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 2010 Annual Report outlining additions to the Registry analysis as well as highlighting major findings.

The Registry is continually evaluating its approach to data analysis. This year it has introduced revision diagnosis cumulative incidence graphs. These are a graphical representation of the reasons for revision over time. The observed pattern provides insight into the different mechanisms that contribute to revision.

This year's report confirms that hip and knee replacement in Australia continues to increase. In 2009, the number of hip and knee replacements reported to the Registry increased by 3.2% compared to 2008 (3.4% for hips and 3.0% for knees). Most procedures were undertaken in the private sector (58.6% for hips and 68.8% for knees in 2009).

The changing use of different classes of partial hip replacement previously reported has continued in 2009. The use of unipolar monoblock prostheses continues to decline, particularly the Austin Moore type prosthesis. Since 2003, use of this prosthesis has decreased by 52.2%, and when used the patients selected are generally older. The proportion of patients aged 85 years or older receiving an Austin Moore has increased from 49.0% in 2004 to 57.2% in 2009. The use of bipolar prostheses has also decreased, reducing by 43.2% since 2003. The use of unipolar modular prostheses has increased by 318.2% during the same period.

Fractured neck of femur is the most common reason for performing primary partial hip replacement. The Registry has previously identified that revision rates of primary partial hip replacement for fractured neck of femur are affected by a number of factors. These include the age at time of surgery, class of prosthesis, method of fixation and the type of prosthesis used.

Unipolar modular and bipolar replacement continue to have a lower cumulative percent revision compared to unipolar monoblock prostheses. The ETS, a recently introduced monoblock prosthesis, has the same outcome as cemented Thompson prostheses.

Bipolar prostheses are revised less frequently than unipolar modular prostheses when individuals are less than 75 years of age. The use of cement fixation reduces the risk of revision by approximately half regardless of the class of partial hip replacement.

The two main classes of primary total hip replacement are total resurfacing and total conventional hip replacement.

Primary total conventional hip is undertaken more often than primary total resurfacing hip replacement (95.0% and 4.9% respectively of all primary total hip replacement in 2009). The use of primary total conventional hip replacement continues to increase, not only in absolute numbers but also as a proportion of all primary total hip replacement (91.6% in 2003).

There are many factors known to influence the outcome of total hip replacement. Previously the Registry has reported the effect of different patient and prosthesis characteristics on the risk of revision. As well as updating this analysis, the Registry is reporting on the use of prostheses with exchangeable femoral necks and a more detailed analysis of bearing surface.

Femoral stems with exchangeable femoral necks have twice the risk of revision compared to all other femoral stems. This is due to increased rates of dislocation and loosening. All but three femoral stems with exchangeable necks have an increased risk of revision. The three exceptions have a short follow up period.

It is now clear that primary total conventional hip replacement using metal on metal bearing surface and head sizes over 28mm have a higher risk of revision compared to all other bearing surfaces. The impact of head size is more apparent in head sizes greater than 32mm.

The increased risk of revision of metal on metal bearing surface is due to higher rates of loosening and metal sensitivity. It is not age related. There is however an interaction between age and head size. The risk of revision for head sizes larger than 32mm is higher regardless of age and this risk is greater the younger the patient.

There is gender variation in outcome, with females having a higher risk of revision when metal on metal bearing surfaces are used. This gender difference is only evident when head size is greater than 32mm.

The higher risk of revision with metal on metal bearing surfaces is not isolated to a small number of prostheses. Of those with head sizes greater than 32mm and over 200 procedures recorded, almost all have a cumulative percent revision that is higher than

the entire group of primary total conventional hip replacement.

Initial outcomes for modified polyethylene show a lower risk of revision compared to non-modified polyethylene in the first nine years. This lower risk is becoming more evident with time. There is no difference in outcome related to head size when using modified polyethylene with head sizes greater than 32mm having the same outcome as those 32mm or less.

New prostheses have continued to come onto the market in 2009. The number of new femoral and acetabular prostheses combinations used in primary total conventional hip replacement increased, with a further 154 combinations recorded.

The use of primary total resurfacing hip replacement has declined for the fourth consecutive year. There was a 17.6% reduction in primary total resurfacing procedures compared to 2008. Analysis on a variety of factors affecting outcome have been presented. These include primary diagnosis, gender, age, head size and type of prosthesis. Patients having a total resurfacing for osteoarthritis are revised less frequently than patients with developmental dysplasia. Females have a significantly higher risk of revision compared to males. Males have an age related risk of revision, which is significantly higher from 65 years or older.

As reported last year, the difference in outcome related to gender is largely due to the size of the femoral component. There is an inverse relationship between risk of revision and size of the femoral head component.

The five classes of primary partial knee replacement are partial resurfacing, unispacer, bicompartmental, patella/trochlear and unicompartmental knee replacement. Two of these (partial resurfacing and bicompartmental) are relatively recent technologies introduced to the Australian market and reported for the first time two years ago. Both of these single product procedures continue to have higher rates of revision compared to other knee replacement procedures with the exception of the unispacer.

Patella/trochlear procedures continue to be undertaken in small numbers (226 reported in 2009). The cumulative percent revision at nine years for patella/trochlear replacement is 25.1%. Age and gender are significant risk factors.

The use of unicompartmental knee replacement continues to decline. There were 26.2% less unicompartmental knee replacements undertaken in 2009 compared to 2003. Age at the time of surgery is a major factor affecting the outcome, the younger the patient the greater the risk of revision.

Primary total knee replacements account for 80.0% of all knee replacements and has increased in use by 55.9% since 2003.

Patient and prostheses characteristics are important factors affecting the outcome of primary total knee replacement. Primary diagnosis, age and gender as well as prosthesis stability, bearing mobility, patella resurfacing and the type of prosthesis used all impact on the risk of revision.

Rheumatoid arthritis has the lowest risk of revision of any primary diagnosis. The risk of revision increases with decreasing age. After three and a half years, those aged less than 55 years have over four and a half times the risk of revision compared to those aged 75 or older. Males have a higher incidence of revision. This is in part due to a higher rate of reported infection.

Tibial prostheses with fixed bearings have a lower risk of revision compared to mobile bearing tibial prostheses. The Registry identifies three types of fixed bearings with all-polyethylene tibial prostheses having the highest risk of revision of the fixed bearing tibial prostheses.

Posterior stabilised primary total knees are revised more than minimally stabilised knees. The risk of revision in the first nine years is increased if the patella is not resurfaced and this risk is highest if a posterior stabilised prosthesis is used.

The Registry has had sufficient data to present preliminary information on the outcome of revision hip and knee replacement for a number of years. Although this analysis is complex, it has become increasingly evident that regardless of the class of primary procedure revised and the type of revision, there is a high risk of subsequent re-revision.

The risk of re-revision of a revised primary total resurfacing hip is similar to the risk of re-revision of a revised primary total conventional hip replacement. The risk of re-revision of a primary unicompartmental knee revised to a total knee is the same as the re-revision risk of a revised primary total knee replacement. For primary total knee replacement insert only revision has the highest risk of re-revision compared to all other types of revision. Patella resurfacing undertaken after a primary total knee has over three times the cumulative percent revision at seven years compared to a primary total knee replacement.

A unique and important function of registries is the ability to provide population based data on the comparative outcome of individual prostheses in a community. In this report, the Registry has presented the outcome of individual prostheses within each class of prosthesis. There is significant variation depending on the type of prosthesis used.

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 on 'Prostheses with Higher than Anticipated Rates of Revision'.

This year the Registry has identified 65 prostheses or prostheses combinations. For the first time detailed analysis for each of these prostheses and prostheses combinations is available as a supplementary report on the Registry website.

INTRODUCTION

The 2010 Hip and Knee Arthroplasty Report is based on the analysis of 547,607 primary and revision hip and knee procedures recorded by the Registry with a procedure date up to and including 31 December 2009. This is an increase of 74,641 procedures compared to the 2009 Annual Report.

In addition, there are 10 supplementary reports that complete the AOANJRR Annual Report for 2010.

1. Lay Summary
2. Demographics of Hip and Knee Arthroplasty
3. Cement in Hip and Knee Arthroplasty
4. Mortality of Hip and Knee Arthroplasty
5. Demographics of Shoulder, Elbow and Wrist Arthroplasty
6. Outcome of Shoulder Arthroplasty
7. Demographics and Outcome of Ankle Arthroplasty
8. Demographics of Spinal Disc Arthroplasty
9. Investigations of Prostheses with Higher than Anticipated Rates of Revision
10. Analysis of State and Territory Health Data – All Arthroplasty 1993/1994 – 2008/2009

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 2009, the number of hip replacement procedures increased by 3.4% compared to the year prior and the number of knees by 3.0%. Since 2003, the first year of complete national data collection by the Registry, the number of hip procedures has increased by 26.3% and the number of knee procedures by 42.6%.

It is anticipated that this rate of increase will continue in the foreseeable 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 – 2008/2009'.

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 of 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 risk 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 (120 in 2009). 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 proportion of revision hip replacement has declined from 13.0% in 2003 to 11.2% in 2009. This equates to 600 less hip revisions in 2009 and 2,352 less since 2003.

Similarly, the proportion of revision knee procedures has declined from a peak of 8.8% in 2004 to 7.9% in 2009, equating to 378 less knee revisions in 2009 and 1,194 less since 2004.

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 Registry 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 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 Registry 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 2008/09 financial year, the Registry received almost 1,300 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% 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 set of data 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, in 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. This year the Registry has 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 31 July 2010 and 1 August 2010. Following the workshop the report is provided to the AOA Board for consideration and final approval prior to publication.

Presentation of 2010 Annual Report

This year, there are four sections to the report; 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.

In previous years, the printed report has included chapters on cement use and mortality following hip and knee replacement. Data for these chapters are now presented as separate supplementary reports.

Demographics and outcome of joint replacement other than hip and knee are also available as separate supplementary reports on the Registry website.

For the first time the Registry is making available detailed analyses of prostheses or combinations of prostheses that have been identified as having a higher than anticipated rate of revision. 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.

HIP REPLACEMENT

Categories of Hip Replacement

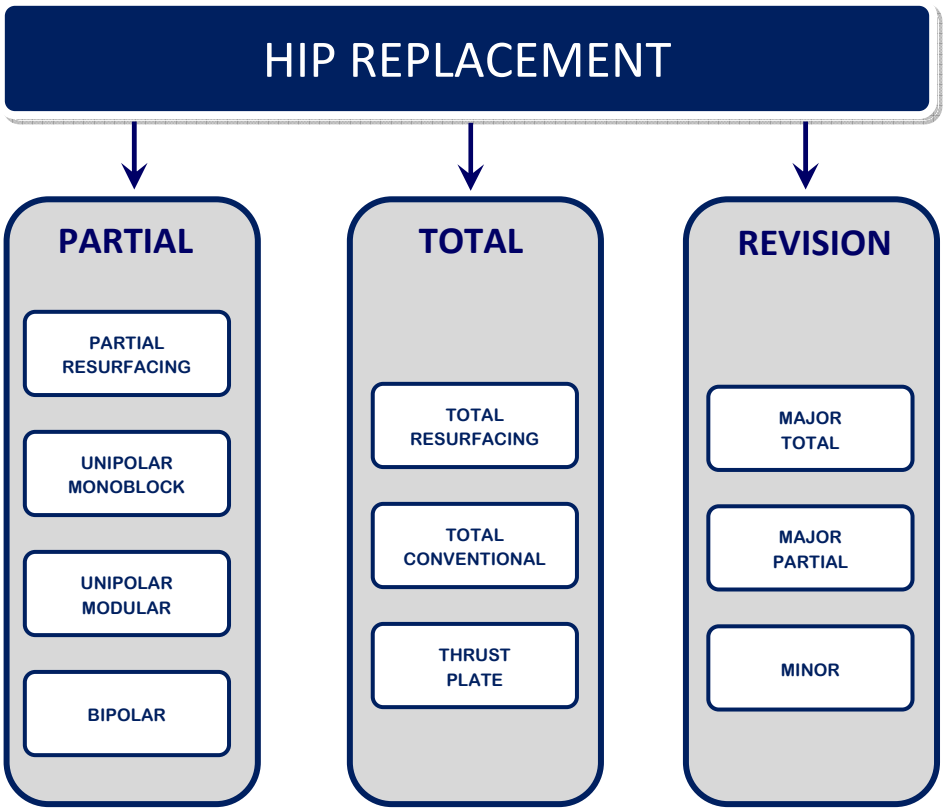
The Registry groups hip replacement into three broad categories, primary partial, primary total and revision hip replacement.

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 another component is 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 258,333 hip replacements reported to the Registry with a procedure date up to and including 31 December 2009. This is an additional 33,943 hip procedures compared to the number reported last year. When considering all procedures currently recorded by the Registry primary partial hips account for 16.4% of all hip replacements, primary total hips 71.5% and revision hip replacement 12.1% (Table H1).

Table H1: Number of Hip Replacements

Hip Category	Number	Percent
Primary Partial Hip	42369	16.4
Primary Total Hip	184629	71.5
Revision Hip	31335	12.1
TOTAL	**258333**	**100.0**

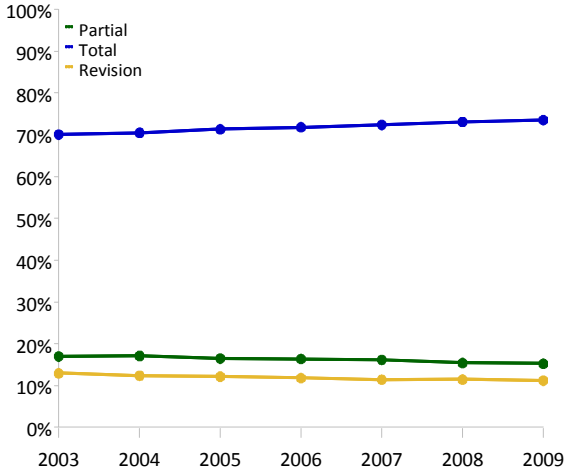
In 2009, the number of hip replacements reported to the Registry increased by 1,100 (3.4%) compared to 2008. During the last 12 months the use of primary partial increased by 2.2%, primary total by 4.0% and revision hip replacement by 1.1%.

Since 2003, the number of hip replacement procedures has increased by 26.3%. Primary total hip replacement has increased by 32.5%, primary partial 13.6% and revision hip replacement 9.3%.

In 2009, primary total hip replacement accounted for 73.5% of all hip replacement procedures. This has increased from 70.1% in 2003. Primary partial hip replacement has decreased from 17.0% in 2003 to 15.3% in 2009 (Figure H1).

Revision hip replacement as a proportion of all hip replacement procedures has declined from 13.0% in 2003 to 11.2% in 2009. This equates to 600 less revision procedures in 2009 compared to what would have been the case if the proportion of revision procedures had not declined from 13.0%.

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 and Knee Arthroplasty' available on the Registry website, www.dmac.adelaide.edu.au/aoanjrr/publications.jsp.

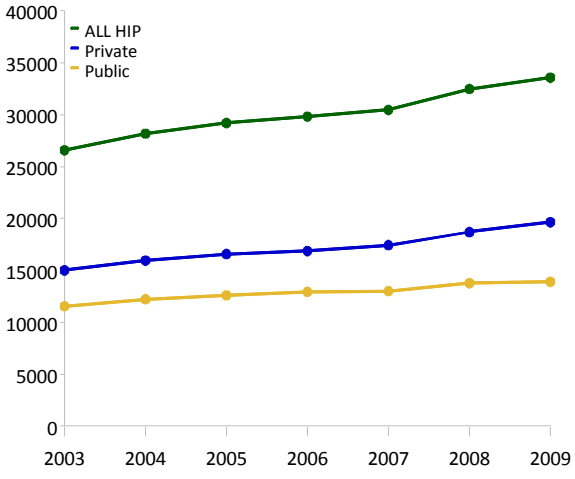
Public and Private Sector

More than half of all hip replacement procedures reported to the Registry have been undertaken in private hospitals (58.6% in 2009).

There were 19,662 private sector hip replacements reported for 2009, an increase of 5.1% compared to 2008. In the public sector, there were 13,918 hip replacements, an increase of 1.0% compared to 2008.

Since 2003, hip replacement in the private sector has increased by 30.9% compared to 20.3% in the public sector (Figure H2).

Figure H2: Hip Replacement by Hospital Sector



There were 4,103 public sector primary partial hip replacements reported for 2009, an increase of 2.3% compared to 2008. In the private sector, there were 1,022 partial hip replacements, an increase of 1.7% compared to 2008. Since 2003, primary partial hip replacement in the public sector has increased by 14.3% compared to 10.8% in the private sector.

In 2009, 16,360 private sector primary total hip replacements were reported, an increase of 5.8% compared to 2008. In the public sector, there were 8,330 primary total hip replacements, an increase of 0.6% compared to 2008. Since 2003, primary total hip replacement in the private sector has increased by 36.0% compared to 26.1% in the public sector.

There were 2,280 private sector revision hip replacements reported for 2009, an increase of 2.1% compared to 2008. In the public sector, there were 1,485 revision hip replacements, a decrease of 0.3% compared to 2008. Since 2003, revision hip replacement in the private sector has increased by 10.1% compared to 8.1% in the public sector. This reflects the overall increase of hip replacement surgery in the private 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 prosthesis 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 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.

Table HP1: Partial Hip Replacement by Class

Partial Hip Class	Number	Percent
Partial Resurfacing	13	0.0
Unipolar Monoblock	19792	46.7
Unipolar Modular	12753	30.1
Bipolar	9811	23.2
TOTAL	**42369**	**100.0**

Use of Partial Hip Replacement

The most common class of primary partial hip replacement is unipolar monoblock. This accounts for 46.7% of all partial hip procedures, followed by unipolar modular (30.1%) and bipolar (23.2%). 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 97.4% of unipolar monoblock, 92.7% of unipolar modular and 89.2% of bipolar.

The outcome of primary partial hip replacement varies depending on the class. At nine years, bipolar has the lowest cumulative percent revision followed by unipolar modular and unipolar monoblock (Tables HP2 and HP3). This is most apparent in the less than 75 year age group (Tables HP4 and HP5 and Figure HP1).

These devices are used in a population known to have a high early mortality and consequently longer term revision outcomes become less relevant. Mortality data for partial hip replacement are detailed in Table HP4. The prosthesis specific differences are 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 and Knee 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

Partial Hip Class	N Revised	N Deceased	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Unipolar Monoblock	723	13256	19792	44544	1.62 (1.51, 1.75)
Unipolar Modular	369	4553	12753	25562	1.44 (1.30, 1.60)
Bipolar	298	4432	9811	30656	0.97 (0.86, 1.09)
TOTAL	**1390**	**22241**	**42356**	**100762**	**1.38 (1.31, 1.45)**

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

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Unipolar Monoblock	3.0 (2.7, 3.3)	5.0 (4.6, 5.4)	6.1 (5.6, 6.6)	6.8 (6.2, 7.5)	7.7 (6.5, 9.0)
Unipolar Modular	2.1 (1.8, 2.4)	3.9 (3.4, 4.3)	5.5 (4.8, 6.2)	7.0 (5.9, 8.2)	7.0 (5.9, 8.2)
Bipolar	2.2 (1.9, 2.5)	3.3 (2.9, 3.7)	4.2 (3.7, 4.7)	4.5 (4.0, 5.1)	4.7 (4.1, 5.4)

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

CPM	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Unipolar Monoblock	34.1 (33.4, 34.8)	57.4 (56.7, 58.1)	73.0 (72.3, 73.8)	82.7 (81.9, 83.4)	89.3 (88.4, 90.3)
Unipolar Modular	21.3 (20.6, 22.1)	38.6 (37.5, 39.6)	52.9 (51.5, 54.3)	65.2 (63.2, 67.1)	72.2 (69.5, 74.8)
Bipolar	19.3 (18.6, 20.1)	35.6 (34.6, 36.6)	49.0 (47.8, 50.1)	59.9 (58.6, 61.3)	68.4 (66.2, 70.5)

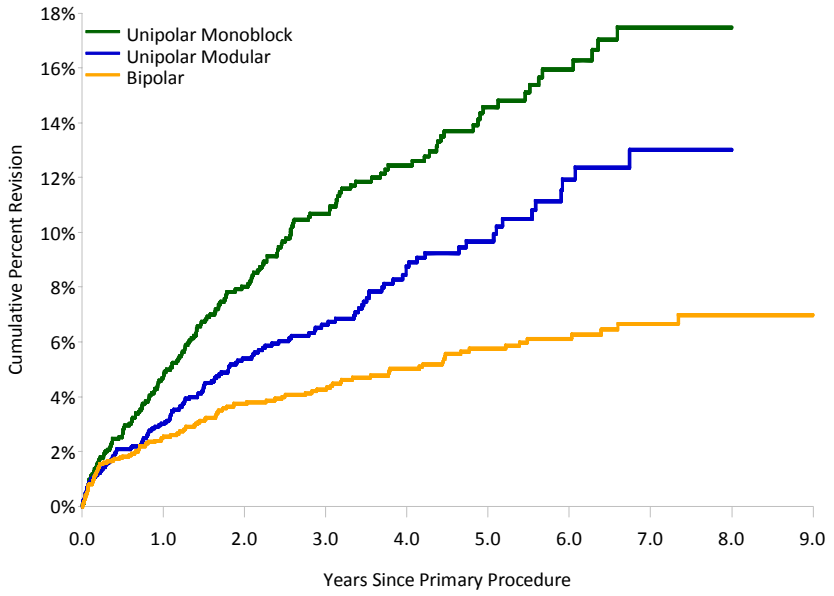
Table HP5: Revision Rates of Primary Partial Hip Replacement in Patients <75 Years by Class

Hip Type	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Unipolar Monoblock	167	1821	5080	3.29 (2.81, 3.83)
Unipolar Modular	151	2660	6449	2.34 (1.98, 2.75)
Bipolar	114	2562	9287	1.23 (1.01, 1.47)
TOTAL	**432**	**7043**	**20816**	**2.08 (1.88, 2.28)**

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

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Unipolar Monoblock	4.7 (3.8, 6.0)	10.7 (9.1, 12.6)	14.6 (12.4, 17.0)	17.5 (14.8, 20.6)	
Unipolar Modular	3.0 (2.4, 3.8)	6.6 (5.5, 7.9)	9.7 (8.1, 11.6)	13.0 (10.5, 16.1)	
Bipolar	2.5 (2.0, 3.3)	4.3 (3.5, 5.2)	5.8 (4.7, 7.0)	6.7 (5.5, 8.1)	7.0 (5.7, 8.6)

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



HR - adjusted for age and gender

Unipolar Monoblock vs Bipolar
0 - 3Mth: HR=1.22 (0.75, 1.98),p=0.415
3Mth+: HR=3.38 (2.54, 4.49),p<0.001

Unipolar Modular vs Bipolar
0 - 3Mth: HR=0.89 (0.56, 1.42),p=0.623
3Mth+: HR=2.13 (1.59, 2.85),p<0.001

Unipolar Monoblock vs Unipolar Modular
Entire Period: HR=1.54 (1.23, 1.92),p<0.001

Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Unipolar Monoblock	1821	1213	935	719	538	371	258	156	81	25
Unipolar Modular	2660	1769	1266	877	578	359	211	119	59	20
Bipolar	2562	1949	1620	1358	1138	887	603	361	155	43

Partial Resurfacing

The Registry has recorded 13 partial resurfacing procedures, the principal diagnoses are avascular necrosis (46.2%) and Perthes (23.1%).

Most patients are male (76.9%) and all aged less than 55 years. All procedures replaced part of the femoral articular surface.

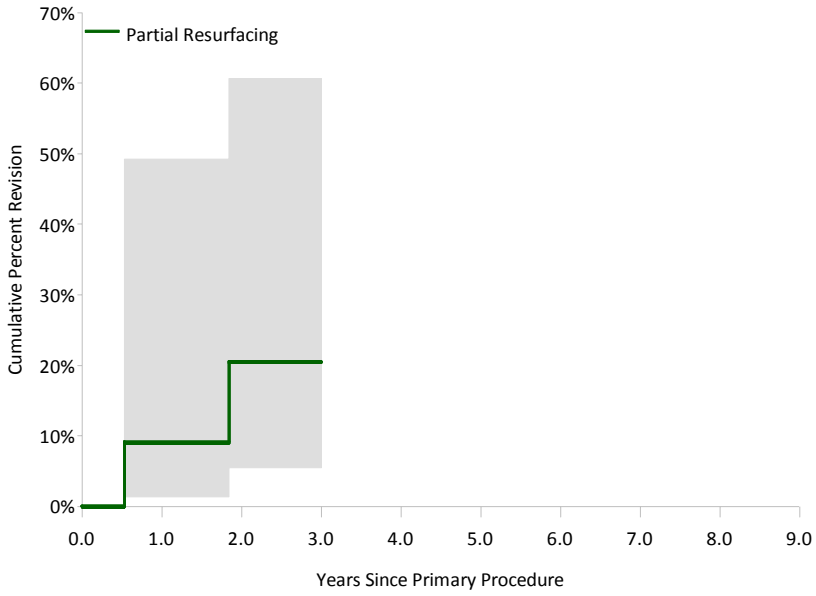
The cumulative percent revision is 9.1% at one year and 20.5% at three years (Table HP7 and Figure HP2).

Of the three revisions, two were for loosening and on one occasion the prosthesis dislocated. 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	7 Yrs	9 Yrs
Partial Resurfacing	9.1 (1.3, 49.2)	20.5 (5.5, 60.7)			

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



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Partial Resurfacing	13	10	7	4	2	1	0	0	0	0

Unipolar Monoblock

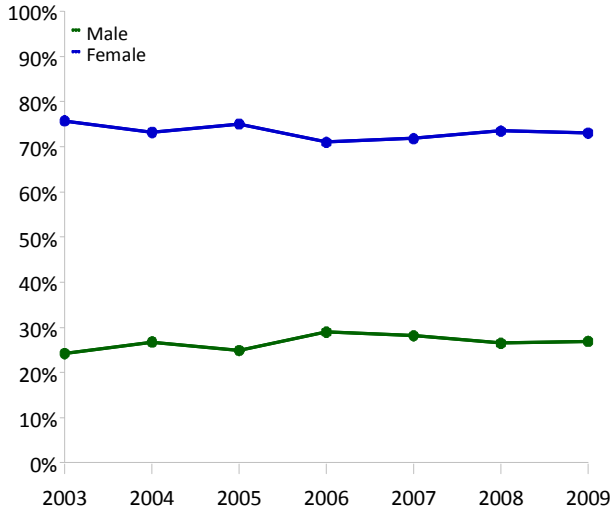
Demographics

There have been 19,792 unipolar monoblock procedures reported to the Registry, an additional 1,607 procedures compared to the last report.

The use of all monoblock hip replacement in Australia continues to decline. The number of procedures reported in 2009 was 5.6% less than 2008 and 37.1% less compared to 2003.

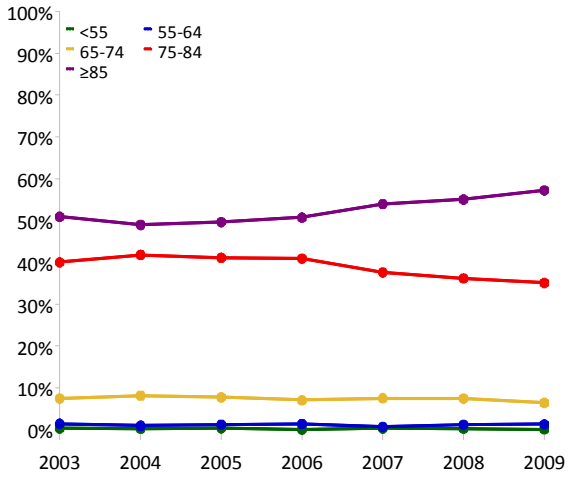
Fractured neck of femur is the principal diagnosis for unipolar monoblock hip replacement (97.4%).

Figure HP3: Primary Unipolar Monoblock Hip Replacement by Gender



Most patients are female (74.1%) and aged 75 years or older (90.8%). The proportion of patients aged 85 years or older has increased from 49.0% in 2004 to 57.2% in 2009 (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 has decreased by 52.2% since 2003. The Thompson type has decreased by 25.7% during the same period. Over the last three years, the use of the ETS has remained constant (Table HP8).

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

2003		2006		2007		2008		2009	
Model	N	Model	N	Model	N	Model	N	Model	N
Austin-Moore	1988	Austin-Moore	1209	Austin-Moore	1118	Austin-Moore	1035	Austin-Moore	950
Thompson	526	Thompson	576	Thompson	452	Thompson	393	Thompson	391
		ETS	196	ETS	233	ETS	247	ETS	241
Most Used									
(2) 100.0%	2514	(3) 100.0%	1981	(3) 100.0%	1803	(3) 100.0%	1675	(3) 100.0%	1582

Outcome

The cumulative percent revision at nine years for this procedure when undertaken for fractured neck of femur is 7.7% (Table HP9 and Figure HP5).

The main reasons for revision of unipolar monoblock hip replacement are loosening/lysis (50.6%) and fracture (17.3%). The majority of unipolar monoblock hip replacements are revised to a total hip replacement (62.1%) (Tables HP10 and HP11).

Age and fixation of the femoral stem are risk factors for revision.

The risk 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 risk of revision. There is no difference after this time (Tables HP16 and HP17 and Figure HP8).

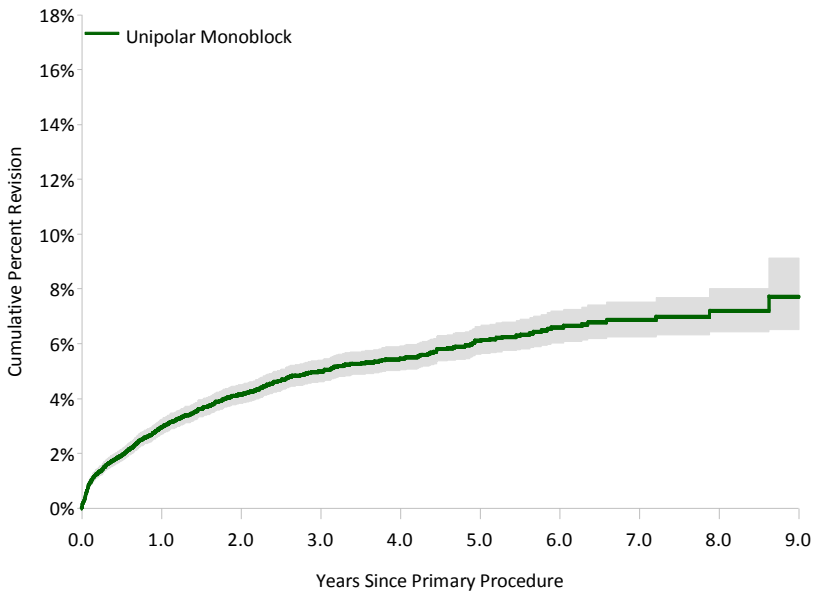
Although the Thompson type prosthesis is intended to be used with cement, the Registry does have outcome data when it is used without cement. The five year cumulative percent revision with cement is 5.1% and without is 13.0%.

There is no difference in the three year cumulative percent revision between the three different types of unipolar monoblock prostheses when used with cement fixation (Tables HP18 and HP19 and 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	7 Yrs	9 Yrs
Unipolar Monoblock	2.9 (2.7, 3.2)	5.0 (4.6, 5.4)	6.1 (5.6, 6.6)	6.9 (6.2, 7.5)	7.7 (6.5, 9.1)

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



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Unipolar Monoblock	19268	11415	8286	5960	4172	2730	1642	918	393	97

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

Reason for Revision	Number	Percent
Loosening/Lysis	366	50.6
Fracture	125	17.3
Prosthesis Dislocation	75	10.4
Infection	67	9.3
Pain	50	6.9
Chondrolysis/Acetab. Erosion	22	3.0
Other	18	2.5
TOTAL	**723**	**100.0**

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

Type of Revision	Number	Percent
THR (Femoral/Acetabular)	449	62.1
Femoral Only	128	17.7
Bipolar Head and Femoral	79	10.9
Removal of Prostheses	31	4.3
Cement Spacer	25	3.5
Minor Components	7	1.0
Reinsertion of Components	4	0.6
TOTAL	**723**	**100.0**

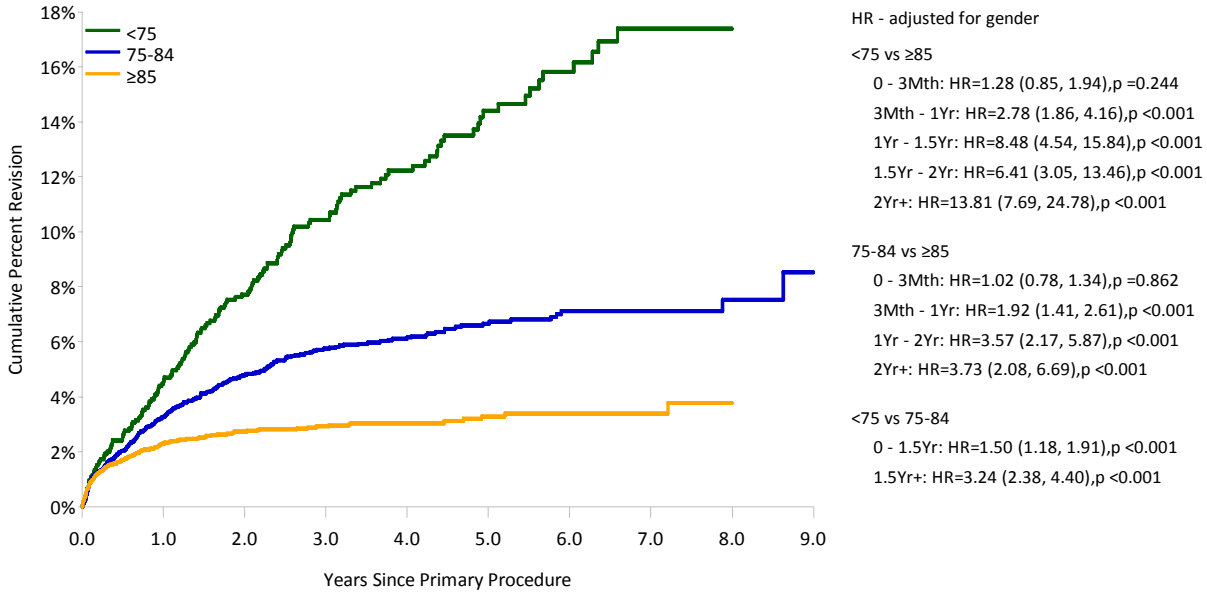
Table HP12: Revision Rates of Primary Unipolar Monoblock Hip Replacement by Age (Primary Diagnosis Fractured NOF)

Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
<75	160	1763	4973	3.22 (2.74, 3.76)
75-84	332	7761	19371	1.71 (1.53, 1.91)
≥85	210	9744	19134	1.10 (0.95, 1.26)
TOTAL	**702**	**19268**	**43478**	**1.61 (1.50, 1.74)**

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	7 Yrs	9 Yrs
<75	4.5 (3.6, 5.8)	10.4 (8.8, 12.3)	14.4 (12.2, 16.9)	17.4 (14.6, 20.6)	
75-84	3.3 (2.9, 3.8)	5.7 (5.1, 6.4)	6.7 (5.9, 7.5)	7.1 (6.3, 8.0)	8.5 (6.5, 11.1)
≥85	2.3 (2.0, 2.7)	2.9 (2.5, 3.4)	3.3 (2.8, 3.8)	3.4 (2.9, 4.0)	

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



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
<75	1763	1184	918	706	531	364	251	152	79	25
75-84	7761	4896	3661	2712	1944	1340	814	475	204	50
≥85	9744	5335	3707	2542	1697	1026	577	291	110	22

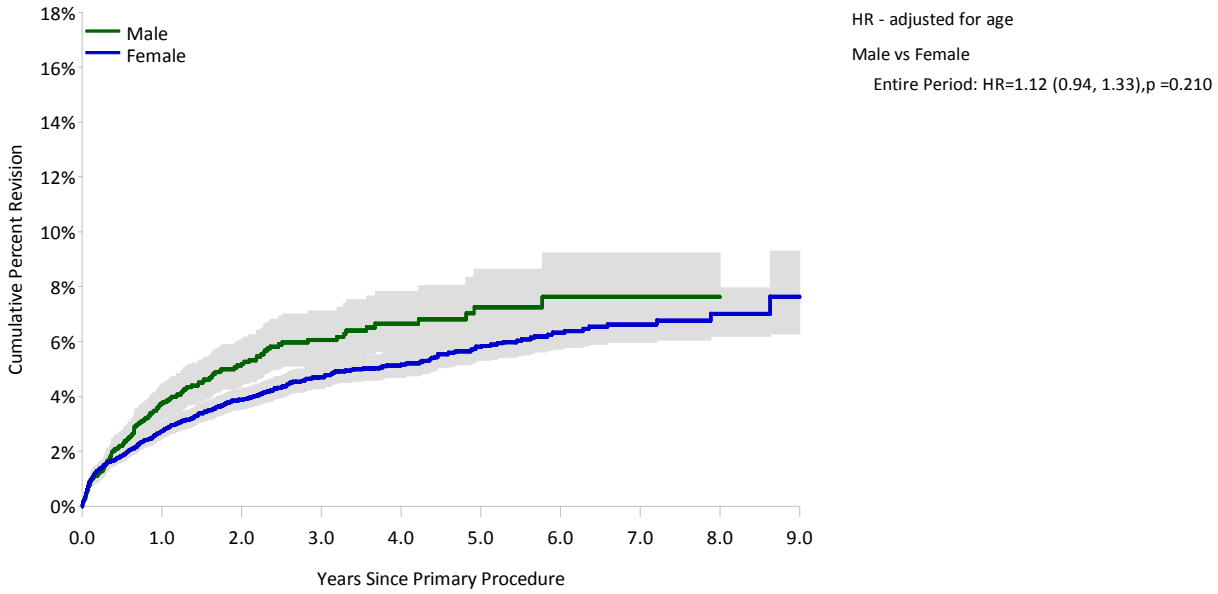
Table HP14: Revision Rates of Unipolar Monoblock Hip Replacement by Gender (Primary Diagnosis Fractured NOF)

Gender	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	174	4988	7985	2.18 (1.87, 2.53)
Female	528	14280	35493	1.49 (1.36, 1.62)
TOTAL	**702**	**19268**	**43478**	**1.61 (1.50, 1.74)**

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

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Male	3.8 (3.2, 4.5)	6.1 (5.2, 7.1)	7.2 (6.1, 8.6)	7.6 (6.3, 9.2)	
Female	2.7 (2.5, 3.0)	4.7 (4.3, 5.2)	5.8 (5.3, 6.4)	6.6 (6.0, 7.4)	7.6 (6.3, 9.3)

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



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Male	4988	2289	1467	955	626	398	227	127	54	14
Female	14280	9126	6819	5005	3546	2332	1415	791	339	83

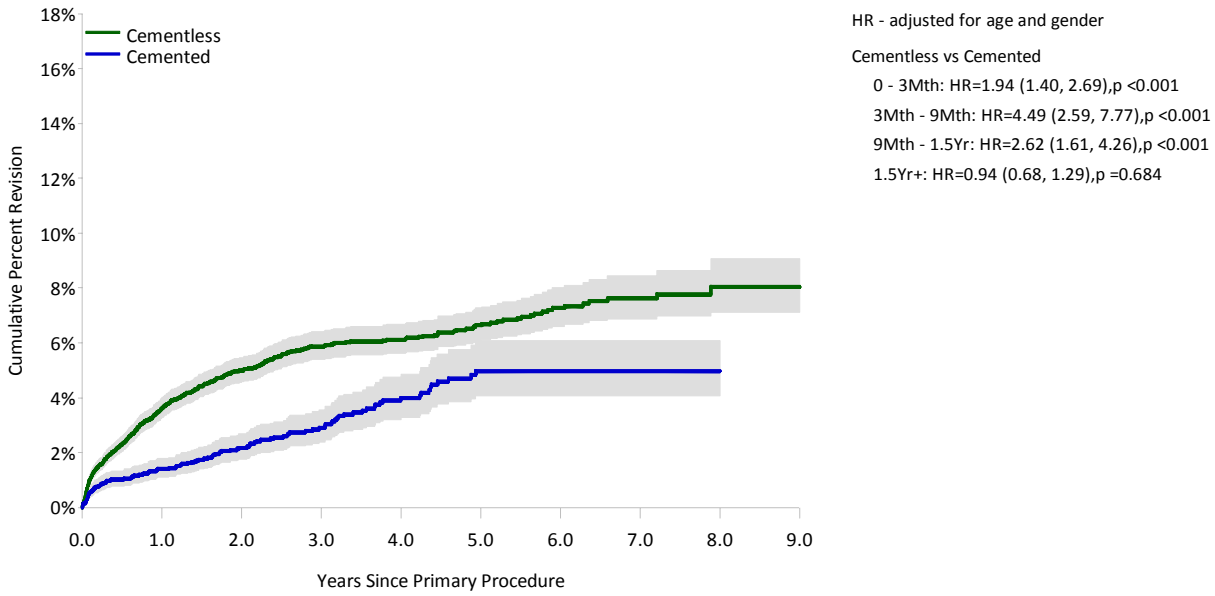
Table HP16: Revision Rates of Primary Unipolar Monoblock Hip Replacement by Femoral Fixation (Primary Diagnosis Fractured NOF)

Femoral Fixation	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Cementless	571	13550	30963	1.84 (1.70, 2.00)
Cemented	131	5718	12515	1.05 (0.88, 1.24)
TOTAL	**702**	**19268**	**43478**	**1.61 (1.50, 1.74)**

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	7 Yrs	9 Yrs
Cementless	3.6 (3.3, 4.0)	5.9 (5.4, 6.4)	6.6 (6.1, 7.3)	7.6 (6.9, 8.4)	8.0 (7.1, 9.1)
Cemented	1.4 (1.1, 1.8)	2.9 (2.4, 3.6)	5.0 (4.1, 6.1)	5.0 (4.1, 6.1)	

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	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Cementless	13550	7909	5800	4247	3064	2059	1271	710	298	74
Cemented	5718	3506	2486	1713	1108	671	371	208	95	23

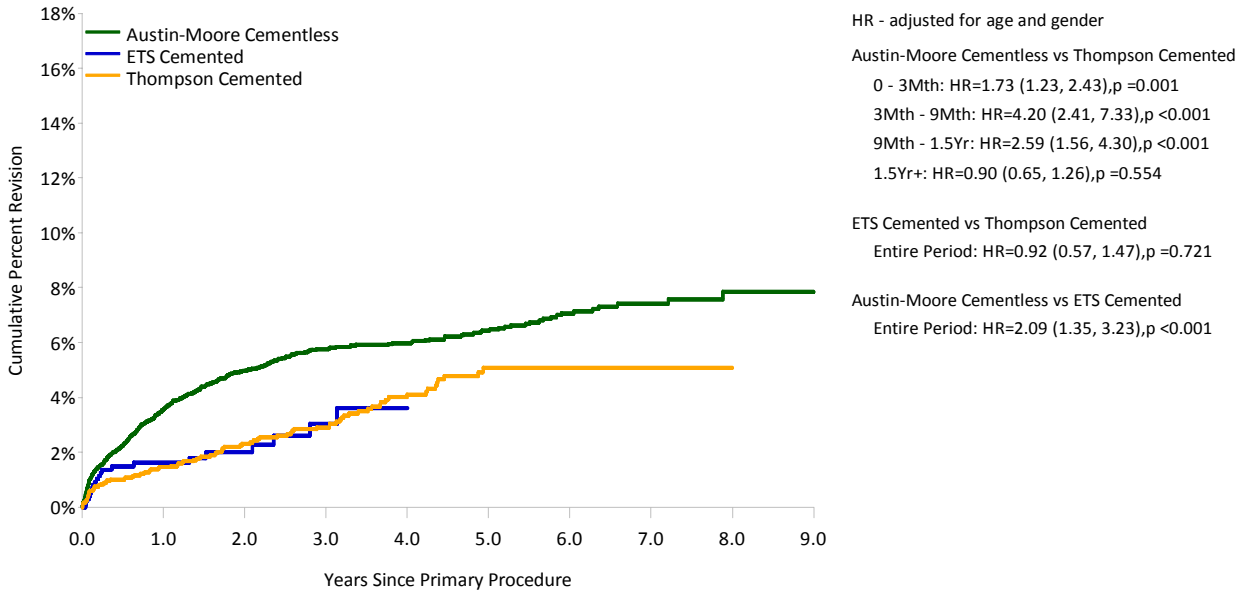
Table HP18: Revision Rates of Primary Unipolar Monoblock Hip Replacement

Unipolar Monoblock	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Austin-Moore Type Cemented	9	518	941	0.96 (0.44, 1.82)
Austin-Moore Type Cementless	556	13468	30719	1.81 (1.66, 1.97)
ETS Cemented	21	1077	1745	1.20 (0.75, 1.84)
Thompson Type Cemented	106	4293	10146	1.04 (0.86, 1.26)
Thompson Type Cementless	31	436	994	3.12 (2.12, 4.43)
TOTAL	**723**	**19792**	**44544**	**1.62 (1.51, 1.75)**

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

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Austin-Moore Type Cemented	1.0 (0.4, 2.8)	3.3 (1.6, 6.9)	4.9 (2.2, 10.7)		
Austin-Moore Type Cementless	3.6 (3.2, 3.9)	5.8 (5.3, 6.3)	6.4 (5.9, 7.0)	7.4 (6.7, 8.2)	7.8 (6.9, 8.9)
ETS Cemented	1.6 (1.0, 2.7)	3.0 (1.8, 5.0)			
Thompson Type Cemented	1.4 (1.1, 1.9)	2.9 (2.3, 3.6)	5.1 (4.1, 6.3)	5.1 (4.1, 6.3)	
Thompson Type Cementless	6.4 (4.3, 9.7)	9.9 (6.8, 14.4)	13.0 (8.8, 18.9)		

Figure HP9: Cumulative Percent Revision of Cementless Austin Moore Type and Cemented Thompson Type and ETS Hip Prostheses



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Austin-Moore Cementless	13468	7856	5753	4220	3035	2037	1251	706	299	72
ETS Cemented	1077	615	374	193	84	22	0	0	0	0
Thompson Cemented	4293	2714	1989	1428	967	620	359	203	93	23

Unipolar Modular

Demographics

There have been 12,753 unipolar modular procedures reported to the Registry, an additional 2,812 procedures compared to the last report.

The number of unipolar modular procedures reported in 2009 was 11.5% more than 2008 and 318.2% more compared to 2003.

Fractured neck of femur is the principal diagnosis for unipolar modular hip replacement (92.7%).

Most patients are female (72.2%) and aged 75 years or older (79.1%). The proportion of patients aged 85 years or older has increased from 29.7% in 2005 to 41.1% in 2009 (Figures HP10 and HP11).

Figure HP10: Primary Unipolar Modular Hip Replacement by Gender

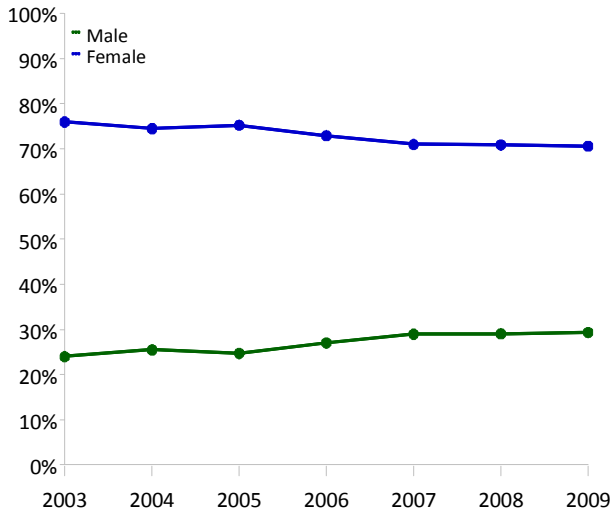
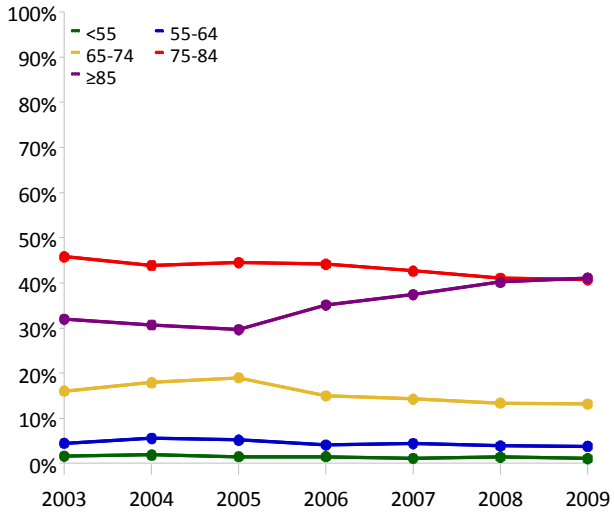


Figure HP11: Primary Unipolar Modular Hip Replacement by Age



There were 22 different unipolar modular head prostheses and 41 different stem prostheses used in 2009, a small increase compared to 2008. Overall there have been 136 unipolar modular head and stem combinations recorded by the Registry (Tables HP18 and HP19).

In 2009, the Unitrax head was the most frequently used unipolar modular head (32.9%) and the Exeter V40 was the most frequently used stem (32.2%) (Tables HP20 and HP21).

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

2003		2006		2007		2008		2009	
Model	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**
Unitrax	193	Unitrax	502	Unitrax	647	Unipolar (S&N)	782	Unitrax	916
Unipolar (Zimmer)	142	Unipolar (S&N)	400	Unipolar (S&N)	603	Unitrax	751	Unipolar (S&N)	887
Unipolar (S&N)	89	VerSys Endo	191	VerSys Endo	328	VerSys Endo	341	VerSys Endo	374
VerSys Endo	75	Unipolar (Corin)	184	Modular Cathcart	140	Modular Cathcart	181	Modular Cathcart	209
Hemi (Mathys)	64	Unipolar (Zimmer)	161	Unipolar (Corin)	139	Unipolar (Corin)	144	Unipolar (Zimmer)	116
Hemi (Depuy)	46	Modular Cathcart	84	Unipolar (Zimmer)	138	Unipolar (Zimmer)	114	Unipolar (Corin)	104
Unipolar (Plus)	38	Hemi (Mathys)	64	Unipolar (Plus)	90	Unipolar (Plus)	86	Metasul	79
Ultima	16	Unipolar (Plus)	63	Hemi (Mathys)	40	Metasul	27	Unipolar (Plus)	53
Cormet 2000	1	Endo II	38	Metasul	28	Hemi (Mathys)	18	Endo II	16
Metasul	1	Hemi (Depuy)	15	Pharo	13	Endo II	14	Furlong LOL	6
Ten Most Used									
(10) 99.8%	665	(10) 98.0%	1702	(10) 98.0%	2166	(10) 98.4%	2458	(10) 99.1%	2760
Remainder									
(1) 0.2%	1	(12) 2.0%	35	(11) 2.0%	45	(9) 1.6%	39	(12) 0.9%	25
TOTAL									
(11) 100.0%	666	(22) 100.0%	1737	(21) 100.0%	2211	(19) 100.0%	2497	(22) 100.0%	2785

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

2003		2006		2007		2008		2009	
Model	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**
Exeter V40	179	Exeter V40	479	Exeter V40	614	Exeter V40	720	Exeter V40	896
Alloclassic	111	Spectron EF	201	CPT	306	Spectron EF	355	CPCS	441
CPT	91	CPT	174	Spectron EF	277	CPCS	348	Spectron EF	382
Spectron EF	88	CPCS	169	CPCS	274	CPT	312	CPT	356
Fullfix Stem	49	Alloclassic	132	Alloclassic	157	Corail	176	Corail	198
SL-Plus	38	Trifit	124	Corail	140	Alloclassic	146	Alloclassic	193
Elite Plus	33	Corail	82	SL-Plus	90	SL-Plus	91	SL-Plus	85
CCA	15	SL-Plus	61	Trifit	76	Taper Fit	71	Metafix	53
Thompson Modular	15	Taper Fit	61	Taper Fit	59	Trifit	67	Taper Fit	44
C-Stem	13	CCA	40	Platform	30	Platform	40	Taperloc	18
Ten Most Used									
(10) 94.9%	632	(10) 87.7%	1523	(10) 91.5%	2023	(10) 93.2%	2326	(10) 95.7%	2666
Remainder									
(12) 5.1%	34	(30) 12.3%	214	(30) 8.5%	188	(27) 6.8%	171	(31) 4.3%	119
TOTAL									
(22) 100.0%	666	(40) 100.0%	1737	(40) 100.0%	2211	(37) 100.0%	2497	(41) 100.0%	2785

Outcome

The cumulative percent revision at seven years for this procedure when undertaken for fractured neck of femur is 7.1% (Table HP22 and Figure HP12).

The main reasons for revision are prosthesis dislocation (18.7%), loosening/lysis (18.4%), infection (18.4%) and fracture (17.3%). The majority of revisions of primary unipolar modular are acetabular only (44.2%), followed by femoral/acetabular revisions (22.5%) (Tables HP23 and HP24).

Age, gender and fixation of the femoral stem are risk factors for revision.

The risk 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 risk of revision between one month and one and a half years (Tables HP27 and HP28 and Figure HP14).

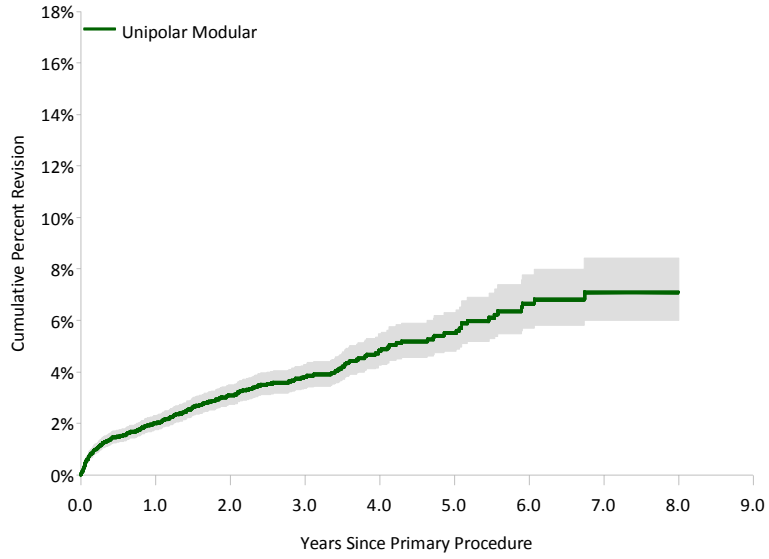
Cementless fixation has a higher risk of revision (Tables HP29 and HP30 and Figure HP15).

The revision rates 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	7 Yrs	9 Yrs
Unipolar Modular	2.0 (1.8, 2.3)	3.8 (3.4, 4.3)	5.5 (4.8, 6.3)	7.1 (6.0, 8.4)	

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



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Unipolar Modular	11821	7143	4728	2993	1754	1030	590	285	133	38

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

Reason for Revision	Number	Percent
Prosthesis Dislocation	69	18.7
Loosening/Lysis	68	18.4
Infection	68	18.4
Fracture	64	17.3
Pain	54	14.6
Chondrolysis/Acetab. Erosion	35	9.5
Other	11	3.0
TOTAL	**369**	**100.0**

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

Type of Revision	Number	Percent
Acetabular Only	163	44.2
THR (Femoral/Acetabular)	83	22.5
Femoral Only	44	11.9
Head Only	31	8.4
Minor Components	14	3.8
Cement Spacer	13	3.5
Bipolar Head and Femoral	13	3.5
Removal of Prostheses	7	1.9
Cement Only	1	0.3
TOTAL	**369**	**100.0**

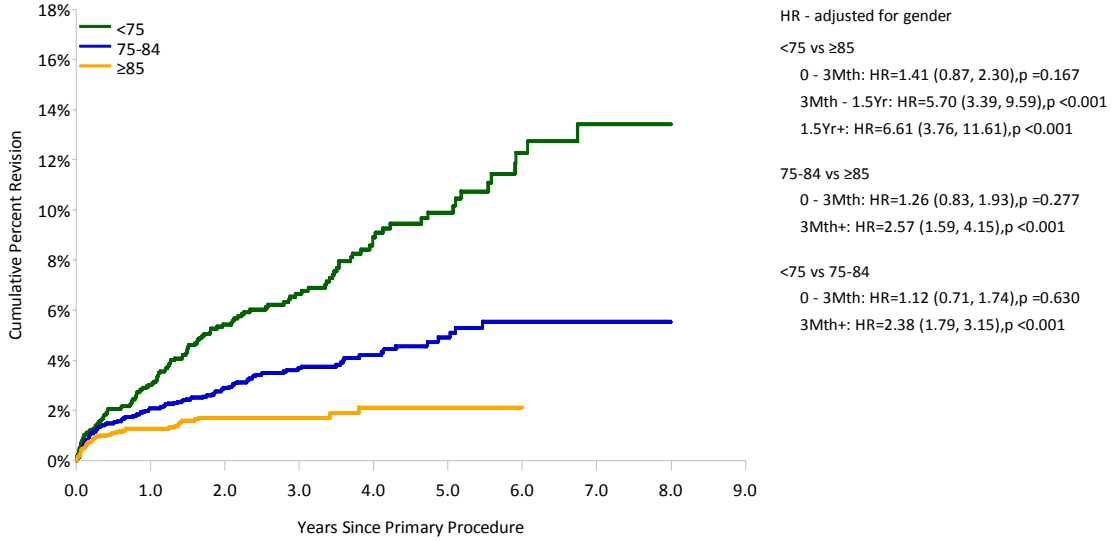
Table HP25: Revision Rates of Primary Unipolar Modular Hip Replacement by Age (Primary Diagnosis Fractured NOF)

Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
<75	142	2407	5991	2.37 (2.00, 2.79)
75-84	141	5072	10983	1.28 (1.08, 1.51)
≥85	56	4342	6820	0.82 (0.62, 1.07)
TOTAL	**339**	**11821**	**23794**	**1.42 (1.28, 1.58)**

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	7 Yrs	9 Yrs
<75	3.0 (2.4, 3.9)	6.6 (5.5, 8.0)	9.9 (8.2, 11.9)	13.4 (10.7, 16.7)	
75-84	2.1 (1.7, 2.5)	3.7 (3.1, 4.4)	4.9 (4.0, 6.0)	5.5 (4.4, 6.9)	
≥85	1.3 (1.0, 1.7)	1.7 (1.3, 2.2)	2.1 (1.5, 3.0)		

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



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
<75	2407	1632	1178	820	540	340	200	113	56	20
75-84	5072	3217	2196	1437	858	509	303	140	62	15
≥85	4342	2294	1354	736	356	181	87	32	15	3

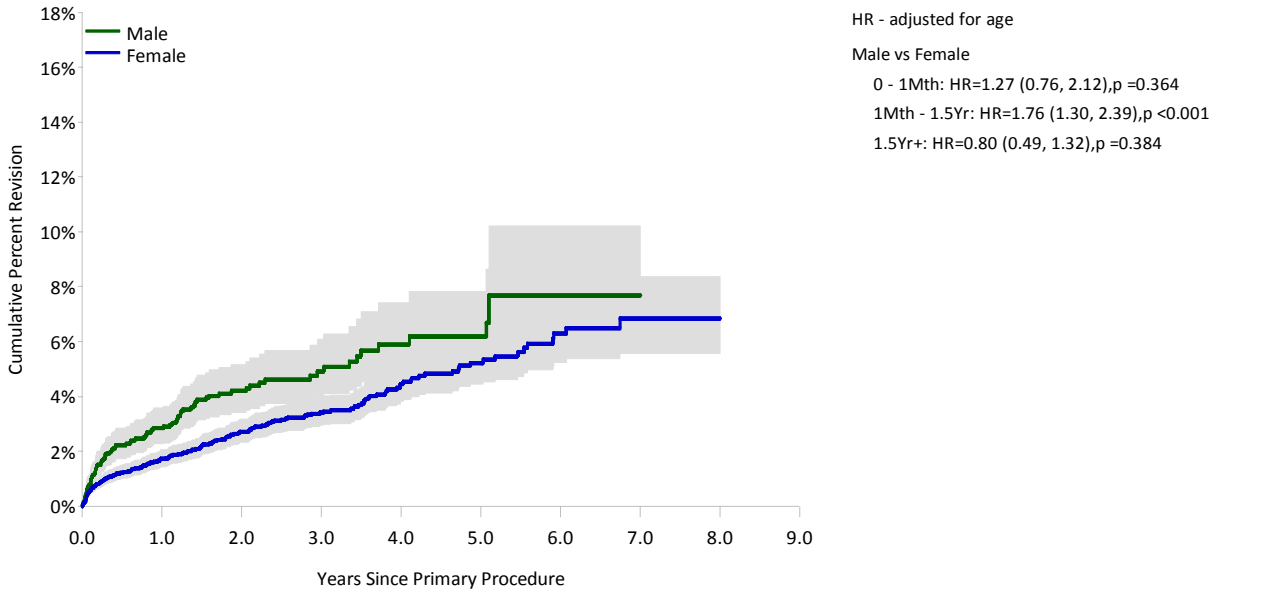
Table HP27: Revision Rates of Unipolar Modular Hip Replacement by Gender (Primary Diagnosis Fractured NOF)

Gender	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	109	3270	5356	2.04 (1.67, 2.45)
Female	230	8551	18438	1.25 (1.09, 1.42)
TOTAL	**339**	**11821**	**23794**	**1.42 (1.28, 1.58)**

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

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Male	2.8 (2.3, 3.6)	4.9 (4.0, 6.1)	6.2 (4.9, 7.8)	7.7 (5.8, 10.2)	
Female	1.7 (1.4, 2.0)	3.4 (2.9, 4.0)	5.2 (4.4, 6.1)	6.8 (5.6, 8.4)	

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



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Male	3270	1684	1016	598	342	205	106	53	24	7
Female	8551	5459	3712	2395	1412	825	484	232	109	31

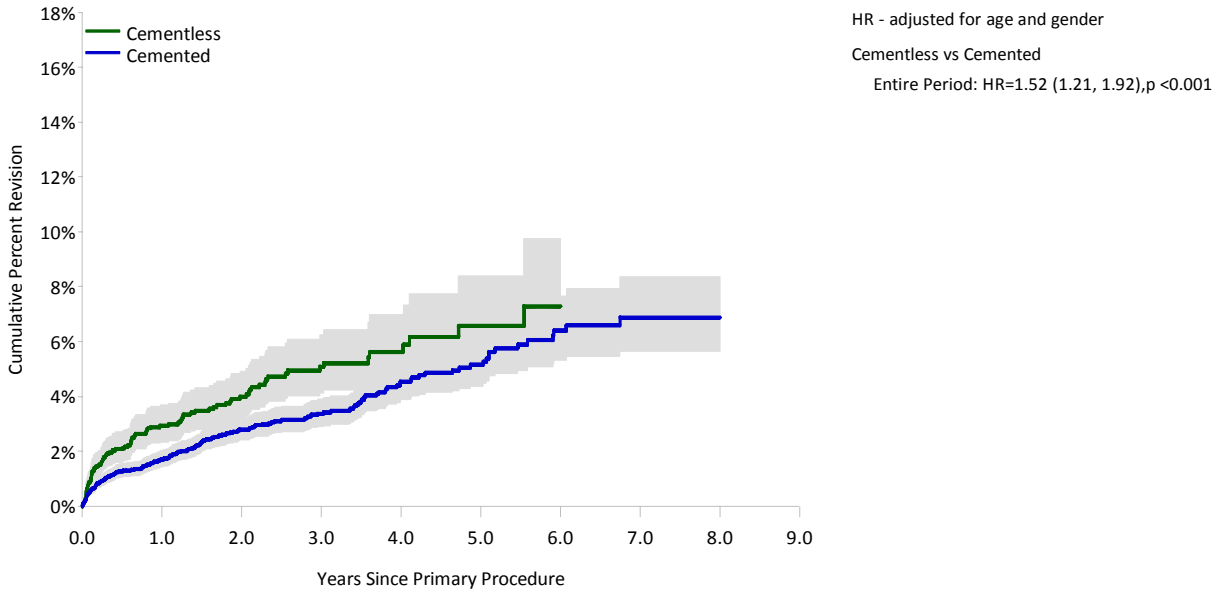
Table HP29: Revision Rates of Primary Unipolar Modular Hip Replacement by Femoral Fixation (Primary Diagnosis Fractured NOF)

Femoral Fixation	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Cementless	107	2930	5576	1.92 (1.57, 2.32)
Cemented	232	8891	18219	1.27 (1.11, 1.45)
TOTAL	**339**	**11821**	**23794**	**1.42 (1.28, 1.58)**

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	7 Yrs	9 Yrs
Cementless	2.9 (2.3, 3.7)	5.1 (4.1, 6.2)	6.6 (5.1, 8.4)		
Cemented	1.7 (1.4, 2.0)	3.4 (2.9, 3.9)	5.1 (4.4, 6.0)	6.9 (5.7, 8.4)	

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	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Cementless	2920	1791	1170	691	365	193	78	17	3	0
Cemented	8841	5342	3552	2297	1387	835	512	268	130	38

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)
Hemi Head (Mathys)	CCA	7	357	1237	0.57 (0.23, 1.17)
Hemi Head (Mathys)	Fullfix Stem	5	226	708	0.71 (0.23, 1.65)
Metasul	Alloclassic	2	134	137	1.46 (0.18, 5.27)
Modular Cathcart	Corail	18	597	762	2.36 (1.40, 3.73)
Ultima	Thompson Modular	1	132	543	0.18 (0.00, 1.03)
Unipolar Head (Corin)	Taper Fit	8	254	414	1.93 (0.84, 3.81)
Unipolar Head (Corin)	Trifit	6	286	546	1.10 (0.40, 2.39)
Unipolar Head (Plus)	SL-Plus	16	458	1077	1.49 (0.85, 2.41)
Unipolar Head (S&N)	CPCS	30	1337	1794	1.67 (1.13, 2.39)
Unipolar Head (S&N)	Spectron EF	34	1710	3528	0.96 (0.67, 1.35)
Unipolar Head (Zimmer)	Alloclassic	31	861	2119	1.46 (0.99, 2.08)
Unipolar Head (Zimmer)	CPT	7	153	786	0.89 (0.36, 1.84)
Unitrax	Exeter V40	103	3533	6722	1.53 (1.25, 1.86)
VerSys Endo	CPT	36	1401	2506	1.44 (1.01, 1.99)
VerSys Endo	VerSys	5	127	245	2.04 (0.66, 4.76)
Other (121)		60	1187	2438	2.46 (1.88, 3.17)
TOTAL		**369**	**12753**	**25562**	**1.44 (1.30, 1.60)**

Note: Only prostheses 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	7 Yrs	9 Yrs
Hemi Head (Mathys)	CCA	1.0 (0.3, 3.0)	2.6 (1.2, 5.4)	2.6 (1.2, 5.4)	2.6 (1.2, 5.4)	
Hemi Head (Mathys)	Fullfix Stem	1.5 (0.5, 4.7)	2.8 (1.2, 6.5)	2.8 (1.2, 6.5)		
Metasul	Alloclassic	1.6 (0.4, 6.3)				
Modular Cathcart	Corail	2.9 (1.7, 4.8)	6.5 (3.6, 11.6)			
Ultima	Thompson Modular	0.8 (0.1, 5.5)	0.8 (0.1, 5.5)	0.8 (0.1, 5.5)		
Unipolar Head (Corin)	Taper Fit	1.9 (0.7, 5.0)	5.3 (2.5, 10.9)			
Unipolar Head (Corin)	Trifit	1.5 (0.6, 4.1)	3.1 (1.3, 7.2)			
Unipolar Head (Plus)	SL-Plus	2.1 (1.1, 4.0)	4.9 (2.8, 8.3)	6.3 (3.4, 11.4)		
Unipolar Head (S&N)	CPCS	2.0 (1.3, 3.0)	2.9 (2.0, 4.3)			
Unipolar Head (S&N)	Spectron EF	1.3 (0.8, 2.1)	2.8 (1.9, 4.2)	4.3 (2.9, 6.4)	4.9 (3.2, 7.4)	
Unipolar Head (Zimmer)	Alloclassic	2.9 (1.9, 4.5)	4.1 (2.8, 5.9)	5.3 (3.6, 7.9)		
Unipolar Head (Zimmer)	CPT	0.7 (0.1, 5.1)	3.1 (1.2, 8.1)	5.2 (2.3, 11.3)	6.6 (3.1, 13.6)	
Unitrax	Exeter V40	1.8 (1.4, 2.4)	3.9 (3.1, 4.9)	6.7 (5.2, 8.5)	8.2 (6.1, 10.9)	
VerSys Endo	CPT	1.7 (1.1, 2.6)	3.8 (2.6, 5.5)	4.8 (2.9, 7.8)		
VerSys Endo	VerSys	4.2 (1.6, 10.9)				
Other (121)		4.1 (3.0, 5.5)	6.2 (4.7, 8.1)	7.8 (5.8, 10.5)		

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

Bipolar

Demographics

There have been 9,811 bipolar procedures reported to the Registry, an additional 778 procedures compared to the last report.

The number of bipolar procedures reported in 2009 was 10.0% less than 2008 and 43.2% less compared to 2003.

Fractured neck of femur is the principal diagnosis for bipolar hip replacement (89.2%).

Most patients are female (73.1%) and aged 75 years or older (73.9%). The proportion of patients aged 85 years or older has increased from 25.8% in 2003 to 39.6% in 2009 (Figures HP16 and HP17).

Figure HP16: Primary Bipolar Hip Replacement by Gender

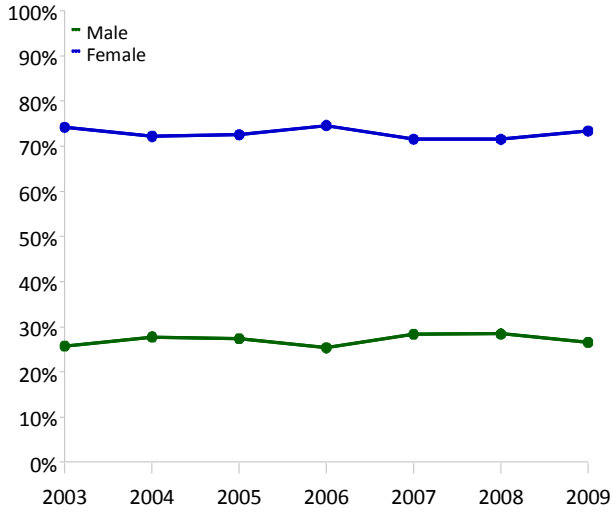
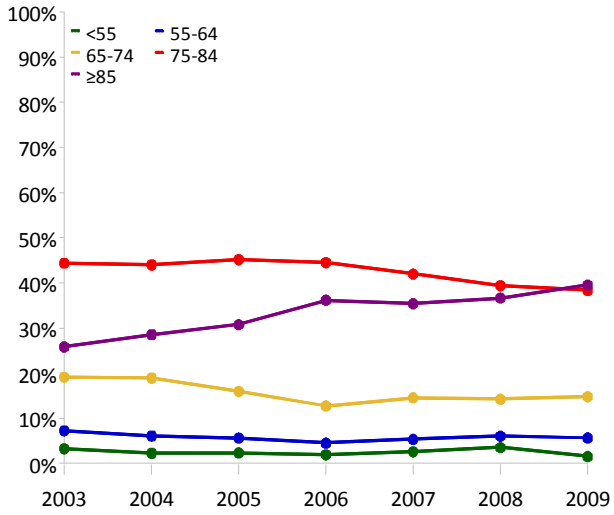


Figure HP17: Primary Bipolar Hip Replacement by Age



There were 10 different bipolar head prostheses and 36 different stem prostheses used in 2009. Overall there have been 194 bipolar head and stem combinations reported to the Registry (Tables HP33 and HP34).

In 2009, the UHR remains the most frequently used bipolar head (53.2%) (Table HP26) and the Exeter V40, remains the most frequently used stem (43.9%) (Tables HP33 and HP34).

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

2003		2006		2007		2008		2009	
Model	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**
UHR	750	UHR	555	UHR	443	UHR	462	UHR	402
Hastings	140	Tandem	220	Tandem	173	Tandem	128	Tandem	122
Convene	115	Multipolar Bipolar	102	Multipolar Bipolar	144	Multipolar Bipolar	117	Multipolar Bipolar	111
Bipolar (Sulzer)	91	Self-Centering	70	Hastings	64	Hastings	71	Hastings	64
Self-Centering	87	Hastings	58	Self-Centering	53	Self-Centering	36	Self-Centering	30
Multipolar Bipolar	59	Convene	41	Ringloc	18	Ringloc	17	Ringloc	10
Bipolar (Mathys)	39	Bipolar (Zimmer)	38	UHL	6	UHL	8	UHL	6
Bipolar (Lima)	19	Bipolar (Sulzer)	32	Bipolar (Eska)	5	Bipolar (Lima)	1	Bipolar (Eska)	5
Ringloc	19	Ringloc	20	Bipolar (Lima)	3			Bipolar (Medacta)	5
UHL	5	Bipolar (Mathys)	7	Bipolar (Plus)	2			Bipolar (Generic)	1
Ten Most Used									
(10) 99.5%	1324	(10) 98.0%	1143	(10) 99.9%	911	(8) 100.0%	840	(10) 100.0%	756
Remainder									
(2) 0.5%	7	(6) 2.0%	23	(1) 0.1%	1	(0) 0.0%	0	(0) 0.0%	0
TOTAL									
(12) 100.0%	1331	(16) 100.0%	1166	(11) 100.0%	912	(8) 100.0%	840	(10) 100.0%	756

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

2003		2006		2007		2008		2009	
Model	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**
Exeter V40	622	Exeter V40	485	Exeter V40	371	Exeter V40	372	Exeter V40	332
Elite Plus	94	CPCS	222	CPCS	133	CPCS	76	CPCS	83
Alloclassic	75	Alloclassic	78	Corail	62	VerSys	65	CPT	45
CPCS	65	Corail	58	CPT	57	Corail	53	VerSys	44
C-Stem	61	VerSys	57	VerSys	46	Accolade	35	Corail	43
Omnifit	59	CPT	30	Alloclassic	32	Spectron EF	34	Accolade	39
VerSys	45	Spectron EF	28	Spectron EF	31	CPT	32	C-Stem	27
Spectron EF	30	Accolade	24	Accolade	30	ABGII	20	Spectron EF	25
ABGII	26	Omnifit	24	C-Stem	19	Alloclassic	17	Alloclassic	11
CCA	25	Elite Plus	20	ABGII	15	C-Stem	17	Omnifit	11
Ten Most Used									
(10) 82.8%	1102	(10) 88.0%	1026	(10) 87.3%	796	(10) 85.8%	721	(10) 87.3%	660
Remainder									
(44) 17.2%	229	(36) 12.0%	140	(27) 12.7%	116	(24) 14.2%	119	(26) 12.7%	96
TOTAL									
(54) 100.0%	1331	(46) 100.0%	1166	(37) 100.0%	912	(34) 100.0%	840	(36) 100.0%	756

Outcome

The cumulative percent revision at nine years for this procedure when undertaken for fractured neck of femur is 4.3% (Table HP35 and Figure HP18).

The main reasons for revision of bipolar hip replacement are loosening/lysis (23.5%), fracture (22.1%), infection (18.8%) and prosthesis dislocation (17.4%). The majority of revisions of primary bipolar are acetabular only (35.6%), followed by femoral/acetabular revisions (24.5%) and bipolar head and femoral revisions (21.8%) (Tables HP36 and HP37).

Age and fixation of the femoral stem are risk factors for revision.

There is a higher risk of revision in patients less than 75 years of age. There is however, no difference in the risk of revision between the two older age groups (75-84 and ≥85 years) (Tables HP38 and HP39 and Figure HP19). This is evident in both males and females.

There is no difference in the risk of revision between males and females (Tables HP40 and HP41 and Figure HP20).

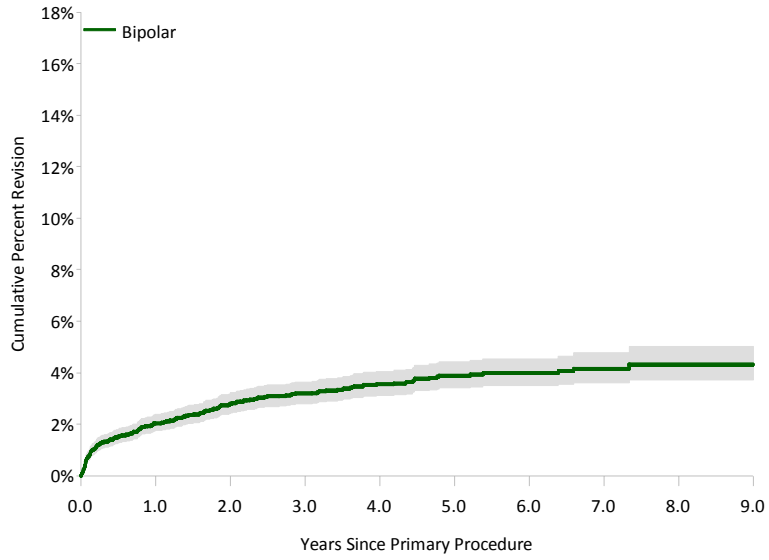
Bipolar hip replacement has a higher risk of revision in the first three months when cementless stems are used. There is no difference in the risk of revision after this time (Tables HP42 and HP43 and Figure HP21).

The revision rates 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	7 Yrs	9 Yrs
Bipolar	2.0 (1.7, 2.4)	3.2 (2.8, 3.6)	3.9 (3.4, 4.4)	4.2 (3.6, 4.8)	4.3 (3.7, 5.0)

Figure HP18: Cumulative Percent Revision of Primary Bipolar Hip Replacement (Primary Diagnosis Fractured NOF)



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Bipolar	8748	6476	5236	4186	3186	2261	1438	793	298	81

Table HP36: Primary Bipolar Hip Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	70	23.5
Fracture	66	22.1
Infection	56	18.8
Prosthesis Dislocation	52	17.4
Pain	26	8.7
Chondrolysis/Acetab. Erosion	14	4.7
Other	14	4.7
TOTAL	**298**	**100.0**

Table HP37: Primary Bipolar Hip Replacement by Type of Revision

Type of Revision	Number	Percent
Acetabular Only	106	35.6
THR (Femoral/Acetabular)	73	24.5
Bipolar Head and Femoral	65	21.8
Head Only	15	5.0
Femoral Only	15	5.0
Cement Spacer	14	4.7
Minor Components	6	2.0
Removal of Prostheses	4	1.3
TOTAL	**298**	**100.0**

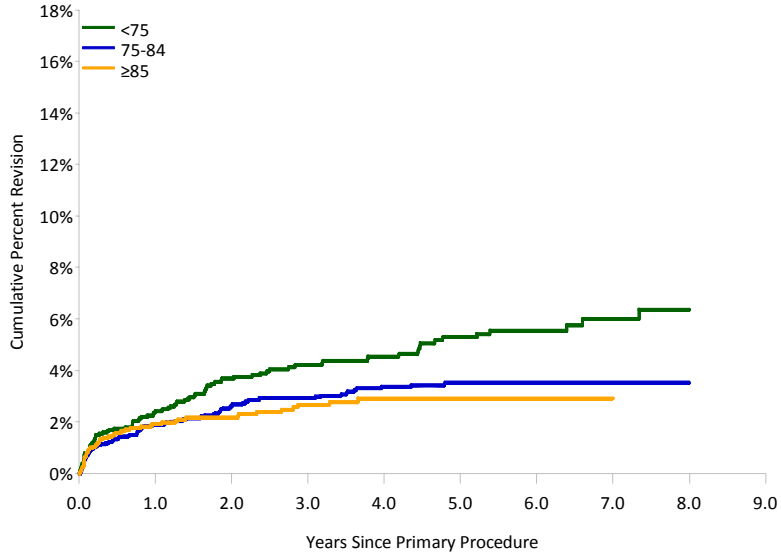
Table HP38: Revision Rates of Primary Bipolar Hip Replacement by Age (Primary Diagnosis Fractured NOF)

Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
<75	90	2102	8099	1.11 (0.89, 1.37)
75-84	104	3904	13123	0.79 (0.65, 0.96)
≥85	57	2742	6615	0.86 (0.65, 1.12)
TOTAL	**251**	**8748**	**27837**	**0.90 (0.79, 1.02)**

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

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
<75	2.4 (1.8, 3.2)	4.2 (3.3, 5.3)	5.3 (4.3, 6.5)	6.0 (4.8, 7.5)	
75-84	1.9 (1.5, 2.4)	2.9 (2.4, 3.6)	3.5 (2.9, 4.3)	3.5 (2.9, 4.3)	
≥85	1.9 (1.4, 2.6)	2.7 (2.0, 3.5)	2.9 (2.2, 3.8)	2.9 (2.2, 3.8)	

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



HR - adjusted for gender

<75 vs ≥85

0 - 3Mth: HR=1.36 (0.85, 2.18),p =0.202

3Mth - 6Mth: HR=0.98 (0.35, 2.73),p =0.969

6Mth+: HR=2.04 (1.35, 3.09),p <0.001

75-84 vs ≥85

Entire Period: HR=1.10 (0.80, 1.52),p =0.562

<75 vs 75-84

Entire Period: HR=1.51 (1.14, 2.00),p =0.004

Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
<75	2102	1679	1417	1194	1005	791	534	324	137	38
75-84	3904	3012	2487	2029	1539	1087	684	374	143	37
≥85	2742	1785	1332	963	642	383	220	95	18	6

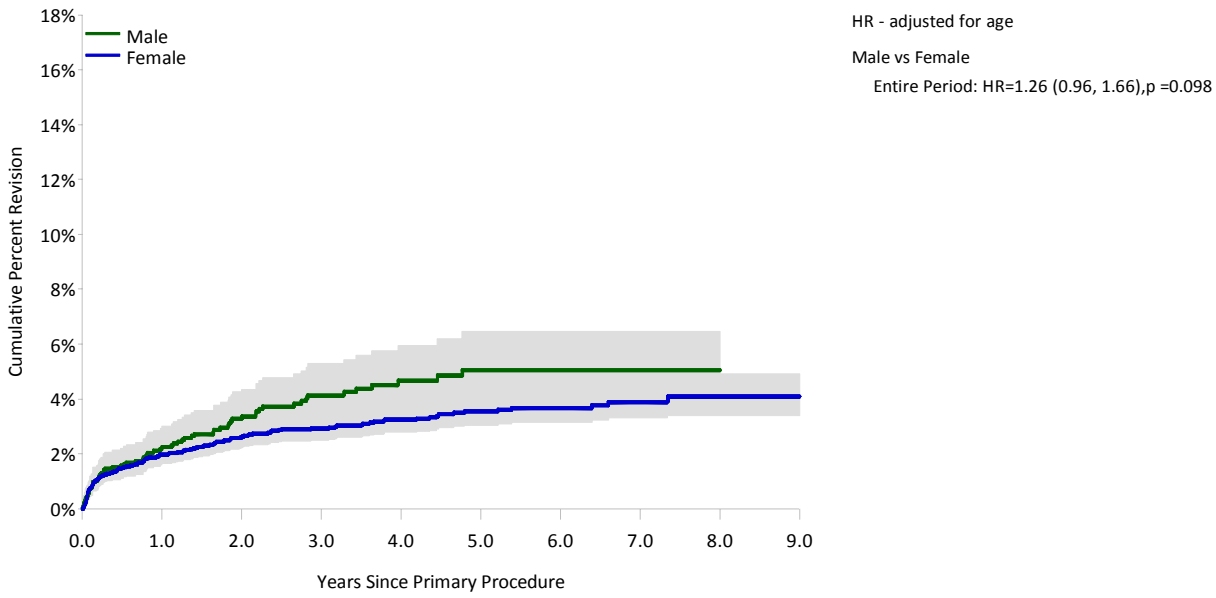
Table HP40: Revision Rates of Bipolar Hip Replacement by Gender (Primary Diagnosis Fractured NOF)

Gender	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	72	2295	6031	1.19 (0.93, 1.50)
Female	179	6453	21807	0.82 (0.71, 0.95)
TOTAL	**251**	**8748**	**27837**	**0.90 (0.79, 1.02)**

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

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Male	2.2 (1.7, 3.0)	4.1 (3.2, 5.3)	5.0 (3.9, 6.4)	5.0 (3.9, 6.4)	
Female	2.0 (1.7, 2.4)	2.9 (2.5, 3.4)	3.6 (3.0, 4.1)	3.9 (3.3, 4.6)	4.1 (3.4, 4.9)

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



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Male	2295	1507	1147	869	623	437	262	144	47	21
Female	6453	4969	4089	3317	2563	1824	1176	649	251	60

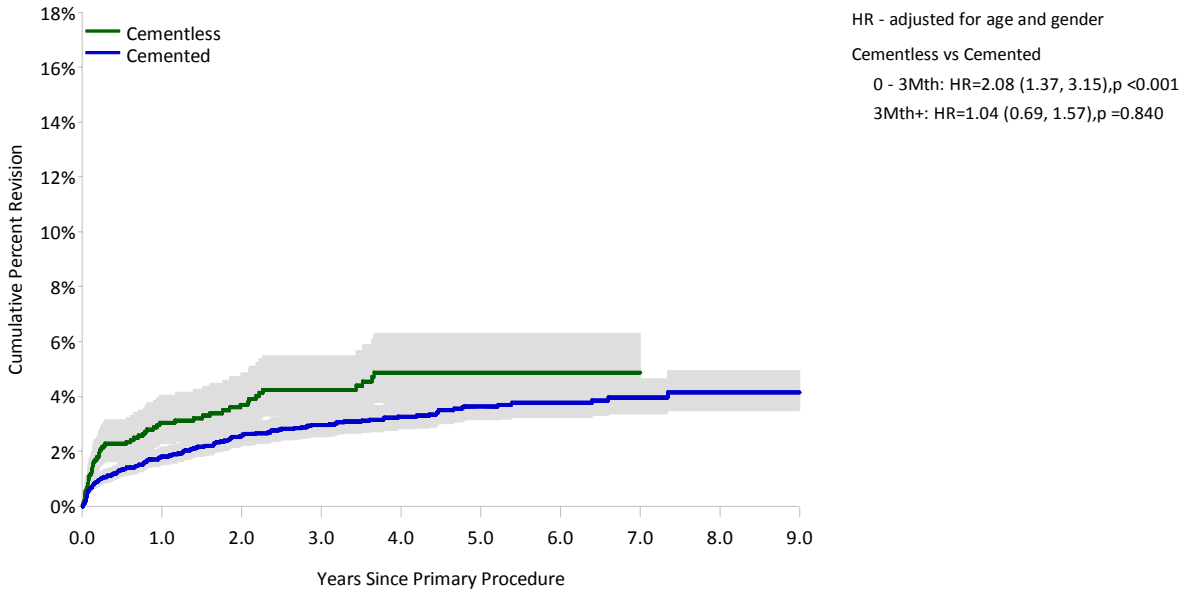
Table HP42: Revision Rates of Primary Bipolar Hip Replacement by Femoral Fixation (Primary Diagnosis Fractured NOF)

Femoral Fixation	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Cementless	61	1630	4741	1.29 (0.98, 1.65)
Cemented	190	7118	23096	0.82 (0.71, 0.95)
TOTAL	**251**	**8748**	**27837**	**0.90 (0.79, 1.02)**

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	7 Yrs	9 Yrs
Cementless	3.0 (2.3, 4.1)	4.2 (3.3, 5.5)	4.9 (3.8, 6.3)	4.9 (3.8, 6.3)	
Cemented	1.8 (1.5, 2.2)	2.9 (2.5, 3.4)	3.6 (3.1, 4.2)	4.0 (3.4, 4.6)	4.1 (3.5, 4.9)

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



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Cementless	1630	1185	929	727	522	337	185	85	27	9
Cemented	7118	5291	4307	3459	2664	1924	1253	708	271	72

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 Ballhead (Sulzer)	Alloclassic	9	308	1234	0.73 (0.33, 1.38)
Centrax	Exeter	6	202	1059	0.57 (0.21, 1.23)
Convene	CPCS	13	345	1229	1.06 (0.56, 1.81)
Convene	Spectron EF	7	165	665	1.05 (0.42, 2.17)
Hastings	C-Stem	8	184	650	1.23 (0.53, 2.42)
Hastings	Corail	5	201	486	1.03 (0.33, 2.40)
Hastings	Elite Plus	14	298	1259	1.11 (0.61, 1.87)
Multipolar Bipolar	CPT	8	215	396	2.02 (0.87, 3.98)
Multipolar Bipolar	VerSys	6	388	877	0.68 (0.25, 1.49)
Self-Centering	C-Stem	2	110	384	0.52 (0.06, 1.88)
Self-Centering	Corail	5	127	277	1.81 (0.59, 4.21)
Self-Centering	Elite Plus	3	238	951	0.32 (0.07, 0.92)
Tandem	CPCS	13	572	1090	1.19 (0.64, 2.04)
Tandem	Spectron EF	9	137	240	3.74 (1.71, 7.10)
UHR	ABGII	10	172	516	1.94 (0.93, 3.56)
UHR	Accolade	4	136	211	1.90 (0.52, 4.85)
UHR	Exeter	8	207	1046	0.76 (0.33, 1.51)
UHR	Exeter V40	87	3747	11121	0.78 (0.63, 0.96)
UHR	Omnifit	18	341	1361	1.32 (0.78, 2.09)
Other (175)		63	1718	5602	1.12 (0.86, 1.44)
TOTAL		**298**	**9811**	**30656**	**0.97 (0.86, 1.09)**

Note: Only prostheses 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	7 Yrs	9 Yrs
Bipolar Ballhead (Sulzer)	Alloclassic	1.1 (0.3, 3.3)	2.7 (1.3, 5.6)	3.7 (1.9, 7.1)		
Centrax	Exeter	2.1 (0.8, 5.5)	2.7 (1.1, 6.5)	2.7 (1.1, 6.5)	2.7 (1.1, 6.5)	
Convene	CPCS	2.2 (1.1, 4.6)	3.3 (1.8, 6.1)	4.8 (2.8, 8.2)		
Convene	Spectron EF	2.0 (0.6, 6.0)	3.7 (1.6, 8.9)	6.0 (2.8, 12.4)		
Hastings	C-Stem	2.8 (1.2, 6.7)	5.6 (2.8, 11.2)	5.6 (2.8, 11.2)		
Hastings	Corail	2.7 (1.1, 6.3)	2.7 (1.1, 6.3)			
Hastings	Elite Plus	1.9 (0.8, 4.6)	4.3 (2.3, 7.9)	5.5 (3.1, 9.5)	7.3 (4.2, 12.5)	
Multipolar Bipolar	CPT	3.6 (1.7, 7.5)	4.6 (2.3, 9.3)			
Multipolar Bipolar	VerSys	1.0 (0.3, 3.1)	2.4 (1.0, 5.3)	2.4 (1.0, 5.3)		
Self-Centering	C-Stem	1.0 (0.1, 6.6)	2.1 (0.5, 8.3)			
Self-Centering	Corail	4.1 (1.7, 9.5)				
Self-Centering	Elite Plus	0.0 (0.0, 0.0)	0.6 (0.1, 3.9)	1.4 (0.3, 5.7)		
Tandem	CPCS	2.3 (1.2, 4.2)	3.4 (1.9, 5.9)			
Tandem	Spectron EF	2.5 (0.8, 7.7)				
UHR	ABGII	3.8 (1.7, 8.4)	4.8 (2.3, 10.0)			
UHR	Accolade	2.8 (0.9, 8.8)				
UHR	Exeter	1.6 (0.5, 4.9)	3.5 (1.6, 7.6)	4.9 (2.5, 9.7)	4.9 (2.5, 9.7)	
UHR	Exeter V40	1.8 (1.4, 2.3)	2.5 (2.0, 3.1)	3.3 (2.6, 4.1)	3.4 (2.7, 4.3)	
UHR	Omnifit	4.8 (2.9, 7.8)	5.2 (3.2, 8.3)	5.7 (3.5, 9.0)	6.5 (4.0, 10.3)	
Other (175)		2.7 (2.0, 3.6)	4.0 (3.1, 5.2)	4.9 (3.8, 6.3)	5.2 (4.0, 6.7)	

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

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 (92.7%), followed by total resurfacing (7.2%). 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	171104	92.7
Total Resurfacing	13307	7.2
Thrust Plate	218	0.1
Primary Total Hip	**184629**	**100.0**

Osteoarthritis is the principal diagnosis for primary total hip replacement (88.7%).

At nine 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 and Knee 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	5077	171104	652317	0.78 (0.76, 0.80)
Total Resurfacing	548	13307	55420	0.99 (0.91, 1.08)
Thrust Plate	4	218	1044	0.38 (0.10, 0.98)
TOTAL	**5629**	**184629**	**708781**	**0.79 (0.77, 0.82)**

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

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Total Conventional	1.6 (1.5, 1.6)	2.7 (2.6, 2.8)	3.5 (3.4, 3.6)	4.4 (4.3, 4.6)	5.4 (5.2, 5.7)
Total Resurfacing	1.9 (1.7, 2.1)	3.2 (2.9, 3.5)	4.6 (4.2, 5.0)	6.2 (5.6, 6.8)	7.4 (6.4, 8.6)
Thrust Plate	0.9 (0.2, 3.7)	1.5 (0.5, 4.7)	2.3 (0.8, 6.0)	2.3 (0.8, 6.0)	

Primary Total Conventional Hip Replacement

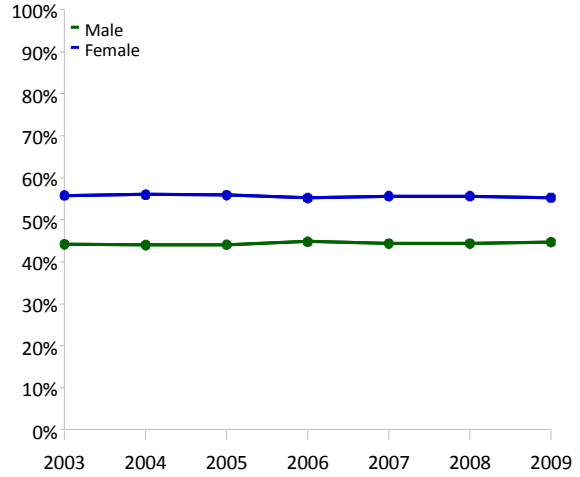
Demographics

There have been 171,104 total conventional procedures reported to the Registry, an additional 23,682 procedures compared to the last report.

Osteoarthritis is the principal diagnosis of total conventional hip replacement (88.3%), followed by avascular necrosis (3.7%), fractured neck of femur (3.6%), rheumatoid arthritis (1.3%) and developmental dysplasia (1.3%).

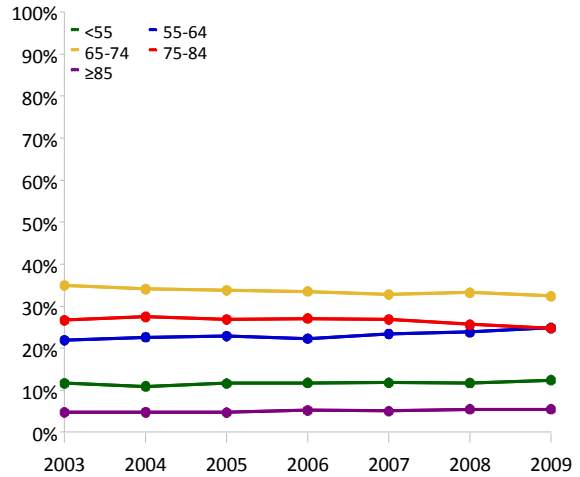
Total conventional hip replacement is more common in females (55.4%). This proportion has remained constant since 2003 (Figure HT1).

Figure HT1: Primary Total Conventional Hip Replacement by Gender



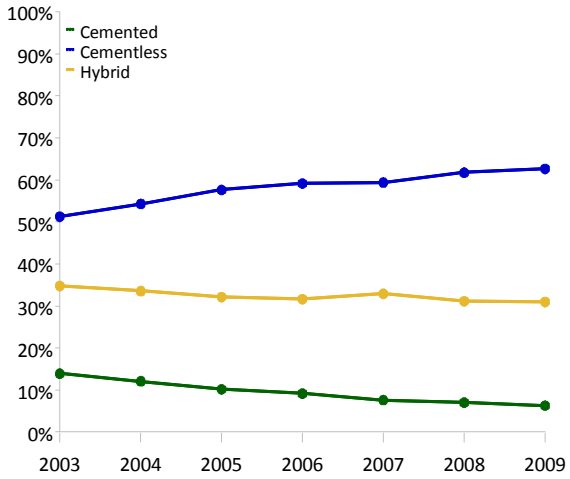
There has been a small increase in the proportion of patients aged 55-64 years (21.9% in 2003 to 24.9% in 2009). There has been no increase in the proportion of patients younger than 55 years during the same period (Figure HT2).

Figure HT2: Primary Total Conventional Hip Replacement by Age



The use of cementless fixation has increased from 51.3% in 2003 to 62.7% in 2009. During the same period, cemented fixation has declined from 13.9% to 6.3% and hybrid from 34.8% to 31.0% (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. In 2009 these were followed by the Secur-Fit, Accolade and CPT (Table HT4).

The percentage of procedures using the ten most used stems has increased from 63.2% in 2003 to 69.3% in 2009. The ten most used cemented and cementless stems are separately listed in Tables HT6 and HT7.

The Trident remains the most used acetabular prosthesis. There has been no change in the five most used prostheses in the last 12 months (Table HT5).

The percentage of procedures using the ten most used acetabular prostheses has increased from 74.9% in 2003 to 77.8% in 2009. The ten most used cemented and cementless acetabular prostheses are separately listed in Tables HT8 and HT9.

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

2003		2006		2007		2008		2009	
Model	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**
Exeter V40	3900	Exeter V40	4477	Exeter V40	4709	Exeter V40	4836	Exeter V40	5236
ABGII	1028	Corail	1432	Corail	2053	Corail	3145	Corail	3584
Synergy	1000	Synergy	1404	Accolade	1565	Accolade	1168	Secur-Fit	1273
VerSys	885	Accolade	1350	Synergy	1107	Synergy	1106	Accolade	1108
Alloclassic	819	Alloclassic	1059	Alloclassic	1077	Alloclassic	1074	CPT	1023
Spectron EF	783	Spectron EF	817	Spectron EF	828	CPT	1061	Synergy	1021
Secur-Fit Plus	713	Summit	622	CPT	737	Secur-Fit	833	Alloclassic	914
Omnifit	618	VerSys	591	SL-Plus	565	Anthology	707	Spectron EF	721
C-Stem	565	CPT	555	Summit	563	Spectron EF	686	SL-Plus	698
S-Rom	484	ABGII	518	VerSys	522	Summit	663	CPCS	689
Ten Most Used									
(10) 63.2%	10795	(10) 65.3%	12825	(10) 67.3%	13726	(10) 68.6%	15279	(10) 69.3%	16267
Remainder									
(70) 36.8%	6276	(89) 34.7%	6809	(98) 32.7%	6658	(98) 31.4%	6987	(100) 30.7%	7198
TOTAL									
(80) 100.0%	17071	(99) 100.0%	19634	(108) 100.0%	20384	(108) 100.0%	22266	(110) 100.0%	23465

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

2003		2006		2007		2008		2009	
Model	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**
Trident	3986	Trident	5737	Trident	6068	Trident	5627	Trident	6452
Reflection	1998	Reflection	2531	Reflection	2528	Pinnacle	3258	Pinnacle	4000
Trilogy	1524	Pinnacle	1727	Pinnacle	2149	R3	1892	R3	2242
Vitalock	955	Trilogy	1295	Trilogy	1365	Trilogy	1629	Trilogy	1378
Duraloc	905	Allofit	982	ASR	1184	Reflection	1400	Reflection	1108
ABGII	826	ASR	958	Allofit	891	ASR	1172	Allofit	906
Allofit	793	Contemporary	606	BHR	580	Allofit	950	Trab Metal Shell	803
Mallory-Head	729	BHR	549	Trab Metal Shell	490	Trab Metal Shell	614	DeltaMotion	510
Contemporary	539	Mallory-Head	433	Contemporary	444	BHR	475	Versafit	441
Pinnacle	537	EPF-Plus	409	EPF-Plus	432	Contemporary	424	ASR	425
Ten Most Used									
(10) 74.9%	12792	(10) 77.6%	15227	(10) 79.1%	16131	(10) 78.3%	17441	(10) 77.8%	18265
Remainder									
(65) 25.1%	4279	(76) 22.4%	4407	(75) 20.9%	4253	(73) 21.7%	4825	(72) 22.2%	5200
TOTAL									
(75) 100.0%	17071	(86) 100.0%	19634	(85) 100.0%	20384	(83) 100.0%	22266	(82) 100.0%	23465

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

2003		2006		2007		2008		2009	
Model	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**
Exeter V40	3900	Exeter V40	4474	Exeter V40	4708	Exeter V40	4836	Exeter V40	5235
Spectron EF	783	Spectron EF	817	Spectron EF	828	CPT	1061	CPT	1022
C-Stem	565	CPT	555	CPT	737	Spectron EF	685	Spectron EF	721
CPT	477	CPCS	516	CPCS	494	CPCS	634	CPCS	689
Elite Plus	445	C-Stem	351	C-Stem	383	C-Stem	243	C-Stem	232
MS 30	358	MS 30	262	MS 30	193	MS 30	217	Omnifit	220
Omnifit	339	Omnifit	164	Omnifit	165	Omnifit	180	MS 30	146
Charnley	321	Charnley	148	VerSys	129	Charnley	162	Charnley	118
CPCS	244	Elite Plus	112	Charnley	108	R120	53	R120	26
VerSys	146	VerSys	111	Adapter	53	Adapter	38	Lubinus SP II	24
Ten Most Used									
(10) 91.8%	7578	(10) 94.9%	7510	(10) 95.1%	7798	(10) 96.0%	8109	(10) 97.2%	8433
Remainder									
(35) 8.2%	677	(32) 5.1%	406	(27) 4.9%	398	(35) 4.0%	337	(35) 2.8%	244
TOTAL									
(45) 100.0%	8255	(42) 100.0%	7916	(37) 100.0%	8196	(45) 100.0%	8446	(45) 100.0%	8677

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

2003		2006		2007		2008		2009	
Model	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**
ABGII	1025	Corail	1431	Corail	2053	Corail	3145	Corail	3583
Synergy	979	Synergy	1398	Accolade	1563	Accolade	1168	Secur-Fit	1271
Alloclassic	819	Accolade	1350	Synergy	1095	Synergy	1097	Accolade	1106
VerSys	739	Alloclassic	1057	Alloclassic	1077	Alloclassic	1074	Synergy	1012
Secur-Fit Plus	712	Summit	621	SL-Plus	565	Secur-Fit	832	Alloclassic	914
S-Rom	483	ABGII	518	Summit	558	Anthology	703	SL-Plus	698
Secur-Fit	482	Secur-Fit	503	Anthology	508	SL-Plus	661	Anthology	676
Corail	376	VerSys	480	Secur-Fit	490	Summit	643	Quadra-H	530
Accolade	333	SL-Plus	479	S-Rom	473	S-Rom	450	Summit	429
Mallory-Head	329	S-Rom	438	ABGII	429	ABGII	369	Taperloc	382
Ten Most Used									
(10) 71.2%	6277	(10) 70.6%	8275	(10) 72.3%	8811	(10) 73.4%	10142	(10) 71.7%	10601
Remainder									
(48) 28.8%	2539	(68) 29.4%	3443	(75) 27.7%	3377	(73) 26.6%	3678	(76) 28.3%	4187
TOTAL									
(58) 100.0%	8816	(78) 100.0%	11718	(85) 100.0%	12188	(83) 100.0%	13820	(86) 100.0%	14788

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

2003		2006		2007		2008		2009	
Model	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**
Contemporary	539	Contemporary	605	Contemporary	444	Contemporary	424	Exeter Contemporary	391
Exeter	256	Exeter Contemporary	297	Exeter Contemporary	355	Exeter Contemporary	356	Contemporary	340
Reflection	256	Reflection	233	Reflection	224	Reflection	212	Reflection	151
Exeter Contemporary	227	Exeter	133	Exeter	109	Exeter	115	Exeter	142
Charnley Ogee	199	Elite Plus LPW	86	Brunswick	72	ZCA	88	Brunswick	71
Elite Plus LPW	149	Brunswick	78	ZCA	59	Charnley	79	ZCA	69
Low Profile Cup	130	CCB	67	Charnley	55	Brunswick	69	CCB	57
Elite Plus Ogee	110	Charnley Ogee	65	CCB	52	CCB	48	Charnley	53
Charnley	102	ZCA	56	Elite Plus LPW	41	Low Profile Cup	41	Marathon	43
ZCA	90	Elite Plus Ogee	50	Low Profile Cup	36	Charnley Ogee	36	Charnley Ogee	30
Ten Most Used									
(10) 84.3%	2058	(10) 87.8%	1670	(10) 88.7%	1447	(10) 89.8%	1468	(10) 86.1%	1347
Remainder									
(33) 15.7%	382	(28) 12.2%	233	(31) 11.3%	185	(30) 10.2%	166	(30) 13.9%	217
TOTAL									
(43) 100.0%	2440	(38) 100.0%	1903	(41) 100.0%	1632	(40) 100.0%	1634	(40) 100.0%	1564

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

2003		2006		2007		2008		2009	
Model	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**
Trident	3983	Trident	5724	Trident	6049	Trident	5608	Trident	6423
Reflection	1742	Reflection	2298	Reflection	2304	Pinnacle	3256	Pinnacle	4000
Trilogy	1524	Pinnacle	1726	Pinnacle	2146	R3	1890	R3	2240
Vitalock	954	Trilogy	1294	Trilogy	1363	Trilogy	1621	Trilogy	1370
Duraloc	900	Allofit	978	ASR	1184	Reflection	1188	Reflection	957
ABGII	825	ASR	958	Allofit	889	ASR	1170	Allofit	903
Allofit	786	BHR	549	BHR	577	Allofit	945	Trabecular Metal Shell	787
Mallory-Head	728	Mallory-Head	433	Trabecular Metal Shell	479	Trabecular Metal Shell	603	DeltaMotion	510
Pinnacle	536	EPF-Plus	409	EPF-Plus	431	BHR	474	Versafit	441
Fitmore	521	Durom	322	Mallory-Head	395	EPF-Plus	410	ASR	424
Ten Most Used									
(10) 85.4%	12499	(10) 82.9%	14691	(10) 84.3%	15817	(10) 83.2%	17165	(10) 82.4%	18055
Remainder									
(40) 14.6%	2132	(51) 17.1%	3040	(51) 15.7%	2935	(49) 16.8%	3467	(47) 17.6%	3846
TOTAL									
(50) 100.0%	14631	(61) 100.0%	17731	(61) 100.0%	18752	(59) 100.0%	20632	(57) 100.0%	21901

Outcome by Patient Characteristics

The cumulative percent revision at nine years for primary total conventional hip replacement undertaken for osteoarthritis is 5.2% (Table HT10 and Figure HT4).

Reason for Revision

The most common reasons for revisions of primary total conventional hip replacement are loosening/lysis (29.9%), followed by prostheses dislocation (27.6%), infection (16.7%), fracture (14.7%) and pain (2.0%) (Table HT11).

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 incidence of the five most common reasons for revision all increase with time, however the rate of increase varies depending on the reason for revision. 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. Pain is the fifth most common reason for revision. It has a linear increase but the incidence remains low over the entire period (Figure HT5).

Type of Revision

The type of revision used is influenced by the reason for revision. As these change with time, the relative proportion of each type of revision will also change with time. Currently, the five most common types of revision of primary total conventional hip replacement recorded by the Registry are femoral only revision (29.3%), acetabular only (24.9%), head and insert (18.3%), femoral/acetabular (12.3%) and head only (5.6%) (Table HT12).

Primary Diagnosis

Eleven primary diagnoses for total conventional hip replacement have been reported to the Registry. The outcomes of the five most common (osteoarthritis, avascular necrosis, fractured neck of femur, rheumatoid arthritis and developmental dysplasia) are listed in Tables HT13 and HT14.

Primary total conventional hip replacement performed for osteoarthritis has a significantly lower risk of revision compared to avascular necrosis, fractured neck of femur and rheumatoid arthritis. Osteoarthritis has a significantly lower risk of revision compared to developmental dysplasia in the first three months, but there is no difference after this time (Figure HT6).

Age and Gender

There is a significant difference in the risk of revision with respect to age (Tables HT15 and HT16 and Figure HT7).

Previously the Registry has not identified a difference in the risk of revision with respect to gender, however, this year it has identified a higher risk of revision for males after one and a half years (Tables HT17 and HT18 and Figure HT8).

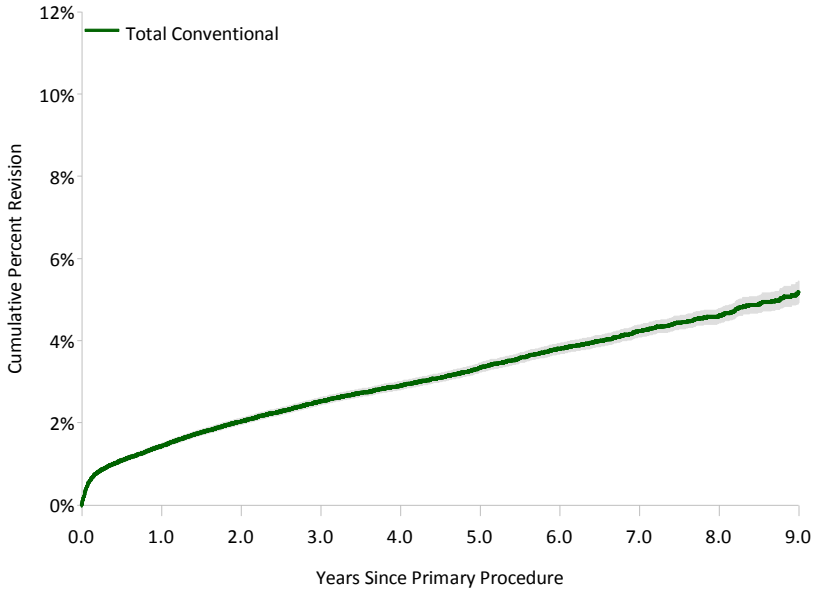
As previously reported there continues to be a difference in the risk of revision between age within gender. For females, the risk of revision decreases with increasing age. Females under 55 years have the highest risk of revision at nine years (6.5%) compared to females 75 years or older (4.2%) (Tables HT19 and HT20 and Figure HT9).

The relationship between risk of revision and age is not apparent for males at nine years. Males under 55 years have a cumulative percent revision of 5.0% compared to 5.7% for males 75 years or older (Figure HT10).

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

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Total Conventional	1.4 (1.4, 1.5)	2.5 (2.4, 2.6)	3.3 (3.2, 3.5)	4.2 (4.1, 4.4)	5.2 (4.9, 5.5)

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



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Total Conventional	151063	126845	105391	86005	67941	51155	35751	22143	10277	2607

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

Reason for Revision	Number	Percent
Loosening/Lysis	1519	29.9
Prosthesis Dislocation	1400	27.6
Infection	846	16.7
Fracture	744	14.7
Pain	104	2.0
Leg Length Discrepancy	64	1.3
Metal Sensitivity	62	1.2
Malposition	54	1.1
Wear Acetabulum	52	1.0
Implant Breakage Stem	35	0.7
Implant Breakage Acetabular	33	0.6
Incorrect Sizing	29	0.6
Instability	28	0.6
Implant Breakage Head	20	0.4
Other	87	1.7
TOTAL	**5077**	**100.0**

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

Type of Revision	Number	Percent
Femoral Only	1488	29.3
Acetabular Only	1265	24.9
Head/Insert	927	18.3
THR (Femoral/Acetabular)	627	12.3
Head Only	286	5.6
Cement Spacer	245	4.8
Minor Components	82	1.6
Insert Only	71	1.4
Removal of Prostheses	41	0.8
Head/Neck	32	0.6
Reinsertion of Components	6	0.1
Bipolar Head and Femoral	2	0.0
Saddle	2	0.0
Neck Only	2	0.0
Neck/Insert	1	0.0
TOTAL	**5077**	**100.0**

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

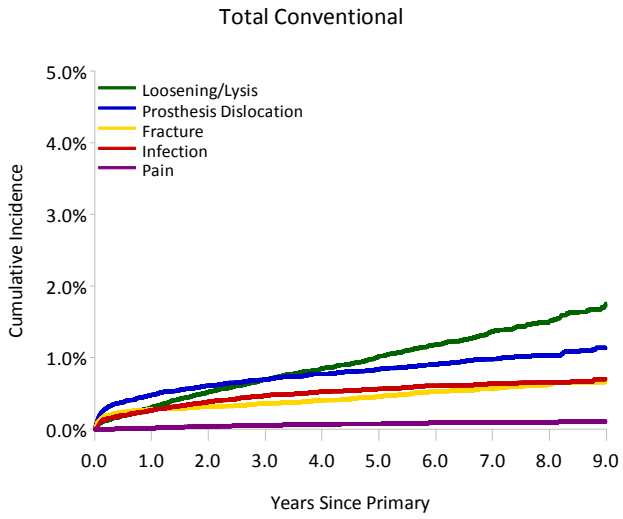


Table HT13: Revision Rates of Primary Total Conventional Hip Replacement by Primary Diagnosis

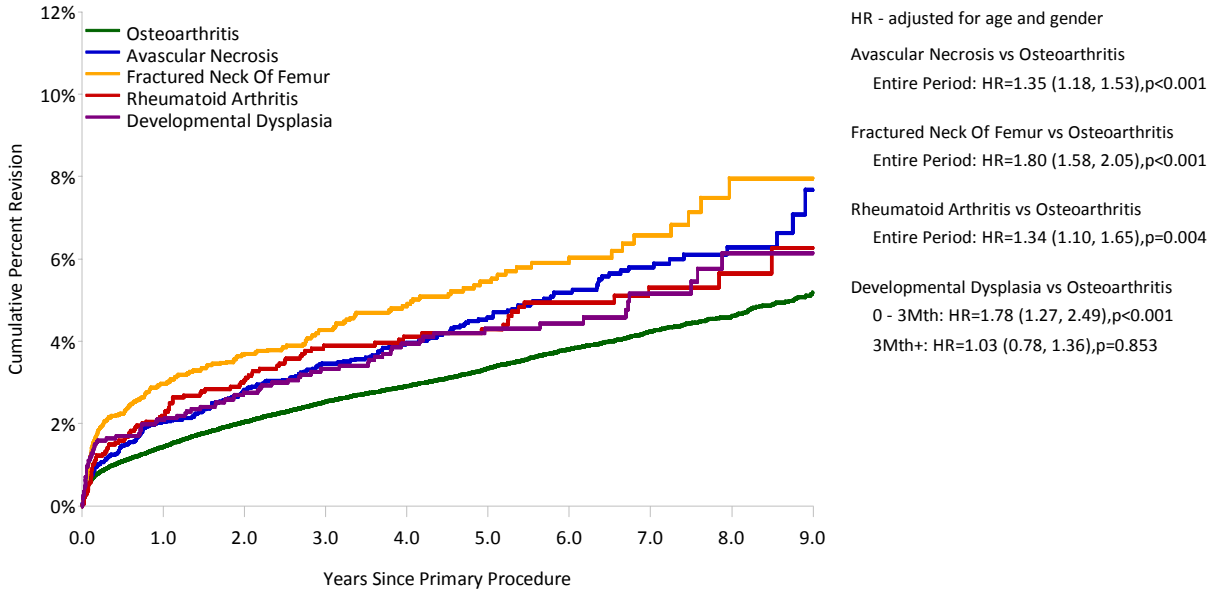
Primary Diagnosis	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Osteoarthritis	4284	151063	581454	0.74 (0.71, 0.76)
Avascular Necrosis	253	6402	25351	1.00 (0.88, 1.13)
Fractured Neck Of Femur	250	6208	17370	1.44 (1.27, 1.63)
Rheumatoid Arthritis	96	2306	10057	0.95 (0.77, 1.17)
Developmental Dysplasia	87	2273	9519	0.91 (0.73, 1.13)
Other (7)	107	2852	8567	1.25 (1.02, 1.51)
TOTAL	**5077**	**171104**	**652317**	**0.78 (0.76, 0.80)**

Note: Only prostheses with over 1000 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	7 Yrs	9 Yrs
Osteoarthritis	1.4 (1.4, 1.5)	2.5 (2.4, 2.6)	3.3 (3.2, 3.5)	4.2 (4.1, 4.4)	5.2 (4.9, 5.5)
Avascular Necrosis	2.0 (1.7, 2.4)	3.5 (3.0, 4.0)	4.6 (4.0, 5.2)	5.8 (5.0, 6.6)	7.7 (6.0, 9.7)
Fractured Neck Of Femur	3.0 (2.5, 3.4)	4.3 (3.7, 4.9)	5.4 (4.7, 6.3)	6.6 (5.6, 7.7)	8.0 (6.4, 9.9)
Rheumatoid Arthritis	2.2 (1.7, 2.9)	3.9 (3.1, 4.8)	4.3 (3.5, 5.3)	5.3 (4.3, 6.6)	6.3 (4.7, 8.3)
Developmental Dysplasia	2.1 (1.6, 2.8)	3.3 (2.6, 4.2)	4.3 (3.4, 5.4)	5.2 (4.1, 6.5)	6.1 (4.7, 8.0)
Other (7)	2.8 (2.2, 3.5)	4.1 (3.4, 5.1)	4.9 (4.0, 6.0)	5.5 (4.4, 6.8)	5.8 (4.6, 7.2)

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



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Osteoarthritis	151063	126845	105391	86005	67941	51155	35751	22143	10277	2607
Avascular Necrosis	6402	5379	4489	3707	3028	2304	1666	1038	515	137
Fractured Neck Of Femur	6208	4524	3322	2427	1708	1155	748	429	186	43
Rheumatoid Arthritis	2306	2018	1751	1502	1217	950	722	471	239	78
Developmental Dysplasia	2273	1918	1655	1415	1162	929	664	431	217	58

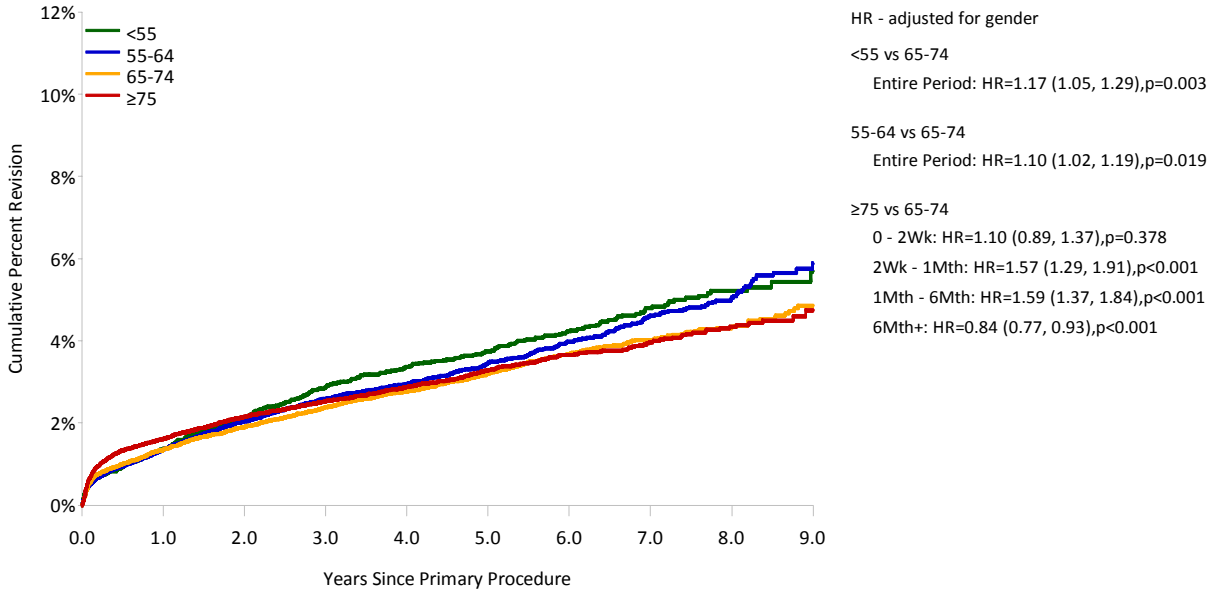
Table HT15: Revision Rates of Primary Total Conventional Hip Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
<55	489	15287	60366	0.81 (0.74, 0.89)
55-64	1051	35423	137036	0.77 (0.72, 0.81)
65-74	1461	53311	211155	0.69 (0.66, 0.73)
≥75	1283	47042	172897	0.74 (0.70, 0.78)
TOTAL	**4284**	**151063**	**581454**	**0.74 (0.71, 0.76)**

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

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
<55	1.4 (1.2, 1.6)	2.9 (2.6, 3.2)	3.8 (3.4, 4.1)	4.8 (4.3, 5.3)	5.7 (4.9, 6.6)
55-64	1.3 (1.2, 1.5)	2.6 (2.4, 2.8)	3.5 (3.2, 3.7)	4.6 (4.3, 4.9)	5.9 (5.3, 6.5)
65-74	1.4 (1.3, 1.5)	2.4 (2.3, 2.5)	3.2 (3.0, 3.4)	4.0 (3.8, 4.3)	4.9 (4.5, 5.3)
≥75	1.6 (1.5, 1.7)	2.5 (2.4, 2.7)	3.3 (3.1, 3.5)	4.0 (3.7, 4.2)	4.7 (4.3, 5.3)

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



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
<55	15287	12833	10722	8816	7044	5437	4000	2616	1273	353
55-64	35423	29582	24528	20031	16068	12190	8600	5408	2650	724
65-74	53311	45231	37843	31298	24998	19042	13490	8378	3859	976
≥75	47042	39199	32298	25860	19831	14486	9661	5741	2495	554

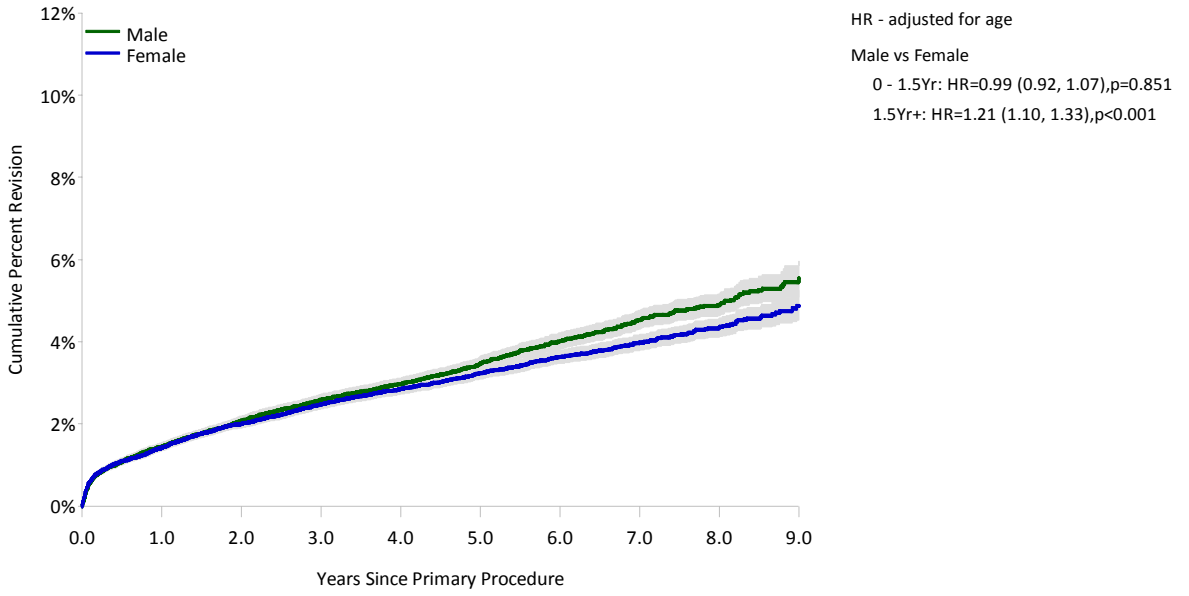
Table HT17: Revision Rates of Primary Total Conventional Hip Replacement by Gender (Primary Diagnosis OA)

Gender	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	2048	69295	265715	0.77 (0.74, 0.80)
Female	2236	81768	315739	0.71 (0.68, 0.74)
TOTAL	**4284**	**151063**	**581454**	**0.74 (0.71, 0.76)**

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

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Male	1.4 (1.4, 1.5)	2.6 (2.5, 2.7)	3.5 (3.3, 3.6)	4.5 (4.3, 4.8)	5.5 (5.1, 6.0)
Female	1.4 (1.3, 1.5)	2.5 (2.4, 2.6)	3.2 (3.1, 3.4)	4.0 (3.8, 4.2)	4.9 (4.5, 5.2)

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



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Male	69295	58062	48107	39198	30853	23274	16339	10234	4787	1195
Female	81768	68783	57284	46807	37088	27881	19412	11909	5490	1412

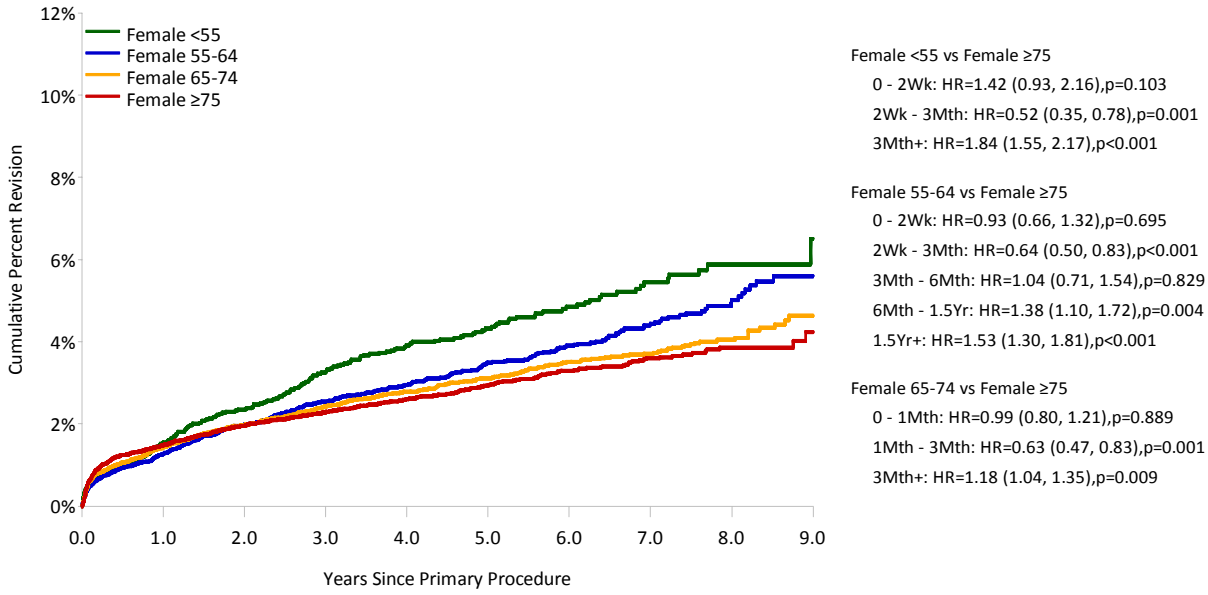
Table HT19: Revision Rates of Primary Total Conventional Hip Replacement by Age and Gender (Primary Diagnosis OA)

Gender	Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	<55	237	8225	32850	0.72 (0.63, 0.82)
	55-64	540	17532	69120	0.78 (0.72, 0.85)
	65-74	710	25355	100225	0.71 (0.66, 0.76)
	≥75	561	18183	63519	0.88 (0.81, 0.96)
Female	<55	252	7062	27516	0.92 (0.81, 1.04)
	55-64	511	17891	67916	0.75 (0.69, 0.82)
	65-74	751	27956	110929	0.68 (0.63, 0.73)
	≥75	722	28859	109377	0.66 (0.61, 0.71)
TOTAL		**4284**	**151063**	**581454**	**0.74 (0.71, 0.76)**

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

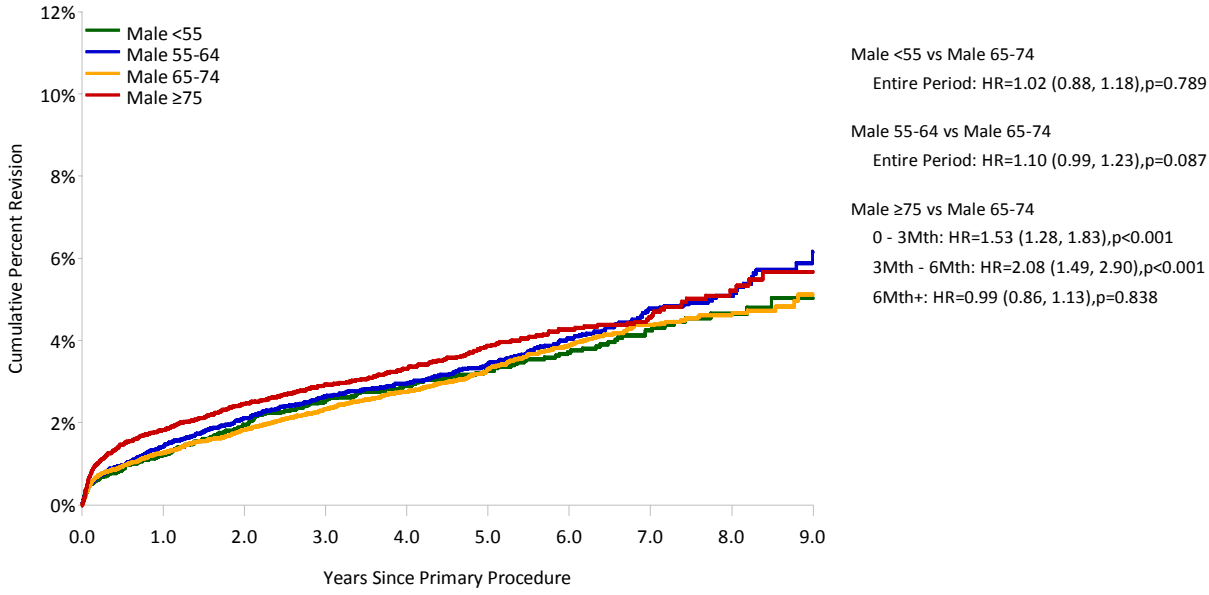
Gender	Age	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Male	<55	1.2 (1.0, 1.5)	2.5 (2.2, 2.9)	3.3 (2.8, 3.8)	4.2 (3.7, 4.9)	5.0 (4.2, 6.0)
	55-64	1.4 (1.2, 1.6)	2.6 (2.4, 2.9)	3.4 (3.1, 3.8)	4.8 (4.3, 5.3)	6.2 (5.3, 7.1)
	65-74	1.3 (1.1, 1.4)	2.3 (2.1, 2.6)	3.3 (3.0, 3.6)	4.4 (4.0, 4.8)	5.1 (4.5, 5.8)
	≥75	1.8 (1.6, 2.0)	2.9 (2.7, 3.2)	3.9 (3.5, 4.2)	4.6 (4.1, 5.0)	5.7 (4.9, 6.5)
Female	<55	1.5 (1.3, 1.9)	3.3 (2.8, 3.8)	4.3 (3.8, 4.9)	5.4 (4.7, 6.3)	6.5 (5.2, 8.2)
	55-64	1.3 (1.1, 1.5)	2.5 (2.3, 2.8)	3.5 (3.2, 3.9)	4.4 (4.0, 4.9)	5.6 (4.9, 6.4)
	65-74	1.4 (1.3, 1.6)	2.4 (2.2, 2.6)	3.1 (2.9, 3.4)	3.7 (3.4, 4.0)	4.6 (4.1, 5.2)
	≥75	1.5 (1.4, 1.6)	2.3 (2.1, 2.5)	2.9 (2.7, 3.2)	3.6 (3.3, 3.9)	4.2 (3.6, 4.9)

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	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Female	<55	7062	5902	4920	4031	3229	2453	1791	1150	546	141
	55-64	17891	14866	12267	9949	7940	5944	4110	2549	1237	365
	65-74	27956	23712	19814	16423	13184	10059	7138	4398	2014	527
	≥75	28859	24303	20283	16404	12735	9425	6373	3812	1693	379

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	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Male	<55	8225	6931	5802	4785	3815	2984	2209	1466	727	212
	55-64	17532	14716	12261	10082	8128	6246	4490	2859	1413	359
	65-74	25355	21519	18029	14875	11814	8983	6352	3980	1845	449
	≥75	18183	14896	12015	9456	7096	5061	3288	1929	802	175

Outcome by Prostheses Characteristics

Fixation

At nine years hybrid fixation has the lowest cumulative percent revision (hybrid 4.5%, cemented and cementless 5.4%) (Tables HT21 and HT22).

Cementless fixation has a higher risk of revision in the first month compared to cemented, however after three years it has a lower risk of revision (Figure HT11). Compared to hybrid fixation, it has a higher risk of revision up to four years. There is no difference in the risk of revision after this time (Figure HT11).

Cemented fixation has a lower risk of revision when compared to hybrid fixation in the first month however, after nine months it has a higher risk of revision (Figure HT11).

There are age related differences in the risk of revision for cemented and cementless fixation. The risk of revision for cemented fixation decreases with increasing age. The risk of revision for cementless fixation increases with increasing age. The risk for hybrid fixation does not vary with age (Tables HT23 and HT24 and Figures HT12-HT14).

Cementless fixation has the highest risk of revision in the older age group (≥75 years) and this difference is most evident in the first two years (Figure HT15).

Hybrid fixation has a lower risk of revision compared to cemented fixation in the 55-64 and 65-74 year age groups. It is the same in the <55 and ≥75 year age groups. Compared to cementless fixation hybrid is the same in the <55 year age group but has a lower risk of revision in all other age groups, although in the 65-74 year age group this is only in the first three months.

Femoral Stems with Exchangeable Necks

A femoral stem with an exchangeable neck has a separate neck that connects proximally to the stem.

In the 2008 Annual report, the Registry raised the question as to whether this prosthesis design had the potential to increase the risk of revision.

The most recent analysis confirms that femoral stems with exchangeable necks have a significantly higher risk of revision compared to all other primary total conventional hip replacement (adj HR=2.13; 95%CI(1.88, 2.42), p<0.001) (Tables HT25 and HT26 and Figure HT16).

With the exception of three, all femoral stems with exchangeable necks have a higher rate of revision compared to primary total conventional hip replacement. The three exceptions have a short follow up (Tables HT27 and HT28).

There is an increased incidence of revision for loosening and dislocation (Figure HT17).

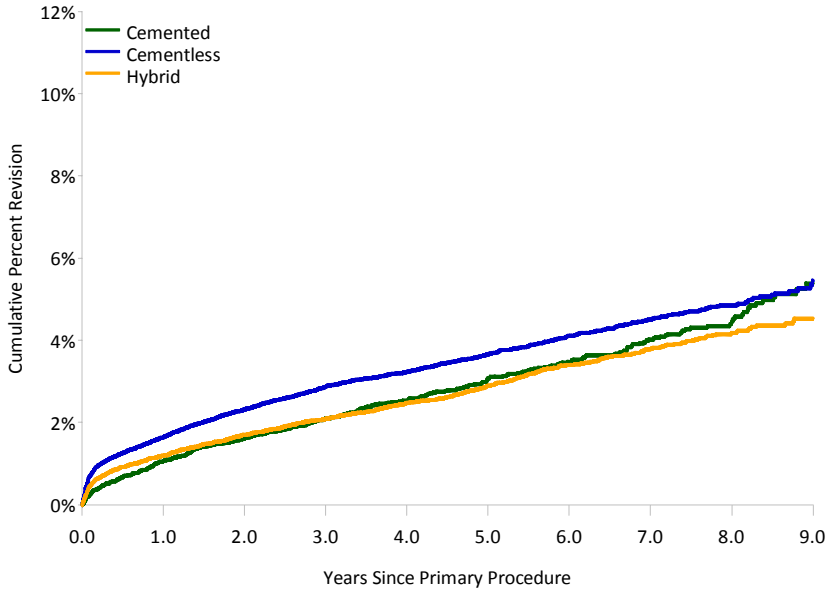
Table HT21: Revision Rates of Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis OA)

Fixation	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Cemented	466	15596	73879	0.63 (0.57, 0.69)
Cementless	2575	85661	309827	0.83 (0.80, 0.86)
Hybrid	1243	49806	197747	0.63 (0.59, 0.66)
TOTAL	**4284**	**151063**	**581454**	**0.74 (0.71, 0.76)**

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

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Cemented	1.1 (0.9, 1.2)	2.1 (1.9, 2.3)	3.1 (2.8, 3.4)	4.0 (3.6, 4.4)	5.4 (4.7, 6.1)
Cementless	1.6 (1.6, 1.7)	2.9 (2.8, 3.0)	3.7 (3.5, 3.8)	4.5 (4.3, 4.7)	5.4 (5.0, 5.9)
Hybrid	1.2 (1.1, 1.3)	2.1 (2.0, 2.2)	2.9 (2.7, 3.1)	3.8 (3.6, 4.0)	4.5 (4.2, 4.9)

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



HR - adjusted for age and gender

Cemented vs Hybrid
- 0 - 1Mth: HR=0.49 (0.34, 0.70),p<0.001
- 1Mth - 9Mth: HR=1.00 (0.80, 1.25),p=0.989
- 9Mth - 1.5Yr: HR=1.33 (1.04, 1.70),p=0.022
- 1.5Yr+: HR=1.18 (1.02, 1.36),p=0.025

Cementless vs Hybrid
- 0 - 2Wk: HR=1.73 (1.37, 2.17),p<0.001
- 2Wk - 3Mth: HR=1.36 (1.18, 1.57),p<0.001
- 3Mth - 6Mth: HR=1.10 (0.87, 1.38),p=0.437
- 6Mth - 4Yr: HR=1.30 (1.18, 1.44),p<0.001
- 4Yr+: HR=1.01 (0.86, 1.18),p=0.916

Cementless vs Cemented
- 0 - 1Mth: HR=3.13 (2.20, 4.44),p<0.001
- 1Mth - 1.5Yr: HR=1.13 (0.99, 1.29),p=0.065
- 1.5Yr - 2Yr: HR=1.22 (0.95, 1.56),p=0.116
- 2Yr - 3Yr: HR=1.21 (0.99, 1.48),p=0.066
- 3Yr+: HR=0.86 (0.74, 0.99),p=0.039

Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Cemented	15596	14017	12447	10893	9190	7488	5668	3855	2039	585
Cementless	85661	70539	57390	46027	35464	25876	17496	10317	4394	1008
Hybrid	49806	42289	35554	29085	23287	17791	12587	7971	3844	1014

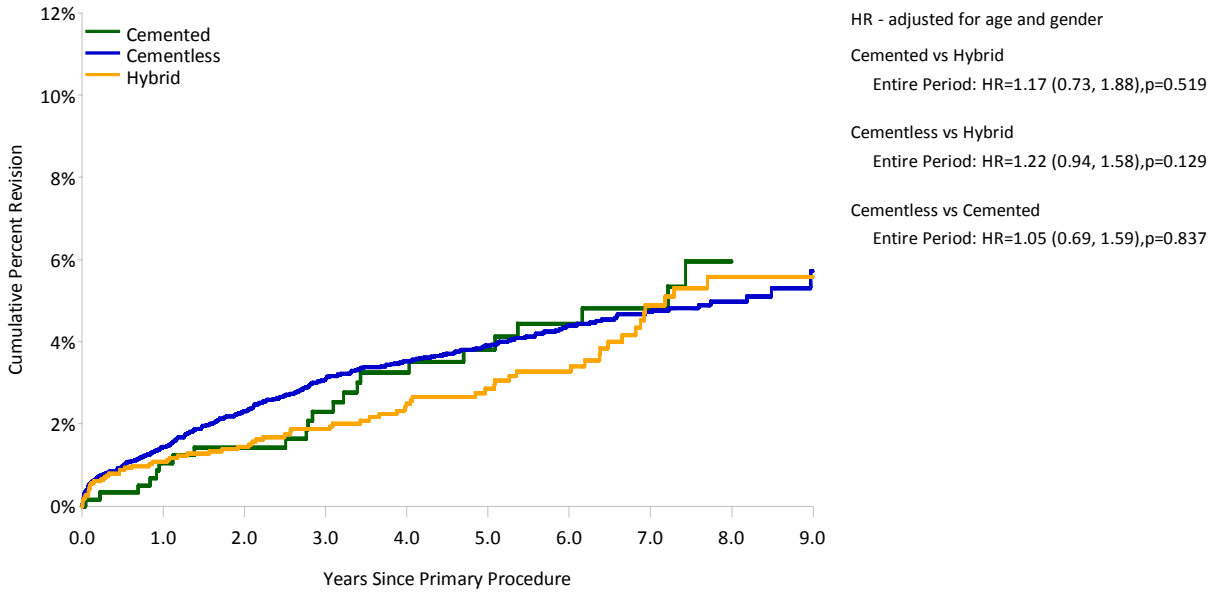
Table HT23: Revision Rates of Primary Total Conventional Hip Replacement by Fixation and Age (Primary Diagnosis OA)

Age	Fixation	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
<55	Cemented	23	605	3034	0.76 (0.48, 1.14)
	Cementless	398	12360	47370	0.84 (0.76, 0.93)
	Hybrid	68	2322	9961	0.68 (0.53, 0.87)
55-64	Cemented	82	1935	9641	0.85 (0.68, 1.06)
	Cementless	761	25566	94775	0.80 (0.75, 0.86)
	Hybrid	208	7922	32620	0.64 (0.55, 0.73)
65-74	Cemented	184	5404	27151	0.68 (0.58, 0.78)
	Cementless	793	29536	107784	0.74 (0.69, 0.79)
	Hybrid	484	18371	76219	0.64 (0.58, 0.69)
≥75	Cemented	177	7652	34053	0.52 (0.45, 0.60)
	Cementless	623	18199	59897	1.04 (0.96, 1.13)
	Hybrid	483	21191	78946	0.61 (0.56, 0.67)
TOTAL		**4284**	**151063**	**581454**	**0.74 (0.71, 0.76)**

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

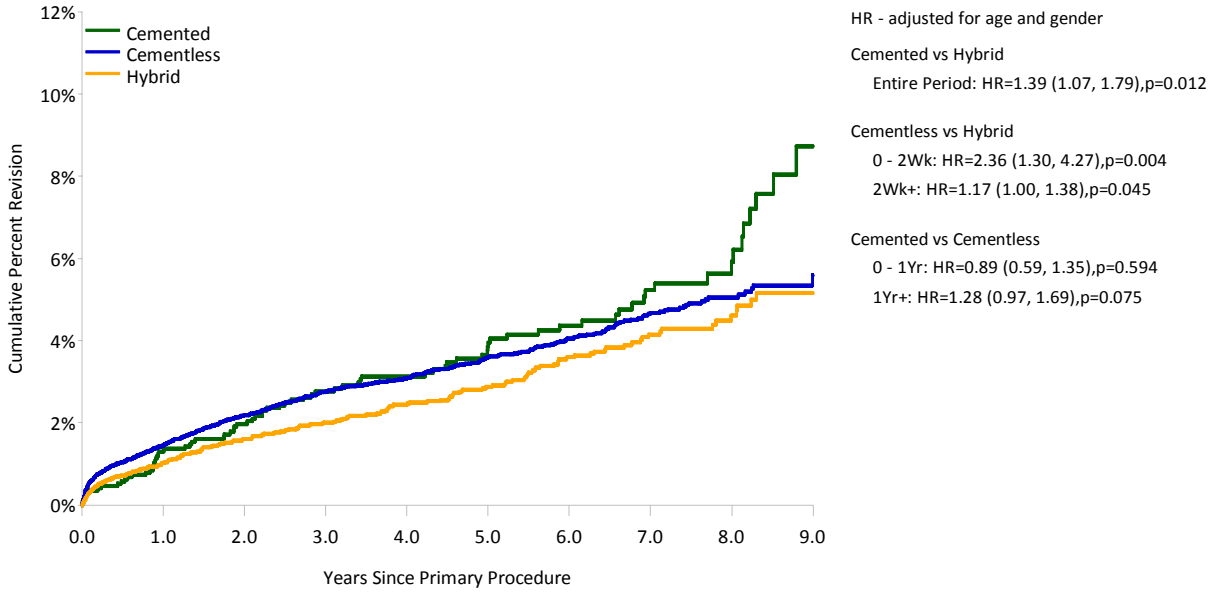
Age	Fixation	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
<55	Cemented	1.1 (0.5, 2.3)	2.3 (1.3, 4.0)	3.8 (2.4, 6.0)	4.8 (3.1, 7.4)	
	Cementless	1.4 (1.2, 1.7)	3.1 (2.8, 3.5)	3.9 (3.5, 4.3)	4.7 (4.2, 5.3)	5.7 (4.7, 6.9)
	Hybrid	1.1 (0.7, 1.6)	1.9 (1.4, 2.6)	2.9 (2.1, 3.8)	4.9 (3.7, 6.4)	5.6 (4.2, 7.3)
55-64	Cemented	1.3 (0.9, 1.9)	2.8 (2.1, 3.7)	3.9 (3.1, 5.1)	5.2 (4.1, 6.7)	8.7 (6.5, 11.7)
	Cementless	1.4 (1.3, 1.6)	2.8 (2.5, 3.0)	3.6 (3.3, 3.9)	4.7 (4.3, 5.1)	5.6 (4.9, 6.4)
	Hybrid	1.0 (0.8, 1.3)	2.0 (1.7, 2.4)	2.9 (2.5, 3.4)	4.1 (3.6, 4.8)	5.2 (4.3, 6.2)
65-74	Cemented	1.0 (0.8, 1.3)	2.2 (1.8, 2.7)	3.2 (2.7, 3.8)	4.6 (3.9, 5.3)	5.6 (4.7, 6.6)
	Cementless	1.5 (1.4, 1.6)	2.5 (2.3, 2.7)	3.3 (3.0, 3.5)	3.9 (3.6, 4.3)	4.9 (4.2, 5.8)
	Hybrid	1.2 (1.1, 1.4)	2.2 (2.0, 2.4)	3.1 (2.8, 3.4)	3.8 (3.5, 4.2)	4.5 (3.9, 5.1)
≥75	Cemented	1.0 (0.8, 1.3)	1.8 (1.5, 2.2)	2.7 (2.3, 3.1)	3.1 (2.6, 3.7)	4.0 (3.1, 5.2)
	Cementless	2.3 (2.1, 2.6)	3.4 (3.1, 3.7)	4.2 (3.8, 4.6)	5.1 (4.6, 5.6)	5.7 (5.0, 6.5)
	Hybrid	1.2 (1.1, 1.4)	2.0 (1.8, 2.3)	2.7 (2.5, 3.0)	3.4 (3.1, 3.8)	4.1 (3.5, 4.9)

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



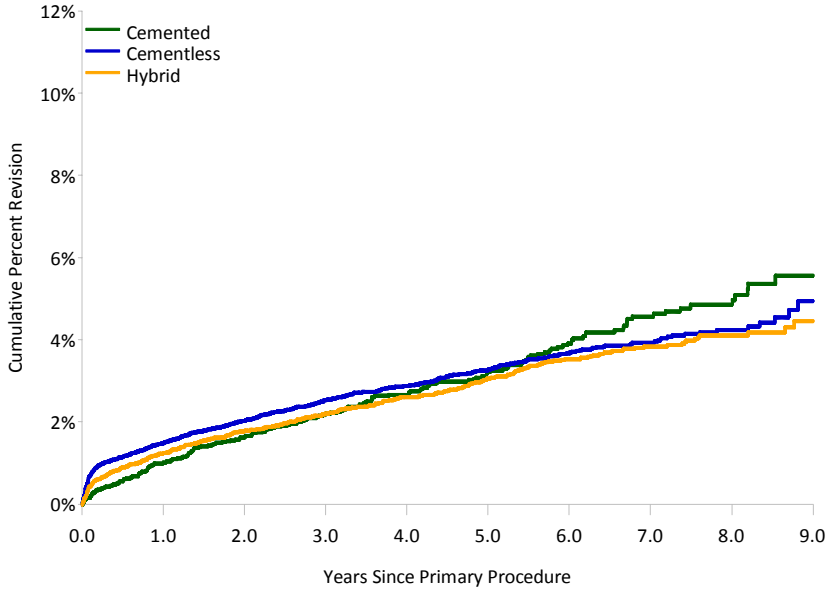
Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Cemented	605	543	486	433	370	309	264	195	107	31
Cementless	12360	10320	8530	6964	5506	4168	3001	1923	886	222
Hybrid	2322	1970	1706	1419	1168	960	735	498	280	100

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	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Cemented	1935	1731	1541	1383	1187	1006	812	591	321	101
Cementless	25566	21100	17272	13941	11024	8181	5613	3365	1530	387
Hybrid	7922	6751	5715	4707	3857	3003	2175	1452	799	236

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



HR - adjusted for age and gender

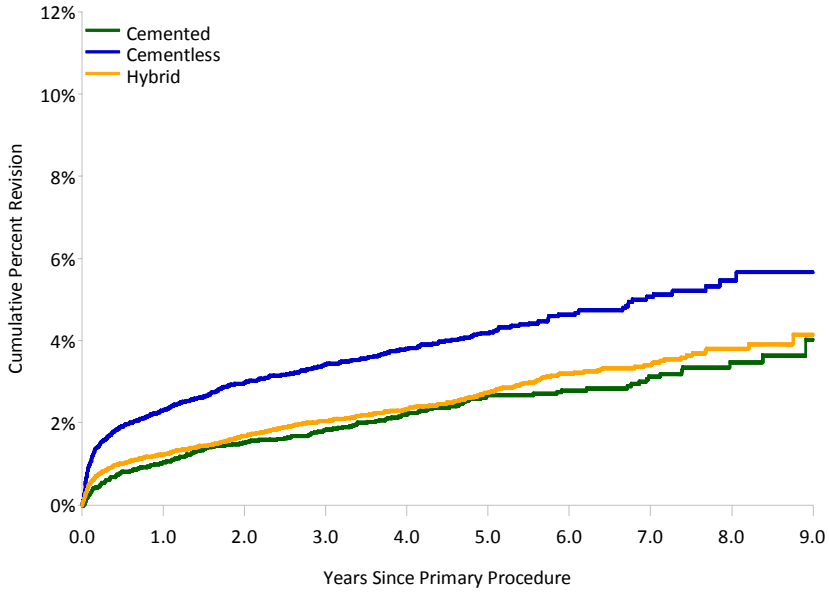
Cemented vs Hybrid
- 0 - 1Mth: HR=0.35 (0.17, 0.71),p=0.003
- 1Mth+: HR=1.26 (1.05, 1.50),p=0.011

Cementless vs Hybrid
- 0 - 3Mth: HR=1.53 (1.24, 1.88),p<0.001
- 3Mth+: HR=0.95 (0.83, 1.09),p=0.496

Cementless vs Cemented
- 0 - 1Mth: HR=4.47 (2.21, 9.07),p<0.001
- 1Mth - 3Mth: HR=1.14 (0.80, 1.62),p=0.465
- 3Mth+: HR=0.76 (0.64, 0.91),p=0.002

Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Cemented	5404	4913	4479	4003	3448	2863	2202	1524	806	232
Cementless	29536	24506	19934	16053	12427	9079	6116	3547	1452	308
Hybrid	18371	15812	13430	11242	9123	7100	5172	3307	1601	436

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



HR - adjusted for age and gender

Cementless vs Cemented
- 0 - 2Wk: HR=5.63 (2.27, 13.97),p<0.001
- 2Wk - 1Mth: HR=2.36 (1.70, 3.29),p<0.001
- 1Mth - 3Mth: HR=2.01 (1.47, 2.75),p<0.001
- 3Mth - 1.5Yr: HR=1.62 (1.27, 2.08),p<0.001
- 1.5Yr+: HR=1.28 (1.02, 1.61),p=0.031

Hybrid vs Cemented
- 0 - 2Wk: HR=3.47 (1.38, 8.71),p=0.008
- 2Wk+: HR=1.03 (0.87, 1.23),p=0.721

Cementless vs Hybrid
- 0 - 3Mth: HR=1.90 (1.57, 2.31),p<0.001
- 3Mth - 2Yr: HR=1.65 (1.35, 2.03),p<0.001
- 2Yr+: HR=1.14 (0.91, 1.44),p=0.250

Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Cemented	7652	6830	5941	5074	4185	3310	2390	1545	805	221
Cementless	18199	14613	11654	9069	6507	4448	2766	1482	526	91
Hybrid	21191	17756	14703	11717	9139	6728	4505	2714	1164	242

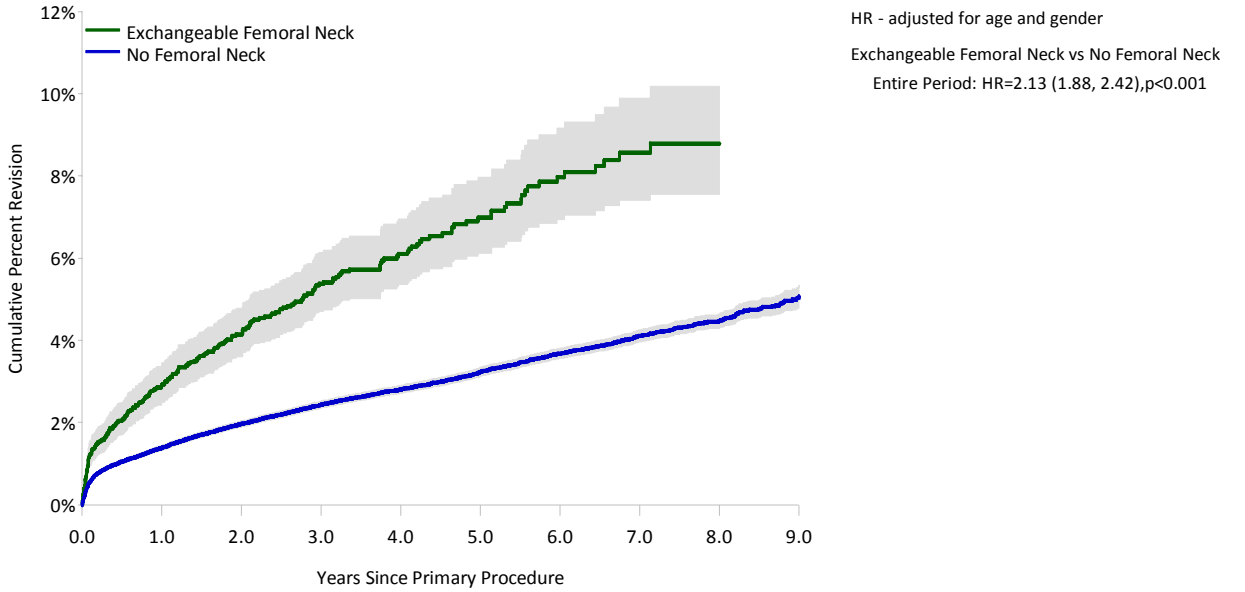
Table HT25: Revision Rates of Primary Total Conventional Hip Replacement by Type of Femoral Neck (Primary Diagnosis OA)

Type of Femoral Neck	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Exchangeable Femoral Neck	262	5186	15815	1.66 (1.46, 1.87)
No Femoral Neck	4022	145877	565639	0.71 (0.69, 0.73)
TOTAL	**4284**	**151063**	**581454**	**0.74 (0.71, 0.76)**

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	7 Yrs	9 Yrs
Exchangeable Femoral Neck	2.9 (2.5, 3.4)	5.4 (4.7, 6.1)	7.0 (6.1, 8.0)	8.6 (7.4, 9.9)	
No Femoral Neck	1.4 (1.3, 1.4)	2.4 (2.4, 2.5)	3.2 (3.1, 3.3)	4.1 (4.0, 4.3)	5.1 (4.8, 5.3)

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	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Exchangeable Femoral Neck	5186	3919	2979	2283	1619	1132	755	457	153	32
No Femoral Neck	145877	122926	102412	83722	66322	50023	34996	21686	10124	2575

Table HT27: Revision Rates of Primary Total Conventional Hip Replacement using an Exchangeable Femoral Neck by Component Used (Primary Diagnosis OA)

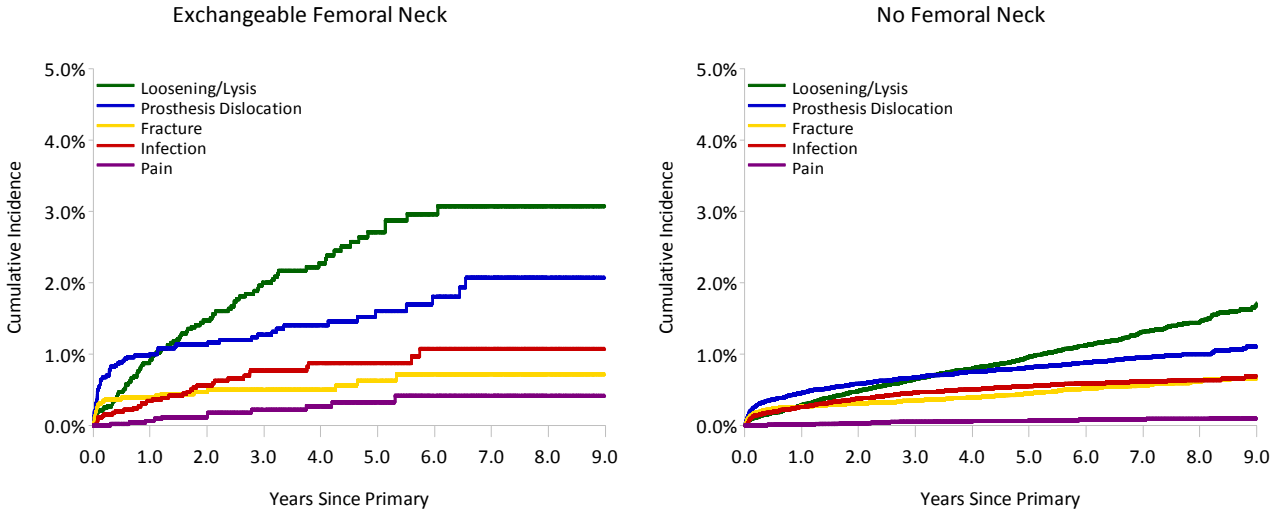
Femoral Neck Component	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
ABGII	5	108	106	4.72 (1.53, 11.01)
Adapter	33	599	1212	2.72 (1.87, 3.82)
Apex	35	1165	2226	1.57 (1.10, 2.19)
F2L	49	692	4034	1.21 (0.90, 1.61)
Integrale	2	263	285	0.70 (0.08, 2.53)
M-Cor	1	111	183	0.55 (0.01, 3.05)
M/L Taper Kinectiv	4	335	162	2.47 (0.67, 6.31)
Margron	58	553	2944	1.97 (1.50, 2.55)
Modular Neck (Group Lepine)	28	476	2187	1.28 (0.85, 1.85)
Profemur	30	471	1388	2.16 (1.46, 3.09)
R120	2	102	155	1.29 (0.16, 4.67)
UniSyn	12	226	680	1.76 (0.91, 3.08)
Other (6)	3	85	252	1.19 (0.25, 3.49)
TOTAL	**262**	**5186**	**15815**	**1.66 (1.46, 1.87)**

Note: Only prostheses with over 50 procedures have been listed.

Table HT28: 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	7 Yrs	9 Yrs
ABGII	3.8 (1.4, 9.7)				
Adapter	3.4 (2.2, 5.3)	7.8 (5.5, 11.1)			
Apex	2.3 (1.6, 3.4)	4.1 (2.8, 5.8)			
F2L	3.2 (2.1, 4.8)	5.5 (4.1, 7.5)	6.7 (5.0, 8.9)	7.7 (5.8, 10.2)	7.7 (5.8, 10.2)
Integrale	0.4 (0.1, 2.7)				
M-Cor	0.0 (0.0, 0.0)				
M/L Taper Kinectiv	3.4 (1.0, 11.2)				
Margron	5.3 (3.7, 7.5)	7.3 (5.4, 9.9)	9.7 (7.4, 12.6)	12.5 (9.7, 16.1)	12.5 (9.7, 16.1)
Modular Neck (Group Lepine)	2.1 (1.2, 3.9)	4.4 (2.8, 6.8)	6.2 (4.2, 9.1)	7.2 (4.9, 10.4)	
Profemur	4.0 (2.5, 6.2)	7.0 (4.9, 9.9)	7.4 (5.2, 10.4)		
R120	0.0 (0.0, 0.0)				
UniSyn	3.6 (1.8, 7.1)	5.3 (3.0, 9.5)	6.3 (3.5, 11.0)		
Other (6)	0.0 (0.0, 0.0)	1.9 (0.3, 12.9)			

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



Bearing Surface

The Registry is reporting on five different bearing surfaces with more than 200 procedures. There are a small number of procedures where the bearing surface is reported as 'Other'. This group contains procedures where the bearing surface is yet to be classified or where the bearing surface combinations have less than 200 procedures (Tables HT29 and HT30).

Ceramicised metal is reported as a separate bearing surface for the first time. This has a shorter follow up than other bearing surfaces and has largely been combined with modified polyethylene. Comparisons to other bearing surfaces should be interpreted with caution.

Metal on Metal

Metal/metal bearing surface has the highest risk of revision compared to all other bearing surfaces (Figure HT18).

The difference between metal/metal and other bearing surfaces is not evident when the head size is 28mm or less (Tables HT31 and HT32 and Figures HT19 and HT20). There is a difference when the head size is greater than 28mm. In this group, the cumulative percent revision at seven years is 7.7% for metal/metal, compared to 3.9% for ceramic/ceramic, 4.1% for ceramic/polyethylene and 3.2% for metal/polyethylene.

To further evaluate the effect of head size with metal/metal bearing surface, analysis was undertaken comparing four head size groups (≤28, 30-32, 36-40, >40mm) (Tables HT33 and HT34 and Figure HT21). The two larger head size groups were associated with an increased risk of revision compared to the two groups with head sizes 32mm or less. The higher risk of revision for head sizes greater than 32mm becomes evident after two years (Tables HT35 and HT36 and Figure HT22).

Initial age related analysis did not show any difference in the risk of revision for metal/metal bearing surfaces (Tables HT37 and HT38 and Figure HT23). There is an interaction between age and head size. The risk of revision for head sizes larger than 32mm is higher regardless of age and this risk is greater the younger the patient (Tables HT39 and HT40 and Figure HT24).

Females have a higher risk of revision (Tables HT41 and HT42 and Figure HT25). This is only evident for head sizes greater than 32mm (Tables HT43 and HT44 and Figure HT26).

Cumulative incidence of reasons for revision with respect to time are also presented. Comparing metal/metal to metal/polyethylene there is a higher incidence of revisions for loosening/lysis and metal sensitivity for the metal/metal group. The cumulative incidence at nine years for these two revision diagnoses for metal/metal is 3.3% and 0.5% respectively compared to metal/polyethylene 1.8% and 0.0% respectively (Figure HT27). These differences are more evident in the greater than 32mm head size for metal/metal (Figure HT28).

Metal sensitivity has only been reported for metal/metal articulations and is largely confined to head sizes greater than 32mm. At nine years, cumulative incidence of metal sensitivity is 0.7% for head sizes greater than 32mm and 0.1% for head sizes less than 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 in metal/metal articulations with larger head sizes (Figure HT28).

In order to determine if the higher revision rate of metal/metal articulations with greater than 32mm head sizes is prosthesis specific, the Registry has analysed all prostheses head/acetabular combinations with more than 200 procedures. There are 12 combinations that meet these criteria, many contribute to the higher revision rate (Tables HT45 and HT46).

Modified Polyethylene

For the first time the Registry is reporting the outcome of modified polyethylene. This includes polyethylene that is cross-linked or has the addition of Vitamin E. At this time, the number of 'E-poly' prostheses reported to the Registry is small so they have not been separately analysed. Non-modified polyethylene includes all other polyethylene.

Modified polyethylene has a lower risk of revision compared to non-modified polyethylene (Tables HT47 and HT48 and Figure HT29). At this time there is no difference in the risk of revision for modified polyethylene related to head size (≤32 and >32mm). This is also true for non-modified polyethylene, however the numbers are small for head sizes greater than 32mm (Tables HT49 and HT50 and Figure HT30).

Table HT29: Revision Rates of Primary Total Conventional Hip Replacement by Bearing Surface (Primary Diagnosis OA)

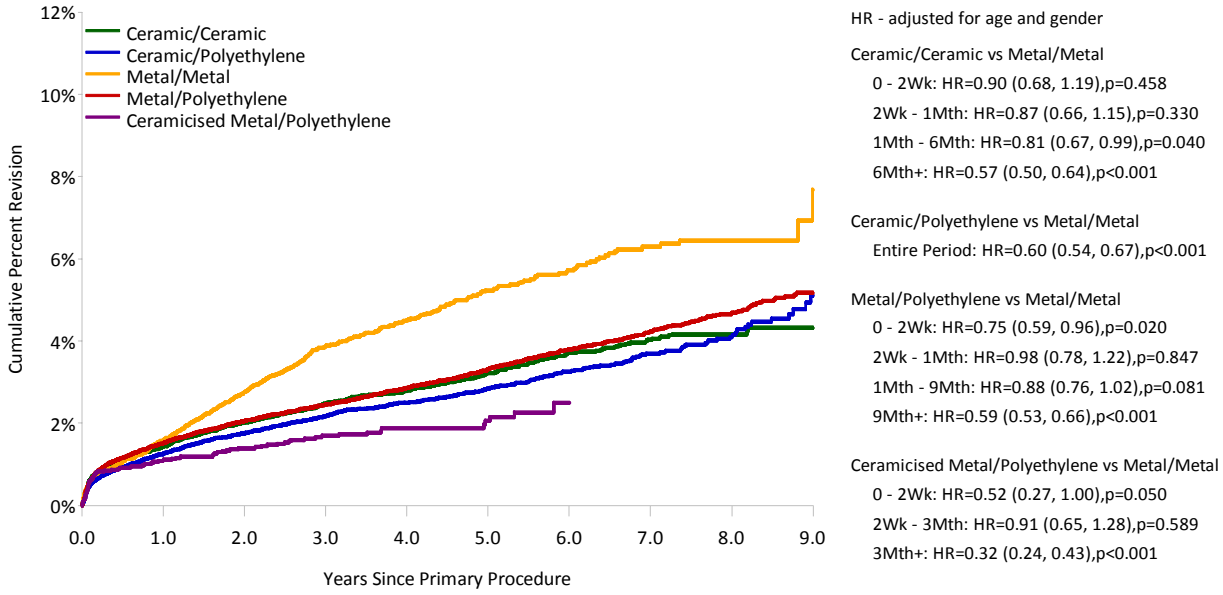
Bearing Surface	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Ceramic/Ceramic	793	29945	111047	0.71 (0.67, 0.77)
Ceramic/Polyethylene	903	34560	143224	0.63 (0.59, 0.67)
Metal/Metal	667	17808	58503	1.14 (1.06, 1.23)
Metal/Polyethylene	1818	62550	250414	0.73 (0.69, 0.76)
Ceramicised Metal/Polyethylene	93	5807	17248	0.54 (0.44, 0.66)
Other (4)	10	393	1018	0.98 (0.47, 1.81)
TOTAL	**4284**	**151063**	**581454**	**0.74 (0.71, 0.76)**

Note: Other Includes ceramic/metal, metal/ceramic, ceramicised metal/ceramic and unknown
Only prostheses with over 200 procedures have been listed.

Table HT30: Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Bearing Surface (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Ceramic/Ceramic	1.4 (1.3, 1.6)	2.5 (2.3, 2.7)	3.2 (3.0, 3.5)	4.0 (3.7, 4.4)	4.3 (3.9, 4.7)
Ceramic/Polyethylene	1.3 (1.1, 1.4)	2.2 (2.0, 2.3)	2.8 (2.6, 3.1)	3.7 (3.4, 4.0)	5.1 (4.4, 5.9)
Metal/Metal	1.6 (1.4, 1.8)	3.9 (3.6, 4.2)	5.2 (4.8, 5.7)	6.3 (5.7, 6.9)	7.7 (6.0, 9.7)
Metal/Polyethylene	1.5 (1.4, 1.6)	2.5 (2.3, 2.6)	3.3 (3.2, 3.5)	4.2 (4.0, 4.5)	5.2 (4.8, 5.5)
Ceramicised Metal/Polyethylene	1.1 (0.9, 1.4)	1.7 (1.4, 2.1)	2.1 (1.6, 2.6)		
Other (4)	2.2 (1.0, 4.5)	3.5 (1.8, 7.1)	3.5 (1.8, 7.1)	3.5 (1.8, 7.1)	

Figure HT18: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Bearing Surface (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Ceramic/Ceramic	29945	24473	20086	16402	13129	9857	6765	3996	1602	286
Ceramic/Polyethylene	34560	31103	26556	21902	17256	12950	8879	5112	2057	530
Metal/Metal	17808	15347	11922	8579	5727	3617	2317	1446	670	125
Metal/Polyethylene	62550	50943	42915	36221	29931	23592	17416	11539	5913	1651
Ceramicised Metal/Polyethylene	5807	4764	3762	2780	1793	1051	309	0	0	0

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

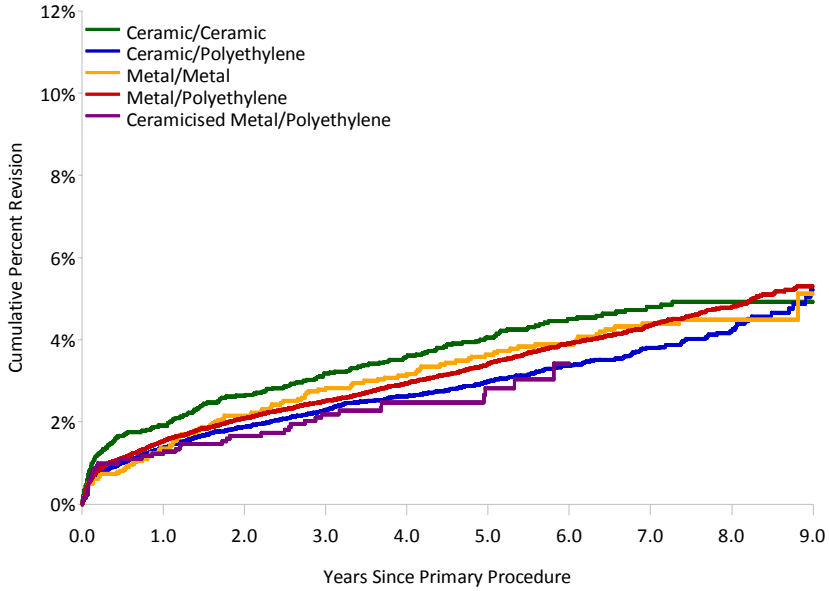
Bearing Surface	Head Size	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Ceramic/Ceramic	≤28mm	215	5259	28088	0.77 (0.67, 0.87)
Ceramic/Ceramic	>28mm	578	24686	82959	0.70 (0.64, 0.76)
Ceramic/Polyethylene	≤28mm	744	24325	119017	0.63 (0.58, 0.67)
Ceramic/Polyethylene	>28mm	159	10235	24207	0.66 (0.56, 0.77)
Metal/Metal	≤28mm	108	2746	16618	0.65 (0.53, 0.78)
Metal/Metal	>28mm	559	15062	41885	1.33 (1.23, 1.45)
Metal/Polyethylene	≤28mm	1405	40236	202616	0.69 (0.66, 0.73)
Metal/Polyethylene	>28mm	413	22314	47797	0.86 (0.78, 0.95)
Ceramicised Metal/Polyethylene	≤28mm	43	1819	6817	0.63 (0.46, 0.85)
Ceramicised Metal/Polyethylene	>28mm	50	3988	10431	0.48 (0.36, 0.63)
TOTAL		**4274**	**150670**	**580435**	**0.74 (0.71, 0.76)**

Note: Excluding ceramic/metal, metal/ceramic, ceramicised metal/ceramic and unknown

Table HT32: 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	7 Yrs	9 Yrs
Ceramic/Ceramic	≤28mm	1.9 (1.6, 2.3)	3.2 (2.7, 3.7)	4.1 (3.5, 4.7)	4.8 (4.2, 5.5)	4.9 (4.3, 5.6)
Ceramic/Ceramic	>28mm	1.3 (1.2, 1.5)	2.3 (2.1, 2.5)	3.0 (2.7, 3.3)	3.9 (3.5, 4.3)	4.3 (3.7, 4.8)
Ceramic/Polyethylene	≤28mm	1.4 (1.2, 1.5)	2.3 (2.1, 2.5)	3.0 (2.8, 3.2)	3.8 (3.5, 4.1)	5.2 (4.5, 6.0)
Ceramic/Polyethylene	>28mm	1.0 (0.8, 1.2)	1.9 (1.6, 2.2)	2.3 (1.9, 2.8)	4.1 (2.9, 5.9)	
Metal/Metal	≤28mm	1.4 (1.0, 1.9)	2.8 (2.3, 3.5)	3.6 (3.0, 4.4)	4.4 (3.6, 5.3)	5.1 (3.8, 6.9)
Metal/Metal	>28mm	1.6 (1.4, 1.9)	4.2 (3.8, 4.6)	5.9 (5.3, 6.5)	7.7 (6.6, 9.0)	
Metal/Polyethylene	≤28mm	1.5 (1.4, 1.7)	2.5 (2.4, 2.7)	3.4 (3.2, 3.6)	4.4 (4.1, 4.6)	5.3 (5.0, 5.7)
Metal/Polyethylene	>28mm	1.5 (1.3, 1.6)	2.3 (2.1, 2.5)	2.9 (2.5, 3.2)	3.2 (2.7, 3.8)	
Ceramicised Metal/Polyethylene	≤28mm	1.3 (0.9, 1.9)	2.2 (1.6, 3.0)	2.8 (2.0, 3.9)		
Ceramicised Metal/Polyethylene	>28mm	1.0 (0.8, 1.4)	1.4 (1.0, 1.9)	1.5 (1.1, 2.0)		

Figure HT19: Cumulative Percent Revision of Primary Total Conventional Hip Replacement using ≤28mm Head Size by Bearing Surface (Primary Diagnosis OA)



HR - adjusted for age and gender

Ceramic/Ceramic vs Metal/Metal
Entire Period: HR=1.18 (0.93, 1.49),p=0.164

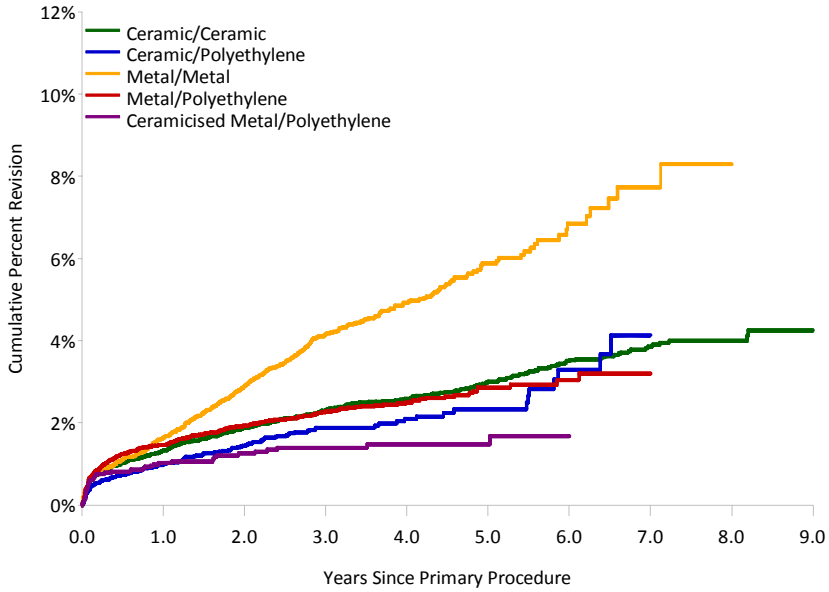
Ceramic/Polyethylene vs Metal/Metal
Entire Period: HR=0.94 (0.77, 1.16),p=0.568

Metal/Polyethylene vs Metal/Metal
Entire Period: HR=1.06 (0.87, 1.29),p=0.563

Ceramicised Metal/Polyethylene vs Metal/Metal
Entire Period: HR=0.84 (0.59, 1.20),p=0.342

Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Ceramic/Ceramic	5259	4948	4624	4206	3754	3152	2400	1584	685	145
Ceramic/Polyethylene	24325	23230	21207	18695	15621	12108	8514	4985	2048	530
Metal/Metal	2746	2636	2523	2382	2185	1941	1663	1242	572	97
Metal/Polyethylene	40236	36115	33169	29959	26157	21730	16705	11325	5878	1645
Ceramicised Metal/Polyethylene	1819	1659	1468	1195	867	554	177	0	0	0

Figure HT20: Cumulative Percent Revision of Primary Total Conventional Hip Replacement using >28mm Head Size by Bearing Surface (Primary Diagnosis OA)



HR - adjusted for age and gender

Ceramic/Ceramic vs Metal/Metal
0 - 2Wk: HR=0.81 (0.58, 1.14),p=0.231
2Wk - 1Mth: HR=1.01 (0.70, 1.46),p=0.955
1Mth - 3Mth: HR=0.70 (0.50, 0.99),p=0.041
3Mth - 1.5Yr: HR=0.59 (0.49, 0.72),p<0.001
1.5Yr+: HR=0.41 (0.34, 0.49),p<0.001

Ceramic/Polyethylene vs Metal/Metal
Entire Period: HR=0.46 (0.39, 0.55),p<0.001

Metal/Polyethylene vs Metal/Metal
0 - 2Wk: HR=0.75 (0.53, 1.06),p=0.102
2Wk - 1Mth: HR=1.41 (0.99, 2.01),p=0.057
1Mth - 3Mth: HR=0.84 (0.60, 1.17),p=0.300
3Mth - 6Mth: HR=0.89 (0.63, 1.26),p=0.503
6Mth - 9Mth: HR=0.69 (0.44, 1.08),p=0.107
9Mth+: HR=0.32 (0.26, 0.39),p<0.001

Ceramicised Metal/Polyethylene vs Metal/Metal
0 - 2Wk: HR=0.50 (0.23, 1.08),p=0.077
2Wk - 1Mth: HR=1.35 (0.74, 2.44),p=0.324
1Mth - 3Mth: HR=0.62 (0.31, 1.24),p=0.175
3Mth+: HR=0.19 (0.12, 0.30),p<0.001

Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Ceramic/Ceramic	24686	19525	15462	12196	9375	6705	4365	2412	917	141
Ceramic/Polyethylene	10235	7873	5349	3207	1635	842	365	127	9	0
Metal/Metal	15062	12711	9399	6197	3542	1676	654	204	98	28
Metal/Polyethylene	22314	14828	9746	6262	3774	1862	711	214	35	6
Ceramicised Metal/Polyethylene	3988	3105	2294	1585	926	497	132	0	0	0

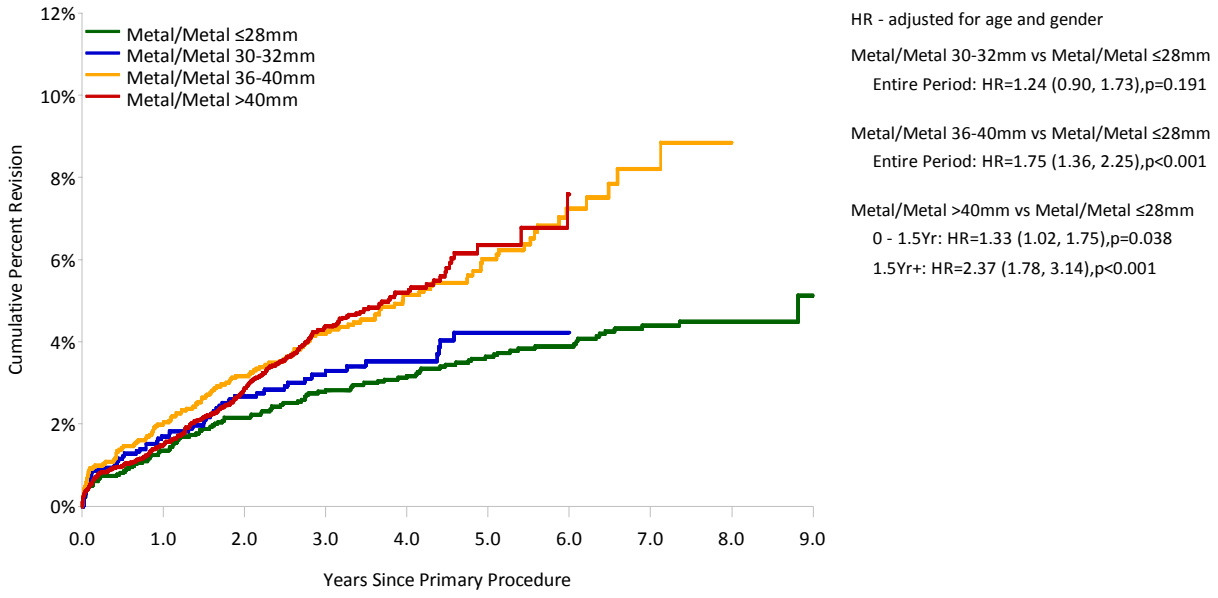
Table HT33: Revision Rates of Metal/Metal Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)

Bearing Surface	Head Size	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Metal/Metal	≤28mm	108	2746	16618	0.65 (0.53, 0.78)
	30-32mm	57	1843	5873	0.97 (0.74, 1.26)
	36-40mm	152	3262	11320	1.34 (1.14, 1.57)
	>40mm	350	9957	24692	1.42 (1.27, 1.57)
TOTAL		**667**	**17808**	**58503**	**1.14 (1.06, 1.23)**

Table HT34: 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	9 Yrs
Metal/Metal	≤28mm	1.4 (1.0, 1.9)	2.8 (2.3, 3.5)	3.6 (3.0, 4.4)	4.4 (3.6, 5.3)	5.1 (3.8, 6.9)
	30-32mm	1.7 (1.2, 2.4)	3.3 (2.5, 4.3)	4.2 (3.2, 5.6)		
	36-40mm	2.1 (1.6, 2.6)	4.2 (3.5, 5.0)	6.0 (5.1, 7.1)	8.2 (6.6, 10.1)	
	>40mm	1.5 (1.3, 1.8)	4.4 (3.9, 4.9)	6.4 (5.5, 7.4)		

Figure HT21: Cumulative Percent Revision of Metal/Metal Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Metal/Metal	≤28mm	2746	2636	2523	2382	2185	1941	1663	1242	572	97
	30-32mm	1843	1576	1265	950	696	388	119	3	0	0
	36-40mm	3262	2776	2222	1749	1341	896	422	172	97	28
	>40mm	9957	8359	5912	3498	1505	392	113	29	1	0

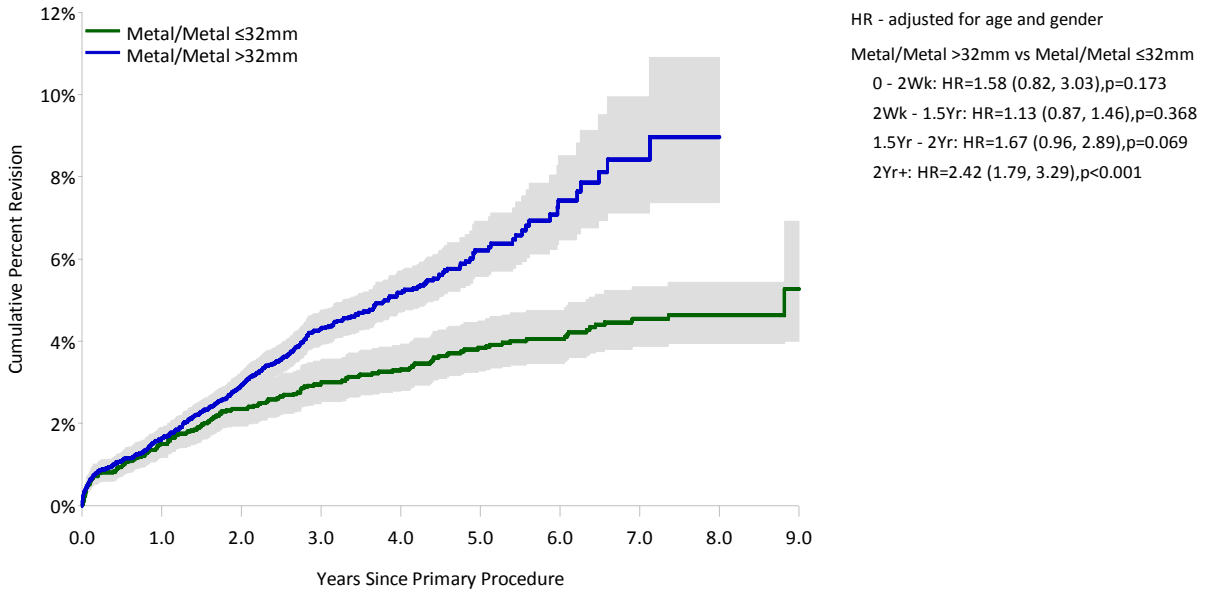
Table HT35: Revision Rates of Metal/Metal Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)

Bearing Surface	Head Size	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Metal/Metal	≤32mm	165	4589	22491	0.73 (0.63, 0.85)
	>32mm	502	13219	36012	1.39 (1.27, 1.52)
TOTAL		**667**	**17808**	**58503**	**1.14 (1.06, 1.23)**

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	9 Yrs
Metal/Metal	≤32mm	1.5 (1.2, 1.9)	3.0 (2.5, 3.6)	3.8 (3.3, 4.5)	4.5 (3.9, 5.3)	5.3 (4.0, 6.9)
	>32mm	1.6 (1.4, 1.9)	4.3 (3.9, 4.7)	6.2 (5.6, 6.9)	8.4 (7.1, 9.9)	

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	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Metal/Metal	≤32mm	4589	4212	3788	3332	2881	2329	1782	1245	572	97
	>32mm	13219	11135	8134	5247	2846	1288	535	201	98	28

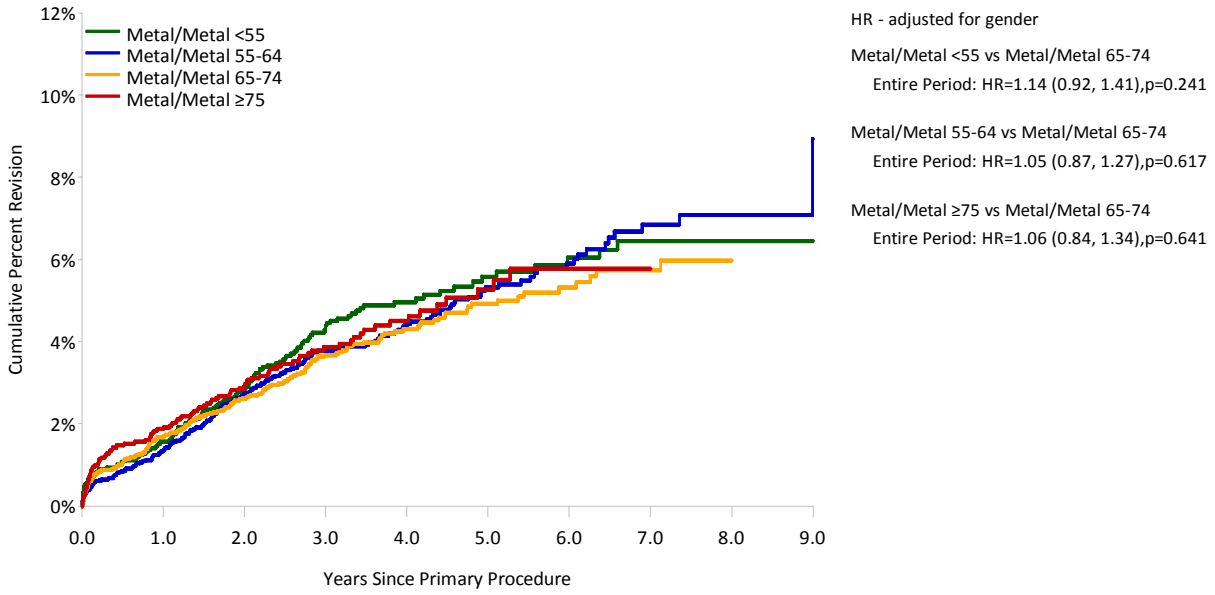
Table HT37: Revision Rates of Metal/Metal Primary Total Conventional Hip Replacement by Age (Primary Diagnosis OA)

Bearing Surface	Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Metal/Metal	<55	139	3425	11708	1.19 (1.00, 1.40)
	55-64	220	5880	19417	1.13 (0.99, 1.29)
	65-74	201	5564	18634	1.08 (0.93, 1.24)
	≥75	107	2939	8744	1.22 (1.00, 1.48)
TOTAL		**667**	**17808**	**58503**	**1.14 (1.06, 1.23)**

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	7 Yrs	9 Yrs
Metal/Metal	<55	1.6 (1.2, 2.1)	4.4 (3.7, 5.3)	5.6 (4.7, 6.7)	6.4 (5.3, 7.8)	6.4 (5.3, 7.8)
	55-64	1.4 (1.1, 1.7)	3.8 (3.3, 4.4)	5.3 (4.6, 6.2)	6.9 (5.8, 8.1)	8.9 (5.8, 13.6)
	65-74	1.7 (1.4, 2.1)	3.7 (3.2, 4.3)	4.9 (4.2, 5.7)	5.7 (4.9, 6.8)	
	≥75	1.9 (1.5, 2.5)	3.9 (3.1, 4.7)	5.3 (4.2, 6.5)	5.8 (4.6, 7.3)	

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	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Metal/Metal	<55	3425	2968	2325	1697	1141	758	530	369	196	50
	55-64	5880	5048	3901	2797	1918	1228	819	509	240	49
	65-74	5564	4838	3781	2784	1895	1209	733	443	196	24
	≥75	2939	2493	1915	1301	773	422	235	125	38	2

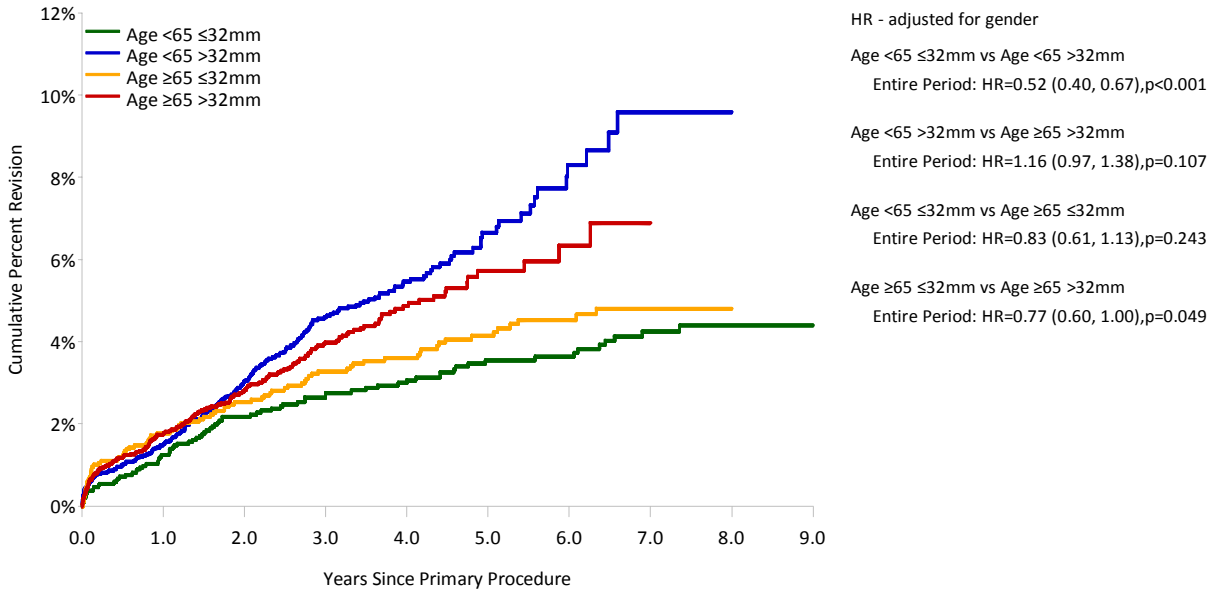
Table HT39: Revision Rates of Metal/Metal Primary Total Conventional Hip Replacement by Age and Head Size (Primary Diagnosis OA)

Head Size	Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
≤32mm	<65	80	2392	12160	0.66 (0.52, 0.82)
	≥65	85	2197	10332	0.82 (0.66, 1.02)
>32mm	<65	279	6913	18966	1.47 (1.30, 1.65)
	≥65	223	6306	17046	1.31 (1.14, 1.49)
TOTAL		**667**	**17808**	**58503**	**1.14 (1.06, 1.23)**

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	7 Yrs	9 Yrs
≤32mm	<65	1.2 (0.9, 1.8)	2.8 (2.1, 3.5)	3.5 (2.8, 4.5)	4.3 (3.4, 5.3)	4.4 (3.5, 5.5)
	≥65	1.8 (1.3, 2.4)	3.3 (2.6, 4.2)	4.1 (3.3, 5.2)	4.8 (3.9, 6.0)	
>32mm	<65	1.5 (1.2, 1.8)	4.6 (4.0, 5.2)	6.7 (5.8, 7.7)	9.6 (7.7, 11.9)	
	≥65	1.8 (1.5, 2.1)	4.0 (3.4, 4.6)	5.7 (4.9, 6.7)	6.9 (5.4, 8.8)	

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



Number at Risk		0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
≤32mm	<65	2392	2206	1977	1727	1527	1287	1032	759	376	78
	≥65	2197	2006	1811	1605	1354	1042	750	486	196	19
>32mm	<65	6913	5810	4249	2767	1532	699	317	119	60	21
	≥65	6306	5325	3885	2480	1314	589	218	82	38	7

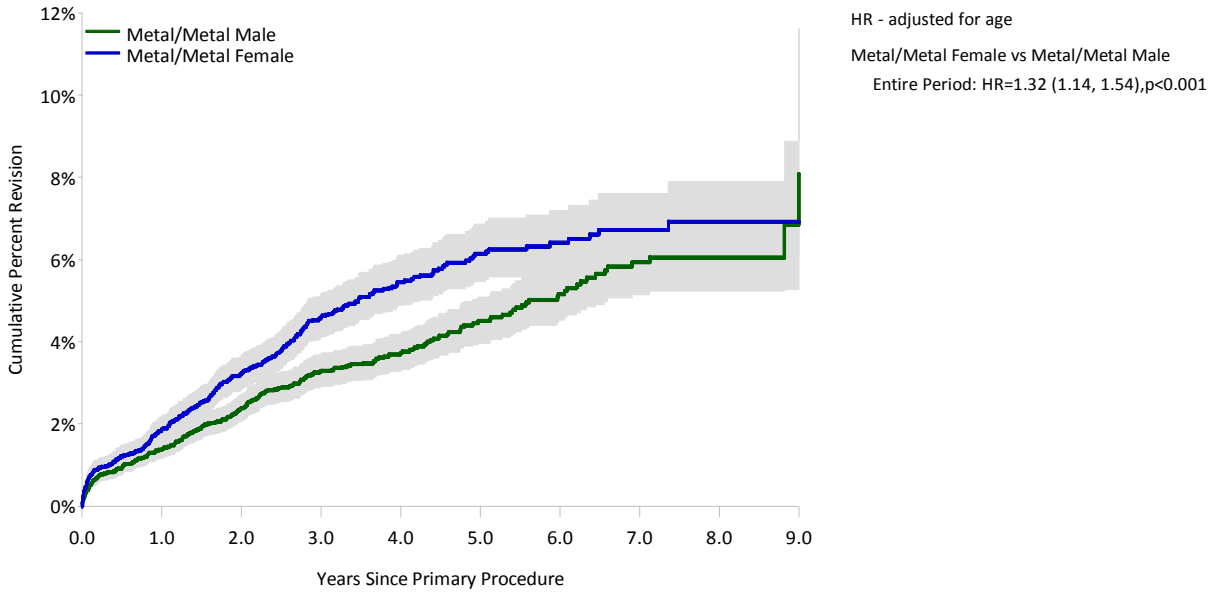
Table HT41: Revision Rates of Metal/Metal Primary Total Conventional Hip Replacement by Gender (Primary Diagnosis OA)

Bearing Surface	Gender	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Metal/Metal	Male	322	9937	32271	1.00 (0.89, 1.11)
	Female	345	7871	26232	1.32 (1.18, 1.46)
TOTAL		**667**	**17808**	**58503**	**1.14 (1.06, 1.23)**

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	7 Yrs	9 Yrs
Metal/Metal	Male	1.4 (1.2, 1.6)	3.3 (2.9, 3.7)	4.5 (4.0, 5.1)	5.9 (5.1, 6.8)	8.1 (5.6, 11.6)
	Female	1.9 (1.6, 2.2)	4.6 (4.1, 5.2)	6.1 (5.5, 6.9)	6.7 (5.9, 7.6)	6.9 (6.1, 7.9)

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	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Metal/Metal	Male	9937	8501	6548	4672	3107	1958	1292	848	414	75
	Female	7871	6846	5374	3907	2620	1659	1025	598	256	50

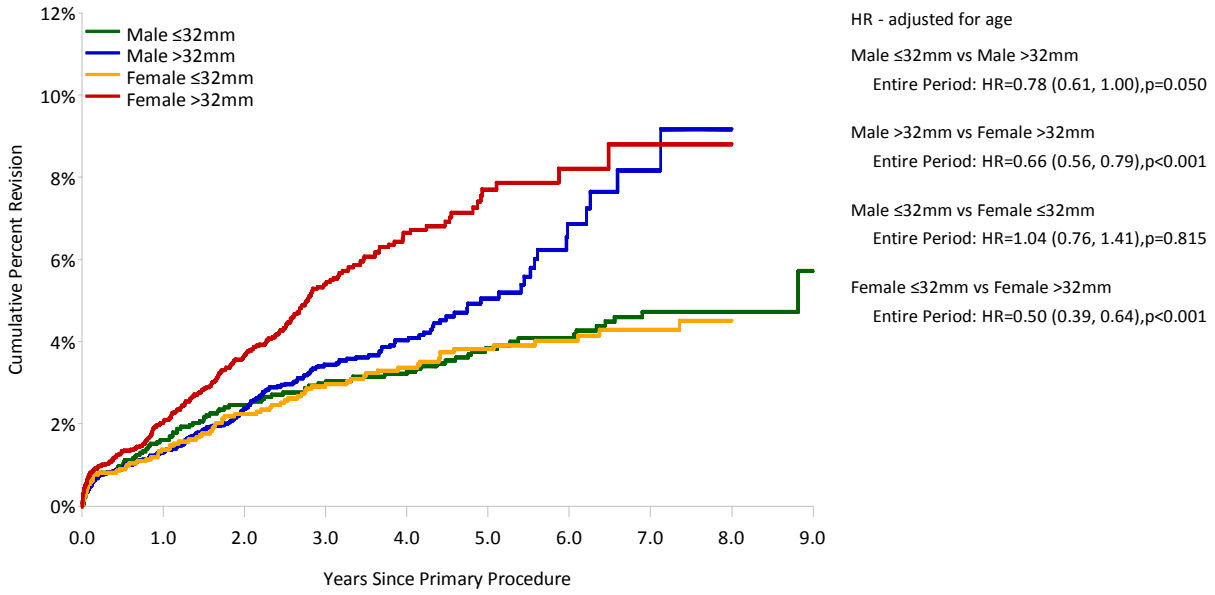
Table HT43: Revision Rates of Metal/Metal Primary Total Conventional Hip Replacement by Gender and Head Size (Primary Diagnosis OA)

Gender	Head Size	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	≤32mm	88	2363	11913	0.74 (0.59, 0.91)
	>32mm	234	7574	20358	1.15 (1.01, 1.31)
Female	≤32mm	77	2226	10578	0.73 (0.57, 0.91)
	>32mm	268	5645	15654	1.71 (1.51, 1.93)
TOTAL		**667**	**17808**	**58503**	**1.14 (1.06, 1.23)**

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	7 Yrs	9 Yrs
Male	≤32mm	1.6 (1.2, 2.2)	3.0 (2.4, 3.9)	3.8 (3.1, 4.8)	4.7 (3.8, 5.9)	5.7 (3.9, 8.4)
	>32mm	1.3 (1.1, 1.6)	3.4 (3.0, 4.0)	5.0 (4.3, 5.9)	8.2 (6.3, 10.6)	
Female	≤32mm	1.4 (1.0, 2.0)	3.0 (2.3, 3.8)	3.8 (3.0, 4.8)	4.3 (3.4, 5.4)	
	>32mm	2.1 (1.7, 2.5)	5.4 (4.8, 6.2)	7.7 (6.7, 8.9)	8.8 (7.2, 10.7)	

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	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Male	≤32mm	2363	2163	1954	1726	1513	1256	997	736	356	59
	>32mm	7574	6338	4594	2946	1594	702	295	112	58	16
Female	≤32mm	2226	2049	1834	1606	1368	1073	785	509	216	38
	>32mm	5645	4797	3540	2301	1252	586	240	89	40	12

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

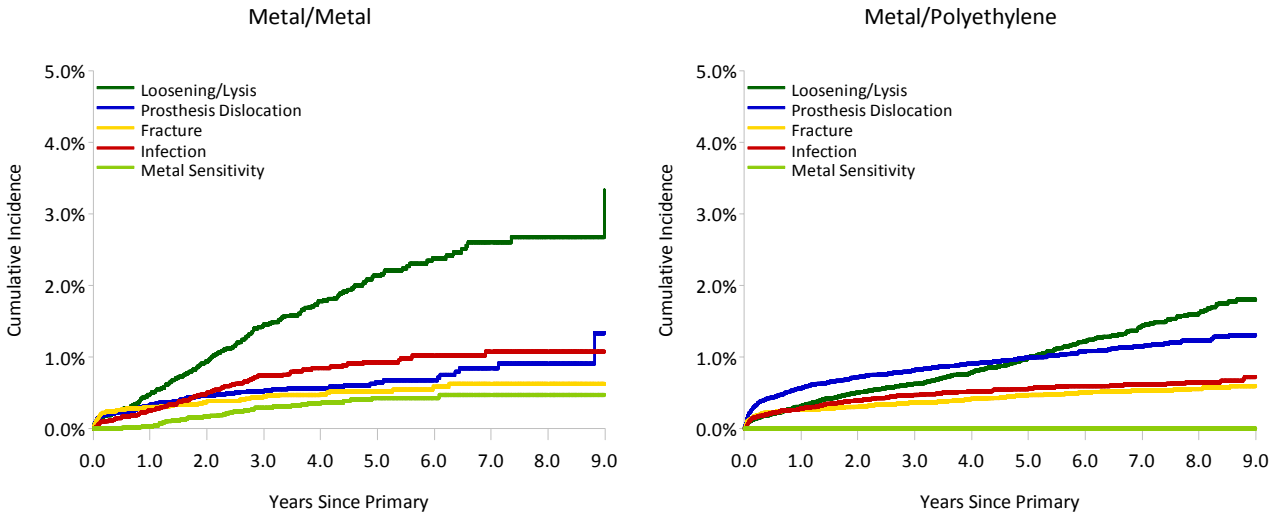


Figure HT28: Revision Diagnosis Cumulative Incidence of Metal/Metal and Metal/Polyethylene Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)

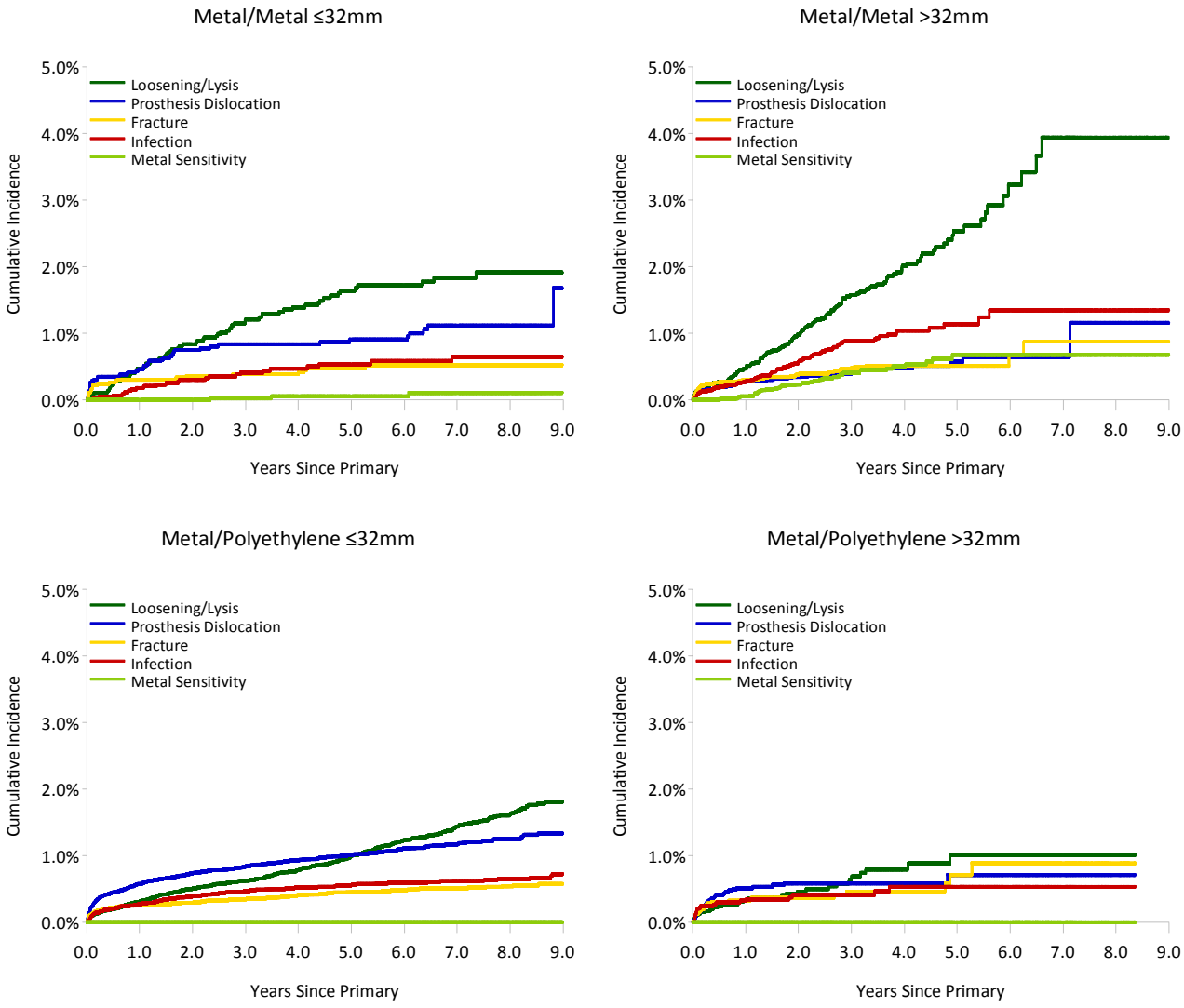


Table HT45: Revision Rates of Metal/Metal Primary Total Conventional Hip Replacement using Head Size >32mm by Prostheses Used (Primary Diagnosis OA)

Head Surface	Acetabular Surface	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
ASR	ASR	179	3969	9666	1.85 (1.59, 2.14)
Articul/Eze	Ultamet	34	1294	4114	0.83 (0.57, 1.15)
BHR	BHR	50	2117	5708	0.88 (0.65, 1.15)
BHR	R3	10	424	435	2.30 (1.10, 4.22)
Bionik	Bionik	21	370	781	2.69 (1.66, 4.11)
Cormet 2000	Cormet	20	545	1586	1.26 (0.77, 1.95)
Icon	Icon	13	295	637	2.04 (1.09, 3.49)
M2a	M2a	38	761	3309	1.15 (0.81, 1.58)
M2a	Recap	17	844	2004	0.85 (0.49, 1.36)
Metasul	Durom	39	1087	3206	1.22 (0.87, 1.66)
Mitch TRH	Mitch TRH	17	539	987	1.72 (1.00, 2.76)
S-Rom	Ultamet	10	279	1340	0.75 (0.36, 1.37)
Other (24)		54	695	2239	2.41 (1.81, 3.15)
TOTAL		**502**	**13219**	**36012**	**1.39 (1.27, 1.52)**

Note: Only prostheses 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	9 Yrs
ASR	ASR	1.6 (1.3, 2.1)	5.9 (5.0, 6.8)	7.8 (6.4, 9.6)		
Articul/Eze	Ultamet	1.8 (1.2, 2.8)	2.7 (1.9, 3.8)	3.5 (2.4, 5.1)		
BHR	BHR	0.7 (0.4, 1.2)	2.6 (1.9, 3.6)	4.9 (3.4, 7.1)		
BHR	R3	2.4 (1.2, 4.8)				
Bionik	Bionik	3.4 (2.0, 5.9)	8.0 (5.1, 12.5)			
Cormet 2000	Cormet	1.4 (0.7, 2.9)	3.4 (2.0, 5.7)	7.1 (4.4, 11.5)		
Icon	Icon	2.5 (1.2, 5.2)	6.5 (3.5, 11.7)			
M2a	M2a	1.9 (1.1, 3.1)	4.0 (2.8, 5.7)	5.5 (4.0, 7.6)		
M2a	Recap	1.6 (0.9, 2.8)	2.2 (1.3, 3.6)			
Metasul	Durom	1.3 (0.8, 2.2)	4.0 (2.9, 5.5)	4.6 (3.3, 6.4)		
Mitch TRH	Mitch TRH	1.5 (0.8, 3.1)				
S-Rom	Ultamet	2.2 (1.0, 4.7)	3.3 (1.7, 6.2)	3.8 (2.0, 6.9)		
Other (24)		2.6 (1.6, 4.2)	6.4 (4.5, 9.1)	11.7 (8.5, 15.9)	17.2 (12.9, 22.8)	

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

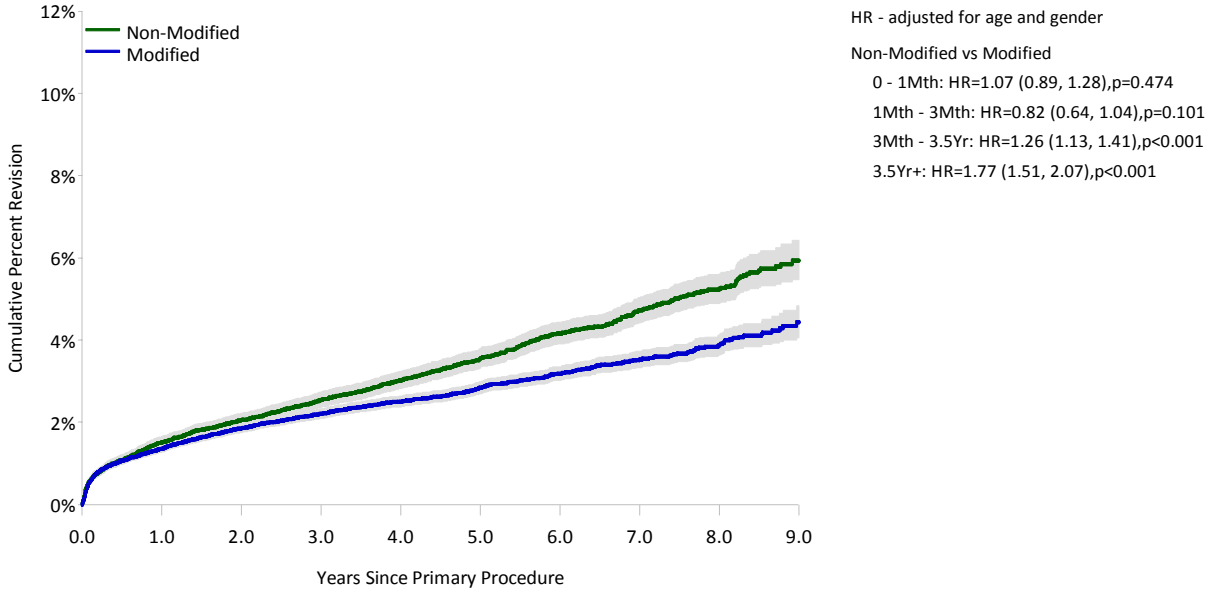
Table HT47: Revision Rates of Primary Total Conventional Hip Replacement by Type of Polyethylene (Primary Diagnosis OA)

Polyethylene Surface	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Non-modified	1106	31868	145228	0.76 (0.72, 0.81)
Modified	1708	71049	265658	0.64 (0.61, 0.67)
TOTAL	**2814**	**102917**	**410886**	**0.68 (0.66, 0.71)**

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	7 Yrs	9 Yrs
Non-modified	1.5 (1.4, 1.7)	2.5 (2.4, 2.7)	3.6 (3.3, 3.8)	4.7 (4.4, 5.0)	5.9 (5.5, 6.4)
Modified	1.4 (1.3, 1.4)	2.2 (2.1, 2.3)	2.8 (2.7, 3.0)	3.5 (3.3, 3.7)	4.4 (4.1, 4.8)

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	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Non-modified	31868	27625	24085	21195	18178	14919	11295	7583	3750	1024
Modified	71049	59185	49148	39708	30802	22674	15309	9068	4220	1157

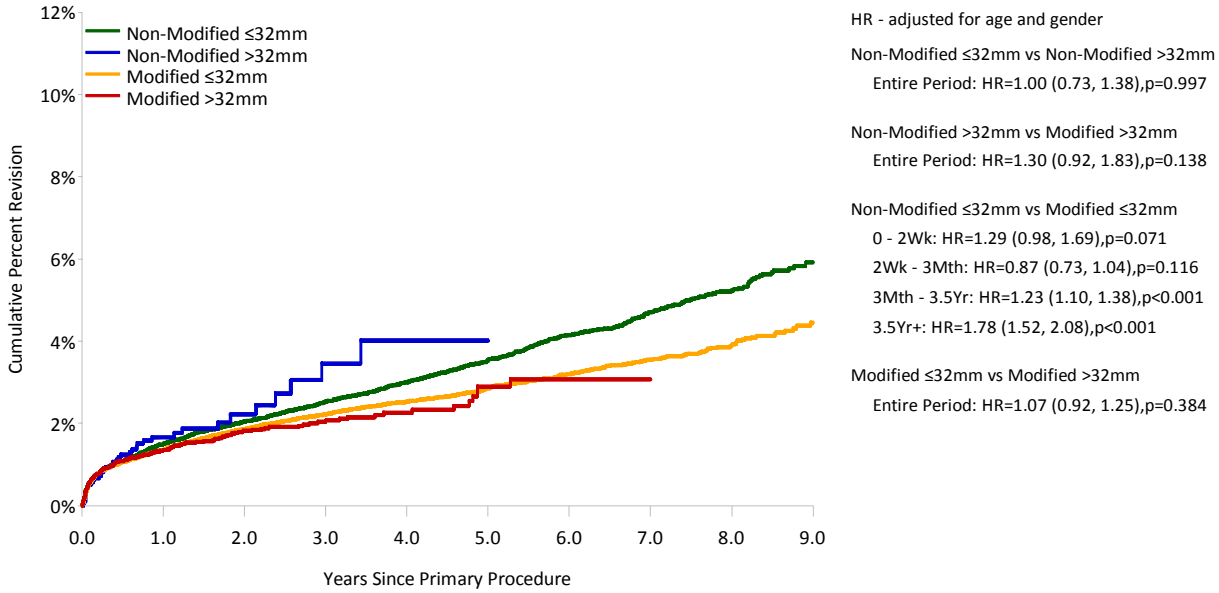
Table HT49: Revision Rates of Primary Total Conventional Hip Replacement by Type of Polyethylene and Head Size (Primary Diagnosis OA)

Polyethylene Surface	Head Size	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Non-modified	≤32mm	1067	29736	142286	0.75 (0.71, 0.80)
	>32mm	39	2132	2941	1.33 (0.94, 1.81)
Modified	≤32mm	1518	59613	242837	0.63 (0.59, 0.66)
	>32mm	190	11436	22821	0.83 (0.72, 0.96)
TOTAL		**2814**	**102917**	**410886**	**0.68 (0.66, 0.71)**

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	7 Yrs	9 Yrs
Non-modified	≤32mm	1.5 (1.4, 1.7)	2.5 (2.3, 2.7)	3.5 (3.3, 3.8)	4.7 (4.4, 5.0)	5.9 (5.4, 6.4)
	>32mm	1.7 (1.2, 2.4)	3.5 (2.3, 5.3)	4.0 (2.5, 6.3)		
Modified	≤32mm	1.4 (1.3, 1.5)	2.2 (2.1, 2.4)	2.9 (2.7, 3.0)	3.5 (3.3, 3.8)	4.5 (4.1, 4.9)
	>32mm	1.3 (1.1, 1.6)	2.1 (1.8, 2.4)	2.9 (2.3, 3.6)	3.1 (2.4, 3.9)	

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	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Non-modified	≤32mm	29736	26506	23626	20968	18062	14875	11282	7583	3750	1024
	>32mm	2132	1119	459	227	116	44	13	0	0	0
Modified	≤32mm	59613	51645	44411	36960	29379	21944	15026	9000	4210	1157
	>32mm	11436	7540	4737	2748	1423	730	283	68	10	0

Prostheses Types

There are 1,539 stem and acetabular combinations for primary total conventional hip replacement recorded by the Registry, 154 more than 2008. The revision rates and yearly cumulative percent revision of the 62 combinations with more than 400 procedures are listed in Tables HT51 – HT56. Although the listed combinations are a small proportion of the possible combinations, they represent 77% 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 1,477 stem and acetabular combinations, making up 23% 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 number of revisions per 100 observed component years varies from 0.16 to 0.92. The MS30/Low Profile Cup and the Exeter/Exeter have the lowest nine year cumulative percent revision of 1.7% and 4.9% respectively (Tables HT51 and HT52). The Spectron EF/Reflection has the highest cumulative percent revision of 9.0% at nine years. The Norwegian Registry has recently identified the Spectron EF cemented stem as having a higher rate of revision compared to other cemented stems[1]. This higher rate of revision was only evident in small sized prostheses. The Australian Registry has undertaken the same analysis confirming the findings of the Norwegian analysis including the relationship to the Size 1 femoral component (data not shown).

There are 42 cementless total conventional stem and acetabular combinations listed. The number of revisions per 100 observed component years varies from 0.34 to 3.07 revisions. The Natural Hip/Fitmore, Alloclassic/Trilogy and Secure-Fit Plus/Trident cementless combinations have less than 0.5 revisions per 100 observed component years. Of the six combinations reported with a nine year cumulative percent revision the Secure-Fit Plus/Trident combination is the lowest (3.0%) (Tables HT53 and HT54).

There are 19 combinations of total conventional hip replacement with hybrid fixation (femoral cemented). The rate of revision per 100 observed component years varies from 0.34 to 1.49. The Exeter/Vitalock has the lowest cumulative percent revision at nine years (4.1%) (Tables HT55 and HT56).

[1] *Espehaug B, Furnes O, Engesæter L, Havelin L. 18 years of results with cemented primary hip prostheses in the Norwegian Arthroplasty Register. Acta Orthopaedic 2009; 80(4): 402-412.*

Table HT51: 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	18	626	2298	0.78 (0.46, 1.24)
CPT	ZCA	14	537	2694	0.52 (0.28, 0.87)
Charnley	Charnley	14	590	2692	0.52 (0.28, 0.87)
Charnley	Charnley Ogee	33	709	3588	0.92 (0.63, 1.29)
Exeter	Contemporary	26	494	3390	0.77 (0.50, 1.12)
Exeter	Exeter	16	420	3133	0.51 (0.29, 0.83)
Exeter V40	Contemporary	95	3903	15320	0.62 (0.50, 0.76)
Exeter V40	Exeter	48	1588	7352	0.65 (0.48, 0.87)
Exeter V40	Exeter Contemporary	58	2296	7334	0.79 (0.60, 1.02)
MS 30	Low Profile Cup	6	640	3641	0.16 (0.06, 0.36)
Spectron EF	Reflection	51	1482	6996	0.73 (0.54, 0.96)
Other (296)		195	5683	26839	0.73 (0.63, 0.84)
TOTAL		**574**	**18968**	**85278**	**0.67 (0.62, 0.73)**

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

Table HT52: Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Cement Fixation

Femoral Component	Acetabular Component	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
CPCS	Reflection	1.3 (0.7, 2.6)	2.9 (1.8, 4.8)	3.5 (2.2, 5.7)	4.8 (2.6, 8.9)	
CPT	ZCA	0.6 (0.2, 1.8)	1.8 (0.9, 3.6)	2.4 (1.3, 4.4)	2.9 (1.6, 5.5)	
Charnley	Charnley	0.5 (0.2, 1.7)	1.2 (0.6, 2.7)	2.4 (1.3, 4.6)	3.0 (1.6, 5.6)	
Charnley	Charnley Ogee	1.0 (0.5, 2.1)	2.8 (1.8, 4.4)	4.7 (3.2, 6.8)	6.0 (4.3, 8.5)	
Exeter	Contemporary	1.9 (1.0, 3.6)	3.9 (2.4, 6.0)	4.3 (2.8, 6.6)	5.4 (3.6, 8.0)	6.0 (4.1, 8.8)
Exeter	Exeter	1.0 (0.4, 2.6)	1.2 (0.5, 2.9)	2.3 (1.2, 4.4)	3.5 (2.0, 6.0)	4.9 (3.0, 8.0)
Exeter V40	Contemporary	1.2 (0.9, 1.6)	2.3 (1.9, 2.9)	2.7 (2.2, 3.3)	3.4 (2.7, 4.4)	
Exeter V40	Exeter	0.9 (0.5, 1.5)	2.2 (1.6, 3.2)	3.3 (2.4, 4.4)	4.6 (3.3, 6.2)	
Exeter V40	Exeter Contemporary	1.3 (0.9, 1.9)	2.4 (1.8, 3.3)	3.2 (2.4, 4.3)	4.8 (3.5, 6.8)	
MS 30	Low Profile Cup	0.3 (0.1, 1.3)	0.5 (0.2, 1.6)	1.0 (0.4, 2.3)	1.0 (0.4, 2.3)	1.7 (0.6, 4.7)
Spectron EF	Reflection	1.0 (0.6, 1.7)	2.0 (1.4, 2.9)	3.1 (2.2, 4.3)	4.6 (3.4, 6.4)	9.0 (5.9, 13.6)
Other (296)		1.4 (1.1, 1.7)	2.3 (1.9, 2.7)	3.7 (3.2, 4.3)	4.6 (3.9, 5.3)	5.6 (4.7, 6.7)

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

Table HT53: 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	123	2771	15594	0.79 (0.66, 0.94)
ABGII	ABGII (Shell/Insert)	24	752	3452	0.70 (0.45, 1.03)
ABGII	Trident	81	1861	6940	1.17 (0.93, 1.45)
Accolade	Trident	173	6301	18114	0.96 (0.82, 1.11)
Adapter	Bionik	21	477	939	2.24 (1.38, 3.42)
Alloclassic	Allofit	115	4302	16346	0.70 (0.58, 0.84)
Alloclassic	Durom	28	612	1813	1.54 (1.03, 2.23)
Alloclassic	Fitmore	59	1394	6660	0.89 (0.67, 1.14)
Alloclassic	Trabecular Metal Shell	11	677	1325	0.83 (0.41, 1.49)
Alloclassic	Trilogy	4	531	1180	0.34 (0.09, 0.87)
Anthology	R3	15	932	899	1.67 (0.93, 2.75)
Anthology	Reflection	11	748	1614	0.68 (0.34, 1.22)
CLS	Allofit	22	645	2795	0.79 (0.49, 1.19)
CLS	Fitmore	23	521	2893	0.80 (0.50, 1.19)
Citation	Trident	29	1086	4145	0.70 (0.47, 1.00)
Citation	Vitalock	20	555	3608	0.55 (0.34, 0.86)
Corail	ASR	142	2888	6509	2.18 (1.84, 2.57)
Corail	Duraloc	30	1247	4725	0.63 (0.43, 0.91)
Corail	Pinnacle	138	7575	13277	1.04 (0.87, 1.23)
Epoch	Trilogy	25	838	2695	0.93 (0.60, 1.37)
F2L	SPH-Blind	41	613	3802	1.08 (0.77, 1.46)
Mallory-Head	Mallory-Head	79	2245	10868	0.73 (0.58, 0.91)
Natural Hip	Fitmore	19	837	4479	0.42 (0.26, 0.66)
Omnifit	Secur-Fit	41	508	3238	1.27 (0.91, 1.72)
Omnifit	Trident	41	1109	5877	0.70 (0.50, 0.95)
Quadra-H	Versafit	17	671	553	3.07 (1.79, 4.92)
S-Rom	Option	24	666	4265	0.56 (0.36, 0.84)
S-Rom	Pinnacle	54	1956	5759	0.94 (0.70, 1.22)
SL-Plus	EPF-Plus	64	1988	5561	1.15 (0.89, 1.47)
SL-Plus	R3	10	523	451	2.22 (1.06, 4.08)
Secur-Fit	Trident	103	4772	16506	0.62 (0.51, 0.76)
Secur-Fit Plus	Trident	91	3522	19521	0.47 (0.38, 0.57)
Stability	Duraloc	19	401	2678	0.71 (0.43, 1.11)
Summit	ASR	45	1118	3229	1.39 (1.02, 1.86)
Summit	Pinnacle	35	2225	6832	0.51 (0.36, 0.71)
Synergy	BHR	15	725	1979	0.76 (0.42, 1.25)
Synergy	R3	16	1167	1093	1.46 (0.84, 2.38)
Synergy	Reflection	187	7011	32101	0.58 (0.50, 0.67)
Taperloc	M2a	20	489	1884	1.06 (0.65, 1.64)
Taperloc	Mallory-Head	24	833	3845	0.62 (0.40, 0.93)
Taperloc	Recap	13	472	1102	1.18 (0.63, 2.02)
VerSys	Trilogy	129	3856	18025	0.72 (0.60, 0.85)
Other (778)		812	20938	75756	1.07 (1.00, 1.15)
TOTAL		**2993**	**95358**	**344928**	**0.87 (0.84, 0.90)**

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

Table HT54: Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Cementless Fixation

Femoral Component	Acetabular Component	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
ABGII	ABGII	1.7 (1.3, 2.3)	3.0 (2.4, 3.8)	4.1 (3.4, 4.9)	5.3 (4.4, 6.3)	5.5 (4.6, 6.6)
ABGII	ABGII (Shell/Insert)	1.7 (1.0, 3.0)	2.3 (1.5, 3.8)	3.1 (2.0, 4.7)	4.1 (2.7, 6.3)	
ABGII	Trident	2.2 (1.6, 3.0)	4.0 (3.2, 5.1)	5.0 (4.0, 6.3)	6.5 (5.0, 8.4)	
Accolade	Trident	1.5 (1.2, 1.9)	3.0 (2.5, 3.5)	4.0 (3.3, 4.7)	5.0 (3.7, 6.8)	
Adapter	Bionik	2.7 (1.5, 4.6)	5.8 (3.7, 9.1)			
Alloclassic	Allofit	1.6 (1.2, 2.0)	2.6 (2.1, 3.1)	3.3 (2.8, 4.1)	3.4 (2.8, 4.2)	
Alloclassic	Durom	1.4 (0.7, 2.7)	5.1 (3.4, 7.6)	6.2 (4.2, 9.0)		
Alloclassic	Fitmore	2.3 (1.6, 3.2)	3.6 (2.7, 4.7)	4.3 (3.3, 5.6)	4.9 (3.8, 6.4)	
Alloclassic	Trabecular Metal Shell	1.7 (1.0, 3.2)	1.7 (1.0, 3.2)	1.7 (1.0, 3.2)		
Alloclassic	Trilogy	0.6 (0.2, 1.9)	0.9 (0.3, 2.3)			
Anthology	R3	1.7 (1.0, 2.9)				
Anthology	Reflection	1.2 (0.6, 2.4)	1.6 (0.9, 2.8)			
CLS	Allofit	1.6 (0.9, 3.0)	3.1 (2.0, 4.9)	3.4 (2.2, 5.3)	5.2 (3.2, 8.4)	
CLS	Fitmore	2.0 (1.1, 3.6)	4.2 (2.7, 6.4)	4.4 (2.9, 6.7)	5.2 (3.4, 7.8)	
Citation	Trident	1.8 (1.2, 2.8)	2.5 (1.7, 3.7)	3.2 (2.1, 4.7)	3.2 (2.1, 4.7)	
Citation	Vitalock	0.5 (0.2, 1.7)	2.2 (1.3, 3.8)	2.8 (1.7, 4.6)	3.7 (2.3, 5.9)	5.1 (3.1, 8.4)
Corail	ASR	2.1 (1.6, 2.7)	6.4 (5.3, 7.6)			
Corail	Duraloc	1.4 (0.9, 2.2)	1.9 (1.3, 2.9)	2.7 (1.8, 4.0)	3.6 (2.4, 5.3)	
Corail	Pinnacle	1.7 (1.4, 2.0)	2.3 (1.9, 2.8)	2.9 (2.3, 3.7)		
Epoch	Trilogy	2.3 (1.5, 3.6)	3.1 (2.0, 4.7)	3.1 (2.0, 4.7)	3.6 (2.3, 5.7)	
F2L	SPH-Blind	3.1 (2.0, 4.8)	4.9 (3.5, 7.0)	6.2 (4.5, 8.4)	7.1 (5.3, 9.6)	
Mallory-Head	Mallory-Head	1.8 (1.3, 2.5)	2.3 (1.8, 3.1)	3.1 (2.4, 4.0)	4.3 (3.3, 5.5)	6.6 (4.9, 8.9)
Natural Hip	Fitmore	1.1 (0.6, 2.1)	1.5 (0.8, 2.6)	2.1 (1.3, 3.4)	3.0 (1.9, 4.9)	
Omnifit	Secur-Fit	3.2 (1.9, 5.1)	5.0 (3.4, 7.3)	6.7 (4.8, 9.3)	7.8 (5.7, 10.7)	
Omnifit	Trident	1.7 (1.1, 2.7)	2.8 (1.9, 4.0)	3.9 (2.8, 5.3)	4.4 (3.2, 6.0)	
Quadra-H	Versafit	2.8 (1.7, 4.7)				
S-Rom	Option	1.5 (0.8, 2.8)	2.4 (1.5, 3.9)	3.4 (2.2, 5.1)	3.9 (2.6, 5.9)	
S-Rom	Pinnacle	1.9 (1.4, 2.7)	3.1 (2.4, 4.1)	3.7 (2.8, 5.1)		
SL-Plus	EPF-Plus	1.8 (1.3, 2.5)	3.4 (2.6, 4.4)	4.6 (3.4, 6.1)		
SL-Plus	R3	2.5 (1.2, 4.9)				
Secur-Fit	Trident	1.3 (1.0, 1.7)	2.1 (1.7, 2.7)	2.6 (2.1, 3.2)	3.5 (2.8, 4.3)	
Secur-Fit Plus	Trident	1.3 (1.0, 1.7)	2.1 (1.6, 2.6)	2.6 (2.1, 3.2)	2.8 (2.3, 3.5)	3.0 (2.4, 3.7)
Stability	Duraloc	0.7 (0.2, 2.3)	2.3 (1.2, 4.3)	2.5 (1.4, 4.6)	4.8 (2.9, 7.8)	
Summit	ASR	1.2 (0.7, 2.0)	4.8 (3.5, 6.5)	7.1 (4.3, 11.5)		
Summit	Pinnacle	1.2 (0.8, 1.8)	1.6 (1.1, 2.3)	2.0 (1.4, 2.9)		
Synergy	BHR	1.2 (0.7, 2.4)	2.2 (1.3, 3.8)			
Synergy	R3	1.5 (0.9, 2.5)				
Synergy	Reflection	1.5 (1.2, 1.8)	2.3 (2.0, 2.7)	2.6 (2.3, 3.1)	3.3 (2.8, 3.9)	4.9 (2.9, 8.1)
Taperloc	M2a	1.7 (0.8, 3.3)	3.5 (2.1, 5.8)	5.5 (3.5, 8.5)		
Taperloc	Mallory-Head	1.7 (1.0, 2.9)	2.4 (1.5, 3.8)	2.8 (1.8, 4.4)	3.5 (2.3, 5.4)	
Taperloc	Recap	2.2 (1.2, 4.1)	3.3 (1.9, 5.8)			
VerSys	Trilogy	2.2 (1.8, 2.7)	2.9 (2.4, 3.5)	3.4 (2.9, 4.1)	3.9 (3.3, 4.7)	4.7 (3.3, 6.8)
Other (778)		2.0 (1.9, 2.3)	3.7 (3.4, 4.0)	4.9 (4.5, 5.2)	6.0 (5.5, 6.4)	7.0 (6.2, 7.9)

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

Table HT55: Revision Rates of Primary Total Conventional Hip Replacement with Hybrid Fixation (femoral cemented)

Femoral Component	Acetabular Component	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
C-Stem	Duraloc	41	1040	5199	0.79 (0.57, 1.07)
C-Stem	Pinnacle	13	665	1701	0.76 (0.41, 1.31)
CPCS	R3	8	589	536	1.49 (0.64, 2.94)
CPCS	Reflection	28	1915	6323	0.44 (0.29, 0.64)
CPT	Trabecular Metal Shell	15	669	1277	1.17 (0.66, 1.94)
CPT	Trilogy	96	3876	14204	0.68 (0.55, 0.83)
Elite Plus	Duraloc	70	1078	6732	1.04 (0.81, 1.31)
Exeter	Vitalock	45	1218	9354	0.48 (0.35, 0.64)
Exeter V40	ABGII	29	999	5904	0.49 (0.33, 0.71)
Exeter V40	Mallory-Head	15	873	3881	0.39 (0.22, 0.64)
Exeter V40	Pinnacle	5	413	781	0.64 (0.21, 1.49)
Exeter V40	Trident	416	20325	62687	0.66 (0.60, 0.73)
Exeter V40	Trilogy	11	474	1759	0.63 (0.31, 1.12)
Exeter V40	Vitalock	47	1959	11233	0.42 (0.31, 0.56)
MS 30	Allofit	23	1041	4421	0.52 (0.33, 0.78)
Omnifit	Trident	52	1648	7407	0.70 (0.52, 0.92)
Spectron EF	BHR	5	433	1045	0.48 (0.16, 1.12)
Spectron EF	Reflection	143	4373	19366	0.74 (0.62, 0.87)
VerSys	Trilogy	12	713	3545	0.34 (0.17, 0.59)
Other (403)		403	11855	52586	0.77 (0.69, 0.84)
TOTAL		**1477**	**56156**	**219941**	**0.67 (0.64, 0.71)**

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

Table HT56: Yearly Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Hybrid Fixation (femoral cemented)

Femoral Component	Acetabular Component	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
C-Stem	Duraloc	2.2 (1.5, 3.3)	3.1 (2.2, 4.3)	3.8 (2.8, 5.3)	4.9 (3.5, 6.8)	
C-Stem	Pinnacle	1.6 (0.9, 2.9)	2.4 (1.4, 4.1)	2.4 (1.4, 4.1)		
CPCS	R3	1.4 (0.7, 2.7)				
CPCS	Reflection	0.9 (0.6, 1.5)	1.2 (0.8, 1.8)	1.4 (0.9, 2.2)	3.6 (2.0, 6.4)	
CPT	Trabecular Metal Shell	1.8 (1.0, 3.3)	3.4 (1.9, 6.0)			
CPT	Trilogy	1.4 (1.1, 1.8)	2.3 (1.8, 2.8)	3.0 (2.4, 3.8)	3.7 (2.9, 4.6)	
Elite Plus	Duraloc	1.9 (1.2, 2.9)	3.5 (2.6, 4.9)	5.4 (4.2, 7.0)	6.9 (5.5, 8.8)	8.9 (6.6, 11.9)
Exeter	Vitalock	1.6 (1.0, 2.5)	2.3 (1.6, 3.4)	2.5 (1.8, 3.6)	3.3 (2.4, 4.5)	4.1 (3.1, 5.5)
Exeter V40	ABGII	1.2 (0.7, 2.1)	1.5 (0.9, 2.5)	2.2 (1.5, 3.4)	3.6 (2.5, 5.2)	
Exeter V40	Mallory-Head	0.6 (0.3, 1.4)	1.2 (0.6, 2.3)	1.4 (0.7, 2.6)	2.5 (1.4, 4.3)	
Exeter V40	Pinnacle	0.6 (0.1, 2.3)	1.9 (0.8, 4.6)			
Exeter V40	Trident	1.2 (1.1, 1.4)	2.0 (1.8, 2.3)	2.8 (2.5, 3.1)	3.7 (3.2, 4.2)	
Exeter V40	Trilogy	1.5 (0.7, 3.2)	2.4 (1.3, 4.5)	2.9 (1.6, 5.5)		
Exeter V40	Vitalock	0.9 (0.6, 1.5)	1.7 (1.2, 2.3)	2.1 (1.6, 2.9)	2.6 (1.9, 3.5)	
MS 30	Allofit	1.3 (0.7, 2.2)	2.0 (1.3, 3.1)	2.5 (1.6, 3.8)	2.9 (1.8, 4.5)	
Omnifit	Trident	1.8 (1.2, 2.6)	3.0 (2.3, 4.1)	3.4 (2.6, 4.5)	4.0 (3.0, 5.3)	
Spectron EF	BHR	0.5 (0.1, 2.1)	1.4 (0.5, 3.7)			
Spectron EF	Reflection	1.1 (0.8, 1.5)	2.2 (1.8, 2.7)	3.3 (2.8, 4.0)	5.0 (4.2, 6.1)	6.2 (5.0, 7.7)
VerSys	Trilogy	1.1 (0.6, 2.3)	1.6 (0.9, 2.9)	1.6 (0.9, 2.9)	1.9 (1.1, 3.4)	
Other (403)		1.6 (1.4, 1.8)	2.8 (2.5, 3.2)	3.8 (3.4, 4.2)	4.7 (4.2, 5.2)	5.2 (4.7, 5.9)

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

Primary Total Resurfacing Hip Replacement

Demographics

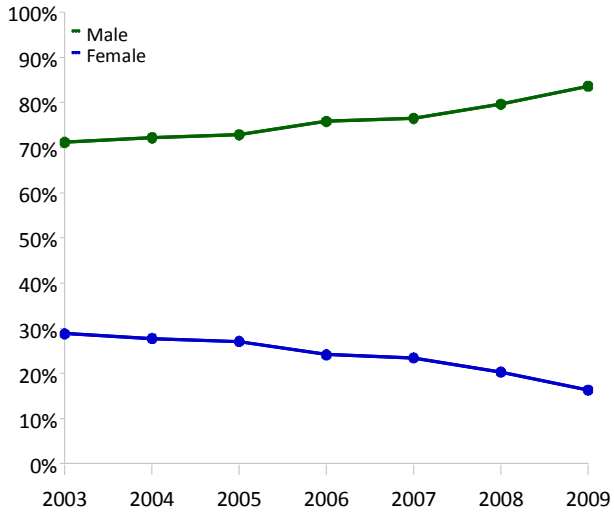
There have been 13,307 total resurfacing procedures reported to the Registry, an additional 1,214 procedures compared to the last report.

The use of resurfacing hip replacement in Australia continues to decline. The number of procedures reported in 2009 was 17.6% less than 2008 and 34.6% less compared to the peak in 2005.

Osteoarthritis is the principal diagnosis for total resurfacing hip replacement (94.6%), followed by developmental dysplasia (2.7%), avascular necrosis (1.8%), rheumatoid arthritis (0.4%) and other inflammatory arthritis (0.4%).

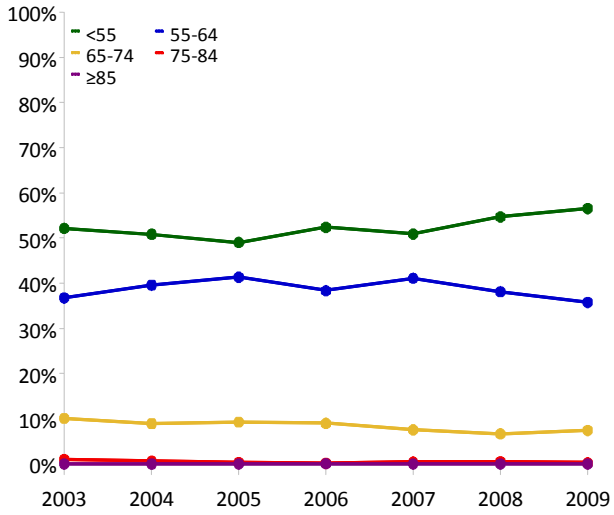
Most patients are male and the proportion of males has increased from 71.2% in 2003 to 83.7% in 2009 (Figure HT31).

Figure HT31: Primary Total Resurfacing Hip Replacement by Gender



There has been a slight increase in patients younger than 55 years since 2005 (49.1% in 2005 to 56.6% in 2009) (Figure HT32).

Figure HT32: Primary Total Resurfacing Hip Replacement by Age



The majority of total resurfacings use hybrid fixation (94.0% in 2009), however there has been an increase in the proportion of cementless fixation, increasing from 2.3% in 2003 to 5.8% in 2009. The bearing surface for resurfacing hip replacement is metal/metal in almost all cases.

The BHR remains the most used resurfacing hip prosthesis (68.1%) but is declining in use. The Mitch TRH, ASR and Durom have also shown a decline in use in 2009 (Table HT57).

Table HT57: Ten Most Used Resurfacing Heads in Primary Total Resurfacing Hip Replacement

2003		2006		2007		2008		2009	
Model	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**
BHR	1357	BHR	984	BHR	889	BHR	741	BHR	622
Durom	58	ASR	257	Mitch TRH	208	Mitch TRH	231	Mitch TRH	193
ASR	43	Durom	143	ASR	176	ASR	133	ASR	91
Cormet	42	Adept	126	Durom	105	Durom	88	Adept	67
Cormet 2000 HAP	38	Mitch TRH	96	Adept	85	Cormet	71	Bionik	54
Conserve Plus	7	Cormet Bi-Coated	62	Cormet Bi-Coated	61	Adept	62	Cormet	52
		Bionik	33	Recap	42	Recap	46	Durom	46
		Icon	30	Bionik	33	Bionik	43	Recap	45
		Cormet	12	Icon	25	Icon	20	Cormet Bi-Coated	22
		Conserve Plus	11	Cormet	15	Cormet Bi-Coated	19	Icon	6
Ten Most Used									
(6) 100.0%	1545	(10) 99.3%	1754	(10) 99.7%	1639	(10) 99.9%	1454	(10) 99.9%	1198
Remainder									
(0) 0.0%	0	(2) 0.7%	13	(2) 0.3%	5	(1) 0.1%	1	(1) 0.1%	1
TOTAL									
(6) 100.0%	1545	(12) 100.0%	1767	(12) 100.0%	1644	(11) 100.0%	1455	(11) 100.0%	1199

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

Outcome

The cumulative percent revision at nine years for primary total resurfacing hip replacement undertaken for osteoarthritis is 7.2% (Table HT58 and Figure HT33).

Reasons for Revision

The main reasons for revision of primary resurfacing hip replacements are fracture (35.6%), loosening/lysis (33.4%), infection (8.2%), metal sensitivity (7.1%) and pain (5.3%) (Table HT59).

The five most common reasons for revision are shown in Figure HT34. 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 six years exceeds fracture to become the most common reason for revision. The remaining reasons for revision have a low incidence.

Type of Revision

The main types of revision of resurfacing hip replacement are isolated femoral (52.4%), total hip replacement (36.7%) and acetabular only (7.5%) (Table HT60).

Primary Diagnosis

The outcomes of the three most common primary diagnoses (osteoarthritis, developmental dysplasia and avascular necrosis) are listed in Tables HT61 and HT62. Primary resurfacing hip replacement for osteoarthritis has a significantly lower risk of revision compared to developmental dysplasia (Figure HT35).

Age and Gender

There is a higher risk of revision for patients 65 years or older (Tables HT63 and HT64 and Figure HT36).

Females have twice the risk of revision compared to males (seven year cumulative percent revision of 9.3% and 4.5% respectively) (Tables HT65 and HT66 and Figure HT37).

There is no age related difference in the risk of revision for females. The age related revision risk is only associated with males (Tables HT67 and HT68 and Figures HT38 and HT39).

Head Size

As previously reported, there is a relationship between femoral component head size and the risk of revision. Head sizes of 44mm or less have more than six times the risk of revision compared to head sizes 55mm or greater (Tables HT69 and HT70 and Figure HT40).

The effect of femoral component head size is evident in both males and females. Gender difference in outcome for total resurfacing hip replacement is largely due to differences in femoral head size. There is no significant difference between gender in the risk of revision after adjusting for femoral component head size. Males and females with femoral component head size less than 50mm have a similar cumulative percent revision at seven years (10.2% and 10.3% respectively). Males and females with head sizes 50mm or greater also have a similar seven year cumulative percent revision (3.5% and 3.3% respectively) (Tables HT71 and HT72 and Figure HT41).

Revision diagnosis cumulative incidence varies with head size. Head sizes less then 50mm have a higher incidence of the five most common reasons for revision (Figure HT42).

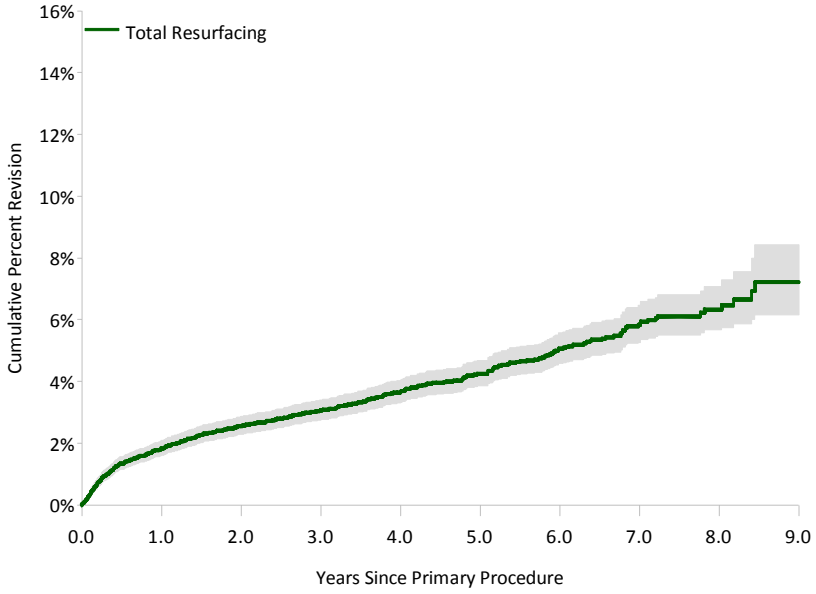
Prosthesis Types

The revision rates and yearly cumulative percent revision of total resurfacing hip prostheses are listed in Tables HT73 and HT74. There are five prostheses with over 1,000 observed component years, the BHR, ASR, Durom, Cormet and Mitch TRH. At five years, the BHR has the lowest cumulative percent revision (3.5%) compared to Cormet (6.0%), Durom (7.6%) and ASR (10.9%).

Table HT58: Yearly Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Total Resurfacing	1.8 (1.6, 2.1)	3.1 (2.8, 3.4)	4.2 (3.9, 4.7)	5.8 (5.3, 6.5)	7.2 (6.2, 8.4)

Figure HT33: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Total Resurfacing	12587	11186	9707	8115	6449	4735	3205	1851	661	81

Table HT59: Primary Total Resurfacing Hip Replacement by Reason for Revision

Reason for Revision	Number	Percent
Fracture	195	35.6
Loosening/Lysis	183	33.4
Infection	45	8.2
Metal Sensitivity	39	7.1
Pain	29	5.3
Avascular Necrosis	17	3.1
Prosthesis Dislocation	15	2.7
Malposition	12	2.2
Other	13	1.1
TOTAL	**548**	**100.0**

Table HT60: Primary Total Resurfacing Hip Replacement by Type of Revision

Type of Revision	Number	Percent
Femoral Only	287	52.4
THR (Femoral/Acetabular)	201	36.7
Acetabular Only	41	7.5
Cement Spacer	15	2.7
Removal of Prostheses	4	0.7
TOTAL	**548**	**100.0**

Figure HT34: Revision Diagnosis Cumulative Incidence of Primary Total Resurfacing Hip Replacement (Primary Diagnosis OA)

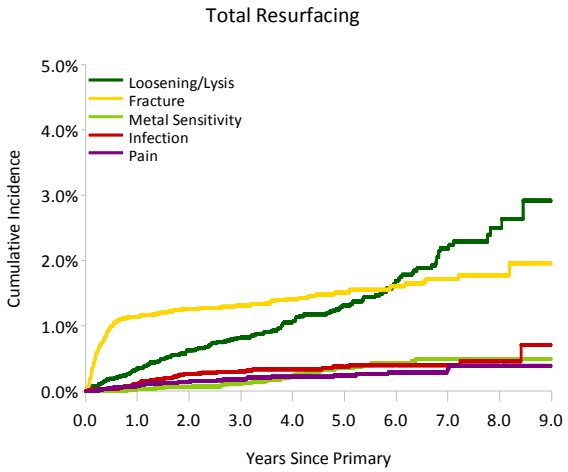


Table HT61: Revision Rates of Primary Total Resurfacing Hip Replacement by Primary Diagnosis

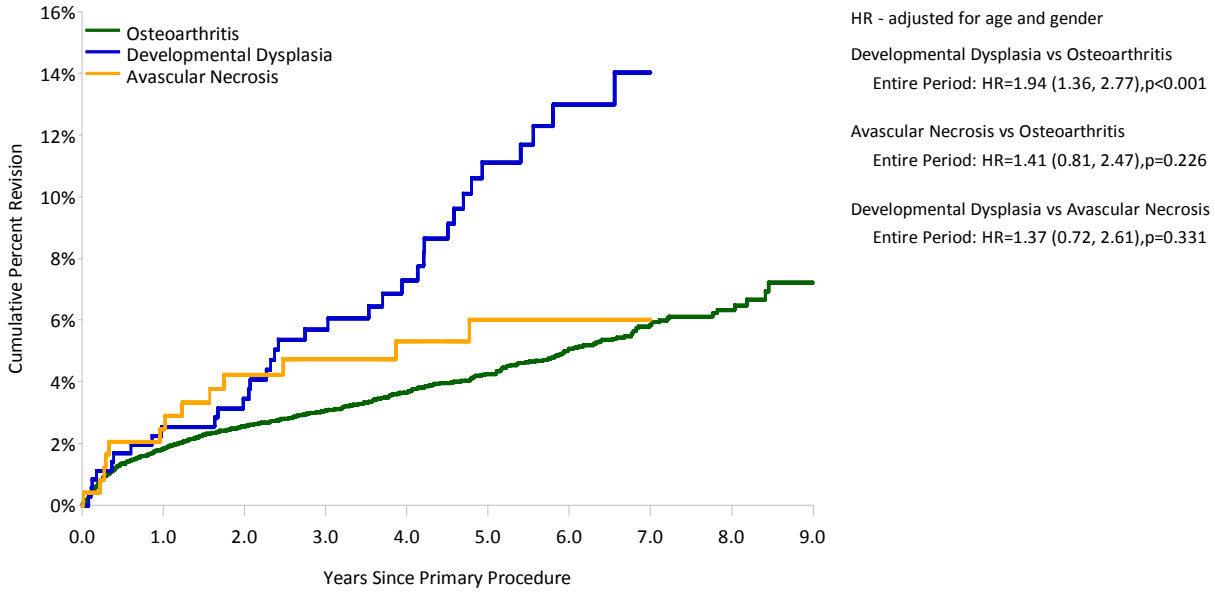
Primary Diagnosis	N Revised	N Total	Obs. Years	Revision/100 Obs. Yrs (95% CI)
Osteoarthritis	490	12587	52020	0.94 (0.86, 1.03)
Developmental Dysplasia	35	359	1682	2.08 (1.45, 2.89)
Avascular Necrosis	13	246	1192	1.09 (0.58, 1.87)
Other (6)	10	115	527	1.90 (0.91, 3.49)
TOTAL	**548**	**13307**	**55420**	**0.99 (0.91, 1.08)**

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

Table HT62: Yearly Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Primary Diagnosis

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Osteoarthritis	1.8 (1.6, 2.1)	3.1 (2.8, 3.4)	4.2 (3.9, 4.7)	5.8 (5.3, 6.5)	7.2 (6.2, 8.4)
Developmental Dysplasia	2.5 (1.3, 4.8)	5.7 (3.7, 8.8)	11.1 (7.9, 15.6)	14.0 (10.0, 19.5)	
Avascular Necrosis	2.5 (1.1, 5.4)	4.7 (2.6, 8.4)	6.0 (3.5, 10.2)	6.0 (3.5, 10.2)	
Other (6)	2.6 (0.8, 7.9)	5.7 (2.6, 12.2)	9.5 (5.0, 17.6)		

Figure HT35: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Primary Diagnosis



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Osteoarthritis	12587	11186	9707	8115	6449	4735	3205	1851	661	81
Developmental Dysplasia	359	335	311	269	211	169	116	67	18	4
Avascular Necrosis	246	231	202	177	162	130	94	55	17	2

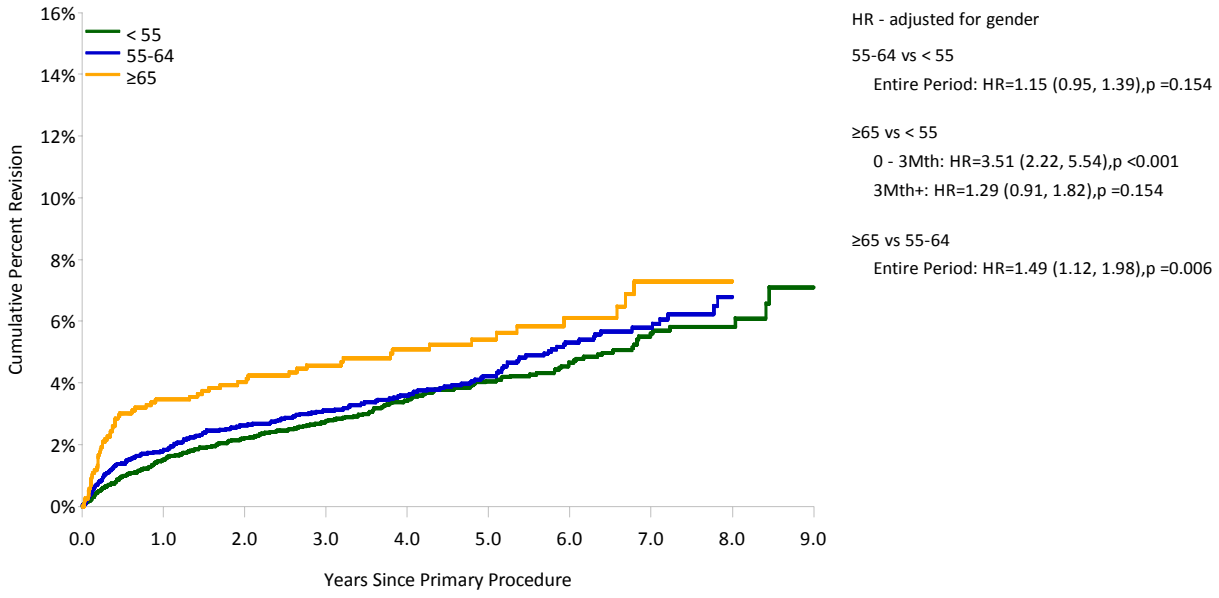
Table HT63: Revision Rates of Primary Total Resurfacing Hip Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
< 55	227	6377	26170	0.87 (0.76, 0.99)
55-64	199	5004	20677	0.96 (0.83, 1.11)
≥65	64	1206	5173	1.24 (0.95, 1.58)
TOTAL	**490**	**12587**	**52020**	**0.94 (0.86, 1.03)**

Table HT64: Yearly Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Age (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
< 55	1.5 (1.2, 1.9)	2.7 (2.3, 3.2)	4.1 (3.5, 4.7)	5.6 (4.8, 6.5)	7.1 (5.6, 9.1)
55-64	1.8 (1.5, 2.2)	3.1 (2.6, 3.6)	4.2 (3.6, 4.9)	5.8 (4.9, 6.8)	
≥65	3.5 (2.6, 4.7)	4.6 (3.5, 6.0)	5.4 (4.2, 7.0)	7.3 (5.5, 9.7)	

Figure HT36: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Age (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
< 55	6377	5633	4846	4054	3207	2390	1649	956	353	52
55-64	5004	4483	3907	3238	2583	1855	1223	705	254	26
≥65	1206	1070	954	823	659	490	333	190	54	3

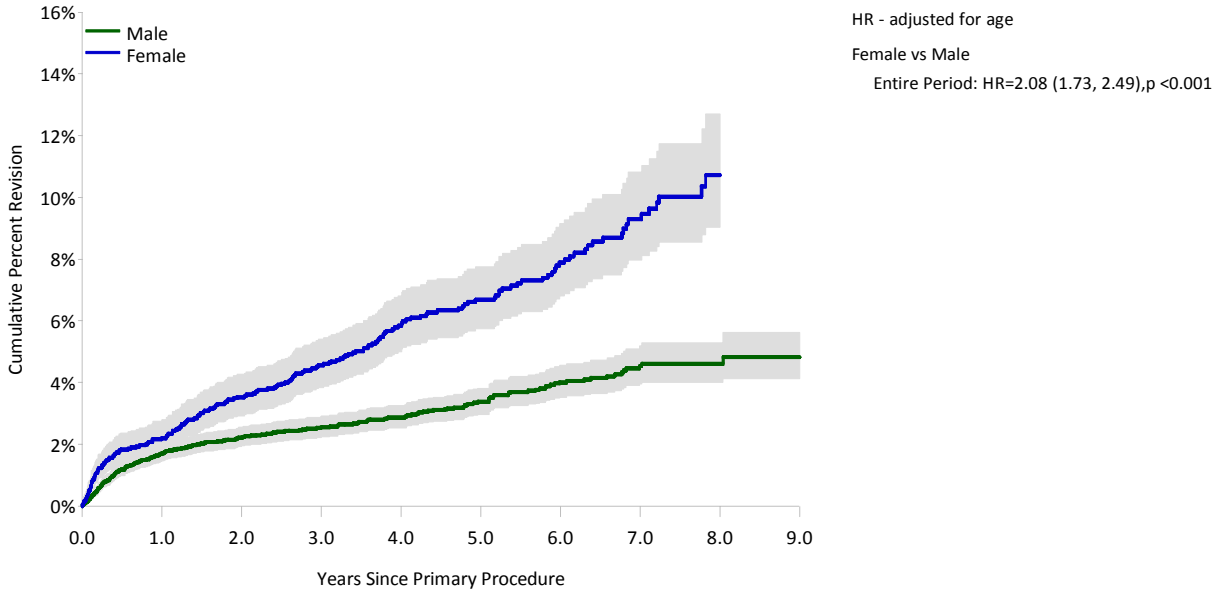
Table HT65: Revision Rates of Primary Total Resurfacing Hip Replacement by Gender (Primary Diagnosis OA)

Gender	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	287	9495	38255	0.75 (0.67, 0.84)
Female	203	3092	13764	1.47 (1.28, 1.69)
TOTAL	**490**	**12587**	**52020**	**0.94 (0.86, 1.03)**

Table HT66: Yearly Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Male	1.7 (1.5, 2.0)	2.5 (2.2, 2.9)	3.4 (3.0, 3.8)	4.5 (4.0, 5.2)	4.8 (4.1, 5.6)
Female	2.2 (1.7, 2.8)	4.6 (3.8, 5.4)	6.7 (5.7, 7.7)	9.3 (8.0, 10.8)	

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



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Male	9495	8348	7177	5964	4686	3422	2290	1308	454	57
Female	3092	2838	2530	2151	1763	1313	915	543	207	24

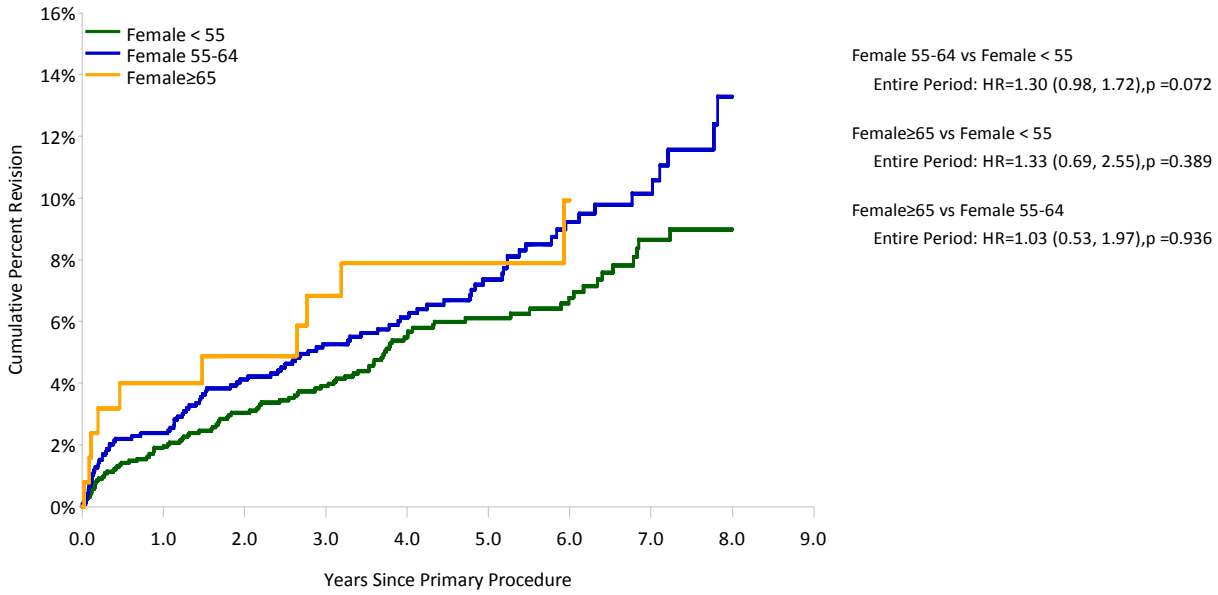
Table HT67: Revision Rates of Primary Total Resurfacing Hip Replacement by Age and Gender (Primary Diagnosis OA)

Gender	Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	< 55	125	4602	18386	0.68 (0.57, 0.81)
	55-64	108	3814	15277	0.71 (0.58, 0.85)
	≥65	54	1079	4593	1.18 (0.88, 1.53)
Female	< 55	102	1775	7785	1.31 (1.07, 1.59)
	55-64	91	1190	5400	1.69 (1.36, 2.07)
	≥65	10	127	580	1.73 (0.83, 3.17)
TOTAL		**490**	**12587**	**52020**	**0.94 (0.86, 1.03)**

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

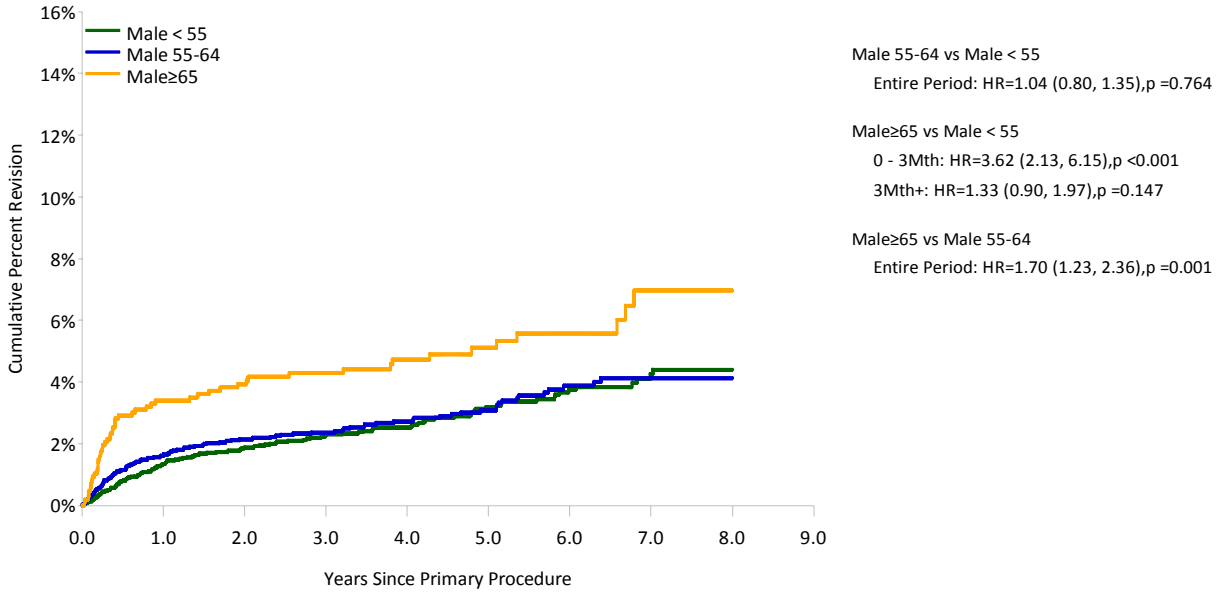
Gender	Age	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Male	< 55	1.4 (1.1, 1.7)	2.3 (1.8, 2.8)	3.2 (2.6, 3.9)	4.3 (3.5, 5.2)	
	55-64	1.7 (1.3, 2.1)	2.4 (1.9, 2.9)	3.1 (2.5, 3.8)	4.1 (3.3, 5.1)	
	≥65	3.4 (2.5, 4.7)	4.3 (3.2, 5.7)	5.1 (3.9, 6.8)	7.0 (5.1, 9.5)	
Female	< 55	2.0 (1.4, 2.7)	3.9 (3.1, 5.0)	6.1 (5.0, 7.5)	8.6 (6.9, 10.8)	
	55-64	2.4 (1.6, 3.4)	5.3 (4.1, 6.8)	7.4 (5.9, 9.2)	10.1 (8.1, 12.7)	
	≥65	4.0 (1.7, 9.3)	6.8 (3.5, 13.2)	7.9 (4.2, 14.7)		

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



Number at Risk		0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Female	< 55	1775	1622	1442	1218	971	723	511	308	117	16
	55-64	1190	1104	984	842	716	531	360	207	82	8
	≥65	127	112	104	91	76	59	44	28	8	0

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



Number at Risk		0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Male	< 55	4602	4011	3404	2836	2236	1667	1138	648	236	36
	55-64	3814	3379	2923	2396	1867	1324	863	498	172	18
	≥65	1079	958	850	732	583	431	289	162	46	3

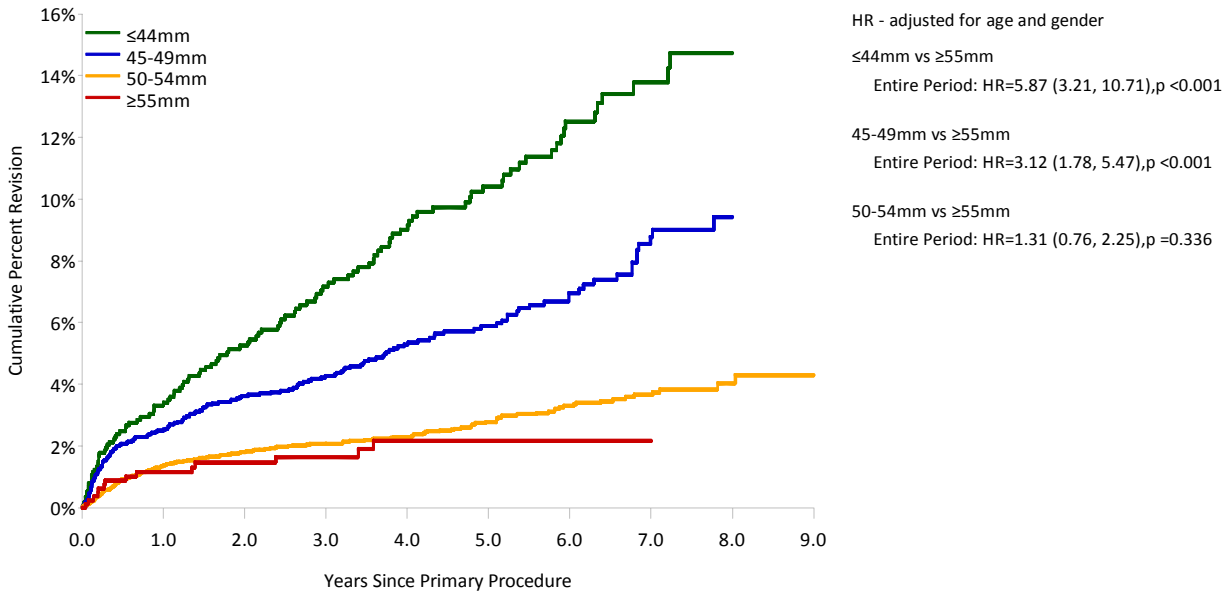
Table HT69: Revision Rates of Primary Total Resurfacing Hip Replacement by Head Size (Primary Diagnosis OA)

Head Size	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
≤44mm	116	1139	5077	2.28 (1.89, 2.74)
45-49mm	167	3083	12291	1.36 (1.16, 1.58)
50-54mm	193	7543	31736	0.61 (0.53, 0.70)
≥55mm	14	822	2917	0.48 (0.26, 0.81)
TOTAL	**490**	**12587**	**52020**	**0.94 (0.86, 1.03)**

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

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
≤44mm	3.4 (2.5, 4.6)	7.2 (5.7, 8.9)	10.4 (8.6, 12.6)	13.8 (11.4, 16.7)	
45-49mm	2.5 (2.0, 3.2)	4.3 (3.6, 5.1)	5.9 (5.0, 6.9)	8.8 (7.3, 10.5)	
50-54mm	1.4 (1.1, 1.7)	2.1 (1.8, 2.4)	2.8 (2.4, 3.2)	3.7 (3.1, 4.3)	4.3 (3.5, 5.3)
≥55mm	1.1 (0.6, 2.2)	1.6 (0.9, 2.9)	2.2 (1.3, 3.7)	2.2 (1.3, 3.7)	

Figure HT40: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Head Size (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
≤44mm	1139	1035	917	761	639	505	367	209	92	12
45-49mm	3083	2733	2334	1914	1482	1069	699	409	165	13
50-54mm	7543	6736	5893	4998	3998	2942	1990	1130	372	50
≥55mm	822	682	563	442	330	219	149	103	32	6

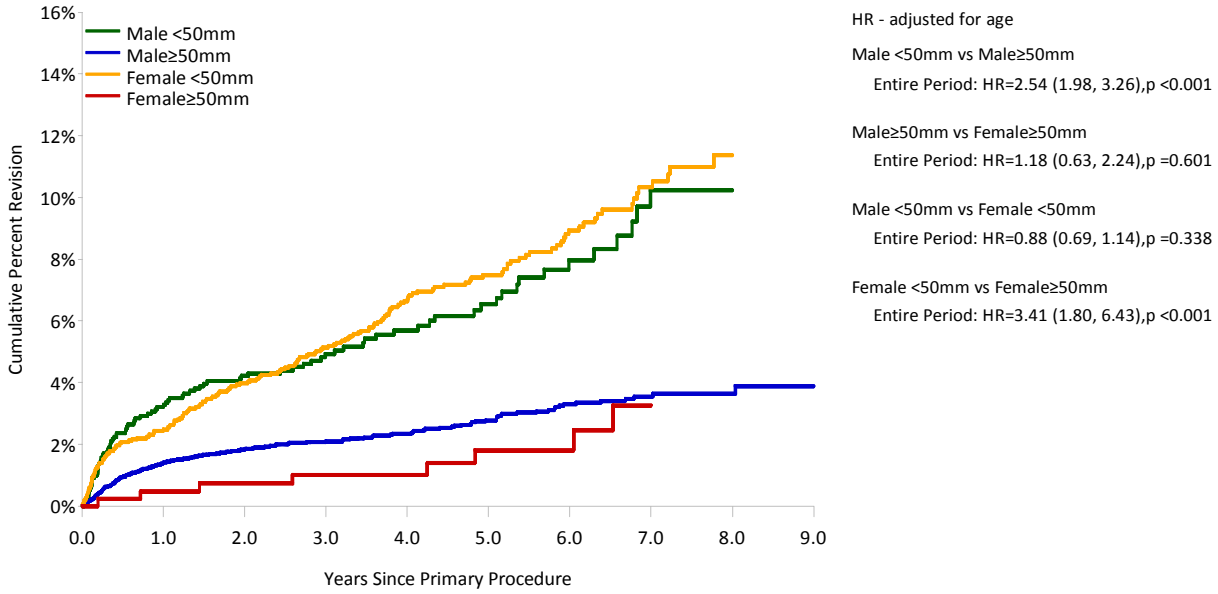
Table HT71: Revision Rates of Primary Total Resurfacing Hip Replacement by Gender and Head Size (Primary Diagnosis OA)

Gender	Head Size	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	<50mm	90	1555	5693	1.58 (1.27, 1.94)
	≥50mm	197	7940	32563	0.60 (0.52, 0.70)
Female	<50mm	193	2667	11675	1.65 (1.43, 1.90)
	≥50mm	10	425	2090	0.48 (0.23, 0.88)
TOTAL		**490**	**12587**	**52020**	**0.94 (0.86, 1.03)**

Table HT72: 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	7 Yrs	9 Yrs
Male	<50mm	3.3 (2.5, 4.3)	4.9 (3.9, 6.2)	6.5 (5.2, 8.2)	10.2 (7.9, 13.3)	
	≥50mm	1.4 (1.2, 1.7)	2.1 (1.8, 2.4)	2.8 (2.4, 3.2)	3.5 (3.0, 4.2)	3.9 (3.2, 4.7)
Female	<50mm	2.5 (1.9, 3.1)	5.1 (4.3, 6.1)	7.5 (6.4, 8.7)	10.3 (8.8, 12.1)	
	≥50mm	0.5 (0.1, 1.9)	1.0 (0.4, 2.7)	1.8 (0.8, 4.1)	3.3 (1.5, 6.9)	

Figure HT41: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender and Head Size (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Male	<50mm	1555	1333	1093	853	647	478	303	167	78	3
	≥50mm	7940	7015	6084	5111	4039	2944	1987	1141	376	54
Female	<50mm	2667	2435	2158	1822	1474	1096	763	451	179	22
	≥50mm	425	403	372	329	289	217	152	92	28	2

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

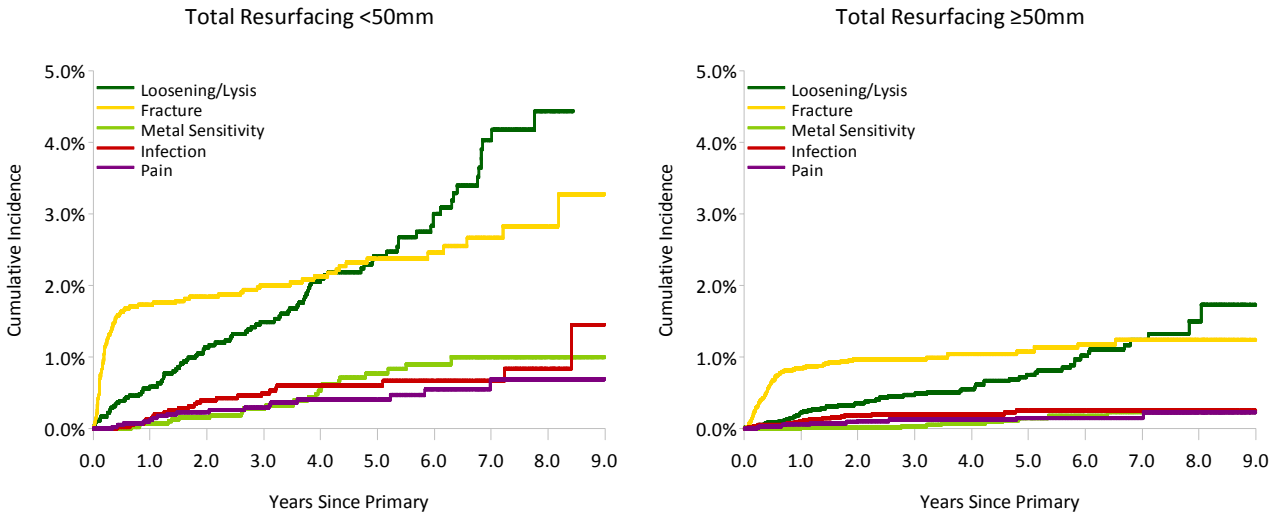


Table HT73: Revision Rates of Primary Total Resurfacing Hip Replacement

Head Component	Acetabular Component	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
ASR	ASR	86	1167	3862	2.23 (1.78, 2.75)
Adept	Adept	4	359	843	0.47 (0.13, 1.22)
BHR	BHR	322	9056	42655	0.75 (0.67, 0.84)
Bionik	Bionik	9	175	327	2.75 (1.26, 5.23)
Cormet	Cormet	22	319	1229	1.79 (1.12, 2.71)
Cormet HAP Bi-Coated	Cormet	12	234	702	1.71 (0.88, 2.99)
Durom	Durom	52	813	2963	1.76 (1.31, 2.30)
Icon	Icon	2	103	295	0.68 (0.08, 2.45)
Mitch TRH	Mitch TRH	11	728	1249	0.88 (0.44, 1.58)
Recap	Recap	9	176	406	2.22 (1.01, 4.21)
Other (5)		19	177	889	2.14 (1.29, 3.34)
TOTAL		**548**	**13307**	**55420**	**0.99 (0.91, 1.08)**

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

Table HT74: Yearly Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement

Head Component	Acetabular Component	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
ASR	ASR	3.4 (2.5, 4.7)	6.1 (4.8, 7.7)	10.9 (8.7, 13.6)		
Adept	Adept	0.6 (0.1, 2.2)	1.4 (0.5, 3.7)			
BHR	BHR	1.5 (1.3, 1.8)	2.5 (2.2, 2.9)	3.5 (3.1, 4.0)	4.9 (4.4, 5.5)	6.2 (5.2, 7.4)
Bionik	Bionik	3.8 (1.7, 8.4)	6.6 (3.2, 13.6)			
Cormet	Cormet	1.9 (0.9, 4.2)	4.8 (2.7, 8.4)	6.0 (3.5, 10.2)	12.8 (8.0, 20.1)	
Cormet HAP Bi-Coated	Cormet	2.3 (0.9, 5.3)	4.9 (2.6, 8.9)			
Durom	Durom	3.3 (2.2, 4.8)	5.2 (3.8, 7.0)	7.6 (5.7, 10.0)		
Icon	Icon	1.0 (0.1, 6.8)	2.1 (0.5, 8.2)			
Mitch TRH	Mitch TRH	1.2 (0.6, 2.4)	2.1 (1.1, 4.0)			
Recap	Recap	3.6 (1.6, 7.9)	6.0 (3.2, 11.4)			
Other (5)		5.7 (3.1, 10.3)	8.1 (4.9, 13.3)	10.0 (6.3, 15.6)		

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

KNEE REPLACEMENT

Categories of Knee Replacement

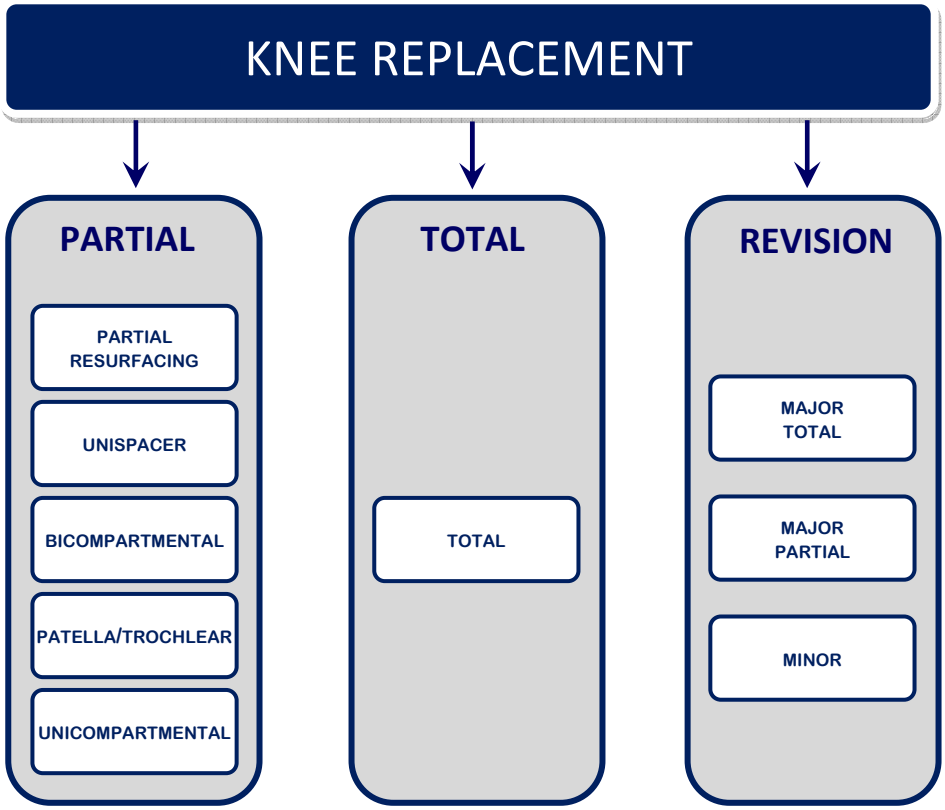
The Registry groups knee replacement into three broad categories, primary partial, primary total and revision knee replacement.

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 prostheses used. The classes of primary partial knee 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 another component is 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 chapter on revision outcomes.



Use of Knee Replacement

This report analyses 289,274 knee replacements reported to the Registry with a procedure date up to and including 31 December 2009. This is an additional 40,675 knee procedures compared to the number reported last year. When considering all procedures currently recorded by the Registry, primary partial knees account for 11.7% of all knee replacement, primary total knees 80.0% and revision knee replacement 8.4% (Table K1).

Table K1: Number of Knee Replacements

Knee Category	Number	Percent
Partial Knee	33703	11.7
Total Knee	231409	80.0
Revision Knee	24162	8.4
TOTAL	**289274**	**100.0**

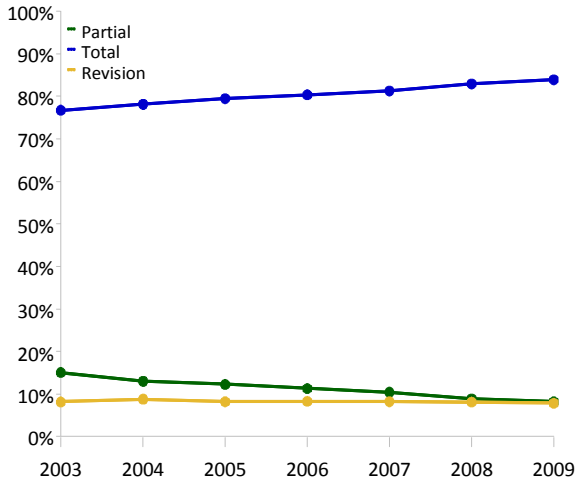
In 2009, the number of knee replacements reported to the Registry increased by 1,179 (3.0%) compared to 2008. During the last 12 months primary partial knees decreased by 5.4%, primary total knees increased by 4.3% and revision knee replacement decreased by 0.5%.

Since 2003, the number of knee replacement procedures has increased by 42.6%. Primary total knee replacement has increased by 55.9% and revision knee replacement 37.2%. Primary partial knee replacement has declined by 22.5%.

In 2009, primary total knee replacement accounted for 83.9% of all knee replacement procedures. This has increased from 76.8% in 2003. Primary partial knee replacement decreased from 15.1% in 2003 to 8.2% in 2009 (Figure K1).

The proportion of revision knee procedures has declined from a peak of 8.8% in 2004 to 7.9% in 2009. This equates to 378 less revision procedures in 2009 compared to what would have been the case if the proportion of revision procedures had not declined from 8.8%.

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 Hip and Knee Arthroplasty' available on the Registry website, www.dmac.adelaide.edu.au/aoanjrr/publications.jsp.

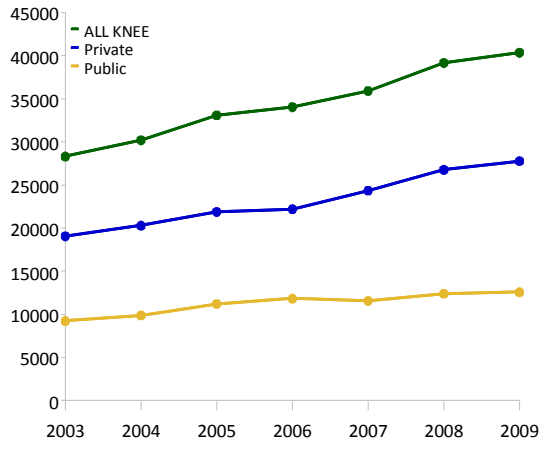
Public and Private Sector

More than two thirds of all knee replacement procedures reported to the Registry have been undertaken in private hospitals (68.8% in 2009).

There were 27,778 private sector knee replacements reported for 2009, an increase of 3.7% compared to 2008. In the public sector, there were 12,586 knee replacements, an increase of 1.4% compared to 2008.

Since 2003, knee replacement in the private sector has increased by 45.6% compared to 36.2% in the public sector (Figure K2).

Figure K2: Knee Replacement by Hospital Sector



There were 2,759 private sector primary partial knee replacements reported for 2009, a decrease of 2.5% compared to 2008. In the public sector, there were 547 partial knee replacements, a decrease of 18.0% compared to 2008. Since 2003, primary partial knee replacement in the private sector has decreased by 19.0% compared to 36.5% in the public sector.

In 2009, 22,822 private sector primary total knee replacements were reported, an increase of 5.3% compared to 2008. In the public sector, there were 11,062 primary total knee replacements, an increase of 2.2% compared to 2008. Since 2003, primary total knee replacement in the private sector has increased by 62.2% compared to 44.4% in the public sector.

There were 2,197 private sector revision knee replacements reported for 2009, a decrease of 3.5% compared to 2008. In the public sector, there were 977 revision knee replacements, an increase of 6.9% compared to 2008. Since 2003, revision knee replacement in the private sector has increased by 37.7% compared to 36.1% 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 94.6% of all partial knee replacements. Patella/trochlear replacement (4.5%) 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	134	0.4
Unispacer	40	0.1
Bicompartmental	126	0.4
Patella/Trochlear	1519	4.5
Unicompartmental	31884	94.6
TOTAL	**33703**	**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 Hip and 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	19	134	309	6.15 (3.70, 9.60)
Unispacer	29	40	99	29.16 (19.53, 41.88)
Bicompartmental	9	126	181	4.98 (2.28, 9.46)
Patella/Trochlear	172	1519	5221	3.29 (2.82, 3.83)
Unicompartmental	2445	31884	134456	1.82 (1.75, 1.89)
TOTAL	**2674**	**33703**	**140267**	**1.91 (1.83, 1.98)**

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

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Partial Resurfacing	6.5 (3.3, 12.6)	16.7 (10.8, 25.6)			
Unispacer	42.5 (29.0, 59.2)	67.5 (53.0, 81.2)	67.5 (53.0, 81.2)		
Bicompartmental	6.3 (3.0, 12.8)				
Patella/Trochlear	2.8 (2.0, 3.8)	8.7 (7.2, 10.5)	15.1 (12.8, 17.7)	22.6 (19.1, 26.5)	25.1 (20.8, 30.0)
Unicompartmental	2.2 (2.1, 2.4)	6.1 (5.8, 6.4)	8.6 (8.3, 9.0)	11.4 (10.9, 11.9)	13.4 (12.6, 14.2)

Partial Resurfacing

The Registry has data on 134 procedures. This has increased by 21 procedures compared to the number reported last year. The use of partial resurfacing has declined each year for the last three years.

The most common reason reported for undertaking a partial resurfacing procedure is osteoarthritis (89.6%). The majority of procedures have been on patients aged less than 55 years (75.4%). There has been an even gender distribution.

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

Of the 134 procedures 118 had one cap implanted (femoral 96, patellar 8, tibial 6, trochlear 6 and unknown 2). There have been 14 partial resurfacings with two caps implanted (femoral/trochlear and patella 11, femoral and patellar 1 and where both caps were used on the femoral articular surface 2). Three caps were implanted in two procedures, both had caps to the femoral, patellar and trochlear articular surfaces.

The cumulative percent revision of partial resurfacing procedures undertaken for osteoarthritis is 6.4% at one year and 17.9% at three years (Table KP4 and Figure KP1).

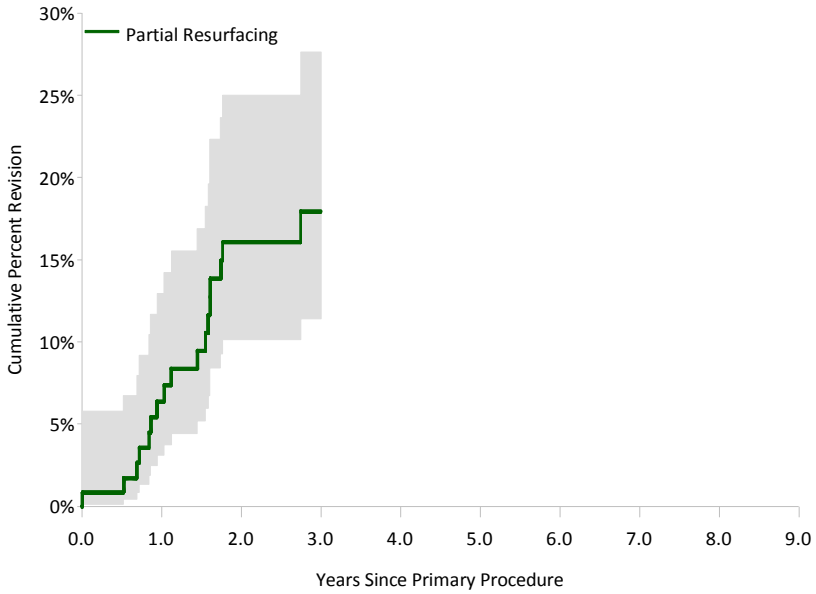
The main reasons for revision are progression of disease (47.4%), loosening (26.3%) and pain (10.5%).

Most primary partial resurfacings are revised to either unicompartmental (36.8%) or total knee replacement (36.8%). In 15.8% of revisions another partial resurfacing prosthesis was used.

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

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Partial Resurfacing	6.4 (3.1, 12.9)	17.9 (11.4, 27.6)			

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



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Partial Resurfacing	120	96	69	41	9	0	0	0	0	0

Unispacer

There have been 40 unispacer procedures reported to the Registry. This is one more than last year however the additional procedure was a late notification of a procedure undertaken in 2004. 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 64 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. At three years, 58.1% of Zimmer UniSpacer prostheses were revised (Tables KP5 and KP6 and Figure KP2).

The main reason for revision was pain (24.1%), followed by loosening, progression of disease and synovitis.

Most unispacer procedures were revised to a unicompartmental knee replacement (65.5%) or a total knee (20.7%). The remainder of the revisions involved a further unispacer replacement.

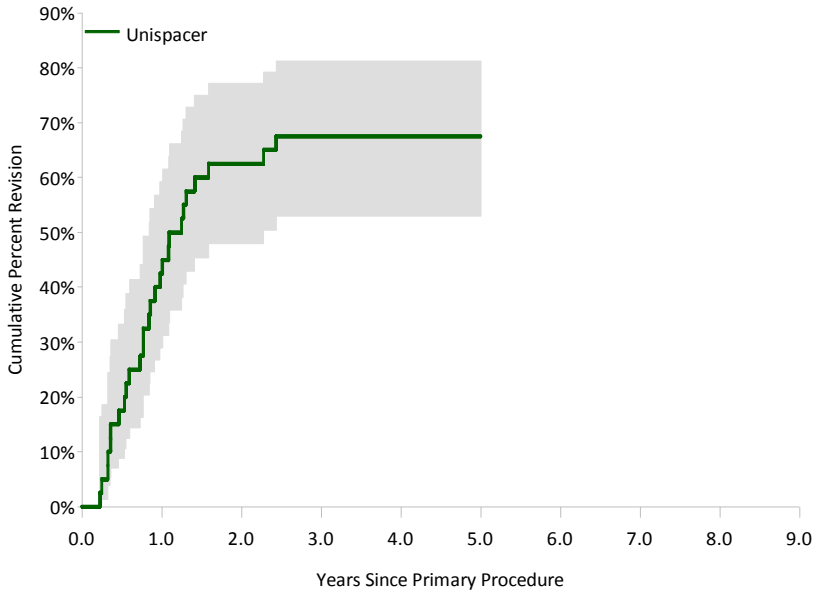
Table KP5: Revision Rates of Primary Unispacer Knee Replacement

Unispacer	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
InterCushion	9	9	8	110.76 (50.64, 210.3)
UniSpacer	20	31	91	21.90 (13.38, 33.82)
Primary Unispacer	**29**	**40**	**99**	**29.16 (19.53, 41.88)**

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

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 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	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Unispacer	40	23	15	13	13	12	4	0	0	0

Bicompartmental

The Registry has data on 126 bicompartmental procedures, an additional 36 procedures compared to the last report.

The principal diagnosis for bicompartmental knee replacement is osteoarthritis (97.6%). It is used more frequently in females (58.7%) and 50.8% of patients are aged less than 65 years at the time of surgery.

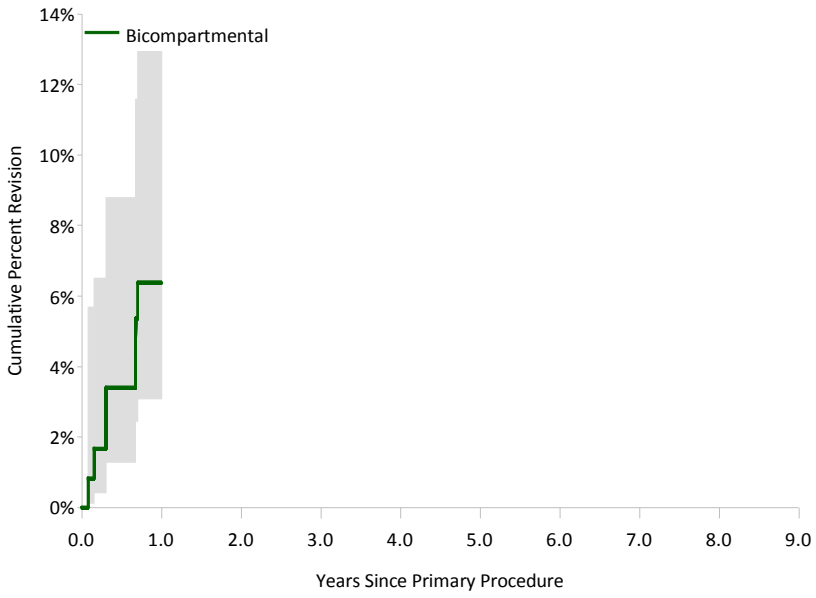
The bicompartmental knee is a single company product. One femoral component, the Journey Deuce, has been combined with two different tibial components the Journey (14.3%) and the Journey Deuce (84.9%). Most have been used with a patellar replacement (79.4%).

The cumulative percent revision of bicompartmental knee replacement at one year is 6.4% (Table KP7 and Figure KP3). Patellofemoral pain was the main reason for revision (55.6%). Eight of the nine revisions involved the addition of a patellar prosthesis only. One procedure was 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	7 Yrs	9 Yrs
Bicompartmental	6.4 (3.1, 12.9)				

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



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Bicompartmental	123	84	34	3	0	0	0	0	0	0

Patella/Trochlear

Demographics

There have been 1,519 patella/trochlear procedures reported to the Registry, an additional 227 procedures compared to the last report.

The principal diagnosis for this procedure is osteoarthritis (98.7%). It is more common in females (75.4%) and is usually undertaken on patients less than 65 years of age (66.8%) (Figures KP4 and KP5).

Figure KP4: Primary Patella/Trochlear Knee Replacement by Gender

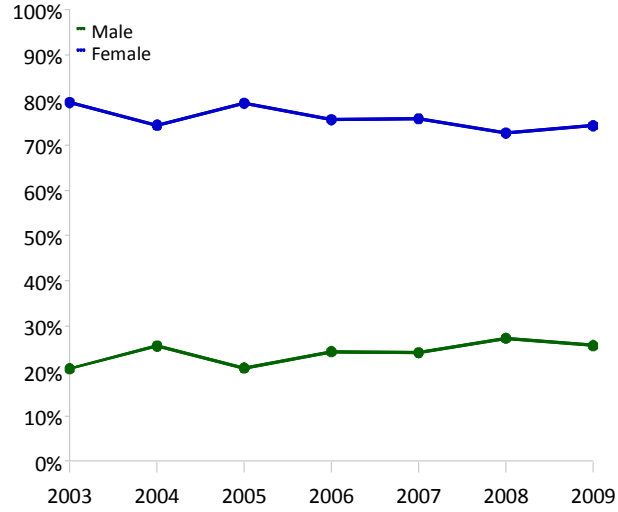
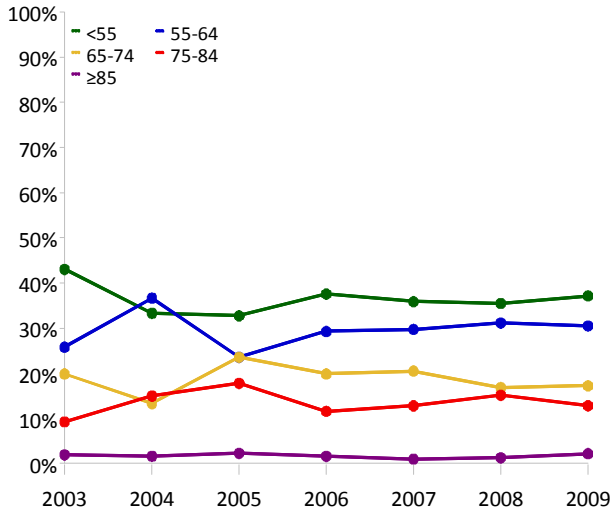


Figure KP5: Primary Patella/Trochlear Knee Replacement by Age



In 2009, seven different patellar/trochlear prostheses were used, the four most common were the Avon, RBK, Competitor and Gender Solutions. The Gender Solutions prosthesis was reported for the first time in 2009. The LCS, along with the Avon, was the most common in 2008, however in 2009, the LCS declined to the fifth most used prosthesis (Table KP8).

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

2003		2006		2007		2008		2009	
Model	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**
LCS	56	Avon	67	LCS	78	Avon	66	Avon	55
Avon	43	LCS	65	Avon	51	LCS	66	RBK	50
Lubinus Patella Glide	29	RBK	37	RBK	30	Competitor	57	Competitor	42
Themis	13	Competitor	5	Competitor	27	RBK	37	Gender Solutions	42
MOD III	9	MOD III	3	Vanguard	4	Vanguard	5	LCS	32
RBK	1	Themis	3	MOD III	2			Lubinus Patella Glide	3
		Lubinus Patella Glide	1	Themis	2			Vanguard	2
				Lubinus Patella Glide	1				
Most Used									
(6) 100.0%	151	(7) 100.0%	181	(8) 100.0%	195	(5) 100.0%	231	(7) 100.0%	226

Outcome

The cumulative percent revision at seven years for primary patella/trochlear knee replacement undertaken for osteoarthritis is 22.4% (Table KP9 and Figure KP6).

Progression of disease (34.9%) is the most common reason for revision followed by loosening (21.5%) and pain (11.0%) (Table KP10).

When a primary patella/trochlear procedure is revised it is usually revised to a total knee replacement (73.8%) (Table KP11).

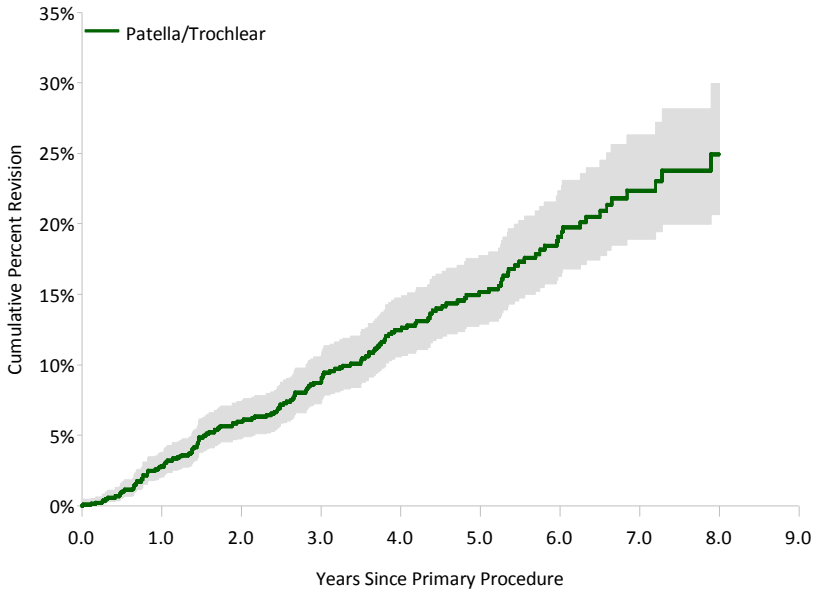
Age and gender are risk factors for revision. The risk of revision in patients younger than 65 years of age is significantly higher than patents 65 years or older (Tables KP12 and KP13 and Figure KP7). Males have a significantly higher risk of revision compared to females (Tables KP14 and KP15 and Figure KP8).

The outcomes of patella/trochlear prostheses with more than 20 procedures are detailed in Table KP16 and those with more than 100 procedures in Table KP17.

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

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Patella/Trochlear	2.8 (2.0, 3.8)	8.7 (7.2, 10.5)	15.2 (12.9, 17.8)	22.4 (18.9, 26.3)	

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



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Patella/Trochlear	1519	1255	992	778	577	416	255	132	61	22

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

Reason for Revision	Number	Percent
Progression Of Disease	60	34.9
Loosening/Lysis	37	21.5
Pain	19	11.0
Implant Breakage Patella	13	7.6
Patellofemoral Pain	9	5.2
Malalignment	7	4.1
Other	27	15.7
TOTAL	**172**	**100.0**

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

Type of Revision	Number	Percent
TKR (Tibial/Femoral)	127	73.8
Patella Only	34	19.8
Patella/Trochlear Resurfacing	7	4.1
UKR (Uni Tibial/Uni Femoral)	2	1.2
Removal of Prostheses	2	1.2
TOTAL	**172**	**100.0**

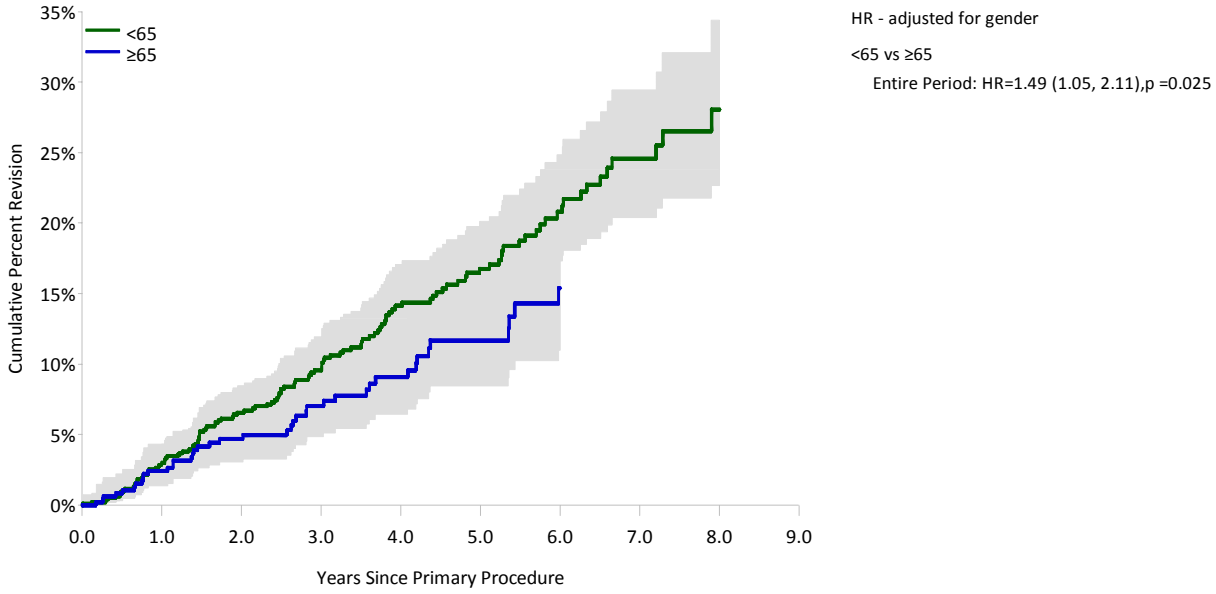
Table KP12: Revision Rates of Patella/Trochlear Knee Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
<65	128	997	3480	3.68 (3.07, 4.37)
≥65	42	502	1680	2.50 (1.80, 3.38)
TOTAL	**170**	**1499**	**5160**	**3.29 (2.82, 3.83)**

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

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
<65	3.0 (2.0, 4.3)	9.6 (7.7, 11.9)	16.8 (13.9, 20.1)	24.6 (20.4, 29.4)	
≥65	2.4 (1.3, 4.3)	7.0 (4.8, 10.1)	11.7 (8.4, 16.1)		

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



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
<65	997	823	653	518	378	289	174	92	44	20
≥65	502	417	330	253	192	123	77	38	15	2

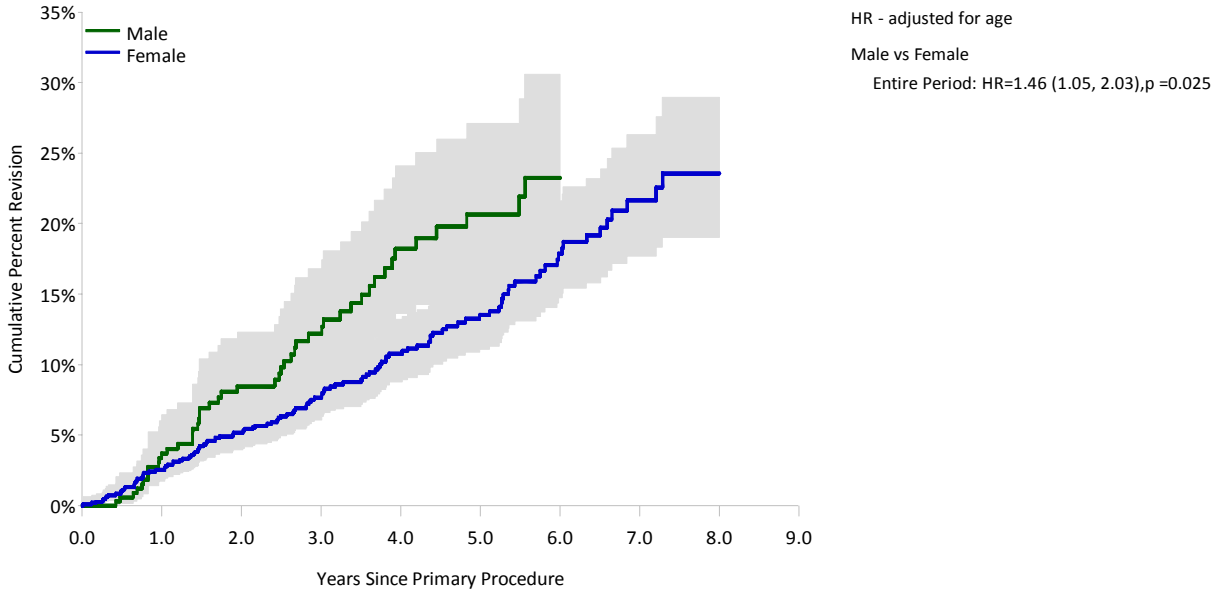
Table KP14: Revision Rates of Patella/Trochlear Knee Replacement by Gender (Primary Diagnosis OA)

Gender	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	50	369	1178	4.24 (3.15, 5.59)
Female	120	1130	3981	3.01 (2.50, 3.60)
TOTAL	**170**	**1499**	**5160**	**3.29 (2.82, 3.83)**

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

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Male	3.7 (2.1, 6.4)	12.2 (8.8, 16.8)	20.7 (15.6, 27.1)		
Female	2.5 (1.7, 3.6)	7.7 (6.1, 9.6)	13.5 (11.1, 16.4)	21.6 (17.7, 26.3)	

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



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Male	369	300	223	170	117	88	53	32	14	7
Female	1130	940	760	601	453	324	198	98	45	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	7	185	440	1.59 (0.64, 3.28)
Avon	Kinemax Plus	34	280	1367	2.49 (1.72, 3.48)
Competitor	Genesis II	2	130	183	1.09 (0.13, 3.95)
Gender Solutions	MBK (Zimmer)	0	39	16	0.00 (0.00, 23.42)
LCS	LCS	68	395	1383	4.92 (3.82, 6.23)
LCS	PFC Sigma	6	32	54	11.07 (4.06, 24.09)
Lubinus Patella Glide	Duracon	12	77	391	3.07 (1.59, 5.36)
Lubinus Patella Glide	Lubinus Patella Glide	11	39	201	5.47 (2.73, 9.78)
MOD III	MOD III	13	64	391	3.33 (1.77, 5.69)
RBK	RBK	11	189	426	2.58 (1.29, 4.62)
Themis	Themis	3	38	193	1.55 (0.32, 4.54)
Other (21)		5	51	176	2.84 (0.92, 6.62)
TOTAL		**172**	**1519**	**5221**	**3.29 (2.82, 3.83)**

Note: Only patella/trochlear prostheses combinations with over 20 procedures have been listed.

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

Resurfacing Trochlear	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Avon	1.6 (0.8, 3.4)	4.9 (3.2, 7.7)	10.0 (7.1, 14.0)	17.9 (12.8, 24.7)	
Competitor	0.0 (0.0, 0.0)				
LCS	4.5 (2.9, 6.9)	12.9 (9.9, 16.9)	22.3 (17.6, 28.0)		
Lubinus Patella Glide	3.4 (1.3, 8.8)	12.3 (7.4, 19.8)	17.4 (11.5, 26.1)		
RBK	2.0 (0.6, 6.0)	6.1 (2.9, 12.8)			
Other (5)	3.8 (1.6, 8.9)	10.0 (5.8, 17.0)	14.0 (8.8, 22.0)		

Note: Only resurfacing trochlear prostheses with over 100 procedures have been listed.

Unicompartmental

Demographics

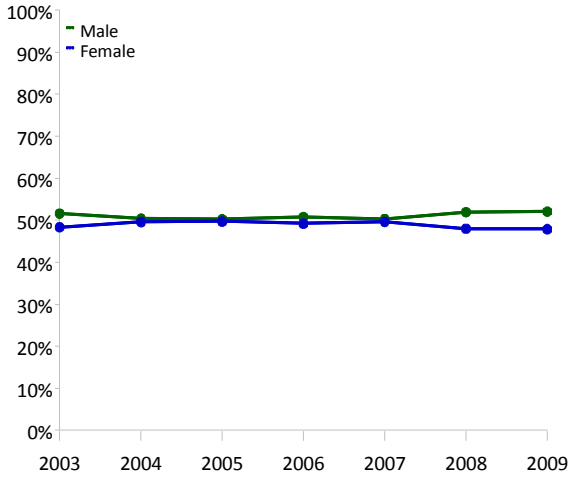
This year the Registry is reporting on 31,884 unicompartmental procedures, an additional 3,062 procedures compared to the last report.

The use of unicompartmental knee replacement continues to decline. The number of procedures reported in 2009 was 5.2% less than 2008 and 26.2% less compared to 2003. Due to the overall increase in other types of knee replacement, the decrease is more apparent when considering the number of unicompartmental knee replacements as a proportion of all knee procedures. In 2003, this proportion was 14.5% reducing to 7.5% in 2009.

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

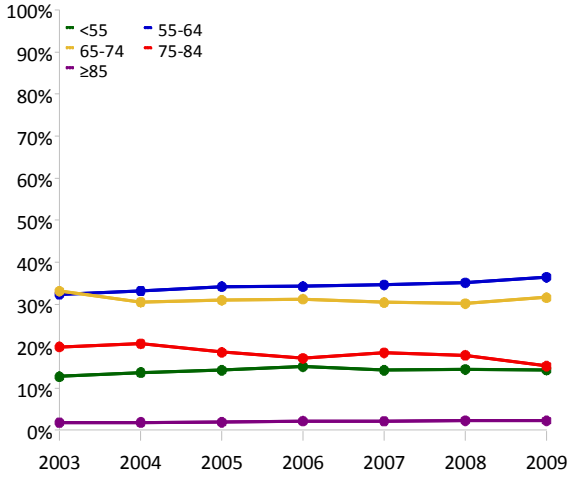
In 2009, similar numbers of males and females underwent unicompartmental knee replacement (males 52.1%). This gender distribution has remained relatively constant since 2003 (Figure KP9).

Figure KP9: Primary Unicompartmental Knee Replacement by Gender



There has been little change in the age distribution apart from a small decline 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 2009, the ten most used prostheses account for 87.6% of all unicompartmental prostheses. This is similar to the proportion reported in recent years but almost 10% less than 2003. In that year, 16 prostheses were used compared to 24 in 2009.

The Oxford 3, ZUK and the Unix were the most used prostheses in 2009. The Oxford and the Journey Deuce are listed for the first time in the ten most used prostheses table (Table KP18). The Oxford is a cementless unicompartmental knee replacement introduced in 2007 and is reported separately from the Oxford 3.

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

2003		2006		2007		2008		2009	
Model	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**
Oxford 3	1366	Oxford 3	1054	Oxford 3	962	Oxford 3	943	Oxford 3	788
Repicci	443	Unix	351	ZUK	449	ZUK	495	ZUK	465
Pres-Fixed	373	Genesis	290	Unix	364	Unix	358	Unix	349
M/G	352	ZUK	288	Freedom/Active	265	GRU	207	Oxford	224
Allegretto Uni	335	Freedom/Active	281	Genesis	218	Pres-Fixed	179	Journey Deuce	174
GRU	319	Pres-Fixed	256	GRU	214	Freedom/Active	160	Pres-Fixed	168
Genesis	276	GRU	222	Pres-Fixed	199	Genesis	125	Freedom/Active	148
Unix	260	M/G	178	Repicci	172	Repicci	118	Repicci	132
Pres-Mobile	121	Repicci	168	Allegretto Uni	124	Allegretto Uni	101	GRU	126
Endo-Model Sled	101	Endo-Model Sled	144	Endo-Model Sled	114	AMC	93	Allegretto Uni	78
Ten Most Used									
(10) 96.2%	3946	(10) 89.1%	3232	(10) 88.3%	3081	(10) 87.1%	2779	(10) 87.6%	2652
Remainder									
(6) 3.8%	157	(11) 10.9%	396	(16) 11.7%	409	(15) 12.9%	413	(14) 12.4%	374
TOTAL									
(16) 100.0%	4103	(21) 100.0%	3628	(26) 100.0%	3490	(25) 100.0%	3192	(24) 100.0%	3026

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 nine years for primary unicompartmental knee replacement undertaken for osteoarthritis is 13.3% (Table KP19 and Figure KP11).

The main reasons for revision are loosening/lysis (49.6%), progression of disease (19.6%) and pain 12.0%. Most are revised to a total knee replacement (83.1%) (Tables KP20 and KP21).

Age, gender, method of fixation and the type of prostheses affect the rate of revision.

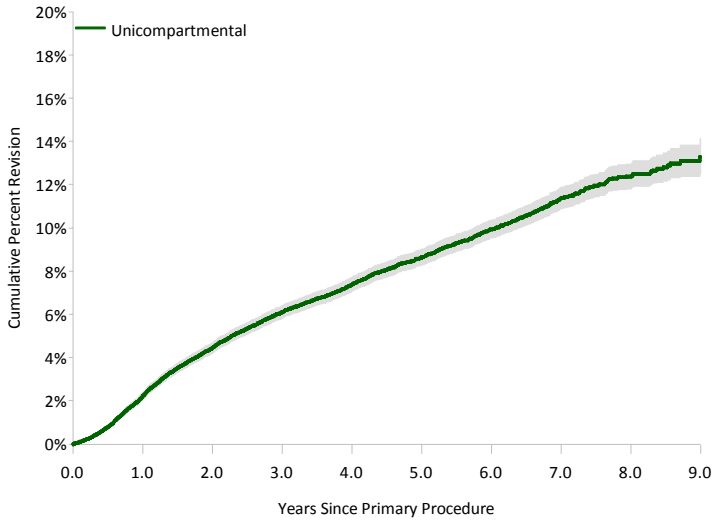
Age is a major risk factor with the risk decreasing with increasing age (Tables KP22 and KP23 and Figure KP12). Females have a higher risk of revision (Tables KP24 and KP25 and Figure KP13). The effect of age on the risk of revision is evident for both males and females (Tables KP26 and KP27 and Figures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

Outcomes of unicompartmental knee prostheses with more than 50 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	7 Yrs	9 Yrs
Unicompartmental	2.2 (2.1, 2.4)	6.1 (5.8, 6.4)	8.6 (8.3, 9.0)	11.4 (10.9, 11.9)	13.3 (12.5, 14.1)

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



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Unicompartmental	31884	28091	24201	20282	16471	12624	9053	5410	2247	454

Table KP20: Primary Unicompartmental Knee Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	1212	49.6
Progression Of Disease	478	19.6
Pain	293	12.0
Infection	113	4.6
Fracture	68	2.8
Wear Tibial	38	1.6
Dislocation	36	1.5
Malalignment	29	1.2
Bearing Dislocation	27	1.1
Other	151	6.2
TOTAL	**2445**	**100.0**

Table KP21: Primary Unicompartmental Knee Replacement by Type of Revision

Type of Revision	Number	Percent
TKR (Tibial/Femoral)	2031	83.1
Uni Insert Only	155	6.3
Uni Tibial Only	131	5.4
Uni Femoral Only	53	2.2
UKR (Uni Tibial/Uni Femoral)	38	1.6
Cement Spacer	20	0.8
Removal of Prostheses	7	0.3
Patella/Trochlear Resurfacing	4	0.2
Reinsertion of Components	3	0.1
Cement Only	2	0.1
Patella Only	1	0.0
TOTAL	**2445**	**100.0**

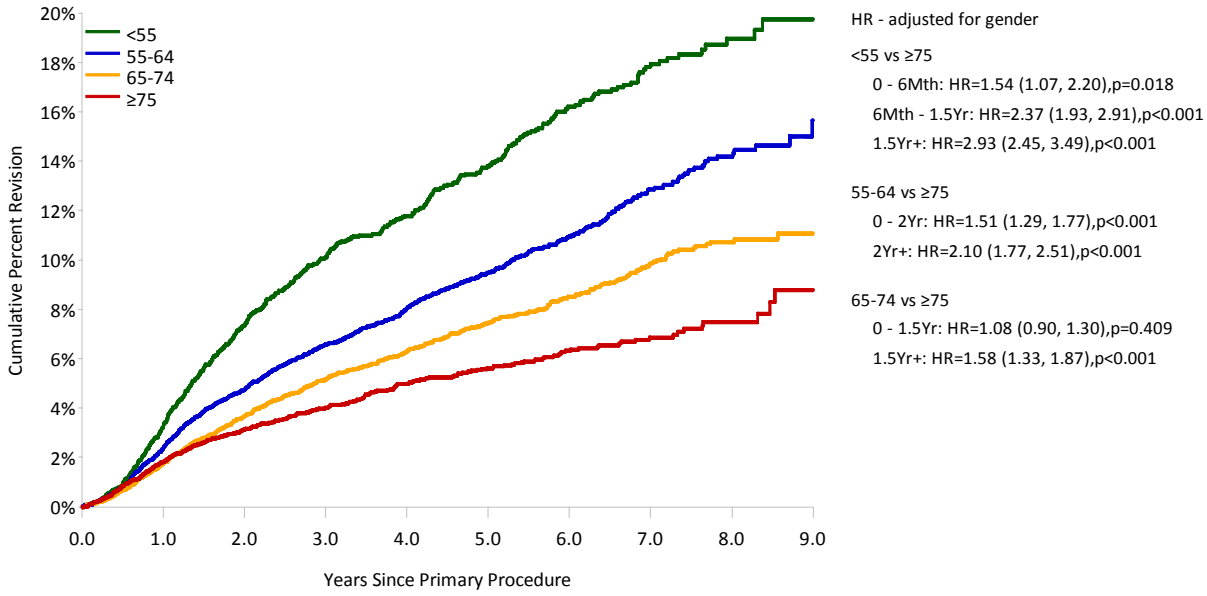
Table KP22: Revision Rates of Primary Unicompartmental Knee Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
<55	539	4424	18021	2.99 (2.74, 3.25)
55-64	883	10532	43456	2.03 (1.90, 2.17)
65-74	669	10032	43715	1.53 (1.42, 1.65)
≥75	320	6538	27613	1.16 (1.04, 1.29)
TOTAL	**2411**	**31526**	**132805**	**1.82 (1.74, 1.89)**

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

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
<55	3.3 (2.8, 3.9)	10.1 (9.2, 11.1)	13.8 (12.6, 15.0)	17.9 (16.4, 19.6)	19.7 (17.8, 21.9)
55-64	2.4 (2.1, 2.7)	6.6 (6.1, 7.1)	9.5 (8.8, 10.2)	12.9 (12.0, 13.8)	15.6 (13.9, 17.6)
65-74	1.8 (1.5, 2.1)	5.2 (4.7, 5.7)	7.5 (6.9, 8.1)	9.8 (9.1, 10.7)	11.1 (10.1, 12.2)
≥75	1.8 (1.5, 2.2)	4.0 (3.5, 4.6)	5.6 (5.0, 6.3)	6.9 (6.1, 7.7)	8.8 (7.2, 10.7)

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



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
<55	4424	3856	3264	2700	2154	1636	1175	727	318	69
55-64	10532	9194	7871	6575	5325	4012	2837	1660	681	131
65-74	10032	8896	7745	6568	5376	4218	3123	1895	806	164
≥75	6538	5824	5035	4194	3407	2586	1795	1048	405	79

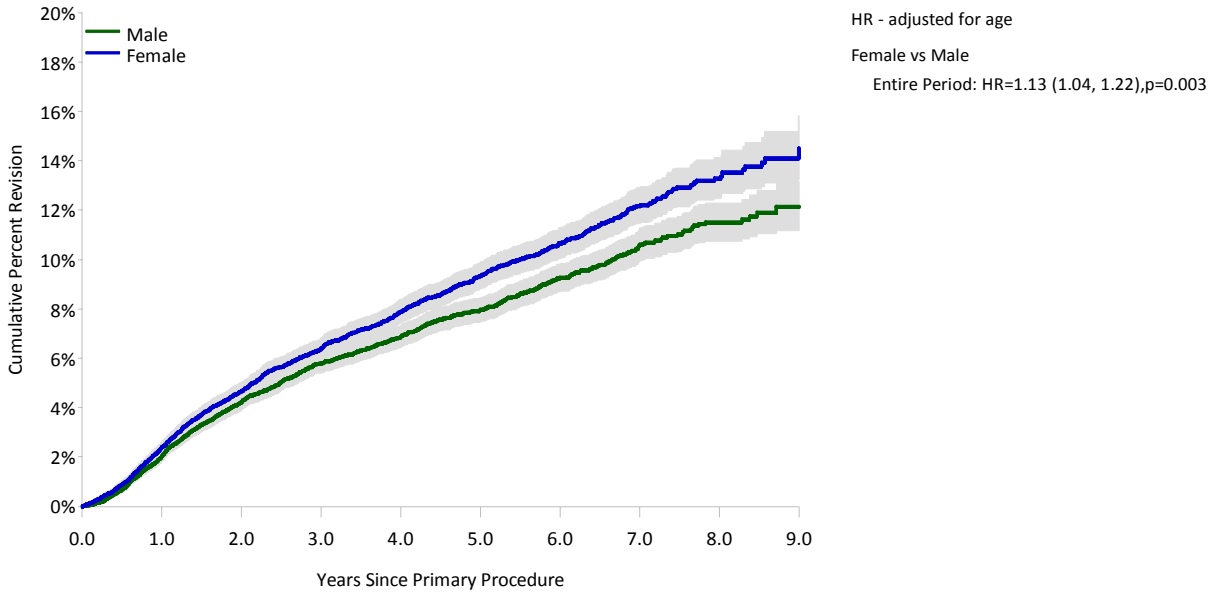
Table KP24: Revision Rates of Primary Unicompartmental Knee Replacement by Gender (Primary Diagnosis OA)

Gender	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	1144	16206	67963	1.68 (1.59, 1.78)
Female	1267	15320	64842	1.95 (1.85, 2.06)
TOTAL	**2411**	**31526**	**132805**	**1.82 (1.74, 1.89)**

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

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Male	2.0 (1.8, 2.3)	5.8 (5.4, 6.2)	8.0 (7.5, 8.5)	10.6 (10.0, 11.3)	12.1 (11.2, 13.2)
Female	2.4 (2.2, 2.7)	6.4 (6.0, 6.8)	9.3 (8.8, 9.9)	12.2 (11.5, 12.9)	14.5 (13.2, 15.8)

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



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Male	16206	14249	12226	10218	8282	6372	4596	2758	1142	225
Female	15320	13521	11689	9819	7980	6080	4334	2572	1068	218

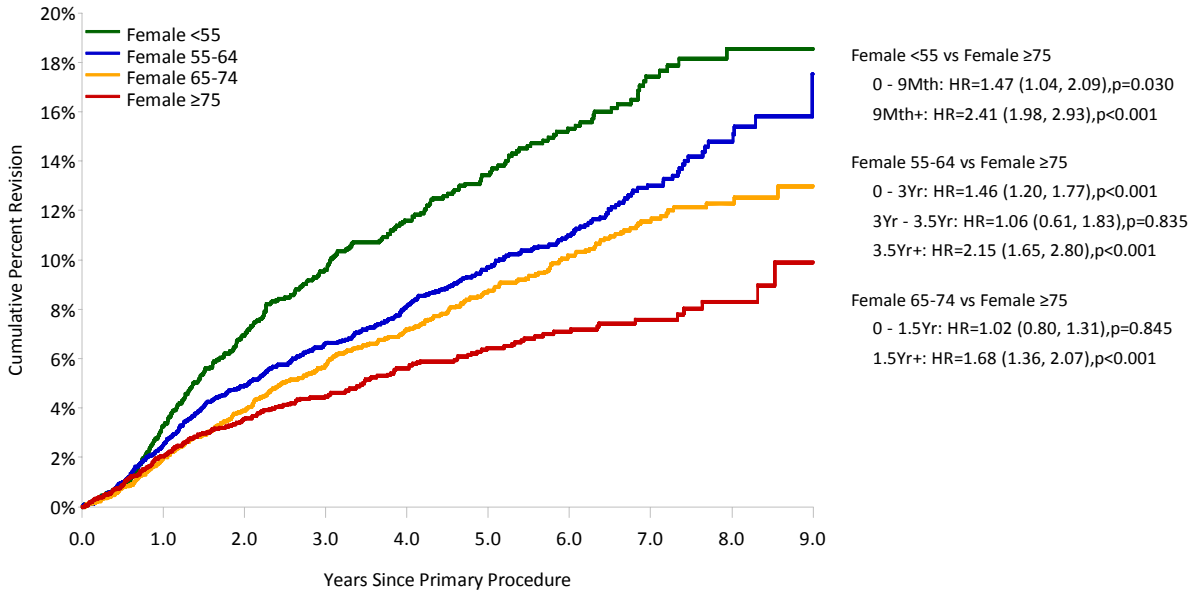
Table KP26: Revision Rates of Primary Unicompartmental Knee Replacement by Gender and Age (Primary Diagnosis OA)

Gender	Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	<55	241	1897	7661	3.15 (2.76, 3.57)
	55-64	449	5451	22665	1.98 (1.80, 2.17)
	65-74	312	5470	23685	1.32 (1.18, 1.47)
	≥75	142	3388	13953	1.02 (0.86, 1.20)
Female	<55	298	2527	10360	2.88 (2.56, 3.22)
	55-64	434	5081	20791	2.09 (1.90, 2.29)
	65-74	357	4562	20030	1.78 (1.60, 1.98)
	≥75	178	3150	13660	1.30 (1.12, 1.51)
TOTAL		**2411**	**31526**	**132805**	**1.82 (1.74, 1.89)**

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

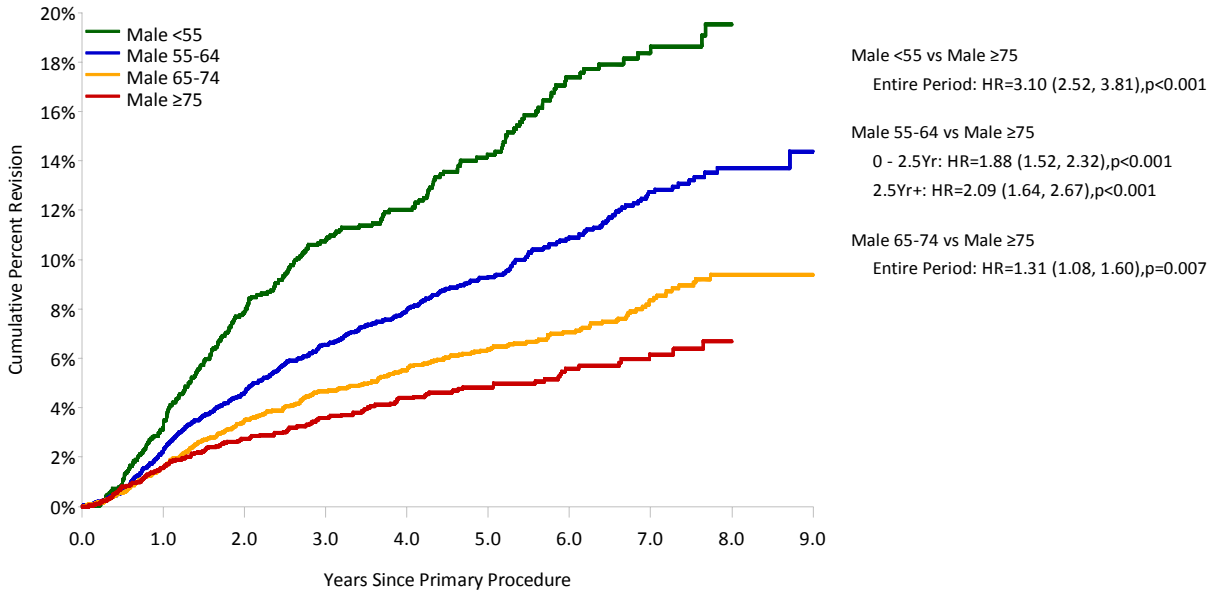
Gender	Age	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Male	<55	3.4 (2.7, 4.4)	10.8 (9.4, 12.4)	14.3 (12.5, 16.2)	18.6 (16.4, 21.2)	
	55-64	2.3 (1.9, 2.8)	6.6 (5.9, 7.3)	9.3 (8.4, 10.3)	12.7 (11.5, 14.1)	14.4 (12.5, 16.5)
	65-74	1.6 (1.3, 2.0)	4.7 (4.1, 5.3)	6.4 (5.6, 7.1)	8.3 (7.4, 9.4)	9.4 (8.2, 10.7)
	≥75	1.6 (1.2, 2.1)	3.6 (3.0, 4.3)	4.8 (4.0, 5.7)	6.2 (5.1, 7.4)	
Female	<55	3.3 (2.6, 4.1)	9.6 (8.4, 10.9)	13.4 (12.0, 15.1)	17.4 (15.5, 19.6)	18.5 (16.3, 21.0)
	55-64	2.5 (2.1, 3.0)	6.6 (5.9, 7.4)	9.7 (8.8, 10.7)	13.0 (11.7, 14.4)	17.5 (14.0, 21.8)
	65-74	2.0 (1.6, 2.5)	5.7 (5.0, 6.5)	8.7 (7.8, 9.8)	11.6 (10.4, 12.9)	13.0 (11.4, 14.8)
	≥75	2.1 (1.6, 2.6)	4.5 (3.8, 5.3)	6.4 (5.5, 7.5)	7.6 (6.5, 8.9)	9.9 (7.6, 12.9)

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



Number at Risk		0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Female	<55	2527	2204	1879	1553	1248	938	670	414	194	44
	55-64	5081	4429	3787	3169	2562	1901	1318	756	286	48
	65-74	4562	4057	3560	3019	2458	1928	1429	873	377	82
	≥75	3150	2831	2463	2078	1712	1313	917	529	211	44

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



Number at Risk		0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Male	<55	1897	1652	1385	1147	906	698	505	313	124	25
	55-64	5451	4765	4084	3406	2763	2111	1519	904	395	83
	65-74	5470	4839	4185	3549	2918	2290	1694	1022	429	82
	≥75	3388	2993	2572	2116	1695	1273	878	519	194	35

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	62	612	1959	3.16 (2.43, 4.06)
Allegretto Uni	Allegretto Uni	167	1856	9731	1.72 (1.47, 2.00)
BalanSys Uni	BalanSys Uni Fixed	10	208	584	1.71 (0.82, 3.15)
BalanSys Uni	BalanSys Uni Mobile	28	195	670	4.18 (2.78, 6.04)
Eius	Eius	23	139	568	4.05 (2.57, 6.08)
Endo-Model Sled	Endo-Model Sled	63	915	3526	1.79 (1.37, 2.29)
Freedom PKR/Active	Freedom PKR/Active	59	1096	2925	2.02 (1.54, 2.60)
GCK	GCK	1	106	122	0.82 (0.02, 4.57)
GRU	GRU	100	1725	6597	1.52 (1.23, 1.84)
Genesis	Genesis	177	1779	7498	2.36 (2.03, 2.74)
Genesis	Journey Deuce	2	168	141	1.42 (0.17, 5.14)
HLS Uni Evolution	HLS Uni Evolution	8	138	311	2.57 (1.11, 5.07)
M/G	M/G	137	2041	10694	1.28 (1.08, 1.51)
Natural Knee II	Natural Knee II	22	143	890	2.47 (1.55, 3.74)
Oxford 3	Oxford	2	231	88	2.29 (0.28, 8.25)
Oxford 3	Oxford 3	847	10335	47331	1.79 (1.67, 1.91)
PFC Sigma	PFC Sigma	21	137	1062	1.98 (1.22, 3.02)
Preservation	Preservation-Fixed	194	2255	9676	2.01 (1.73, 2.31)
Preservation	Preservation-Mobile	84	400	2148	3.91 (3.12, 4.84)
Repicci	Repicci	211	2619	13629	1.55 (1.35, 1.77)
Unix	Unix	155	2638	9988	1.55 (1.32, 1.82)
ZUK	ZUK	45	1768	3310	1.36 (0.99, 1.82)
Other (17)		27	380	1011	2.67 (1.76, 3.88)
TOTAL		**2445**	**31884**	**134456**	**1.82 (1.75, 1.89)**

Note: Only prostheses with over 100 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	7 Yrs	9 Yrs
AMC	AMC	4.0 (2.7, 6.0)	10.9 (8.4, 14.1)	13.6 (10.5, 17.5)		
Allegretto Uni	Allegretto Uni	3.1 (2.4, 4.0)	5.6 (4.7, 6.8)	8.0 (6.8, 9.5)	10.8 (9.2, 12.6)	13.6 (11.2, 16.4)
BalanSys Uni	BalanSys Uni Fixed	3.2 (1.4, 7.0)	4.5 (2.3, 8.9)			
BalanSys Uni	BalanSys Uni Mobile	7.2 (4.4, 11.9)	13.7 (9.6, 19.5)			
Eius	Eius	4.5 (2.0, 9.8)	10.9 (6.6, 17.8)	18.5 (12.3, 27.3)		
Endo-Model Sled	Endo-Model Sled	1.4 (0.8, 2.4)	5.1 (3.8, 6.9)	8.7 (6.8, 11.1)		
Freedom PKR/Active	Freedom PKR/Active	1.2 (0.7, 2.1)	6.4 (4.9, 8.3)			
GCK	GCK	1.4 (0.2, 9.2)				
GRU	GRU	1.5 (1.0, 2.2)	5.0 (4.0, 6.3)	6.9 (5.6, 8.5)		
Genesis	Genesis	2.7 (2.0, 3.6)	8.2 (7.0, 9.6)	10.8 (9.3, 12.5)	13.6 (11.6, 16.0)	
Genesis	Journey Deuce	2.1 (0.5, 8.1)				
HLS Uni Evolution	HLS Uni Evolution	4.8 (2.2, 10.4)				
M/G	M/G	1.6 (1.1, 2.3)	4.2 (3.4, 5.2)	6.4 (5.3, 7.6)	8.2 (6.9, 9.8)	9.9 (7.9, 12.4)
Natural Knee II	Natural Knee II	5.6 (2.8, 10.9)	12.0 (7.6, 18.5)	12.0 (7.6, 18.5)	16.1 (10.9, 23.5)	
Oxford 3	Oxford					
Oxford 3	Oxford 3	2.2 (2.0, 2.6)	6.1 (5.6, 6.6)	8.8 (8.2, 9.4)	11.5 (10.7, 12.3)	13.1 (11.9, 14.4)
PFC Sigma	PFC Sigma	2.2 (0.7, 6.6)	6.6 (3.5, 12.2)	8.1 (4.6, 14.1)	14.2 (9.3, 21.4)	
Preservation	Preservation-Fixed	2.5 (1.9, 3.3)	7.2 (6.2, 8.5)	9.3 (8.0, 10.7)	11.8 (10.1, 13.6)	
Preservation	Preservation-Mobile	5.3 (3.5, 7.9)	15.6 (12.4, 19.6)	19.3 (15.7, 23.6)	22.2 (18.2, 26.8)	
Repicci	Repicci	1.5 (1.1, 2.0)	4.2 (3.5, 5.1)	7.3 (6.2, 8.4)	10.4 (9.0, 12.0)	
Unix	Unix	1.9 (1.5, 2.6)	5.3 (4.4, 6.3)	7.1 (6.0, 8.4)	9.5 (8.0, 11.4)	
ZUK	ZUK	1.4 (0.9, 2.2)	4.4 (3.2, 6.0)			
Other (17)		3.6 (1.9, 6.6)	8.7 (5.5, 13.5)	12.9 (8.4, 19.5)	17.6 (11.9, 25.8)	

Note: There is insufficient follow up to report a one year CPR for the Oxford 3/Oxford combination

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 prostheses 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

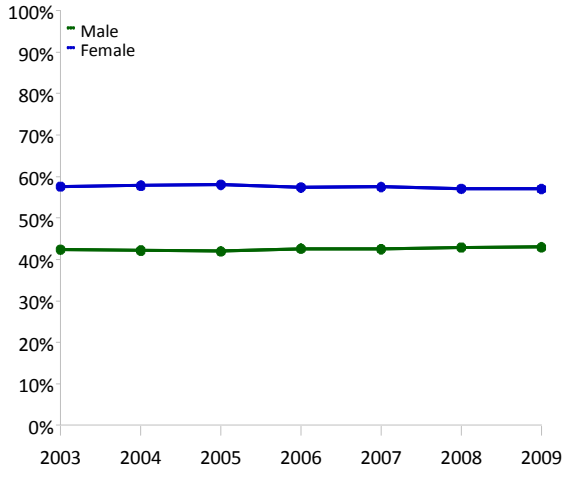
This year the Registry is reporting on 231,409 primary total knee procedures, an additional 34,108 procedures compared to the last report.

The use of primary total knee replacement has increased steadily. In 2009, there were 4.3% more procedures reported than 2008 and 55.9% more than 2003. As a proportion of all knee replacement procedures, primary total knee increased from 76.8% in 2003 to 83.9% in 2009.

As with all other types of primary knee replacement, osteoarthritis is the principal diagnosis for primary total knee replacement (97.1%).

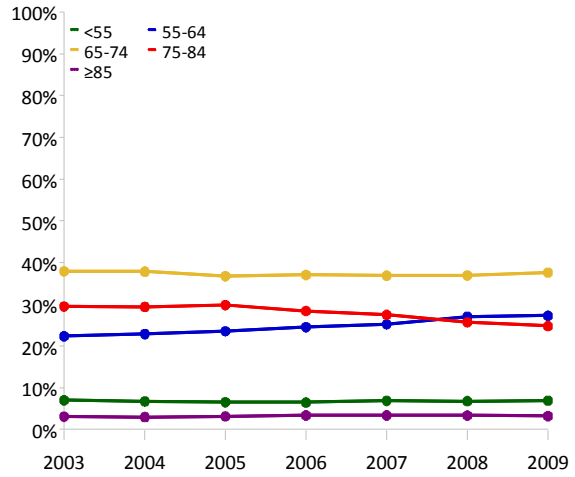
Primary total knee replacement is more common in females (57.3% in 2009). This proportion has remained constant since 2003 (Figure KT1).

Figure KT1: Primary Total Knee Replacement by Gender



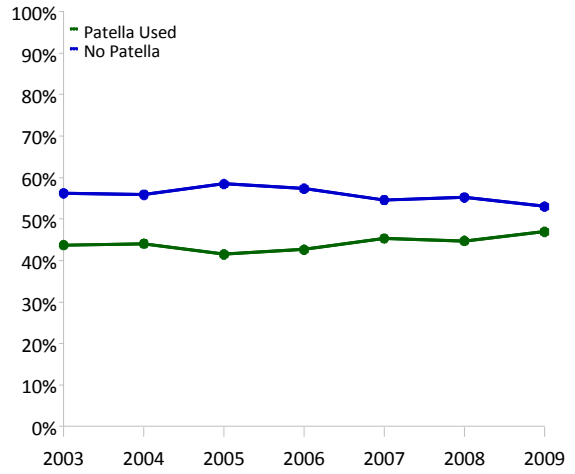
There has been a small increase in the proportion of patients aged 55-64 years (22.4% in 2003 to 27.3% in 2009). The proportion of patients aged 75-84 years has decreased from 29.5% to 24.8% during the same period. The proportion of patients aged less than 55 years is small (7.0% in 2009) and remains unchanged (Figure KT2).

Figure KT2: Primary Total Knee Replacement by Age



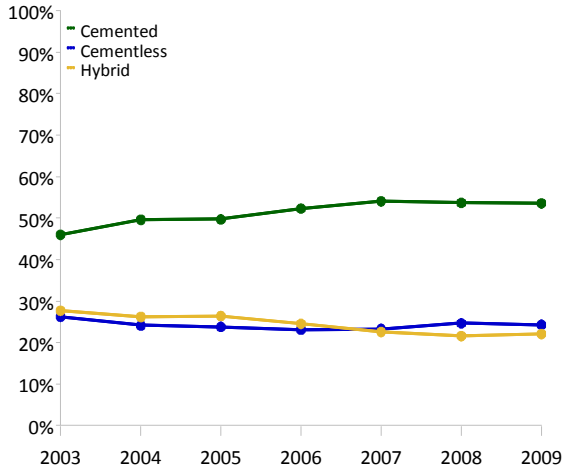
The majority of primary total knee replacements are undertaken without resurfacing the patella (56.1%). Use of patella resurfacing however, has increased from a low of 41.5% in 2005 to 47.0% in 2009 (Figure KT3).

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 53.6% in 2009 (Figure KT4).

Figure KT4: Primary Total Knee Replacement by Fixation



The most used system for primary total knee replacement is based on the femoral prosthesis used. In 2009, this was the Triathlon (13.8%), followed by PFC Sigma (11.4%) and LCS (11.0%) (Table KT1). Each of these systems includes a number of different types of femoral prostheses.

In the previous two years, the Nexgen was the most used femoral prosthesis. The Nexgen included both the Nexgen CR and the Nexgen CR Flex. This year the Registry has reported these prostheses separately. Other Nexgen prostheses that are individually reported include the Nexgen LPS, Nexgen LPS Flex and Nexgen LCCK. In 2009, the use of all Nexgen femoral prostheses combined accounts for 19.7% 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 Hip and 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		2006		2007		2008		2009	
Model	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**
LCS	3184	LCS	3618	LCS	3743	PFC Sigma	4042	Triathlon	4670
Duracon	2847	PFC Sigma	3417	PFC Sigma	3575	LCS	3786	PFC Sigma	3853
Nexgen CR	2154	Scorpio	2558	Nexgen CR Flex	2607	Triathlon	3474	LCS	3737
Scorpio	2115	Genesis II	2452	Triathlon	2333	Nexgen CR Flex	3057	Nexgen CR Flex	3370
PFC Sigma	1944	Nexgen CR Flex	2346	Genesis II	2270	Genesis II	2596	Genesis II	3157
Genesis II	1521	Duracon	2309	Nexgen LPS Flex	2172	Nexgen LPS Flex	2341	Nexgen LPS Flex	2453
Profix	1033	Nexgen LPS Flex	1948	Scorpio	2095	Genesis II Oxinium	2094	Genesis II Oxinium	1957
Natural Knee II	1002	Genesis II Oxinium	1557	Duracon	1964	Scorpio	1381	Vanguard	1772
Nexgen LPS	902	Triathlon	1009	Genesis II Oxinium	1787	Duracon	1380	Scorpio NRG	1267
Genesis II Oxinium	725	Profix	875	Vanguard	762	Vanguard	1251	Scorpio	1172
Ten Most Used									
(10) 80.2%	17427	(10) 80.7%	22089	(10) 79.8%	23308	(10) 78.2%	25402	(10) 80.9%	27408
Remainder									
(39) 19.8%	4305	(43) 19.3%	5282	(43) 20.2%	5905	(45) 21.8%	7097	(46) 19.1%	6476
TOTAL									
(49) 100.0%	21732	(53) 100.0%	27371	(53) 100.0%	29213	(55) 100.0%	32499	(56) 100.0%	33884

Table KT2: Ten Most Used Femoral Prostheses in Cemented Primary Total Knee Replacement

2003		2006		2007		2008		2009	
Model	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**
Duracon	1245	PFC Sigma	2054	PFC Sigma	2098	PFC Sigma	2214	Genesis II	2552
Genesis II	1089	Nexgen LPS Flex	1856	Nexgen LPS Flex	2075	Nexgen LPS Flex	2197	Triathlon	2456
LCS	984	Genesis II	1809	Genesis II Oxinium	1773	Genesis II Oxinium	2064	Nexgen LPS Flex	2287
PFC Sigma	839	Genesis II Oxinium	1539	Genesis II	1761	Genesis II	1969	PFC Sigma	1972
Nexgen LPS	828	Duracon	1173	Triathlon	1344	Triathlon	1916	Genesis II Oxinium	1919
Nexgen CR	797	Scorpio	840	Duracon	1082	Nexgen CR Flex	1070	Nexgen CR Flex	1059
Scorpio	713	LCS	805	Nexgen CR Flex	996	LCS	761	Vanguard	849
Nexgen LPS Flex	690	Nexgen CR Flex	731	Scorpio	799	Vanguard	733	LCS	804
Profix	636	Triathlon	715	LCS	798	Duracon	649	Scorpio NRG	736
Genesis II Oxinium	548	Profix	562	Profix	398	Journey	588	Journey	582
Ten Most Used									
(10) 83.7%	8369	(10) 84.4%	12084	(10) 83.1%	13124	(10) 81.1%	14161	(10) 83.8%	15216
Remainder									
(33) 16.3%	1633	(40) 15.6%	2241	(38) 16.9%	2672	(41) 18.9%	3297	(41) 16.2%	2938
TOTAL									
(43) 100.0%	10002	(50) 100.0%	14325	(48) 100.0%	15796	(51) 100.0%	17458	(51) 100.0%	18154

Table KT3: Ten Most Used Femoral Prostheses in Cementless Primary Total Knee Replacement

2003		2006		2007		2008		2009	
Model	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**
LCS	1470	LCS	2085	LCS	2237	LCS	2320	LCS	2077
Nexgen CR	788	Nexgen CR Flex	785	Nexgen CR Flex	798	Nexgen CR Flex	1136	Triathlon	1283
Scorpio	500	Scorpio	603	Triathlon	571	Triathlon	918	Nexgen CR Flex	1179
Natural Knee II	499	PFC Sigma	448	PFC Sigma	442	RBK	485	RBK	503
Active Knee	483	Duracon	415	Scorpio	394	PFC Sigma	446	PFC Sigma	499
Duracon	477	RBK	367	RBK	379	Scorpio NRG	443	Scorpio NRG	386
PFC Sigma	314	Active Knee	266	Active Knee	373	Active Knee	388	Active Knee	312
RBK	302	Natural Knee II	263	Duracon	360	Duracon	302	Score	211
Profix	187	Triathlon	186	Natural Knee II	221	Scorpio	214	Profix	208
Maxim	141	Nexgen CR	171	Profix	170	Natural Knee II	164	Scorpio	207
Ten Most Used									
(10) 90.5%	5161	(10) 88.3%	5589	(10) 87.2%	5945	(10) 85.0%	6816	(10) 83.3%	6865
Remainder									
(13) 9.5%	543	(16) 11.7%	740	(17) 12.8%	869	(20) 15.0%	1205	(19) 16.7%	1374
TOTAL									
(23) 100.0%	5704	(26) 100.0%	6329	(27) 100.0%	6814	(30) 100.0%	8021	(29) 100.0%	8239

Table KT4: Ten Most Used Femoral Prostheses in Hybrid Primary Total Knee Replacement

2003		2006		2007		2008		2009	
Model	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**
Duracon	1125	Scorpio	1115	PFC Sigma	1035	PFC Sigma	1382	PFC Sigma	1382
Scorpio	902	PFC Sigma	915	Scorpio	902	Nexgen CR Flex	851	Nexgen CR Flex	1132
PFC Sigma	791	Nexgen CR Flex	830	Nexgen CR Flex	813	LCS	705	Triathlon	931
LCS	730	LCS	728	LCS	708	Triathlon	640	LCS	856
Nexgen CR	569	Duracon	721	Duracon	522	Scorpio	596	Vanguard	765
Genesis II	377	Genesis II	575	Genesis II	463	Genesis II	504	Genesis II	516
Maxim	249	Nexgen CR	251	Triathlon	418	Vanguard	480	Scorpio	453
Natural Knee II	232	Active Knee	202	Vanguard	337	Duracon	429	Duracon	223
Profix	210	Maxim	183	Maxim	204	Scorpio NRG	219	Nexgen LPS Flex	166
AGC	191	Profix	150	Nexgen CR	153	Nexgen LPS Flex	143	Scorpio NRG	145
Ten Most Used									
(10) 89.2%	5376	(10) 84.4%	5670	(10) 84.1%	5555	(10) 84.7%	5949	(10) 87.7%	6569
Remainder									
(25) 10.8%	650	(25) 15.6%	1047	(26) 15.9%	1048	(30) 15.3%	1071	(30) 12.3%	922
TOTAL									
(35) 100.0%	6026	(35) 100.0%	6717	(36) 100.0%	6603	(40) 100.0%	7020	(40) 100.0%	7491

Outcome by Patient Characteristics

Primary total knee replacement has the lowest risk of revision compared to all other primary knee replacement. The cumulative percent revision at nine years for primary total knee replacement undertaken for osteoarthritis is 5.1% (Table KT5 and Figure KT5).

Reason for Revision

The main reasons for revision are loosening/lysis (31.3%), infection (22.2%), patellofemoral pain (14.3%), pain (9.1%) and instability (5.5%) (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 time it increases at a slower rate. Loosening/lysis shows a linear increase and at one year exceeds infection to become the most common reason for revision. 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 (23.3%), patella only replacement (22.0%) and insert only exchange (20.5%) (Table KT7).

Primary Diagnosis

Nine different primary diagnoses for primary total knee replacement have been reported to the Registry. The four most common are osteoarthritis, rheumatoid arthritis, other inflammatory arthritis and avascular necrosis.

Rheumatoid arthritis has the lowest risk of revision. There is no difference between osteoarthritis, other inflammatory arthritis and avascular necrosis (Tables KT8 and KT9 and Figure KT7).

Age and Gender

Age is a major factor affecting the outcome of primary total knee replacement. The risk of revision increases with decreasing age. The age related difference in the risk of revision increases with time. After three and a half years, those aged less than 55 years have four and a half times the risk of revision compared to those aged 75 or older (Tables KT10 and KT11 and Figure KT8).

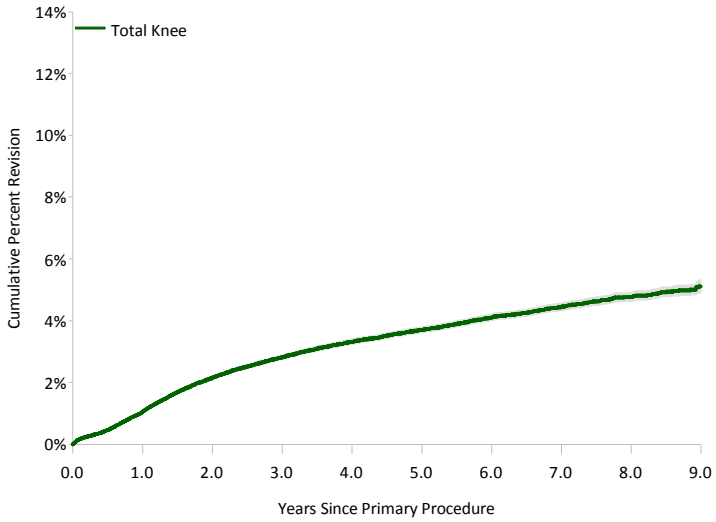
Males have a significantly higher risk of revision (Tables KT12 and KT13 and Figure KT9). Age related differences in outcome are evident for both males and females (Tables K14 and KT15 and Figures KT11 and KT12).

Loosening/lysis is the most common reason for revision in both males and females. Males have a higher incidence of revision for infection than females. At nine years the cumulative incidence of infection is 1.3% for males and 0.6% 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	7 Yrs	9 Yrs
Total Knee	1.0 (1.0, 1.1)	2.8 (2.7, 2.9)	3.7 (3.6, 3.8)	4.4 (4.3, 4.6)	5.1 (4.9, 5.3)

Figure KT5: Cumulative Percent Revision of Primary Total Knee Replacement (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Total Knee	224672	187581	152594	122286	94730	69293	47416	28507	12729	3187

Table KT6: Primary Total Knee Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	2057	31.1
Infection	1468	22.2
Patellofemoral Pain	949	14.3
Pain	602	9.1
Instability	367	5.5
Arthrofibrosis	307	4.6
Fracture	153	2.3
Malalignment	136	2.1
Wear Tibial	91	1.4
Incorrect Sizing	85	1.3
Other	399	6.0
TOTAL	**6614**	**100.0**

Table KT7: Primary Total Knee Replacement by Type of Revision

Type of Revision	Number	Percent
TKR (Tibial/Femoral)	1538	23.3
Patella Only	1458	22.0
Insert Only	1355	20.5
Tibial Only	771	11.7
Femoral Only	570	8.6
Insert/Patella	488	7.4
Cement Spacer	365	5.5
Removal of Prostheses	47	0.7
Minor Components	15	0.3
Cement Only	6	0.0
Reinsertion of Components	1	0.0
TOTAL	**6614**	**100.0**

Figure KT6: Revision Diagnosis Cumulative Incidence of Primary Total Knee Replacement

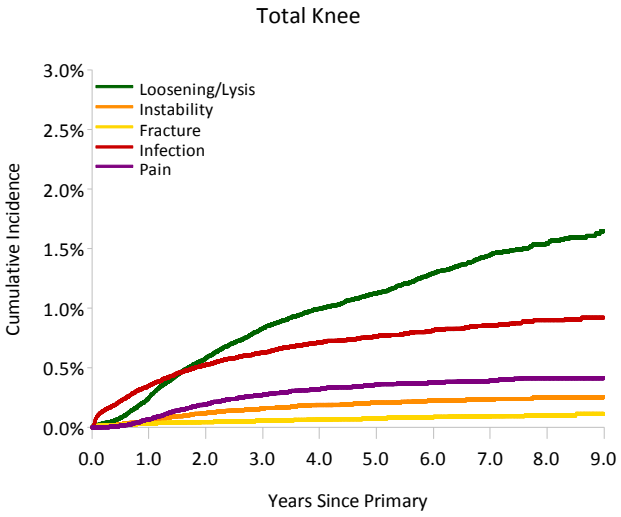


Table KT8: Revision Rates of Primary Total Knee Replacement by Primary Diagnosis

Primary Diagnosis	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Osteoarthritis	6414	224672	828636	0.77 (0.76, 0.79)
Rheumatoid Arthritis	99	4258	18038	0.55 (0.45, 0.67)
Other Inflammatory Arthritis	38	1137	4515	0.84 (0.60, 1.16)
Avascular Necrosis	29	848	3219	0.90 (0.60, 1.29)
Other (5)	34	494	1438	2.37 (1.64, 3.30)
TOTAL	**6614**	**231409**	**855846**	**0.77 (0.75, 0.79)**

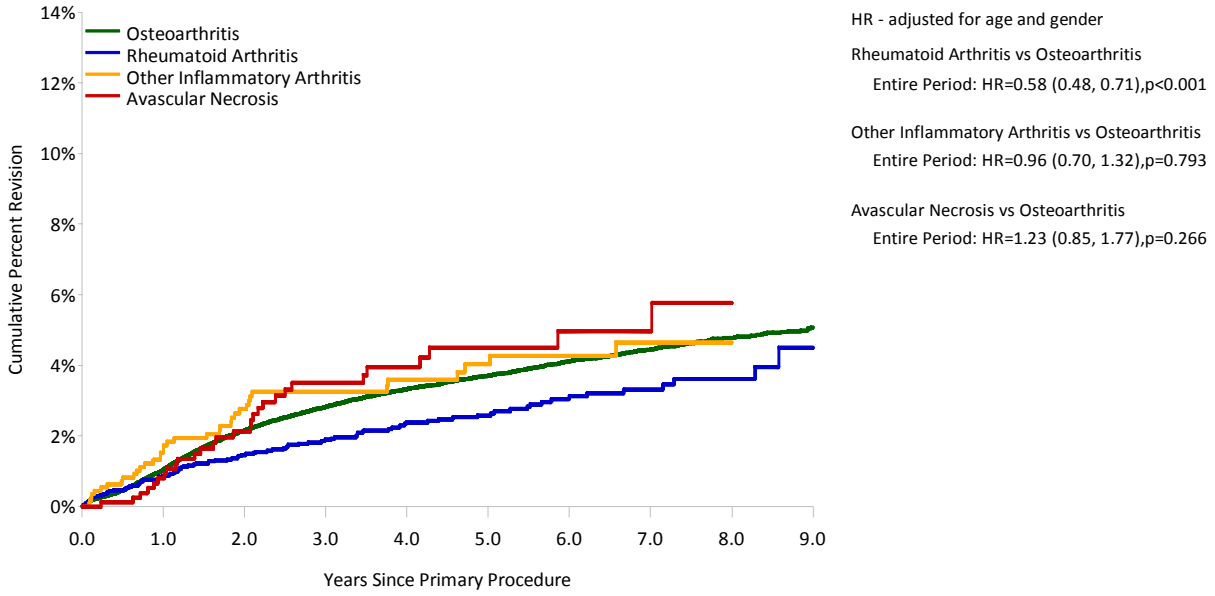
Note: Only prostheses with over 300 procedures have been listed.

Table KT9: Yearly Cumulative Percent Revision of Primary Total Knee Replacement by Primary Diagnosis

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Osteoarthritis	1.0 (1.0, 1.1)	2.8 (2.7, 2.9)	3.7 (3.6, 3.8)	4.4 (4.3, 4.6)	5.1 (4.9, 5.3)
Rheumatoid Arthritis	0.9 (0.6, 1.2)	1.9 (1.5, 2.4)	2.6 (2.1, 3.2)	3.3 (2.7, 4.1)	4.5 (3.2, 6.3)
Other Inflammatory Arthritis	1.7 (1.1, 2.7)	3.2 (2.3, 4.6)	4.0 (2.9, 5.6)	4.6 (3.3, 6.6)	
Avascular Necrosis	0.8 (0.4, 1.8)	3.5 (2.3, 5.2)	4.5 (3.1, 6.6)	5.0 (3.4, 7.3)	
Other (5)	1.9 (0.9, 3.7)	7.4 (5.0, 10.8)	10.4 (7.2, 15.0)	15.2 (9.8, 23.1)	

Note: Only prostheses with over 300 procedures have been listed.

Figure KT7: Cumulative Percent Revision of Primary Total Knee Replacement by Primary Diagnosis



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Osteoarthritis	224672	187581	152594	122286	94730	69293	47416	28507	12729	3187
Rheumatoid Arthritis	4258	3747	3209	2694	2182	1677	1197	758	352	98
Other Inflammatory Arthritis	1137	950	807	650	527	400	299	194	111	28
Avascular Necrosis	848	713	596	478	369	267	196	120	47	6

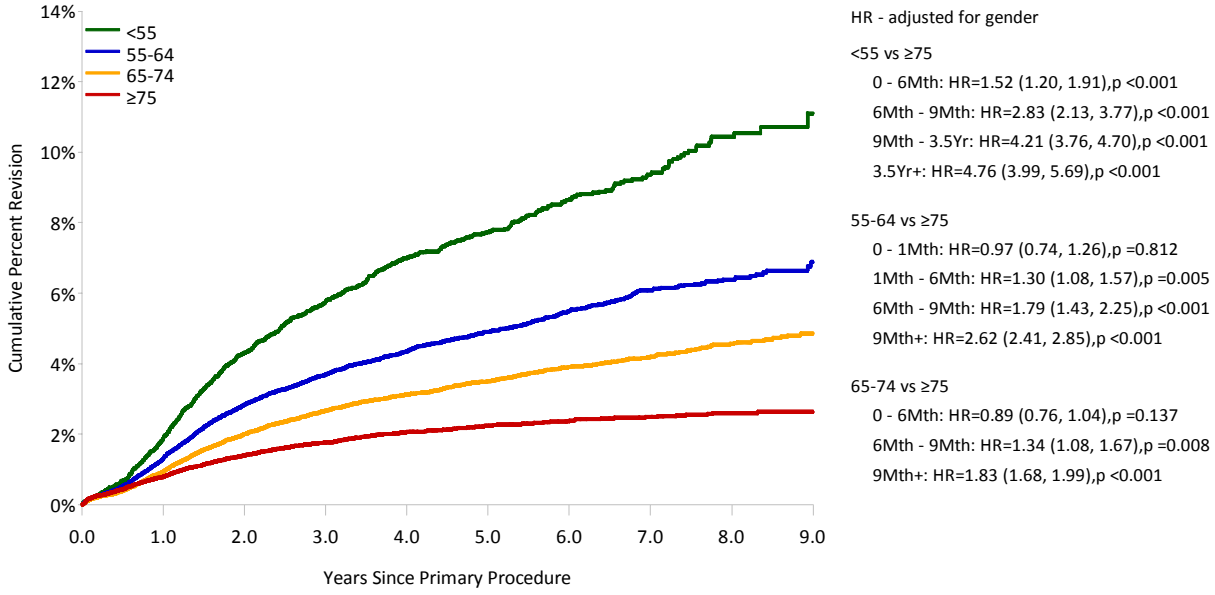
Table KT10: Revision Rates of Primary Total Knee Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
<55	861	14437	52727	1.63 (1.53, 1.75)
55-64	2014	54724	194567	1.04 (0.99, 1.08)
65-74	2310	84721	319800	0.72 (0.69, 0.75)
≥75	1229	70790	261543	0.47 (0.44, 0.50)
TOTAL	**6414**	**224672**	**828636**	**0.77 (0.76, 0.79)**

Table KT11: Yearly Cumulative Percent Revision of Primary Total Knee Replacement by Age (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
<55	1.9 (1.7, 2.2)	5.8 (5.3, 6.2)	7.7 (7.2, 8.3)	9.4 (8.7, 10.1)	11.1 (10.0, 12.4)
55-64	1.3 (1.2, 1.4)	3.7 (3.5, 3.9)	4.9 (4.7, 5.1)	6.1 (5.8, 6.4)	6.9 (6.4, 7.4)
65-74	0.9 (0.9, 1.0)	2.7 (2.5, 2.8)	3.5 (3.4, 3.7)	4.2 (4.0, 4.4)	4.9 (4.6, 5.2)
≥75	0.8 (0.7, 0.9)	1.8 (1.7, 1.9)	2.2 (2.1, 2.4)	2.5 (2.3, 2.6)	2.6 (2.4, 2.8)

Figure KT8: Cumulative Percent Revision of Primary Total Knee Replacement by Age (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
<55	14437	11927	9604	7684	6023	4493	3130	1879	838	206
55-64	54724	44887	35689	28346	21819	15962	10956	6624	2919	738
65-74	84721	71018	58175	47054	36887	27477	19031	11688	5354	1392
≥75	70790	59749	49126	39202	30001	21361	14299	8316	3618	851

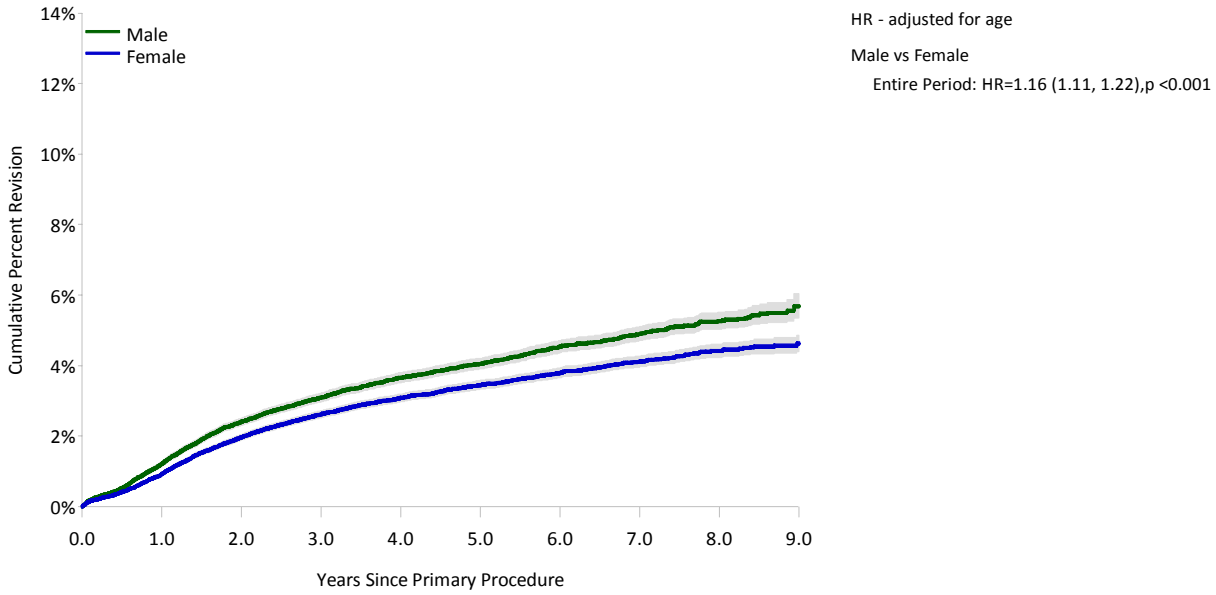
Table KT12: Revision Rates of Primary Total Knee Replacement by Gender (Primary Diagnosis OA)

Gender	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	3033	96825	352564	0.86 (0.83, 0.89)
Female	3381	127847	476072	0.71 (0.69, 0.73)
TOTAL	**6414**	**224672**	**828636**	**0.77 (0.76, 0.79)**

Table KT13: Yearly Cumulative Percent Revision of Primary Total Knee Replacement by Gender (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Male	1.2 (1.1, 1.3)	3.1 (3.0, 3.2)	4.0 (3.9, 4.2)	4.9 (4.7, 5.1)	5.7 (5.3, 6.0)
Female	0.9 (0.9, 1.0)	2.6 (2.5, 2.7)	3.4 (3.3, 3.6)	4.1 (4.0, 4.3)	4.6 (4.4, 4.9)

Figure KT9: Cumulative Percent Revision of Primary Total Knee Replacement by Gender (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Male	96825	80395	65071	51941	39998	29193	19951	12058	5381	1370
Female	127847	107186	87523	70345	54732	40100	27465	16449	7348	1817

Figure KT10: Revision Diagnosis Cumulative Incidence of Primary Total Knee Replacement by Gender

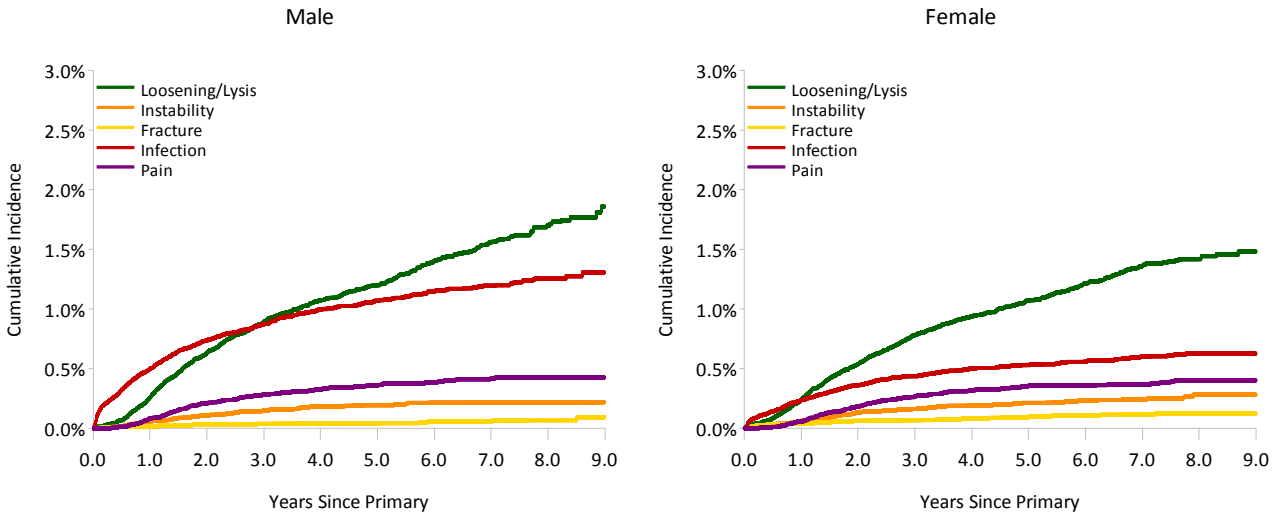


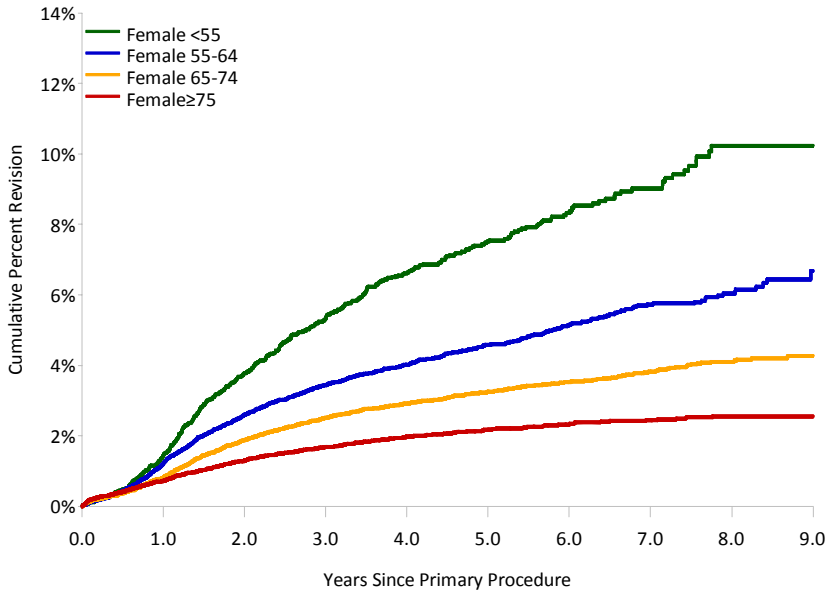
Table KT14: Revision Rates of Primary Total Knee Replacement by Gender and Age (Primary Diagnosis OA)

Gender	Age	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Male	<55	411	6345	23403	1.76 (1.59, 1.93)
	55-64	994	24985	88590	1.12 (1.05, 1.19)
	65-74	1118	37377	139149	0.80 (0.76, 0.85)
	≥75	510	28118	101422	0.50 (0.46, 0.55)
Female	<55	450	8092	29324	1.53 (1.40, 1.68)
	55-64	1020	29739	105977	0.96 (0.90, 1.02)
	65-74	1192	47344	180651	0.66 (0.62, 0.70)
	≥75	719	42672	160121	0.45 (0.42, 0.48)
TOTAL		**6414**	**224672**	**828636**	**0.77 (0.76, 0.79)**

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	7 Yrs	9 Yrs
Male	<55	2.5 (2.1, 2.9)	6.3 (5.7, 7.0)	8.0 (7.3, 8.9)	9.8 (8.8, 10.9)	12.2 (10.1, 14.6)
	55-64	1.4 (1.3, 1.6)	4.0 (3.7, 4.3)	5.3 (4.9, 5.6)	6.5 (6.1, 7.0)	7.1 (6.5, 7.9)
	65-74	1.1 (1.0, 1.2)	2.9 (2.7, 3.1)	3.8 (3.6, 4.1)	4.7 (4.4, 5.0)	5.6 (5.1, 6.2)
	≥75	0.9 (0.8, 1.0)	1.9 (1.7, 2.1)	2.3 (2.1, 2.6)	2.5 (2.3, 2.8)	2.7 (2.4, 3.1)
Female	<55	1.5 (1.2, 1.8)	5.3 (4.8, 5.9)	7.5 (6.8, 8.3)	9.0 (8.2, 10.0)	10.2 (9.1, 11.5)
	55-64	1.2 (1.1, 1.4)	3.4 (3.2, 3.7)	4.6 (4.3, 4.9)	5.7 (5.3, 6.1)	6.7 (6.0, 7.5)
	65-74	0.8 (0.7, 0.9)	2.5 (2.3, 2.7)	3.2 (3.1, 3.4)	3.8 (3.6, 4.1)	4.3 (4.0, 4.6)
	≥75	0.7 (0.6, 0.8)	1.7 (1.5, 1.8)	2.2 (2.0, 2.3)	2.4 (2.2, 2.6)	2.6 (2.3, 2.8)

Figure KT11: Cumulative Percent Revision of Primary Total Knee Replacement for Females by Age (Primary Diagnosis OA)



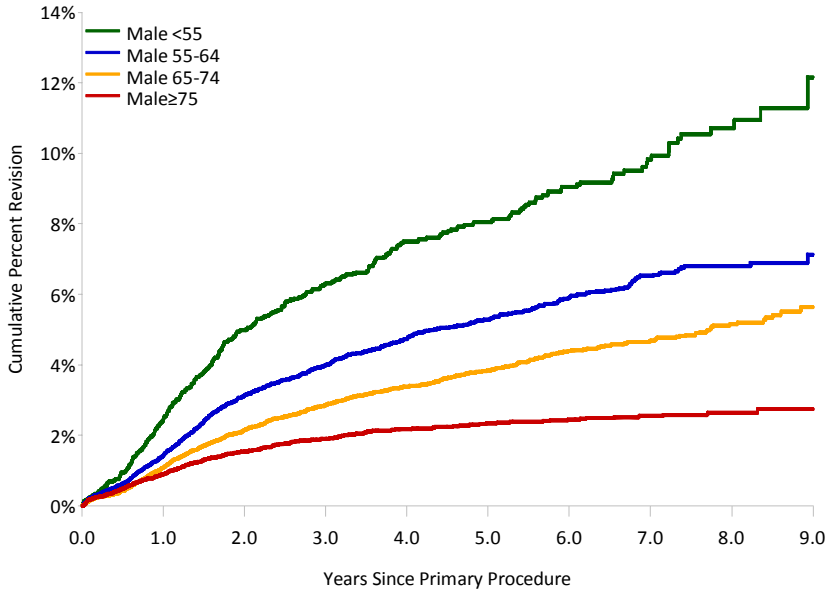
Female <55 vs Female≥75
- 0 - 6Mth: HR=1.17 (0.82, 1.67),p =0.376
- 6Mth - 9Mth: HR=2.45 (1.65, 3.63),p <0.001
- 9Mth - 1.5Yr: HR=4.42 (3.50, 5.57),p <0.001
- 1.5Yr - 2Yr: HR=3.35 (2.46, 4.55),p <0.001
- 2Yr+: HR=4.69 (3.92, 5.62),p <0.001

Female 55-64 vs Female≥75
- 0 - 3Mth: HR=0.84 (0.62, 1.13),p =0.244
- 3Mth - 9Mth: HR=1.69 (1.36, 2.11),p <0.001
- 9Mth - 1.5Yr: HR=2.81 (2.32, 3.41),p <0.001
- 1.5Yr - 2.5Yr: HR=2.13 (1.77, 2.57),p <0.001
- 2.5Yr+: HR=2.66 (2.25, 3.14),p <0.001

Female 65-74 vs Female≥75
- 0 - 6Mth: HR=0.93 (0.76, 1.15),p =0.516
- 6Mth - 9Mth: HR=1.18 (0.89, 1.57),p =0.242
- 9Mth - 1.5Yr: HR=1.88 (1.56, 2.27),p <0.001
- 1.5Yr+: HR=1.65 (1.44, 1.89),p <0.001

Number at Risk		0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Female	<55	8092	6705	5385	4274	3318	2475	1692	1027	438	111
	55-64	29739	24466	19425	15477	11942	8718	5968	3530	1544	377
	65-74	47344	39790	32805	26603	20971	15612	10840	6661	3099	811
	≥75	42672	36225	29908	23991	18501	13295	8965	5231	2267	518

Figure KT12: Cumulative Percent Revision of Primary Total Knee Replacement for Males by Age (Primary Diagnosis OA)



Male <55 vs Male≥75
- 0 - 9Mth: HR=2.27 (1.78, 2.89),p <0.001
- 9Mth - 1.5Yr: HR=3.78 (2.95, 4.86),p <0.001
- 1.5Yr+: HR=4.77 (3.90, 5.83),p <0.001

Male 55-64 vs Male≥75
- 0 - 9Mth: HR=1.42 (1.17, 1.71),p <0.001
- 9Mth - 1.5Yr: HR=2.36 (1.92, 2.90),p <0.001
- 1.5Yr+: HR=3.03 (2.55, 3.59),p <0.001

Male 65-74 vs Male≥75
- 0 - 9Mth: HR=1.03 (0.86, 1.24),p =0.722
- 9Mth - 1.5Yr: HR=1.64 (1.33, 2.01),p <0.001
- 1.5Yr - 2.5Yr: HR=2.01 (1.63, 2.48),p <0.001
- 2.5Yr+: HR=2.41 (1.99, 2.91),p <0.001

Number at Risk		0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Male	<55	6345	5222	4219	3410	2705	2018	1438	852	400	95
	55-64	24985	20421	16264	12869	9877	7244	4988	3094	1375	361
	65-74	37377	31228	25370	20451	15916	11865	8191	5027	2255	581
	≥75	28118	23524	19218	15211	11500	8066	5334	3085	1351	333

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 risk of revision compared to all mobile bearings. This risk 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 risk 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 and if used it is usually in complex clinical situations (Table KT20). Therefore, these prostheses have not been included in any comparative outcome analysis for primary total knee replacement.

Posterior stabilised prostheses have a significantly higher risk of revision compared to minimally stabilised (Tables KT20 and KT21 and Figure KT15).

Patellar Resurfacing

Resurfacing the patella is associated with a lower risk of revision in the first nine years (Tables KT22 and KT23 and Figure KT16).

The risk of revision when resurfacing the patella varies between minimally and posterior stabilised prostheses. Posterior stabilised without patellar resurfacing has the highest risk of revision (Tables KT24 and KT25 and Figure KT17).

Fixation

There is no difference between cemented and hybrid fixation. The risk of revision in the first one and a half years is less for both cemented and hybrid compared to cementless. After this time, the risk of revision for cementless is less compared to cemented and hybrid fixation (Tables KT26 and KT27 and Figure KT18).

Prostheses Types

There are 320 femoral and tibial prostheses combinations for primary total knee replacement recorded by the Registry, 17 more than 2008. The revision rates and yearly cumulative percent revision of the 78 combinations with more than 300 procedures are listed in Tables KT28 – KT33. Although the listed combinations are a small proportion of the possible combinations, they represent 96.0% of all primary total knee replacements.

The 'Other' group is the combined outcome of all prostheses combinations with less than 300 procedures. This group has 242 combinations, making up 4.0% of all primary total knee replacement.

There are 29 cemented total femoral and tibial prostheses combinations with more than 300 procedures. The rate of revision per 100 observed component years varies from 0.31 to 2.15. The Nexgen CR/Nexgen has the lowest cumulative percent revision at nine years of 2.9% (Tables KT28 and KT29).

There are 26 cementless total femoral and tibial prostheses combinations with more than 300 procedures. The rate of revision per 100 observed component years varies from 0.26 to 2.46 revisions. The Advantim/Advantim has the lowest cumulative percent revision at nine years of 1.5% (Tables KT30 and KT31).

There are 23 combinations of total knee replacement with hybrid fixation. The rate of revision per 100 observed component years varies from 0.39 to 1.32. The AGC/AGC has the lowest cumulative percent revision at nine years of 2.7% (Tables KT32 and KT33).

The Registry has undertaken an analysis of the LCS Duofix femoral prosthesis, which was recalled in 2009. The Registry had recorded 4,862 procedures using this prosthesis up to and including 31 December 2009. It has a higher revision rate compared to all other primary total knee replacements (adj HR=1.20; 95%CI(1.00, 1,44), p=0.046).

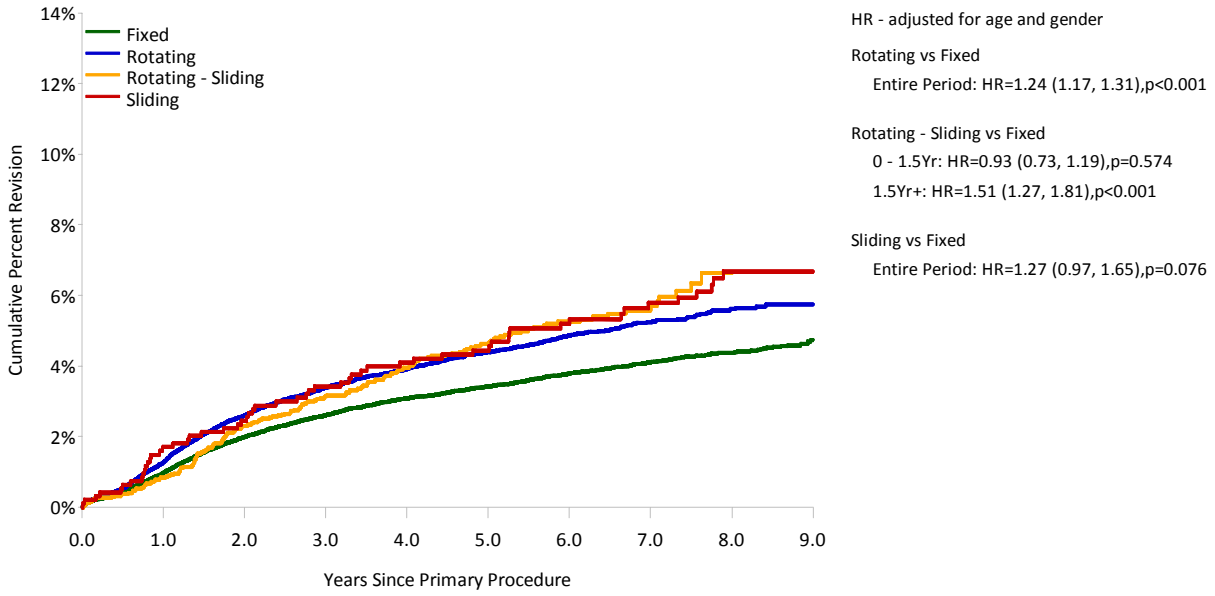
Table KT16: Revision Rates of Primary Total Knee Replacement by Bearing Mobility (Primary Diagnosis OA)

Bearing Mobility	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Fixed	4236	162962	592879	0.71 (0.69, 0.74)
Rotating	1923	56248	207365	0.93 (0.89, 0.97)
Rotating - Sliding	194	4418	21056	0.92 (0.80, 1.06)
Sliding	56	948	6868	0.82 (0.62, 1.06)
Unknown	5	96	468	1.07 (0.35, 2.49)
TOTAL	**6414**	**224672**	**828636**	**0.77 (0.76, 0.79)**

Table KT17: Yearly Cumulative Percent Revision of Primary Total Knee Replacement by Bearing Mobility (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Fixed	1.0 (0.9, 1.0)	2.6 (2.5, 2.7)	3.4 (3.3, 3.5)	4.1 (4.0, 4.2)	4.7 (4.5, 5.0)
Rotating	1.3 (1.2, 1.4)	3.4 (3.2, 3.6)	4.4 (4.2, 4.6)	5.2 (5.0, 5.5)	5.7 (5.4, 6.1)
Rotating - Sliding	0.8 (0.6, 1.1)	3.1 (2.6, 3.7)	4.6 (4.0, 5.4)	5.6 (4.8, 6.5)	
Sliding	1.7 (1.0, 2.8)	3.4 (2.4, 4.8)	4.4 (3.3, 6.0)	5.8 (4.4, 7.6)	6.7 (5.1, 8.6)

Figure KT13: Cumulative Percent Revision of Primary Total Knee Replacement by Bearing Mobility (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Fixed	162962	134773	109047	87443	67478	49057	33678	20230	9046	2277
Rotating	56248	47549	38606	30563	23661	17282	11493	6865	3012	653
Rotating - Sliding	4418	4242	3951	3330	2677	2130	1510	779	190	19
Sliding	948	925	906	877	851	780	706	613	469	236

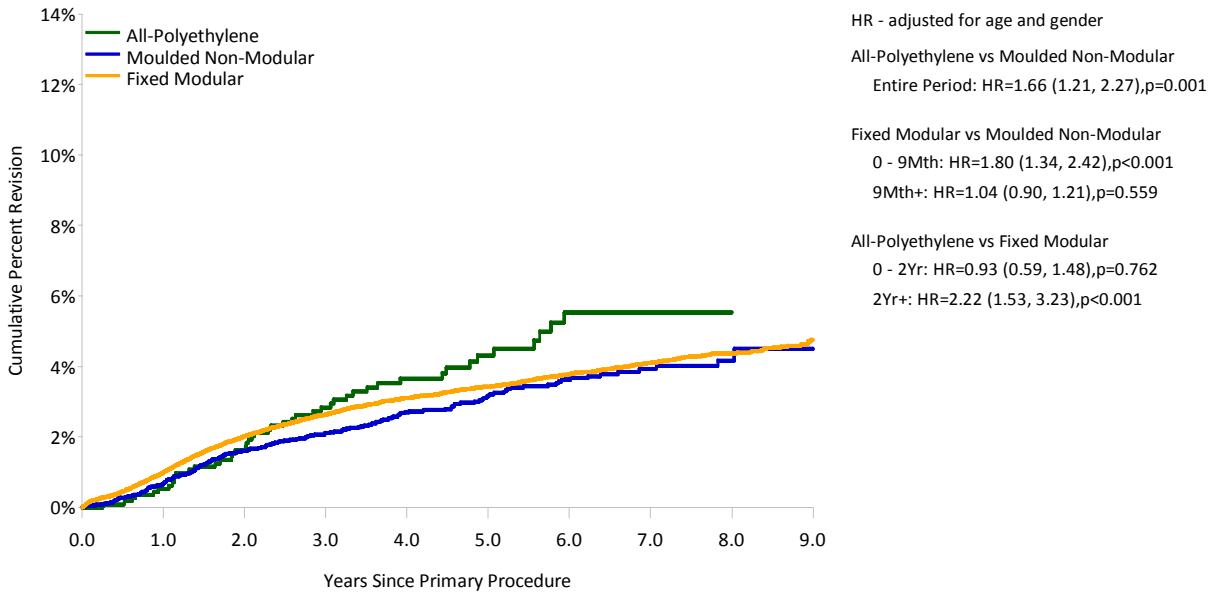
Table KT18: Revision Rates of Primary Total Knee Replacement by Fixed Bearing Type (Primary Diagnosis OA)

Fixed Bearing Type	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
All-Polyethylene	46	1174	5358	0.86 (0.63, 1.15)
Moulded Non-Modular	233	10612	36712	0.63 (0.56, 0.72)
Fixed Modular	3957	151176	550810	0.72 (0.70, 0.74)
TOTAL	**4236**	**162962**	**592879**	**0.71 (0.69, 0.74)**

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	7 Yrs	9 Yrs
All-Polyethylene	0.5 (0.2, 1.2)	2.8 (2.0, 4.0)	4.3 (3.2, 5.9)	5.5 (4.1, 7.5)	
Moulded Non-Modular	0.7 (0.5, 0.9)	2.1 (1.8, 2.5)	3.2 (2.8, 3.7)	3.9 (3.4, 4.6)	4.5 (3.7, 5.4)
Fixed Modular	1.0 (0.9, 1.0)	2.6 (2.5, 2.7)	3.4 (3.3, 3.5)	4.1 (4.0, 4.2)	4.7 (4.5, 5.0)

Figure KT14: Cumulative Percent Revision of Primary Total Knee Replacement by Fixed Bearing Type (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
All-Polyethylene	1174	1116	1015	899	693	527	326	132	50	6
Moulded Non-Modular	10612	8768	6870	5351	3917	2766	1943	1161	575	182
Fixed Modular	151176	124889	101162	81193	62868	45764	31409	18937	8421	2089

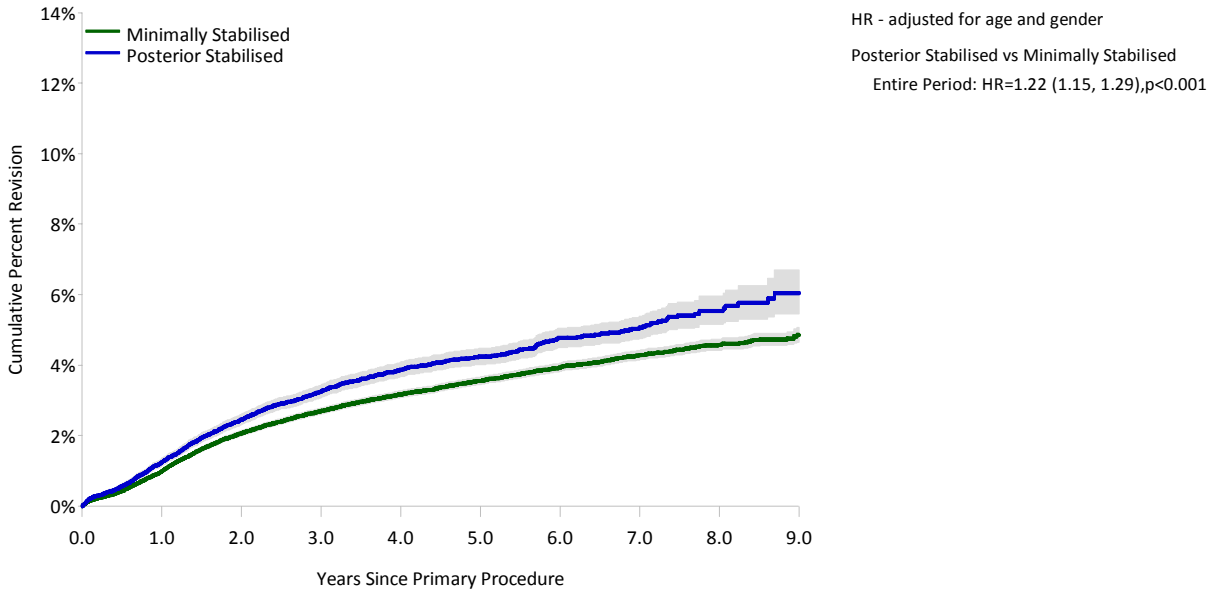
Table KT20: Revision Rates of Primary Total Knee Replacement by Stability (Primary Diagnosis OA)

Stability	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Minimally Stabilised	4822	170562	661204	0.73 (0.71, 0.75)
Posterior Stabilised	1545	52223	163072	0.95 (0.90, 1.00)
Fully Stabilised	34	1594	3327	1.02 (0.71, 1.43)
Hinged	8	197	565	1.42 (0.61, 2.79)
Unknown	5	96	468	1.07 (0.35, 2.49)
TOTAL	**6414**	**224672**	**828636**	**0.77 (0.76, 0.79)**

Table KT21: Yearly Cumulative Percent Revision of Primary Total Knee Replacement by Stability (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Minimally Stabilised	1.0 (0.9, 1.0)	2.7 (2.6, 2.8)	3.6 (3.4, 3.7)	4.3 (4.1, 4.4)	4.8 (4.6, 5.1)
Posterior Stabilised	1.2 (1.2, 1.4)	3.2 (3.1, 3.4)	4.2 (4.0, 4.5)	5.1 (4.8, 5.4)	6.0 (5.5, 6.7)

Figure KT15: Cumulative Percent Revision of Primary Total Knee Replacement by Stability (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Minimally Stabilised	170562	144574	119866	97984	77591	57834	40490	24768	11237	2827
Posterior Stabilised	52223	41765	31970	23824	16767	11193	6744	3636	1448	350

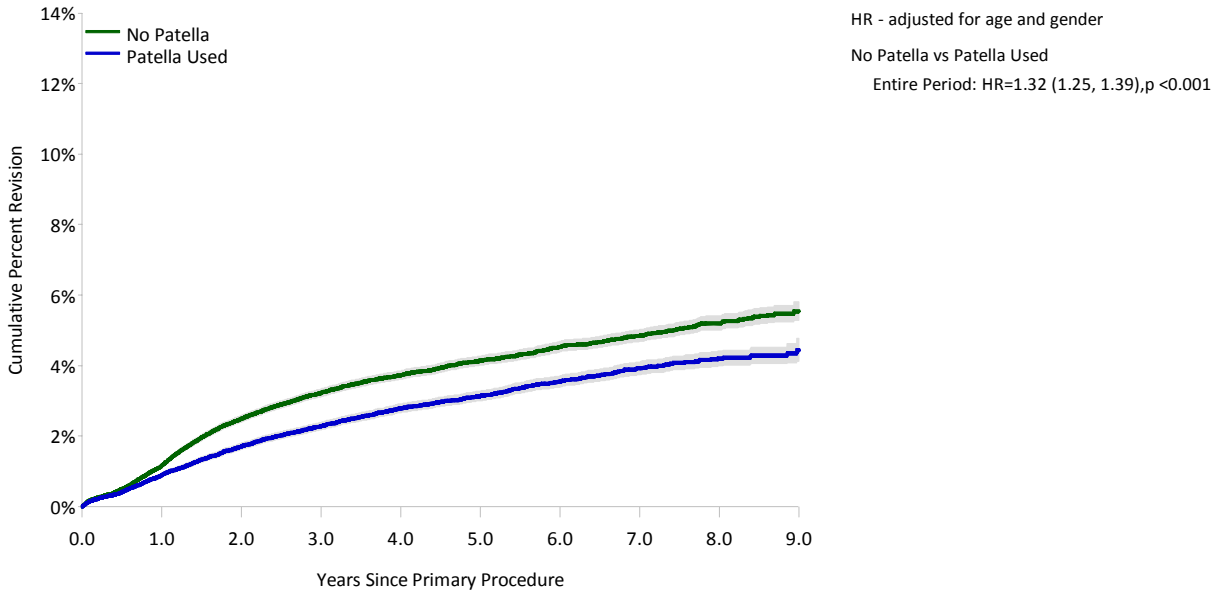
Table KT22: Revision Rates of Primary Total Knee Replacement by Patella Usage (Primary Diagnosis OA)

Patella Usage	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
No Patella	4090	126594	473449	0.86 (0.84, 0.89)
Patella Used	2324	98078	355187	0.65 (0.63, 0.68)
TOTAL	**6414**	**224672**	**828636**	**0.77 (0.76, 0.79)**

Table KT23: Yearly Cumulative Percent Revision of Primary Total Knee Replacement by Patella Usage (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
No Patella	1.2 (1.1, 1.2)	3.2 (3.1, 3.3)	4.1 (4.0, 4.3)	4.8 (4.7, 5.0)	5.5 (5.3, 5.8)
Patella Used	0.9 (0.8, 1.0)	2.3 (2.2, 2.4)	3.1 (3.0, 3.3)	3.9 (3.7, 4.1)	4.4 (4.1, 4.8)

Figure KT16: Cumulative Percent Revision of Primary Total Knee Replacement by Patella Usage (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
No Patella	126594	106514	86880	70176	54367	39486	27226	16622	7689	2172
Patella Used	98078	81067	65714	52110	40363	29807	20190	11885	5040	1015

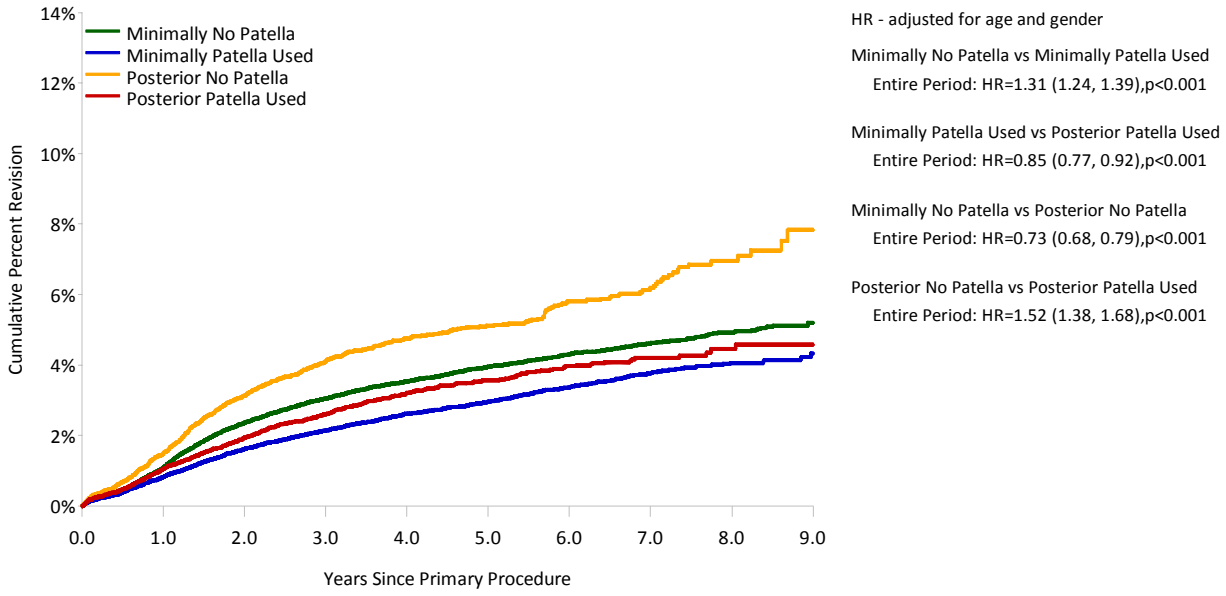
Table KT24: Revision Rates of Primary Total Knee Replacement by Stability and Patella Usage (Primary Diagnosis OA)

Stability	Patella Usage	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Minimally	No Patella	3237	103313	400937	0.81 (0.78, 0.84)
Minimally	Patella Used	1585	67249	260268	0.61 (0.58, 0.64)
Posterior	No Patella	829	22463	70243	1.18 (1.10, 1.26)
Posterior	Patella Used	716	29760	92829	0.77 (0.72, 0.83)
TOTAL		**6367**	**222785**	**824276**	**0.77 (0.75, 0.79)**

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	7 Yrs	9 Yrs
Minimally	No Patella	1.1 (1.0, 1.2)	3.0 (2.9, 3.2)	3.9 (3.8, 4.1)	4.6 (4.4, 4.8)	5.2 (4.9, 5.5)
Minimally	Patella Used	0.8 (0.8, 0.9)	2.1 (2.0, 2.3)	2.9 (2.8, 3.1)	3.8 (3.6, 4.0)	4.3 (4.0, 4.7)
Posterior	No Patella	1.5 (1.3, 1.7)	4.1 (3.8, 4.4)	5.1 (4.8, 5.5)	6.2 (5.7, 6.7)	7.8 (6.8, 9.0)
Posterior	Patella Used	1.1 (0.9, 1.2)	2.6 (2.4, 2.8)	3.6 (3.3, 3.9)	4.2 (3.8, 4.6)	4.6 (4.1, 5.1)

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	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Minimally	No Patella	103313	87829	72801	59673	46969	34560	24218	14976	6967	1994
Minimally	Patella Used	67249	56745	47065	38311	30622	23274	16272	9792	4270	833
Posterior	No Patella	22463	18112	13672	10214	7170	4759	2893	1585	697	172
Posterior	Patella Used	29760	23653	18298	13610	9597	6434	3851	2051	751	178

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	3084	114215	408772	0.75 (0.73, 0.78)
Cementless	1586	53910	197832	0.80 (0.76, 0.84)
Hybrid	1613	56287	220993	0.73 (0.69, 0.77)
TOTAL	**6283**	**224412**	**827596**	**0.76 (0.74, 0.78)**

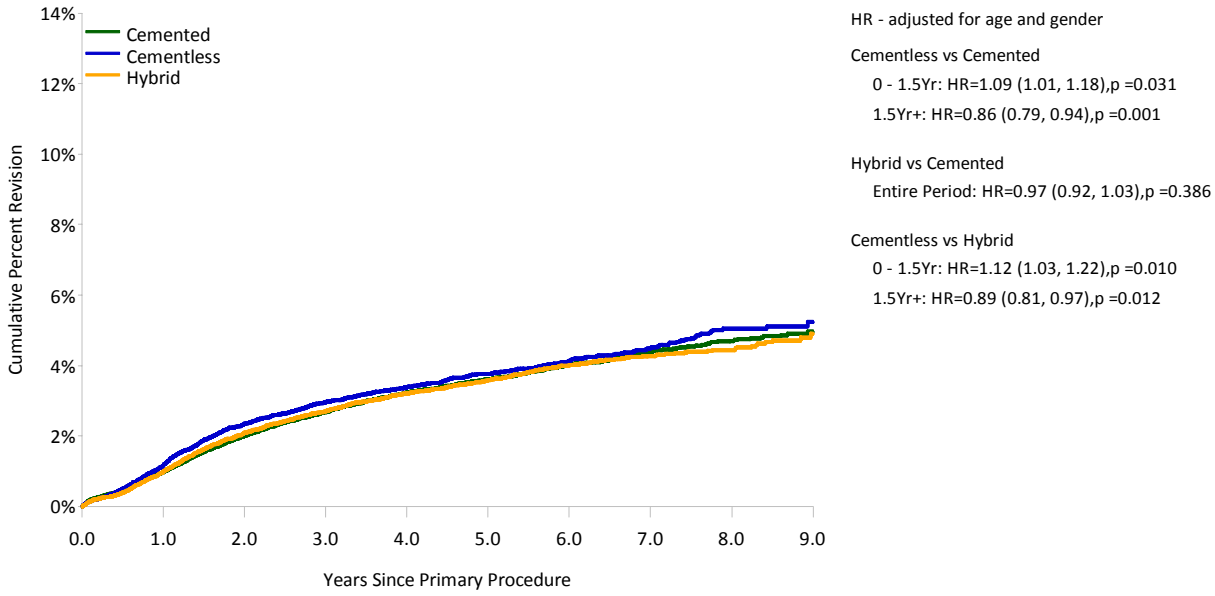
Note: Excluding cementless Genesis Oxinium and Profix Oxinium

Table KT27: Yearly Cumulative Percent Revision of Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Cemented	1.0 (0.9, 1.0)	2.7 (2.6, 2.8)	3.6 (3.5, 3.7)	4.4 (4.2, 4.6)	5.0 (4.7, 5.2)
Cementless	1.2 (1.1, 1.3)	3.0 (2.8, 3.1)	3.8 (3.6, 4.0)	4.5 (4.2, 4.7)	5.2 (4.8, 5.7)
Hybrid	1.0 (0.9, 1.1)	2.7 (2.6, 2.9)	3.6 (3.4, 3.8)	4.3 (4.1, 4.5)	4.9 (4.5, 5.3)

Note: Excluding cementless Genesis Oxinium and Profix Oxinium

Figure KT18: Cumulative Percent Revision of Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Cemented	114215	94585	76052	59840	45555	33019	22262	13577	6383	1583
Cementless	53910	44853	36256	29228	22861	16747	11462	6585	2701	701
Hybrid	56287	47924	40135	33090	26188	19406	13574	8306	3638	903

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	98	3097	14950	0.66 (0.53, 0.80)
Active Knee	Active Knee	11	401	1048	1.05 (0.52, 1.88)
Advance	Advance	41	612	3093	1.33 (0.95, 1.80)
Duracon	Duracon	269	9160	42663	0.63 (0.56, 0.71)
Genesis II	Genesis II	387	14244	50234	0.77 (0.70, 0.85)
Genesis II	Mobile Bearing Knee	15	329	1230	1.22 (0.68, 2.01)
Genesis II Oxinium	Genesis II	300	10181	29312	1.02 (0.91, 1.15)
Genesis II Oxinium	Mobile Bearing Knee	14	346	1496	0.94 (0.51, 1.57)
Journey	Journey	46	1630	2323	1.98 (1.45, 2.64)
Kinemax Plus	Kinemax Plus	58	1827	10398	0.56 (0.42, 0.72)
LCS	LCS	219	4105	26129	0.84 (0.73, 0.96)
LCS	MBT	100	4739	14818	0.67 (0.55, 0.82)
Maxim	Maxim	26	567	2972	0.87 (0.57, 1.28)
Natural Knee II	Natural Knee II	30	1452	6308	0.48 (0.32, 0.68)
Nexgen CR	Nexgen	62	3514	20130	0.31 (0.24, 0.39)
Nexgen CR Flex	Nexgen	56	4722	11490	0.49 (0.37, 0.63)
Nexgen LPS	Nexgen	125	4246	22571	0.55 (0.46, 0.66)
Nexgen LPS Flex	Nexgen	266	12165	34332	0.77 (0.68, 0.87)
Optetrak-PS	Optetrak	74	1355	4482	1.65 (1.30, 2.07)
Optetrak-PS	Optetrak RBK	8	375	686	1.17 (0.50, 2.30)
PFC Sigma	MBT	76	4043	11459	0.66 (0.52, 0.83)
PFC Sigma	PFC Sigma	196	9495	34095	0.57 (0.50, 0.66)
Profix	Mobile Bearing Knee	39	333	1812	2.15 (1.53, 2.94)
Profix	Profix	148	3949	17525	0.84 (0.71, 0.99)
RBK	RBK	29	1014	2888	1.00 (0.67, 1.44)
Scorpio	Scorpio/Series 7000	200	6023	24889	0.80 (0.70, 0.92)
Scorpio NRG	Scorpio/Series 7000	7	1462	1609	0.44 (0.17, 0.90)
Triathlon	Triathlon	74	6648	10615	0.70 (0.55, 0.88)
Vanguard	Maxim	28	1970	2776	1.01 (0.67, 1.46)
Other (115)		208	4480	17051	1.22 (1.06, 1.40)
TOTAL		**3210**	**118484**	**425382**	**0.75 (0.73, 0.78)**

Note: Some Cementless components have been cemented.
Only prostheses with over 300 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	7 Yrs	9 Yrs
AGC	AGC	0.6 (0.4, 1.0)	2.3 (1.8, 3.0)	3.5 (2.8, 4.3)	4.2 (3.4, 5.2)	5.0 (3.9, 6.4)
Active Knee	Active Knee	1.4 (0.6, 3.4)	4.2 (2.3, 7.5)	4.2 (2.3, 7.5)		
Advance	Advance	1.9 (1.0, 3.3)	5.0 (3.5, 7.2)	6.2 (4.4, 8.6)	8.2 (6.0, 11.1)	
Duracon	Duracon	1.0 (0.8, 1.2)	2.3 (2.0, 2.7)	3.1 (2.8, 3.6)	3.8 (3.4, 4.4)	4.4 (3.7, 5.1)
Genesis II	Genesis II	1.1 (0.9, 1.2)	2.9 (2.6, 3.2)	3.6 (3.3, 4.0)	4.3 (3.9, 4.8)	4.5 (4.0, 5.0)
Genesis II	Mobile Bearing Knee	2.4 (1.1, 5.0)	4.7 (2.6, 8.1)	5.9 (3.5, 9.9)	5.9 (3.5, 9.9)	
Genesis II Oxinium	Genesis II	1.3 (1.1, 1.6)	3.4 (3.0, 3.8)	4.7 (4.1, 5.3)	5.3 (4.5, 6.1)	
Genesis II Oxinium	Mobile Bearing Knee	0.6 (0.1, 2.3)	4.0 (2.3, 7.0)	4.5 (2.6, 7.8)	4.5 (2.6, 7.8)	
Journey	Journey	1.8 (1.1, 2.7)	5.5 (4.1, 7.6)			
Kinemax Plus	Kinemax Plus	0.9 (0.5, 1.4)	2.3 (1.7, 3.2)	2.9 (2.2, 3.9)	3.9 (3.0, 5.1)	4.1 (3.1, 5.3)
LCS	LCS	1.0 (0.7, 1.4)	3.7 (3.2, 4.3)	4.8 (4.2, 5.5)	5.7 (5.0, 6.5)	6.0 (5.2, 6.8)
LCS	MBT	0.9 (0.6, 1.2)	2.2 (1.8, 2.8)	3.1 (2.4, 3.8)	4.5 (3.4, 5.9)	
Maxim	Maxim	1.2 (0.6, 2.6)	2.9 (1.8, 4.7)	4.9 (3.3, 7.1)	5.7 (3.7, 8.8)	
Natural Knee II	Natural Knee II	0.5 (0.2, 1.0)	1.5 (1.0, 2.3)	2.0 (1.3, 3.1)	3.6 (2.4, 5.3)	
Nexgen CR	Nexgen	0.4 (0.3, 0.7)	1.3 (1.0, 1.7)	1.6 (1.3, 2.1)	1.8 (1.4, 2.4)	2.9 (2.0, 4.2)
Nexgen CR Flex	Nexgen	0.6 (0.4, 0.9)	1.4 (1.1, 1.9)	2.4 (1.6, 3.4)		
Nexgen LPS	Nexgen	0.8 (0.6, 1.1)	2.1 (1.7, 2.6)	2.7 (2.2, 3.3)	3.7 (3.1, 4.4)	4.4 (3.4, 5.6)
Nexgen LPS Flex	Nexgen	0.9 (0.8, 1.1)	2.5 (2.2, 2.8)	3.6 (3.2, 4.1)	3.8 (3.2, 4.4)	
Optetrak-PS	Optetrak	1.5 (1.0, 2.4)	5.7 (4.4, 7.3)	7.3 (5.7, 9.1)	9.9 (6.9, 14.0)	
Optetrak-PS	Optetrak RBK	1.5 (0.6, 3.5)	3.3 (1.5, 6.9)			
PFC Sigma	MBT	0.7 (0.5, 1.0)	2.0 (1.6, 2.7)	3.1 (2.4, 4.0)	3.8 (2.7, 5.2)	
PFC Sigma	PFC Sigma	0.9 (0.7, 1.1)	2.0 (1.7, 2.4)	2.7 (2.3, 3.2)	3.0 (2.5, 3.5)	4.1 (2.8, 6.0)
Profix	Mobile Bearing Knee	2.1 (1.0, 4.4)	7.9 (5.5, 11.5)	10.8 (7.8, 14.7)	13.4 (9.8, 18.1)	
Profix	Profix	1.3 (1.0, 1.7)	3.2 (2.7, 3.9)	4.2 (3.5, 4.9)	4.7 (4.0, 5.7)	5.1 (4.1, 6.4)
RBK	RBK	1.1 (0.6, 2.0)	3.3 (2.2, 4.9)	4.8 (3.2, 7.4)	5.5 (3.5, 8.6)	
Scorpio	Scorpio/Series 7000	1.0 (0.8, 1.3)	2.9 (2.5, 3.4)	3.9 (3.3, 4.5)	4.7 (4.0, 5.4)	5.2 (4.2, 6.3)
Scorpio NRG	Scorpio/Series 7000	0.2 (0.1, 0.7)				
Triathlon	Triathlon	0.8 (0.6, 1.1)	1.8 (1.4, 2.3)			
Vanguard	Maxim	1.2 (0.7, 1.8)	2.8 (1.8, 4.5)			
Other (115)		1.3 (1.0, 1.7)	4.2 (3.5, 4.9)	6.2 (5.3, 7.2)	7.7 (6.7, 8.9)	8.6 (7.4, 10.0)

Note: Some Cementless components have been cemented.
Only prostheses with over 300 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	112	3181	12461	0.90 (0.74, 1.08)
Advance	Advance	19	346	1676	1.13 (0.68, 1.77)
Advantim	Advantim	9	751	3402	0.26 (0.12, 0.50)
Columbus	Columbus	13	335	607	2.14 (1.14, 3.66)
Duracon	Duracon	104	3441	15931	0.65 (0.53, 0.79)
Genesis II	Genesis II	17	325	691	2.46 (1.43, 3.94)
Genesis II	Mobile Bearing Knee	16	475	3083	0.52 (0.30, 0.84)
LCS	LCS	116	2314	15721	0.74 (0.61, 0.89)
LCS	MBT	399	14110	46115	0.87 (0.78, 0.95)
Maxim	Maxim	21	603	3758	0.56 (0.35, 0.85)
Natural Knee II	Natural Knee	49	906	5218	0.94 (0.69, 1.24)
Natural Knee II	Natural Knee II	55	1590	7051	0.78 (0.59, 1.02)
Nexgen CR	Nexgen	84	3514	19571	0.43 (0.34, 0.53)
Nexgen CR Flex	Nexgen	65	4950	11615	0.56 (0.43, 0.71)
Nexgen LPS	Nexgen	12	483	887	1.35 (0.70, 2.36)
PFC Sigma	AMK	22	1358	5086	0.43 (0.27, 0.65)
PFC Sigma	MBT	78	1767	5471	1.43 (1.13, 1.78)
Profix	Profix	44	1274	4884	0.90 (0.65, 1.21)
RBK	RBK	87	2969	9879	0.88 (0.71, 1.09)
Rocc	Rocc	10	357	829	1.21 (0.58, 2.22)
Rotaglide Plus	Rotaglide Plus	15	364	1968	0.76 (0.43, 1.26)
Score	Score	6	358	319	1.88 (0.69, 4.09)
Scorpio	Scorpio/Series 7000	151	3651	16005	0.94 (0.80, 1.11)
Scorpio NRG	Scorpio/Series 7000	10	960	1145	0.87 (0.42, 1.61)
Triathlon	Triathlon	31	2958	3905	0.79 (0.54, 1.13)
Vanguard	Maxim	6	357	822	0.73 (0.27, 1.59)
Other (46)		196	1614	5483	3.57 (3.09, 4.11)
TOTAL		**1747**	**55311**	**203582**	**0.86 (0.82, 0.90)**

Note: Only prostheses with over 300 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	7 Yrs	9 Yrs
Active Knee	Active Knee	1.0 (0.7, 1.5)	3.2 (2.6, 4.0)	4.3 (3.6, 5.2)	4.8 (3.9, 5.8)	
Advance	Advance	2.6 (1.3, 5.2)	5.7 (3.6, 9.1)	6.6 (4.2, 10.1)	6.6 (4.2, 10.1)	
Advantim	Advantim	0.3 (0.1, 1.1)	1.3 (0.7, 2.6)	1.5 (0.8, 3.0)	1.5 (0.8, 3.0)	1.5 (0.8, 3.0)
Columbus	Columbus	2.8 (1.4, 5.4)	5.6 (3.1, 10.2)			
Duracon	Duracon	1.1 (0.8, 1.5)	2.7 (2.2, 3.3)	3.3 (2.7, 4.0)	3.8 (3.1, 4.7)	4.0 (3.2, 4.9)
Genesis II	Genesis II	2.1 (1.0, 4.7)	10.1 (6.0, 16.9)			
Genesis II	Mobile Bearing Knee	1.5 (0.7, 3.1)	1.9 (1.0, 3.6)	2.8 (1.7, 4.8)	3.5 (2.1, 5.7)	3.5 (2.1, 5.7)
LCS	LCS	1.4 (1.0, 2.0)	3.3 (2.7, 4.2)	4.2 (3.4, 5.1)	4.8 (4.0, 5.8)	5.9 (4.9, 7.1)
LCS	MBT	1.2 (1.0, 1.4)	3.1 (2.8, 3.4)	3.8 (3.4, 4.2)	4.6 (4.0, 5.2)	
Maxim	Maxim	1.7 (0.9, 3.1)	3.0 (1.9, 4.8)	3.4 (2.2, 5.2)	3.4 (2.2, 5.2)	
Natural Knee II	Natural Knee	1.3 (0.8, 2.3)	2.9 (2.0, 4.3)	4.3 (3.2, 5.9)	6.3 (4.7, 8.5)	
Natural Knee II	Natural Knee II	0.9 (0.5, 1.5)	2.3 (1.6, 3.2)	3.3 (2.4, 4.5)	5.6 (4.1, 7.7)	
Nexgen CR	Nexgen	0.6 (0.4, 1.0)	2.0 (1.6, 2.6)	2.3 (1.8, 2.9)	2.7 (2.2, 3.3)	3.7 (2.3, 6.0)
Nexgen CR Flex	Nexgen	0.7 (0.5, 1.0)	1.6 (1.2, 2.1)	2.5 (1.8, 3.4)		
Nexgen LPS	Nexgen	2.2 (1.2, 4.3)	2.7 (1.4, 5.1)			
PFC Sigma	AMK	0.6 (0.3, 1.2)	1.6 (1.0, 2.5)	2.3 (1.5, 3.6)	2.3 (1.5, 3.6)	
PFC Sigma	MBT	2.5 (1.8, 3.4)	4.9 (3.9, 6.2)	5.8 (4.6, 7.4)	6.9 (5.3, 9.0)	
Profix	Profix	1.2 (0.7, 2.1)	3.6 (2.6, 5.0)	4.4 (3.3, 6.0)	5.2 (3.7, 7.2)	
RBK	RBK	1.3 (0.9, 1.7)	3.0 (2.4, 3.8)	3.9 (3.1, 4.9)	5.0 (3.9, 6.4)	
Rocc	Rocc	1.4 (0.6, 3.4)	3.9 (2.0, 7.7)			
Rotaglide Plus	Rotaglide Plus	0.8 (0.3, 2.6)	2.9 (1.6, 5.4)	3.6 (2.1, 6.3)	4.5 (2.7, 7.6)	
Score	Score	2.3 (0.9, 6.1)				
Scorpio	Scorpio/Series 7000	1.5 (1.1, 1.9)	3.5 (2.9, 4.2)	4.6 (3.9, 5.4)	5.4 (4.5, 6.4)	
Scorpio NRG	Scorpio/Series 7000	0.9 (0.4, 1.8)				
Triathlon	Triathlon	0.9 (0.5, 1.4)	2.1 (1.3, 3.4)			
Vanguard	Maxim	0.6 (0.2, 2.4)	2.2 (1.0, 4.8)			
Other (46)		4.8 (3.8, 6.1)	15.6 (13.6, 17.9)	17.1 (15.0, 19.5)	18.3 (16.0, 20.9)	

Note: Only prostheses with over 300 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	26	1272	6604	0.39 (0.26, 0.58)
Active Knee	Active Knee	25	1004	3587	0.70 (0.45, 1.03)
Advance	Advance	12	313	1303	0.92 (0.48, 1.61)
Duracon	Duracon	250	7558	38789	0.64 (0.57, 0.73)
Genesis II	Genesis II	114	4089	15887	0.72 (0.59, 0.86)
LCS	LCS	93	2173	13498	0.69 (0.56, 0.84)
LCS	MBT	96	4395	13077	0.73 (0.59, 0.90)
Maxim	Maxim	43	1346	6004	0.72 (0.52, 0.96)
Natural Knee II	Natural Knee II	37	1500	7396	0.50 (0.35, 0.69)
Nexgen CR	Nexgen	69	3099	16347	0.42 (0.33, 0.53)
Nexgen CR Flex	Nexgen	43	4515	10738	0.40 (0.29, 0.54)
Nexgen LPS	Nexgen	24	838	3008	0.80 (0.51, 1.19)
Nexgen LPS Flex	Nexgen	6	540	1036	0.58 (0.21, 1.26)
PFC Sigma	MBT	129	3562	11439	1.13 (0.94, 1.34)
PFC Sigma	PFC Sigma	110	4811	18335	0.60 (0.49, 0.72)
Profix	Mobile Bearing Knee	42	627	3191	1.32 (0.95, 1.78)
Profix	Profix	30	766	3690	0.81 (0.55, 1.16)
RBK	RBK	11	422	1384	0.79 (0.40, 1.42)
Scorpio	Scorpio/Series 7000	252	7450	32818	0.77 (0.68, 0.87)
Scorpio NRG	Scorpio/Series 7000	4	440	578	0.69 (0.19, 1.77)
Triathlon	Triathlon	20	2098	2760	0.72 (0.44, 1.12)
Vanguard	Maxim	22	1303	1843	1.19 (0.75, 1.81)
Vanguard	Vanguard	2	379	345	0.58 (0.07, 2.09)
Other (83)		197	3114	13225	1.49 (1.29, 1.71)
TOTAL		**1657**	**57614**	**226882**	**0.73 (0.70, 0.77)**

Note: Only prostheses with over 300 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	7 Yrs	9 Yrs
AGC	AGC	0.8 (0.4, 1.5)	1.5 (1.0, 2.4)	2.0 (1.3, 3.1)	2.7 (1.8, 4.0)	2.7 (1.8, 4.0)
Active Knee	Active Knee	0.5 (0.2, 1.2)	2.3 (1.5, 3.6)	3.2 (2.0, 5.1)		
Advance	Advance	1.3 (0.5, 3.5)	3.1 (1.6, 5.8)	4.6 (2.4, 8.6)		
Duracon	Duracon	1.2 (1.0, 1.4)	2.6 (2.2, 3.0)	3.4 (3.0, 3.9)	4.0 (3.5, 4.5)	4.8 (3.8, 6.0)
Genesis II	Genesis II	1.0 (0.7, 1.4)	2.9 (2.4, 3.6)	3.5 (2.9, 4.2)	3.8 (3.1, 4.6)	3.8 (3.1, 4.6)
LCS	LCS	1.0 (0.6, 1.5)	2.5 (1.9, 3.3)	3.6 (2.9, 4.5)	4.9 (3.9, 6.0)	5.4 (4.3, 6.8)
LCS	MBT	1.0 (0.7, 1.4)	2.5 (2.0, 3.1)	3.3 (2.7, 4.1)	3.4 (2.8, 4.3)	
Maxim	Maxim	0.7 (0.4, 1.4)	2.3 (1.6, 3.3)	3.8 (2.8, 5.2)	4.2 (3.1, 5.8)	
Natural Knee II	Natural Knee II	1.0 (0.6, 1.6)	2.0 (1.4, 2.9)	2.5 (1.8, 3.5)	3.1 (2.2, 4.4)	
Nexgen CR	Nexgen	0.4 (0.3, 0.7)	1.7 (1.3, 2.3)	2.4 (1.9, 3.1)	2.6 (2.1, 3.3)	3.2 (2.3, 4.4)
Nexgen CR Flex	Nexgen	0.6 (0.4, 0.9)	1.2 (0.9, 1.7)	1.4 (1.0, 1.9)		
Nexgen LPS	Nexgen	0.4 (0.1, 1.2)	2.7 (1.7, 4.3)	4.7 (3.1, 7.1)	4.7 (3.1, 7.1)	
Nexgen LPS Flex	Nexgen	0.5 (0.1, 1.8)	1.6 (0.7, 3.6)			
PFC Sigma	MBT	1.6 (1.2, 2.1)	3.8 (3.2, 4.6)	5.1 (4.2, 6.1)	5.9 (4.8, 7.1)	
PFC Sigma	PFC Sigma	0.8 (0.6, 1.2)	2.3 (1.9, 2.9)	3.0 (2.4, 3.6)	3.1 (2.6, 3.8)	4.0 (3.1, 5.3)
Profix	Mobile Bearing Knee	1.4 (0.8, 2.8)	4.9 (3.5, 7.0)	6.6 (4.9, 8.9)	7.8 (5.7, 10.6)	
Profix	Profix	1.2 (0.6, 2.3)	3.1 (2.1, 4.7)	4.1 (2.8, 5.9)	5.0 (3.4, 7.1)	
RBK	RBK	0.3 (0.0, 1.8)	2.8 (1.4, 5.6)	3.9 (2.1, 7.3)		
Scorpio	Scorpio/Series 7000	0.9 (0.7, 1.1)	2.8 (2.4, 3.2)	3.8 (3.3, 4.3)	4.7 (4.1, 5.4)	5.6 (4.5, 7.0)
Scorpio NRG	Scorpio/Series 7000	0.9 (0.3, 2.8)				
Triathlon	Triathlon	0.7 (0.4, 1.2)	1.8 (1.1, 3.0)			
Vanguard	Maxim	1.2 (0.6, 2.1)	2.8 (1.8, 4.4)			
Vanguard	Vanguard	0.3 (0.0, 1.9)				
Other (83)		2.2 (1.7, 2.8)	6.2 (5.3, 7.2)	7.5 (6.5, 8.6)	8.7 (7.6, 10.0)	10.3 (8.7, 12.1)

Note: Only prostheses with over 300 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 reach 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 nine 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 31,335 hip revisions reported to the Registry with a procedure date up to and including 31 December 2009. This is an additional 3,820 procedures compared to the last report.

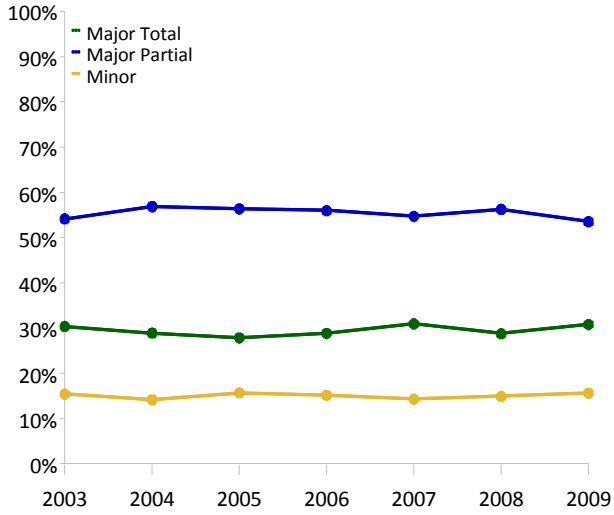
Type of Revision

Most revisions recorded by the Registry are major revisions (85.3%). The most common types of revision are acetabular only (31.7%), femoral/acetabular (30.5%) and femoral only (17.9%) (Table R1).

Minor revisions account for 14.7% 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).

There has been no change in the proportion of major partial, major total and minor revisions since 2003 (Figure R1).

Figure R1: Revision Hip Replacement by Class



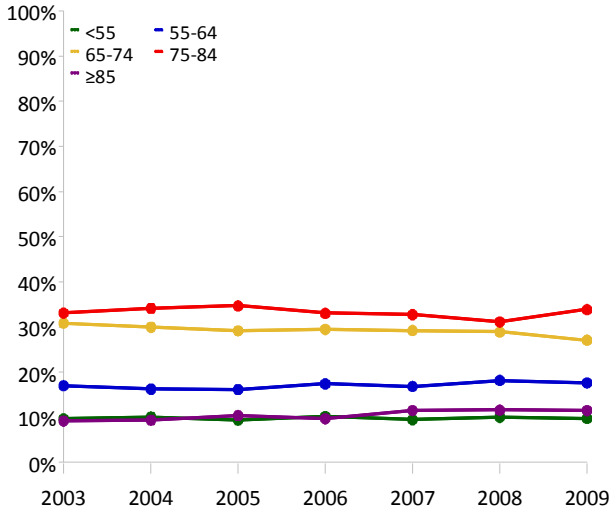
Reason for Revision

The most common reasons for revision are loosening/lysis (55.4%), dislocation (14.4%) infection (11.7%) and fracture (9.0%) (Table R2).

Age and Gender

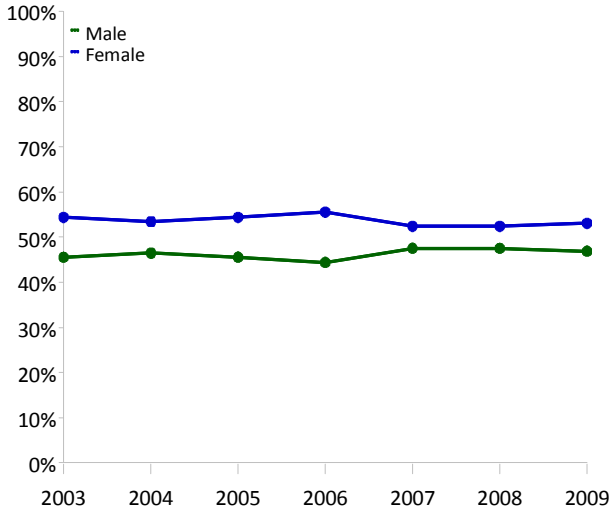
Most revisions occur in the 75-84 year age group. There has been little change in the age distribution of revision procedures since 2003 (Figure R2).

Figure R2: Revision Hip Replacement by Age



Revision hip replacement is more common in females. There has been no change in the proportion of females undergoing revisions (Figure R3).

Figure R3: Revision Hip Replacement by Gender



Detailed information on the demographics of revision hip replacement is provided in the supplementary report 'Demographics of Hip and Knee Arthroplasty' 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 7,022 first revision procedures where the primary procedure has been recorded by the Registry. This is an additional 1,290 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 (79.0%) compared to the 'All Revisions' group (85.3%). There are also less acetabular only and 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 (21.0% compared to 14.7%) (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 (31.5% compared to 55.4%). Other diagnoses such as dislocation, infection and fracture are also more common (Table R2).

Table R1: Revision Hip Replacement by Type of Revision

Type of Revision	Revision of Known Primary		All Revisions	
	Number	Percent	Number	Percent
Major Revision				
Acetabular Only	1576	22.4	9945	31.7
THR (Femoral/Acetabular)	1436	20.5	9561	30.5
Femoral Only	1964	28.0	5615	17.9
Cement Spacer	312	4.4	898	2.9
Bipolar Head and Femoral	159	2.3	354	1.1
Removal of Prostheses	87	1.2	307	1.0
Reinsertion of Components	10	0.1	22	0.1
Saddle	2	0.0	9	0.0
Thrust Plate	1	0.0	3	0.0
N Major	**5547**	**79.0**	**26714**	**85.3**
Minor Revision				
Head/Insert	927	13.2	3293	10.5
Head Only	332	4.7	626	2.0
Insert Only	71	1.0	335	1.1
Minor Components	109	1.6	300	1.0
Head/Neck	32	0.5	58	0.2
Neck Only	2	0.0	6	0.0
Neck/Insert	1	0.0	2	0.0
Cement Only	1	0.0	1	0.0
N Minor	**1475**	**21.0**	**4621**	**14.7**
TOTAL	**7022**	**100.0**	**31335**	**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	2212	31.5	17363	55.4
Prosthesis Dislocation	1612	23.0	4523	14.4
Infection	1082	15.4	3655	11.7
Fracture	1195	17.0	2825	9.0
Wear Acetabulum	52	0.7	847	2.7
Pain	263	3.7	544	1.7
Implant Breakage Acetabular	33	0.5	310	1.0
Implant Breakage Stem	44	0.6	280	0.9
Metal Sensitivity	101	1.4	138	0.4
Malposition	76	1.1	130	0.4
Other	352	5.0	720	2.3
TOTAL	**7022**	**100.0**	**31335**	**100.0**

Outcome of First Revision of Primary Total Conventional Hip Replacement

This analysis examines the risk of subsequent revision following the first revision of a known primary total conventional hip replacement.

There are 3,540 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 risk of re-revision compared to major partial and major total revisions. There is no difference in the risk of re-revision comparing major partial and major total revisions (Tables R3 and R4 and Figure R4).

The outcome 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)

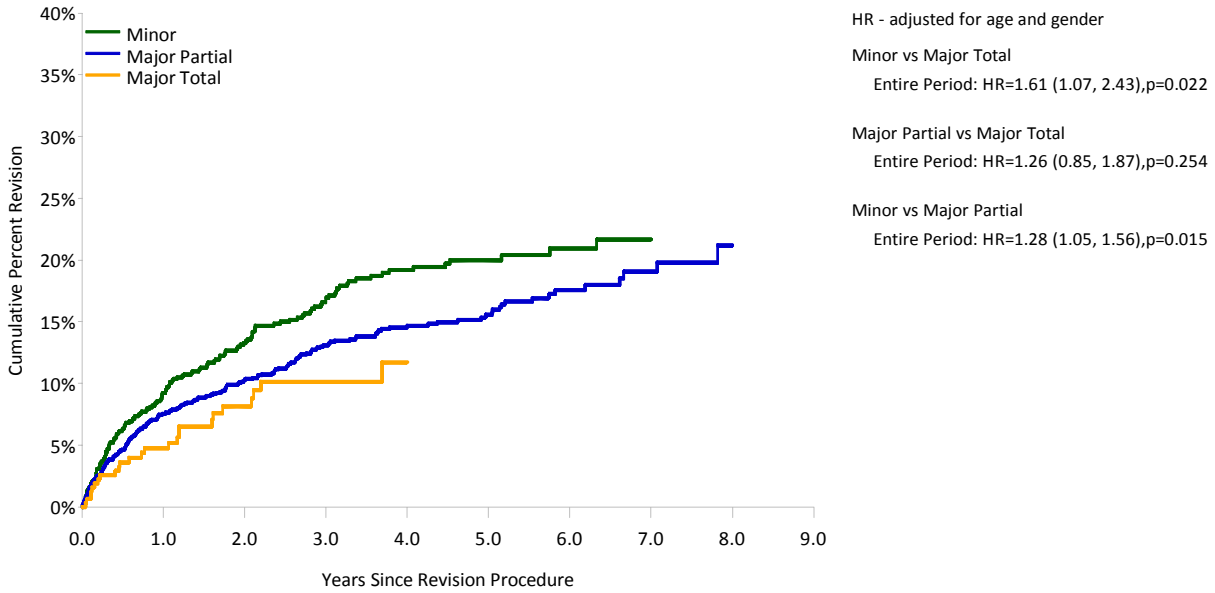
Revision of Primary	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Minor	152	966	2971	5.12 (4.33, 6.00)
Major Partial	262	2249	6248	4.19 (3.70, 4.73)
Major Total	27	325	719	3.75 (2.47, 5.46)
All Revision	**441**	**3540**	**9938**	**4.44 (4.03, 4.87)**

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	7 Yrs	9 Yrs
Minor	9.2 (7.5, 11.3)	16.9 (14.5, 19.8)	20.0 (17.2, 23.2)	21.7 (18.4, 25.5)	
Major Partial	7.5 (6.5, 8.8)	13.1 (11.5, 14.8)	15.6 (13.7, 17.6)	19.1 (16.4, 22.1)	
Major Total	4.8 (2.8, 7.9)	10.1 (6.8, 15.0)			
All Revision	**7.8 (6.9, 8.7)**	**14.0 (12.7, 15.4)**	**16.7 (15.2, 18.4)**	**19.8 (17.7, 22.1)**	

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	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Minor	966	729	570	452	332	224	129	61	25	7
Major Partial	2249	1642	1236	905	624	407	229	117	51	9
Major Total	325	227	147	88	50	34	18	7	3	2

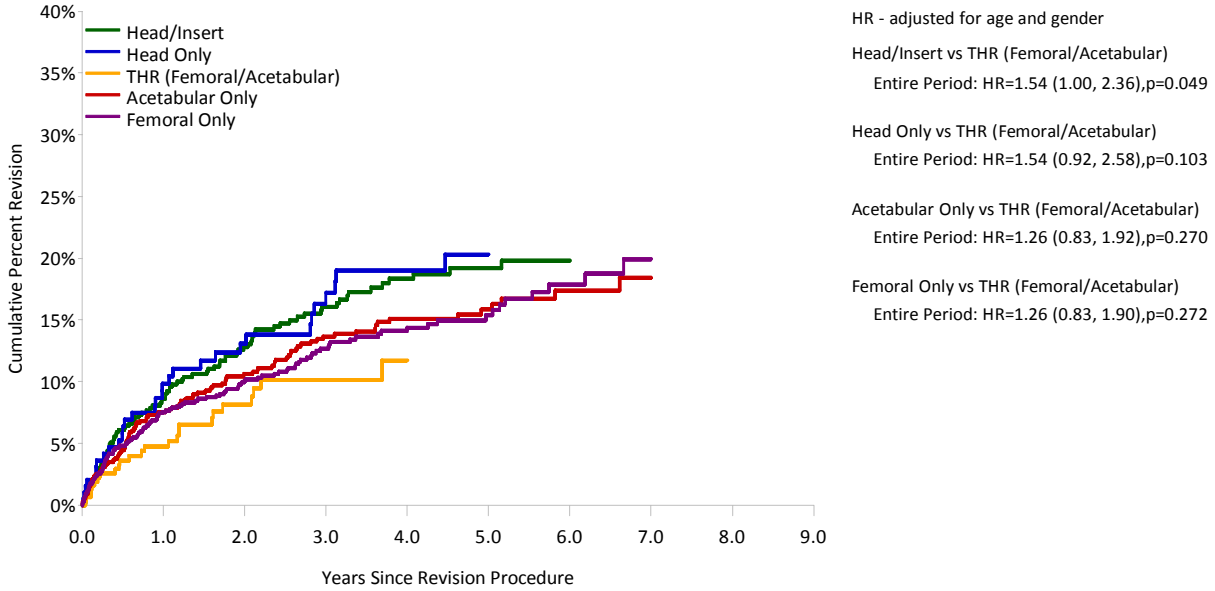
Table R5: Re-revision Rates of Known Primary Total Conventional Hip Replacement (Primary Diagnosis OA, excluding first revision for Infection)

Revision of Primary	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Head/Insert	94	635	1916	4.91 (3.96, 6.00)
Head Only	31	195	643	4.82 (3.28, 6.85)
THR (Femoral/Acetabular)	27	325	719	3.75 (2.47, 5.46)
Acetabular Only	121	1014	2928	4.13 (3.43, 4.94)
Femoral Only	141	1232	3298	4.27 (3.60, 5.04)
TOTAL	**414**	**3401**	**9505**	**4.36 (3.95, 4.80)**

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	7 Yrs	9 Yrs
Head/Insert	8.6 (6.6, 11.2)	16.1 (13.1, 19.6)	19.2 (15.8, 23.2)		
Head Only	9.8 (6.3, 15.2)	17.2 (12.1, 24.1)	20.3 (14.5, 28.0)		
THR (Femoral/Acetabular)	4.8 (2.8, 7.9)	10.1 (6.8, 15.0)			
Acetabular Only	7.5 (6.0, 9.4)	13.7 (11.4, 16.3)	15.8 (13.2, 18.9)	18.4 (14.9, 22.6)	
Femoral Only	7.6 (6.1, 9.3)	12.7 (10.6, 15.0)	15.4 (12.9, 18.3)	19.9 (16.0, 24.7)	

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	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Head/Insert	635	475	374	297	212	140	78	33	10	2
Head Only	195	153	121	95	72	52	30	19	9	2
THR (Femoral/Acetabular)	325	227	147	88	50	34	18	7	3	2
Acetabular Only	1014	741	565	428	302	200	116	68	35	7
Femoral Only	1232	898	668	474	319	204	110	48	16	2

Outcome of First Revision of Primary Total Resurfacing Hip Replacement

There are 447 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 only (57.7%) followed by femoral/acetabular (34.9%) and acetabular only revisions (7.4%).

There is no difference in the risk 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)

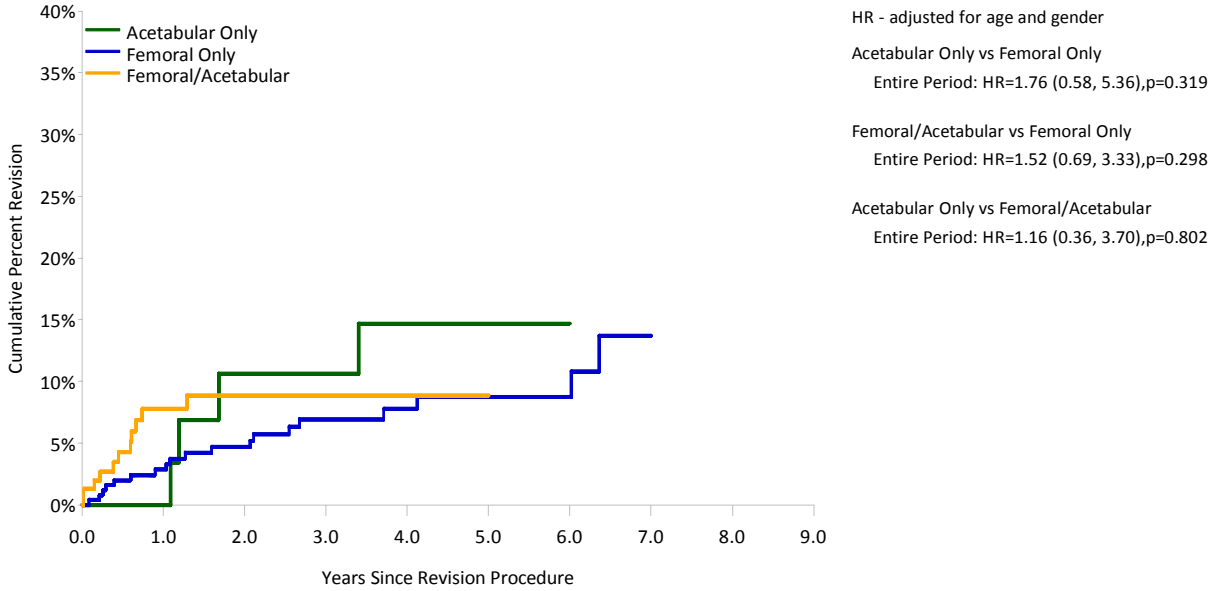
Revision of Primary	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Acetabular Only	4	33	129	3.11 (0.85, 7.96)
Femoral Only	19	258	896	2.12 (1.28, 3.31)
THR (Femoral/Acetabular)	11	156	301	3.65 (1.82, 6.54)
All Revision	**34**	**447**	**1326**	**2.56 (1.78, 3.58)**

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	7 Yrs	9 Yrs
Acetabular Only	0.0 (0.0, 0.0)	10.6 (3.5, 29.5)	14.7 (5.8, 34.7)		
Femoral Only	2.9 (1.4, 5.9)	6.9 (4.2, 11.3)	8.7 (5.4, 14.0)	13.7 (7.6, 23.9)	
THR (Femoral/Acetabular)	7.8 (4.2, 14.1)	8.9 (5.0, 15.6)	8.9 (5.0, 15.6)		
All Revision	4.2 (2.6, 6.6)	6.5 (4.4, 9.5)	8.1 (5.6, 11.5)		

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	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Acetabular Only	33	30	23	22	16	11	8	2	0	0
Femoral Only	258	221	184	140	102	72	44	19	1	0
THR (Femoral/Acetabular)	156	91	65	36	22	11	3	3	2	0

Revision Knee

Demographics of All Revision

This analysis is of 24,162 knee revisions reported to the Registry with a procedure date up to and including 31 December 2009. This is an additional 3,220 procedures compared to the last report.

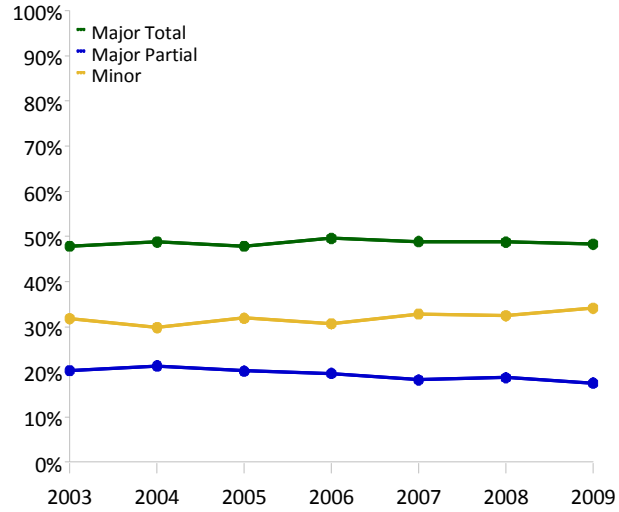
Type of Revision

Most revisions recorded by the Registry are major revisions (67.4%). The most common major revisions are tibial/femoral (48.3%) and tibial only (8.2%) (Table R9).

Minor revisions account for 32.6% of all knee revisions. The most common are insert only (13.4%), patellar only (10.3%) and insert/patella (7.3%) (Table R9).

There has been no change in the proportion of major total, major partial and minor revisions since 2003 (Figure R7).

Figure R7: Revision Knee Replacement by Class



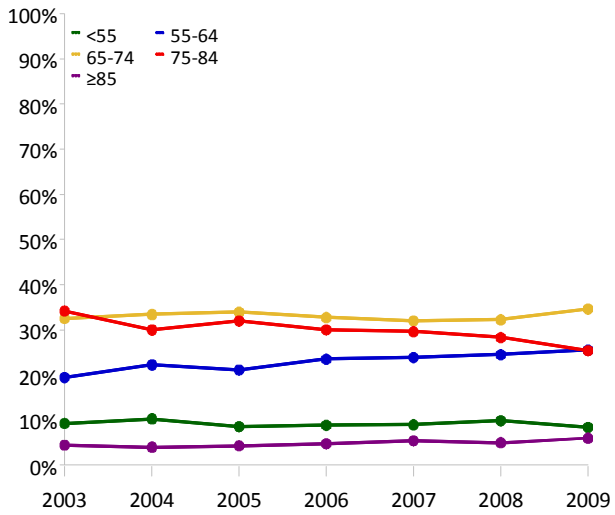
Reason for Revision

The most common reasons for revision are loosening/lysis (42.4%), infection (18.0%) and pain (13.1%) (Table R10).

Age and Gender

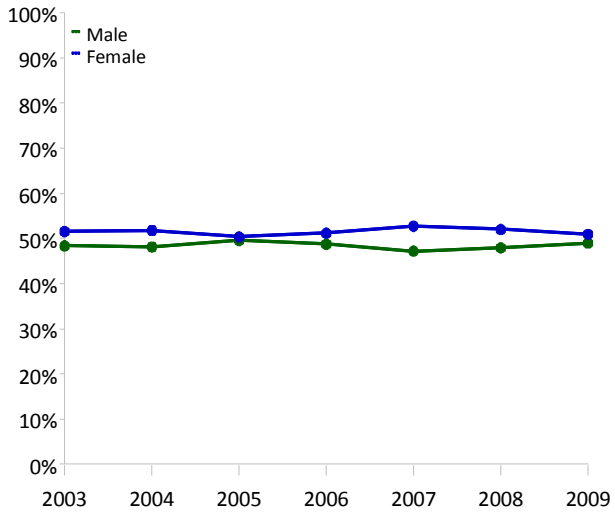
Most revisions occur in the 65-74 year age group. The number of revisions in the 75-84 year age group has been declining (Figure R8).

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



Demographics of Revisions of Known Primary

This year the Registry is analysing 9,288 first revision procedures where the primary procedure has been recorded by the Registry. This is an additional 1,651 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 (62.0%) compared to the 'All Revisions' group (67.4%), with less tibial/femoral revisions (39.9% compared to 48.3%) (Table R9).

There is a higher proportion of minor revisions (38.0% compared to 32.6%) (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 (35.7% compared to 42.4%). Of the three most common reasons, pain is the only reason that has a higher proportion in the 'Revisions of known Primary Procedures' group (20.5% compared to 13.1%) (Table R10).

Table R9: Revision Knee Replacement by Type of Revision

Type of Revision	Revision of Known Primary		All Revisions	
	Number	Percent	Number	Percent
Major Revision				
TKR (Tibial/Femoral)	3710	39.9	11666	48.3
Tibial Only	771	8.3	1989	8.2
Femoral Only	570	6.1	1077	4.5
Cement Spacer	384	4.1	1042	4.3
Uni Tibial Only	131	1.4	168	0.7
Removal of Prostheses	57	0.6	139	0.6
UKR (Uni Tibial/Uni Femoral)	66	0.7	102	0.4
Uni Femoral Only	53	0.6	76	0.3
Patella/Trochlear Resurfacing	12	0.1	31	0.1
Reinsertion of Components	4	0.0	6	0.0
Bicompartmental			1	0.0
N Major	**5758**	**62.0**	**16297**	**67.4**
Minor Revision				
Insert Only	1355	14.6	3230	13.4
Patella Only	1501	16.2	2493	10.3
Insert/Patella	488	5.3	1766	7.3
Uni Insert Only	155	1.7	246	1.0
Minor Components	15	0.2	98	0.4
Cement Only	8	0.1	14	0.1
Removal of Patella			8	0.0
Partial Resurfacing	3	0.0	4	0.0
Unispacer	4	0.0	4	0.0
Cement Spacer	1	0.0	2	0.0
N Minor	**3530**	**38.0**	**7865**	**32.6**
TOTAL	**9288**	**100.0**	**24162**	**100.0**

Table R10: Revision Knee Replacement by Reason for Revision

Reason for Revision	Revisions of Known Primary		All Revisions	
	Number	Percent	Number	Percent
Loosening/Lysis	3315	35.7	10249	42.4
Infection	1585	17.1	4340	18.0
Pain	924	9.9	1592	6.6
Patellofemoral Pain	982	10.6	1582	6.5
Wear Tibial	131	1.4	1512	6.3
Progression Of Disease	552	5.9	955	4.0
Instability	388	4.2	766	3.2
Implant Breakage Tibial	70	0.8	522	2.2
Arthrofibrosis	319	3.4	487	2.0
Fracture	224	2.4	458	1.9
Malalignment	173	1.9	286	1.2
Bearing Dislocation	123	1.3	203	0.8
Implant Breakage Patella	31	0.3	172	0.7
Incorrect Sizing	105	1.1	151	0.6
Wear Patella	5	0.1	131	0.5
Patella Maltracking	70	0.8	128	0.5
Implant Breakage Femoral	17	0.2	100	0.4
Prosthesis Dislocation	31	0.3	77	0.3
Metal Sensitivity	25	0.3	69	0.3
Synovitis	36	0.4	69	0.3
Patella Erosion	40	0.4	43	0.2
Avascular Necrosis	33	0.4	40	0.2
Heterotopic Bone	3	0.0	14	0.1
Tumour	5	0.1	12	0.0
Wear Femoral	1	0.0	10	0.0
Incorrect Side	2	0.0	2	0.0
Other	98	1.1	192	0.8
TOTAL	**9288**	**100.0**	**24162**	**100.0**

Outcome of First Revision of Primary Unicompartmental Knee Replacement

This analysis examines the risk of subsequent revision following the first revision of a known primary unicompartmental knee replacement.

There are 2,291 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 risk 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 almost 30% at three years. This compares to a re-revision of 9.8% at the same time if a unicompartmental knee is revised to a total knee replacement (Tables R11 and R12 and Figure R10).

The most common '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. There is no difference in the risk of re-revision between these two procedures (Tables R13 and R14 and Figure R11).

The outcome of revising a unicompartmental knee replacement to a total knee is the same as revision of a total knee to a total knee (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)

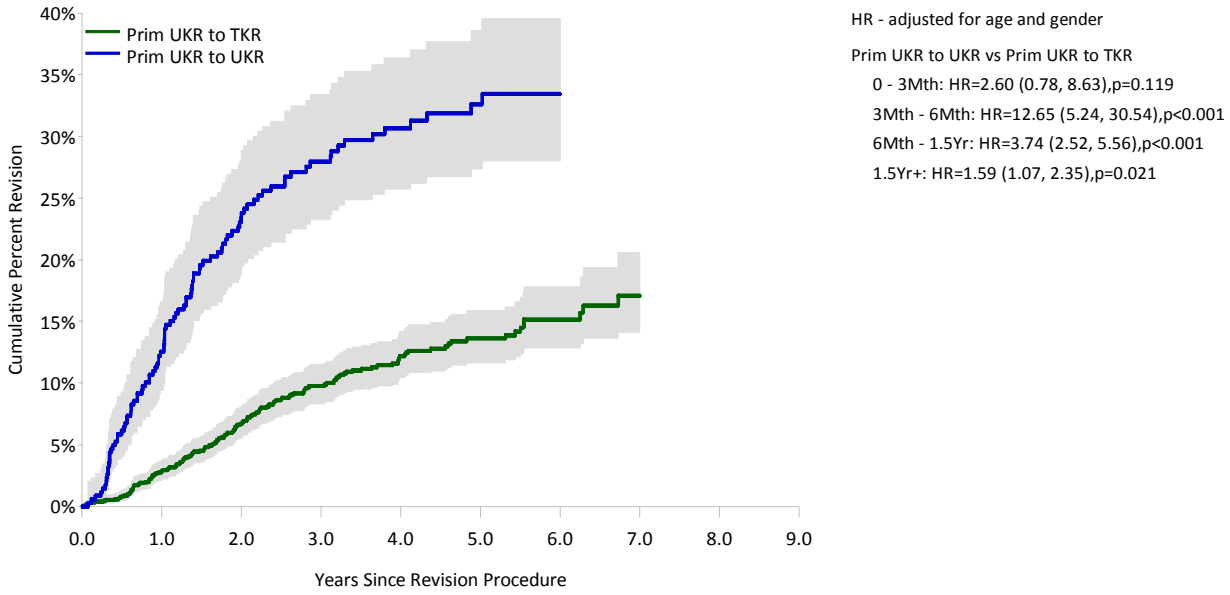
Revisions of Primary	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Prim UKR to TKR	175	1937	5758	3.04 (2.61, 3.52)
Prim UKR to UKR	99	354	1153	8.59 (6.98, 10.45)
All Revision	**274**	**2291**	**6911**	**3.96 (3.51, 4.46)**

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	7 Yrs	9 Yrs
Prim UKR to TKR	2.9 (2.2, 3.8)	9.8 (8.3, 11.5)	13.6 (11.7, 15.9)	17.1 (14.1, 20.6)	
Prim UKR to UKR	12.5 (9.4, 16.6)	27.9 (23.3, 33.4)	32.6 (27.4, 38.6)		
All Revision	**4.4 (3.6, 5.4)**	**12.8 (11.3, 14.5)**	**16.9 (15.0, 19.0)**	**19.9 (17.3, 22.9)**	

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	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Prim UKR to TKR	1937	1561	1179	850	584	372	193	80	15	1
Prim UKR to UKR	354	281	214	171	128	85	58	34	12	4

Table R13: Re-revision Rates of Known Primary Unicompartmental Knee Replacement (Primary Diagnosis OA, excluding first revision for Infection)

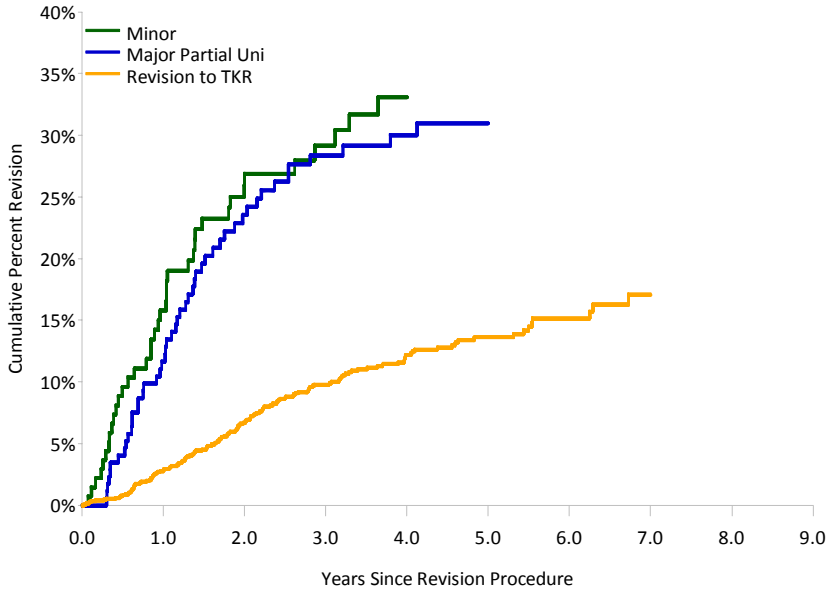
Revisions of Primary	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Minor	41	140	422	9.73 (6.98, 13.20)
Major Partial Uni	52	180	624	8.33 (6.22, 10.92)
Major Total Uni	6	34	107	5.61 (2.06, 12.21)
Revision to TKR	175	1937	5758	3.04 (2.61, 3.52)
TOTAL	**274**	**2291**	**6911**	**3.96 (3.51, 4.46)**

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	7 Yrs	9 Yrs
Minor	15.8 (10.6, 23.2)	29.1 (21.9, 38.2)			
Major Partial Uni	11.7 (7.7, 17.5)	28.4 (22.0, 36.1)	31.0 (24.3, 39.0)		
Revision to TKR	2.9 (2.2, 3.8)	9.8 (8.3, 11.5)	13.6 (11.7, 15.9)	17.1 (14.1, 20.6)	

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=11.16 (5.56, 22.39),p<0.001
6Mth+: HR=2.30 (1.53, 3.45),p<0.001

Major Partial Uni vs Revision to TKR
0 - 1.5Yr: HR=4.05 (2.70, 6.07),p<0.001
1.5Yr+: HR=1.66 (1.01, 2.72),p=0.045

Minor vs Major Partial Uni
Entire Period: HR=1.13 (0.75, 1.69),p=0.572

Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Minor	140	106	78	59	42	29	21	13	4	1
Major Partial Uni	180	147	114	97	76	51	33	18	6	1
Revision to TKR	1937	1561	1179	850	584	372	193	80	15	1

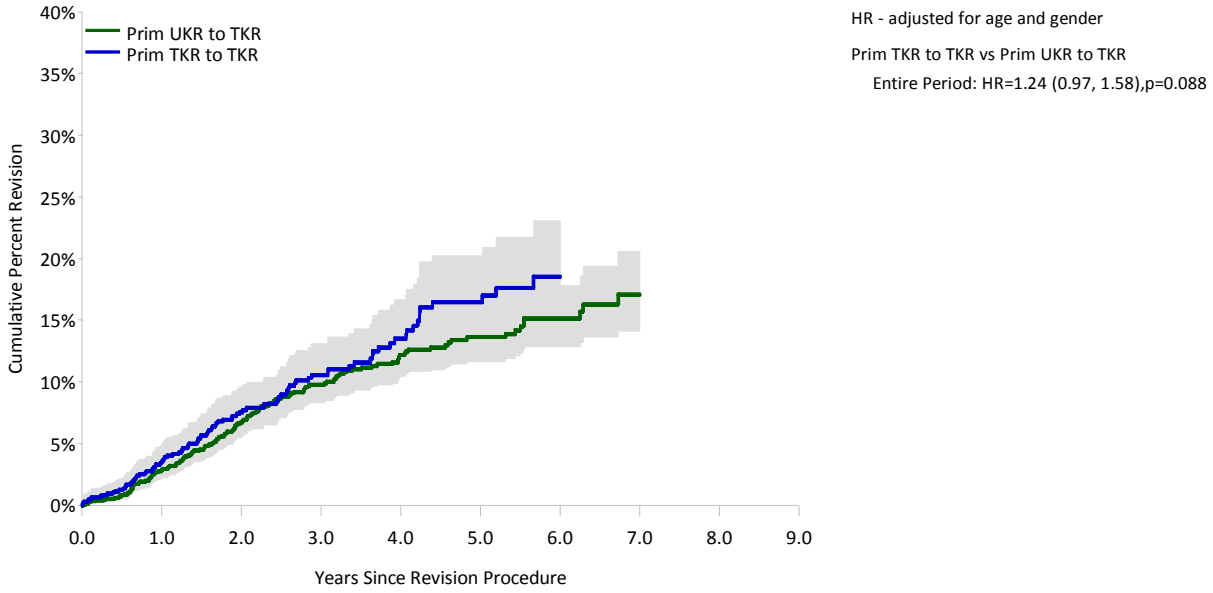
Table R15: Re-revision Rates of Known Primary Knee Replacement (Primary Diagnosis OA, excluding first revision for Infection)

Revisions of Primary	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Prim UKR to TKR	175	1937	5758	3.04 (2.61, 3.52)
Prim TKR to TKR	102	1083	2836	3.60 (2.93, 4.37)
TOTAL	**277**	**3020**	**8594**	**3.22 (2.85, 3.63)**

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	7 Yrs	9 Yrs
Prim UKR to TKR	2.9 (2.2, 3.8)	9.8 (8.3, 11.5)	13.6 (11.7, 15.9)	17.1 (14.1, 20.6)	
Prim TKR to TKR	3.6 (2.5, 4.9)	10.6 (8.5, 13.1)	16.5 (13.4, 20.2)		

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	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Prim UKR to TKR	1937	1561	1179	850	584	372	193	80	15	1
Prim TKR to TKR	1083	821	583	394	246	157	73	33	6	1

Outcome of First Revision of Primary Total Knee Replacement

This analysis examines the risk of subsequent revision following the first revision of a known primary total knee replacement.

There are 4,946 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.

Minor revisions have a similar risk of re-revision compared to major partial and major total revisions. Major partial revisions have a higher risk compared to major total (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 higher risk of re-revision than tibial/femoral revision (Figure R13).

Revising the patella either alone or in combination with an insert exchange has the same risk of re-revision as a major revision. Revising the insert alone has the highest risk of re-revision of any first revision of a known primary total knee replacement (Tables R19 and R20 and Figures R13 and R14).

Table R17: Revision Rates of Re-revision of Known Primary Total Knee Replacement (Primary Diagnosis OA, excluding first revision for Infection)

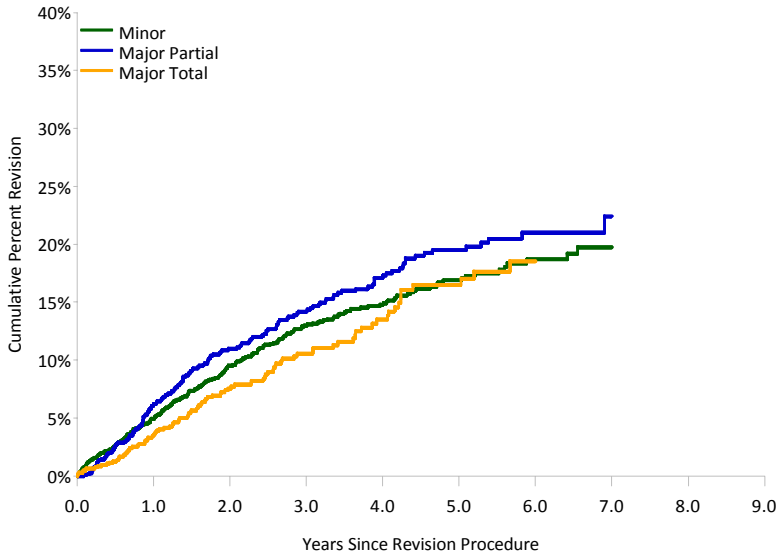
Revision of Primary	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Minor	295	2641	7183	4.11 (3.65, 4.60)
Major Partial	172	1222	3762	4.57 (3.91, 5.31)
Major Total	102	1083	2836	3.60 (2.93, 4.37)
All Revision	**569**	**4946**	**13780**	**4.13 (3.80, 4.48)**

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	7 Yrs	9 Yrs
Minor	4.9 (4.1, 5.9)	13.0 (11.5, 14.6)	16.9 (15.0, 19.0)	19.7 (17.1, 22.7)	
Major Partial	6.2 (5.0, 7.8)	14.2 (12.1, 16.6)	19.5 (16.8, 22.5)	22.4 (18.6, 26.9)	
Major Total	3.6 (2.5, 4.9)	10.6 (8.5, 13.1)	16.5 (13.4, 20.2)		
All Revision	**5.0 (4.4, 5.7)**	**12.8 (11.7, 13.9)**	**17.5 (16.1, 19.0)**	**20.2 (18.3, 22.3)**	

Figure R13: Cumulative Percent Re-revision of Known Primary Total Knee Replacement (Primary Diagnosis OA, excluding first revision for Infection)



HR - adjusted for age and gender

Minor vs Major Total
Entire Period: HR=1.17 (0.93, 1.46),p=0.182

Major Partial vs Major Total
Entire Period: HR=1.32 (1.04, 1.69),p=0.025

Major Partial vs Minor
Entire Period: HR=1.14 (0.94, 1.37),p=0.186

Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Minor	2641	2010	1448	1010	683	407	220	104	27	6
Major Partial	1222	971	754	566	415	272	131	50	14	1
Major Total	1083	821	583	394	246	157	73	33	6	1

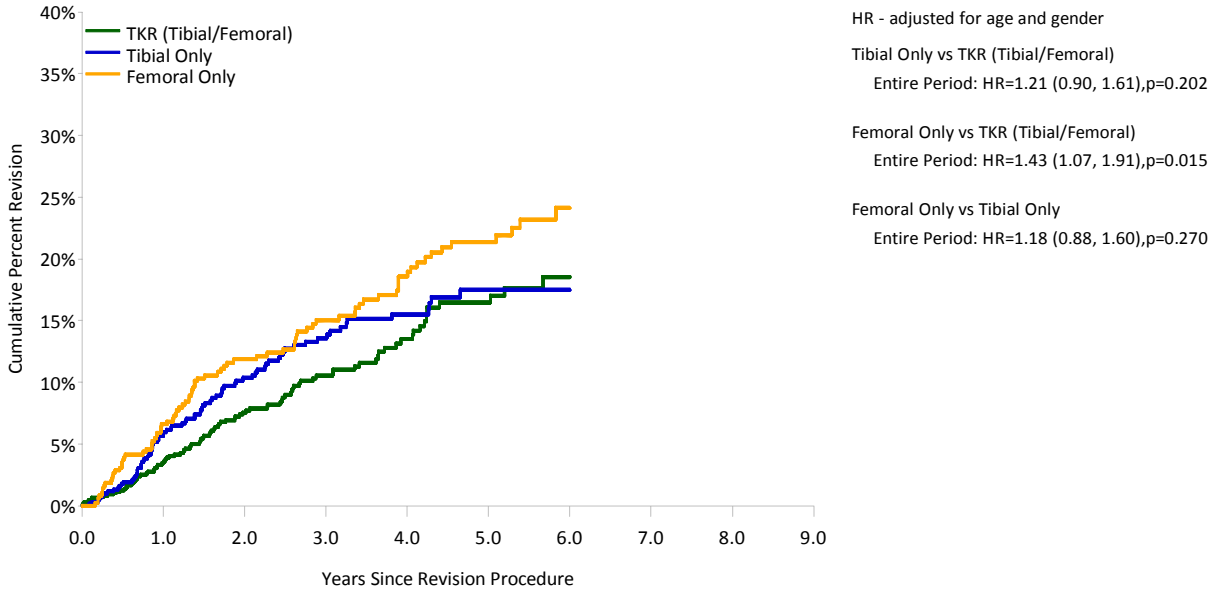
Table R19: Re-revision Rates of Known Primary Total Knee Replacement (Primary Diagnosis OA, excluding first revision for Infection)

Revision of Primary	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Insert/Patella	48	464	1336	3.59 (2.65, 4.76)
Insert Only	127	748	1884	6.74 (5.62, 8.02)
Patella Only	118	1422	3936	3.00 (2.48, 3.59)
TKR (Tibial/Femoral)	102	1083	2836	3.60 (2.93, 4.37)
Tibial Only	86	716	2054	4.19 (3.35, 5.17)
Femoral Only	85	505	1704	4.99 (3.98, 6.17)
TOTAL	**566**	**4938**	**13751**	**4.12 (3.78, 4.47)**

Table R20: Yearly Cumulative Percent Re-revision of Known Primary Total Knee Replacement (Primary Diagnosis OA, excluding first revision for Infection)

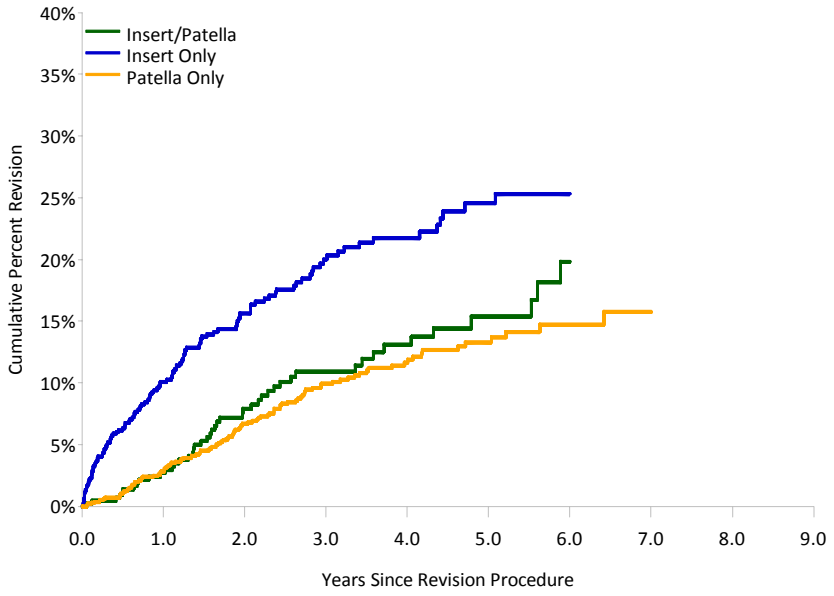
CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Insert/Patella	2.7 (1.5, 4.8)	10.9 (7.9, 14.9)	15.4 (11.3, 20.7)		
Insert Only	10.1 (8.0, 12.6)	20.0 (16.8, 23.7)	24.5 (20.6, 29.2)		
Patella Only	2.8 (2.1, 3.9)	9.9 (8.2, 12.0)	13.3 (11.0, 16.1)	15.7 (12.5, 19.7)	
TKR (Tibial/Femoral)	3.6 (2.5, 4.9)	10.6 (8.5, 13.1)	16.5 (13.4, 20.2)		
Tibial Only	6.0 (4.4, 8.1)	13.6 (10.9, 16.8)	17.5 (14.1, 21.6)		
Femoral Only	6.6 (4.7, 9.3)	15.0 (11.9, 18.9)	21.4 (17.4, 26.1)		

Figure R13: 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	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
TKR (Tibial/Femoral)	1083	821	583	394	246	157	73	33	6	1
Tibial Only	716	558	419	290	203	126	72	33	10	1
Femoral Only	505	412	334	275	212	146	59	17	4	0

Figure R14: 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=1.16 (0.83, 1.63),p=0.386

Insert Only vs Patella Only

0 - 3Mth: HR=9.28 (4.40, 19.56),p<0.001

3Mth - 9Mth: HR=2.32 (1.37, 3.93),p=0.001

9Mth - 1.5Yr: HR=2.57 (1.57, 4.22),p<0.001

1.5Yr+: HR=1.16 (0.77, 1.72),p=0.478

Insert Only vs Insert/Patella

0 - 3Mth: HR=7.99 (3.67, 17.40),p<0.001

3Mth - 1.5Yr: HR=2.11 (1.38, 3.24),p<0.001

1.5Yr+: HR=1.00 (0.63, 1.57),p=0.983

Number at Risk	0 Yr	1 Yrs	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs
Insert/Patella	464	360	264	195	137	80	45	23	9	2
Insert Only	748	540	376	247	172	101	61	27	6	1
Patella Only	1422	1105	803	563	371	223	113	53	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 risk 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, eleven 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 2010 Annual Report are available on the Registry website, www.dmac.adelaide.edu.au/aoanjrr/publications.jsp.

Primary Partial Hip Replacement

Unipolar Modular

The Taperloc femoral stem has a higher risk of revision compared to all other unipolar modular prostheses (adj HR=2.50; 95%CI (1.24, 5.05), p=0.010). There have been 115 prostheses used. Of the eight revisions, three have been revised for dislocation and three for loosening. The Taperloc has not been identified as an individual prosthesis previously but was identified when used in combination with the Endo II head in the 2006, 2007 and 2008 Annual Report.

The Modular Cathcart/Corail prostheses combination has been identified as having a higher than anticipated revision rate in the previous two annual reports. This was due largely to an increased incidence of fracture compared to other unipolar prostheses. This remains the situation (44% of all revisions compared to 16%) however, there is no difference in the overall revision rate compared to all other unipolar prostheses (adj HR=1.51; 95%CI (0.94, 2.43), p=0.089).

Table IP1: Revision Rate of Individual Unipolar Modular Hip identified as having a Higher than Anticipated Revision Rate

Unipolar Head/Femoral	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Newly Identified				
**Taperloc	115	274	2.92	Entire Period: HR=2.50 (1.24, 5.05), p=0.010

Note: All Components have been compared to all other Unipolar Modular Hip components.
**Femoral Component

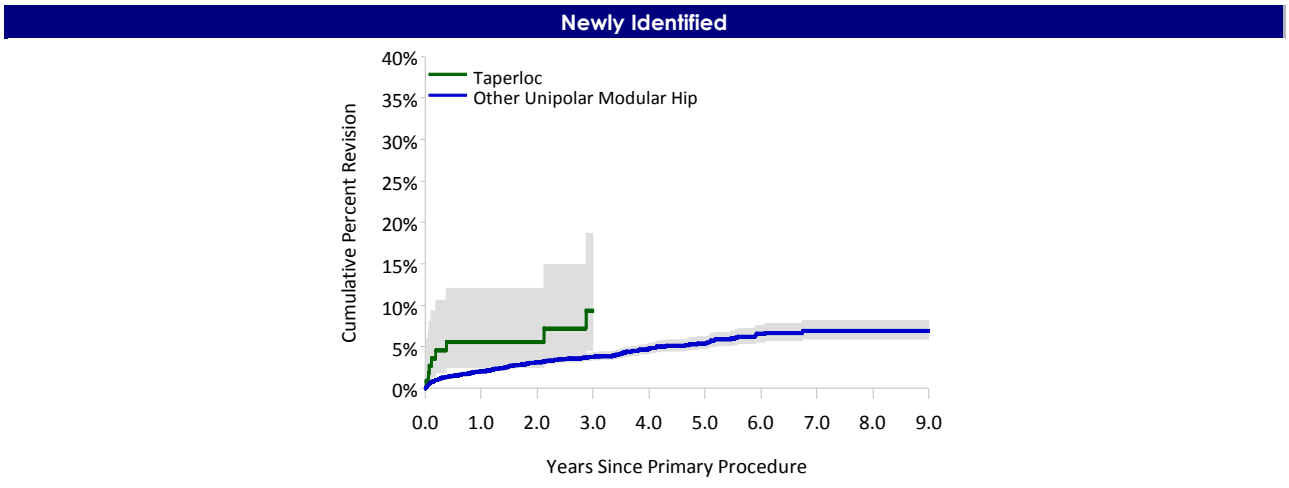
Table IP2: Yearly Cumulative Percent Revision of Individual Unipolar Modular Hip identified as having a Higher than Anticipated Revision Rate

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Newly Identified					
**Taperloc	5.6 (2.5, 12.0)	9.3 (4.5, 18.7)			

Table IP3: Yearly Usage of Individual Unipolar Modular Hip identified as having a Higher than Anticipated Revision Rate

Year of Implant	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Newly Identified											
**Taperloc						31	29	17	8	12	18

Figure IP1: Cumulative Percent Revision of Individual Unipolar Modular Hip newly identified



Bipolar

The Tandem/Spectron EF bipolar prostheses combination has a higher risk of revision after two years compared to all other bipolar prosthesis (adj HR=10.8; 95%CI (3.34, 34.96), p<0.001). The Registry has information on 137 procedures, nine of which have been revised, five for loosening. The risk of revision is related to the size of the femoral prosthesis, with Size 1 being the only size that is significantly different from all other bipolar prostheses.

The Registry has re-identified the Ringloc component (previously called Bipolar Head, Biomet), as well as the UHR/ABGII and the UHR/Omnifit combinations.

Table IP4: 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
Re-Identified and still used				
*Ringloc	147	419	2.15	Entire Period: HR=1.98 (1.02, 3.86), p=0.043
UHR/ABGII	172	516	1.94	Entire Period: HR=1.97 (1.05, 3.70), p=0.034
UHR/Omnifit	341	1361	1.32	Entire Period: HR=1.62 (1.01, 2.61), p=0.046
Newly Identified				
Tandem/Spectron EF	137	240	3.74	0-2Yr: HR=1.78 (0.79, 4.01), p=0.163 2Yr+: HR=10.81 (3.34, 34.96), p<0.001

Note All Components have been compared to all other Bipolar Hip components.
* Bipolar Head Component

Table IP5: Yearly Cumulative Percent Revision of Individual Bipolar Hip identified as having a Higher than Anticipated Revision Rate

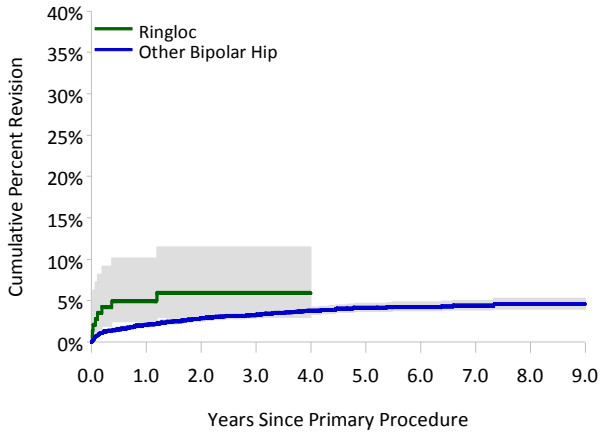
CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Re-Identified and still used					
*Ringloc	5.0 (2.4, 10.2)	5.9 (3.0, 11.5)			
UHR/ABGII	3.8 (1.7, 8.4)	4.8 (2.3, 10.0)			
UHR/Omnifit	4.8 (2.9, 7.8)	5.2 (3.2, 8.3)	5.7 (3.5, 9.0)	6.5 (4.0, 10.3)	
Newly Identified					
Tandem/Spectron EF	2.5 (0.8, 7.7)				

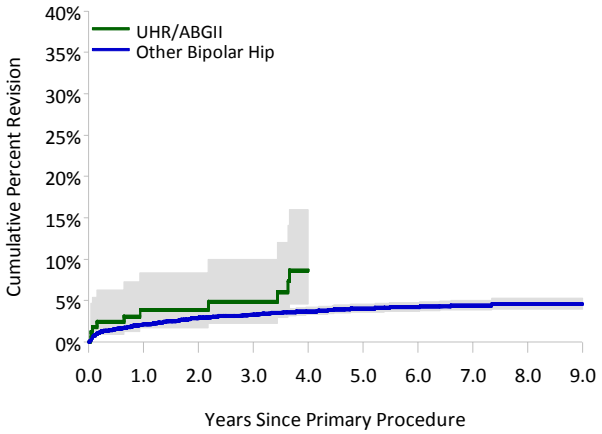
Table IP6: Yearly Usage of Individual Bipolar Hip identified as having a Higher than Anticipated Revision Rate

Year of Implant	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Re-Identified and still used											
*Ringloc	1	3	6	16	19	21	16	20	18	17	10
UHR/ABGII			1	24	25	36	34	10	15	20	7
UHR/Omnifit	5	25	47	68	59	42	31	24	12	17	11
Newly Identified											
Tandem/Spectron EF						3	21	24	30	34	25

Figure IP2: Cumulative Percent Revision of Individual Bipolar Hip re-identified and still used

Re-identified and still used





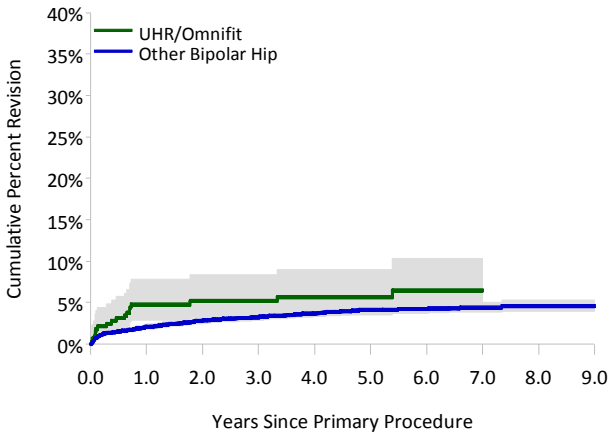
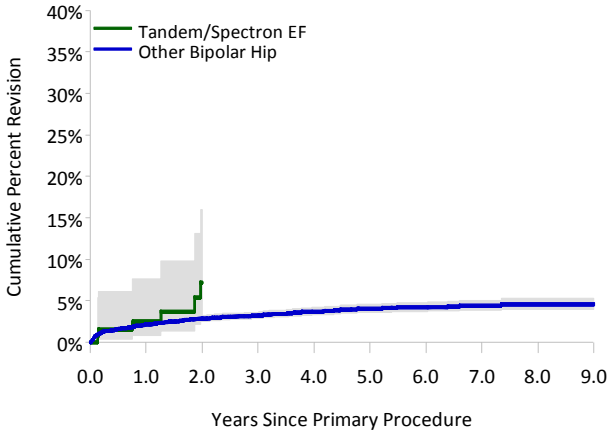


Figure IP3: Cumulative Percent Revision of Individual Bipolar Hip newly identified

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 1,539 combinations used in primary total conventional hip replacement. This is 154 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.

The CBH, K2, Adaptor (cementless) and Quadra-H femoral stems, the Icon acetabular prosthesis and the S-Rom/Duraloc combination are newly Identified. The Registry has previously identified the Adaptor cemented stem and this year is also identifying the Adaptor cementless stem. The Quadra-H and the Icon have been previously identified in combination with other prostheses but this year they are being individually identified.

The CBH femoral stem has been used in 125 procedures and has a one year cumulative percent revision of 4.3%. It has three times the risk of revision compared to all other total conventional hip replacement (adj HR=2.98; 95%CI (1.49, 5.97), p=0.002). Five of the eight revisions were for loosening.

The K2 femoral stem has been used in 263 procedures and has a one year cumulative percent revision of 4.8%. It has over three times the risk of revision compared to all other total conventional hip replacement (adj HR=3.26; 95%CI (1.85, 5.74), p<0.001). Of the 12 revisions, five were for dislocation and three for loosening.

The Adaptor cementless stem has been used in 567 procedures and has a three year cumulative percent revision of 5.4%. It has twice the risk of revision compared to all other total conventional hip replacement (adj HR=1.99; 95%CI (1.32, 2.99), p=0.001). Of the 23 revisions, five were for loosening, five for dislocation and four for pain.

The Quadra-H femoral stem has been used in 837 procedures and has a one year cumulative percent revision of 3.1%. It has over five times the risk of revision in the first two weeks compared to all other total conventional hip replacement (adj 0-2wk HR =5.12; 95%CI (2.82, 9.29), p<0.001). There is no difference in the risk of revision after this time. Of the 23 revisions, nine have been for fracture and four for dislocation.

The Icon acetabular component has been used in 351 procedures and has a three year cumulative percent revision of 6.6%. It has over twice the risk of revision compared to all other total conventional hip replacement (adj HR=2.22; 95%CI (1.38, 3.58), p=0.001). Of the 17 revisions, seven were for dislocation and five for infection.

The S-Rom/Duraloc combination has been used in 166 procedures and has a seven year cumulative percent revision of 6.9%. It has two and a half times the risk of revision compared to all other total conventional hip replacement (adj HR=2.46; 95%CI (1.54, 3.91), p<0.001). Seven of the 18 revisions were for loosening and six for lysis.

The CLS/Trilogy combination and the Anca Fit femoral stem have been previously identified prostheses. This year's analysis shows no significant difference in the revision rate compared to all other total conventional hip replacement (CLS/Trilogy adj HR=1.90; 95%CI (0.95, 3.80), p=0.070; Anca_Fit adj HR=1.84; 95%CI (0.96, 3.54), p=0.067).

Table IP7: 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	1145	1.75	0 - 3.5Yr: HR=1.18 (0.53, 2.63), p=0.681 3.5Yr - 4Yr: HR=12.82 (4.75, 34.57), p<0.001 4Yr+: HR=4.83 (2.59, 9.02), p<0.001
Elite Plus/Apollo	52	353	2.55	Entire Period: HR=4.00 (2.08, 7.69), p<0.001
Elite Plus/Charnley LPW	89	546	2.01	Entire Period: HR=2.99 (1.65, 5.39), p<0.001
F2L/Delta	110	419	2.63	Entire Period: HR=3.33 (1.85, 6.01), p<0.001
H Moos/Mueller	19	101	7.92	Entire Period: HR=11.56 (5.78, 23.13), p<0.001
Secur-Fit Plus/Secur-Fit	197	1134	1.68	Entire Period: HR=2.46 (1.57, 3.86), p<0.001
*Lyderic II	164	753	1.59	Entire Period: HR=2.25 (1.28, 3.97), p=0.004
*Margron	688	3597	2.17	Entire Period: HR=3.09 (2.47, 3.86), p<0.001
*Revitan (non mod)	82	481	1.66	Entire Period: HR=2.44 (1.22, 4.86), p=0.011
**Artek	178	1280	2.97	0 - 1.5Yr: HR=2.05 (0.97, 4.29), p=0.058 1.5Yr+: HR=6.11 (4.27, 8.73), p<0.001
**Inter-Op	33	227	3.52	Entire Period: HR=5.52 (2.76, 11.04), p<0.001
**MBA	124	619	1.94	Entire Period: HR=2.82 (1.60, 4.98), p<0.001
**SPH-Blind	951	5540	1.37	Entire Period: HR=2.03 (1.62, 2.54), p<0.001
Re-Identified and still used				
Alloclassic/Durom	614	1822	1.54	0 - 1.5Yr: HR=0.96 (0.53, 1.73), p=0.883 1.5Yr+: HR=3.49 (2.16, 5.63), p<0.001
Esop/Atlas	170	619	1.62	Entire Period: HR=2.04 (1.10, 3.79), p=0.024
ML Taper/Fitmore	115	216	2.78	Entire Period: HR=2.57 (1.15, 5.72), p=0.020
*Adapter (cemented)	141	322	4.04	0 - 1.5Yr: HR=3.63 (1.89, 6.99), p<0.001 1.5Yr+: HR=6.10 (2.28, 16.27), p<0.001
*Profemur Z	185	709	2.82	Entire Period: HR=3.60 (2.32, 5.59), p<0.001
*UniSyn	289	861	1.97	0 - 1Mth: HR=4.81 (2.40, 9.63), p<0.001 1Mth+: HR=1.55 (0.81, 2.99), p=0.186
**Bionik	565	1103	2.54	Entire Period: HR=2.41 (1.66, 3.49), p<0.001
**ASR	4406	10830	1.94	0 - 2Wk: HR=1.37 (0.83, 2.26), p=0.211 2Wk - 1Mth: HR=0.28 (0.10, 0.75), p=0.011 1Mth - 9Mth: HR=1.13 (0.82, 1.55), p=0.460 9Mth - 1.5Yr: HR=2.81 (2.13, 3.71), p<0.001 1.5Yr+: HR=4.13 (3.36, 5.08), p<0.001
Newly Identified				
S-Rom/Duraloc	166	1049	1.72	Entire Period: HR=2.46 (1.54, 3.91), p<0.001
*Adapter (cementless)	567	1092	2.11	Entire Period: HR=1.99 (1.32, 2.99), p=0.001
*CBH	125	270	2.97	Entire Period: HR=2.98 (1.49, 5.97), p=0.002
*K2	263	229	5.23	Entire Period: HR=3.26 (1.85, 5.74), p<0.001
*Quadra-H	837	690	3.33	0 - 2Wk: HR=5.12 (2.82, 9.29), p<0.001 2Wk+: HR=1.31 (0.74, 2.31), p=0.348
**Icon	351	752	2.26	Entire Period: HR=2.22 (1.38, 3.58), p=0.001

Note: All Components have been compared to all other Total Conventional Hip components.
** Acetabular Component
* Femoral Component

Table IP8: 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	7 Yrs	9 Yrs
Identified and no longer used					
Charnley/Duraloc	0.6 (0.1, 3.9)	2.9 (1.2, 6.7)	9.6 (6.0, 15.2)	12.9 (8.4, 19.4)	
Elite Plus/Apollo	2.0 (0.3, 13.4)	4.0 (1.0, 15.1)	12.1 (5.6, 25.0)	18.6 (10.1, 32.8)	
Elite Plus/Charnley LPW	1.2 (0.2, 8.2)	6.1 (2.6, 14.1)	11.3 (6.1, 20.7)	12.8 (7.1, 22.6)	12.8 (7.1, 22.6)
F2L/Delta	5.5 (2.5, 11.8)	10.1 (5.7, 17.5)			
H Moos/Mueller	5.6 (0.8, 33.4)	33.3 (16.6, 59.6)	38.9 (20.8, 64.7)	38.9 (20.8, 64.7)	
Secur-Fit Plus/Secur-Fit	3.1 (1.4, 6.7)	7.3 (4.4, 11.9)	7.8 (4.8, 12.7)	10.3 (6.6, 16.1)	
*Lyderic II	3.1 (1.3, 7.2)	5.7 (3.0, 10.8)	7.5 (4.2, 13.3)		
*Margron	5.8 (4.3, 7.9)	8.4 (6.6, 10.8)	10.5 (8.4, 13.2)	13.3 (10.6, 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)	21.1 (15.7, 28.1)	
**Inter-Op	12.1 (4.7, 29.1)	15.2 (6.6, 32.6)	21.4 (10.8, 39.8)	24.9 (13.3, 43.7)	24.9 (13.3, 43.7)
**MBA	4.0 (1.7, 9.4)	8.3 (4.5, 14.8)	10.6 (6.1, 18.0)		
**SPH-Blind	3.8 (2.8, 5.2)	5.7 (4.4, 7.4)	7.3 (5.8, 9.2)	8.6 (6.9, 10.7)	
Re-Identified and still used					
Alloclassic/Durom	1.4 (0.7, 2.7)	5.1 (3.4, 7.5)	6.2 (4.2, 9.0)		
Esop/Atlas	3.0 (1.2, 6.9)	3.7 (1.7, 8.1)	6.3 (3.0, 13.1)		
ML Taper/Fitmore	5.2 (2.4, 11.3)				
*Adapter (cemented)	4.4 (2.0, 9.6)				
*Profemur Z	6.0 (3.4, 10.6)	10.6 (6.9, 16.1)			
*UniSyn	3.9 (2.2, 6.9)	5.2 (3.1, 8.7)	8.8 (4.9, 15.7)		
**Bionik	3.2 (2.0, 5.2)	6.9 (4.6, 10.2)			
**ASR	1.8 (1.4, 2.2)	5.9 (5.1, 6.9)	9.3 (7.3, 11.9)		
Newly Identified					
S-Rom/Duraloc	3.1 (1.3, 7.2)	5.1 (2.6, 9.9)	5.8 (3.0, 10.8)	6.9 (3.7, 12.6)	
*Adapter (cementless)	2.7 (1.6, 4.5)	5.4 (3.5, 8.3)			
*CBH	4.3 (1.8, 10.0)				
*K2	4.8 (2.7, 8.6)				
*Quadra-H	3.1 (2.0, 4.7)				
**Icon	3.3 (1.8, 5.9)	6.6 (3.9, 11.0)			

Note: ** Acetabular Component
* Femoral Component

Table IP9: 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
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							
Secur-Fit Plus/Secur-Fit		1	40	60	27	21	26	22			
*Lyderic II			5	28	16	64	23	12	8	8	
*Margron		28	56	130	123	140	96	85	28	2	
*Revitan (non mod)				6	53	23					
**Artek	12	33	111	22							
**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	112	112	46
Esop/Atlas					8	51	24	39	20	16	12
ML Taper/Fitmore							7	11	24	70	3
*Adapter (cemented)							7	41	52	33	8
*Profemur Z						41	79	56	6	1	2
*UniSyn				1	15	40	75	31	36	45	46
**Bionik							11	147	136	137	134
**ASR						84	583	958	1184	1172	425
Newly Identified											
S-Rom/Duraloc	12	28	14	39	31	28	3	3	1	4	3
*Adapter (cementless)							19	140	131	121	156
*CBH						12	7	14	37	28	27
*K2								1	22	80	160
*Quadra-H									65	242	530
**Icon						3	40	79	83	68	78

Note: ** Acetabular Component
* Femoral Component

Figure IP4: Cumulative Percent Revision of Individual Total Conventional Hip re-identified and still used

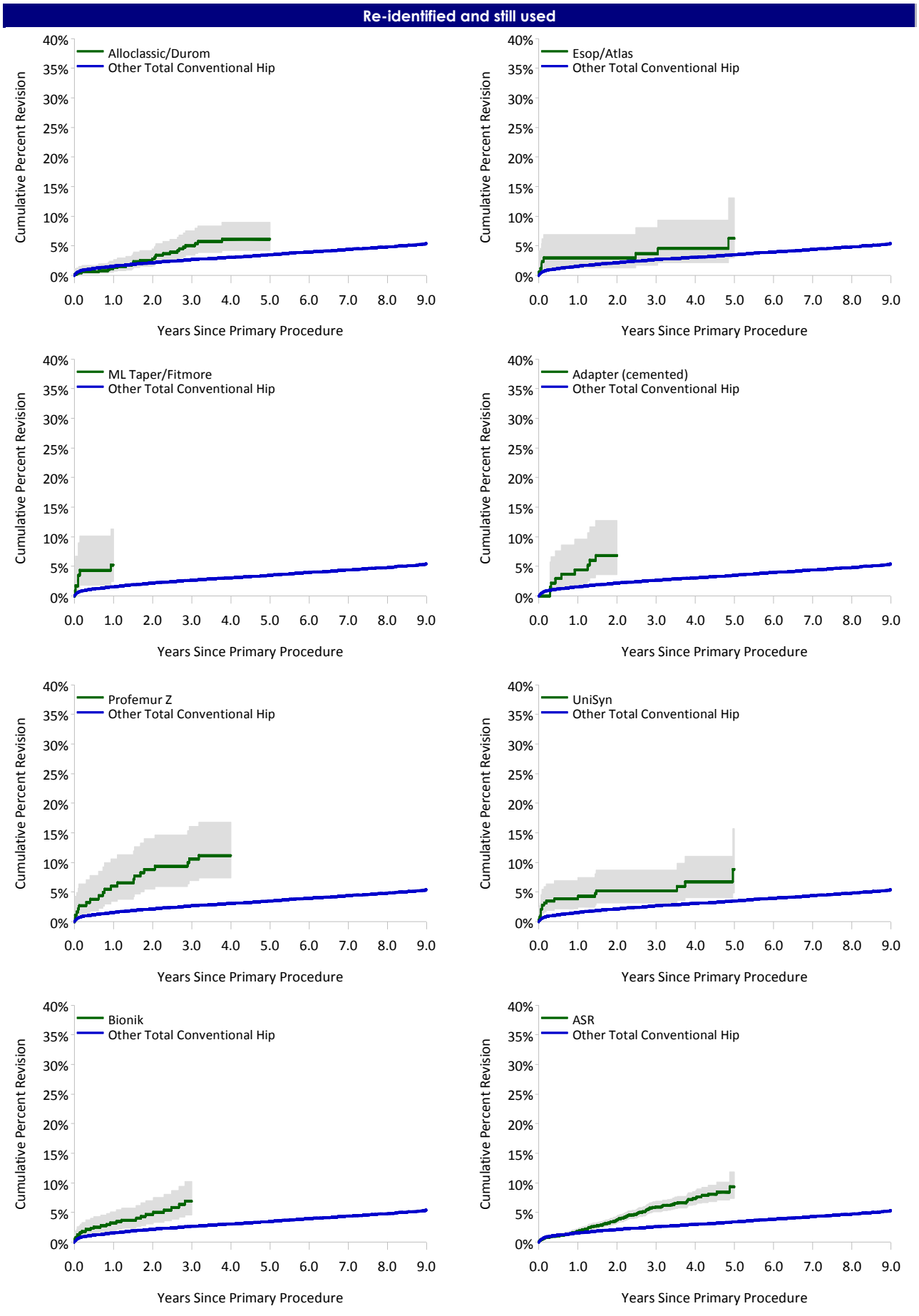
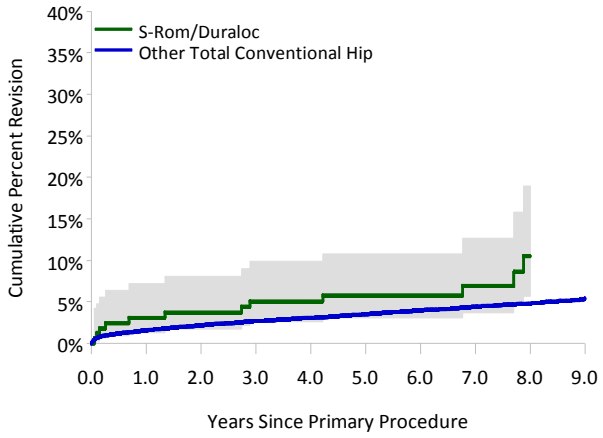
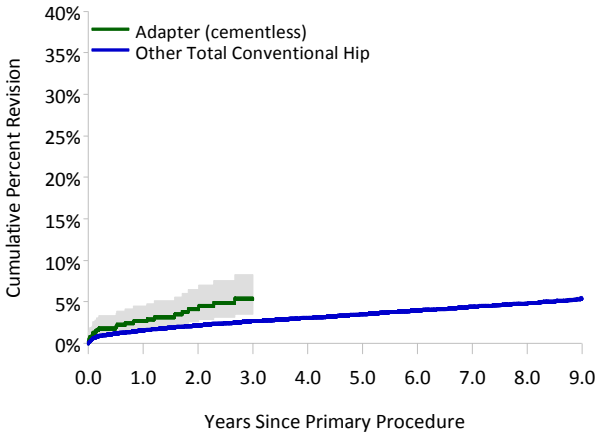
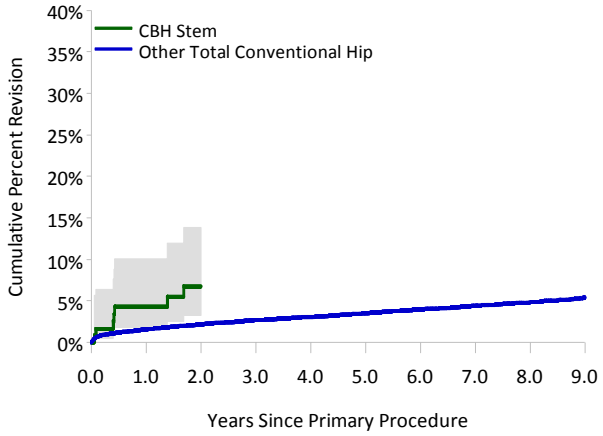


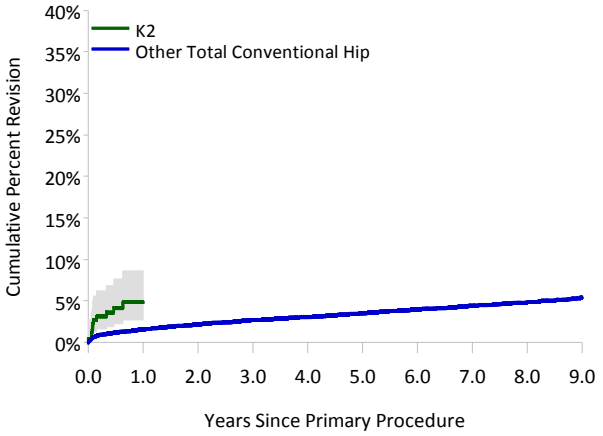
Figure IP5: Cumulative Percent Revision of Individual Total Conventional Hip newly identified

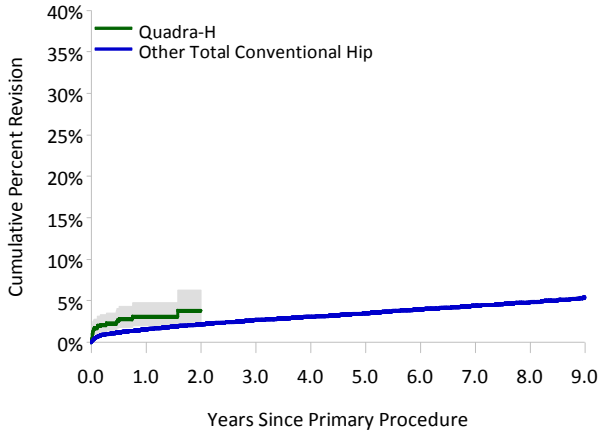
Newly Identified

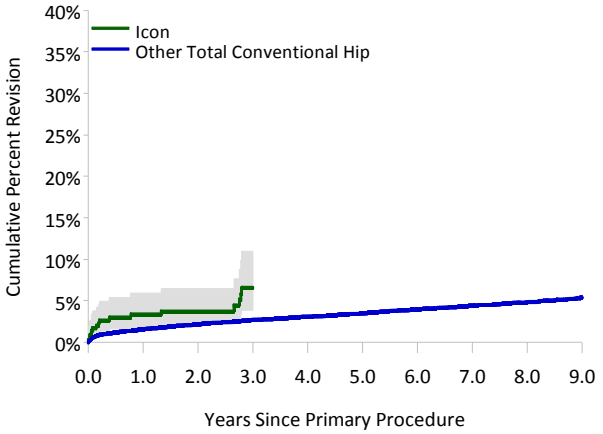












Total Resurfacing

The Bionik resurfacing component is newly identified and has been used in 175 procedures. It has a three year cumulative percent revision of 6.6% and over twice the risk of revision compared to all other resurfacing hip replacement (adj HR=2.31; 95%CI (1.19, 4.47), p=0.013). Of the nine revisions, five were for loosening and three for fracture.

The Recap has been a previously identified prosthesis. This year's analysis shows no significant difference in the risk of revision compared to all other resurfacing hip replacement (adj HR=1.93; 95%CI (1.00, 3.74), p=0.050).

Table IP10: 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				
*Cormet 2000 HAP	95	544	2.02	Entire Period: HR=2.40 (1.32, 4.36), p=0.004
Re-Identified and still used				
ASR/ASR	1167	3862	2.23	Entire Period: HR=2.32 (1.84, 2.92), p<0.001
Durom/Durom	813	2963	1.76	Entire Period: HR=1.91 (1.43, 2.54), p<0.001
Newly Identified				
Bionik/Bionik	175	327	2.75	Entire Period: HR=2.31 (1.19, 4.47), p=0.013

Note: All Components have been compared to all other Total Resurfacing Hip components.
* Resurfacing Head Component

Table IP11: 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	9 Yrs
Identified and no longer used					
*Cormet 2000 HAP	6.3 (2.9, 13.5)	8.4 (4.3, 16.1)	9.5 (5.0, 17.4)	12.5 (7.1, 21.6)	
Re-Identified and still used					
ASR/ASR	3.4 (2.5, 4.7)	6.1 (4.8, 7.7)	10.9 (8.7, 13.6)		
Durom/Durom	3.3 (2.2, 4.8)	5.2 (3.8, 7.0)	7.6 (5.7, 10.0)		
Newly Identified					
Bionik/Bionik	3.8 (1.7, 8.4)	6.6 (3.2, 13.6)			

Table IP12: 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
Identified and no longer used											
*Cormet 2000 HAP			1	17	38	39					
Re-Identified and still used											
ASR/ASR					43	165	302	257	176	133	91
Durom/Durom					58	166	207	143	105	88	46
Newly Identified											
Bionik/Bionik							12	33	33	43	54

Figure IP6: Cumulative Percent Revision of Individual Total Resurfacing Hip re-identified and still used

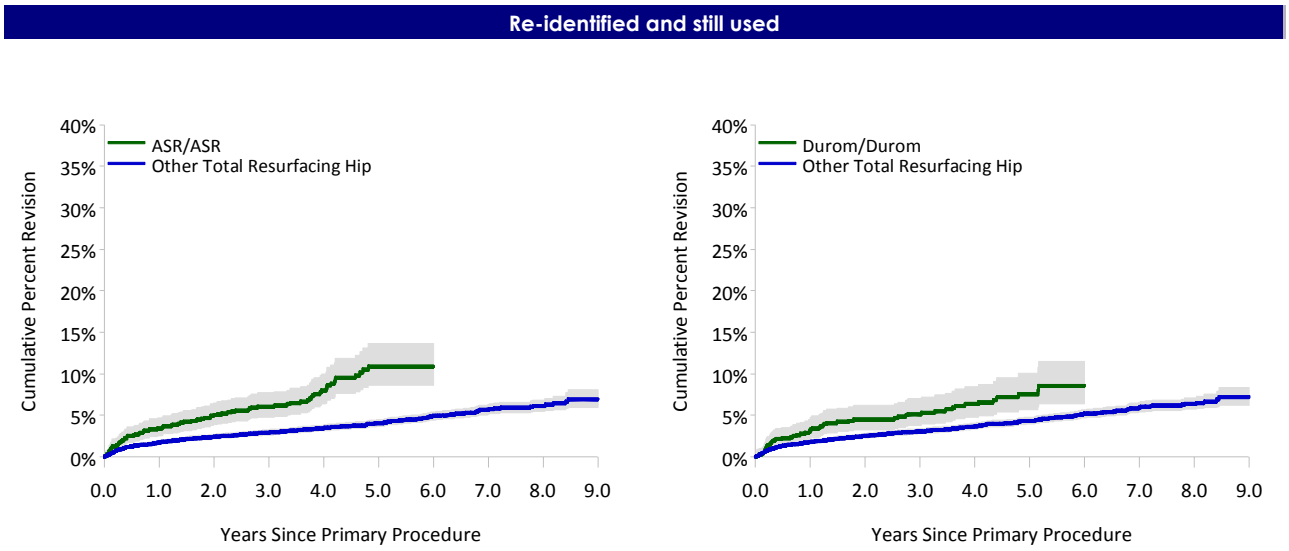
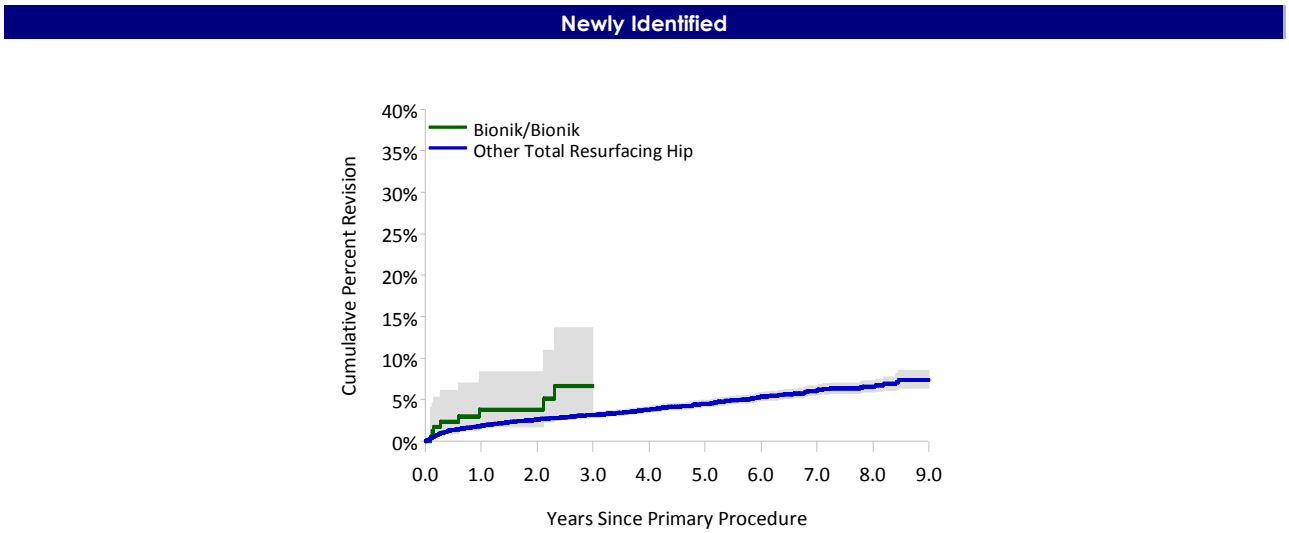


Figure IP7: Cumulative Percent Revision of Individual Total Resurfacing Hip newly identified



Primary Partial Knee Replacement

Patella/Trochlear

There are no newly identified patella/trochlear prostheses in this group.

Table IP13: 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
Re-Identified and still used				
**LCS	438	1481	5.13	Entire Period: HR=2.04 (1.50, 2.76), p<0.001

Note: All Components have been compared to all other Patella/Trochlear Knee components.
** Trochlear Component

Table IP14: Yearly Cumulative Percent Revision of Individual Patella/Trochlear Knee identified as having a Higher than Anticipated Revision Rate

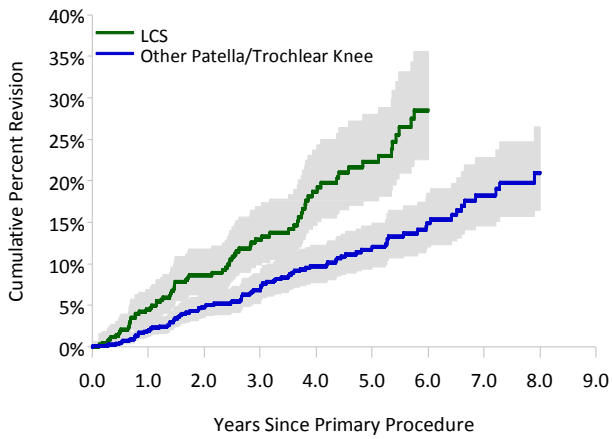
CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Re-Identified and still used					
**LCS	4.5 (2.9, 6.9)	12.9 (9.9, 16.9)	22.3 (17.6, 28.0)		

Table IP15: 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
Re-Identified and still used											
**LCS				26	56	68	47	65	78	66	32

Figure IP8: Cumulative Percent Revision of Individual Patella/Trochlear Knee re-identified and still used

Re-Identified and still used



Unicompartmental

The Eius unicompartmental prostheses is newly identified. It has been used in 139 procedures and has a five year cumulative percent revision of 18.5%. It has over one and a half times the risk of revision compared to all other unicompartmental knee replacement (adj HR=1.75; 95%CI (1.16, 2.64), p=0.007). Of the 23 revisions, nine were for loosening/lysis, six were progression of disease and six for pain.

Table IP16: 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	145	8.29	Entire Period: HR=4.80 (2.72, 8.45), p<0.001
**Preservation-Mobile	400	2148	3.91	Entire Period: HR=1.94 (1.56, 2.41), p<0.001
Re-Identified and still used				
AMC/AMC	612	1959	3.16	Entire Period: HR=1.56 (1.21, 2.00), p<0.001
BalanSys Uni/BalanSys Uni Mobile	195	670	4.18	0 - 6Mth: HR=5.10 (2.52, 10.30), p<0.001 6Mth+: HR=1.65 (1.06, 2.57), p=0.025
Newly Identified				
Eius/ Eius	139	568	4.05	Entire Period: HR=1.75 (1.16, 2.64), p=0.007

Note: All Components have been compared to all other Unicompartmental Knee components.
** Unicompartmental Tibial Component

Table IP17: Yearly Cumulative Percent Revision of Individual Unicompartmental Knee identified as having a Higher than Anticipated Revision Rate

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Identified and no longer used					
Advance/Advance	10.8 (4.2, 26.3)	27.8 (16.0, 45.6)	32.1 (18.9, 50.9)		
**Preservation-Mobile	5.3 (3.5, 7.9)	15.6 (12.4, 19.6)	19.3 (15.7, 23.6)	22.2 (18.2, 26.8)	
Re-Identified and still used					
AMC/AMC	4.0 (2.7, 6.0)	10.9 (8.4, 14.1)	13.6 (10.5, 17.5)		
BalanSys Uni/BalanSys Uni Mobile	7.2 (4.4, 11.9)	13.7 (9.6, 19.5)			
Newly Identified					
Eius/ Eius	4.5 (2.0, 9.8)	10.9 (6.6, 17.8)	18.5 (12.3, 27.3)		

Table IP18: 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
Identified and no longer used											
Advance/Advance					13	11	7	2	3	1	
**Preservation-Mobile			15	149	121	59	26	17	13		
Re-Identified and still used											
AMC/AMC					80	66	123	84	107	93	59
BalanSys Uni/BalanSys Uni Mobile						37	51	63	33	9	2
Newly Identified											
Eius/ Eius				10	21	27	37	21	8	8	7

Figure IP9: Cumulative Percent Revision of Individual Unicompartmental Knee re-identified and still used

Re-identified and still used

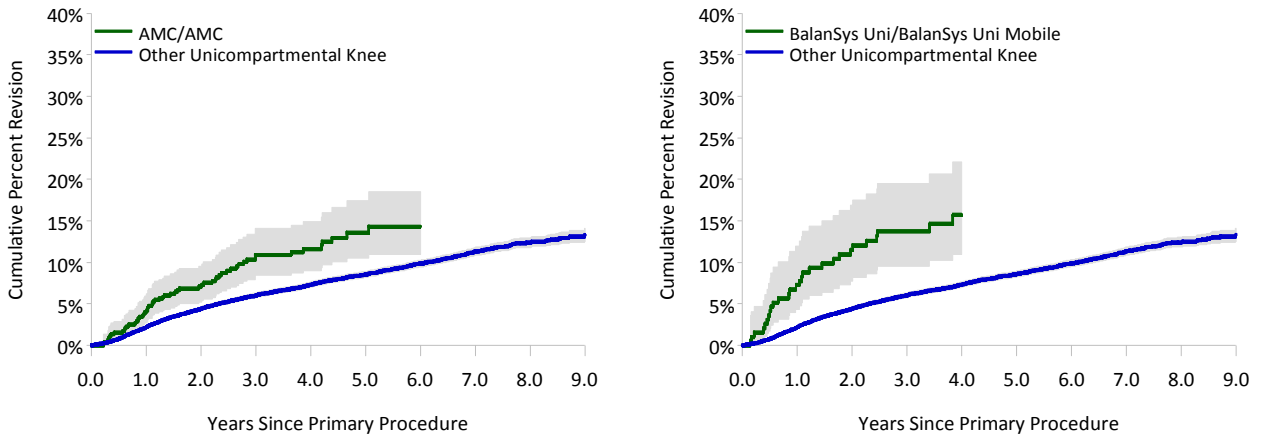
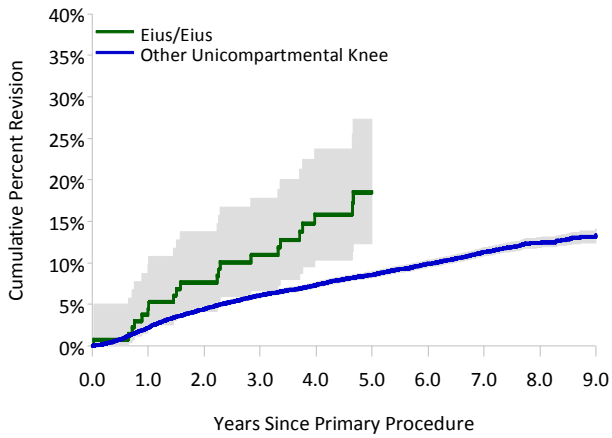


Figure IP10: Cumulative Percent Revision of Individual Unicompartmental Knee newly identified

Newly Identified



Primary Total Knee Replacement

Genesis II CR (cementless) /Genesis II (cementless) and Optetrak-CR/Optetrak are newly identified.

Genesis II CR (cementless)/Genesis II (cementless) has been used in 264 procedures and has a three year cumulative percent revision of 11.0%. It has two and a half times the risk of revision compared to all other total knee replacement (adj HR=2.45; 95%CI (1.45, 4.14), p<0.001). Of the 14 revisions, five were for loosening/lysis and three for patellofemoral pain.

Optetrak-CR/Optetrak is the fourth Optetrak combination to be identified. This combination has been used in 385 procedures. It has a seven year cumulative percent revision of 8.1% and has over one and a half times the risk of revision compared to all other total knee replacement (adj HR=1.69; 95%CI (1.10, 2.59), p=0.016). Of the 21 revisions, seven were for patellofemoral pain and six for loosening/lysis.

Two prostheses that are no longer used have been identified for the first time. They are the Genesis Cemented and the Renasys. They are listed in the 'Identified and no longer used' group.

Table IP19: 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	3017	1.03	Entire Period: HR=1.63 (1.15, 2.33), p=0.006
Gemini MK II/Gemini MK II	21	124	4.03	Entire Period: HR=5.58 (2.33, 13.36), p<0.001
Genesis (cemented) /Genesis (cemented)	62	404	2.23	Entire Period: HR=3.76 (1.95, 7.21), p<0.001
Genesis II Oxinium (cementless) /Genesis II	110	487	8.63	Entire Period: HR=10.40 (7.67, 14.08), p<0.001
Genesis II Oxinium (cementless) /MBK	88	314	16.57	Entire Period: HR=18.74 (14.26, 24.63), p<0.001
Genesis II Oxinium PS (cemented) /Genesis II (Keel)	269	773	4.92	Entire Period: HR=4.90 (3.56, 6.74), p<0.001
IB II/IB II	199	1475	1.83	0 - 2Yr: HR=0.76 (0.25, 2.37), p=0.639 2Yr - 2.5Yr: HR=4.55 (1.46, 14.16), p=0.008 2.5Yr+: HR=5.55 (3.61, 8.53), p<0.001
Interax/Interax	58	415	1.93	Entire Period: HR=3.37 (1.68, 6.74), p<0.001
Profix Oxinium Cless/MBK	158	705	9.51	Entire Period: HR=12.15 (9.55, 15.45), p<0.001
Profix Oxinium Cless/Profix	75	345	8.12	Entire Period: HR=9.65 (6.66, 14.00), p<0.001
Optetrak-PS/Optetrak-PS	55	193	5.71	Entire Period: HR=7.35 (4.07, 13.28), p<0.001
Rotaglide Plus/Rotaglide Plus	631	3333	1.32	0 - 1.5Yr: HR=1.14 (0.65, 2.01), p=0.655 1.5Yr+: HR=2.35 (1.66, 3.33), p<0.001
Trac/Trac	138	996	1.71	Entire Period: HR=2.58 (1.60, 4.16), p<0.001
*Renasys	121	420	1.90	Entire Period: HR=2.20 (1.10, 4.40), p=0.025
Re-Identified and still used				
Columbus/Columbus	533	1012	1.88	Entire Period: HR=1.94 (1.24, 3.04), p=0.003
Eska RP/Eska RP	40	119	5.90	Entire Period: HR=6.94 (3.31, 14.57), p<0.001
Journey/Journey	1638	2330	1.97	0 - 9Mth: HR=0.89 (0.48, 1.65), p=0.700 9Mth - 1.5Yr: HR=2.88 (1.95, 4.23), p<0.001 1.5Yr+: HR=2.04 (1.09, 3.79), p=0.024
Optetrak-PS/Optetrak	1498	5148	1.59	Entire Period: HR=1.96 (1.58, 2.44), p<0.001
Optetrak-PS/Optetrak RBK	539	992	2.02	Entire Period: HR=2.02 (1.30, 3.13), p=0.001
Profix/Mobile Bearing Knee	1231	6206	1.69	Entire Period: HR=2.22 (1.83, 2.69), p<0.001
TC-Plus/TC-Plus	94	297	2.02	Entire Period: HR=2.49 (1.12, 5.51), p=0.025
Newly Identified				
Genesis II CR (cementless) /Genesis II (cementless)	264	535	2.62	Entire Period: HR=2.45 (1.45, 4.14), p<0.001
Optetrak-CR/Optetrak	385	1741	1.21	Entire Period: HR=1.69 (1.10, 2.59), p=0.016

Note: All Components have been compared to all other Total Knee components.
* Femoral Component

Table IP20: Yearly Cumulative Percent Revision of Individual Total Knee identified as having a Higher than Anticipated Revision Rate

CPR	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 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)	6.8 (4.7, 9.7)	8.6 (6.0, 12.1)
Gemini MK II/Gemini MK II	9.5 (2.5, 33.0)	14.3 (4.8, 38.0)	23.8 (10.7, 48.1)	23.8 (10.7, 48.1)	
Genesis (cemented) /Genesis (cemented)	0.0 (0.0, 0.0)	6.7 (2.6, 16.8)	10.0 (4.6, 20.9)	14.1 (7.3, 26.3)	14.1 (7.3, 26.3)
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)	15.0 (11.1, 20.1)			
IB II/IB II	0.0 (0.0, 0.0)	3.6 (1.7, 7.3)	7.8 (4.8, 12.7)	11.8 (7.9, 17.3)	15.5 (10.8, 21.9)
Interax/Interax	0.0 (0.0, 0.0)	5.4 (1.8, 15.7)	11.1 (5.1, 23.0)	15.4 (8.0, 28.6)	15.4 (8.0, 28.6)
Profix Oxinium Cless/MBK	8.3 (4.9, 13.9)	40.2 (32.9, 48.3)	41.5 (34.2, 49.7)		
Profix Oxinium Cless/Profix	13.3 (7.4, 23.4)	36.1 (26.4, 48.1)	37.5 (27.6, 49.5)		
Optetrak-PS/Optetrak-PS	1.8 (0.3, 12.2)	16.4 (8.9, 29.2)	21.0 (11.2, 37.5)		
Rotaglide Plus/Rotaglide Plus	0.8 (0.3, 1.9)	4.2 (2.8, 6.1)	6.1 (4.4, 8.4)	8.1 (6.0, 10.9)	
Trac/Trac	2.2 (0.7, 6.6)	5.9 (3.0, 11.4)	9.0 (5.2, 15.2)	9.8 (5.8, 16.2)	
*Renasys	2.5 (0.8, 7.5)	4.4 (1.9, 10.3)			
Re-Identified and still used					
Columbus/Columbus	2.4 (1.3, 4.3)	4.8 (2.9, 7.9)			
Eska RP/Eska RP	7.8 (2.6, 22.2)	13.6 (5.9, 29.8)			
Journey/Journey	1.7 (1.1, 2.7)	5.5 (4.1, 7.6)			
Optetrak-PS/Optetrak	1.5 (1.0, 2.3)	5.7 (4.5, 7.2)	7.1 (5.7, 8.8)	8.9 (6.6, 12.0)	
Optetrak-PS/Optetrak RBK	2.5 (1.4, 4.3)	5.4 (3.4, 8.5)			
Profix/Mobile Bearing Knee	2.2 (1.5, 3.2)	6.5 (5.2, 8.0)	8.5 (7.0, 10.3)	10.0 (8.2, 12.1)	
TC-Plus/TC-Plus	2.5 (0.6, 9.7)	9.2 (4.2, 19.6)	9.2 (4.2, 19.6)		
Newly Identified					
Genesis II CR (cementless) /Genesis II (cementless)	2.3 (1.0, 5.4)	11.0 (6.2, 19.3)			
Optetrak-CR/Optetrak	1.4 (0.6, 3.3)	4.5 (2.7, 7.4)	5.3 (3.3, 8.4)	8.1 (5.1, 12.7)	

Note: * Femoral Component

Table IP21: 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
Identified and no longer used											
AMK/AMK	41	108	134	53	51	37					
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	10	30	18								
Profix Oxinium Cless/MBK				63	95						
Profix Oxinium Cless/Profix				10	65						
Optetrak-PS/Optetrak-PS						8	14	18	15		
Rotaglide Plus/Rotaglide Plus			56	125	151	110	101	43	30	15	
Trac/Trac	7	36	52	33	9	1					
*Renasys							51	53	4	14	
Re-Identified and still used											
Columbus/Columbus							49	92	89	148	155
Eska RP/Eska RP							9	24	5	0	2
Journey/Journey								134	326	591	587
Optetrak-PS/Optetrak		14	22	90	130	155	252	253	216	167	199
Optetrak-PS/Optetrak RBK							1	81	173	166	118
Profix/Mobile Bearing Knee			55	214	204	349	269	54	60	12	14
TC-Plus/TC-Plus					1	27	27	6	6	9	18
Newly Identified											
Genesis II CR (cementless) /Genesis II (cementless)		3	8	9	11	3	0	25	29	93	83
Optetrak-CR/Optetrak			19	88	66	44	24	37	37	42	28

Note: * Femoral Component

Figure IP11: Cumulative Percent Revision of Individual Total Knee re-identified and still used

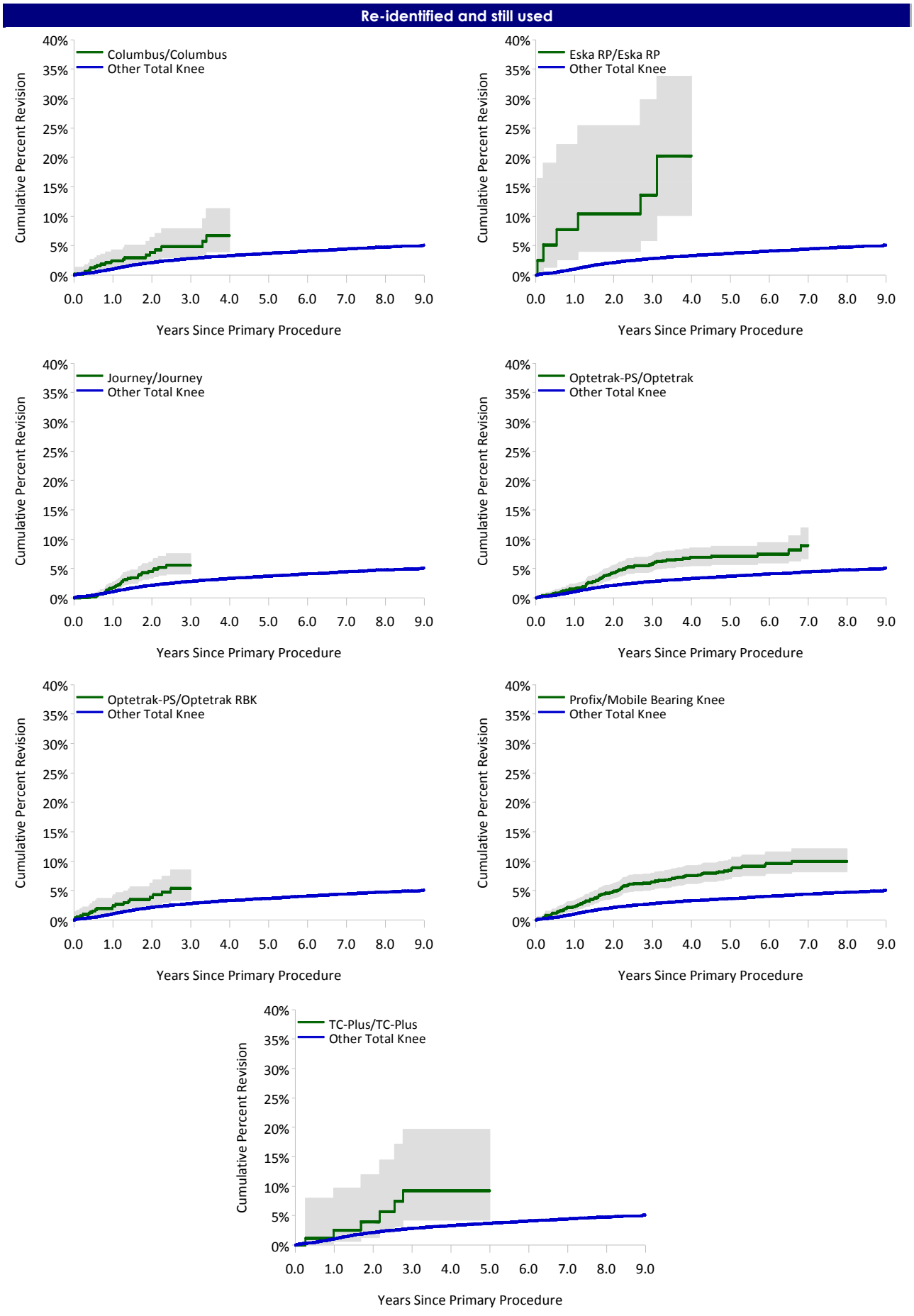
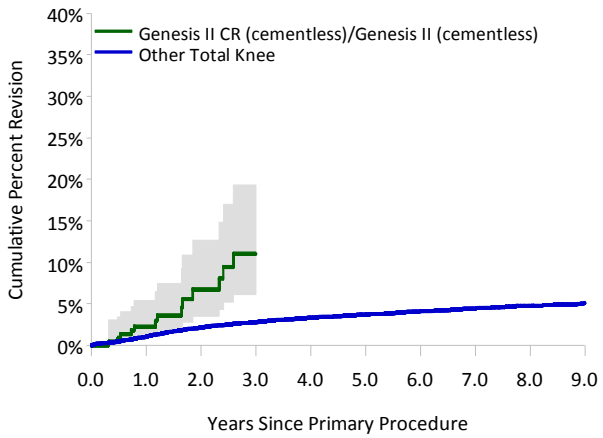
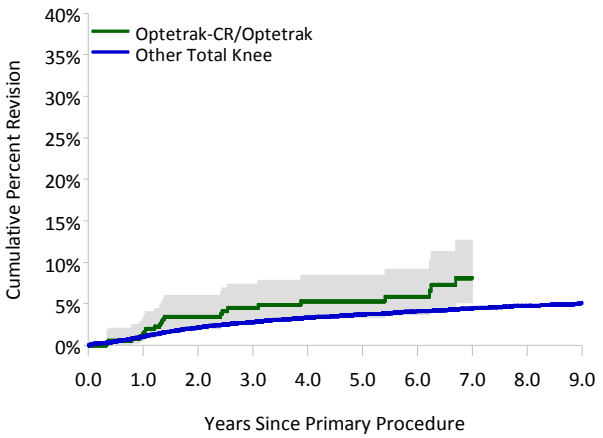


Figure IP12: Cumulative Percent Revision of Individual Total Knee newly identified

Newly Identified





APPENDICES

APPENDIX 1

Participating Hospitals & Coordinators

NEW SOUTH WALES

PUBLIC HOSPITALS

Name of Hospital	Registry Coordinator	
Albury Base Hospital	Elwyn Black	ANUM Theatre
Armidale Hospital	Debbie Spokes/Cheryl Fardon	NUM Theatre/Theatre Clerk
Bankstown/Lidcombe Hospital	John Mati/Aron Priscion	RN Orthopaedic Theatre
Bathurst Base Hospital	Kylie Peers	NUM Theatre
Bega District Hospital	Melanie Rossi	RN Theatre
Blacktown Hospital	Cathy Jiear/Sergio Jumanong	NUM Theatre/A/Nurse Educator
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	Stella George	NUM Theatre
Gosford Hospital	Sandra Smith	Set up Coordinator Theatre
Goulburn Base Hospital	Maria Daniel/Karen Goode	NUM Theatre/Theatre Admin Clerk
Hornsby & Ku-Ring-Gai Hospital	Bessie Chu	CNS Theatre
Institute of Rheumatology & Orthopaedic Surgery	Alex Vesley	NUM Theatre
John Hunter Hospital	Felicia Bristow	Equipment NUM
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	Rhonda Sneddon	NUM Anaesthetics & Recovery
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 Wright	NUM Theatre/Theatre Clerk
Royal Newcastle Centre	Rosalee Baird	NUM Theatre
Royal North Shore Hospital	Eileen Cole	Research Physiotherapist/Dept Ortho
Royal Prince Alfred Hospital	Lisa Hatton	NUM Theatre
Ryde Hospital	Karen Jones	NUM Theatre
Shoalhaven Group Hospital	Miep Mulder	Senior Nurse Manager Theatre
St George Hospital	Simon Cheng	A/NUM Orthopaedic Theatre
St Vincent's Public Hospital	Mary Theresa Butler	NUM Peri operative Services
Sutherland Hospital	Sara Apolloni	CNS Theatre
Tamworth Base Hospital	Kevin Attard	RN Theatre
The Prince of Wales Hospital	Anne-Marie Daly	NUM Orthopaedics
Tweed Hospital	Amanda Budd/Gail Bennett	CNS Theatre
Wagga Wagga Base Hospital	Alison Giese/Melissa Chapman	CNS Orthopaedic Theatre
Westmead Hospital	Elizabeth Stefidas	NUM Theatre
Wollongong Hospital	Carol Jackson	CNS Orthopaedics
Wyong Hospital	Marilyn Randall/Janice Marks	CNS Logistics/ANUM Theatre

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	Marilyn Chauncy	Orthopaedic Resource Manager
Berkeley Vale Private Hospital	Michelle Turner	QA/Education Coordinator
Brisbane Waters Private Hospital	Toni Hoad	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	Deputy CEO/DON
Delmar Private Hospital	Julie Mitchell/Cathy Byrne	NUM Theatre/Medical Records
Dubbo Private Hospital	Sally Cross	RN Theatre
Dudley Private Hospital	James Bird/Louise Johnson	NUM Theatre/CNS Theatre
Figtree Private Hospital	Jan Goldrick	Theatre
Forster Private Hospital	Julie Bate	NUM Theatre
Hawkesbury Health Service	Megan McAndrew	CNS Theatre
Holroyd Private Hospital	Sid Turingan	NUM Theatre
Hunters Hill Private Hospital	Jenny May	NUM Orthopaedic Theatre
Hunter Valley Private	Margaret Water/Joanne Lalic	NUM Theatre/2IC Theatre
Hurstville Community Pte Hospital	Kathryn Boyce	Orthopaedic Case Manager
Kareena Private Hospital	Deirdre Baulch	NUM/CNS Orthopaedics
Lake Macquarie Private Hospital	Robert Reddie	Theatre
Lingard Private Hospital	Margaret Nowak	NUM Theatre
Maitland Private Hospital	Leyanne Beavis	NUM Theatre
Macquarie University Hospital	Simmy Masuku	NUM Orthopaedic Theatre
Mayo Private Hospital	Emma Clarke	NUM Theatre
National Day Surgery Sydney	Elizabeth Carroll/Louise Jones	Director of Nursing/Floor Manager
Nepean Private Hospital	Jan Weinert	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	Julie Guthrie	Clinical Orthopaedic Manager
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 Bathurst	Diane Carter	CNS Theatre
St Vincent’s Private Hospital Darlinghurst	Astiness Kalach	Health Information Manager
St Vincent’s Private Hospital Lismore	Janelle Hospers	CNS, Orthopaedic Care Coord
Strathfield Private Hospital	Donna Reichel	Perioperative Manager
Sydney Adventist Hospital	Jill Parker	CNS Orthopaedic Theatre
Sydney Private Hospital	Fiona Wallace	NUM Operating Theatres
Sydney South West Private	Angela Wilbow/Harold Faustino	CNC Orthopaedics
Tamara Private Hospital	Kris Wall	NUM Operating Theatre
The Mater Hospital	Toni Cummins	CNS Theatre
The Prince of Wales Private Hospital	Angela Grein	Orthopaedic NUM
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	Peri operative Services Manager
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/Carolyn Bourke	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	Anne Dick	Associate Charge Nurse Theatre
Goulburn Valley Health	Carmen Feehan/Denise Feehan	CNS/Pre-admission Clinic
Kerang District Health	Margie Christian	NUM Operating Theatre
Kyabram & District Health Services	Kristen Elliott	NUM Theatre
Latrobe Regional Hospital	Simone Lovison	Clinical Nurse Specialist
Maroondah Hospital	Bernard Morskate	CNS Orthopaedic Theatre
Mildura Base Hospital	Gwenda Smith	NUM Theatre
Monash Medical Centre, Clayton Campus	Candice Brown	Orthopaedic ANUM
Monash Medical Centre, Moorabbin Campus	Sushila Tomlinson	ANUM Theatre
Northeast Health Service Wangaratta	Lynn Reid/Larissa Laverty	ACN/Theatre Bookings Reception Clerk
Peninsula Health Service, Frankston Hospital	Donna Anderson	ANUM Theatre
Portland District Health	Tersia Steyn	RN Theatre
Sandringham & District Memorial Hospital	Di David	Coordinator Orthopaedic Clinic
Seymour District Memorial Hospital	Wendy Townsend	Peri-operative Services Unit Manager
South West Healthcare Warrnambool Campus	Tony Kelly	Peri operative Services Manager
St Vincent's Public Hospital	Glynda Bonollo/Sharon Norman	ANUM/Clinical Resource Nurse
Stawell Regional Health	Chris Gillmartin/Barb Savage	NUM Theatre/Theatre Nurse
Sunshine Hospital	Joy Curley	RN Theatre
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 Lauletta	Acting AUM Orthopaedics
The Royal Melbourne Hospital	Michelle Killick/Kerrie Crosato	RN Operating Theatre
West Gippsland Healthcare Group	Christine Evans/Bernie Notman	ACN Theatre/CNS
West Wimmera Health Service	Christine Dufty	NUM OR/CSSD ICP
Western District Health Service	Jane Sanders	ANUM Theatre
Western Hospital	Vicki Mahaljcek/Elisha Christie	RN Theatre/Secretary Ortho Dept
Williamstown Hospital	Maureen Clark	ANUM Theatre
Wimmera Health Care Group	Maree Markby/Catherine Jensen	NUM Theatre/ANUM 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	Jenny Salmond	Hospital Project Officer
Cabrini Private Hospital, Malvern	Jenny Salmond	Hospital Project Officer
Como Private Hospital	Sharon McIntyre	NUM Theatre
Cotham Private Hospital	Justine Grover	RN Orthopaedic Theatre
Epworth Hospital	T Weerakkody/F Bartholomew	ANUM Orthopaedic Theatre
Epworth Eastern Hospital	Erin Seal	Orthopaedic Department
Epworth Freemason Hospital	Claudia Nozzolillo	CNS Orthopaedic Theatre
Essendon Private Hospital	Chan Leong	NUM Theatre
Geelong Private Hospital	Wilna Steyn/Robyn Pugh	Orthopaedic Services Mgr/Assistant
Glenferrie Private Hospital	Samantha Jervois	Theatre Manager
John Fawkner Hospital	Vera Shaw	AUM Orthopaedic Theatre
Knox Private Hospital	Sharni Brown	Billings Officer Theatre
Latrobe Private Hospital	Jenny Telfer/Charmaine D'Cruz	NUM Theatre/RN 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	Debbie Thow	ANUM General Theatres
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	NUM Theatre
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	Angie Patterson	CNS Orthopaedic Theatre
St John of God Health Care, Warrnambool	Leanne McPherson/Gill Wheaton	NUM Theatre/ANUM Theatre
St John of God Hospital, Berwick	Fiona Lanting	CNS Operating Theatres
St Vincent's & Mercy Private Hospital, Mercy Campus	Sue Zidziunas	CNS Orthopaedics
St Vincent's & Mercy Private Hospital, St Vincent's	Julie Keyte/Deanna Delle-Virgini	ANUM/RN Orthopaedic Theatre
The Avenue Hospital	Annellen Watson	ANUM Orthopaedics
The Valley Private Hospital	Anne Diamond	NUM Perioperative Services
Vimy House Private Hospital	Joy Miller	ANUM Theatre
Wangaratta Private Hospital	Janet McKie	ANUM Theatre
Warringal Hospital	Kylie Leys	RN Theatre
Waverley Private Hospital	Rebecca Juzva	Orthopaedic AUM
Western Private Hospital	Lynette Glenn	NUM Theatre

QUEENSLAND

PUBLIC HOSPITALS

Name of Hospital	Registry Coordinator	
Bundaberg Base Hospital	Gail Doherty	CNC Theatre
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	Trisha Tierney	Acting NUM Theatre
Logan Hospital	Denise Maher	Director Support Orthopaedics
Mackay Base Hospital	Casey Rideout/Tania Laffin	RN Theatre/Admin Officer
Maryborough Hospital	Heather Zillman	RN Theatre
Mater Misericordiae Public Adult's Hospital	Simon Journeaux	Director of Orthopaedics
Mater Misericordiae Public Children's Hospital	Vicki Livett	NUM Theatre
Nambour General Hospital	Kay Friend	Nurse Mgr, Logistics & Procurement
Prince Charles Hospital	Sue Grice/Louise Hood	Clinical Nurse/Clinical Data Mgr
Princess Alexandra Hospital	Jo-Anne de Plater/Gail Brodrick	CN Orthopaedics/RN Ortho 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	Annette Flynn	Nurse Researcher
Toowoomba Hospital	Amanda Lostroh/Simon Bowly	RN Theatre
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	Anne Ashton	Peri Operative Service Manager
Greenslopes Private Hospital	Kelly Williams	CN Orthopaedic Theatre
Hervey Bay Surgical Centre	Natalie Short	RN 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 Hospital Pimlico	Anna Grimley/Jo Humphreys	CN Orthopaedic Theatre
Mater Misericordiae Hospital Bundaberg	James Turner/Karen Smith	ANUM/CN Orthopaedic Theatre
Mater Misericordiae Hospital Gladstone	Judy Sayre/Alison Drinkwater	NUM /L2Theatre
Mater Misericordiae Hospital Mackay	Danell Curtis	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	Peta Quaife	Peri Operative Coordinator
Peninsula Private Hospital	Joan Fellowes	NUM Theatre
Pindara Private Hospital	Carli Nicolaou/Tracey Clark	CN Orthopaedic Theatre
St Andrew's Private Hospital	Kimberley Davies	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	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	Jo Knappstein	A/CN Theatre
Flinders Medical Centre	Jo Drabsch	CN Theatre
Gawler Health Service	Karen McKinlay	CN Theatre
Lyell McEwin Hospital	Fiona Brinkies	CN Theatre
Modbury Public Hospital	Lisa Pearson	RN Orthopaedic 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	Margie Sinclair	CN Theatre
Noarlunga Hospital	Carol Dawson	RN Theatre
Port Augusta	Joan Jericho	NUM Theatre
Port Lincoln Hospital	Chris 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 Theatre/Dept Ortho
South Coast District Hospital	Jill Cooper/Judy Anderson	EO DON/CN Theatre
Whyalla Health Service	Carol McSorley	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	Linda Keech	CN Theatre
Calvary Health Care Adelaide	Maria Young	CN Theatre
Calvary Wakefield Hospital	Evelyn Carroll	CN Orthopaedic Theatre
Flinders Private Hospital	Anastasia Paffas	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	Nic Shute	Clinical Coder Medical Records
St Andrew's Private Hospital	Heather Crosby/Leeandra White	RN Orthopaedic Theatre
Stirling & District Hospital	Nick Clarke/Tanya Hanlon	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	Letchumy Krishnasamy	CN Orthopaedic Theatre
Kalgoorlie Regional Hospital	Nicole Hintz	Clinical Manager Theatre
Osborne Park Hospital	Jenny Misiewicz/Anita Maxwell	CN Theatre
Royal Perth Hospital, Shenton Park	Christopher Sheen	Orthopaedic Coordinator
Royal Perth Hospital, Wellington St	Carmel McCormack	NUM Theatre
Sir Charles Gairdner Hospital	Sandra Miller	Quality Improvement Coordinator

PRIVATE HOSPITALS

Name of Hospital	Registry Coordinator	
Bethesda Hospital	Deborah Bell	Peri-operative Services Mgr
Hollywood Private Hospital	Judith Corbett	CN Theatre
Joondalup Health Campus	Jenni Hughes/Marlene Ingham	Health Information Manager/CN Ortho
Mercy Hospital Mt Lawley	Ty Masi/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	Lee McDonald	EN Theatre
St John of God Health Care Murdoch	S Hunter/L Scrase/PMaloney	Orthopaedic Coord/Ortho Technician
St John of God Health Care Subiaco	Daniel Boylson	Clinical Coordinator Ortho

TASMANIA

PUBLIC HOSPITALS

Name of Hospital	Registry Coordinator	
Launceston General Hospital	P van Nynanten/Madeleine Smith	CN Orthopaedic Theatre
Mersey Community Hospital	Grace Kamphuis	NUM Theatre
North West Regional Hospital, Burnie Campus	B Kerr/R Watkins/R Dicker/T McCaskill	Peri Op CN/CN/RN/RN
Royal Hobart Hospital	Carolyn Douglas	RN Theatre

PRIVATE HOSPITALS

Name of Hospital	Registry Coordinator	
Calvary Health Care Tasmania, St Luke's Campus	Anne Boot/Toni Morice	CNC Theatre/ Theatre Clerk
Calvary Hospital	M Newman/A Copping/T Malloy	CNS Ortho/CNS Neuro/HIM
Hobart Private Hospital	Sarah Bird/Janine Dohnt	NUM Theatre/Ortho RN
North-West Private Hospital	Linda Wynwood	CN Theatre

AUSTRALIAN CAPITAL TERRITORY

PUBLIC HOSPITALS

Name of Hospital		Registry Coordinator
The Canberra Hospital	Helen Boyd/Milton Jamieson	CNS Ortho Theatre/RN Level 2
Calvary Health Care	Belinda Carruthers	RN Orthopaedic Theatre

PRIVATE HOSPITALS

Name of Hospital		Registry Coordinator
Calvary John James Hospital	Phillippa Parkins	RN Orthopaedics
The National Capital Private Hospital	Theresa Moran	NUM Orthopaedic Theatre
Calvary Health Care	Belinda Carruthers	RN Orthopaedic Theatre

NORTHERN TERRITORY

PUBLIC HOSPITALS

Name of Hospital		Registry Coordinator
Alice Springs Hospital	Maria Berridge/Ndina Chaita	Acting CNM/RN3 Orthopaedics
Royal Darwin Hospital	Tanya Anderson	NUM Theatre

PRIVATE HOSPITALS

Name of Hospital		Registry Coordinator
Darwin Private Hospital	Barbara Kulbac	RN Theatre

FORMERLY PARTICIPATING HOSPITALS – NOW CEASED JOINT REPLACEMENT

NEW SOUTH WALES

Auburn Health Service
Blue Mountains District ANZAC Memorial Hospital
Canada Bay Private Hospital
MacArthur Private Hospital
Mosman Private Hospital
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

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 regression, 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 2001.

Censoring: When the outcome of interest is the time to a defined event, for example revision of a prosthesis, the event may not occur during the available period of observation. For example, the Registry analyses its data on prosthesis revision for the period ending 31 December each year, and many prostheses will not have been revised by that time. Unless the prosthesis was revised prior to 31 December the outcome is unknown. For the majority, we only know that up until 31 December they had not yet been revised. The times to revision for these prostheses are said to have been censored at 31 December. Statistical methods exist to ensure that censored data are not ignored in analysis, rather information on survival up until the time of censoring is used to give the best possible estimates of survival or revision probabilities.

Chi-Square Test (χ2) Test: Any test whose statistic has a chi-square distribution under the null hypothesis is called a chi-square test. A common example is a test for association between two categorical variables whose data are arrayed in a cross-classification table of counts (Pearson's chi-square test). This can be generalised to many situations where the distribution of observed data is being compared to an expected theoretical distribution.

Competing risk: Any event that changes the probability of occurrence of another event is known as a competing risk for the other event. For example, death is a competing risk for revision because the probability of revision after death cannot be assumed to be the same as the probability of revision before death. For example, 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 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 hazard (for 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 to three months following primary and three months following primary to the end of observation. DDH has a significantly higher revision rate compared to OA in the first three months following 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 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: The cumulative number of years that a procedure is at risk of being revised. This is calculated for each procedure 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 (31/12/2009) 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 observed component years for a particular category.

For example

1. A primary total hip procedure performed on 1/1/2009 was revised on 1/7/2009. Therefore, the number of days that this procedure is at risk of being revised is 183 days. This patient 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 1/1/2009 died without being revised on 1/4/2009. This individual has 0.25 component years.
3. A primary procedure on 1/1/2009 and has not been revised. This individual has 1 component year (as observation time is censored at 31/12/2009).

Survival Curve: A plot of the proportion of subjects who have not yet experienced a defined event (for example death, 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	Implant Breakage Head	*Wear and implant breakage*
9	Wear Acetabulum	
10	Implant Breakage Stem	
11	Implant Breakage Acetabular/Insert	
12	Dislocation	*Stability of prosthesis*
13	Instability	
14	Fracture (Femur/Acetabular/Neck/Periprosthetic)	*Fracture of bone*
15	Chondrolysis/Acetabular Erosion	*Progression of disease on non-operated part of joint*
16	Progression of Disease	
17	Synovitis	*New diseases occurring in association with joint replacement*
18	Avascular Necrosis	
19	Heterotopic Bone	
20	Pain	*Pain*
21	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 Tibial/Insert	*Wear and implant breakage*
9	Wear Femoral	
10	Wear Patella	
11	Implant Breakage Femoral	
12	Implant Breakage Tibial	
13	Implant Breakage Patella	
14	Bearing Dislocation	
15	Dislocation	*Stability of prosthesis*
16	Instability	
17	Patellar Maltracking	
18	Fracture (Femur/Tibia/Patella/Periprosthetic)	*Fracture of bone*
19	Progression of Disease	*Progression of disease on non-operated part of joint*
20	Patellar Erosion	
21	Synovitis	*New diseases occurring in association with joint replacement*
22	Arthrofibrosis	
23	Avascular Necrosis	
24	Heterotopic Bone	
25	Patellofemoral Pain	*Pain*
26	Pain	
27	Other	*Remaining diagnoses*

APPENDIX 4

Patient Consent and Confidentiality Guidelines

PATIENT CONSENT

The Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR) obtains consent to include information from individuals undergoing joint replacement by using the 'opt off' approach. The implementation of the new Commonwealth Legislation at the end of 2001 resulted in the Registry meeting 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 clearly 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 wish to opt off, have enquires or wish to 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 will be 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, Mr 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 the 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 November 2001 and again for a further five years in November 2006. 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

PRIMARY HIP

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

49312-00	Excision arthroplasty of hip (removal of prosthesis without replacement)
49324-00	Revision of total arthroplasty of hip
49327-00	Revision of total arthroplasty with bone graft to acetabulum
49330-00	Revision of total arthroplasty with bone graft to femur
49333-00	Revision of total arthroplasty with bone graft to acetabulum and femur
49339-00	Revision of total arthroplasty with anatomic specific allograft to acetabulum
49342-00	Revision of total arthroplasty of hip with anatomic specific allograft to femur
49345-00	Revision of total arthroplasty with anatomic specific allograft to acetabulum & femur
49346-00	Revision of partial arthroplasty hip replacement

PRIMARY TOTAL KNEE

Patellofemoral Replacement

49534-00	Total replacement arthroplasty of patellofemoral joint of knee

Unicompartmental Knee

49517-00	Hemi arthroplasty of knee

Primary Total Knee

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

49512-00	Arthrodesis with removal of prosthesis
49515-00	Removal-prostheses from knee
49527-00	Revision of total arthroplasty of knee
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