Hip and Knee Arthroplasty

ANNUAL REPORT 2013

AUSTRALIAN ORTHOPAEDIC ASSOCIATION

National Joint Replacement Registry

AUSTRALIAN ORTHOPAEDIC ASSOCIATION NATIONAL JOINT REPLACEMENT REGISTRY

ANNUAL REPORT

Prepared by

Deputy Directors
Mr David Davidson
Professor Richard de Steiger

Director
Professor Stephen Graves

Coordinators
Ms Ann Tomkins
Ms Robyn Vial
Ms Lisa Miller

Professor John Lynch
Ms Liddy Griffith
Mr Scott Miller
Ms Michelle Lorimer
Mr Yen-Liang Liu
Ms Kara Cashman
Mr Tyman Stanford
Ms Grace O'Donohue
Data Management & Analysis Centre
University of Adelaide

The AOANJRR is funded by the Commonwealth Government

Director: Professor Stephen Graves

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

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

Coordinator: Ms Ann Tomkins

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

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

www.aoa.org.au

ISSN 1445-3657

Suggested citation:
Australian Orthopaedic Association National Joint Replacement Registry. Annual Report. Adelaide:AOA; 2013

Australian Orthopaedic Association
National Joint Replacement Registry

ANNUAL REPORT
2013

Hip and Knee Arthroplasty
September 1999 to December 2012

CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

This summary gives an overview of the 2013 Annual Report, outlining additions to the Registry analysis as well as highlighting major findings.

Two new chapters have been included this year. The first is an analysis examining the impact of surgeon experience on the revision rates of primary total hip and primary total knee replacement. The second is an analysis of the outcome of arthroplasty used in the management of fractured neck of femur.

Surgeon experience was defined as the length of time between completion of training and procedure. Three different groups were identified (less than 3, 3-7 and 8 or more years experience). More experienced surgeons have a lower rate of revision but the effect of experience varies depending on the choice of prosthesis. The two most commonly used hip prostheses combinations do not show any difference in rates of revision. When comparing the four most commonly used knee prostheses, two do not show a difference with experience, one shows a reduced rate of revision after three years experience and the remaining prosthesis has a reduced rate of revision after eight years experience.

The reason for including the new chapter on the outcome of arthroplasty management of fractured neck of femur is to enable the Registry to present a more detailed comparative analysis on the use of both primary partial and primary total conventional hip replacement for the treatment of this condition. In addition, the effect of age and fixation for both partial and total conventional hip replacement, as well as head size for total conventional hip replacement are also examined.

When comparing the three different types of partial hip replacement (unipolar monoblock, unipolar modular and bipolar) with each other and with total conventional hip replacement there is considerable difference in the rate of mortality. This variation is almost certainly due to patient selection. Primary total conventional hip replacement is used more frequently in younger and possibly healthier patients. Partial hip replacement and unipolar monoblock procedures in particular, are preferentially used in older patients who are likely to have more comorbidities.

There is also a difference in the rate of revision depending on the class of prostheses used and this varies with age. Bipolar hip replacement has the lowest rate of revision overall and also within each of the three different age groups (younger than 70, 70-79 and 80 years and older). This outcome however is no different to primary total conventional hip replacement in those younger than 79 years and no different to unipolar modular prostheses in those 80 years or older.

The use of femoral stem cement fixation for partial hip replacement reduced the rate of revision in the two older age groups. In primary total conventional hip replacement cement fixation of the femoral stem has a lower rate of revision in the younger than 70 and 70-79 year age groups. Cementing both the femoral stem and the acetabular cup in the 80 year and older age group is associated with the lowest rate of revision.

Head size is another factor affecting the outcome of primary total conventional hip replacement used for the treatment of fractured neck of femur. Head size of 32mm has the lowest rate of revision when considering revision for any reason. Smaller head sizes (less than 32mm) have the highest rate of revision for dislocation in all age groups. Increasing head size from 32mm to 36mm or larger does not appear to confer any additional protection against revision for dislocation.

In 2011, the Registry reported for the first time on ten year outcomes for both hip and knee replacement. This year the Registry presents data on an increased number of prostheses combinations that have reached this milestone. At ten years, 46.6% of all primary total hip and 24.2% of all primary total knee prostheses combinations have greater than 95% survivorship.

The number of hip and knee replacement procedures undertaken each year continues to increase. However the increase in the last 12 months has been less than previously observed. In 2012, the number of procedures undertaken increased by 1.6% compared to 2011 (0.1% for hips and 2.7% for knees). Most procedures were undertaken in the private sector (59.4% for hips and 70.5% for knees in 2012).

Despite the inclusion of the new chapter on arthroplasty management of fractured neck of femur the Registry has retained a separate chapter on partial hip replacement in this report. This is to enable the outcomes for different prostheses types in each class of partial hip replacement to be presented.

There has been a reduction in the use of new total conventional hip prostheses and prostheses combinations being used in Australia. In 2010, there were 330 new combinations used, this reduced to 97 in 2011; however in 2012 the number of new combinations increased to 131.

For the first time the Registry has undertaken an analysis on the effect of fixation excluding large head (greater than 32mm) metal/metal articulations. These procedures were excluded because they were predominately used in cementless procedures, known to have a higher rate of revision and are now rarely used. When these procedures are excluded cementless fixation has a lower rate of revision compared to cement fixation in those aged less than 75 years and compared to hybrid fixation in those aged less than 65 years. Cementless fixation has a higher rate of revision compared to both hybrid and cement fixation in the 75 year or older age group.

The lower revision rate of cross-linked polyethylene compared to non cross-linked polyethylene is again highlighted. This is due to a reduced rate of revision for both dislocation and loosening/lysis. The reduced rate of revision for dislocation is likely due to increased use of larger head sizes (32mm or greater) in cross-linked polyethylene procedures. Cross-linked polyethylene has a lower rate of revision compared to non cross-linked regardless of whether a metal, ceramic or ceramised metal femoral head is used. This year, for the first time, the Registry presents data on four acetabular prostheses, each of which have large numbers of both cross-linked and non cross-linked polyethylene. All four prostheses have a lower rate of revision when cross-linked polyethylene is used.

The main factor affecting the outcome of ceramic/ceramic bearings is head size. Head sizes less than 32mm have a higher rate of revision compared to all larger head sizes. There is no difference in the rate of revision when 30-32mm heads are compared to larger head sizes.

The use of primary total resurfacing hip replacement continues to decline, reducing by 23.4% in 2012 compared to 2011. It accounted for only 1.6% of all hip procedures in 2012. A higher proportion of resurfacing procedures are undertaken in younger males (97.1% in 2012). The Registry has previously identified that this patient population has the best outcome for this procedure.

The findings for knee replacement are similar to previous reports.

Unicompartmental knee replacement is by far the most common partial knee replacement. Its use has been declining for a number of years; this has continued in 2012 reducing by a further 12.9% compared to 2011. It has a higher rate of revision than primary total knee replacement.

Two analyses for total knee replacement are being reported for the first time. The first is the outcome of cross-linked polyethylene. There is some evidence to suggest that cross-linked polyethylene may reduce the rate of revision for some minimally stabilised primary total knee replacement prostheses.

The second new total knee analysis relates to the use of computer navigation. The use of computer navigation has increased each year and in 2012 was used in 22.3% of primary total knee replacement procedures. At nine years, there is no difference in the rate of revision when navigated and non-navigated primary total knee replacements are compared.

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

This year the Registry has identified 100 prostheses or prostheses combinations (59 hip and 41 knee). Of these, eight hip and six knee prostheses are reported for the first time. One of the hips and one of the knees reported for the first time are no longer used. Detailed analyses of all identified prostheses and prostheses combinations are available as a supplementary report on the Registry website.

As in previous years, the Registry publishes a number of supplementary reports covering a range of topics. This year 15 supplementary reports will be available on the Registry website, *aoanjrr.dmac.adelaide.edu.au/annual-reports-2013*.

INTRODUCTION

The 2013 Hip and Knee Arthroplasty Report is based on the analysis of 799,815 primary and revision hip and knee procedures recorded by the Registry with a procedure date up to and including 31 December 2012. This is an increase of 86,738 procedures compared to the 2012 Annual Report.

In addition, there are 15 supplementary reports that complete the AOANJRR Annual Report for 2013.

1. Lay Summary
2. Demographics of Hip Arthroplasty
3. Demographics of Knee Arthroplasty
4. Cement in Hip and Knee Arthroplasty
5. Mortality of Hip and Knee Arthroplasty
6. Revision of Hip and Knee Arthroplasty
7. Metal on Metal Total Conventional Hip Arthroplasty
8. Metal and Ceramic Bearing Surface in Total Conventional Hip Arthroplasty
9. Unispacer Knee Arthroplasty
10. Demographics and Outcome of Shoulder Arthroplasty
11. Demographics and Outcome of Elbow and Wrist Arthroplasty
12. Demographics and Outcome of Ankle Arthroplasty
13. Demographics of Spinal Disc Arthroplasty
14. Investigations of Prostheses with Higher than Anticipated Rates of Revision
15. Analysis of State and Territory Health Data – All Arthroplasty 1993/1994 – 2011/2012

These reports are available on the Registry website *aoanjrr.dmac.adelaide.edu.au/annual-reports-2013*.

Data are submitted to the Registry by all hospitals (public and private) undertaking joint replacement. Currently there are 304 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 2012, the number of hip replacement procedures increased by 0.1% compared to the year prior and the number of knees by 2.7%. Since 2003, the first year of complete national data collection by the Registry, the number of hip procedures has increased by 40.9% and the number of knee procedures by 69.1%.

It is anticipated that this rate of increase will continue in the future. The Registry has previously detailed the rate of increase from 1993/1994 by comparing the number and type of joint replacements undertaken each year using data supplied by the State and Territory Health Departments. These data are presented in the supplementary report 'Analysis of State and Territory Health Data – All Arthroplasty 1993/1994 – 2011/2012'.

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

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

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

In 1998, the Commonwealth Department of Health and Ageing (DoHA) agreed to fund the AOA to establish the Registry.

The Registry began data collection on 1 September 1999. Implementation was undertaken in a staged manner in each of the Australian states and territories becoming national during 2002 (Appendix 6). The Department of Health and Ageing continues to provide funding to maintain the Registry. In June 2009, Federal Parliament passed legislation to enable the government to cost recover this funding from the orthopaedic industry.

The purpose of the Registry is to define, improve and maintain the quality of care for individuals receiving joint replacement surgery. This is achieved by

collecting a defined minimum data set that enables outcomes to be determined based on patient characteristics, prosthesis type and features, method of prosthesis fixation and surgical technique used.

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

Aims

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

Benefits

Information obtained by the analysis of Registry data is used to benefit the community. The Registry releases this information through publicly available annual and supplementary reports, journal publications and ad hoc reports (209 in 2012). These ad hoc reports are specific analyses requested by surgeons, hospitals, academic institutions, Government and government agencies as well as orthopaedic companies.

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

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

The percentage of revision hip replacement decreased from 12.6% in 2011 to 11.8% in 2012.

The percentage of revision knee procedures has declined from a peak of 8.8% in 2004 to 7.8% in 2012, equating to 455 less knee revisions in 2012.

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

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

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

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

Committee members include: -

- Chair, Department of Health and Ageing
- AOANJRR Director

a representative of

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

Data Collection

Hospitals provide data on specific Registry forms, which are completed in theatre at the time of surgery and submitted to the Registry monthly. Examples of Registry data forms are available on the website *aoanjrr.dmac.adelaide.edu.au/data-collection*.

The Registry uses a paper-based system, however it has established mechanisms to collect data electronically when it becomes feasible for contributing hospitals. To date 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 2011/12 financial year, the Registry received 1,200 less procedures than were provided in the various health department data files. The Registry will follow up with hospitals to provide unreported data.

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 around 94.5% of Registry records verified against health department data. Following the retrieval of unreported records and checking of unmatched data, the Registry is able to obtain an almost complete dataset relating to hip and knee replacement in Australia.

Outcome Assessment

The Registry describes the time to first revision using the Kaplan-Meier estimates of survivorship. The cumulative percent revision at a certain time, for example five years, is the complement (in probability) of the Kaplan-Meier survivorship function at that time, multiplied by 100. The cumulative percent revision accounts for right censoring due to death and 'closure' of the database at the time of analysis.

In previous annual reports, the Registry has reported the revisions per 100 observed component years. This statistic provides a good estimate of the rate of revision, however, it does not allow for changes in the rate of revision over time. A more informative estimate of the rate of revision over time is the cumulative percent revision. As the Registry is now reporting 12 year follow-up, the revisions per 100 observed component years have not been included in this report.

Confidence intervals for the cumulative percent revision are unadjusted point-wise Greenwood estimates and should not be used to infer significant differences in revision between groups. Reported hazard ratios should be used when judging statistical significance.

Hazard ratios (HR) from Cox proportional hazards models, adjusting for age and 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. Analytical comparisons of revision rates using the proportional hazards model are based on all available data (*Pocock SJ, Clayton TC, Altman DG. Survival plots of time to event outcomes in clinical trials: good practice and pitfalls, Lancet 2002; 359: 1686-89*).

In the presence of a competing risk for revision, the Kaplan-Meier method is known to overestimate the true probability of revision. Death of the patient before revision presents such a competing risk. In circumstances where the risk of death is high (for example, in elderly patients with fractured neck of femur) the bias in the Kaplan-Meier estimates may be substantial and the reported cumulative percent revision should be interpreted with caution.

The Registry is currently investigating the introduction of different analytic methods to cope with competing risks. Cumulative incidence is one method of estimating the probability of revision in the presence of competing risks. Revision diagnosis cumulative incidence graphs deal with the competing risks of reasons for revision, highlighting the differences between groups in the pattern of revision over time. They also provide important insight into different mechanisms of failure.

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

An important Registry focus has been the continued development of a standardised algorithm to identify 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 of the report.

Report Review Prior to Publication

Members of the AOA Arthroplasty Society were invited to attend a two-day workshop to review, comment and provide advice on all sections of the report. The workshop was held in Adelaide on the weekend of 3 and 4 August 2013. Following the workshop the report was provided to the AOA Board for consideration and final approval prior to publication.

Presentation of 2013 Annual Report

In the 2013 Annual Report, the surgeon experience effect on the outcome of primary total conventional hip and primary total knee replacement is reported for the first time. This analysis examines the relationship between the experience of the surgeon undertaking the procedure and the revision rate.

The Registry has also included a section investigating the outcome of primary partial hip and total conventional hip replacement performed for fractured neck of femur.

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

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

The Revision hip and knee section is now provided as a separate supplementary report on the website.

Acknowledgements

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

The Registry acknowledges the cooperation and support provided by those undertaking the surgery and completing the data forms, in particular all orthopaedic surgeons, registrars and nursing staff.

The Registry would also like to acknowledge the ongoing support of all hospitals both public and private that undertake arthroplasty surgery nationally. The support provided by each hospital through their nominated coordinator(s) is appreciated. A complete list of participating hospitals and coordinators is presented in Appendix 1.

SURGEON EXPERIENCE

Introduction

Patient, surgeon and prosthesis factors affect the outcome of hip and knee replacement. Last year, the Registry found surgeons averaging more than 70 procedures per year had the lowest rate of revision for both primary total hip and knee replacement procedures. This effect varied depending on the prosthesis used. Some prostheses had very little difference in outcome related to the number of procedures undertaken by a surgeon.

The Registry also reported variation between individual surgeons averaging the same number of procedures per year. One reason for this variation was also prosthesis selection. When a prosthesis known to have a higher than anticipated rate of revision was used, the revision rate was high regardless of surgeon volume. Another possible reason for variation between surgeons performing a similar volume is surgeon experience.

For the first time the Registry is undertaking an analysis to determine if the rate of revision is related to the experience of the surgeon performing the procedure. The Registry also aims to determine if this relationship is different for hip and knee replacement and if it varies depending on the type of prostheses used.

The Registry anonymously analysed data using surgeon code for individual surgeons. Surgeon experience was defined in two ways. Surgeons with a birth date during or prior to 1960 were considered to have more than eight years experience for all procedures reported to the Registry since 2003. For all other surgeons, experience was defined as the time between the date a surgeon was admitted as a Fellow of the Royal Australasian College of Surgeons (RACS) and the procedure date. The awarding of the Fellowship was used as a surrogate for the completion of training. The Registry obtained details of those surgeons who have become Fellows of the RACS since 1995. Using this approach the Registry was able to assign procedures by surgeon experience.

Surgeon experience was divided into three groups:

- <3 years – procedures performed by surgeons operating for less than three years,
- 3-7 years – procedures performed by surgeons operating for between three and seven years,
- ≥8 years – procedures performed by surgeons operating for eight or more years.

Primary Total Conventional Hip Replacement

Outcome and Number of Procedures

There are 849 surgeons performing primary total conventional hip replacement who have a surgeon code recorded in the Registry.

Surgeons with less than three years experience use on average two different prostheses combinations per year (range 1-9 prostheses), compared to three prostheses combinations for surgeons with both three to seven years and eight or more years experience (range 1-11 and 1-14 prostheses respectively).

The most experienced group have a lower rate of revision compared to the three to seven year group. This group also has a lower rate of revision compared to the group with less than three years experience but only in the first three months. There is no difference in the rate of revision between the two groups with less experience when compared over the entire period (Table SE1 and Figure SE1). This however is not the case when analysing revision rates in the first 12 months. Surgeons with less than three years experience have a higher revision rate compared to both the three to seven and eight or more years experience. Those with three to seven years experience have a higher rate of revision compared to the eight or more years experience group (Figure SE2).

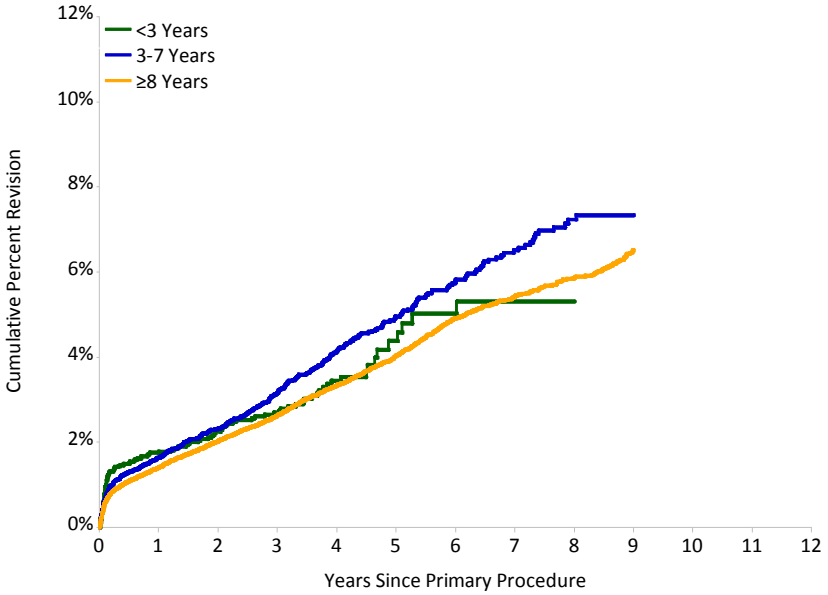
Specific Hip Prostheses

To determine if prostheses choice affected the difference in surgeon experience related revision rates the Registry repeated the analysis for specific prostheses combinations. The criterion for choosing a prostheses combination was that there had to be at least 500 procedures for that combination per surgeon experience group. Only two primary total conventional hip prostheses combinations fulfilled this criterion. They were the Exeter V40/Trident and Corail/Pinnacle combinations. There is no difference in the rate of revision when comparing surgeon experience within each of these two prostheses combinations (Table SE2 and Figures SE3 and SE4).

Table SE1: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Surgeon Experience (Primary Diagnosis OA)

Surgeon Experience	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs
<3 Years	121	4306	1.8 (1.4, 2.2)	2.7 (2.2, 3.3)	4.4 (3.5, 5.5)	5.3 (4.1, 6.9)	
3-7 Years	565	17243	1.6 (1.4, 1.8)	3.2 (2.9, 3.5)	5.0 (4.5, 5.5)	6.5 (5.9, 7.2)	
≥8 Years	2821	93936	1.4 (1.3, 1.5)	2.6 (2.5, 2.8)	4.0 (3.9, 4.2)	5.4 (5.2, 5.7)	
TOTAL	**3507**	**115485**					

Figure SE1: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Surgeon Experience (Primary Diagnosis OA)



HR - adjusted for age and gender

<3 Years vs ≥8 Years

0 - 3Mth: HR=1.58 (1.21, 2.05),p<0.001

3Mth+: HR=0.81 (0.63, 1.04),p=0.102

3-7 Years vs ≥8 Years

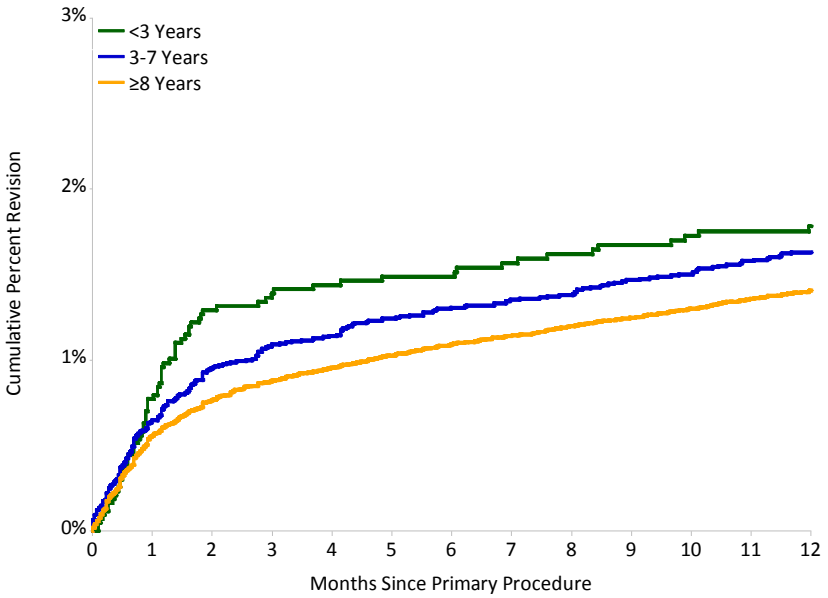
Entire Period: HR=1.20 (1.09, 1.31),p<0.001

3-7 Years vs <3 Years

Entire Period: HR=1.13 (0.93, 1.37),p=0.230

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	12 Yrs
<3 Years	4306	3483	2048	461	228	0	0
3-7 Years	17243	13514	7190	2974	1622	0	0
≥8 Years	93936	76384	45726	21767	11568	0	0

Figure SE2: One Year Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Surgeon Experience (Primary Diagnosis OA)



HR - adjusted for age and gender

<3 Years vs ≥8 Years

0 - 2Wk: HR=0.99 (0.54, 1.82),p=0.984

2Wk - 3Mth: HR=1.81 (1.35, 2.43),p<0.001

3Mth+: HR=0.81 (0.63, 1.04),p=0.104

3-7 Years vs ≥8 Years

0 - 2Wk: HR=1.25 (0.94, 1.68),p=0.126

2Wk - 1Mth: HR=1.07 (0.81, 1.43),p=0.625

1Mth+: HR=1.20 (1.09, 1.33),p<0.001

<3 Years vs 3-7 Years

0 - 2Wk: HR=0.79 (0.42, 1.51),p=0.481

2Wk - 3Mth: HR=1.59 (1.16, 2.17),p=0.003

3Mth+: HR=0.67 (0.52, 0.88),p=0.003

Table SE2: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Prosthesis Type and Surgeon Experience (Primary Diagnosis OA)

Prosthesis and Experience		N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs
Exeter V40/Trident	<3 Years	18	1128	1.2 (0.7, 2.0)	1.4 (0.8, 2.4)	3.1 (1.5, 6.1)		
	3-7 Years	39	2779	0.8 (0.5, 1.2)	1.1 (0.8, 1.7)	2.2 (1.5, 3.3)	2.6 (1.8, 3.9)	
	≥8 Years	172	12740	0.8 (0.6, 1.0)	1.4 (1.1, 1.6)	1.7 (1.4, 2.0)	2.5 (2.0, 3.0)	
Corail/Pinnacle	<3 Years	12	526	1.9 (1.1, 3.6)	2.2 (1.2, 4.0)	3.9 (1.6, 9.3)		
	3-7 Years	64	2882	1.6 (1.2, 2.1)	2.6 (2.0, 3.3)	3.5 (2.4, 5.3)	4.6 (2.7, 7.8)	
	≥8 Years	180	8860	1.4 (1.2, 1.7)	2.3 (2.0, 2.8)	3.6 (2.8, 4.4)	4.5 (3.3, 6.0)	

Figure SE3: Cumulative Percent Revision of Exeter V40/Trident Primary Total Conventional Hip Replacement by Surgeon Experience (Primary Diagnosis OA)

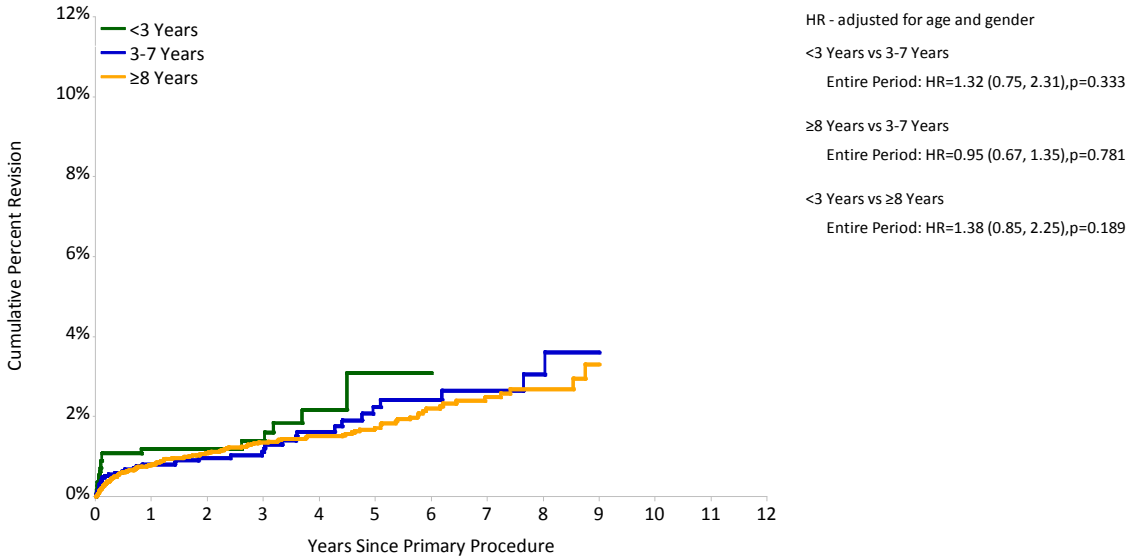
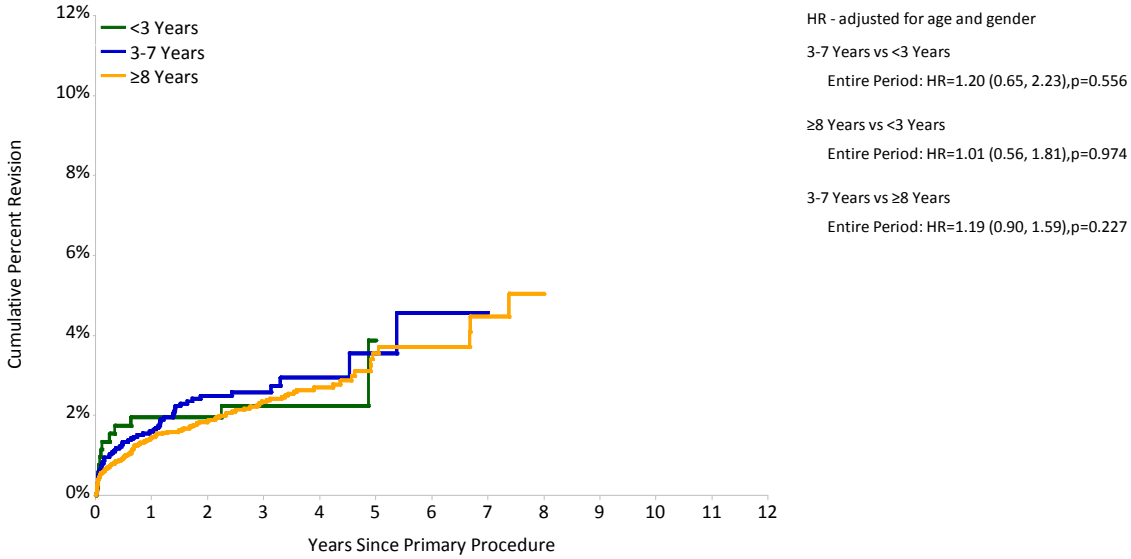


Figure SE4: Cumulative Percent Revision of Corail/Pinnacle Primary Total Conventional Hip Replacement by Surgeon Experience (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	12 Yrs
Exeter V40/Trident	<3 Years	1128	861	455	56	39	0	0
	3-7 Years	2779	2181	1111	576	317	0	0
	≥8 Years	12740	10287	5754	2452	1096	0	0
Corail/Pinnacle	<3 Years	526	443	281	54	1	0	0
	3-7 Years	2882	2069	680	108	46	0	0
	≥8 Years	8860	6658	3000	624	218	0	0

Primary Total Knee Replacement

Outcome and Number of Procedures

There are 904 surgeons performing total knee replacement who have a surgeon code recorded in the Registry.

Surgeons with less than three years experience use, on average, two different prostheses combinations per year (range 1-6 prostheses). This does not differ with experience, with surgeons with both three to seven years and eight or more years experience also using, on average, two different prostheses combinations per year (range 1-7 prostheses).

Surgeons with eight or more years experience have a lower rate of revision compared to the two less experienced groups. This is over the entire period for the less than three years group and only in the first year when compared to the three to seven years experience group. Surgeons with three to seven years experience have a lower rate of revision compared to surgeons with less than three years experience over the entire period (Table SE3 and Figure SE5).

Specific Knee Prostheses

Prostheses specific analysis similar to that undertaken for primary total conventional hip replacement was also performed for knee procedures. There were four primary total knee prostheses combinations with at least 500 procedures per surgeon experience group; Triathlon/Triathlon, Genesis II/Genesis II, LCS/MBT and Nexgen CR Flex/Nexgen.

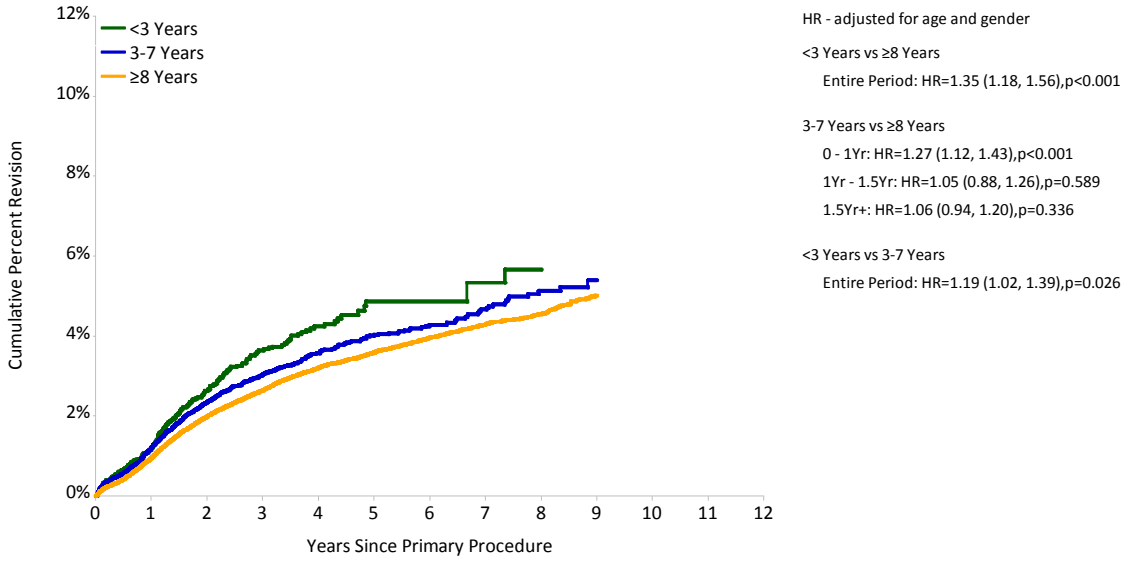
Two prostheses combinations have experience related differences. Surgeons using the Triathlon/Triathlon have a lower rate of revision after eight or more years experience (Table SE4 and Figure SE6). Surgeons with three or more years experience have a lower rate of revision when the Genesis II/Genesis II prosthesis combination is used. (Table SE4 and Figure SE7).

There is no difference in the rate of revision when comparing surgeon experience within the LCS/MBT and Nexgen CR Flex/Nexgen prostheses combinations (Tables SE4 and Figures SE8 and SE9).

Table SE3: Cumulative Percent Revision of Primary Total Knee Replacement by Surgeon Experience (Primary Diagnosis OA)

Surgeon Experience	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs
<3 Years	202	6573	1.2 (1.0, 1.5)	3.6 (3.1, 4.2)	4.9 (4.1, 5.7)	5.3 (4.4, 6.4)	
3-7 Years	756	28926	1.2 (1.1, 1.4)	3.0 (2.8, 3.3)	4.0 (3.7, 4.4)	4.7 (4.3, 5.1)	
≥8 Years	3651	147425	1.0 (0.9, 1.0)	2.6 (2.5, 2.7)	3.6 (3.5, 3.7)	4.3 (4.1, 4.5)	
TOTAL	**4609**	**182924**					

Figure SE5: Cumulative Percent Revision of Primary Total Knee Replacement by Surgeon Experience (Primary Diagnosis OA)



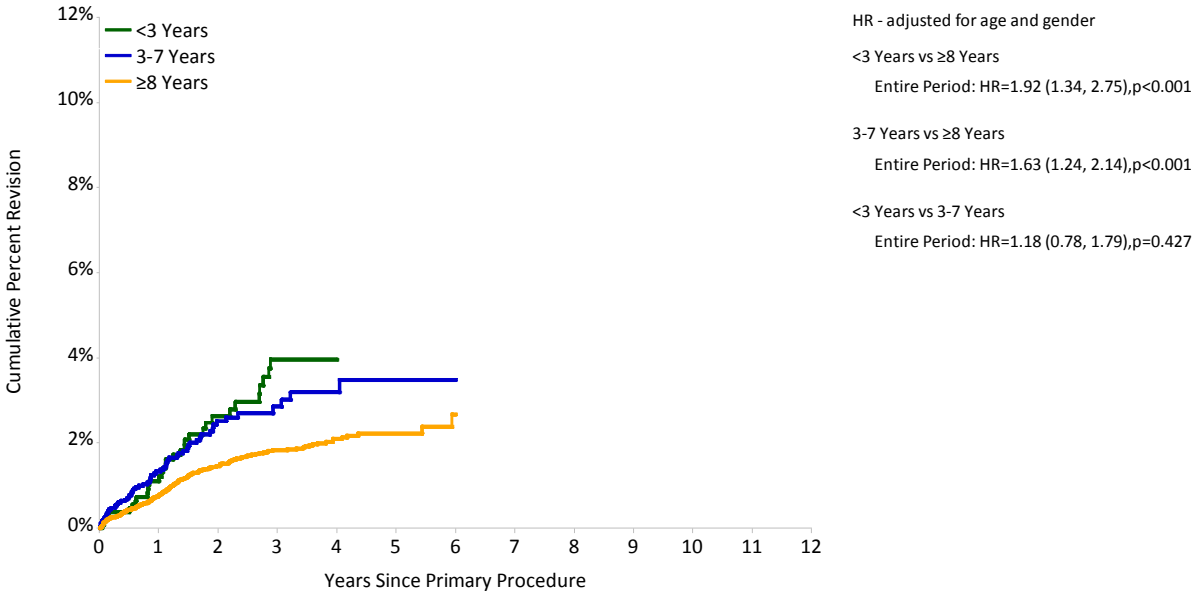
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	12 Yrs
<3 Years	6573	5268	3106	769	356	0	0
3-7 Years	28926	22611	11502	4636	2345	0	0
≥8 Years	147425	118454	68552	30566	15648	0	0

Table SE4: Cumulative Percent Revision of Primary Total Knee Replacement by Prosthesis Type and Surgeon Experience (Primary Diagnosis OA)

Prosthesis and Experience	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs
<3 Years	34	1349	1.2 (0.7, 2.0)	4.0 (2.8, 5.6)			
3-7 Years	65	3498	1.3 (1.0, 1.8)	2.8 (2.2, 3.7)	3.5 (2.6, 4.7)		
≥8 Years	252	18459	0.8 (0.6, 0.9)	1.8 (1.6, 2.1)	2.2 (1.9, 2.6)		
Triathlon/Triathlon	**351**	**23306**					
<3 Years	29	821	1.5 (0.8, 2.6)	4.0 (2.7, 6.0)	5.3 (3.6, 7.9)		
3-7 Years	84	3805	1.0 (0.7, 1.4)	2.4 (1.9, 3.0)	3.0 (2.4, 3.9)	5.1 (3.6, 7.3)	
≥8 Years	216	9625	0.9 (0.7, 1.1)	2.5 (2.2, 2.9)	3.1 (2.7, 3.6)	3.9 (3.3, 4.6)	
Genesis II/Genesis II	**329**	**14251**					
<3 Years	11	649	0.9 (0.4, 2.1)	2.3 (1.2, 4.4)	3.2 (1.6, 6.5)		
3-7 Years	30	2648	0.8 (0.5, 1.3)	1.5 (1.0, 2.2)	1.9 (1.2, 3.0)	1.9 (1.2, 3.0)	
≥8 Years	117	10637	0.5 (0.4, 0.7)	1.3 (1.0, 1.6)	1.6 (1.4, 2.0)	1.8 (1.4, 2.2)	
NexgenCR Flex/Nexgen	**158**	**13934**					
<3 Years	15	590	1.0 (0.5, 2.3)	1.9 (1.0, 3.6)	3.3 (1.9, 5.8)	4.3 (2.3, 7.9)	
3-7 Years	28	1487	0.9 (0.5, 1.6)	2.6 (1.7, 4.0)	3.9 (2.5, 6.0)	3.9 (2.5, 6.0)	
≥8 Years	189	8899	0.7 (0.5, 0.9)	2.3 (2.0, 2.7)	3.4 (2.9, 4.0)	4.2 (3.5, 4.9)	
LCS/MBT	**232**	**10976**					

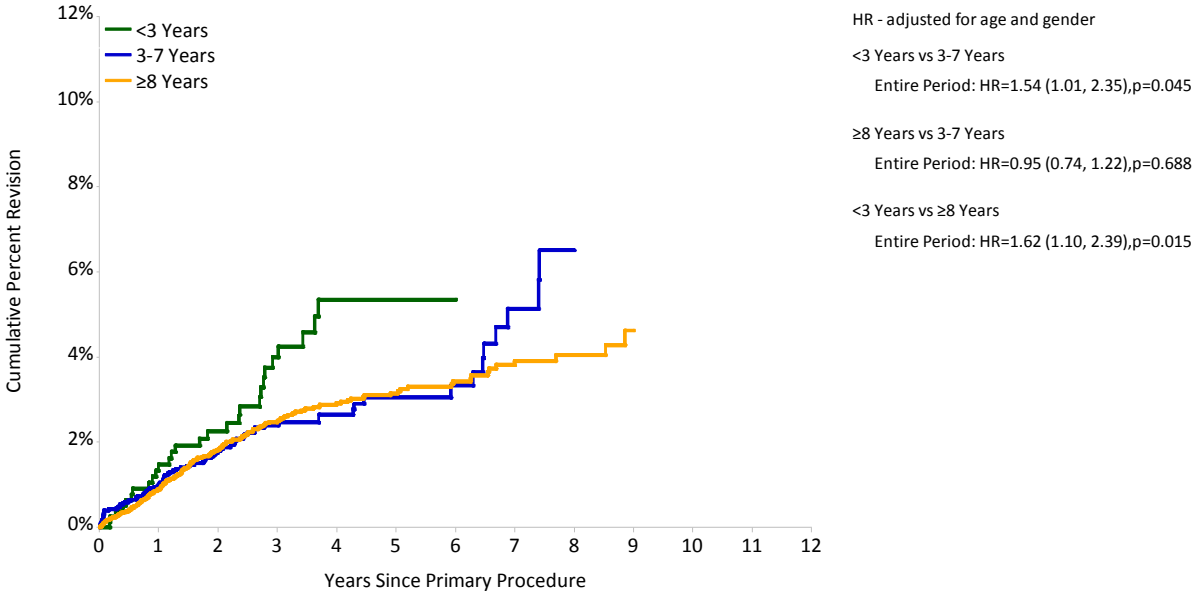
Note: LCS/MBT combination is excluding LCS and MBT Duofix prostheses

Figure SE6: Cumulative Percent Revision of Triathlon/Triathlon Primary Total Knee Replacement by Surgeon Experience (Primary Diagnosis OA)



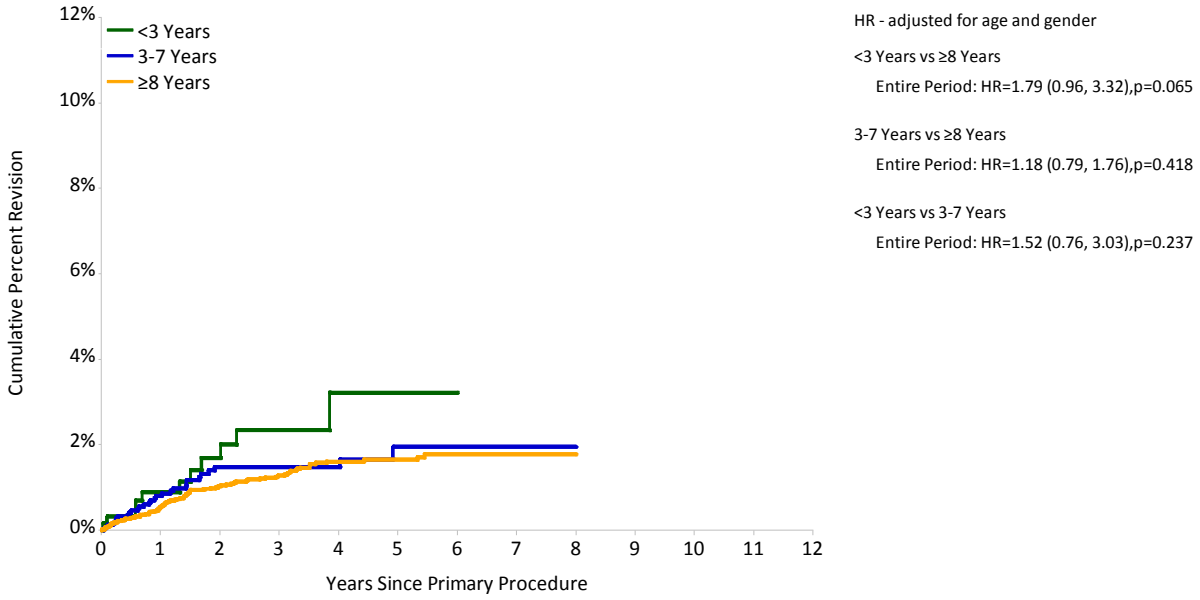
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	12 Yrs
<3 Years	1349	1001	463	4	0	0	0
3-7 Years	3498	2197	615	188	17	0	0
≥8 Years	18459	13653	5715	906	34	0	0

Figure SE7: Cumulative Percent Revision of Genesis II/Genesis II Primary Total Knee Replacement by Surgeon Experience (Primary Diagnosis OA)



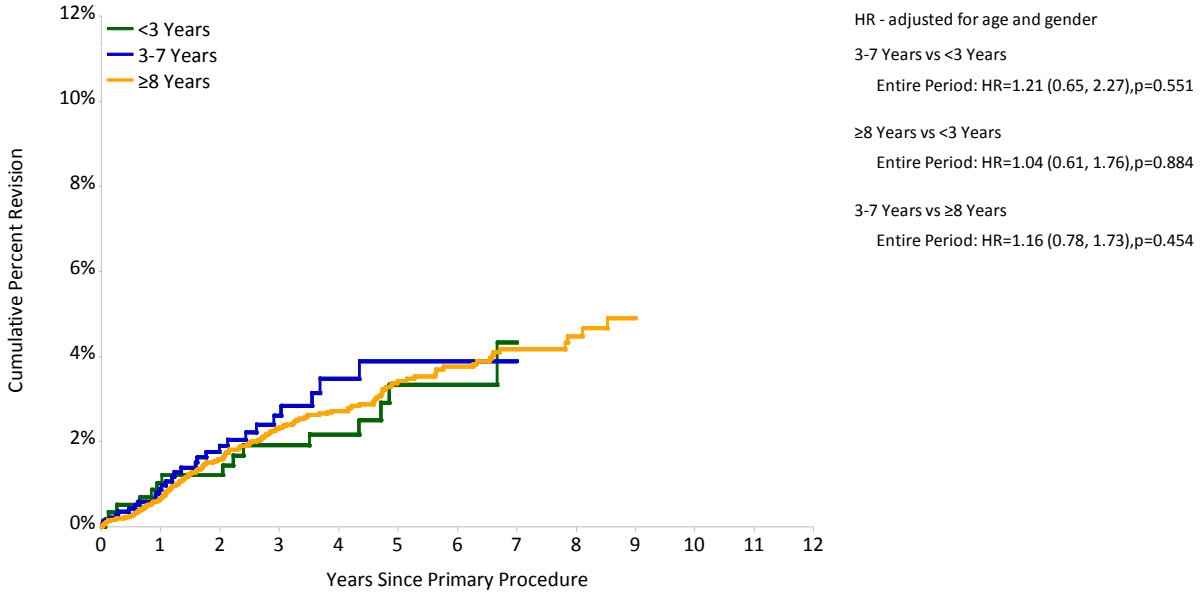
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	12 Yrs
<3 Years	821	695	385	48	37	0	0
3-7 Years	3805	3157	1518	505	203	0	0
≥8 Years	9625	7699	4258	1961	1001	0	0

Figure SE8: Cumulative Percent Revision of Nexgen CR Flex/Nexgen Primary Total Knee Replacement by Surgeon Experience (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	12 Yrs
<3 Years	649	455	251	47	29	0	0
3-7 Years	2648	1824	766	337	176	0	0
≥8 Years	10637	8251	4448	1758	719	0	0

Figure SE9: Cumulative Percent Revision of LCS/MBT Primary Total Knee Replacement by Surgeon Experience (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	12 Yrs
<3 Years	590	553	406	224	83	0	0
3-7 Years	1487	1023	423	183	52	0	0
≥8 Years	8899	6712	3951	1954	1113	0	0

Conclusion

The Registry has identified that surgeon experience has an effect on the outcome of primary total conventional hip and primary total knee replacement. When considering the outcome across all prostheses, more experienced surgeons have a lower rate of revision. The effect of experience on the rate of revision for both primary total hip and knee replacement varies depending on the choice of prosthesis.

The Registry has data on two hip prostheses combinations with more than 500 procedures in each of the three surgeon experience groups. There is no difference in revision rate for either combination when the three groups are compared.

There were four knee prostheses that had more than 500 procedures in each of the three surgeon experience groups. There is no experience related difference for two of these prostheses. Of the remaining two prostheses, there is a reduced rate of revision after eight years experience for one and after three years for the other.

ARTHROPLASTY MANAGEMENT OF FRACTURED NECK OF FEMUR

Introduction

The Registry has previously reported that the approach to arthroplasty management of fractured neck of femur patients has changed over the last decade. The purpose of this analysis is to highlight the trends in utilisation and provide a comprehensive report on the comparative outcome of the different classes of arthroplasty prostheses used for the management of this condition.

Data on usage, the outcomes of revision and mortality are reported for all procedures. Data are also reported for three different age groups (<70, 70-79 and ≥80 years). Additionally, in each of these age groups, the effect of fixation (for each class of arthroplasty prostheses) and femoral head size (for primary total conventional hip replacement) has also been examined.

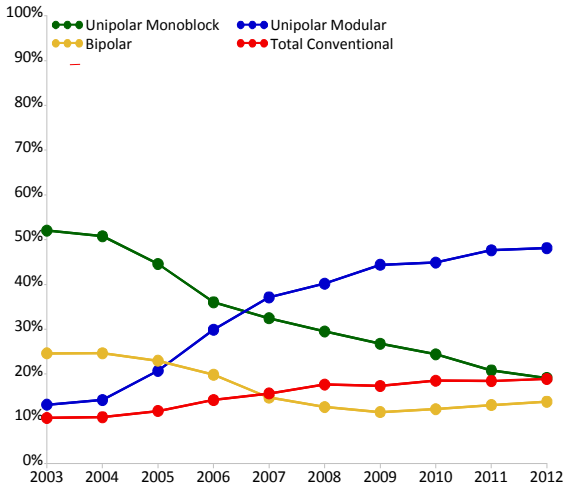
Fractured Neck of Femur (All Patients)

Usage

The Registry has data on 65,891 primary hip arthroplasty procedures with a diagnosis of fractured neck of femur. Most are partial hip replacements and include unipolar monoblock (36.0%), unipolar modular (32.0%) and bipolar replacement (17.1%). Primary total conventional hip replacement accounts for the remaining 14.9% of procedures.

Between 2003 and 2012, the use of unipolar monoblock and bipolar hip replacement reduced from 52.0% and 24.6% to 19.1% and 13.8% respectively. Over the same time, unipolar modular and total conventional hip replacement increased from 13.2% and 10.2% to 48.1% and 18.9% respectively (Figure F1).

Figure F1: Primary Hip Replacement by Class (Primary Diagnosis Fractured NOF)



Outcome

Both mortality and revision rate vary by class of prosthesis. Unipolar monoblock prostheses are associated with the highest ten year cumulative percent mortality (92.0%) followed by unipolar modular (79.3%), bipolar (73.8%) and primary total conventional hip replacement (58.4%) (Table F1).

Bipolar hip replacement has the lowest cumulative percent revision at ten years (5.6%), followed by unipolar monoblock (7.9%), unipolar modular (8.5%) and primary total conventional hip replacement (9.3%) (Table F2).

Table F1: Cumulative Percent Mortality of Primary Hip Replacement by Class (Primary Diagnosis Fractured NOF)

Hip Class	N Deceased	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Unipolar Monoblock	17953	23716	35.1 (34.5, 35.7)	58.7 (58.0, 59.3)	74.5 (73.9, 75.1)	92.0 (91.4, 92.5)	94.3 (93.7, 94.9)
Unipolar Modular	9503	21086	22.1 (21.5, 22.6)	40.8 (40.1, 41.6)	56.1 (55.2, 57.0)	79.3 (77.8, 80.8)	
Bipolar	6137	11298	19.2 (18.5, 20.0)	36.1 (35.2, 37.1)	50.1 (49.1, 51.2)	73.8 (72.5, 74.9)	79.5 (77.6, 81.3)
Total Conventional	2799	9791	8.8 (8.3, 9.4)	20.3 (19.5, 21.3)	33.0 (31.8, 34.2)	58.4 (56.3, 60.6)	
TOTAL	**36392**	**65891**					

Table F2: Cumulative Percent Revision of Primary Hip Replacement by Class (Primary Diagnosis Fractured NOF)

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Unipolar Monoblock	891	23716	3.0 (2.7, 3.2)	4.9 (4.5, 5.2)	6.0 (5.5, 6.4)	7.9 (7.1, 8.7)	8.4 (7.2, 9.8)
Unipolar Modular	660	21086	2.0 (1.8, 2.2)	3.7 (3.4, 4.0)	5.0 (4.6, 5.5)	8.5 (7.2, 10.0)	
Bipolar	363	11298	2.1 (1.8, 2.4)	3.3 (3.0, 3.7)	4.1 (3.6, 4.5)	5.6 (4.9, 6.4)	6.0 (5.0, 7.1)
Total Conventional	463	9791	2.9 (2.6, 3.3)	4.5 (4.0, 4.9)	5.9 (5.3, 6.5)	9.3 (8.0, 10.7)	
TOTAL	**2377**	**65891**					

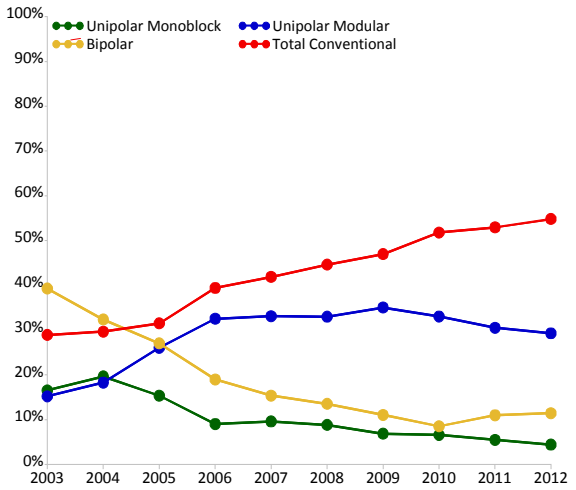
Fractured Neck of Femur (Patients <70 years)

Usage

The Registry has recorded 7,028 primary hip replacements for fractured neck of femur in patients less than 70 years. Primary total conventional hip replacement accounts for 41.9% of these procedures.

The proportion of primary total conventional hip replacement has increased from 28.9% in 2003 to 54.8% in 2012. Unipolar modular also increased from 15.2% in 2003 to a peak of 35.1% in 2009. Since 2009, it has declined to 29.3% in 2012. The use of unipolar monoblock procedures has declined from a peak of 19.7% in 2004 to 4.4% in 2012. Bipolar hip replacement also declined from 39.3% in 2003 to 8.5% in 2010. Since 2010, it has increased slightly to 11.5% in 2012 (Figure F2).

Figure F2: Primary Hip Replacement in Patients <70 by Class (Primary Diagnosis Fractured NOF)



Outcome

Mortality and revision rate vary with class. Primary total conventional hip replacement has the lowest cumulative percent mortality at ten years (26.8%) and unipolar monoblock the highest (72.4%). Ten year cumulative percent mortality following the use of bipolar hip replacement is 46.8% and unipolar modular hip is 55.1% (Table F3).

There is no difference in the rate of revision when comparing bipolar and primary total conventional hip replacement. The ten year cumulative percent revision for these two classes of prostheses is 10.0% and 12.2% respectively. Primary total conventional hip replacement has a lower rate of revision compared to both unipolar monoblock over the entire period and unipolar modular prostheses after the first three months. The ten year cumulative percent revision for unipolar monoblock is 14.9% and for unipolar modular is 18.1% (Table F4 and Figure F3).

The method of fixation (cemented or cementless) did not affect the outcome for either unipolar monoblock or unipolar modular prostheses. Cemented bipolar hip replacement has a lower rate of revision but only in the first two weeks (Table F4 and Figure F4-F6).

In primary total conventional hip replacement there is no difference between hybrid and cemented fixation. Hybrid fixation however has a lower rate of revision compared to cementless fixation (Table F4 and Figure F7).

Head size also affects the outcome in primary total conventional hip replacement. Three head sizes were compared; less than 32mm, 32mm and 36mm or larger.

Head size of 32mm is the most frequently used head size (41.2%) and when considering the overall rate of revision for any reason it is lower than for head sizes less than 32mm. There is no difference in revision rate compared to head sizes 36mm or larger (Table F5 and Figure F8).

Procedures using head sizes less than 32mm have a higher rate of revision for dislocation compared to a head size of 32mm (Table F5 and Figure F9).

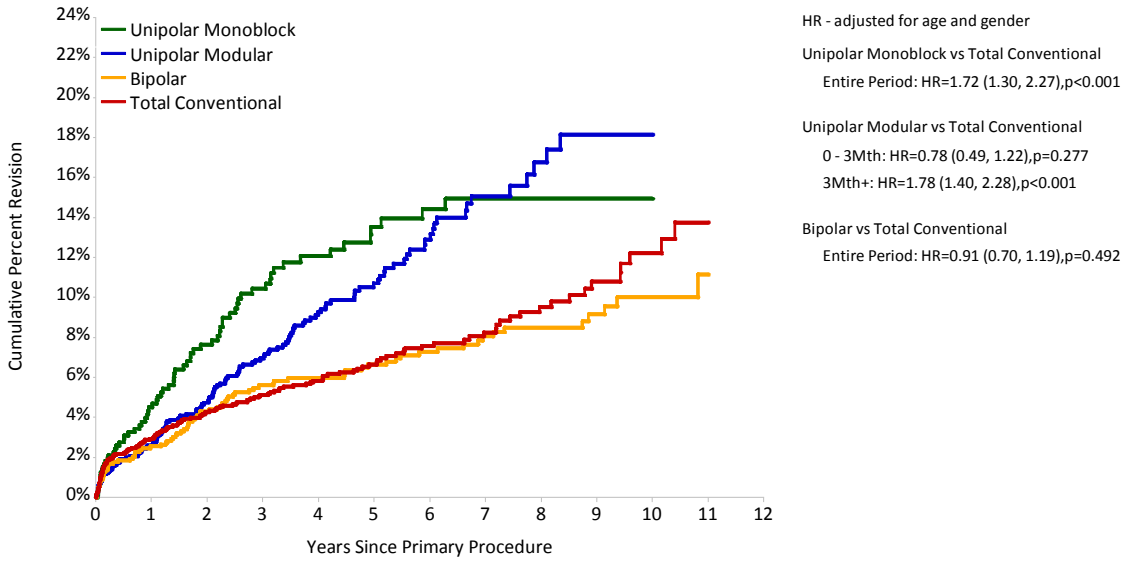
Table F3: Cumulative Percent Mortality of Primary Hip Replacement in Patients <70 by Class (Primary Diagnosis Fractured NOF)

Hip Class	N Deceased	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs
Unipolar Monoblock	432	773	26.2 (23.2, 29.5)	41.4 (37.9, 45.2)	54.7 (50.8, 58.7)	72.4 (67.8, 76.8)
Unipolar Modular	590	1942	15.9 (14.3, 17.7)	25.9 (23.9, 28.1)	34.2 (31.7, 36.9)	55.1 (49.5, 60.8)
Bipolar	490	1367	13.5 (11.8, 15.5)	24.5 (22.2, 27.0)	31.2 (28.6, 34.0)	46.8 (43.4, 50.3)
Total Conventional	389	2946	5.3 (4.5, 6.2)	10.5 (9.3, 11.8)	16.0 (14.4, 17.8)	26.8 (23.5, 30.3)
TOTAL	**1901**	**7028**				

Table F4: Cumulative Percent Revision of Primary Hip Replacement in Patients <70 by Class and Fixation (Primary Diagnosis Fractured NOF)

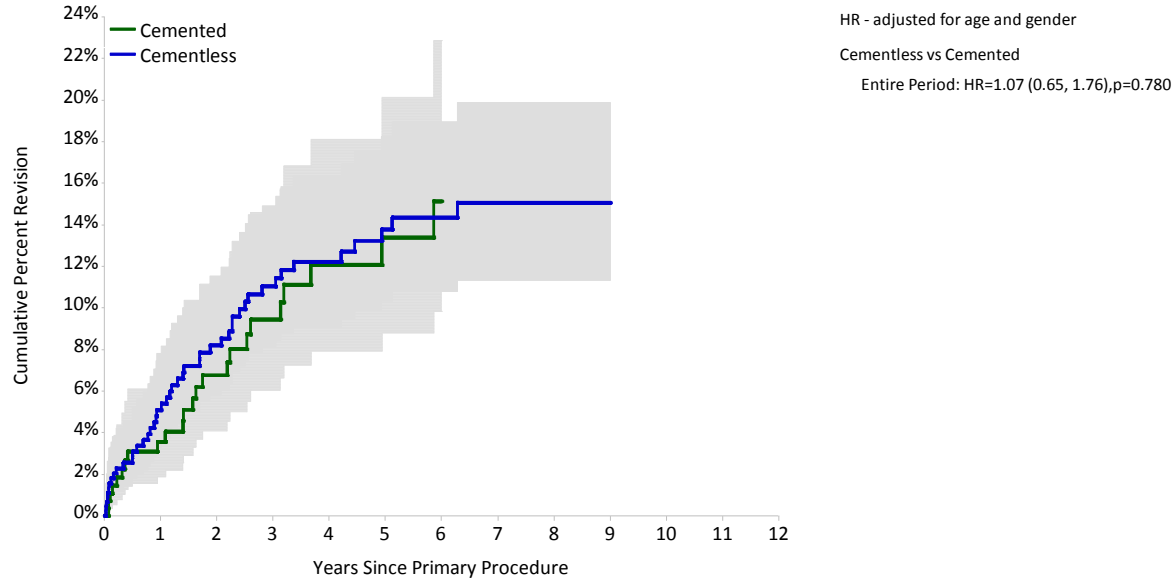
Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs
Unipolar Monoblock	**71**	**773**	**4.5 (3.1, 6.4)**	**10.4 (8.1, 13.4)**	**13.5 (10.7, 17.1)**	**14.9 (11.8, 18.8)**
Cemented	24	297	3.6 (1.9, 6.8)	9.4 (6.0, 14.6)	13.4 (8.8, 20.1)	
Cementless	47	476	5.1 (3.3, 7.8)	11.0 (8.1, 14.9)	13.8 (10.3, 18.2)	
Unipolar Modular	**148**	**1942**	**2.6 (1.9, 3.4)**	**7.0 (5.7, 8.5)**	**10.7 (9.0, 12.8)**	**18.1 (14.7, 22.3)**
Cemented	110	1537	2.1 (1.5, 3.0)	6.1 (4.8, 7.7)	10.6 (8.6, 13.0)	18.7 (14.7, 23.7)
Cementless	38	405	4.4 (2.7, 7.0)	10.2 (7.2, 14.1)	11.3 (8.1, 15.6)	
Bipolar	**85**	**1367**	**2.5 (1.8, 3.6)**	**5.6 (4.4, 7.1)**	**6.6 (5.3, 8.4)**	**10.0 (7.9, 12.7)**
Cemented	69	1093	2.1 (1.4, 3.2)	5.5 (4.1, 7.2)	6.8 (5.2, 8.8)	10.5 (8.1, 13.5)
Cementless	16	274	4.2 (2.3, 7.5)	6.1 (3.7, 10.0)	6.1 (3.7, 10.0)	
Total Conventional	**173**	**2946**	**2.9 (2.3, 3.6)**	**5.1 (4.3, 6.1)**	**6.6 (5.6, 7.8)**	**12.2 (9.8, 15.1)**
Cemented	15	318	2.3 (1.1, 4.8)	3.3 (1.7, 6.2)	4.9 (2.6, 9.1)	
Cementless	104	1398	3.4 (2.6, 4.5)	6.2 (4.9, 7.7)	8.4 (6.8, 10.3)	15.6 (11.8, 20.4)
Hybrid	54	1230	2.5 (1.7, 3.5)	4.3 (3.2, 5.7)	4.8 (3.5, 6.5)	7.1 (5.1, 9.8)
TOTAL	**477**	**7028**				

Figure F3: Cumulative Percent Revision of Primary Hip Replacement in Patients <70 by Class (Primary Diagnosis Fractured NOF)



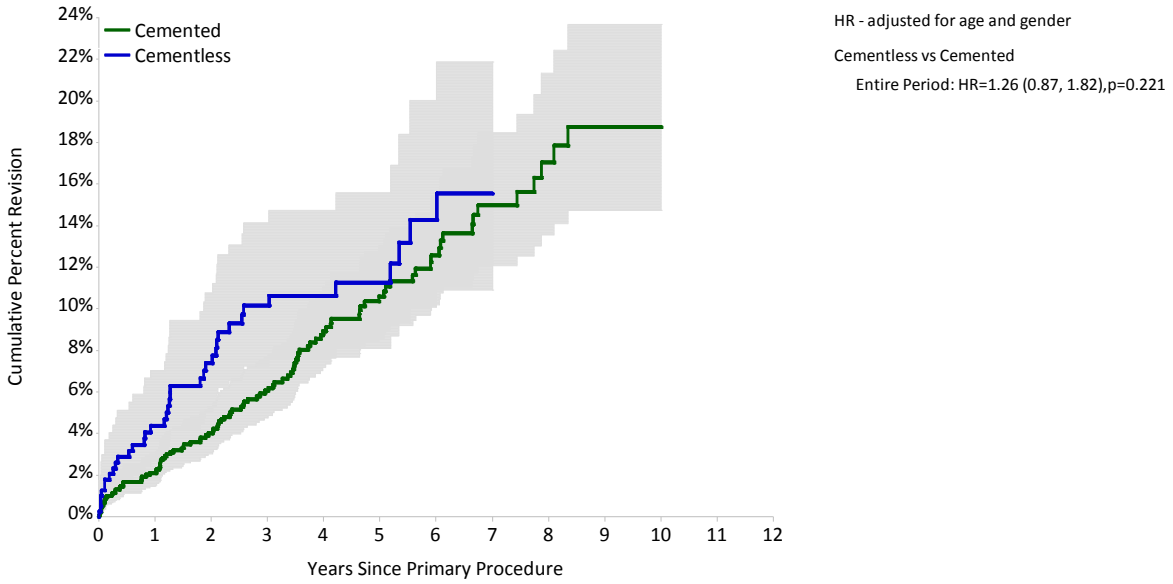
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Unipolar Monoblock	773	525	345	218	45	8
Unipolar Modular	1942	1412	868	477	44	7
Bipolar	1367	1079	817	630	151	20
Total Conventional	2946	2325	1494	886	139	13

Figure F4: Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement in Patients <70 by Fixation (Primary Diagnosis Fractured NOF)



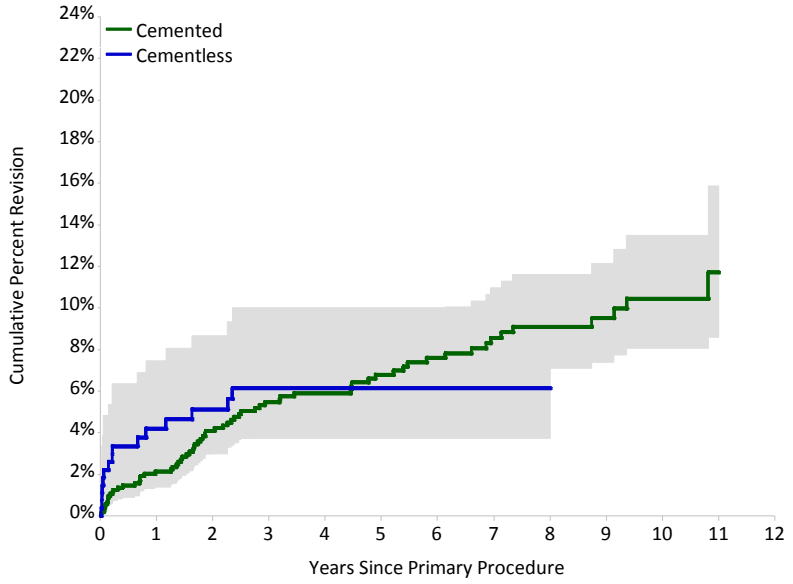
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	297	202	114	64	7	2
Cementless	476	323	231	154	38	6

Figure F5: Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement in Patients <70 by Fixation (Primary Diagnosis Fractured NOF)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	1537	1106	678	372	42	7
Cementless	405	306	190	105	2	0

Figure F6: Cumulative Percent Revision of Primary Bipolar Hip Replacement in Patients <70 by Fixation (Primary Diagnosis Fractured NOF)



HR - adjusted for age and gender

Cementless vs Cemented

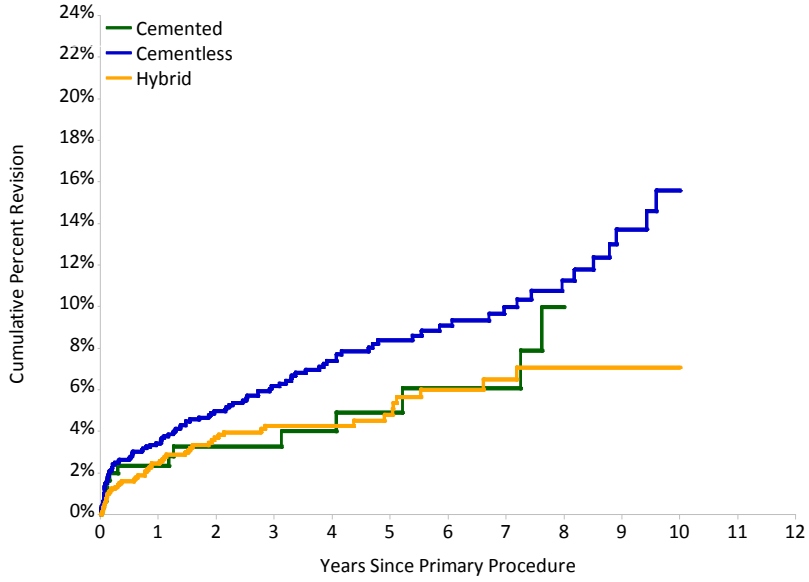
0 - 2Wk: HR=7.96 (1.46, 43.44),p=0.016

2Wk - 2Yr: HR=1.01 (0.48, 2.10),p=0.984

2Yr+: HR=0.38 (0.12, 1.24),p=0.107

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	1093	859	653	491	135	16
Cementless	274	220	164	139	16	4

Figure F7: Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients <70 by Fixation (Primary Diagnosis Fractured NOF)



HR - adjusted for age and gender

Cementless vs Cemented

Entire Period: HR=1.34 (0.78, 2.31),p=0.289

Hybrid vs Cemented

Entire Period: HR=0.88 (0.50, 1.56),p=0.661

Cementless vs Hybrid

Entire Period: HR=1.52 (1.09, 2.13),p=0.013

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	318	219	136	86	13	1
Cementless	1398	1144	776	471	67	6
Hybrid	1230	962	582	329	59	6

Table F5: Cumulative Percent Revision for all revisions of Primary Total Conventional Hip Replacement in Patients <70 by Head Size (Primary Diagnosis Fractured NOF)

Head Size	N Revised	N Dislocated	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs
<32mm	70	19	811	3.5 (2.4, 5.0)	5.7 (4.3, 7.7)	6.9 (5.2, 9.0)	13.2 (10.2, 17.0)
32mm	44	11	1112	2.2 (1.5, 3.3)	4.3 (3.1, 5.9)	5.2 (3.7, 7.2)	
≥36mm	39	8	773	3.8 (2.6, 5.5)	5.8 (4.2, 8.0)	6.8 (4.9, 9.6)	
TOTAL	**153**	**38**	**2696**				

Note: excludes 3 procedures where the head size is unknown and 247 with metal head >32mm

Figure F8: Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients <70 by Head Size (Primary Diagnosis Fractured NOF)

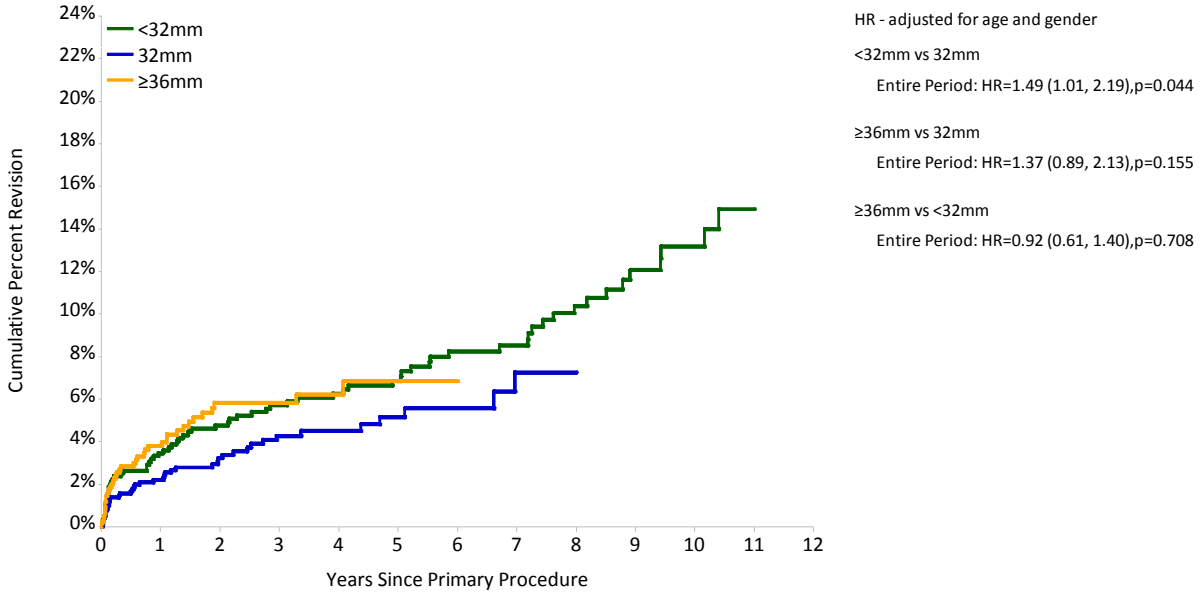
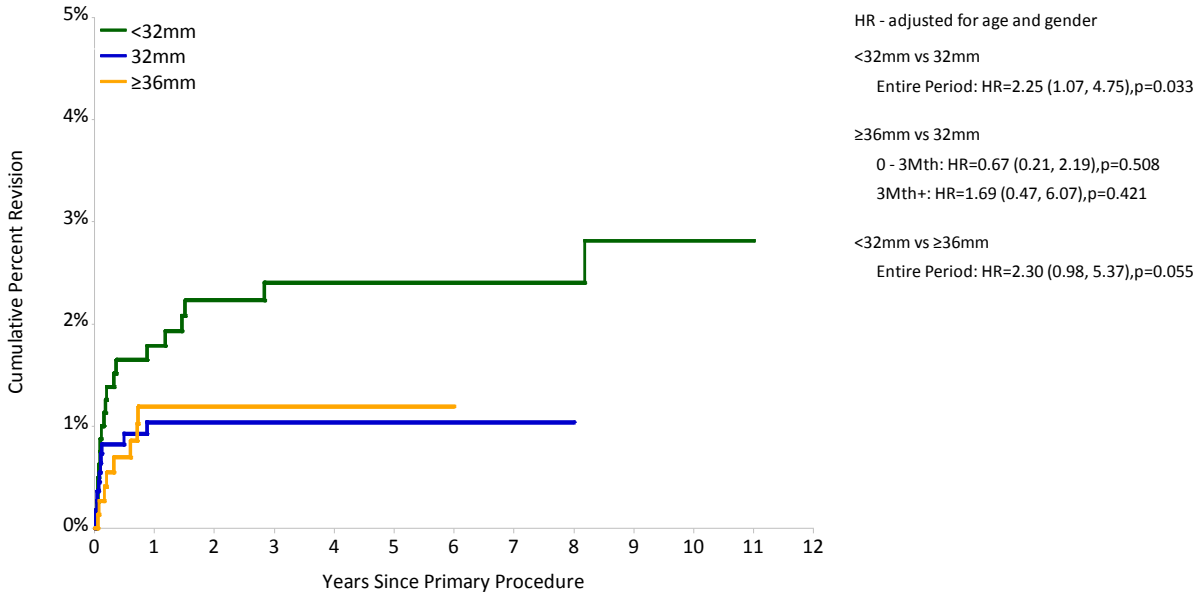


Figure F9: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement in Patients <70 by Head Size (Primary Diagnosis Fractured NOF)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
<32mm	811	694	548	426	118	13
32mm	1112	851	470	239	15	0
≥36mm	773	542	268	95	4	0

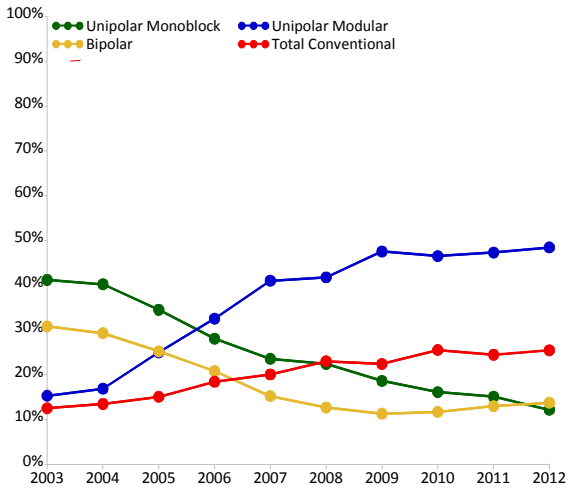
Fractured Neck of Femur (Patients 70-79 years)

Usage

The Registry has recorded 16,210 primary hip replacements for fractured neck of femur in patients 70 to 79 years. Unipolar modular is used in 33.0% of these procedures.

Between 2003 and 2012, the use of unipolar modular prostheses increased from 15.3% to 48.5%. Primary total conventional hip replacement increased from 12.6% to 25.5%. There was a decline in unipolar monoblock from 41.2% to 12.2% and bipolar from 30.9% to 13.8% (Figure F10).

Figure F10: Primary Hip Replacement in Patients 70-79 by Class (Primary Diagnosis Fractured NOF)



Outcome

Although overall mortality is higher for patients 70-79 years compared to less than 70 years there is a similar variation in mortality based on class. Primary total conventional hip replacement has the lowest mortality at ten years (54.1%), followed by bipolar (63.0%), unipolar modular (68.0%) and unipolar monoblock (85.4%) (Table F6).

There is no difference in the rate of revision when comparing bipolar and primary total conventional hip replacement. The ten year cumulative percent revision for these two classes of prostheses is 5.6% and 7.8% respectively. Bipolar prostheses have a lower revision rate compared to both unipolar monoblock and unipolar modular prostheses. The ten year cumulative percent revision for unipolar monoblock is 11.9% and for unipolar modular is 10.3% (Table F7 and Figure F11).

Cement fixation has a lower rate of revision compared to cementless fixation for unipolar monoblock, primary total conventional hip and unipolar modular only in the first nine months for this latter class. There is no difference in the rate of revision between fixation when using bipolar hip prostheses (Table F7 and Figures F12-F15).

In primary total conventional hip replacement, the most common head size is 32mm (38.3%). There is no difference in the overall rate of revision for any reason when the three different head size groups are compared (Table F8 and Figure F16).

The rate of revision for dislocation is over two and half times greater for head sizes less than 32mm compared to 36mm or larger. There is no difference in the dislocation rate between head sizes 32mm and 36mm or larger (Table F8 and Figure F17).

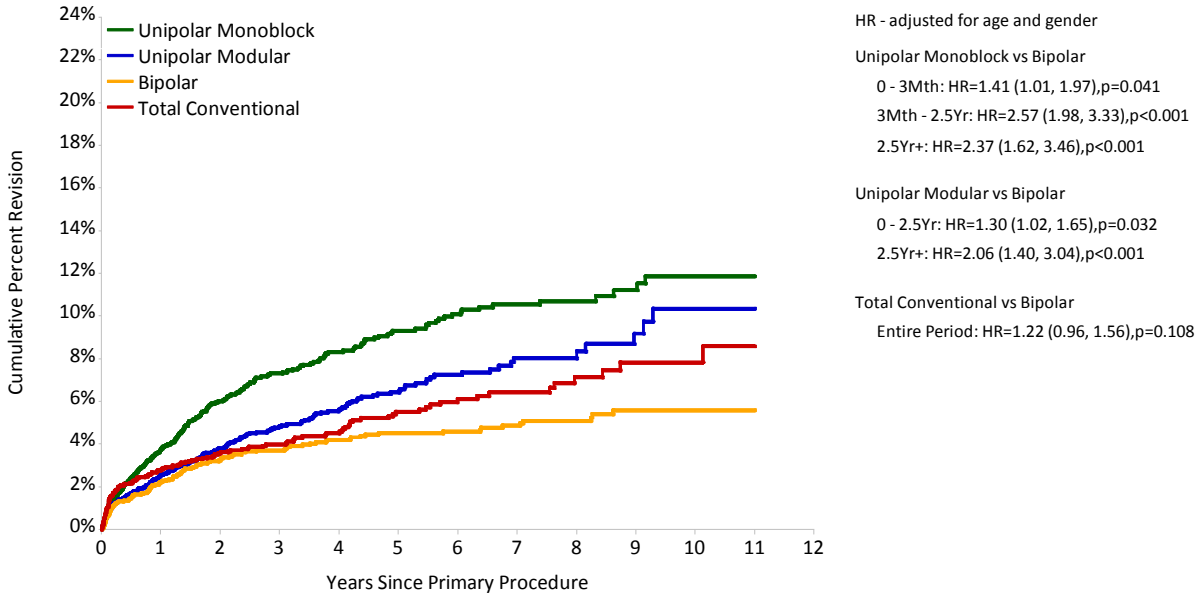
Table F6: Cumulative Percent Mortality of Primary Hip Replacement in Patients 70-79 by Class (Primary Diagnosis Fractured NOF)

Hip Class	N Deceased	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs
Unipolar Monoblock	3154	4583	27.9 (26.6, 29.3)	49.7 (48.2, 51.3)	64.5 (63.0, 66.0)	85.4 (83.9, 86.8)
Unipolar Modular	1927	5349	14.8 (13.9, 15.9)	29.2 (27.9, 30.6)	42.3 (40.6, 44.0)	68.0 (64.9, 71.0)
Bipolar	1486	3175	14.4 (13.2, 15.7)	26.7 (25.2, 28.4)	38.2 (36.4, 40.1)	63.0 (60.7, 65.3)
Total Conventional	777	3103	6.4 (5.5, 7.3)	16.3 (14.9, 17.9)	26.4 (24.5, 28.4)	54.1 (50.4, 57.9)
TOTAL	**7344**	**16210**				

Table F7: Cumulative Percent Revision of Primary Hip Replacement in Patients 70-79 by Class and Fixation (Primary Diagnosis Fractured NOF)

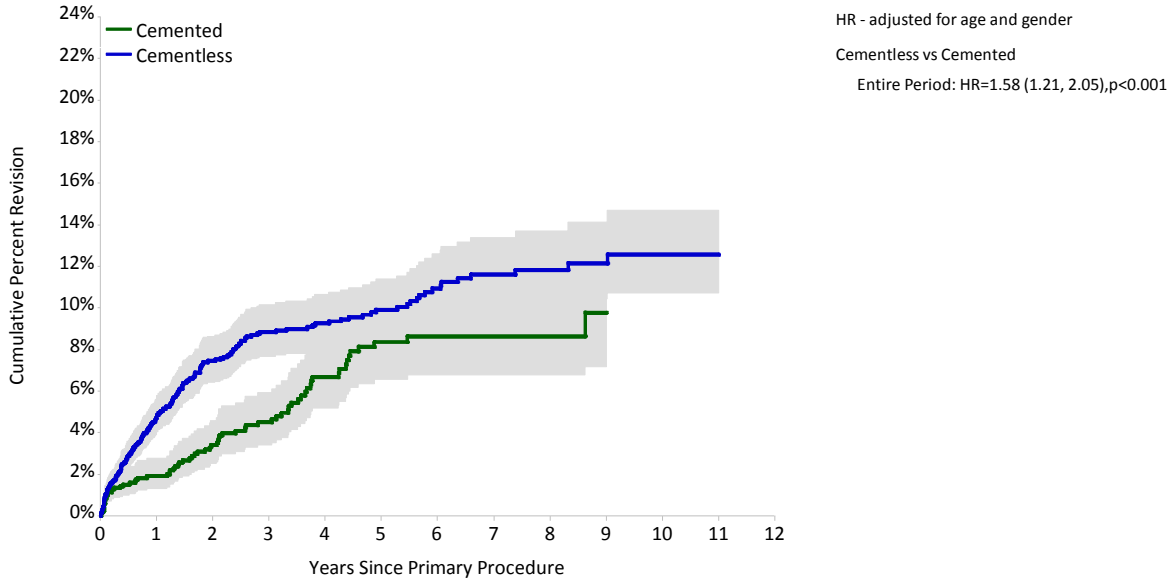
Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs
Unipolar Monoblock	**288**	**4583**	**3.8 (3.2, 4.4)**	**7.3 (6.4, 8.3)**	**9.3 (8.2, 10.5)**	**11.9 (10.2, 13.7)**
Cemented	75	1619	1.9 (1.3, 2.8)	4.5 (3.4, 5.9)	8.4 (6.6, 10.6)	
Cementless	213	2964	4.8 (4.0, 5.7)	8.8 (7.7, 10.2)	9.9 (8.6, 11.4)	12.6 (10.7, 14.7)
Unipolar Modular	**241**	**5349**	**2.5 (2.1, 3.0)**	**4.8 (4.2, 5.5)**	**6.4 (5.6, 7.4)**	**10.3 (8.2, 13.0)**
Cemented	182	4264	2.1 (1.7, 2.7)	4.5 (3.8, 5.3)	6.2 (5.2, 7.3)	10.7 (8.3, 13.7)
Cementless	59	1085	4.1 (3.0, 5.5)	5.9 (4.5, 7.7)	7.4 (5.7, 9.7)	
Bipolar	**121**	**3175**	**2.2 (1.8, 2.8)**	**3.7 (3.0, 4.5)**	**4.5 (3.7, 5.4)**	**5.6 (4.6, 6.8)**
Cemented	94	2566	2.0 (1.5, 2.6)	3.5 (2.8, 4.4)	4.4 (3.5, 5.4)	5.3 (4.2, 6.5)
Cementless	27	609	3.3 (2.1, 5.2)	4.5 (3.0, 6.7)	5.1 (3.4, 7.4)	
Total Conventional	**141**	**3103**	**2.8 (2.3, 3.5)**	**4.0 (3.3, 4.8)**	**5.5 (4.6, 6.6)**	**7.8 (6.3, 9.7)**
Cemented	15	546	1.2 (0.5, 2.6)	1.7 (0.8, 3.4)	3.8 (2.1, 6.7)	
Cementless	68	1089	4.0 (3.0, 5.4)	5.5 (4.2, 7.1)	7.6 (5.9, 9.7)	
Hybrid	58	1468	2.5 (1.8, 3.5)	3.7 (2.8, 4.9)	4.5 (3.4, 6.0)	7.5 (5.2, 10.7)
TOTAL	**791**	**16210**				

Figure F11: Cumulative Percent Revision of Primary Hip Replacement in Patients 70-79 by Class (Primary Diagnosis Fractured NOF)



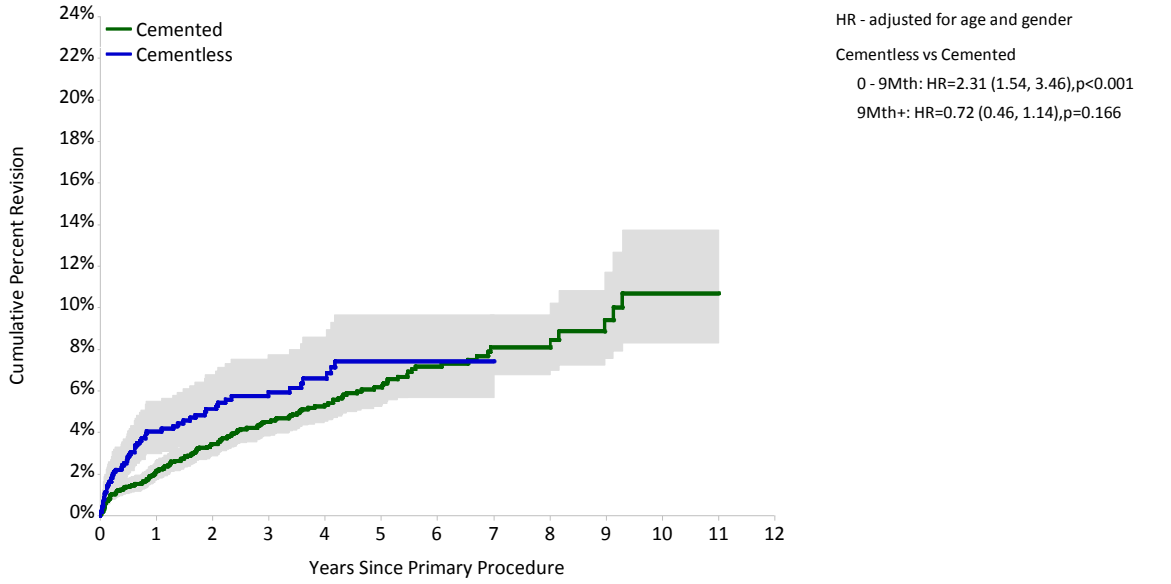
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Unipolar Monoblock	4583	3074	1864	1106	168	23
Unipolar Modular	5349	3883	2286	1154	97	11
Bipolar	3175	2501	1867	1370	255	29
Total Conventional	3103	2493	1614	942	128	14

Figure F12: Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement in Patients 70-79 by Fixation (Primary Diagnosis Fractured NOF)



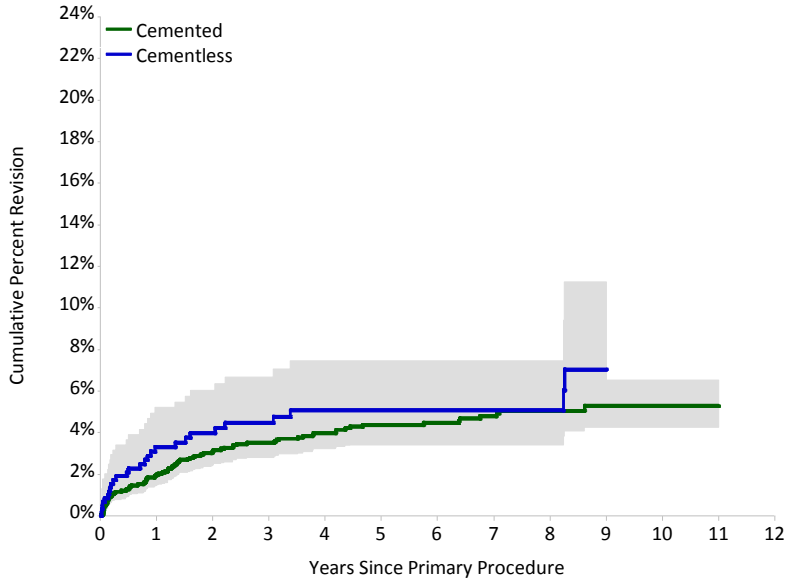
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	1619	1113	653	376	37	4
Cementless	2964	1961	1211	730	131	19

Figure F13: Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement in Patients 70-79 by Fixation (Primary Diagnosis Fractured NOF)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	4264	3078	1787	933	89	11
Cementless	1085	805	499	221	8	0

Figure F14: Cumulative Percent Revision of Primary Bipolar Hip Replacement in Patients 70-79 by Fixation (Primary Diagnosis Fractured NOF)



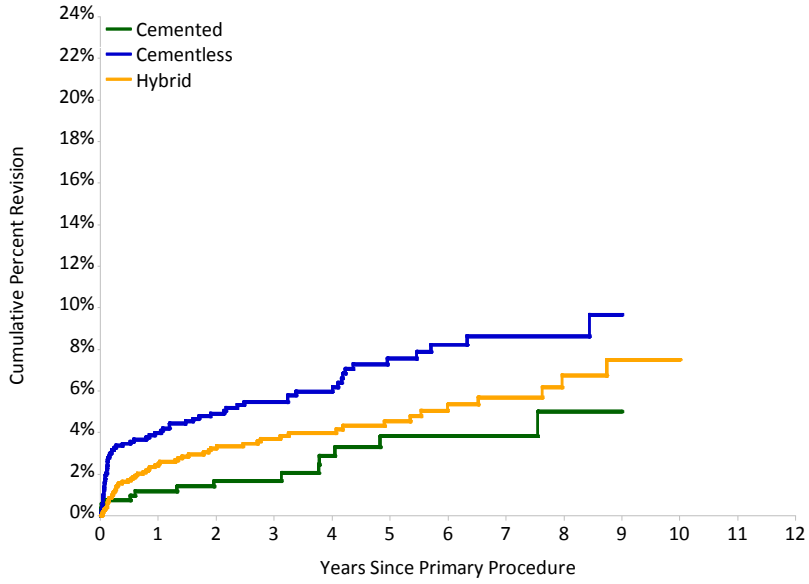
HR - adjusted for age and gender

Cementless vs Cemented

Entire Period: HR=1.26 (0.82, 1.93),p=0.294

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	2566	2041	1534	1137	227	27
Cementless	609	460	333	233	28	2

Figure F15: Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients 70-79 by Fixation (Primary Diagnosis Fractured NOF)



HR - adjusted for age and gender

Cementless vs Cemented

Entire Period: HR=2.24 (1.28, 3.92),p=0.004

Hybrid vs Cemented

Entire Period: HR=1.45 (0.82, 2.55),p=0.203

Cementless vs Hybrid

0 - 1Mth: HR=3.91 (1.78, 8.61),p<0.001

1Mth+: HR=1.22 (0.82, 1.81),p=0.326

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	546	441	283	180	24	6
Cementless	1089	884	579	340	39	4
Hybrid	1468	1168	752	422	65	4

Table F8: Cumulative Percent Revision for all revisions of Primary Total Conventional Hip Replacement in Patients 70-79 by Head Size (Primary Diagnosis Fractured NOF)

Head Size	N Revised	N Dislocated	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs
<32mm	59	23	1008	3.0 (2.1, 4.3)	4.6 (3.4, 6.1)	6.2 (4.7, 8.0)	7.8 (6.0, 10.2)
32mm	40	14	1135	2.5 (1.7, 3.6)	3.7 (2.6, 5.1)	3.9 (2.8, 5.4)	
≥36mm	27	6	824	2.6 (1.7, 4.0)	3.2 (2.1, 4.8)	5.0 (3.2, 7.8)	
TOTAL	**126**	**43**	**2967**				

Note: excludes 4 procedures where the head size is unknown and 132 with metal head >32mm

Figure F16: Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients 70-79 by Head Size (Primary Diagnosis Fractured NOF)

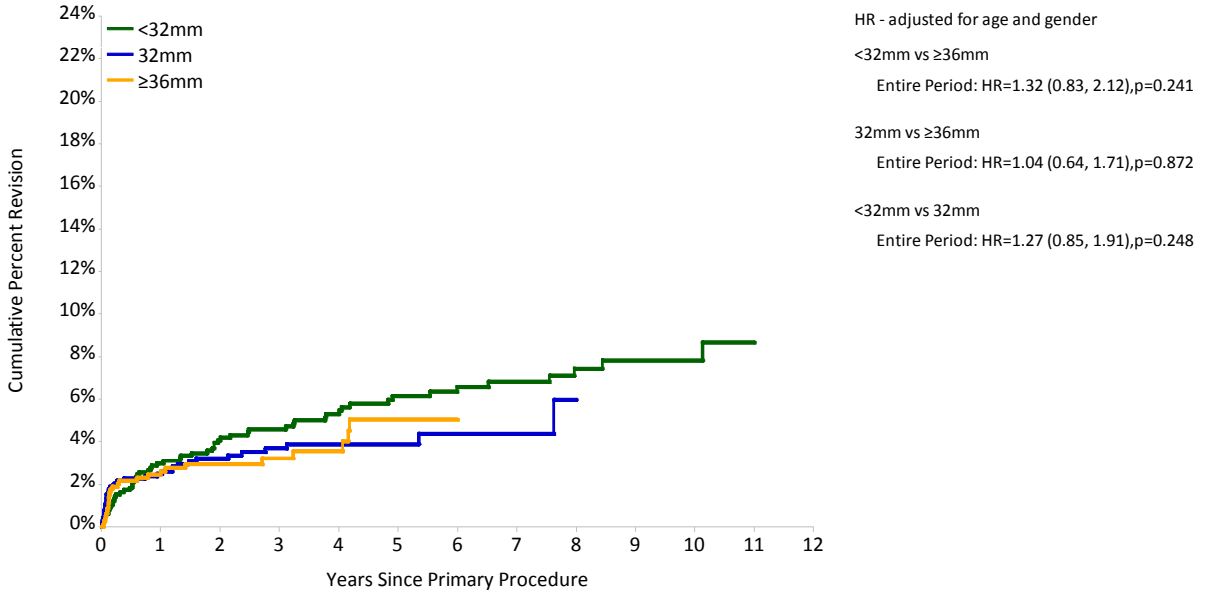
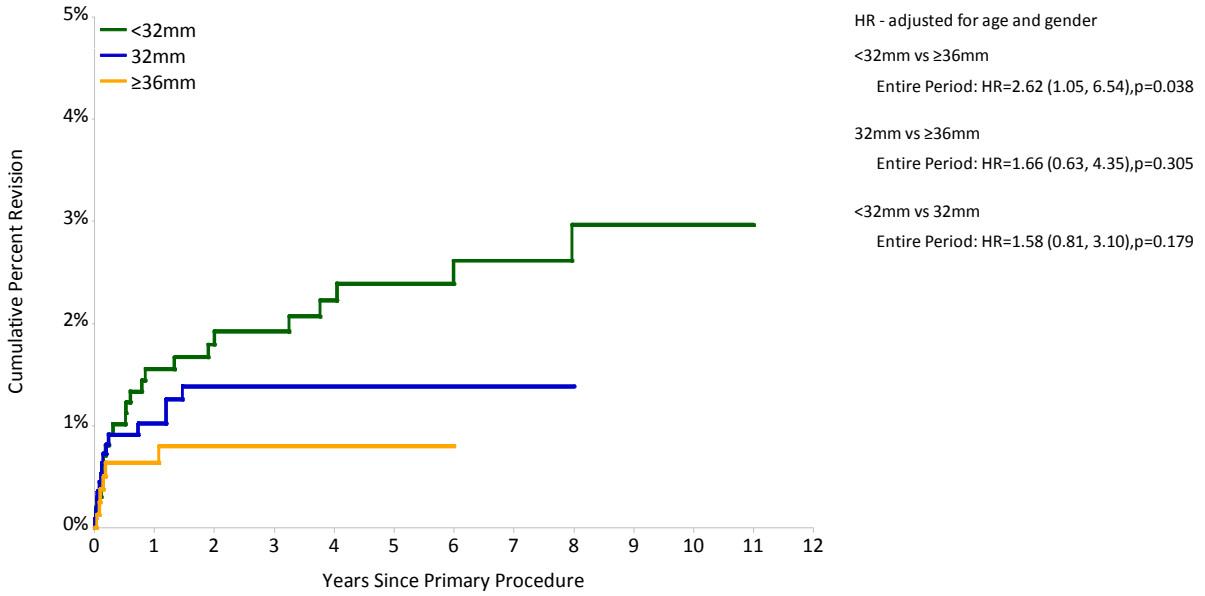


Figure F17: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement in Patients 70-79 by Head Size (Primary Diagnosis Fractured NOF)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
<32mm	1008	882	693	499	115	14
32mm	1135	865	504	250	9	0
≥36mm	824	623	312	125	1	0

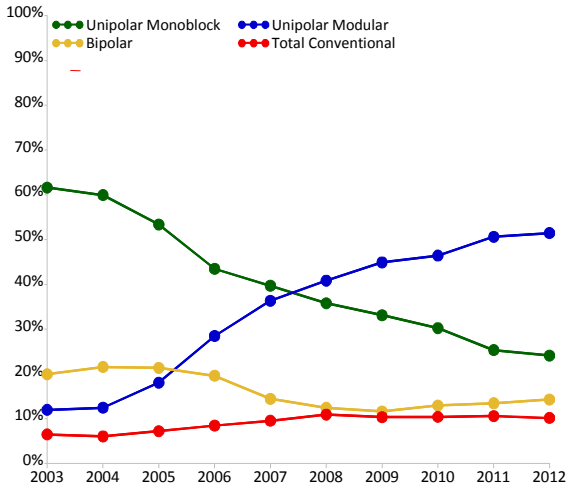
Fractured Neck of Femur (Patients ≥80 years)

Usage

The Registry has recorded 42,653 primary hip replacements for fractured neck of femur in patients 80 years or older. Unipolar monoblock is the most used prosthesis class and accounts for 43.0% of these procedures.

Between 2003 and 2012, the use of unipolar modular increased from 12.0% to 51.4%. There was also a small increase in primary total conventional hip replacement from 6.5% to 10.2%. There was a decline in use of unipolar monoblock from 61.6% to 24.1%. There was also a decline in use of bipolar prostheses from 19.9% to 11.6% in 2009, however its use has remained relatively constant since then (Figure F18).

Figure F18: Primary Hip Replacement in Patients ≥80 by Class (Primary Diagnosis Fractured NOF)



Outcome

The overall cumulative percent mortality at ten years in this age group is higher than in the younger age groups, and the difference between classes is not as evident (Table F9).

There is no difference in the rate of revision when comparing unipolar modular and bipolar hip prostheses. The ten year cumulative percent revision for these two classes of prostheses is 3.4% and 3.9% respectively. Unipolar modular prostheses have a lower rate of revision compared to both unipolar monoblock and primary total conventional hip replacement. The ten year cumulative percent revision for unipolar monoblock is 6.1% and for primary total conventional hip is 6.4% (Table F10 and Figure F19).

Cement fixation has a lower rate of revision compared to cementless fixation regardless of hip class. For primary total conventional hip replacement, cement fixation also has a lower rate of revision compared to hybrid fixation (Table F10 and Figures F20-23).

In primary total conventional hip replacement, the most common head size is 32mm (39.5%). There is no difference in the rate of revision for any reason when the three different head size groups are compared (Table F11 and Figure F24).

The rate of revision for dislocation is higher with head sizes less than 32mm compared to 32mm. This difference is evident after one month. There is no difference in the rate of revision for dislocation between head sizes 32mm and 36mm or larger (Table F11 and Figure F25).

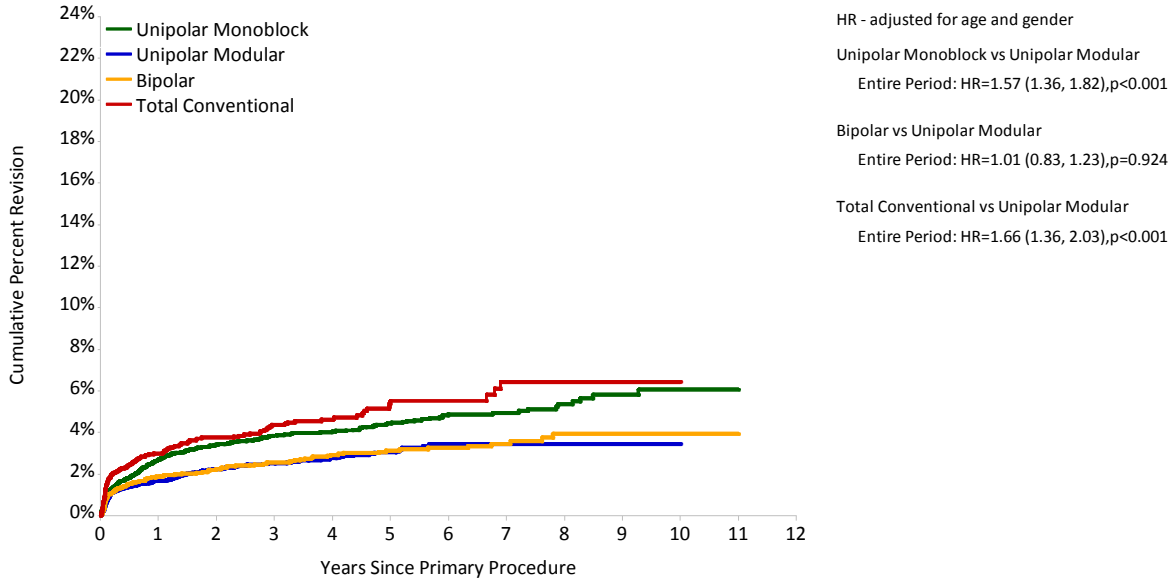
Table F9: Cumulative Percent Mortality of Primary Hip Replacement in Patients ≥80 by Class (Primary Diagnosis Fractured NOF)

Hip Class	N Deceased	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs
Unipolar Monoblock	14367	18360	37.2 (36.5, 38.0)	61.6 (60.9, 62.4)	77.8 (77.1, 78.5)	94.4 (93.9, 94.9)
Unipolar Modular	6986	13795	25.8 (25.0, 26.5)	47.8 (46.8, 48.7)	65.4 (64.3, 66.5)	89.0 (87.3, 90.6)
Bipolar	4161	6756	22.7 (21.7, 23.7)	43.1 (41.9, 44.4)	60.2 (58.8, 61.5)	86.0 (84.6, 87.4)
Total Conventional	1633	3742	13.7 (12.6, 14.9)	31.1 (29.5, 32.8)	51.1 (49.0, 53.2)	84.7 (81.7, 87.4)
TOTAL	**27147**	**42653**				

Table F10: Cumulative Percent Revision of Primary Hip Replacement in Patients ≥80 by Class and Fixation (Primary Diagnosis Fractured NOF)

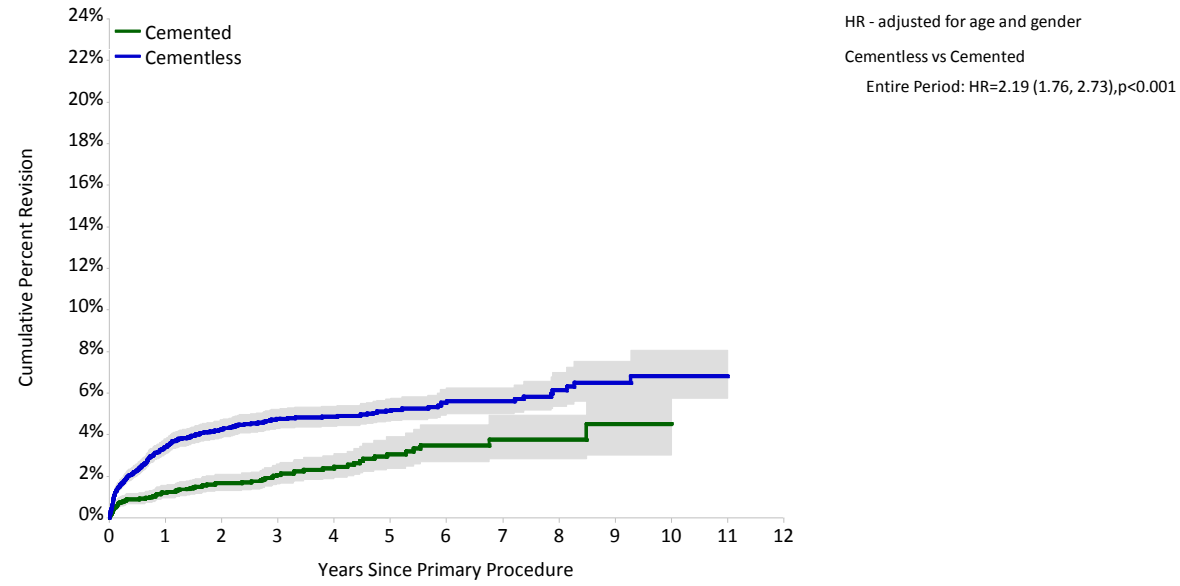
Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs
Unipolar Monoblock	**532**	**18360**	**2.7 (2.4, 3.0)**	**3.9 (3.5, 4.2)**	**4.4 (4.0, 4.9)**	**6.1 (5.2, 7.1)**
Cemented	99	6020	1.2 (0.9, 1.6)	2.1 (1.6, 2.6)	3.1 (2.4, 3.9)	4.5 (3.0, 6.8)
Cementless	433	12340	3.4 (3.1, 3.8)	4.7 (4.3, 5.2)	5.1 (4.6, 5.7)	6.8 (5.8, 8.0)
Unipolar Modular	**271**	**13795**	**1.7 (1.4, 1.9)**	**2.5 (2.2, 2.8)**	**3.0 (2.6, 3.5)**	**3.4 (2.9, 4.0)**
Cemented	190	10804	1.5 (1.2, 1.7)	2.2 (1.9, 2.6)	2.7 (2.3, 3.2)	3.2 (2.6, 3.9)
Cementless	81	2991	2.3 (1.8, 3.0)	3.3 (2.7, 4.2)	4.0 (3.1, 5.2)	
Bipolar	**157**	**6756**	**1.9 (1.6, 2.3)**	**2.6 (2.2, 3.0)**	**3.1 (2.6, 3.7)**	**3.9 (3.2, 4.8)**
Cemented	100	5398	1.6 (1.3, 2.0)	2.1 (1.7, 2.5)	2.4 (2.0, 3.0)	2.9 (2.2, 3.7)
Cementless	57	1358	3.0 (2.2, 4.2)	4.6 (3.4, 6.2)	6.1 (4.5, 8.1)	
Total Conventional	**149**	**3742**	**3.0 (2.5, 3.6)**	**4.4 (3.7, 5.2)**	**5.5 (4.6, 6.6)**	**6.4 (5.1, 8.0)**
Cemented	11	855	0.6 (0.3, 1.5)	1.9 (1.0, 3.4)	1.9 (1.0, 3.4)	
Cementless	66	1223	4.2 (3.1, 5.5)	5.6 (4.3, 7.2)	7.1 (5.4, 9.4)	
Hybrid	72	1664	3.3 (2.5, 4.4)	4.7 (3.7, 6.0)	6.1 (4.7, 7.9)	
TOTAL	**1109**	**42653**				

Figure F19: Cumulative Percent Revision of Primary Hip Replacement in Patients ≥80 by Class (Primary Diagnosis Fractured NOF)



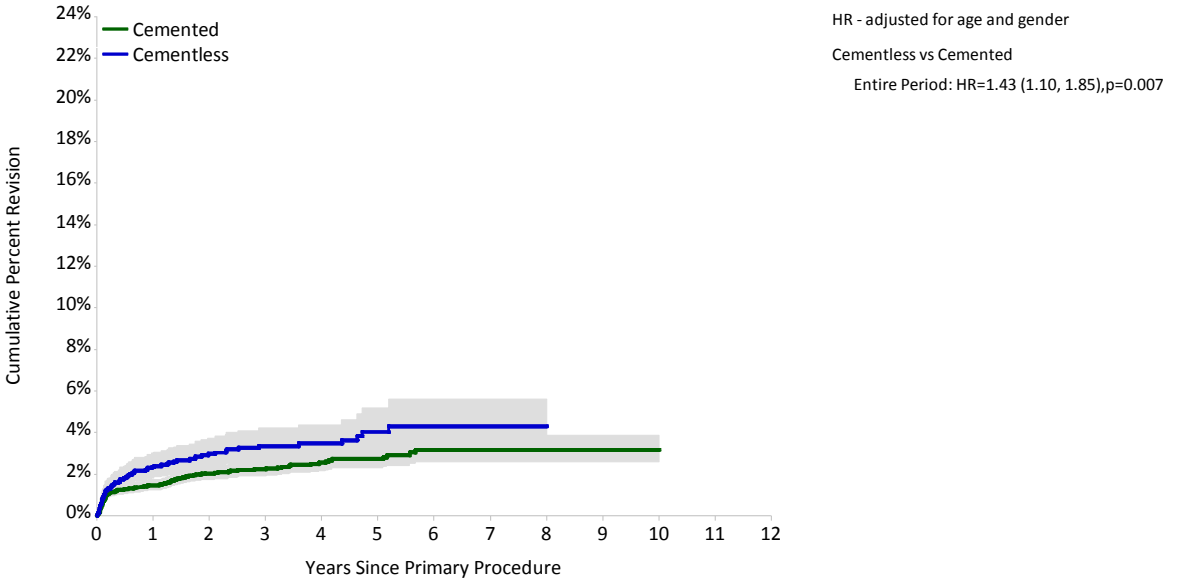
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Unipolar Monoblock	18360	10655	5627	2713	225	18
Unipolar Modular	13795	8534	3886	1462	50	5
Bipolar	6756	4691	2843	1634	138	10
Total Conventional	3742	2777	1585	732	44	3

Figure F20: Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement in Patients ≥80 by Fixation (Primary Diagnosis Fractured NOF)



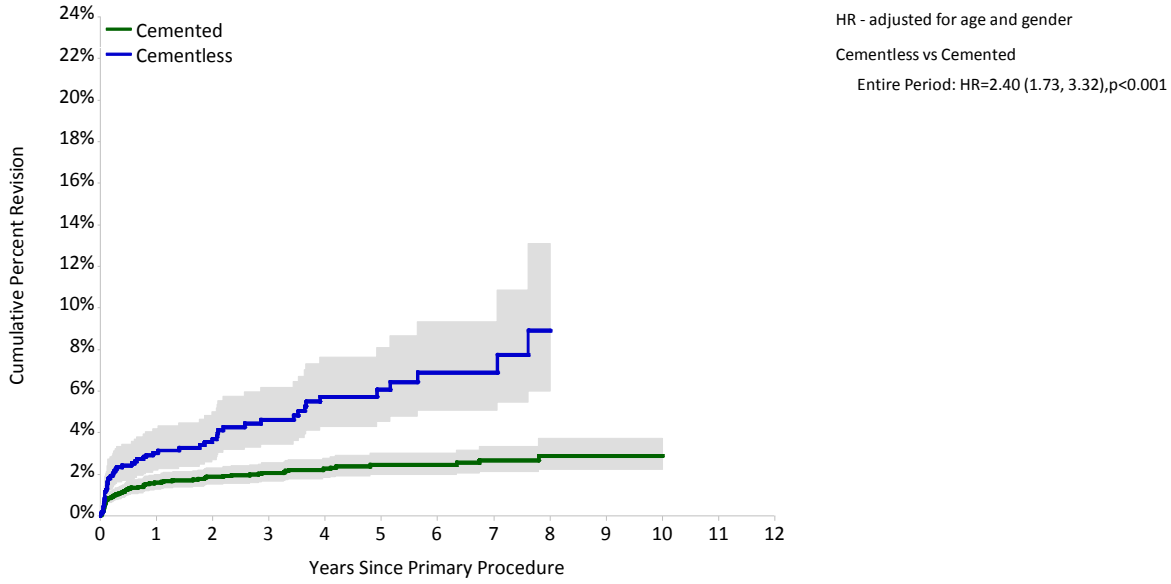
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	6020	3607	1799	800	54	4
Cementless	12340	7048	3828	1913	171	14

Figure F21: Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement in Patients ≥80 by Fixation (Primary Diagnosis Fractured NOF)



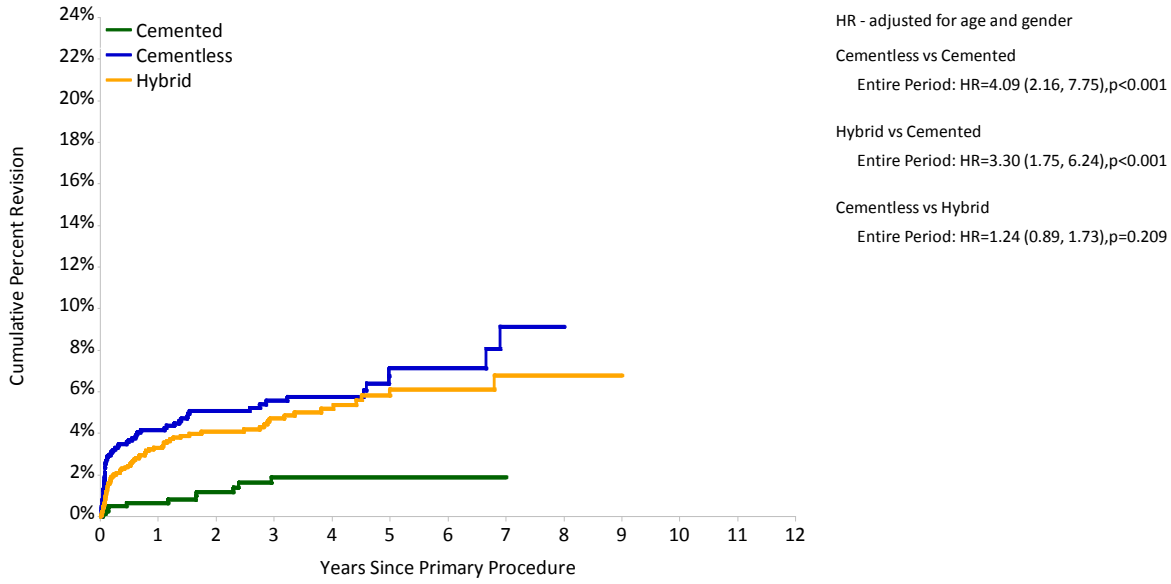
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	10804	6543	2847	1055	49	5
Cementless	2991	1991	1039	407	1	0

Figure F22: Cumulative Percent Revision of Primary Bipolar Hip Replacement in Patients ≥80 by Fixation (Primary Diagnosis Fractured NOF)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	5398	3799	2320	1362	121	9
Cementless	1358	892	523	272	17	1

Figure F23: Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients ≥80 by Fixation (Primary Diagnosis Fractured NOF)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	855	624	361	162	16	1
Cementless	1223	917	526	249	9	0
Hybrid	1664	1236	698	321	19	2

Table F11: Cumulative Percent Revision for all revisions of Primary Total Conventional Hip Replacement in Patients ≥80 by Head Size (Primary Diagnosis Fractured NOF)

Head Size	N Revised	N Dislocated	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs
<32mm	54	26	1162	3.5 (2.5, 4.8)	4.7 (3.5, 6.2)	5.7 (4.3, 7.6)	6.6 (4.9, 9.0)
32mm	47	16	1399	2.8 (2.0, 3.8)	3.9 (2.9, 5.2)	4.4 (3.2, 5.9)	
≥36mm	32	11	982	2.4 (1.5, 3.6)	4.1 (2.8, 5.9)	5.2 (3.4, 7.9)	
TOTAL	**133**	**53**	**3543**				

Note: excludes 7 procedures where the head size is unknown and 192 with metal head >32mm

Figure F24: Cumulative Percent Revision of Primary Total Conventional Hip Replacement in Patients ≥80 by Head Size (Primary Diagnosis Fractured NOF)

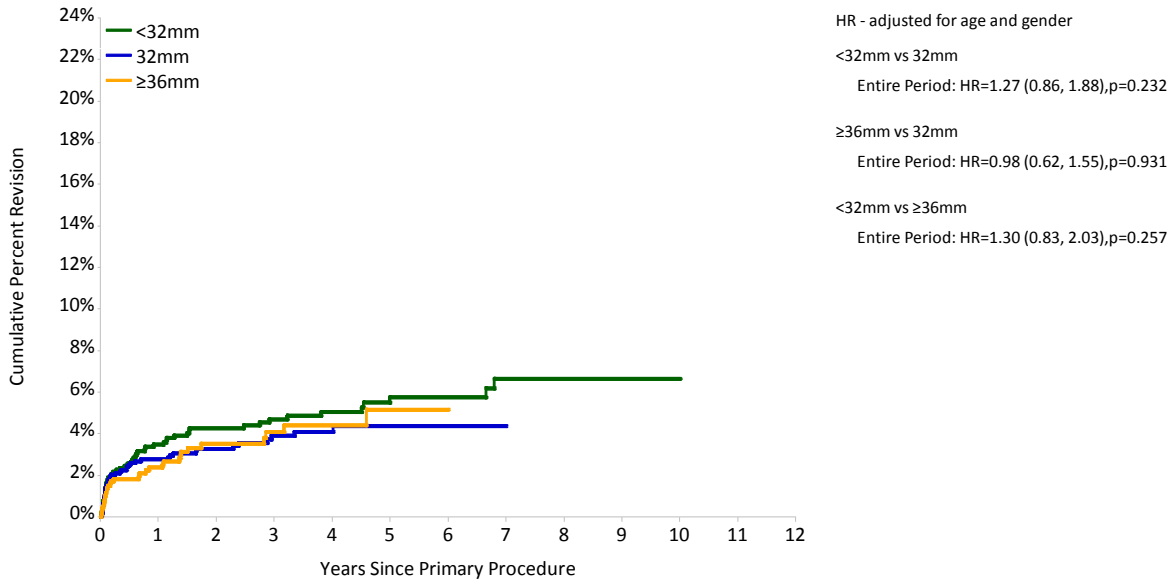
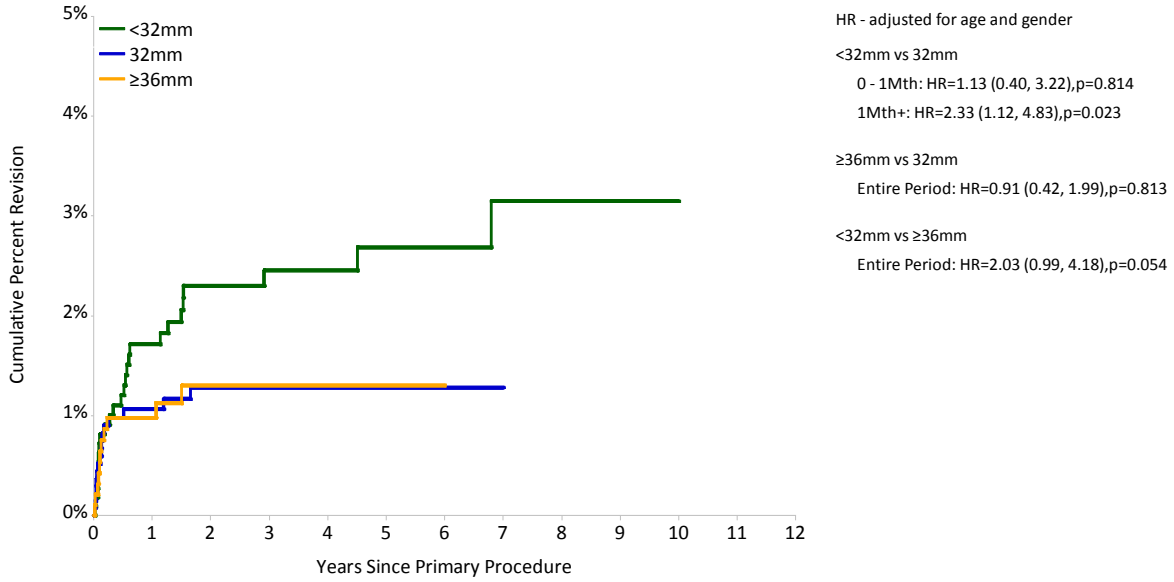


Figure F25: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement in Patients ≥80 by Head Size (Primary Diagnosis Fractured NOF)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
<32mm	1162	900	618	370	41	3
32mm	1399	1035	540	220	3	0
≥36mm	982	683	310	95	0	0

Conclusion

The considerable variation in mortality related to the class of prostheses used, which is particularly evident in the younger age groups, is almost certainly due to patient selection. Primary total conventional hip replacement is used more frequently in younger and possibly healthier patients. Unipolar monoblock procedures on the other hand are preferentially used in older patients who are likely to have more comorbidities.

The rate of revision also varies by prosthesis class. When used for the management of fractured neck of femur, bipolar hip replacement has the lowest rate of revision overall and within each of the three different age groups. This outcome however is no different to primary total conventional hip replacement in the younger than 70 and 70-79 year age groups. There is also no difference compared to unipolar modular prostheses in the 80 years or older age group.

When partial hip replacement is used, cement fixation has a lower rate of revision in the two older age groups. In primary total conventional hip replacement, cement fixation of the femoral stem has the lowest rate of revision in the younger than 70 and 70-79 year age groups. In the 80 years or older age group, cementing both the femoral stem and the acetabular cup has the lowest rate of revision.

There is some variation in revision rates for different head sizes used in primary total conventional hip replacement. When considering revision for any reason, the only difference is a lower revision rate with the use of 32mm head sizes when compared to less than 32mm in the youngest age group. There is no difference in the rate of revision when these head sizes are compared within the two older age groups. There are however differences in the rate of revision for dislocation. Head sizes less than 32mm have a higher rate of revision for dislocation in all age groups. Increasing head size from 32mm to 36mm or larger does not appear to confer any additional protection against revision for dislocation.

TEN YEAR PROSTHESES OUTCOMES

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

Hip Replacement

The Registry is reporting the ten year cumulative percent revision for femoral stem and acetabular prostheses combinations used in primary total conventional hip replacement. A combination is included if the Registry has recorded more than 350 procedures. This year the Registry is reporting on the outcome of 58 femoral and acetabular combinations with ten year data, which is eight more than last year. Prostheses with ten year data account for 58.4% of all primary total conventional hip procedures. Of these combinations, 20 were not used in 2012 and they account for 5.8% of all primary total conventional hip procedures.

The ten year cumulative percent revision for the femoral stem and acetabular component combinations ranges from 2.0% to 12.7% (Table TY1).

There are 27 (46.6%) hip prostheses combinations with a ten year cumulative percent revision (for any reason) of less than 5.0%.

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

Femoral Stem	Acetabular Component	N Revised	N Total	1 Yr CPR	5 Yrs CPR	10 Yrs CPR
ABGII	ABGII	161	2706	1.7 (1.3, 2.3)	4.1 (3.4, 5.0)	7.0 (6.0, 8.2)
ABGII	ABGII (Shell/Insert)	41	801	1.5 (0.9, 2.6)	3.5 (2.4, 5.1)	8.6 (6.0, 12.2)
ABGII	Trident (Shell)	114	2134	2.3 (1.7, 3.0)	4.9 (4.0, 5.9)	8.5 (6.8, 10.6)
Accolade	Trident (Shell)	277	7973	1.5 (1.3, 1.8)	3.8 (3.4, 4.3)	6.0 (4.4, 8.0)
Alloclassic	Allofit	132	4402	1.2 (0.9, 1.6)	2.8 (2.3, 3.3)	4.5 (3.6, 5.6)
Alloclassic	Fitmore	80	1460	2.9 (2.1, 3.9)	5.1 (4.1, 6.4)	6.8 (5.4, 8.6)
Alloclassic	Metasul*	18	371	0.8 (0.3, 2.5)	3.6 (2.1, 6.1)	4.8 (3.0, 7.8)
C-Stem	Duraloc*	55	894	2.0 (1.3, 3.2)	3.8 (2.7, 5.4)	8.3 (6.1, 11.1)
C-Stem	Elite Plus LPW*	14	367	0.6 (0.1, 2.2)	2.7 (1.4, 5.1)	5.9 (3.4, 10.2)
CLS	Allofit	29	682	1.3 (0.7, 2.6)	3.7 (2.5, 5.6)	5.8 (3.9, 8.6)
CLS	Fitmore	28	561	1.8 (1.0, 3.3)	4.7 (3.2, 6.9)	5.5 (3.8, 8.0)
CPCS	Reflection (Cup)	19	582	0.7 (0.3, 1.9)	2.7 (1.6, 4.6)	6.5 (3.4, 12.1)
CPCS	Reflection (Shell)	44	2185	0.9 (0.6, 1.4)	1.7 (1.2, 2.4)	4.9 (3.0, 8.0)
CPT	Trilogy	137	4987	1.3 (1.0, 1.6)	2.8 (2.3, 3.4)	4.7 (3.8, 5.8)
CPT	ZCA	19	620	0.3 (0.1, 1.3)	2.3 (1.3, 4.1)	5.3 (3.2, 8.6)
Charnley	Charnley Ogee*	47	630	1.1 (0.5, 2.3)	5.0 (3.5, 7.2)	9.4 (6.8, 12.7)
Charnley	Charnley*	25	563	0.5 (0.2, 1.7)	2.2 (1.2, 3.9)	5.9 (3.8, 9.1)
Charnley	Vitalock*	26	370	1.9 (0.9, 3.9)	4.4 (2.7, 7.1)	7.5 (5.1, 11.0)
Citation	Trident (Shell)*	34	1075	1.7 (1.1, 2.6)	3.1 (2.2, 4.3)	3.9 (2.7, 5.7)
Citation	Vitalock*	18	508	0.4 (0.1, 1.6)	2.0 (1.1, 3.7)	4.2 (2.6, 6.7)
Corail	Duraloc	38	1264	1.0 (0.6, 1.8)	2.4 (1.6, 3.5)	4.7 (3.2, 7.1)
Corail	Pinnacle	387	17314	1.5 (1.3, 1.7)	3.4 (3.0, 3.8)	4.8 (3.9, 5.9)
Elite Plus	Duraloc*	76	953	1.6 (1.0, 2.6)	5.1 (3.9, 6.8)	8.7 (6.9, 10.9)
Epoch	Trilogy	37	990	2.4 (1.6, 3.6)	3.5 (2.5, 4.9)	5.7 (3.3, 9.7)
Exeter	Contemporary*	27	426	1.9 (1.0, 3.8)	4.2 (2.6, 6.6)	6.0 (4.0, 9.0)
Exeter	Vitalock*	47	1075	1.4 (0.8, 2.3)	2.3 (1.5, 3.4)	4.4 (3.3, 6.0)
Exeter V40	ABGII	26	936	0.9 (0.4, 1.7)	1.7 (1.0, 2.8)	3.4 (2.3, 5.0)
Exeter V40	Contemporary	138	3870	1.3 (1.0, 1.7)	3.0 (2.5, 3.7)	5.5 (4.5, 6.7)
Exeter V40	Exeter Contemporary	78	2554	1.3 (0.9, 1.8)	3.0 (2.3, 3.8)	4.8 (3.6, 6.5)
Exeter V40	Exeter*	46	1526	0.9 (0.5, 1.5)	2.8 (2.0, 3.8)	3.8 (2.8, 5.1)

Femoral Stem	Acetabular Component	N Revised	N Total	1 Yr CPR	5 Yrs CPR	10 Yrs CPR
Exeter V40	Mallory-Head	21	1110	0.5 (0.2, 1.1)	1.1 (0.6, 2.1)	3.6 (2.3, 5.8)
Exeter V40	Trident (Shell)	586	29189	1.0 (0.9, 1.1)	2.3 (2.1, 2.5)	4.1 (3.6, 4.8)
Exeter V40	Trilogy	15	500	2.0 (1.1, 3.7)	2.7 (1.6, 4.7)	5.9 (2.3, 14.9)
Exeter V40	Vitalock*	53	1795	0.8 (0.5, 1.4)	2.3 (1.7, 3.1)	3.1 (2.3, 4.0)
F2L	SPH-Blind*	43	571	2.8 (1.7, 4.5)	6.1 (4.4, 8.4)	7.4 (5.5, 10.0)
MS 30	Allofit	30	1193	1.3 (0.8, 2.1)	2.3 (1.5, 3.4)	3.0 (2.1, 4.5)
MS 30	Fitmore	7	417	0.0 (0.0, 0.0)	1.2 (0.5, 3.2)	2.4 (1.2, 5.1)
MS 30	Low Profile Cup	10	553	0.4 (0.1, 1.5)	1.0 (0.4, 2.5)	2.5 (1.3, 4.9)
Mallory-Head	Mallory-Head	103	2600	1.9 (1.4, 2.5)	3.0 (2.4, 3.8)	5.4 (4.3, 6.7)
Meridian	Vitalock*	20	354	0.9 (0.3, 2.6)	3.5 (2.0, 6.1)	5.9 (3.8, 9.0)
Natural Hip	Allofit	8	506	0.8 (0.3, 2.1)	1.2 (0.6, 2.7)	2.0 (1.0, 4.1)
Natural Hip	Fitmore*	23	881	0.5 (0.2, 1.2)	1.9 (1.1, 3.1)	3.8 (2.5, 5.9)
Omnifit	Secur-Fit*	67	716	2.4 (1.5, 3.8)	6.2 (4.6, 8.2)	10.1 (7.9, 12.8)
Omnifit	Trident (Shell)	99	2979	1.7 (1.3, 2.2)	3.2 (2.6, 4.0)	4.1 (3.3, 5.0)
S-Rom	Duraloc Option*	23	524	1.7 (0.9, 3.3)	3.3 (2.1, 5.2)	5.0 (3.3, 7.5)
S-Rom	Pinnacle	65	2049	1.9 (1.4, 2.6)	3.3 (2.6, 4.3)	5.0 (3.4, 7.4)
SL-Plus	EPF-Plus	77	2031	1.6 (1.1, 2.2)	3.5 (2.7, 4.4)	7.2 (4.3, 12.0)
Secur-Fit	Trident (Shell)	165	6342	1.5 (1.2, 1.8)	2.9 (2.4, 3.4)	3.9 (3.3, 4.7)
Secur-Fit Plus	Trident (Shell)	119	4901	1.2 (0.9, 1.5)	2.2 (1.8, 2.7)	3.4 (2.8, 4.2)
Spectron EF	Reflection (Cup)	69	1354	1.0 (0.6, 1.7)	2.8 (2.0, 3.9)	9.0 (7.0, 11.7)
Spectron EF	Reflection (Shell)	174	4305	1.0 (0.7, 1.4)	2.8 (2.3, 3.3)	6.5 (5.5, 7.8)
Stability	Duraloc*	31	372	0.5 (0.1, 2.1)	2.2 (1.1, 4.3)	9.2 (6.4, 13.3)
Summit	Pinnacle	65	3382	1.0 (0.7, 1.4)	2.1 (1.6, 2.8)	3.9 (2.5, 5.9)
Synergy	Reflection (Shell)	221	6872	1.4 (1.2, 1.8)	2.5 (2.2, 2.9)	4.6 (3.9, 5.4)
Synergy	Trident (Shell)	7	423	0.7 (0.2, 2.2)	1.7 (0.8, 3.9)	2.4 (1.1, 5.3)
Taperloc	M2a*	42	471	1.5 (0.7, 3.1)	6.8 (4.8, 9.6)	12.7 (9.1, 17.6)
Taperloc	Mallory-Head	35	996	1.5 (0.9, 2.5)	2.9 (1.9, 4.3)	5.0 (3.5, 7.0)
VerSys	Trilogy	167	4452	2.2 (1.8, 2.7)	3.4 (2.9, 4.0)	4.5 (3.8, 5.3)
TOTAL		**4563**	**146617**			

Note: Only prosthesis combinations with over 350 procedures have been listed.
** denotes prosthesis combinations with no reported use in Primary Total Conventional Hip Procedures in 2012*

Knee Replacement

There are 34 total knee replacement combinations with over 350 procedures that have ten year outcome data. This is one more than last year. The listed prostheses most often represent a family of devices that have a range of different femoral and tibial components combined with different tibial inserts listed under one prosthesis name.

This group of knee prostheses accounts for 68.3% of all primary total knee replacement procedures reported to the Registry. Six prostheses were not used in 2012. These prostheses account for 6.8% of all primary total knee replacement procedures.

The cumulative percent revision at ten years ranges from 3.0% to 11.9% (Table TY2). There are eight (23.5%) knee prostheses with a ten year cumulative percent revision (for any reason) of less than 5.0%.

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

Femoral Component	Tibial Component	N Revised	N Total	1 Yr CPR	5 Yrs CPR	10 Yrs CPR
AGC	AGC	176	4766	0.6 (0.4, 0.8)	3.1 (2.6, 3.7)	4.8 (4.1, 5.6)
AMK	AMK*	34	402	1.5 (0.7, 3.4)	5.9 (4.0, 8.8)	8.7 (6.2, 12.1)
Active Knee	Active Knee	268	6473	1.0 (0.8, 1.3)	4.2 (3.7, 4.8)	7.8 (6.5, 9.3)
Advance	Advance	22	453	2.6 (1.5, 4.7)	5.1 (3.2, 8.3)	11.9 (6.5, 21.2)
Advance	Advance II	78	1367	1.6 (1.0, 2.4)	5.5 (4.4, 7.0)	7.5 (5.9, 9.4)
Advantim	Advantim	27	1297	0.8 (0.4, 1.5)	2.2 (1.5, 3.4)	3.3 (2.1, 5.0)
BalanSys	BalanSys	16	719	0.5 (0.2, 1.5)	3.6 (2.0, 6.3)	5.1 (2.9, 9.1)
Duracon	Duracon*	811	19826	1.1 (1.0, 1.3)	3.4 (3.2, 3.7)	4.9 (4.5, 5.3)
Genesis II	Genesis II	880	27268	1.1 (1.0, 1.2)	3.8 (3.5, 4.0)	5.1 (4.7, 5.5)
Genesis II	Profix Mobile	67	1164	2.0 (1.3, 2.9)	5.1 (3.9, 6.6)	7.4 (5.7, 9.5)
Genesis II Oxinium Cted	Genesis II	614	15379	1.5 (1.3, 1.7)	4.8 (4.5, 5.3)	7.3 (6.4, 8.3)
Kinemax Plus	Kinemax Plus*	81	1815	0.9 (0.6, 1.5)	3.1 (2.4, 4.0)	4.7 (3.7, 5.9)
LCS	LCS	483	8279	1.1 (0.9, 1.3)	4.4 (4.0, 4.9)	6.2 (5.6, 6.8)
LCS	MBT	1302	32799	1.1 (1.0, 1.2)	4.8 (4.5, 5.0)	6.3 (5.9, 6.8)
MBK (Zimmer)	Nexgen*	26	448	0.9 (0.3, 2.4)	4.1 (2.6, 6.5)	5.9 (4.0, 8.6)
Maxim	Maxim*	121	2447	1.1 (0.7, 1.6)	3.9 (3.2, 4.8)	5.7 (4.7, 6.8)
Natural Knee II	Natural Knee II	251	6002	0.9 (0.7, 1.1)	2.9 (2.5, 3.4)	6.4 (5.6, 7.4)
Nexgen CR	Nexgen	251	9951	0.5 (0.3, 0.6)	2.0 (1.7, 2.3)	3.0 (2.6, 3.4)
Nexgen CR	Nexgen TM CR	34	674	1.4 (0.7, 2.6)	5.5 (3.9, 7.7)	6.6 (4.5, 9.6)
Nexgen LPS	Nexgen	217	5697	1.0 (0.7, 1.2)	3.2 (2.8, 3.8)	4.9 (4.3, 5.6)
Nexgen LPS Flex	Nexgen	533	19085	0.9 (0.8, 1.0)	3.4 (3.1, 3.7)	5.6 (4.9, 6.3)
Optetrak-CR	Optetrak	22	412	1.3 (0.5, 3.0)	5.2 (3.3, 8.0)	6.5 (4.3, 9.8)
Optetrak-PS	Optetrak	130	2055	1.4 (1.0, 2.1)	7.2 (6.0, 8.6)	10.1 (8.0, 12.7)
PFC Sigma	AMK	40	1765	0.7 (0.4, 1.3)	2.6 (1.9, 3.6)	3.6 (2.5, 5.2)
PFC Sigma	MBT	495	13044	1.2 (1.0, 1.4)	4.4 (4.1, 4.9)	5.4 (4.8, 6.0)
PFC Sigma	PFC Sigma	498	22056	0.8 (0.7, 1.0)	2.6 (2.4, 2.9)	4.1 (3.6, 4.7)
Profix	Profix	227	5366	1.1 (0.8, 1.4)	3.8 (3.3, 4.3)	5.2 (4.6, 6.0)
Profix	Profix Mobile*	90	986	2.3 (1.6, 3.5)	8.2 (6.6, 10.1)	10.2 (8.1, 12.7)
Profix Oxinium Cted	Profix	70	1049	2.0 (1.3, 3.0)	6.6 (5.2, 8.4)	8.1 (6.3, 10.3)
RBK	RBK	236	7251	1.2 (1.0, 1.5)	4.1 (3.6, 4.7)	5.3 (4.5, 6.3)
Rotaglide Plus	Rotaglide Plus*	52	616	0.8 (0.3, 2.0)	5.8 (4.1, 8.0)	10.0 (7.6, 13.0)
Scorpio	Scorpio	49	828	1.3 (0.7, 2.4)	5.2 (3.9, 7.1)	6.8 (5.1, 9.1)
Scorpio	Scorpio+	229	4481	1.1 (0.9, 1.5)	4.5 (3.9, 5.1)	6.5 (5.7, 7.5)
Scorpio	Series 7000	574	13972	1.0 (0.9, 1.2)	3.8 (3.5, 4.2)	5.9 (5.4, 6.5)
TOTAL		**9004**	**240192**			

Note: Only prosthesis combinations with over 350 procedures have been listed.
** denotes prosthesis combinations with no reported use in Primary Total Knee Procedures in 2012*

HIP REPLACEMENT

Categories of Hip Replacement

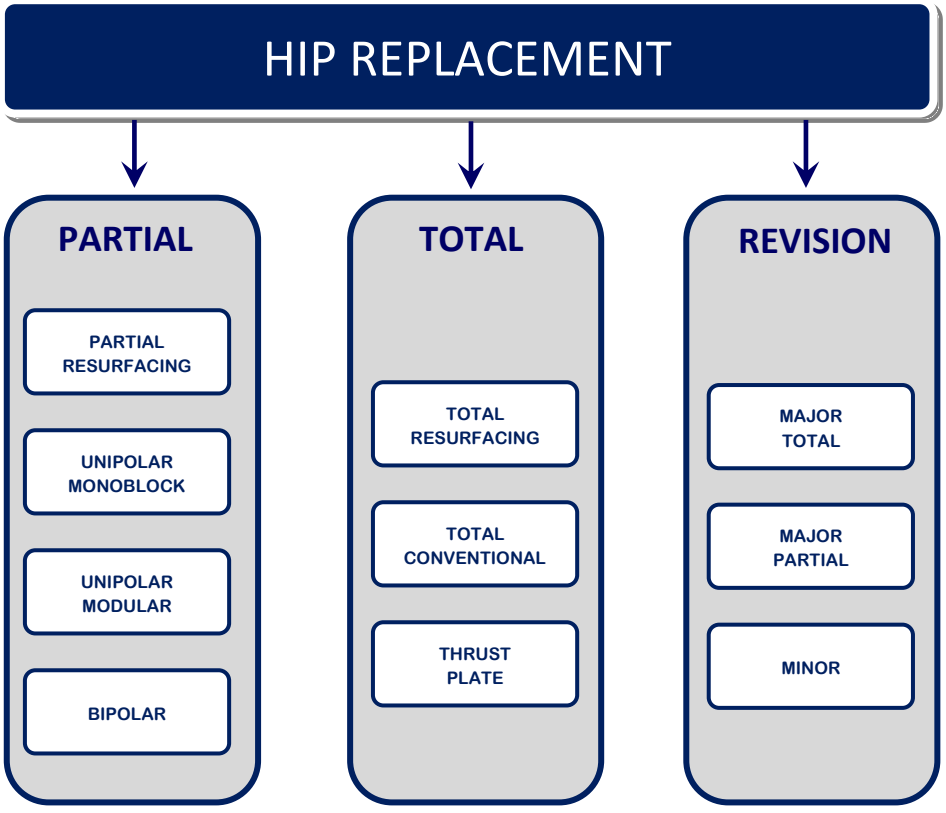
The Registry groups hip replacement into three broad categories; primary partial, primary total and revision hip replacement.

A primary replacement is an initial replacement procedure undertaken on a joint and involves replacing either part (partial) or all (total) of the articular surface.

Primary partial and primary total hip replacement are further sub-categorised into classes depending on the type of prostheses used. Partial hip classes are partial resurfacing, unipolar monoblock, unipolar modular and bipolar. Total hip classes are resurfacing, conventional and thrust plate. Definitions for each of these are detailed in the relevant chapters.

Revision hips are re-operations of previous hip replacements where one or more of the prosthetic components are replaced, removed, or one or more components are added. Revisions include re-operations of primary partial, primary total or previous revision procedures. Hip revisions are sub-categorised into three classes, major total, major partial or minor revisions.

Detailed information on revision hip replacement is provided in a supplementary report available on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2013.



Use of Hip Replacement

This report analyses 370,587 hip replacements reported to the Registry with a procedure date up to and including 31 December 2012. This is an additional 38,236 hip procedures compared to the number reported last year. When considering all hip procedures currently recorded by the Registry, primary partial hips account for 16.0% of all hip replacements, primary total hips 71.9% and revision hip replacement 12.1% (Table H1).

Table H1: Number of Hip Replacements

Hip Category	Number	Percent
Primary Partial Hip	59393	16.0
Primary Total Hip	266465	71.9
Revision Hip	44729	12.1
TOTAL	**370587**	**100.0**

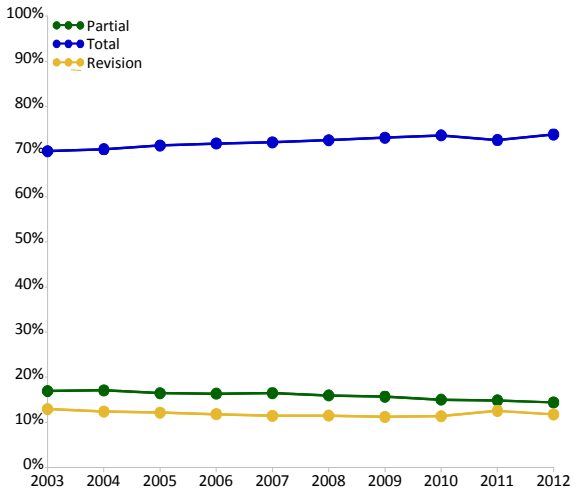
The number of hip replacements undertaken in 2012 increased by only 49 (0.1%) compared to 2011. During the last 12 months, the use of primary partial decreased by 2.9%, primary total increased by 1.9% and revision hip replacement decreased by 6.2% (Figure H1).

The number of hip replacement procedures undertaken in 2012 was 40.9% higher than undertaken in 2003. The corresponding increase in primary total hip replacement was 48.3%, primary partial 19.8% and revision hip replacement 28.2%.

Primary total hip replacement accounted for 73.8% of all hip replacement procedures in 2012, an increase from 2011. Primary partial hip replacement remains at 14.4% (Figure H1).

In the 2012 Annual Report, the Registry reported an increase in the number of revision hip procedures. This year the number of revision hip procedures has decreased by 291 (6.2%). As a percentage of all hip replacement, revisions have decreased from 12.6% in 2011 to 11.8% in 2012 (Figure H1). In 2011, the ASR XL prosthesis accounted for 14.2% revisions, this has decreased to 8.6% in 2012.

Figure H1: Proportion of Hip Replacement



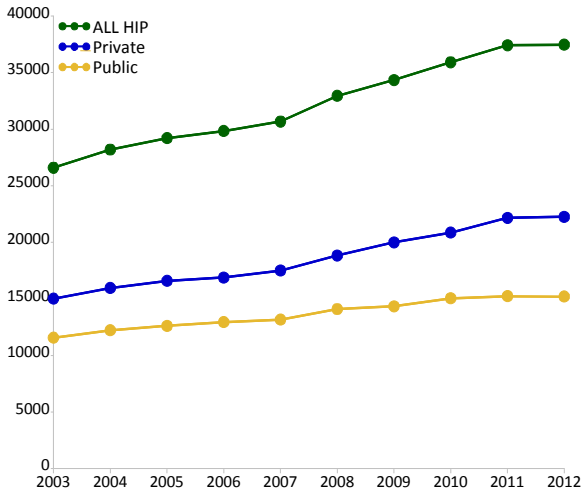
Detailed information on the demographics of each category of hip replacement is provided in the supplementary report 'Demographics of Hip Arthroplasty' available on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2013.

Public and Private Sector

More than half of all hip replacement procedures reported to the Registry are undertaken in private hospitals (59.4% in 2012).

There were 22,254 private sector hip replacements reported in 2012, an increase of 0.4% compared to 2011. In the public sector, there were 15,212 hip replacements, a decrease of 0.2% compared to 2011.

Figure H2: Hip Replacement by Hospital Sector



Since 2003, hip replacement in the private sector has increased by 48.1% compared to 31.5% in the public sector (Figure H2).

There were 4,514 public sector primary partial hip replacements reported in 2012, a decrease of 1.7% compared to 2011. In the private sector, there were 891 partial hip replacements, a decrease of 8.7% compared to 2011. Since 2003, primary partial hip replacement in the public sector has increased by 25.8% compared to a decrease of 3.4% in the private sector.

In 2012, 18,616 private sector primary total hip replacements were reported, an increase of 2.9% compared to 2011. In the public sector, there were 9,031 primary total hip replacements, a decrease of 0.2% compared to 2011. Since 2003, primary total hip replacement in the private sector has increased by 54.7% compared to 36.7% in the public sector.

There were 2,747 private sector revision hip replacements reported in 2012, a decrease of 11.3% compared to 2011. In the public sector, there were 1,667 revision hip replacements, an increase of 3.7% compared to 2011. Since 2003, revision hip replacement in the private sector has increased by 32.7% compared to 21.3% in the public sector.

PRIMARY PARTIAL HIP REPLACEMENT

Classes of Partial Hip Replacement

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

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

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

Use of Partial Hip Replacement

The most common class of primary partial hip replacement is unipolar monoblock. This accounts for 41.0% of all partial hip procedures, followed by unipolar modular (37.8%) and bipolar (21.2%). 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 97.5% of unipolar monoblock, 93.9% of unipolar modular and 89.7% of bipolar hip replacements.

The outcome of primary partial hip replacement varies depending on the class. At ten years, bipolar has the lowest cumulative percent revision followed by unipolar monoblock and unipolar modular (Table HP2).

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

Detailed information on the demographics of each class of primary partial hip replacement is provided in the supplementary report 'Demographics of Hip Arthroplasty' available on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2013.

Table HP1: Partial Hip Replacement by Class

Partial Hip Class	Number	Percent
Partial Resurfacing	14	0.0
Unipolar Monoblock	24329	41.0
Unipolar Modular	22452	37.8
Bipolar	12598	21.2
TOTAL	**59393**	**100.0**

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

Partial Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Unipolar Monoblock	917	24329	3.0 (2.8, 3.3)	4.9 (4.6, 5.3)	6.0 (5.6, 6.4)	7.8 (7.1, 8.7)	8.3 (7.2, 9.7)
Unipolar Modular	728	22452	2.1 (1.9, 2.3)	3.8 (3.5, 4.1)	5.2 (4.8, 5.6)	8.8 (7.5, 10.2)	
Bipolar	417	12598	2.1 (1.9, 2.4)	3.4 (3.0, 3.7)	4.2 (3.8, 4.6)	6.0 (5.3, 6.8)	6.3 (5.4, 7.4)
TOTAL	**2062**	**59379**					

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

Partial Hip Class	N Deceased	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Unipolar Monoblock	18431	24329	35.2 (34.6, 35.9)	58.8 (58.1, 59.4)	74.5 (73.9, 75.1)	92.0 (91.5, 92.5)	94.4 (93.8, 95.0)
Unipolar Modular	10232	22452	22.5 (21.9, 23.0)	41.2 (40.5, 41.9)	56.4 (55.5, 57.2)	79.3 (77.8, 80.7)	
Bipolar	6941	12598	20.3 (19.6, 21.0)	37.3 (36.4, 38.2)	51.2 (50.2, 52.2)	74.2 (73.1, 75.3)	79.6 (77.9, 81.3)
TOTAL	**35604**	**59379**					

Partial Resurfacing

The Registry has recorded 14 partial resurfacing procedures, five of which have been revised. There have been no new procedures recorded since 2009. Osteonecrosis is the principal diagnosis (50%) and 11 patients are male. All but one of these prostheses have been used to replace part of the femoral articular surface. The remaining procedure was a partial acetabular surface replacement.

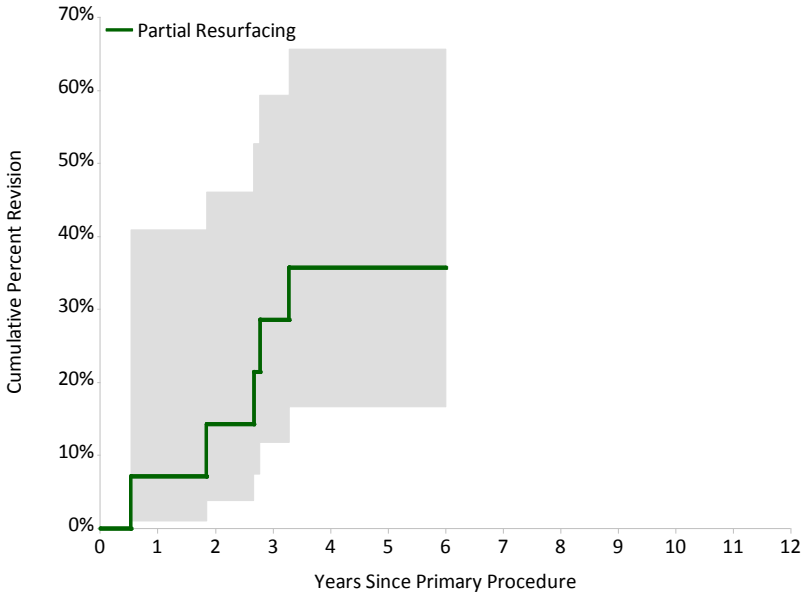
The cumulative percent revision is 7.1% at one year and 35.7% at five years (Table HP4 and Figure HP1).

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

Table HP4: Cumulative Percent Revision of Primary Partial Resurfacing Hip Replacement

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Partial Resurfacing	5	14	7.1 (1.0, 40.9)	28.6 (11.8, 59.4)	35.7 (16.7, 65.7)		

Figure HP1: Cumulative Percent Revision of Primary Partial Resurfacing Hip Replacement



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Partial Resurfacing	14	13	10	7	0	0

Unipolar Monoblock

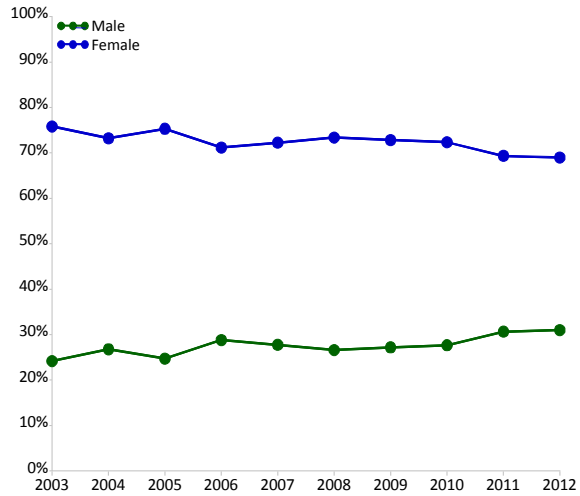
Demographics

There have been 24,329 unipolar monoblock procedures reported to the Registry; an additional 1,400 procedures compared to the 2012 Annual Report.

The use of monoblock hip replacement in Australia continues to decline. The number of procedures reported in 2012 was 10.0% less than 2011 and 50.4% less than 2003.

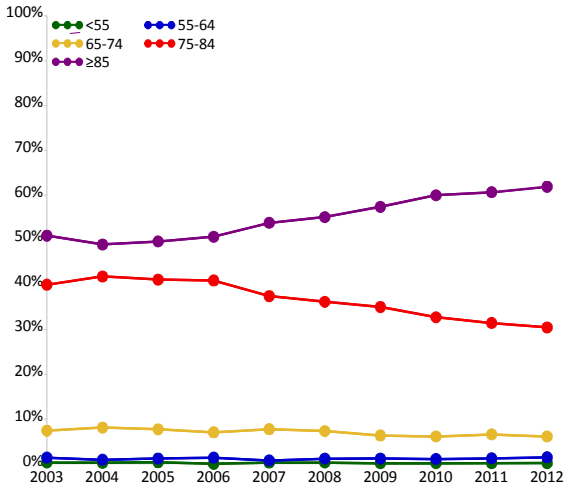
Fractured neck of femur is the principal diagnosis for primary unipolar monoblock hip replacement (97.5%).

Figure HP2: Primary Unipolar Monoblock Hip Replacement by Gender



Most patients are female (73.5%) and the majority of patients are aged 75 years or older (91.1%). The proportion of patients aged 85 years or older has increased from 51.0% in 2003 to 61.9% in 2012 (Figures HP2 and HP3).

Figure HP3: Primary Unipolar Monoblock Hip Replacement by Age



The three types of unipolar monoblock prostheses are the Austin Moore type, Thompson type and Exeter Trauma Stem (ETS). The use of the Austin-Moore type decreased by 6.3% in 2012 compared to 2011 and by 67.6% since 2003. The Thompson type decreased by 16.3% compared to 2011 and by 41.3% since 2003. The use of the ETS decreased by 10.9% in 2012 and accounted for 23.6% of all monoblock prostheses (Table HP5).

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

2003		2009		2010		2011		2012	
N	Model	N	Model	N	Model	N	Model	N	Model
1988	Austin-Moore	1020	Austin-Moore	840	Austin-Moore	688	Austin-Moore	645	Austin-Moore
526	Thompson	415	Thompson	473	Thompson	369	Thompson	309	Thompson
		261	ETS	260	ETS	330	ETS	294	ETS
Most Used									
2514	(2) 100.0%	1696	(3) 100.0%	1573	(3) 100.0%	1387	(3) 100.0%	1248	(3) 100.0%

Outcome

The cumulative percent revision at twelve years for this procedure when undertaken for fractured neck of femur is 8.4% (Table HP6 and Figure HP4).

The main reasons for revision of primary unipolar monoblock hip replacement are loosening/lysis (47.2%) and fracture (19.0%). The majority of unipolar monoblock hip replacements are revised to a total hip replacement (61.5%) (Tables HP7 and HP8).

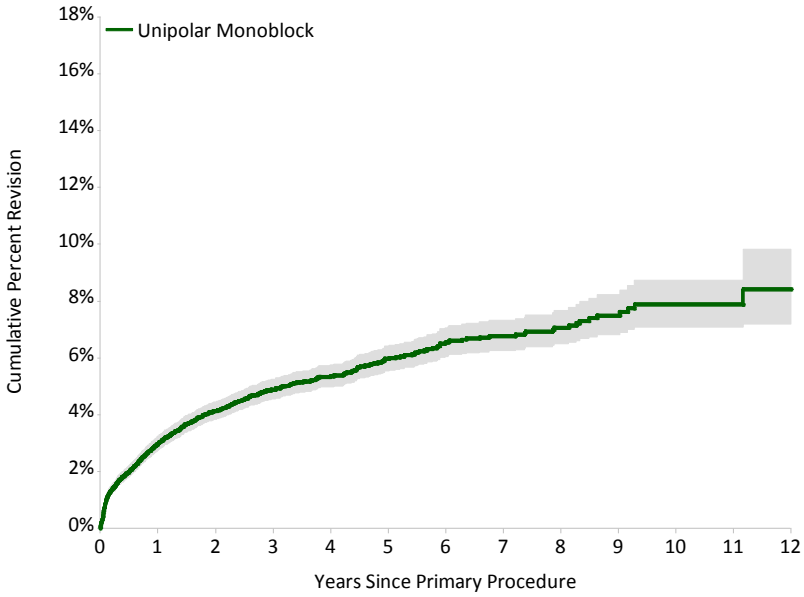
The Austin Moore cementless prosthesis has a higher rate of revision in the first 1.5 years when compared to the Thompson type cemented, and over the entire period compared to the ETS. There is no difference in the rate of revision between the cemented ETS and cemented Thompson type (Table HP9 and Figure HP5).

Further analysis of unipolar monoblock hip procedures can be found in the Arthroplasty Management of Fractured Neck of Femur section of this report.

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

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Unipolar Monoblock	891	23716	3.0 (2.7, 3.2)	4.9 (4.5, 5.2)	6.0 (5.5, 6.4)	7.9 (7.1, 8.7)	8.4 (7.2, 9.8)

Figure HP4: Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement (Primary Diagnosis Fractured NOF)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Unipolar Monoblock	23716	14254	7836	4037	438	49

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

Reason for Revision	Number	Percent
Loosening/Lysis	433	47.2
Fracture	174	19.0
Prosthesis Dislocation	104	11.3
Infection	86	9.4
Pain	63	6.9
Chondrolysis/Acetab. Erosion	34	3.7
Malposition	10	1.1
Other	13	1.4
TOTAL	**917**	**100.0**

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

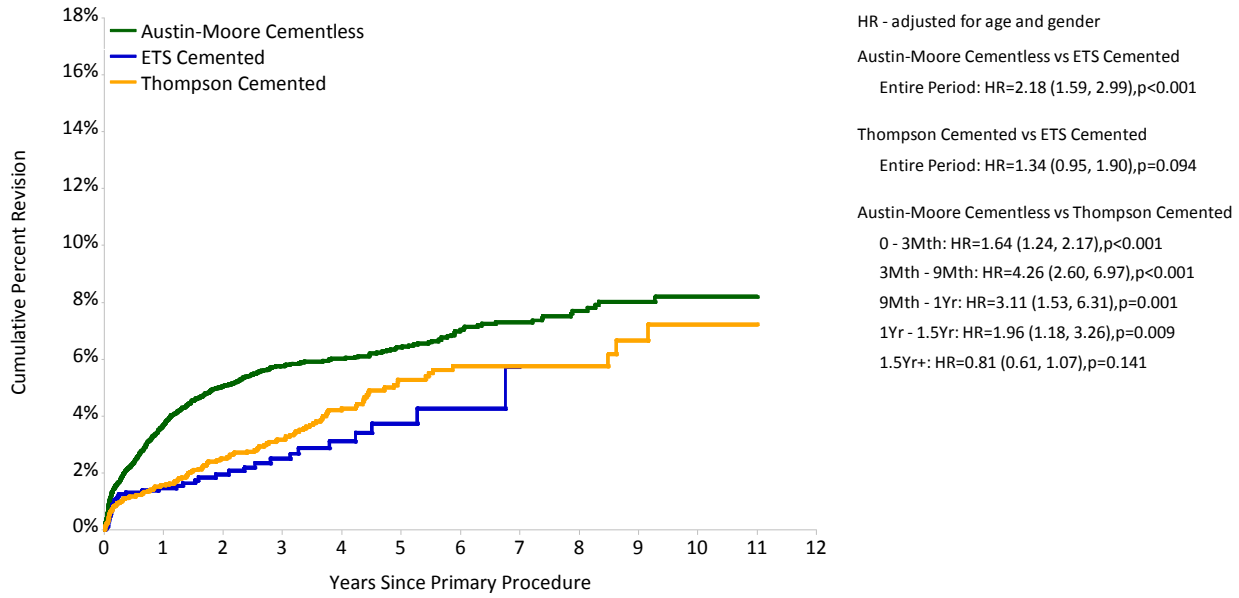
Type of Revision	Number	Percent
THR (Femoral/Acetabular)	564	61.5
Femoral Component	169	18.4
Bipolar Head and Femoral	89	9.7
Removal of Prostheses	38	4.1
Cement Spacer	35	3.8
Minor Components	12	1.3
Reinsertion of Components	5	0.5
Insert Only	2	0.2
Incomplete	1	0.1
Bipolar Only	1	0.1
Cement Only	1	0.1
TOTAL	**917**	**100.0**

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

Table HP9: Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement by Prosthesis Type

Monoblock Prosthesis	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs
Austin-Moore Type Cemented	12	769	1.1 (0.5, 2.5)	2.6 (1.3, 5.0)	4.1 (2.1, 7.8)	4.1 (2.1, 7.8)	
Austin-Moore Type Cementless	672	15642	3.7 (3.4, 4.1)	5.8 (5.3, 6.2)	6.4 (5.9, 7.0)	7.3 (6.7, 8.0)	8.2 (7.3, 9.1)
ETS Cemented	41	1993	1.5 (1.0, 2.2)	2.5 (1.7, 3.6)	3.7 (2.6, 5.5)	5.7 (3.2, 10.2)	
Thompson Type Cemented	151	5395	1.6 (1.2, 2.0)	3.2 (2.6, 3.8)	5.3 (4.4, 6.3)	5.8 (4.8, 6.9)	7.2 (5.5, 9.5)
Thompson Type Cementless	41	530	6.7 (4.7, 9.5)	9.5 (6.9, 13.1)	11.7 (8.3, 16.3)	11.7 (8.3, 16.3)	
TOTAL	**917**	**24329**					

Figure HP5: Cumulative Percent Revision of Primary Unipolar Monoblock Hip Replacement by Prosthesis Type



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Austin-Moore Cementless	15642	9213	5207	2772	333	36
ETS Cemented	1993	1217	573	217	0	0
Thompson Cemented	5395	3436	1857	968	100	10

Unipolar Modular

Demographics

There have been 22,452 unipolar modular procedures reported to the Registry, an additional 3,295 procedures compared to the previous report.

The number of unipolar modular procedures reported in 2012 was 1.7% less than 2011 but 380.2% more than 2003.

Fractured neck of femur is the principal diagnosis for primary unipolar modular hip replacement (93.9%).

Most patients are female (72.4%) and the majority of patients are aged 75 years or older (81.2%). The proportion of patients aged 85 years or older has increased from 32.0% in 2003 to 45.8% in 2012 (Figures HP6 and HP7).

Figure HP7: Primary Unipolar Modular Hip Replacement by Age

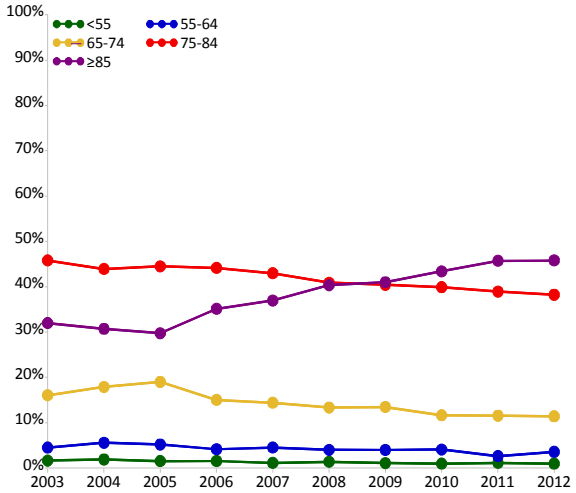
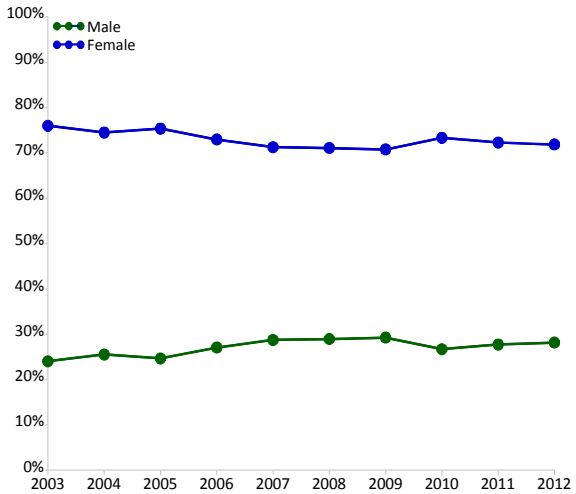


Figure HP6: Primary Unipolar Modular Hip Replacement by Gender



There were 21 different unipolar modular head prostheses and 49 different stem prostheses used in 2012. Overall there have been 174 unipolar modular head and stem combinations recorded by the Registry. The ten most frequently used unipolar modular head prostheses and femoral stems are listed in Tables HP10 and HP11.

In 2012, the Unitrax head was the most frequently used unipolar modular head (40.5%). The Exeter V40 was the most frequently used stem (39.2%).

The ten most used unipolar modular head prostheses account for 99.0% of all primary unipolar modular hip procedures. The ten most used femoral stems account for 93.6% of all primary unipolar modular hip procedures (Tables HP10 and HP11).

Table HP10: Ten Most Used Unipolar Head Prostheses in Primary Unipolar Modular Hip Replacement

2003		2009		2010		2011		2012	
N	Model	N	Model	N	Model	N	Model	N	Model
217	Unipolar (Zimmer)	966	Unipolar (S&N)	1163	Unitrax	1298	Unitrax	1295	Unitrax
193	Unitrax	949	Unitrax	734	Unipolar (S&N)	740	Unipolar (S&N)	883	Unipolar (S&N)
89	Unipolar (S&N)	513	Unipolar (Zimmer)	601	Unipolar (Zimmer)	620	Unipolar (Zimmer)	520	Unipolar (Zimmer)
64	Unipolar (Mathys)	219	Cathcart	182	Cathcart	147	Metasul	149	Metasul
46	Elite	107	Unipolar (Corin)	81	Unipolar (Corin)	140	Cathcart	111	Cathcart
38	Unipolar (Plus)	85	Metasul	62	Metasul	114	U2	90	U2
16	Ultima	20	Unipolar (Plus)	48	Unipolar (Plus)	68	Unipolar (Corin)	59	Unipolar (Corin)
1	Metasul	16	Endo II	22	U2	42	Unipolar (Lima)	27	Unipolar (Lima)
1	Optimom	11	Femoral (JRI)	21	Conserve	25	Conserve	17	Unipolar (Plus)
1	Unipolar (Sulzer)	5	Femoral (Eska)	21	Femoral (JRI)	22	Unipolar (Plus)	15	Pharo
Ten Most Used									
666	(10) 100.0%	2891	(10) 99.4%	2935	(10) 98.5%	3216	(10) 98.8%	3166	(10) 99.0%
Remainder									
0	(0) 0%	17	(8) 0.6%	45	(10) 1.5%	38	(11) 1.2%	32	(11) 1.0%
TOTAL									
666	(10) 100.0%	2908	(18) 100.0%	2980	(20) 100.0%	3254	(21) 100.0%	3198	(21) 100.0%

Table HP11: Ten Most Used Femoral Stem Prostheses in Primary Unipolar Modular Hip Replacement

2003		2009		2010		2011		2012	
N	Model	N	Model	N	Model	N	Model	N	Model
180	Exeter V40	928	Exeter V40	1112	Exeter V40	1244	Exeter V40	1255	Exeter V40
111	Alloclassic	459	CPCS	499	CPT	578	CPT	568	CPT
91	CPT	375	CPT	327	CPCS	323	CPCS	451	CPCS
70	Spectron EF	336	Spectron EF	271	Spectron EF	275	Spectron EF	228	Spectron EF
49	Fullfix Stem	208	Corail	162	Corail	154	Alloclassic	153	SL-Plus
38	SL-Plus	202	Alloclassic	145	Alloclassic	125	Corail	90	E2
33	Elite Plus	97	SL-Plus	82	SL-Plus	111	E2	89	Corail
18	Basis	60	Basis	63	Basis	80	SL-Plus	67	Alloclassic
15	CCA	55	Metafix	55	Metafix	58	Basis	54	Metafix
15	Thompson Mod Stem	45	Taper Fit	38	Omnifit	47	Metafix	38	Basis
Ten Most Used									
620	(10) 93.1%	2765	(10) 95.1%	2754	(10) 92.4%	2995	(10) 92.0%	2993	(10) 93.6%
Remainder									
46	(12) 6.9%	143	(34) 4.9%	226	(39) 7.6%	259	(40) 8.0%	205	(39) 6.4%
TOTAL									
666	(22) 100.0%	2908	(44) 100.0%	2980	(49) 100.0%	3254	(50) 100.0%	3198	(49) 100.0%

Outcome

The cumulative percent revision at ten years for this procedure when undertaken for fractured neck of femur is 8.5% (Table HP12 and Figure HP8).

The main reasons for revision are prosthesis dislocation (20.3%), infection (18.5%), loosening/lysis (16.5%) and fracture (15.4%) (Table HP13).

The majority of revisions of primary unipolar modular are acetabular only revisions (45.5%), followed by THR (femoral/acetabular) revisions (19.2%) (Table HP14).

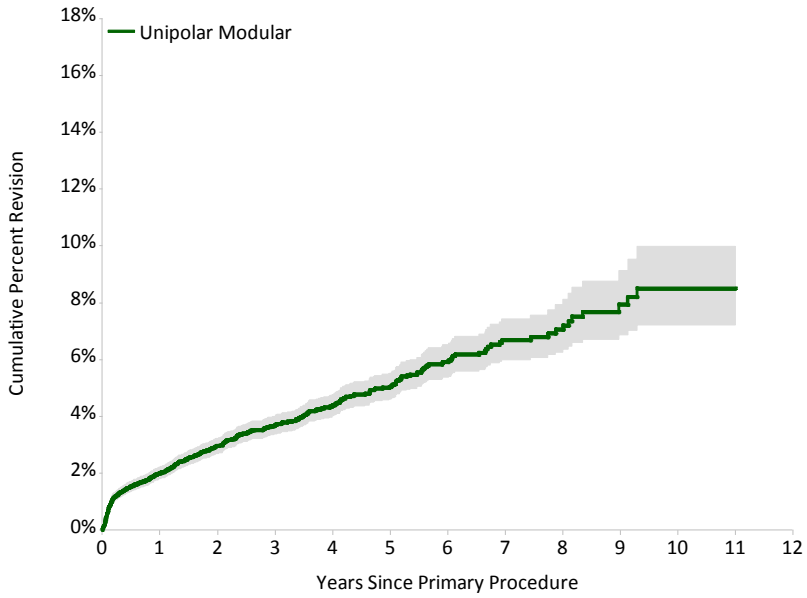
The cumulative percent revision of individual combinations of unipolar modular stem/head prostheses with 100 or more procedures are detailed in Table HP15.

Further analysis of unipolar modular hip procedures can be found in the Arthroplasty Management of Fractured Neck of Femur section of this report.

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

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Unipolar Modular	660	21086	2.0 (1.8, 2.2)	3.7 (3.4, 4.0)	5.0 (4.6, 5.5)	8.5 (7.2, 10.0)	

Figure HP8: Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement (Primary Diagnosis Fractured NOF)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Unipolar Modular	21086	13829	7040	3093	191	23

Table HP13: Primary Unipolar Modular Hip Replacement by Reason for Revision

Reason for Revision	Number	Percent
Prosthesis Dislocation	148	20.3
Infection	135	18.5
Loosening/Lysis	120	16.5
Fracture	112	15.4
Pain	98	13.5
Chondrolysis/Acetab. Erosion	90	12.4
Malposition	1	0.1
Other	24	3.3
TOTAL	**728**	**100.0**

Table HP14: Primary Unipolar Modular Hip Replacement by Type of Revision

Type of Revision	Number	Percent
Acetabular Component	331	45.5
THR (Femoral/Acetabular)	140	19.2
Femoral Component	88	12.1
Head Only	77	10.6
Cement Spacer	30	4.1
Minor Components	24	3.3
Bipolar Head and Femoral	17	2.3
Removal of Prostheses	14	1.9
Bipolar Only	4	0.5
Reinsertion of Components	2	0.3
Cement Only	1	0.1
TOTAL	**728**	**100.0**

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

Table HP15: Cumulative Percent Revision of Primary Unipolar Modular Hip Replacement by Prosthesis Type

Unipolar Head	Femoral Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs
Cathcart	Corail	49	984	4.1 (2.9, 5.7)	6.4 (4.7, 8.5)	8.0 (5.7, 11.1)	
Metasul	Alloclassic	10	317	2.4 (1.2, 5.0)	4.4 (2.3, 8.5)		
Metasul	CPT	2	169	2.2 (0.5, 9.5)			
U2	E2	0	218	0.0 (0.0, 0.0)			
Ultima	Thompson Modular Stem	1	133	0.8 (0.1, 5.5)	0.8 (0.1, 5.5)	0.8 (0.1, 5.5)	
Unipolar Head (Corin)	Metafix	0	217	0.0 (0.0, 0.0)			
Unipolar Head (Corin)	Taper Fit	14	304	2.2 (1.0, 4.9)	6.0 (3.5, 10.3)	6.9 (4.1, 11.7)	
Unipolar Head (Corin)	Tri-Fit	6	288	1.5 (0.6, 4.0)	2.6 (1.2, 5.9)	2.6 (1.2, 5.9)	
Unipolar Head (Mathys)	CCA	8	357	1.0 (0.3, 3.0)	2.6 (1.2, 5.3)	2.6 (1.2, 5.3)	
Unipolar Head (Mathys)	Fullfix Stem	6	210	1.1 (0.3, 4.3)	2.4 (0.9, 6.4)	2.4 (0.9, 6.4)	
Unipolar Head (Plus)	SL-Plus	21	435	2.4 (1.3, 4.4)	5.1 (3.2, 8.1)	6.3 (4.0, 9.8)	
Unipolar Head (S&N)	Basis	18	478	2.0 (1.0, 3.9)	3.7 (2.1, 6.6)	7.2 (4.3, 11.9)	
Unipolar Head (S&N)	CPCS	65	2449	2.0 (1.5, 2.7)	3.5 (2.7, 4.5)	4.4 (3.2, 5.9)	
Unipolar Head (S&N)	Platform	5	108	4.2 (1.6, 10.7)	4.2 (1.6, 10.7)		
Unipolar Head (S&N)	SL-Plus	4	402	1.2 (0.4, 3.2)	1.2 (0.4, 3.2)		
Unipolar Head (S&N)	Spectron EF	60	2188	1.6 (1.1, 2.3)	3.1 (2.3, 4.1)	4.0 (3.0, 5.3)	
Unipolar Head (Zimmer)	Alloclassic	46	1101	3.0 (2.1, 4.3)	4.2 (3.1, 5.8)	5.3 (3.9, 7.2)	
Unipolar Head (Zimmer)	CPT	91	3108	1.6 (1.2, 2.2)	3.5 (2.8, 4.5)	5.1 (3.9, 6.5)	
Unipolar Head (Zimmer)	VerSys	6	171	3.2 (1.2, 8.6)	3.2 (1.2, 8.6)		
Unitrax	Accolade	7	113	0.9 (0.1, 6.4)	7.2 (3.3, 15.3)		
Unitrax	Exeter V40	231	7195	1.8 (1.5, 2.2)	3.6 (3.1, 4.2)	5.8 (4.9, 6.7)	
Unitrax	Omnifit	4	167	2.9 (1.1, 7.8)			
Other (152)		74	1340	4.2 (3.2, 5.6)	6.1 (4.7, 7.8)	7.7 (5.9, 9.9)	
TOTAL		**728**	**22452**				

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

Bipolar

Demographics

There have been 12,598 bipolar procedures reported to the Registry, an additional 999 procedures compared to the last report.

The number of bipolar procedures undertaken in 2012 was 3.3% more than 2011 but 27.9% less than 2003.

Fractured neck of femur is the principal diagnosis for bipolar hip replacement (89.7%).

Most patients are female (72.6%) and aged 75 years or older (75.6%). The proportion of patients aged 85 years or older has increased from 25.8% in 2003 to 46.6% in 2012 (Figures HP9 and HP10).

Figure HP9: Primary Bipolar Hip Replacement by Gender

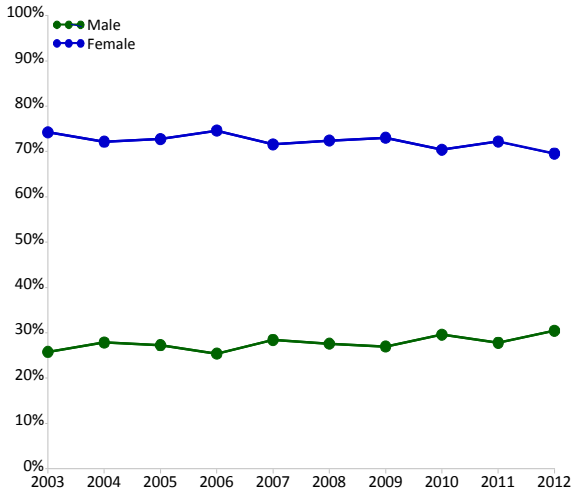
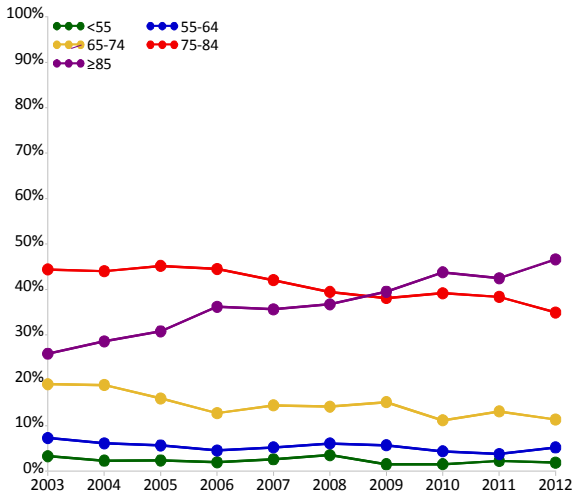


Figure HP10: Primary Bipolar Hip Replacement by Age



There were 15 different bipolar head prostheses and 38 different stem prostheses used in 2012. Overall there have been 222 bipolar head and stem combinations reported to the Registry (Tables HP16 and HP17).

In 2012, the UHR remains the most frequently used bipolar head (52.7%) and the Exeter V40 remains the most frequently used stem (46.0%).

The ten most used bipolar head prostheses account for 98.9% of all bipolar hip procedures. The ten most used femoral stems account for 85.2% of all bipolar hip procedures (Tables HP16 and HP17).

Table HP16: Ten Most Used Bipolar Head Prostheses in Primary Bipolar Hip Replacement

2003		2009		2010		2011		2012	
N	Model	N	Model	N	Model	N	Model	N	Model
750	UHR	413	UHR	460	UHR	429	UHR	505	UHR
140	Hastings	124	Tandem	127	Tandem	136	Multipolar Bipolar	145	Tandem
115	Convene	114	Multipolar Bipolar	100	Multipolar Bipolar	113	Tandem	101	Multipolar Bipolar
91	Bipolar (Zimmer)	67	Hastings	72	Hastings	71	Self-Centering	56	Self-Centering
87	Self-Centering	30	Self-Centering	35	Self-Centering	56	Hastings	36	Bipolar (Lima)
59	Multipolar Bipolar	16	Bipolar (Medacta)	13	Ringloc	32	Bipolar (Lima)	35	Hastings
39	Bipolar (Mathys)	11	Ringloc	12	Bipolar (Medacta)	29	Bipolar (Medacta)	26	Bipolar (Medacta)
19	Bipolar (Lima)	6	UHL	10	Moonstone	25	Ringloc	23	Moonstone
19	Ringloc	5	Bipolar (Eska)	5	Bipolar (Lima)	23	Moonstone	17	Ringloc
5	UHL	3	Moonstone	5	UHL	8	Bipolar (ISP)	4	Bipolar (Eska)
Ten Most Used									
1324	(10) 99.5%	789	(10) 99.9%	839	(10) 98.9%	922	(10) 99.4%	948	(10) 98.9%
Remainder									
7	(2) 0.5%	1	(1) 0.1%	9	(4) 1.1%	6	(3) 0.6%	11	(5) 1.1%
TOTAL									
1331	(12) 100.0%	790	(11) 100.0%	848	(14) 100.0%	928	(13) 100.0%	959	(15) 100.0%

Table HP17: Ten Most Used Femoral Stem Prostheses in Primary Bipolar Hip Replacement

2003		2009		2010		2011		2012	
N	Model	N	Model	N	Model	N	Model	N	Model
622	Exeter V40	341	Exeter V40	409	Exeter V40	408	Exeter V40	441	Exeter V40
94	Elite Plus	84	CPCS	95	CPCS	85	CPT	93	CPCS
75	Alloclassic	46	CPT	57	Corail	77	CPCS	66	Corail
65	CPCS	44	Corail	54	CPT	56	Corail	61	CPT
61	C-Stem	44	VerSys	33	VerSys	28	Accolade	53	Accolade
59	Omnifit	41	Accolade	31	Accolade	25	VerSys	24	C2
45	VerSys	28	C-Stem	14	Spectron EF	24	Quadra-C	21	Basis
26	ABGII	22	Spectron EF	13	C-Stem	22	Spectron EF	20	Quadra-C
25	CCA	12	GMRS	13	Hyperion	21	Summit	20	VerSys
25	Spectron EF	11	Alloclassic	11	GMRS	17	Alloclassic	18	Alloclassic
Ten Most Used									
1097	(10) 82.4%	673	(10) 85.2%	730	(10) 86.1%	763	(10) 82.2%	817	(10) 85.2%
Remainder									
234	(45) 17.6%	117	(28) 14.8%	118	(36) 13.9%	165	(33) 17.8%	142	(28) 14.8%
TOTAL									
1331	(55) 100.0%	790	(38) 100.0%	848	(46) 100.0%	928	(43) 100.0%	959	(38) 100.0%

Outcome

The cumulative percent revision at twelve years for this procedure when undertaken for fractured neck of femur is 6.0% (Table HP18 and Figure HP11).

The main reasons for revision of bipolar hip replacement are fracture (23.3%), loosening/lysis (21.3%), infection (18.0%) and prosthesis dislocation (17.7%) (Table HP19).

The majority of revisions of primary bipolar are acetabular only revisions (36.5%), followed by THR (femoral/acetabular) revisions (23.7%) and bipolar head and femoral revisions (13.9%) (Table HP20).

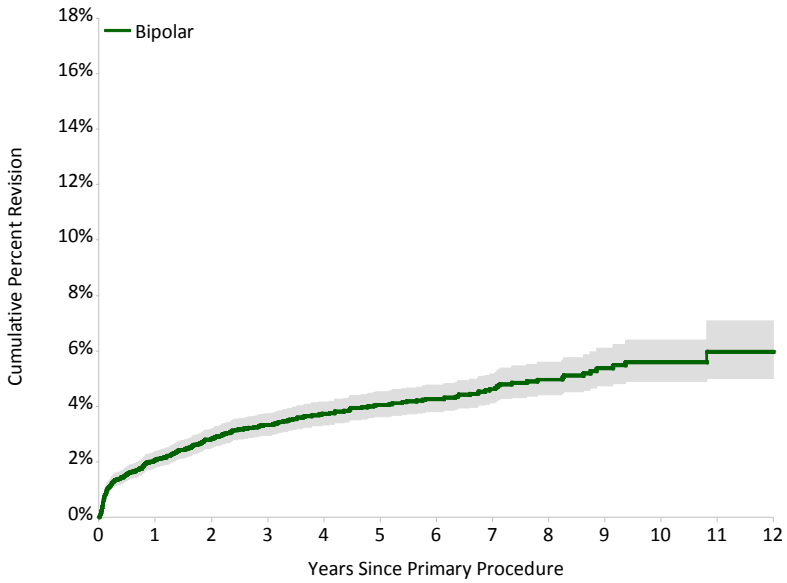
The cumulative percent revision of individual combinations of bipolar stem/head prostheses with 100 or more procedures are detailed in Table HP21.

Further analysis of bipolar hip procedures can be found in the Arthroplasty Management of Fractured Neck of Femur section of this report.

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

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Bipolar	363	11298	2.1 (1.8, 2.4)	3.3 (3.0, 3.7)	4.1 (3.6, 4.5)	5.6 (4.9, 6.4)	6.0 (5.0, 7.1)

Figure HP11: Cumulative Percent Revision of Primary Bipolar Hip Replacement (Primary Diagnosis Fractured NOF)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Bipolar	11298	8271	5527	3634	544	59

Table HP19: Primary Bipolar Hip Replacement by Reason for Revision

Reason for Revision	Number	Percent
Fracture	97	23.3
Loosening/Lysis	89	21.3
Infection	75	18.0
Prosthesis Dislocation	74	17.7
Pain	36	8.6
Chondrolysis/Acetab. Erosion	31	7.4
Malposition	2	0.5
Other	13	3.1
TOTAL	**417**	**100.0**

Table HP20: Primary Bipolar Hip Replacement by Type of Revision

Type of Revision	Number	Percent
Acetabular Component	152	36.5
THR (Femoral/Acetabular)	99	23.7
Bipolar Head and Femoral	58	13.9
Bipolar Only	38	9.1
Femoral Component	22	5.3
Cement Spacer	21	5.0
Head Only	13	3.1
Minor Components	8	1.9
Removal of Prostheses	6	1.4
TOTAL	**417**	**100.0**

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

Table HP21: Cumulative Percent Revision of Primary Bipolar Hip Replacement by Prosthesis Type

Bipolar Head	Femoral Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs
Bipolar Head (Zimmer)	Alloclassic	9	358	0.9 (0.3, 2.8)	2.3 (1.1, 4.9)	2.8 (1.4, 5.4)	
Centrax	Exeter	7	200	2.1 (0.8, 5.5)	2.8 (1.2, 6.5)	2.8 (1.2, 6.5)	3.9 (1.7, 9.0)
Convene	CPCS	16	345	2.2 (1.1, 4.6)	3.3 (1.8, 6.1)	5.2 (3.1, 8.8)	
Convene	Spectron EF	7	123	2.6 (0.9, 8.0)	3.8 (1.4, 10.1)	6.6 (2.9, 14.4)	
Hastings	C-Stem	10	207	2.5 (1.1, 6.0)	5.8 (3.1, 10.5)	5.8 (3.1, 10.5)	
Hastings	Charnley	5	107	0.0 (0.0, 0.0)	2.9 (0.7, 11.0)		
Hastings	Corail	10	300	2.9 (1.5, 5.7)	3.5 (1.8, 6.8)	3.5 (1.8, 6.8)	
Hastings	Elite Plus	14	298	1.9 (0.8, 4.6)	4.3 (2.3, 7.9)	5.4 (3.1, 9.5)	6.8 (4.0, 11.4)
Multipolar Bipolar	Alloclassic	4	124	2.6 (0.8, 7.9)	2.6 (0.8, 7.9)		
Multipolar Bipolar	CPT	10	415	2.2 (1.1, 4.5)	2.7 (1.4, 5.3)	2.7 (1.4, 5.3)	
Multipolar Bipolar	VerSys	10	467	1.0 (0.4, 2.8)	2.8 (1.4, 5.3)	3.3 (1.8, 6.3)	
Self-Centering	C-Stem	2	105	0.0 (0.0, 0.0)	1.2 (0.2, 8.4)	1.2 (0.2, 8.4)	
Self-Centering	Corail	8	204	3.7 (1.8, 7.7)	3.7 (1.8, 7.7)	3.7 (1.8, 7.7)	
Self-Centering	Elite Plus	3	238	0.0 (0.0, 0.0)	0.6 (0.1, 3.9)	1.3 (0.3, 5.2)	
Tandem	CPCS	23	840	2.1 (1.2, 3.5)	3.6 (2.3, 5.5)	4.0 (2.6, 6.1)	
Tandem	Spectron EF	5	140	1.6 (0.4, 6.1)	4.2 (1.6, 11.2)		
UHR	ABGII	15	177	4.4 (2.1, 8.9)	5.1 (2.6, 10.1)	10.5 (6.1, 17.9)	
UHR	Accolade	10	241	3.4 (1.6, 7.1)	5.9 (3.1, 11.1)		
UHR	Exeter	8	202	1.6 (0.5, 5.0)	3.5 (1.6, 7.7)	5.0 (2.5, 9.8)	5.0 (2.5, 9.8)
UHR	Exeter V40	127	4981	1.7 (1.4, 2.2)	2.6 (2.1, 3.2)	3.3 (2.7, 4.0)	4.4 (3.5, 5.5)
UHR	Omnifit	21	362	5.1 (3.2, 8.1)	5.4 (3.5, 8.5)	5.9 (3.8, 9.1)	7.2 (4.7, 11.2)
Other (201)		93	2164	2.9 (2.2, 3.7)	4.7 (3.8, 5.9)	5.4 (4.4, 6.8)	8.3 (6.3, 11.0)
TOTAL		**417**	**12598**				

Note: Only combinations 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 (94.1%), followed by total resurfacing (5.8%). 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	250847	94.1
Total Resurfacing	15360	5.8
Thrust Plate	258	0.1
TOTAL	**266465**	**100.0**

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

At 12 years, total conventional hip replacement has a lower cumulative percent revision compared to total resurfacing (Table HT2).

Detailed information on the demographics of each class of primary total hip replacement is provided in the supplementary report 'Demographics of Hip Arthroplasty' available on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2013.

Table HT2: Cumulative Percent Revision of Primary Total Hip Replacement by Class

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Total Conventional	9806	250847	1.6 (1.6, 1.7)	2.8 (2.8, 2.9)	4.0 (3.9, 4.1)	6.8 (6.6, 7.0)	8.2 (7.9, 8.6)
Total Resurfacing	1050	15360	1.8 (1.6, 2.0)	3.4 (3.1, 3.7)	5.4 (5.0, 5.8)	10.0 (9.3, 10.7)	11.7 (10.1, 13.5)
Thrust Plate	12	258	0.8 (0.2, 3.1)	1.2 (0.4, 3.7)	4.3 (2.2, 8.1)	7.1 (3.9, 12.7)	
TOTAL	**10868**	**266465**					

Primary Total Conventional Hip Replacement

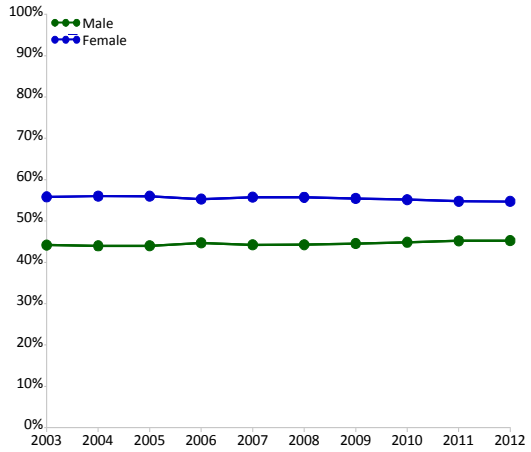
Demographics

There have been 250,847 total conventional procedures reported to the Registry, an additional 27,508 procedures compared to the last report.

Osteoarthritis is the principal diagnosis for total conventional hip replacement (88.4%), followed by fractured neck of femur (3.9%), osteonecrosis (3.5%), developmental dysplasia (1.3%) and rheumatoid arthritis (1.2%).

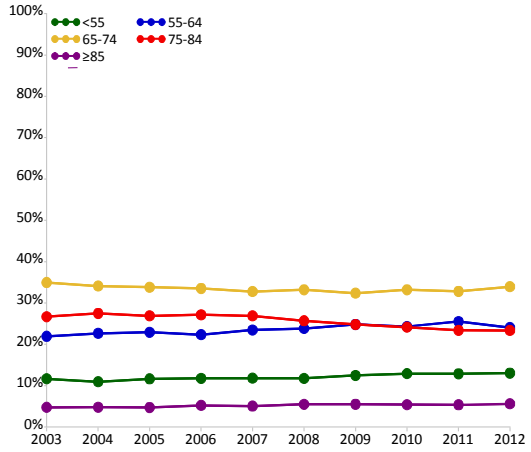
Total conventional hip replacement is more common in females (55.3%). This proportion has remained the same since the Registry first received full national data in 2003 (Figure HT1).

Figure HT1: Primary Total Conventional Hip Replacement by Gender



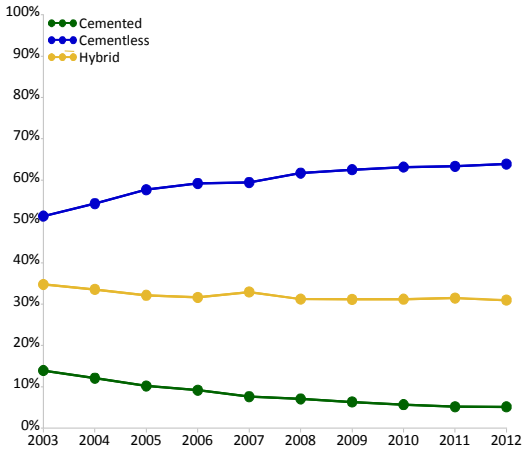
There has been a small increase in the proportion of patients aged 55-64 years (21.9% in 2003 to 24.0% in 2012). There has also been a small increase in the proportion of patients younger than 55 during this period (11.7% in 2003 and 13.0% in 2012) (Figure HT2).

Figure HT2: Primary Total Conventional Hip Replacement by Age



The use of cementless fixation has increased from 51.3% in 2003 to 63.9% in 2012. During the same period, cemented fixation has declined from 13.9% to 5.1% 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. The Quadra-H is the third most used stem in 2012, and this has increased by 33.0% since 2011 (Table HT3). In 2012, 67.2% of total conventional hip replacements used stems that are reported in the ten most used femoral component list. Eight of these are cementless. The ten most used cemented and cementless stems are listed in Tables HT5 and HT6. In 2012, 97.0% of cemented total conventional hip replacements used stems that are reported in the ten most used cemented femoral components compared to 68.0% in the cementless group.

The Trident, Pinnacle and R3 remain the most frequently used acetabular prostheses for total conventional hip replacement. For the first time the Exceed prosthesis is listed in the ten most used acetabular prostheses. In 2012, 80.1% of total conventional hip replacements used acetabular components from the ten most used acetabular component list (Table HT4). All of the acetabular components in this list are cementless prostheses. The ten most used cemented and cementless acetabular prostheses are listed separately in Tables HT7 and HT8.

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

2003		2009		2010		2011		2012	
N	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**
3901	Exeter V40	5323	Exeter V40	5656	Exeter V40	6127	Exeter V40	6124	Exeter V40
1029	ABGII	3613	Corail	4022	Corail	4263	Corail	4407	Corail
1000	Synergy	1125	Accolade	1195	CPT	1419	Quadra-H	1887	Quadra-H
885	VerSys	1049	CPT	1035	Secur-Fit	1226	CPT	1265	CPT
819	Alloclassic	1032	Synergy	979	Quadra-H	1118	Secur-Fit	1071	Secur-Fit
780	Spectron EF	921	Secur-Fit	979	Synergy	868	Synergy	765	Synergy
713	Secur-Fit Plus	920	Alloclassic	907	Accolade	814	Accolade	727	Polarstem
618	Omnifit	743	Spectron EF	755	Anthology	686	Anthology	703	Taperloc
565	C-Stem	709	CPCS	685	Alloclassic	632	CPCS	664	Anthology
484	S-Rom	707	SL-Plus	647	M/L Taper Kinectiv	574	M/L Taper Kinectiv	658	Accolade
Ten Most Used									
10794	(10) 63.2%	16142	(10) 67.7%	16860	(10) 66.2%	17727	(10) 66.8%	18271	(10) 67.2%
Remainder									
6279	(70) 36.8%	7708	(102) 32.3%	8593	(104) 33.8%	8809	(101) 33.2%	8919	(93) 32.8%
TOTAL									
17073	(80) 100.0%	23850	(112) 100.0%	25453	(114) 100.0%	26536	(111) 100.0%	27190	(103) 100.0%

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

2003		2009		2010		2011		2012	
N	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**
3986	Trident (Shell)	6571	Trident (Shell)	6777	Trident (Shell)	6951	Trident (Shell)	6757	Trident (Shell)
1748	Reflection (Shell)	4050	Pinnacle	5117	Pinnacle	5094	Pinnacle	5425	Pinnacle
1524	Trilogy	2289	R3	2451	R3	2643	R3	2965	R3
955	Vitalock	1420	Trilogy	1223	Trilogy	1411	Versafit	1825	Versafit
907	Duraloc	991	Reflection (Shell)	1117	Continuum	1308	Trilogy	1306	Continuum
827	ABGII	914	Allofit	814	Reflection (Shell)	1230	Continuum	1115	Trilogy
793	Allofit	821	Trabecular Metal (Shell)	812	Versafit	747	Allofit	669	Allofit
729	Mallory-Head	513	DeltaMotion	794	Allofit	681	DeltaMotion	592	DeltaMotion
539	Contemporary	453	Versafit	688	DeltaMotion	595	Reflection (Shell)	574	Exceed
537	Pinnacle	430	ASR	482	Trabecular Metal (Shell)	457	Delta PF	554	Delta PF
Ten Most Used									
12545	(10) 73.5%	18452	(10) 77.4%	20275	(10) 79.7%	21117	(10) 79.6%	21782	(10) 80.1%
Remainder									
4528	(66) 26.5%	5398	(72) 22.6%	5178	(73) 20.3%	5419	(66) 20.4%	5408	(55) 19.9%
TOTAL									
17073	(76) 100.0%	23850	(82) 100.0%	25453	(83) 100.0%	26536	(76) 100.0%	27190	(65) 100.0%

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

2003		2009		2010		2011		2012	
N	Model	N	Model	N	Model	N	Model	N	Model
3901	Exeter V40	5323	Exeter V40	5655	Exeter V40	6126	Exeter V40	6124	Exeter V40
780	Spectron EF	1048	CPT	1194	CPT	1226	CPT	1265	CPT
565	C-Stem	743	Spectron EF	640	Spectron EF	632	CPCS	631	CPCS
477	CPT	709	CPCS	626	CPCS	495	Spectron EF	415	Spectron EF
445	Elite Plus	226	Omnifit	237	Omnifit	304	C-Stem AMT	377	C-Stem AMT
358	MS 30	150	MS 30	217	C-Stem AMT	159	Omnifit	192	MS 30
339	Omnifit	144	C-Stem AMT	179	MS 30	129	MS 30	171	Omnifit
321	Charnley	120	Charnley	158	C-Stem	107	C-Stem	113	Quadra-C
244	CPCS	92	C-Stem	59	Charnley	104	E2	93	C-Stem
146	VerSys	27	R120	44	Profemur XM	61	Quadra-C	88	E2
Ten Most Used									
7576	(10) 91.8%	8582	(10) 96.9%	9009	(10) 96.8%	9343	(10) 96.6%	9469	(10) 97.0%
Remainder									
679	(36) 8.2%	276	(35) 3.1%	298	(34) 3.2%	326	(28) 3.4%	292	(28) 3.0%
TOTAL									
8255	(46) 100.0%	8858	(45) 100.0%	9307	(44) 100.0%	9669	(38) 100.0%	9761	(38) 100.0%

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

2003		2009		2010		2011		2012	
N	Model	N	Model	N	Model	N	Model	N	Model
1027	ABGII	3612	Corail	4019	Corail	4262	Corail	4406	Corail
979	Synergy	1123	Accolade	1035	Secur-Fit	1417	Quadra-H	1887	Quadra-H
819	Alloclassic	1023	Synergy	979	Synergy	1118	Secur-Fit	1071	Secur-Fit
739	VerSys	921	Secur-Fit	978	Quadra-H	868	Synergy	765	Synergy
712	Secur-Fit Plus	920	Alloclassic	907	Accolade	814	Accolade	727	Polarstem
483	S-Rom	707	SL-Plus	753	Anthology	686	Anthology	703	Taperloc
482	Secur-Fit	692	Anthology	685	Alloclassic	574	M/L Taper Kinectiv	663	Anthology
375	Corail	531	Quadra-H	646	M/L Taper Kinectiv	558	Alloclassic	653	Accolade
333	Accolade	434	Summit	514	Summit	521	Taperloc	506	M/L Taper Kinectiv
329	Mallory-Head	385	Taperloc	477	SL-Plus	423	Summit	469	Alloclassic
Ten Most Used									
6278	(10) 71.2%	10348	(10) 69.0%	10993	(10) 68.1%	11241	(10) 66.6%	11850	(10) 68.0%
Remainder									
2540	(47) 28.8%	4644	(78) 31.0%	5153	(86) 31.9%	5626	(81) 33.4%	5579	(71) 32.0%
TOTAL									
8818	(57) 100.0%	14992	(88) 100.0%	16146	(96) 100.0%	16867	(91) 100.0%	17429	(81) 100.0%

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

2003		2009		2010		2011		2012	
N	Model	N	Model	N	Model	N	Model	N	Model
539	Contemporary	393	Exeter Contemporary	383	Exeter Contemporary	337	Exeter X3 Rimfit	501	Exeter X3 Rimfit
256	Exeter	348	Contemporary	303	Contemporary	282	Contemporary	274	Contemporary
250	Reflection (Cup)	146	Reflection (Cup)	142	Marathon	206	Exeter Contemporary	122	Marathon
227	Exeter Contemporary	143	Exeter	127	Reflection (Cup)	138	Marathon	110	Exeter Contemporary
199	Charnley Ogee	78	Brunswick	123	Exeter	120	Brunswick	102	Brunswick
149	Elite Plus LPW	70	ZCA	113	ZCA	94	Reflection (Cup)	98	Reflection (Cup)
130	Low Profile Cup	58	CCB	101	Brunswick	88	ZCA	93	ZCA
110	Elite Plus Ogee	55	Charnley	48	Exeter X3 Rimfit	31	CCB	45	Low Profile Cup
102	Charnley	44	Marathon	46	CCB	29	Low Profile Cup	30	Polarcup
90	ZCA	30	Charnley Ogee	30	Low Profile Cup	20	Trident (Shell)	21	CCB
Ten Most Used									
2052	(10) 84.1%	1365	(10) 85.6%	1416	(10) 93.1%	1345	(10) 93.7%	1396	(10) 95.6%
Remainder									
388	(33) 15.9%	229	(33) 14.4%	105	(27) 6.9%	91	(25) 6.3%	64	(20) 4.4%
TOTAL									
2440	(43) 100.0%	1594	(43) 100.0%	1521	(37) 100.0%	1436	(35) 100.0%	1460	(30) 100.0%

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

2003		2009		2010		2011		2012	
N	Model	N	Model	N	Model	N	Model	N	Model
3983	Trident (Shell)	6549	Trident (Shell)	6762	Trident (Shell)	6931	Trident (Shell)	6748	Trident (Shell)
1742	Reflection (Shell)	4050	Pinnacle	5116	Pinnacle	5090	Pinnacle	5424	Pinnacle
1524	Trilogy	2286	R3	2445	R3	2639	R3	2963	R3
954	Vitalock	1412	Trilogy	1223	Trilogy	1411	Versafit	1823	Versafit
902	Duraloc	984	Reflection (Shell)	1116	Continuum	1304	Trilogy	1305	Continuum
826	ABGII	910	Allofit	812	Versafit	1227	Continuum	1114	Trilogy
786	Allofit	805	Trabecular Metal (Shell)	806	Reflection (Shell)	747	Allofit	669	Allofit
728	Mallory-Head	513	DeltaMotion	793	Allofit	681	DeltaMotion	592	DeltaMotion
536	Pinnacle	453	Versafit	688	DeltaMotion	589	Reflection (Shell)	574	Exceed
521	Fitmore	429	ASR	472	Trabecular Metal (Shell)	456	Delta PF	554	Delta PF
Ten Most Used									
12502	(10) 85.4%	18391	(10) 82.6%	20233	(10) 84.5%	21075	(10) 84.0%	21766	(10) 84.6%
Remainder									
2131	(40) 14.6%	3865	(44) 17.4%	3699	(49) 15.5%	4025	(47) 16.0%	3964	(38) 15.4%
TOTAL									
14633	(50) 100.0%	22256	(54) 100.0%	23932	(59) 100.0%	25100	(57) 100.0%	25730	(48) 100.0%

Outcome by Patient Characteristics

The cumulative percent revision at 12 years for primary total conventional hip replacement undertaken for osteoarthritis is 8.0% (Table HT9 and Figure HT4).

Reason for Revision

The most common reasons for revision of primary total conventional hip replacement are loosening/lysis (28.4%), followed by prosthesis dislocation (21.3%), infection (15.6%), fracture (14.5%) and metal related pathology (MRP) (7.5%) (Table HT10 and Figure HT5).

The Registry has previously used the term metal sensitivity to refer to the entire spectrum of surgeon identified metal related pathology reported to the Registry. The Registry has now changed this to metal related pathology (MRP) on the advice of surgeons attending the Surgeon Review Workshop. In the absence of any international consensus as to the appropriate terminology for this encompassing diagnosis, it was agreed that the Registry should use the term MRP. In the last three years, MRP as a reason for revision increased from 1.2% to 7.5%. Almost all revisions for MRP are secondary to the use of metal/metal bearings (Figure HT6). There have only been 15 revision procedures reported to the Registry with a diagnosis of MRP when non metal/metal bearings have been used.

The Registry combines loosening and lysis as a single diagnosis. This is because they usually occur in association, particularly in late revision. On occasion lysis is reported without an associated diagnosis of loosening (2.4% of revision procedures). This most frequently occurs with metal/metal bearings and at 12 years the cumulative percent revision for lysis is 0.9%. It is less frequent with non metal/metal bearings where the 12 year cumulative percent revision is 0.2% (Figure HT6).

The cumulative incidence of the five most common reasons for revision vary with time. 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. As is the case with revision for dislocation, the rate of revision for infection and fracture is higher early. MRP shows an increase in incidence after three years.

Type of Revision

The five most common types of revision recorded by the Registry are acetabular only (31.5%), femoral only (26.4%), head and insert (15.4%), THR (femoral/acetabular) (12.8%) and head only (4.7%) (Table HT11).

Primary Diagnosis

The outcomes of the five most common primary diagnoses (osteoarthritis, fractured neck of femur, osteonecrosis, developmental dysplasia and rheumatoid arthritis) are listed in Table HT12.

The rate of revision varies depending on the primary diagnosis. Osteoarthritis has a lower rate of revision compared to fractured neck of femur. This is also true for osteonecrosis for the first year, but after this time there is no difference. Osteoarthritis has a lower rate of revision compared to developmental dysplasia in the first month, but there is no difference after this time. There is no difference in the rate of revision between osteoarthritis and rheumatoid arthritis (Figure HT7).

Further analysis of total conventional hip procedures performed for fracture neck of femur can be found in the Arthroplasty Management of Fractured Neck of Femur chapter of this report.

Age and Gender

There is a difference in the rate of revision with respect to age. Patients aged 75 or older have a lower rate of revision than all other age groups after six months (Table HT13 and Figure HT8).

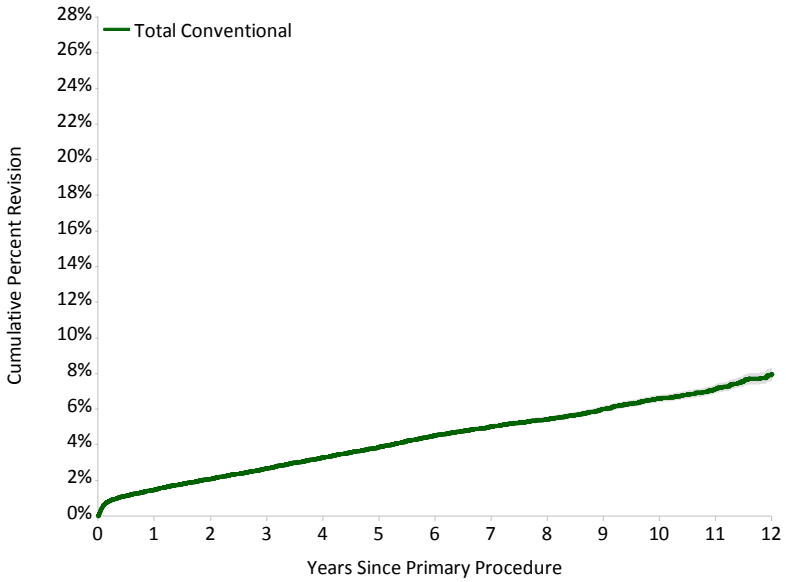
Males have a higher rate of revision, however the difference is small. The 12 year cumulative percent revision is 8.4% for males and 7.6% for females (Table HT14 and Figure HT9).

The Registry continues to report a difference in the rate of revision between age within gender. For females, the rate of revision decreases with increasing age. Females under 55 years have a higher cumulative percent revision at 12 years (12.7%) compared to females 75 years or older (5.0%). The relationship between revision rate and age for males is not as apparent, although there is a higher cumulative percent revision at 12 years in the two age groups below 65 years compared to the two older age groups (Table HT14 and Figures HT10 and HT11).

Table HT9: Cumulative Percent Revision of Primary Total Conventional Hip Replacement (Primary Diagnosis OA)

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Total Conventional	8374	221771	1.5 (1.4, 1.5)	2.7 (2.6, 2.7)	3.9 (3.8, 4.0)	6.6 (6.4, 6.8)	8.0 (7.6, 8.3)

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



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Total Conventional	221771	192501	140894	96934	19116	2221

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

Reason for Revision	Number	Percent
Loosening/Lysis	2787	28.4
Prosthesis Dislocation	2086	21.3
Infection	1532	15.6
Fracture	1422	14.5
Metal Related Pathology	738	7.5
Pain	230	2.3
Leg Length Discrepancy	119	1.2
Malposition	99	1.0
Implant Breakage Stem	80	0.8
Implant Breakage Acetabular	75	0.8
Instability	67	0.7
Incorrect Sizing	66	0.7
Implant Breakage Acetabular Insert	56	0.6
Wear Acetabular Insert	50	0.5
Implant Breakage Head	23	0.2
Other	376	3.8
TOTAL	**9806**	**100.0**

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

Type of Revision	Number	Percent
Acetabular Component	3092	31.5
Femoral Component	2591	26.4
Head/Insert	1511	15.4
THR (Femoral/Acetabular)	1255	12.8
Head Only	460	4.7
Cement Spacer	452	4.6
Minor Components	140	1.4
Insert Only	110	1.1
Head/Neck/Insert	72	0.7
Removal of Prostheses	56	0.6
Head/Neck	47	0.5
Reinsertion of Components	9	0.1
Neck Only	4	0.0
Bipolar Only	3	0.0
Saddle	2	0.0
Neck/Insert	1	0.0
Bipolar Head and Femoral	1	0.0
TOTAL	**9806**	**100.0**

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

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

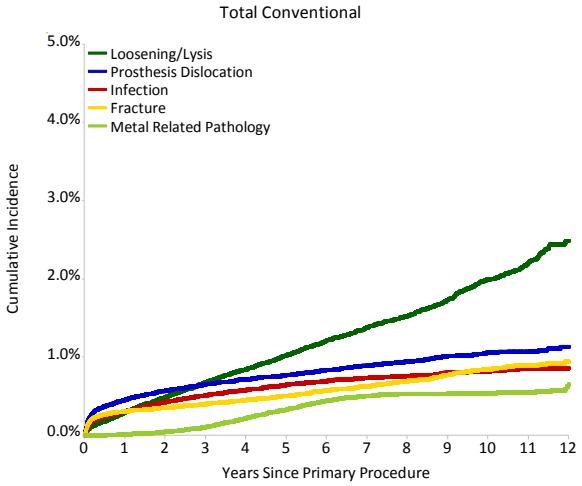


Figure HT6: Revision Diagnosis Cumulative Incidence of Primary Total Conventional Hip Replacement (Primary Diagnosis OA) for Lysis, loosening and Metal Related Pathology (M/M and other bearing surfaces)

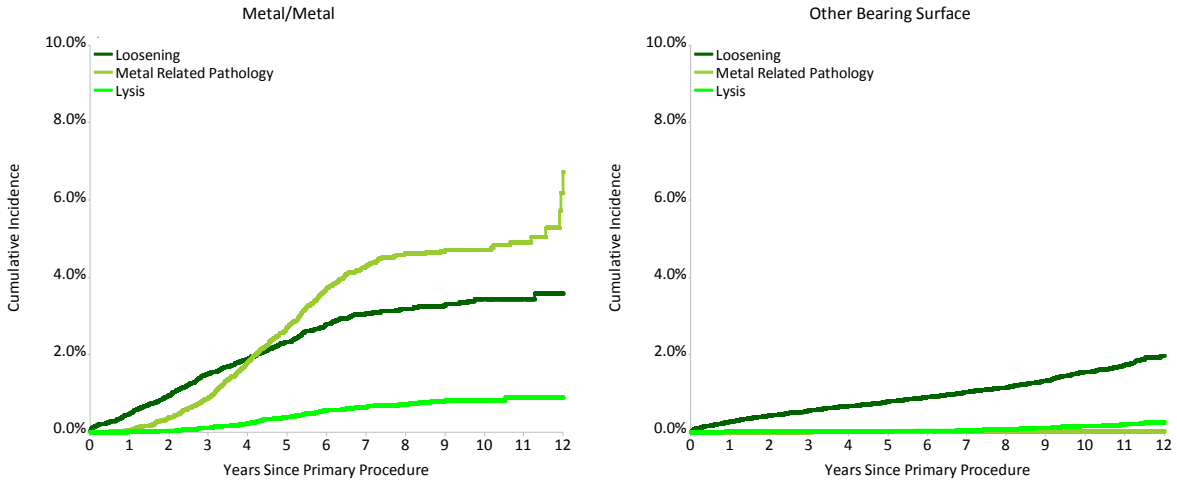
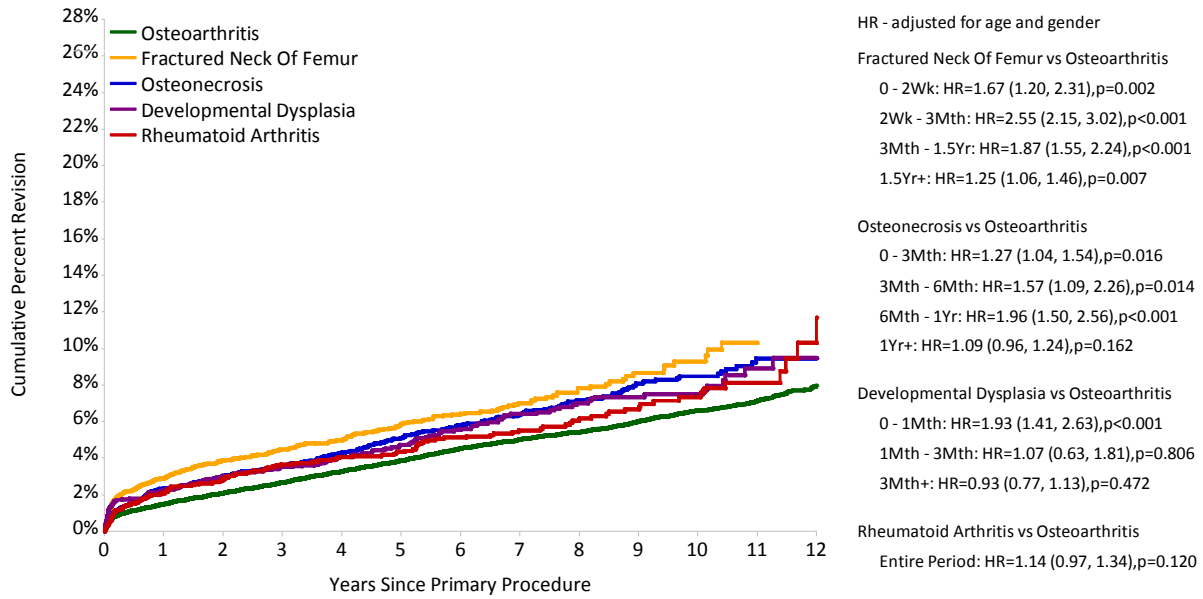


Table HT12: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Primary Diagnosis

Primary Diagnosis	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Osteoarthritis	8374	221771	1.5 (1.4, 1.5)	2.7 (2.6, 2.7)	3.9 (3.8, 4.0)	6.6 (6.4, 6.8)	8.0 (7.6, 8.3)
Fractured Neck Of Femur	463	9791	2.9 (2.6, 3.3)	4.5 (4.0, 4.9)	5.9 (5.3, 6.5)	9.3 (8.0, 10.7)	
Osteonecrosis	451	8817	2.3 (2.0, 2.7)	3.6 (3.2, 4.1)	5.1 (4.6, 5.7)	8.5 (7.6, 9.4)	9.4 (8.3, 10.7)
Developmental Dysplasia	167	3225	2.2 (1.8, 2.8)	3.5 (2.9, 4.2)	4.7 (4.0, 5.6)	7.5 (6.3, 8.8)	9.5 (7.6, 11.7)
Rheumatoid Arthritis	151	2956	2.1 (1.6, 2.7)	3.6 (3.0, 4.4)	4.3 (3.6, 5.2)	7.3 (6.1, 8.8)	11.7 (8.3, 16.2)
Other (6)	200	4287	2.9 (2.4, 3.5)	4.6 (3.9, 5.4)	5.6 (4.8, 6.5)	8.6 (7.2, 10.2)	
TOTAL	**9806**	**250847**					

Note: Only primary diagnoses with over 2,000 procedures have been listed.

Figure HT7: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Primary Diagnosis

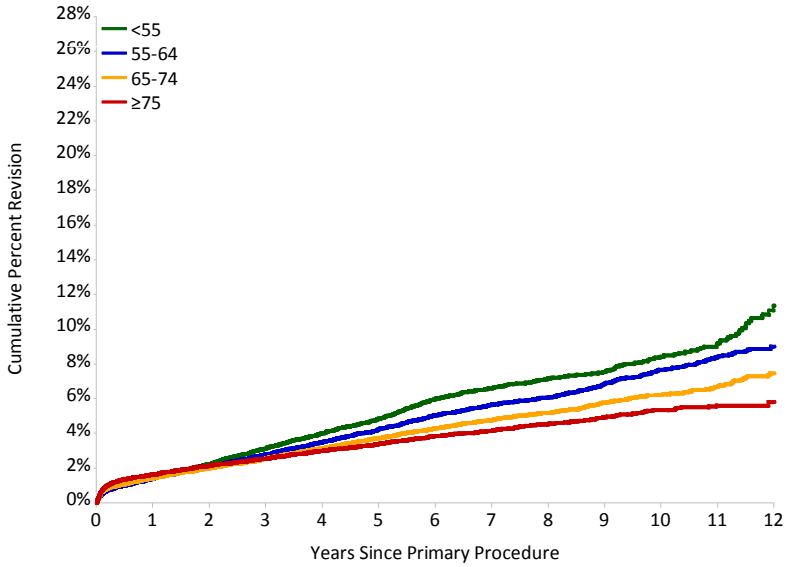


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Osteoarthritis	221771	192501	140894	96934	19116	2221
Fractured Neck Of Femur	9791	7595	4693	2560	311	30
Osteonecrosis	8817	7649	5726	4014	869	111
Developmental Dysplasia	3225	2808	2176	1612	421	54
Rheumatoid Arthritis	2956	2636	2077	1557	399	64

Table HT13: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
<55	1134	23548	1.4 (1.3, 1.6)	3.1 (2.9, 3.4)	4.8 (4.5, 5.2)	8.4 (7.9, 9.0)	11.3 (10.1, 12.7)
55-64	2244	53301	1.4 (1.3, 1.5)	2.8 (2.6, 2.9)	4.2 (4.0, 4.4)	7.7 (7.3, 8.1)	9.0 (8.4, 9.6)
65-74	2863	77783	1.4 (1.3, 1.5)	2.6 (2.4, 2.7)	3.7 (3.6, 3.9)	6.2 (5.9, 6.5)	7.5 (7.0, 8.0)
≥75	2133	67139	1.6 (1.5, 1.7)	2.5 (2.4, 2.7)	3.4 (3.2, 3.5)	5.3 (5.0, 5.6)	5.8 (5.3, 6.4)
TOTAL	**8374**	**221771**					

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



HR - adjusted for gender

<55 vs ≥75

0 - 2Wk: HR=1.01 (0.78, 1.30),p=0.956

2Wk - 3Mth: HR=0.59 (0.49, 0.72),p<0.001

3Mth - 6Mth: HR=0.88 (0.66, 1.18),p=0.398

6Mth - 2Yr: HR=1.65 (1.43, 1.91),p<0.001

2Yr+: HR=2.03 (1.84, 2.24),p<0.001

55-64 vs ≥75

0 - 6Mth: HR=0.73 (0.65, 0.81),p<0.001

6Mth - 2Yr: HR=1.48 (1.32, 1.66),p<0.001

2Yr+: HR=1.68 (1.55, 1.82),p<0.001

65-74 vs ≥75

0 - 6Mth: HR=0.79 (0.72, 0.87),p<0.001

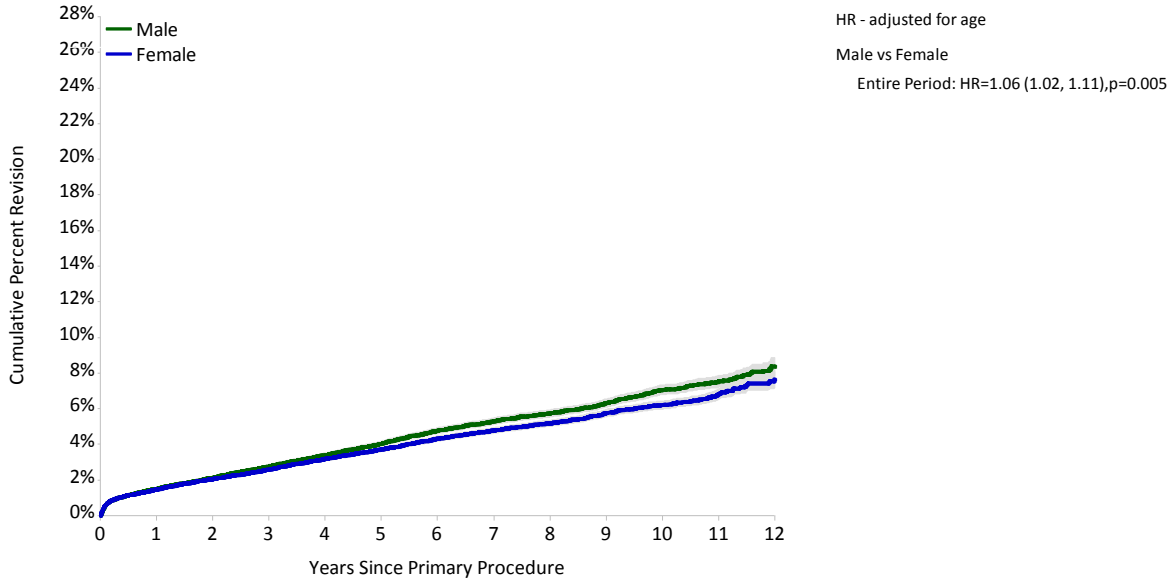
6Mth+: HR=1.29 (1.20, 1.38),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
<55	23548	20387	14705	10323	2523	332
55-64	53301	46503	33934	23530	5070	672
65-74	77783	67757	50395	35462	7397	842
≥75	67139	57854	41860	27619	4126	375

Table HT14: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Age and Gender (Primary Diagnosis OA)

Gender and Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Male <55	575	12871	1.2 (1.0, 1.4)	2.8 (2.5, 3.2)	4.5 (4.1, 5.0)	8.1 (7.3, 8.9)	10.3 (8.9, 11.9)
55-64	1135	26412	1.5 (1.3, 1.6)	2.9 (2.7, 3.1)	4.3 (4.1, 4.6)	7.8 (7.3, 8.3)	9.0 (8.2, 10.0)
65-74	1357	36625	1.4 (1.3, 1.5)	2.5 (2.4, 2.7)	3.7 (3.5, 4.0)	6.5 (6.1, 6.9)	7.5 (6.8, 8.3)
≥75	937	26015	1.8 (1.7, 2.0)	2.9 (2.7, 3.2)	3.9 (3.7, 4.2)	6.5 (5.9, 7.1)	7.3 (6.0, 8.9)
TOTAL	**4004**	**101923**	**1.5 (1.4, 1.6)**	**2.8 (2.7, 2.9)**	**4.0 (3.9, 4.2)**	**7.1 (6.8, 7.3)**	**8.4 (7.9, 8.9)**
Female <55	559	10677	1.7 (1.5, 2.0)	3.5 (3.1, 3.9)	5.2 (4.7, 5.7)	8.9 (8.0, 9.8)	12.7 (10.5, 15.2)
55-64	1109	26889	1.3 (1.2, 1.5)	2.7 (2.5, 2.9)	4.1 (3.9, 4.4)	7.5 (7.0, 8.1)	9.0 (8.2, 9.9)
65-74	1506	41158	1.5 (1.3, 1.6)	2.6 (2.4, 2.8)	3.7 (3.5, 3.9)	6.0 (5.6, 6.4)	7.4 (6.7, 8.1)
≥75	1196	41124	1.5 (1.4, 1.6)	2.3 (2.1, 2.5)	3.0 (2.9, 3.2)	4.7 (4.4, 5.1)	5.0 (4.6, 5.5)
TOTAL	**4370**	**119848**	**1.5 (1.4, 1.5)**	**2.6 (2.5, 2.7)**	**3.7 (3.6, 3.8)**	**6.2 (6.0, 6.4)**	**7.6 (7.2, 8.1)**

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



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Male	101923	88168	63989	43816	8795	1018
Female	119848	104333	76905	53118	10321	1203

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

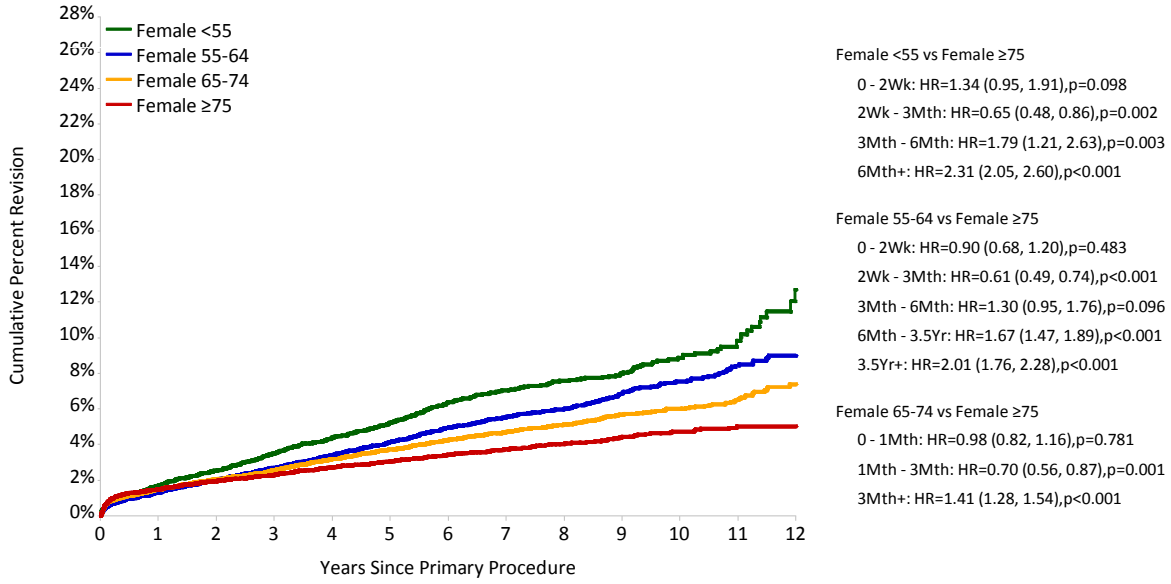
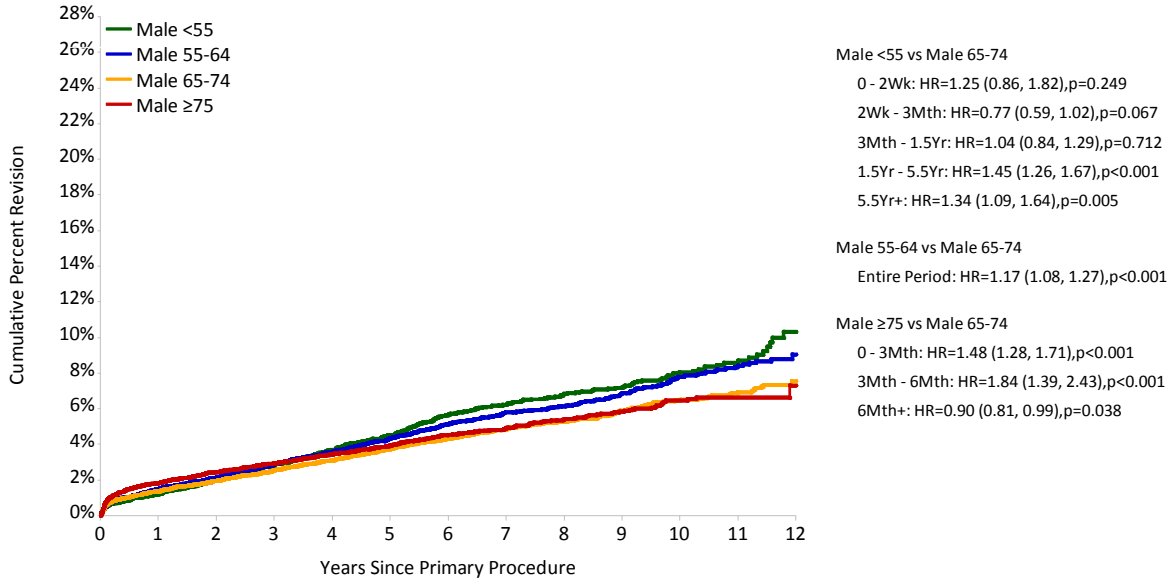


Figure HT11: Cumulative Percent Revision of Primary Total Conventional Hip Replacement for Males by Age (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Male	<55	12871	11100	7938	5585	1412	201
	55-64	26412	22970	16695	11699	2653	328
	65-74	36625	31958	23720	16650	3430	377
	≥75	26015	22140	15636	9882	1300	112
Female	<55	10677	9287	6767	4738	1111	131
	55-64	26889	23533	17239	11831	2417	344
	65-74	41158	35799	26675	18812	3967	465
	≥75	41124	35714	26224	17737	2826	263

Outcome by Prostheses Characteristics

Fixation

At 12 years, hybrid fixation has the lowest cumulative percent revision of 6.2% compared to cemented (7.8%) and cementless fixation (9.0%) (Table HT15). Hybrid fixation has a lower rate of revision compared to cementless fixation over the entire period and after six years when compared to cement fixation. Cementless fixation has a higher rate of revision compared to cement fixation initially but after six years the rate of revision for cementless fixation is less than cement fixation (Figure HT12).

For this report the outcome of fixation has also been analysed excluding all procedures with metal/metal bearings using femoral heads larger than 32mm. The reason for excluding this group is because it has been predominately used in cementless procedures, is known to have a higher rate of revision, and is now rarely used.

After excluding large head metal/metal bearings the 12 year cumulative percent revision is 5.9% for hybrid, 7.8% for cemented and 6.8% for cementless fixation (Table HT16). Hybrid fixation continues to have a lower rate of revision compared to cement and cementless fixation, however for cementless fixation this difference is only evident in the first three years. Cementless fixation has a higher rate of revision compared to cement fixation in the first six months, but after three years the rate of revision is lower for cementless fixation (Figure HT13).

There are age related differences in the rate of revision for the different types of fixation and these differences change when large head metal/metal bearings are excluded from the analysis.

Hybrid fixation has a lower rate of revision compared to cementless fixation in the under 55 year age group. There are only a small number of procedures using cement fixation in this age group and there is no difference compared to either hybrid or cementless fixation (Table HT17 and Figure HT14). The comparative outcomes change when large head metal/metal bearings are excluded. Cementless fixation has a lower rate of revision compared to both hybrid and cement fixation after 2.5 years (Table HT18 and Figure HT15).

Hybrid fixation has a lower rate of revision compared to cemented and cementless fixation in the 55-64 year age group and cementless fixation has a lower rate of revision compared to cement fixation after 6.5 years (Table HT17 and Figure HT16). The revision rate for cementless fixation is reduced when large head metal/metal bearings are excluded. It is lower than cement fixation after 1.5 years and hybrid fixation after six years (Table HT 18 and Figure HT17).

Hybrid fixation has a lower rate of revision compared to cemented and cementless fixation in the 65-74 year age group and cementless fixation has the same revision rate as cement fixation after one month (Table HT17 and Figure HT18). The rate of revision of cementless fixation is reduced when the large head metal/metal bearings are excluded. There is no difference between hybrid and cementless fixation after three months and cementless fixation has a lower rate of revision after six months compared to cement fixation (Table HT18 and Figure HT19).

There is no difference in hybrid and cement fixation in the 75 years and older age group after two weeks. Both hybrid and cement fixation have a lower rate of revision compared to cementless fixation in this age group (Table HT17 and Figure HT20). There is a reduction in the rate of revision for cementless fixation when the large head metal/metal bearings are excluded but this is not sufficient to change the outcome compared to hybrid and cement fixation (Table HT18 and Figure HT21).

Excluding large head metal/metal bearings has reduced the rate of revision for cementless fixation more than hybrid and cement fixation. This impacts on the comparative outcomes particularly in younger age groups. After varying time periods cementless fixation has a lower rate of revision compared to cement fixation for all ages less than 75 years. It also has a lower rate of revision after varying time periods compared to hybrid fixation in those aged less than 65 years. Both hybrid and cement fixation continue to have a lower rate of revision compared to cementless fixation in the older patient group.

Femoral Stems with Exchangeable Necks

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

Femoral stems with exchangeable necks were used in 8,971 primary total conventional hip procedures undertaken for the treatment of osteoarthritis. Outcomes were compared to 212,800 procedures using fixed neck femoral stems for the same diagnosis.

This is the fourth year the Registry has reported that this group of prostheses has a higher rate of revision

compared to femoral stems with fixed necks. The proportion of procedures using exchangeable necks peaked in 2010 at 6.8% of all primary total conventional hip procedures. In 2012, this proportion decreased to 3.6% of procedures. The cumulative percent revision at ten years for exchangeable neck prostheses is 10.8% compared to 6.4% for fixed femoral stems (Table HT19 and Figure HT22).

The increase in the rate of revision is due to a higher incidence of revision for loosening/lysis (3.6% at ten years compared to 1.9% for fixed femoral neck), dislocation (1.7% compared to 1.0%) and fracture (1.3% compared to 0.8%) (Figure HT23). Of the revisions for exchangeable femoral necks, 1.5% are for implant breakage of the femoral component.

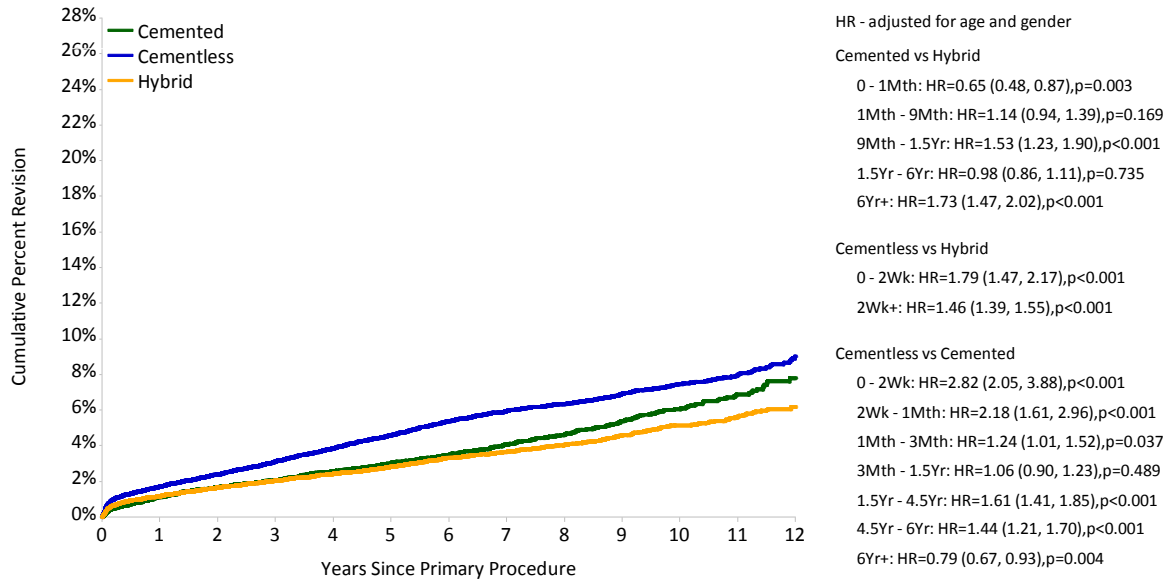
The higher rate of revision when using exchangeable necks is evident for all bearing surfaces with the exception of metal on metal, which has an increased rate of revision when using either exchangeable or fixed neck stems (Table HT20 and Figure HT24).

There are six exchangeable femoral neck prostheses with a cumulative percent revision at five or more years. All have more than 500 procedures reported to the Registry and all have a higher rate of revision than fixed neck stems (Table HT21).

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

Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	727	18719	1.1 (1.0, 1.3)	2.1 (1.9, 2.3)	3.0 (2.8, 3.3)	6.0 (5.6, 6.6)	7.8 (7.0, 8.7)
Cementless	5583	131733	1.7 (1.6, 1.8)	3.1 (3.0, 3.2)	4.6 (4.5, 4.7)	7.5 (7.2, 7.7)	9.0 (8.5, 9.6)
Hybrid	2064	71319	1.2 (1.1, 1.3)	2.0 (1.9, 2.1)	2.8 (2.7, 3.0)	5.1 (4.9, 5.4)	6.2 (5.7, 6.6)
TOTAL	**8374**	**221771**					

Figure HT12: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis OA)

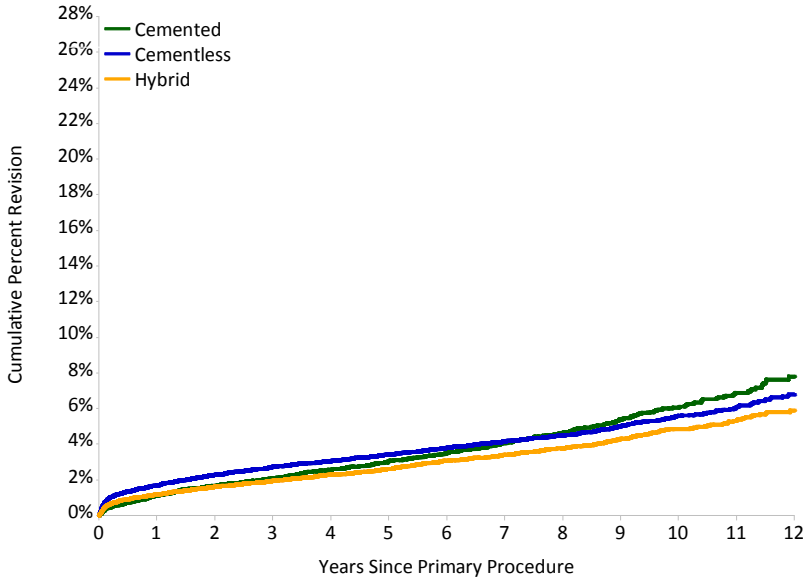


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	18719	17158	14142	11016	3103	454
Cementless	131733	113013	80586	53632	9301	896
Hybrid	71319	62330	46166	32286	6712	871

Table HT16: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis OA, excluding large heads (>32mm) metal/metal bearings)

Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	727	18704	1.1 (1.0, 1.3)	2.1 (1.9, 2.3)	3.0 (2.8, 3.3)	6.0 (5.6, 6.6)	7.8 (7.0, 8.7)
Cementless	3875	119039	1.7 (1.6, 1.8)	2.7 (2.6, 2.8)	3.4 (3.3, 3.5)	5.6 (5.4, 5.8)	6.8 (6.3, 7.2)
Hybrid	1902	69643	1.2 (1.1, 1.2)	1.9 (1.8, 2.0)	2.6 (2.5, 2.7)	4.9 (4.6, 5.1)	5.9 (5.4, 6.4)
TOTAL	**6504**	**207386**					

Figure HT13: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis OA, excluding large heads (>32mm) metal/metal bearings)



HR - adjusted for age and gender

Cemented vs Hybrid

0 - 1Mth: HR=0.62 (0.46, 0.83),p=0.001

1Mth - 6Mth: HR=0.94 (0.74, 1.19),p=0.604

6Mth+: HR=1.38 (1.25, 1.52),p<0.001

Cementless vs Hybrid

0 - 2Wk: HR=1.83 (1.50, 2.24),p<0.001

2Wk - 3Mth: HR=1.43 (1.27, 1.61),p<0.001

3Mth - 6Mth: HR=1.13 (0.93, 1.38),p=0.231

6Mth - 3Yr: HR=1.37 (1.25, 1.51),p<0.001

3Yr+: HR=0.97 (0.88, 1.06),p=0.468

Cementless vs Cemented

0 - 2Wk: HR=2.93 (2.12, 4.04),p<0.001

2Wk - 1Mth: HR=2.37 (1.74, 3.21),p<0.001

1Mth - 6Mth: HR=1.38 (1.10, 1.73),p=0.006

6Mth - 1.5Yr: HR=0.97 (0.85, 1.12),p=0.714

1.5Yr - 3Yr: HR=1.02 (0.88, 1.18),p=0.803

3Yr+: HR=0.70 (0.63, 0.78),p<0.001

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	18704	17144	14128	11010	3103	454
Cementless	119039	100656	69808	47205	9144	876
Hybrid	69643	60704	44824	31472	6683	869

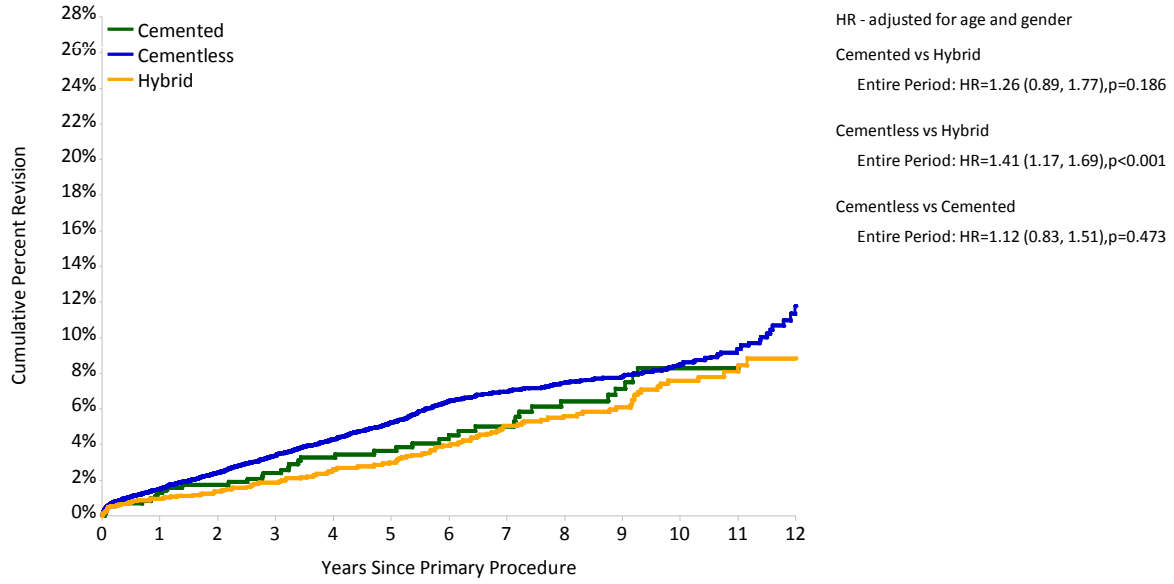
Table HT17: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Fixation and Age (Primary Diagnosis OA)

Age	Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
<55	Cemented	44	728	1.3 (0.7, 2.4)	2.4 (1.5, 3.9)	3.6 (2.4, 5.5)	8.3 (6.0, 11.4)	
	Cementless	956	19293	1.5 (1.4, 1.7)	3.4 (3.1, 3.7)	5.2 (4.9, 5.6)	8.5 (7.9, 9.2)	11.8 (10.1, 13.6)
	Hybrid	134	3527	1.0 (0.7, 1.4)	1.9 (1.4, 2.4)	3.0 (2.4, 3.7)	7.6 (6.2, 9.2)	8.8 (7.1, 11.0)
55-64	Cemented	141	2345	1.5 (1.1, 2.1)	2.9 (2.3, 3.7)	4.0 (3.2, 4.9)	9.1 (7.6, 10.8)	11.8 (9.7, 14.3)
	Cementless	1710	39211	1.5 (1.4, 1.6)	3.0 (2.8, 3.2)	4.7 (4.4, 4.9)	7.9 (7.4, 8.3)	8.9 (8.1, 9.7)
	Hybrid	393	11745	1.1 (0.9, 1.3)	2.0 (1.8, 2.3)	2.9 (2.6, 3.3)	6.3 (5.6, 7.1)	7.8 (6.8, 9.0)
65-74	Cemented	293	6378	1.0 (0.8, 1.3)	2.2 (1.8, 2.6)	3.2 (2.8, 3.7)	6.6 (5.9, 7.5)	8.1 (7.0, 9.4)
	Cementless	1783	45528	1.6 (1.5, 1.7)	2.9 (2.7, 3.1)	4.3 (4.1, 4.5)	6.8 (6.4, 7.2)	8.1 (7.3, 9.0)
	Hybrid	787	25877	1.2 (1.1, 1.3)	2.1 (1.9, 2.3)	2.9 (2.7, 3.2)	5.0 (4.6, 5.5)	6.1 (5.4, 7.0)
≥75	Cemented	249	9268	1.1 (0.9, 1.3)	1.8 (1.5, 2.1)	2.6 (2.3, 3.0)	4.1 (3.6, 4.8)	5.0 (3.8, 6.5)
	Cementless	1134	27701	2.3 (2.1, 2.4)	3.4 (3.2, 3.7)	4.5 (4.2, 4.8)	7.2 (6.6, 7.8)	7.4 (6.8, 8.1)
	Hybrid	750	30170	1.2 (1.1, 1.4)	2.0 (1.8, 2.2)	2.6 (2.4, 2.8)	4.3 (3.9, 4.7)	4.5 (4.1, 5.1)
TOTAL		**8374**	**221771**					

Table HT18: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Fixation and Age (Primary Diagnosis OA, excluding large heads (>32mm) metal/metal bearings)

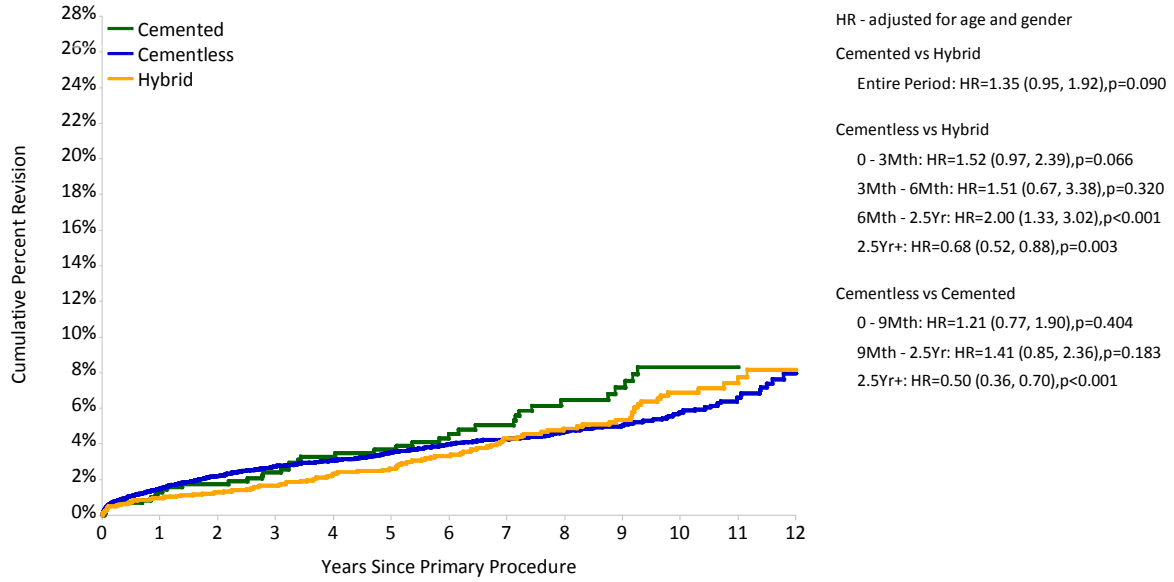
Age	Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
<55	Cemented	44	725	1.3 (0.7, 2.4)	2.4 (1.5, 3.9)	3.7 (2.4, 5.5)	8.3 (6.0, 11.4)	
	Cementless	564	16540	1.5 (1.3, 1.7)	2.7 (2.5, 3.0)	3.5 (3.2, 3.9)	5.8 (5.2, 6.4)	7.9 (6.7, 9.4)
	Hybrid	116	3400	0.9 (0.7, 1.3)	1.7 (1.3, 2.2)	2.6 (2.0, 3.3)	6.9 (5.6, 8.5)	8.1 (6.4, 10.3)
55-64	Cemented	141	2341	1.5 (1.1, 2.1)	2.9 (2.3, 3.7)	4.0 (3.2, 4.9)	9.1 (7.6, 10.8)	11.8 (9.7, 14.3)
	Cementless	1086	34831	1.5 (1.4, 1.6)	2.5 (2.3, 2.7)	3.2 (3.0, 3.4)	5.6 (5.1, 6.0)	6.3 (5.7, 7.0)
	Hybrid	361	11388	1.1 (0.9, 1.3)	1.9 (1.7, 2.2)	2.7 (2.4, 3.1)	6.0 (5.3, 6.8)	7.5 (6.4, 8.7)
65-74	Cemented	293	6376	1.0 (0.8, 1.3)	2.2 (1.8, 2.6)	3.2 (2.8, 3.7)	6.6 (5.9, 7.5)	8.1 (7.0, 9.4)
	Cementless	1275	41782	1.6 (1.5, 1.7)	2.6 (2.4, 2.7)	3.3 (3.1, 3.5)	5.0 (4.7, 5.4)	6.3 (5.5, 7.3)
	Hybrid	718	25280	1.2 (1.0, 1.3)	2.0 (1.8, 2.2)	2.7 (2.5, 2.9)	4.7 (4.3, 5.1)	5.8 (5.1, 6.7)
≥75	Cemented	249	9262	1.1 (0.9, 1.3)	1.8 (1.5, 2.1)	2.6 (2.3, 3.0)	4.1 (3.6, 4.8)	5.0 (3.8, 6.5)
	Cementless	950	25886	2.3 (2.1, 2.4)	3.3 (3.0, 3.5)	3.9 (3.7, 4.2)	6.4 (5.8, 7.0)	6.6 (5.9, 7.3)
	Hybrid	707	29575	1.2 (1.1, 1.3)	1.9 (1.8, 2.1)	2.5 (2.3, 2.7)	4.1 (3.7, 4.5)	4.4 (3.9, 4.9)
TOTAL		**6504**	**207386**					

Figure HT14: Cumulative Percent Revision of Primary Total Conventional Hip Replacement for Patients Aged <55 Years by Fixation (Primary Diagnosis OA)



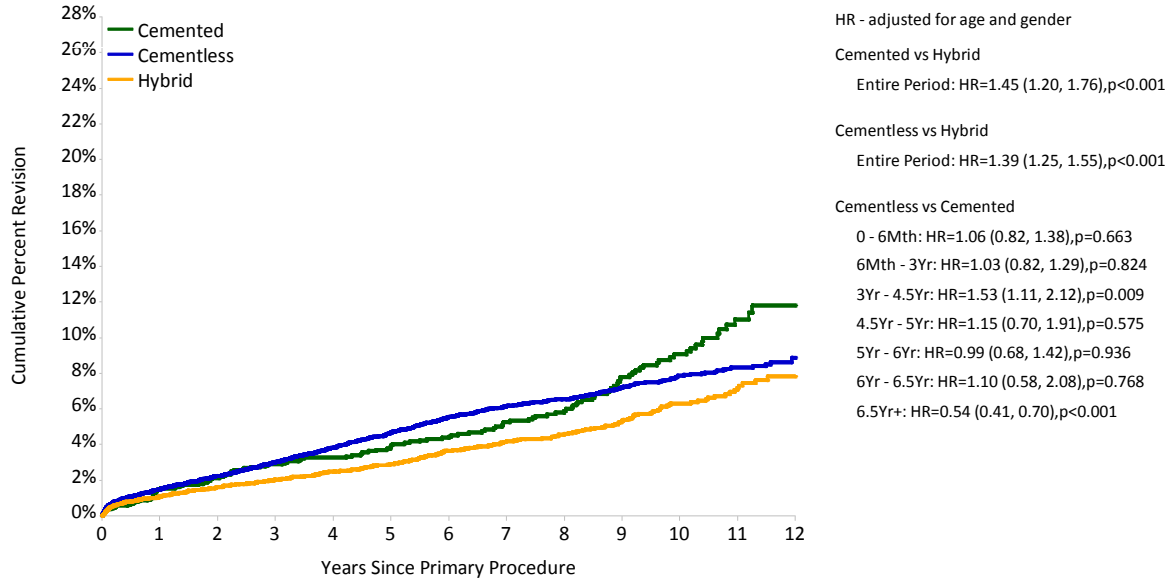
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	728	666	574	464	186	30
Cementless	19293	16666	11883	8216	1863	208
Hybrid	3527	3055	2248	1643	474	94

Figure HT15: Cumulative Percent Revision of Primary Total Conventional Hip Replacement for Patients Aged <55 Years by Fixation (Primary Diagnosis OA, excluding large heads (>32mm) metal/metal bearings)



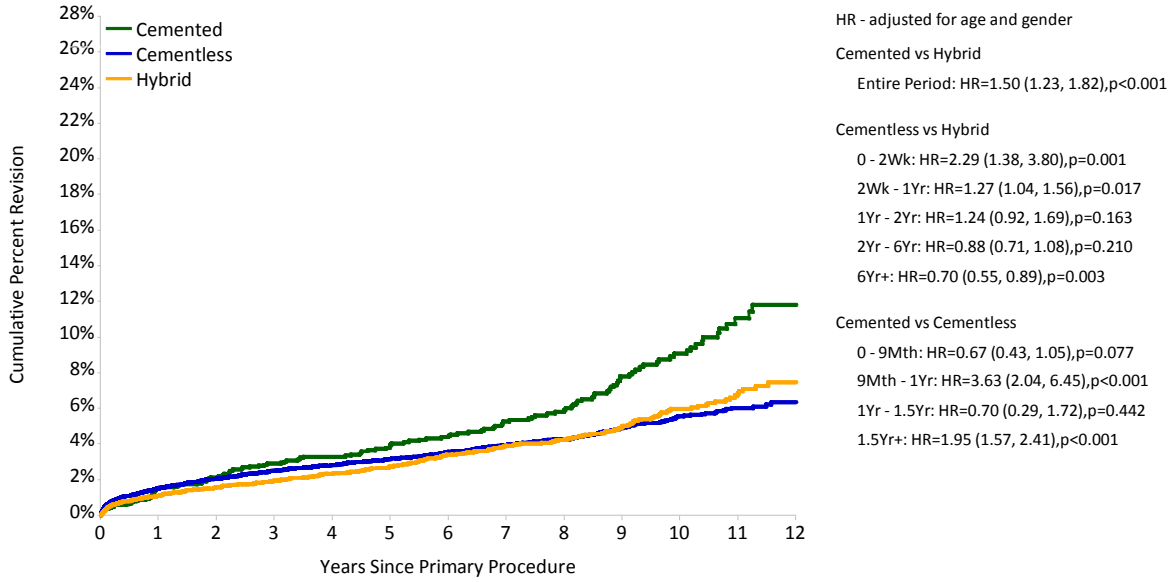
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	725	663	571	462	186	30
Cementless	16540	13974	9584	6825	1814	201
Hybrid	3400	2930	2143	1576	471	94

Figure HT16: Cumulative Percent Revision of Primary Total Conventional Hip Replacement for Patients Aged 55-64 Years by Fixation (Primary Diagnosis OA)



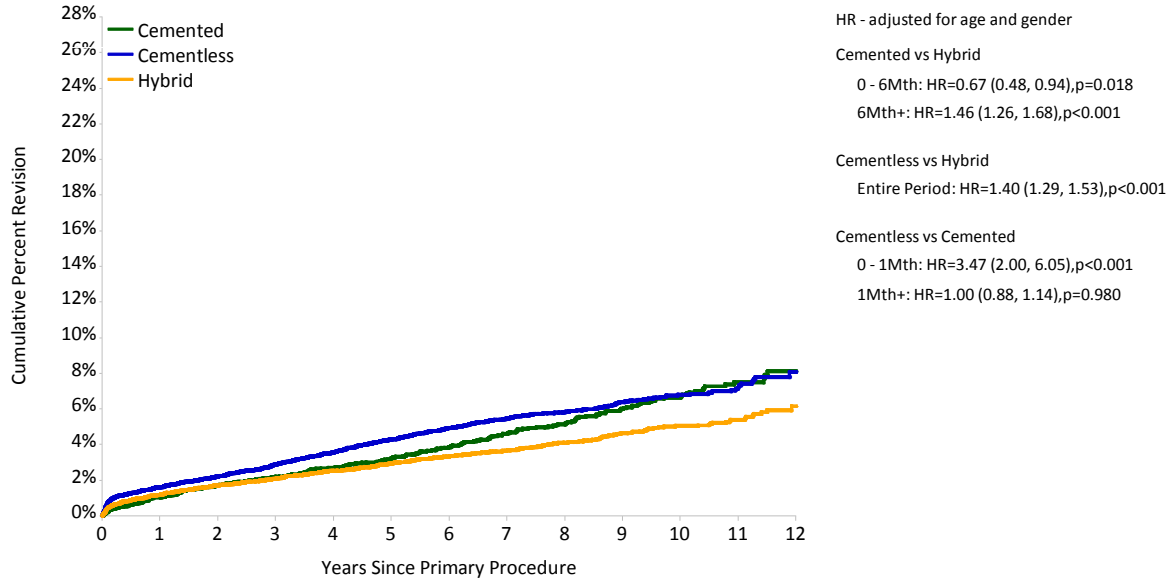
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	2345	2165	1819	1464	540	87
Cementless	39211	33997	24481	16590	3166	362
Hybrid	11745	10341	7634	5476	1364	223

Figure HT17: Cumulative Percent Revision of Primary Total Conventional Hip Replacement for Patients Aged 55-64 Years by Fixation (Primary Diagnosis OA, excluding large heads (>32mm) metal/metal bearings)



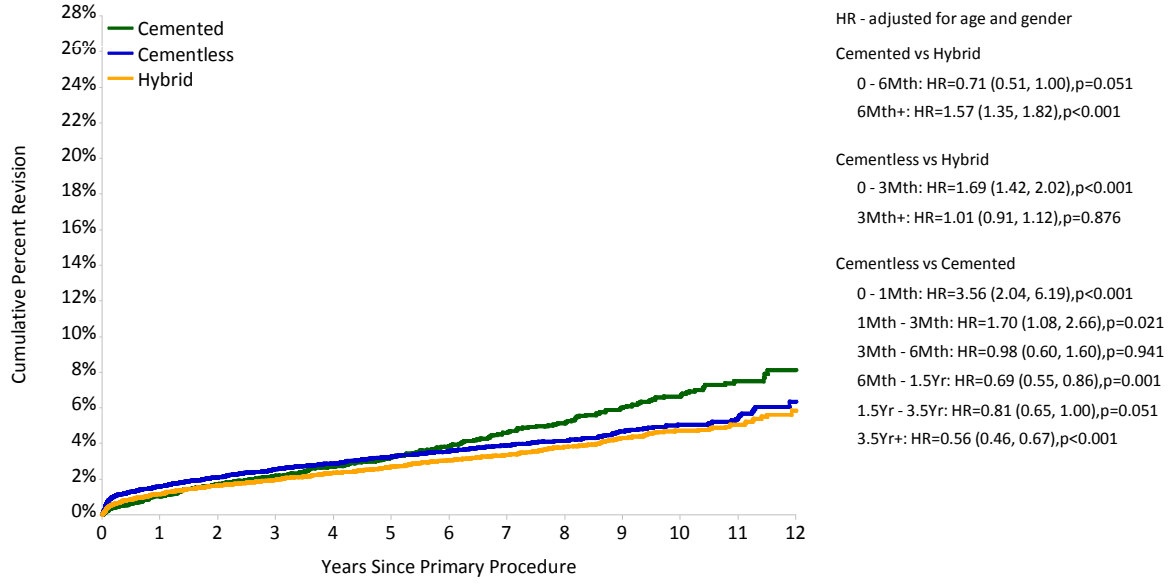
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	2341	2162	1816	1464	540	87
Cementless	34831	29711	20749	14360	3110	353
Hybrid	11388	9990	7340	5299	1360	223

Figure HT18: Cumulative Percent Revision of Primary Total Conventional Hip Replacement for Patients Aged 65-74 Years by Fixation (Primary Diagnosis OA)



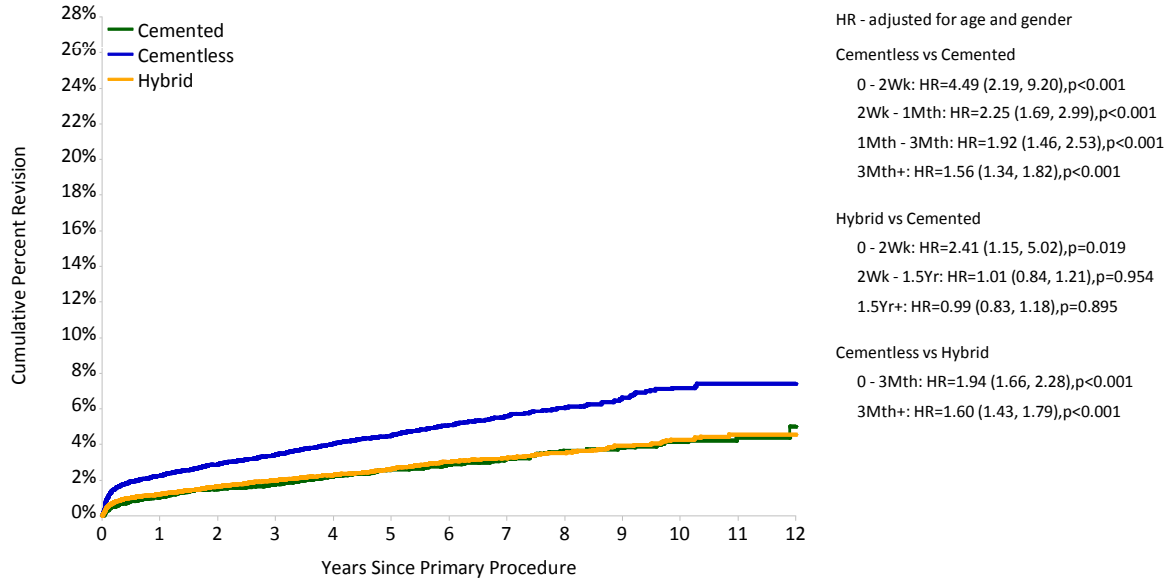
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	6378	5918	5035	4123	1315	199
Cementless	45528	39023	27991	18753	3185	263
Hybrid	25877	22816	17369	12586	2897	380

Figure HT19: Cumulative Percent Revision of Primary Total Conventional Hip Replacement for Patients Aged 65-74 Years by Fixation (Primary Diagnosis OA, excluding large heads (>32mm) metal/metal bearings)



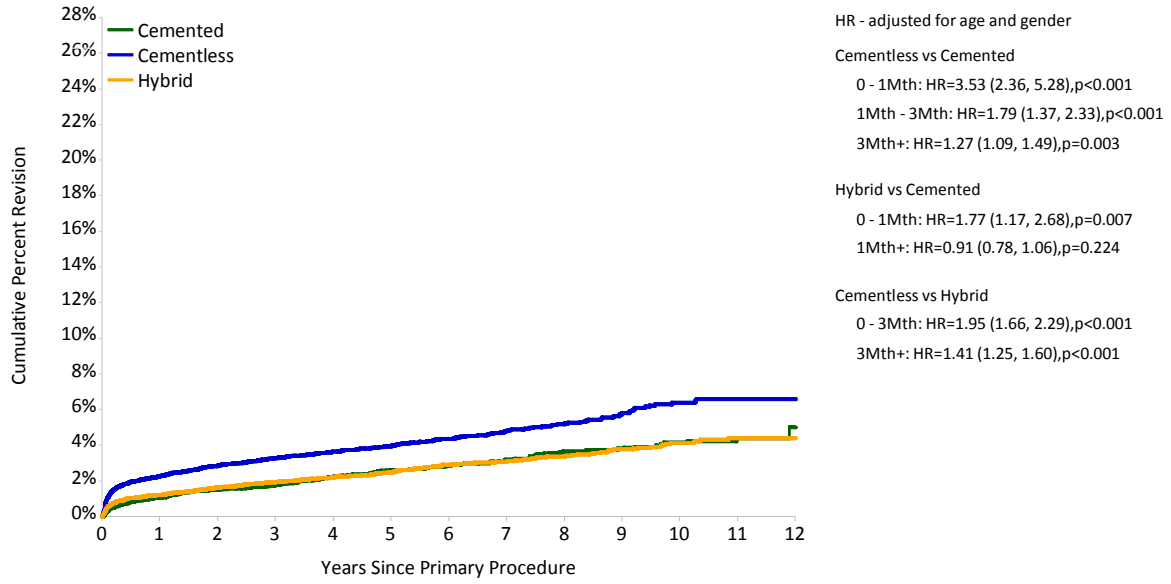
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	6376	5916	5033	4122	1315	199
Cementless	41782	35370	24754	16810	3148	259
Hybrid	25280	22238	16888	12297	2886	379

Figure HT20: Cumulative Percent Revision of Primary Total Conventional Hip Replacement for Patients Aged ≥75 Years by Fixation (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	9268	8409	6714	4965	1062	138
Cementless	27701	23327	16231	10073	1087	63
Hybrid	30170	26118	18915	12581	1977	174

Figure HT21: Cumulative Percent Revision of Primary Total Conventional Hip Replacement for Patients Aged ≥75 Years by Fixation (Primary Diagnosis OA, excluding large heads (>32mm) metal/metal bearings)

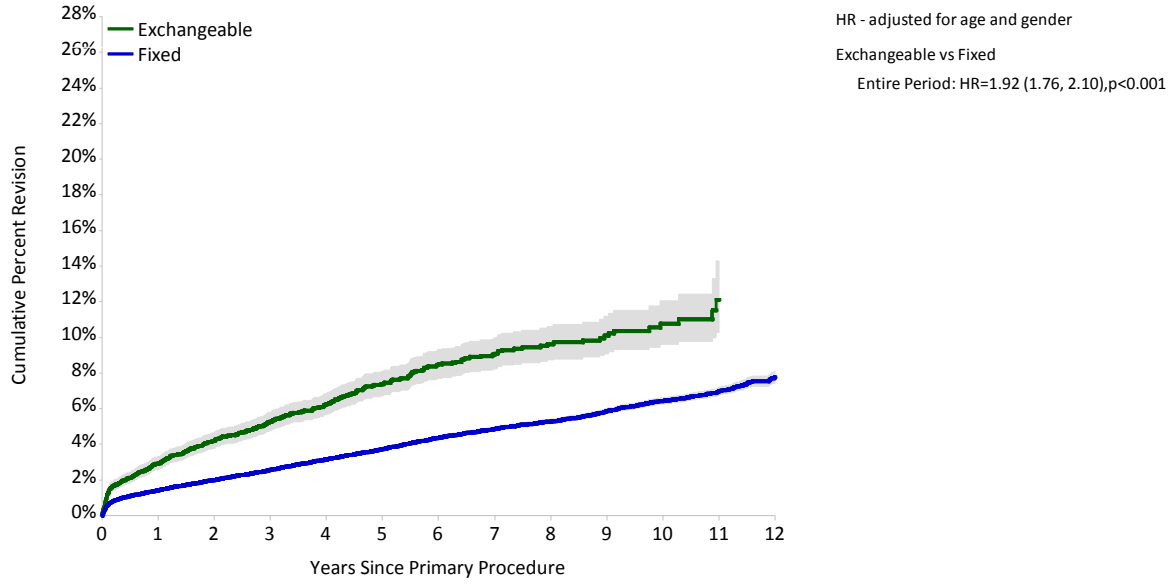


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	9262	8403	6708	4962	1062	138
Cementless	25886	21601	14721	9210	1072	63
Hybrid	29575	25546	18453	12300	1966	173

Table HT19: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Type of Femoral Neck (Primary Diagnosis OA)

CPR	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Exchangeable Femoral Neck	544	8971	2.9 (2.6, 3.3)	5.3 (4.8, 5.8)	7.4 (6.7, 8.1)	10.8 (9.6, 12.1)	
Fixed Femoral Neck	7830	212800	1.4 (1.4, 1.5)	2.6 (2.5, 2.6)	3.7 (3.6, 3.8)	6.4 (6.3, 6.6)	7.8 (7.4, 8.1)
TOTAL	**8374**	**221771**					

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



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Exchangeable Femoral Neck	8971	7796	4606	2557	410	28
Fixed Femoral Neck	212800	184705	136288	94377	18706	2193

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

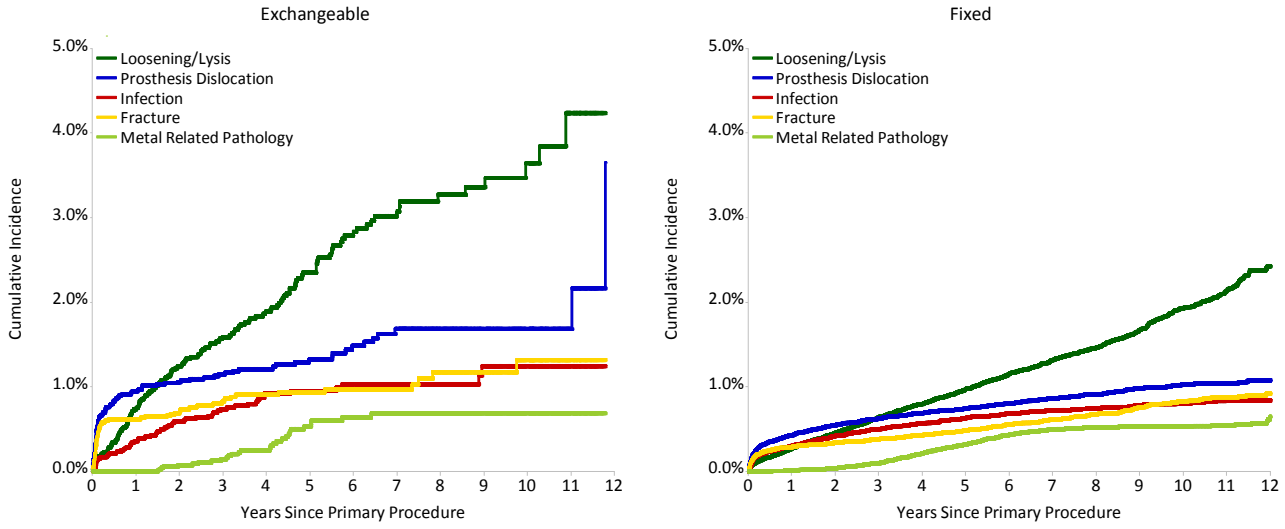


Table HT20: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Type of Femoral Neck and Bearing Surface (Primary Diagnosis OA)

Bearing Surface	Femoral Neck	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Ceramic/Ceramic	Exchangeable	286	4602	3.2 (2.7, 3.7)	5.2 (4.5, 5.9)	6.7 (5.9, 7.6)	9.8 (8.5, 11.4)	
	Fixed	1263	45931	1.3 (1.2, 1.4)	2.3 (2.1, 2.4)	2.9 (2.8, 3.1)	4.8 (4.5, 5.2)	5.5 (5.0, 6.0)
Ceramic/Non-XL Poly	Exchangeable	17	236	5.2 (3.0, 9.0)	8.0 (5.0, 12.7)	8.0 (5.0, 12.7)		
	Fixed	161	2725	1.6 (1.2, 2.2)	2.8 (2.2, 3.5)	3.6 (2.9, 4.4)	7.7 (6.6, 9.1)	9.3 (7.8, 11.0)
Ceramic/XL Poly	Exchangeable	36	936	2.4 (1.6, 3.7)	4.1 (2.8, 5.8)	4.6 (3.1, 6.7)		
	Fixed	515	20256	1.4 (1.3, 1.6)	2.4 (2.2, 2.6)	2.9 (2.6, 3.2)	5.1 (4.5, 5.8)	5.3 (4.6, 6.0)
Metal/Metal	Exchangeable	107	1292	2.3 (1.6, 3.3)	5.7 (4.5, 7.1)	10.8 (8.9, 13.2)		
	Fixed	2007	18130	1.6 (1.4, 1.8)	5.0 (4.7, 5.4)	9.6 (9.2, 10.1)	15.5 (14.8, 16.3)	18.6 (16.4, 21.1)
Metal/Non-XL Poly	Exchangeable	35	452	2.9 (1.7, 5.0)	6.9 (4.8, 9.8)	7.8 (5.6, 11.0)		
	Fixed	910	15497	1.4 (1.3, 1.6)	2.6 (2.3, 2.9)	3.8 (3.5, 4.1)	7.7 (7.2, 8.3)	10.1 (9.3, 11.1)
Metal/XL Poly	Exchangeable	63	1434	2.7 (1.9, 3.7)	4.3 (3.2, 5.7)	6.4 (4.6, 9.1)	12.9 (8.7, 18.8)	
	Fixed	2752	99348	1.4 (1.3, 1.5)	2.2 (2.1, 2.3)	2.8 (2.7, 3.0)	4.5 (4.3, 4.8)	5.3 (4.9, 5.7)
Other (5)	Exchangeable	0	7	0.0 (0.0, 0.0)				
	Fixed	213	10773	1.3 (1.1, 1.6)	1.8 (1.6, 2.1)	2.1 (1.8, 2.4)		
TOTAL	**TOTAL**	**8365**	**221619**					

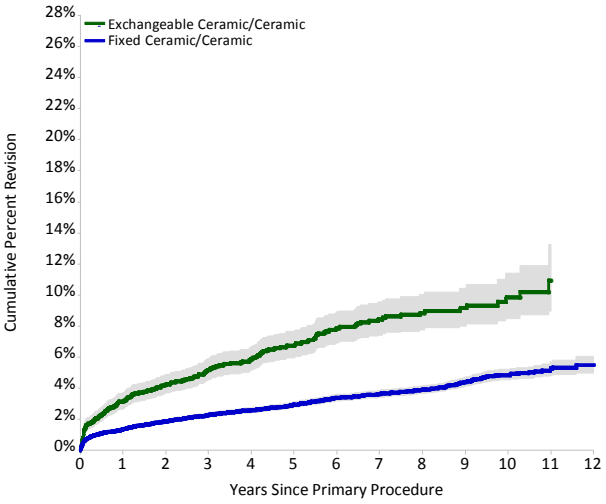
Note: Excludes 152 procedures where the bearing surface is yet to be identified.
'Cross-linked Polyethylene' is reported as 'XL Poly' in the above table

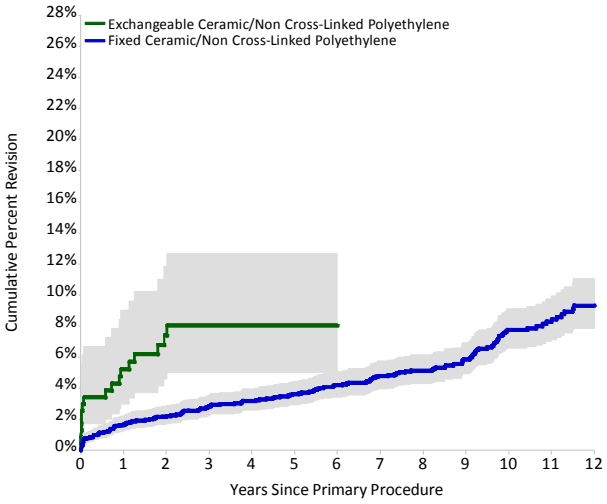
Table HT21: Cumulative Percent Revision of Primary Total Conventional Hip Replacement using an Exchangeable Femoral Neck by Prosthesis Type (Primary Diagnosis OA)

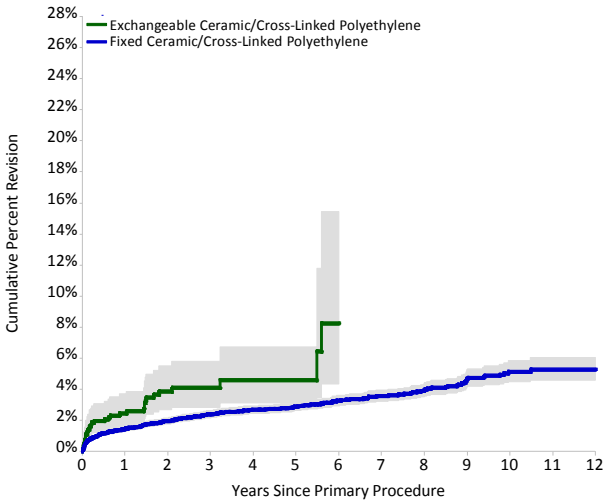
Prosthesis Type	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
ABGII	28	230	3.9 (2.1, 7.4)	10.3 (6.6, 16.0)			
Adapter	82	731	3.4 (2.3, 5.0)	7.7 (5.9, 9.9)	13.3 (10.7, 16.5)		
Apex	97	1980	2.6 (2.0, 3.4)	4.4 (3.6, 5.5)	6.0 (4.9, 7.4)		
F2L	56	693	3.2 (2.1, 4.8)	5.5 (4.1, 7.5)	6.9 (5.2, 9.1)	8.1 (6.3, 10.5)	
Femoral Neck (Amplitude)	13	524	1.0 (0.4, 2.3)	2.7 (1.5, 4.9)			
M-Cor	4	110	0.0 (0.0, 0.0)	2.8 (0.9, 8.4)			
M/L Taper Kinectiv	62	1919	2.6 (2.0, 3.4)	3.8 (2.9, 4.9)			
MBA	42	591	2.2 (1.3, 3.8)	4.4 (3.0, 6.5)	5.9 (4.1, 8.3)	10.3 (7.3, 14.3)	
MSA	15	187	6.5 (3.6, 11.4)				
Margron	74	553	5.3 (3.7, 7.5)	7.3 (5.4, 9.8)	9.4 (7.2, 12.2)	15.3 (12.1, 19.2)	
Metha	10	84	10.7 (5.7, 19.6)	11.9 (6.6, 21.0)			
Profemur	49	1048	2.9 (2.0, 4.1)	5.0 (3.7, 6.7)	5.7 (4.2, 7.7)		
R120	5	152	1.3 (0.3, 5.2)	2.9 (1.1, 7.7)			
Other (6)	7	169	1.9 (0.6, 5.7)	4.5 (2.0, 10.0)			
TOTAL	**544**	**8971**					

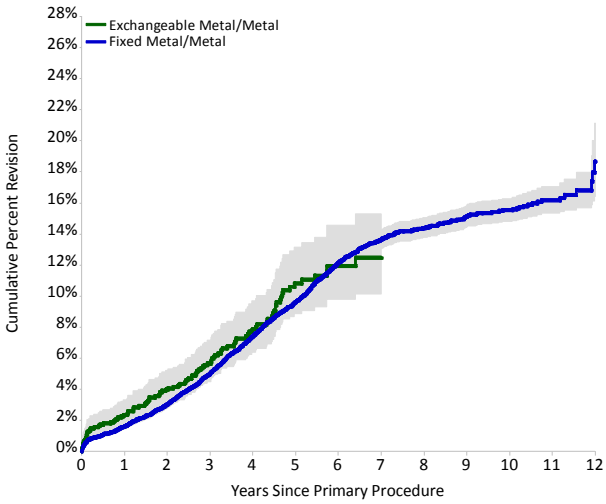
Note: Only Femoral Neck Prostheses with over 60 procedures have been listed.
The AOANJRR has reclassified some components, therefore some components no longer appear in the table

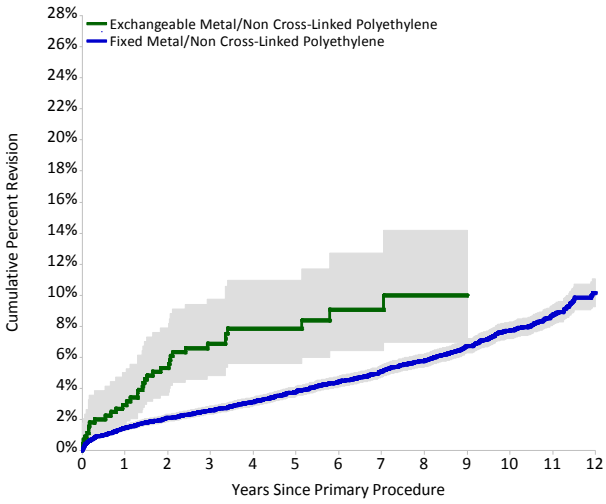
Figure HT24: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Type of Femoral Neck and Bearing Surface (Primary Diagnosis OA)

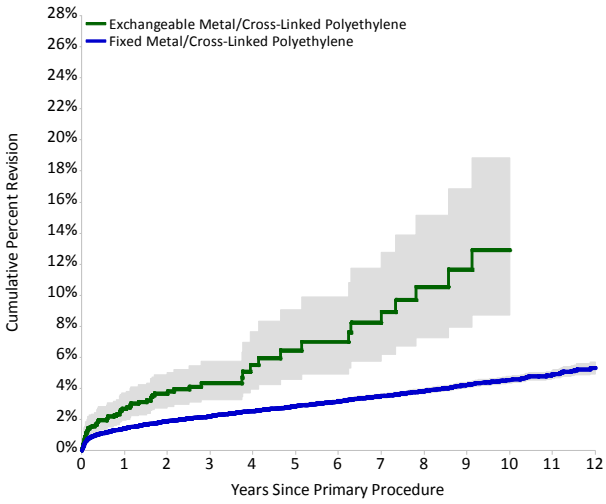












Data Period: 1 Sept 1999 – 31 Dec 2012

Bearing Surface

Bearing surface is a combination of the material used for the femoral head and acetabular insert or cup. For this analysis the Registry identified three types of femoral head (metal, ceramic and ceramicised metal) and four types of acetabular articular surface (cross-linked polyethylene, non cross-linked polyethylene, ceramic and metal).

Comparison of Bearing Surfaces

The Registry has information on ten bearing surfaces. The three most common bearings are metal/cross-linked polyethylene, ceramic/ceramic and ceramic/cross-linked polyethylene. There is no difference in revision rates when metal/cross-linked and ceramic/cross-linked polyethylene are compared (Tables HT22 and HT23 and Figure HT25).

Metal/cross-linked polyethylene has a lower rate of revision compared to ceramic/ceramic bearings and also compared to non cross-linked polyethylene when used with either metal or ceramic femoral heads (Tables HT22 and HT23 and Figure HT25). A more detailed analysis of cross-linked polyethylene and the three most common bearing surfaces follows.

Ceramicised metal/cross-linked polyethylene has the lowest cumulative percent revision at five years (2.0%) (Tables HT22 and HT23 and Figure HT25). As the Registry has mentioned in previous reports, this result should be interpreted with caution. This bearing is a single company product that has only been used with a small number of femoral stem and acetabular component combinations. Unlike the other widely used bearings, it is not possible to correct for the confounding effect of the femoral and acetabular prostheses. It is not clear if the lower rate of revision is an effect of the bearing surface or reflects the use of a limited number of femoral and acetabular prostheses.

Metal/metal bearings have the highest rate of revision of all bearing surfaces. The Registry has previously reported that this increased rate of revision is associated with the use of large head (>32mm) metal/metal bearings. There was almost no use of metal/metal bearings in 2012 with only 110 (76 ≤32mm and 34 >32mm) procedures being reported.

In addition, the Registry has information on two types of ceramic and metal bearings. These have been used in small numbers (316 ceramic/metal and 53 metal/ceramic).

Due to infrequent use in 2012, the metal/metal analysis as well as an analysis of ceramic/metal and metal/ceramic bearings have not been included in this report but is available in supplementary reports on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2013.

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

Bearing Surface	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Ceramic/Ceramic	1549	50533	1.5 (1.4, 1.6)	2.5 (2.4, 2.7)	3.3 (3.1, 3.5)	5.3 (5.0, 5.6)	6.2 (5.6, 7.0)
Ceramic/Non-XL Poly	178	2961	1.9 (1.5, 2.5)	3.2 (2.6, 4.0)	4.0 (3.3, 4.8)	8.0 (6.8, 9.4)	9.6 (8.1, 11.3)
Ceramic/XL Poly	551	21192	1.5 (1.3, 1.7)	2.5 (2.2, 2.7)	3.0 (2.7, 3.3)	5.3 (4.6, 6.0)	5.6 (4.8, 6.5)
Ceramic/Metal	10	300	1.7 (0.7, 4.0)	3.6 (1.9, 6.7)			
Metal/Metal	2114	19422	1.7 (1.5, 1.8)	5.1 (4.8, 5.4)	9.7 (9.2, 10.1)	15.5 (14.8, 16.3)	18.6 (16.4, 21.0)
Metal/Non-XL Poly	945	15949	1.5 (1.3, 1.7)	2.7 (2.5, 3.0)	3.9 (3.6, 4.2)	7.8 (7.3, 8.4)	10.2 (9.4, 11.2)
Metal/XL Poly	2815	100782	1.4 (1.4, 1.5)	2.2 (2.1, 2.3)	2.9 (2.8, 3.0)	4.6 (4.4, 4.8)	5.4 (5.0, 5.8)
Metal/Ceramic	5	49	6.2 (2.0, 17.9)	6.2 (2.0, 17.9)	6.2 (2.0, 17.9)	12.2 (5.1, 27.5)	
Ceramicised Metal/Non-XL Poly	22	276	1.8 (0.8, 4.3)	3.7 (2.0, 6.8)	4.1 (2.3, 7.3)		
Ceramicised Metal/XL Poly	176	10154	1.3 (1.1, 1.5)	1.7 (1.4, 2.0)	2.0 (1.7, 2.3)		
TOTAL	**8365**	**221618**					

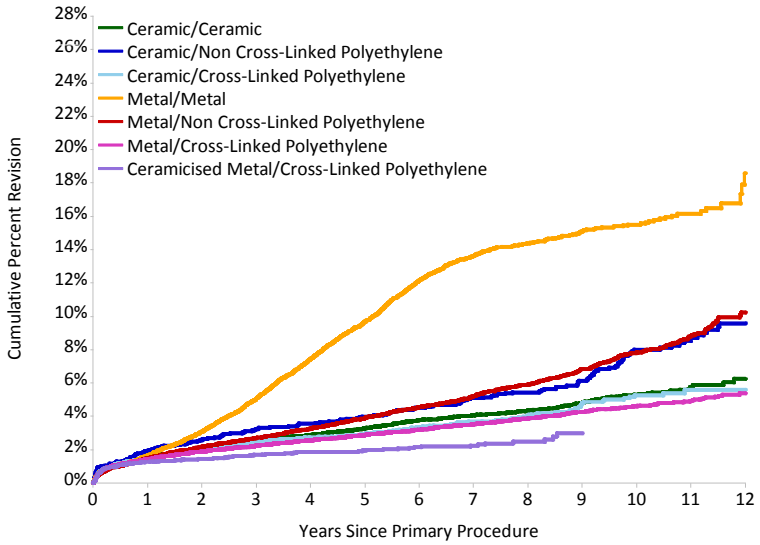
Note: Excludes 152 procedures with unknown bearing surface and one procedure with Ceramicised Metal/Ceramic bearing surface
'Cross-linked Polyethylene' is reported as 'XL Poly' in the above table

Table HT23: Hazard Rate Comparison of Primary Total Conventional Hip Replacement by Bearing Surface (Primary Diagnosis OA)

Bearing Surface	Time Period	Hazard Ratio*	P value
Metal/Cross-linked Polyethylene		**1**	
Ceramic/Ceramic	Entire Period	1.09 (1.02, 1.16)	0.012
Ceramic/Non Cross-linked Polyethylene	Entire Period	1.58 (1.36, 1.84)	<0.001
Ceramic/Cross-linked Polyethylene	Entire Period	1.04 (0.95, 1.14)	0.415
Metal/Metal	0 - 2Wk	1.35 (1.04, 1.75)	0.024
	2Wk - 6Mth	0.87 (0.74, 1.04)	0.123
	6Mth - 9Mth	1.19 (0.85, 1.67)	0.303
	9Mth - 1.5Yr	2.40 (2.04, 2.82)	<0.001
	1.5Yr - 2Yr	3.57 (2.93, 4.34)	<0.001
	2Yr - 3Yr	5.22 (4.55, 5.99)	<0.001
	3Yr - 6Yr	7.40 (6.72, 8.14)	<0.001
	6Yr - 7Yr	5.03 (4.00, 6.32)	<0.001
	7Yr+	2.11 (1.68, 2.66)	<0.001
Metal/Non Cross-linked Polyethylene	0 - 3Mth	0.88 (0.73, 1.06)	0.186
	3Mth - 9Mth	1.27 (0.99, 1.62)	0.055
	9Mth - 3.5Yr	1.51 (1.32, 1.72)	<0.001
	3.5Yr - 6.5Yr	1.94 (1.67, 2.25)	<0.001
	6.5Yr+	2.43 (2.09, 2.82)	<0.001
Ceramicised Metal/ Cross-linked Polyethylene	0 - 2Wk	0.68 (0.42, 1.10)	0.113
	2Wk - 6Mth	1.05 (0.85, 1.30)	0.641
	6Mth+	0.50 (0.39, 0.63)	<0.001

Note: Only bearing surfaces with more than 1,000 procedures are included in the analysis
** Hazard Ratios have been adjusted for age and gender*

Figure HT25: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Bearing Surface (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Ceramic/Ceramic	50533	42704	29276	19729	3918	285
Ceramic/Non Cross-linked Polyethylene	2961	2655	2289	2055	934	231
Ceramic/Cross-linked Polyethylene	21192	16987	10532	6398	993	147
Metal/Metal	19422	18852	16582	10952	1384	118
Metal/Non Cross-linked Polyethylene	15949	15099	13497	11505	4108	543
Metal/Cross-linked Polyethylene	100782	87223	62834	42591	7736	893
Ceramicised Metal/Cross-Linked Polyethylene	10154	8230	5299	3344	0	0

Cross-linked Polyethylene

Cross-linked polyethylene has been used in 132,128 procedures reported to the Registry. This includes 1,059 procedures that have cross-linked polyethylene with the addition of Vitamin E. The Registry has previously identified that cross-linked polyethylene has a lower revision rate compared to non cross-linked polyethylene. In this year's report a more detailed analysis is presented including a comparison of cross-linked and non cross-linked polyethylene for specific acetabular prostheses.

Cross-linked polyethylene has a lower rate of revision compared to non cross-linked polyethylene and this is evident after only three months (Table HT24 and Figure HT26). The difference increases with time and the 12 year cumulative percent revision is 5.3% and 10.1% respectively. The reasons for the lower rate of revision are a reduced rate of revision for both dislocation and loosening/lysis.

When considering all reasons for revision there is variation in revision rate depending on head size. This is most evident in the non cross-linked polyethylene group where the rate of revision increases as head size increases. In the cross-linked polyethylene group, the 32mm head size has the lowest rate of revision (Table HT24 and Figures HT28 and HT29).

At one year, the cumulative incidence of revision for prosthesis dislocation is 0.4% for cross-linked compared to 0.7% for non cross-linked polyethylene (Figure HT27). Head sizes of 32mm or more were used in 56.5% of cross-linked polyethylene procedures and only 12.7% of non cross-linked polyethylene procedures. There is no difference in the rate of revision for dislocation between cross-linked and non cross-linked polyethylene when head sizes 32mm or less than 32mm are compared. The reason the rate of revision for dislocation differs between cross-linked and non cross-linked polyethylene is because there is a higher proportion of larger head sizes used with cross-linked polyethylene. This may also explain the early difference in the overall rate of revision between the two types of polyethylene.

At 12 years, the cumulative incidence of revision for loosening/lysis is 1.5% for cross-linked compared to 4.2% for non cross-linked polyethylene (Figure HT27). This lower rate of revision for loosening/lysis when cross-linked polyethylene is used is evident within each head size group (Figure HT30).

Cross-linked polyethylene and non cross-linked polyethylene are combined with three different femoral head bearing surfaces; ceramic, metal and ceramicised metal. Within each of these bearing surfaces, there is a lower rate of revision for cross-linked polyethylene compared to non cross-linked polyethylene (Figure HT31). For a ceramic head, this difference is over the entire period. For metal and ceramicised metal heads the difference is only apparent after nine months and 1.5 years respectively.

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

The Reflection Cup has an eight year follow-up for both types of polyethylene. Cross-linked polyethylene has been used in 47.4% of Reflection Cup total conventional hip procedures. Cross-linked polyethylene has a lower rate of revision after 3.5 years compared to non cross-linked polyethylene (Table HT25 and Figure HT32). All non cross-linked and 89.0% of cross-linked polyethylene procedures use head sizes 32mm or less. The lower rate of revision in cross-linked polyethylene is due to a lower rate of revision for loosening/lysis. For procedures with head sizes 32mm or less, the five year cumulative incidence of revision for loosening/lysis is 0.9% for cross-linked and 1.3% for non cross-linked polyethylene.

The Allofit Shell has a ten year follow-up with an insert using both types of polyethylene. Cross-linked polyethylene is used in 87.4% of Allofit Shell total conventional hip procedures. Cross-linked polyethylene has a lower rate of revision compared to non cross-linked polyethylene (Table HT25 and Figure HT33). All non cross-linked and 77.0% of cross-linked polyethylene procedures use head sizes 32mm or less. The lower rate of revision when using cross-linked polyethylene inserts is due to a lower incidence for multiple reasons for revision.

The Duraloc Shell has a ten year follow-up with an insert using both types of polyethylene. Cross-linked polyethylene is used in 36.4% of Duraloc Shell total conventional hip procedures. Cross-linked polyethylene has a lower rate of revision after 1.5 years compared to non cross-linked polyethylene (Table HT25 and Figure HT34). All cross-linked and 79% of non cross-linked polyethylene procedures use head sizes 32mm or less. The lower rate of revision in cross-linked polyethylene is due to a lower rate of revision for loosening/lysis. The ten year cumulative incidence of revision for loosening/lysis is 1.4% for cross-linked and 4.3% for non cross-linked polyethylene.

The Reflection Shell has an 11 year follow-up period with an insert using both types of polyethylene. Cross-linked polyethylene is used in 82.0% of Reflection Shell

total conventional hip procedures. Cross-linked polyethylene has a lower rate of revision after three months compared to non cross-linked polyethylene (Table HT25 and Figure HT35). All non cross-linked and cross-linked polyethylene procedures use head sizes 32mm or less. The lower rate of revision in cross-linked polyethylene is due to a lower rate of revision for prosthesis dislocation and loosening/lysis. The one year cumulative incidence of revision for prosthesis dislocation is 0.2% for cross-linked and 0.7% for non cross-linked polyethylene. The ten year cumulative incidence of revision for loosening/lysis is 0.9% for cross-linked and 4.6% for non cross-linked polyethylene.

Table HT24: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Type of Polyethylene (Primary Diagnosis OA)

Polyethylene by Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Non Cross-linked	**1145**	**19186**	**1.6 (1.4, 1.7)**	**2.8 (2.6, 3.1)**	**3.9 (3.6, 4.2)**	**7.9 (7.4, 8.4)**	**10.1 (9.4, 10.9)**
<32mm	1052	16749	1.5 (1.3, 1.7)	2.7 (2.4, 2.9)	3.8 (3.5, 4.1)	7.8 (7.4, 8.4)	10.0 (9.3, 10.8)
32mm	66	1823	1.8 (1.3, 2.5)	3.5 (2.7, 4.5)	4.0 (3.1, 5.1)		
>32mm	27	614	3.1 (1.9, 4.9)	6.7 (4.3, 10.4)	8.6 (5.5, 13.4)		
Cross-linked	**3542**	**132128**	**1.4 (1.4, 1.5)**	**2.2 (2.1, 2.3)**	**2.8 (2.7, 2.9)**	**4.6 (4.4, 4.8)**	**5.3 (5.0, 5.7)**
<32mm	2007	57589	1.4 (1.4, 1.5)	2.3 (2.2, 2.4)	3.0 (2.8, 3.1)	4.8 (4.6, 5.0)	5.5 (5.1, 5.9)
32mm	863	43397	1.3 (1.2, 1.4)	2.0 (1.9, 2.2)	2.4 (2.3, 2.6)	3.5 (3.1, 3.9)	
>32mm	672	31142	1.5 (1.4, 1.6)	2.3 (2.1, 2.5)	3.1 (2.8, 3.4)	5.1 (3.5, 7.5)	
Total	**4687**	**151314**					

Figure HT26: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Type of Polyethylene (Primary Diagnosis OA)

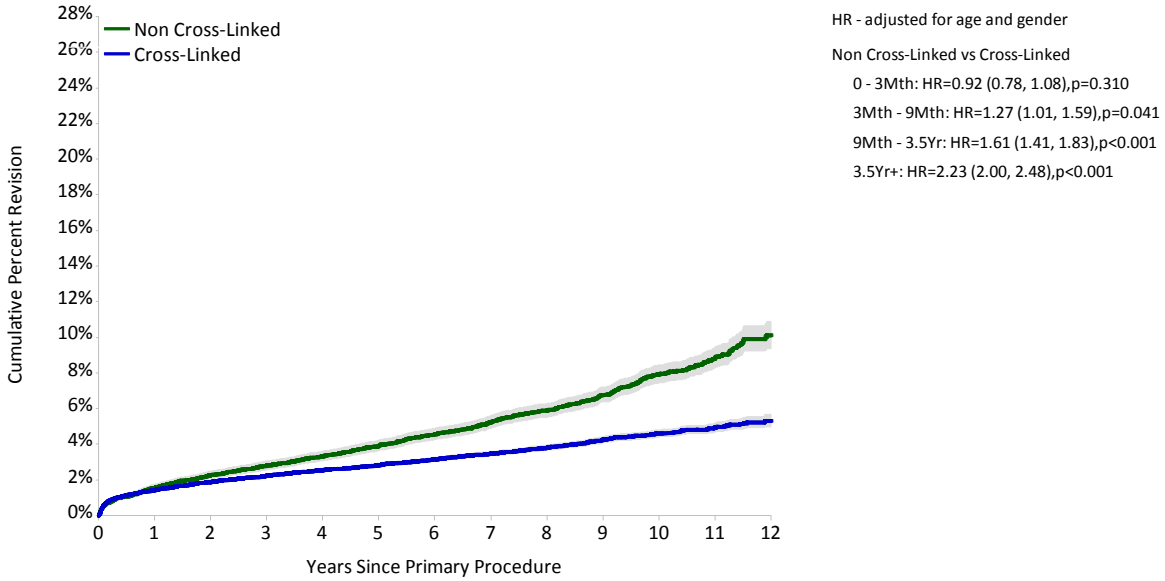


Figure HT27: Cumulative Incidence Revision Diagnosis of Primary Total Conventional Hip Replacement by Type of Polyethylene (Primary Diagnosis OA)

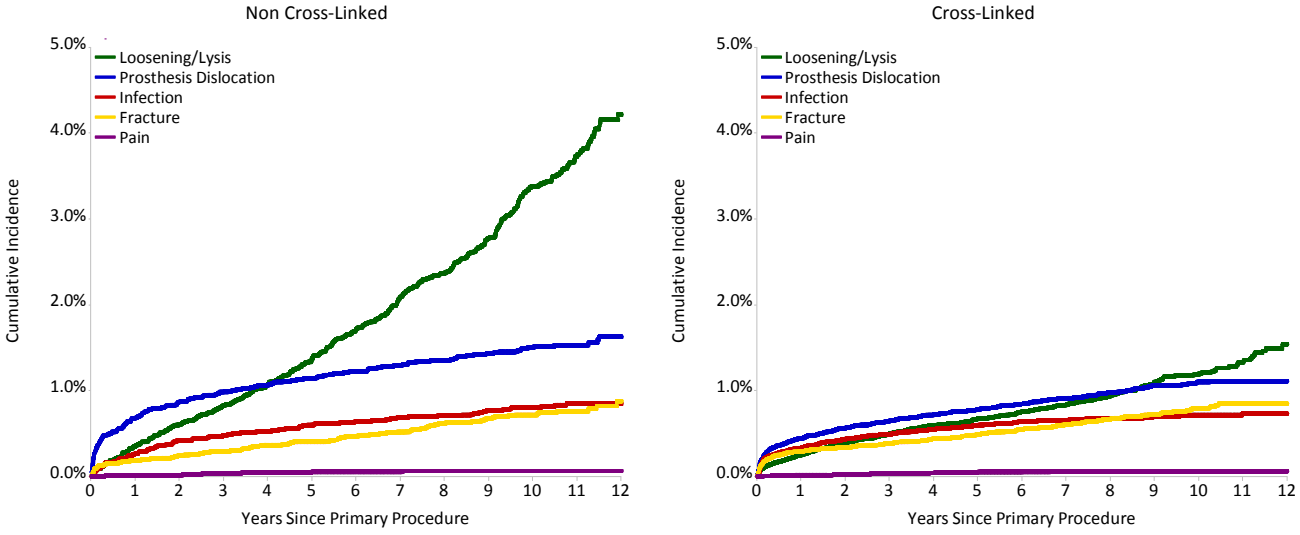
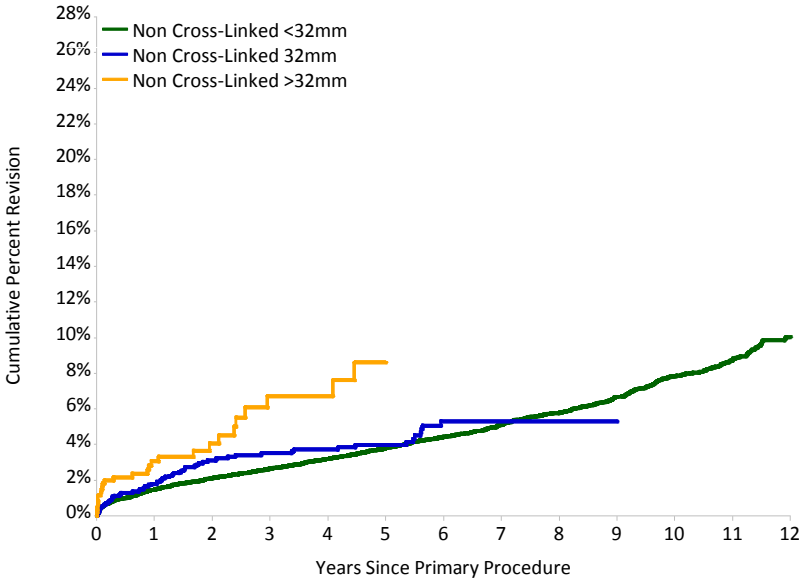


Figure HT28: Cumulative Percent Revision of Primary Total Conventional Hip Replacement using Non Cross-linked Polyethylene by Head Size (Primary Diagnosis OA)



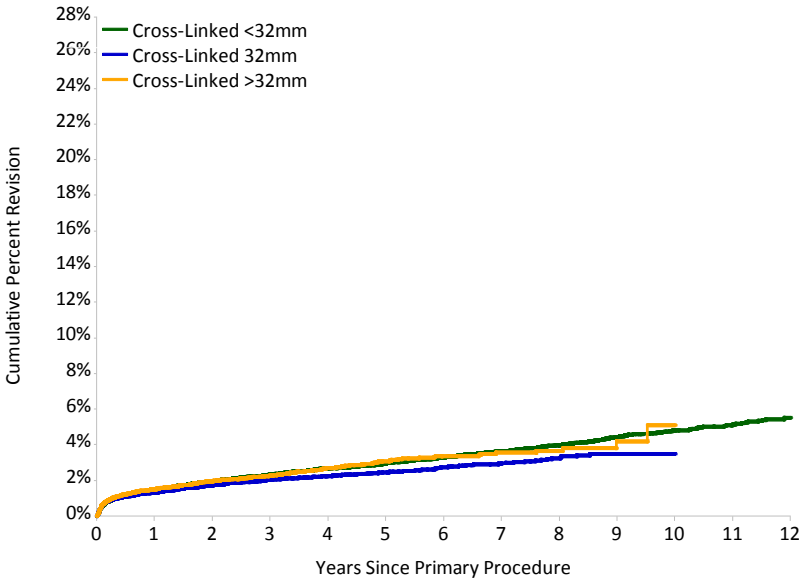
HR - adjusted for age and gender

Non Cross-Linked 32mm vs Non Cross-Linked <32mm
Entire Period: HR=1.17 (0.91, 1.50),p=0.222

Non Cross-Linked >32mm vs Non Cross-Linked <32mm
Entire Period: HR=2.08 (1.41, 3.06),p<0.001

Non Cross-Linked >32mm vs Non Cross-Linked 32mm
Entire Period: HR=1.78 (1.14, 2.78),p=0.012

Figure HT29: Cumulative Percent Revision of Primary Total Conventional Hip Replacement using Cross-linked Polyethylene by Head Size (Primary Diagnosis OA)



HR - adjusted for age and gender

Cross-Linked <32mm vs Cross-Linked 32mm
0 - 1Mth: HR=0.97 (0.83, 1.13),p=0.687
1Mth+: HR=1.25 (1.15, 1.37),p<0.001

Cross-Linked >32mm vs Cross-Linked 32mm
Entire Period: HR=1.15 (1.04, 1.28),p=0.006

Cross-Linked <32mm vs Cross-Linked >32mm
Entire Period: HR=1.02 (0.94, 1.12),p=0.602

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Non Cross-linked	**19186**	**18023**	**16031**	**13774**	**5042**	**774**
<32mm	16749	16080	14875	13086	5003	773
32mm	1823	1535	1013	624	39	1
>32mm	614	408	143	64	0	0
Cross-linked	**132128**	**112440**	**78665**	**52333**	**8729**	**1040**
<32mm	57589	53567	45801	37182	8485	1037
32mm	43397	34704	20402	10556	187	3
>32mm	31142	24169	12462	4595	57	0

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

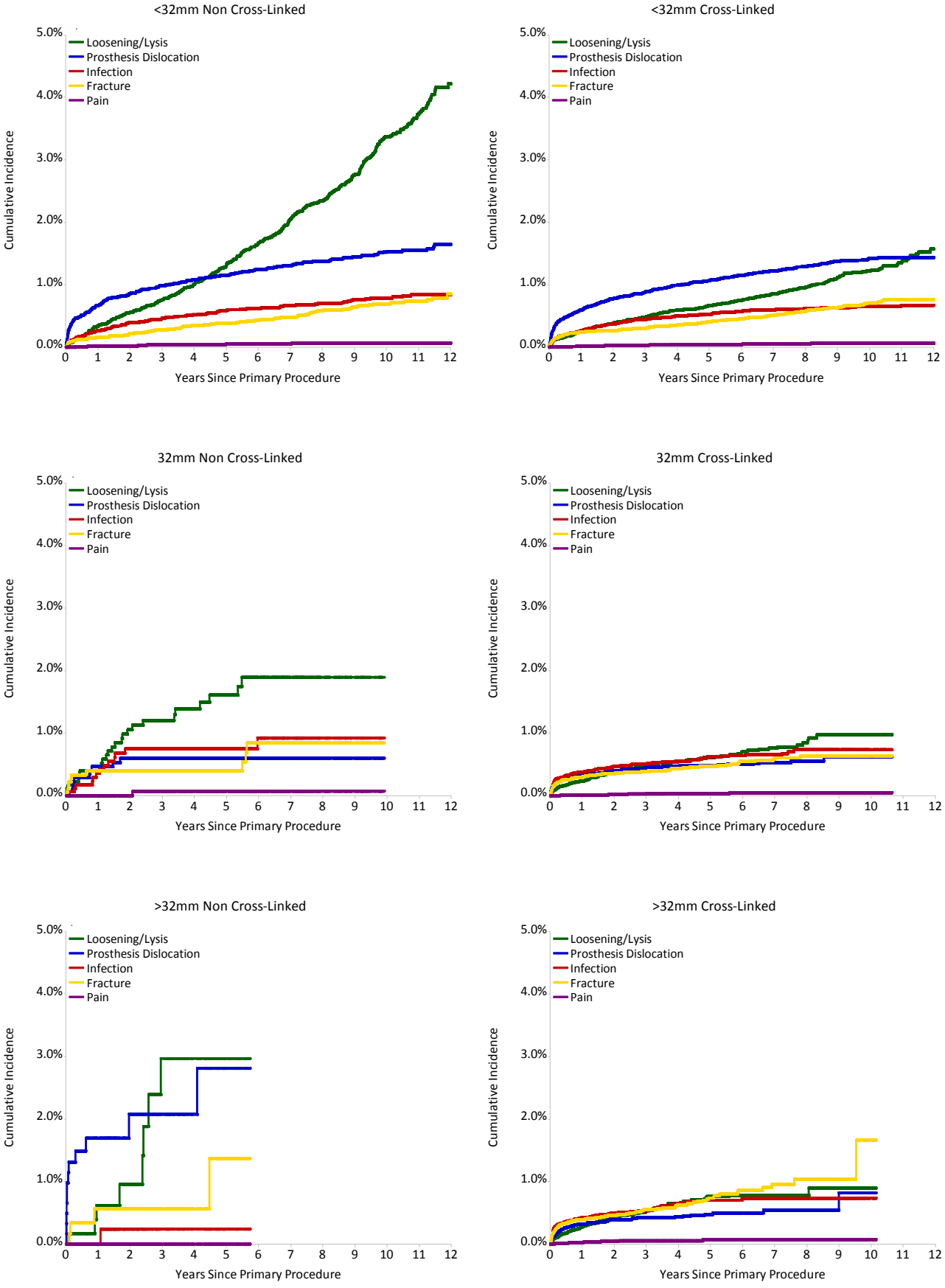
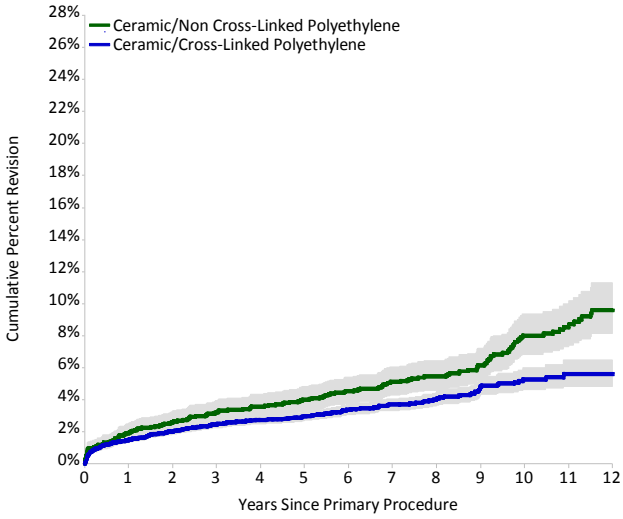
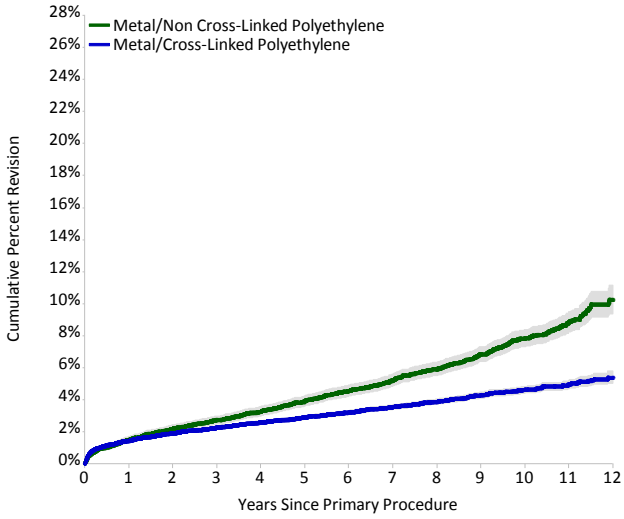


Figure HT31: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Head Surface and Type of Polyethylene (Primary Diagnosis OA)





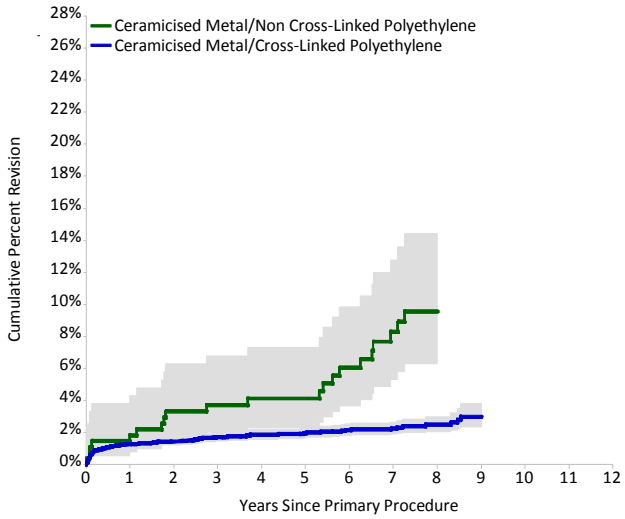


Table HT25: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Prosthesis Type and Polyethylene Bearing Surface (Primary Diagnosis OA)

Prosthesis Type		N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Reflection (Cup)	Non Cross-linked	82	1073	0.6 (0.3, 1.3)	1.9 (1.3, 3.0)	3.3 (2.4, 4.6)	10.7 (8.6, 13.4)	12.4 (9.7, 15.8)
	Cross-linked	17	967	1.2 (0.7, 2.1)	1.4 (0.8, 2.4)	2.2 (1.3, 3.5)		
	Total	**99**	**2040**					
Allofit (Shell)	Non Cross-linked	40	841	1.6 (0.9, 2.7)	2.3 (1.5, 3.6)	3.2 (2.2, 4.7)	5.2 (3.8, 7.1)	
	Cross-linked	124	5823	1.2 (0.9, 1.5)	1.8 (1.5, 2.2)	2.3 (1.9, 2.8)	3.4 (2.7, 4.2)	
	Total	**164**	**6664**					
Duraloc (Shell)	Non Cross-linked	239	2992	1.6 (1.2, 2.1)	2.8 (2.3, 3.5)	4.1 (3.4, 4.8)	9.0 (7.9, 10.3)	12.1 (10.4, 14.0)
	Cross-linked	56	1713	1.3 (0.9, 2.0)	2.2 (1.6, 3.0)	2.9 (2.2, 3.9)	5.3 (3.7, 7.7)	
	Total	**295**	**4705**					
Reflection (Shell)	Non Cross-linked	189	2316	1.6 (1.2, 2.2)	3.2 (2.6, 4.0)	4.3 (3.5, 5.2)	9.9 (8.5, 11.5)	12.8 (10.7, 15.3)
	Cross-linked	238	10563	1.1 (0.9, 1.3)	1.6 (1.4, 1.9)	2.0 (1.7, 2.3)	3.6 (3.0, 4.5)	
	Total	**427**	**12879**					

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

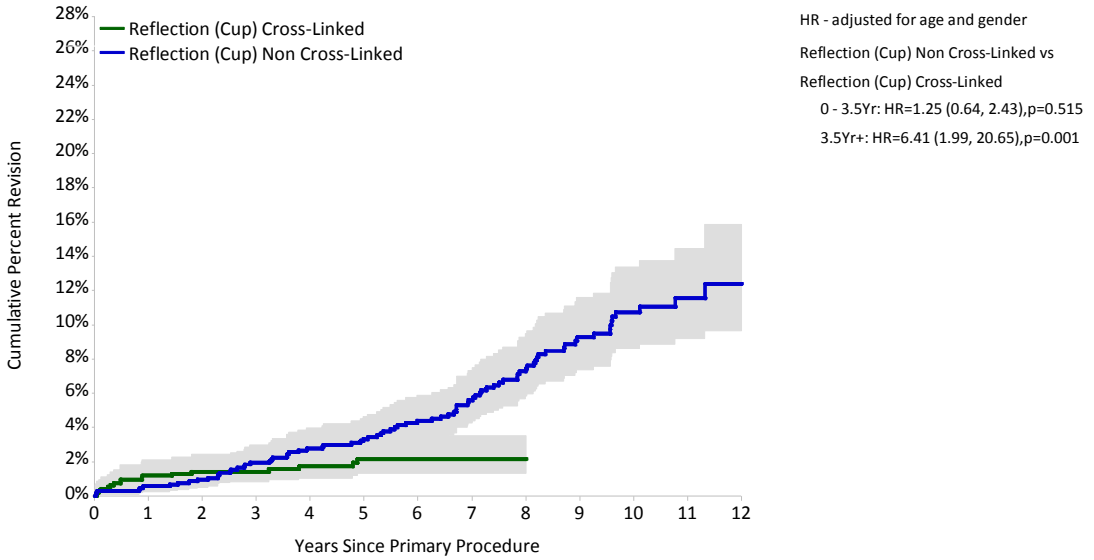


Figure HT33: Cumulative Percent Revision of Allofit (Shell) Primary Total Conventional Hip Replacement by Type of Polyethylene (Primary Diagnosis OA)

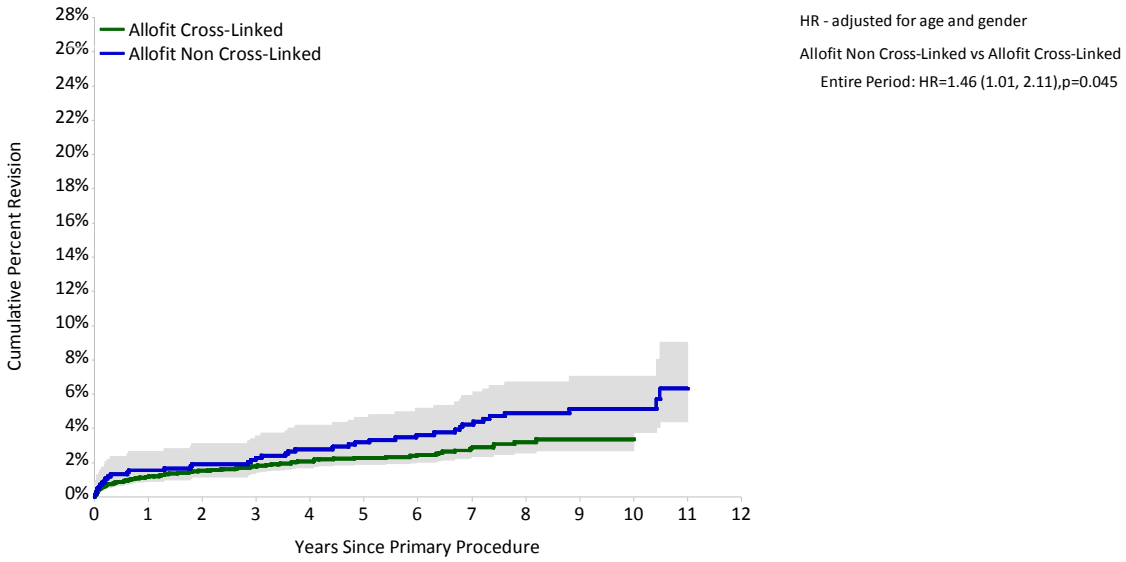


Figure HT34: Cumulative Percent Revision of Duraloc (Shell) Primary Total Conventional Hip Replacement by Type of Polyethylene (Primary Diagnosis OA)

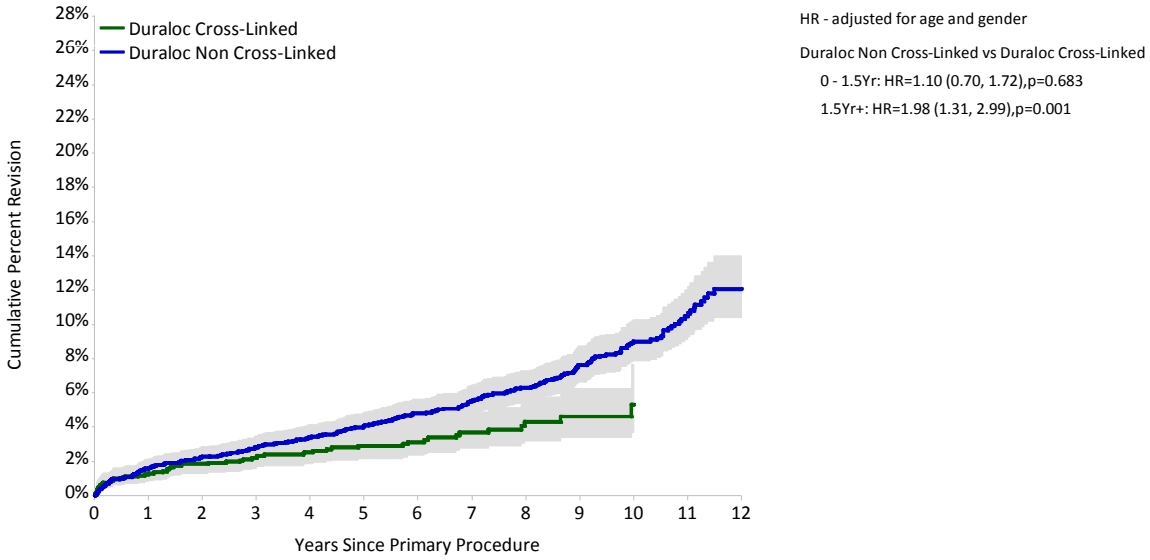
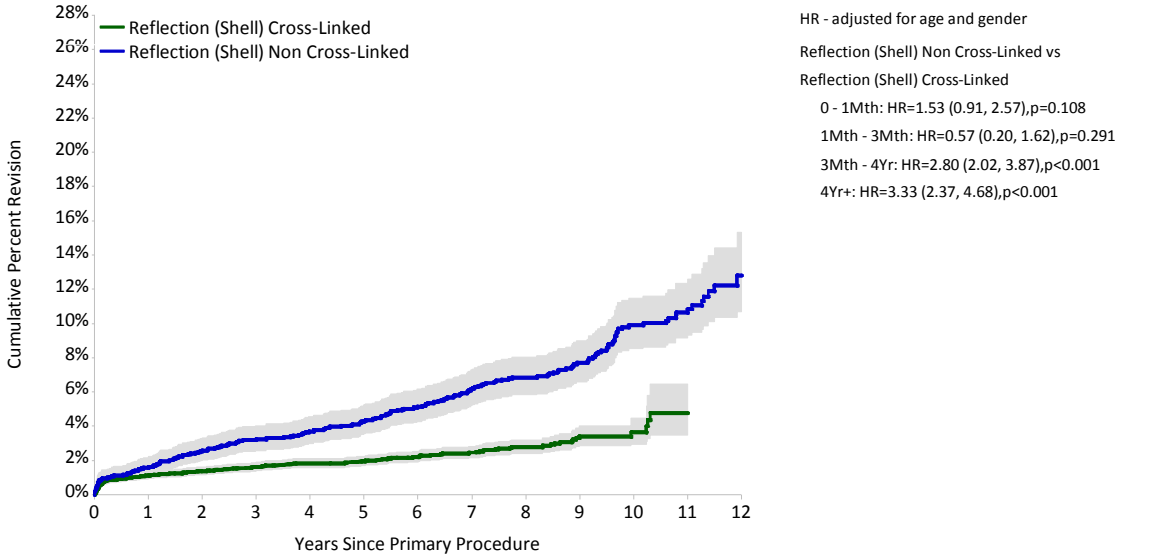


Figure HT35: Cumulative Percent Revision of Reflection (Shell) Primary Total Conventional Hip Replacement by Type of Polyethylene (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Reflection (Cup)	Non Cross-linked	1073	1045	969	854	306	42
	Cross-linked	967	868	673	432	0	0
Allofit (Shell)	Non Cross-linked	841	822	785	714	231	7
	Cross-linked	5823	5125	3708	2296	118	0
Duraloc (Shell)	Non Cross-linked	2992	2913	2741	2555	1105	130
	Cross-linked	1713	1650	1422	969	133	0
Reflection (Shell)	Non Cross-linked	2316	2237	2111	1936	822	134
	Cross-linked	10563	9928	8475	6498	376	7

Ceramic on Ceramic Bearing

Ceramic on ceramic bearings are the second most common bearing reported to the Registry. This bearing has been used in 50,533 primary total conventional hip replacement undertaken for osteoarthritis. This year the Registry is reporting an expanded analysis for ceramic on ceramic bearing surface. This analysis includes outcome by head size and fixation, as well as head size, age and gender within fixation.

To evaluate the effect of head size an analysis was undertaken comparing four head size groups (≤28, 30-32, 36-38, ≥40mm). The follow-up period for the ≥40mm head size is much shorter than the other three head sizes. Head sizes 30-32mm have a lower rate of revision compared to head sizes 28mm or less. There is no difference between head sizes 30-32mm when compared to the two larger head size groups (Table HT26 and Figure HT36). Head sizes 28mm or less have a higher rate of revisions for prosthesis dislocation compared to the other head size groups. At one year, the cumulative incidence of dislocation is 1.0% for head sizes 28mm or less compared to 0.4% for 30-32mm, 0.3% for 36-38mm and 0.2% for head sizes 40mm or larger (Figure HT37).

The majority of procedures using ceramic on ceramic bearing surfaces are cementless (84.4%). Hybrid fixation accounts for 15.6%. Hybrid fixation has a lower rate of revision in the first 2.5 years compared to cementless fixation (Table HT27 and Figure HT38).

The use of cementless fixation does not affect head size related variation in the rates of revision. The higher rate of revision of smaller head sizes (28mm or less) is still evident (Table HT28 and Figure HT39). Those aged 75 years or older have a higher rate of revision compared to the three younger age groups (Table HT28 and Figure HT40). This most likely reflects the use of cementless fixation rather than the bearing. There does not appear to be a clinically gender related difference for ceramic on ceramic bearings when cementless fixation is used (Table HT28 and Figure HT41).

The use of hybrid fixation does not alter the head size related variation in the rates of revision (Table HT29 and Figure HT42). The age related difference with cementless fixation is not as evident when hybrid fixation is used (Table HT29 and Figure HT43). There is no gender difference in the rate of revision for hybrid fixation (Table HT29 and Figure HT44).

Table HT26: Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)

Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
≤28mm	355	6322	2.1 (1.8, 2.5)	3.4 (3.0, 3.9)	4.3 (3.8, 4.9)	6.5 (5.9, 7.3)	7.8 (6.8, 9.0)
30-32mm	658	21067	1.4 (1.2, 1.6)	2.3 (2.1, 2.6)	3.0 (2.7, 3.3)	5.0 (4.5, 5.4)	5.2 (4.7, 5.8)
36-38mm	488	19886	1.5 (1.3, 1.7)	2.5 (2.3, 2.8)	3.3 (3.0, 3.7)	5.0 (4.2, 6.1)	
≥40mm	48	3258	1.1 (0.8, 1.5)	2.1 (1.5, 3.0)			
TOTAL	**1549**	**50533**					

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

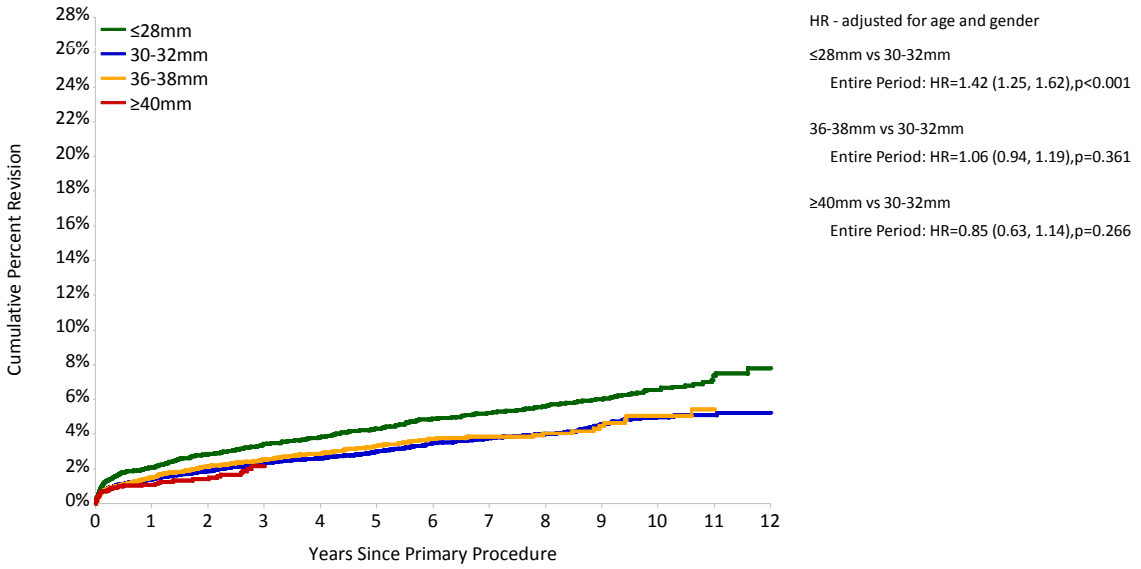
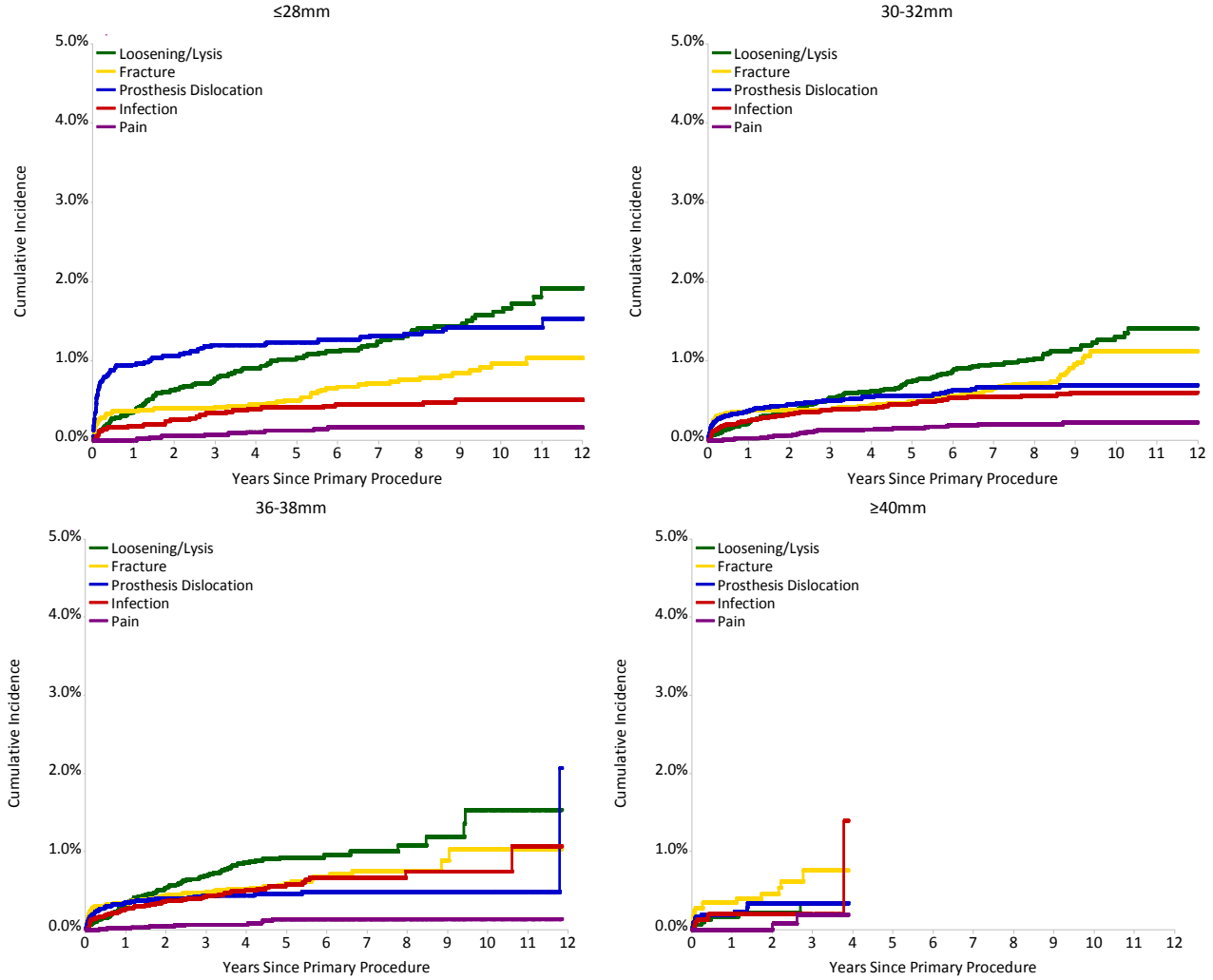


Figure HT37: Cumulative Incidence Revision Diagnosis of Ceramic/Ceramic Primary Total Conventional Hip Replacement by Head Size (Primary Diagnosis OA)



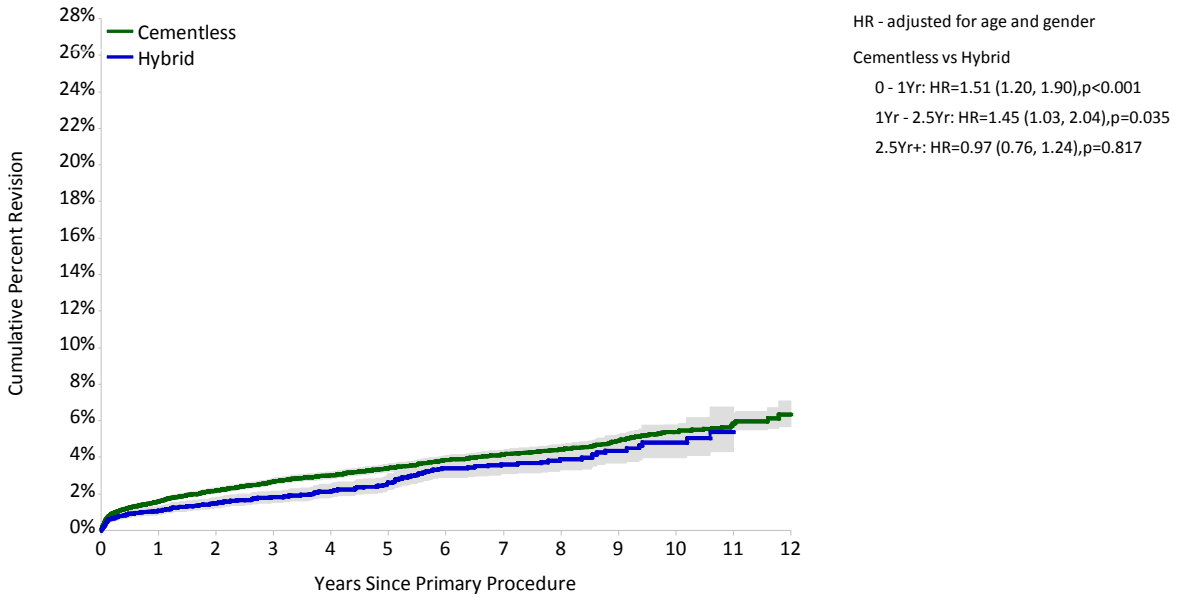
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
≤28mm	6322	6030	5567	4951	1677	151
30-32mm	21067	18812	14501	10778	1885	116
36-38mm	19886	15603	8697	4000	356	18
≥40mm	3258	2259	511	0	0	0

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

Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cementless	1351	42634	1.6 (1.5, 1.7)	2.7 (2.5, 2.9)	3.4 (3.2, 3.6)	5.4 (5.0, 5.8)	6.3 (5.7, 7.1)
Hybrid	198	7876	1.1 (0.9, 1.3)	1.8 (1.5, 2.2)	2.6 (2.2, 3.1)	4.8 (4.0, 5.8)	

Note: excludes 23 procedures using cement fixation. None of these procedures have been revised.

Figure HT38: Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cementless	42634	35889	24407	16626	3472	280
Hybrid	7876	6792	4850	3090	446	5

Table HT28: Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement with Cementless Fixation by Head Size, Age and Gender (Primary Diagnosis OA)

Cementless Fixation		N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Head size	≤28mm	300	4992	2.3 (1.9, 2.8)	3.7 (3.2, 4.2)	4.6 (4.0, 5.2)	6.7 (6.0, 7.6)	8.1 (7.0, 9.4)
	30-32mm	560	16660	1.5 (1.3, 1.7)	2.5 (2.3, 2.8)	3.2 (2.9, 3.5)	5.1 (4.6, 5.6)	5.3 (4.8, 6.0)
	36-38mm	444	17773	1.6 (1.4, 1.8)	2.6 (2.4, 2.9)	3.4 (3.0, 3.7)	5.1 (4.1, 6.2)	
	≥40mm	47	3209	1.1 (0.8, 1.5)	2.1 (1.5, 3.0)			
Age	<55	264	8558	1.4 (1.1, 1.6)	2.4 (2.1, 2.8)	3.3 (2.9, 3.8)	5.3 (4.5, 6.1)	7.6 (5.7, 10.0)
	55-64	450	15374	1.4 (1.2, 1.6)	2.5 (2.2, 2.8)	3.2 (2.9, 3.5)	4.8 (4.3, 5.4)	5.1 (4.5, 5.7)
	65-74	412	13294	1.6 (1.4, 1.8)	2.7 (2.4, 3.0)	3.4 (3.0, 3.7)	5.4 (4.7, 6.1)	6.0 (5.1, 7.1)
	≥75	225	5408	2.4 (2.0, 2.8)	3.5 (3.1, 4.1)	4.3 (3.7, 5.0)	7.8 (6.5, 9.5)	
Gender	Male	656	21325	1.5 (1.3, 1.6)	2.6 (2.4, 2.9)	3.4 (3.1, 3.7)	5.3 (4.8, 5.8)	6.2 (5.2, 7.3)
	Female	695	21309	1.7 (1.5, 1.9)	2.7 (2.5, 3.0)	3.5 (3.2, 3.8)	5.5 (5.0, 6.0)	6.5 (5.7, 7.5)
	Total	**1351**	**42634**	**1.6 (1.5, 1.7)**	**2.7 (2.5, 2.9)**	**3.4 (3.2, 3.6)**	**5.4 (5.0, 5.8)**	**6.3 (5.7, 7.1)**

Figure HT39: Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement with Cementless Fixation by Head Size (Primary Diagnosis OA)

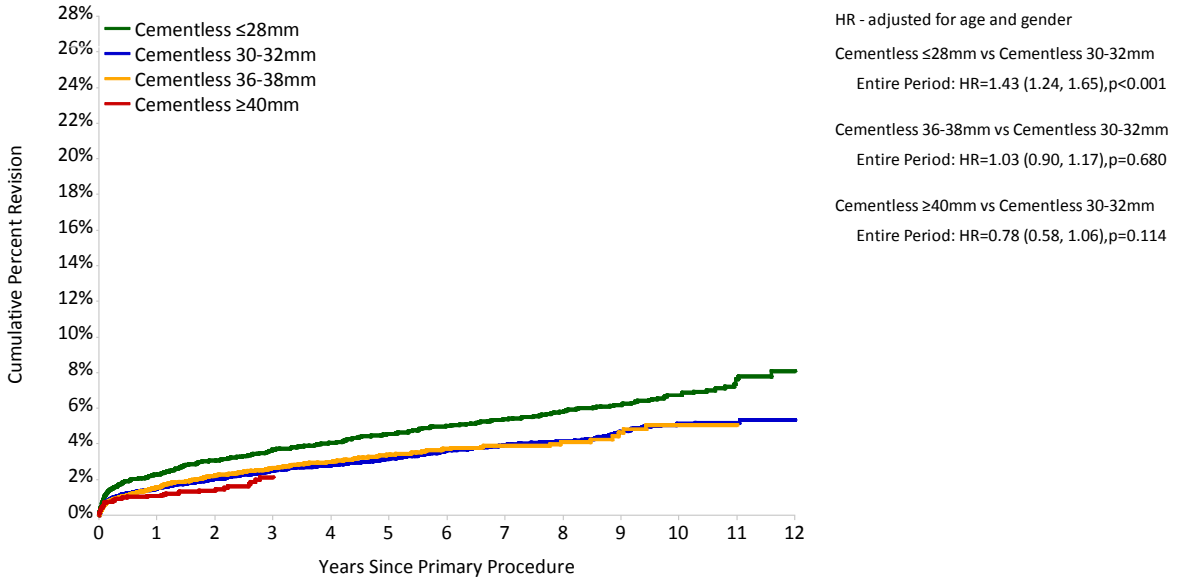


Figure HT40: Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement with Cementless Fixation by Age (Primary Diagnosis OA)

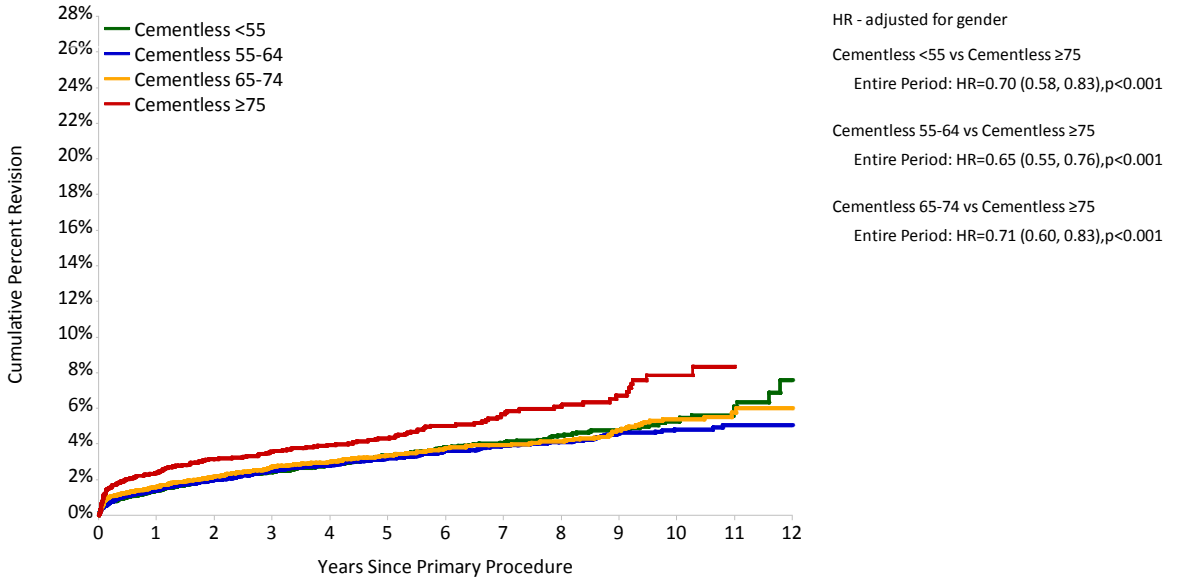
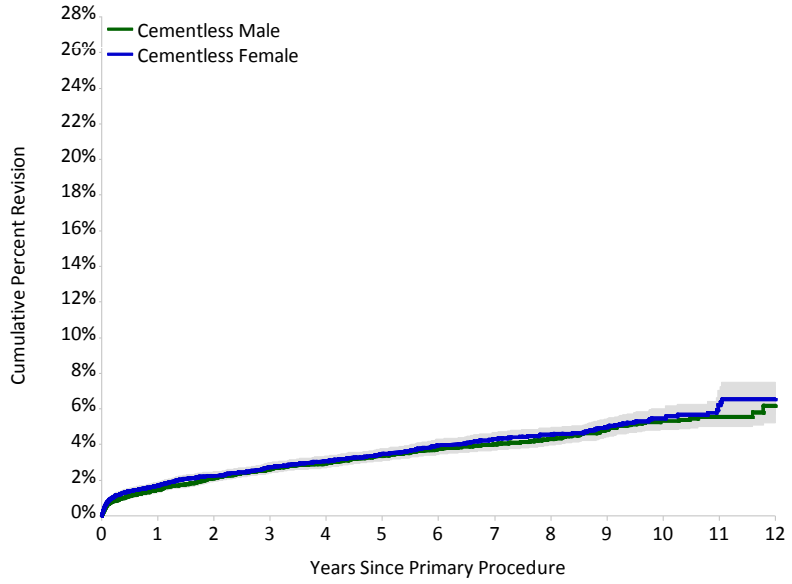


Figure HT41: Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement with Cementless Fixation by Gender (Primary Diagnosis OA)



HR - adjusted for age

Cementless Female vs Cementless Male

0 - 1.5Yr: HR=1.18 (1.02, 1.36),p=0.021

1.5Yr - 2.5Yr: HR=0.56 (0.41, 0.78),p<0.001

2.5Yr+: HR=1.09 (0.90, 1.32),p=0.352

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Head Size	≤28mm	4992	4780	4504	4112	1476	146
	30-32mm	16660	14951	11764	9091	1701	116
	36-38mm	17773	13929	7631	3423	295	18
	≥40mm	3209	2229	508	0	0	0
Age	<55	8558	7165	4773	3329	871	86
	55-64	15374	13101	9061	6242	1369	116
	65-74	13294	11135	7609	5172	1007	72
	≥75	5408	4488	2964	1883	225	6
Gender	Male	21325	17932	12038	8361	1869	163
	Female	21309	17957	12369	8265	1603	117

Table HT29: Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement with Hybrid Fixation by Head Size, Age and Gender (Primary Diagnosis OA)

Hybrid Fixation		N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Head size	≤28mm	55	1326	1.3 (0.8, 2.1)	2.5 (1.7, 3.5)	3.4 (2.5, 4.6)	5.9 (4.4, 7.8)	
	30-32mm	98	4393	1.0 (0.7, 1.4)	1.7 (1.3, 2.1)	2.3 (1.9, 2.9)	4.3 (3.3, 5.7)	
	36-38mm	44	2108	1.0 (0.7, 1.6)	1.6 (1.1, 2.3)	2.7 (1.9, 3.8)	4.6 (2.7, 8.0)	
	≥40mm	1	49	2.6 (0.4, 17.2)				
Age	<55	36	1082	1.2 (0.7, 2.1)	2.3 (1.5, 3.5)	3.3 (2.3, 4.9)	6.2 (4.2, 9.1)	
	55-64	61	2648	0.8 (0.5, 1.2)	1.5 (1.0, 2.1)	2.4 (1.8, 3.3)	4.2 (3.1, 5.7)	
	65-74	56	2628	0.9 (0.6, 1.3)	1.4 (1.0, 2.0)	2.3 (1.7, 3.1)	5.1 (3.5, 7.4)	
	≥75	45	1518	1.8 (1.2, 2.6)	2.7 (2.0, 3.7)	3.1 (2.3, 4.3)	3.9 (2.8, 5.3)	
Gender	Male	97	3557	1.4 (1.0, 1.8)	1.9 (1.4, 2.4)	2.9 (2.3, 3.6)	5.2 (4.0, 6.8)	
	Female	101	4319	0.8 (0.6, 1.2)	1.8 (1.4, 2.2)	2.4 (1.9, 3.0)	4.4 (3.4, 5.8)	
	Total	**198**	**7876**	**1.1 (0.9, 1.3)**	**1.8 (1.5, 2.2)**	**2.6 (2.2, 3.1)**	**4.8 (4.0, 5.8)**	

Figure HT42: Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement with Hybrid Fixation by Head Size (Primary Diagnosis OA)

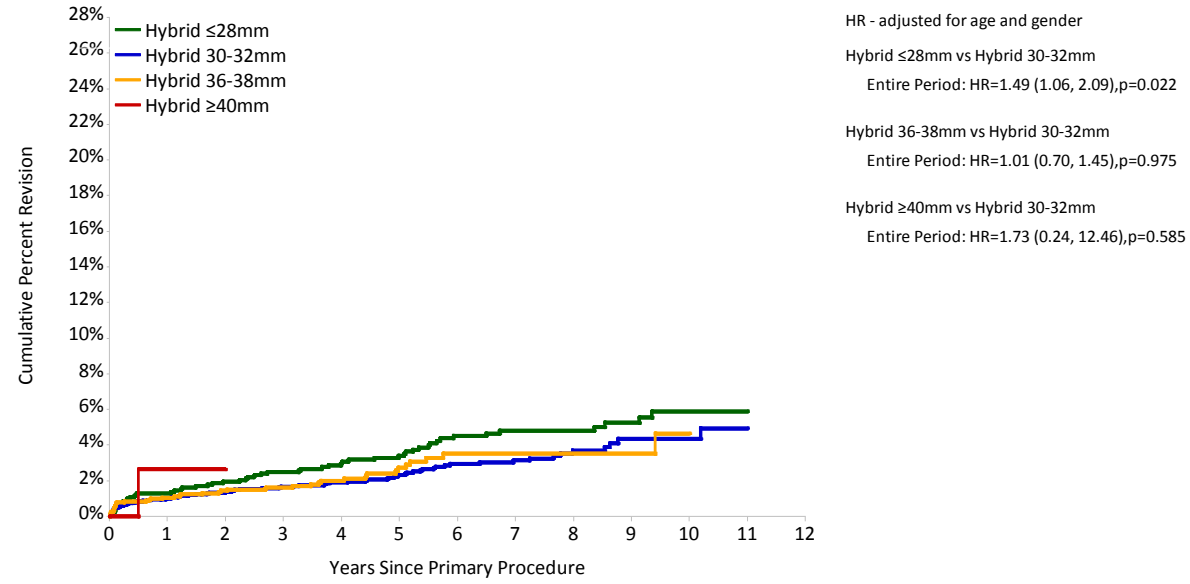


Figure HT43: Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement with Hybrid Fixation by Age (Primary Diagnosis OA)

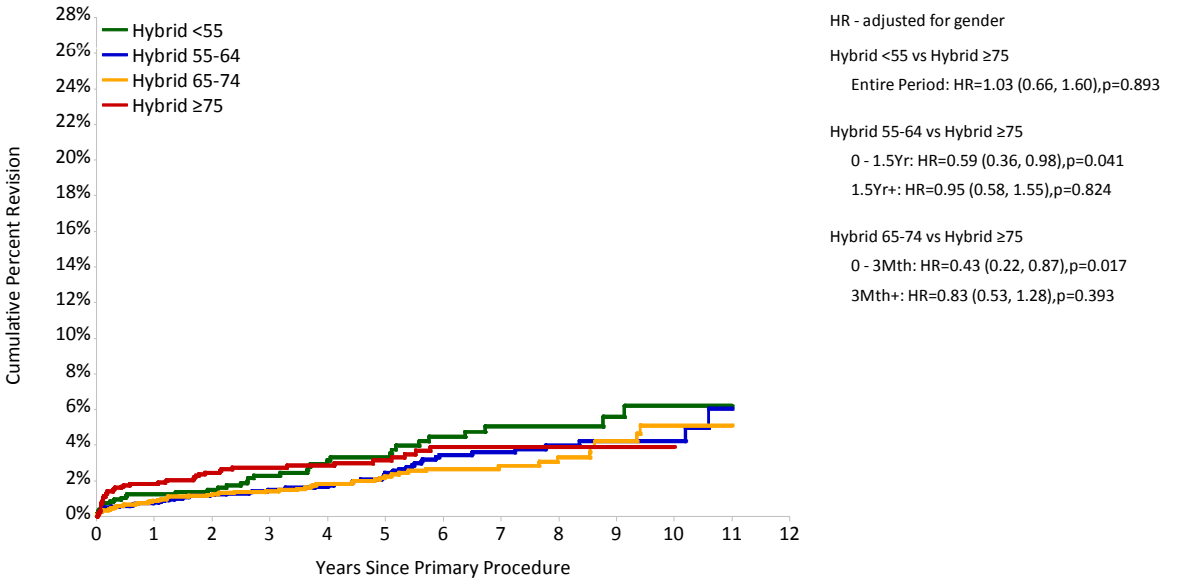
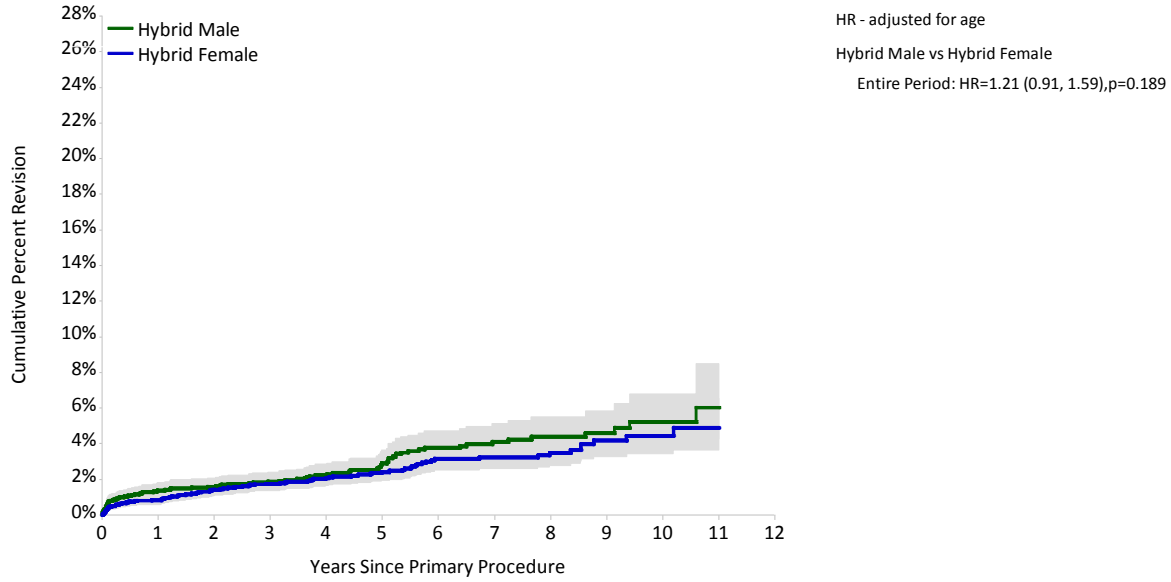


Figure HT44: Cumulative Percent Revision of Ceramic/Ceramic Primary Total Conventional Hip Replacement with Hybrid Fixation by Gender (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Head Size	≤28mm	1326	1246	1060	836	201	5
	30-32mm	4393	3847	2725	1680	184	0
	36-38mm	2108	1669	1062	574	61	0
	≥40mm	49	30	3	0	0	0
Age	<55	1082	929	657	453	102	1
	55-64	2648	2309	1613	1019	147	0
	65-74	2628	2250	1649	1038	135	2
	≥75	1518	1304	931	580	62	2
Gender	Male	3557	3032	2113	1338	194	0
	Female	4319	3760	2737	1752	252	5

Prostheses Types

There are 2,097 different stem and acetabular combinations for primary total conventional hip replacement recorded by the Registry, 131 more than 2011. The cumulative percent revision of the 82 combinations with more than 500 procedures is listed in Tables HT30 – HT32. Although the listed combinations are a small proportion of the possible combinations, they represent 77.9% of all primary total conventional hip replacements.

The 'Other' group is the combined outcome of all prostheses combinations with less than 500 procedures. This group has a total of 2,015 stem and acetabular combinations, making up 22.1% of all primary total conventional hip replacement.

There are ten total conventional stem and acetabular combinations with more than 500 procedures using cement fixation. The MS30/Low Profile Cup and the Exeter V40/Exeter have the lowest ten year cumulative percent revision of 2.5% and 4.4% respectively (Table HT30).

There are 47 cementless total conventional stem and acetabular combinations listed. Of the six combinations reported with a 12 year cumulative percent revision, the Secure-Fit Plus/Trident combination has the lowest cumulative percentage revision (3.9%), followed by the VerSys/Triology (4.9%) (Table HT31).

There are 25 combinations of total conventional hip replacement with hybrid fixation. The Exeter/Vitalock has the lowest cumulative percent revision at 12 years (5.4%), and there are seven other combinations with a cumulative percent revision of less than 5.0% at ten years (Table HT32).

Table HT30: Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Cement Fixation

Femoral Component	Acetabular Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
CPCS	Reflection (Cup)	25	732	1.3 (0.7, 2.4)	2.5 (1.5, 4.1)	3.1 (2.0, 4.9)	6.4 (3.7, 11.1)	
CPT	ZCA	23	711	0.4 (0.1, 1.3)	2.2 (1.3, 3.7)	2.8 (1.7, 4.6)	5.5 (3.6, 8.6)	
Charnley	Charnley	25	591	0.5 (0.2, 1.6)	1.0 (0.5, 2.3)	2.1 (1.2, 3.8)	5.6 (3.6, 8.7)	
Charnley	Charnley Ogee	52	709	1.0 (0.5, 2.1)	3.0 (1.9, 4.5)	4.8 (3.4, 6.8)	9.2 (6.9, 12.4)	
Exeter V40	Contemporary	169	4707	1.5 (1.2, 1.9)	2.6 (2.2, 3.1)	3.2 (2.7, 3.8)	5.7 (4.8, 6.8)	
Exeter V40	Exeter	59	1712	0.8 (0.5, 1.4)	1.9 (1.3, 2.7)	3.0 (2.3, 4.0)	4.4 (3.4, 5.7)	
Exeter V40	Exeter Contemporary	93	2978	1.3 (0.9, 1.8)	2.4 (1.9, 3.0)	3.0 (2.4, 3.8)	4.9 (3.8, 6.5)	
Exeter V40	Exeter X3 Rimfit	6	876	0.8 (0.3, 1.8)				
MS 30	Low Profile Cup	13	672	0.6 (0.2, 1.6)	0.8 (0.3, 1.9)	1.2 (0.6, 2.5)	2.5 (1.3, 4.6)	5.4 (2.3, 12.3)
Spectron EF	Reflection (Cup)	76	1598	1.0 (0.6, 1.7)	1.7 (1.1, 2.5)	2.6 (1.9, 3.7)	8.9 (6.9, 11.4)	10.6 (8.0, 14.0)
Other (346)		355	7942	1.5 (1.2, 1.8)	2.5 (2.1, 2.9)	3.7 (3.3, 4.2)	6.8 (6.1, 7.6)	8.3 (7.3, 9.5)
TOTAL		**896**	**23228**					

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

Table HT31: Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Cementless Fixation

Femoral Component	Acetabular Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
ABGII	ABGII	174	2909	1.8 (1.4, 2.4)	3.1 (2.6, 3.8)	4.2 (3.5, 5.0)	7.0 (6.0, 8.2)	7.9 (6.7, 9.3)
ABGII	ABGII (Shell/Insert)	44	850	1.5 (0.9, 2.6)	2.6 (1.7, 3.9)	3.7 (2.6, 5.3)		
ABGII	Trident (Shell)	128	2256	2.4 (1.9, 3.1)	4.2 (3.4, 5.2)	5.2 (4.3, 6.3)	8.8 (7.1, 10.8)	
Accolade	Trident (Shell)	304	8632	1.6 (1.3, 1.8)	2.9 (2.5, 3.3)	3.9 (3.4, 4.3)	6.0 (4.6, 7.8)	
Adapter	Bionik	59	513	3.1 (1.9, 5.1)	7.0 (5.1, 9.6)	12.6 (9.7, 16.3)		
Alloclassic	Allofit	164	5106	1.5 (1.2, 1.8)	2.3 (1.9, 2.7)	3.0 (2.6, 3.6)	4.8 (4.0, 5.8)	
Alloclassic	Durom	56	621	1.3 (0.7, 2.6)	5.0 (3.5, 7.0)	7.1 (5.3, 9.6)		
Alloclassic	Fitmore	87	1624	2.7 (2.0, 3.6)	4.0 (3.1, 5.1)	5.0 (4.0, 6.2)	6.8 (5.4, 8.5)	
Alloclassic	Trabecular Metal (Shell)	27	887	2.3 (1.5, 3.6)	3.0 (2.1, 4.5)	3.4 (2.3, 5.0)		
Alloclassic	Trilogy	8	744	0.6 (0.2, 1.5)	0.7 (0.3, 1.7)	1.1 (0.5, 2.4)		
Anthology	R3	56	2852	1.6 (1.1, 2.1)	2.1 (1.6, 2.8)	3.1 (2.1, 4.6)		
Anthology	Reflection (Shell)	14	848	1.2 (0.6, 2.2)	1.5 (0.8, 2.5)	1.8 (1.1, 3.0)		
Apex	Fin II	20	773	1.5 (0.8, 2.7)	2.2 (1.3, 3.6)	3.3 (2.0, 5.6)		
CLS	Allofit	33	734	1.5 (0.8, 2.7)	3.4 (2.2, 5.0)	3.7 (2.5, 5.5)	6.1 (4.2, 8.8)	
CLS	Fitmore	31	616	2.0 (1.1, 3.5)	4.2 (2.8, 6.2)	4.6 (3.1, 6.7)	5.4 (3.7, 7.6)	
Citation	Trident (Shell)	39	1188	1.7 (1.1, 2.6)	2.4 (1.7, 3.4)	3.0 (2.2, 4.2)	4.0 (2.8, 5.6)	
Citation	Vitalock	28	555	0.5 (0.2, 1.7)	2.2 (1.2, 3.8)	2.8 (1.7, 4.5)	5.9 (4.0, 8.4)	5.9 (4.0, 8.4)
Corail	ASR	832	2900	2.2 (1.7, 2.8)	11.1 (10.0, 12.3)	25.8 (24.2, 27.6)		
Corail	Duraloc	48	1430	1.4 (0.9, 2.2)	2.2 (1.5, 3.1)	2.9 (2.1, 3.9)	4.8 (3.4, 6.7)	
Corail	Pinnacle	441	18960	1.6 (1.4, 1.8)	2.5 (2.3, 2.8)	3.5 (3.1, 3.9)		
Epoch	Trilogy	38	1020	2.5 (1.7, 3.6)	3.4 (2.5, 4.8)	3.6 (2.6, 5.0)	4.5 (3.1, 6.3)	
F2L	SPH-Blind	46	614	3.1 (2.0, 4.8)	4.9 (3.5, 7.0)	6.1 (4.5, 8.4)	7.4 (5.6, 9.8)	
M/L Taper Kinectiv	Continuum	37	1129	2.7 (1.9, 3.9)				
Mallory-Head	Mallory-Head	117	2693	1.9 (1.5, 2.5)	2.4 (1.9, 3.1)	3.2 (2.6, 4.0)	5.9 (4.8, 7.2)	8.0 (6.2, 10.4)
Natural Hip	Fitmore	28	888	1.0 (0.5, 1.9)	1.6 (1.0, 2.7)	2.3 (1.4, 3.5)	4.4 (3.0, 6.6)	
Omnifit	Secur-Fit	52	508	3.2 (1.9, 5.1)	5.0 (3.4, 7.3)	6.6 (4.7, 9.2)	10.8 (8.2, 14.2)	
Omnifit	Trident (Shell)	58	1219	2.0 (1.3, 2.9)	3.3 (2.4, 4.5)	4.2 (3.2, 5.6)	5.5 (4.2, 7.1)	
Polarstem	R3	23	1260	1.9 (1.2, 2.9)	2.6 (1.5, 4.4)			
Quadra-H	Versafit	98	4327	2.1 (1.7, 2.6)	3.2 (2.6, 4.0)	3.2 (2.6, 4.0)		
S-Rom	Duraloc Option	31	666	1.5 (0.8, 2.8)	2.4 (1.5, 3.9)	3.4 (2.2, 5.0)	5.0 (3.5, 7.1)	
S-Rom	Pinnacle	92	2700	2.0 (1.5, 2.6)	3.3 (2.6, 4.1)	3.6 (2.9, 4.5)		
SL-Plus	EPF-Plus	84	2253	1.7 (1.2, 2.3)	2.8 (2.2, 3.6)	3.5 (2.7, 4.3)		
SL-Plus	R3	37	1065	2.0 (1.3, 3.1)	4.1 (3.0, 5.7)			
Secur-Fit	DeltaMotion	12	669	0.8 (0.3, 1.9)	2.5 (1.4, 4.5)			
Secur-Fit	Trident (Shell)	181	6882	1.5 (1.2, 1.8)	2.4 (2.0, 2.8)	2.9 (2.5, 3.4)	3.8 (3.2, 4.6)	
Secur-Fit Plus	Trident (Shell)	140	5301	1.3 (1.0, 1.6)	2.0 (1.6, 2.4)	2.4 (2.0, 2.9)	3.7 (3.1, 4.5)	3.9 (3.2, 4.8)
Summit	ASR	311	1118	1.2 (0.7, 2.0)	6.5 (5.2, 8.1)	19.4 (17.1, 22.0)		
Summit	Pinnacle	69	3604	1.0 (0.8, 1.5)	1.6 (1.2, 2.1)	2.1 (1.6, 2.7)		
Synergy	BHR	40	817	1.6 (0.9, 2.7)	3.0 (2.0, 4.4)	4.1 (2.9, 5.8)		
Synergy	R3	74	2817	1.7 (1.2, 2.2)	2.9 (2.2, 3.7)			
Synergy	Reflection (Shell)	251	7459	1.5 (1.3, 1.8)	2.3 (2.0, 2.7)	2.6 (2.3, 3.0)	4.8 (4.1, 5.6)	5.6 (4.6, 6.9)
Taperloc	Exceed	21	1317	0.9 (0.5, 1.7)	2.3 (1.5, 3.7)			
Taperloc	M2a	45	514	1.8 (0.9, 3.4)	4.4 (2.9, 6.5)	7.2 (5.2, 9.9)		
Taperloc	Mallory-Head	36	1077	1.6 (1.0, 2.6)	2.4 (1.6, 3.6)	2.9 (2.0, 4.2)	4.6 (3.2, 6.4)	
Taperloc	Recap	29	501	2.4 (1.4, 4.2)	4.1 (2.7, 6.3)	5.7 (3.9, 8.3)		
Tri-Lock	DeltaMotion	2	575	0.3 (0.1, 1.4)				
VerSys	Trilogy	169	4165	2.3 (1.9, 2.8)	3.2 (2.7, 3.7)	3.7 (3.1, 4.3)	4.9 (4.1, 5.8)	4.9 (4.1, 5.8)
Other (980)		1664	33755	2.2 (2.1, 2.4)	3.8 (3.6, 4.1)	5.2 (5.0, 5.5)	8.9 (8.4, 9.4)	11.5 (10.4, 12.8)
TOTAL		**6378**	**145911**					

Note: Only combinations with over 500 procedures have been listed.

Table HT32: Cumulative Percent Revision of Primary Total Conventional Hip Replacement with Hybrid Fixation

Femoral Component	Acetabular Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
C-Stem	Duraloc	63	981	2.4 (1.6, 3.5)	3.1 (2.2, 4.4)	4.0 (2.9, 5.5)	8.7 (6.6, 11.4)	
C-Stem	Pinnacle	22	660	2.4 (1.4, 3.9)	3.5 (2.2, 5.3)	3.5 (2.2, 5.3)		
C-Stem AMT	Pinnacle	8	935	0.4 (0.1, 1.2)	1.2 (0.6, 2.7)	1.8 (0.8, 4.1)		
CPCS	R3	37	1593	1.7 (1.1, 2.5)	2.6 (1.8, 3.7)			
CPCS	Reflection (Shell)	59	2511	1.0 (0.7, 1.5)	1.3 (1.0, 1.9)	1.8 (1.3, 2.5)	5.6 (3.7, 8.5)	
CPT	Allofit	10	718	0.9 (0.4, 1.9)	1.5 (0.8, 2.8)	1.8 (0.9, 3.3)		
CPT	Continuum	18	946	1.8 (1.1, 2.9)				
CPT	Trabecular Metal (Shell)	36	1017	2.0 (1.3, 3.2)	3.4 (2.4, 4.8)	4.4 (3.1, 6.2)		
CPT	Trilogy	169	5555	1.5 (1.2, 1.9)	2.4 (2.0, 2.8)	3.1 (2.6, 3.7)	5.1 (4.2, 6.2)	
Elite Plus	Duraloc	93	1078	2.0 (1.3, 3.0)	3.6 (2.7, 5.0)	5.4 (4.2, 7.0)	9.7 (7.9, 11.9)	11.4 (9.2, 14.2)
Exeter	Vitalock	57	1217	1.6 (1.0, 2.5)	2.3 (1.6, 3.4)	2.5 (1.8, 3.6)	4.7 (3.5, 6.1)	5.4 (4.1, 6.9)
Exeter V40	ABGII	33	1053	1.2 (0.7, 2.0)	1.5 (0.9, 2.4)	2.1 (1.4, 3.2)	3.7 (2.6, 5.2)	
Exeter V40	Hemispherical	19	597	2.3 (1.3, 3.9)	3.4 (2.1, 5.3)	3.7 (2.3, 5.7)		
Exeter V40	Mallory-Head	21	1166	0.5 (0.2, 1.1)	0.9 (0.5, 1.7)	1.0 (0.5, 1.9)	3.5 (2.2, 5.5)	
Exeter V40	Pinnacle	15	850	1.2 (0.6, 2.2)	2.0 (1.2, 3.4)	2.0 (1.2, 3.4)		
Exeter V40	R3	14	810	1.0 (0.5, 2.1)	2.5 (1.4, 4.4)			
Exeter V40	Trident (Shell)	717	33093	1.1 (1.0, 1.2)	1.8 (1.7, 2.0)	2.5 (2.3, 2.7)	4.4 (3.9, 5.0)	
Exeter V40	Trilogy	17	586	1.7 (0.9, 3.2)	2.6 (1.5, 4.3)	2.8 (1.7, 4.7)		
Exeter V40	Vitalock	60	1959	0.9 (0.6, 1.5)	1.7 (1.2, 2.3)	2.3 (1.7, 3.1)	3.3 (2.5, 4.2)	
MS 30	Allofit	35	1274	1.3 (0.8, 2.1)	1.8 (1.2, 2.8)	2.4 (1.6, 3.5)	3.8 (2.6, 5.7)	
Omnifit	Trident (Shell)	66	2124	1.8 (1.3, 2.5)	2.9 (2.2, 3.7)	3.1 (2.4, 4.0)	3.9 (3.0, 5.0)	
Spectron EF	BHR	30	532	0.8 (0.3, 2.0)	3.0 (1.8, 4.9)	6.9 (4.7, 10.0)		
Spectron EF	R3	29	1061	1.5 (0.9, 2.5)	3.4 (2.3, 5.0)			
Spectron EF	Reflection (Shell)	192	4851	1.1 (0.8, 1.4)	2.0 (1.6, 2.4)	2.8 (2.3, 3.3)	6.5 (5.5, 7.7)	9.5 (7.4, 12.2)
VerSys	Trilogy	14	721	1.1 (0.6, 2.2)	1.6 (0.9, 2.8)	1.6 (0.9, 2.8)	2.3 (1.3, 4.0)	
Other (689)		698	13820	1.8 (1.6, 2.1)	3.2 (2.9, 3.5)	4.5 (4.2, 4.9)	7.6 (7.0, 8.2)	8.3 (7.6, 9.1)
TOTAL		**2532**	**81708**					

Note: Only combinations with over 500 procedures have been listed.

Primary Total Resurfacing Hip Replacement

Demographics

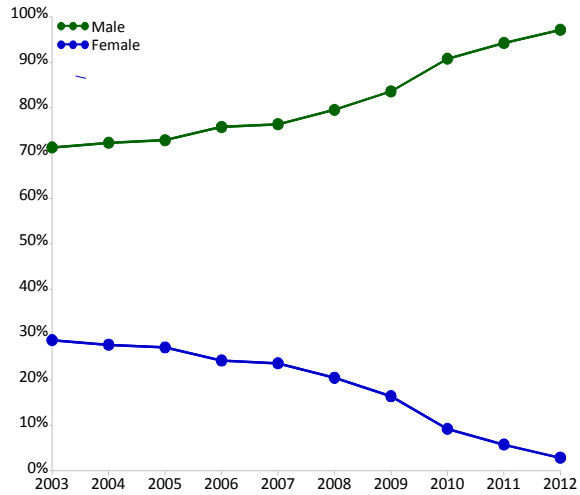
There have been 15,360 total resurfacing procedures reported to the Registry, an additional 459 procedures compared to the last report.

The use of resurfacing hip replacement in Australia continues to decline. The number of procedures reported in 2012 was 23.4% less than in 2011 and 75.4% less compared to the peak in 2005.

Osteoarthritis is the principal diagnosis for total resurfacing hip replacement (95.1%), followed by developmental dysplasia (2.4%) and osteonecrosis (1.7%).

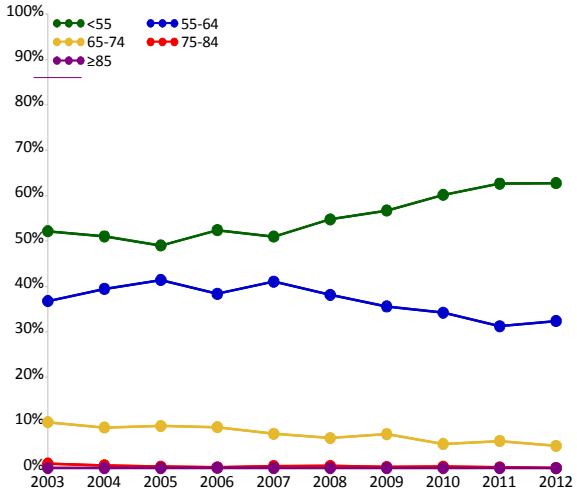
Most patients are male and the proportion of males has increased from 71.2% in 2003 to 97.1% in 2012 (Figure HT45).

Figure HT45: Primary Total Resurfacing Hip Replacement by Gender



Most patients are under the age of 55 years (62.7%) (Figure HT46).

Figure HT46: Primary Total Resurfacing Hip Replacement by Age



The majority of total resurfacings use hybrid fixation (99.1% in 2012).

There were six types of resurfacing prostheses used in 2012. Only two of these were used in more than ten procedures. The BHR remains the most used resurfacing hip prosthesis, accounting for 75.6% of resurfacing prostheses implanted in 2012 (Table HT33). The number of procedures using the BHR declined from 442 in 2011 to 341 in 2012.

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

2003		2009		2010		2011		2012	
N	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**
1359	BHR	632	BHR	604	BHR	442	BHR	341	BHR
58	Durom	196	Mitch TRH	188	Mitch TRH	93	Mitch TRH	89	Adept
43	ASR	91	ASR	53	Adept	27	Adept	10	Mitch TRH
42	Cormet	75	Cormet	50	Cormet	10	Cormet	7	ACCIS
38	Cormet 2000 HAP	70	Adept	24	Durom	10	Durom	4	Cormet
7	Conserve Plus	54	Bionik	19	Bionik	3	Recap		
		46	Durom	16	Recap	2	ACCIS		
		45	Recap	10	Icon	2	Bionik		
		6	Icon						
		1	Conserve Plus						
Ten Most Used									
1547 (6)	100.0%	1216 (10)	99.9%	964 (8)	100.0%	589 (8)	100.0%	451 (5)	100.0%
Remainder									
0 (0)	0%	1 (1)	0.1%	0 (0)	0%	0 (0)	0%	0 (0)	0%
TOTAL									
1547 (6)	100.0%	1217 (11)	100.0%	964 (8)	100.0%	589 (8)	100.0%	451 (5)	100.0%

Outcome

The cumulative percent revision at 12 years for primary total resurfacing hip replacement undertaken for osteoarthritis is 11.2% (Table HT34 and Figure HT47).

Reasons for Revision

The main reasons for revision of primary total resurfacing hip replacement are loosening/lysis (33.0%), fracture (22.9%), MRP (20.0%), infection (7.0%) and pain (5.7%) (Table HT35).

The five most common reasons for revision are shown in Figure HT48. The incidence of revision for fracture increases rapidly in the first year, however after this time the incidence increases at a slower rate. Loosening/lysis shows a linear increase and at five years exceeds fracture to become the most common reason for revision. The incidence of revision for MRP continues to increase.

Type of Revision

The main types of revision of resurfacing hip replacement are total hip replacement (59.8%), isolated femoral (32.8%), and acetabular only (4.6%) (Table HT36). In previous reports, the most common type of revision was femoral only revision, however in the 2011 Annual Report revision of both the acetabular and femoral components to a total conventional hip replacement became the most common type of revision. In this report, revision to a total conventional hip replacement has increased by a further 6.5%, and this is associated with a continued decline in both femoral only, and acetabular only revisions.

Primary Diagnosis

The outcomes of the three most common primary diagnoses (osteoarthritis, developmental dysplasia and osteonecrosis) are listed in Table HT37. Primary total resurfacing hip replacement for osteoarthritis has a lower rate of revision compared to developmental dysplasia. There is no difference in the rate of revision of osteonecrosis compared to osteoarthritis (Figure HT49).

Age and Gender

Patients 65 years or older have a higher rate of revision than patients aged less than 55 years and 55-64 years for the first six months only. After six months, patients 65 years or older have a lower rate of revision compared to patients less than 55 years, and there is no difference in the rate of revision compared to patients 55-64 years. There is no difference in the rate of revision between patients aged less than 55 years and 55-64 years (Table HT38 and Figure HT50).

Females have a higher rate of revision compared to males. After one year, the rate of revision is over three times higher for females compared to males (Table HT39 and Figure HT51). While there is no age related difference in the rate of revision for females (Table HT39 and Figure HT52), there is with males. Males over the age of 65 years have a higher rate of revision compared to males less than 55 years and 55 to 64 years for the first six months only, with no difference after this time (Table HT39 and Figure HT53).

Head Size

There is a decrease in the rate of revision as the femoral component head size increases. Femoral head sizes of 44mm or less and 45-49mm have over twice the rate of revision compared to head sizes 55mm or larger. There is no difference for head sizes 50-54mm compared to 55mm or larger (Table HT40 and Figure HT54). The effect of femoral component head size is evident within both males and females (Table HT41 and Figure HT55).

Revision diagnosis cumulative incidence varies with head size. Head sizes less than 50mm have a higher incidence of each of the five most common reasons for revision, with the exception of pain (Figure HT56).

Prosthesis Types

Cumulative percent revision of total resurfacing hip prostheses are listed in Table HT42. The BHR resurfacing prosthesis has the lowest cumulative percent revision (5.1%) of the five prostheses with 7 year data.

Table HT34: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement (Primary Diagnosis OA)

Hip Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Total Resurfacing	954	14608	1.8 (1.6, 2.0)	3.3 (3.0, 3.6)	5.1 (4.8, 5.5)	9.6 (9.0, 10.4)	11.2 (9.6, 13.1)

Figure HT47: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement (Primary Diagnosis OA)

Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Total Resurfacing	14608	13889	12140	9419	1792	81

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

Reason for Revision	Number	Percent
Loosening/Lysis	347	33.0
Fracture	240	22.9
Metal Related Pathology	210	20.0
Infection	74	7.0
Pain	60	5.7
Osteonecrosis	30	2.9
Prosthesis Dislocation	22	2.1
Malposition	18	1.7
Other	49	4.7
TOTAL	**1050**	**100.0**

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

Type of Revision	Number	Percent
THR (Femoral/Acetabular)	628	59.8
Femoral Component	344	32.8
Acetabular Component	48	4.6
Cement Spacer	26	2.5
Removal of Prostheses	4	0.4
TOTAL	**1050**	**100.0**

Figure HT48: Revision Diagnosis Cumulative Incidence of Primary Total Resurfacing Hip Replacement (Primary Diagnosis OA)

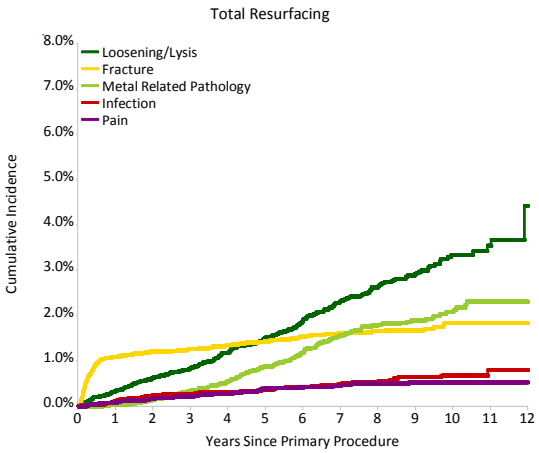
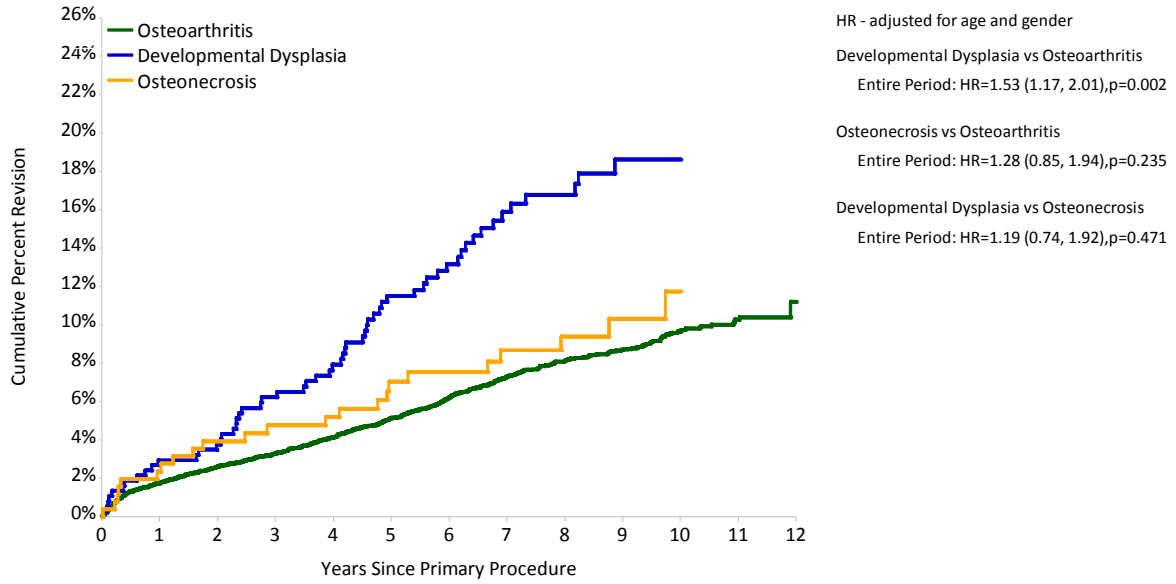


Table HT37: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Primary Diagnosis

Primary Dignosis	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Osteoarthritis	954	14608	1.8 (1.6, 2.0)	3.3 (3.0, 3.6)	5.1 (4.8, 5.5)	9.6 (9.0, 10.4)	11.2 (9.6, 13.1)
Developmental Dysplasia	59	375	2.9 (1.6, 5.2)	6.2 (4.2, 9.2)	11.5 (8.6, 15.3)	18.6 (14.5, 23.6)	
Osteonecrosis	24	256	2.4 (1.1, 5.2)	4.8 (2.7, 8.2)	7.0 (4.4, 11.1)	11.7 (7.6, 17.9)	
Other (6)	13	121	2.5 (0.8, 7.5)	5.1 (2.3, 11.1)	9.9 (5.6, 17.3)		
TOTAL	**1050**	**15360**					

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

Figure HT49: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Primary Diagnosis

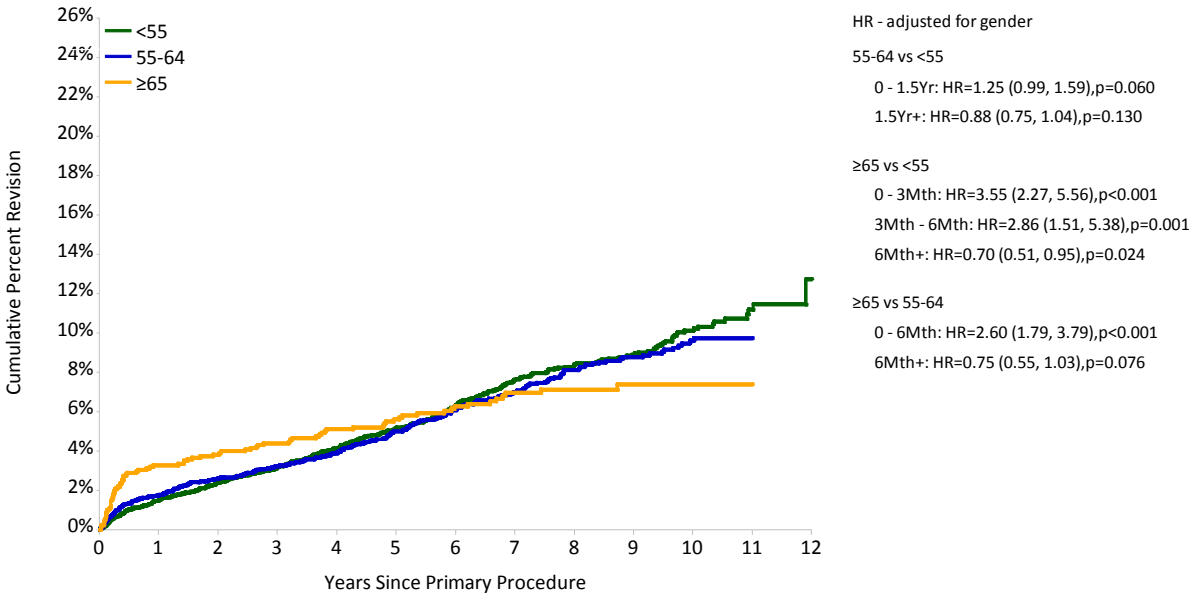


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Osteoarthritis	14608	13889	12140	9419	1792	81
Developmental Dysplasia	375	363	339	287	65	4
Osteonecrosis	256	247	231	193	55	2

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

Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
<55	503	7619	1.5 (1.3, 1.8)	3.2 (2.8, 3.6)	5.2 (4.6, 5.7)	10.1 (9.2, 11.2)	12.7 (10.2, 15.9)
55-64	368	5668	1.8 (1.5, 2.1)	3.2 (2.8, 3.7)	5.0 (4.4, 5.6)	9.6 (8.6, 10.8)	
≥65	83	1321	3.3 (2.4, 4.4)	4.4 (3.4, 5.7)	5.6 (4.5, 7.0)	7.4 (5.9, 9.2)	
TOTAL	**954**	**14608**					

Figure HT50: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Age (Primary Diagnosis OA)

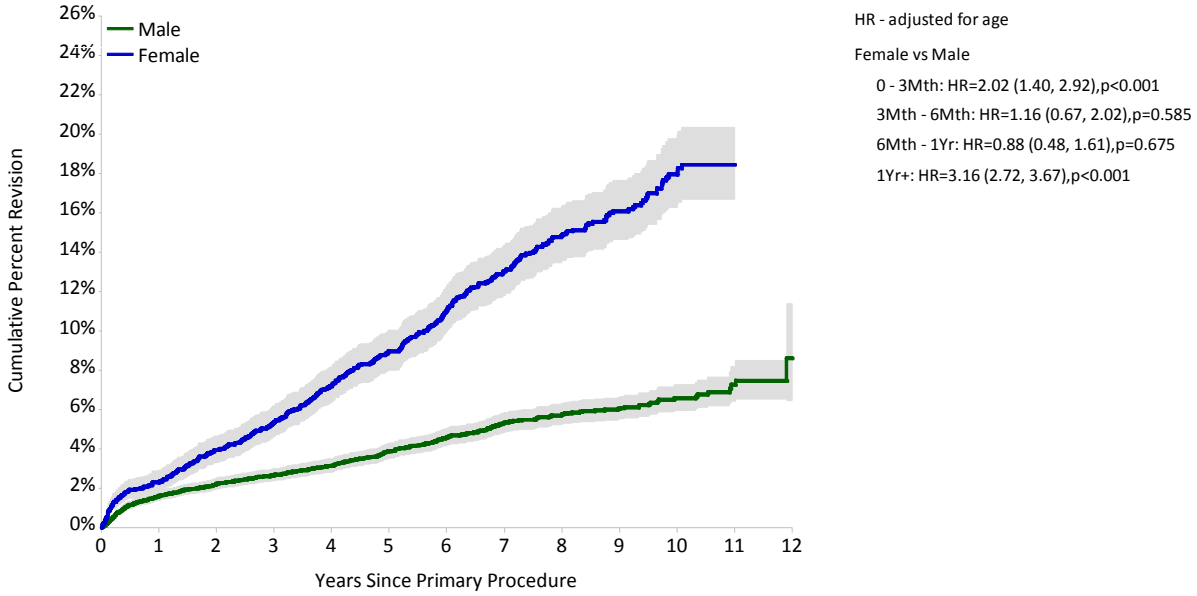


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
<55	7619	7225	6191	4713	937	52
55-64	5668	5415	4815	3787	680	26
≥65	1321	1249	1134	919	175	3

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

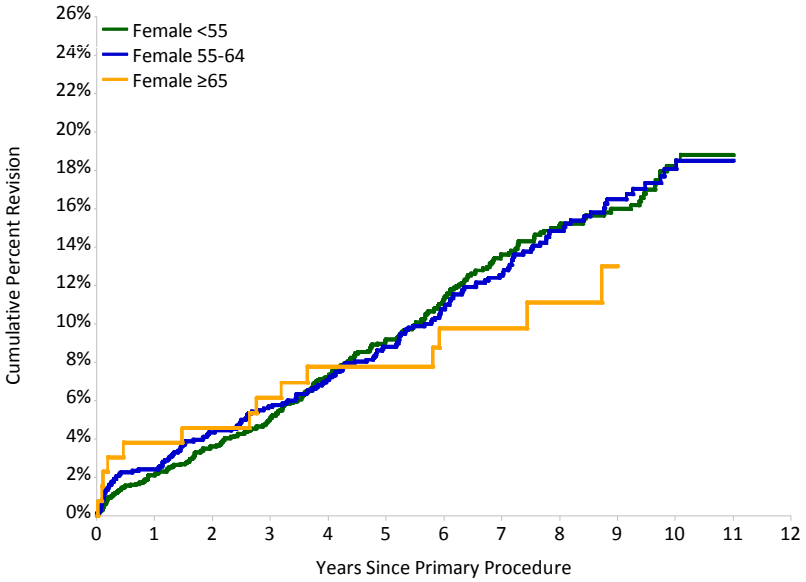
Gender and Age		N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Male	<55	251	5757	1.3 (1.0, 1.6)	2.5 (2.1, 2.9)	3.6 (3.1, 4.2)	6.7 (5.8, 7.7)	
	55-64	199	4423	1.6 (1.3, 2.0)	2.5 (2.1, 3.0)	3.8 (3.3, 4.5)	6.5 (5.5, 7.6)	
	≥65	69	1190	3.2 (2.3, 4.4)	4.2 (3.2, 5.5)	5.3 (4.2, 6.8)	6.6 (5.2, 8.3)	
	TOTAL	**519**	**11370**	**1.6 (1.4, 1.9)**	**2.7 (2.4, 3.0)**	**3.9 (3.5, 4.3)**	**6.6 (6.0, 7.3)**	**8.6 (6.5, 11.4)**
Female	<55	252	1862	2.2 (1.6, 2.9)	5.1 (4.2, 6.2)	9.2 (7.9, 10.6)	18.2 (16.0, 20.7)	
	55-64	169	1245	2.4 (1.7, 3.4)	5.7 (4.5, 7.1)	8.8 (7.3, 10.6)	18.1 (15.5, 21.1)	
	≥65	14	131	3.8 (1.6, 8.9)	6.1 (3.1, 11.9)	7.8 (4.3, 14.0)		
	TOTAL	**435**	**3238**	**2.3 (1.9, 2.9)**	**5.4 (4.6, 6.2)**	**9.0 (8.0, 10.0)**	**18.0 (16.3, 19.8)**	

Figure HT51: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Male	11370	10742	9201	7002	1280	57
Female	3238	3147	2939	2417	512	24

Figure HT52: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement for Females by Age (Primary Diagnosis OA)



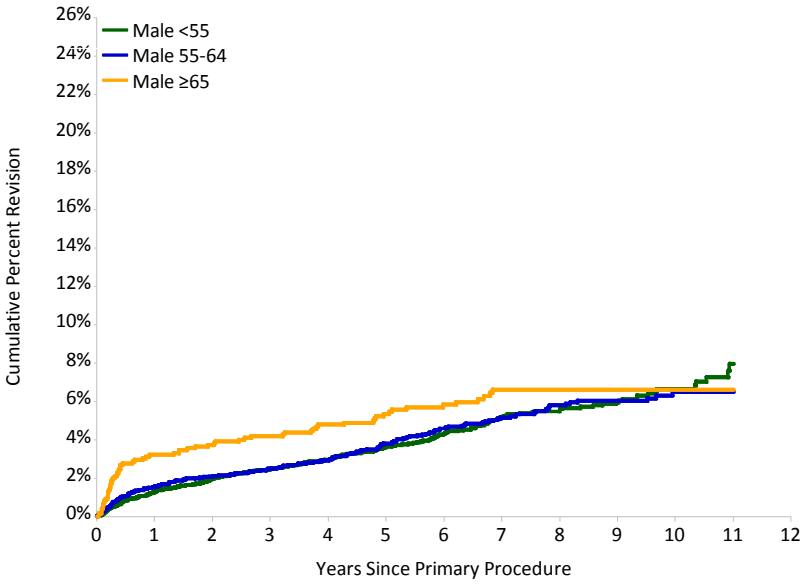
Female 55-64 vs Female <55
Entire Period: HR=0.99 (0.81, 1.20),p=0.883

Female ≥65 vs Female <55
0 - 3Mth: HR=2.33 (0.83, 6.51),p=0.107
3Mth+: HR=0.60 (0.32, 1.12),p=0.109

Female ≥65 vs Female 55-64
Entire Period: HR=0.77 (0.45, 1.33),p=0.345

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Female	<55	1862	1812	1695	1372	293	16
	55-64	1245	1209	1125	945	192	8
	≥65	131	126	119	100	27	0

Figure HT53: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement for Males by Age (Primary Diagnosis OA)



Male 55-64 vs Male <55
Entire Period: HR=0.99 (0.82, 1.19),p=0.915

Male ≥65 vs Male <55
0 - 3Mth: HR=3.35 (2.03, 5.52),p<0.001
3Mth - 6Mth: HR=2.36 (1.20, 4.62),p=0.012
6Mth+: HR=0.80 (0.56, 1.14),p=0.216

Male ≥65 vs Male 55-64
0 - 3Mth: HR=3.39 (2.04, 5.61),p<0.001
3Mth - 6Mth: HR=2.38 (1.21, 4.68),p=0.011
6Mth+: HR=0.81 (0.57, 1.16),p=0.244

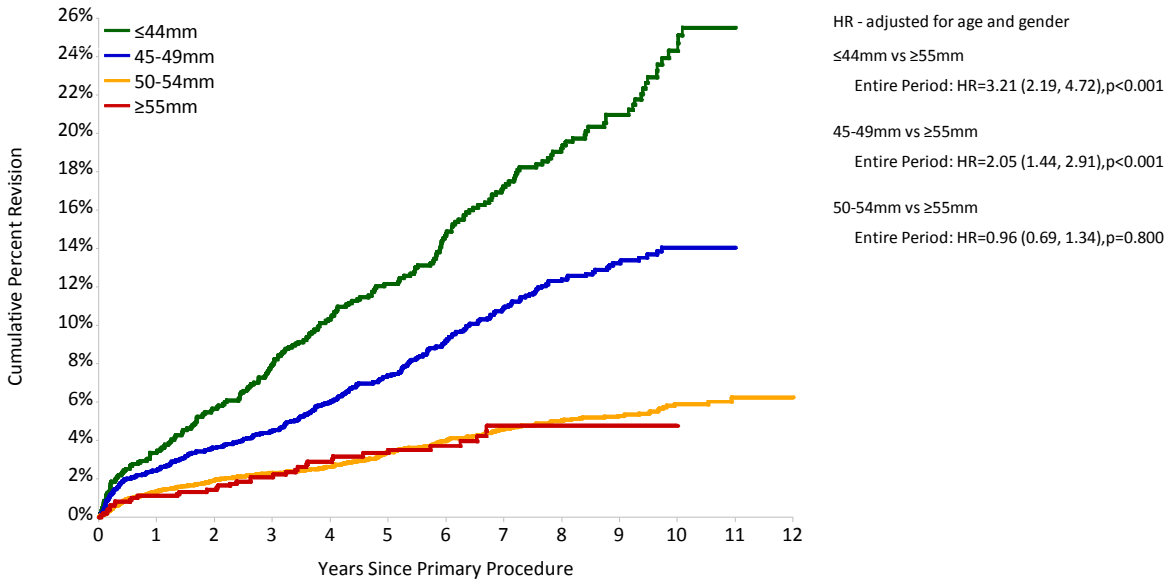
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Male	<55	5757	5413	4496	3341	644	36
	55-64	4423	4206	3690	2842	488	18
	≥65	1190	1123	1015	819	148	3

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

Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
≤44mm	218	1192	3.4 (2.5, 4.6)	8.0 (6.6, 9.7)	12.1 (10.4, 14.2)	24.3 (21.2, 27.7)	
45-49mm	337	3452	2.5 (2.0, 3.0)	4.5 (3.9, 5.3)	7.4 (6.5, 8.4)	14.0 (12.5, 15.7)	
50-54mm	361	8952	1.4 (1.1, 1.6)	2.3 (2.0, 2.6)	3.4 (3.0, 3.8)	5.9 (5.2, 6.6)	6.2 (5.4, 7.2)
≥55mm	38	1011	1.1 (0.6, 2.0)	2.1 (1.4, 3.2)	3.3 (2.3, 4.8)	4.8 (3.4, 6.7)	
TOTAL	**954**	**14607**					

Note: Excludes 1 procedure with unknown head size.

Figure HT54: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Head Size (Primary Diagnosis OA)



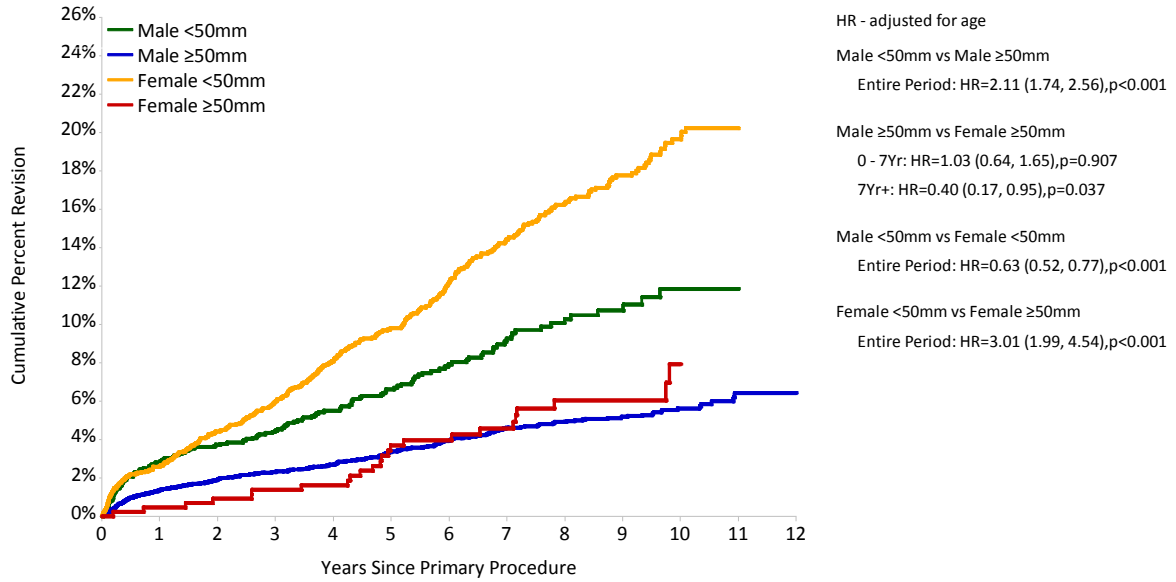
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
≤44mm	1192	1147	1051	858	189	12
45-49mm	3452	3275	2939	2242	396	13
50-54mm	8952	8505	7345	5763	1107	50
≥55mm	1011	961	804	556	100	6

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

Gender	Head Size	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Male	<50mm	144	1852	2.9 (2.2, 3.7)	4.5 (3.6, 5.5)	6.6 (5.5, 7.9)	11.9 (9.8, 14.3)	
	≥50mm	375	9517	1.4 (1.1, 1.6)	2.3 (2.0, 2.6)	3.4 (3.0, 3.8)	5.6 (5.0, 6.3)	6.4 (5.5, 7.5)
Female	<50mm	411	2792	2.6 (2.1, 3.3)	6.0 (5.2, 7.0)	9.8 (8.7, 11.0)	19.6 (17.8, 21.7)	
	≥50mm	24	446	0.5 (0.1, 1.8)	1.4 (0.6, 3.0)	3.7 (2.2, 6.1)	7.9 (5.0, 12.3)	
TOTAL		**954**	**14607**					

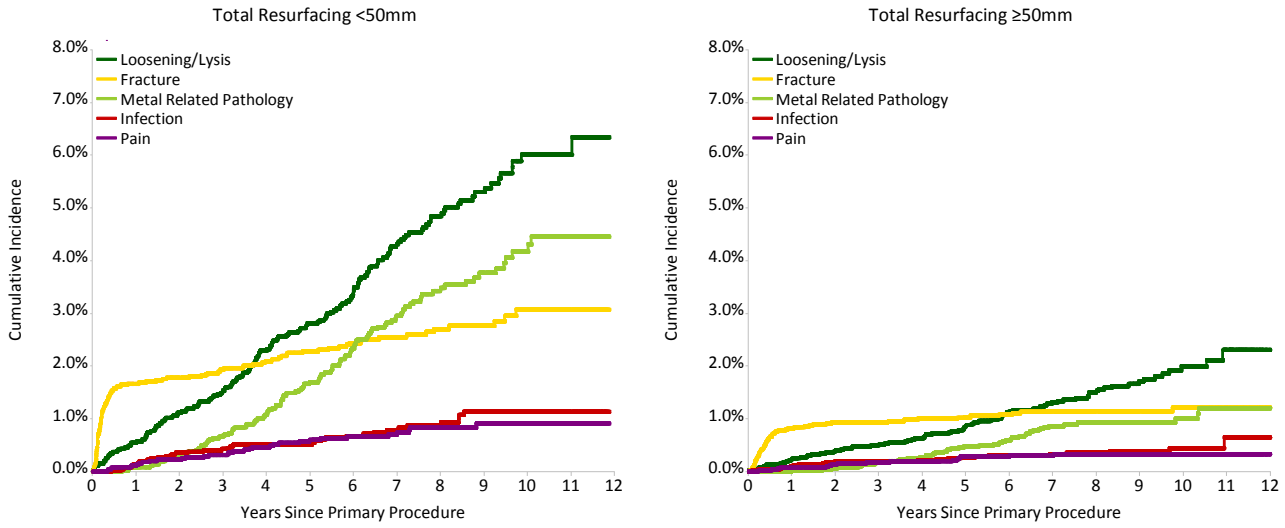
Note: Excludes 1 procedure with unknown head size.

Figure HT55: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Gender and Head Size (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Male	<50mm	1852	1714	1470	1045	161	3
	≥50mm	9517	9027	7730	5957	1119	54
Female	<50mm	2792	2708	2520	2055	424	22
	≥50mm	446	439	419	362	88	2

Figure HT56: Revision Diagnosis Cumulative Incidence of Primary Total Resurfacing Hip Replacement by Head Size (Primary Diagnosis OA)



Data Period: 1 Sept 1999 – 31 Dec 2012

Table HT42: Cumulative Percent Revision of Primary Total Resurfacing Hip Replacement by Prosthesis Type

Head Component	Acetabular Component	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs
ASR	ASR	246	1167	3.3 (2.5, 4.5)	7.1 (5.8, 8.8)	15.4 (13.4, 17.7)	23.9 (21.2, 26.8)	
Adept	Adept	15	531	1.4 (0.7, 2.9)	2.1 (1.1, 3.9)	2.7 (1.5, 4.8)		
BHR	BHR	529	10474	1.4 (1.2, 1.7)	2.5 (2.2, 2.8)	3.6 (3.3, 4.0)	5.1 (4.6, 5.6)	7.1 (6.5, 7.8)
Bionik	Bionik	31	199	3.5 (1.7, 7.2)	12.4 (8.5, 17.9)	17.3 (12.2, 24.2)		
Cormet	Cormet	76	622	2.1 (1.2, 3.6)	5.6 (4.0, 7.8)	9.3 (7.1, 12.1)	14.1 (11.1, 17.8)	20.7 (15.9, 26.7)
Durom	Durom	73	847	3.2 (2.2, 4.6)	5.4 (4.0, 7.1)	7.6 (6.0, 9.7)	9.0 (7.2, 11.3)	
Icon	Icon	5	113	0.9 (0.1, 6.1)	1.8 (0.4, 6.9)	4.0 (1.5, 10.6)		
Mitch TRH	Mitch TRH	25	1024	1.2 (0.7, 2.1)	2.2 (1.4, 3.3)	2.7 (1.8, 4.0)		
Recap	Recap	21	195	5.1 (2.8, 9.3)	8.8 (5.5, 13.7)	10.8 (7.0, 16.2)		
Other (8)		29	188	5.3 (2.9, 9.7)	7.6 (4.6, 12.5)	9.9 (6.4, 15.3)	12.4 (8.4, 18.3)	
TOTAL		**1050**	**15360**					

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

KNEE REPLACEMENT

Categories of Knee Replacement

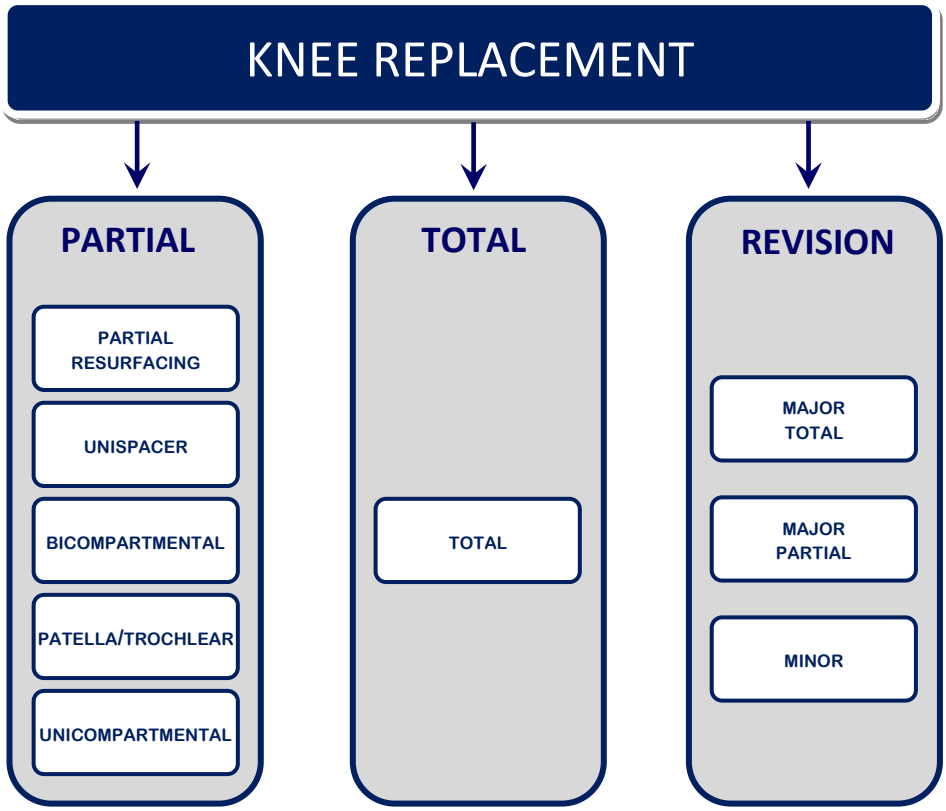
The Registry groups knee replacement into three broad categories, primary partial, primary total and revision knee replacement.

A primary replacement is an initial replacement procedure undertaken on a joint and involves replacing either part (partial) or all (total) of the articular surface.

Primary partial knees are sub-categorised into classes depending on the type of prosthesis used. The classes of primary partial knee replacement are partial resurfacing, unispacer, bicompartmental, patella/trochlear and unicompartmental. These are defined in the primary partial knee replacement chapter.

Revision knee replacements are re-operations of previous knee replacements where one or more of the prosthetic components are replaced, removed or one or more components are added. Revisions include re-operations of primary partial, primary total or previous revision procedures. Knee revisions are sub-categorised into three classes, major total, major partial or minor revisions.

Detailed information on revision knee replacement is provided in a supplementary report available on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2013.



Use of Knee Replacement

This report analyses 429,228 knee replacements reported to the Registry with a procedure date up to and including 31 December 2012. This is an additional 48,502 knee procedures compared to the number reported last year. When considering all knee procedures currently recorded by the Registry, primary partial knees account for 9.7%, primary total knees 82.0% and revision knee replacement 8.3% (Table K1).

Table K1: Number of Knee Replacements

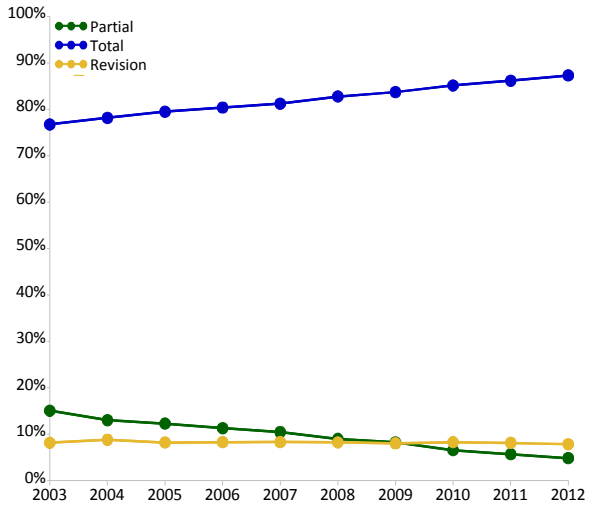
Knee Category	Number	Percent
Primary Partial Knee	41733	9.7
Primary Total Knee	351875	82.0
Revision Knee	35620	8.3
TOTAL	**429228**	**100.0**

The number of knee replacements undertaken in 2012 increased by 1,268 (2.7%) compared to 2011. During the last 12 months primary partial knees decreased by 12.6%, primary total knees increased by 4.1% and revision knee replacement decreased by 1.0%.

Since 2003, the number of knee replacement procedures has increased by 69.1%. Primary total knee replacement has increased by 92.4% and revision knee replacement by 62.4%. Primary partial knee replacement has decreased by 45.7%.

In 2012, primary total knee replacement accounted for 87.3% of all knee replacement procedures. This has increased from 76.7% in 2003. Primary partial knee replacement decreased from 15.1% in 2003 to 4.8% in 2012. The proportion of revision knee procedures has declined from a peak of 8.8% in 2004 to 7.8% in 2012. This equates to 455 less revision procedures in 2012 than would have been expected if the proportion of revision procedures had remained at 8.8% (Figure K1).

Figure K1: Proportion of Knee Replacements



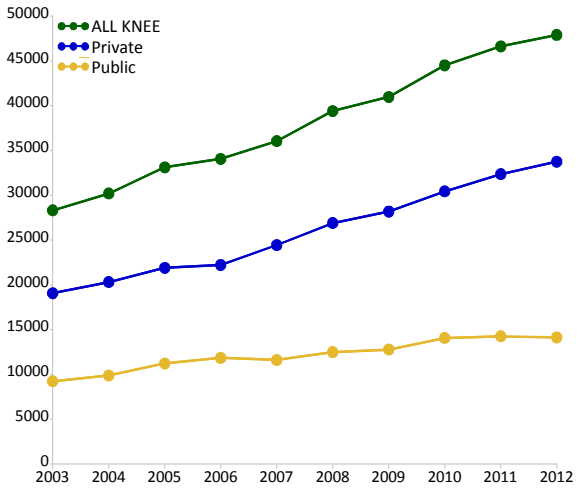
Detailed information on the demographics of each category of knee replacement is provided in the supplementary report 'Demographics of Knee Arthroplasty' available on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2013.

Public and Private Sector

Of all knee replacement procedures reported to the Registry in 2012, 76.9% were undertaken in private hospitals.

In 2012, 33,751 knee replacements were recorded in the private sector, an increase of 4.3% compared to 2011. In the public sector, there were 14,138 knee replacements in 2012, a decrease of 0.9% compared to 2011.

Figure K2: Knee Replacement by Hospital Sector



Since 2003, knee replacement has increased by 76.9% in the private sector compared to 53.0% in the public sector (Figure K2).

There were 2,027 primary partial knee replacements reported for the private sector in 2012, a decrease of 9.3% compared to 2011. In the public sector, there were 293 partial knee replacements, a decrease of 29.7% compared to 2011. Since 2003, primary partial knee replacement has decreased by 40.5% in the private sector compared to 66.0% in the public sector.

In 2012, 29,054 primary total knee replacements were reported in the private sector, an increase of 5.6% compared to 2011. In the public sector, there were 12,756 primary total knee replacements, an increase of 0.7% compared to 2011. Since 2003, primary total knee replacement has increased by 106.5% in the private sector compared to 66.5% in the public sector.

There were 2,670 private sector revision knee replacements reported in 2012, an increase of 2.3% compared to 2011. In the public sector, there were 1,089 revision knee replacements, a decrease of 8.3% compared to 2011. Since 2003, revision knee replacement has increased by 67.2% in the private sector compared to 51.7% 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 replacement is the unicompartmental knee, accounting for 93.7% of all partial knee replacements. The second most common is the patella/trochlear replacement (5.4%), and the three remaining partial knee procedures are reported in small numbers (partial resurfacing, unispacer and bicompartmental knee replacement) (Table KP1).

The unispacer procedure has not been used since 2005. It has the highest revision rate of any type of partial knee replacement (Table KP2). Additional information is provided in a supplementary report on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2013.

Table KP1: Partial Knee Replacement by Class

Partial Knee Class	Number	Percent
Partial Resurfacing	176	0.4
Unispacer	40	0.1
Bicompartmental	165	0.4
Patella/Trochlear	2250	5.4
Unicompartmental	39102	93.7
TOTAL	**41733**	**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 (Table KP2).

Detailed information on the demographics of each class of primary partial knee replacement is provided in the supplementary report 'Demographics of Knee Arthroplasty' available on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2013.

Table KP2: Cumulative Percent Revision of Primary Partial Knee Replacement by Class

Knee Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Partial Resurfacing	46	176	5.4 (2.8, 10.1)	16.5 (11.6, 23.2)	26.4 (19.9, 34.5)		
Unispacer	31	40	42.5 (29.0, 59.2)	67.5 (53.0, 81.2)	67.5 (53.0, 81.2)		
Bicompartmental	18	165	6.1 (3.3, 11.1)	10.9 (6.9, 17.0)			
Patella/Trochlear	336	2250	2.3 (1.7, 3.0)	9.0 (7.8, 10.4)	15.5 (13.8, 17.5)	28.9 (25.7, 32.4)	
Unicompartmental	3856	39102	2.2 (2.1, 2.4)	5.9 (5.7, 6.2)	8.5 (8.2, 8.8)	15.2 (14.7, 15.7)	18.0 (17.0, 19.0)
TOTAL	**4287**	**41733**					

Partial Resurfacing

The Registry has recorded 176 partial resurfacing procedures, an additional 14 procedures compared to the number reported last year.

The most common reason for undertaking a partial resurfacing procedure is osteoarthritis (86.4%). The majority of partial resurfacing procedures have been on patients aged less than 55 years (74.4%) and is undertaken more frequently in males (54.0%).

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

Of the 176 procedures, 150 have one cap implanted, 23 have two and in three procedures three caps have been used. Of those with one cap implanted there were 125 femoral, 10 patellar, 6 tibial, 7 trochlear and 2 unknown. When two caps were implanted there were 20 femoral/trochlear and patella, one femoral and patellar, and two where both devices were used on the femoral articular surface. When three caps were implanted they all involved patellar, trochlear and femoral articular surfaces.

There are 40 procedures that involve resurfacing of the patella/trochlear joint either on one side (17) or both sides (23). The three year cumulative percent revision for one side is 12.5% and 17.0% when both sides are resurfaced.

The cumulative percent revision of partial resurfacing procedures undertaken for osteoarthritis is 5.5% at one year and 28.6% at five years (Table KP3 and Figure KP1).

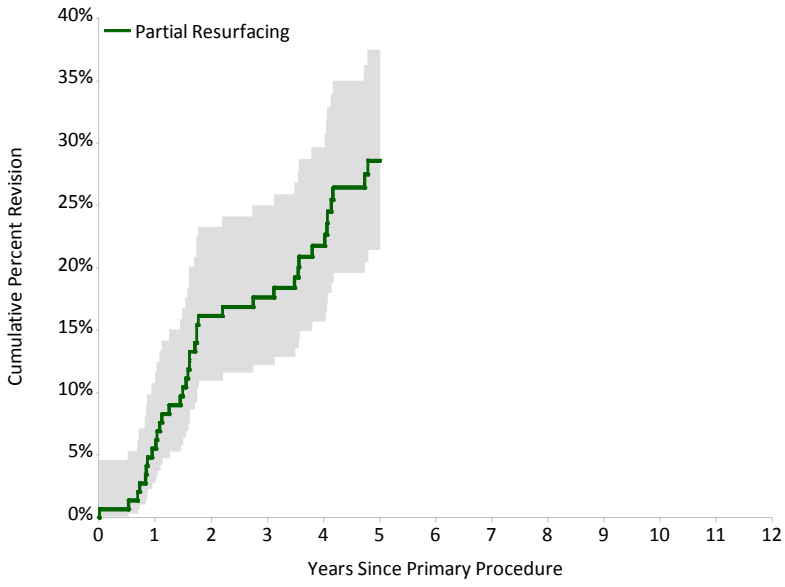
The main reasons for revision are progression of disease (58.7%), loosening (15.2%) and pain (6.5%).

Most primary partial resurfacings are revised to either total knee replacement (54.3%) or unicompartmental (26.1%). The remainder include revision to a patella/trochlear (8.7%), addition of another resurfacing component (8.7%) or removal of the prosthesis (2.2%).

Table KP3: Cumulative Percent Revision of Primary Partial Resurfacing Knee Replacement (Primary Diagnosis OA)

Knee Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Partial Resurfacing	43	152	5.5 (2.8, 10.7)	17.6 (12.3, 25.0)	28.6 (21.5, 37.4)		

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



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Partial Resurfacing	152	136	107	60	0	0

Bicompartmental

The Registry has recorded 165 bicompartmental procedures, an additional four procedures compared to the last report. There have been no further procedures recorded since July 2012.

The principal diagnosis for bicompartmental knee replacement is osteoarthritis (97.0%). It is used more frequently in females (60.6%) and 55.8% of patients are aged less than 65 years at the time of surgery.

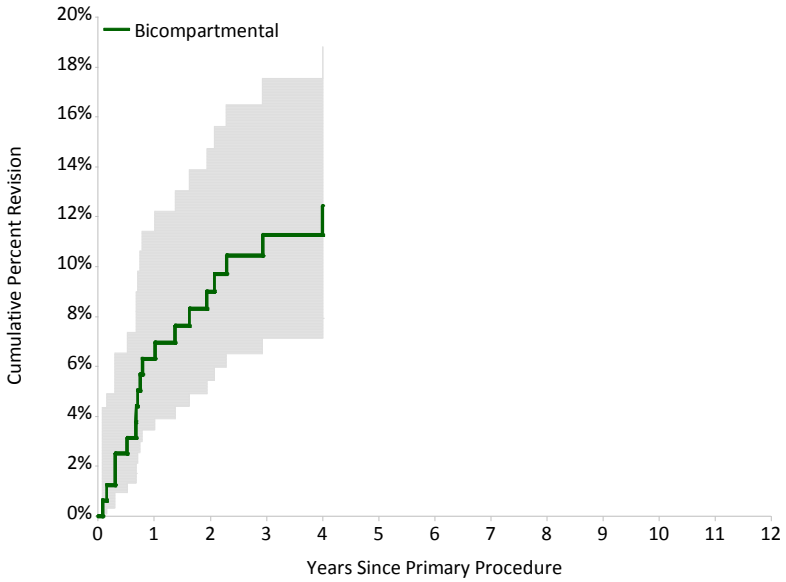
The bicompartmental knee replacement is a single company product. One femoral component, the Journey Deuce, has been combined with two different tibial components the Journey (32.1%) and the Journey Deuce (67.3%). The majority of primary bicompartmental procedures include resurfacing of the patella (84.2%).

The cumulative percent revision of bicompartmental knee replacement is 6.3% at one year and 11.3% at three years (Table KP4 and Figure KP2). The main reasons for revision are patellofemoral pain (27.8%), and pain (16.7%). Of the 18 revisions, one is a unicompartment tibial component revision, nine involve the addition of a patellar prosthesis (one of which is combined with a tibial insert). The remaining eight have been revised to a total knee replacement.

Table KP4: Cumulative Percent Revision of Primary Bicompartmental Knee Replacement (Primary Diagnosis OA)

Knee Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Bicompartmental	18	160	6.3 (3.4, 11.4)	11.3 (7.1, 17.5)			

Figure KP2: Cumulative Percent Revision of Primary Bicompartmental Knee Replacement (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Bicompartmental	160	146	105	30	0	0

Patella/Trochlear

Demographics

There have been 2,250 patella/trochlear knee replacements reported to the Registry, an additional 229 procedures compared to the last report.

The principal diagnosis for patella/trochlear procedures is osteoarthritis (98.9%). This procedure is most common in females (76.4%) and patients less than 65 years of age (68.1%) (Figures KP3 and KP4).

Figure KP3: Primary Patella/Trochlear Knee Replacement by Gender

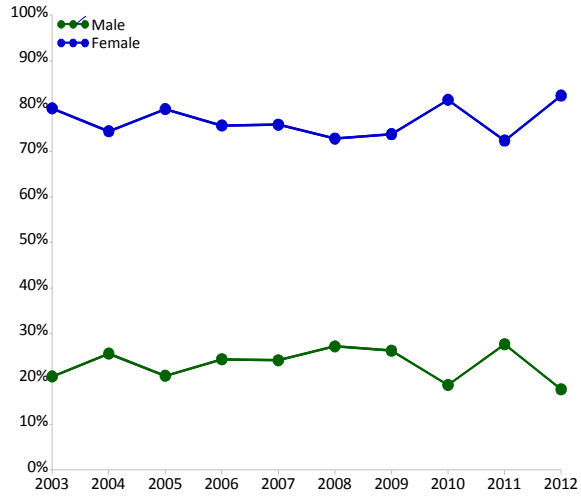
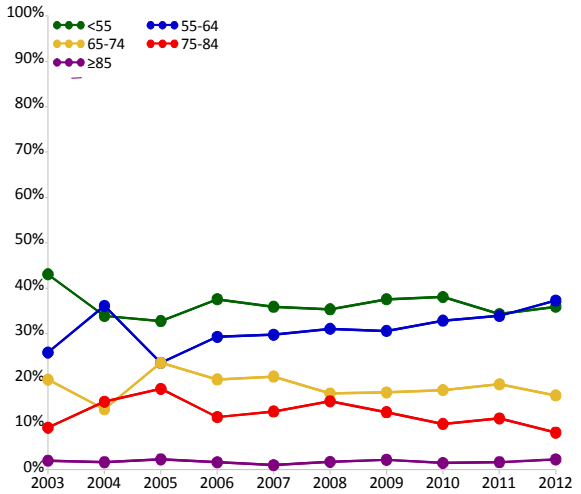


Figure KP4: Primary Patella/Trochlear Knee Replacement by Age



In 2012, the four most common patellar/trochlear prostheses were the Gender Solutions, Competitor, Avon and RBK. The Gender Solutions prosthesis was first reported in 2009 and has remained the most frequently used prosthesis in this class since 2010 (Table KP5).

Table KP5: Most Used Resurfacing Trochlear Prostheses in Primary Patella/Trochlear Knee Replacement

2003		2009		2010		2011		2012	
N	Model	N	Model	N	Model	N	Model	N	Model
56	LCS	56	Avon	82	Gender Solutions	69	Gender Solutions	83	Gender Solutions
43	Avon	51	RBK	71	Avon	62	Competitor	46	Competitor
29	Lubinus	43	Competitor	50	RBK	43	RBK	40	Avon
13	Themis	42	Gender Solutions	48	Competitor	38	Avon	36	RBK
9	MOD III	27	LCS	16	Sigma HP	15	Sigma HP	12	Sigma HP
1	RBK	5	Sigma HP	1	Vanguard	12	Vanguard	3	Vanguard
		3	Lubinus						
		2	Vanguard						
Most Used									
151	(6) 100.0%	229	(8) 100.0%	268	(6) 100.0%	239	(6) 100.0%	220	(6) 100.0%

Outcome

The cumulative percent revision for primary patella/trochlear knee replacement undertaken for osteoarthritis is 15.5% at five years and 28.8% at ten years (Table KP6 and Figure KP5).

Progression of disease (43.5%) is the most common reason for revision of a patella/trochlear knee replacement, followed by loosening/lysis (19.9%) and pain (10.4%) (Table KP7).

When a primary patella/trochlear procedure is revised it is usually revised to a total knee replacement (81.3%) (Table KP8).

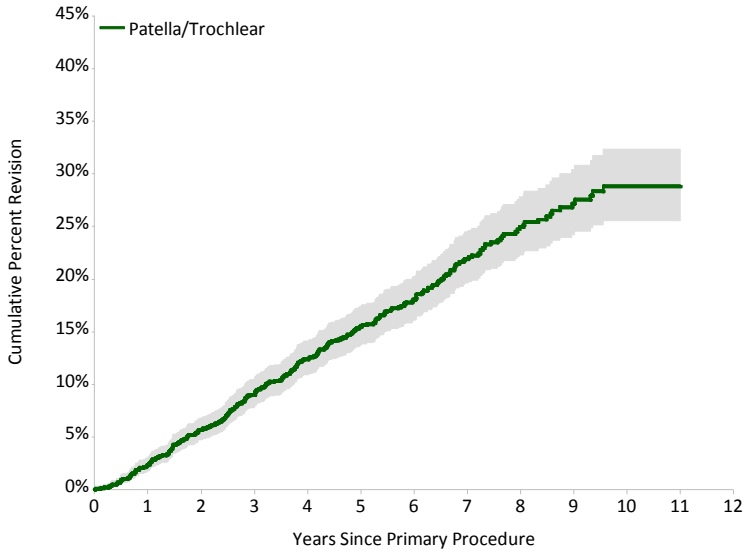
Age and gender are risk factors for revision. Patients younger than 65 years of age have a higher rate of revision than patients 65 years or older (Table KP9 and Figure KP6). Males have a higher rate of revision than females (Table KP9 and Figure KP7).

The outcomes of patella/trochlear prostheses with more than 20 procedures are presented in Table KP10.

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

Knee Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Patella/Trochlear	330	2225	2.3 (1.8, 3.1)	9.0 (7.8, 10.4)	15.5 (13.8, 17.5)	28.8 (25.6, 32.3)	

Figure KP5: Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Patella/Trochlear	2225	1954	1336	852	115	20

Table KP7: Primary Patella/Trochlear Knee Replacement by Reason for Revision

Reason for Revision	Number	Percent
Progression Of Disease	146	43.5
Loosening/Lysis	67	19.9
Pain	35	10.4
Patellofemoral Pain	15	4.5
Implant Breakage Patella	14	4.2
Infection	11	3.3
Malalignment	10	3.0
Other	38	11.3
TOTAL	**336**	**100.0**

Table KP8: Primary Patella/Trochlear Knee Replacement by Type of Revision

Type of Revision	Number	Percent
TKR (Tibial/Femoral)	273	81.3
Patella Only	44	13.1
Patella/Trochlear Resurfacing	13	3.9
UKR (Uni Tibial/Uni Femoral)	3	0.9
Removal of Prostheses	2	0.6
Cement Spacer	1	0.3
TOTAL	**336**	**100.0**

Table KP9: Cumulative Percent Revision of Patella/Trochlear Knee Replacement by Age and Gender (Primary Diagnosis OA)

Age and Gender	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Age <65	246	1510	2.4 (1.7, 3.3)	9.5 (8.0, 11.3)	16.4 (14.3, 18.9)	32.0 (27.9, 36.4)	
Age ≥65	84	715	2.2 (1.3, 3.6)	7.9 (6.0, 10.4)	13.6 (10.8, 17.0)		
Male	91	525	3.4 (2.1, 5.4)	11.5 (8.8, 14.8)	18.6 (14.9, 23.0)		
Female	239	1700	2.0 (1.4, 2.8)	8.2 (6.9, 9.8)	14.5 (12.6, 16.8)	27.9 (24.2, 31.9)	
TOTAL	**330**	**2225**					

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

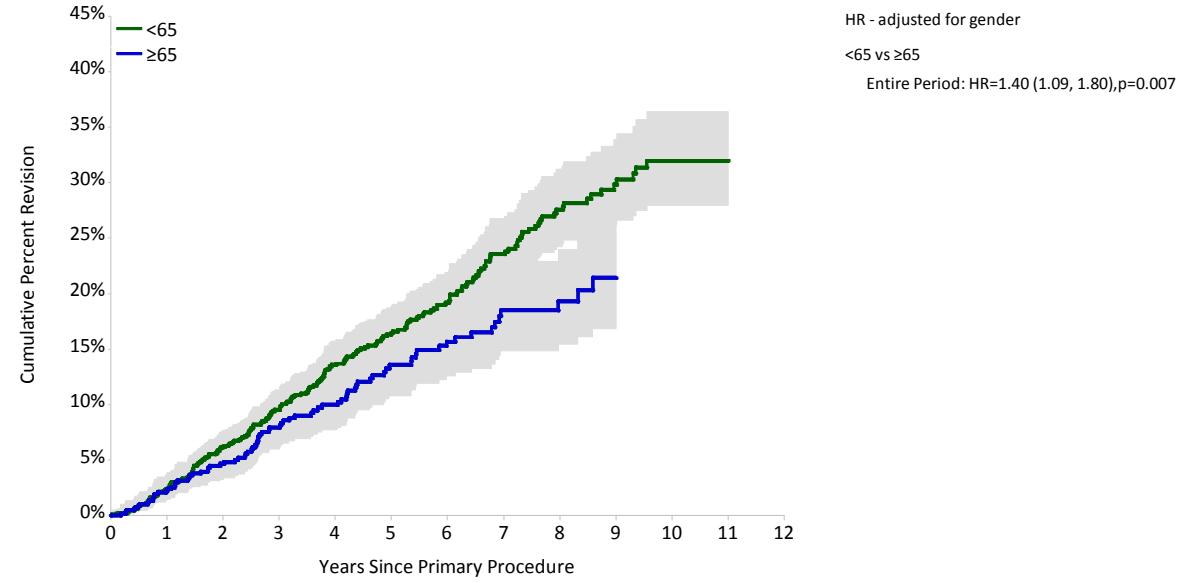
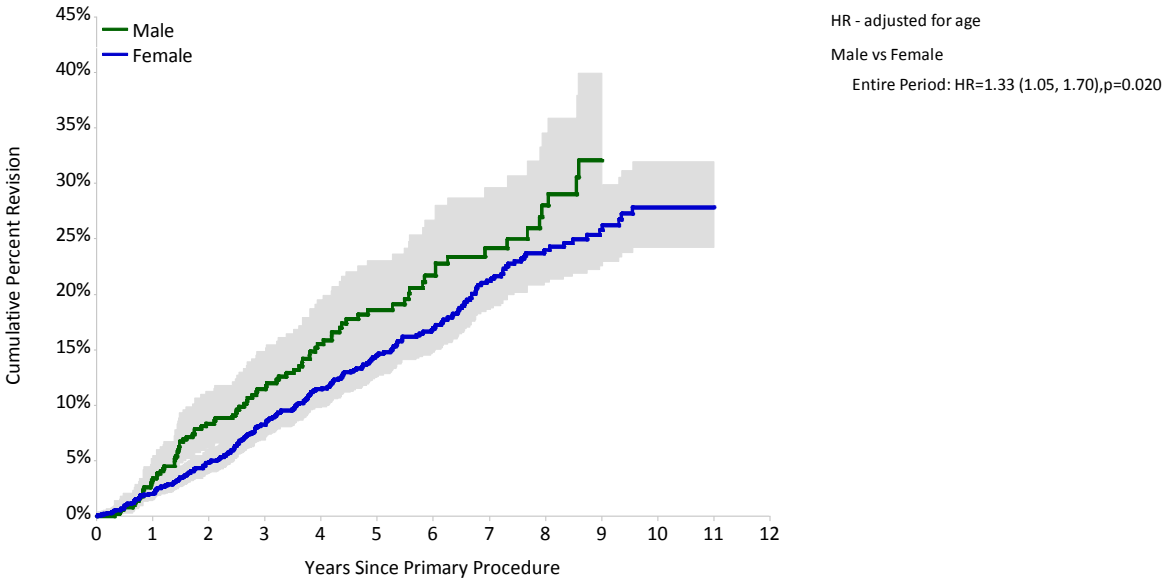


Figure KP7: Cumulative Percent Revision of Patella/Trochlear Knee Replacement by Gender (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Age <65	1510	1317	898	571	84	19
Age ≥65	715	637	438	281	31	1
Male	525	467	317	182	26	6
Female	1700	1487	1019	670	89	14

Table KP10: Cumulative Percent Revision of Primary Patella/Trochlear Knee Replacement by Prosthesis Type

Resurfacing Trochlear	Patella Prosthesis	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs
Avon	Avon	27	280	0.8 (0.2, 3.0)	7.8 (4.9, 12.2)	12.0 (8.0, 17.8)	
Avon	Kinemax Plus	58	307	2.0 (0.9, 4.3)	4.6 (2.8, 7.7)	11.8 (8.5, 16.2)	24.5 (19.1, 31.2)
Avon	Triathlon	0	21	0.0 (0.0, 0.0)			
Competitor	Genesis II	19	283	1.2 (0.4, 3.6)	7.8 (4.7, 12.9)		
Gender Solutions	Nexgen	4	258	1.0 (0.2, 3.9)			
LCS	LCS	109	395	3.5 (2.1, 5.9)	11.7 (8.9, 15.3)	20.7 (16.9, 25.1)	
Lubinus	Duracon	17	77	2.6 (0.7, 10.0)	9.2 (4.5, 18.4)	15.9 (9.4, 26.3)	
Lubinus	Lubinus	12	39	5.1 (1.3, 19.0)	18.1 (9.1, 34.3)	21.1 (11.1, 37.9)	34.0 (20.7, 52.5)
MOD III	MOD III	18	63	4.8 (1.6, 14.0)	14.3 (7.7, 25.7)	17.5 (10.1, 29.4)	26.1 (16.4, 40.0)
RBK	RBK	35	318	2.4 (1.1, 4.9)	10.0 (6.9, 14.6)	14.8 (10.5, 20.7)	
Sigma HP	PFC Sigma	10	68	4.7 (1.5, 13.9)	19.3 (9.6, 36.5)		
Themis	Themis	5	38	2.6 (0.4, 17.2)	2.6 (0.4, 17.2)	8.0 (2.6, 22.7)	
Vanguard	Series A	6	23	4.8 (0.7, 29.3)	29.8 (11.5, 64.2)		
Other (24)		16	80	3.9 (1.3, 11.6)	14.1 (7.8, 24.8)	16.6 (9.4, 28.4)	32.7 (19.4, 51.7)
TOTAL		**336**	**2250**				

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

Unicompartmental

Demographics

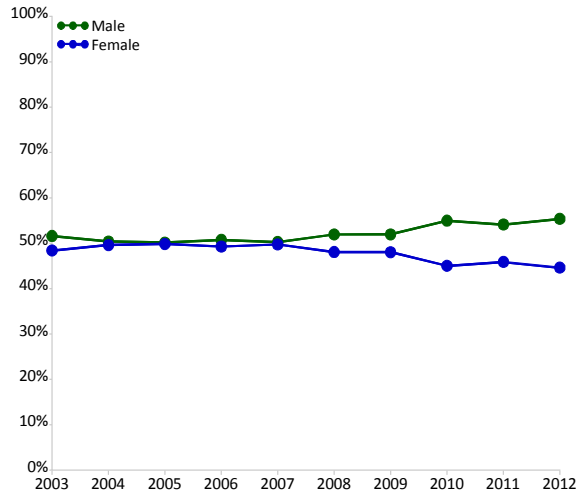
This year the Registry is reporting on 39,102 unicompartmental procedures, an additional 2,131 procedures compared to the last report.

The use of unicompartmental knee replacement continues to decline. The number of unicompartmental knee procedures reported in 2012 was 12.9% less than 2011 and 49.2% less than 2003. As a percentage of all knee replacement, unicompartmental has decreased from 14.5% in 2003 to 4.4% in 2012.

Osteoarthritis is the principal diagnosis, accounting for 98.9% of primary unicompartmental knee replacement.

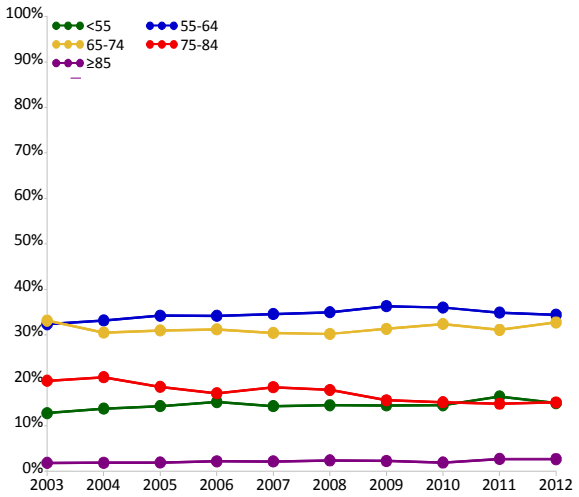
There continues to be a higher proportion of males undergoing unicompartmental knee replacement. This proportion has increased by 5.1% since 2007 (Figure KP8).

Figure KP8: Primary Unicompartmental Knee Replacement by Gender



Unicompartmental knee replacement is most frequently undertaken in patients aged between 55 and 74 years (67.1%). The age distribution has remained relatively constant since 2003, with the exception of a 4.5% decrease in the 75-84 age group over this time (Figure KP9).

Figure KP9: Primary Unicompartmental Knee Replacement by Age



In 2012, the ten most used prostheses accounted for 88.5% of all unicompartmental procedures. This proportion has decreased by 7.6% since 2003, when 17 different prostheses were used compared to 22 prostheses in 2012. The ZUK, Oxford and Oxford 3 were the most used prostheses in 2012. The Oxford is a cementless unicompartmental knee prosthesis introduced in 2007 and is reported separately from the Oxford 3 (Table KP11).

Table KP11: Ten Most Used Tibial Prostheses in Primary Unicompartmental Knee Replacement

2003		2009		2010		2011		2012	
N	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**
1366	Oxford 3	805	Oxford 3	602	Oxford 3	510	Oxford 3	476	ZUK
444	Repicci II	480	ZUK	552	ZUK	509	ZUK	414	Oxford
373	Preservation Fixed	351	Unix	354	Oxford	368	Oxford	373	Oxford 3
352	M/G	228	Oxford	273	Unix	290	Unix	203	Unix
336	Allegretto Uni	176	Journey Deuce	102	Freedom PKR/Active	108	Sigma HP	89	Repicci II
321	GRU	170	Preservation Fixed	93	Genesis	75	Freedom PKR/Active	68	Freedom PKR/Active
274	Genesis	149	Freedom PKR/Active	83	Repicci II	72	Repicci II	64	Journey Deuce
260	Unix	133	Repicci II	81	GRU	70	Journey	62	Sigma HP
121	Preservation Mobile	128	GRU	79	Allegretto Uni	69	GRU	53	GRU
101	Endo-Model Sled	81	Allegretto Uni	64	Sigma HP	61	Genesis	45	Journey
Ten Most Used									
3948	(10) 96.1%	2701	(10) 87.5%	2283	(10) 87.3%	2132	(10) 89.0%	1847	(10) 88.5%
Remainder									
159	(7) 3.9%	386	(16) 12.5%	333	(15) 12.7%	264	(10) 11.0%	239	(12) 11.5%
TOTAL									
4107	(17) 100.0%	3087	(26) 100.0%	2616	(25) 100.0%	2396	(20) 100.0%	2086	(22) 100.0%

Outcome

The cumulative percent revision at twelve years of primary unicompartmental knee replacement undertaken for osteoarthritis is 18.0% (Table KP12 and Figure KP10).

The main reasons for revision are loosening/lysis (46.3%), progression of disease (25.1%) and pain (10.7%). Most are revised to a total knee replacement (85.3%) (Tables KP13 and KP14 and Figure KP11).

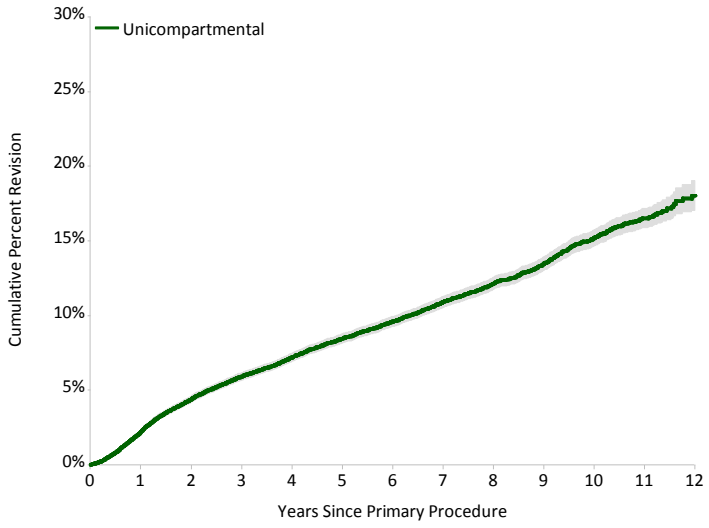
Age is a major factor affecting the outcome of primary unicompartmental knee replacement with the rate of revision decreasing with increasing age (Table KP15 and Figure KP12). Females have a higher rate of revision, and the effect of age on the rate of revision is evident within both males and females (Table KP16 and Figures KP13-KP15).

The type of prosthesis used is also a risk factor for revision. Outcomes of unicompartmental knee prostheses with more than 200 procedures reported to the Registry are presented in Table KP17. The Uniglide is an updated name for the previously reported AMC prosthesis.

Table KP12: Cumulative Percent Revision of Primary Unicompartmental Knee Replacement (Primary Diagnosis OA)

Knee Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Unicompartmental	3811	38682	2.2 (2.1, 2.4)	5.9 (5.7, 6.2)	8.5 (8.2, 8.8)	15.2 (14.7, 15.7)	18.0 (17.1, 19.0)

Figure KP10: Cumulative Percent Revision of Primary Unicompartmental Knee Replacement (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Unicompartmental	38682	35639	29069	21997	4645	380

Table KP13: Primary Unicompartmental Knee Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	1786	46.3
Progression Of Disease	967	25.1
Pain	413	10.7
Infection	159	4.1
Fracture	95	2.5
Bearing Dislocation	81	2.1
Malalignment	46	1.2
Wear Tibial	37	1.0
Instability	33	0.9
Other	239	6.2
TOTAL	**3856**	**100.0**

Table KP14: Primary Unicompartmental Knee Replacement by Type of Revision

Type of Revision	Number	Percent
TKR (Tibial/Femoral)	3289	85.3
Uni Insert Only	231	6.0
Uni Tibial Component	166	4.3
Uni Femoral Component	63	1.6
UKR (Uni Tibial/Uni Femoral)	54	1.4
Cement Spacer	30	0.8
Removal of Prostheses	7	0.2
Patella/Trochlear Resurfacing	6	0.2
Reinsertion of Components	5	0.1
Cement Only	2	0.1
Patella Only	2	0.1
Femoral Component*	1	0.0
TOTAL	**3856**	**100.0**

*Bicompartmental Component

Figure KP11: Revision Diagnosis Cumulative Incidence of Primary Unicompartmental Knee Replacement

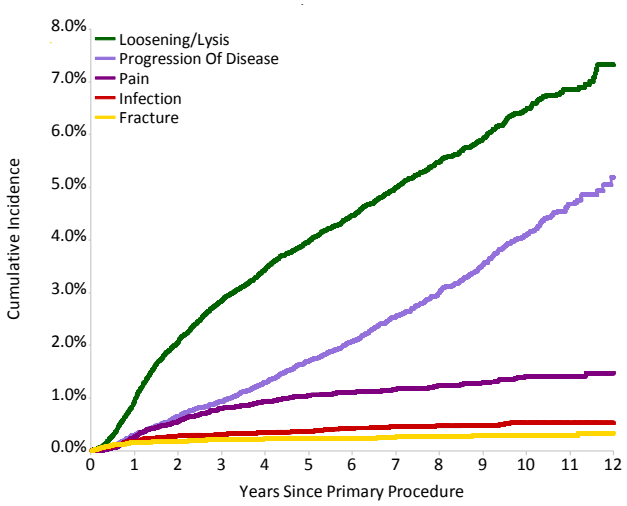
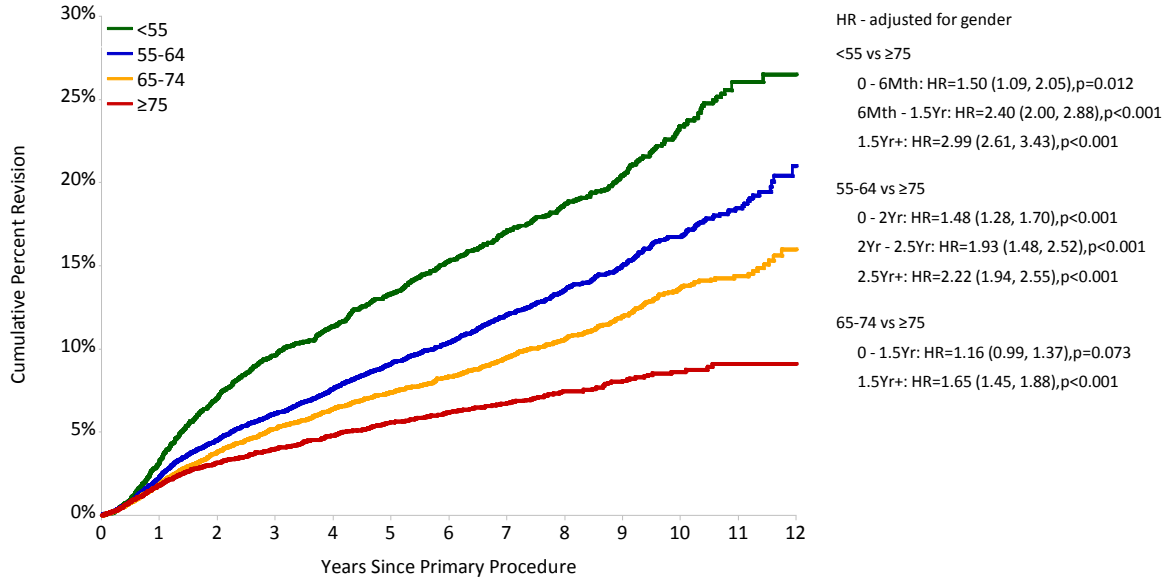


Table KP15: Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
<55	854	5530	3.3 (2.9, 3.8)	9.6 (8.8, 10.5)	13.3 (12.4, 14.3)	23.4 (21.8, 25.1)	26.5 (24.3, 28.9)
55-64	1416	13038	2.3 (2.1, 2.6)	6.1 (5.7, 6.6)	9.1 (8.6, 9.7)	16.7 (15.8, 17.7)	21.0 (19.0, 23.2)
65-74	1083	12311	1.9 (1.7, 2.1)	5.2 (4.8, 5.6)	7.4 (6.9, 7.9)	13.7 (12.8, 14.6)	16.0 (14.5, 17.6)
≥75	458	7803	1.8 (1.5, 2.1)	4.0 (3.6, 4.5)	5.6 (5.1, 6.2)	8.6 (7.8, 9.6)	9.1 (8.1, 10.2)
TOTAL	**3811**	**38682**					

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

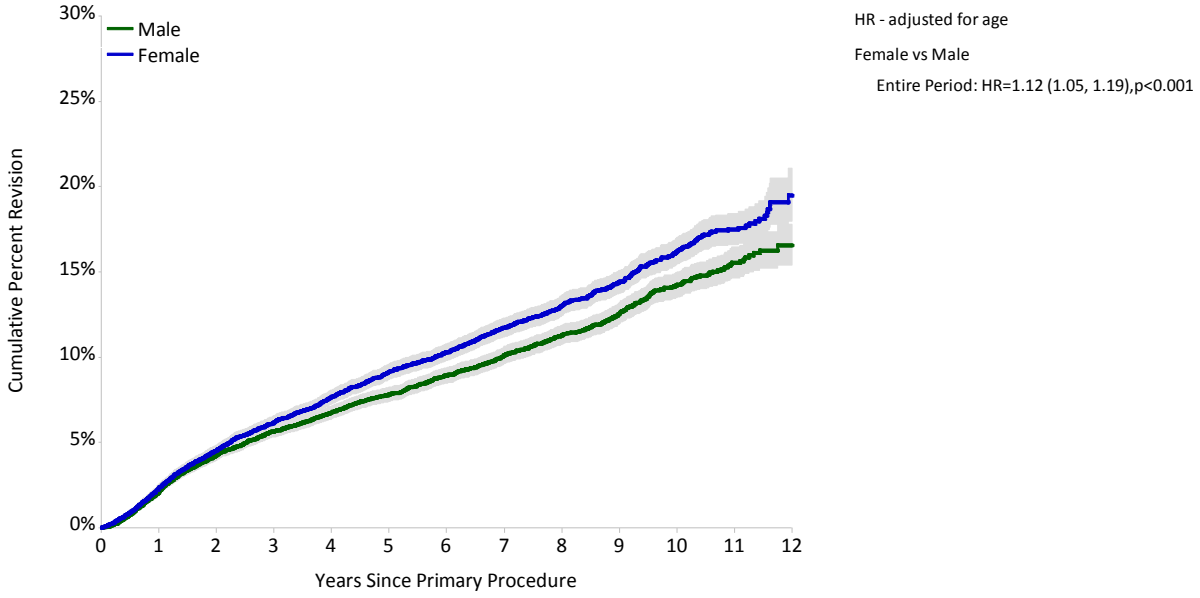


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
<55	5530	5045	3990	3021	667	59
55-64	13038	12020	9820	7381	1517	120
65-74	12311	11377	9341	7210	1659	145
≥75	7803	7197	5918	4385	802	56

Table KP16: Cumulative Percent Revision of Primary Unicompartmental Knee Replacement by Gender and Age (Primary Diagnosis OA)

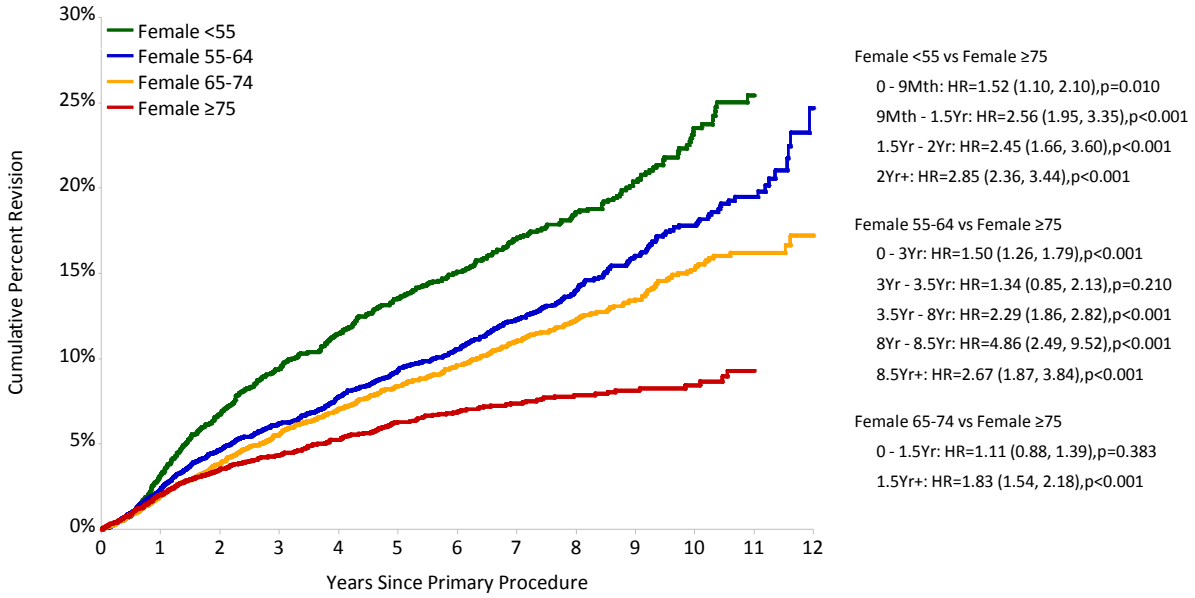
Gender and Age		N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Male	<55	370	2405	3.4 (2.8, 4.3)	9.9 (8.8, 11.3)	13.0 (11.6, 14.6)	23.2 (20.8, 25.8)	
	55-64	705	6815	2.3 (2.0, 2.7)	6.1 (5.5, 6.7)	9.0 (8.2, 9.7)	15.7 (14.5, 17.0)	18.0 (16.4, 19.9)
	65-74	524	6807	1.8 (1.5, 2.1)	4.9 (4.4, 5.5)	6.5 (5.9, 7.2)	12.3 (11.2, 13.5)	15.0 (12.7, 17.6)
	≥75	218	4087	1.6 (1.3, 2.0)	3.6 (3.1, 4.3)	4.9 (4.2, 5.7)	9.0 (7.7, 10.5)	
	TOTAL	**1817**	**20114**	**2.1 (1.9, 2.3)**	**5.7 (5.3, 6.0)**	**7.8 (7.4, 8.2)**	**14.2 (13.5, 15.0)**	**16.6 (15.4, 17.8)**
Female	<55	484	3125	3.2 (2.6, 3.9)	9.4 (8.4, 10.5)	13.5 (12.3, 14.9)	23.5 (21.3, 25.9)	
	55-64	711	6223	2.4 (2.0, 2.8)	6.2 (5.6, 6.9)	9.3 (8.5, 10.1)	17.8 (16.4, 19.3)	24.7 (20.7, 29.3)
	65-74	559	5504	2.0 (1.7, 2.4)	5.6 (5.0, 6.2)	8.4 (7.6, 9.2)	15.3 (14.0, 16.7)	17.2 (15.3, 19.3)
	≥75	240	3716	2.0 (1.6, 2.5)	4.3 (3.7, 5.1)	6.3 (5.5, 7.2)	8.4 (7.4, 9.7)	
	TOTAL	**1994**	**18568**	**2.3 (2.1, 2.6)**	**6.2 (5.8, 6.6)**	**9.1 (8.7, 9.6)**	**16.2 (15.4, 17.0)**	**19.5 (18.0, 21.1)**

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



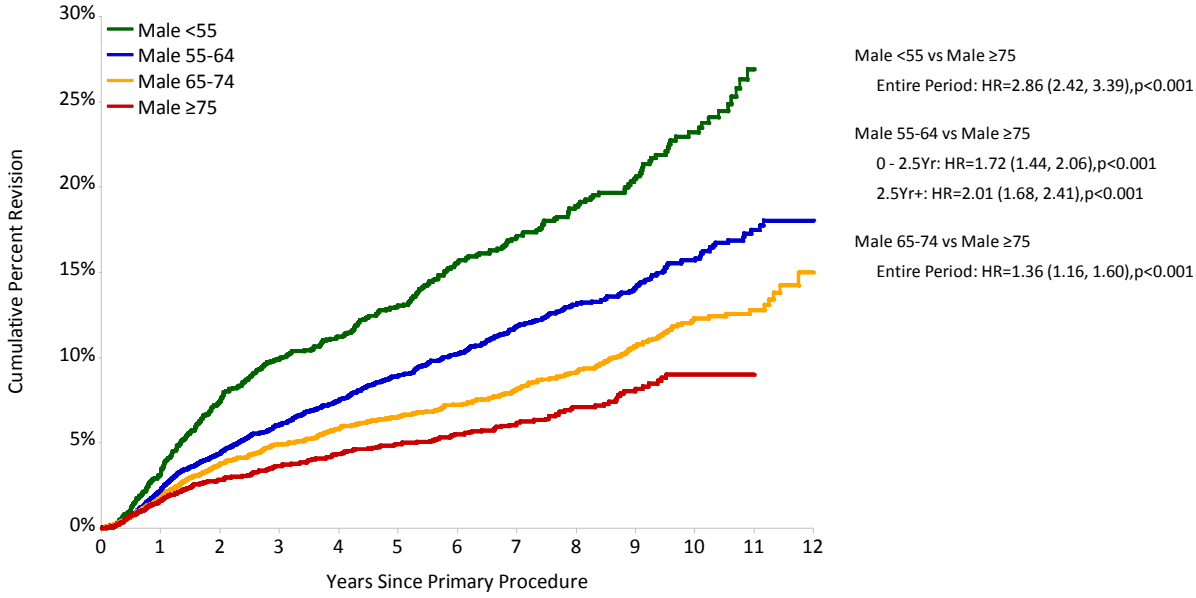
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Male	20114	18449	14845	11173	2371	193
Female	18568	17190	14224	10824	2274	187

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



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Female	<55	3125	2846	2284	1736	375	39
	55-64	6223	5756	4747	3565	687	43
	65-74	5504	5126	4278	3313	776	73
	≥75	3716	3462	2915	2210	436	32

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



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Male	<55	2405	2199	1706	1285	292	20
Male	55-64	6815	6264	5073	3816	830	77
Male	65-74	6807	6251	5063	3897	883	72
Male	≥75	4087	3735	3003	2175	366	24

Table KP17: Cumulative Precent Revision of Primary Unicompartmental Knee Replacement by Prosthesis Type

Uni Femoral	Uni Tibial	N Revised	N Total	1 Yr	3yrs	5 Yrs	10 Yrs	12 Yrs
Allegretto Uni	Allegretto Uni	236	2024	3.0 (2.4, 3.9)	5.6 (4.7, 6.7)	7.8 (6.7, 9.1)	14.5 (12.7, 16.5)	19.1 (15.9, 22.8)
BalanSys Uni	BalanSys Uni Fixed	13	287	2.2 (1.0, 4.9)	3.1 (1.6, 6.1)	4.8 (2.6, 8.6)		
Endo-Model Sled	Endo-Model Sled	103	1071	1.1 (0.7, 2.0)	5.1 (3.9, 6.7)	8.1 (6.5, 10.1)		
Freedom PKR/Active	Freedom PKR/Active	165	1343	1.5 (1.0, 2.4)	7.3 (6.0, 8.9)	13.0 (11.1, 15.2)		
GRU	GRU	154	1936	1.4 (1.0, 2.1)	4.6 (3.7, 5.7)	6.5 (5.4, 7.7)	12.2 (10.2, 14.7)	
Genesis	Genesis	234	1863	2.7 (2.1, 3.6)	8.2 (7.0, 9.6)	10.8 (9.4, 12.4)	16.5 (14.2, 19.1)	
M/G	M/G	186	2133	1.6 (1.1, 2.2)	4.1 (3.4, 5.1)	6.5 (5.5, 7.6)	10.2 (8.8, 11.9)	13.5 (10.5, 17.3)
Oxford 3	Oxford	53	1364	3.2 (2.4, 4.4)	5.1 (3.8, 6.8)			
Oxford 3	Oxford 3	1255	11715	2.3 (2.0, 2.5)	5.9 (5.5, 6.4)	8.6 (8.1, 9.2)	14.6 (13.8, 15.5)	16.8 (15.5, 18.2)
Preservation	Preservation Fixed	287	2318	2.4 (1.9, 3.1)	7.1 (6.1, 8.2)	9.6 (8.4, 10.9)	16.3 (14.3, 18.6)	
Preservation	Preservation Mobile	101	400	5.3 (3.5, 7.9)	15.5 (12.3, 19.5)	19.1 (15.6, 23.3)	27.0 (22.7, 32.0)	
Repicci II	Repicci II	357	2876	1.6 (1.2, 2.1)	4.4 (3.7, 5.2)	7.4 (6.4, 8.5)	17.7 (15.9, 19.6)	
Sigma HP	Sigma HP	8	340	1.4 (0.5, 3.6)	2.5 (1.2, 5.3)			
Uniglide	Uniglide	101	706	4.6 (3.3, 6.5)	10.8 (8.7, 13.4)	13.1 (10.7, 16.0)		
Unix	Unix	264	3416	2.3 (1.8, 2.8)	5.3 (4.5, 6.1)	7.1 (6.2, 8.1)	12.6 (10.9, 14.5)	
ZUK	ZUK	118	3300	1.3 (1.0, 1.8)	3.9 (3.2, 4.7)	5.0 (4.2, 6.1)		
Other (33)		221	2010	3.5 (2.7, 4.4)	8.4 (7.1, 9.8)	10.9 (9.4, 12.6)	21.1 (18.1, 24.5)	22.3 (19.1, 25.9)
TOTAL		**3856**	**39102**					

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

PRIMARY TOTAL KNEE REPLACEMENT

Classes of Total Knee Replacement

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

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

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

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

Low use systems are unlikely to be subdivided because of small numbers or insufficient follow up. The exception is if the system is identified as having a higher than anticipated rate of revision. The Registry then undertakes catalogue range specific analysis to determine if the identified higher than anticipated rate of revision is associated with specific prosthesis characteristics.

To enable the Registry to undertake range specific analysis uniformly across all knee systems it is necessary to link the different catalogue ranges to the specific prosthesis characteristics. This is an ongoing process.

Demographics

This year the Registry is reporting on 351,875 primary total knee procedures, an additional 42,202 procedures compared to the last report.

The use of primary total knee replacement continues to increase. In 2012, there were 4.1% more procedures than 2011 and 92.4% more than 2003. As a proportion of all knee replacement procedures, primary total knee replacement increased from 76.7% in 2003 to 87.3% in 2012.

As with all other types of primary knee replacement, osteoarthritis is the most common diagnosis for primary total knee replacement (97.4%).

Primary total knee replacement is more common in females (56.4% in 2012). This proportion has remained relatively constant since 2003 (Figure KT1).

Figure KT1: Primary Total Knee Replacement by Gender

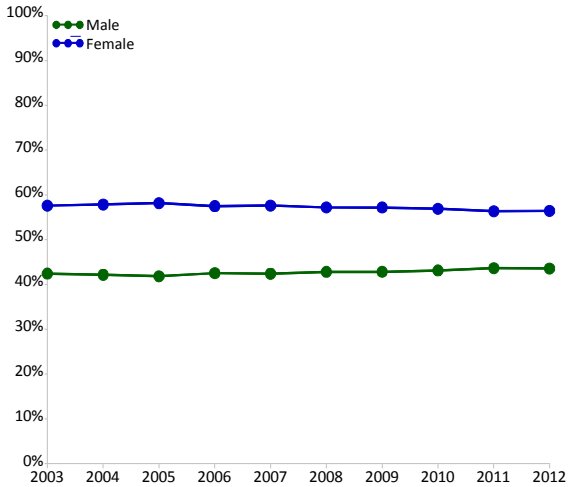
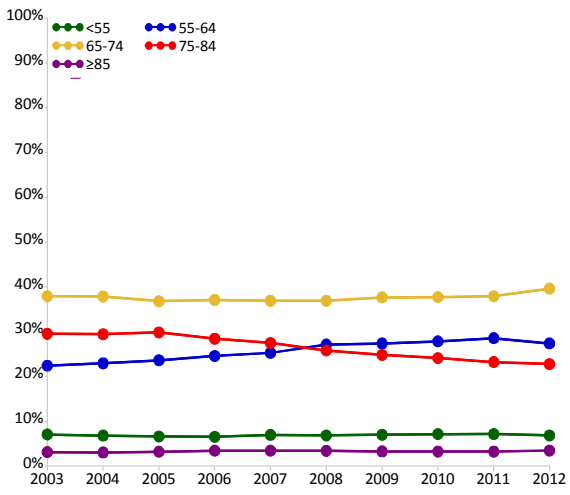


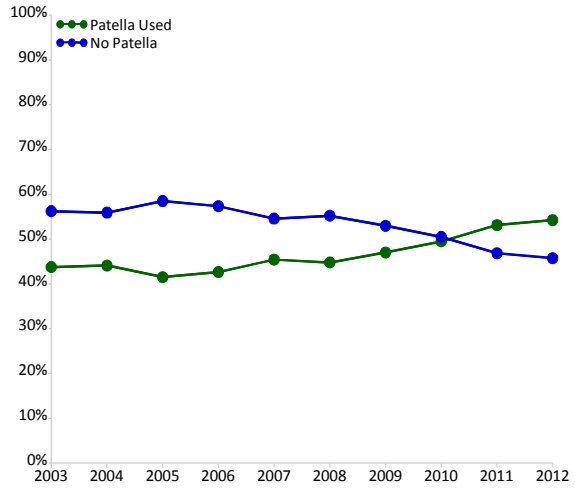
Figure KT2: Primary Total Knee Replacement by Age



Since 2003, there has been a decrease in the proportion of patients aged 75-84 years from 29.5% to 22.8% in 2012. The proportion of patients aged less than 55 years has remained small (6.8% in 2012) (Figure KT2).

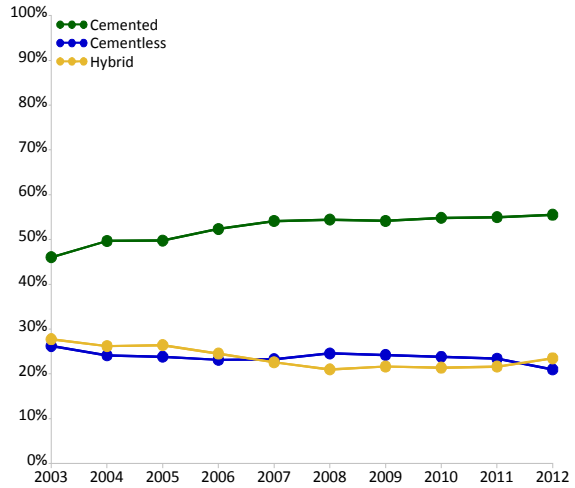
The use of patella resurfacing in primary total knee replacement continues to increase from a low of 41.5% in 2005 to 54.3% in 2012 (Figure KT3).

Figure KT3: Primary Total Knee Replacement by Patella Usage



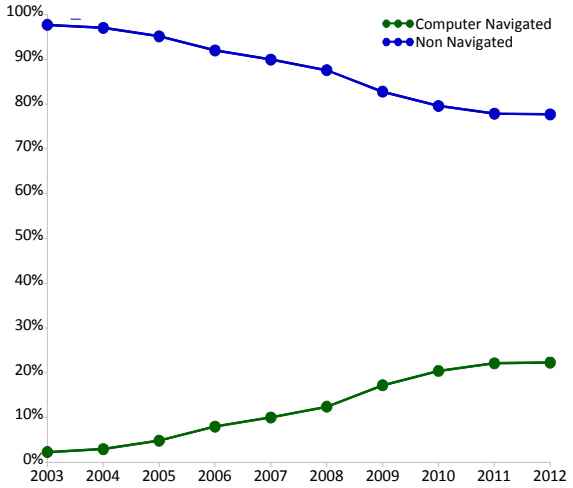
Cementing both femoral and tibial components is the most common method of fixation. This has increased from 46.0% in 2003 to 55.5% in 2012 (Figure KT4).

Figure KT4: Primary Total Knee Replacement by Fixation



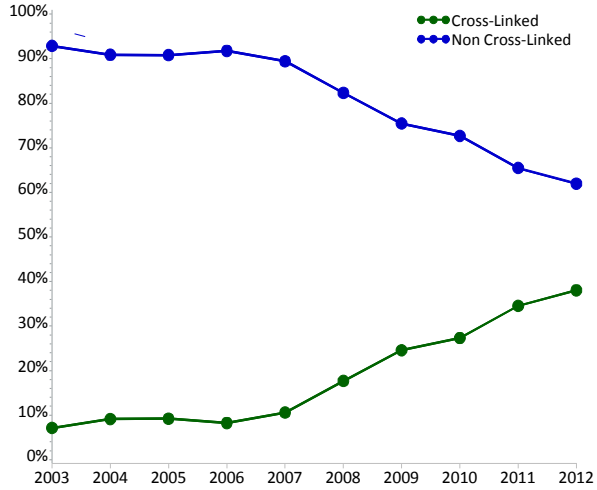
The proportion of primary total knee replacement inserted with computer navigation has increased from 2.3% in 2003 to 22.3% in 2012 (Figure KT5).

Figure KT5: Primary Total Knee Replacement by Computer Navigation



The use of cross-linked polyethylene in primary total knee replacement has also been increasing. In 2003, the proportion of procedures using cross-linked polyethylene was 7.1%. This increased to 38.0% in 2012 (Figure KT6).

Figure KT6: Primary Total Knee Replacement by Type of Polyethylene



In 2012, the most commonly used prosthesis was the Triathlon (18.7%), followed by Nexgen CR Flex (12.6%) and PFC Sigma (9.6%) (Table KT1). The Triathlon and PFC Sigma systems include a number of different types of femoral prostheses. However, Nexgen femoral prostheses are subdivided into Nexgen CR, Nexgen CR Flex, Nexgen LPS, Nexgen LPS Flex and Nexgen LCCK. In 2012, the use of all Nexgen femoral prostheses combined accounted for 20.5% of all primary total knee replacement. The reporting of the ten most used systems for cemented, cementless and hybrid primary total knee replacement is based on the femoral prosthesis (Tables KT2-KT4).

The approach to reporting Genesis II and Genesis II Oxinium has changed compared to previous reports.

At the request of the company, two femoral components have been renamed from Genesis II and Genesis II Oxinium to Legion and Legion Oxinium prostheses. This affects 1587 and 3747 procedures respectively.

Detailed information on the demographics of primary total knee replacement is provided in the supplementary report 'Demographics of Knee Arthroplasty' available on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2013.

Table KT1: Ten Most Used Femoral Prostheses in Primary Total Knee Replacement

2003		2009		2010		2011		2012	
N	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**
3184	LCS	4715	Triathlon	5837	Triathlon	7374	Triathlon	7833	Triathlon
2847	Duracon	3916	PFC Sigma	4385	PFC Sigma	4823	Nexgen CR Flex	5276	Nexgen CR Flex
2150	Nexgen CR	3771	LCS	3797	Nexgen CR Flex	4018	PFC Sigma	4024	PFC Sigma
2115	Scorpio	3407	Nexgen CR Flex	3596	Genesis II	3465	LCS	3345	LCS
1944	PFC Sigma	3003	Genesis II	3595	LCS	3174	Genesis II	3253	Vanguard
1521	Genesis II	2494	Nexgen LPS Flex	2773	Nexgen LPS Flex	2991	Vanguard	3046	Genesis II
1002	Natural Knee II	1789	Vanguard	2716	Vanguard	2642	Nexgen LPS Flex	2588	Nexgen LPS Flex
902	Nexgen LPS	1557	Genesis II Oxinium	1770	Genesis II Oxinium	2100	Genesis II Oxinium	2149	Genesis II Oxinium
883	Profix	1283	Scorpio NRG	1110	Scorpio	1065	RBK	1496	Legion Oxinium
725	Genesis II Oxinium	1176	Scorpio	1021	Scorpio NRG	950	Scorpio	953	Legion
Ten Most Used									
17273	(10) 79.5%	27111	(10) 79.0%	30600	(10) 80.7%	32602	(10) 81.2%	33963	(10) 81.2%
Remainder									
4458	(40) 20.5%	7187	(47) 21.0%	7300	(47) 19.3%	7569	(50) 18.8%	7847	(54) 18.8%
TOTAL									
21731	(50) 100.0%	34298	(57) 100.0%	37900	(57) 100.0%	40171	(60) 100.0%	41810	(64) 100.0%

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

2003		2009		2010		2011		2012	
N	Model	N	Model	N	Model	N	Model	N	Model
1250	Duracon	2508	Triathlon	2945	Genesis II	3526	Triathlon	3953	Triathlon
1089	Genesis II	2422	Genesis II	2928	Triathlon	2586	Genesis II	2439	Genesis II
984	LCS	2351	Nexgen LPS Flex	2470	Nexgen LPS Flex	2385	Nexgen LPS Flex	2248	PFC Sigma
839	PFC Sigma	2026	PFC Sigma	2293	PFC Sigma	2110	PFC Sigma	2206	Nexgen LPS Flex
828	Nexgen LPS	1542	Genesis II Oxinium	1692	Genesis II Oxinium	2098	Genesis II Oxinium	2148	Genesis II Oxinium
793	Nexgen CR	1083	Nexgen CR Flex	1399	Nexgen CR Flex	1946	Nexgen CR Flex	1897	Nexgen CR Flex
713	Scorpio	881	Vanguard	1306	Vanguard	1449	Vanguard	1553	Vanguard
690	Nexgen LPS Flex	815	LCS	903	LCS	1053	LCS	1496	Legion Oxinium
548	Genesis II Oxinium	760	Scorpio NRG	654	Legion Oxinium	934	Legion Oxinium	1069	LCS
506	Profix	597	Journey	548	Scorpio NRG	520	Scorpio NRG	763	Legion
Ten Most Used									
8240 (10)	82.4%	14985 (10)	80.7%	17138 (10)	82.5%	18607 (10)	84.3%	19772 (10)	85.2%
Remainder									
1766 (34)	17.6%	3584 (43)	19.3%	3639 (43)	17.5%	3478 (46)	15.7%	3440 (50)	14.8%
TOTAL									
10006 (44)	100.0%	18569 (53)	100.0%	20777 (53)	100.0%	22085 (56)	100.0%	23212 (60)	100.0%

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

2003		2009		2010		2011		2012	
N	Model	N	Model	N	Model	N	Model	N	Model
1470	LCS	2097	LCS	1861	LCS	1914	Triathlon	1752	Triathlon
788	Nexgen CR	1288	Triathlon	1600	Triathlon	1579	LCS	1653	Nexgen CR Flex
500	Scorpio	1195	Nexgen CR Flex	1259	Nexgen CR Flex	1568	Nexgen CR Flex	1451	LCS
499	Natural Knee II	516	RBK	628	RBK	670	RBK	567	RBK
483	Active Knee	501	PFC Sigma	563	PFC Sigma	544	Vanguard	482	Vanguard
475	Duracon	388	Scorpio NRG	476	Vanguard	490	Active Knee	378	PFC Sigma
314	PFC Sigma	311	Active Knee	388	Active Knee	477	PFC Sigma	372	Active Knee
302	RBK	212	Score	372	Scorpio NRG	332	Scorpio NRG	287	Nexgen LPS Flex
187	Profix	209	Profix	195	Nexgen LPS Flex	203	Score	260	Scorpio NRG
141	Maxim	201	Scorpio	189	Scorpio	197	Nexgen LPS Flex	192	Score
Ten Most Used									
5159 (10)	90.5%	6918 (10)	83.3%	7531 (10)	83.5%	7974 (10)	84.9%	7394 (10)	84.2%
Remainder									
540 (12)	9.5%	1387 (19)	16.7%	1489 (21)	16.5%	1423 (20)	15.1%	1385 (22)	15.8%
TOTAL									
5699 (22)	100.0%	8305 (29)	100.0%	9020 (31)	100.0%	9397 (30)	100.0%	8779 (32)	100.0%

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

2003		2009		2010		2011		2012	
N	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**	**N**	**Model**
1122	Duracon	1389	PFC Sigma	1529	PFC Sigma	1934	Triathlon	2128	Triathlon
902	Scorpio	1129	Nexgen CR Flex	1309	Triathlon	1431	PFC Sigma	1726	Nexgen CR Flex
791	PFC Sigma	919	Triathlon	1139	Nexgen CR Flex	1309	Nexgen CR Flex	1398	PFC Sigma
730	LCS	859	LCS	934	Vanguard	998	Vanguard	1218	Vanguard
569	Nexgen CR	753	Vanguard	831	LCS	833	LCS	825	LCS
377	Genesis II	494	Genesis II	513	Genesis II	457	Genesis II	516	Genesis II
249	Maxim	451	Scorpio	450	Scorpio	441	Scorpio	310	Scorpio
232	Natural Knee II	225	Duracon	139	RBK	158	Nexgen CR	190	Legion
191	AGC	143	Nexgen LPS Flex	123	Nexgen CR	158	RBK	144	Nexgen CR
190	Profix	135	Scorpio NRG	108	Nexgen LPS Flex	109	Active Knee	139	Gender Solutions
Ten Most Used									
5353	(10) 88.8%	6497	(10) 87.5%	7075	(10) 87.3%	7828	(10) 90.1%	8594	(10) 87.5%
Remainder									
673	(25) 11.2%	927	(28) 12.5%	1028	(30) 12.7%	861	(31) 9.9%	1225	(29) 12.5%
TOTAL									
6026	(35) 100.0%	7424	(38) 100.0%	8103	(40) 100.0%	8689	(41) 100.0%	9819	(39) 100.0%

Outcome by Patient Characteristics

Primary total knee replacement has the lowest rate of revision compared to all other classes of primary knee replacement. The cumulative percent revision at 12 years for primary total knee replacement undertaken for osteoarthritis is 6.5% (Table KT5 and Figure KT7).

Reason for Revision

The main reasons for revision are loosening/lysis (29.7%), infection (21.7%), patellofemoral pain (13.2%), pain (8.9%) and instability (5.9%) (Table KT6).

The Registry combines loosening and lysis as a single diagnosis. This is because they usually occur in association. The reporting of lysis, not associated with loosening, has occurred in 1.8% of revision procedures.

The five most common reasons for revision are shown on Figure KT8. Initially infection is the most common reason for revision. Loosening/lysis exceeds infection to become the most common reason after three years. The remaining reasons for revision have a lower incidence than both infection and loosening/lysis.

Type of Revision

The most common types of revision are replacement of both the femoral and tibial prostheses (25.2%), patella only replacement (21.4%) and insert only exchange (20.3%) (Table KT7).

Primary Diagnosis

The four most common primary diagnoses are osteoarthritis, rheumatoid arthritis, other inflammatory arthritis and osteonecrosis. Rheumatoid arthritis has a lower rate of revision compared to osteoarthritis after nine months. There is no difference in the rate of revision between osteoarthritis and the other two diagnoses (Table KT8 and Figure KT9).

Age and Gender

Age is a major factor affecting the outcome of primary total knee replacement. The rate of revision increases with decreasing age, and this difference increases with time. After four years, those aged less than 55 years have over five times the rate of revision compared to those aged 75 years or older (Table KT9 and Figure KT10).

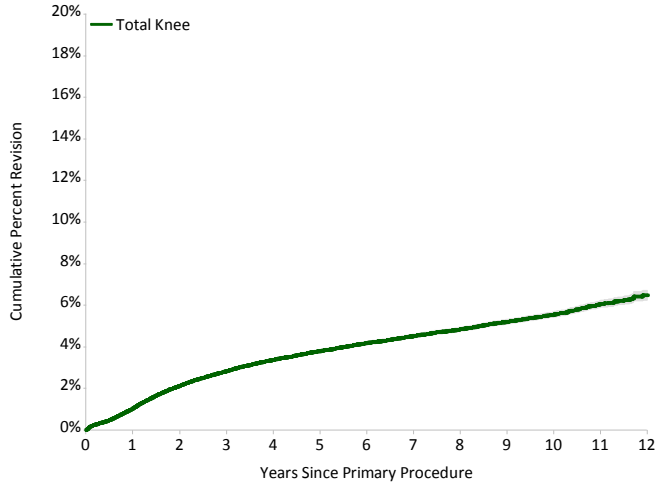
Males have a higher rate of revision compared to females (Table KT10 and Figure KT11). Age related differences in outcome are evident within both males and females (Table KT10 and Figures KT13 and KT14).

Loosening/lysis is the most common reason for revision in both males and females. Males have a higher incidence of revision for surgeon reported infection than females, with a 12 year cumulative incidence of 1.4% and 0.7% respectively (Figure KT12).

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

Knee Class	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Total Knee	11368	342574	1.0 (1.0, 1.1)	2.8 (2.8, 2.9)	3.8 (3.7, 3.9)	5.5 (5.4, 5.7)	6.5 (6.2, 6.7)

Figure KT7: Cumulative Percent Revision of Primary Total Knee Replacement (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Total Knee	342574	295830	210523	141045	24515	2598

Table KT6: Primary Total Knee Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	3473	29.7
Infection	2536	21.7
Patellofemoral Pain	1540	13.2
Pain	1042	8.9
Instability	690	5.9
Arthrofibrosis	435	3.7
Fracture	289	2.5
Patella Erosion	282	2.4
Malalignment	265	2.3
Wear Tibial Insert	186	1.6
Incorrect Sizing	166	1.4
Metal Related Pathology	165	1.4
Other	635	5.4
TOTAL	**11704**	**100.0**

Table KT7: Primary Total Knee Replacement by Type of Revision

Type of Revision	Number	Percent
TKR (Tibial/Femoral)	2951	25.2
Patella Only	2510	21.4
Insert Only	2381	20.3
Tibial Component	1286	11.0
Insert/Patella	1022	8.7
Femoral Component	785	6.7
Cement Spacer	655	5.6
Removal of Prostheses	66	0.6
Minor Components	32	0.3
Reinsertion of Components	7	0.1
Cement Only	6	0.1
Total Femoral	2	0.0
Patella/Trochlear Resurfacing	1	0.0
TOTAL	**11704**	**100.0**

Figure KT8: Revision Diagnosis Cumulative Incidence of Primary Total Knee Replacement

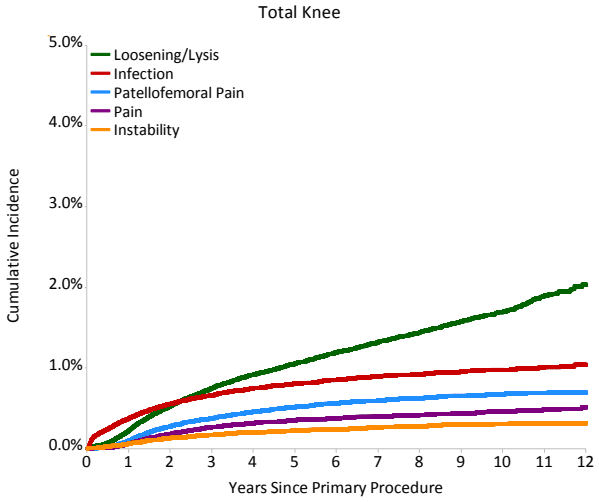
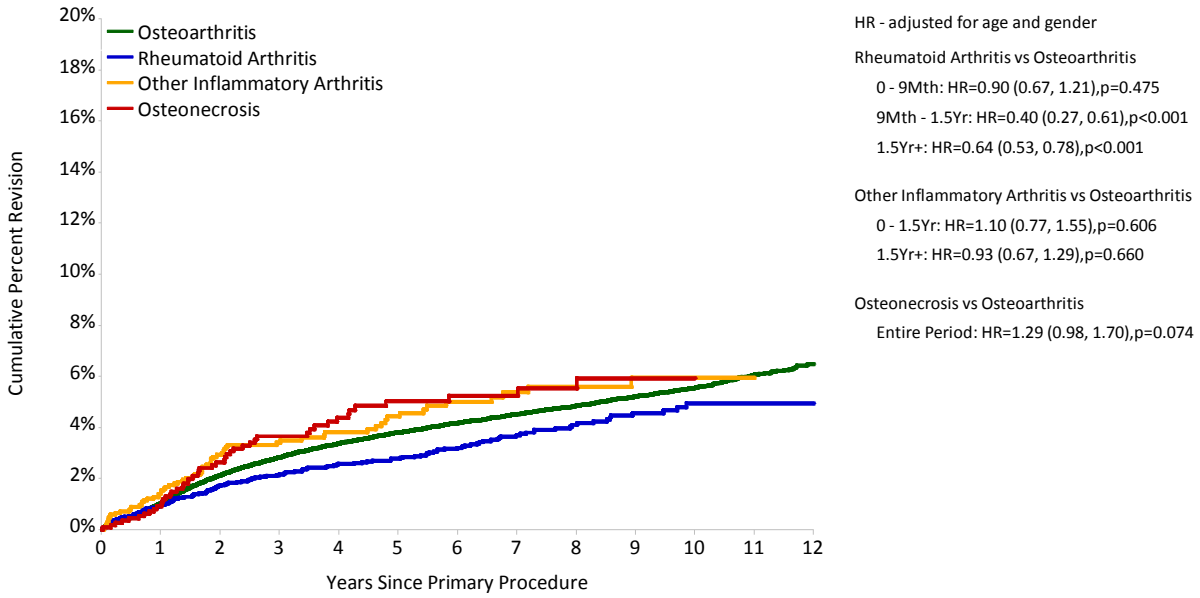


Table KT8: Cumulative Percent Revision of Primary Total Knee Replacement by Primary Diagnosis

Primary Diagnosis	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Osteoarthritis	11368	342574	1.0 (1.0, 1.1)	2.8 (2.8, 2.9)	3.8 (3.7, 3.9)	5.5 (5.4, 5.7)	6.5 (6.2, 6.7)
Rheumatoid Arthritis	168	5648	1.0 (0.7, 1.3)	2.2 (1.8, 2.6)	2.8 (2.3, 3.3)	4.9 (4.1, 5.9)	4.9 (4.1, 5.9)
Other Inflammatory Arthritis	67	1715	1.5 (1.0, 2.3)	3.4 (2.6, 4.5)	4.4 (3.4, 5.7)	5.9 (4.6, 7.7)	
Osteonecrosis	50	1181	0.9 (0.5, 1.7)	3.7 (2.6, 5.0)	5.0 (3.7, 6.7)	5.9 (4.4, 8.0)	
Other (5)	51	757	2.0 (1.1, 3.3)	6.7 (4.8, 9.1)	9.3 (6.9, 12.4)		
TOTAL	**11704**	**351875**					

Note: Only Primary Diagnoses with over 500 procedures have been listed.

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

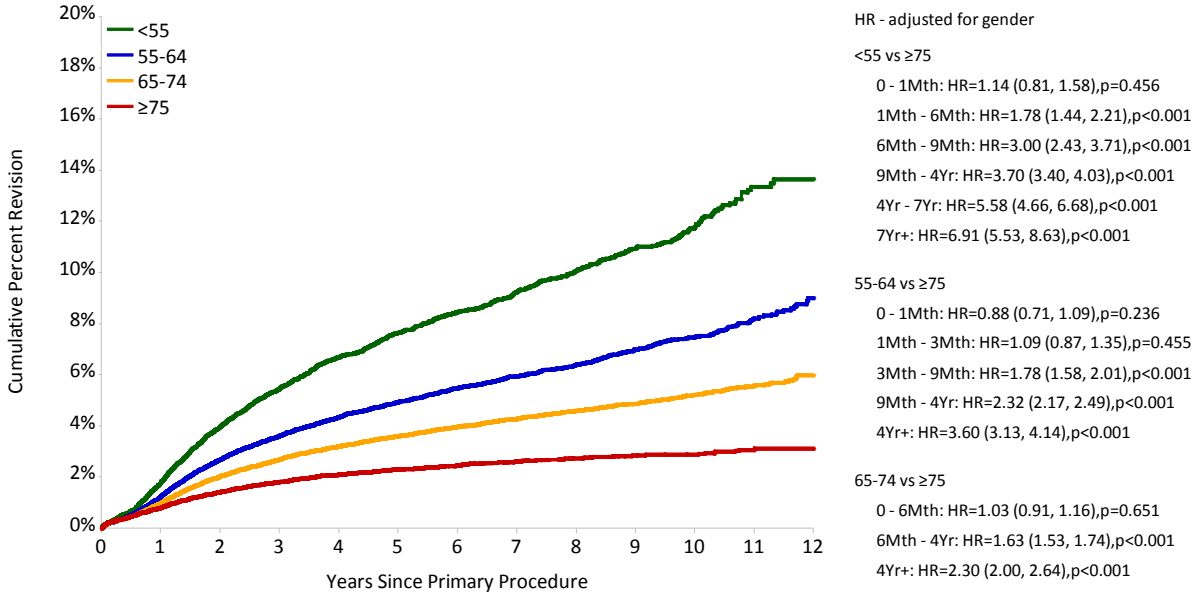


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Osteoarthritis	342574	295830	210523	141045	24515	2598
Rheumatoid Arthritis	5648	5029	3923	2901	641	86
Other Inflammatory Arthritis	1715	1481	1049	733	166	26
Osteonecrosis	1181	1027	754	518	102	4

Table KT9: Cumulative Percent Revision of Primary Total Knee Replacement by Age (Primary Diagnosis OA)

Age	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
<55	1528	22464	1.8 (1.6, 2.0)	5.4 (5.1, 5.8)	7.6 (7.2, 8.1)	11.8 (11.1, 12.5)	13.6 (12.6, 14.7)
55-64	3733	87640	1.2 (1.2, 1.3)	3.6 (3.5, 3.7)	4.9 (4.7, 5.1)	7.5 (7.2, 7.8)	9.0 (8.4, 9.6)
65-74	4100	130209	1.0 (0.9, 1.0)	2.7 (2.6, 2.8)	3.6 (3.5, 3.7)	5.2 (5.0, 5.4)	6.0 (5.6, 6.3)
≥75	2007	102261	0.8 (0.7, 0.8)	1.8 (1.7, 1.9)	2.3 (2.2, 2.4)	2.9 (2.7, 3.0)	3.1 (2.9, 3.3)
TOTAL	**11368**	**342574**					

Figure KT10: Cumulative Percent Revision of Primary Total Knee Replacement by Age (Primary Diagnosis OA)

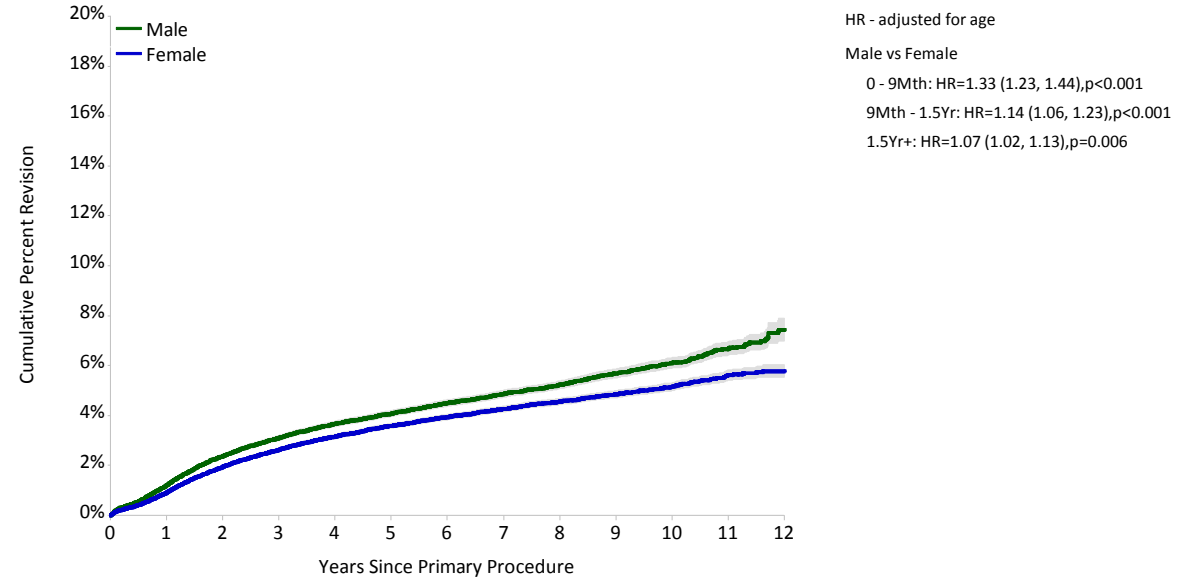


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
<55	22464	19340	13539	9134	1774	190
55-64	87640	75243	52150	34196	6258	676
65-74	130209	112155	80347	54796	10407	1182
≥75	102261	89092	64487	42919	6076	550

Table KT10: Cumulative Percent Revision of Primary Total Knee Replacement by Gender and Age (Primary Diagnosis OA)

Gender and Age		N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Male	<55	687	9763	2.1 (1.9, 2.5)	5.8 (5.3, 6.4)	7.6 (7.0, 8.2)	12.0 (11.0, 13.1)	14.0 (12.5, 15.7)
	55-64	1840	39938	1.4 (1.3, 1.5)	3.9 (3.7, 4.1)	5.3 (5.0, 5.5)	8.1 (7.6, 8.5)	10.2 (9.1, 11.3)
	65-74	1918	57721	1.1 (1.0, 1.2)	2.9 (2.7, 3.0)	3.8 (3.6, 4.0)	5.6 (5.3, 5.9)	6.7 (6.0, 7.4)
	≥75	861	40757	0.9 (0.8, 1.0)	2.0 (1.8, 2.1)	2.4 (2.3, 2.6)	3.2 (2.9, 3.4)	3.6 (3.2, 4.0)
	TOTAL	**5306**	**148179**	**1.2 (1.2, 1.3)**	**3.1 (3.0, 3.2)**	**4.1 (4.0, 4.2)**	**6.1 (5.9, 6.3)**	**7.4 (7.0, 7.9)**
Female	<55	841	12701	1.6 (1.4, 1.8)	5.2 (4.7, 5.6)	7.7 (7.1, 8.2)	11.6 (10.7, 12.5)	13.3 (12.0, 14.8)
	55-64	1893	47702	1.1 (1.0, 1.2)	3.4 (3.2, 3.5)	4.6 (4.4, 4.9)	7.0 (6.6, 7.4)	8.0 (7.3, 8.6)
	65-74	2182	72488	0.9 (0.8, 0.9)	2.5 (2.4, 2.7)	3.4 (3.3, 3.6)	4.9 (4.7, 5.1)	5.5 (5.1, 5.8)
	≥75	1146	61504	0.7 (0.6, 0.8)	1.7 (1.6, 1.8)	2.2 (2.1, 2.3)	2.7 (2.5, 2.9)	2.8 (2.6, 3.1)
	TOTAL	**6062**	**194395**	**0.9 (0.9, 1.0)**	**2.6 (2.5, 2.7)**	**3.6 (3.5, 3.7)**	**5.1 (5.0, 5.3)**	**5.8 (5.5, 6.0)**

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



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Male	148179	127192	89463	59184	10157	1094
Female	194395	168638	121060	81861	14358	1504

Figure KT12: Revision Diagnosis Cumulative Incidence of Primary Total Knee Replacement by Gender (Primary Diagnosis OA)

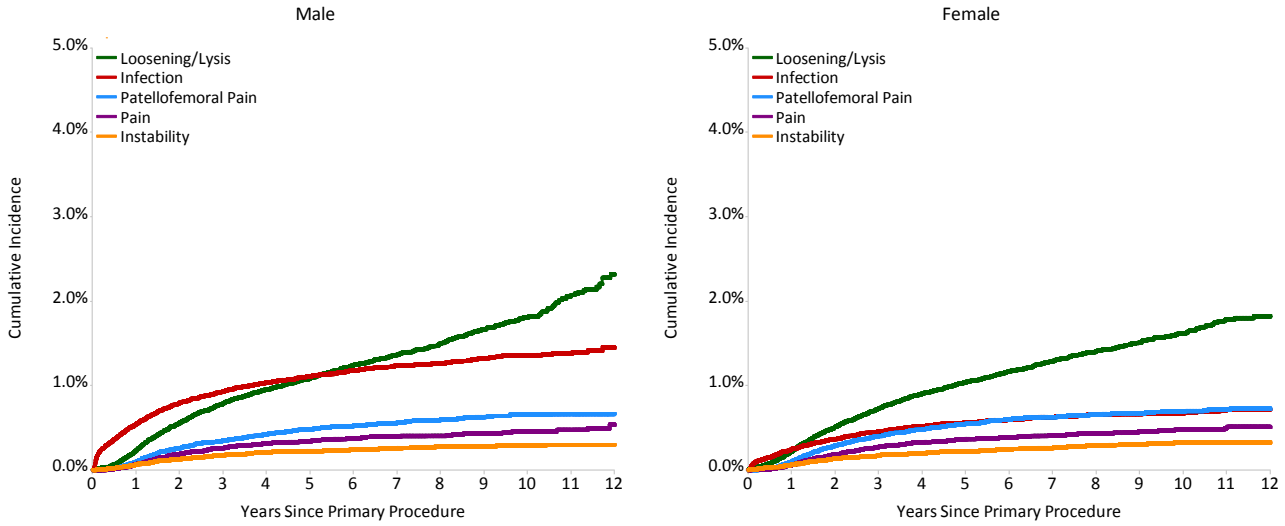
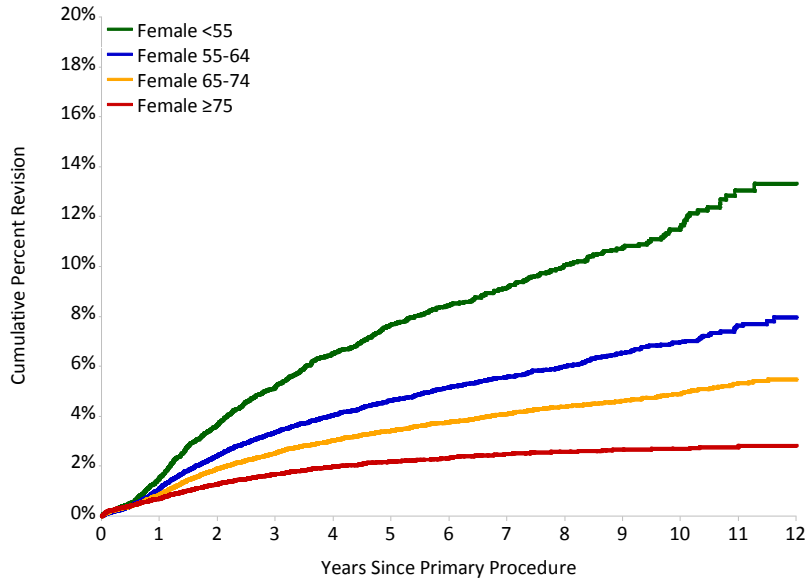


Figure KT13: Cumulative Percent Revision of Primary Total Knee Replacement for Females by Age (Primary Diagnosis OA)



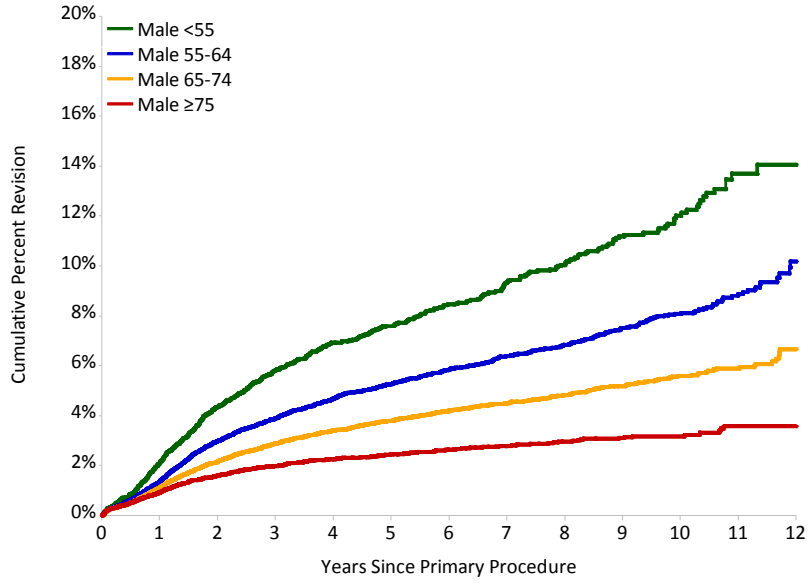
Female <55 vs Female ≥75
0 - 1Mth: HR=0.90 (0.54, 1.51),p=0.692
1Mth - 6Mth: HR=1.51 (1.11, 2.06),p=0.009
6Mth - 9Mth: HR=2.78 (2.04, 3.80),p<0.001
9Mth - 4Yr: HR=3.97 (3.54, 4.46),p<0.001
4Yr+: HR=6.75 (5.48, 8.32),p<0.001

Female 55-64 vs Female ≥75
0 - 3Mth: HR=0.77 (0.60, 0.99),p=0.040
3Mth - 9Mth: HR=1.73 (1.42, 2.10),p<0.001
9Mth - 4Yr: HR=2.38 (2.16, 2.62),p<0.001
4Yr+: HR=3.67 (3.05, 4.42),p<0.001

Female 65-74 vs Female ≥75
0 - 3Mth: HR=0.95 (0.77, 1.17),p=0.618
3Mth - 9Mth: HR=1.20 (0.99, 1.46),p=0.061
9Mth - 4Yr: HR=1.72 (1.57, 1.89),p<0.001
4Yr+: HR=2.39 (1.99, 2.87),p<0.001

Number at Risk		0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Female	<55	12701	10932	7646	5110	974	105
	55-64	47702	41000	28520	18743	3370	352
	65-74	72488	62738	45326	31275	6048	711
	≥75	61504	53968	39568	26733	3966	336

Figure KT14: Cumulative Percent Revision of Primary Total Knee Replacement for Males by Age (Primary Diagnosis OA)



Male <55 vs Male ≥75
0 - 9Mth: HR=1.95 (1.59, 2.39),p<0.001
9Mth - 1.5Yr: HR=2.98 (2.43, 3.67),p<0.001
1.5Yr+: HR=4.46 (3.87, 5.15),p<0.001

Male 55-64 vs Male ≥75
0 - 1Mth: HR=1.21 (0.92, 1.59),p=0.180
1Mth - 9Mth: HR=1.40 (1.18, 1.65),p<0.001
9Mth - 1.5Yr: HR=2.08 (1.77, 2.44),p<0.001
1.5Yr+: HR=2.92 (2.59, 3.29),p<0.001

Male 65-74 vs Male ≥75
0 - 9Mth: HR=1.10 (0.95, 1.28),p=0.201
9Mth - 1.5Yr: HR=1.46 (1.24, 1.72),p<0.001
1.5Yr+: HR=1.96 (1.74, 2.21),p<0.001

Number at Risk		0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Male	<55	9763	8408	5893	4024	800	85
	55-64	39938	34243	23630	15453	2888	324
	65-74	57721	49417	35021	23521	4359	471
	≥75	40757	35124	24919	16186	2110	214

Outcome by Prostheses Characteristics

Fixed and Mobile Bearing

Tibial prostheses are either modular or non-modular. Modular prostheses have a metal baseplate and tibial insert which may be fixed or mobile. Non-modular are either all-polyethylene or polyethylene moulded to a metal baseplate.

Mobile bearings include inserts that move in one of three ways; rotating, sliding or both rotating and sliding. Fixed bearings include non-modular tibial prostheses as well as fixed inserts that do not move relative to the baseplate.

Fixed bearing prostheses have a lower rate of revision compared to rotating over the entire period and rotating-sliding after 2.5 years (Table KT11 and Figure KT15).

The Registry has previously reported that within the fixed bearing group, all-polyethylene tibial prostheses have a higher rate of revision compared to both moulded non-modular tibial prostheses and fixed modular tibial prostheses (Table KT12 and Figure KT16). This result should be interpreted with caution. The Registry has information on only 1,225 all-polyethylene tibial prostheses. The rate of revision varies depending on the prosthesis used. Two all-polyethylene tibial prostheses have a higher rate of revision compared to all other prostheses in this group (Table KT12). When these two prostheses are excluded, there is no difference in the revision rate of all-polyethylene tibial prostheses compared to both moulded non-modular and fixed modular tibial prostheses.

Stability

Stability refers to particular prosthetic features intended to substitute for the intrinsic stability of knee ligaments. The two major categories are minimally and posterior stabilised.

The Registry defines minimally stabilised prostheses as those that have a flat or dished tibial articulation regardless of congruency. Posterior stabilised is defined as a prosthesis with a peg and box design intended to provide additional posterior stability. Alternatively, the additional posterior stability can be provided by a cam and groove design. This design is used less frequently.

Fully stabilised (large peg and box design) and hinged are additional prostheses that provide collateral as well as posterior ligament stability. These prostheses are infrequently used in primary procedures (Table KT13) and if used, usually in complex clinical situations. Therefore, these prostheses have not been included in any comparative outcome analysis for primary total knee replacement.

Posterior stabilised prostheses have a higher rate of revision compared to minimally stabilised (Table KT13 and Figure KT17).

Patellar Resurfacing

Resurfacing the patella has a lower rate of revision compared to procedures with no patella resurfacing (Table KT14 and Figure KT18). When resurfacing the patella, the rate of revision is lower for minimally stabilised compared to posterior stabilised prostheses. Posterior stabilised without patellar resurfacing has the highest rate of revision (Table KT14 and Figure KT19).

Outcomes related to the use of patella resurfacing vary depending on the type of prostheses used. Most have a lower rate of revision when the patella is resurfaced, however some prostheses, for example the Duracon, have no difference in the rate of revision depending on whether the patella is resurfaced or not (Table KT15 and Figures KT20).

Fixation

The outcome of revision varies depending on fixation. Hybrid fixation has a lower rate of revision compared to both cemented and cementless fixation. Cemented fixation has a lower rate of revision than cementless fixation (Table KT16 and Figure KT21).

Computer Navigation

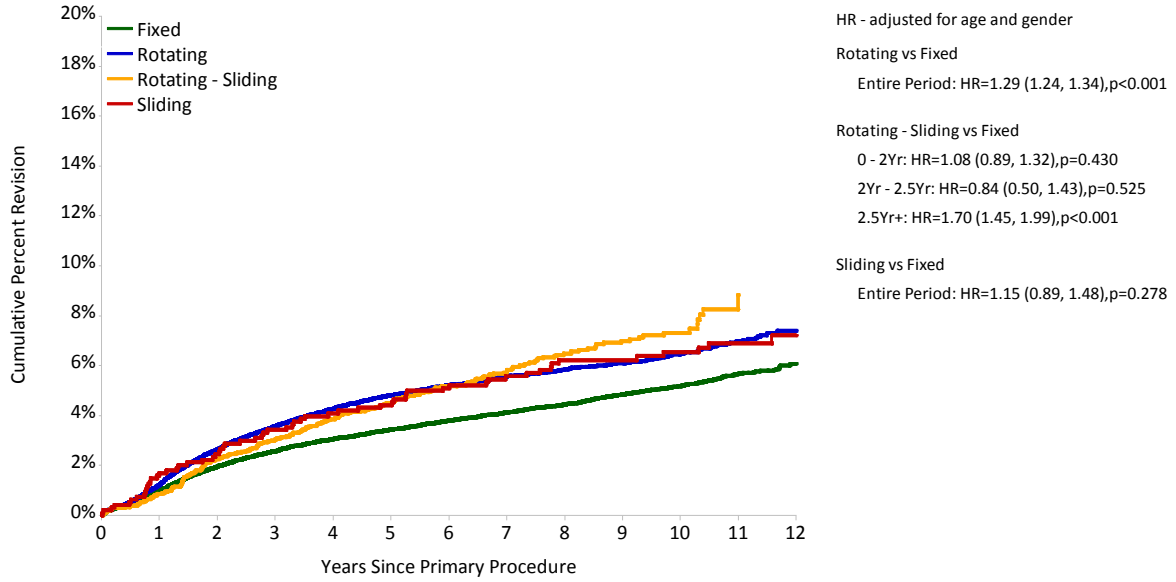
The Registry has data on 42,584 knee replacement procedures undertaken for osteoarthritis that have used computer navigation. There is no difference in the rate of revision between procedures with or without computer navigation and this is not affected by age (Table KT17 and Figure KT22 and KT23).

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

Bearing Mobility	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Fixed	7662	258564	1.0 (0.9, 1.0)	2.6 (2.5, 2.6)	3.4 (3.3, 3.5)	5.2 (5.0, 5.3)	6.1 (5.8, 6.4)
Rotating	3366	78298	1.2 (1.2, 1.3)	3.6 (3.4, 3.7)	4.8 (4.6, 5.0)	6.5 (6.2, 6.7)	7.4 (6.9, 7.9)
Rotating - Sliding	275	4647	0.8 (0.6, 1.2)	3.0 (2.6, 3.6)	4.5 (3.9, 5.1)	7.3 (6.5, 8.3)	
Sliding	61	948	1.7 (1.0, 2.8)	3.4 (2.4, 4.8)	4.4 (3.3, 6.0)	6.5 (5.1, 8.4)	7.2 (5.6, 9.2)
TOTAL	**11364**	**342457**					

Note: Excluding 117 procedures with unknown bearing mobility

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

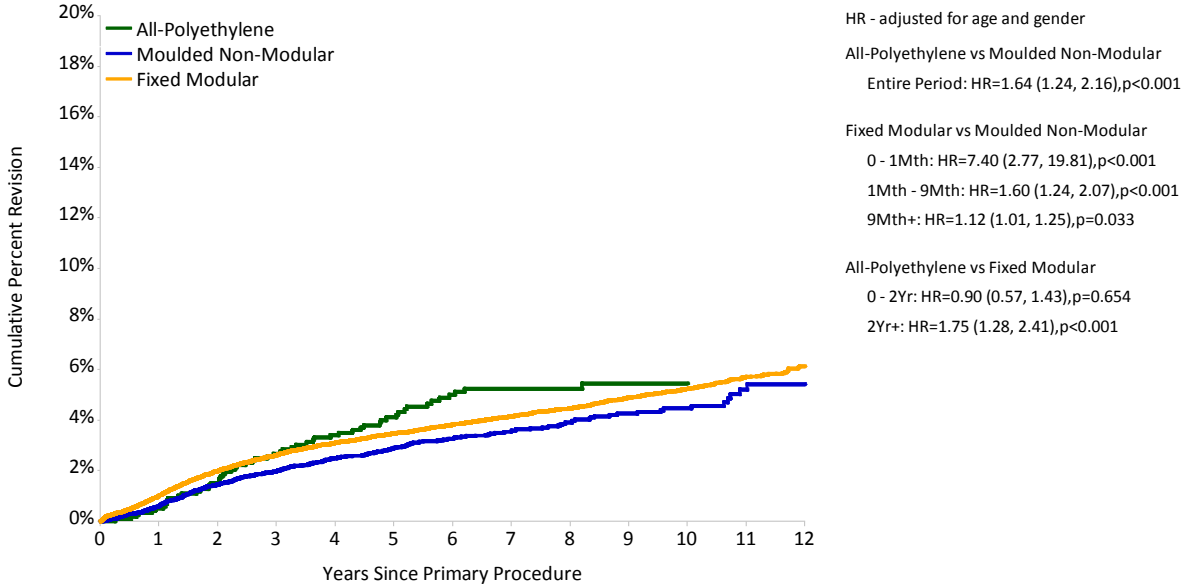


Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Fixed	258564	220480	153042	100857	17318	1851
Rotating	78298	69818	52360	35612	5944	529
Rotating - Sliding	4647	4494	4140	3650	683	10
Sliding	948	925	883	846	554	206

Table KT12: Cumulative Percent Revision of Primary Total Knee Replacement by Fixed Bearing Type (Primary Diagnosis OA)

Fixed Bearing	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
All-Polyethylene	57	1225	0.5 (0.2, 1.1)	2.7 (1.9, 3.8)	4.1 (3.1, 5.4)	5.4 (4.2, 7.0)	
Optetrak-PS	10	52	0.0 (0.0, 0.0)	13.5 (6.7, 26.2)	17.4 (9.4, 30.7)		
Scorpio	36	694	0.6 (0.2, 1.5)	2.8 (1.8, 4.4)	4.4 (3.1, 6.3)	5.7 (4.1, 7.9)	
Other	11	479	0.4 (0.1, 1.7)	1.1 (0.5, 2.7)	2.0 (1.0, 3.9)	3.1 (1.7, 5.6)	
Moulded Non-Modular	405	16356	0.6 (0.5, 0.7)	2.0 (1.8, 2.2)	2.9 (2.6, 3.2)	4.5 (3.9, 5.0)	5.4 (4.5, 6.5)
Fixed Modular	7200	240983	1.0 (1.0, 1.1)	2.6 (2.5, 2.7)	3.5 (3.4, 3.5)	5.2 (5.1, 5.4)	6.1 (5.8, 6.4)

Figure KT16: Cumulative Percent Revision of Primary Total Knee Replacement by Fixed Bearing Type (Primary Diagnosis OA)



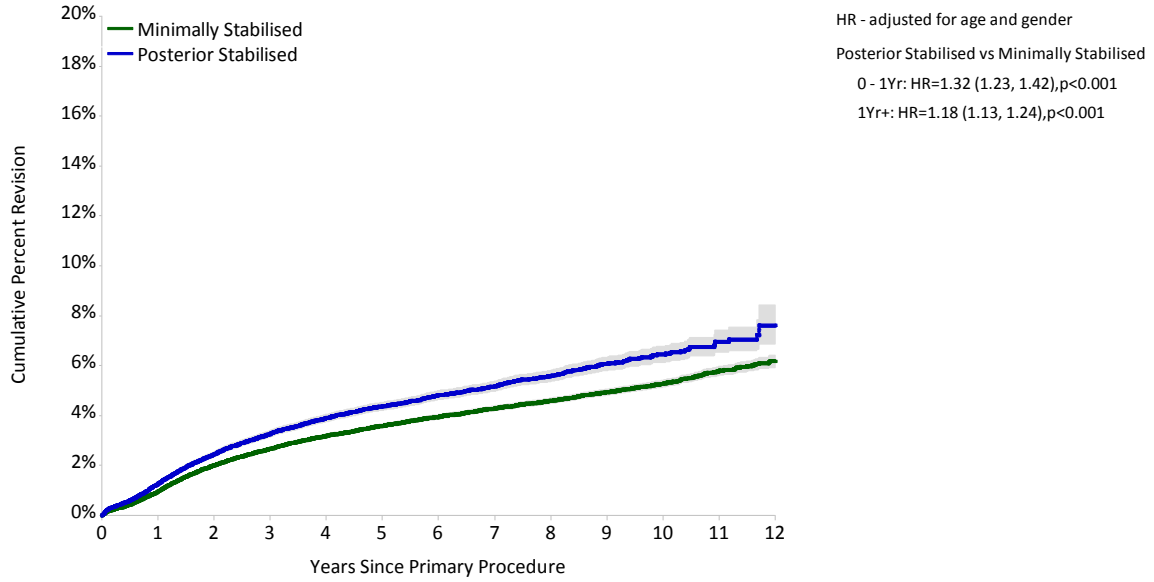
Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
All-Polyethylene	1225	1185	1075	907	106	4
Moulded Non-Modular	16356	14142	9996	6297	994	144
Fixed Modular	240983	205153	141971	93653	16218	1703

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

Stability	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Minimally Stabilised	8039	249334	1.0 (0.9, 1.0)	2.7 (2.6, 2.7)	3.6 (3.5, 3.7)	5.3 (5.1, 5.4)	6.2 (5.9, 6.4)
Posterior Stabilised	3273	91895	1.3 (1.2, 1.3)	3.3 (3.1, 3.4)	4.4 (4.2, 4.5)	6.4 (6.1, 6.8)	7.6 (6.9, 8.4)
Fully Stabilised	34	844	1.6 (0.9, 2.8)	5.0 (3.5, 7.3)	8.9 (5.7, 13.8)		
Hinged	18	384	1.7 (0.8, 3.7)	5.6 (3.3, 9.2)			
TOTAL	**11364**	**342457**					

Note: Excluding 117 procedures with unknown bearing mobility

Figure KT17: Cumulative Percent Revision of Primary Total Knee Replacement by Stability (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Minimally Stabilised	249334	216252	157222	109666	21326	2313
Posterior Stabilised	91895	78497	52648	31002	3118	281

Table KT14: Cumulative Percent Revision of Primary Total Knee Replacement by Stability and Patella Usage (Primary Diagnosis OA)

Stability by Patella Usage		N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
All Stability	No Patella	7010	182939	1.1 (1.1, 1.2)	3.2 (3.1, 3.3)	4.3 (4.2, 4.4)	6.0 (5.9, 6.2)	6.9 (6.6, 7.2)
	Patella Used	4358	159635	0.9 (0.9, 1.0)	2.3 (2.2, 2.4)	3.2 (3.1, 3.3)	4.9 (4.7, 5.1)	5.9 (5.6, 6.4)
Minimally	No Patella	5351	148093	1.0 (1.0, 1.1)	3.0 (2.9, 3.1)	4.0 (3.9, 4.1)	5.7 (5.5, 5.9)	6.5 (6.2, 6.8)
	Patella Used	2688	101241	0.8 (0.8, 0.9)	2.1 (2.0, 2.2)	3.0 (2.8, 3.1)	4.6 (4.4, 4.8)	5.7 (5.3, 6.2)
Posterior	No Patella	1624	34217	1.5 (1.4, 1.7)	4.2 (3.9, 4.4)	5.4 (5.2, 5.7)	7.6 (7.1, 8.1)	9.3 (8.0, 10.7)
	Patella Used	1649	57678	1.1 (1.0, 1.2)	2.7 (2.5, 2.8)	3.6 (3.4, 3.8)	5.7 (5.3, 6.1)	6.3 (5.5, 7.3)

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

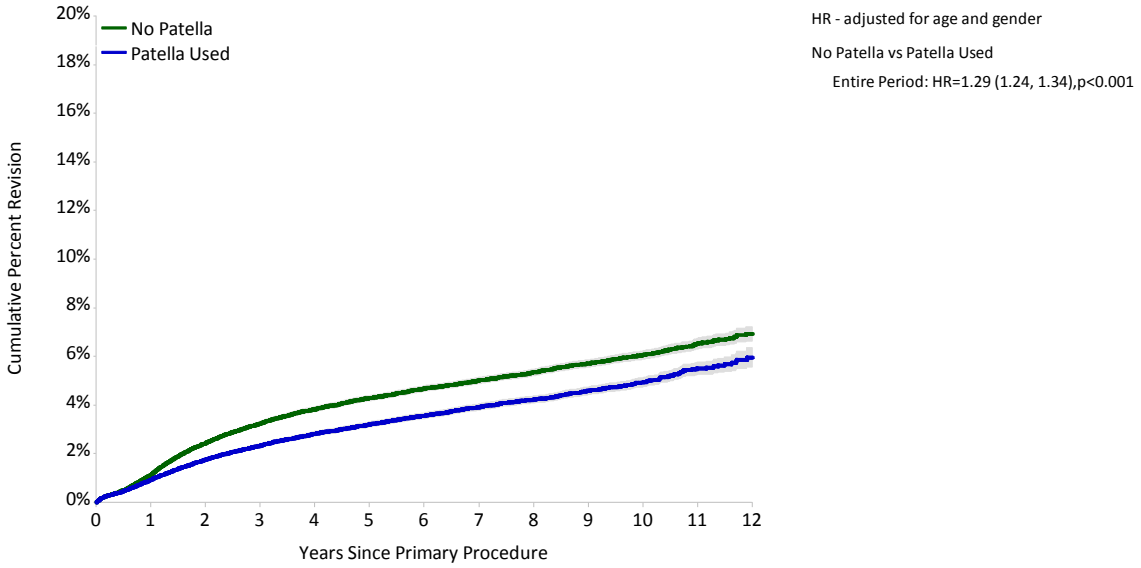
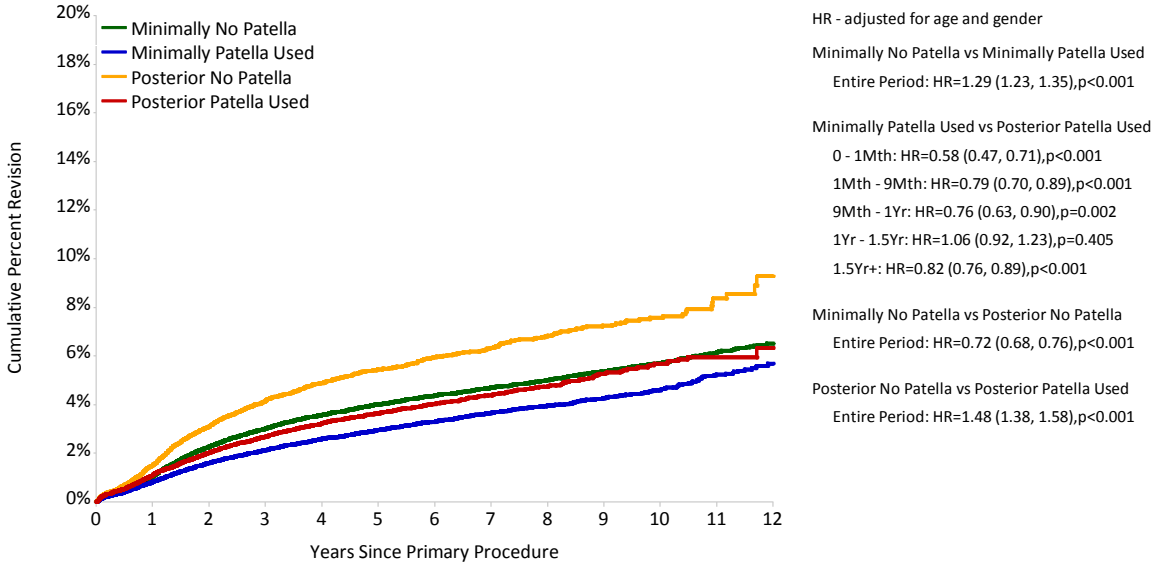


Figure KT19: Cumulative Percent Revision of Primary Total Knee Replacement by Stability and Patella Usage (Primary Diagnosis OA)

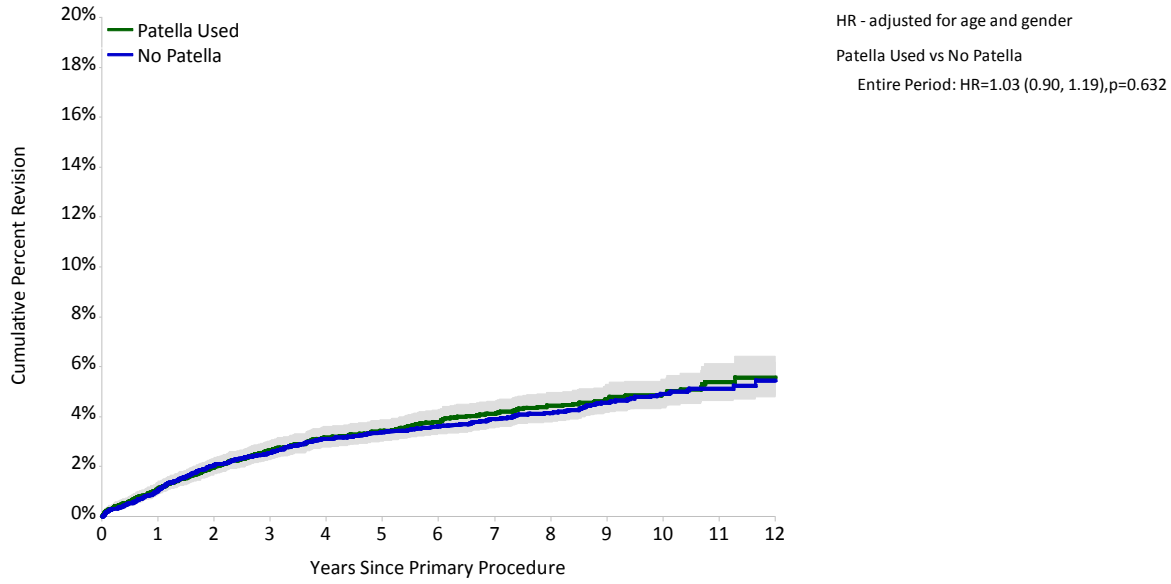


Number at Risk		0 Yr	1 Yrs	3 Yrs	5 Yrs	10 Yrs	12 Yrs
All Stability	No Patella	182939	160744	117896	79994	14227	1766
	Patella Used	159635	135086	92627	61051	10288	832
Minimally	No Patella	148093	129687	95757	66800	12843	1623
	Patella Used	101241	86565	61465	42866	8483	690
Posterior	No Patella	34217	30523	21781	12979	1343	141
	Patella Used	57678	47974	30867	18023	1775	140

Table KT15: Cumulative Percent Revision of Total Knee Replacement by Prosthesis and Patella Usage (Primary Diagnosis OA)

Prosthesis by Patella Usage		N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Duracon	Patella Used	316	7507	1.1 (0.9, 1.4)	2.6 (2.3, 3.0)	3.4 (3.0, 3.9)	4.9 (4.4, 5.5)	5.6 (4.8, 6.4)
	No Patella	520	12960	1.1 (0.9, 1.3)	2.5 (2.3, 2.8)	3.4 (3.1, 3.7)	4.9 (4.5, 5.4)	5.4 (4.8, 6.2)
	Total	**836**	**20467**					

Figure KT20: Cumulative Percent Revision of Duracon Total Knee Replacement by Patella Usage (Primary Diagnosis OA)



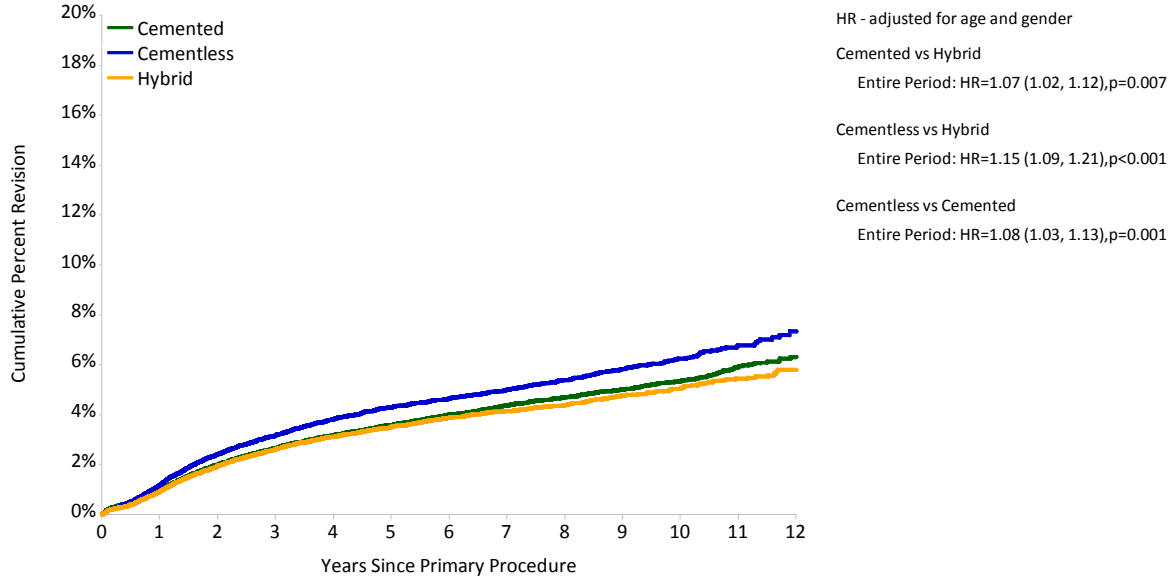
Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Duracon	Patella Used	7507	7333	6843	5732	1592	163
	No Patella	12960	12662	11976	10153	2279	269

Table KT16: Cumulative Percent Revision of Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)

Fixation	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	5546	179290	1.0 (0.9, 1.0)	2.7 (2.6, 2.7)	3.6 (3.5, 3.7)	5.3 (5.2, 5.5)	6.3 (6.0, 6.7)
Cementless	3059	80785	1.2 (1.1, 1.3)	3.2 (3.0, 3.3)	4.3 (4.1, 4.5)	6.2 (6.0, 6.5)	7.3 (6.8, 7.9)
Hybrid	2572	82081	0.9 (0.9, 1.0)	2.6 (2.5, 2.7)	3.5 (3.4, 3.7)	5.1 (4.8, 5.3)	5.8 (5.4, 6.2)
TOTAL	**11177**	**342156**					

Note: Excluding cementless Genesis Oxinium and Profix Oxinium femoral prostheses

Figure KT21: Cumulative Percent Revision of Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cemented	179290	153643	107396	70049	11609	1262
Cementless	80785	70730	50602	33719	5736	587
Hybrid	82081	71101	52294	37057	7133	749

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

Navigation by Age		N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs
Computer Navigated	<65 years	456	15203	1.1 (1.0, 1.3)	3.7 (3.3, 4.0)	5.1 (4.6, 5.6)	6.0 (5.3, 6.7)	
	≥65 years	534	27381	0.9 (0.8, 1.0)	2.4 (2.2, 2.6)	3.0 (2.7, 3.3)	3.6 (3.2, 4.0)	
	Total	**990**	**42584**	**1.0 (0.9, 1.1)**	**2.8 (2.6, 3.0)**	**3.7 (3.5, 4.0)**	**4.4 (4.1, 4.8)**	
Non Navigated	<65 years	4805	94901	1.4 (1.3, 1.5)	4.0 (3.9, 4.2)	5.5 (5.4, 5.7)	6.7 (6.5, 6.9)	8.5 (8.2, 8.7)
	≥65 years	5573	205089	0.9 (0.9, 0.9)	2.3 (2.2, 2.3)	3.0 (2.9, 3.1)	3.5 (3.4, 3.6)	4.2 (4.1, 4.3)
	Total	**10378**	**299990**	**1.1 (1.0, 1.1)**	**2.8 (2.8, 2.9)**	**3.8 (3.7, 3.9)**	**4.5 (4.4, 4.6)**	**5.6 (5.4, 5.7)**

Figure KT22: Cumulative Percent Revision of Primary Total Knee Replacement by Navigation (Primary Diagnosis OA)

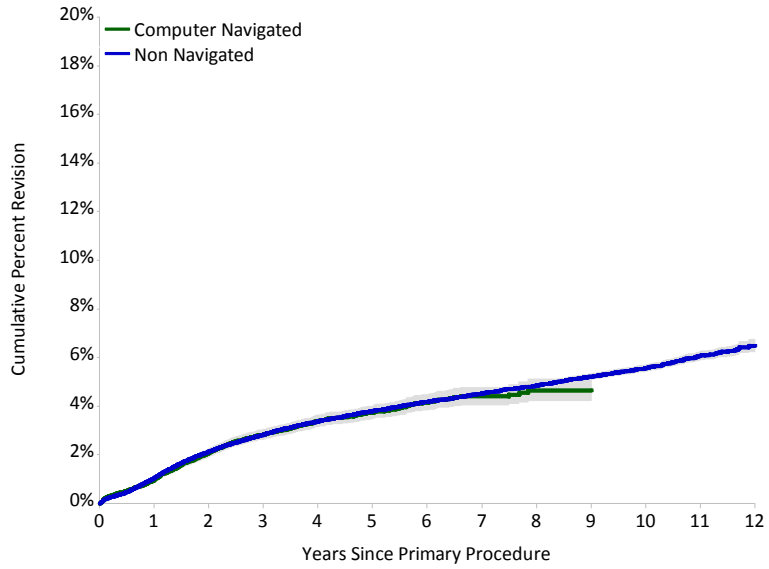
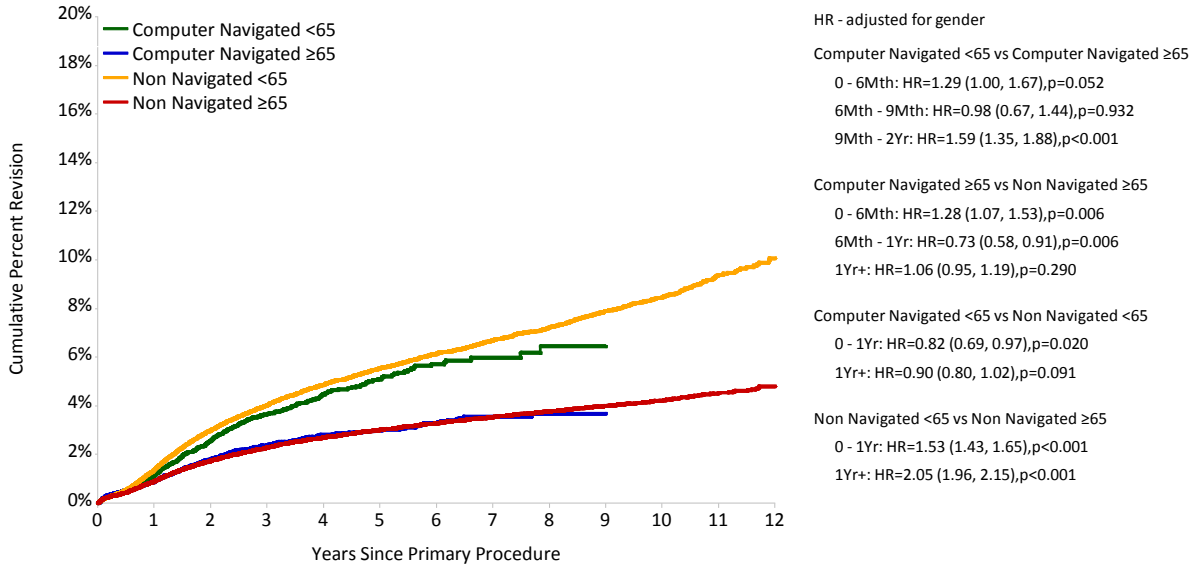


Figure KT23: Cumulative Percent Revision of Primary Total Knee Replacement by Navigation and Age (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Computer Navigated	42584	32908	16089	6597	0	0
<65	15203	11790	5674	2246	0	0
≥65	27381	21118	10415	4351	0	0
Non Navigated	299990	262922	194434	134448	24515	2598
<65	94901	82793	60015	41084	8032	866
≥65	205089	180129	134419	93364	16483	1732

Bearing Surface

There are two tibial bearing surfaces used in primary total knee replacement. They are cross-linked and non cross-linked polyethylene. Prostheses using cross-linked polyethylene have a lower rate of revision compared to prostheses using non cross-linked polyethylene. This difference is evident after three months (Table KT18 and Figure KT24). At ten years, there is a difference in the cumulative incidence for loosening/lysis, 0.9% for cross-linked polyethylene compared to 1.8% for non cross-linked polyethylene (Figure KT25).

In primary total knee replacement cross-linked polyethylene is used less frequently than non cross-linked polyethylene and there is considerable prostheses variation in its use. Consequently any observed difference in revision rate may be confounded by prostheses type. For this reason, subsequent analysis has been limited to specific prostheses that have both cross-linked and non-cross linked polyethylene options. The criteria for inclusion were a minimum of 2,500 procedures in at least one of the polyethylene groups and a follow-up time of five or more years. Three primary total knee prostheses fulfilled these criteria, Natural Knee II, Triathlon and Nexgen. The analysis for each of these prostheses included age, reasons for revision and stability of the prostheses.

The Natural Knee II has both minimally and posterior stabilised options. The posterior stabilised option has been rarely used and so the analysis for the Natural Knee II only includes minimally stabilised prostheses. The Registry has ten year follow-up for both types of polyethylene. Cross-linked polyethylene was used in 52.3% of procedures and has a lower rate of revision after 3.5 years (Table KT19 and Figure KT26). This difference is evident regardless of age. However, the difference is greater for those aged less than 65 years (Table KT19 and Figure KT28). The ten year cumulative incidence of revision for loosening/lysis is 1.1% for cross-linked polyethylene and 3.5% for non cross-linked polyethylene and this difference is more evident in the younger age group (Figures KT27 and KT29).

The Triathlon knee has five year follow-up. Cross-linked polyethylene was used in 67.5% of procedures. There is no difference in revision rate within minimally and posterior stabilised Triathlon prostheses when cross-linked and non cross-linked polyethylene are compared (Figure KT30). There is also no difference when patients aged less than 65 years and 65 years or older are compared within minimally and posterior stabilised prostheses (Figure KT31 and Figure KT33). There is no difference in the reasons for revision between cross-linked and non cross-linked polyethylene except for minimally stabilised prostheses used in those less than 65 years, where non cross-linked polyethylene has a higher rate of revision for infection. The clinical significance of this is uncertain (Figure KT32 and Figure KT34).

The Nexgen has ten year follow-up for both cross-linked and non cross-linked polyethylene for the minimally stabilised and five year follow-up for the posterior stabilised prostheses. The minimally stabilised Nexgen includes Nexgen CR and Nexgen CR Flex. The posterior stabilised group includes Nexgen LPS and LPS Flex prostheses.

Cross-linked polyethylene was used in 73.0% of minimally stabilised Nexgen knees and has a lower rate of revision after one year (Table KT21 and Figure KT35). This difference however is only evident in those aged less than 65 years (Table KT21 and Figure KT36). The ten year cumulative incidence of revision for loosening/lysis in those aged less than 65 years is 1.3% for cross-linked and 2.1% for non cross-linked polyethylene. This is not significantly different (Figure KT37).

Cross-linked polyethylene was used in 27.2% of posterior stabilised Nexgen knees. There is no difference in rate of revision when cross-linked and non cross-linked polyethylene are compared (Table KT21 and Figure KT35). There is also no age related difference and no difference in the reasons for revision (Figures KT38 and KT39).

There is prostheses variation in the effect that cross-linked polyethylene has on the revision rate following primary total knee replacement. A lower revision rate has been identified for two minimally stabilised knees (Natural Knee II and Nexgen). This difference is most evident in younger patients and may be associated with a reduced rate of revision for loosening/lysis. No difference is identified with the Triathlon (both minimally and posterior stabilised) or the posterior stabilised Nexgen.

Table KT18: Cumulative Percent Revision of Primary Total Knee Replacement by Polyethylene Bearing Surface (Primary Diagnosis OA)

Polyethylene	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cross-Linked	1036	65076	0.8 (0.7, 0.9)	2.0 (1.9, 2.1)	2.5 (2.3, 2.7)	3.4 (3.0, 3.9)	
Non Cross-Linked	10330	277327	1.1 (1.1, 1.1)	3.0 (2.9, 3.0)	4.0 (3.9, 4.1)	5.8 (5.7, 5.9)	6.7 (6.5, 7.0)
TOTAL	**11366**	**342403**					

Note: excluding 171 procedures using cross-linked polyethylene with Vitamin-E

Figure KT24: Cumulative Percent Revision of Primary Total Knee Replacement by Polyethylene Bearing Surface (Primary Diagnosis OA)

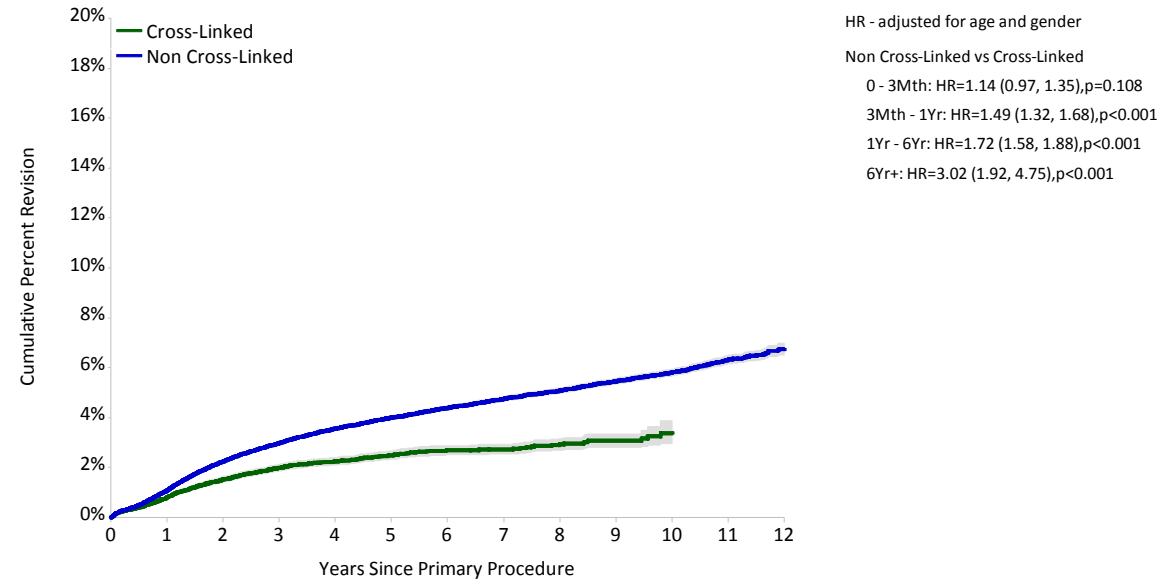
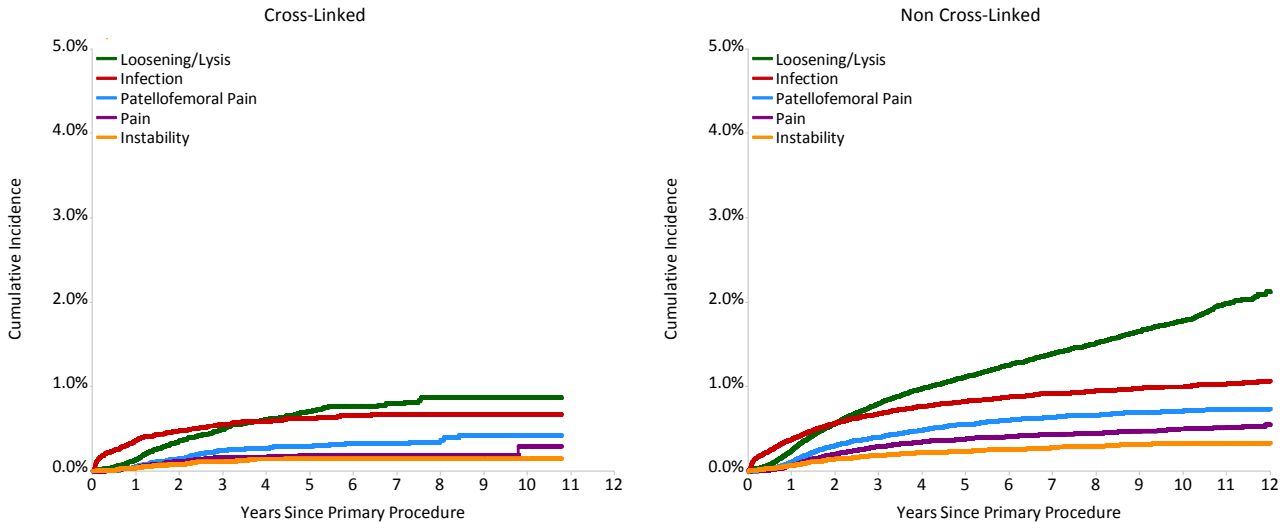


Figure KT25: Revision Diagnosis Cumulative Incidence of Primary Total Knee Replacement by Polyethylene Bearing Surface (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cross-Linked	65076	48740	24498	10711	532	0
Non Cross-Linked	277327	246978	186025	130334	23983	2598

Table KT19: Cumulative Percent Revision of Natural Knee II/Natural Knee II Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

Natural Knee II		N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cross-Linked	<65 years	44	978	1.4 (0.8, 2.3)	3.6 (2.5, 5.0)	4.7 (3.5, 6.4)		
	≥65 years	37	2159	0.7 (0.4, 1.2)	1.4 (1.0, 2.1)	1.8 (1.3, 2.6)		
	Total	**81**	**3137**	0.9 (0.6, 1.3)	2.1 (1.7, 2.7)	2.7 (2.2, 3.4)	3.4 (2.7, 4.4)	
Non Cross-linked	<65 years	86	765	1.0 (0.5, 2.1)	3.0 (2.0, 4.5)	4.7 (3.4, 6.4)	12.9 (10.5, 15.9)	
	≥65 years	83	2094	0.7 (0.4, 1.2)	1.6 (1.1, 2.2)	2.4 (1.8, 3.2)	5.0 (4.0, 6.3)	
	Total	**169**	**2859**	0.8 (0.5, 1.2)	2.0 (1.5, 2.6)	3.0 (2.5, 3.8)	7.5 (6.4, 8.7)	9.6 (7.6, 11.9)
TOTAL		**250**	**5996**					

Figure KT26: Cumulative Percent Revision of Natural Knee II/Natural Knee II Primary Total Knee Replacement by Polyethylene Bearing Surface (Primary Diagnosis OA)

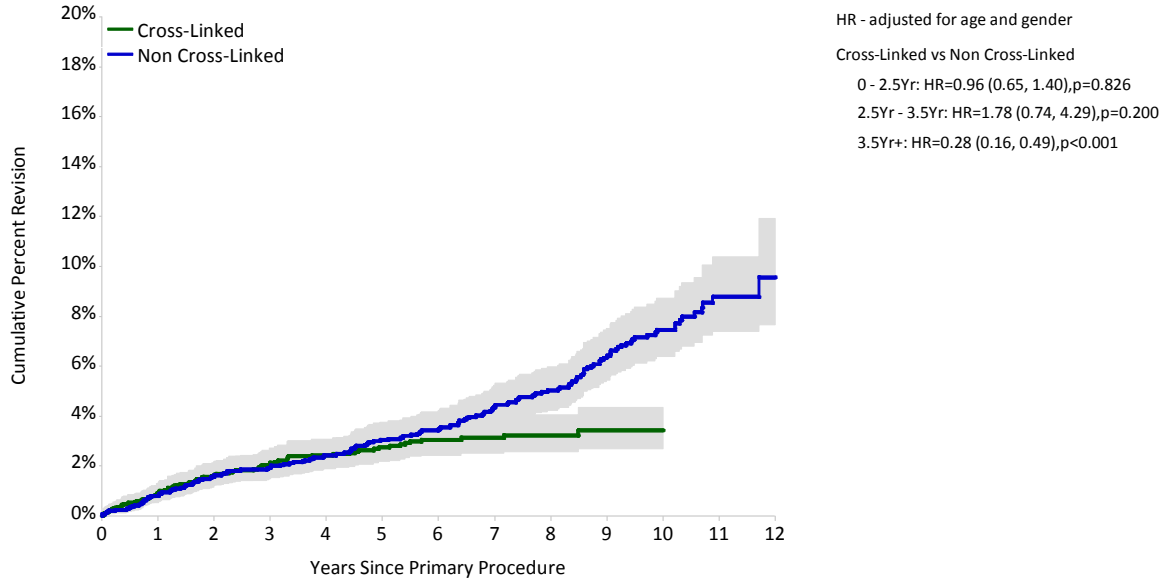
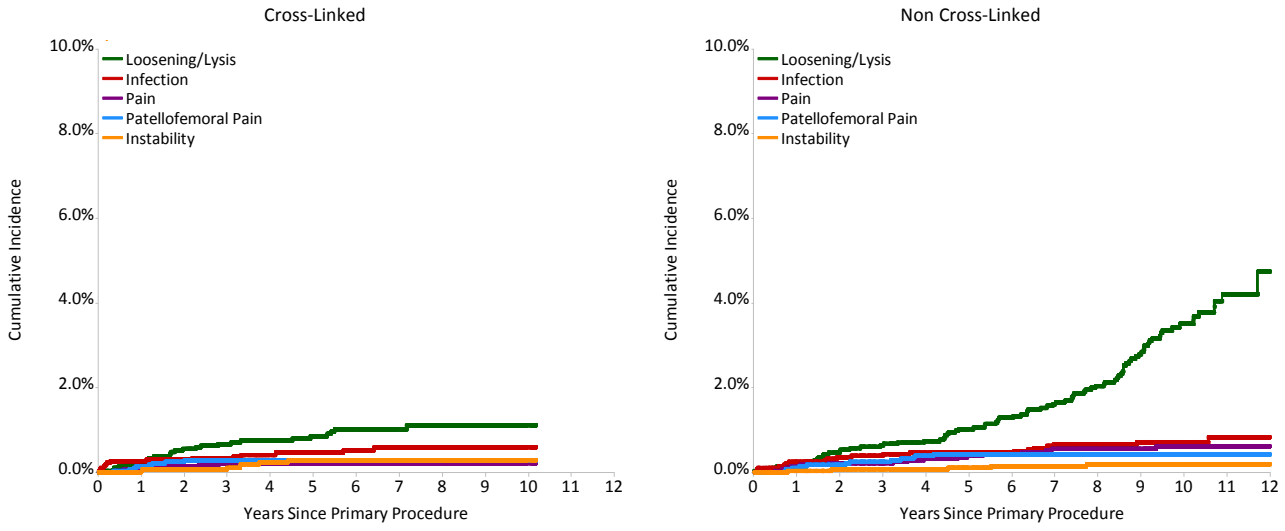
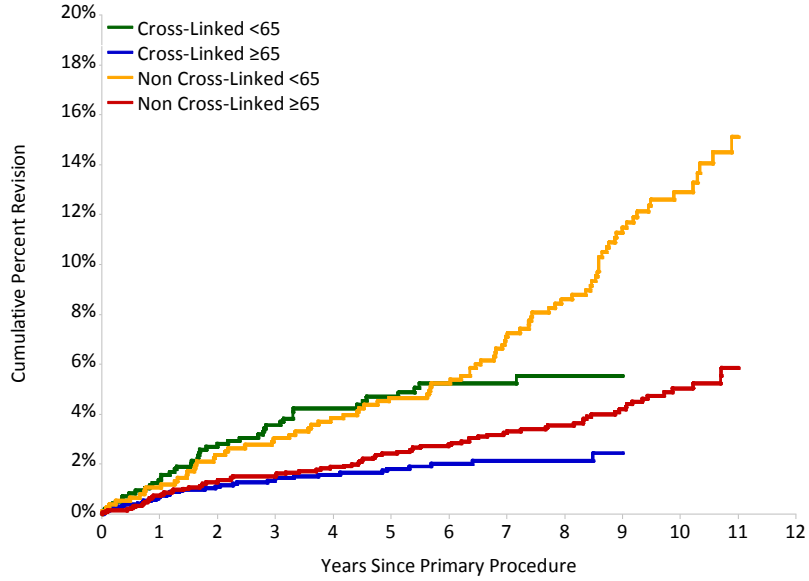


Figure KT27: Revision Diagnosis Cumulative Incidence of Natural Knee II/Natural Knee II Primary Total Knee Replacement by Polyethylene Bearing Surface (Primary Diagnosis OA)



Number at Risk	0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Cross-Linked	3137	2876	2341	1716	63	0
<65 years	978	917	737	564	30	0
≥65 years	2159	1959	1604	1152	33	0
Non Cross-linked	2859	2795	2645	2394	837	62
<65 years	765	753	729	681	268	29
≥65 years	2094	2042	1916	1713	569	33

Figure KT28: Cumulative Percent Revision of Natural Knee II/Natural Knee II Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)



HR - adjusted for gender

Cross-Linked <65 vs Cross-Linked ≥65

Entire Period: HR=2.43 (1.57, 3.76),p<0.001

Cross-Linked ≥65 vs Non Cross-Linked ≥65

Entire Period: HR=0.67 (0.45, 0.99),p=0.045

Cross-Linked <65 vs Non Cross-Linked <65

0 - 2Yr: HR=0.98 (0.59, 1.62),p=0.933

2Yr - 2.5Yr: HR=0.50 (0.11, 2.35),p=0.380

2.5Yr - 3Yr: HR=1.59 (0.44, 5.70),p=0.477

3Yr - 4.5Yr: HR=0.66 (0.26, 1.64),p=0.367

4.5Yr - 5.5Yr: HR=0.92 (0.33, 2.58),p=0.880

5.5Yr+: HR=0.06 (0.01, 0.43),p=0.005

Non Cross-Linked <65 vs Non Cross-Linked ≥65

Entire Period: HR=2.49 (1.84, 3.37),p<0.001

Figure KT29: Revision Diagnosis Cumulative Incidence of Natural Knee II/Natural Knee II Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

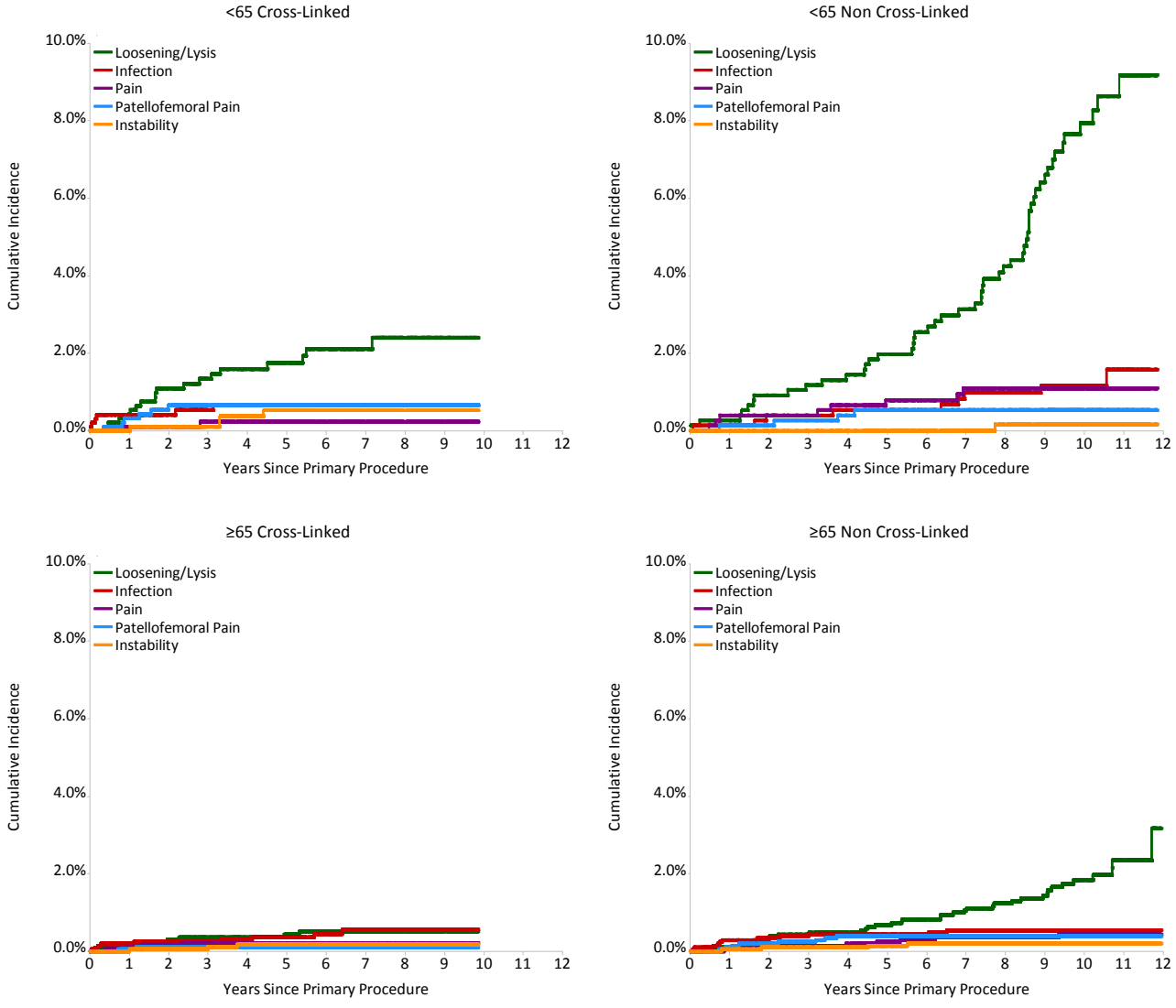
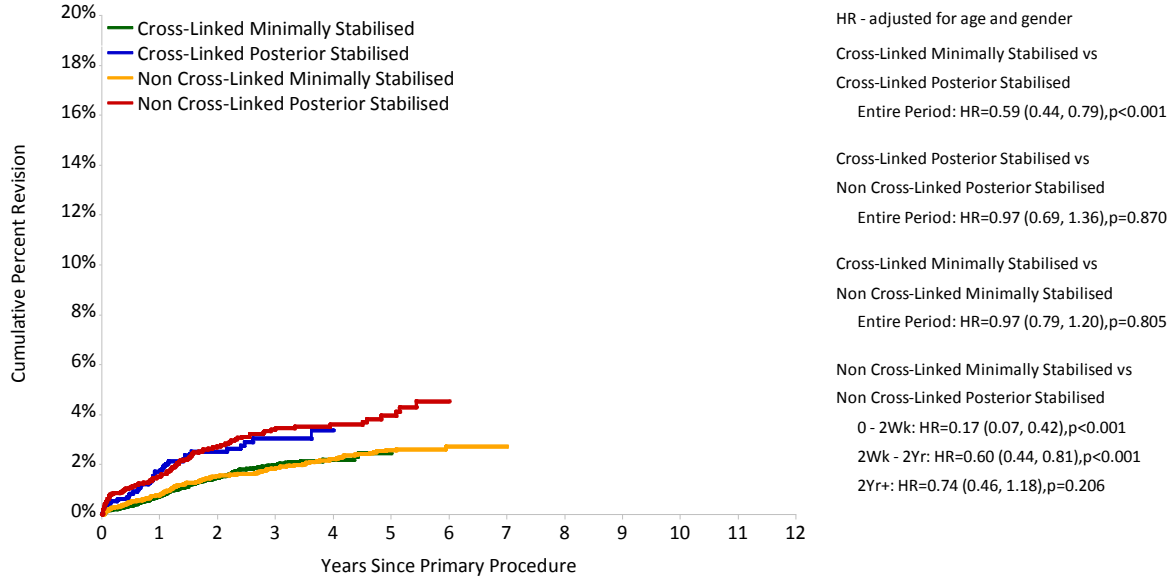


Table KT20: Cumulative Percent Revision of Triathlon/Triathlon Primary Total Knee Replacement by Stability, Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

Triathlon		N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Minimally Stabilised								
Cross-Linked	<65 years	97	6541	0.8 (0.6, 1.1)	2.4 (1.9, 2.9)	3.1 (2.3, 4.2)		
	≥65 years	142	12627	0.7 (0.5, 0.9)	1.8 (1.5, 2.1)	2.1 (1.6, 2.7)		
Non Cross-Linked	<65 years	68	2347	1.0 (0.6, 1.5)	2.7 (2.1, 3.6)	3.8 (3.0, 4.9)		
	≥65 years	83	5105	0.7 (0.5, 1.0)	1.5 (1.1, 1.9)	2.0 (1.6, 2.5)		
	Total	**390**	**26620**					
Posterior Stabilised								
Cross-Linked	<65 years	25	917	2.2 (1.3, 3.5)	3.7 (2.5, 5.6)			
	≥65 years	28	1536	1.5 (1.0, 2.4)	2.6 (1.7, 4.0)			
Non Cross-Linked	<65 years	49	1101	1.9 (1.2, 2.9)	4.9 (3.7, 6.5)	5.4 (4.0, 7.2)		
	≥65 years	47	1842	1.3 (0.9, 2.0)	2.6 (1.9, 3.5)	3.1 (2.3, 4.2)		
	Total	**149**	**5396**					
TOTAL		**539**	**32016**					

Figure KT30: Cumulative Percent Revision of Triathlon/Triathlon Primary Total Knee Replacement by Polyethylene Bearing Surface and Stability (Primary Diagnosis OA)



Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Minimally Stabilised							
Cross-Linked	<65 years	6541	4479	1337	57	0	0
	≥65 years	12627	8571	2560	117	0	0
Non Cross-Linked	<65 years	2347	2093	1487	732	0	0
	≥65 years	5105	4565	3406	1631	0	0
Posterior Stabilised							
Cross-Linked	<65 years	917	638	217	17	0	0
	≥65 years	1536	1020	286	20	0	0
Non Cross-Linked	<65 years	1101	979	574	203	0	0
	≥65 years	1842	1660	1049	403	0	0

Figure KT31: Cumulative Percent Revision of Minimally Stabilised Triathlon/Triathlon Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

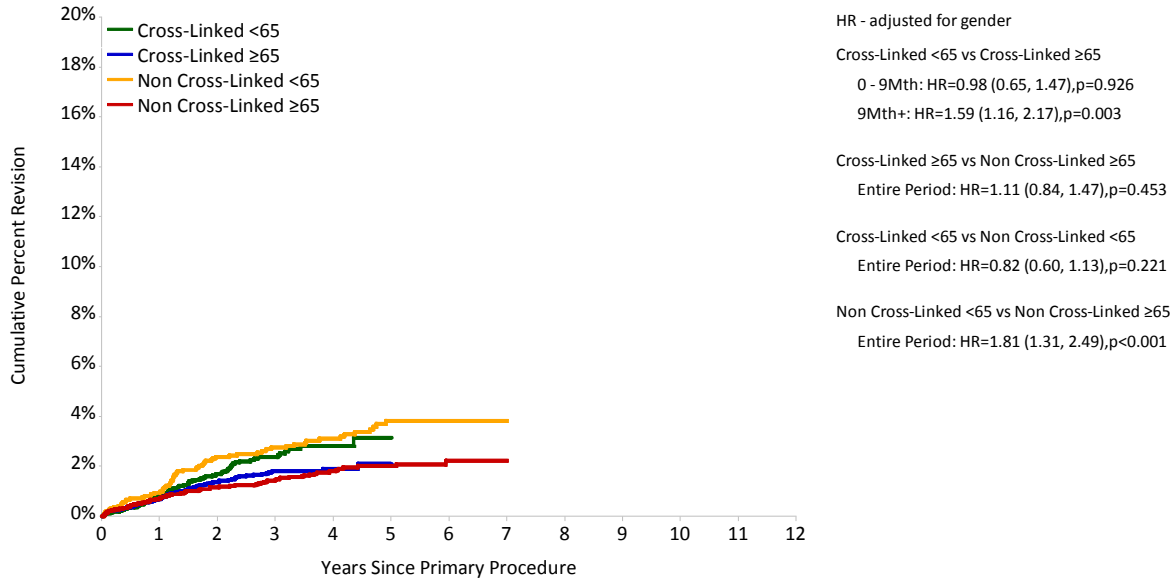


Figure KT32: Revision Diagnosis Cumulative Incidence of Minimally Stabilised Triathlon/Triathlon Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

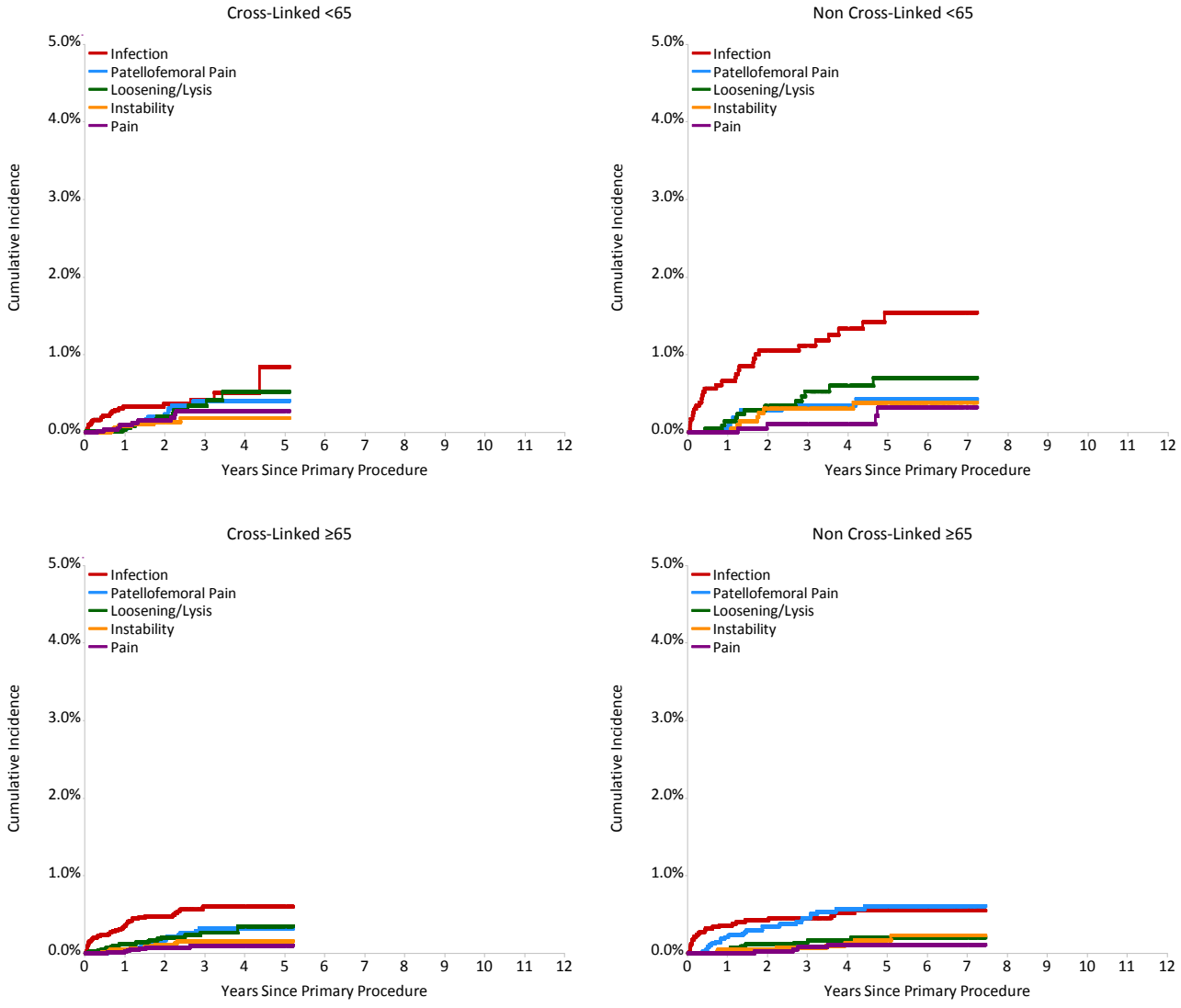


Figure KT33: Cumulative Percent Revision of Posterior Stabilised Triathlon/Triathlon Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

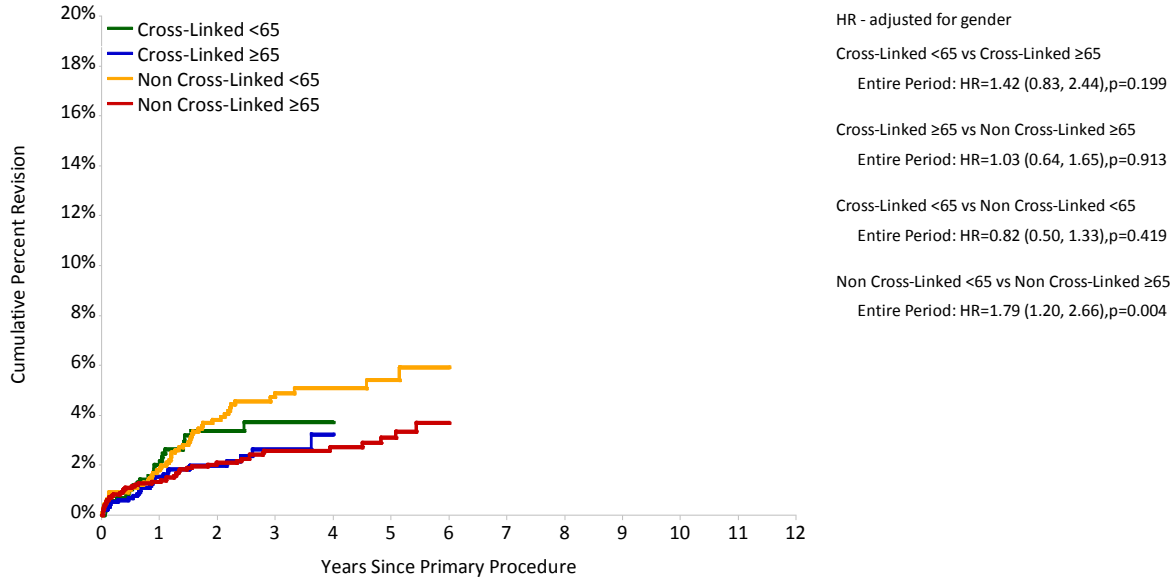


Figure KT34: Revision Diagnosis Cumulative Incidence of Posterior Stabilised Triathlon/Triathlon Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

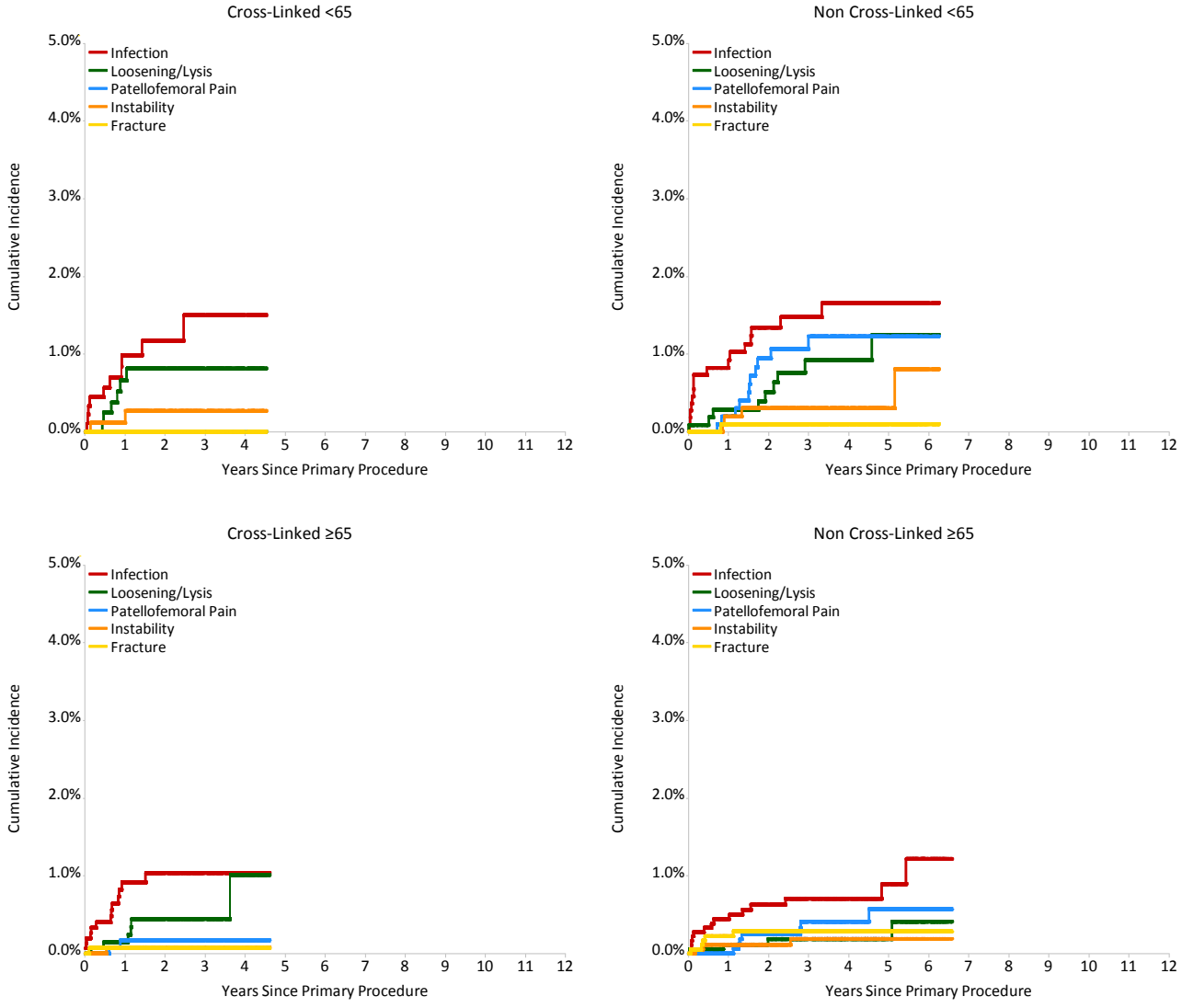
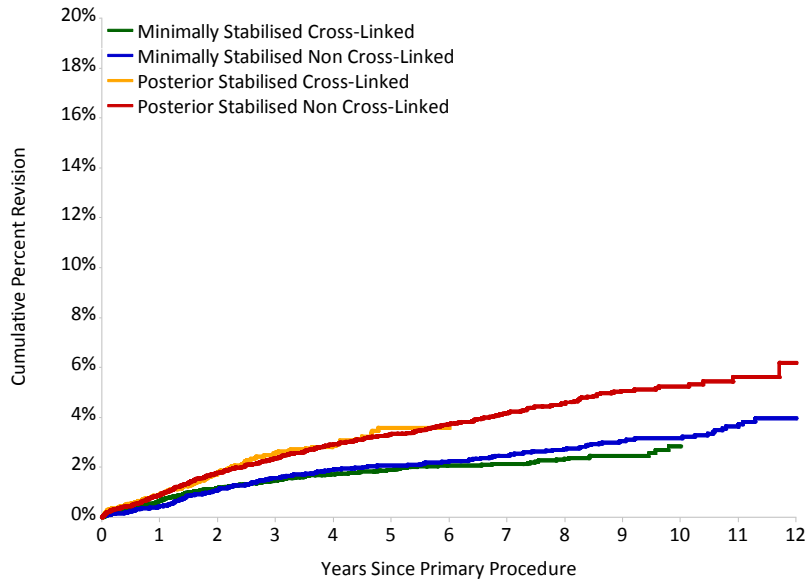


Table KT21: Cumulative Percent Revision of Nexgen/Nexgen Primary Total Knee Replacement by Stability, Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

Nexgen		N Revised	N Total	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Minimally Stabilised								
Cross-Linked	<65 years	159	7273	0.9 (0.7, 1.2)	2.2 (1.8, 2.6)	2.9 (2.4, 3.4)	4.2 (3.2, 5.5)	
	≥65 years	178	15126	0.5 (0.4, 0.7)	1.1 (1.0, 1.3)	1.4 (1.2, 1.7)	2.1 (1.7, 2.7)	
Non Cross-linked	<65 years	87	1874	0.7 (0.4, 1.2)	2.4 (1.8, 3.3)	3.6 (2.8, 4.7)	6.0 (4.7, 7.5)	8.0 (6.2, 10.2)
	≥65 years	111	6383	0.4 (0.2, 0.6)	1.3 (1.1, 1.7)	1.6 (1.3, 2.0)	2.3 (1.9, 2.8)	2.6 (2.0, 3.2)
		535	**30656**					
Posterior Stabilised								
Cross-Linked	<65 years	66	2277	1.2 (0.8, 1.8)	3.6 (2.8, 4.6)	5.2 (3.8, 7.1)		
	≥65 years	75	4478	0.8 (0.6, 1.1)	2.1 (1.6, 2.6)	2.7 (2.1, 3.5)		
Non Cross-linked	<65 years	290	5159	1.1 (0.9, 1.4)	3.4 (2.9, 4.0)	5.0 (4.4, 5.8)	9.1 (8.0, 10.4)	
	≥65 years	319	12868	0.8 (0.7, 1.0)	1.9 (1.7, 2.2)	2.6 (2.3, 2.9)	3.6 (3.1, 4.0)	3.9 (3.3, 4.7)
TOTAL		**750**	**24782**					

Figure KT35: Cumulative Percent Revision of Nexgen/Nexgen Primary Total Knee Replacement by Polyethylene Bearing Surface and Stability (Primary Diagnosis OA)



HR - adjusted for age and gender

Minimally Stabilised Cross-Linked vs Minimally Stabilised Non Cross-Linked

0 - 1Yr: HR=1.11 (0.87, 1.42),p=0.410

1Yr - 3Yr: HR=0.76 (0.59, 0.96),p=0.022

3Yr+: HR=0.63 (0.47, 0.83),p=0.001

Minimally Stabilised Non Cross-Linked vs Posterior Stabilised Non Cross-Linked

Entire Period: HR=0.66 (0.56, 0.78),p<0.001

Minimally Stabilised Cross-Linked vs Posterior Stabilised Cross-Linked

Entire Period: HR=0.57 (0.47, 0.69),p<0.001

Posterior Stabilised Cross-Linked vs Posterior Stabilised Non Cross-Linked

Entire Period: HR=0.95 (0.79, 1.15),p=0.605

Number at Risk		0 Yr	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Minimally Stabilised							
Cross-linked	<65 years	7273	5878	3871	2536	197	0
	≥65 years	15126	12502	8351	5522	269	0
Non Cross-linked	<65 years	1874	1731	1447	1159	547	82
	≥65 years	6383	5890	4902	3963	1371	169
Posterior Stabilised							
Cross-linked	<65 years	2277	1869	918	201	0	0
	≥65 years	4478	3581	1830	409	0	0
Non Cross-linked	<65 years	5159	4731	3798	2898	341	27
	≥65 years	12868	11688	9326	6941	810	63

Figure KT36: Cumulative Percent Revision of Minimally Stabilised Nexgen Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

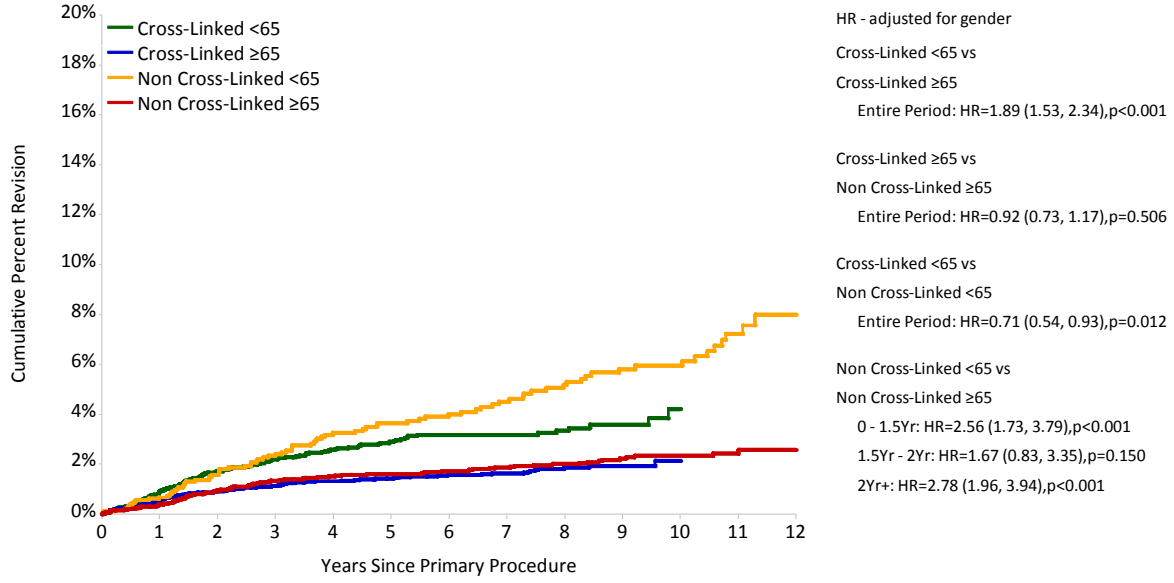


Figure KT37: Revision Diagnosis Cumulative Incidence of Minimally Stabilised Nexgen Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

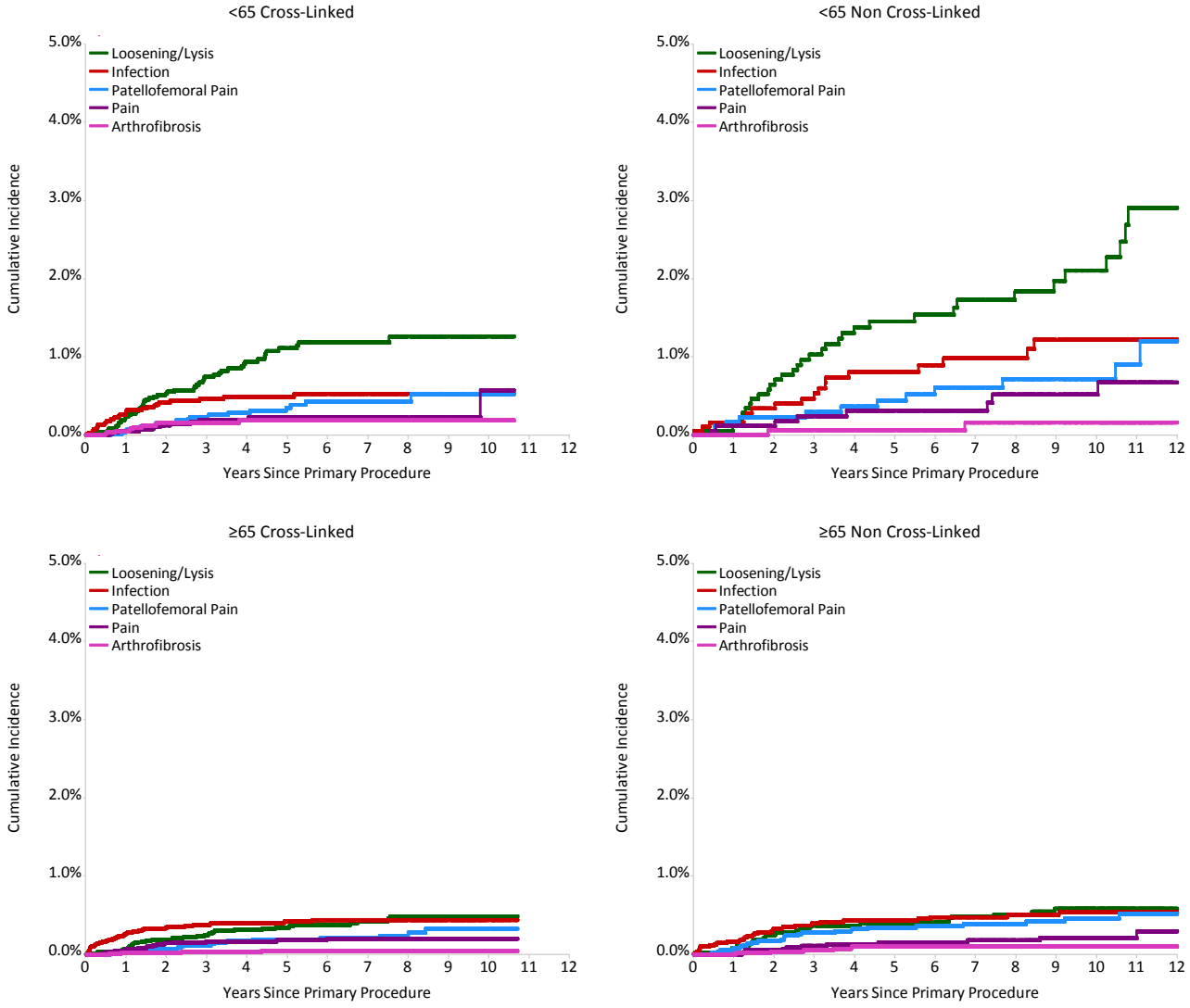


Figure KT38: Cumulative Percent Revision of Posterior Stabilised Nexgen Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)

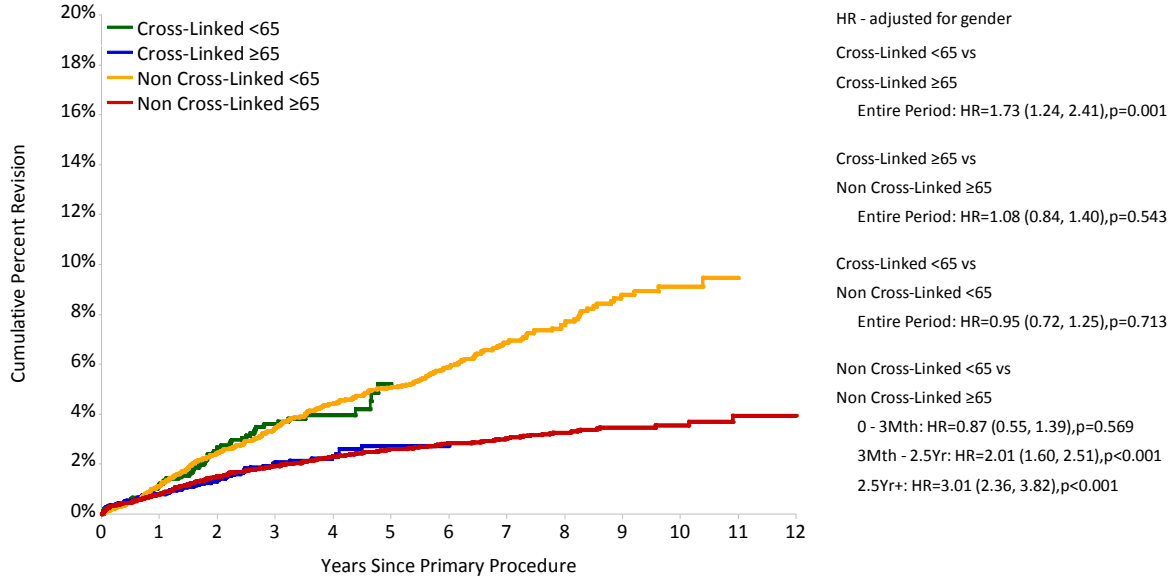
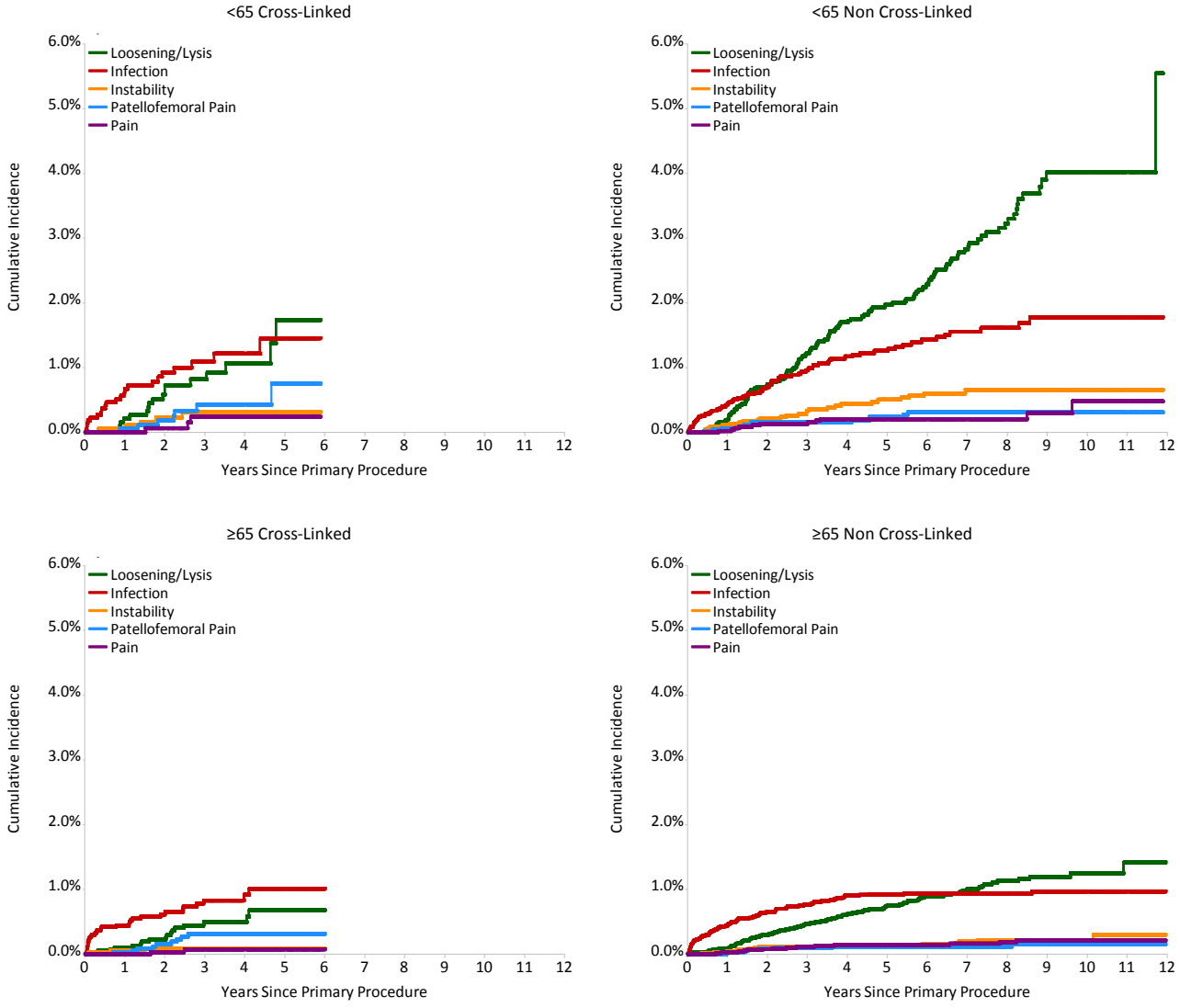


Figure KT39: Revision Diagnosis Cumulative Incidence of Posterior Stabilised Nexgen Primary Total Knee Replacement by Polyethylene Bearing Surface and Age (Primary Diagnosis OA)



Prostheses Types

There are 373 femoral and tibial prostheses combinations for primary total knee replacement recorded by the Registry, 16 more than 2011. The cumulative percent revision of the 89 combinations with more than 400 procedures per prosthesis are listed in Tables KT22 – KT24. Although the listed combinations are a small proportion of the possible combinations, they represent 95.0% of all primary total knee replacement. The 'Other' group is the combined outcome of the remaining 284 prostheses combinations with less than 400 procedures per prosthesis.

There are 24 combinations of primary total knee replacement with hybrid fixation with more than 400 procedures. Of those with a 12 year cumulative percent revision, the AGC/AGC is the lowest at 3.7%. The Nexgen CR/Nexgen is 3.9% at 12 years (Table KT22).

There are 28 cementless total femoral and tibial prostheses combinations with more than 400 procedures. Of those with a 12 year cumulative percent revision, the Nexgen CR/Nexgen is the lowest at 2.8% (Table KT23).

There are 37 cemented total femoral and tibial prostheses combinations with more than 400 procedures. Of those with a 12 year cumulative percent revision, the Nexgen CR/Nexgen is the lowest at 4.3% (Table KT24).

Table KT22: Cumulative Percent Revision of Primary Total Knee Replacement with Hybrid Fixation

Femoral Component	Tibial Component	N Revised	N Total	1 Yr CPR	5 Yrs CPR	10 Yrs CPR	12 Yrs CPR
AGC	AGC	37	1408	0.7 (0.3, 1.3)	2.2 (1.5, 3.2)	3.3 (2.3, 4.6)	3.7 (2.5, 5.5)
Active Knee	Active Knee	47	1323	0.7 (0.4, 1.4)	3.4 (2.4, 4.6)		
Duracon	Duracon	313	7658	1.2 (1.0, 1.5)	3.4 (3.0, 3.8)	4.7 (4.2, 5.3)	5.2 (4.5, 6.1)
Genesis II	Genesis II	188	5471	1.1 (0.8, 1.4)	3.7 (3.2, 4.3)	5.1 (4.3, 6.1)	5.3 (4.4, 6.4)
LCS	LCS	110	2189	1.0 (0.6, 1.5)	3.6 (2.8, 4.4)	5.2 (4.3, 6.4)	6.8 (5.5, 8.5)
LCS	MBT	212	6866	0.9 (0.7, 1.2)	3.9 (3.4, 4.5)	5.7 (4.2, 7.6)	
Maxim	Maxim	65	1348	0.7 (0.4, 1.4)	3.7 (2.8, 4.9)	6.2 (4.7, 8.1)	
Natural Knee II	Natural Knee II	53	1751	1.1 (0.7, 1.7)	2.5 (1.9, 3.4)	4.2 (3.1, 5.7)	
Nexgen CR	Nexgen	86	3395	0.4 (0.2, 0.6)	2.2 (1.7, 2.8)	3.3 (2.6, 4.2)	3.9 (2.9, 5.4)
Nexgen CR Flex	Nexgen	94	7790	0.7 (0.5, 0.9)	1.7 (1.4, 2.1)		
Nexgen CR Flex	Nexgen TM CR	12	722	0.6 (0.2, 1.5)	1.6 (0.9, 2.8)		
Nexgen LPS	Nexgen	38	896	0.5 (0.2, 1.2)	4.6 (3.3, 6.4)	5.3 (3.8, 7.2)	
Nexgen LPS Flex	Nexgen TM LPS	11	485	0.6 (0.2, 1.9)	1.9 (1.0, 3.6)		
PFC Sigma	MBT	220	4643	1.6 (1.2, 2.0)	5.3 (4.7, 6.1)	6.0 (5.2, 6.9)	
PFC Sigma	PFC Sigma	182	8199	0.7 (0.5, 0.9)	2.8 (2.4, 3.2)	4.1 (3.4, 5.0)	4.1 (3.4, 5.0)
Profix	Profix	29	734	0.8 (0.4, 1.8)	3.7 (2.5, 5.5)	4.7 (3.2, 6.8)	
Profix	Profix Mobile	44	562	1.6 (0.8, 3.1)	6.9 (5.1, 9.4)	9.5 (6.7, 13.5)	
RBK	RBK	24	846	0.8 (0.3, 1.7)	4.6 (3.0, 7.1)		
Scorpio	Scorpio+	126	2693	1.0 (0.7, 1.5)	3.9 (3.2, 4.7)	6.4 (5.3, 7.8)	
Scorpio	Series 7000	225	5912	0.8 (0.6, 1.0)	3.6 (3.1, 4.1)	5.3 (4.6, 6.2)	6.2 (5.1, 7.6)
Scorpio NRG	Series 7000	18	698	0.6 (0.2, 1.7)	3.7 (2.3, 5.9)		
Triathlon	Triathlon	99	7423	0.7 (0.5, 0.9)	2.8 (2.2, 3.6)		
Vanguard	Maxim	88	3424	1.1 (0.8, 1.6)	5.4 (4.2, 6.9)		
Vanguard	Vanguard	14	1374	0.3 (0.1, 0.8)			
Other (92)		356	6164	2.0 (1.7, 2.5)	6.6 (5.9, 7.4)	9.4 (8.4, 10.5)	10.9 (9.1, 13.0)
TOTAL		**2691**	**83974**				

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

Table KT23: Cumulative Percent Revision of Primary Total Knee Replacement with Cementless Fixation

Femoral Component	Tibial Component	N Revised	N Total	1 Yr CPR	5 Yrs CPR	10 Yrs CPR	12 Yrs CPR
Active Knee	Active Knee	204	4430	1.1 (0.8, 1.5)	4.5 (3.9, 5.3)	8.1 (6.7, 9.8)	
Advantim	Advantim	24	1111	0.9 (0.5, 1.7)	2.6 (1.7, 3.9)	3.4 (2.1, 5.4)	3.4 (2.1, 5.4)
Columbus	Columbus	33	481	2.8 (1.6, 4.7)	8.0 (5.8, 11.2)		
Duracon	Duracon	149	3526	1.1 (0.8, 1.5)	3.6 (3.0, 4.3)	5.1 (4.3, 6.0)	5.5 (4.6, 6.6)
Genesis II	Genesis II	30	650	1.3 (0.7, 2.6)	6.1 (4.1, 9.0)		
Genesis II	Profix Mobile	22	505	1.4 (0.7, 2.9)	2.9 (1.7, 4.8)	4.5 (2.8, 7.1)	6.5 (4.1, 10.4)
LCS	LCS	134	2335	1.5 (1.1, 2.1)	4.3 (3.5, 5.2)	6.0 (5.1, 7.1)	6.7 (5.6, 8.0)
LCS	MBT	918	18993	1.3 (1.1, 1.4)	5.5 (5.2, 5.9)	7.0 (6.5, 7.6)	
Maxim	Maxim	27	602	1.7 (0.9, 3.1)	3.4 (2.2, 5.2)	4.7 (3.2, 6.9)	
Natural Knee II	Natural Knee II	161	2717	1.0 (0.7, 1.4)	3.7 (3.0, 4.5)	9.1 (7.6, 10.7)	
Nexgen CR	Nexgen	80	3309	0.5 (0.3, 0.8)	2.0 (1.6, 2.5)	2.8 (2.2, 3.5)	2.8 (2.2, 3.5)
Nexgen CR	Nexgen TM CR	32	555	1.5 (0.8, 3.0)	6.5 (4.6, 9.3)		
Nexgen CR Flex	Nexgen	78	3849	1.0 (0.7, 1.4)	2.5 (2.0, 3.2)		
Nexgen CR Flex	Nexgen TM CR	87	5593	0.5 (0.4, 0.8)	2.4 (1.9, 3.1)		
Nexgen LPS	Nexgen TM LPS	18	760	1.3 (0.7, 2.4)	3.5 (2.1, 5.7)		
Nexgen LPS Flex	Nexgen TM LPS	7	603	0.7 (0.3, 1.9)			
PFC Sigma	AMK	40	1778	0.7 (0.4, 1.3)	2.6 (1.8, 3.6)	3.6 (2.4, 5.2)	
PFC Sigma	MBT	123	2766	1.7 (1.3, 2.3)	5.3 (4.4, 6.4)	6.7 (5.3, 8.5)	
Profix	Profix	72	1488	1.1 (0.7, 1.8)	4.6 (3.5, 5.8)	6.4 (5.0, 8.2)	
RBK	RBK	168	4847	1.4 (1.1, 1.8)	4.2 (3.5, 4.9)	5.5 (4.5, 6.8)	
Score	Score	39	941	1.5 (0.8, 2.5)			
Scorpio	Scorpio+	45	694	1.7 (1.0, 3.0)	5.6 (4.1, 7.6)		
Scorpio	Series 7000	167	3513	1.4 (1.0, 1.8)	4.4 (3.8, 5.2)	7.1 (5.9, 8.5)	
Scorpio NRG	Series 7000	63	1925	0.9 (0.6, 1.5)	5.8 (4.1, 8.1)		
Triathlon	Triathlon	132	8226	0.9 (0.7, 1.2)	2.5 (2.0, 3.1)		
Vanguard	Maxim	24	583	1.1 (0.5, 2.4)	5.5 (3.7, 8.1)		
Vanguard	Regenerex	24	849	1.9 (1.2, 3.2)			
Vanguard	Vanguard	10	513	1.7 (0.8, 3.8)			
Other (60)		340	4413	3.0 (2.5, 3.6)	9.2 (8.2, 10.3)	11.8 (10.4, 13.2)	
TOTAL		**3251**	**82555**				

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

Table KT24: Cumulative Percent Revision of Primary Total Knee Replacement with Cement Fixation

Femoral Component	Tibial Component	N Revised	N Total	1 Yr CPR	5 Yrs CPR	10 Yrs CPR	12 Yrs CPR
AGC	AGC	143	3470	0.6 (0.4, 0.9)	3.4 (2.9, 4.2)	5.4 (4.5, 6.5)	6.6 (5.3, 8.2)
Active Knee	Active Knee	22	897	0.9 (0.4, 1.8)	3.7 (2.3, 6.1)		
Advance	Advance II	44	772	1.3 (0.7, 2.5)	5.4 (3.9, 7.5)	8.2 (6.0, 11.2)	
BalanSys	BalanSys	14	716	0.3 (0.1, 1.3)	3.1 (1.7, 5.7)		
Duracon	Duracon	374	9283	1.0 (0.8, 1.2)	3.3 (3.0, 3.7)	5.0 (4.5, 5.6)	5.7 (5.0, 6.6)
Evolis	Evolis	5	514	0.5 (0.1, 1.8)			
Gender Solutions	Natural Knee II	4	423	0.3 (0.0, 2.0)			
Genesis II	Genesis II	681	21919	1.1 (1.0, 1.3)	3.7 (3.4, 4.0)	4.8 (4.4, 5.3)	5.0 (4.6, 5.6)
Genesis II	Profix Mobile	21	472	1.8 (0.9, 3.6)	4.9 (3.1, 7.8)	8.4 (4.8, 14.7)	
Genesis II Oxinium	Genesis II	604	15504	1.4 (1.2, 1.6)	4.8 (4.4, 5.2)	7.1 (6.2, 8.2)	
Journey	Journey	139	2789	1.6 (1.2, 2.2)	7.0 (5.8, 8.4)		
Kinemax Plus	Kinemax Plus	80	1827	0.9 (0.6, 1.5)	3.0 (2.3, 4.0)	4.6 (3.7, 5.8)	7.8 (5.1, 11.8)
LCS	LCS	264	4103	1.0 (0.7, 1.4)	5.0 (4.4, 5.7)	6.9 (6.1, 7.8)	7.6 (6.7, 8.7)
LCS	MBT	204	7791	0.8 (0.6, 1.0)	3.3 (2.8, 3.8)	4.9 (4.1, 5.9)	
Legion	Genesis II	19	1835	1.0 (0.6, 1.7)			
Legion Oxinium	Genesis II	45	3693	0.9 (0.6, 1.3)	3.0 (2.0, 4.5)		
Maxim	Maxim	32	567	1.2 (0.6, 2.6)	4.9 (3.4, 7.1)	5.7 (4.0, 8.1)	
Natural Knee II	Natural Knee II	43	1695	0.5 (0.2, 1.0)	2.0 (1.4, 2.8)	3.8 (2.7, 5.2)	
Nexgen CR	Nexgen	91	3612	0.4 (0.3, 0.7)	1.7 (1.3, 2.2)	2.8 (2.3, 3.5)	4.3 (3.2, 5.7)
Nexgen CR Flex	Natural Knee II	1	479	0.2 (0.0, 1.5)			
Nexgen CR Flex	Nexgen	122	9449	0.6 (0.4, 0.7)	1.9 (1.6, 2.3)		
Nexgen LPS	Nexgen	179	4948	1.0 (0.7, 1.3)	2.9 (2.5, 3.5)	4.6 (4.0, 5.4)	5.6 (4.4, 7.1)
Nexgen LPS Flex	Nexgen	546	19326	0.9 (0.8, 1.0)	3.4 (3.1, 3.7)	5.6 (4.9, 6.3)	
Optetrak-PS	Optetrak	123	1961	1.5 (1.0, 2.2)	7.3 (6.1, 8.8)	10.5 (7.9, 13.9)	
Optetrak-PS	Optetrak RBK	29	528	2.1 (1.2, 3.8)	6.9 (4.8, 9.9)		
PFC Sigma	MBT	160	5868	0.7 (0.5, 1.0)	3.3 (2.8, 3.8)	4.3 (3.4, 5.4)	
PFC Sigma	PFC Sigma	331	14435	0.9 (0.8, 1.1)	2.5 (2.3, 2.9)	4.1 (3.5, 4.8)	6.0 (4.2, 8.6)
Profix	Profix	130	3318	1.1 (0.8, 1.5)	3.3 (2.8, 4.0)	4.8 (4.0, 5.8)	5.1 (4.1, 6.2)
Profix Oxinium	Profix	64	1003	1.7 (1.1, 2.8)	6.5 (5.0, 8.3)		
RBK	RBK	47	1684	0.8 (0.5, 1.4)	3.7 (2.7, 4.9)	4.7 (3.1, 7.1)	
Scorpio	Scorpio	49	830	1.2 (0.7, 2.2)	5.0 (3.7, 6.8)	6.9 (5.2, 9.1)	
Scorpio	Scorpio+	63	1232	1.0 (0.6, 1.7)	5.1 (3.9, 6.5)	5.9 (4.6, 7.5)	
Scorpio	Series 7000	197	4957	1.1 (0.8, 1.4)	3.5 (3.0, 4.1)	6.0 (5.1, 7.0)	6.5 (5.4, 7.7)
Scorpio NRG	Series 7000	42	2990	0.6 (0.4, 1.0)	2.1 (1.5, 3.1)		
Triathlon	Triathlon	322	17149	1.0 (0.8, 1.2)	3.0 (2.6, 3.4)		
Vanguard	Maxim	156	5890	1.2 (1.0, 1.6)	4.5 (3.7, 5.4)		
Vanguard	Vanguard	4	562	0.4 (0.1, 1.8)			
Other (132)		368	6855	1.5 (1.2, 1.8)	5.9 (5.3, 6.7)	9.0 (8.0, 10.1)	10.4 (9.2, 11.8)
TOTAL		**5762**	**185346**				

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

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 AOANJRR Director and Deputy Directors in conjunction with DMAC staff, review the identified prostheses and undertake further investigation. This includes examining for the impact of confounders, and calculating age and gender adjusted hazard ratios. In addition, all prostheses identified in previous reports are re-analysed as part of the Stage 2 analysis. This is not dependent on re-identification in Stage 1. If there is a significant difference compared to the combined hazard rate of all other prostheses in the same class then the prosthesis or prostheses combination progress to Stage 3. The possible exception to this is the presence of confounding factors, such as use in complex primary procedures.

Stage 3 involves review by a panel of independent orthopaedic specialists from the Australian Orthopaedic Association Arthroplasty Society. The panel meets with Registry staff at a two-day workshop to review the Stage 2 analysis and determine which prostheses will be identified in the Annual Report.

Identified prostheses are listed in one of three groups. There are those that have a higher rate of revision but are no longer used in Australia. These are listed to provide ongoing information on the rate of revision. This also enables comparison of other prostheses to the discontinued group.

The second group is prostheses that are being re-identified but are still used. This listing identifies that the prosthesis continues to have a higher than anticipated rate of revision but it also provides information on its continued use. Most identified or re-identified prostheses decline in use. This is usually evident only after the first year because almost a full

year of use has occurred prior to identification in the Annual Report.

The third group, 'Newly Identified' lists prostheses that are being used and are identified for the first time.

The Registry does not make a recommendation or otherwise on the continued use of identified prostheses. Identification is made to ensure that prostheses with a higher rate of revision compared to others in the same class are highlighted.

On occasion, a prosthesis previously identified no longer meets the criteria for inclusion. In this situation, the prosthesis is not subsequently re-identified. Registries monitor the continual real time performance of prostheses within a community and the Annual Report provides a snap shot at a particular time. It is necessary to appreciate that outcomes are continually changing and that many factors may influence that change including identification in the report.

The current approach used by the Registry is most effective at identifying the relative performance of recently introduced prostheses. As the Registry's follow up period increases, it is becoming evident that prostheses with a delayed onset of higher rates of revision are not as readily identified by this approach. The Registry will develop further strategies in the future to identify these prostheses.

This year, 11 independent arthroplasty specialists together with the Chairman of the AOANJRR 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 2013 Annual Report are available on the Registry website, aoanjrr.dmac.adelaide.edu.au/annual-reports-2013.

Primary Partial Hip Replacement

Unipolar Modular

There are no newly identified unipolar modular prostheses.

Bipolar

In the 2012 Annual Report the Tandem/Basis was identified. The Basis stem is derived from the Spectron EF. The Tandem/Basis is no longer identified (HR=2.14 (0.95, 4.81), p=0.064). In 2012, there were 21 more procedures and no further revisions.

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

Bipolar Head/Femoral	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Identified and no longer used				
UHR/ABGII	177	731	2.05	Entire Period: HR=2.43 (1.45, 4.08),p<0.001
Re-Identified and still used				
UHR/Omnifit	362	1734	1.21	Entire Period: HR=1.56 (1.00, 2.42),p=0.048

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

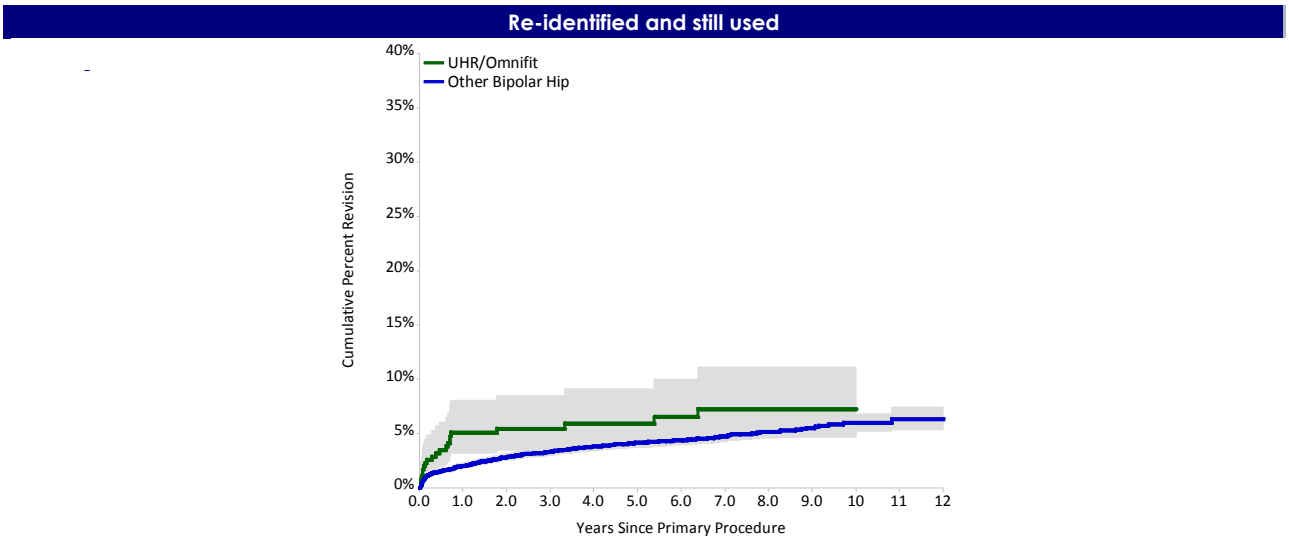
Table IP2: Cumulative Percent Revision of Individual Bipolar Hip identified as having a Higher than Anticipated Revision Rate

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Identified and no longer used					
UHR/ABGII	4.4 (2.1, 8.9)	5.1 (2.6, 10.1)	10.5 (6.1, 17.9)		
Re-Identified and still used					
UHR/Omnifit	5.1 (3.2, 8.1)	5.4 (3.5, 8.5)	5.9 (3.8, 9.1)	7.2 (4.7, 11.2)	

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

Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Identified and no longer used											
UHR/ABGII	25	25	36	34	10	15	20	7	5		
Re-Identified and still used											
UHR/Omnifit	145	59	42	31	24	12	17	11	5	10	6

Figure IP1: Cumulative Percent Revision of Individual Bipolar Hip re-identified and still used



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 2,096 combinations used in primary total conventional hip replacement. This is 131 more than reported last year.

These combinations are the result of mixing and matching different femoral stem and acetabular components, which may be from the same or different companies.

There are seven primary total conventional hip prostheses and prostheses combinations being identified for the first time this year.

The Anca_Fit/Pinnacle has been used in 101 procedures and has a five year cumulative percent revision of 11.1%. There have been 11 revisions, five involving revision to the femoral component only, and three to the head and neck. Fracture (45.5%) and loosening/lysis (27.3%) are the main reasons for revision. The Anca_Fit femoral stem is no longer used.

The Excia (cementless) femoral stem has been used in 153 procedures and has a one year cumulative percent revision of 4.1%. There have been eight revisions, 37.5% involving the femoral component only, and 25.0% involving the head only. Loosening/lysis (50.0%) and fracture (25.0%) are the main reasons for revision.

The ML Taper Kinectiv femoral stem has been used in 2,104 procedures and has a three year cumulative percent revision of 4.0%. There have been 71 revisions, 33.8% involving the femoral component only, and 31.0% involving the head and neck. Fracture (28.2%) and prosthesis dislocation (26.8%) are the main reasons for revision.

The MSA femoral stem has been used in 196 procedures and has a one year cumulative percent revision of 6.2%. There have been 15 revisions, 73.3% involving the femoral component only. Loosening/lysis (60.0%) and fracture (20.0%) are the main reasons for revision.

The Novation femoral stem has been used in 218 procedures and has a one year cumulative percent revision of 5.0%. There have been 12 revisions, 33.3% involving the femoral component only and 25.0% involving the head and insert. Infection (33.3%) and fracture (25.0%) are the main reasons for revision.

The Trabecular Metal femoral stem has been used in 1,239 procedures and has a five year cumulative percent revision of 6.2%. There have been 49 revisions, 34.7% involving the femoral component only, and 18.4% involving the head and insert. Loosening/lysis (26.5%) and prosthesis dislocation (18.4%) are the main reasons for revision.

The SeleXys acetabular component has been used in 314 procedures and has a five year cumulative percent revision of 7.0%. There have been 14 revisions, 57.1% involving the acetabular component only and 21.4% involving the femoral component only. Loosening/lysis (57.1%) is the main reason for revision.

Of the previously identified prostheses, there are 11 that are no longer used. These are the Alloclassic/Durom and Apex/Trilogy combinations, the ABGII (Exchangeable neck), Adapter (Cementless), Edinburgh, and K2 femoral components and the 2000 Plus, Adept, Bionik, Icon and Mitch TRH acetabular components.

The Polarstem femoral component is no longer identified. This was newly identified last year, however since then, there have been an additional 738 procedures and eight revisions. The three year cumulative percent revision is 2.6%.

The Revitan (non mod) was first identified in the 2006 Annual Report. This year, the revision rate for this prosthesis is not significantly different from all other total conventional hip prostheses. The Revitan is no longer used.

Table IP4: Revision Rate of Individual Total Conventional Hip identified as having a Higher than Anticipated Revision Rate

Femoral/Acetabular	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Identified and no longer used				
Alloclassic/Durom	623	3415	1.67	0 - 1.5Yr: HR=0.86 (0.47, 1.55),p=0.605 1.5Yr+: HR=2.83 (2.12, 3.79),p<0.001
Anca_Fit/Pinnacle	101	502	2.19	Entire Period: HR=2.74 (1.52, 4.96),p<0.001
Apex/Trilogy	98	264	2.65	Entire Period: HR=2.51 (1.19, 5.26),p=0.015
Charnley/Duraloc	180	1499	1.87	0 - 3.5Yr: HR=1.12 (0.50, 2.49),p=0.781 3.5Yr+: HR=4.34 (2.85, 6.60),p<0.001
Elite Plus/Apollo	52	448	2.68	Entire Period: HR=3.87 (2.20, 6.82),p<0.001
Elite Plus/Charnley LPW	89	686	1.75	Entire Period: HR=2.35 (1.34, 4.14),p=0.003
F2L/Delta PF	107	666	1.95	Entire Period: HR=2.48 (1.44, 4.28),p=0.001
H Moos/Mueller	19	121	6.59	Entire Period: HR=8.69 (4.34, 17.38),p<0.001
S-Rom/Duraloc	168	1431	1.75	Entire Period: HR=2.22 (1.50, 3.29),p<0.001
Secur-Fit Plus/Secur-Fit	197	1575	1.21	Entire Period: HR=1.64 (1.04, 2.57),p=0.031
*ABGII (Exch Neck)	246	666	4.65	0 - 4Yr: HR=3.95 (2.66, 5.84),p<0.001 4Yr+: HR=36.10 (16.17, 80.63),p<0.001
*Adapter (cemented)	148	660	3.48	0 - 4Yr: HR=3.95 (2.66, 5.84),p<0.001 4Yr+: HR=36.10 (16.17, 80.63),p<0.001
*Adapter (cementless)	742	2922	2.57	Entire Period: HR=2.95 (2.35, 3.71),p<0.001
*Edinburgh	138	558	2.51	Entire Period: HR=3.18 (1.88, 5.37),p<0.001
*K2	599	1628	3.07	Entire Period: HR=3.09 (2.34, 4.08),p<0.001
*LYDERIC II	164	1062	1.22	Entire Period: HR=1.76 (1.02, 3.02),p=0.041
*Margron	688	5176	1.91	Entire Period: HR=2.48 (2.03, 3.02),p<0.001
*Mayo	168	940	1.38	Entire Period: HR=1.74 (1.01, 3.01),p=0.044
*Profemur Z	186	1154	1.91	Entire Period: HR=2.49 (1.64, 3.79),p<0.001
**2000 Plus	135	585	2.05	Entire Period: HR=2.47 (1.40, 4.33),p=0.001
**Adept	121	470	1.91	Entire Period: HR=1.97 (1.03, 3.79),p=0.041
**Artek	177	1619	3.21	0 - 3.5Yr: HR=2.75 (1.68, 4.50),p<0.001 3.5Yr+: HR=5.17 (3.71, 7.19),p<0.001
**ASR	4420	21521	5.77	0 - 2Wk: HR=1.32 (0.80, 2.17),p=0.272 2Wk - 1Mth: HR=0.25 (0.10, 0.68),p=0.006 1Mth - 9Mth: HR=1.11 (0.81, 1.51),p=0.511 9Mth - 1.5Yr: HR=3.17 (2.48, 4.04),p<0.001 1.5Yr - 2Yr: HR=5.33 (4.11, 6.93),p<0.001 2Yr - 3Yr: HR=11.01 (9.48, 12.78),p<0.001 3Yr+: HR=20.49 (18.88, 22.24),p<0.001
**Bionik	608	2631	2.89	0 - 3Mth: HR=1.84 (1.02, 3.33),p=0.043 3Mth+: HR=4.02 (3.14, 5.13),p<0.001
**ExpanSys	70	432	2.08	Entire Period: HR=2.66 (1.39, 5.12),p=0.003
**Hedrocel	46	385	2.08	Entire Period: HR=2.75 (1.38, 5.50),p=0.004
**Icon	399	1747	2.35	Entire Period: HR=2.59 (1.91, 3.52),p<0.001
**Inter-Op	33	283	3.18	Entire Period: HR=4.49 (2.33, 8.62),p<0.001
**MBA	124	834	1.80	Entire Period: HR=2.61 (1.58, 4.33),p<0.001
**Mitch TRH	732	3056	1.67	0 – 3Mth: HR=0.66 (0.27, 1.58),p=0.345 3Mth+: HR=2.32 (1.74, 3.11),p<0.001
**SPH-Blind	952	7745	1.16	0 - 1Mth: HR=2.71 (1.65, 4.43),p<0.001 1Mth - 6Mth: HR=1.51 (0.78, 2.90),p=0.219 6Mth - 2Yr: HR=2.12 (1.36, 3.29),p<0.001 2Yr+: HR=1.23 (0.92, 1.65),p=0.167

Re-Identified and still used				
CPT/Low Profile Cup	103	311	1.93	Entire Period: HR=2.30 (1.04, 5.13),p=0.040
ML Taper/Fitmore	123	507	1.77	Entire Period: HR=2.12 (1.10, 4.08),p=0.024
ML Taper Kinectiv/Continuum	1131	1714	2.16	Entire Period: HR=1.68 (1.21, 2.32),p=0.001
*CBH Stem	265	780	2.69	Entire Period: HR=2.82 (1.84, 4.33),p<0.001
*Furlong	390	1234	1.62	Entire Period: HR=1.79 (1.16, 2.78),p=0.009
*Metha	132	235	5.54	Entire Period: HR=4.38 (2.55, 7.54),p<0.001
*Taper Fit	373	1969	1.63	0 - 2Yr: HR=1.24 (0.64, 2.38),p=0.526 2Yr+: HR=2.93 (1.94, 4.41),p<0.001
*UniSyn	369	1752	1.66	Entire Period: HR=1.90 (1.32, 2.74),p<0.001
**BHR	2966	14391	1.21	0 - 2Wk: HR=0.82 (0.39, 1.73),p=0.607 2Wk - 1Mth: HR=0.18 (0.05, 0.73),p=0.016 1Mth - 3Mth: HR=1.32 (0.80, 2.16),p=0.276 3Mth - 1.5Yr: HR=0.72 (0.47, 1.10),p=0.127 1.5Yr+: HR=1.99 (1.67, 2.37),p<0.001
**Continuum	3828	5582	1.86	0 - 3Mth: HR=1.85 (1.45, 2.35),p<0.001 3Mth+: HR=1.01 (0.72, 1.41),p=0.967
**Cormet	800	4061	1.48	0 - 1.5Yr: HR=1.05 (0.65, 1.68),p=0.852 1.5Yr - 2Yr: HR=0.41 (0.06, 2.94),p=0.378 2Yr - 4Yr: HR=1.73 (1.02, 2.93),p=0.041 4Yr+: HR=3.62 (2.50, 5.26),p<0.001
**Fin II	1666	5086	1.36	Entire Period: HR=1.43 (1.13, 1.81),p=0.002
**Plasmacup	294	676	2.81	Entire Period: HR=2.64 (1.68, 4.14),p<0.001
**Procotyl L	716	1299	2.77	Entire Period: HR=2.38 (1.72, 3.31),p<0.001
Newly Identified				
*Excia (cementless)	153	242	3.31	Entire Period: HR=2.74 (1.37, 5.49),p=0.004
*ML Taper Kinectiv	2104	3878	1.83	Entire Period: HR=1.57 (1.24, 1.99),p<0.001
*MSA	196	327	4.59	Entire Period: HR=3.40 (2.05, 5.65),p<0.001
*Novation	218	230	5.22	Entire Period: HR=3.54 (2.01, 6.23),p<0.001
*Trabecular Metal	1239	2902	1.69	0 - 1Mth: HR=2.72 (1.77, 4.19),p<0.001 1Mth - 5.5Yr: HR=1.16 (0.80, 1.70),p=0.433 5.5Yr+: HR=16.47 (2.32, 116.7),p=0.005
**SeleXys	314	834	1.68	Entire Period: HR=1.70 (1.01, 2.88), p=0.046

Note: All Components have been compared to all other Total Conventional Hip components.
** Femoral Component*
*** Acetabular Component*

Table IP5: Cumulative Percent Revision of Individual Total Conventional Hip identified as having a Higher than Anticipated Revision Rate

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Identified and no longer used					
Alloclassic/Durom	1.3 (0.7, 2.6)	5.0 (3.5, 7.0)	7.1 (5.3, 9.5)		
Anca_Fit/Pinnacle	5.0 (2.1, 11.5)	8.0 (4.1, 15.4)	11.1 (6.3, 19.1)		
Apex/Trilogy	5.1 (2.2, 11.8)	7.4 (3.6, 15.0)			
Charnley/Duraloc	0.6 (0.1, 3.9)	2.9 (1.2, 6.7)	9.4 (5.9, 14.9)	17.2 (12.0, 24.2)	
Elite Plus/Apollo	2.0 (0.3, 13.4)	4.0 (1.0, 15.1)	12.1 (5.6, 25.0)	23.5 (13.7, 38.7)	
Elite Plus/Charnley LPW	1.2 (0.2, 8.2)	6.1 (2.6, 14.1)	11.3 (6.1, 20.7)	16.7 (9.7, 27.9)	
F2L/Delta PF	5.6 (2.6, 12.1)	10.3 (5.9, 17.9)	12.3 (7.3, 20.2)		
H Moos/Mueller	5.6 (0.8, 33.4)	33.3 (16.6, 59.6)	38.9 (20.8, 64.7)	46.5 (26.2, 72.4)	
S-Rom/Duraloc	3.0 (1.3, 7.1)	4.9 (2.5, 9.6)	5.6 (2.9, 10.5)	17.2 (11.3, 25.6)	
Secur-Fit Plus/Secur-Fit	3.1 (1.4, 6.7)	7.3 (4.4, 11.9)	7.8 (4.8, 12.6)	10.2 (6.6, 15.5)	
*ABGII (Exch Neck)	4.1 (2.2, 7.5)	10.5 (6.8, 15.9)			
*Adapter (cemented)	4.1 (1.9, 8.9)	9.1 (5.4, 15.2)	17.6 (11.9, 25.8)		
*Adapter (cementless)	3.3 (2.2, 4.8)	7.0 (5.4, 9.2)	12.1 (9.6, 15.3)		
*Edinburgh	6.0 (3.1, 11.7)	9.8 (5.6, 16.7)	12.5 (7.5, 20.6)		
*K2	5.2 (3.7, 7.3)	7.9 (5.9, 10.4)			
*LYDERIC II	3.1 (1.3, 7.2)	5.7 (3.0, 10.6)	7.1 (4.0, 12.5)		
*Margron	5.8 (4.3, 7.9)	8.4 (6.5, 10.8)	10.2 (8.2, 12.8)	16.2 (13.3, 19.7)	
*Mayo	3.0 (1.3, 7.0)	6.6 (3.7, 11.6)	6.6 (3.7, 11.6)		
*Profemur Z	6.0 (3.4, 10.5)	10.4 (6.7, 15.8)	10.9 (7.2, 16.5)		
**2000 Plus	3.0 (1.1, 7.8)	6.9 (3.6, 12.8)	9.3 (5.2, 16.5)		
**Adept	4.1 (1.7, 9.6)	7.7 (4.1, 14.3)			
**Artek	2.9 (1.2, 6.7)	8.1 (4.9, 13.2)	15.8 (11.1, 22.2)	25.0 (19.1, 32.3)	
**ASR	1.8 (1.5, 2.3)	9.5 (8.7, 10.4)	23.4 (22.1, 24.8)		
**Bionik	3.6 (2.4, 5.5)	7.6 (5.7, 10.1)	14.4 (11.5, 18.0)		
**ExpanSys	2.9 (0.7, 10.9)	5.8 (2.2, 14.6)	10.3 (5.1, 20.4)		
**Hedrocel	4.3 (1.1, 16.3)	6.6 (2.2, 19.2)	6.6 (2.2, 19.2)	20.4 (10.7, 37.0)	
**Icon	3.0 (1.7, 5.3)	7.4 (5.2, 10.6)	11.3 (8.3, 15.4)		
**Inter-Op	12.1 (4.7, 29.1)	15.2 (6.6, 32.6)	21.4 (10.8, 39.8)	28.3 (15.8, 47.4)	
**MBA	4.0 (1.7, 9.4)	8.2 (4.5, 14.8)	10.2 (5.9, 17.2)		
**Mitch TRH	1.5 (0.8, 2.7)	4.5 (3.2, 6.3)	7.6 (5.7, 10.1)		
**SPH-Blind	3.8 (2.8, 5.2)	5.8 (4.5, 7.5)	7.3 (5.8, 9.2)	9.9 (8.1, 12.1)	
Re-Identified and still used					
CPT/Low Profile Cup	4.2 (1.6, 10.9)				
ML Taper/Fitmore	4.9 (2.3, 10.7)	7.8 (4.1, 14.5)			
ML Taper Kinectiv/Continuum	2.7 (1.9, 3.9)				
*CBH Stem	4.0 (2.2, 7.3)	8.7 (5.5, 13.7)	11.7 (7.2, 18.8)		
*Furlong	2.9 (1.6, 5.2)	5.1 (3.2, 8.2)	6.3 (4.0, 10.0)		
*Metha	10.2 (5.9, 17.3)				
*Taper Fit	1.4 (0.6, 3.3)	3.7 (2.1, 6.5)	7.6 (5.0, 11.3)		
*UniSyn	3.8 (2.3, 6.4)	6.0 (3.9, 9.0)	7.8 (5.3, 11.4)		
**BHR	1.2 (0.8, 1.6)	3.1 (2.5, 3.8)	5.8 (4.9, 6.9)		
**Continuum	2.5 (2.0, 3.1)	3.5 (2.8, 4.4)			
**Cormet	1.4 (0.8, 2.5)	3.5 (2.4, 5.1)	6.1 (4.5, 8.3)		
**Fin II	2.8 (2.1, 3.7)	4.0 (3.1, 5.2)	5.5 (4.2, 7.2)		
**Plasmacup	5.9 (3.6, 9.6)	7.4 (4.7, 11.6)			
**Procotyl L	4.1 (2.9, 5.9)				

Newly Identified			
*Excia (cementless)	4.1 (1.9, 8.9)		
*ML Taper Kinectiv	2.7 (2.1, 3.6)	4.0 (3.1, 5.1)	
*MSA	6.2 (3.5, 10.9)		
*Novation	5.0 (2.7, 9.2)		
*Trabecular Metal	3.1 (2.2, 4.2)	3.8 (2.8, 5.2)	6.2 (4.1, 9.3)
**SeleXys	2.8 (1.4, 5.6)	5.6 (3.2, 9.7)	7.0 (3.9, 12.5)

Note: ** Femoral Component*
*** Acetabular Component*

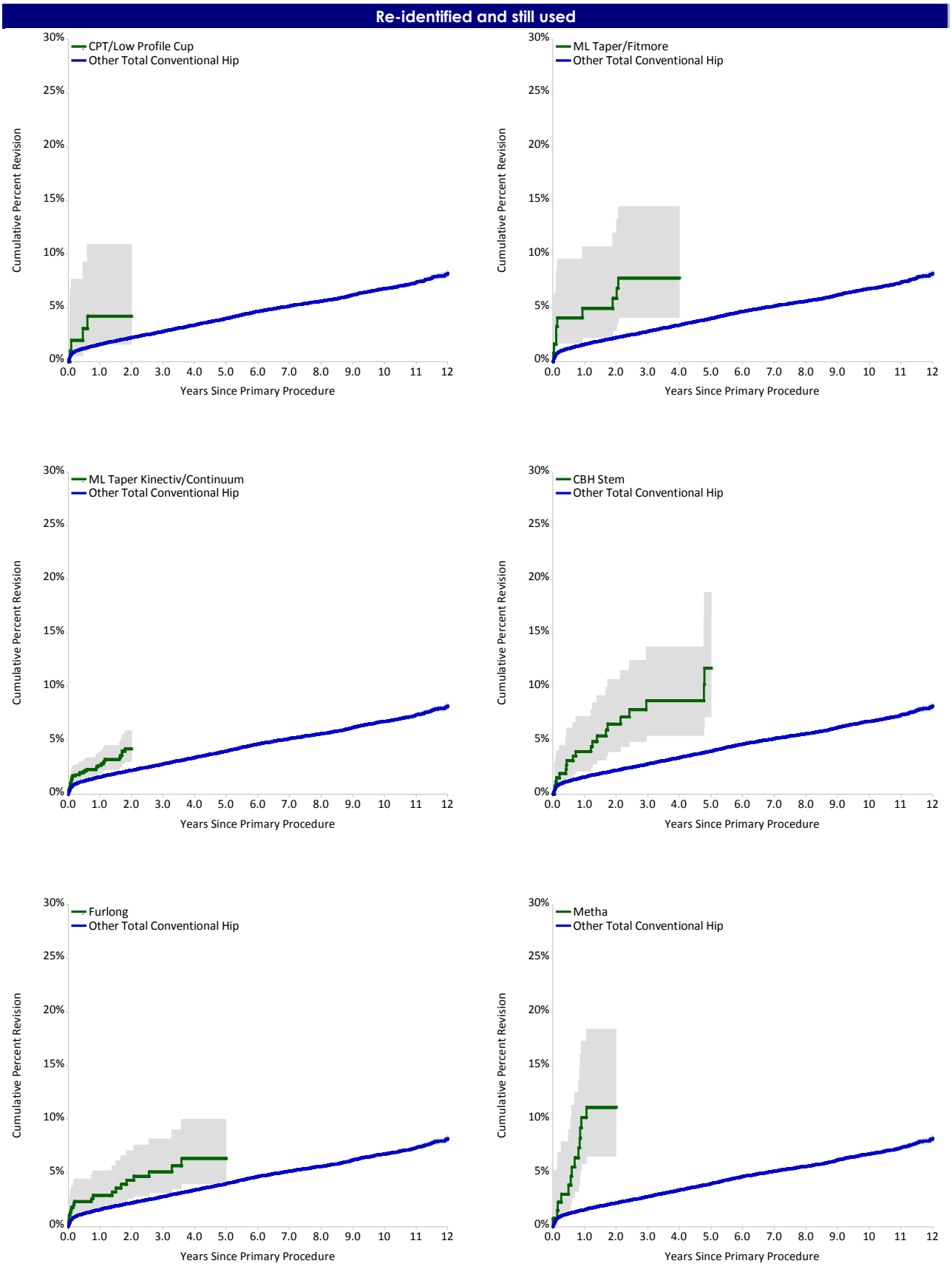
Table IP6: Yearly Usage of Individual Total Conventional Hip identified as having a Higher than Anticipated Revision Rate

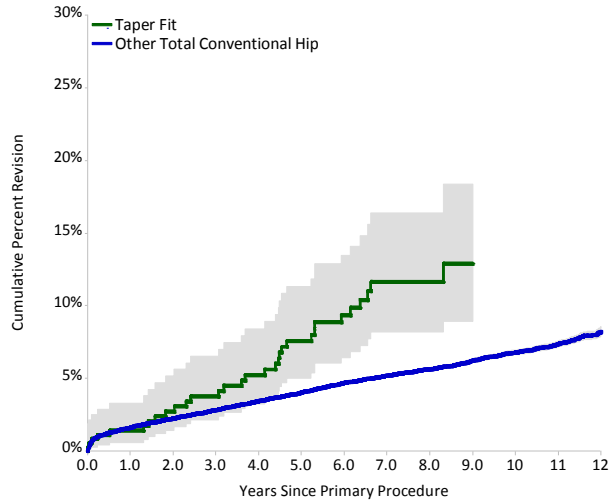
Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Identified and no longer used											
Alloclassic/Durom		3	51	151	139	113	112	46	7	1	
Anca_Fit/Pinnacle					30	55	16				
Apex/Trilogy							15	37	26	20	
Charnley/Duraloc	107	33	19	20	1						
Elite Plus/Apollo	42	10									
Elite Plus/Charnley LPW	74	15									
F2L/Delta PF			7	62	28	10					
H Moos/Mueller	19										
S-Rom/Duraloc	93	33	28	3	3	1	4	3			
Secur-Fit Plus/Secur-Fit	101	27	21	26	22						
*ABGII (Exch Neck)						10	39	69	58	63	7
*Adapter (cemented)				7	41	52	33	8	7		
*Adapter (cementless)				19	140	131	122	158	113	59	
*Edinburgh				20	37	29	18	23	10	1	
*K2					1	22	80	171	204	121	
*LYDERIC II	33	16	64	23	12	8	8				
*Margron	214	123	140	96	85	28	2				
*Mayo	10	11	14	23	24	25	29	30	2		
*Profemur Z			41	79	56	6	1	2	1		
**2000 Plus				11	23	42	14	18	25	2	
**Adept					19	20	29	30	11	12	
**Artek	177										
**ASR			84	583	959	1186	1178	430			
**Bionik				11	147	136	138	134	38	4	
**ExpanSys		1	7	24	29	8	1				
**Hedrocel	37	9									
**Icon			3	40	79	84	68	77	37	11	
**Inter-Op	33										
**MBA	49	29	19	11	9	5	2				
**Mitch TRH					45	274	164	130	82	37	
**SPH-Blind	376	262	205	41	49	19					
Re-Identified and still used											
CPT/Low Profile Cup			15	9	8	7	7	6	9	16	26
ML Taper/Fitmore				7	11	24	70	3		3	5
ML Taper Kinectiv/Continuum								40	376	366	349
*CBH Stem			12	7	14	37	28	27	45	53	42
*Furlong	24	4			1	35	80	73	61	59	53
*Metha								20	53	33	26
*Taper Fit	30	34	65	50	66	26	18	6	8	16	54
*UniSyn	1	15	40	74	32	37	46	47	36	23	18
**BHR	38	66	127	288	550	580	476	404	276	134	27
**Continuum								175	1117	1230	1306
**Cormet	9	53	74	103	115	72	129	124	91	26	4
**Fin II				39	127	175	251	268	318	287	201
**Plasmacup				10	16	13	7	54	60	59	75
**Procotyl L							8	32	268	341	67

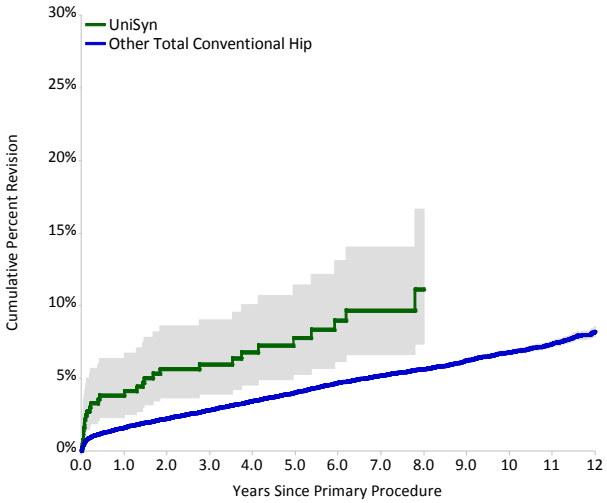
Newly Identified							
*Excia (cementless)			6	34	8	47	58
*ML Taper Kinectiv			36	341	647	574	506
*MSA		2	3	11	58	76	46
*Novation				4	32	53	129
*Trabecular Metal	6	101	147	198	242	270	275
**SeleXys	35	39	27	21	51	70	71

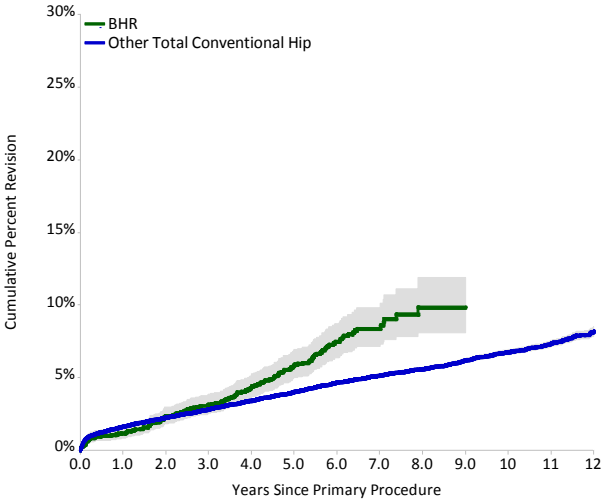
*Note: * Femoral Component*
*** Acetabular Component*

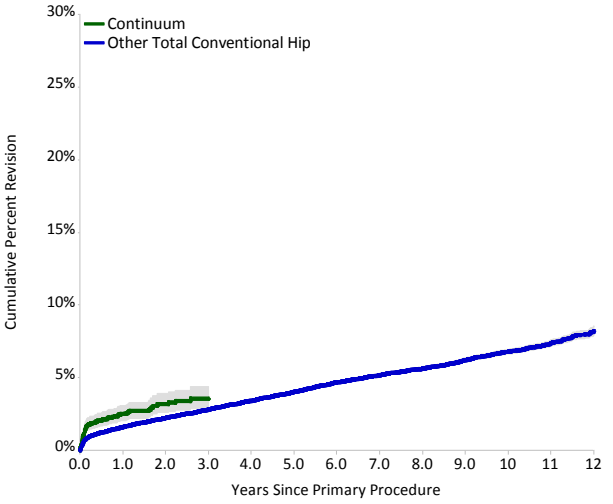
Figure IP2: Cumulative Percent Revision of Individual Total Conventional Hip re-identified and still used

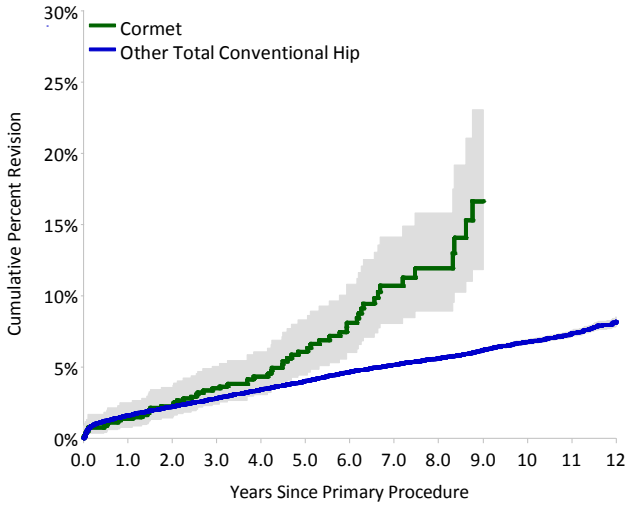


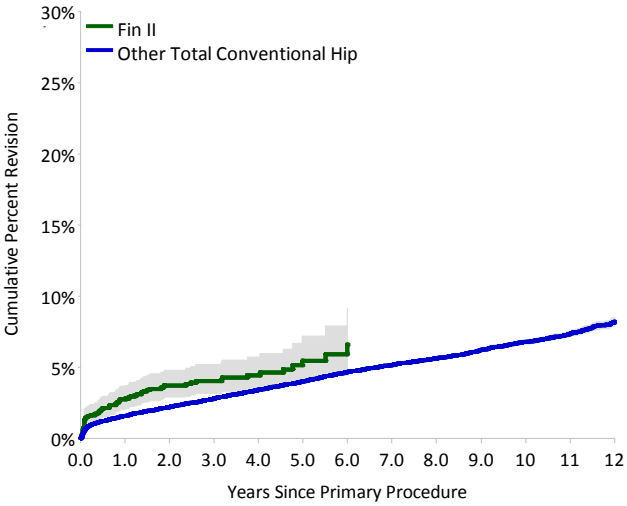

Taper Fit
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12
Years Since Primary Procedure

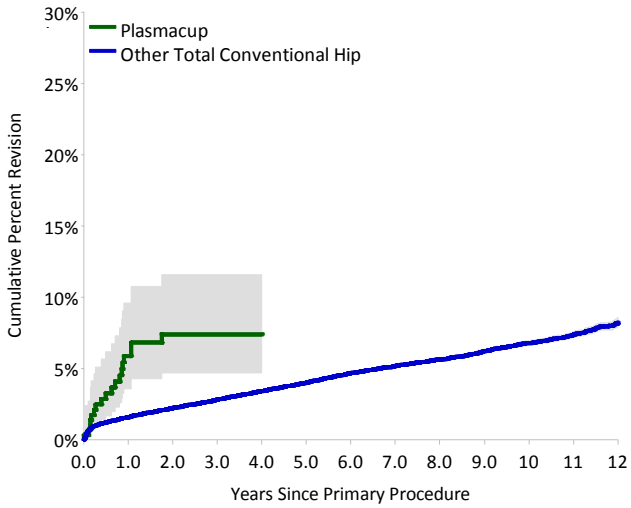

UniSyn
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12
Years Since Primary Procedure


BHR
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12
Years Since Primary Procedure


Continuum
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12
Years Since Primary Procedure


Cormet
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12
Years Since Primary Procedure


Fin II
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12
Years Since Primary Procedure


Plasmacup
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12
Years Since Primary Procedure

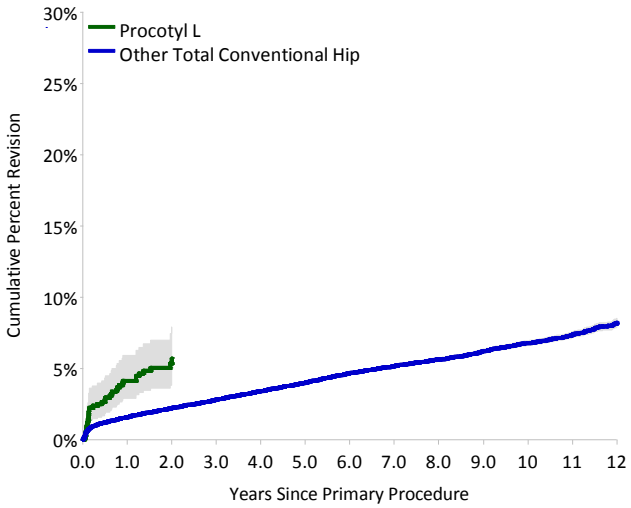
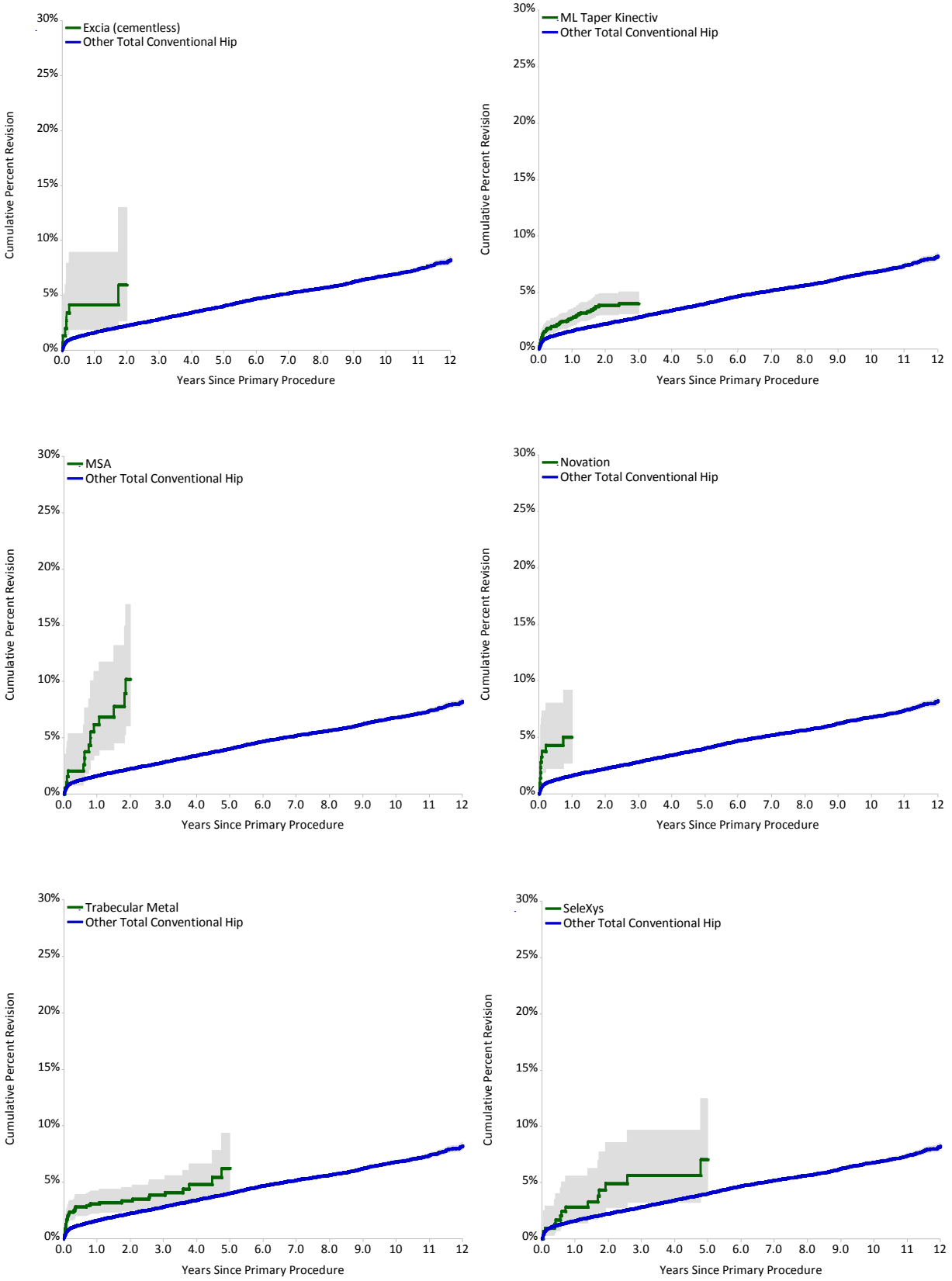

Procotyl L
Other Total Conventional Hip
Cumulative Percent Revision
30%
25%
20%
15%
10%
5%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12
Years Since Primary Procedure

Figure IP3: Cumulative Percent Revision of Individual Total Conventional Hip newly identified

Newly Identified



Total Resurfacing

There is one resurfacing device being identified for the first time, the Cormet/Cormet prosthesis combination. The Cormet/Cormet has been used in 622 procedures and has a ten year cumulative percent revision of 20.7%. There have been 76 revisions, 60.5% of which involved revision to the femoral and acetabular components, and 31.6% to the femoral component only. Loosening/lysis (36.8%), fracture (19.7%) and metal related pathology (23.7%) are the main reasons for revision.

Table IP7: Revision Rate of Individual Total Resurfacing Hip identified as having a Higher than Anticipated Revision Rate

Resurfacing Head/Acetabular	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Identified and no longer used				
ASR/ASR	1167	6865	3.58	0 - 3Mth: HR=1.65 (0.99, 2.75),p=0.053 3Mth - 2Yr: HR=2.06 (1.48, 2.86),p<0.001 2Yr - 4Yr: HR=3.95 (2.91, 5.37),p<0.001 4Yr - 4.5Yr: HR=7.22 (4.48, 11.65),p<0.001 4.5Yr - 5Yr: HR=9.73 (5.81, 16.30),p<0.001 5Yr+: HR=5.75 (4.40, 7.52),p<0.001
Bionik/Bionik	199	847	3.66	Entire Period: HR=3.60 (2.52, 5.16),p<0.001
Durom/Durom	847	5260	1.39	Entire Period: HR=1.36 (1.07, 1.72),p=0.012
Recap/Recap	195	922	2.28	Entire Period: HR=2.17 (1.41, 3.35),p<0.001
*Cormet 2000 HAP	95	785	2.29	Entire Period: HR=2.37 (1.49, 3.78),p<0.001
Newly Identified				
Cormet/Cormet	622	3550	2.14	0 - 1.5Yr: HR=1.15 (0.71, 1.87),p=0.573 1.5Yr+: HR=2.43 (1.86, 3.17),p<0.001

Note: All Components have been compared to all other Total Resurfacing Hip components.
** Resurfacing Head Component*

Table IP8: Cumulative Percent Revision of Individual Total Resurfacing Hip identified as having a Higher than Anticipated Revision Rate

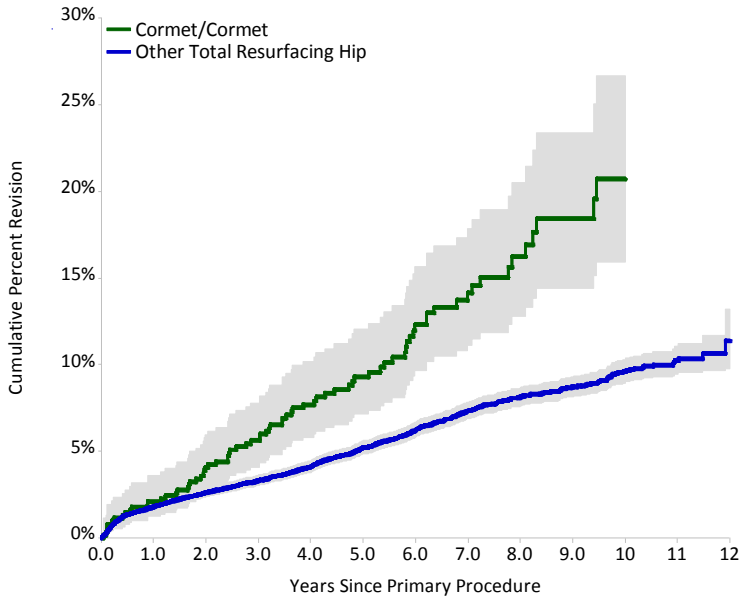
CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Identified and no longer used					
ASR/ASR	3.3 (2.5, 4.5)	7.1 (5.8, 8.8)	15.4 (13.4, 17.7)		
Bionik/Bionik	3.5 (1.7, 7.2)	12.4 (8.5, 17.9)	17.3 (12.2, 24.2)		
Durom/Durom	3.2 (2.2, 4.6)	5.4 (4.0, 7.1)	7.6 (6.0, 9.7)		
Recap/Recap	5.1 (2.8, 9.3)	8.8 (5.5, 13.7)	10.8 (7.0, 16.2)		
*Cormet 2000 HAP	6.3 (2.9, 13.5)	8.4 (4.3, 16.1)	9.5 (5.0, 17.4)	21.1 (13.6, 31.8)	
Newly Identified					
Cormet/Cormet	2.1 (1.2, 3.6)	5.6 (4.0, 7.8)	9.3 (7.1, 12.1)	20.7 (15.9, 26.7)	

Table IP9: Yearly Usage of Individual Total Resurfacing Hip identified as having a Higher than Anticipated Revision Rate

Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Identified and no longer used											
ASR/ASR		43	165	302	257	176	133	91			
Bionik/Bionik				12	33	33	46	54	19	2	
Durom/Durom		58	166	207	143	105	88	46	24	10	
Recap/Recap			27	14	9	42	46	38	16	3	
*Cormet 2000 HAP	18	38	39								
Newly Identified											
Cormet/Cormet	62	42	50	85	74	76	94	75	50	10	4

Figure IP4: Cumulative Percent Revision of Individual Total Resurfacing Hip newly identified

Newly Identified



Primary Partial Knee Replacement

Patella/Trochlear

There is one prosthesis being identified for the first time, the Vanguard trochlear prosthesis.

The Vanguard has been used in 27 procedures and has a three year cumulative percent revision of 29.4%. Of the seven revisions, all have been revised to a total knee (femoral and tibial). Progression of disease (57.1%) and pain (28.6%) are the main reasons for revision.

Table IP10: Revision Rate of Individual Patella/Trochlear Knee identified as having a Higher than Anticipated Revision Rate

Patella/Trochlear	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Identified and no longer used				
**LCS	413	2332	4.89	Entire Period: HR=1.67 (1.33, 2.10),p<0.001
Re-Identified and still used				
PFC Sigma/Sigma HP	68	154	6.51	Entire Period: HR=2.33 (1.23, 4.40),p=0.009
Newly Identified				
**Vanguard	27	67	10.40	Entire Period: HR=3.16 (1.49, 6.72),p=0.002

Note: All Components have been compared to all other Patella/Trochlear Knee components.
*** Trochlear Component*

Table IP11: Cumulative Percent Revision of Individual Patella/Trochlear Knee identified as having a Higher than Anticipated Revision Rate

CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Identified and no longer used					
**LCS	3.9 (2.4, 6.2)	11.9 (9.1, 15.4)	20.5 (16.8, 24.8)		
Re-Identified and still used					
PFC Sigma/Sigma HP	4.7 (1.5, 13.9)	19.3 (9.6, 36.5)			
Newly Identified					
**Vanguard	4.0 (0.6, 25.2)	29.4 (12.9, 58.3)			

Table IP12: Yearly Usage of Individual Patella/Trochlear Knee identified as having a Higher than Anticipated Revision Rate

Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Identified and no longer used											
**LCS	26	56	68	47	65	64	60	27			
Re-Identified and still used											
PFC Sigma/Sigma HP						14	6	5	16	15	12
Newly Identified											
**Vanguard						4	5	2	1	12	3

Figure IP5: Cumulative Percent Revision of Individual Patella/Trochlear Knee re-identified and still used

Re-Identified and still used

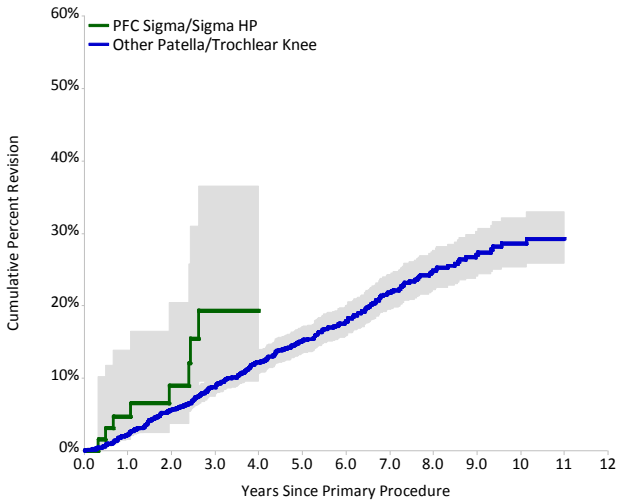
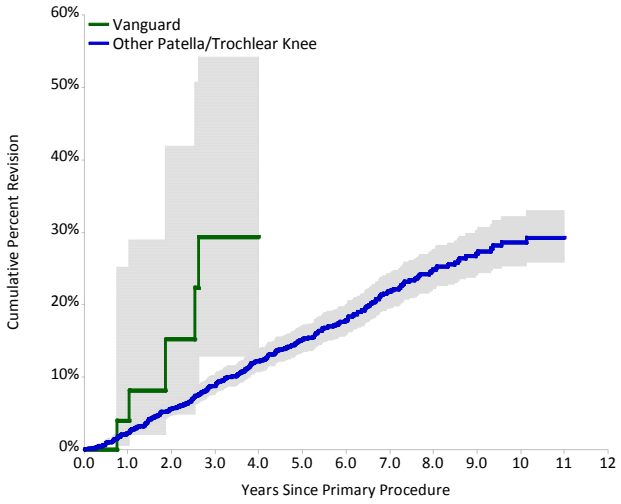


Figure IP6: Cumulative Percent Revision of Individual Patella/Trochlear Knee newly identified

Newly Identified



Unicompartmental

No new unicompartmental knee replacements have been identified as having a higher than anticipated rate of revision.

Since last year's report, the GMK Uni/GMK Uni combination has moved from no longer used to the still used group, as it was used in 19 procedures in 2012. In addition, the AMC prosthesis has been renamed to Uniglide at the request of the company.

Table IP13: Revision Rate of Individual Unicompartmental Knee identified as having a Higher than Anticipated Revision Rate

Femoral/Tibial	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Identified and no longer used				
Advance/Advance	37	209	7.17	Entire Period: HR=4.57 (2.75, 7.59),p<0.001
BalanSys Uni/BalanSys Uni Mobile	199	1145	3.14	0 - 6Mth: HR=4.71 (2.34, 9.50),p<0.001 6Mth+: HR=1.51 (1.04, 2.19),p=0.030
Eius/Eius	142	903	3.21	Entire Period: HR=1.54 (1.07, 2.22),p=0.021
**Preservation Mobile	400	3032	3.33	0 - 1.5Yr: HR=2.25 (1.60, 3.14),p<0.001 1.5Yr - 3Yr: HR=2.63 (1.79, 3.86),p<0.001 3Yr+: HR=1.22 (0.89, 1.68),p=0.215
Re-Identified and still used				
GMK-UNI/GMK-UNI	36	57	8.80	Entire Period: HR=4.96 (2.07, 11.89),p<0.001
Uniglide/Uniglide	706	3643	2.77	Entire Period: HR=1.53 (1.25, 1.86),p<0.001

Note: All Components have been compared to all other Unicompartmental Knee components.
*** Unicompartmental Tibial Component*

Table IP14: Cumulative Percent Revision of Individual Unicompartmental Knee identified as having a Higher than Anticipated Revision Rate

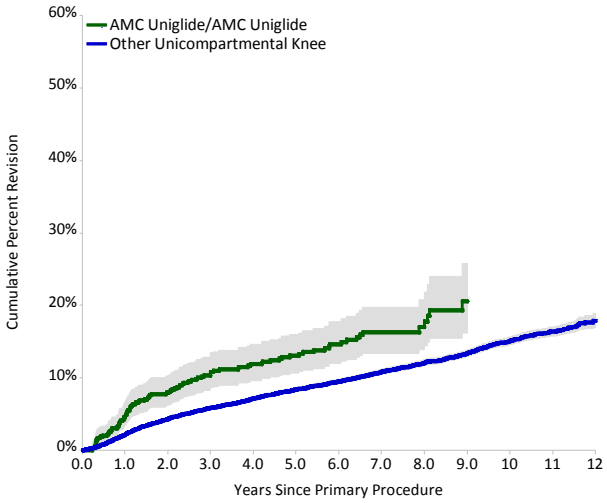
CPR	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Identified and no longer used					
Advance/Advance	10.8 (4.2, 26.3)	27.0 (15.6, 44.4)	33.1 (20.3, 51.0)		
BalanSys Uni/BalanSys Uni Mobile	7.0 (4.2, 11.6)	13.1 (9.1, 18.6)	14.7 (10.5, 20.5)		
Eius/Eius	4.9 (2.4, 10.1)	12.8 (8.2, 19.5)	18.0 (12.6, 25.5)		
**Preservation Mobile	5.3 (3.5, 7.9)	15.5 (12.3, 19.5)	19.1 (15.6, 23.3)	27.0 (22.7, 32.0)	
Re-Identified and still used					
GMK-UNI/GMK-UNI	15.5 (5.1, 42.0)	27.6 (12.3, 54.9)			
Uniglide/Uniglide	4.6 (3.3, 6.5)	10.8 (8.7, 13.4)	13.1 (10.7, 16.0)		

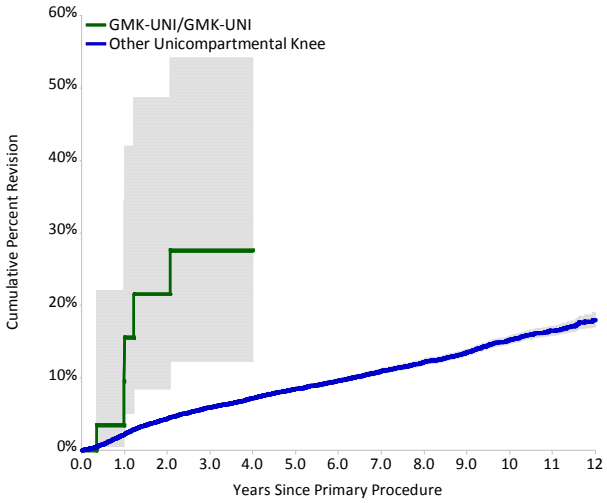
Table IP15: Yearly Usage of Individual Unicompartmental Knee identified as having a Higher than Anticipated Revision Rate

Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Identified and no longer used											
Advance/Advance		13	11	7	2	3	1				
BalanSys Uni/BalanSys Uni Mobile			37	51	63	33	9	2	4		
Eius/Eius	10	21	27	37	21	9	8	7	2		
**Preservation Mobile	164	121	59	26	17	13					
Re-Identified and still used											
GMK-UNI/GMK-UNI							5	10	2	0	19
Uniglide/Uniglide		80	66	123	84	107	93	61	30	38	24

Figure IP7: Cumulative Percent Revision of Individual Unicompartmental Knee re-identified and still used

Re-identified and still used





Primary Total Knee Replacement

There are five total knee prostheses that are being identified for the first time.

The ACS/ACS combination, first recorded in 2011, has been used in 581 procedures and has a one year cumulative percent revision of 3.5%. There have been 12 revisions, five of which are insert only.

The Advance/Advance combination has been used in 461 procedures and has a five year cumulative percent revision of 5.3%. Most revisions are to another total knee (39.1%) or tibial component only (21.7%) and the main reason for revision is loosening/lysis (47.8%).

The Score/Score combination, first recorded in 2004, has been used in 1,228 procedures and has a three year cumulative percent revision of 4.7%. Of the 44 revisions, 31.8% are patella only, and 25.0% are to another total knee. The main reasons for revision are loosening/lysis (15.9%), infection (18.2%), patellofemoral pain (13.6%) and patella erosion (11.4%).

The Trekking/Trekking combination, first recorded in 2010, has been used in 268 procedures and has a one year cumulative percent revision of 3.5%. Of the eight revisions, 50.0% are femoral component only. The main reasons for revision are loosening/lysis (37.5%) and infection (25.0%).

One prosthesis that is no longer used has been identified for the first time. The SAL/SAL combination was used in 56 procedures between 2000 and 2002 and has a ten year cumulative percent revision of 14.8%. Most revisions are to another total knee and the main reason for revision is loosening/lysis.

The TC-Plus/TC-Plus combination is no longer significantly different from all other total knee prostheses (p=0.053). In 2012, there were an additional 36 procedures and 2 revisions. The five year cumulative percent revision is 6.5%.

Table IP16: Revision Rate of Individual Total Knee identified as having a Higher than Anticipated Revision Rate

Femoral/Tibial	N Total	Obs. Years	Revisions/100 Obs. Yrs	Hazard Ratio, P Value
Identified and no longer used				
AMK/AMK	424	3816	0.92	Entire Period: HR=1.56 (1.12, 2.18),p=0.008
Eska RP/Eska RP	40	196	4.08	Entire Period: HR=6.02 (3.01, 12.02),p<0.001
Gemini MK II/Gemini MK II	21	164	3.67	Entire Period: HR=5.70 (2.57, 12.62),p<0.001
Genesis (cemented)/Genesis (cemented)	62	506	1.78	Entire Period: HR=3.18 (1.66, 6.12),p<0.001
Genesis II Oxinium (cementless)/Genesis II	110	658	6.53	Entire Period: HR=8.99 (6.66, 12.13),p<0.001
Genesis II Oxinium (cementless)/Profix Mobile	88	410	12.94	Entire Period: HR=16.60 (12.67, 21.75),p<0.001
Genesis II Oxinium PS (cemented)/Genesis II (Keel)	269	1422	3.73	Entire Period: HR=4.88 (3.73, 6.39),p<0.001
IB II/IB II	199	1847	1.68	0 - 2Yr: HR=0.78 (0.25, 2.42),p=0.669 2Yr - 2.5Yr: HR=4.39 (1.41, 13.63),p=0.010 2.5Yr+: HR=4.79 (3.23, 7.10),p<0.001
Interax/Interax	52	449	2.23	0 - 3.5Yr: HR=1.36 (0.34, 5.44),p=0.663 3.5Yr+: HR=8.12 (4.06, 16.27),p<0.001
Optetrak-PS/Optetrak-PS	55	314	3.82	Entire Period: HR=6.07 (3.45, 10.68),p<0.001
Profix Oxinium (cemented)/Profix Mobile	228	1831	1.31	Entire Period: HR=1.80 (1.21, 2.69),p=0.004
Profix Oxinium (cementless)/Profix Mobile	158	927	7.44	Entire Period: HR=10.76 (8.49, 13.63),p<0.001
Profix Oxinium (cementless)/Profix	75	462	6.71	Entire Period: HR=9.05 (6.36, 12.88),p<0.001
Profix/Profix Mobile	1005	7297	1.27	Entire Period: HR=1.98 (1.62, 2.43),p<0.001
Rotaglide Plus/Rotaglide Plus	631	4788	1.11	0 - 1.5Yr: HR=1.17 (0.66, 2.05),p=0.595 1.5Yr+: HR=2.07 (1.52, 2.81),p<0.001
SAL/SAL	56	528	1.51	0 - 8.5Yr: HR=1.36 (0.51, 3.62),p=0.541 8.5Yr+: HR=8.90 (3.32, 23.87),p<0.001
Trac/Trac	138	1244	1.61	Entire Period: HR=2.58 (1.67, 4.01),p<0.001
*LCS Duofix	4867	22787	1.87	0 - 2Yr: HR=1.68 (1.44, 1.95),p<0.001 2Yr+: HR=3.34 (2.94, 3.79),p<0.001
*Renasys	121	736	1.63	Entire Period: HR=2.38 (1.35, 4.19),p=0.002
Re-Identified and still used				
Buechel-Pappas/Buechel-Pappas	470	1603	1.62	Entire Period: HR=1.72 (1.17, 2.53),p=0.005
Columbus/Columbus	906	3020	1.82	Entire Period: HR=2.23 (1.71, 2.90),p<0.001
E.Motion/E.Motion	341	459	3.48	Entire Period: HR=3.36 (2.06, 5.48),p<0.001
Genesis II CR (cementless)/Genesis II (cementless)	322	1005	1.69	Entire Period: HR=1.83 (1.14, 2.94),p=0.013
HLS Noetos/HLS Noetos	292	1062	1.88	Entire Period: HR=2.22 (1.43, 3.44),p<0.001
Journey/Journey	2790	8743	1.59	0 - 3Mth: HR=0.35 (0.11, 1.08),p=0.067 3Mth - 9Mth: HR=1.64 (1.05, 2.55),p=0.028 9Mth - 1.5Yr: HR=2.26 (1.71, 2.99),p<0.001 1.5Yr+: HR=1.88 (1.48, 2.40),p<0.001
Optetrak-PS/Optetrak	2101	9817	1.36	Entire Period: HR=1.86 (1.57, 2.20),p<0.001
Optetrak-PS/Optetrak RBK	699	2716	1.88	Entire Period: HR=2.33 (1.77, 3.07),p<0.001
Vanguard/Regenerex	876	1500	1.73	Entire Period: HR=1.53 (1.04, 2.24),p=0.031
Newly Identified				
ACS/ACS	581	433	2.77	Entire Period: HR=2.70 (1.53, 4.76),p<0.001
Advance/Advance	461	1388	1.66	Entire Period: HR=1.94 (1.29, 2.92),p=0.001
Score/Score	1228	2873	1.53	Entire Period: HR=1.41 (1.05, 1.90),p=0.021
Trekking/Trekking	268	277	2.89	0 - 1Yr: HR=3.24 (1.54, 6.78),p=0.001 1Yr+: HR=0.99 (0.14, 7.05),p=0.993

Note: All Components have been compared to all other Total Knee components.
** Femoral Component*

Table IP17: Cumulative Percent Revision of Individual Total Knee identified as having a Higher than Anticipated Revision Rate

Femoral/Tibial	1 Yr	3 Yrs	5 Yrs	10 Yrs	12 Yrs
Identified and no longer used					
AMK/AMK	1.4 (0.7, 3.2)	4.6 (3.0, 7.1)	5.6 (3.8, 8.3)	8.5 (6.1, 11.8)	9.8 (7.0, 13.7)
Eska RP/Eska RP	7.5 (2.5, 21.5)	12.7 (5.5, 27.9)	18.2 (9.1, 34.5)		
Gemini MK II/Gemini MK II	9.5 (2.5, 33.0)	14.3 (4.8, 38.0)	23.8 (10.7, 48.1)	23.8 (10.7, 48.1)	
Genesis (cemented)/Genesis (cemented)	0.0 (0.0, 0.0)	6.7 (2.6, 16.8)	10.0 (4.6, 20.9)	16.9 (8.9, 30.7)	
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)/Profix Mobile	24.0 (16.3, 34.4)	52.8 (42.8, 63.5)	57.4 (47.4, 67.9)		
Genesis II Oxinium PS (cemented)/Genesis II (Keel)	4.5 (2.6, 7.7)	14.5 (10.8, 19.3)	18.3 (14.2, 23.5)		
IB II/IB II	0.0 (0.0, 0.0)	3.6 (1.7, 7.3)	7.8 (4.8, 12.7)	15.4 (10.9, 21.5)	
Interax/Interax	0.0 (0.0, 0.0)	2.0 (0.3, 13.4)	8.3 (3.2, 20.7)	13.0 (6.0, 26.8)	24.9 (13.2, 43.8)
Optetrak-PS/Optetrak-PS	1.8 (0.3, 12.2)	16.4 (8.9, 29.1)	20.0 (11.6, 33.3)		
Profix Oxinium (cemented)/Profix Mobile	1.8 (0.7, 4.6)	6.3 (3.8, 10.4)	8.6 (5.6, 13.1)	11.0 (7.5, 16.0)	
Profix Oxinium (cementless)/Profix Mobile	9.0 (5.4, 14.6)	40.2 (32.9, 48.3)	41.5 (34.2, 49.7)		
Profix Oxinium (cementless)/Profix	13.3 (7.4, 23.4)	36.1 (26.4, 48.1)	37.5 (27.6, 49.5)		
Profix/Profix Mobile	2.3 (1.5, 3.4)	6.4 (5.0, 8.1)	8.2 (6.6, 10.1)	10.3 (8.3, 12.9)	
Rotaglide Plus/Rotaglide Plus	0.8 (0.3, 1.9)	4.1 (2.8, 6.0)	5.8 (4.2, 8.0)	9.9 (7.6, 12.9)	
SAL/SAL	0.0 (0.0, 0.0)	1.9 (0.3, 12.6)	1.9 (0.3, 12.6)	14.8 (7.3, 28.6)	
Trac/Trac	2.2 (0.7, 6.6)	5.9 (3.0, 11.4)	9.0 (5.2, 15.2)	15.1 (9.9, 22.7)	
*LCS Duofix	1.5 (1.2, 1.9)	5.8 (5.2, 6.5)	9.1 (8.3, 10.0)		
*Renasys	2.5 (0.8, 7.5)	4.2 (1.8, 9.8)	8.5 (4.7, 15.2)		
Re-Identified and still used					
Buechel-Pappas/Buechel-Pappas	1.9 (1.0, 3.7)	5.1 (3.4, 7.6)	6.4 (4.2, 9.8)		
Columbus/Columbus	2.1 (1.3, 3.3)	6.7 (5.1, 8.8)	7.8 (6.0, 10.1)		
E.Motion/E.Motion	3.8 (2.1, 6.9)				
Genesis II CR (cementless)/Genesis II (cementless)	1.1 (0.3, 3.3)	7.5 (4.5, 12.3)	7.5 (4.5, 12.3)		
HLS Noetos/HLS Noetos	3.2 (1.7, 6.1)	7.2 (4.6, 11.0)	7.7 (5.0, 11.8)		
Journey/Journey	1.6 (1.2, 2.2)	4.9 (4.0, 5.8)	7.0 (5.8, 8.4)		
Optetrak-PS/Optetrak	1.5 (1.1, 2.2)	5.2 (4.2, 6.3)	7.3 (6.1, 8.7)	10.1 (8.0, 12.7)	
Optetrak-PS/Optetrak RBK	2.8 (1.8, 4.3)	7.0 (5.2, 9.3)	8.7 (6.6, 11.4)		
Vanguard/Regenerex	2.1 (1.3, 3.4)				
Newly Identified					
ACS/ACS	3.5 (1.8, 6.5)				
Advance/Advance	2.6 (1.4, 4.6)	5.3 (3.3, 8.5)	5.3 (3.3, 8.5)		
Score/Score	1.3 (0.8, 2.2)	4.7 (3.4, 6.5)			
Trekking/Trekking	3.5 (1.6, 7.3)				

*Note: * Femoral Component*

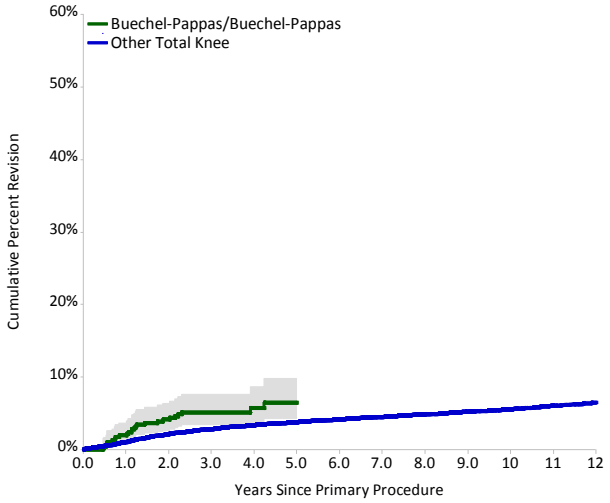
Table IP18: Yearly Usage of Individual Total Knee identified as having a Higher than Anticipated Revision Rate

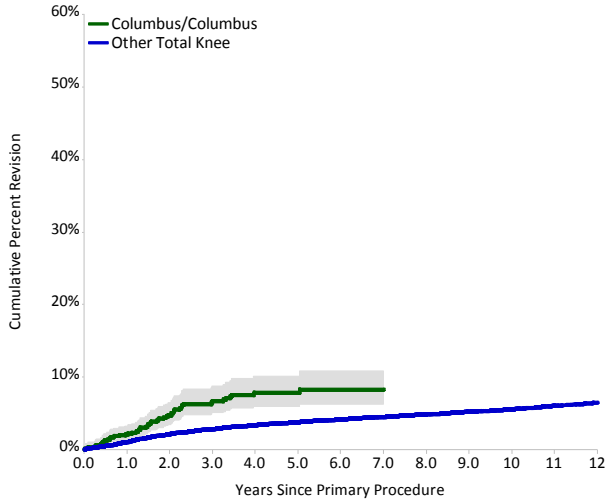
Year of Implant	≤2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Identified and no longer used											
AMK/AMK	336	51	37								
Eska RP/Eska RP				9	24	5	0	2			
Gemini MK II/Gemini MK II	14	7									
Genesis (cemented)/Genesis (cemented)	45	6	3	8							
Genesis II Oxinium (cementless)/Genesis II	4	106									
Genesis II Oxinium (cementless)/Profix Mobile	22	66									
Genesis II Oxinium PS (cemented)/Genesis II (Keel)				18	124	127					
IB II/IB II	187	12									
Interax/Interax	52										
Optetrak-PS/Optetrak-PS			8	14	18	15					
Profix Oxinium (cemented)/Profix Mobile	72	31	91	24	3	4	1	2			
Profix Oxinium (cementless)/Profix Mobile	63	95									
Profix Oxinium (cementless)/Profix	10	65									
Profix/Profix Mobile	197	173	258	245	51	56	11	12	2		
Rotaglide Plus/Rotaglide Plus	181	151	110	101	43	30	15				
SAL/SAL	56										
Trac/Trac	128	9	1								
*LCS Duofix					843	1637	1532	854	1		
*Renasys				51	53	3	14				
Re-Identified and still used											
Buechel-Pappas/Buechel-Pappas				1	39	51	84	100	147	44	4
Columbus/Columbus				49	92	89	148	156	134	136	102
E.Motion/E.Motion								12	87	114	128
Genesis II CR (cementless)/Genesis II (cementless)	20	11	3	0	16	29	34	28	53	61	67
HLS Noetos/HLS Noetos			2	2	47	45	45	56	48	28	19
Journey/Journey					134	337	593	597	464	329	336
Optetrak-PS/Optetrak	126	130	155	252	253	216	167	202	198	202	200
Optetrak-PS/Optetrak RBK				1	81	173	166	119	82	40	37
Vanguard/Regenerex								27	340	345	164
Newly Identified											
ACS/ACS										181	400
Advance/Advance	54	0	8	12	16	2	5	43	115	136	70
Score/Score			5	1	0	17	173	256	287	246	243
Trekking/Trekking									35	102	131

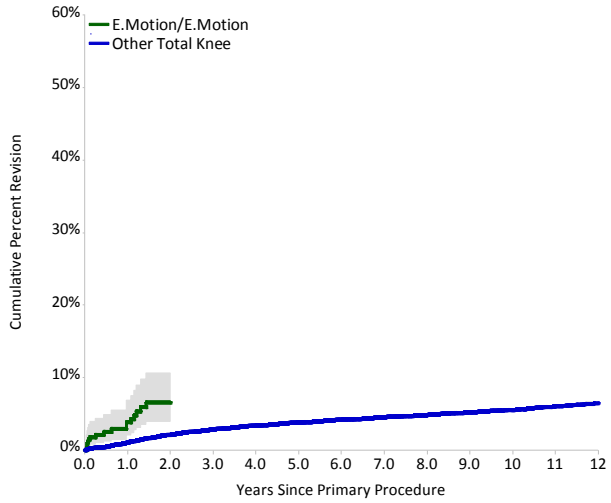
*Note: * Femoral Component*

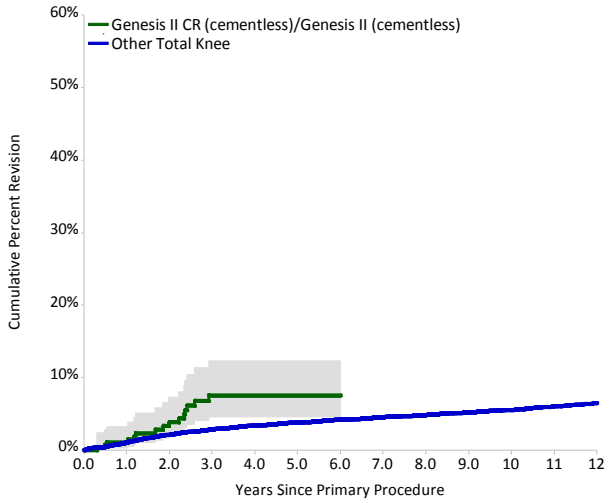
Figure IP8: Cumulative Percent Revision of Individual Total Knee re-identified and still used

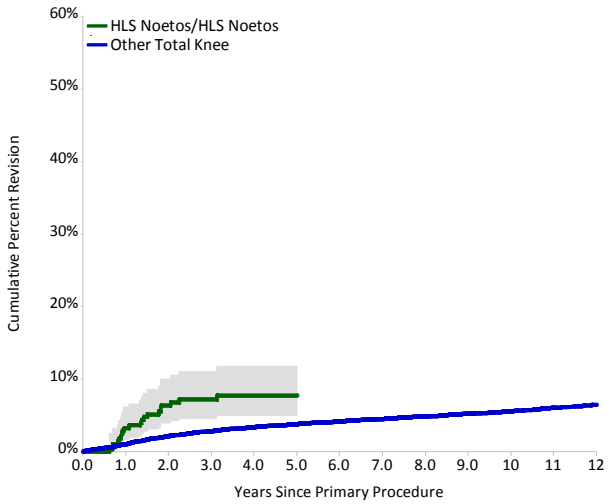
Re-identified and still used

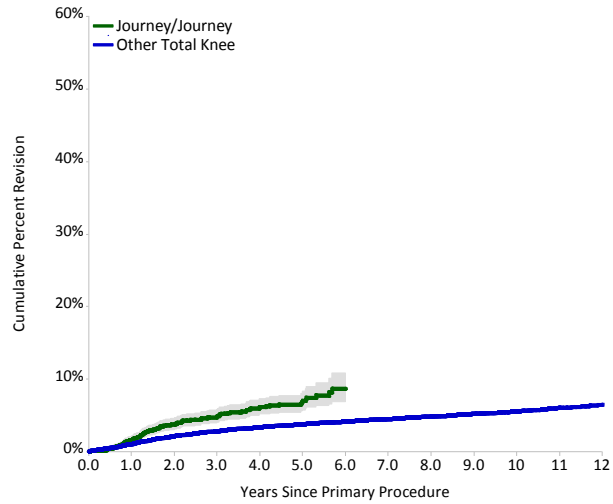


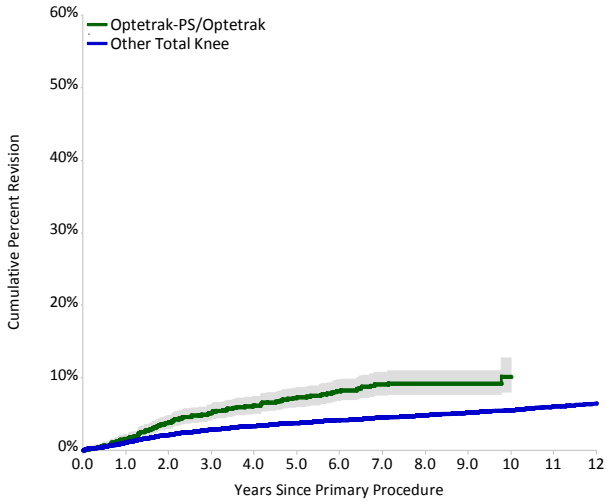


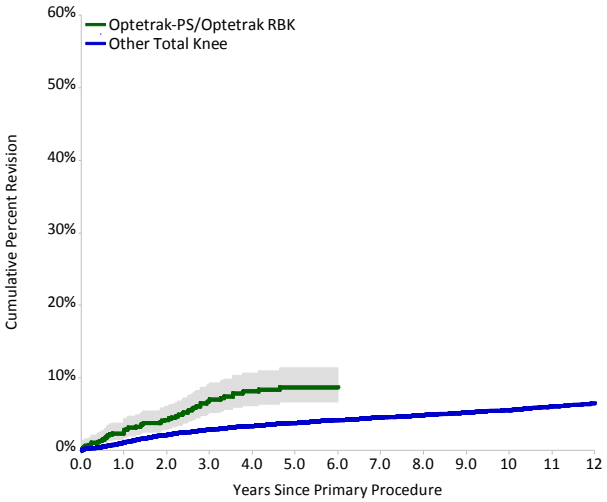









Optetrak-PS/Optetrak
Other Total Knee
Cumulative Percent Revision
60%
50%
40%
30%
20%
10%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12
Years Since Primary Procedure


Optetrak-PS/Optetrak RBK
Other Total Knee
Cumulative Percent Revision
60%
50%
40%
30%
20%
10%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12
Years Since Primary Procedure

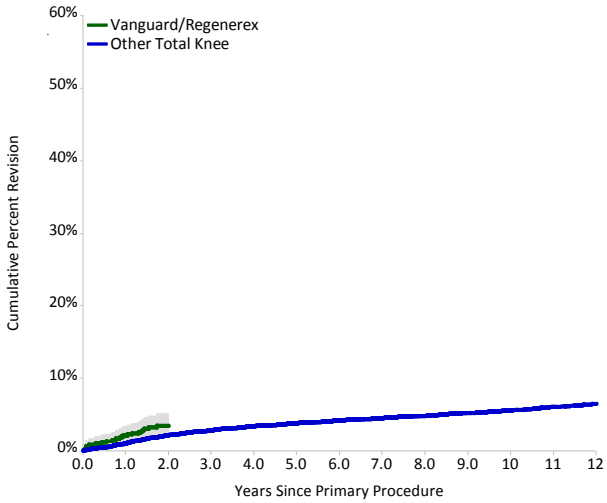
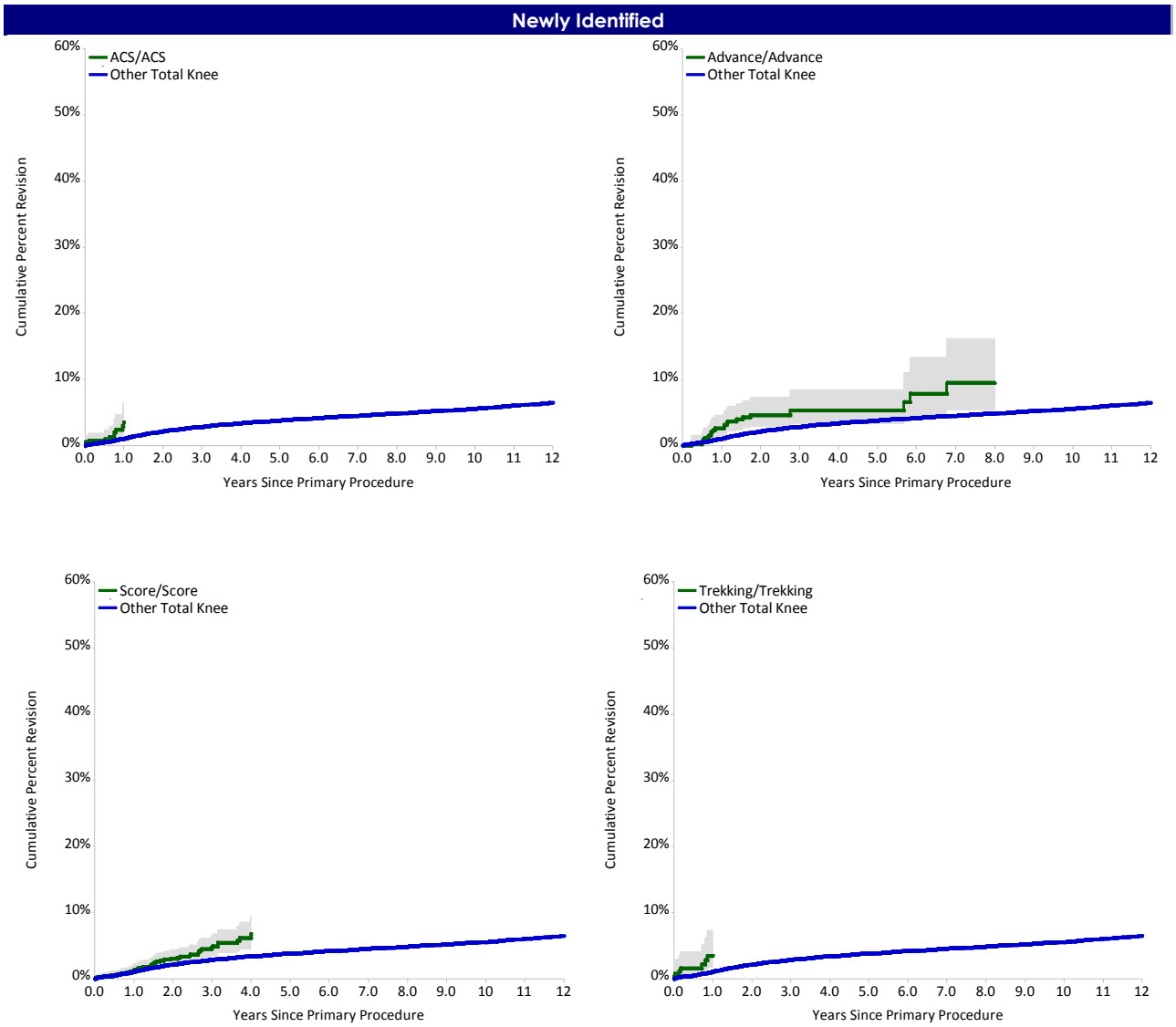

Vanguard/Regenerex
Other Total Knee
Cumulative Percent Revision
60%
50%
40%
30%
20%
10%
0%
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10 11 12
Years Since Primary Procedure

Figure IP9: Cumulative Percent Revision of Individual Total Knee newly identified



APPENDICES

APPENDIX 1

Participating Hospitals & Coordinators

NEW SOUTH WALES

PUBLIC HOSPITALS

Name of Hospital	Registry Coordinator	
Albury Base Hospital	Elwyn Black	Nurse Manager Theatre
Armidale Hospital	Debbie Spokes/Cheryl Fardon	NUM Theatre/Theatre Clerk
Bankstown/Lidcombe Hospital	John Mati/Aron Priscion	CNS/RN Orthopaedic Theatre
Bathurst Base Hospital	Kylie Peers	NUM Theatre
Bega District Hospital	Lena Lee	RN Theatre
Blacktown Hospital	Diane Barben/June Tsang	NUM Theatre/RN Operating Theatre
Bowral and District Hospital	Barbara Wise	NUM Theatre
Broken Hill Health Service	Sue Beahl/Helen Gentle	NUM/RN Theatre
Campbelltown Hospital	Amanda Young	Theatre Reception
Canterbury Hospital	Jenny Cubit	NUM Theatre
Coffs Harbour Health Campus	Eric Dorman	NUM Theatre
Concord Repatriation Hospital	Monique Prowse	NUM Theatre
Dubbo Base Hospital	Cathy Chapman	Theatre Clerks
Fairfield Hospital	Cathy Jiear	Peri operative Services Manager
Gosford Hospital	Kirsty Brown/Toni Hoad	Set up Coordinator Theatre/Acting NUM
Goulburn Base Hospital	Marta Daniel/Karen Goode	NUM Theatre/Theatre Admin Clerk
Grafton Base Hospital	Anthony Corkett	NUM Operating Theatre
Hornsby & Ku-Ring-Gai Hospital	Bessie Chu	CNS Theatre
Institute of Rheumatology & Orthopaedic Surgery	Maria Hatziandreou	NUM Theatre
John Hunter Hospital	Felicia Bristow/Ken Schilling	Equipment Officer/Admin Equip Officer
Lismore Base Hospital	Glen Nettle	CNS Orthopaedic Theatre
Liverpool Health Service	John Murphy	NUM Orthopaedic Theatre
Maitland Hospital	Karen Cheers	NUM Theatre
Manly District Hospital	Heather Liddle/Maryanne Howell	NUM Theatre/CNS Theatre
Manning Rural Referral Hospital	Grahame Cooke	RN Theatre
Mona Vale Hospital	Estelle vont Takach	CN Orthopaedic Theatre
Mt Druitt Hospital	Lydia Baldock	RN Theatre
Murwillumbah District Hospital	Lynne Penglase	NUM Theatre
Nepean Hospital	Debbie Dobbs	RN Operating Theatres
Orange Health Service	Teresa Luczak	Senior Nurse Manager Theatre
Port Macquarie Base Hospital	Pam Campbell/Joanne Atkins	NUM Theatre/Theatre Clerk
Royal Newcastle Centre	Graham Cutler	NUM Theatre
Royal North Shore Hospital	Eileen Cole	Research Physiotherapist, Dept Ortho
Royal Prince Alfred Hospital	Anna Pickering/Jennifer Wilkey	ANUM Theatre/CNS Ortho
Ryde Hospital	Karen Jones	NUM Theatre
Shoalhaven Group Hospital	Leanne McTavish	NUM Orthopaedic
St George Hospital	Simon Cheng	NUM for Clinical Resources Theatre
St Vincent's Public Hospital	Mary Therese Butler/Lee Black	NUM Peri operative Services/Acting NUM
Sutherland Hospital	Sara Apolloni	CNS Theatre
Tamworth Base Hospital	Kevin Attard	RN Theatre
The Prince of Wales Hospital	Frances O'Brien	NUM Orthopaedics
The Tweed Hospital	Amanda Budd/Neroli Prestage	CNS Theatre/ANUM
Wagga Wagga Base Hospital	Alison Giese/Melissa Chapman	CNS Orthopaedic Theatre
Westmead Hospital	Michelle Ward/Ramesh Gopal	Acting NUM/Clinical Support Officer
Wollongong Hospital	Carol Jackson	CNS Orthopaedics
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	Lesley Berry	Orthopaedic Resource Manager
Bathurst Private Hospital	Diane Carter	RN Operating Theatres
Berkeley Vale Private Hospital	Michelle Turner	QA/Education Coordinator
Brisbane Waters Private Hospital	Janis Livingstone	CNS Coord Orthopaedic Theatre
Calvary Health Care Riverina	Annette Somerville	Manager, Health Information Services
Campbelltown Private Hospital	Yvonne Quinn	CNC Orthopaedics
Dalcross Adventist Hospital	Anne Carroll/Kerrie Legg	Deputy CEO_DON/NUM
Delmar Private Hospital	Ros Berrymen/Cathy Byrne	NUM Theatre/Medical Records
Dubbo Private Hospital	Sally Cross	RN Theatre
Dudley Private Hospital	James Bird/Michele Englart	NUM Theatre/RN Theatre
Figtree Private Hospital	Mandy Holmes/Kim Dyer	Theatre Clerk
Forster Private Hospital	Jenny Bullivant	NUM Theatre
Gosford Private Hospital	Claire Monger	RN Orthopaedic Theatre
Hawkesbury Health Service	Megan McVIcar	CNS Theatre
Holroyd Private Hospital	Sid Turingan	NUM Theatre
Hunters Hill Private Hospital	Jenny May	NUM Orthopaedic Theatre
Hunter Valley Private	Renae Pridue	NUM Theatre
Kareena Private Hospital	Deirdre Baulch	NUM/CNS Orthopaedics
Lake Macquarie Private Hospital	Robert Reddie	Theatre Clerk
Lingard Private Hospital	Greg Hewitt/Nicole Garland	NUM Theatre/Theatre Clerk
Maitland Private Hospital	Martine Mead	2IC Operating Theatres
Macquarie University Hospital	Simmy Masuku	NUM Orthopaedic Theatre
Mayo Private Hospital	Suzanna Cini	NUM Theatre
National Day Surgery Sydney	Elizabeth Carroll/Louise Jones	Director of Nursing/Floor Manager
Nepean Private Hospital	Jan Wernert	NUM Theatre
Newcastle Private Hospital	Darren Fogarty	RN Theatre
North Shore Private Hospital	Eileen Cole	Research Physiotherapist, Dept Ortho
Norwest Private Hospital	Lucy Richardson	NUM Orthopaedic Theatre
Nowra Private Hospital	Linda Wright	NUM Theatre
Port Macquarie Private Hospital	Tresna Bell	CNS Orthopaedic Theatre
Shellharbour Private Hospital	Liz Quennel	Medical Records
Southern Highlands Hospital	Lynne Byrne	Theatre Clerk
St George Private Hospital and Medical Centre	Michele McKenna	NUM Orthopaedics
St Luke's Care	Helen Ashley/Sue Bevan	Theatre Manager/CNSTheatre
St Vincent's Private Hospital Darlinghurst	F Crawford/R Liston/V Law	CNS Theatre/CNS Ortho/ROI Coordinator
St Vincent's Private Hospital Lismore	Janelle Hospers	CNS, Orthopaedic Care Coord
Strathfield Private Hospital	Maria Read/Kristy Farrugia	Perioperative Manager/RN Theatre
Sydney Adventist Hospital	Jill Parker/Melissa Ng	CNS Orthopaedic Theatre/RN
Sydney Private Hospital	Leisa Maikey	Administrator, General Theatres
Sydney South West Private	Angela Wilbow/Harold Faustino	Nurse Manager/CNC Orthopaedics
Tamara Private Hospital	Kris Wall	NUM Operating Theatre
The Mater Hospital	Jane Francis/Lenore Curran	CNS Theatre/RN Orthopaedics
The Prince of Wales Private Hospital	Ellaine Lamasan	Orthopaedic NUM
The Surgery Centre, Hurstville	Tracey Dennett	Perioperative Services Manager
Toronto Private Hospital	Stephanie Keys	Theatre Manager
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	R Kentish/K Morris/B Murray	ANUM Orthopaedic Theatres
Ballarat Health Services	Amanda Bell/Kellie Livingston	Equipment ANUM
Bass Coast Regional Health/Wonthaggi Hospital	Barbara Harrison/Debee Thow	Peri operative Services Mgr/Acting NUM
Bendigo Health Care Group	Catherine Jensen	ANUM Orthopaedic Theatre
Box Hill Hospital	Helga Ploschke	Quality Coord Orthopaedic Services
Cohuna District Hospital	Karen Storm	NUM Theatre
Colac Area Health	Amanda Tout	NUM Theatre
Dandenong Hospital	Karen Ferguson/Melanie Murray	ANUM Orthopaedics
Djerriwarrh Health Services, Bacchus Marsh Campus	Linda Aykens/Judy Dehnert	NUM Theatre/ACN
East Grampians Health Service	Jane Smith, Jenny Sargent	Acting NUM/ CN
Echuca Regional Health	Kerryn Giorgianni	ANUM Theatre Dept
Goulburn Valley Health	Fiona Moncrieff/Cara Disint	CNS Orthopaedic Theatre
Kerang District Health	Margie Christian	NUM Operating Theatre
Kyabram & District Health Services	Anne Wilson	NUM Theatre
Latrobe Regional Hospital	Simone Lovison	Clinical Nurse Specialist
Maroondah Hospital	Brooke Retallack	CNS Orthopaedic Theatre
Mildura Base Hospital	Katrina Allen	Perioperative Services Manager
Monash Medical Centre, Clayton Campus	Candice Brown	Orthopaedic ANUM
Monash Medical Centre, Moorabbin Campus	Carol Jackson/ Sushila Tomlinson	NUM/Assistant NUM Theatre
Northeast Health Service Wangaratta	Lynn Reid/Larissa Laverty	ACN Theatre/Theatre Bookings Clerk
Peninsula Health Service, Frankston Hospital	Donna Anderson	ANUM Theatre
Portland District Health	Angela Hand	NUM Theatre
Sandringham & District Memorial Hospital	Eileen Dalach	ANUM Orthpaedics
Seymour District Memorial Hospital	Karen Lamaro	Peri-operative Services Unit Manager
South West Healthcare Warrnambool Campus	Tony Kelly	Peri operative Services Manager
St Vincent's Public Hospital	Shazeli Osman/Stacy Turner	NUM/Clinical Resource Nurse
Stawell Regional Health	Chris Gillmartin/Barb Savage	NUM Theatre/Theatre Nurse
Sunshine Hospital	Joy Curley/Cassandra Mules	RN Theatre/ Purchasing Officer Theatres
Swan Hill District Hospital	Helen Wilkins	NUM Theatre
The Alfred	Caroline McMurray	Coordinator Orthopaedic Dept
The Geelong Hospital, Barwon Health	Lee Rendle	ANUM Theatre
The Northern Hospital	Siew Perry	ANUM Theatre
The Royal Children's Hospital	Sonia Mouat	Acting AUM Orthopaedics
The Royal Melbourne Hospital	Kerrie Crosato	RN Operating Theatre
West Gippsland Healthcare Group	Christine Evans/Bernie Notman	ACN Theatre/CNS
West Wimmera Health Service	Sharon Sanderson/Christine Dufty	Acting Theatre Manager/CSSD ICP
Western District Health Service	Rosalie Saunders	Clinical RN
Western Hospital	Vicki Mahaljcek/Cassandra Mules	RN Theatre/Purchasing Officer Theatres
Williamstown Hospital	Maureen Clark	ANUM Theatre
Wimmera Health Care Group	Maree Markby	NUM Theatre

VICTORIA

PRIVATE HOSPITALS

Name of Hospital	Registry Coordinator	
Beleura Private Hospital	Jean Leyland	AUM Theatre
Bellbird Private Hospital	Belinda Van Denberg	NUM Theatre
Cabrini Private Hospital, Brighton	Brooke Mackay	Admin Assistant
Cabrini Private Hospital, Malvern	Brooke Mackay	Admin Assistant
Como Private Hospital	Gillian Wilson/Nicole Groves	NUM Theatre/CNS Orthopaedics
Cotham Private Hospital	Joanne Oxbrow/Amy Pardoe	Perioperative Services Mgr/ANUM Ortho
Epworth Hospital	Lynne Moyes	ANUM Orthopaedic Theatre
Epworth Eastern Hospital	Erin Verey	RN Orthopaedic Department
Epworth Freemason Hospital	Claudia Nozzolillo	ANUM Orthopaedic Theatre
Essendon Private Hospital	Chan Leong	NUM Theatre
Geelong Private Hospital	Wilna Steyn	Orthopaedic Services Manager
Glenferrie Private Hospital	Samantha Jervois	Theatre Manager
John Fawkner Hospital	Sue Bell	NUM Orthopaedic Theatre
Knox Private Hospital	Laura Tilley	Billings Officer Theatre
Latrobe Private Hospital	Jenny Telfer	NUM Theatre
Linacre Private Hospital	Melissa Dillon	NUM Orthopaedic Theatre
Maryvale Private Hospital	Glenda Chambers	ANUM Orthopaedic Theatre
Masada Private Hospital	Lisa McBain	Theatre Manager
Melbourne Private Hospital	Karen Grant	Theatre Manager
Mildura Private Hospital	Elizabeth Collihole	ACN Theatre
Mitcham Private Hospital	Julie Nankivell/Judith Bond	RN/RN Theatre
Mountain District Hospital	Rosslyn Martin	NUM Theatre
Northpark Private Hospital	Charmain D'cruz	CNS Orthopaedics
Peninsula Private Hospital	Ruth Honan	ANUM Orthopaedic Theatre
Ringwood Private Hospital	Carol Burns	ANUM Theatre
Shepparton Private Hospital	Niki Miller	CNS Orthopaedic Theatre
South Eastern Private Hospital	Nicole O'Brien/Sharryn McKinley	NUM Theatre/Op Services Supervisor
St John of God Ballarat Hospital	Kylie Cross	CN Orthopaedics
St John of God Bendigo Hospital	Jenny Dillon	AUM Theatre
St John of God Geelong Hospital	Colin Hay	Orthopaedic Coordinator, Theatre
St John of God Warrnambool Hospital	Leanne McPherson/Gill Wheaton	DON/Perioperative Services Manager
St John of God Hospital, Berwick	Rebecca Jamieson	ANUM Orthopaedics
St Vincent's Private East Melbourne	Jan Gammon	RN Orthopaedic Theatre
St Vincent's Private Fitzroy	Julie Keyte/Deanna Delle-Virgini	ANUM/RN Orthopaedic Theatre
St Vincent's Private Kew	Fiona Webster/Sue Ziduinas	ANUM Theatre/CNS Theatre
The Avenue Hospital	Annellen Watson	ANUM Orthopaedics
The Valley Private Hospital	Ryan Bracker	NUM Theatre
Wangaratta Private Hospital	Janet McKie	ANUM Theatre
Warringal Hospital	Marilyn Dey	ANUM Operating Theatre
Waverley Private Hospital	Rebecca Juzva	Orthopaedic AUM
Western Private Hospital	Rachel Cassar	NUM Theatre

QUEENSLAND

PUBLIC HOSPITALS

Name of Hospital	Registry Coordinator	
Bundaberg Base Hospital	Maria McAneney	Nursing Director
Cairns Base Hospital	Rebecca Rowley	Orthopaedic Bookings Officer
Caloundra Health Service	Raylee Callaghan	NUM Theatre
Gold Coast Hospital	Meredith Bird	Loan Set Coordinator
Gold Coast Hospital, Robina Campus	Annemarie Brooks/Helen McGuire	CN/RN Theatre
Hervey Bay Hospital	Michelle Alcorn	Clinical Nurse Orthopaedics
Ipswich Hospital	Ross Howells/Jannah O'Sullivan	Inventory Manager
Logan Hospital	Denise Maher	Director Support Orthopaedics
Mackay Base Hospital	Renee Hutchinson/Beth Keogh	NUM Theatre/CN Orthopaedics
Maryborough Hospital	Heather Zillman	RN Theatre
Mater Misericordiae Public Adult's Hospital	Christine Thompson	Clinical Nurse
Mater Misericordiae Public Children's Hospital	Vicki Livett	NUM Theatre
Nambour General Hospital	Kay Friend	Nurse Mgr, Logistics & Procurement
The Prince Charles Hospital	Sue Grice/Louise Tuppin/R Seddon	Clinical Nurse/Clinical Data Mgr/RN
Princess Alexandra Hospital	Jo-Anne de Plater	CN Orthopaedic Theatres
Queen Elizabeth II Jubilee Hospital	Donna Cal	EN Theatre
Redcliffe Hospital	R Thursfield/G van Fleet/K Williamson	Program Coord/Snr Health Info Mgr
Redland Public Hospital	Trish O'Farrell	RN Theatre
Rockhampton Base Hospital	Chantel Harrison/Stephen Stoddart	CN Orthopaedics/RN Ortho Theatre
Royal Brisbane & Women's Hospital	Elaine Hausler/Anna Dowe	Num/RN Operating Theatres
Royal Children's Hospital Brisbane	Noelle Coleman	Cinical Nurse
Toowoomba Hospital	Amanda Lostroh/Freya Chadwick	RN Theatre/Level 2 RN Orthopaedics
Townsville Hospital	Sharon Cooke/Clare Duane	RN Ortho Theatre/Acting L2 Ortho

QUEENSLAND

PRIVATE HOSPITALS

Name of Hospital	Registry Coordinator	
Allamanda Private Hospital	Margaret Law	NUM Theatre
Brisbane Private Hospital	Liz Drabble	Theatre Logistics Coordinator
Cairns Private Hospital	Wendy Gould	RN Theatre
Caloundra Private Hospital	Christine Wells/Todd Mimnaw	CN Theatre
Friendly Society's Hospital	Jo Peterson	Perioperative Services Manager
Greenslopes Private Hospital	Kelly Williams	CN Orthopaedic Theatre
Hervey Bay Surgical Centre	Yvonne Howlett	CNC Theatre
Hillcrest Rockhampton Private Hospital	Lyn Martin	NUM Theatre
Holy Spirit Northside Hospital	Lexie Brace	CN Orthopaedic Theatre
John Flynn Hospital	Paula Archer	RN Orthopaedics
Mater Health Services North Queensland	Jo Humphreys/Anjela Hunt	CN Orthopaedic Theatre
Mater Misericordiae Hospital Bundaberg	James Turner/Karen Smith	ANUM/CN Orthopaedic Theatre
Mater Misericordiae Hospital Gladstone	Alison Drinkwater	NUM Orthopaedic Theatre
Mater Misericordiae Hospital Mackay	Danell Curtis	Nurse Coordinator
Mater Misericordiae Hospital Rockhampton	Michelle Havik/Tim Harkin	RN Orthopaedics
Mater Misericordiae Private Hospital	Sarah Way	Perioperative Registered Nurse
Mater Private Hospital Redland	Erina Harris	RN Theatre
Nambour Selangor Private Hospital	Jenai Bavill	RN Theatre
Noosa Hospital	Janet McMeekin	CN Theatre
North West Private Hospital	Elizabeth Hill/Lyndal Schnitzerling	Peri Operative CN/Orthopaedic CN
Peninsula Private Hospital	Joan Fellowes	NUM Theatre
Pindara Private Hospital	Carli Nicolaou	CN Orthopaedic Theatre
St Andrew's Private Hospital	Mel Grant	CSSD Theatre
St Andrew's Hospital, Toowoomba	Jeff van Leeuwen	Manager Peri-operative Services
St Andrew's War Memorial Hospital	Tracey Liesch	Clinical Manager Peri Operative
St Stephen's Private Hospital	Sheila Jensen	RN Theatre
St Vincent's Hospital, Toowoomba	Judy Plotecki	RN Peri-operative Services
Sunnybank Private Hospital	Judy Aslette	2IC Orthopaedics
The Sunshine Coast Hospital	Phil Hall	RN Theatre
Wesley Hospital	Debra Tyszkiewicz	CNM Ward 1M

SOUTH AUSTRALIA

PUBLIC HOSPITALS

Name of Hospital	Registry Coordinator	
Clare Hospital and Health Services	Libby Hoffmann	NUM Theatre
Flinders Medical Centre	Jo Drabsch/Lyn Healey	CN Theatre/ACSC Ortho Trauma Theatre
Gawler Health Service	Sharon Soones	RN Theatre
Lyell McEwin Hospital	Fiona Brinkies	CN Theatre
Modbury Public Hospital	Lisa Pearson	CN Theatre
Mt Barker District Solders Memorial Hospital	Emma Crowder	RN Theatre
Mt Gambier Regional Hospital	Kylie Duncan	Assoc Clinical Services Coord
Murray Bridge Soldiers Memorial Hospital	Janine Colwell	CPC
Naracoorte Health Service	Margie Sinclair	CN Theatre
Noarlunga Hospital	Carol Dawson	RN Theatre
Port Augusta	Leann Cutler	NUM Theatre
Port Lincoln Hospital	Christine Weber	NUM Theatre
Port Pirie Hospital	Sue Wilkinson	NUM Theatre
Queen Elizabeth Hospital	Carol Saniotis	Nursing Management Facilitator
Repatriation General Hospital	Joy Telfer/Sue Brown	Clinical Nurse/RN
Riverland Regional Hospital	Viv Turner/Leanne Zerna	RN Theatre
Royal Adelaide Hospital	Lisa Lewington/Sue Pannach	CN Ortho Theatre/Clin outcomes coord
South Coast District Hospital	Jill Cooper/Judy Anderson	EO DON/CN Theatre
Whyalla Health Service	Amanda Horgan	CN Theatre
Women's and Children's Hospital	Margaret Betterman	CN Theatre

PRIVATE HOSPITALS

Name of Hospital	Registry Coordinator	
Ashford Community Hospital	Lisa Kowalik	A/CN Theatre
Burnside War Memorial Hospital	Meriel Wilson	Manager Medical Records
Calvary Central Districts Hospital	Adele Alves	Clinical Nurse
Calvary Health Care Adelaide	Maria Young	CN Theatre
Calvary Wakefield Hospital	Kieran McEvoy	Clinical Manager, Orthopaedic Theatre
Flinders Private Hospital	Marcus Ender	CN Orthopaedics
Glenelg Community Hospital	Jan Lewandowski	CN Orthopaedic Theatre
North Eastern Community Hospital	Anne Sciacca	Theatre Manager
Parkwynd Private Hospital	Helen Madigan	CN Orthopaedic Theatre
Sportsmed SA	Magi Odgaard/Catherine Ryan	Clinical Coders Medical Records
St Andrew's Private Hospital	H Crosby/L White	RN Orthopaedic Theatre
Stirling & District Hospital	Nick Clarke/Tanya Hanlon	CN Manager/CNC Theatre
The Memorial Hospital	Katrina Smith	CN Orthopaedic Liaison
Western Hospital	Margaret Witts	RN Theatre

WESTERN AUSTRALIA

PUBLIC HOSPITALS

Name of Hospital	Registry Coordinator	
Albany Regional Hospital	Heather Watson	RN Theatre
Armadale Health Service	Eleri Griffiths/Deb Carkeek	Mgr Surgical Services/Ortho Tech
Bunbury Regional Hospital	Anthea Amonini	Orthopaedic Technician Theatre
Freemantle Hospital	Steven Johnson	Orthopaedic Technician Theatre
Geraldton Hospital	Vicki Richards	CN Theatre
Kaleeya Hospital	Elsy Jiji	CN Orthopaedic Theatre
Kalgoorlie Regional Hospital	Nicole Hintz	Clinical Manager Theatre
Osborne Park Hospital	Jenny Misiewicz/Anita Maxwell	CN Theatre
Rockingham General Hospital	Carol Beaney	CN Theatre
Royal Perth Hospital, Shenton Park	Sladjana Neskovic	Orthopaedic Coordinator
Royal Perth Hospital, Wellington St	Carmel McCormack	NUM Theatre
Sir Charles Gairdner Hospital	Angela Bibb	Theatre Floor Coordinator

PRIVATE HOSPITALS

Name of Hospital	Registry Coordinator	
Bethesda Hospital	Kristina Markusic/Maree Zak	CN Orthopaedics/Theatre Co-ordinator
Hollywood Private Hospital	Judith Corbett	CN Theatre
Joondalup Health Campus	J Hughes/D Crowley/J Larkan	HIM/CN Ortho/Deputy HIM
Mercy Hospital Mt Lawley	Greg Cox/Stuart Meek	Orthopaedic Technicians
Mount Hospital	Jacqui McDonald	Orthopaedic Coordinator
Peel Health Campus	Jan Birmingham	CN Orthopaedic Theatre
South Perth Hospital	Alice Gill	CN Orthopaedics
St John of God Health Care Bunbury	Alison Hawkes	Theatre Manager
St John of God Health Care Geraldton	Kristie Hutton	Clinical Nurse Educator, Theatre
St John of God Health Care Murdoch	Samantha Hunter/Caris Stead	Orthopaedic Coordinator/AOrtho Coord
St John of God Health Care Subiaco	Andrew Grimm	Orthopaedic Coordinator
Waikiki Private Hospital	Bill Muir	Operating Theatre Manager

TASMANIA

PUBLIC HOSPITALS

Name of Hospital	Registry Coordinator	
Launceston General Hospital	P van Nynanten/Madeleine Smith	CN Orthopaedic Theatre
North West Regional Hospital, Burnie Campus	B Kerr/ R Dicker/T Minifie	Peri Op NUM/RN/RN
Royal Hobart Hospital	Paula Horgan	RN Theatre

PRIVATE HOSPITALS

Name of Hospital	Registry Coordinator	
Calvary Health Care Tasmania, St John's Campus	Cate Farrell	RN Orthopaedic Theatre
Calvary Health Care Tasmania, St Luke's Campus	Anne Boot/Toni Morice	CNC Theatre/ Theatre Clerk
Calvary Hospital	B Stephensen/A Copping/S Ramsley	A/CNS Ortho/CNS Neuro/RN Ortho
Hobart Private Hospital	Saman Borazjani/Janine Dohnt	Peri Op Services Manager/Ortho RN
North-West Private Hospital	Roz Watkins/Klylie Smith	NUM Theatre/CN Orthopaedics

AUSTRALIAN CAPITAL TERRITORY

PUBLIC HOSPITALS

Name of Hospital	Registry Coordinator	
The Canberra Hospital	Helen Boyd/Milton Jamieson	CNS Orthopaedic Theatre/RN
Calvary Health Care	Shawn Therese Duynhoven	Orthopaedic Liaison Nurse

PRIVATE HOSPITALS

Name of Hospital	Registry Coordinator	
Calvary John James Hospital	Tuula Karhu	RN3 Orthopaedics
The National Capital Private Hospital	Mary-Jane Leibhardt	NUM Orthopaedic Theatre
Calvary Health Care	Shawn Therese Duynhoven	Orthopaedic Liaison Nurse
Canberra Specialist Surgical Centre	M Gower/L Tuohy/A Glyde	Asst DON/Dir Clinica; Serv/CNS

NORTHERN TERRITORY

PUBLIC HOSPITALS

Name of Hospital	Registry Coordinator	
Alice Springs Hospital	Fiona O'donnell/Ndina Chaita	Main Theatres Coord /RN3 Ortho
Royal Darwin Hospital	Tanya Anderson	NUM Theatre

PRIVATE HOSPITALS

Name of Hospital	Registry Coordinator	
Darwin Private Hospital	Chris Brennan/Bev Hinchcliffe	NUM Theatre/RN Level 2 Ortho

---

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
St Vincent's Private Hospital, Bathurst
Sydney Hospital & Sydney Eye Hospital
Hurstville Community Private Hospital

QUEENSLAND

Caboolture Private Hospital
Gladstone Hospital
Logan Private Hospital
Mater Women's & Children's Hospital Hyde Park
Pioneer Valley Hospital
Riverview Private Hospital

VICTORIA

Hartwell Private Hospital
Repatriation Hospital, Heidelberg
Vaucluse Hospital

SOUTH AUSTRALIA

Abergeldie Hospital
Blackwood Hospital
Northern Yorke Peninsula Hospital

TASMANIA

Calvary Health Care Tasmania St Vincent's Campus
Mersey Community Hospital

WESTERN AUSTRALIA

Galliers Private Hospital

APPENDIX 2

Glossary of Statistical Terms

Adjustment: The process of re-estimating a crude measure, such as a rate or rate ratio, to minimise the effects of a difference in the distribution of a characteristic, such as age, between groups being compared on that measure. Adjustment may be carried out in the context of a modelling procedure, for example, linear or proportional hazards regression models, or by standardising the data set against a reference population with a known age distribution, for example, the World Standard Population or the Australian population defined by the Australian Bureau of Statistics Census in a specified year.

Censoring: When the outcome of interest is the time to a defined event, for example, revision of a prosthesis, the event may not occur during the available period of observation. For example, the Registry analyses its data on prosthesis revision for the period ending 31 December each year, and many prostheses will not have been revised by that time. Unless the prosthesis was revised prior to 31 December the outcome is unknown. For the majority, we only know that up until 31 December they had not yet been revised. The times to revision for these prostheses are said to have been censored at 31 December. Statistical methods exist to ensure that censored data are not ignored in analysis, rather information on survival up until the time of censoring is used to give the best possible estimates of survival or revision probabilities.

Chi-Square Test (χ2) Test: Any test whose statistic has a chi-square distribution under the null hypothesis is called a chi-square test. A common example is a test for association between two categorical variables whose data are arrayed in a cross-classification table of counts (Pearson's chi-square test). This can be generalised to many situations where the distribution of observed data is being compared to an expected theoretical distribution.

Competing Risk: Any event that changes the probability of occurrence of another event is known as a competing risk for the other event. For example, death is a competing risk for revision because the probability of revision after death cannot be assumed to be the same as the probability of revision before death. Another example is that if interest centres on specific causes of revision, then each cause (infection, loosening etc) is a competing risk for each other cause. Treating a competing risk event as a right censoring will bias the estimation of the risk of the event of interest.

Confidence Interval: A set of values for a summary measure, such as a rate or rate ratio, constructed so the set has a specified probability of including the true value of the measure. The specified probability is called the confidence interval, the end points are called lower and upper confidence limits; 95% confidence intervals are most common.

Cox Model or Proportional Hazards Model: A statistical model that relates the hazard for an individual at any time *t* to an (unspecified) baseline hazard and a set of predictor variables, such as treatment type, age, gender etc. The Cox model produces hazard ratios that allow comparisons between groups of the rate of the event of interest. The main assumption of a Cox model is that the ratio of hazards between, say, two groups that we wish to compare, does not vary over time. If the hazard for prosthesis Model A is twice that of prosthesis Model B at three years, it will also be twice at four years, and so on. This is referred to as the 'proportional hazards assumption'. If the hazard ratio is not proportional over the entire time of observation then a time varying model is used, which estimates a separate hazard ratio within each pre-defined time period. Within each time period, the hazards are proportional. The Registry uses a set algorithm which iteratively chooses time points until the assumption of proportional hazards is met for each time period. The time points are selected based on where the greatest change in hazard occurs between the two comparison groups, weighted by the number of events in that time period.

Cumulative Incidence Function: An estimator of the actual probability of revision in the presence of a competing risk. In these circumstances, the Kaplan-Meier estimate, which treats competing risks as censored, overestimates the true probability. In the competing risks paradigm, patients who have already had a revision or died are excluded from the set at risk of being revised. Under Kaplan-Meier only patients who have already been revised are excluded from the risk set; dead patients are analysed as though they are still at risk of revision.

Cumulative Percent Revision: otherwise known as the 'cumulative failure rate'. This is defined as 100 x [1- S(*t*)] where S(*t*) is the survivorship probability estimated by the Kaplan-Meier method (see survival curve, below). The cumulative percent revision gives the percent of procedures revised up until time *t*, and allows for right censoring due to death (but see Cumulative Incidence Function above) or closure of the database for analysis.

Hazard Ratio: A hazard is an estimate of the instantaneous risk of occurrence of an event, for example death, at a point in time, *t*. This is sometimes called the 'force of mortality'. A hazard ratio results from dividing one group's hazard by another's to give a comparative measure of the instantaneous risk of experiencing the event of interest. In

this report, hazard ratios are adjusted for age and gender as appropriate. Hazard ratios are either for the entire survivorship period (if proportional; see "Cox Model or Proportional Hazards Model" section above) or for specific time periods (if the hazard for the entire survivorship period is not proportional).

For example, a comparison of Primary Total Conventional Hip Replacement for a Primary Diagnosis of Avascular Necrosis (AVN), Developmental Dysplasia of the Hip (DDH) and Osteoarthritis (OA):

1. Avascular Necrosis vs Osteoarthritis.
   Entire Period: HR=1.34 (1.16, 1.54), p<0.001

The hazard ratio for this comparison is proportional over the entire time of observation. AVN has a significantly higher rate of event (in this case, revision) compared to OA over the entire time of observation (p<0.001). The hazard is 1.34 times higher for AVN compared to OA and, with 95% confidence, the true hazard for AVN will lie between 1.16 times higher and 1.54 times higher than the hazard for OA.

2. Developmental Dysplasia vs Osteoarthritis
   0-3Mth: HR=1.75 (1.21, 2.52), p=0.002
   3Mth+: HR=1.07 (0.78, 1.45), p=0.683

The hazard ratio is not proportional over the entire time of observation so the hazard ratio has been divided into two periods; the time from primary arthroplasty to three months following the primary, and three months following the primary to the end of observation. DDH has a significantly higher revision rate compared to OA in the first three months following the primary (p=0.002). The hazard for revision in the first three months is 1.75 times higher for DDH than for OA and, with 95% confidence, the true hazard for DDH will lie between 1.21 and 2.52 times higher. From three months following the primary to the end of observation there is no significant difference in the revision rate between DDH and OA (p=0.683).

Incidence Rate: The number of new occurrences of an event divided by a measure of the population at risk of that event over a specified time period. The population at risk is often given in terms of person-time: for example, if 6 persons are each at risk over 4 months, they contribute 6 x 1/3 = 2 person-years to the denominator of the incidence rate. The incidence rate ratio (IRR) is commonly used to compare the incidence rates of two groups. If the two groups incidence rates are the same, an IRR of 1 results.

Log Rank Test: A family of statistical tests that compares the survival experience of two or more groups over the entire time of observation (contrast with comparison of survival at a defined time, e.g. five-year survival.)

Observed Component Years: For each procedure, component time is the time during which it is at risk of being revised. This is calculated as the number of days from the date of the primary procedure until either the date of revision, date of death or end of study (31/12/2012) whichever happens first. This is then divided by 365.25 to obtain the number of 'component years'. Each primary procedure then contributes this calculated number of component years to the overall total component years for a particular category of prosthesis.

For example

1. A primary total hip procedure performed on 1/1/2012 was revised on 1/7/2012. Therefore, the number of days that this procedure is at risk of being revised is 183 days. This prosthesis then contributes 0.5 (183/365.25) component years to the overall number of observed component years for the total hip procedure category.
2. A patient with a primary procedure on 1/1/2012 died without being revised on 1/4/2012. This procedure contributes 0.25 component years.
3. A primary procedure occurs on 1/1/2012 and has not been revised. This procedure contributes 1 component year (as observation time is censored at 31/12/2012).

Survival Curve: A plot of the proportion of subjects who have not yet experienced a defined event (for example, death or revision of prosthesis) versus time. The Kaplan-Meier method is the one most commonly used. The curve takes account of subjects whose ultimate survival time is not known, a phenomenon called 'censoring'. The survival estimate at each time is accompanied by a confidence interval based on the method of Greenwood. An interval is interpretable only at the time for which it was estimated and the sequence of intervals (depicted as shading on the Kaplan-Meier curve) cannot be used to judge the significance of any perceived difference over the entire time of observation. Often, for convenience, the curve is presented to show the proportion revised by a certain time, rather than the proportion not being revised ("surviving"). In the Registry, we call this cumulative percent revision (CPR). The Kaplan-Meier method is biased in the presence of a competing risk and will overestimate the risk of revision. In such circumstances, use of the cumulative incidence function for all competing risks, rather than the Kaplan-Meier estimate, is advised. The cumulative incidence of all competing risks must be assessed simultaneously to avoid bias in interpretation.

APPENDIX 3

Diagnosis Hierarchy for Revision Hip Replacement

Rank	Diagnosis	Category
1	Tumour	*Dominant diagnosis independent of prosthesis/surgery*
2	Infection	
3	Leg Length Discrepancy	*Surgical procedure*
4	Incorrect Sizing	
5	Malposition	
6	Metal Related Pathology	*Reaction to prosthesis*
7	Loosening/Lysis	
8	Wear Hip Insert	*Wear and implant breakage*
9	Wear Acetabular Cup/Shell	
10	Wear Head	
11	Implant Breakage Head	
12	Implant Breakage Stem	
13	Implant Breakage Hip Insert	
14	Implant Breakage Acetabular Cup/Shell	
15	Prosthesis Dislocation	*Stability of prosthesis*
16	Instability	
17	Fracture (Femur/Acetabular/Neck/Periprosthetic)	*Fracture of bone*
18	Chondrolysis/Acetabular Erosion	*Progression of disease on non-operated part of joint*
19	Progression of Disease	
20	Synovitis	*New diseases occurring in association with joint replacement*
21	Osteonecrosis/AVN	
22	Heterotopic Bone	
23	Pain	*Pain*
24	Other	*Remaining diagnoses*

Diagnosis Hierarchy for Revision Knee Replacement

Rank	Diagnosis	Category
1	Tumour	*Dominant diagnosis independent of prosthesis/surgery*
2	Infection	
3	Incorrect Side	*Surgical procedure*
4	Incorrect Sizing	
5	Malalignment	
6	Metal Related Pathology	*Reaction to prosthesis*
7	Loosening/Lysis	
8	Wear Knee Insert	*Wear and implant breakage*
9	Wear Tibial Tray	
10	Wear Femoral	
11	Wear Patella	
12	Implant Breakage Femoral	
13	Implant Breakage Knee Insert	
14	Implant Breakage Tibial Tray	
15	Implant Breakage Patella	
16	Bearing Dislocation	*Stability of prosthesis/knee*
17	Patella Dislocation	
18	Prosthesis Dislocation	
19	Instability	
20	Patella Maltracking	
21	Fracture (Femur/Tibia/Patella/Periprosthetic)	*Fracture of bone*
22	Progression of Disease	*Progression of disease on non-operated part of joint*
23	Patellar Erosion	
24	Synovitis	*New diseases occurring in association with joint replacement*
25	Arthrofibrosis	
26	Osteonecrosis/AVN	
27	Heterotopic Bone	
28	Patellofemoral Pain	*Pain*
29	Pain	
30	Other	*Remaining diagnoses*

APPENDIX 4

Patient Consent and Confidentiality Guidelines

PATIENT CONSENT

The Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR) obtains consent to include information from individuals undergoing joint replacement by using the 'opt off' approach. The implementation of the new Commonwealth Legislation at the end of 2001 resulted in the Registry meeting the Privacy Commission to ensure that the system used for patient consent is within the privacy guidelines.

Using this approach, patients are provided with a Patient Information Sheet. This explains what information is required, how it is collected and the avenues to take should an individual not want their information included in the Registry. The information is provided to patients by surgeons and hospitals prior to surgery. To accommodate patients that may have enquires, wish to opt off or discuss any issues a freecall number is available to contact the Registry.

PATIENT CONFIDENTIALITY

Joint replacement patients will not be contacted directly by the Registry. No individual patient will be identified during analysis or in reports and publications produced by the Registry. Patient operative and prostheses data is managed in accordance with the Guidelines for the Protection of Privacy in the Conduct of Medical Research. Personal data collected are for use by the AOA National Joint Replacement Registry only. The Registry has been listed as a Federal Quality Assurance Activity and all information is protected *(refer to section below).*

DATA MANAGEMENT & CONFIDENTIALITY

The Data Management & Analysis Centre (DMAC), University of Adelaide undertakes data entry, validation and analysis and provides secure data storage. DMAC was established in 1993. Professor John Lynch is the Director of DMAC. The centre staff include data managers, database programmers, statisticians and data assistants. It is engaged in an increasing variety of work, including clinical trials, pharmacoepidemiological studies, consultations and cohort studies.

The list of personnel with access to identified Registry information is as follows:

Director, Professor Stephen Graves
Deputy Director, Mr David Davidson
Deputy Director, Professor Richard de Steiger
Coordinator, Ms Ann Tomkins
Assistant Coordinator, Ms Robyn Vial
DMAC staff including data managers, data assistants, statisticians and programmers.

Declaration of the project as a Quality Assurance Activity ensures that Registry and DMAC staff are bound to maintain confidentiality. Confidentiality not only applies to individual patients but also includes surgeons and hospitals.

DMAC has security systems to restrict access to DMAC and Registry staff only. There are policies and procedures in place as well as software barriers to protect personal information. These include the use of codes, passwords and encryption.

The proforma used for data collection are stored in a secure locked room at DMAC. After a period of time the forms are scanned and electronically stored. As with all data these are securely stored. All data are retained in accordance with good scientific practice.

SURGEON CONFIDENTIALITY

Surgeon confidentiality is assured. The purpose of the Registry is to provide demographic and outcome information relevant to joint replacement surgery. Surgeon name is not recorded in the Registry database. In addition to this, the AOANJRR Committee made a decision in October 1999 to remove surgeon name from Registry forms. The Board of the AOA ratified this decision and consequently Registry staff blackout surgeon name, whether it is hand written or printed on the hospital patient identification, on all forms received by the Registry.

It is an important Registry function to provide a service to surgeons that allows them to monitor and audit their own performance. For this reason, surgeons have a choice to identify themselves by code, which can be linked to their

procedures. This is optional and there is no requirement to provide the surgeon code. These codes are provided to surgeons by AOA.

Surgeons are provided with access to their own information through a secure internet facility. It is important to emphasise that surgeons have the choice of using their code and that surgeon name is not recorded in the database and is permanently removed from Registry forms.

FEDERAL QUALITY ASSURANCE ACTIVITY

The AOANJRR was initially declared a Federal Quality Assurance Activity in March 1999, by the then Federal Minister for Health and Aged Care, Dr Wooldridge. This was renewed in 2001, 2006 and for a further five years in August 2011. This declaration ensures freedom from subpoena and absolute confidentiality of information held by the Registry.

The Quality Assurance legislation is part of the Health Insurance Act of 1973. This act was amended in 1992 to include quality assurance confidentiality. The Act operates on the underlying assumption that quality assurance activities are in the public interest.

A declaration as a Quality Assurance Activity by the Commonwealth Minister of Health and Ageing prohibits the disclosure of information, which identifies individual patients or health care providers that is known solely as a result of the declared quality assurance activity. It is not possible to provide identifying information to any individual or organisation including the government.

The protection provided by the declaration assures surgeons, hospitals and government that information supplied to the Registry remains confidential and secure. The act also protects persons engaging in those activities in good faith from civil liability in respect of those activities.

APPENDIX 5

Patient Information

INTRODUCTION - *about the Registry*

You are about to have a joint replacement. Joint replacement is very successful and most people do not require any further surgery following this procedure. However, a number of people who have a joint replacement may at some time in the future require another operation on that joint. This may occur due to a variety of reasons; the most common being that the joint replacement has worn out. Furthermore, differences between the many types of artificial joints available may affect the time at which they wear out and require replacing. In order to improve the success of this surgery, the Australian Orthopaedic Association has set up a National Joint Replacement Registry so that joint replacement and prostheses can be monitored.

The purpose of the Registry is to assess the performance of all joint replacement. If a joint replacement is identified as having a problem, the Registry can assist hospitals to locate those people who may be affected. To do this it is important to record information on every person having a joint replacement. More than 70,000 people have joint replacement surgery each year in Australia. It is also important to record details on any subsequent operations and the reason the surgery was performed. By analysing this information it will be possible to identify the cause of any problems as well as determine which types of joint replacement have the best results. To be successful, the Registry needs to gather information on as many people having joint replacement surgery as possible. We are asking you to participate in the Registry, by allowing us to document information relevant to your operation.

YOUR INVOLVEMENT - *the information we need*

The information we require includes your name, date of birth, address, Medicare number, hospital identity number, the name of the hospital and the reason you are having a joint replacement. This information is necessary to accurately link you to the artificial joint inserted as well as linking any following joint surgery you may have, to your previous records. We will also record the day of the operation, which joint was operated on and the type of artificial joint used. No other personal information is recorded. Hospitals and Government will from time to time provide information that enables the Registry to check the accuracy of its data.

INFORMATION - *how we will keep your information confidential*

Your personal information is confidential and cannot be used outside the Registry. Procedures are in place to protect your information and to keep it confidential. When your details have been entered into the Registry your record will be given a specific Registry number. In addition you cannot be identified in any reports produced by the Registry.

HOW WE WILL COLLECT THE INFORMATION

Although we are asking to record your operation details in the Registry you are not required to do anything. Your surgeon and/or theatre staff will complete the form that contains your personal details at the time of your operation and send it to us. The information will be entered into the Registry database.

RISKS AND BENEFITS - *to you*

There are no risks to you by having your details in the Registry. Your information is protected and we are not allowed to identify you by law. The Registry will produce general reports on a variety of factors that influence the success of joint replacement surgery. This will improve the quality of future joint replacement surgery.

WHAT TO DO IF YOU DON'T WANT TO BE IN THE REGISTRY

We understand that not everyone is comfortable about having his or her personal details documented in a Registry. If you feel this way and do not want your details recorded please contact Ann Tomkins, Registry Coordinator on 1800 068 419 *(freecall)*. A decision on whether or not you wish to be involved in the Registry does not affect your treatment in any way.

If you have any questions, concerns or require further information on the National Joint Replacement Registry please do not hesitate to contact the Registry Coordinator.

Concerns or complaints related to the data collection process may be directed to the Registry on 1800 068 419 (freecall) or alternatively the Australian Government, Office of the Privacy Commissioner on 1300 363 992

APPENDIX 6

Implementation of National Joint Replacement Registry

The Registry was implemented in a staged manner on a state-by-state basis. The table below shows the commencement date for each state. Implementation was completed nationally by mid 2002; therefore 2003 was the first year of complete national data.

State/Territory	Commencement Date
South Australia	September 1999
Queensland	April 2000
Western Australia	April 2000
Victoria	July 2000
Tasmania	September 2000
Northern Territory	October 2000
Australian Capital Territory	May 2001
New South Wales	June 2001

APPENDIX 7

ICD-10-AM CODES

HIP REPLACEMENT

PARTIAL HIP REPLACEMENT

49315-00	Partial arthroplasty (excludes Austin Moore)
47522-00	Austin Moore

PRIMARY TOTAL HIP REPLACEMENT

49318-00	Total arthroplasty of hip unilateral
49319-00	Total arthroplasty of hip bilateral
90607-00 [1489]	Resurfacing of hip, unilateral
90607-01 [1489]	Resurfacing of hip, bilateral

REVISION HIP REPLACEMENT

49312-00	Excision arthroplasty of hip (removal of prosthesis without replacement)
49324-00	Revision of total arthroplasty of hip
49327-00	Revision of total arthroplasty with bone graft to acetabulum
49330-00	Revision of total arthroplasty with bone graft to femur
49333-00	Revision of total arthroplasty with bone graft to acetabulum and femur
49339-00	Revision of total arthroplasty of hip with anatomic specific allograft to acetabulum
49342-00	Revision of total arthroplasty of hip with anatomic specific allograft to femur
49345-00	Revision of total arthroplasty with anatomic specific allograft to acetabulum & femur
49346-00	Revision of partial arthroplasty hip replacement

KNEE REPLACEMENT

PARTIAL KNEE REPLACEMENT

Patellofemoral Knee Replacement

49534-01	Total replacement arthroplasty of patellofemoral joint of knee

Unicompartmental Knee Replacement

49517-00	Hemi arthroplasty of knee

PRIMARY TOTAL KNEE REPLACEMENT

49518-00	Total arthroplasty of knee unilateral
49519-00	Total arthroplasty of knee bilateral
49521-00	Total arthroplasty of knee with bone graft to femur unilateral
49521-01	Total arthroplasty of knee with bone graft to femur bilateral
49521-02	Total arthroplasty of knee with bone graft to tibia unilateral
49521-03	Total arthroplasty of knee with bone graft to tibia bilateral
49524-00	Total arthroplasty of knee with bone graft to femur and tibia unilateral
49524-01	Total arthroplasty of knee with bone graft to femur and tibia bilateral

REVISION KNEE REPLACEMENT

49512-00	Arthrodesis with removal of prosthesis
49515-00	Removal-prostheses from knee
49527-00	Revision of total arthroplasty of knee excluding patella resurfacing
49530-00	Revision of total arthroplasty of knee with bone graft to femur
49530-01	Revision of total arthroplasty of knee with bone graft to tibia
49533-00	Revision of total arthroplasty of knee with bone graft to femur and tibia
49554-00	Revision of total arthroplasty of knee with anatomic specific allograft
90562-00	Patella resurfacing