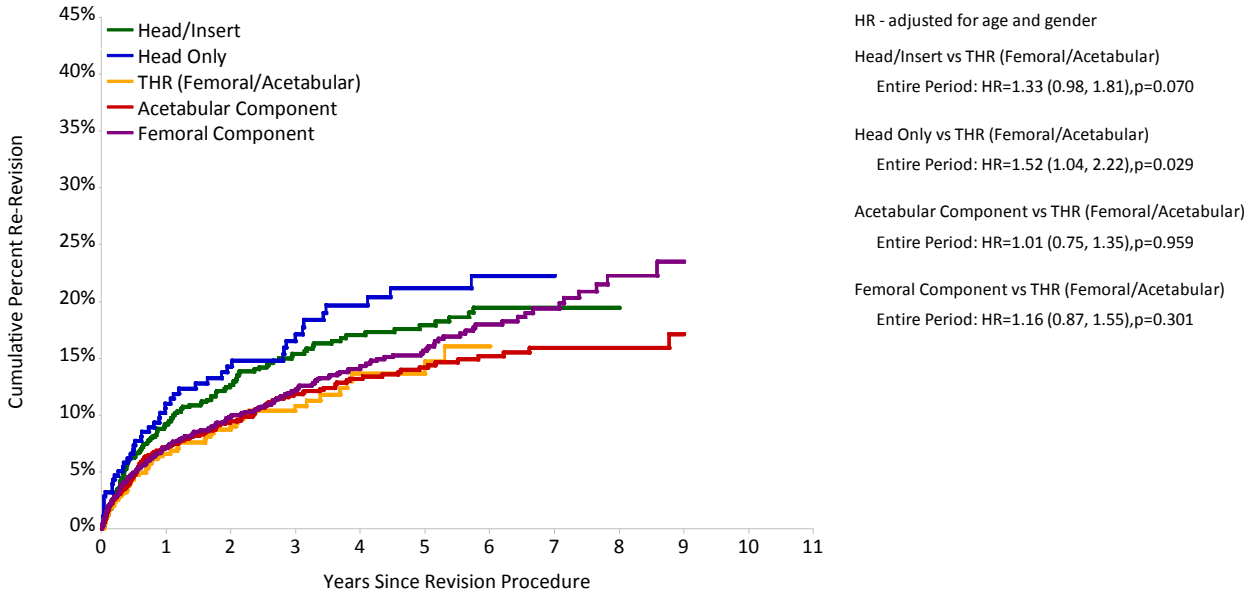
Table R5: Re-revision Rates of Known Primary Total Conventional Hip Replacement (Primary Diagnosis OA, excluding first revision for Infection)

Revision of Primary	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Head/Insert	128	859	2955	4.33 (3.61, 5.15)
Head Only	50	281	1020	4.90 (3.64, 6.46)
THR (Femoral/Acetabular)	59	613	1494	3.95 (3.01, 5.09)
Acetabular Component	193	2017	5232	3.69 (3.19, 4.25)
Femoral Component	223	1773	5667	3.94 (3.44, 4.49)
TOTAL	**653**	**5543**	**16367**	**3.99 (3.69, 4.31)**

Table R6: Yearly Cumulative Percent Re-revision of Known Primary Total Conventional Hip Replacement (Primary Diagnosis OA, excluding first revision for Infection)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Head/Insert	9.2 (7.4, 11.4)	15.4 (12.9, 18.3)	17.9 (15.1, 21.1)		
Head Only	11.0 (7.8, 15.5)	17.1 (12.8, 22.6)	21.2 (16.2, 27.5)		
THR (Femoral/Acetabular)	6.6 (4.8, 9.0)	10.8 (8.2, 14.2)	14.7 (10.9, 19.6)		
Acetabular Component	7.2 (6.1, 8.5)	11.8 (10.2, 13.7)	14.2 (12.2, 16.4)		
Femoral Component	7.1 (6.0, 8.5)	12.2 (10.6, 14.1)	15.7 (13.6, 17.9)		

Figure R5: Cumulative Percent Re-revision of Known Primary Total Conventional Hip Replacement (Primary Diagnosis OA, excluding first revision for Infection)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Head/Insert	859	660	402	252	8	2
Head Only	281	211	140	92	9	2
THR (Femoral/Acetabular)	613	408	202	80	3	1
Acetabular Component	2017	1201	671	389	30	6
Femoral Component	1773	1341	812	423	16	2

Outcome of First Revision of Primary Total Resurfacing Hip Replacement

There are 736 procedures available for analysis. These are obtained by only including first revisions of primary total resurfacing hip replacement undertaken for osteoarthritis and excluding all first revisions with a diagnosis of infection.

As most resurfacing prostheses are a combination of a solid metal acetabular component and a one-piece femoral component, the only possible revision is a major revision.

The most common type of major revision is a femoral/acetabular (53.4%) followed by femoral only (41.4%) and acetabular only revisions (5.2%).

There is no difference in the rate of re-revision when these three types of revision are compared (Tables R7 and R8 and Figure R6).

Table R7: Re-revision Rates of Known Primary Total Resurfacing Hip Replacement (Primary Diagnosis OA, excluding first revision for Infection)

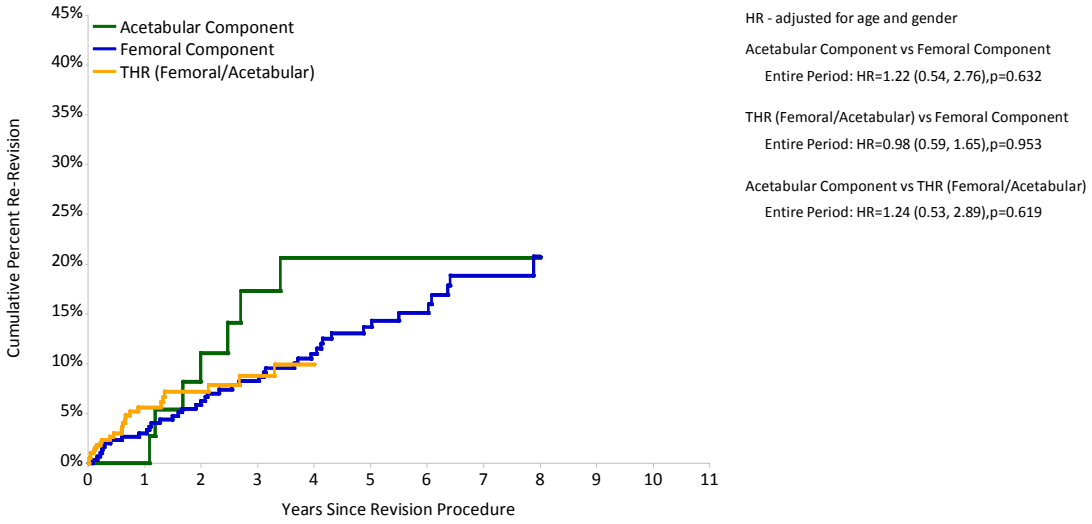
Revision of Primary	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Acetabular Component	7	38	190	3.68 (1.48, 7.58)
Femoral Component	41	305	1411	2.91 (2.09, 3.94)
THR (Femoral/Acetabular)	27	393	752	3.59 (2.37, 5.23)
All Revision	**75**	**736**	**2353**	**3.19 (2.51, 4.00)**

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

Table R8: Yearly Cumulative Percent Re-revision of Known Primary Total Resurfacing Hip Replacement (Primary Diagnosis OA, excluding first revision for Infection)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Acetabular Component	0.0 (0.0, 0.0)	17.3 (8.1, 34.6)	20.6 (10.3, 38.6)		
Femoral Component	3.0 (1.6, 5.7)	8.2 (5.5, 12.2)	13.7 (9.9, 18.7)		
THR (Femoral/Acetabular)	5.6 (3.5, 8.8)	8.8 (5.7, 13.4)			
All Revision	**4.1 (2.8, 5.9)**	**9.5 (7.2, 12.3)**	**14.5 (11.4, 18.3)**		

Figure R6: Cumulative Percent Re-revision of Known Primary Total Resurfacing Hip Replacement (Primary Diagnosis OA, excluding first revision for Infection)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Acetabular Component	38	37	26	20	0	0
Femoral Component	305	280	212	135	1	0
THR (Femoral/Acetabular)	393	206	88	34	2	0

Revision Knee

Demographics of All Revision

This analysis is of 31,698 knee revisions reported to the Registry with a procedure date up to and including 31 December 2011. This is an additional 3,875 procedures compared to the last report.

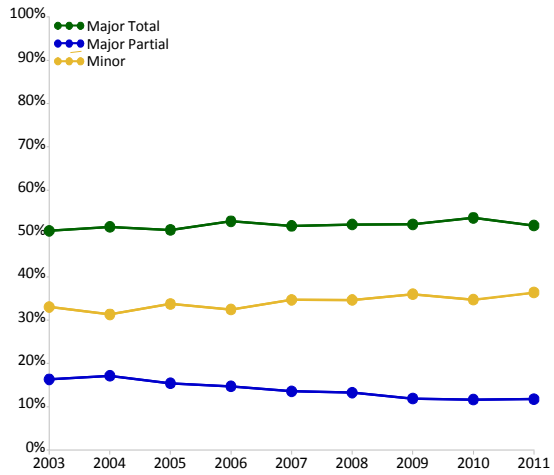
Type of Revision

Most revisions recorded by the Registry are major revisions (67.3%). The most common major revisions are tibial/femoral (48.9%) and tibial only (7.8%) (Table R9).

Minor revisions account for 32.7% of all knee revisions. The most common are insert only (13.5%), patella only (10.5%) and insert/patella (7.2%) (Table R9).

There has been little change in the proportion of major total, major partial and minor revisions since 2003 (Figure R7).

Figure R7: Revision Knee Replacement by Class



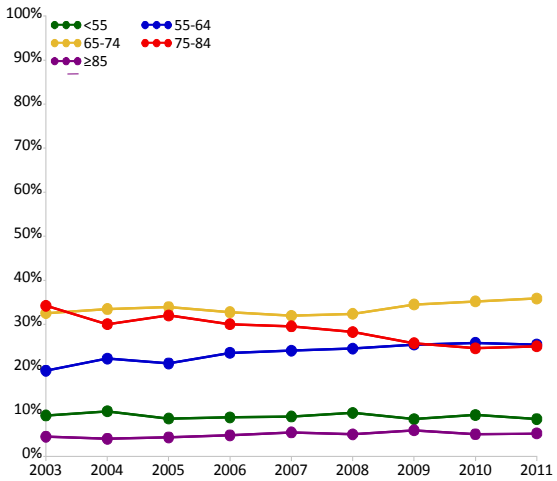
Reason for Revision

The most common reasons for revision are loosening/lysis (40.3%), infection (19.1%) and pain (12.9%) (Table R10).

Age and Gender

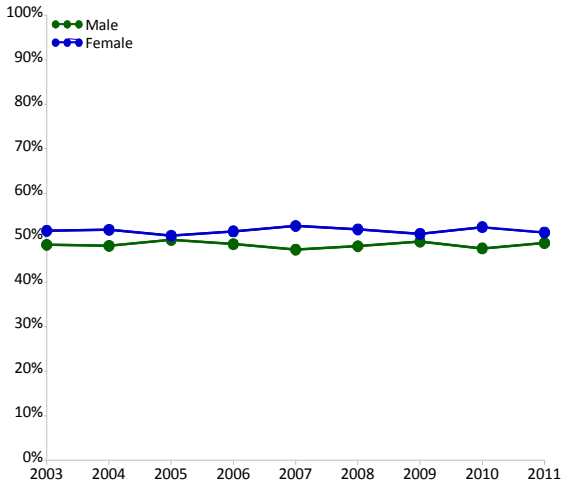
Most revisions occur in the 65-74 year age group. The proportion of revisions that are in the 75-84 year age group has declined from 34.2% in 2003 to 25.0% in 2011 (Figure R8).

Figure R8: Revision Knee Replacement by Age



Revision knee replacement is more common in females. There has been little change in the gender proportion (Figure R9).

Figure R9: Revision Knee Replacement by Gender



Detailed information on demographics of revision knee replacement is provided in the supplementary report 'Demographics of Knee Arthroplasty', which is available on the Registry website.
www.dmac.adelaide.edu.au/aoanjrr/publications.jsp.

Demographics of Revisions of Known Primary

This year the Registry is analysing 13,612 first revision procedures where the primary procedure has been recorded by the Registry. This is an additional 2,277 procedures compared to the last report.

Type of Revision

There are differences in the types of revision between the 'Revisions of known Primary Procedures' group and the 'All Revisions' group.

The 'Revisions of known Primary Procedures' group has a smaller proportion of major revisions (61.6%) compared to the 'All Revisions' group (67.3%), with less tibial/femoral revisions (41.1% compared to 48.9%) (Table R9).

There is a higher proportion of minor revisions (38.4% compared to 32.7%) (Table R9).

Reason for Revision

There are differences in the reasons for revision. Loosening/lysis is still the most common reason but the proportion is less in the 'Revisions of known Primary Procedures' group (34.0% compared to 40.3%). Of the three most common reasons, pain is the only reason that has a higher proportion in the 'Revisions of known Primary Procedures' group (19.7% compared to 12.9%) (Table R10).

Table R9: Revision Knee Replacement by Type of Revision

	Revision of Known Primary		All Revisions	
Type of Revision	**Number**	**Percent**	**Number**	**Percent**
Major Revision				
TKR (Tibial/Femoral)	5600	41.1	15485	48.9
Tibial Component	1103	8.1	2486	7.8
Cement Spacer	589	4.3	1516	4.8
Femoral Component	697	5.1	1215	3.8
Uni Tibial Component	158	1.2	198	0.6
Removal of Prostheses	64	0.5	158	0.5
UKR (Uni Tibial/Uni Femoral)	85	0.6	132	0.4
Uni Femoral Component	61	0.4	86	0.3
Patella/Trochlear Resurfacing	20	0.1	45	0.1
Reinsertion of Components	9	0.1	13	0.0
N Major	**8386**	**61.6**	**21334**	**67.3**
Minor Revision				
Insert Only	1956	14.4	4273	13.5
Patella Only	2200	16.2	3338	10.5
Insert/Patella	826	6.1	2291	7.2
Uni Insert Only	205	1.5	305	1.0
Minor Components	23	0.2	125	0.4
Cement Only	8	0.1	15	0.0
Removal of Patella			8	0.0
Partial Resurfacing	3	0.0	4	0.0
Unispacer	4	0.0	4	0.0
Uni Insert/Patella	1	0.0	1	0.0
N Minor	**5226**	**38.4**	**10364**	**32.7**
TOTAL	**13612**	**100.0**	**31698**	**100.0**

Table R10: Revision Knee Replacement by Reason for Revision

Reason for Revision	Revision of Known Primary		All Revisions	
	Number	Percent	Number	Percent
Loosening/Lysis	4628	34.0	12785	40.3
Infection	2303	16.9	6053	19.1
Pain	1299	9.5	2100	6.6
Patellofemoral Pain	1383	10.2	1996	6.3
Progression Of Disease	929	6.8	1460	4.6
Wear Tibial Insert	165	1.2	1387	4.4
Instability	607	4.5	1111	3.5
Fracture	320	2.4	608	1.9
Arthrofibrosis	388	2.9	565	1.8
Wear Tibial	48	0.4	451	1.4
Malalignment	264	1.9	408	1.3
Implant Breakage Tibial Insert	45	0.3	312	1.0
Implant Breakage Tibial	52	0.4	288	0.9
Patella Erosion	204	1.5	255	0.8
Incorrect Sizing	179	1.3	246	0.8
Bearing Dislocation	150	1.1	241	0.8
Metal Sensitivity	133	1.0	209	0.7
Implant Breakage Patella	46	0.3	207	0.7
Wear Patella	29	0.2	189	0.6
Prosthesis Dislocation	74	0.5	139	0.4
Patella Maltracking	76	0.6	137	0.4
Implant Breakage Femoral	28	0.2	120	0.4
Synovitis	61	0.4	97	0.3
Osteonecrosis	48	0.4	57	0.2
Tumour	7	0.1	19	0.1
Heterotopic Bone	4	0.0	18	0.1
Wear Femoral	2	0.0	10	0.0
Patella Dislocation	1	0.0	6	0.0
Incorrect Side	3	0.0	3	0.0
Other	136	1.0	221	0.7
TOTAL	**13612**	**100.0**	**31698**	**100.0**

Outcome of First Revision of Primary Unicompartmental Knee Replacement

This analysis examines the rate of subsequent revision following the first revision of a known primary unicompartmental knee replacement.

There are 3,163 procedures available for analysis. These are obtained by only including first revisions of primary unicompartmental knees that were undertaken for osteoarthritis and excluding all first revisions with a diagnosis of infection.

The lowest rate of re-revision for a revised primary unicompartmental knee replacement is when it is revised to a total knee. Revision to another unicompartmental knee replacement has a cumulative percent re-revision of 38.8% at eight years. This compares to a re-revision of 16.6% if a unicompartmental knee is revised to a total knee replacement (Tables R11 and R12 and Figure R10).

Only 45 of the 3,163 unicompartmental knee revisions reported to the Registry were revisions that involved the removal of both tibial and femoral components and then subsequently replaced by another unicompartmental knee replacement. Most 'Uni to Uni' revisions are minor revisions where the insert is exchanged, or major partial revisions where either the tibial or femoral prostheses only is revised (Tables R13 and R14 and Figure R11).

There is a difference in the outcome of revising a unicompartmental knee replacement to a total knee replacement compared to revising a total knee to a total knee replacement. The rate of re-revision of a 'Uni to Total' is less than a 'Total to Total' revision (Tables R15 and R16 and Figure R12).

Table R11: Re-revision Rates of Known Primary Unicompartmental Knee Replacement (Primary Diagnosis OA, excluding first revision for Infection)

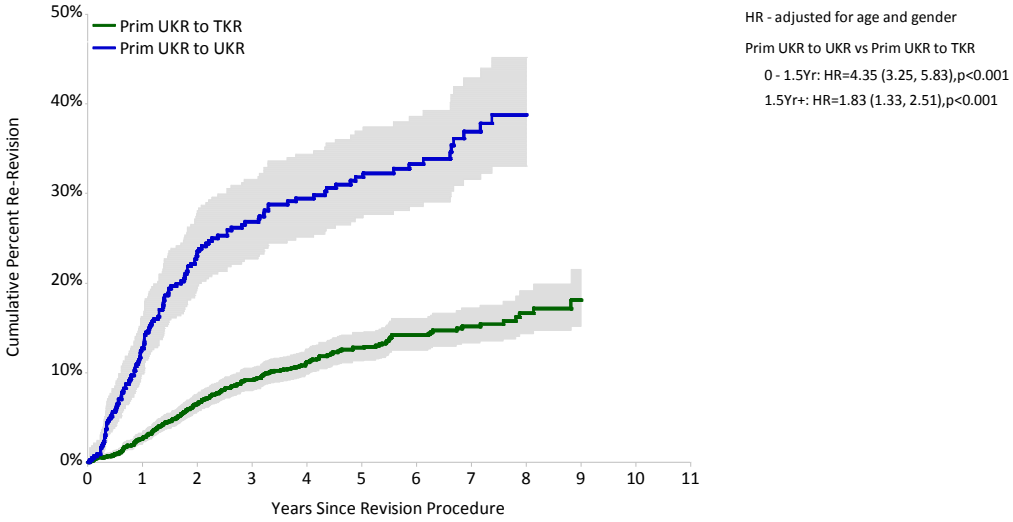
Revision of Primary	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Prim UKR to TKR	263	2722	9826	2.68 (2.36, 3.02)
Prim UKR to UKR	132	441	1704	7.75 (6.48, 9.19)
All Revision	**395**	**3163**	**11530**	**3.43 (3.10, 3.78)**

Note: Excluding Patella/Trochlear Resurfacing and revisions where no femoral and tibial components were inserted.

Table R12: Yearly Cumulative Percent Re-revision of Known Primary Unicompartmental Knee Replacement (Primary Diagnosis OA, excluding first revision for Infection)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Prim UKR to TKR	2.8 (2.2, 3.5)	9.2 (8.0, 10.5)	12.8 (11.3, 14.5)		
Prim UKR to UKR	12.7 (9.9, 16.3)	26.8 (22.7, 31.5)	31.8 (27.3, 37.0)		
All Revision	**4.2 (3.5, 5.0)**	**11.8 (10.6, 13.1)**	**15.7 (14.2, 17.3)**		

Figure R10: Cumulative Percent Re-revision of Known Primary Unicompartmental Knee Replacement (Primary Diagnosis OA, excluding first revision for Infection)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Prim UKR to TKR	2722	2234	1437	794	12	1
Prim UKR to UKR	441	348	232	156	10	3

Table R13: Re-revision Rates of Known Primary Unicompartmental Knee Replacement (Primary Diagnosis OA, excluding first revision for Infection)

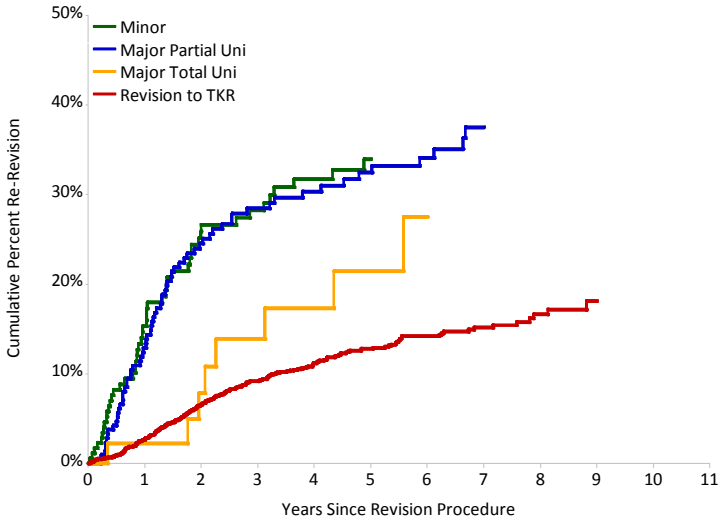
Revision of Primary	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Minor	52	181	627	8.30 (6.20, 10.88)
Major Partial Uni	70	215	897	7.80 (6.08, 9.86)
Major Total Uni	10	45	180	5.56 (2.67, 10.23)
Revision to TKR	263	2722	9826	2.68 (2.36, 3.02)
TOTAL	**395**	**3163**	**11530**	**3.43 (3.10, 3.78)**

Note: Excluding Patella/Trochlear Resurfacing and revisions where no femoral and tibial components were inserted.

Table R14: Yearly Cumulative Percent Re-revision of Known Primary Unicompartmental Knee Replacement (Primary Diagnosis OA, excluding first revision for Infection)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Minor	15.3 (10.6, 21.8)	28.2 (21.7, 36.2)	34.0 (26.6, 42.7)		
Major Partial Uni	12.9 (9.0, 18.2)	28.4 (22.7, 35.3)	32.5 (26.3, 39.7)		
Major Total Uni	2.2 (0.3, 14.7)	13.9 (6.0, 30.4)	21.4 (10.6, 40.4)		
Revision to TKR	2.8 (2.2, 3.5)	9.2 (8.0, 10.5)	12.8 (11.3, 14.5)		

Figure R11: Cumulative Percent Re-revision of Known Primary Unicompartmental Knee Replacement (Primary Diagnosis OA, excluding first revision for Infection)



HR - adjusted for age and gender

Minor vs Revision to TKR
0 - 6Mth: HR=8.68 (4.63, 16.28),p<0.001
6Mth+: HR=2.45 (1.73, 3.45),p<0.001

Major Partial Uni vs Revision to TKR
0 - 1.5Yr: HR=4.63 (3.27, 6.55),p<0.001
1.5Yr+: HR=1.74 (1.15, 2.64),p=0.009

Major Total Uni vs Revision to TKR
Entire Period: HR=1.85 (0.98, 3.49),p=0.058

Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Minor	181	128	86	52	4	1
Major Partial Uni	215	177	121	90	4	1
Major Total Uni	45	43	25	14	2	1
Revision to TKR	2722	2234	1437	794	12	1

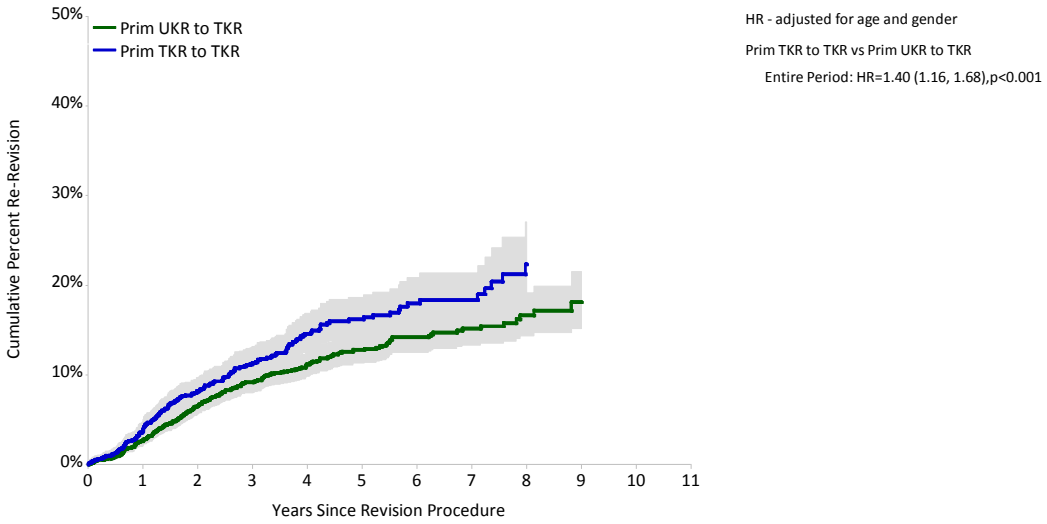
Table R15: Re-revision Rates of Known Primary Knee Replacement (Primary Diagnosis OA, excluding first revision for Infection)

Primary Revisions	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Prim UKR to TKR	263	2722	9826	2.68 (2.36, 3.02)
Prim TKR to TKR	198	1889	5447	3.64 (3.15, 4.18)
TOTAL	**461**	**4611**	**15273**	**3.02 (2.75, 3.31)**

Table R16: Yearly Cumulative Percent Re-revision of Known Primary Knee Replacement (Primary Diagnosis OA, excluding first revision for Infection)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Prim UKR to TKR	2.8 (2.2, 3.5)	9.2 (8.0, 10.5)	12.8 (11.3, 14.5)		
Prim TKR to TKR	3.9 (3.0, 4.9)	11.3 (9.7, 13.2)	16.2 (14.0, 18.6)		

Figure R12: Cumulative Percent Re-revision of Known Primary Knee Replacement (Primary Diagnosis OA, excluding first revision for Infection)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Prim UKR to TKR	2722	2234	1437	794	12	1
Prim TKR to TKR	1889	1415	755	360	7	1

Outcome of First Revision of Primary Total Knee Replacement

This analysis examines the rate of subsequent revision following the first revision of a known primary total knee replacement.

There are 7,455 procedures available for analysis. These are obtained by only including first revisions of primary total knee replacement that were undertaken for osteoarthritis and excluding all first revisions with a diagnosis of infection.

Major partial revisions have a significantly higher rate of re-revision compared to both minor and major total revisions. Minor revisions have a significantly higher rate of re-revision in the first six months compared to major total revisions. After this time, there is no difference in the outcome (Tables R17 and R18 and Figure R13).

Comparing the three types of major revision the only difference found is that femoral only revision has a significantly higher rate of re-revision than tibial/femoral revision (Figure R14).

Revising the patella alone has the same rate of re-revision as revising the patella in combination with an insert exchange. At five years, the cumulative percent revision is 14.3% and 15.4% respectively. Revising the insert alone has the highest rate of re-revision of the three types of minor revision, however this difference is only evident in the first 1.5 years (Tables R19 and R20 and Figure R15).

Table R17: Re-Revision Rates of Known Primary Total Knee Replacement (Primary Diagnosis OA, excluding first revision for Infection)

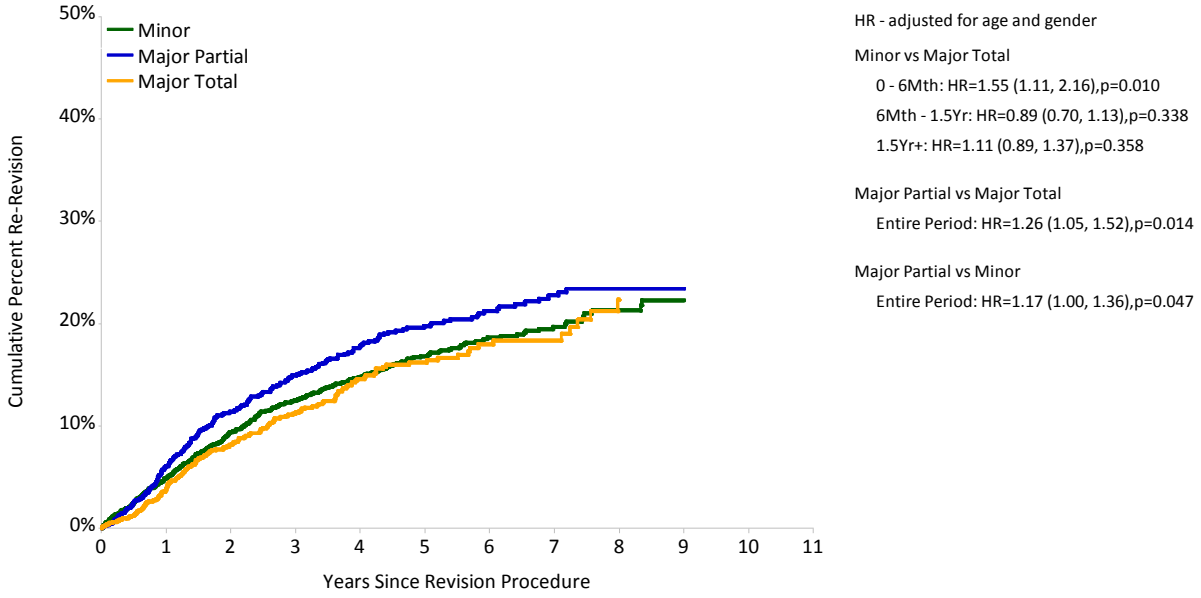
Revision of Primary	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Minor	481	3924	12687	3.79 (3.46, 4.15)
Major Partial	257	1642	6000	4.28 (3.78, 4.84)
Major Total	198	1889	5447	3.64 (3.15, 4.18)
All Revision	**936**	**7455**	**24134**	**3.88 (3.63, 4.14)**

Note: Excluding revisions where no femoral and tibial components have been inserted.

Table R18: Yearly Cumulative Percent Re-revision of Known Primary Total Knee Replacement (Primary Diagnosis OA, excluding first revision for Infection)

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Minor	4.9 (4.2, 5.6)	12.5 (11.3, 13.7)	16.8 (15.4, 18.4)		
Major Partial	6.1 (5.0, 7.4)	14.9 (13.1, 17.0)	19.8 (17.5, 22.2)		
Major Total	3.9 (3.0, 4.9)	11.3 (9.7, 13.2)	16.2 (14.0, 18.6)		
All Revision	**4.9 (4.4, 5.4)**	**12.8 (11.9, 13.7)**	**17.4 (16.3, 18.5)**	**23.5 (21.4, 25.7)**	

Figure R13: Cumulative Percent Re-revision of Known Primary Total Knee Replacement (Primary Diagnosis OA, excluding first revision for Infection)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Minor	3924	3064	1803	919	25	6
Major Partial	1642	1310	863	510	11	1
Major Total	1889	1415	755	360	7	1

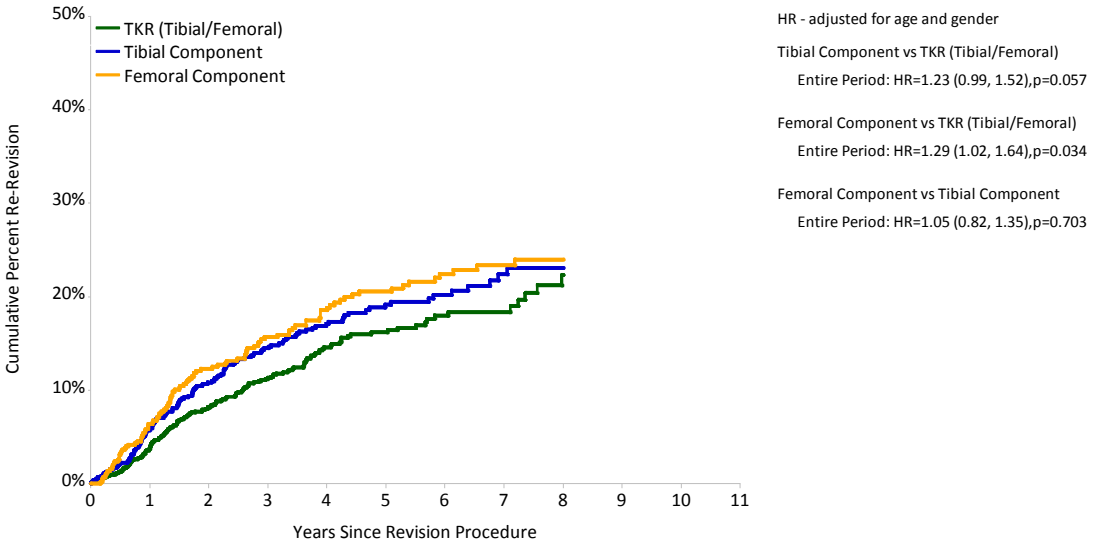
Table R19: Re-revision Rates of Known Primary Total Knee Replacement (Primary Diagnosis OA, excluding first revision for Infection)

Revision of Primary	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Insert/Patella	83	786	2419	3.43 (2.73, 4.25)
Insert Only	188	1032	3259	5.77 (4.97, 6.66)
Patella Only	208	2096	6965	2.99 (2.59, 3.42)
TKR (Tibial/Femoral)	198	1889	5447	3.64 (3.15, 4.18)
Tibial Component	149	1026	3513	4.24 (3.59, 4.98)
Femoral Component	107	614	2483	4.31 (3.53, 5.21)
TOTAL	**933**	**7443**	**24085**	**3.87 (3.63, 4.13)**

Table R20: Yearly Cumulative Percent Re-revision of Known Primary Total Knee Replacement (Primary Diagnosis OA, excluding first revision for Infection)

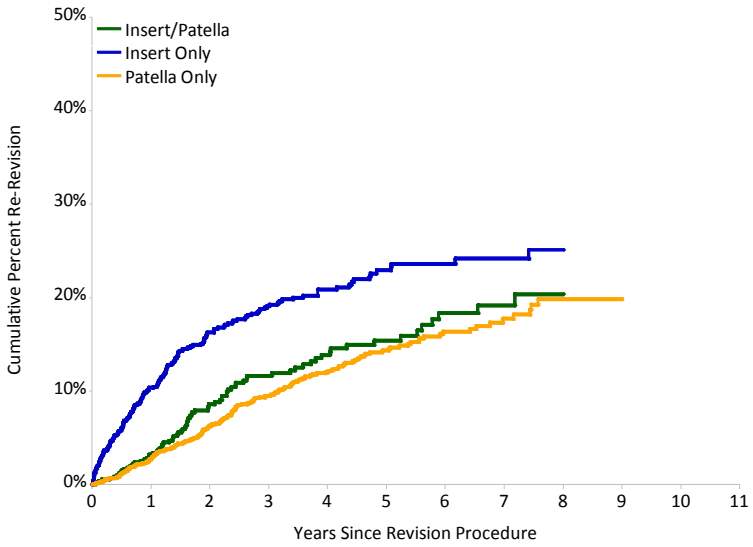
CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Insert/Patella	3.2 (2.1, 4.8)	11.6 (9.2, 14.7)	15.4 (12.3, 19.2)		
Insert Only	10.3 (8.6, 12.4)	19.1 (16.6, 21.9)	22.9 (19.9, 26.3)		
Patella Only	2.7 (2.1, 3.6)	9.5 (8.1, 11.1)	14.3 (12.4, 16.5)		
TKR (Tibial/Femoral)	3.9 (3.0, 4.9)	11.3 (9.7, 13.2)	16.2 (14.0, 18.6)		
Tibial Component	5.9 (4.6, 7.7)	14.5 (12.2, 17.1)	19.1 (16.3, 22.4)		
Femoral Component	6.4 (4.6, 8.7)	15.7 (12.8, 19.1)	20.6 (17.1, 24.6)		

Figure R14: Cumulative Percent Major Re-revision of Known Primary Total Knee Replacement (Primary Diagnosis OA, excluding first revision for Infection)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
TKR (Tibial/Femoral)	1889	1415	755	360	7	1
Tibial Component	1026	808	509	269	8	1
Femoral Component	614	500	353	241	3	0

Figure R15: Cumulative Percent Minor Re-revision of Known Primary Total Knee Replacement (Primary Diagnosis OA, excluding first revision for Infection)



HR - adjusted for age and gender

Insert/Patella vs Patella Only

Entire Period: HR=1.11 (0.86, 1.43),p=0.427

Insert Only vs Patella Only

0 - 3Mth: HR=7.91 (4.27, 14.64),p<0.001

3Mth - 1.5Yr: HR=2.69 (2.01, 3.60),p<0.001

1.5Yr+: HR=0.88 (0.65, 1.21),p=0.435

Insert Only vs Insert/Patella

0 - 3Mth: HR=7.13 (3.78, 13.47),p<0.001

3Mth - 1.5Yr: HR=2.43 (1.74, 3.39),p<0.001

1.5Yr+: HR=0.80 (0.56, 1.13),p=0.207

Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Insert/Patella	786	601	318	182	8	2
Insert Only	1032	784	473	219	5	1
Patella Only	2096	1671	1005	513	12	3

PROSTHESES WITH HIGHER THAN ANTICIPATED RATES OF REVISION

Introduction

A unique and important function of registries is that they are able to provide population based data on the comparative outcome of individual prostheses in a community. Outcomes data are necessary to enable an evidence-based approach to prostheses selection. For many prostheses the only source of outcomes data are registry reports.

It is evident from registry data that most prostheses have comparable outcomes. A number however have revision rates that are statistically higher than other prostheses in the same class. The Registry identifies these as 'prostheses with a higher than anticipated rate of revision'.

The Registry has developed a standardised three-stage approach to identify prostheses that are outliers with respect to revision rate. The comparator group includes all other prostheses within the same class regardless of their rate of revision. This is a more pragmatic approach than comparing to a select group of prostheses with the lowest revision rates.

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.

Additionally, if a component represents more than 25% of the group, its revision rate is excluded from estimation of the group's overall rate.

The Registry has the capacity to assess the outcome of individual prostheses or the combination of prostheses used in a procedure. It is apparent from previous reports that individual prostheses that perform well in one combination may not perform well in another. Therefore, the outcome of an individual prosthesis is partly dependent on the combination of the different prostheses used.

Consequently, the Registry undertakes two different analyses in Stage 1. The first assesses the outcome of all combinations. The second assesses all individual prostheses regardless of the combination. Both analyses are reviewed to determine if a higher revision rate is identified with a single combination, multiple combinations or uniformly with all combinations. If prostheses are identified in a single combination, that combination progresses to Stage 2. An individual prosthesis progresses to Stage 2 if it is identified in multiple combinations or uniformly across all combinations.

In Stage 2, the Director and Deputy Directors of the Registry in conjunction with DMAC staff, review the identified prostheses and undertake further investigation. This includes examining for the impact of confounders, and calculating age and gender adjusted hazard ratios. In addition, all prostheses identified in previous reports are re-analysed as part of the Stage 2 analysis. This is not dependent on re-identification in Stage 1. If there is a significant difference compared to the combined hazard rate of all other prostheses in the same class then the prosthesis or prostheses combination progress to Stage 3. The possible exception to this is the presence of confounding factors, such as use in complex primary procedures.

Stage 3 involves review by a panel of independent orthopaedic specialists from the Australian Orthopaedic Association Arthroplasty Society. The panel meets with Registry staff at a two-day workshop to review the Stage 2 analysis and determine which prostheses will be identified in the Annual Report.

Identified prostheses are listed in one of three groups. There are those that have a higher rate of revision but are no longer used in Australia. These are listed to provide ongoing information on the rate of revision. This also enables comparison of other prostheses to the discontinued group.

The second group is prostheses that are being re-identified but are still used. This listing identifies that the prosthesis continues to have a higher than anticipated rate of revision but it also provides information on its continued use. Most identified or re-identified prostheses decline in use. This is usually evident only after the first year because almost a full

year of use has occurred prior to the identification in the Annual Report.

The third group, 'Newly Identified' lists prostheses that are being used and 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, 11 independent arthroplasty specialists together with the Chairman of the NJRR Committee, the Director and the two Deputy Directors of the Registry 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.

The full analysis for all prostheses identified as having a higher than anticipated rate of revision in the 2012 Annual Report are available on the Registry website, www.dmac.adelaide.edu.au/aoanjrr/publications.jsp.

Primary Partial Hip Replacement

Unipolar Modular

There are no newly identified unipolar modular prostheses. The Taperloc femoral component is no longer significantly different from all other unipolar modular prostheses.

Bipolar

The Tandem/Basis combination is newly identified. It has been used in 62 procedures and has a five year cumulative percent revision of 17.2%. There have been six revisions, five of which were major. Three revisions were for loosening/lysis and two for infection (adj HR=2.71 (1.21, 6.09), p=0.015).

In the 2011 Annual Report the Tandem/Spectron EF was identified. The Basis stem is derived from the Spectron EF and was included within the Spectron EF range for the 2011 analysis. Now that the Basis stem has been removed from the Spectron EF range the Tandem/Spectron EF is no longer identified.

Table IP1: Revision Rate of Individual Bipolar Hip identified as having a Higher than Anticipated Revision Rate

Bipolar Head/Femoral	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Identified and no longer used				
UHR/ABGII	177	668	1.65	Entire Period: HR=1.84 (1.01, 3.34),p=0.047
Re-Identified and still used				
UHR/Omnifit	354	1617	1.30	Entire Period: HR=1.62 (1.04, 2.52),p=0.031
Newly Identified				
Tandem/Basis	62	165	3.63	Entire Period: HR=2.71 (1.21, 6.09),p=0.015

Note: All Components have been compared to all other Bipolar Hip components.
** Femoral Component
* Bipolar Head Component

Table IP2: Yearly Cumulative Percent Revision of Individual Bipolar Hip identified as having a Higher than Anticipated Revision Rate

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs
Identified and no longer used					
UHR/ABGII	4.4 (2.1, 8.9)	5.2 (2.6, 10.1)	8.3 (4.6, 14.8)		
Re-Identified and still used					
UHR/Omnifit	5.2 (3.3, 8.2)	5.6 (3.5, 8.7)	6.0 (3.9, 9.3)	7.5 (4.8, 11.5)	
Newly Identified					
Tandem/Basis	2.0 (0.3, 13.6)	12.3 (5.2, 27.4)	17.2 (7.7, 35.9)		

Table IP3: Yearly Usage of Individual Bipolar Hip identified as having a Higher than Anticipated Revision Rate

Year of Implant	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Identified and no longer used													
UHR/ABGII			1	24	25	36	34	10	15	20	7	5	
Re-Identified and still used													
UHR/Omnifit	5	25	47	68	59	42	31	24	12	17	11	5	8
Newly Identified													
Tandem/Basis							10	13	9	11	4	7	8

Figure IP1: Cumulative Percent Revision of Individual Bipolar Hip re-identified and still used

Re-identified and still used

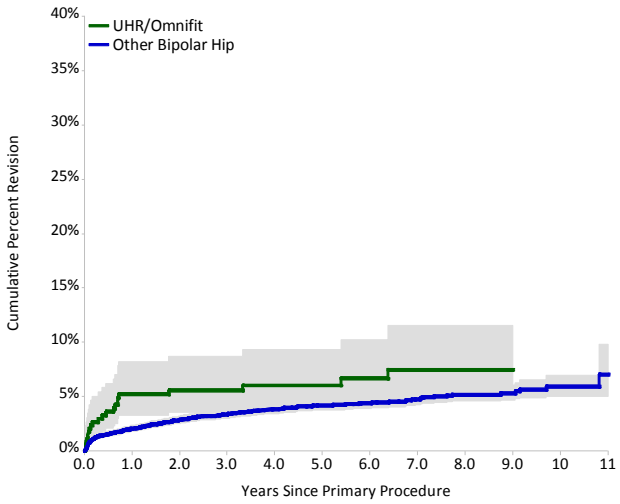
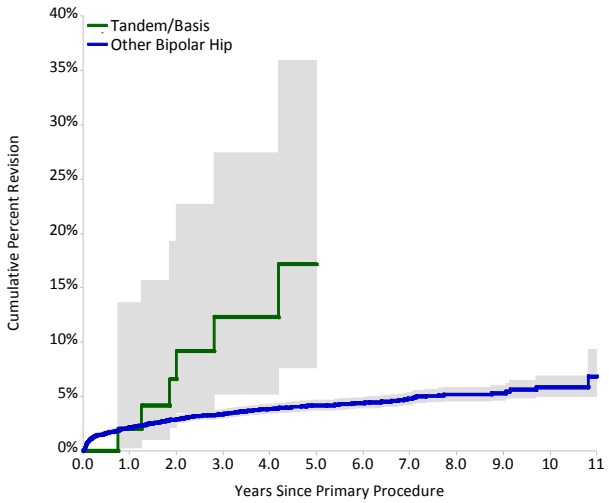


Figure IP2: Cumulative Percent Revision of Individual Bipolar Hip newly identified

Newly Identified



Primary Total Hip Replacement

Total Conventional

There is a large number of femoral stem and acetabular component combinations available for comparative analysis. The Registry has information on 1,966 combinations used in primary total conventional hip replacement. This is 97 more than reported last year.

These combinations are the result of mixing and matching different femoral stem and acetabular components, which may be from the same or different companies.

There are nine primary total hip prostheses and prostheses combinations being identified for the first time.

The ABGII Exchangeable Neck femoral stem has been used in 239 procedures and has a three year cumulative percent revision of 9.9%. There have been 18 revisions, 14 major. The femoral stem was replaced in 12 revisions. Fracture (44.4%) was the main reason for revision, followed by loosening/lysis (16.7%) (adj HR=3.58 (2.25, 5.69), p<0.001).

The Apex/Trilogy combination has been used in 97 procedures and has a three year cumulative percent revision of 8.6%. There have been seven revisions, three involved replacement of the femoral component only. Loosening/lysis (28.6%) and fracture (28.6%) were the main reasons for revision (adj HR=3.35 (1.60, 7.01), p=0.001).

The BHR acetabular component has been used in 2,937 conventional total hip replacement procedures. It has a five year cumulative percent revision of 5.3%. There have been 133 revisions, 83 of which involved replacement of the acetabular component. The main reasons for revision were metal sensitivity (25.6%) and loosening/lysis (23.3%) 1.5Yr+: adj HR=1.89 (1.53, 2.33), p<0.001)

The Continuum acetabular component has been used in 2,509 procedures and has a one year cumulative percent revision of 2.4%. There have been 59 revisions, 32 major. Prosthesis dislocation was the main reason for revision (47.5%) (0 - 3Mth: adj HR=1.77 (1.31, 2.41), p<0.001, 3Mth - 1.5Yr: adj HR=0.92 (0.53, 1.58), p=0.751, 1.5Yr+: adj HR=2.88 (1.08, 7.69), p=0.035).

The Cormet acetabular component has been used in 796 procedures and has a five year cumulative percent revision of 6.1%. There have been 45 revisions, 44 major. Loosening/lysis was the main cause of revision (35.6%) (2Yr+: adj HR=2.39 (1.64, 3.49), p<0.001).

The Furlong femoral stem has been used in 340 procedures and has a three year cumulative percent revision of 5.1%. There have been 17 revisions, 11 major. Prosthesis dislocation was the main reason for revision (47.1%), followed by loosening/lysis (17.6%) (adj HR 1.90 (1.18, 3.06), p=0.008).

The Metha femoral stem has been used in 105 procedures and has a one year cumulative percent revision of 12.7%. There have been 12 revisions, nine of which involved replacement of the femoral stem. Loosening/lysis occurred in ten cases (adj HR=6.29 (3.57, 11.09), p<0.001).

The Mitch TRH acetabular component has been used in 731 procedures and has a three year cumulative percent revision of 4.3%. There have been 37 revisions, 22 of which involved replacement of the acetabular component. Loosening/lysis occurred in 16 cases (0 - 3Mth: adj HR=0.68 (0.28, 1.63), p=0.388, 3Mth+: adj HR=2.10 (1.48, 2.97), p<0.001).

The Polarstem femoral stem has been used in 733 procedures and has a three year cumulative percent revision of 3.0%. There have been 18 revisions, ten minor. Infection was the main reason for revision (38.9%) (0 - 1Mth: adj HR=2.81 (1.59, 4.95), p<0.001, 1Mth+: adj HR=0.72 (0.33, 1.61), p=0.429).

There are five prostheses that are no longer identified, Quadra-H, Ancafit, Esop/Atlas, Spectron EF/R3 and Trabecular Metal Stem/Trabecular Metal Shell.

Previously the Registry has highlighted that the Quadra-H femoral stem was associated with a higher rate of revision in the first two weeks and after this period there was no difference. The Registry has undertaken an analysis of the procedures performed in the last two years and this difference is no longer evident.

Table IP4: Revision Rate of Individual Total Conventional Hip identified as having a Higher than Anticipated Revision Rate

Femoral/Acetabular	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Identified and no longer used				
Charnley/Duraloc	180	1391	1.87	0 - 3.5Yr: HR=1.11 (0.50, 2.48),p=0.791 3.5Yr+: HR=4.75 (3.06, 7.38),p<0.001
Elite Plus/Apollo	52	420	2.86	Entire Period: HR=4.18 (2.37, 7.37),p<0.001
Elite Plus/Charnley LPW	89	643	1.87	Entire Period: HR=2.54 (1.44, 4.47),p=0.001
F2L/Delta	110	600	2.16	Entire Period: HR=2.75 (1.60, 4.73),p<0.001
H Moos/Mueller	19	115	6.96	Entire Period: HR=9.35 (4.67, 18.70),p<0.001
S-Rom/Duraloc	168	1312	1.75	Entire Period: HR=2.28 (1.52, 3.44),p<0.001
Secur-Fit Plus/Secur-Fit	197	1431	1.33	Entire Period: HR=1.82 (1.16, 2.86),p=0.009
*Adapter (cemented)	148	555	3.42	0 - 6Mth: HR=2.40 (0.90, 6.39),p=0.080 6Mth+: HR=5.22 (3.15, 8.66),p<0.001
*LYDERIC II	164	973	1.34	Entire Period: HR=1.89 (1.10, 3.26),p=0.021
*Margron	688	4669	1.97	Entire Period: HR=2.60 (2.12, 3.20),p<0.001
*Mayo	167	795	1.63	Entire Period: HR=2.03 (1.18, 3.49),p=0.010
*Profemur Z	186	1011	2.08	Entire Period: HR=2.69 (1.75, 4.12),p<0.001
*Revitan (non mod)	82	618	1.46	Entire Period: HR=1.97 (1.02, 3.78),p=0.042
**Artek	178	1519	3.03	Entire Period: HR=3.96 (2.96, 5.30),p<0.001
**ASR	4419	18454	4.89	0 - 2Wk: HR=1.36 (0.83, 2.23),p=0.228 2Wk - 1Mth: HR=0.26 (0.10, 0.71),p=0.008 1Mth - 9Mth: HR=1.13 (0.83, 1.54),p=0.448 9Mth - 1Yr: HR=2.62 (1.67, 4.11),p<0.001 1Yr - 2Yr: HR=4.26 (3.51, 5.18),p<0.001 2Yr - 3Yr: HR=10.31 (8.81, 12.06),p<0.001 3Yr - 5Yr: HR=17.24 (15.25, 19.48),p<0.001 5Yr+: HR=26.89 (22.45, 32.22),p<0.001
**ExpanSys	71	383	2.35	Entire Period: HR=3.00 (1.56, 5.76),p<0.001
**Hedrocel	46	358	2.23	Entire Period: HR=3.03 (1.51, 6.05),p=0.001
**Inter-Op	33	266	3.39	Entire Period: HR=4.87 (2.54, 9.36),p<0.001
**MBA	124	769	1.95	Entire Period: HR=2.81 (1.69, 4.67),p<0.001
**SPH-Blind	951	7032	1.25	0 - 1Mth: HR=2.81 (1.72, 4.60),p<0.001 1Mth+: HR=1.57 (1.25, 1.98),p<0.001

Femoral/Acetabular	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Re-Identified and still used				
Alloclassic/Durom	623	2905	1.41	0 - 1.5Yr: HR=0.87 (0.48, 1.57),p=0.647 1.5Yr - 3Yr: HR=3.49 (2.22, 5.49),p<0.001 3Yr+: HR=1.57 (0.87, 2.84),p=0.134
CPT/Low Profile Cup	77	243	2.06	Entire Period: HR=2.50 (1.04, 6.00),p=0.040
ML Taper/Fitmore	118	410	2.19	Entire Period: HR=2.53 (1.32, 4.86),p=0.005
ML Taper Kinectiv/Continuum	780	790	2.78	Entire Period: HR=1.78 (1.17, 2.71),p=0.006
*Adapter (cementless)	742	2300	2.56	Entire Period: HR=2.78 (2.15, 3.60),p<0.001
*CBH Stem	222	566	2.65	Entire Period: HR=2.70 (1.63, 4.49),p<0.001
*Edinburgh	138	471	2.76	Entire Period: HR=3.37 (1.95, 5.80),p<0.001
*K2	598	1090	4.22	Entire Period: HR=3.65 (2.73, 4.88),p<0.001
*Taper Fit	319	1712	1.58	0 - 2Yr: HR=1.06 (0.50, 2.22),p=0.880 2Yr+: HR=3.17 (2.04, 4.92),p<0.001
*UniSyn	350	1444	1.59	Entire Period: HR=1.82 (1.21, 2.73),p=0.004
**2000 Plus	135	473	2.11	Entire Period: HR=2.42 (1.30, 4.49),p=0.005
**Adept	121	364	2.20	Entire Period: HR=2.16 (1.08, 4.32),p=0.029
**Bionik	608	2146	2.89	0 - 3Mth: HR=1.89 (1.05, 3.42),p=0.034 3Mth+: HR=3.90 (2.96, 5.14),p<0.001
**Fin II	1463	3655	1.64	Entire Period: HR=1.64 (1.27, 2.12),p<0.001
**Icon	399	1418	2.33	Entire Period: HR=2.49 (1.77, 3.51),p<0.001
**Plasmacup	219	444	3.61	Entire Period: HR=3.29 (2.01, 5.37),p<0.001
**Procotyl	649	647	3.55	Entire Period: HR=2.30 (1.53, 3.47),p<0.001
Newly Identified				
Apex/Trilogy	97	173	4.05	Entire Period: HR=3.35 (1.60, 7.01),p=0.001
*ABGII (Exchangeable Neck)	239	449	4.01	Entire Period: HR=3.58 (2.25, 5.69),p<0.001
*Furlong	340	955	1.78	Entire Period: HR=1.90 (1.18, 3.06),p=0.008
*Metha	105	127	9.48	Entire Period: HR=6.29 (3.57, 11.09),p<0.001
*Polarstem	733	959	1.88	0 - 1Mth: HR=2.81 (1.59, 4.95),p<0.001 1Mth+: HR=0.72 (0.33, 1.61),p=0.429
**BHR	2937	11796	1.13	0 - 2Wk: HR=0.86 (0.41, 1.81),p=0.686 2Wk - 1Mth: HR=0.19 (0.05, 0.78),p=0.020 1Mth - 3Mth: HR=1.38 (0.84, 2.27),p=0.197 3Mth - 1.5Yr: HR=0.71 (0.45, 1.10),p=0.121 1.5Yr+: HR=1.89 (1.53, 2.33),p<0.001
**Continuum	2509	2530	2.33	0 - 3Mth: HR=1.77 (1.31, 2.41),p<0.001 3Mth - 1.5Yr: HR=0.92 (0.53, 1.58),p=0.751 1.5Yr+: HR=2.88 (1.08, 7.69),p=0.035
**Cormet	796	3381	1.33	0 - 1.5Yr: HR=1.08 (0.67, 1.74),p=0.758 1.5Yr - 2Yr: HR=0.45 (0.06, 3.22),p=0.428 2Yr+: HR=2.39 (1.64, 3.49),p<0.001
**Mitch TRH	731	2399	1.54	0 - 3Mth: HR=0.68 (0.28, 1.63),p=0.388 3Mth+: HR=2.10 (1.48, 2.97),p<0.001

Note: All Components have been compared to all other Total Conventional Hip components.
** Acetabular Component
* Femoral Component

Table IP5: Yearly Cumulative Percent Revision of Individual Total Conventional Hip identified as having a Higher than Anticipated Revision Rate

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Identified and no longer used					
Charnley/Duraloc	0.6 (0.1, 3.9)	2.9 (1.2, 6.7)	9.4 (5.9, 14.9)	17.5 (12.1, 25.0)	
Elite Plus/Apollo	2.0 (0.3, 13.4)	4.0 (1.0, 15.1)	12.1 (5.6, 25.0)	25.1 (14.2, 42.0)	
Elite Plus/Charnley LPW	1.2 (0.2, 8.2)	6.1 (2.6, 14.1)	11.3 (6.1, 20.7)	18.3 (10.3, 31.1)	
F2L/Delta	5.5 (2.5, 11.8)	10.1 (5.7, 17.5)	12.0 (7.1, 19.7)		
H Moos/Mueller	5.6 (0.8, 33.4)	33.3 (16.6, 59.6)	38.9 (20.8, 64.7)	46.5 (26.2, 72.4)	
S-Rom/Duraloc	3.0 (1.3, 7.1)	4.9 (2.5, 9.6)	5.6 (3.0, 10.5)		
Secur-Fit Plus/Secur-Fit	3.1 (1.4, 6.7)	7.3 (4.4, 11.9)	7.8 (4.8, 12.6)		
*Adapter (cemented)	4.1 (1.9, 8.9)	9.3 (5.5, 15.5)			
*LYDERIC II	3.1 (1.3, 7.2)	5.7 (3.0, 10.6)	7.2 (4.0, 12.6)		
*Margron	5.8 (4.3, 7.9)	8.4 (6.5, 10.8)	10.3 (8.2, 12.8)	15.6 (12.7, 19.0)	
*Mayo	3.0 (1.3, 7.1)	6.8 (3.8, 12.0)	6.8 (3.8, 12.0)		
*Profemur Z	6.0 (3.4, 10.5)	10.4 (6.8, 15.8)	11.0 (7.2, 16.5)		
*Revitan (non mod)	2.4 (0.6, 9.4)	6.1 (2.6, 14.0)	8.6 (4.2, 17.1)		
**Artek	2.8 (1.2, 6.7)	8.0 (4.8, 13.1)	15.7 (11.0, 22.0)	24.9 (19.0, 32.2)	
**ASR	1.8 (1.5, 2.3)	9.3 (8.4, 10.2)	21.7 (20.3, 23.2)		
**ExpanSys	2.8 (0.7, 10.8)	5.7 (2.2, 14.4)	10.3 (5.0, 20.4)		
**Hedrocel	4.3 (1.1, 16.3)	6.6 (2.2, 19.2)	6.6 (2.2, 19.2)	27.8 (12.2, 55.7)	
**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, 17.3)		
**SPH-Blind	3.8 (2.8, 5.2)	5.8 (4.5, 7.5)	7.3 (5.8, 9.2)	10.2 (8.3, 12.5)	
Re-Identified and still used					
Alloclassic/Durom	1.3 (0.7, 2.6)	5.0 (3.5, 7.1)	6.3 (4.6, 8.7)		
CPT/Low Profile Cup	4.1 (1.3, 12.2)	6.6 (2.4, 17.3)	9.6 (3.9, 22.8)		
ML Taper/Fitmore	5.1 (2.3, 11.1)	8.0 (4.2, 14.8)			
ML Taper Kinectiv/Continuum	2.5 (1.6, 4.0)				
*Adapter (cementless)	3.2 (2.1, 4.7)	7.1 (5.3, 9.5)	12.3 (9.3, 16.2)		
*CBH Stem	3.9 (1.9, 7.6)	8.9 (5.2, 15.0)			
*Edinburgh	6.0 (3.1, 11.7)	9.1 (5.1, 15.9)			
*K2	5.5 (3.9, 7.7)	9.3 (6.9, 12.6)			
*Taper Fit	1.3 (0.5, 3.4)	3.4 (1.8, 6.2)	7.5 (4.9, 11.4)		
*UniSyn	3.5 (2.0, 6.0)	5.4 (3.4, 8.5)	7.6 (5.0, 11.6)		
**2000 Plus	3.0 (1.1, 7.8)	6.5 (3.3, 12.6)			
**Adept	4.2 (1.7, 9.7)	7.1 (3.6, 13.6)			
**Bionik	3.6 (2.4, 5.5)	8.1 (6.1, 10.7)	14.6 (11.3, 19.0)		
**Fin II	2.9 (2.1, 3.9)	4.5 (3.5, 5.9)	6.4 (4.5, 9.0)		
**Icon	3.1 (1.7, 5.3)	7.1 (4.8, 10.3)	11.2 (7.9, 15.8)		
**Plasmacup	7.4 (4.4, 12.2)	8.9 (5.5, 14.3)			
**Procotyl	3.8 (2.5, 5.8)				
Newly Identified					
Apex/Trilogy	5.4 (2.3, 12.5)	8.6 (4.1, 17.4)			
*ABGII (Exchangeable Neck)	3.9 (2.1, 7.4)	9.9 (5.6, 17.2)			
*Furlong	2.7 (1.4, 5.2)	5.1 (3.0, 8.7)			
*Metha	12.7 (7.2, 22.0)				
*Polarstem	2.3 (1.4, 3.7)	3.0 (1.8, 5.0)			
**BHR	1.2 (0.8, 1.6)	3.1 (2.5, 3.8)	5.3 (4.4, 6.4)		
**Continuum	2.4 (1.9, 3.2)				
**Cormet	1.4 (0.8, 2.5)	3.3 (2.2, 4.9)	6.1 (4.3, 8.5)		
**Mitch TRH	1.5 (0.8, 2.7)	4.3 (3.0, 6.2)			

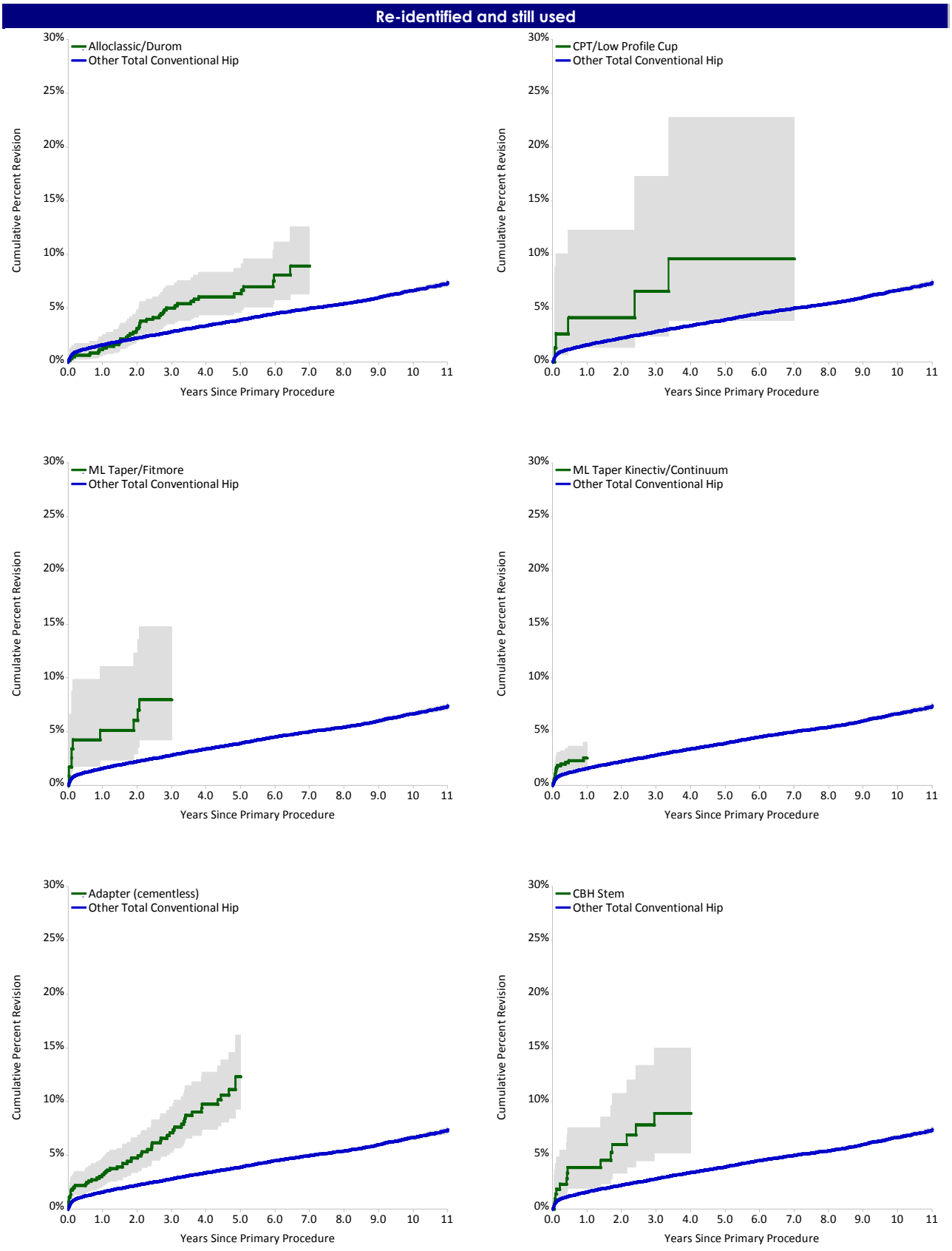
Note: ** Acetabular Component, * Femoral Component

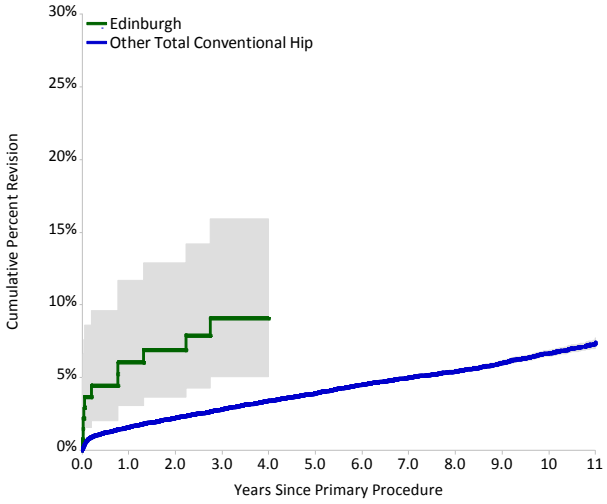
Table IP6: Yearly Usage of Individual Total Conventional Hip identified as having a Higher than Anticipated Revision Rate

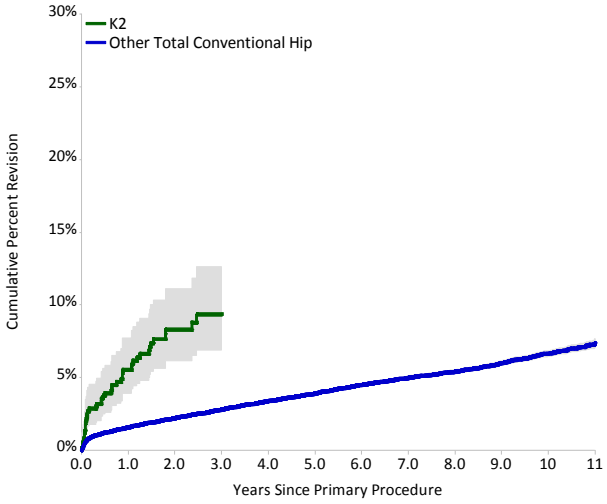
Year of Implant	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Identified and no longer used													
Charnley/Duraloc		6	60	41	33	19	20	1					
Elite Plus/Apollo		9	16	17	10								
Elite Plus/Charnley LPW	3	19	23	29	15								
F2L/Delta						10	62	28	10				
H Moos/Mueller		5	9	5									
S-Rom/Duraloc	12	28	14	39	33	28	3	3	1	4	3		
Secur-Fit Plus/Secur-Fit		1	40	60	27	21	26	22					
*Adapter (cemented)							7	41	52	33	8	7	
*LYDERIC II			5	28	16	64	23	12	8	8			
*Margron		28	56	130	123	140	96	85	28	2			
*Mayo		1		9	11	14	23	24	25	29	29	2	
*Profemur Z						41	79	56	6	1	2	1	
*Revitan (non mod)				6	53	23							
**Artek	12	33	111	22									
**ASR						84	583	959	1186	1178	429		
**ExpanSys					1	7	24	30	8	1			
**Hedrocel		2	9	26	9								
**Inter-Op		9	24										
**MBA			8	41	29	19	11	9	5	2			
**SPH-Blind		32	116	228	262	204	41	49	19				
Re-Identified and still used													
Alloclassic/Durom					3	51	151	139	113	112	46	7	1
CPT/Low Profile Cup						15	9	8	7	7	6	9	16
ML Taper/Fitmore							7	11	24	70	3		3
ML Taper Kinectiv/Continuum											40	374	366
*Adapter (cementless)							19	140	131	122	158	113	59
*CBH Stem						12	7	14	37	28	27	44	53
*Edinburgh							20	37	29	18	23	10	1
*K2								1	22	80	171	203	121
*Taper Fit			14	16	34	65	50	66	26	18	6	8	16
*UniSyn				1	15	40	74	32	37	46	47	36	22
**2000 Plus							11	23	42	14	18	25	2
**Adept								19	20	29	30	11	12
**Bionik							11	147	136	138	134	38	4
**Fin II							39	127	175	251	268	317	286
**Icon						3	40	79	84	68	77	37	11
**Plasmacup							10	16	13	7	54	60	59
**Procotyl										8	32	269	340
Newly Identified													
Apex/Trilogy										15	37	25	20
*ABGII (Exchangeable Neck)									10	39	69	58	63
*Furlong		5	7	15	4	0	0	1	35	80	73	61	59
*Metha											20	53	32
*Polarstem									10	72	116	157	378
**BHR			1	38	66	127	289	550	580	476	400	276	134
**Continuum											175	1109	1225
**Cormet			1	8	53	74	103	115	72	129	124	91	26
**Mitch TRH								45	274	164	130	81	37

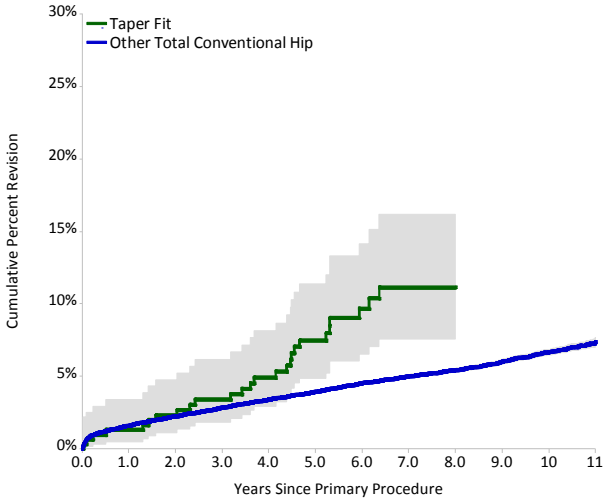
Note: ** Acetabular Component, * Femoral Component

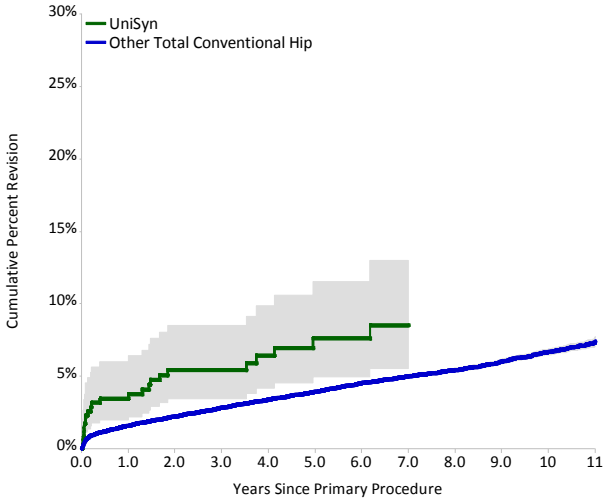
Figure IP3: Cumulative Percent Revision of Individual Total Conventional Hip re-identified and still used

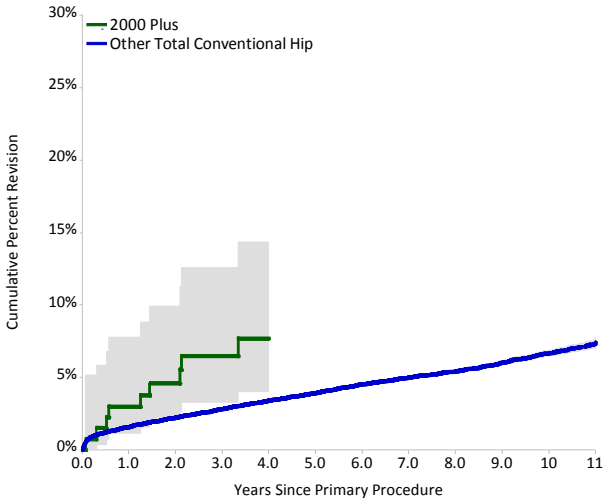


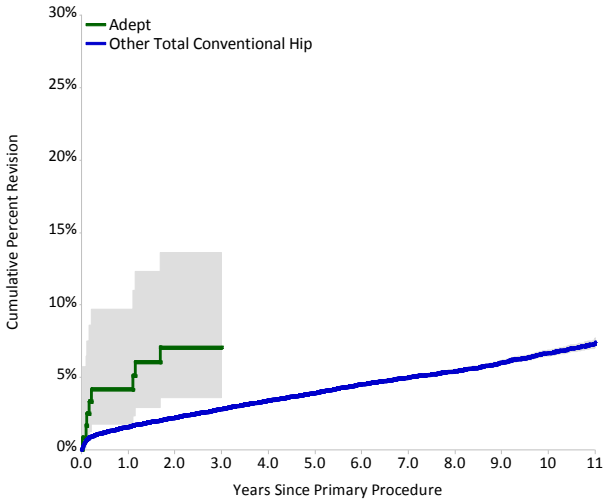

Edinburgh
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11
Years Since Primary Procedure

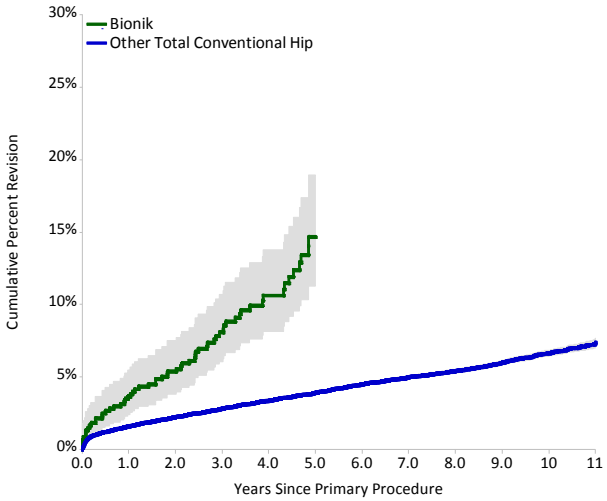

K2
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11
Years Since Primary Procedure

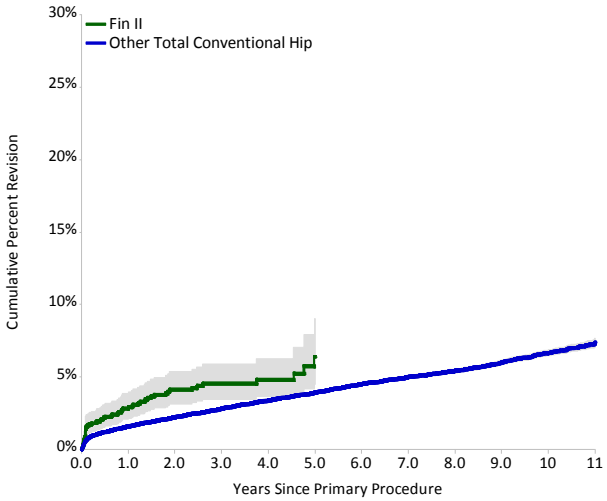

Taper Fit
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11
Years Since Primary Procedure

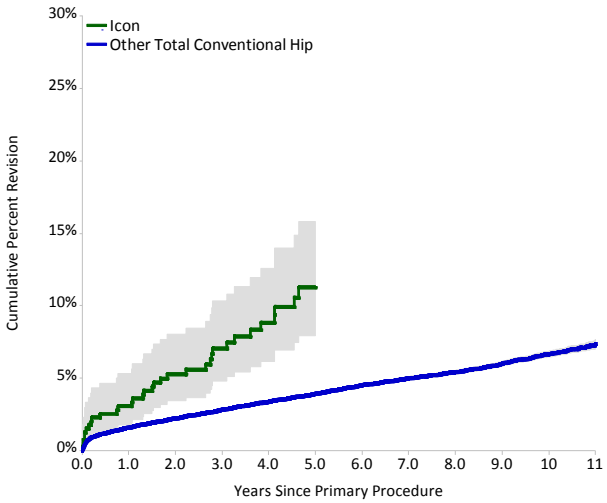

UniSyn
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11
Years Since Primary Procedure

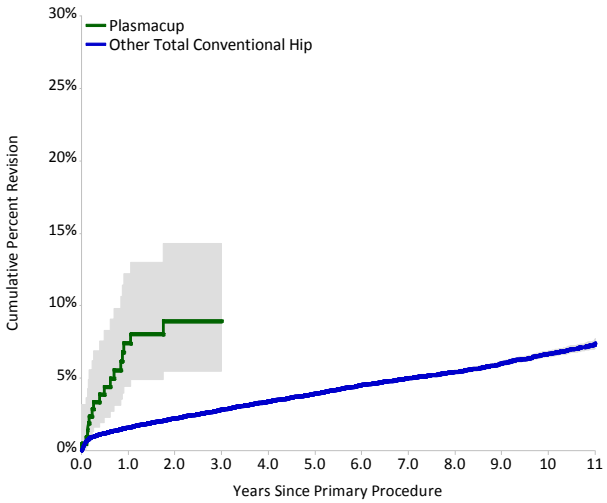

2000 Plus
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11
Years Since Primary Procedure


Adept
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11
Years Since Primary Procedure


Bionik
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11
Years Since Primary Procedure


Fin II
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11
Years Since Primary Procedure


Icon
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11
Years Since Primary Procedure


Plasmacup
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11
Years Since Primary Procedure

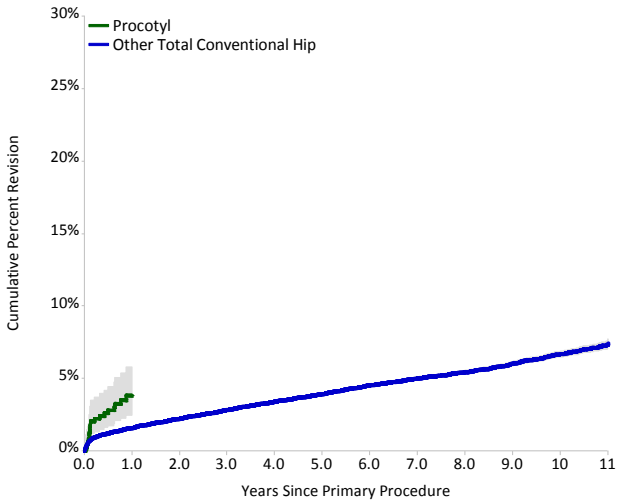
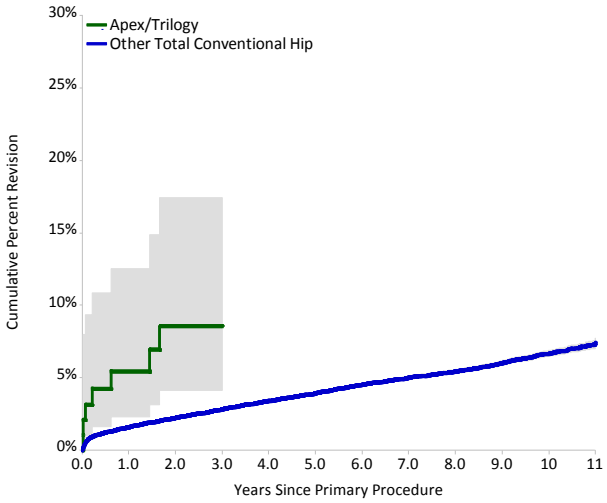
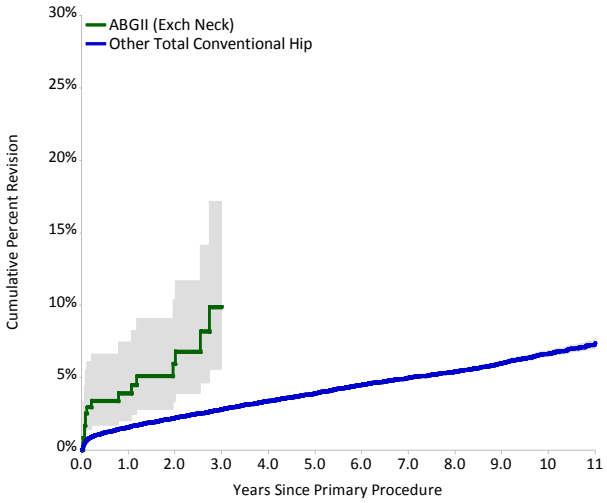
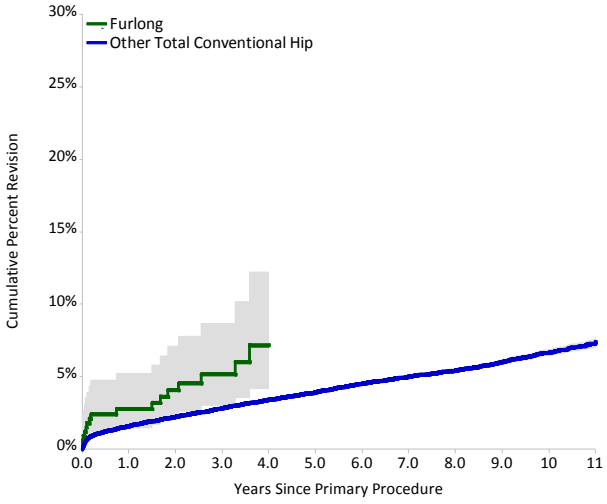

Procotyl
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11
Years Since Primary Procedure

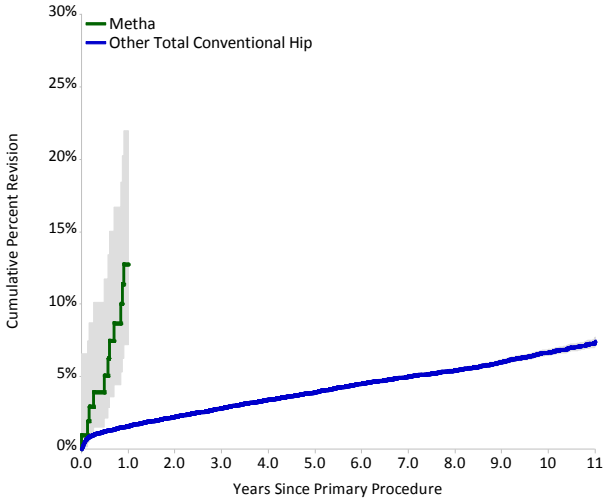
Figure IP4: Cumulative Percent Revision of Individual Total Conventional Hip newly identified

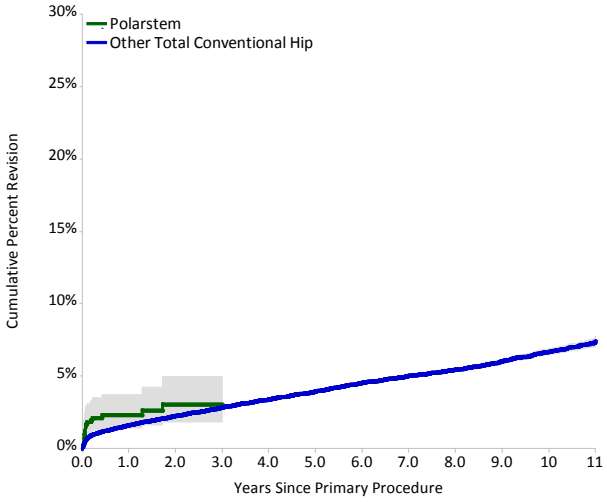
Newly Identified

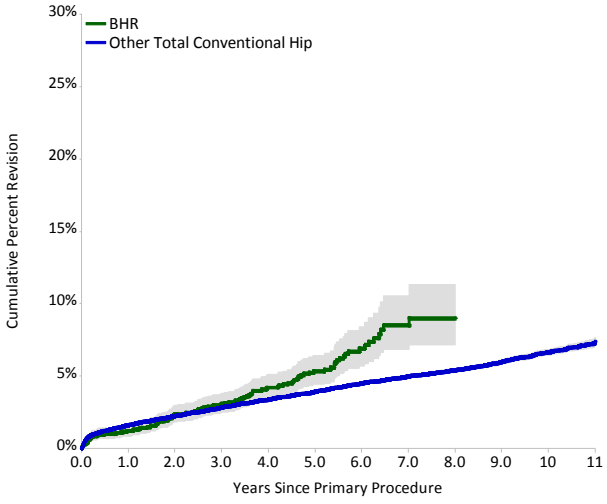


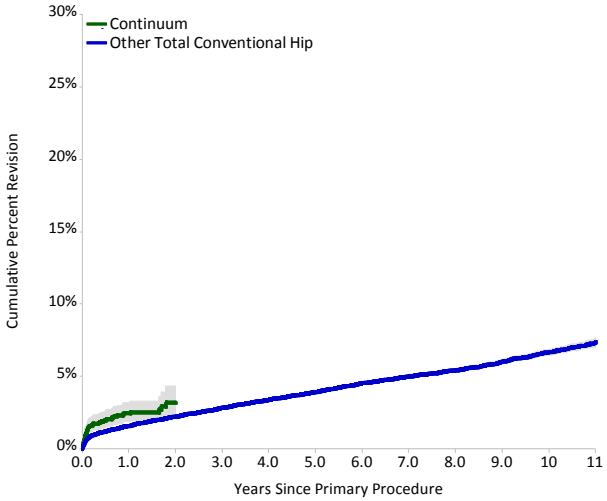


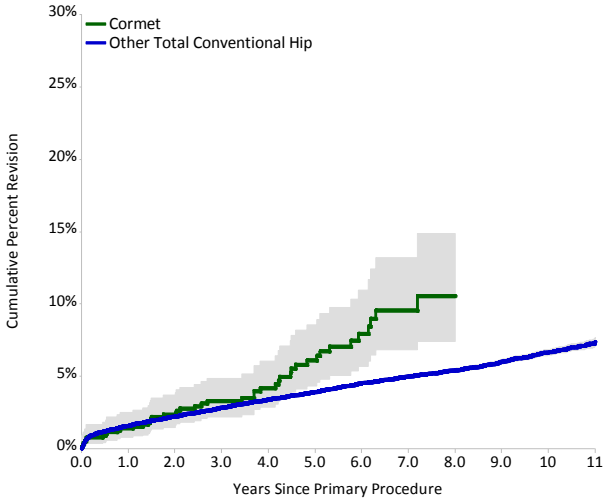


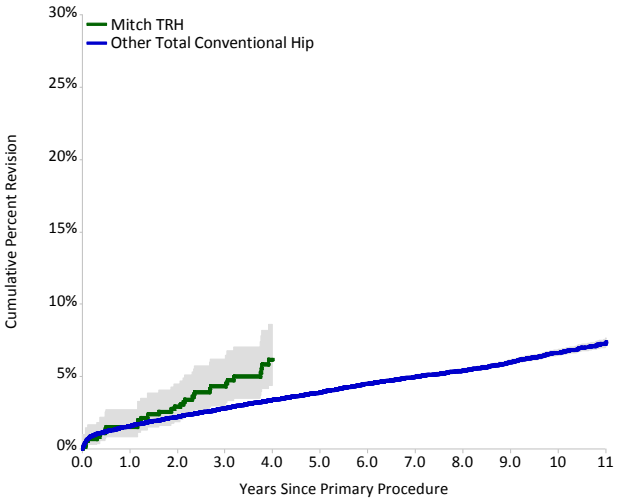







Continuum
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11
Years Since Primary Procedure


Cormet
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11
Years Since Primary Procedure


Mitch TRH
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11
Years Since Primary Procedure

Total Resurfacing

There are no newly identified resurfacing prostheses.

Five resurfacing devices have previously been identified as having a higher than anticipated rate of revision. The Registry has recorded procedures for three of these in 2011, the Durom, Bionik and Recap resurfacing hip prostheses. All continue to have a higher than anticipated rate of revision.

Table IP7: Revision Rate of Individual Total Resurfacing Hip 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	1167	5936	3.37	0 - 3Mth: HR=1.66 (1.00, 2.76),p=0.052 3Mth - 1.5Yr: HR=1.95 (1.33, 2.86),p<0.001 1.5Yr - 4.5Yr: HR=4.21 (3.26, 5.43),p<0.001 4.5Yr - 5Yr: HR=9.56 (5.35, 17.08),p<0.001 5Yr+: HR=6.40 (4.58, 8.94),p<0.001
*Cormet 2000 HAP	95	708	2.26	Entire Period: HR=2.38 (1.45, 3.90),p<0.001
Re-Identified and still used				
Bionik/Bionik	197	673	3.42	Entire Period: HR=3.32 (2.19, 5.04),p<0.001
Durom/Durom	847	4494	1.49	Entire Period: HR=1.49 (1.16, 1.92),p=0.001
Recap/Recap	195	750	2.80	Entire Period: HR=2.65 (1.71, 4.08),p<0.001

Note: All Components have been compared to all other Total Resurfacing Hip components.
* Resurfacing Head Component

Table IP8: Yearly Cumulative Percent Revision of Individual Total Resurfacing Hip identified as having a Higher than Anticipated Revision Rate

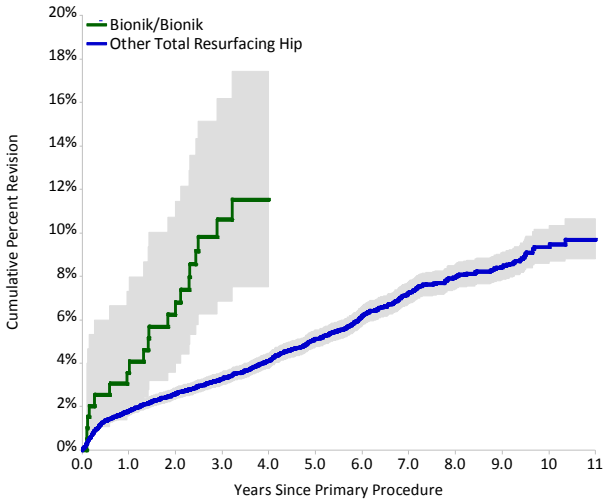
CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs
Identified and no longer used					
ASR/ASR	3.3 (2.5, 4.5)	7.1 (5.8, 8.7)	14.7 (12.7, 17.0)	23.4 (20.2, 26.9)	
*Cormet 2000 HAP	6.3 (2.9, 13.5)	8.4 (4.3, 16.1)	9.5 (5.0, 17.4)	12.6 (7.4, 21.2)	
Re-Identified and still used					
Bionik/Bionik	3.6 (1.7, 7.3)	10.6 (6.9, 16.2)			
Durom/Durom	3.2 (2.2, 4.6)	5.4 (4.1, 7.2)	7.5 (5.8, 9.6)	9.3 (7.3, 11.9)	
Recap/Recap	5.2 (2.8, 9.4)	9.0 (5.7, 14.0)	11.8 (7.6, 18.1)		

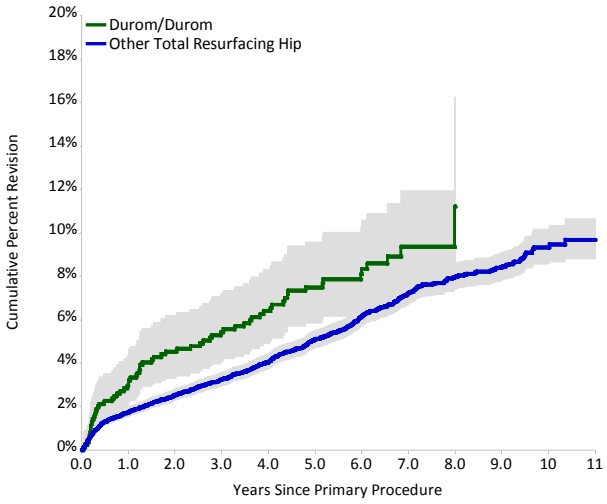
Table IP9: Yearly Usage of Individual Total Resurfacing Hip identified as having a Higher than Anticipated Revision Rate

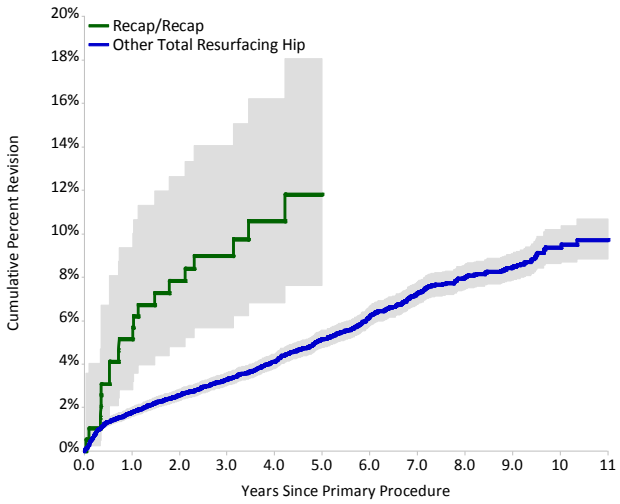
Year of Implant	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Identified and no longer used													
ASR/ASR					43	165	302	257	176	133	91		
*Cormet 2000 HAP			1	17	38	39							
Re-Identified and still used													
Bionik/Bionik							12	33	33	46	54	17	2
Durom/Durom					58	166	207	143	105	88	46	24	10
Recap/Recap						27	14	9	42	46	38	16	3

Figure IP5: Cumulative Percent Revision of Individual Total Resurfacing Hip re-identified and still used

Re-identified and still used







Primary Partial Knee Replacement

Patella/Trochlear

There are no newly identified patella/trochlear prostheses

Table IP10: Revision Rate of Individual Patella/Trochlear Knee identified as having a Higher than Anticipated Revision Rate

Patella/Trochlear	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Identified and no longer used				
**LCS	413	2053	5.31	Entire Period: HR=1.77 (1.39, 2.25),p<0.001
Re-Identified and still used				
PFC Sigma/Sigma HP	56	103	6.77	Entire Period: HR=2.40 (1.13, 5.13),p=0.023

Note: All Components have been compared to all other Patella/Trochlear Knee components.
** Trochlear Component

Table IP11: Yearly Cumulative Percent Revision of Individual Patella/Trochlear Knee identified as having a Higher than Anticipated Revision Rate

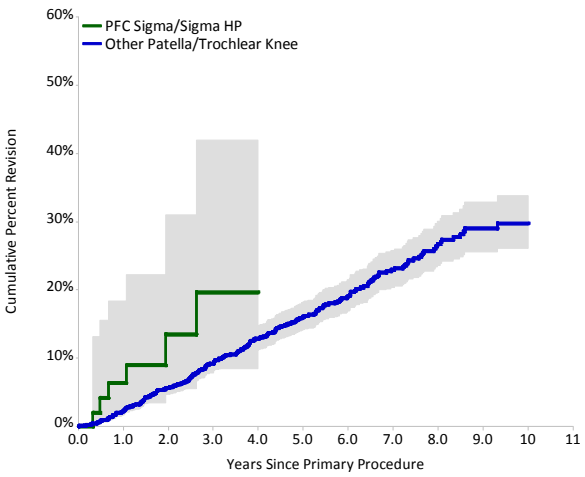
CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Identified and no longer used					
**LCS	3.9 (2.4, 6.2)	12.0 (9.2, 15.5)	21.6 (17.7, 26.3)		
Re-Identified and still used					
PFC Sigma/Sigma HP	6.3 (2.1, 18.4)	19.7 (8.4, 42.0)			

Table IP12: Yearly Usage of Individual Patella/Trochlear Knee identified as having a Higher than Anticipated Revision Rate

Year of Implant	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Identified and no longer used													
**LCS				26	56	68	47	65	64	60	27		
Re-Identified and still used													
PFC Sigma/Sigma HP									14	6	5	16	15

Figure IP6: Cumulative Percent Revision of Individual Patella/Trochlear Knee re-identified and still used

Re-Identified and still used



Unicompartmental

No new unicompartmental knee replacements have been identified as having a higher than anticipated rate of revision.

Table IP13: Revision Rate of Individual Unicompartmental Knee identified as having a Higher than Anticipated Revision Rate

Femoral/Tibial	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Identified and no longer used				
Advance/Advance	37	190	6.84	Entire Period: HR=4.30 (2.49, 7.41),p<0.001
**Preservation Mobile	400	2750	3.42	0 - 1.5Yr: HR=2.25 (1.60, 3.14),p<0.001
				1.5Yr - 3Yr: HR=2.59 (1.76, 3.81),p<0.001
				3Yr+: HR=1.21 (0.85, 1.72),p=0.293
BalanSys Uni/BalanSys Uni Mobile	199	992	3.23	0 - 6Mth: HR=4.93 (2.45, 9.94),p<0.001
				6Mth+: HR=1.45 (0.97, 2.17),p=0.069
Eius/Eius	142	794	3.27	Entire Period: HR=1.54 (1.05, 2.27),p=0.028
GMK-UNI/GMK-UNI	17	37	13.52	Entire Period: HR=6.94 (2.89, 16.69),p<0.001
Re-Identified and still used				
AMC/AMC	680	3067	2.77	Entire Period: HR=1.49 (1.20, 1.85),p<0.001

Note: All Components have been compared to all other Unicompartmental Knee components.
** Unicompartmental Tibial Component

Table IP14: Yearly Cumulative Percent Revision of Individual Unicompartmental Knee identified as having a Higher than Anticipated Revision Rate

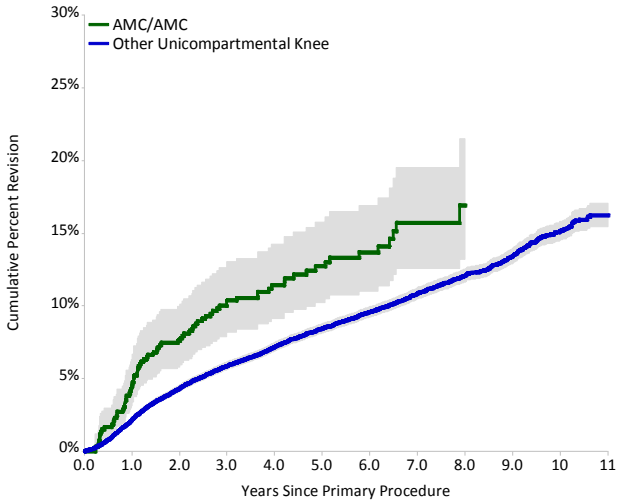
CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Identified and no longer used					
Advance/Advance	10.8 (4.2, 26.3)	27.0 (15.6, 44.4)	30.3 (18.0, 48.2)		
**Preservation Mobile	5.3 (3.5, 7.9)	15.5 (12.3, 19.5)	18.9 (15.4, 23.1)		
BalanSys Uni/BalanSys Uni Mobile	7.0 (4.2, 11.6)	13.2 (9.2, 18.8)	14.9 (10.6, 20.7)		
Eius/Eius	4.9 (2.4, 10.1)	12.2 (7.8, 18.9)	17.8 (12.3, 25.4)		
GMK-UNI/GMK-UNI	17.6 (6.1, 45.3)	30.5 (13.9, 58.7)			
Re-Identified and still used					
AMC/AMC	4.4 (3.1, 6.3)	10.4 (8.2, 13.0)	12.7 (10.2, 15.7)		

Table IP15: Yearly Usage of Individual Unicompartmental Knee identified as having a Higher than Anticipated Revision Rate

Year of Implant	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Identified and no longer used													
Advance/Advance					13	11	7	2	3	1			
**Preservation Mobile			15	149	121	59	26	17	13				
BalanSys Uni/BalanSys Uni Mobile						37	51	63	33	9	2	4	
Eius/Eius				10	21	27	37	21	9	8	7	2	
GMK-UNI/GMK-UNI										5	10	2	
Re-Identified and still used													
AMC/AMC					80	66	123	84	107	93	61	30	36

Figure IP7: Cumulative Percent Revision of Individual Unicompartmental Knee re-identified and still used

Re-identified and still used



Primary Total Knee Replacement

There are four total knee prostheses that are being identified for the first time.

The E.Motion/E.Motion combination has been used in 212 procedures and has a one year cumulative percent revision of 4.0%. There have been ten revisions, six of which were major (adj HR=4.60 (2.48, 8.55), p<0.001).

The Vanguard/Regenerex combination has been used in 706 procedures and has a one year cumulative percent revision of 2.4%. There have been 17 revisions, six of which were insert only revisions. Infection (47.1%) and loosening/lysis (23.5%) were the main reasons for revision (adj HR=2.03 (1.26, 3.26), p=0.003).

The Optetrak-CR/Optetrak combination is no longer significantly different from other total knees. There have been 11 more primary procedures with no further revisions.

Two prostheses that are no longer used have been identified for the first time. They are the LCS Duofix femoral component and the Profix Oxinium (cemented)/MBK combination. They are listed in the 'Identified and no longer used' group.

The Optetrak-CR / Optetrak combination is no longer significantly different from all other total knee prostheses.

Table IP16: Revision Rate of Individual Total Knee identified as having a Higher than Anticipated Revision Rate

Femoral/Tibial	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Identified and no longer used				
AMK/AMK	424	3566	0.95	Entire Period: HR=1.60 (1.14, 2.24),p=0.006
Eska RP/Eska RP	40	173	4.62	Entire Period: HR=6.42 (3.22, 12.81),p<0.001
Gemini MK II/Gemini MK II	21	152	3.30	Entire Period: HR=4.91 (2.04, 11.79),p<0.001
Genesis (cemented)/Genesis (cemented)	62	473	1.90	Entire Period: HR=3.33 (1.73, 6.41),p<0.001
Genesis II Oxinium (cementless)/Genesis II	110	603	7.13	Entire Period: HR=9.40 (6.97, 12.69),p<0.001
Genesis II Oxinium (cementless)/MBK	88	379	14.00	Entire Period: HR=17.28 (13.19, 22.63),p<0.001
Genesis II Oxinium PS (cemented)/Genesis II (Keel)	269	1212	4.04	Entire Period: HR=4.87 (3.68, 6.44),p<0.001
IB II/IB II	199	1731	1.73	0 - 2Yr: HR=0.77 (0.25, 2.39),p=0.654 2Yr - 2.5Yr: HR=4.39 (1.41, 13.65),p=0.010 2.5Yr+: HR=5.04 (3.37, 7.53),p<0.001
Interax/Interax	52	434	1.84	0 - 3.5Yr: HR=1.34 (0.34, 5.38),p=0.675 3.5Yr+: HR=6.64 (2.98, 14.81),p<0.001
Optetrak-PS/Optetrak-PS	55	276	4.35	Entire Period: HR=6.49 (3.69, 11.41),p<0.001
Profix Oxinium (cemented)/MBK	228	1650	1.39	Entire Period: HR=1.83 (1.22, 2.76),p=0.003
Profix Oxinium (cementless)/MBK	158	859	7.92	Entire Period: HR=11.01 (8.67, 13.98),p<0.001
Profix Oxinium (cementless)/Profix	75	425	7.30	Entire Period: HR=9.45 (6.64, 13.45),p<0.001
Profix/Mobile Bearing Knee	1005	6536	1.35	Entire Period: HR=2.00 (1.62, 2.46),p<0.001
Rotaglide Plus/Rotaglide Plus	631	4326	1.13	0 - 1.5Yr: HR=1.15 (0.65, 2.03),p=0.620 1.5Yr+: HR=2.05 (1.48, 2.83),p<0.001
Trac/Trac	138	1168	1.54	Entire Period: HR=2.45 (1.54, 3.88),p<0.001
*LCS Duofix	4867	18557	1.98	0 - 2Yr: HR=1.63 (1.40, 1.90),p<0.001 2Yr+: HR=3.50 (3.03, 4.05),p<0.001
*Renasys	121	635	1.73	Entire Period: HR=2.35 (1.30, 4.24),p=0.004

Femoral/Tibial	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Re-Identified and still used				
Buechel-Pappas/Buechel-Pappas	465	1167	1.63	Entire Period: HR=1.60 (1.02, 2.51),p=0.041
Columbus/Columbus	804	2245	1.96	Entire Period: HR=2.26 (1.68, 3.04),p<0.001
Genesis II CR (cementless)/Genesis II (cementless)	255	752	1.86	Entire Period: HR=1.96 (1.16, 3.30),p=0.011
HLS Noetos/HLS Noetos	272	811	2.22	Entire Period: HR=2.44 (1.54, 3.87),p<0.001
Journey/Journey	2447	6323	1.79	0 - 3Mth: HR=0.41 (0.13, 1.26),p=0.119 3Mth - 9Mth: HR=1.84 (1.18, 2.86),p=0.006 9Mth - 1.5Yr: HR=2.34 (1.74, 3.14),p<0.001 1.5Yr+: HR=1.91 (1.43, 2.57),p<0.001
Optetrak-PS/Optetrak	1900	8103	1.42	Entire Period: HR=1.87 (1.55, 2.24),p<0.001
Optetrak-PS/Optetrak RBK	661	2117	2.22	Entire Period: HR=2.54 (1.91, 3.38),p<0.001
TC-Plus/TC-Plus	159	526	1.71	Entire Period: HR=1.94 (1.01, 3.72),p=0.047
Newly Identified				
E.Motion/E.Motion	212	204	4.91	Entire Period: HR=4.60 (2.48, 8.55),p<0.001
Vanguard/Regenerex	706	721	2.36	Entire Period: HR=2.03 (1.26, 3.26),p=0.003

Note: All Components have been compared to all other Total Knee components.
* Femoral Component

Table IP17: Yearly Cumulative Percent Revision of Individual Total Knee identified as having a Higher than Anticipated Revision Rate

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	11 Yrs
Identified and no longer used					
AMK/AMK	1.4 (0.7, 3.2)	4.6 (3.0, 7.1)	5.6 (3.8, 8.3)	8.6 (6.2, 12.0)	8.6 (6.2, 12.0)
Eska RP/Eska RP	7.5 (2.5, 21.5)	12.9 (5.6, 28.3)	18.7 (9.3, 35.4)		
Gemini MK II/Gemini MK II	9.5 (2.5, 33.0)	14.3 (4.8, 38.0)	23.8 (10.7, 48.1)		
Genesis (cemented)/Genesis (cemented)	0.0 (0.0, 0.0)	6.7 (2.6, 16.8)	10.0 (4.6, 20.9)	17.3 (9.0, 31.8)	
Genesis II Oxinium (cementless)/Genesis II	11.0 (6.4, 18.6)	38.3 (29.8, 48.2)	39.3 (30.7, 49.2)		
Genesis II Oxinium (cementless)/MBK	24.0 (16.3, 34.4)	52.8 (42.8, 63.5)	57.4 (47.4, 67.9)		
Genesis II Oxinium PS (cemented)/Genesis II (Keel)	4.5 (2.6, 7.7)	14.5 (10.8, 19.3)	18.4 (14.2, 23.6)		
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, 21.6)	
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)	20.6 (10.5, 38.1)
Optetrak-PS/Optetrak-PS	1.8 (0.3, 12.2)	16.4 (8.9, 29.1)	20.4 (11.8, 33.8)		
Profix Oxinium (cemented)/MBK	1.8 (0.7, 4.6)	6.3 (3.8, 10.4)	8.6 (5.6, 13.2)		
Profix Oxinium (cementless)/MBK	9.0 (5.4, 14.6)	40.2 (32.9, 48.3)	41.5 (34.2, 49.7)		
Profix Oxinium (cementless)/Profix	13.3 (7.4, 23.4)	36.1 (26.4, 48.1)	37.5 (27.6, 49.5)		
Profix/Mobile Bearing Knee	2.3 (1.5, 3.4)	6.4 (5.0, 8.1)	8.2 (6.7, 10.1)		
Rotaglide Plus/Rotaglide Plus	0.8 (0.3, 1.9)	4.1 (2.8, 6.0)	5.8 (4.2, 8.0)		
Trac/Trac	2.2 (0.7, 6.6)	5.9 (3.0, 11.4)	9.0 (5.2, 15.2)	14.4 (9.3, 22.0)	
*LCS Duofix	1.5 (1.2, 1.9)	5.6 (5.0, 6.3)	9.5 (8.5, 10.6)		
*Renasys	2.5 (0.8, 7.5)	4.2 (1.8, 9.8)	8.8 (4.8, 15.7)		
Re-Identified and still used					
Buechel-Pappas/Buechel-Pappas	2.0 (1.0, 3.8)	4.8 (3.1, 7.6)			
Columbus/Columbus	2.3 (1.4, 3.7)	6.4 (4.7, 8.7)	7.8 (5.8, 10.6)		
Genesis II CR (cementless)/Genesis II (cementless)	0.9 (0.2, 3.5)	8.2 (4.7, 14.2)	8.2 (4.7, 14.2)		
HLS Noetos/HLS Noetos	3.6 (1.9, 6.7)	7.4 (4.6, 11.6)	8.1 (5.2, 12.8)		
Journey/Journey	1.8 (1.3, 2.4)	5.4 (4.5, 6.6)	7.3 (5.9, 9.1)		
Optetrak-PS/Optetrak	1.6 (1.1, 2.3)	5.2 (4.2, 6.4)	7.1 (5.9, 8.6)		
Optetrak-PS/Optetrak RBK	3.0 (1.9, 4.6)	7.2 (5.3, 9.7)	9.9 (7.3, 13.4)		
TC-Plus/TC-Plus	2.1 (0.7, 6.4)	7.9 (3.9, 15.7)	7.9 (3.9, 15.7)		
Newly Identified					
E.Motion/E.Motion	4.0 (1.9, 8.6)				
Vanguard/Regenerex	2.4 (1.4, 4.2)				

Note: * Femoral Component

Table IP18: Yearly Usage of Individual Total Knee identified as having a Higher than Anticipated Revision Rate

Year of Implant	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Identified and no longer used													
AMK/AMK	41	108	134	53	51	37							
Eska RP/Eska RP							9	24	5	0	2		
Gemini MK II/Gemini MK II			4	10	7								
Genesis (cemented)/Genesis (cemented)		18	19	8	6	3	8						
Genesis II Oxinium (cementless)/Genesis II				4	106								
Genesis II Oxinium (cementless)/MBK				22	66								
Genesis II Oxinium PS (cemented)/Genesis II (Keel)							18	124	127				
IB II/IB II		64	90	33	12								
Interax/Interax	8	28	16										
Optetrak-PS/Optetrak-PS						8	14	18	15				
Profix Oxinium (cemented)/MBK			23	49	31	91	24	3	4	1	2		
Profix Oxinium (cementless)/MBK				63	95								
Profix Oxinium (cementless)/Profix				10	65								
Profix/Mobile Bearing Knee			32	165	173	258	245	51	56	11	12	2	
Rotaglide Plus/Rotaglide Plus			56	125	151	110	101	43	30	15			
Trac/Trac	7	36	52	33	9	1							
*LCS Duofix								843	1637	1532	854	1	
*Renasys							51	53	3	14			
Re-Identified and still used													
Buechel-Pappas/Buechel-Pappas							1	39	51	84	100	146	44
Columbus/Columbus							49	92	89	148	156	134	136
Genesis II CR (cementless)/Genesis II (cementless)		3	8	9	11	3		16	29	34	28	53	61
HLS Noetos/HLS Noetos						2	2	47	45	45	56	48	27
Journey/Journey								134	337	593	597	464	322
Optetrak-PS/Optetrak		14	22	90	130	155	252	253	216	167	202	197	202
Optetrak-PS/Optetrak RBK							1	81	173	166	118	82	40
TC-Plus/TC-Plus					1	27	27	6	6	9	18	38	27
Newly Identified													
E.Motion/E.Motion											12	87	113
Vanguard/Regenerex											27	338	341

Note: * Femoral Component

Figure IP8: Cumulative Percent Revision of Individual Total Knee re-identified and still used

Re-identified and still used

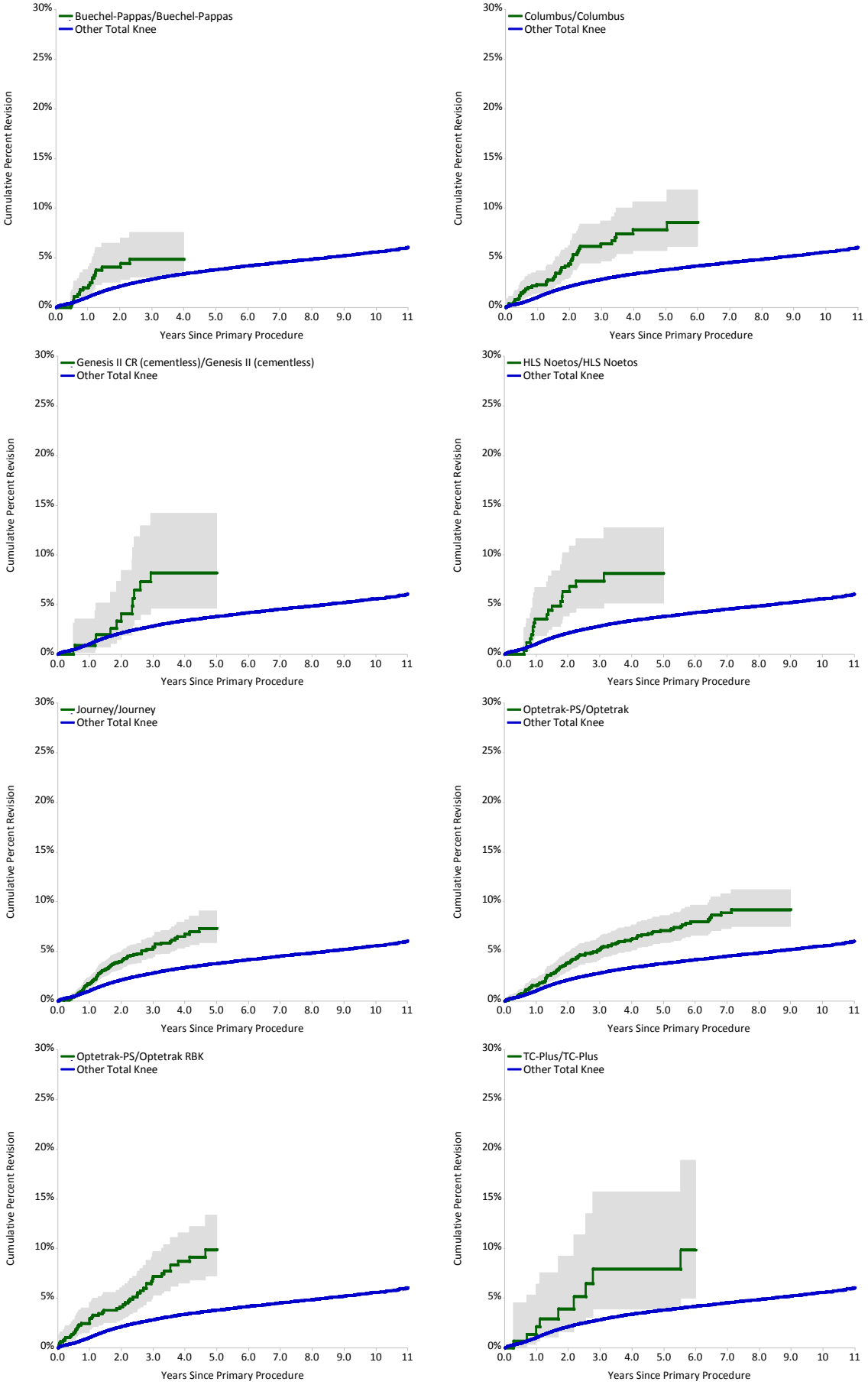
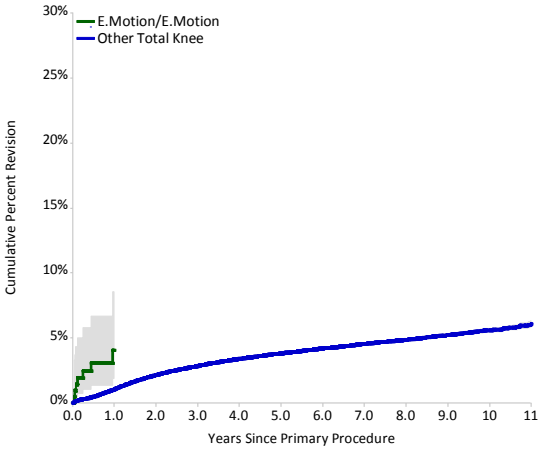
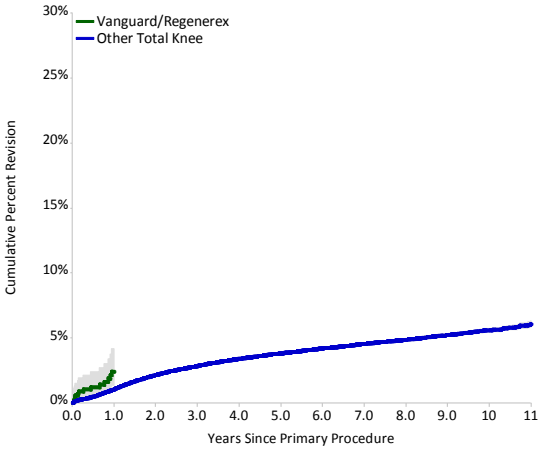


Figure IP9: Cumulative Percent Revision of Individual Total Knee newly identified

Newly Identified





APPENDICES

APPENDIX 1

Participating Hospitals & Coordinators

NEW SOUTH WALES

PUBLIC HOSPITALS

Name of Hospital	Registry Coordinator	
Albury Base Hospital	Elwyn Black	Nurse Manager Theatre
Armidale Hospital	Debbie Spokes/Cheryl Fardon	NUM Theatre/Theatre Clerk
Bankstown/Lidcombe Hospital	John Mati/Aron Priscion	CNS/RN Orthopaedic Theatre
Bathurst Base Hospital	Kylie Peers	NUM Theatre
Bega District Hospital	Melanie Rossi	RN Theatre
Blacktown Hospital	Diane Barben/June Tsang	NUM Theatre/RN Operating Theatre
Bowral and District Hospital	Barbara Wise	NUM Theatre
Broken Hill Health Service	Sue Beahl/Helen Gentle	NUM/RN Theatre
Campbelltown Hospital	Amanda Young	Theatre Reception
Canterbury Hospital	Jenny Cubit	NUM Theatre
Coffs Harbour Health Campus	Eric Dorman	NUM Theatre
Concord Repatriation Hospital	Monique Prowse	NUM Theatre
Dubbo Base Hospital	Cathy Chapman, Celia Taylor	Theatre Clerks
Fairfield Hospital	Cathy Jiear	Peri operative Services Manager
Gosford Hospital	Kirsty Brown/Toni Hoad	Set up Coordinator Theatre/Acting NUM
Goulburn Base Hospital	Marta Daniel/Karen Goode	NUM Theatre/Theatre Admin Clerk
Grafton Base Hospital	Anthony Corkett	NUM Operating Theatre
Hornsby & Ku-Ring-Gai Hospital	Bessie Chu	CNS Theatre
Institute of Rheumatology & Orthopaedic Surgery	Maria Hatziandreou	NUM Theatre
John Hunter Hospital	Felicia Bristow/Ken Schilling	Equipment Officer/Admin Equip Officer
Lismore Base Hospital	Glen Nettle	CNS Orthopaedic Theatre
Liverpool Health Service	John Murphy	NUM Orthopaedic Theatre
Maitland Hospital	Karen Cheers	NUM Theatre
Manly District Hospital	Heather Liddle/Maryanne Howell	NUM Theatre/RN Theatre
Manning Rural Referral Hospital	Grahame Cooke	RN Theatre
Mona Vale Hospital	Estelle vont Takach	CN Orthopaedic Theatre
Mt Druitt Hospital	Lydia Baldock	RN Theatre
Murwillumbah District Hospital	Lynne Penglase	NUM Theatre
Nepean Hospital	Debbie Dobbs	RN Operating Theatres
Orange Health Service	Teresa Luczak	Senior Nurse Manager Theatre
Port Macquarie Base Hospital	Pam Campbell/Joanne Atkins	NUM Theatre/Theatre Clerk
Royal Newcastle Centre	Rosalee MacLeod	NUM Theatre
Royal North Shore Hospital	Eileen Cole	Research Physiotherapist, Dept Ortho
Royal Prince Alfred Hospital	Lisa Hatton Andrew McClelland	NUM Theatre/Temp replacement
Ryde Hospital	Karen Jones	NUM Theatre
Shoalhaven Group Hospital	Leanne McTavish	NUM Orthopaedic
St George Hospital	Simon Cheng	A/NUM Orthopaedic Theatre
St Vincent's Public Hospital	Mary Therese Butler/Lee Black	NUM Peri operative Services/Acting NUM
Sutherland Hospital	Sara Apolloni	CNS Theatre
Tamworth Base Hospital	Kevin Attard	RN Theatre
The Prince of Wales Hospital	Anne-Marie Daly	NUM Orthopaedics
The Tweed Hospital	Amanda Budd/Neroli Prestage	CNS Theatre/ANUM
Wagga Wagga Base Hospital	Alison Giese/Melissa Chapman	CNS Orthopaedic Theatre
Westmead Hospital	Michelle Ward/Ramesh Gopal	Acting NUM/Clinical Support Officer
Wollongong Hospital	Carol Jackson	CNS Orthopaedics

NEW SOUTH WALES

PRIVATE HOSPITALS

Name of Hospital	Registry Coordinator	
Albury Wodonga Private Hospital	Beverly Francis	CNS Orthopaedic Theatre
Armidale Private Hospital	Cheryl Constance	NUM Theatre
Baringa Private Hospital	Lesley Berry	Orthopaedic Resource Manager
Bathurst Private Hospital	Diane Carter	RN Operating Theatres
Berkeley Vale Private Hospital	Michelle Turner	QA/Education Coordinator
Brisbane Waters Private Hospital	Janis Livingstone	CNS Coord Orthopaedic Theatre
Calvary Health Care Riverina	Annette Somerville	Manager, Health Information Services
Campbelltown Private Hospital	Yvonne Quinn	CNC Orthopaedics
Dalcross Private Hospital	Anne Carroll/Kerrie Legg	Deputy CEO_DON/NUM
Delmar Private Hospital	Ros Berrymen/Cathy Byrne	NUM Theatre/Medical Records
Dubbo Private Hospital	Sally Cross	RN Theatre
Dudley Private Hospital	James Bird/Michele Englart	NUM Theatre/RN Theatre
Figtree Private Hospital	Mandy Holmes/Kim Dyer	Theatre Clerk
Forster Private Hospital	Jenny Bullivant	NUM Theatre
Hawkesbury Health Service	Megan McVIcar	CNS Theatre
Holroyd Private Hospital	Sid Turingan	NUM Theatre
Hunters Hill Private Hospital	Jenny May	NUM Orthopaedic Theatre
Hunter Valley Private	Renae Pridue/Joanne Lalic	NUM Theatre/2IC Theatre
Kareena Private Hospital	Deirdre Baulch	NUM/CNS Orthopaedics
Lake Macquarie Private Hospital	Robert Reddie	Theatre
Lingard Private Hospital	Greg Hewitt/Nicole Garland	NUM Theatre/Theatre Clerk
Maitland Private Hospital	Martine Mead	2IC Operating Theatres
Macquarie University Hospital	Simmy Masuku	NUM Orthopaedic Theatre
Mayo Private Hospital	Suzanna Cini	NUM Theatre
National Day Surgery Sydney	Elizabeth Carroll/Louise Jones	Director of Nursing/Floor Manager
Nepean Private Hospital	Jan Wernert	NUM Theatre
Newcastle Private Hospital	Fiona MacDonald	CNS Theatre
North Gosford Private Hospital	Claire Monger	RN Orthopaedic Theatre
North Shore Private Hospital	Eileen Cole	Research Physiotherapist, Dept Ortho
Norwest Private Hospital	Lucy Richardson	NUM Orthopaedic Theatre
Nowra Private Hospital	Linda Wright	NUM Theatre
Port Macquarie Private Hospital	Tresna Bell	CNS Orthopaedic Theatre
Shellharbour Private Hospital	Liz Quennel	Medical Records
Southern Highlands Hospital	Lynne Byrne	Theatre Clerk
St George Private Hospital and Medical Centre	Michele McKenna	NUM Orthopaedics
St Luke's Care	Helen Ashley/Sue Bevan	Theatre Manager/CNSTheatre
St Vincent's Private Hospital Darlinghurst	F Crawford/R Liston/V Law	CNS Theatre/CNS Ortho/ROI Coordinator
St Vincent's Private Hospital Lismore	Janelle Hospers	CNS, Orthopaedic Care Coord
Strathfield Private Hospital	Kerry Torning/Kristy Farrugia	Perioperative Manager/RN
Sydney Adventist Hospital	Jill Parker/Melissa Ng	CNS Orthopaedic Theatre/RN
Sydney Private Hospital	Fiona Wallace	NUM Operating Theatres
Sydney South West Private	Angela Wilbow/Harold Faustino	Nurse Manager/CNC Orthopaedics
Tamara Private Hospital	Kris Wall	NUM Operating Theatre
The Mater Hospital	Toni Cummins/Lenore Curran	CNS Theatre/RN Orthopaedics
The Prince of Wales Private Hospital	Ellaine Lamasan	Orthopaedic NUM
The Surgery Centre, Hurstville	Tracey Dennett	Perioperative Services Manager
Toronto Private Hospital	Scott Neesom	Theatre Clerk/Purchasing Officer
Warners Bay Private Hospital	Annette Harrison	CNS Theatre
Westmead Private Hospital	Karen O'Shaughnessy	CNS Orthopaedic Theatre

VICTORIA

PUBLIC HOSPITALS

Name of Hospital	Registry Coordinator	
Austin Health	Ross Kentish/Kath Morris	ANUM Orthopaedic Theatre
Ballarat Health Services	Amanda Bell/Kellie Livingston	Equipment ANUM
Bass Coast Regional Health/Wonthaggi Hospital	Barbara Harrison/Debee Thow	Peri operative Services Mgr/Acting NUM
Bendigo Health Care Group	Dot Smith	ANUM Orthopaedic Theatre
Box Hill Hospital	Helga Ploschke	Quality Coord Orthopaedic Services
Cohuna District Hospital	Jenny Brereton	NUM Theatre
Colac Area Health	Amanda Tout	NUM Theatre
Dandenong Hospital	Karen Ferguson/Melanie Murray	ANUM Orthopaedics
Djerriwarrh Health Services, Bacchus Marsh Campus	Linda Aykens/Judy Dehnert	NUM Theatre/ACN
East Grampians Health Service	Brian Lomax	Manager – Peri operative Service
Echuca Regional Health	Kerryn Giorgianni	ANUM Theatre Dept
Goulburn Valley Health	Fiona Moncriess/Cara Disint	RN Theatre/CNS Orthopaedic Theatre
Kerang District Health	Margie Christian	NUM Operating Theatre
Kyabram & District Health Services	Anne Wilson	NUM Theatre
Latrobe Regional Hospital	Simone Lovison	Clinical Nurse Specialist
Maroondah Hospital	Brooke Retallack	CNS Orthopaedic Theatre
Mildura Base Hospital	Gwenda Smith	NUM Theatre
Monash Medical Centre, Clayton Campus	Candice Brown	Orthopaedic ANUM
Monash Medical Centre, Moorabbin Campus	Catherine Pitts	ANUM Theatre
Northeast Health Service Wangaratta	Lynn Reid/Larissa Laverty	ACN Theatre/Theatre Bookings Reception
Peninsula Health Service, Frankston Hospital	Donna Anderson	ANUM Theatre
Portland District Health	Angela Hand	NUM Theatre
Sandringham & District Memorial Hospital	Eileen Dalach	ANUM Orthpaedics
Seymour District Memorial Hospital	Karen Lamaro	Peri-operative Services Unit Manager
South West Healthcare Warrnambool Campus	Tony Kelly	Peri operative Services Manager
St Vincent's Public Hospital	Shazeli Osman/Kirra McDonald	NUM/Clinical Resource Nurse
Stawell Regional Health	Chris Gillmartin/Barb Savage	NUM Theatre/Theatre Nurse
Sunshine Hospital	Joy Curley/Cassandra Mules	RN Theatre/ Purchasing Officer Theatres
Swan Hill District Hospital	Helen Wilkins	NUM Theatre
The Alfred	Caroline McMurray	Coordinator Orthopaedic Dept
The Geelong Hospital, Barwon Health	Lee Rendle	ANUM Theatre
The Northern Hospital	Siew Perry	ANUM Theatre
The Royal Children's Hospital	Sonia Mouat	Acting AUM Orthopaedics
The Royal Melbourne Hospital	Kerrie Crosato	RN Operating Theatre
West Gippsland Healthcare Group	Christine Evans/Bernie Notman	ACN Theatre/CNS
West Wimmera Health Service	Lisa Newcombe/Christine Dufty	NUM OR/CSSD ICP
Western District Health Service	Jane Sanders	ANUM Theatre
Western Hospital	Vicki Mahaljcek/Cassandra Mules	RN Theatre/Purchasing Officer Theatres
Williamstown Hospital	Maureen Clark	ANUM Theatre
Wimmera Health Care Group	Maree Markby	NUM Theatre

VICTORIA

PRIVATE HOSPITALS

Name of Hospital	Registry Coordinator	
Beleura Private Hospital	Jean Leyland	AUM Theatre
Bellbird Private Hospital	Bronwyn Gilmore	Theatre Manager
Cabrini Private Hospital, Brighton	Brooke Mackay	Admin Assistant
Cabrini Private Hospital, Malvern	Brooke Mackay	Admin Assistant
Como Private Hospital	Gillian Wilson	NUM Theatre
Cotham Private Hospital	Joanne Oxbrow/Amy Pardoe	Perioperative Services Mgr/ANUM Ortho
Epworth Hospital	Lynne Moyes	ANUM Orthopaedic Theatre
Epworth Eastern Hospital	Erin Seal	RN Orthopaedic Department
Epworth Freemason Hospital	Claudia Nozzolillo	ANUM Orthopaedic Theatre
Essendon Private Hospital	Chan Leong	NUM Theatre
Geelong Private Hospital	Wilna Steyn	Orthopaedic Services Manager
Glenferrie Private Hospital	Samantha Jervois	Theatre Manager
John Fawkner Hospital	Sue Bell	NUM Orthopaedic Theatre
Knox Private Hospital	Laura Tilley	Billings Officer Theatre
Latrobe Private Hospital	Jenny Telfer	NUM Theatre
Linacre Private Hospital	Melissa Dillon	NUM Orthopaedic Theatre
Maryvale Private Hospital	Glenda Chambers	ANUM Orthopaedic Theatre
Masada Private Hospital	Lisa McBain	Theatre Manager
Melbourne Private Hospital	Karen Grant	Theatre Manager
Mildura Private Hospital	Elizabeth Collihole	ACN Theatre
Mitcham Private Hospital	Julie Nankivell/Judith Bond	RN/RN Theatre
Mountain District Hospital	Rosslyn Martin	NUM Theatre
Northpark Private Hospital	Suzanne Farrelly	NUM Theatre
Peninsula Private Hospital	Ruth Honan	ANUM Orthopaedic Theatre
Ringwood Private Hospital	Carol Burns	ANUM Theatre
Shepparton Private Hospital	Niki Miller	CNS Orthopaedic Theatre
South Eastern Private Hospital	Nicole O'Brien/Sharryn McKinley	NUM Theatre/Op Services Supervisor
St John of God Health Care, Ballarat	Kylie Cross	CN Orthopaedics
St John of God Health Care, Bendigo	Jenny Dillon	AUM Theatre
St John of God Health Care, Geelong	Colin Hay	Orthopaedic Coordinator, Theatre
St John of God Health Care, Warrnambool	Leanne McPherson/Gill Wheaton	DON/Perioperative Services Manager
St John of God Hospital, Berwick	Belinda Marden	CNS Orthopaedics
St Vincent's Private East Melbourne	Jan Gammon	RN Orthopaedic Theatre
St Vincent's Private Fitzroy	Julie Keyte/Deanna Delle-virgini	ANUM/RN Orthopaedic Theatre
St Vincent's Private Kew	Fiona Webster	ANUM Theatre
The Avenue Hospital	Annellen Watson	ANUM Orthopaedics
The Valley Private Hospital	Nicole O'Brien	NUM Perioperative Services
Wangaratta Private Hospital	Janet McKie	ANUM Theatre
Warringal Hospital	Kylie Leys	RN Operating Theatre
Waverley Private Hospital	Rebecca Juzva	Orthopaedic AUM
Western Private Hospital	Rachel Cassar	NUM Theatre

QUEENSLAND

PUBLIC HOSPITALS

Name of Hospital	Registry Coordinator	
Bundaberg Base Hospital	Maria McAneney	Nursing Director
Cairns Base Hospital	Rebecca Rowley	Orthopaedic Bookings Officer
Caloundra Health Service	Raylee Callaghan	NUM Theatre
Gold Coast Hospital	Meredith Bird	Loan Set Coordinator
Gold Coast Hospital, Robina Campus	Annemarie Brooks/Helen McGuire	CN/RN Theatre
Hervey Bay Hospital	Michelle Alcorn	Clinical Nurse Orthopaedics
Ipswich Hospital	Ross Howells/Jannah O'Sullivan	Inventory Manager
Logan Hospital	Denise Maher	Director Support Orthopaedics
Mackay Base Hospital	Carmel Warren/Casey Noonan	Acting NUM Pre-admission/RN Theatre
Maryborough Hospital	Heather Zillman	RN Theatre
Mater Misericordiae Public Adult's Hospital	Christine Thompson	Clinical Nurse
Mater Misericordiae Public Children's Hospital	Vicki Livett	NUM Theatre
Nambour General Hospital	Kay Friend	Nurse Mgr, Logistics & Procurement
The Prince Charles Hospital	Sue Grice/Louise Tuppin/R Seddon	Clinical Nurse/Clinical Data Mgr/RN
Princess Alexandra Hospital	Jo-Anne de Plater	CN Orthopaedic Theatres
Queen Elizabeth II Jubilee Hospital	Donna Cal	EN Theatre
Redcliffe Hospital	R Thursfield/G van Fleet/K Williamson	Program Coord/Snr Health Info Mgr
Redland Public Hospital	Trish O'Farrell	RN Theatre
Rockhampton Base Hospital	C Harrison/S Stoddart	CN Orthopaedics/RN Ortho Theatre
Royal Brisbane & Women's Hospital	Elaine Hausler/Anna Dowe	Num/RN Operating Theatres
Toowoomba Hospital	Amanda Lostroh/Freya Chadwick	RN Theatre/Level 2 RN Orthopaedics
Townsville Hospital	Sharon Cooke/Natasha Johnston	RN Orthopaedic Theatre

PRIVATE HOSPITALS

Name of Hospital	Registry Coordinator	
Allamanda Private Hospital	Margaret Law	NUM Theatre
Brisbane Private Hospital	Liz Drabble	Theatre Logistics Coordinator
Cairns Private Hospital	Wendy Gould	RN Theatre
Caloundra Private Hospital	Christine Wells/Todd Mimnaw	CN Theatre
Friendly Society's Hospital	Jo Peterson	Perioperative Services Manager
Greenslopes Private Hospital	Kelly Williams	CN Orthopaedic Theatre
Hervey Bay Surgical Centre	Yvonne Howlett	CNC Theatre
Hillcrest Rockhampton Private Hospital	Lyn Martin	NUM Theatre
Holy Spirit Northside Hospital	Leanne Brace	Senior Level 1, Orthopaedic Theatre
John Flynn Hospital	Paula Archer	RN Orthopaedics
Mater Health Services North Queensland	Anna Grimley/Jo Humphreys	CN Orthopaedic Theatre
Mater Misericordiae Hospital Bundaberg	James Turner/Karen Smith	ANUM/CN Orthopaedic Theatre
Mater Misericordiae Hospital Gladstone	Alison Drinkwater	NUM Orthopaedic Theatre
Mater Misericordiae Hospital Mackay	Alison Ashburner	Nurse Coordinator
Mater Misericordiae Hospital Rockhampton	Lynda Hossack	RN Orthopaedics
Mater Misericordiae Private Hospital	Melissa Gordon	Acting CNC Theatre
Mater Private Hospital Redland	Erina Harris	RN Theatre
Nambour Selangor Private Hospital	Karen Hicks	RN Theatre
Noosa Hospital	Janet McMeekin	CN Theatre
North West Private Hospital	Elizabeth Hill	Peri Operative Clinical Nurse
Peninsula Private Hospital	Joan Fellowes	NUM Theatre
Pindara Private Hospital	Carli Nicolaou	CN Orthopaedic Theatre
St Andrew's Private Hospital	Mel Grant	CSSD Theatre
St Andrew's Hospital, Toowoomba	Jeff van Leeuwen	Manager Peri-operative Services
St Andrew's War Memorial Hospital	Tracey Liesch	Clinical Manager Peri Operative
St Stephen's Private Hospital	Sheila Jensen	RN Theatre
St Vincent's Hospital, Toowoomba	Judy Plotecki	RN Peri-operative Services
Sunnybank Private Hospital	Judy Aslette	2IC Orthopaedics
The Sunshine Coast Hospital	Phil Hall	RN Theatre
Wesley Hospital	Debra Tyszkiewicz	CNM Ward 1M

SOUTH AUSTRALIA

PUBLIC HOSPITALS

Name of Hospital	Registry Coordinator	
Clare Hospital and Health Services	Libby Hoffmann	NUM Theatre
Flinders Medical Centre	Jo Drabsch/Lyndal Klei	CN Theatre/ACN Ortho Trauma Theatre
Gawler Health Service	Sharon Soones	RN Theatre
Lyell McEwin Hospital	Fiona Brinkies	CN Theatre
Modbury Public Hospital	Dennis Gedo	CN Theatre
Mt Barker District Solders Memorial Hospital	Emma Crowder	RN Theatre
Mt Gambier Regional Hospital	Kylie Duncan	Assoc Clinical Services Coord
Murray Bridge Soldiers Memorial Hospital	Chris Jarvis	CN Theatre
Naracoorte Health Service	Trina Berry	Asst Clinical Services Coordinator
Noarlunga Hospital	Carol Dawson	RN Theatre
Port Augusta	Leann Cutler	NUM Theatre
Port Lincoln Hospital	Christine Weber	NUM Theatre
Port Pirie Hospital	Sue Wilkinson	NUM Theatre
Queen Elizabeth Hospital	Carol Saniotis	Nursing Management Facilitator
Repatriation General Hospital	Joy Telfer	Clinical Nurse
Riverland Regional Hospital	Viv Turner/Leanne Zerna	RN Theatre
Royal Adelaide Hospital	Lisa Lewington/Sue Pannach	CN Ortho /Clinical Outcomes Coord
South Coast District Hospital	Jill Cooper/Judy Anderson	EO DON/CN Theatre
Whyalla Health Service	Amanda Horgan	CN Theatre
Women's and Children's Hospital	Margaret Betterman	CN Theatre

PRIVATE HOSPITALS

Name of Hospital	Registry Coordinator	
Ashford Community Hospital	Lisa Kowalik	A/CN Theatre
Burnside War Memorial Hospital	Meriel Wilson	Manager Medical Records
Calvary Central Districts Hospital	Jeremy Gredig	Clinical Nurse
Calvary Health Care Adelaide	Maria Young	CN Theatre
Calvary Wakefield Hospital	Evelyn Carroll	CN Orthopaedic Theatre
Flinders Private Hospital	Marcus Ender	CN Orthopaedics
Glenelg Community Hospital	Jan Lewandowski	CN Orthopaedic Theatre
North Eastern Community Hospital	Anne Sciacca	Theatre Manager
Parkwynd Private Hospital	Helen Madigan	CN Orthopaedic Theatre
Sportsmed SA	Magi Odgaard/Catherine Ryan	Clinical Coders Medical Records
St Andrew's Private Hospital	H Crosby/L White	RN Orthopaedic Theatre
Stirling & District Hospital	Nick Clarke/Tanya Hanlon	CN Manager/CNC Theatre
The Memorial Hospital	Katrina Smith	CN Orthopaedic Liaison
Western Hospital	Margaret Witts	RN Theatre

WESTERN AUSTRALIA

PUBLIC HOSPITALS

Name of Hospital	Registry Coordinator	
Albany Regional Hospital	Heather Watson	RN Theatre
Armadale Health Service	Eleri Griffiths/Deb Carkeek	Mgr Surgical Services/Ortho Tech
Bunbury Regional Hospital	Anthea Amonini	Orthopaedic Technician Theatre
Freemantle Hospital	Steven Johnson	Orthopaedic Technician Theatre
Geraldton Hospital	Vicki Richards	CN Theatre
Kaleeya Hospital	Elsy Kolavayalil	CN Orthopaedic Theatre
Kalgoorlie Regional Hospital	Nicole Hintz	Clinical Manager Theatre
Osborne Park Hospital	Jenny Misiewicz/Anita Maxwell	CN Theatre
Rockingham General Hospital	Carol Beaney	CN Theatre
Royal Perth Hospital, Shenton Park	Janelle Austin	Orthopaedic Coordinator
Royal Perth Hospital, Wellington St	Carmel McCormack	NUM Theatre
Sir Charles Gairdner Hospital	Donna Partridge	Administration Assistant

PRIVATE HOSPITALS

Name of Hospital	Registry Coordinator	
Bethesda Hospital	Kristina Markusic/Tanja Radick	CN Orthopaedics/Theatre Coord
Hollywood Private Hospital	Judith Corbett	CN Theatre
Joondalup Health Campus	J Hughes/D Crowley/J Larkan	HIM/CN Ortho/Deputy HIM
Mercy Hospital Mt Lawley	Greg Cox/Stuart Meek	Orthopaedic Technicians
Mount Hospital	Jacqui McDonald	Orthopaedic Coordinator
Peel Health Campus	Jan Birmingham	CN Orthopaedic Theatre
South Perth Hospital	Carrol Colquhun	Acting CNM Theatre
St John of God Health Care Bunbury	Alison Hawkes	Theatre Manager
St John of God Health Care Geraldton	Kristie Hutton	Clinical Nurse Educator, Theatre
St John of God Health Care Murdoch	Samantha Hunter	Orthopaedic Coordinator
St John of God Health Care Subiaco	Andrew Grimm	Orthopaedic Coordinator

TASMANIA

PUBLIC HOSPITALS

Name of Hospital	Registry Coordinator	
Launceston General Hospital	P van Nynanten/Madeleine Smith	CN Orthopaedic Theatre
North West Regional Hospital, Burnie Campus	B Kerr/ R Dicker/T Minifie	Peri Op CN/RN/RN
Royal Hobart Hospital	Paula Horgan	RN Theatre

PRIVATE HOSPITALS

Name of Hospital	Registry Coordinator	
Calvary Health Care Tasmania, St John's Campus	Cate Farrell	RN Orthopaedic Theatre
Calvary Health Care Tasmania, St Luke's Campus	Anne Boot/Toni Morice	CNC Theatre/ Theatre Clerk
Calvary Hospital	B Stephensen/A Copping/S Paynter	A/CNS Ortho/CNS Neuro/Supply Mgr
Hobart Private Hospital	Sarah Bird/Janine Dohnt	Peri Op Services Manager/Ortho RN
North-West Private Hospital	Roz Watkins/Annette Russell	NUM Theatre/Admin Theatre

AUSTRALIAN CAPITAL TERRITORY

PUBLIC HOSPITALS

Name of Hospital	Registry Coordinator	
The Canberra Hospital	Helen Boyd/Milton Jamieson	CNS Orthopaedic Theatre/RN
Calvary Health Care	Belinda Carruthers	RN Orthopaedic Theatre

PRIVATE HOSPITALS

Name of Hospital	Registry Coordinator	
Calvary John James Hospital	Phillippa Parkins	RN2 Orthopaedics
The National Capital Private Hospital	Mary-Jane Leibhardt	NUM Orthopaedic Theatre
Calvary Health Care	Shawn Therese Duynhoven	Orthopaedic Liaison Nurse
Canberra Specialist Surgical Centre	Fiona Grant	Director of Nursing

NORTHERN TERRITORY

PUBLIC HOSPITALS

Name of Hospital	Registry Coordinator	
Alice Springs Hospital	Fiona O'donnell/Ndina Chaita	Op Theatres Coord/RN3 Ortho
Royal Darwin Hospital	Tanya Anderson	NUM Theatre

PRIVATE HOSPITALS

Name of Hospital	Registry Coordinator	
Darwin Private Hospital	Chris Brennan/Ann Wharton	NUM Theatre/Floor Coordinator

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FORMERLY PARTICIPATING HOSPITALS – NOW CEASED JOINT REPLACEMENT

NEW SOUTH WALES

Auburn Health Service
Blue Mountains District ANZAC Memorial Hospital
Canada Bay Private Hospital
Hurstville Community Private Hospital
MacArthur Private Hospital
Mosman Private Hospital
St Vincent's Private Hospital, Bathurst
Sydney Hospital & Sydney Eye Hospital

QUEENSLAND

Caboolture Private Hospital
Gladstone Hospital
Logan Private Hospital
Mater Women's & Children's Hospital Hyde Park
Pioneer Valley Hospital
Riverview Private Hospital

VICTORIA

Hartwell Private Hospital
Repatriation Hospital, Heidelberg
Vaucluse Hospital

SOUTH AUSTRALIA

Abergeldie Hospital
Blackwood Hospital
Northern Yorke Peninsula Hospital

TASMANIA

Calvary Health Care Tasmania St Vincent's Campus
Mersey Community Hospital

WESTERN AUSTRALIA

Galliers Private Hospital
Waikiki Private Hospital

APPENDIX 2

Glossary of Statistical Terms

Adjustment: The process of re-estimating a crude measure, such as a rate or rate ratio, to minimise the effects of a difference in the distribution of a characteristic, such as age, between groups being compared on that measure. Adjustment may be carried out in the context of a modelling procedure, for example, linear or proportional hazards regression models, or by standardising the data set against a reference population with a known age distribution, for example, the World Standard Population or the Australian population defined by the Australian Bureau of Statistics Census in a specified year.

Censoring: When the outcome of interest is the time to a defined event, for example, revision of a prosthesis, the event may not occur during the available period of observation. For example, the Registry analyses its data on prosthesis revision for the period ending 31 December each year, and many prostheses will not have been revised by that time. Unless the prosthesis was revised prior to 31 December the outcome is unknown. For the majority, we only know that up until 31 December they had not yet been revised. The times to revision for these prostheses are said to have been censored at 31 December. Statistical methods exist to ensure that censored data are not ignored in analysis, rather information on survival up until the time of censoring is used to give the best possible estimates of survival or revision probabilities.

Chi-Square Test ($\chi 2$) Test: Any test whose statistic has a chi-square distribution under the null hypothesis is called a chi-square test. A common example is a test for association between two categorical variables whose data are arrayed in a cross-classification table of counts (Pearson's chi-square test). This can be generalised to many situations where the distribution of observed data is being compared to an expected theoretical distribution.

Competing Risk: Any event that changes the probability of occurrence of another event is known as a competing risk for the other event. For example, death is a competing risk for revision because the probability of revision after death cannot be assumed to be the same as the probability of revision before death. Another example is that if interest centres on specific causes of revision, then each cause (infection, loosening etc) is a competing risk for each other cause. Treating a competing risk event as a right censoring will bias the estimation of the risk of the event of interest.

Confidence Interval: A set of values for a summary measure, such as a rate or rate ratio, constructed so the set has a specified probability of including the true value of the measure. The specified probability is called the confidence interval, the end points are called lower and upper confidence limits; 95% confidence intervals are most common.

Cox Model or Proportional Hazards Model: A statistical model that relates the hazard for an individual at any time *t* to an (unspecified) baseline hazard and a set of predictor variables, such as treatment type, age, gender etc. The Cox model produces hazard ratios that allow comparisons between groups of the rate of the event of interest. The main assumption of a Cox model is that the ratio of hazards between, say, two groups that we wish to compare, does not vary over time. If the hazard for prosthesis Model A is twice that of prosthesis Model B at three years, it will also be twice at four years, and so on. This is referred to as the 'proportional hazards assumption'. If the hazard ratio is not proportional over the entire time of observation then a time varying model is used, which estimates a separate hazard ratio within each pre-defined time period. Within each time period, the hazards are proportional. The Registry uses a set algorithm which iteratively chooses time points until the assumption of proportional hazards is met for each time period. The time points are selected based on where the greatest change in hazard occurs between the two comparison groups, weighted by the number of events in that time period.

Cumulative Incidence Function: An estimator of the actual probability of revision in the presence of a competing risk. In these circumstances, the Kaplan-Meier estimate, which treats competing risks as censored, overestimates the true probability. In the competing risks paradigm, patients who have already had a revision or died are excluded from the set at risk of being revised. Under Kaplan-Meier only patients who have already been revised are excluded from the risk set; dead patients are analysed as though they are still at risk of revision.

Cumulative Percent Revision: otherwise known as the 'cumulative failure rate'. This is defined as 100 x [1- S(*t*)] where S(*t*) is the survivorship probability estimated by the Kaplan-Meier method (see survival curve, below). The cumulative percent revision gives the percent of procedures revised up until time *t*, and allows for right censoring due to death (but see Cumulative Incidence Function above) or closure of the database for analysis.

Hazard Ratio: A hazard is an estimate of the instantaneous risk of occurrence of an event, for example death, at a point in time, *t*. This is sometimes called the 'force of mortality'. A hazard ratio results from dividing one group's hazard by another's to give a comparative measure of the instantaneous risk of experiencing the event of interest. In this report, hazard ratios are adjusted for age and gender as appropriate. Hazard ratios are either for the entire

survivorship period (if proportional; see "Cox Model or Proportional Hazards Model" section above) or for specific time periods (if the hazard for the entire survivorship period is not proportional).

For example, a comparison of Primary Total Conventional Hip Replacement for a Primary Diagnosis of Avascular Necrosis (AVN), Developmental Dysplasia of the Hip (DDH) and Osteoarthritis (OA):

1. Avascular Necrosis vs Osteoarthritis.
   Entire Period: HR=1.34 (1.16, 1.54), p<0.001

The hazard ratio for this comparison is proportional over the entire time of observation. AVN has a significantly higher rate of event (in this case, revision) compared to OA over the entire time of observation (p<0.001). The hazard is 1.34 times higher for AVN compared to OA and, with 95% confidence, the true hazard for AVN will lie between 1.16 times higher and 1.54 times higher than the hazard for OA.

2. Developmental Dysplasia vs Osteoarthritis
   0-3Mth: HR=1.75 (1.21, 2.52), p=0.002
   3Mth+: HR=1.07 (0.78, 1.45), p=0.683

The hazard ratio is not proportional over the entire time of observation so the hazard ratio has been divided into two periods; the time from primary arthroplasty to three months following the primary, and three months following the primary to the end of observation. DDH has a significantly higher revision rate compared to OA in the first three months following the primary (p=0.002). The hazard for revision in the first three months is 1.75 times higher for DDH than for OA and, with 95% confidence, the true hazard for DDH will lie between 1.21 and 2.52 times higher. From three months following the primary to the end of observation there is no significant difference in the revision rate between DDH and OA (p=0.683).

Incidence Rate: The number of new occurrences of an event divided by a measure of the population at risk of that event over a specified time period. The population at risk is often given in terms of person-time: for example, if 6 persons are each at risk over 4 months, they contribute 6 x 1/3 = 2 person-years to the denominator of the incidence rate. The incidence rate ratio (IRR) is commonly used to compare the incidence rates of two groups. If the two groups incidence rates are the same, an IRR of 1 results.

Log Rank Test: A family of statistical tests that compares the survival experience of two or more groups over the entire time of observation (contrast with comparison of survival at a defined time, e.g. five-year survival.)

Observed Component Years: For each procedure, its 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 (31/12/2011) 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 1/1/2011 was revised on 1/7/2011. 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 1/1/2011 died without being revised on 1/4/2011. This procedure contributes 0.25 component years.
3. A primary procedure occurs on 1/1/2011 and has not been revised. This procedure contributes 1 component year (as observation time is censored at 31/12/2011).

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 the cumulative percent revision (CPR). The Kaplan-Meier method is biased in the presence of a competing risk and will overestimate the risk of revision. In such circumstances, use of the cumulative incidence function for all competing risks, rather than the Kaplan-Meier estimate, is advised. The cumulative incidence of all competing risks must be assessed simultaneously to avoid bias in interpretation.

APPENDIX 3

Diagnosis Hierarchy for Revision Hip Replacement

Rank	Diagnosis	Category
1	Tumour	*Dominant diagnosis independent of prosthesis/surgery*
2	Infection	
3	Leg Length Discrepancy	*Surgical procedure*
4	Incorrect Sizing	
5	Malposition	
6	Metal Sensitivity	*Reaction to prosthesis*
7	Loosening/Lysis	
8	Wear Hip Insert	*Wear and implant breakage*
9	Wear Acetabular Cup/Shell	
10	Wear Head	
11	Implant Breakage Head	
12	Implant Breakage Stem	
13	Implant Breakage Hip Insert	
14	Implant Breakage Acetabular Cup/Shell	
15	Prosthesis Dislocation	*Stability of prosthesis*
16	Instability	
17	Fracture (Femur/Acetabular/Neck/Periprosthetic)	*Fracture of bone*
18	Chondrolysis/Acetabular Erosion	*Progression of disease on non-operated part of joint*
19	Progression of Disease	
20	Synovitis	*New diseases occurring in association with joint replacement*
21	Osteonecrosis/AVN	
22	Heterotopic Bone	
23	Pain	*Pain*
24	Other	*Remaining diagnoses*

Diagnosis Hierarchy for Revision Knee Replacement

Rank	Diagnosis	Category
1	Tumour	*Dominant diagnosis independent of prosthesis/surgery*
2	Infection	
3	Incorrect Side	*Surgical procedure*
4	Incorrect Sizing	
5	Malalignment	
6	Metal Sensitivity	*Reaction to prosthesis*
7	Loosening/Lysis	
8	Wear Knee Insert	*Wear and implant breakage*
9	Wear Tibial Tray	
10	Wear Femoral	
11	Wear Patella	
12	Implant Breakage Femoral	
13	Implant Breakage Knee Insert	
14	Implant Breakage Tibial Tray	
15	Implant Breakage Patella	
16	Bearing Dislocation	*Stability of prosthesis/knee*
17	Patella Dislocation	
18	Prosthesis Dislocation	
19	Instability	
20	Patella Maltracking	
21	Fracture (Femur/Tibia/Patella/Periprosthetic)	*Fracture of bone*
22	Progression of Disease	*Progression of disease on non-operated part of joint*
23	Patellar Erosion	
24	Synovitis	*New diseases occurring in association with joint replacement*
25	Arthrofibrosis	
26	Osteonecrosis/AVN	
27	Heterotopic Bone	
28	Patellofemoral Pain	*Pain*
29	Pain	
30	Other	*Remaining diagnoses*

APPENDIX 4

Patient Consent and Confidentiality Guidelines

PATIENT CONSENT

The Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR) obtains consent to include information from individuals undergoing joint replacement by using the 'opt off' approach. The implementation of the new Commonwealth Legislation at the end of 2001 resulted in the Registry meeting the Privacy Commission to ensure that the system used for patient consent is within the privacy guidelines.

Using this approach, patients are provided with a Patient Information Sheet. This explains what information is required, how it is collected and the avenues to take should an individual not want their information included in the Registry. The information is provided to patients by surgeons and hospitals prior to surgery. To accommodate patients that may have enquires, wish to opt off or discuss any issues a freecall number is available to contact the Registry.

PATIENT CONFIDENTIALITY

Joint replacement patients will not be contacted directly by the Registry. No individual patient will be identified during analysis or in reports and publications produced by the Registry. Patient operative and prostheses data is managed in accordance with the Guidelines for the Protection of Privacy in the Conduct of Medical Research. Personal data collected are for use by the AOA National Joint Replacement Registry only. The Registry has been listed as a Federal Quality Assurance Activity and all information is protected *(refer to section below).*

DATA MANAGEMENT & CONFIDENTIALITY

The Data Management & Analysis Centre (DMAC), University of Adelaide undertakes data entry, validation and analysis and provides secure data storage. DMAC was established in 1993. Professor Philip Ryan, Professor in Public Health, heads 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
Coordinator, Ms Ann Tomkins
DMAC staff including data manager and 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 and Ageing 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 70,000 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