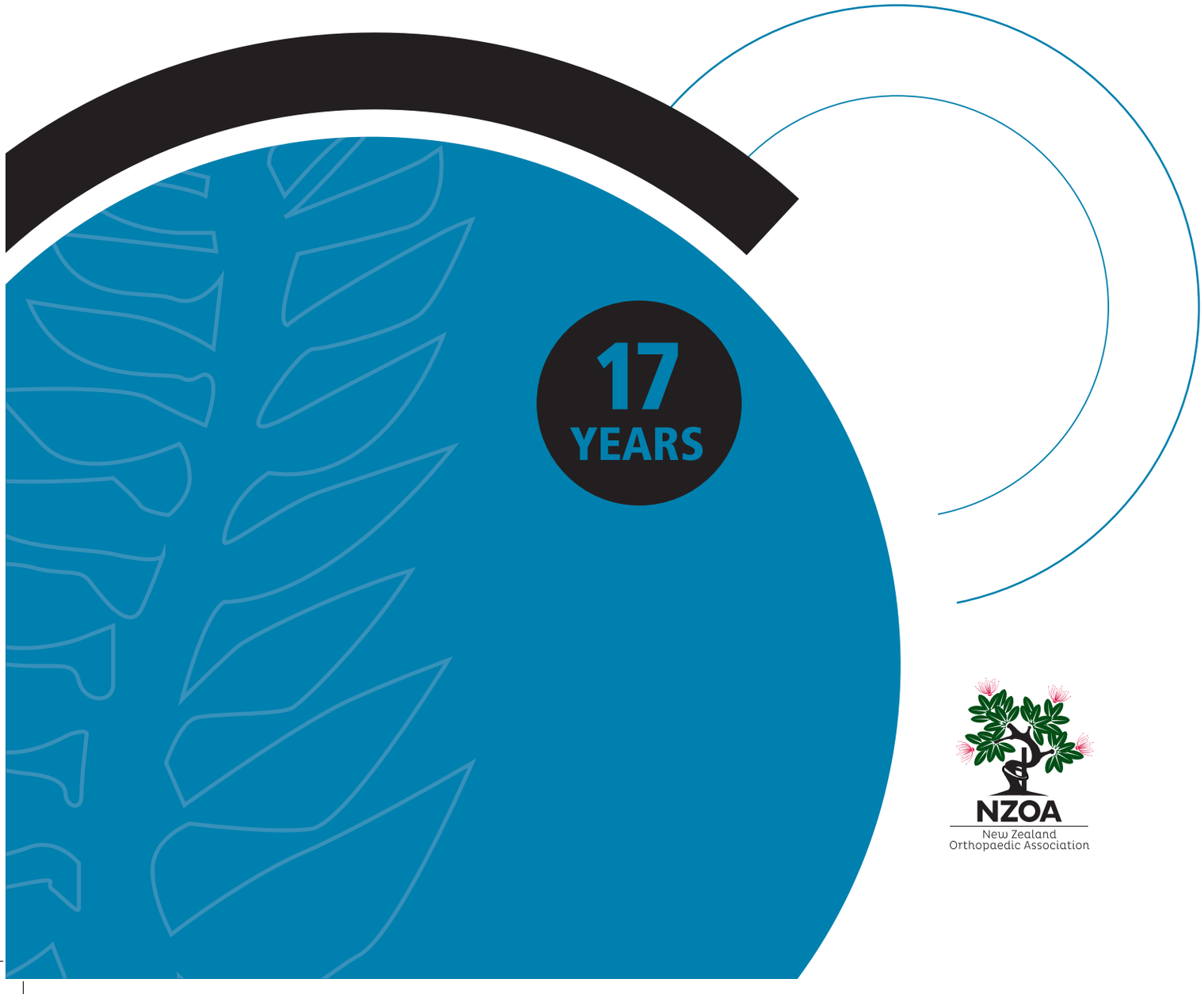
THE NEW ZEALAND JOINT REGISTRY

SEVENTEEN YEAR REPORT
JANUARY 1999 TO DECEMBER 2015



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EDITORIAL COMMENT

It is our great pleasure to present the seventeen year report of the New Zealand Orthopaedic Association's New Zealand Joint Registry.

This year's report contains updated data from last year's report as well as new analyses including revision rates for "mismatched" hip prostheses, Oxford scores for major hip and knee implants, revision rates for different bearing surfaces for the same hip prosthesis combinations, Kaplan Meier (KM) curves for BMI groupings and unicompartmental prostheses.

In this year's report the format of previous years has been followed such that each arthroplasty section is self- contained. This does, however, result in a certain amount of intersection repetition.

The total number of registered joint arthroplasties at 31st of December 2015 was 239,726, which had been performed on 166,094 individual patients, of which 32,163 (19%) had died during the 17 year period.

The number of observed component years (ocys) contained within the Registry is now well in excess of one million. The increase of 19,870 registered joints for 2015 compared to the 19,190 in 2014 represents an overall annual gain of 3.5%, compared to the percentage gain of 5.5 in 2014. When compared to 2014 registrations the big gains for primary joint arthroplasties in 2015 were for elbow (58%), shoulder (22%) and unicompartmental knees (14%). There was a small increase for hips (0.3%), no change for ankles and a 2.1% decrease for knees. Due to this reduction the proportion of knees to hips has fallen from 47.1% in 2014 to 46.4% in 2015.

As for previous years, analyses of revision data have been confined to primary registered arthroplasties.

Hip Arthroplasty

There are 110,208 primary hip arthroplasties in the Registry of which 5,092 have been revised (4.7%), a total of 695,879 ocys, an overall revision rate of 0.73 per 100 ocys (95% confidence interval; 0.71 -0.75) and a 16 year K M prosthesis survival of 86.2% (cemented 87.5%; uncemented 85.9% and hybrid 85.6%). The proportion of uncemented (45.4%) and hybrid (44%) has risen slightly at the expense of fully cemented arthroplasties when compared to 2014. However, the KM curves continue to demonstrate better longer term survival for fully cemented arthroplasties. There were 8,373 primary hip registrations for 2015 and the overall mean BMI for hips is 28.86.

There are 1,074 (1,001 in 2014) hip prosthesis combinations in the Registry but only 208 (19%) with 50 or more registrations.

As in previous years, the three types of hip fixation have been analysed against the four age bands: less than 55 years; 55-64 years; 65-74 years, and greater than 75 years. The data shows that overall the hybrid hip has the best performance.

The ceramic on plastic bearing surface continues to increase in popularity and rose to 35% of total in 2015. It is noteworthy that no metal on metal hip arthroplasties were registered in 2015 for head size > 28mm. However, overall the use of 36mm head sizes increased by 2.1% in 2015 and the increasing use of the ceramic >36 mm head has so far been vindicated in that the revision rate remains low at a mean of three years. On the other hand metal on metal articulations fare poorly when revision rates are analysed against head size, bearing surface materials, age bands and cemented/uncemented/ hybrid variants.

In response to negative media publicity earlier this year regarding the failure of the all-metal version of the Pinnacle cup, the bearing surface options for 6 of the more commonly used acetabulae have been analysed separately and it confirms that the metal bearing surfaces have a significantly higher revision rate for the Pinnacle and R3 porous cups and although higher for RM pressfit, Trident and Tritanium cups do not reach statistical significance due to their relatively small numbers.

In another response to adverse publicity the revision rates for combinations with components manufactured from different companies (component "mismatches") has been calculated for 10 "mismatches" with more than 500 implantations. Just three of them; the Exeter V40 - Continuum TM, Spectron - Duraloc and the Exeter - Duraloc combinations have significantly higher revision rates than the overall mean rate of 0.73 /100 ocys @ the 95% confidence interval.

The use of cross linked polyethylene continues its upward trend, making up 89.1% of the total polyethylene in 2015.

KM curves for the various types of uncemented hip arthroplasties dramatically illustrate the higher revision rates for metal on metal hip arthroplasty.

The Corail-Pinnacle combination remains currently the most popular but the ExeterV40-Trident combination has accumulated the most component years at 34,056 from 6,712 primary arthroplasties and has the very low revision rate of 0.46/100 ocys.

Revision rates for individual hip component combinations (minimum of 50 primary procedures) assembled in order of numbers of arthroplasties as well as revision rates have again been calculated as well as the tables listing combinations by fixation method to make it easier for readers to determine the combination options used within the three types of prosthesis fixation. There is also the table of prosthesis combinations based on the femoral component which should help readers find specific combinations. Three combinations (four in 2014) which are still currently being used have revision rates significantly higher ($p<0.05$) than the overall rate of 0.73/100 ocys and two of them, Exeter V40-Continuum and Synergy

"In this year's report the format of previous years has been followed such that each arthroplasty section is self-contained. This does, however, result in a certain amount of intersection repetition."

Porous-R3 Porous, were in the top ten combinations implanted in 2015. It is also worth noting that the revision rate for monoblock stems which have been implanted for an average of 10.5 years is very low at 0.47/100 ocys.

Revision rates for X linked and standard polyethylene have again been compared for both metal and ceramic heads. It was demonstrated that the combination of ceramic head with X linked polyethylene has a significantly lower revision rate compared to the standard polyethylene varieties used with both the metal and ceramic heads.

KM curves for some of the hip combinations with a minimum of 1,500 arthroplasties and 10 years of analysable data have once again been included as well as 12 year KM curves for those combinations with a minimum of 2,000 procedures. It is noted that the Exeter combinations, except for Exeter-Contemporary, are among the better and the Spectron combinations among the poorer KM curves. Note the excellent survival of the Muller-Muller combination.

Again this year the KM curves for minor (defined as replacement of liners, bearings, heads, patellae) versus major (defined as replacement of acetabular, femoral, or tibial components +/- minor components) revisions for both hips and knees have been compared. As was shown last year, the revision rate after a major revision is significantly better than for a minor revision for both hips and knees, thus suggesting that some minor revisions perhaps should have been full revisions.

There has been a further increase in the number of primary hip revisions with ALVAL (aseptic lymphocytic vascular-associated lesions), or similar, listed as the reason for revision. In 2011 the number increased from15 to 72; in 2012 to 102; in 2013 to 146; in 2014 to 182 and in 2015 to 232. Forty-four hips have now been revised for high blood ion levels. These reflect the continuing failure rate of metal on metal hip prosthesis combinations which have >36mm heads. It is worth noting in this context that 52% of the conventional ASR prostheses have been revised.

Other analyses recently introduced, including yearly stacked graphs to demonstrate changes over the last 15 years of head size, bearing surfaces, polyethylene and reasons for revision, have again been included as well as KM curves for cemented/uncemented stems and cups, different head sizes, the different bearing surfaces and cross linked vs standard polyethylene. All graphically illustrate different survival trends.

New this year are revision rate tables and KM curves for the five different BMI groupings which confirm the higher prosthesis revision rate for the morbidly obese (BMI>40) group.

Resurfacing hip arthroplasty registrations continue to decline from the high of 203 in 2009 with just 77 registered in 2015. The revision rate has fallen slightly to 1.25/100 ocys.

The Best and the Worst Combinations

From the 17 years of accumulated data it is possible to recommend the generic component combinations which currently should provide the best long term survival. These are: acetabulum – cemented; bearing surfaces - ceramic head with X linked polyethylene liner; head size 32 mm; stem - cemented.

Conversely the component combinations to avoid are: acetabulum - uncemented metal; bearing surfaces - metal on metal; head size >= 36mm; stem - uncemented.

Knee Arthroplasty

There are 86,186 registered primary knee arthroplasties of which 2,569 have been revised (2.9%), a total of 521,421 ocys with the overall revision rate 0.49/100 ocys, (95% confidence interval; 0.47-0.51) and the excellent sixteen year KM survival of 93.20%. There were 7,260 primary knee registrations for 2015 and the overall mean BMI for knees is 31.17.

As was done for recent annual reports several variants of basically the same knee prosthesis type e.g. Nexgen, LCS, which are registered separately, have been merged into the one group to enable comparable statistical analyses with other prostheses which may have also had variants but are registered as one or two prostheses.

There are 59 different types of knee prostheses in the Registry with 30 (50%) having fewer than 10 registrations.

The Triathlon remains as the current most popular prosthesis but the Attune has overtaken the Nexgen for second place. Calculation of revision rates for individual prostheses with a minimum of 50 arthroplasties shows that among the bigger registered numbers the Duracon, although no longer implanted, has the lowest revision rate of 0.30/100 ocys. The Nexgen has the biggest number of registrations at 17,919 and 111,818 ocys. Two of the currently used prostheses, Balansys and Legion, as well as the uncemented version of the LCS knee have significantly higher revision rates than the overall rate of 0.49/100 ocys @ the 95% confidence.

KM curves for six of the cemented knee prostheses with a minimum of 10 years of analysable data have again been included. The Duracon has the highest and the LCS and Nexgen the lowest (but still very good) survival.

Although uncemented knee arthroplasty represents just 4% of all primary knee arthroplasties it has a significantly higher revision rate ($p<0.05$) than either fully cemented or hybrid in which the tibial component is cemented and the femoral component uncemented. The KM curves for the three types of fixation show that the uncemented curve continues to steeply diverge from the other two.

Image guidance (IG), first recorded by the Registry in 2005, remains quite popular for primary knee arthroplasty and during 2015 was used in 15% of procedures, down from 18% in 2014. Comparison of revision rates for IG with non IG procedures demonstrates a rate of 0.50 versus 0.49/100 ocys. There is no statistical difference between the two at ten years.

The analyses comparing revision rates and 16 year KM curves of fixed versus mobile bearing knees continue to show that there is no longer a significantly higher revision rate for mobile bearings and the KM curves beyond 10 years are superimposed.

Again this year, separate analyses for cruciate retaining versus posterior stabilised knee prostheses demonstrate that overall there are significantly higher revision rates for posterior stabilised prostheses. This is also graphically illustrated with the KM survival graphs.

There are 417 patello-femoral prostheses registered, with 61 added in 2015, compared to 64 in 2014. Thirty six (8.6%) have been revised and the revision rate at 2.05/100 ocys is four times that for total knee arthroplasty. All except five were revised to a total knee arthroplasty.

New this year are revision rate tables and survival curves for the five different BMI groupings but unlike hip arthroplasty the morbidly obese (BMI>40) group do not have statistically significant different revision rates or KM curves.

Unicompartmental knee arthroplasty

There are 9,635 registered primary unicompartmental prostheses of which 757 have been revised (7.9%), a total of 60,707 ocys with the overall revision rate 1.25/100 ocys, (95% confidence interval; 1.16-1.34) and a 14 year K M survival of 83.29%. Pain is the main reason for revision in almost 50% of cases. There were 809 registrations in 2015, a 14% increase over 2014

Once again the Oxford uncemented prosthesis was very dominant, accounting for more than the total of all the others in 2015. It also continues to have a low revision rate at 0.70/100 ocys. However, the lowest revision rate is currently the Zimmer unicompartmental prosthesis at 0.53/100 ocys. Both of these prostheses have a mean implantation time of just over three years compared to eight years for the Oxford 3, which for many years was the most popular unicompartmental replacement but has a current revision rate of 1.40/100 ocys.

A KM survival curve further demonstrates the divergence of the Oxford from the Oxford uncemented and Zimmer prostheses.

The use of the minimally invasive approach for the unicompartmental knee arthroplasty remains steady at approximately 25% with it being used in 26% of procedures in 2015. It is to be noted that the minimally invasive approach is associated with a significantly lower revision rate compared to the conventional medial parapatellar approach.

When a unicompartmental arthroplasty is converted to a total knee arthroplasty there is a significantly increased subsequent revision rate at 1.67/100ocys which is 3.4 times that for a primary total knee arthroplasty revision rate of 0.49 at the 95% confidence interval This statistic is even more significant following revision of a unicompartmental to a further unicompartmental arthroplasty (11x).

Ankle arthroplasty

There are 1,261 primary registered ankle prostheses of which 134 have been revised (10.3%), a total of 6,590 ocys, a mean revision rate of 2.03/100 ocys and a ten year KM survival of 81.43%.

There were 101 primary ankle arthroplasties registered in 2015 which was one fewer than the previous year. The Salto prosthesis (mobile and fixed bearing versions ie the Salto Talaris) totally overshadowed all others, accounting for 87% of the 2015 registrations. The Salto prosthesis has by far the lowest revision rate (1.08) with a mean implantation time of 3.7 years. The Infinity prosthesis made its debut in 2015.

Shoulder arthroplasty

There are 7,305 registered primary shoulder prostheses of which 356 have been revised (4.9%), a total of 34,369 ocys, a mean revision rate of 1.04/100 ocys and a 12 year KM survival of 91.2%. There were 974 shoulder prostheses within 5 different categories registered during 2015, 22% up on 2014 and continuing the steady year by year increase.

There was no further addition to the Humeral Sphere category and the stack graph demonstrates the evolution over time of the six categories with the reverse prostheses continuing to gain in popularity and accounting in 2015 for 63% of the registered primary shoulders.

With regard to revision rates, there is a significantly higher revision rate for Partial Resurfacing compared to all the other groups. This is also graphically illustrated in the KMs for the six different prosthesis categories. Revision rates also vary greatly among the large number of registered prostheses within the different categories but it is noteworthy that the Conventional SMR with the L1 glenoid, which for some years has been among the most popular of the prosthesis options, has five times the revision rate of the long established Global and the Bigliani/Flatow and 7 times that of the Global AP Conventional total prostheses.

Arthroplasties using uncemented glenoids continue to show five times the revision rate compared to those having cemented glenoids.

Elbow arthroplasty

There are 476 registered primary elbow prostheses of which 29 have been revised (4.9%), a total of 2,811 ocys, a mean revision rate of 1.03/100 ocys and a nine year KM survival of 91.8%. Numbers registered in 2015 increased by 41, an increase of 15 (54%) over 2014, which is the biggest ever annual registration. The Coonrad Morrey prosthesis which has been the most popular since the Registry began has been overtaken by its successor the Zimmer Nexel.

Deep Infection

Once again we have compared the deep infection revision rates within six months of the arthroplasty for primary hip and knee arthroplasty against the theatre environment. Six months has been chosen, as infection within this time period is highly likely to have been introduced at the time of surgery. This year's analyses again demonstrate that for primary hip and knee arthroplasty there was an increased risk for revision for deep infection when the primary procedure was carried out in a laminar flow theatre with a space suit compared to a conventional theatre without a space suit (2.4 & 2.5 times respectively for hip and knee). The use of space suits also significantly increases the risk of revision for deep infection in both conventional and laminar flow theatres. There has been little change in the percentage of arthroplasties performed in laminar flow theatres or in the use of space suits over the last few years.

Oxford 12 Questionnaire

Six month, 5, 10 and 15 year scores analyses of the individual score categories for primary hip and knee arthroplasties continue to demonstrate that the six-month score is indicative of the longer term outcome. In particular there has been no diminution of the percentage of people with residual pain for both hips and knees and the ability to kneel for knees over the 15 years.

It is noteworthy that the 15 year scores still have a similar high percentage of excellent/good outcomes as the 6 month, 5 and 10 year outcomes. For the 1,538 15 year hip scores available for analysis, 86% had excellent/good scores which compares well with the 84% at 6 months following primary arthroplasty. The findings are similar for the 1,113 available 15 year knee scores, with 79% excellent/good compared to 74% at 6 months post primary arthroplasty.

For revision arthroplasty scores at 6 months just 63% (hip) and 53% (knee) were excellent/good.

As noted in previous years, the statistically significant relationship between the six month, five and ten year scores and revision within two years of the score date for primary hips, knees (including unicompartmental) and shoulders (six months and five years only) has again been demonstrated.

Due to the large number of recorded six month Oxford hip and knee scores the score groupings have been further broken down to demonstrate an even more convincing relationship between score and risk of revision within two years.

Once again analyses of hip and knee six month post - first revision arthroplasty questionnaire data has been undertaken and it demonstrates a similar relationship between the Oxford score at six months and the second revision within two years.

This year Oxford score analyses for some of the larger number hip and knee prostheses have been undertaken and show that there is little score difference among these prostheses at six months and without exception they have higher (better) scores at five years. In addition, this year, six month Oxford mean scores were determined for each of the five BMI groups for hip and knee arthroplasty and the morbidly obese hip group had a significantly lower score than the others except for BMI<19 group.

With regard to shoulder arthroplasty Conventional Total and Resurfacing Head types have significantly higher six month and five year scores.

Deceased Person's Data

A deceased person's data is valid in perpetuity for all analyses involving the time interval prior to the person's death e.g. if a person dies eight years post primary hip replacement their data is always valid for all analyses for that eight year period. Hence the rider "deceased patients censored at time of death."

Publications and Presentations

Since last year's report further peer reviewed papers based on registry data have been published in, accepted by or submitted to international journals as well multiple podium presentations (see Appendix 2).

Alastair Rothwell	*Supervisor*
Toni Hobbs	*Coordinator*
Chris Frampton	*Statistician*

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PARTICIPATING HOSPITALS

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PROFILE OF THE AVERAGE NEW ZEALAND ORTHOPAEDIC SURGEON*

From our analyses, in 2015 the average orthopaedic surgeon performed:

41 Total hip arthroplasties

with 45% using uncemented,11% fully cemented and 44% hybrid prostheses; has a 86.2% survival at 16 years and a revision rate of 0.73 per 100 component years; 84% at six months, 89% at 5 years, 87% at 10yrs and 86% at 15 years had an excellent or good Oxford score.

35 Total knee arthroplasties

with almost all cemented but only 12 with patellae resurfaced; has a 93.20% survival at 16 years and a revision rate of 0.49 per 100 component years; 74% at six months, 83% at 5 years, 82% at 10 years and 79% at 15 years had an excellent or good Oxford score.

11 Unicompartmental knee arthroplasties

with 57% uncemented; has an 83.29% survival at 14 years and a revision rate of 1.25 per 100 component years; 83% at six months, 88% at 5 years and 82% at ten years had an excellent or good Oxford score.

13 Shoulder arthroplasties

with a 2:1 split between reverse and conventional shoulder arthroplasty; 91.20% survival at 12 years and a revision rate of 1.04 per 100 component years; 69% at six months, 78% at 5 years and 73% at 10 years had excellent or good Oxford scores.

6 Total ankle arthroplasties

has an 81.43% survival at 10 years and a revision rate of 2.03 per 100 component years. Due to a change from Oxford derived to the Manchester-Oxford foot and ankle questionnaire in 2015 there are no PROM analyses.

2 Total elbow arthroplasties

has a 91.80% survival at nine years and a revision rate of 1.03 per 100 component years. Due to a change from Oxford derived to the validated Oxford elbow questionnaire in 2015 there are no PROM analyses.

Averages derived from the number of surgeons recorded performing the above procedures during 2015 and not from the total pool of orthopaedic surgeons.

DEVELOPMENT AND IMPLEMENTATION OF THE NEW ZEALAND JOINT REGISTRY

The year 1997 marked 30 years since the first total hip replacement had been performed in New Zealand and as a way of marking this milestone it was unanimously agreed by the membership of the New Zealand Orthopaedic Association (NZOA) to adopt a proposal by the then President, Alastair Rothwell, to set up a National Joint Registry.

New Zealand surgeons had always been heavily dependent upon northern hemisphere teaching, training and outcome studies for developing their joint arthroplasty practice and it was felt that it was more than timely to determine the characteristics of joint arthroplasty practice in New Zealand and compare the outcomes with northern hemisphere counterparts. It was further considered that New Zealand would be ideally suited for a National Registry with its strong and co-operative NZOA membership, close relationship with the implant supply industry and its relatively small population. Advantages of a Registry were seen to be: survivorship of different types of implants and techniques; revision rates and reasons for these; infection and dislocation rates; patient satisfaction outcomes; audit for individual surgeons, hospitals, and regions; opportunities for in-depth studies of certain cohorts and as a database for fundraising for research.

Administrative Network

It was decided that the Registry should be based in the Department of Orthopaedic Surgery, Christchurch Hospital, and initially run by three part-time staff: a Registry Supervisor (Alastair Rothwell), the Registry Coordinator (Toni Hobbs) and the Registry Secretary (Pat Manning). As all three already worked in the Orthopaedic Department, it was a cost-effective and efficient arrangement to get the Registry underway.

New Zealand was divided into 19 geographic regions and an orthopaedic surgeon in each region was designated as the Regional Coordinator whose task was to set up and maintain the data collection network within the hospitals for that region.

This network included a Theatre Nurse Coordinator in every hospital in New Zealand who voluntarily took responsibility for supervising the completion, collection and dispatch of the data forms to the Registry.

Data Collection Forms

The clear message from the NZOA membership was to keep the forms for data collection simple and user friendly. The Norwegian Joint Register's form was used as a starting point but a number of changes were made following early trials. The forms are largely if not completely filled out by the operating theatre circulating nurse ready to be checked and signed by the surgeon at the end of the operation.

Database

The Microsoft Access 97 database programme was chosen because it is easy to use, has powerful query functions, can cope with one patient having several procedures on one or more joints over a lifetime and has "add on" provisions.

The database is expected to meet the projected requirements of the Registry for at least 20 years. It can accommodate software upgrades as required.

Patient Generated Outcomes

The New Zealand Registry was one of the first to collect data from patient generated outcomes. The validated Oxford Hip and Knee outcomes questionnaires were chosen and questions were added to these, relating to dislocation, infection and any other complication that did not require further joint surgery. It was agreed that these questionnaires should be sent to all registered patients six months following surgery and then at five yearly intervals. The initial response rate was between 70 and 75% and this has remained steady over the five year period.

However, because of the large number of registered primary hip and knee arthroplasties and, on the advice of our statistician, questionnaires have been sent out on a random selection basis since July 2002 to achieve an annual response of 20% for each group. All patients in the other arthroplasty groups, including revision arthroplasty, are sent the questionnaires.

Funding

Several sources of funding were investigated including contributions from the Ministry of Health, various funding agencies, medical insurance societies and an implant levy payable by surgeons and public hospitals to supplement a grant from the NZOA. In the early years the Registry had a "hand to mouth" existence relying on grants from the NZOA and Wishbone Trust until it received significant annual grants from the Accident Compensation Corporation. From 2002, funding became more reliable with the surgeons paying a $10 levy, increased to $15 in 2008 and to $20 in 2012 for each joint registered from a private hospital, and the Ministry of Health agreeing to pay $72,000 a year as part of the Government Joint Initiative. Since 2005 the Southern Cross Hospitals have contributed $10,000 annually.

Ethical Approval

Application was made to the Canterbury Ethical Committee early in 1998; first for approval for hospital data collection without the need for patient consent and second for the patient generated outcomes using the Oxford 12 questionnaire plus the additional questions. The first part of the application was initially readily approved but the second part required several amendments to patient information and consent forms before approval was obtained.

A reapplication had to be made when the Ethics Committee of a private hospital chain refused to allow their nurses to participate in the project unless there was prior written patient consent. This view was supported by the Privacy Commissioner on the grounds that the Registry data includes patient identification details. The approval process was eventually successful but did delay the New Zealand-wide launch.

Surgeon and Hospital Reports

It was agreed that, every six months, reports were to be generated from the Registry database for primary and revision hip and knee replacements and to consist of: the number of procedures performed by the individual surgeon or at the hospital; the total number of procedures performed in the region in which the surgeon works; and the national total and cumulative totals for each of these categories. Six month and, more recently, five year Oxford 12 scores are also included. Since 2008 each surgeon also receives their individual revision rate for their registered primary arthroplasties, and the reports have become annual rather than six monthly.

Introduction of the Registry

The National Joint Registry was introduced as a planned staged procedure.

Stage I: November 1997 to March 1998

The base administrative structure was established. The data forms and the database were developed and a trial was performed at Burwood Hospital.

Stage II: April 1998 to June 1998

Further trialling was performed throughout the Christchurch Hospitals and the data forms and information packages were further refined.

Stage III: July 1998 to March 1999

The data collection was expanded into five selected New Zealand regions for trial and assessment.

In addition communication networks and the distribution of information packages into the remaining regions of New Zealand were carried out.

Stage IV: April 1st 1999

The National Joint Registry became fully operational throughout New Zealand.

INCLUSION OF OTHER JOINT REPLACEMENT ARTHROPLASTIES

At the request of the NZOA membership, the database for the Registry was expanded to include total hip replacements for fractured neck of femur, unicompartmental replacements for knees, and total joint replacements for ankles, elbows and shoulders (including hemiarthroplasty for the latter). Commencement of this data collection was in January 2000 and this information is included in the annual surgeon and hospital reports.

The validated Oxford questionnaire was available for the shoulder and derived, but not validated, questionnaires developed for the elbow and ankle joints. All persons receiving total arthroplasty of the above joints, as well as unicompartmental knee arthroplasties, are sent questionnaires with a reply rate of between 70 and 75%. As for hips and knees, the questionnaires are sent out six months post-surgery and then at five yearly intervals.

Monitoring of Data Collection

The aim of the Registry is to achieve a minimum of 90% compliance for all hospitals undertaking joint replacement surgery in New Zealand.

It is quite easy to check the compliance for public hospitals as they are required to make regular returns with details of all joint replacement surgery to the NZ Health Information Service. For a small fee, the registered joints from the Registry can be compared against the hospital returns for the same period and the compliance calculated. Any obvious discrepancies are checked out with the hospitals concerned and the situation remedied. It is more difficult with private hospital surgery as they are not required to file electronic returns. However, by enlisting the aid of prosthesis supply companies, it is possible to check the use of prostheses region by region and any significant discrepancy is further investigated. In addition any change in the pattern of returns from both public and private hospitals is investigated.

The most recent compliance audit in March 2016 again demonstrated a New Zealand-wide public hospital compliance of > 95% when compared to NZHIS data.

Registered patient deaths are also obtained from the NZHIS.

NZJR Staff

The current staff are Data Operators (1.6 FTEs) Registry co-ordinator (0.8 FTEs) Registry Supervisor (0.4 FTEs) and Statistician (0.4 FTEs).

NUMBER OF JOINTS ANALYSED
1ST JANUARY 1999- 31ST DECEMBER 2015

Numbers of procedures registered

Procedure	17 years	16 years	15 years	14 years	13 years	12 years	11 years
Hip.primary	110,208	101,835	93,491	85,780	78,289	71,069	63,702
Knee.primary	86,186	78,898	71,506	64,812	58,452	52,196	46,107
Hip.revision	16,251	15,083	13,954	12,713	11,593	10,462	9,451
Knee.unicompartmental	9,635	8,826	8,114	7,388	6,668	6,059	5,457
Shoulder.primary	7,305	6,331	5,530	4,783	4,085	3,506	3,012
Knee.revision	6,739	6,122	5,580	5,092	4,608	4,160	3,732
Ankle.primary	1,261	1,160	1,058	945	837	728	603
Shoulder.revision	571	502	436	360	306	256	214
Elbow.primary	476	435	409	387	363	330	300
Cervical disc.primary	314	268	224	200	168	122	98
Ankle.revision	179	161	141	116	94	69	56
Lumbar disc.primary	153	151	149	142	140	129	111
Elbow.revision	81	78	70	67	64	56	49
Lumbar disc.revision	6	4	3	3	3	3	3
Cervical disc.revision	2	2	1	1	1	1	1
Reoperation	3						
TOTAL	239,726	219,856	200,666	182,789	165,671	149,146	132,896

Bilateral joint replacements carried out under the same anaesthetic

Bilateral hips

2,095 patients (4,190 hips) 4% of primary hips

Bilateral knees

3,533 patients (7,066 knees) 8% of primary knees

Bilateral Unicompartmental knees

764 patients (1,528 knees) 17% of unicompartmental knees

Bilateral ankles

2 patients (4 ankles)

Bilateral shoulders

4 patients (8 shoulders)

During the 17-year period 166,094 individual patients were registered, of which 32,163 (19%) have died.

Trainee Surgeons: In the following analyses consultants took responsibility for their registrar surgeon procedures.

HIP ARTHROPLASTY

PRIMARY HIP ARTHROPLASTY

The **seventeen-year** report analyses data for the period January 1999 – December 2015. There were 110,208 primary hip procedures registered including 1,595 resurfacing arthroplasties. This is an additional 8,373 compared to last year's report and represents a 0.3% increase in hip registrations for 2015 compared to the 8.2% for 2014.

1999	4,114
2000	4,715
2001	4,932
2002	4,830
2003	5,058
2004	6,029
2005	6,322
2006	6,430
2007	6,962
2008	7,004
2009	7,306
2010	7,366
2011	7,220
2012	7,491
2013	7,711
2014	8,345
2015	8,373

Data Analysis

Age and sex distribution

The average age for all patients with primary hip arthroplasty was 66.96 years, with a range of 13.43 – 100.95 years.

All hip arthroplasty

	Female	Male
Number	58,137	52,071
Percentage	52.75	47.25
Mean age	68.42	65.34
Maximum age	100.95	99.62
Minimum age	13.43	15.86
Standard dev.	11.54	11.50

Conventional hip arthroplasty

	Female	Male
Number	57,879	50,734
Percentage	53.29	46.71
Mean age	68.50	65.70
Maximum age	100.95	99.62
Minimum age	13.43	15.86
Standard dev.	11.49	11.36

Resurfacing hip arthroplasty

	Female	Male
Number	258	1,337
Percentage	16.18	83.82
Mean age	50.07	51.90
Maximum age	65.88	75.69
Minimum age	25.72	17.74
Standard dev.	7.15	8.56

Annual numbers for Resurfacing hips

2004	21
2005	38
2006	169
2007	188
2008	191
2009	203
2010	185
2011	142
2012	102
2013	90
2014	89
2015	77

Body Mass Index

BMI registrations for primary hip replacements. The average was 28.86 with a range of 14 – 62 and a standard deviation of 5.56.

Previous operation

None	105,643
Internal fixation	2,090
Osteotomy	583
Arthrodesis	82

Diagnosis

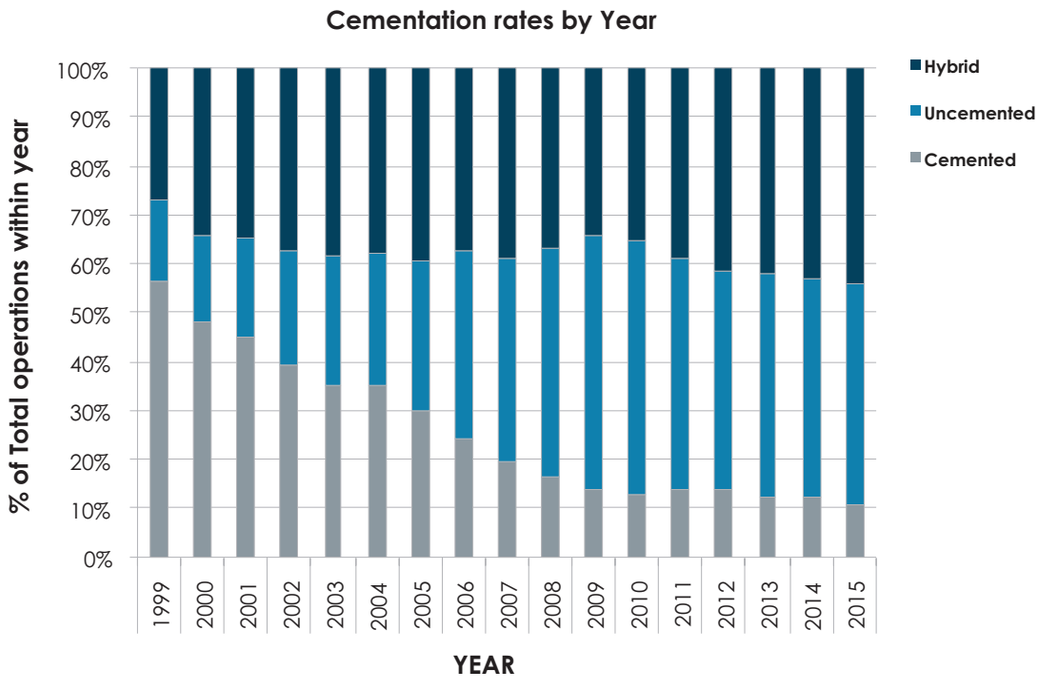
Osteoarthritis	96,291
Acute fracture NOF	4,036
Avascular necrosis	3,363
Developmental dysplasia	2,431
Rheumatoid arthritis	1,459
Old fracture NOF	1,349
Other inflammatory	828
Tumour	516
Post-acute dislocation	319

Approach

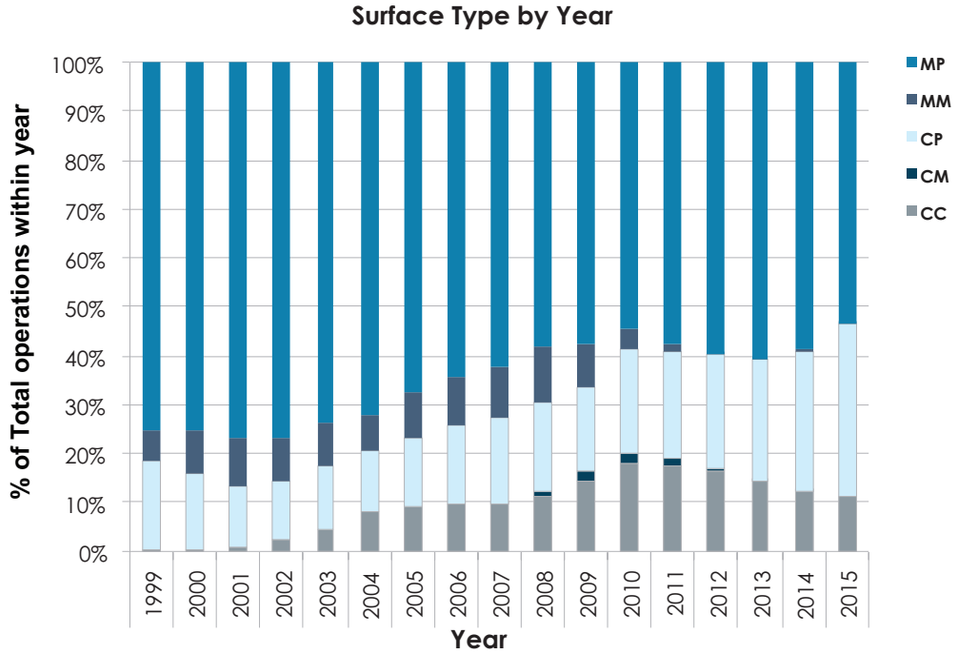
Posterior	70,988
Lateral	28,589
Anterior	4,045
Minimally invasive	1,748
Trochanteric osteotomy	198
Image guided surgery	480

Image guided surgery was added to the updated forms at the beginning of 2005, but there continues to be little interest in the technique. The minimally invasive approach has also waned after a surge in 2008.

Comparison of proportions of cemented vs uncemented vs hybrid by year

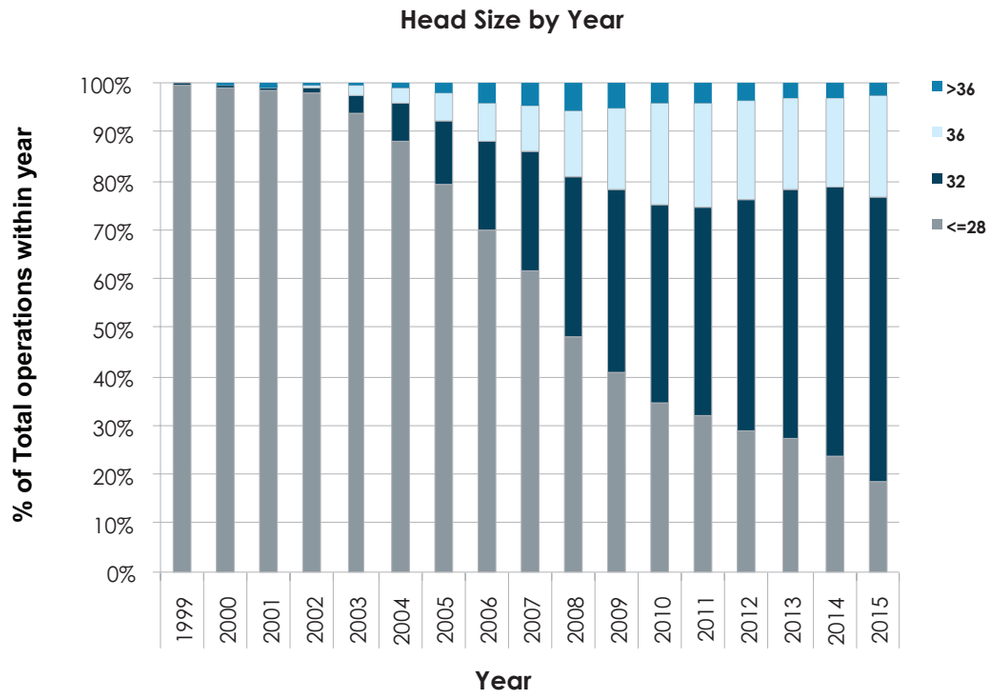


Comparison of different bearing surface usage over time



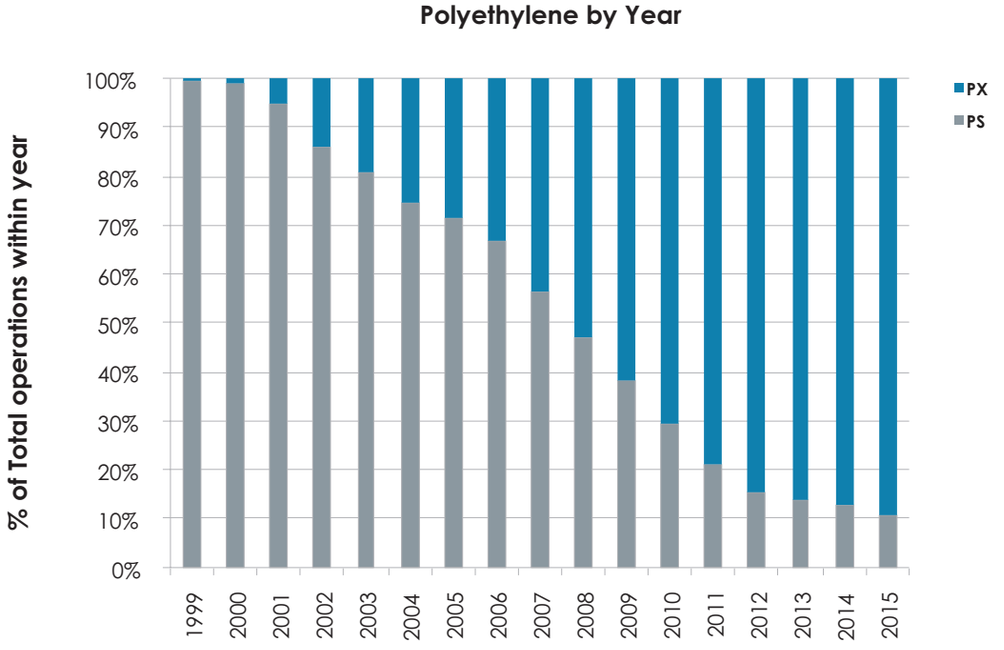
CC = ceramic/ceramic; CP = ceramic/polyethylene; CM = ceramic/metal; MM = metal/metal & MP = metal/polyethylene

Comparison of head size usage over time



CC = ceramic/ceramic; CP = ceramic/polyethylene; CM = ceramic/metal; MM = metal/metal & MP = metal/polyethylene

Comparison usage of standard vs cross linked polyethylene over time



PS = standard & PX = cross linked polyethylene

Bone graft

Femoral autograft	226
Femoral allograft	44
Femoral synthetic	7
Acetabular autograft	882
Acetabular allograft	113
Acetabular synthetic	5

Cement

Femur cemented	67,478 (61%)
Antibiotic in cement	44,128 (65%)
Acetabulum cemented	25,898 (24%)
Antibiotic in cement	16,053 (62%)

Systemic antibiotic prophylaxis

Patient number receiving at least one systemic antibiotic:	105,656 (96%)

A cephalosporin was used in 87% of patients.

Operating theatre

Conventional	66,355
Laminar flow	42,085
Space suits	32,207

In 2015, 41% of arthroplasties were performed in laminar flow theatres, down from 42% in 2014, and 31% with space suits, which is 2% lower than for 2014.

ASA Class

This was introduced with the updated forms at the beginning of 2005.

Definitions

ASA class 1: A healthy patient

ASA class 2: A patient with mild systemic disease

ASA class 3: A patient with severe systemic disease that limits activity but is not incapacitating

ASA class 4: A patient with an incapacitating systemic disease that is a constant threat to life

ASA	Number	Percentage
1	12,950	17
2	45,426	59
3	17,484	23
4	642	1

For the eleven-year period 2005 – 2015, there were 76,502 (95%) primary hip procedures with the ASA class recorded.

Operative time (skin to skin in minutes)

Mean	79 minutes

Surgeon grade

The updated forms introduced in 2005 have separated advanced trainee into supervised and unsupervised. The following figures are for the eleven-year period 2005 – 2015.

Consultant	69,787
Advanced trainee supervised	6,655
Advanced trainee unsupervised	2,232
Basic trainee	1,679

Prosthesis usage

Conventional primary hips

Top 10 femoral components used in 2015

Exeter V40	3,121
Corail	1,111
Stemsys	379
Twinsys uncemented	341
MS 30	307
Accolade II	306
C-stem AMT	300
CPT	295
Twinsys cemented	262
Synergy porous	257

The only change from 2014 is that the Accolade II has made its first appearance at the expense of the CLS.

Top 10 acetabular components used in 2015

Pinnacle	1,660
Continuum TM	985
RM Pressfit	984
Trident	956
R3 porous	612
Tritanium	611
Fitmore	407
Trilogy	331
Exeter X3	305
Contemporary	288

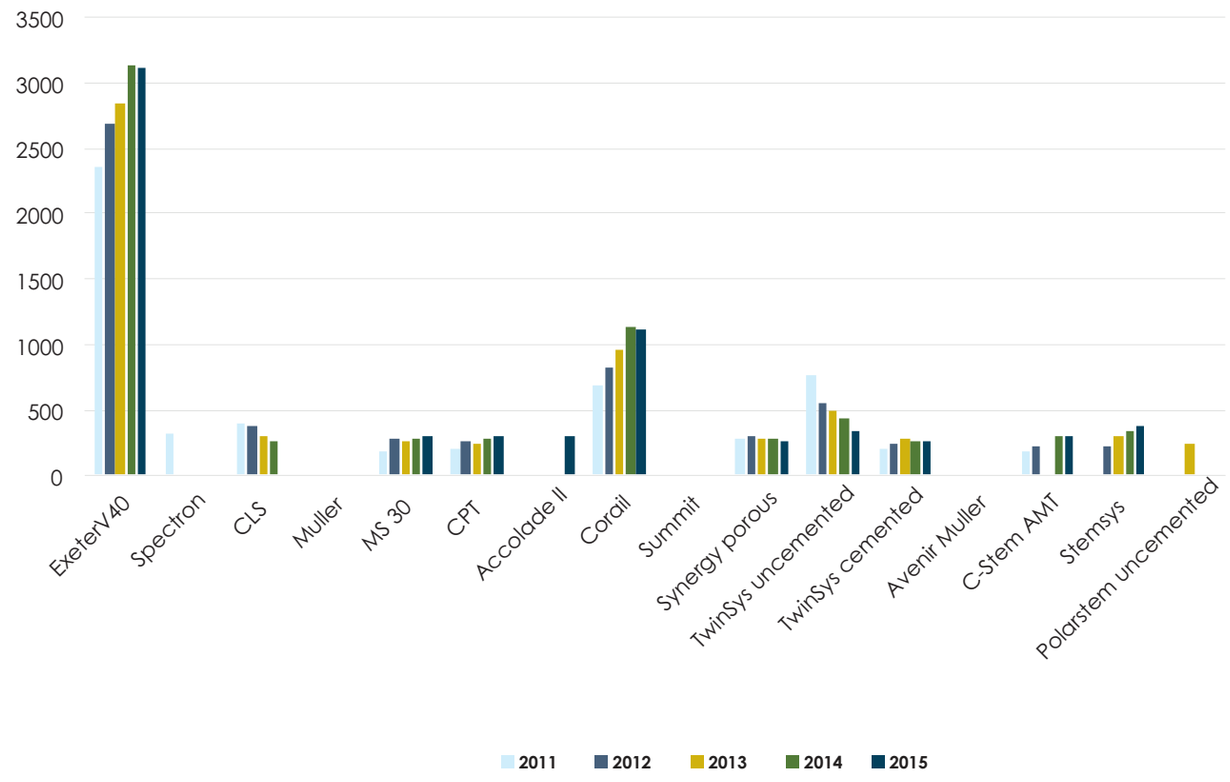
No change from 2014.

Top Ten Combinations used in 2015

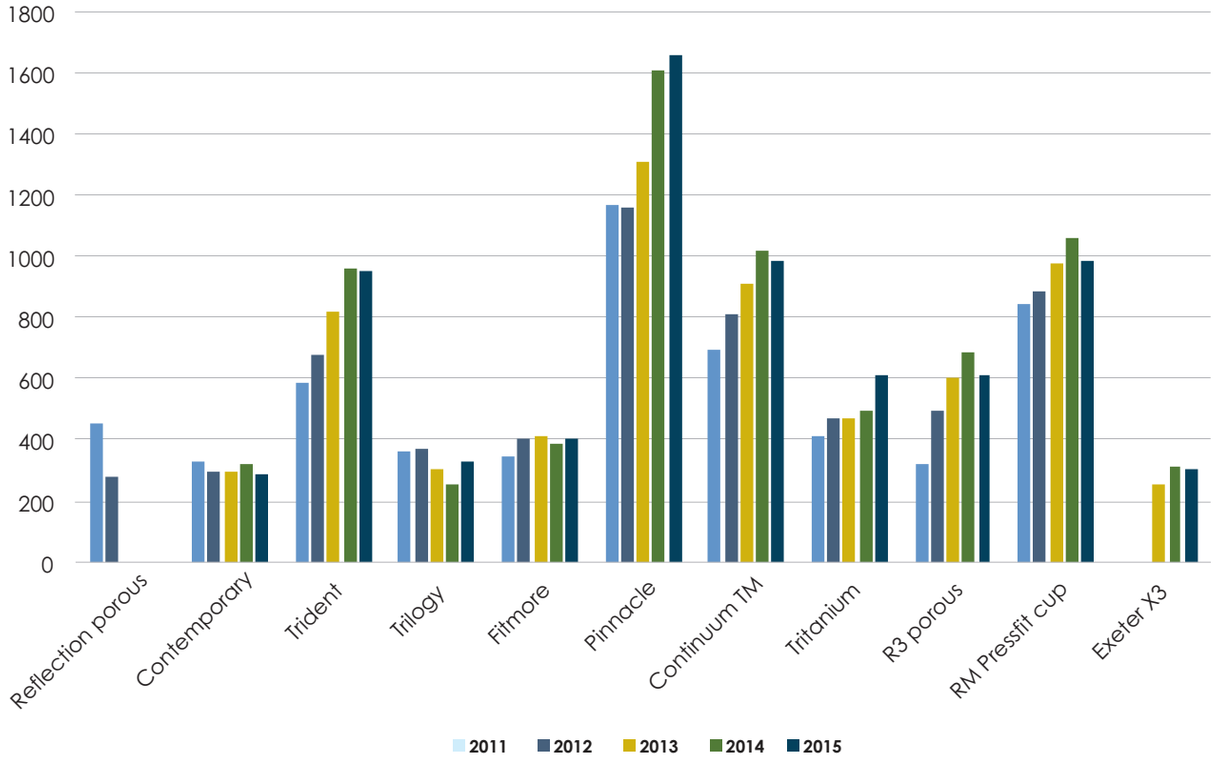
Femur	Acetabulum	All Years	2015
Corail	Pinnacle	6,468	936
Exeter V40	Trident	7,472	759
Exeter V40	Tritanium	1,798	424
Exeter V40	Continuum TM	1,660	345
TwinSys uncemented	RM Pressfit cup	4,064	326
Exeter V40	Exeter X3	1,297	304
Exeter V40	Contemporary	5,944	277
Polarstem uncemented	R3 porous	740	237
C-Stem AMT	Pinnacle	1,124	222
Synergy Porous	R3 porous	1,281	221

No change from 2014.

Most used femoral components per year for five years (2011- 2015)



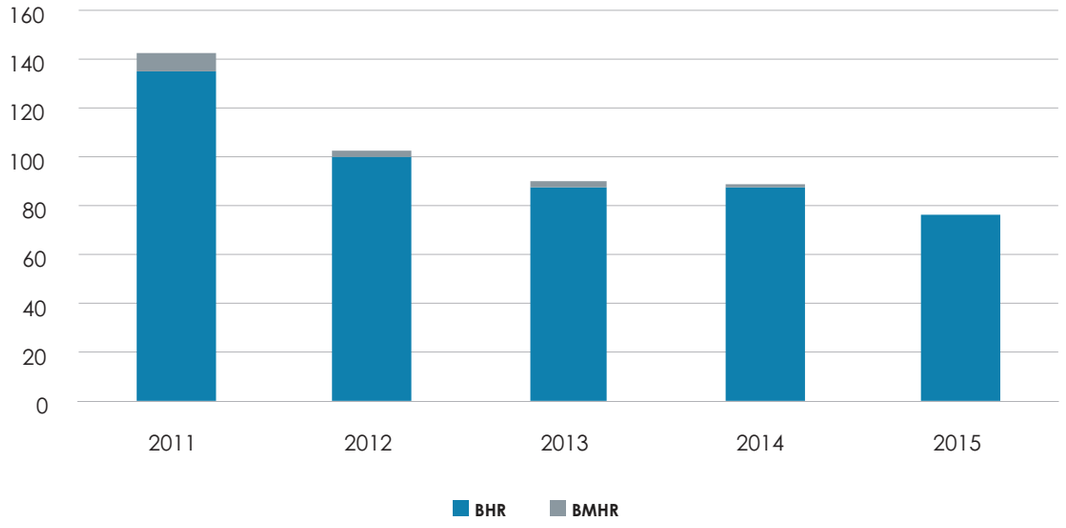
Most used acetabular components per year for five years (2011 – 2015)



Resurfacing hips components used in 2015

BHR	77

Resurfacing Components per year for five years (2011 – 2015)



Surgeon and Hospital Workload

Surgeons

In 2015, 206 surgeons performed 8,373 total hip replacements, an average of 41 procedures per surgeon.

26 surgeons performed less than 10 procedures and 60 performed more than 50.

Hospitals

In 2015, primary hip replacement was performed in 51 hospitals, 27 public and 24 private.

The average number of total hip replacements per hospital was 164.

REVISION HIP ARTHROPLASTY

Revision is defined by the Registry as a new operation in a previously replaced hip joint during which one of the components is exchanged, removed, manipulated or added. It includes excision arthroplasty and amputation, but not soft tissue procedures. A two-stage procedure is registered as one revision.

Data Analysis

For the seventeen-year period January 1999 – December 2015, there were 16,251 revision hip procedures registered. This is an additional 1,168 compared to last year's report.

The average age for a revision hip replacement was 70.03 years, with a range of 17.52–100.28 years.

Revision hips

	Female	Male
Number	7,853	8,398
Percentage	47.09	52.91
Mean age	70.24	69.83
Maximum age	100.28	97.17
Minimum age	17.52	25.68
Standard dev.	12.12	10.82

The percentage of revision to primary hips performed is 13% and the ratio is 1:7.

Body Mass Index

For the six year period 2010 - 2015, there were 2,075 BMI registrations for revision hip replacements. The average BMI was 28.83 with a range of 15- 55 with a standard deviation of 5.65.

Revision of Registered Primary Hip Arthroplasties

This section analyses data for revisions of **registered primary hip arthroplasties** for the seventeen year period.

There were 5,092 revisions of the 108,613 primary conventional hip replacements (4.7%) and 119 revisions of the 1,595 resurfacing hip replacements (7.5%), a total of 5,211 revisions.

Conventional hip arthroplasty analyses

Time to revision for conventional hips

Mean	1,869 days
Maximum	6,053 days
Minimum	0 days
Standard deviation	1,597 days

Reason for revision

Dislocation	1,177
Loosening acetabular component	1,140
Loosening femoral component	875
Pain	731
Deep infection	603
Fracture femur	526
ALVAL*	232
High blood level of metal ions	44

There was often more than one reason listed on the data form and all were entered.

** ALVAL(aseptic lymphocytic vascular-associated lesions) also includes listed revision reasons of metallosis, pseudotumour, hypersensitivity and synovitis. They all relate to metal on metal bearing revisions.*

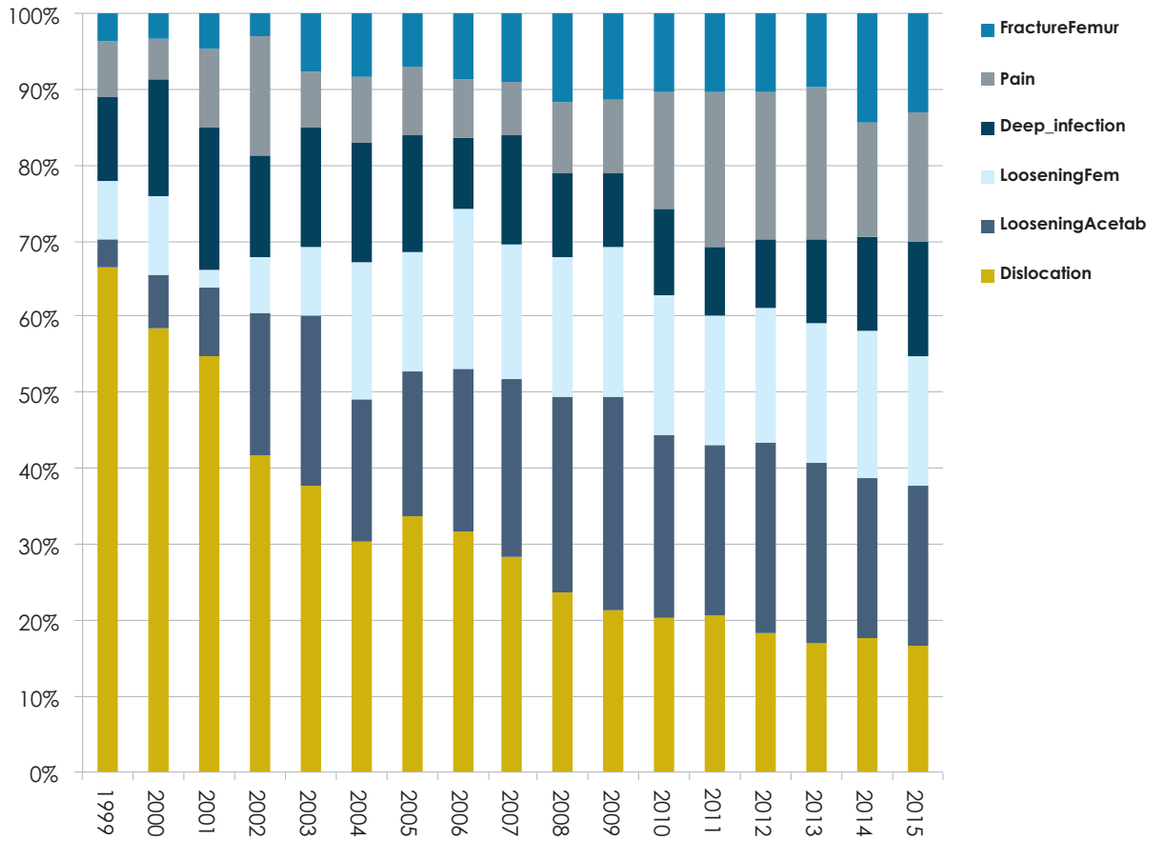
Analysis by time of the 6 main reasons for revision

Years	Dislocation		Loosening Acetabulum		Loosening Femur		Deep infection		Pain		Fracture Femur	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
0	511	43.42	131	11.49	86	9.83	240	39.80	63	8.62	197	37.45
1	144	12.23	70	6.14	66	7.54	87	14.43	82	11.22	31	5.89
2	98	8.33	68	5.96	63	7.20	61	10.12	75	10.26	35	6.65
3	81	6.88	77	6.75	60	6.86	43	7.13	60	8.21	27	5.13
4	51	4.33	65	5.70	59	6.74	30	4.98	53	7.25	37	7.03
5	58	4.93	70	6.14	59	6.74	25	4.15	62	8.48	23	4.37
6	51	4.33	87	7.63	76	8.69	23	3.81	58	7.93	21	3.99
7	35	2.97	78	6.84	74	8.46	19	3.15	43	5.88	25	4.75
8	37	3.14	86	7.54	55	6.29	21	3.48	44	6.02	27	5.13
9	18	1.53	92	8.07	54	6.17	22	3.65	35	4.79	25	4.75
10	25	2.12	71	6.23	66	7.54	14	2.32	36	4.92	22	4.18
11	17	1.44	70	6.14	54	6.17	6	1.00	44	6.02	17	3.23
12	22	1.87	57	5.00	41	4.69	4	0.66	24	3.28	15	2.85
13	12	1.02	60	5.26	27	3.09	4	0.66	17	2.33	8	1.52
14	9	0.76	28	2.46	16	1.83	2	0.33	15	2.05	14	2.66
15	8	0.68	30	2.63	19	2.17	2	0.33	20	2.74	2	0.38
Total	**1,177**	**100**	**1,140**	**100**	**875**	**100**	**603**	**100**	**731**	**100**	**526**	**100**

Analyses of percentages of the 6 main reasons for revision by year

	Dislocation	Loosening Acetabulum	Loosening Femur	Deep infection	Pain	Fracture Femur
	%	%	%	%	%	%
1999	54.55	3.03	6.06	9.09	6.06	3.03
2000	61.82	7.27	10.91	16.36	5.45	3.64
2001	55.95	9.52	2.38	19.05	10.71	4.76
2002	44.94	20.22	7.87	14.61	16.85	3.37
2003	42.31	25.38	10.00	17.69	8.46	8.46
2004	33.78	20.95	20.27	17.57	9.46	9.46
2005	34.13	19.16	16.17	15.57	8.98	7.19
2006	32.71	21.96	21.50	9.81	7.94	8.88
2007	29.48	24.25	18.28	14.93	7.46	9.33
2008	24.92	26.75	19.45	11.25	10.03	12.16
2009	22.19	29.59	20.55	10.14	10.41	11.78
2010	21.59	25.81	19.60	12.16	16.63	10.92
2011	20.66	22.61	17.15	8.77	20.66	10.33
2012	17.27	23.91	16.70	8.73	18.41	9.87
2013	15.85	21.92	17.20	10.29	18.55	9.11
2014	15.59	18.82	17.20	11.11	13.26	12.72
2015	16.07	20.13	16.40	14.45	16.23	12.66

NB each year column does not add up to 100% as often more than one cause for revision is listed and there are other reasons for revision other than the six above listed in the Registry.



Resurfaced Hip Analyses

There were 1,595 resurfacing hips registered for the period 2000 – 2015, and 119 (7.5%) have been revised.

Time to revision for resurfaced hips

Mean	1,724 days
Maximum	3,668 days
Minimum	10 days
Standard deviation	988 days

Reason for revision

Pain	37
Loosening acetabulum	15
Deep infection	13
Loosening femoral component	14
Fracture femur	10
Dislocation	2

Statistical note

In the tables below there are two statistical terms readers may not be familiar with:

i) Observed component years

This is the number of registered primary procedures multiplied by the number of years each component has been in place.

ii) Rate/100 component years

This is equivalent to the yearly revision rate expressed as a percentage and is derived by dividing the number of prostheses revised by the observed component years multiplied by 100. It therefore allows for the number of years of post-operative follow up in calculating the revision rate. These rates are usually very low, hence it is expressed per 100 component years rather than per component year. Statisticians consider that this is a more accurate way of deriving a revision rate for comparison when analysing data with widely varying follow up times. It is also important to note the confidence intervals. The closer they are to the estimated revision rate/100 component years, the more precise the estimate is.

Statistical Significance

Where it is stated that a difference among results is significant the p value is 0.05 or less. In most of these situations this is because there is no overlap of the confidence intervals (CI's) but sometimes significance can apply in the presence of CI overlap.

Primary Hip Arthroplasties

All Primary Total Hip Arthroplasties (excluding Resurfacing arthroplasties)

No. Ops.	Observed comp. Yrs	Number Revised	Rate/100-component-years	Exact 95% confidence interval	
108,613	695,879	5,092	0.73	0.71	0.75

There are 1,074 (1,001 in 2014) hip prosthesis combinations in the Registry; 674 (63%) have 10 or fewer registered procedures and 323 (30%) one only.

The tables below contain the analyses of the 208 (19%) that have a minimum of 50 primary registered procedures. As stated above it is important to note the confidence intervals and observed component years in conjunction with the revision rates.

Revisions versus Hip Prostheses Combinations Sorted on Number of Implantations

(Minimum of 50 registrations)

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Exeter V40	Trident	7,472	40,623.9	177	0.44	0.37	0.50
Corail	Pinnacle	6,468	25,539.1	180	0.70	0.61	0.82
Exeter V40	Contemporary	5,944	37,957.8	169	0.45	0.38	0.52
TwinSys uncemented	RM Pressfit cup	4,064	18,430.5	118	0.64	0.53	0.77
Spectron	Reflection cemented	2,946	26,759.2	281	1.05	0.93	1.18
Spectron	Reflection porous	2,755	22,459.9	175	0.78	0.67	0.90
Exeter V40	Trilogy	2,344	13,534.5	59	0.44	0.33	0.56
CLS	Fitmore	2,154	17,747.7	86	0.48	0.39	0.60
Accolade	Trident	1,867	15,840.0	85	0.54	0.43	0.66
Exeter V40	Tritanium	1,798	4,380.0	41	0.94	0.67	1.27
CLS	Morscher	1,682	18,727.3	90	0.48	0.39	0.59
MS 30	Fitmore	1,675	9,358.7	31	0.33	0.22	0.46
Summit	Pinnacle	1,667	8,033.7	72	0.90	0.70	1.13
Exeter V40	Continuum TM	1,660	4,203.8	46	1.09	0.79	1.45
Exeter V40	Exeter	1,636	12,892.3	62	0.48	0.37	0.62
Exeter V40	Pinnacle	1,616	6,407.2	31	0.48	0.33	0.69
Exeter	Contemporary	1,551	16,869.0	166	0.98	0.84	1.14
Exeter V40	RM Pressfit cup	1,469	5,867.0	16	0.27	0.16	0.44
Exeter	Exeter	1,326	13,856.2	96	0.69	0.56	0.85
Exeter V40	Exeter X3	1,297	2,823.7	12	0.42	0.21	0.72
TwinSys cemented	RM Pressfit cup	1,288	4,654.4	26	0.56	0.36	0.82
Synergy Porous	R3 porous	1,281	3,554.4	41	1.15	0.82	1.55
CLS	CLS Expansion	1,263	12,988.2	100	0.77	0.63	0.94
TwinSys uncemented	Selexys TPS	1,231	7,259.5	90	1.24	0.99	1.52
Synergy Porous	Reflection porous	1,178	8,628.9	36	0.42	0.29	0.57
Spectron	Duraloc	1,153	12,235.4	147	1.20	1.02	1.41
C-Stem AMT	Pinnacle	1,124	3,224.8	22	0.68	0.43	1.03
Exeter V40	Duraloc	987	8,896.8	81	0.91	0.72	1.13

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Exeter	Osteolock	836	9,872.7	64	0.65	0.50	0.83
CPT	Continuum TM	834	1,804.7	19	1.05	0.63	1.64
Exeter V40	Reflection cemented	800	3,706.0	13	0.35	0.19	0.60
MS 30	Morscher	787	8,318.5	51	0.61	0.45	0.80
CPT	Trilogy	760	4,741.3	44	0.93	0.67	1.23
Lateral straight stem	Muller PE cup	749	6,451.6	35	0.54	0.37	0.75
CCA	CCB	745	5,038.1	24	0.48	0.31	0.71
Polarstem uncemented	R3 porous	740	1,296.9	10	0.77	0.37	1.42
CLS	Duraloc	699	7,761.8	68	0.88	0.68	1.11
Exeter V40	Fitmore	634	2,466.3	5	0.20	0.05	0.44
Exeter V40	Morscher	630	5,882.6	28	0.48	0.31	0.68
Standard straight stem	Muller PE cup	628	5,050.4	16	0.32	0.17	0.50
Elite plus	Duraloc	608	6,049.3	97	1.60	1.29	1.95
Exeter	Duraloc	553	6,950.2	87	1.25	1.00	1.54
Exeter	Morscher	551	7,165.5	31	0.43	0.29	0.61
CPT	ZCA	540	4,809.5	27	0.56	0.36	0.80
H-Max S	Delta-TT Cup	537	1,143.6	10	0.87	0.42	1.61
Lateral straight stem	RM cup	533	4,217.0	36	0.85	0.60	1.18
CLS	Trilogy	509	2,761.6	15	0.54	0.29	0.87
SL monoblock	Muller PE cup	488	4,969.9	19	0.38	0.22	0.58
Femoral Stem Press Fit	Continuum TM	483	1,390.6	16	1.15	0.66	1.87
CLS	RM Pressfit cup	482	2,460.8	16	0.65	0.37	1.06
Exeter V40	Reflection porous	474	2,904.8	9	0.31	0.13	0.57
Corail	Duraloc	464	4,160.8	38	0.91	0.65	1.25
MS 30	Muller PE cup	462	4,045.3	15	0.37	0.21	0.61
Stemsys	Fixa Ti Por	462	1,016.0	7	0.69	0.25	1.35
Charnley	Charnley	456	4,731.7	20	0.42	0.26	0.65
CLS	Continuum TM	447	1,236.0	11	0.89	0.44	1.59
Exeter V40	CCB	432	1,821.9	7	0.38	0.15	0.79
Spectron	R3 porous	392	1,360.7	5	0.37	0.12	0.86
Versys cemented	ZCA	391	3,630.0	24	0.66	0.41	0.97
TwinSys cemented	CCB	385	1,545.7	8	0.52	0.20	0.98
Accolade II	Tritanium	381	505.6	3	0.59	0.08	1.58
Trabecular Metal Stem	Continuum TM	376	972.1	14	1.44	0.79	2.42
Exeter V40	R3 porous	371	860.4	5	0.58	0.16	1.27
TwinSys uncemented	Delta-PF Cup	370	1,934.3	1	0.05	0.00	0.24
CBC Stem	RM Pressfit cup	363	1,631.5	17	1.04	0.61	1.67
ABGII	Trident	342	3,191.1	23	0.72	0.46	1.08

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Accolade II	Trident	342	499.3	4	0.80	0.17	1.90
S-Rom	Pinnacle	337	2,678.6	27	1.01	0.66	1.47
Polarstem uncemented	Reflection porous	335	1,200.8	12	1.00	0.49	1.69
CLS	Reflection porous	332	2,117.4	17	0.80	0.47	1.29
SL modular stem	RM cup	322	4,044.4	33	0.82	0.56	1.15
Stemsys	DeltaMotion Cup	307	1,219.2	4	0.33	0.07	0.78
Charnley	Charnley Cup Ogee	303	3,400.4	21	0.62	0.37	0.93
Elite plus	Charnley	298	3,331.8	21	0.63	0.38	0.95
Lateral straight stem	Weber	287	2,501.7	9	0.36	0.16	0.68
Elite plus	Elite Plus LPW	282	2,720.0	12	0.44	0.23	0.77
Stemsys	Agilis Ti-por	279	455.5	4	0.88	0.24	2.25
Versys	Trilogy	272	3,288.6	15	0.46	0.26	0.75
Exeter V40	Osteolock	270	2,744.2	13	0.47	0.24	0.79
C-Stem AMT	Marathon cemented	268	1,071.1	6	0.56	0.21	1.22
MS 30	Continuum TM	265	649.7	5	0.77	0.21	1.69
MS 30	Trilogy	256	1,218.9	3	0.25	0.05	0.72
Versys cemented	Trilogy	237	2,298.2	7	0.30	0.12	0.63
Exeter	Trilogy	213	2,559.6	13	0.51	0.27	0.87
CPT	Duraloc	212	2,190.0	13	0.59	0.32	1.02
Stemsys	RM Pressfit cup	211	458.2	2	0.44	0.02	1.40
Spectron	Morscher	210	2,444.4	24	0.98	0.61	1.44
TwinSys uncemented	Trilogy	209	1,265.9	8	0.63	0.27	1.25
CLS	Durom	198	1,545.7	45	2.91	2.12	3.90
Corail	Continuum TM	193	405.3	4	0.99	0.27	2.53
CLS	Allofit	192	1,469.2	17	1.16	0.65	1.81
CBC Stem	Expansys shell	183	1,425.4	19	1.33	0.78	2.04
Accolade	Pinnacle	180	1,137.8	2	0.18	0.02	0.63
Stemsys	Delta-PF Cup	177	219.5	1	0.46	0.01	2.54
Avenir Muller uncemented	Continuum TM	173	634.6	8	1.26	0.49	2.38
Lateral straight stem	RM Pressfit cup	168	880.9	3	0.34	0.07	1.00
Exeter V40	Trabecular Metal Shell	166	669.3	8	1.20	0.47	2.36
CLS	Trident	165	1,477.3	11	0.74	0.35	1.29
Friendly	Delta-PF Cup	164	1,230.5	4	0.33	0.09	0.83
CPCS	R3 porous	161	254.8	0	0.00	0.00	1.45
Corail	ASR	156	983.9	74	7.52	5.86	9.39
Corail	Fitmore	155	220.1	4	1.82	0.50	4.65
Accolade	Tritanium	152	644.2	2	0.31	0.04	1.12
Spectron	Mallory-Head	152	1,487.2	7	0.47	0.17	0.92

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Omnifit	Trident	149	1,472.0	12	0.82	0.42	1.42
TwinSys cemented	RM cup	148	1,123.5	4	0.36	0.10	0.91
CPT	Trident	145	1,267.8	11	0.87	0.43	1.55
Summit	Trilogy	145	885.0	5	0.56	0.18	1.32
Corail	Trilogy	144	478.9	3	0.63	0.13	1.83
Femoral Stem Press Fit	Trilogy	142	859.4	4	0.47	0.13	1.19
Corail	Reflection porous	140	1,001.6	1	0.10	0.00	0.56
ABGII	Duraloc	139	1,658.0	31	1.87	1.27	2.65
Standard straight stem	RM cup	138	1,298.1	10	0.77	0.34	1.37
Standard straight stem	RM Pressfit cup	137	819.4	1	0.12	0.00	0.68
CPT	Fitmore	136	644.5	8	1.24	0.54	2.45
Corail	Ultima	135	1,058.8	3	0.28	0.06	0.83
CCA	RM Pressfit cup	134	1,025.0	3	0.29	0.06	0.86
Standard straight stem	Weber	134	1,145.9	3	0.26	0.05	0.77
Exeter V40	Bio-clad poly	133	723.0	2	0.28	0.03	1.00
Exeter V40	Delta-TT Cup	132	271.5	2	0.74	0.09	2.66
Corail	Tritanium	131	407.6	4	0.98	0.27	2.51
S-Rom	ASR	130	698.7	93	13.31	10.74	16.31
Exeter	CLS Expansion	129	1,460.1	10	0.68	0.33	1.26
MS 30	Contemporary	128	1,083.3	7	0.65	0.26	1.33
Exeter V40	Monoblock Acetabular Cup	123	1,301.4	5	0.38	0.12	0.90
TwinSys uncemented	Continuum TM	123	456.2	3	0.66	0.14	1.92
TwinSys uncemented	RM cup	122	703.7	4	0.57	0.15	1.46
C-stem AMT	Pinnacle	121	144.2	2	1.39	0.17	5.01
Exeter	Muller PE cup	119	1,336.5	6	0.45	0.16	0.98
ABG	Duraloc	116	1,663.1	29	1.74	1.14	2.47
Accolade	Muller PE cup	114	1,022.5	1	0.10	0.00	0.54
Synergy Porous	BHR Acetabular Cup	114	813.6	19	2.34	1.41	3.65
CLS	RM cup	113	939.8	14	1.49	0.78	2.43
Exeter	Bio-clad poly	113	1,178.4	6	0.51	0.16	1.05
Prodigy	Duraloc	113	1,327.7	19	1.43	0.86	2.23
Elite plus	Elite Plus Ogee	110	987.7	5	0.51	0.16	1.18
Echo(TM) Bi-metric	G7 acetabular shell	109	149.7	2	1.34	0.16	4.83
ABGII	Delta-PF Cup	107	1,017.6	10	0.98	0.47	1.81
CLS	Weill ring	106	1,354.7	9	0.66	0.30	1.26
Avenir Muller uncemented	RM cup	105	549.9	1	0.18	0.00	1.01
Basis	Reflection porous	105	589.5	1	0.17	0.00	0.95
Mallory-Head	M2A	105	993.9	13	1.31	0.70	2.24

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Summit	Duraloc	101	969.8	5	0.52	0.17	1.20
Avenir Muller uncemented	Pinnacle	99	526.3	3	0.57	0.08	1.52
Lateral straight stem	ZCA	98	553.5	1	0.18	0.00	1.01
Corail	Monoblock Acetabular Cup	95	694.3	4	0.58	0.16	1.48
Femoral Stem Press Fit	Trident	95	202.1	1	0.49	0.01	2.76
H-Max S	Delta-PF Cup	95	124.6	2	1.61	0.19	5.80
Exeter V40	Muller PE cup	94	772.9	3	0.39	0.08	1.13
MS 30	ZCA all-poly cup	94	272.3	0	0.00	0.00	1.35
Anthology Porous	BHR Acetabular Cup	93	569.0	25	4.39	2.84	6.49
Avenir Muller uncemented	Tritanium	91	407.1	0	0.00	0.00	0.91
MS 30	RM Pressfit cup	89	602.3	3	0.50	0.07	1.33
Exeter V40	CLS Expansion	88	870.5	1	0.11	0.00	0.64
Exeter V40	ZCA all-poly cup	88	194.9	0	0.00	0.00	1.89
Summit	ASR	88	595.2	29	4.87	3.26	7.00
Synergy Porous	Delta-PF Cup	88	526.4	0	0.00	0.00	0.70
H-Max M	Delta-TT Cup	86	423.7	2	0.47	0.06	1.71
CPT	Tritanium	85	378.5	5	1.32	0.43	3.08
CPT	Monoblock Acetabular Cup	84	754.1	7	0.93	0.37	1.91
Exeter	Trident	84	1,070.9	0	0.00	0.00	0.34
SL modular stem	Muller PE cup	83	997.4	2	0.20	0.02	0.72
Exeter V40	ZCA	82	426.2	1	0.23	0.01	1.31
Corail	RM Pressfit cup	81	157.8	2	1.27	0.15	4.58
CPT	ZCA all-poly cup	81	246.5	1	0.41	0.01	2.26
CLS	Monoblock Acetabular Cup	80	652.8	4	0.61	0.17	1.57
Corail	Delta-PF Cup	78	681.7	1	0.15	0.00	0.82
Lateral straight stem	Continuum TM	78	266.3	2	0.75	0.09	2.71
S-Rom	Ultima	78	1,044.9	9	0.86	0.39	1.64
Spectron	Fitmore	78	854.3	4	0.47	0.13	1.20
Spectron	Trident	78	744.1	3	0.40	0.08	1.18
TwinSys cemented	Continuum TM	77	134.2	0	0.00	0.00	2.75
Corail	DeltaMotion Cup	76	286.9	0	0.00	0.00	1.29
AML MMA	Duraloc	74	884.0	9	1.02	0.47	1.93
CCA	Contemporary	74	736.3	10	1.36	0.65	2.50
Trabecular Metal Stem	Monoblock Acetabular Cup	74	613.9	3	0.49	0.07	1.30
ABG	ABGII	72	991.6	14	1.41	0.77	2.37
Contemporary	Contemporary	71	824.5	10	1.21	0.54	2.15
H-Max M	Delta-PF Cup	71	364.5	6	1.65	0.60	3.58

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Corail	Trident	70	258.6	3	1.16	0.24	3.39
Lateral straight stem	ZCA all-poly cup	70	241.7	0	0.00	0.00	1.53
Lateral straight stem	Trilogy	69	421.8	8	1.90	0.82	3.74
Zimmer Femoral Stem Press-Fit	Continuum TM	69	203.0	3	1.48	0.30	4.32
Spectron	Biomex acet shell porous	68	879.5	1	0.11	0.00	0.63
ABGII	Pinnacle	67	474.3	3	0.63	0.13	1.85
CLS	Pinnacle	66	401.0	1	0.25	0.01	1.39
Furlong	Furlong	66	623.0	5	0.80	0.22	1.76
Spectron	Muller PE cup	66	610.8	7	1.15	0.41	2.25
Anthology Porous	R3 porous	65	383.4	24	6.26	4.01	9.31
TwinSys cemented	Selexys TPS	65	306.5	4	1.30	0.36	3.34
Wagner cone stem	Fitmore	65	615.5	3	0.49	0.10	1.42
Zimmer M/L Taper	Continuum TM	65	181.6	0	0.00	0.00	2.03
CPT	Pinnacle	64	387.5	2	0.52	0.06	1.86
Friendly	Delta-TT Cup	64	239.9	3	1.25	0.26	3.65
CLS	Tritanium	63	150.5	2	1.33	0.16	4.80
Tri-Lock BPS	Pinnacle	62	252.8	3	1.19	0.16	3.17
CBC Stem	Fitmore	59	435.8	5	1.15	0.37	2.68
CLS	Artek	59	631.6	24	3.80	2.43	5.65
Echo(TM) Bi-metric	Exceed ABT Ringloc-X	57	152.1	1	0.66	0.02	3.66
Femoral Stem Press Fit	Delta-TT Cup	56	139.0	2	1.44	0.17	5.20
C-Stem	Elite Plus Ogee	55	489.4	2	0.41	0.05	1.48
MS 30	Duraloc	55	662.2	6	0.91	0.33	1.97
C-Stem AMT	RM Pressfit cup	54	200.0	1	0.50	0.01	2.79
AML	Duraloc	53	678.1	3	0.44	0.09	1.29
C-Stem	Duraloc	53	553.8	6	1.08	0.34	2.23
Exeter V40	Weber	53	479.5	0	0.00	0.00	0.77
C-Stem	Marathon cemented	50	121.5	0	0.00	0.00	3.04
Standard straight stem	ZCA all-poly cup	50	170.6	1	0.59	0.00	3.27

Revisions versus Hip Prostheses Combinations Sorted on Revision Rate

(Minimum of 50 primary registered arthroplasties)

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
*S-Rom	ASR	130	698.7	93	13.31	10.74	16.31
*Corail	ASR	156	983.9	74	7.52	5.86	9.39
*Anthology Porous	R3 porous	65	383.4	24	6.26	4.01	9.31
*Summit	ASR	88	595.2	29	4.87	3.26	7.00
*Anthology Porous	BHR Acetabular Cup	93	569.0	25	4.39	2.84	6.49
*CLS	Artek	59	631.6	24	3.80	2.43	5.65
*CLS	Durom	198	1,545.7	45	2.91	2.12	3.90
*Synergy Porous	BHR Acetabular Cup	114	813.6	19	2.34	1.41	3.65
*Lateral straight stem	Trilogy	69	421.8	8	1.90	0.82	3.74
*ABGII	Duraloc	139	1,658.0	31	1.87	1.27	2.65
Corail	Fitmore	155	220.1	4	1.82	0.50	4.65
*ABG	Duraloc	116	1,663.1	29	1.74	1.14	2.47
H-Max M	Delta-PF Cup	71	364.5	6	1.65	0.60	3.58
H-Max S	Delta-PF Cup	95	124.6	2	1.61	0.19	5.80
*Elite plus	Duraloc	608	6,049.3	97	1.60	1.29	1.95
*CLS	RM cup	113	939.8	14	1.49	0.78	2.43
Zimmer Femoral Stem Press-Fit	Continuum TM	69	203.0	3	1.48	0.30	4.32
*#Trabecular Metal Stem	Continuum TM	376	972.1	14	1.44	0.79	2.42
Femoral Stem Press Fit	Delta-TT Cup	56	139.0	2	1.44	0.17	5.20
*Prodigy	Duraloc	113	1,327.7	19	1.43	0.86	2.23
*ABG	ABGII	72	991.6	14	1.41	0.77	2.37
C-stem AMT	Pinnacle	121	144.2	2	1.39	0.17	5.01
CCA	Contemporary	74	736.3	10	1.36	0.65	2.50
Echo(TM) Bi-metric	G7 acetabular shell	109	149.7	2	1.34	0.16	4.83
CBC Stem	Expansys shell	183	1,425.4	19	1.33	0.78	2.04
*CLS	Tritanium	63	150.5	2	1.33	0.16	4.80
CPT	Tritanium	85	378.5	5	1.32	0.43	3.08
Mallory-Head	M2A	105	993.9	13	1.31	0.70	2.24
TwinSys cemented	Selexys TPS	65	306.5	4	1.30	0.36	3.34
Corail	RM Pressfit cup	81	157.8	2	1.27	0.15	4.58
Avenir Muller uncemented	Continuum TM	173	634.6	8	1.26	0.49	2.38
*Exeter	Duraloc	553	6,950.2	87	1.25	1.00	1.54
Friendly	Delta-TT Cup	64	239.9	3	1.25	0.26	3.65
CPT	Fitmore	136	644.5	8	1.24	0.54	2.45
*TwinSys uncemented	Selexys TPS	1,231	7,259.5	90	1.24	0.99	1.52
Contemporary	Contemporary	71	824.5	10	1.21	0.54	2.15

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
*Spectron	Duraloc	1,153	12,235.4	147	1.20	1.02	1.41
Exeter V40	Trabecular Metal Shell	166	669.3	8	1.20	0.47	2.36
Tri-Lock BPS	Pinnacle	62	252.8	3	1.19	0.16	3.17
Corail	Trident	70	258.6	3	1.16	0.24	3.39
CLS	Allofit	192	1,469.2	17	1.16	0.65	1.81
*# Synergy Porous	R3 porous	1,281	3,554.4	41	1.15	0.82	1.55
Femoral Stem Press Fit	Continuum TM	483	1,390.6	16	1.15	0.66	1.87
CBC Stem	Fitmore	59	435.8	5	1.15	0.37	2.68
Spectron	Muller PE cup	66	610.8	7	1.15	0.41	2.25
*# Exeter V40	Continuum TM	1,660	4,203.8	46	1.09	0.79	1.45
C-Stem	Duraloc	53	553.8	6	1.08	0.34	2.23
CPT	Continuum TM	834	1,804.7	19	1.05	0.63	1.64
*Spectron	Reflection cemented	2,946	26,759.2	281	1.05	0.93	1.18
CBC Stem	RM Pressfit cup	363	1,631.5	17	1.04	0.61	1.67
AML MMA	Duraloc	74	884.0	9	1.02	0.47	1.93
S-Rom	Pinnacle	337	2,678.6	27	1.01	0.66	1.47
Polarstem uncemented	Reflection porous	335	1,200.8	12	1.00	0.49	1.69
Corail	Continuum TM	193	405.3	4	0.99	0.27	2.53
*Exeter	Contemporary	1,551	16,869.0	166	0.98	0.84	1.14
ABGII	Delta-PF Cup	107	1,017.6	10	0.98	0.47	1.81
Spectron	Morscher	210	2,444.4	24	0.98	0.61	1.44
Corail	Tritanium	131	407.6	4	0.98	0.27	2.51
Exeter V40	Tritanium	1,798	4,380.0	41	0.94	0.67	1.27
CPT	Monoblock Acetabular Cup	84	754.1	7	0.93	0.37	1.91
CPT	Trilogy	760	4,741.3	44	0.93	0.67	1.23
Corail	Duraloc	464	4,160.8	38	0.91	0.65	1.25
Exeter V40	Duraloc	987	8,896.8	81	0.91	0.72	1.13
MS 30	Duraloc	55	662.2	6	0.91	0.33	1.97
Summit	Pinnacle	1,667	8,033.7	72	0.90	0.70	1.13
CLS	Continuum TM	447	1,236.0	11	0.89	0.44	1.59
Stemsys	Agilis Ti-por	279	455.5	4	0.88	0.24	2.25
CLS	Duraloc	699	7,761.8	68	0.88	0.68	1.11
H-Max S	Delta-TT Cup	537	1,143.6	10	0.87	0.42	1.61
CPT	Trident	145	1,267.8	11	0.87	0.43	1.55
S-Rom	Ultima	78	1,044.9	9	0.86	0.39	1.64
Lateral straight stem	RM cup	533	4,217.0	36	0.85	0.60	1.18
SL modular stem	RM cup	322	4,044.4	33	0.82	0.56	1.15
Omnifit	Trident	149	1,472.0	12	0.82	0.42	1.42

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
CLS	Reflection porous	332	2,117.4	17	0.80	0.47	1.29
Furlong	Furlong	66	623.0	5	0.80	0.22	1.76
Accolade II	Trident	342	499.3	4	0.80	0.17	1.90
Spectron	Reflection porous	2,755	22,459.9	175	0.78	0.67	0.90
Polarstem uncemented	R3 porous	740	1,296.9	10	0.77	0.37	1.42
Standard straight stem	RM cup	138	1,298.1	10	0.77	0.34	1.37
CLS	CLS Expansion	1,263	12,988.2	100	0.77	0.63	0.94
MS 30	Continuum TM	265	649.7	5	0.77	0.21	1.69
Lateral straight stem	Continuum TM	78	266.3	2	0.75	0.09	2.71
CLS	Trident	165	1,477.3	11	0.74	0.35	1.29
Exeter V40	Delta-TT Cup	132	271.5	2	0.74	0.09	2.66
ABGII	Trident	342	3,191.1	23	0.72	0.46	1.08
Corail	Pinnacle	6,468	25,539.1	180	0.70	0.61	0.82
Exeter	Exeter	1,326	13,856.2	96	0.69	0.56	0.85
Stemsys	Fixa Ti Por	462	1,016.0	7	0.69	0.25	1.35
Exeter	CLS Expansion	129	1,460.1	10	0.68	0.33	1.26
C-Stem AMT	Pinnacle	1,124	3,224.8	22	0.68	0.43	1.03
CLS	Weill ring	106	1,354.7	9	0.66	0.30	1.26
Versys cemented	ZCA	391	3,630.0	24	0.66	0.41	0.97
TwinSys uncemented	Continuum TM	123	456.2	3	0.66	0.14	1.92
Echo(TM) Bi-metric	Exceed ABT RinglocX	57	152.1	1	0.66	0.02	3.66
CLS	RM Pressfit cup	482	2,460.8	16	0.65	0.37	1.06
Exeter	Osteolock	836	9,872.7	64	0.65	0.50	0.83
MS 30	Contemporary	128	1,083.3	7	0.65	0.26	1.33
TwinSys uncemented	RM Pressfit cup	4,064	18,430.5	118	0.64	0.53	0.77
ABGII	Pinnacle	67	474.3	3	0.63	0.13	1.85
TwinSys uncemented	Trilogy	209	1,265.9	8	0.63	0.27	1.25
Elite plus	Charnley	298	3,331.8	21	0.63	0.38	0.95
Corail	Trilogy	144	478.9	3	0.63	0.13	1.83
Charnley	Charnley Cup Ogee	303	3,400.4	21	0.62	0.37	0.93
MS 30	Morscher	787	8,318.5	51	0.61	0.45	0.80
CLS	Monoblock Acetabular Cup	80	652.8	4	0.61	0.17	1.57
CPT	Duraloc	212	2,190.0	13	0.59	0.32	1.02
Accolade II	Tritanium	381	505.6	3	0.59	0.08	1.58
Standard straight stem	ZCA all-poly cup	50	170.6	1	0.59	0.00	3.27
Exeter V40	R3 porous	371	860.4	5	0.58	0.16	1.27
Corail	Monoblock Acetabular Cup	95	694.3	4	0.58	0.16	1.48

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Avenir Muller uncemented	Pinnacle	99	526.3	3	0.57	0.08	1.52
TwinSys uncemented	RM cup	122	703.7	4	0.57	0.15	1.46
Summit	Trilogy	145	885.0	5	0.56	0.18	1.32
CPT	ZCA	540	4,809.5	27	0.56	0.36	0.80
C-Stem AMT	Marathon cemented	268	1,071.1	6	0.56	0.21	1.22
TwinSys cemented	RM Pressfit cup	1,288	4,654.4	26	0.56	0.36	0.82
CLS	Trilogy	509	2,761.6	15	0.54	0.29	0.87
Lateral straight stem	Muller PE cup	749	6,451.6	35	0.54	0.37	0.75
Accolade	Trident	1,867	15,840.0	85	0.54	0.43	0.66
TwinSys cemented	CCB	385	1,545.7	8	0.52	0.20	0.98
CPT	Pinnacle	64	387.5	2	0.52	0.06	1.86
Summit	Duraloc	101	969.8	5	0.52	0.17	1.20
Exeter	Bio-clad poly	113	1,178.4	6	0.51	0.16	1.05
Exeter	Trilogy	213	2,559.6	13	0.51	0.27	0.87
Elite plus	Elite Plus Ogee	110	987.7	5	0.51	0.16	1.18
C-Stem AMT	RM Pressfit cup	54	200.0	1	0.50	0.01	2.79
MS 30	RM Pressfit cup	89	602.3	3	0.50	0.07	1.33
Femoral Stem Press Fit	Trident	95	202.1	1	0.49	0.01	2.76
Trabecular Metal Stem	Monoblock Acetabular Cup	74	613.9	3	0.49	0.07	1.30
Wagner cone stem	Fitmore	65	615.5	3	0.49	0.10	1.42
CLS	Fitmore	2,154	17,747.7	86	0.48	0.39	0.60
Exeter V40	Pinnacle	1,616	6,407.2	31	0.48	0.33	0.69
Exeter V40	Exeter	1,636	12,892.3	62	0.48	0.37	0.62
CLS	Morscher	1,682	18,727.3	90	0.48	0.39	0.59
CCA	CCB	745	5,038.1	24	0.48	0.31	0.71
Exeter V40	Morscher	630	5,882.6	28	0.48	0.31	0.68
Exeter V40	Osteolock	270	2,744.2	13	0.47	0.24	0.79
H-Max M	Delta-TT Cup	86	423.7	2	0.47	0.06	1.71
Spectron	Mallory-Head	152	1,487.2	7	0.47	0.17	0.92
Spectron	Fitmore	78	854.3	4	0.47	0.13	1.20
Femoral Stem Press Fit	Trilogy	142	859.4	4	0.47	0.13	1.19
Versys	Trilogy	272	3,288.6	15	0.46	0.26	0.75
Stemsys	Delta-PF Cup	177	219.5	1	0.46	0.01	2.54
Exeter	Muller PE cup	119	1,336.5	6	0.45	0.16	0.98
Exeter V40	Contemporary	5,944	37,957.8	169	0.45	0.38	0.52
AML	Duraloc	53	678.1	3	0.44	0.09	1.29
Elite plus	Elite Plus LPW	282	2,720.0	12	0.44	0.23	0.77
Stemsys	RM Pressfit cup	211	458.2	2	0.44	0.02	1.40

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Exeter V40	Trilogy	2,344	13,534.5	59	0.44	0.33	0.56
Exeter V40	Trident	7,472	40,623.9	177	0.44	0.37	0.50
Exeter	Morscher	551	7,165.5	31	0.43	0.29	0.61
Exeter V40	Exeter X3	1,297	2,823.7	12	0.42	0.21	0.72
Charnley	Charnley	456	4,731.7	20	0.42	0.26	0.65
Synergy Porous	Reflection porous	1,178	8,628.9	36	0.42	0.29	0.57
C-Stem	Elite Plus Ogee	55	489.4	2	0.41	0.05	1.48
CPT	ZCA all-poly cup	81	246.5	1	0.41	0.01	2.26
Spectron	Trident	78	744.1	3	0.40	0.08	1.18
Exeter V40	Muller PE cup	94	772.9	3	0.39	0.08	1.13
Exeter V40	CCB	432	1,821.9	7	0.38	0.15	0.79
Exeter V40	Monoblock Acetabular Cup	123	1,301.4	5	0.38	0.12	0.90
SL monoblock	Muller PE cup	488	4,969.9	19	0.38	0.22	0.58
MS 30	Muller PE cup	462	4,045.3	15	0.37	0.21	0.61
Spectron	R3 porous	392	1,360.7	5	0.37	0.12	0.86
Lateral straight stem	Weber	287	2,501.7	9	0.36	0.16	0.68
TwinSys cemented	RM cup	148	1,123.5	4	0.36	0.10	0.91
Exeter V40	Reflection cemented	800	3,706.0	13	0.35	0.19	0.60
Lateral straight stem	RM Pressfit cup	168	880.9	3	0.34	0.07	1.00
MS 30	Fitmore	1,675	9,358.7	31	0.33	0.22	0.46
Stemsys	DeltaMotion Cup	307	1,219.2	4	0.33	0.07	0.78
Friendly	Delta-PF Cup	164	1,230.5	4	0.33	0.09	0.83
Standard straight stem	Muller PE cup	628	5,050.4	16	0.32	0.17	0.50
Accolade	Tritanium	152	644.2	2	0.31	0.04	1.12
Exeter V40	Reflection porous	474	2,904.8	9	0.31	0.13	0.57
Versys cemented	Trilogy	237	2,298.2	7	0.30	0.12	0.63
CCA	RM Pressfit cup	134	1,025.0	3	0.29	0.06	0.86
Corail	Ultima	135	1,058.8	3	0.28	0.06	0.83
Exeter V40	Bio-clad poly	133	723.0	2	0.28	0.03	1.00
Exeter V40	RM Pressfit cup	1,469	5,867.0	16	0.27	0.16	0.44
Standard straight stem	Weber	134	1,145.9	3	0.26	0.05	0.77
CLS	Pinnacle	66	401.0	1	0.25	0.01	1.39
MS 30	Trilogy	256	1,218.9	3	0.25	0.05	0.72
Exeter V40	ZCA	82	426.2	1	0.23	0.01	1.31
Exeter V40	Fitmore	634	2,466.3	5	0.20	0.05	0.44
SL modular stem	Muller PE cup	83	997.4	2	0.20	0.02	0.72
Avenir Muller uncemented	RM cup	105	549.9	1	0.18	0.00	1.01

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Lateral straight stem	ZCA	98	553.5	1	0.18	0.00	1.01
Accolade	Pinnacle	180	1,137.8	2	0.18	0.02	0.63
Basis	Reflection porous	105	589.5	1	0.17	0.00	0.95
Corail	Delta-PF Cup	78	681.7	1	0.15	0.00	0.82
Standard straight stem	RM Pressfit cup	137	819.4	1	0.12	0.00	0.68
Exeter V40	CLS Expansion	88	870.5	1	0.11	0.00	0.64
Spectron	Biomex acet shell porous	68	879.5	1	0.11	0.00	0.63
Corail	Reflection porous	140	1,001.6	1	0.10	0.00	0.56
Accolade	Muller PE cup	114	1,022.5	1	0.10	0.00	0.54
TwinSys uncemented	Delta-PF Cup	370	1,934.3	1	0.05	0.00	0.24
CPCS	R3 porous	161	254.8	0	0.00	0.00	1.45
MS 30	ZCA all-poly cup	94	272.3	0	0.00	0.00	1.35
Avenir Muller uncemented	Tritanium	91	407.1	0	0.00	0.00	0.91
Exeter V40	ZCA all-poly cup	88	194.9	0	0.00	0.00	1.89
Synergy Porous	Delta-PF Cup	88	526.4	0	0.00	0.00	0.70
Exeter	Trident	84	1,070.9	0	0.00	0.00	0.34
TwinSys cemented	Continuum TM	77	134.2	0	0.00	0.00	2.75
Corail	DeltaMotion Cup	76	286.9	0	0.00	0.00	1.29
Lateral straight stem	ZCA all-poly cup	70	241.7	0	0.00	0.00	1.53
Zimmer M/L Taper	Continuum TM	65	181.6	0	0.00	0.00	2.03
Exeter V40	Weber	53	479.5	0	0.00	0.00	0.77
C-Stem	Marathon cemented	50	121.5	0	0.00	0.00	3.04

*Those marked with an * in the above table have revision rates significantly higher than the overall rate of 0.73 /100 ocys @ the 95% confidence interval. There are several other combinations with high revision rates but without statistical significance because of the wide CIs.*

*Those marked with a # as well as an * indicate those combinations used during 2015.*

It is noteworthy that 52% of the ASR combinations have now been revised.

Revisions versus Hip Prostheses Combinations and Fixation Method Sorted on Number of Implantations

(Minimum of 50 primary registered arthroplasties)

Fully Cemented

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Exeter V40	Contemporary	5,944	37,957.8	169	0.45	0.38	0.52
*Spectron	Reflection cemented	2,946	26,759.2	281	1.05	0.93	1.18
Exeter V40	Exeter	1,636	12,892.3	62	0.48	0.37	0.62
*Exeter	Contemporary	1,551	16,869.0	166	0.98	0.84	1.14
Exeter	Exeter	1,326	13,856.2	96	0.69	0.56	0.85
Exeter V40	Exeter X3	1,297	2,823.7	12	0.42	0.21	0.72
Exeter V40	Reflection cemented	800	3,706.0	13	0.35	0.19	0.60
Lateral straight stem	Muller PE cup	749	6,451.6	35	0.54	0.37	0.75
CCA	CCB	745	5,038.1	24	0.48	0.31	0.71
Standard straight stem	Muller PE cup	628	5,050.4	16	0.32	0.17	0.50
CPT	ZCA	540	4,809.5	27	0.56	0.36	0.80
SL monoblock	Muller PE cup	488	4,969.9	19	0.38	0.22	0.58
MS 30	Muller PE cup	462	4,045.3	15	0.37	0.21	0.61
Charnley	Charnley	456	4,731.7	20	0.42	0.26	0.65
Exeter V40	CCB	432	1,821.9	7	0.38	0.15	0.79
Versys cemented	ZCA	391	3,630.0	24	0.66	0.41	0.97
TwinSys cemented	CCB	385	1,545.7	8	0.52	0.20	0.98
Charnley	Charnley Cup Ogee	303	3,400.4	21	0.62	0.37	0.93
Elite plus	Charnley	298	3,331.8	21	0.63	0.38	0.95
Lateral straight stem	Weber	287	2,501.7	9	0.36	0.16	0.68
Elite plus	Elite Plus LPW	282	2,720.0	12	0.44	0.23	0.77
C-Stem AMT	Marathon cemented	268	1,071.1	6	0.56	0.21	1.22
Standard straight stem	Weber	134	1,145.9	3	0.26	0.05	0.77
Exeter V40	Bio-clad poly	133	723.0	2	0.28	0.03	1.00
MS 30	Contemporary	128	1,083.3	7	0.65	0.26	1.33
Exeter	Muller PE cup	119	1,336.5	6	0.45	0.16	0.98
Exeter	Bio-clad poly	113	1,178.4	6	0.51	0.16	1.05
Elite plus	Elite Plus Ogee	110	987.7	5	0.51	0.16	1.18
Lateral straight stem	ZCA	98	553.5	1	0.18	0.00	1.01
Exeter V40	Muller PE cup	94	772.9	3	0.39	0.08	1.13
MS 30	ZCA all-poly cup	94	272.3	0	0.00	0.00	1.35
Exeter V40	ZCA all-poly cup	88	194.9	0	0.00	0.00	1.89
SL modular stem	Muller PE cup	83	997.4	2	0.20	0.02	0.72
Exeter V40	ZCA	82	426.2	1	0.23	0.01	1.31

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
CPT	ZCA all-poly cup	81	246.5	1	0.41	0.01	2.26
CCA	Contemporary	74	736.3	10	1.36	0.65	2.50
Contemporary	Contemporary	71	824.5	10	1.21	0.54	2.15
Lateral straight stem	ZCA all-poly cup	70	241.7	0	0.00	0.00	1.53
Spectron	Muller PE cup	66	610.8	7	1.15	0.41	2.25
C-Stem	Elite Plus Ogee	55	489.4	2	0.41	0.05	1.48
Exeter V40	Weber	53	479.5	0	0.00	0.00	0.77
C-Stem	Marathon cemented	50	121.5	0	0.00	0.00	3.04
Standard straight stem	ZCA all-poly cup	50	170.6	1	0.59	0.00	3.27

*Those marked with an * in the above table have revision rates significantly higher than the overall rate of 0.73 /100 ocys @ the 95% confidence interval. There are three combinations with high revision rates but without statistical significance.*

Uncemented

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Corail	Pinnacle	6,468	25,539.1	180	0.70	0.61	0.82
TwinSys uncemented	RM Pressfit cup	4,064	18,430.5	118	0.64	0.53	0.77
CLS	Fitmore	2,154	17,747.7	86	0.48	0.39	0.60
Accolade	Trident	1,867	15,840.0	85	0.54	0.43	0.66
CLS	Morscher	1,682	18,727.3	90	0.48	0.39	0.59
Summit	Pinnacle	1,667	8,033.7	72	0.90	0.70	1.13
*#Synergy Porous	R3 porous	1,281	3,554.4	41	1.15	0.82	1.55
CLS	CLS Expansion	1,263	12,988.2	100	0.77	0.63	0.94
*TwinSys uncemented	Selexys TPS	1,231	7,259.5	90	1.24	0.99	1.52
Synergy Porous	Reflection porous	1,178	8,628.9	36	0.42	0.29	0.57
Polarstem uncemented	R3 porous	740	1,296.9	10	0.77	0.37	1.42
CLS	Duraloc	699	7,761.8	68	0.88	0.68	1.11
H-Max S	Delta-TT Cup	537	1,143.6	10	0.87	0.42	1.61
CLS	Trilogy	509	2,761.6	15	0.54	0.29	0.87
Femoral Stem Press Fit	Continuum TM	483	1,390.6	16	1.15	0.66	1.87
CLS	RM Pressfit cup	482	2,460.8	16	0.65	0.37	1.06
Corail	Duraloc	464	4,160.8	38	0.91	0.65	1.25
Stemsys	Fixa Ti Por	462	1,016.0	7	0.69	0.25	1.35
CLS	Continuum TM	447	1,236.0	11	0.89	0.44	1.59
Accolade II	Tritanium	381	505.6	3	0.59	0.08	1.58
*#Trabecular Metal Stem	Continuum TM	376	972.1	14	1.44	0.79	2.42
TwinSys uncemented	Delta-PF Cup	370	1,934.3	1	0.05	0.00	0.24

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
CBC Stem	RM Pressfit cup	363	1,631.5	17	1.04	0.61	1.67
ABGII	Trident	342	3,191.1	23	0.72	0.46	1.08
Accolade II	Trident	342	499.3	4	0.80	0.17	1.90
S-Rom	Pinnacle	337	2,678.6	27	1.01	0.66	1.47
Polarstem uncemented	Reflection porous	335	1,200.8	12	1.00	0.49	1.69
CLS	Reflection porous	332	2,117.4	17	0.80	0.47	1.29
Stemsys	DeltaMotion Cup	307	1,219.2	4	0.33	0.07	0.78
Stemsys	Agilis Ti-por	279	455.5	4	0.88	0.24	2.25
Versys	Trilogy	272	3,288.6	15	0.46	0.26	0.75
Stemsys	RM Pressfit cup	211	458.2	2	0.44	0.02	1.40
TwinSys uncemented	Trilogy	209	1,265.9	8	0.63	0.27	1.25
*CLS	Durom	198	1,545.7	45	2.91	2.12	3.90
Corail	Continuum TM	193	405.3	4	0.99	0.27	2.53
CLS	Allofit	192	1,469.2	17	1.16	0.65	1.81
*CBC Stem	Expansys shell	183	1,425.4	19	1.33	0.78	2.04
Accolade	Pinnacle	180	1,137.8	2	0.18	0.02	0.63
Stemsys	Delta-PF Cup	177	219.5	1	0.46	0.01	2.54
Avenir Muller uncemented	Continuum TM	173	634.6	8	1.26	0.49	2.38
CLS	Trident	165	1,477.3	11	0.74	0.35	1.29
*Corail	ASR	156	983.9	74	7.52	5.86	9.39
Corail	Fitmore	155	220.1	4	1.82	0.50	4.65
Accolade	Tritanium	152	644.2	2	0.31	0.04	1.12
Summit	Trilogy	145	885.0	5	0.56	0.18	1.32
Corail	Trilogy	144	478.9	3	0.63	0.13	1.83
Femoral Stem Press Fit	Trilogy	142	859.4	4	0.47	0.13	1.19
Corail	Reflection porous	140	1,001.6	1	0.10	0.00	0.56
*ABGII	Duraloc	139	1,658.0	31	1.87	1.27	2.65
Corail	Tritanium	131	407.6	4	0.98	0.27	2.51
*S-Rom	ASR	130	698.7	93	13.31	10.74	16.31
Omnifit	Trident	126	1,253.0	11	0.88	0.41	1.52
TwinSys uncemented	Continuum TM	123	456.2	3	0.66	0.14	1.92
TwinSys uncemented	RM cup	122	703.7	4	0.57	0.15	1.46
*ABG	Duraloc	116	1,663.1	29	1.74	1.14	2.47
*Synergy Porous	BHR Acetabular Cup	114	813.6	19	2.34	1.41	3.65
*CLS	RM cup	113	939.8	14	1.49	0.78	2.43
*Prodigy	Duraloc	113	1,327.7	19	1.43	0.86	2.23
Echo(TM) Bi-metric	G7 acetabular shell	109	149.7	2	1.34	0.16	4.83
ABGII	Delta-PF Cup	107	1,017.6	10	0.98	0.47	1.81

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
CLS	Weill ring	106	1,354.7	9	0.66	0.30	1.26
Avenir Muller uncemented	RM cup	105	549.9	1	0.18	0.00	1.01
Mallory-Head	M2A	105	993.9	13	1.31	0.70	2.24
Summit	Duraloc	101	969.8	5	0.52	0.17	1.20
Avenir Muller uncemented	Pinnacle	99	526.3	3	0.57	0.08	1.52
Corail	Monoblock Acetabular Cup	95	694.3	4	0.58	0.16	1.48
Femoral Stem Press Fit	Trident	95	202.1	1	0.49	0.01	2.76
H-Max S	Delta-PF Cup	95	124.6	2	1.61	0.19	5.80
*Anthology Porous	BHR Acetabular Cup	91	559.6	24	4.29	2.75	6.38
Avenir Muller uncemented	Tritanium	91	407.1	0	0.00	0.00	0.91
*Summit	ASR	88	595.2	29	4.87	3.26	7.00
Synergy Porous	Delta-PF Cup	88	526.4	0	0.00	0.00	0.70
H-Max M	Delta-TT Cup	86	423.7	2	0.47	0.06	1.71
Corail	RM Pressfit cup	81	157.8	2	1.27	0.15	4.58
CLS	Monoblock Acetabular Cup	80	652.8	4	0.61	0.17	1.57
Corail	Delta-PF Cup	78	681.7	1	0.15	0.00	0.82
S-Rom	Ultima	78	1,044.9	9	0.86	0.39	1.64
Corail	DeltaMotion Cup	76	286.9	0	0.00	0.00	1.29
AML MMA	Duraloc	74	884.0	9	1.02	0.47	1.93
Trabecular Metal Stem	Monoblock Acetabular Cup	74	613.9	3	0.49	0.07	1.30
*ABG	ABGII	72	991.6	14	1.41	0.77	2.37
H-Max M	Delta-PF Cup	71	364.5	6	1.65	0.60	3.58
Corail	Trident	70	258.6	3	1.16	0.24	3.39
Zimmer Femoral Stem Press-Fit	Continuum TM	69	203.0	3	1.48	0.30	4.32
ABGII	Pinnacle	67	474.3	3	0.63	0.13	1.85
CLS	Pinnacle	66	401.0	1	0.25	0.01	1.39
Furlong	Furlong	66	623.0	5	0.80	0.22	1.76
*Anthology Porous	R3 porous	65	383.4	24	6.26	4.01	9.31
Wagner cone stem	Fitmore	65	615.5	3	0.49	0.10	1.42
Zimmer M/L Taper	Continuum TM	64	181.0	0	0.00	0.00	2.04
CLS	Tritanium	63	150.5	2	1.33	0.16	4.80
Tri-Lock BPS	Pinnacle	62	252.8	3	1.19	0.16	3.17
CBC Stem	Fitmore	59	435.8	5	1.15	0.37	2.68
*CLS	Artek	59	631.6	24	3.80	2.43	5.65
Echo(TM) Bi-metric	Exceed ABT Ringloc-X	57	152.1	1	0.66	0.02	3.66

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Femoral Stem Press Fit	Delta-TT Cup	56	139.0	2	1.44	0.17	5.20
AML	Duraloc	53	678.1	3	0.44	0.09	1.29

*Those marked with an * in the above table have revision rates significantly higher than the overall rate of 0.73 /100 ocys @ the 95% confidence interval. There are several other combinations with high revision rates but without statistical significance because of the wide CIs.*

*Those marked with a # as well as an * indicate those combinations used during 2015.*

Hybrid

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Exeter V40	Trident	7,472	40,623.9	177	0.44	0.37	0.50
Spectron	Reflection porous	2,755	22,459.9	175	0.78	0.67	0.90
Exeter V40	Trilogy	2,344	13,534.5	59	0.44	0.33	0.56
Exeter V40	Tritanium	1,798	4,380.0	41	0.94	0.67	1.27
MS 30	Fitmore	1,675	9,358.7	31	0.33	0.22	0.46
*#Exeter V40	Continuum TM	1,660	4,203.8	46	1.09	0.79	1.45
Exeter V40	Pinnacle	1,616	6,407.2	31	0.48	0.33	0.69
Exeter V40	RM Pressfit cup	1,469	5,867.0	16	0.27	0.16	0.44
TwinSys cemented	RM Pressfit cup	1,288	4,654.4	26	0.56	0.36	0.82
Spectron	Duraloc	1,153	12,235.4	147	1.20	1.02	1.41
C-Stem AMT	Pinnacle	1,124	3,224.8	22	0.68	0.43	1.03
Exeter V40	Duraloc	987	8,896.8	81	0.91	0.72	1.13
Exeter	Osteolock	836	9,872.7	64	0.65	0.50	0.83
CPT	Continuum TM	834	1,804.7	19	1.05	0.63	1.64
MS 30	Morscher	787	8,318.5	51	0.61	0.45	0.80
CPT	Trilogy	760	4,741.3	44	0.93	0.67	1.23
Exeter V40	Fitmore	634	2,466.3	5	0.20	0.05	0.44
Exeter V40	Morscher	630	5,882.6	28	0.48	0.31	0.68
*Elite plus	Duraloc	608	6,049.3	97	1.60	1.29	1.95
*Exeter	Duraloc	553	6,950.2	87	1.25	1.00	1.54
Exeter	Morscher	551	7,165.5	31	0.43	0.29	0.61
Lateral straight stem	RM cup	533	4,217.0	36	0.85	0.60	1.18
Exeter V40	Reflection porous	474	2,904.8	9	0.31	0.13	0.57
Spectron	R3 porous	392	1,360.7	5	0.37	0.12	0.86
Exeter V40	R3 porous	371	860.4	5	0.58	0.16	1.27
SL modular stem	RM cup	322	4,044.4	33	0.82	0.56	1.15
Exeter V40	Osteolock	270	2,744.2	13	0.47	0.24	0.79
MS 30	Continuum TM	265	649.7	5	0.77	0.21	1.69
MS 30	Trilogy	256	1,218.9	3	0.25	0.05	0.72
Versys cemented	Trilogy	237	2,298.2	7	0.30	0.12	0.63
Exeter	Trilogy	213	2,559.6	13	0.51	0.27	0.87
CPT	Duraloc	212	2,190.0	13	0.59	0.32	1.02
Spectron	Morscher	210	2,444.4	24	0.98	0.61	1.44

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Lateral straight stem	RM Pressfit cup	168	880.9	3	0.34	0.07	1.00
Exeter V40	Trabecular Metal Shell	166	669.3	8	1.20	0.47	2.36
Friendly	Delta-PF Cup	164	1,230.5	4	0.33	0.09	0.83
CPCS	R3 porous	161	254.8	0	0.00	0.00	1.45
Spectron	Mallory-Head	152	1,487.2	7	0.47	0.17	0.92
TwinSys cemented	RM cup	148	1,123.5	4	0.36	0.10	0.91
CPT	Trident	145	1,267.8	11	0.87	0.43	1.55
Standard straight stem	RM cup	138	1,298.1	10	0.77	0.34	1.37
Standard straight stem	RM Pressfit cup	137	819.4	1	0.12	0.00	0.68
CPT	Fitmore	136	644.5	8	1.24	0.54	2.45
CCA	RM Pressfit cup	134	1,025.0	3	0.29	0.06	0.86
Corail	Ultima	134	1,050.1	3	0.29	0.06	0.83
Exeter V40	Delta-TT Cup	132	271.5	2	0.74	0.09	2.66
Exeter	CLS Expansion	129	1,460.1	10	0.68	0.33	1.26
Exeter V40	Monoblock Acetabular	123	1,301.4	5	0.38	0.12	0.90
C-stem AMT	Pinnacle	121	144.2	2	1.39	0.17	5.01
Accolade	Muller PE cup	114	1,022.5	1	0.10	0.00	0.54
Basis	Reflection porous	105	589.5	1	0.17	0.00	0.95
MS 30	RM Pressfit cup	89	602.3	3	0.50	0.07	1.33
Exeter V40	CLS Expansion	88	870.5	1	0.11	0.00	0.64
CPT	Tritanium	85	378.5	5	1.32	0.43	3.08
CPT	Monoblock Acetabular Cup	84	754.1	7	0.93	0.37	1.91
Exeter	Trident	84	1,070.9	0	0.00	0.00	0.34
Lateral straight stem	Continuum TM	78	266.3	2	0.75	0.09	2.71
Spectron	Fitmore	78	854.3	4	0.47	0.13	1.20
Spectron	Trident	78	744.1	3	0.40	0.08	1.18
TwinSys cemented	Continuum TM	77	134.2	0	0.00	0.00	2.75
*Lateral straight stem	Trilogy	69	421.8	8	1.90	0.82	3.74
Spectron	Biomex acet shell porous	68	879.5	1	0.11	0.00	0.63
TwinSys cemented	Selexys TPS	65	306.5	4	1.30	0.36	3.34
CPT	Pinnacle	64	387.5	2	0.52	0.06	1.86
Friendly	Delta-TT Cup	64	239.9	3	1.25	0.26	3.65
MS 30	Duraloc	55	662.2	6	0.91	0.33	1.97
C-Stem AMT	RM Pressfit cup	54	200.0	1	0.50	0.01	2.79
C-Stem	Duraloc	53	553.8	6	1.08	0.34	2.23

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*Those marked with a # as well as an * indicate those combinations used during 2015.*

Prosthesis Combinations based on Femur in alphabetical order

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
ABG	Duraloc	116	1,663.1	29	1.74	1.14	2.47
ABG	ABGII	72	991.6	14	1.41	0.77	2.37
ABGII	Trident	342	3,191.1	23	0.72	0.46	1.08
ABGII	Duraloc	139	1,658.0	31	1.87	1.27	2.65
ABGII	Delta-PF Cup	107	1,017.6	10	0.98	0.47	1.81
ABGII	Pinnacle	67	474.3	3	0.63	0.13	1.85
Accolade	Trident	1,867	15,840.0	85	0.54	0.43	0.66
Accolade	Pinnacle	180	1,137.8	2	0.18	0.02	0.63
Accolade	Tritanium	152	644.2	2	0.31	0.04	1.12
Accolade	Muller PE cup	114	1,022.5	1	0.10	0.00	0.54
Accolade II	Tritanium	381	505.6	3	0.59	0.08	1.58
Accolade II	Trident	342	499.3	4	0.80	0.17	1.90
AML	Duraloc	53	678.1	3	0.44	0.09	1.29
AML MMA	Duraloc	74	884.0	9	1.02	0.47	1.93
Anthology Porous	BHR Acetabular Cup	93	569.0	25	4.39	2.84	6.49
Anthology Porous	R3 porous	65	383.4	24	6.26	4.01	9.31
Avenir Muller uncemented	Continuum TM	173	634.6	8	1.26	0.49	2.38
Avenir Muller uncemented	RM cup	105	549.9	1	0.18	0.00	1.01
Avenir Muller uncemented	Pinnacle	99	526.3	3	0.57	0.08	1.52
Avenir Muller uncemented	Tritanium	91	407.1	0	0.00	0.00	0.91
Basis	Reflection porous	105	589.5	1	0.17	0.00	0.95
CBC Stem	RM Pressfit cup	363	1,631.5	17	1.04	0.61	1.67
CBC Stem	Expansys shell	183	1,425.4	19	1.33	0.78	2.04
CBC Stem	Fitmore	59	435.8	5	1.15	0.37	2.68
CCA	CCB	745	5,038.1	24	0.48	0.31	0.71
CCA	RM Pressfit cup	134	1,025.0	3	0.29	0.06	0.86
CCA	Contemporary	74	736.3	10	1.36	0.65	2.50
Charnley	Charnley	456	4,731.7	20	0.42	0.26	0.65
Charnley	Charnley Cup Ogee	303	3,400.4	21	0.62	0.37	0.93
CLS	Fitmore	2,154	17,747.7	86	0.48	0.39	0.60
CLS	Morscher	1,682	18,727.3	90	0.48	0.39	0.59
CLS	CLS Expansion	1,263	12,988.2	100	0.77	0.63	0.94
CLS	Duraloc	699	7,761.8	68	0.88	0.68	1.11
CLS	Trilogy	509	2,761.6	15	0.54	0.29	0.87
CLS	RM Pressfit cup	482	2,460.8	16	0.65	0.37	1.06
CLS	Continuum TM	447	1,236.0	11	0.89	0.44	1.59
CLS	Reflection porous	332	2,117.4	17	0.80	0.47	1.29

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
CLS	Durom	198	1,545.7	45	2.91	2.12	3.90
CLS	Allofit	192	1,469.2	17	1.16	0.65	1.81
CLS	Trident	165	1,477.3	11	0.74	0.35	1.29
CLS	RM cup	113	939.8	14	1.49	0.78	2.43
CLS	Weill ring	106	1,354.7	9	0.66	0.30	1.26
CLS	Monoblock Acetabular Cup	80	652.8	4	0.61	0.17	1.57
CLS	Pinnacle	66	401.0	1	0.25	0.01	1.39
CLS	Tritanium	63	150.5	2	1.33	0.16	4.80
CLS	Artek	59	631.6	24	3.80	2.43	5.65
Contemporary	Contemporary	71	824.5	10	1.21	0.54	2.15
Corail	Pinnacle	6,468	25,539.1	180	0.70	0.61	0.82
Corail	Duraloc	464	4,160.8	38	0.91	0.65	1.25
Corail	Continuum TM	193	405.3	4	0.99	0.27	2.53
Corail	ASR	156	983.9	74	7.52	5.86	9.39
Corail	Fitmore	155	220.1	4	1.82	0.50	4.65
Corail	Trilogy	144	478.9	3	0.63	0.13	1.83
Corail	Reflection porous	140	1,001.6	1	0.10	0.00	0.56
Corail	Ultima	135	1,058.8	3	0.28	0.06	0.83
Corail	Tritanium	131	407.6	4	0.98	0.27	2.51
Corail	Monoblock Acetabular Cup	95	694.3	4	0.58	0.16	1.48
Corail	RM Pressfit cup	81	157.8	2	1.27	0.15	4.58
Corail	Delta-PF Cup	78	681.7	1	0.15	0.00	0.82
Corail	DeltaMotion Cup	76	286.9	0	0.00	0.00	1.29
Corail	Trident	70	258.6	3	1.16	0.24	3.39
CPCS	R3 porous	161	254.8	0	0.00	0.00	1.45
CPT	Continuum TM	834	1,804.7	19	1.05	0.63	1.64
CPT	Trilogy	760	4,741.3	44	0.93	0.67	1.23
CPT	ZCA	540	4,809.5	27	0.56	0.36	0.80
CPT	Duraloc	212	2,190.0	13	0.59	0.32	1.02
CPT	Trident	145	1,267.8	11	0.87	0.43	1.55
CPT	Fitmore	136	644.5	8	1.24	0.54	2.45
CPT	Tritanium	85	378.5	5	1.32	0.43	3.08
CPT	Monoblock Acetabular Cup	84	754.1	7	0.93	0.37	1.91
CPT	ZCA all-poly cup	81	246.5	1	0.41	0.01	2.26
CPT	Pinnacle	64	387.5	2	0.52	0.06	1.86
C-Stem	Elite Plus Ogee	55	489.4	2	0.41	0.05	1.48
C-Stem	Duraloc	53	553.8	6	1.08	0.34	2.23
C-Stem	Marathon cemented	50	121.5	0	0.00	0.00	3.04

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
C-Stem AMT	Pinnacle	1,245	3,369.1	24	0.71	0.46	1.06
C-Stem AMT	Marathon cemented	268	1,071.1	6	0.56	0.21	1.22
C-Stem AMT	RM Pressfit cup	54	200.0	1	0.50	0.01	2.79
Echo(TM) Bi-metric	G7 acetabular shell	109	149.7	2	1.34	0.16	4.83
Echo(TM) Bi-metric	Exceed ABT Ringloc-X	57	152.1	1	0.66	0.02	3.66
Elite plus	Duraloc	608	6,049.3	97	1.60	1.29	1.95
Elite plus	Charnley	298	3,331.8	21	0.63	0.38	0.95
Elite plus	Elite Plus LPW	282	2,720.0	12	0.44	0.23	0.77
Elite plus	Elite Plus Ogee	110	987.7	5	0.51	0.16	1.18
Exeter	Contemporary	1,551	16,869.0	166	0.98	0.84	1.14
Exeter	Exeter	1,326	13,856.2	96	0.69	0.56	0.85
Exeter	Osteolock	836	9,872.7	64	0.65	0.50	0.83
Exeter	Duraloc	553	6,950.2	87	1.25	1.00	1.54
Exeter	Morscher	551	7,165.5	31	0.43	0.29	0.61
Exeter	Trilogy	213	2,559.6	13	0.51	0.27	0.87
Exeter	CLS Expansion	129	1,460.1	10	0.68	0.33	1.26
Exeter	Muller PE cup	119	1,336.5	6	0.45	0.16	0.98
Exeter	Bio-clad poly	113	1,178.4	6	0.51	0.16	1.05
Exeter	Trident	84	1,070.9	0	0.00	0.00	0.34
Exeter V40	Trident	7,472	40,623.9	177	0.44	0.37	0.50
Exeter V40	Contemporary	5,944	37,957.8	169	0.45	0.38	0.52
Exeter V40	Trilogy	2,344	13,534.5	59	0.44	0.33	0.56
Exeter V40	Tritanium	1,798	4,380.0	41	0.94	0.67	1.27
Exeter V40	Continuum TM	1,660	4,203.8	46	1.09	0.79	1.45
Exeter V40	Exeter	1,636	12,892.3	62	0.48	0.37	0.62
Exeter V40	Pinnacle	1,616	6,407.2	31	0.48	0.33	0.69
Exeter V40	RM Pressfit cup	1,469	5,867.0	16	0.27	0.16	0.44
Exeter V40	Exeter X3	1,297	2,823.7	12	0.42	0.21	0.72
Exeter V40	Duraloc	987	8,896.8	81	0.91	0.72	1.13
Exeter V40	Reflection cemented	800	3,706.0	13	0.35	0.19	0.60
Exeter V40	Fitmore	634	2,466.3	5	0.20	0.05	0.44
Exeter V40	Morscher	630	5,882.6	28	0.48	0.31	0.68
Exeter V40	Reflection porous	474	2,904.8	9	0.31	0.13	0.57
Exeter V40	CCB	432	1,821.9	7	0.38	0.15	0.79
Exeter V40	R3 porous	371	860.4	5	0.58	0.16	1.27
Exeter V40	Osteolock	270	2,744.2	13	0.47	0.24	0.79
Exeter V40	Trabecular Metal Shell	166	669.3	8	1.20	0.47	2.36
Exeter V40	Bio-clad poly	133	723.0	2	0.28	0.03	1.00

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Exeter V40	Delta-TT Cup	132	271.5	2	0.74	0.09	2.66
Exeter V40	Monoblock Acetabular Cup	123	1,301.4	5	0.38	0.12	0.90
Exeter V40	Muller PE cup	94	772.9	3	0.39	0.08	1.13
Exeter V40	CLS Expansion	88	870.5	1	0.11	0.00	0.64
Exeter V40	ZCA all-poly cup	88	194.9	0	0.00	0.00	1.89
Exeter V40	ZCA	82	426.2	1	0.23	0.01	1.31
Exeter V40	Weber	53	479.5	0	0.00	0.00	0.77
Femoral Stem Press Fit	Continuum TM	483	1,390.6	16	1.15	0.66	1.87
Femoral Stem Press Fit	Trilogy	142	859.4	4	0.47	0.13	1.19
Femoral Stem Press Fit	Trident	95	202.1	1	0.49	0.01	2.76
Femoral Stem Press Fit	Delta-TT Cup	56	139.0	2	1.44	0.17	5.20
Friendly	Delta-PF Cup	164	1,230.5	4	0.33	0.09	0.83
Friendly	Delta-TT Cup	64	239.9	3	1.25	0.26	3.65
Furlong	Furlong	66	623.0	5	0.80	0.22	1.76
H-Max M	Delta-TT Cup	86	423.7	2	0.47	0.06	1.71
H-Max M	Delta-PF Cup	71	364.5	6	1.65	0.60	3.58
H-Max S	Delta-TT Cup	537	1,143.6	10	0.87	0.42	1.61
H-Max S	Delta-PF Cup	95	124.6	2	1.61	0.19	5.80
**Lateral straight stem	Muller PE cup	749	6,451.6	35	0.54	0.37	0.75
Lateral straight stem	RM cup	533	4,217.0	36	0.85	0.60	1.18
Lateral straight stem	Weber	287	2,501.7	9	0.36	0.16	0.68
Lateral straight stem	RM Pressfit cup	168	880.9	3	0.34	0.07	1.00
Lateral straight stem	ZCA	98	553.5	1	0.18	0.00	1.01
Lateral straight stem	Continuum TM	78	266.3	2	0.75	0.09	2.71
Lateral straight stem	ZCA all-poly cup	70	241.7	0	0.00	0.00	1.53
Lateral straight stem	Trilogy	69	421.8	8	1.90	0.82	3.74
Mallory-Head	M2A	105	993.9	13	1.31	0.70	2.24
MS 30	Fitmore	1,675	9,358.7	31	0.33	0.22	0.46
MS 30	Morscher	787	8,318.5	51	0.61	0.45	0.80
MS 30	Muller PE cup	462	4,045.3	15	0.37	0.21	0.61
MS 30	Continuum TM	265	649.7	5	0.77	0.21	1.69
MS 30	Trilogy	256	1,218.9	3	0.25	0.05	0.72
MS 30	Contemporary	128	1,083.3	7	0.65	0.26	1.33
MS 30	ZCA all-poly cup	94	272.3	0	0.00	0.00	1.35
MS 30	RM Pressfit cup	89	602.3	3	0.50	0.07	1.33
MS 30	Duraloc	55	662.2	6	0.91	0.33	1.97
Omnifit	Trident	149	1,472.0	12	0.82	0.42	1.42
Polarstem uncemented	R3 porous	740	1,296.9	10	0.77	0.37	1.42
Polarstem uncemented	Reflection porous	335	1,200.8	12	1.00	0.49	1.69

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Prodigy	Duraloc	113	1,327.7	19	1.43	0.86	2.23
SL modular stem	RM cup	322	4,044.4	33	0.82	0.56	1.15
SL modular stem	Muller PE cup	83	997.4	2	0.20	0.02	0.72
SL monoblock	Muller PE cup	488	4,969.9	19	0.38	0.22	0.58
Spectron	Reflection cemented	2,946	26,759.2	281	1.05	0.93	1.18
Spectron	Reflection porous	2,755	22,459.9	175	0.78	0.67	0.90
Spectron	Duraloc	1,153	12,235.4	147	1.20	1.02	1.41
Spectron	R3 porous	392	1,360.7	5	0.37	0.12	0.86
Spectron	Morscher	210	2,444.4	24	0.98	0.61	1.44
Spectron	Mallory-Head	152	1,487.2	7	0.47	0.17	0.92
Spectron	Fitmore	78	854.3	4	0.47	0.13	1.20
Spectron	Trident	78	744.1	3	0.40	0.08	1.18
Spectron	Biomex acet shell porous	68	879.5	1	0.11	0.00	0.63
Spectron	Muller PE cup	66	610.8	7	1.15	0.41	2.25
S-Rom	Pinnacle	337	2,678.6	27	1.01	0.66	1.47
S-Rom	ASR	130	698.7	93	13.31	10.74	16.31
S-Rom	Ultima	78	1,044.9	9	0.86	0.39	1.64
Standard straight stem	Muller PE cup	628	5,050.4	16	0.32	0.17	0.50
Standard straight stem	RM cup	138	1,298.1	10	0.77	0.34	1.37
Standard straight stem	RM Pressfit cup	137	819.4	1	0.12	0.00	0.68
Standard straight stem	Weber	134	1,145.9	3	0.26	0.05	0.77
Standard straight stem	ZCA all-poly cup	50	170.6	1	0.59	0.00	3.27
Stemsys	Fixa Ti Por	462	1,016.0	7	0.69	0.25	1.35
Stemsys	DeltaMotion Cup	307	1,219.2	4	0.33	0.07	0.78
Stemsys	Agilis Ti-por	279	455.5	4	0.88	0.24	2.25
Stemsys	RM Pressfit cup	211	458.2	2	0.44	0.02	1.40
Stemsys	Delta-PF Cup	177	219.5	1	0.46	0.01	2.54
Summit	Pinnacle	1,667	8,033.7	72	0.90	0.70	1.13
Summit	Trilogy	145	885.0	5	0.56	0.18	1.32
Summit	Duraloc	101	969.8	5	0.52	0.17	1.20
Summit	ASR	88	595.2	29	4.87	3.26	7.00
Synergy Porous	R3 porous	1,281	3,554.4	41	1.15	0.82	1.55
Synergy Porous	Reflection porous	1,178	8,628.9	36	0.42	0.29	0.57
Synergy Porous	BHR Acetabular Cup	114	813.6	19	2.34	1.41	3.65
Synergy Porous	Delta-PF Cup	88	526.4	0	0.00	0.00	0.70
Trabecular Metal Stem	Continuum TM	376	972.1	14	1.44	0.79	2.42

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Trabecular Metal Stem	Monoblock Acetabular Cup	74	613.9	3	0.49	0.07	1.30
Tri-Lock BPS	Pinnacle	62	252.8	3	1.19	0.16	3.17
TwinSys cemented	RM Pressfit cup	1,288	4,654.4	26	0.56	0.36	0.82
TwinSys cemented	CCB	385	1,545.7	8	0.52	0.20	0.98
TwinSys cemented	RM cup	148	1,123.5	4	0.36	0.10	0.91
TwinSys cemented	Continuum TM	77	134.2	0	0.00	0.00	2.75
TwinSys cemented	Selexys TPS	65	306.5	4	1.30	0.36	3.34
TwinSys uncemented	RM Pressfit cup	4,064	18,430.5	118	0.64	0.53	0.77
TwinSys uncemented	Selexys TPS	1,231	7,259.5	90	1.24	0.99	1.52
TwinSys uncemented	Delta-PF Cup	370	1,934.3	1	0.05	0.00	0.24
TwinSys uncemented	Trilogy	209	1,265.9	8	0.63	0.27	1.25
TwinSys uncemented	Continuum TM	123	456.2	3	0.66	0.14	1.92
TwinSys uncemented	RM cup	122	703.7	4	0.57	0.15	1.46
Versys	Trilogy	272	3,288.6	15	0.46	0.26	0.75
Versys cemented	ZCA	391	3,630.0	24	0.66	0.41	0.97
Versys cemented	Trilogy	237	2,298.2	7	0.30	0.12	0.63
Wagner cone stem	Fitmore	65	615.5	3	0.49	0.10	1.42
Zimmer Femoral Stem Press-Fit	Continuum TM	69	203.0	3	1.48	0.30	4.32
Zimmer M/L Taper	Continuum TM	65	181.6	0	0.00	0.00	2.03

*** The Muller femoral component has been relabelled the Lateral Straight Stem*

Revision rates for combinations with components manufactured from different companies (component mismatches)
(Minimum of 500 implantations)

Femur Prosthesis	Acetabular Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Exeter V40	Trilogy	2,344	13,534.5	59	0.44	0.33	0.56
Exeter V40	Continuum TM	1,660	4,203.8	46	1.09	0.79	1.45
Exeter V40	Pinnacle	1,616	6,407.2	31	0.48	0.33	0.69
Exeter V40	RM Pressfit cup	1,469	5,867.0	16	0.27	0.16	0.44
Spectron	Duraloc	1,153	12,235.4	147	1.20	1.02	1.41
CLS	Duraloc	699	7,761.8	68	0.88	0.68	1.11
Exeter V40	Fitmore	634	2,466.3	5	0.20	0.05	0.44
Exeter V40	Morscher	630	5,882.6	28	0.48	0.31	0.68
Exeter	Duraloc	553	6,950.2	87	1.25	1.00	1.54
Lateral straight stem	RM cup	533	4,217.0	36	0.85	0.60	1.18

The Exeter V40 - Continuum TM, Spectron - Duraloc and the Exeter - Duraloc combinations have significantly higher revision rates than the overall rate of 0.73 /100 ocys @ the 95% confidence interval.

Revision vs Bearing Surface Articulations vs Head size 28mm, 32mm, 36mm & >36mm

Size	Surfaces	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
<=28	CC	733	6,051.5	45	0.74	0.54	1.00
<=28	CM	23	101.3	2	1.97	0.11	6.34
<=28	CP	10,601	84,054.8	581	0.69	0.64	0.75
<=28	MM	2,855	32,439.4	232	0.72	0.62	0.81
<=28	MP	44,272	355,802.7	2,499	0.70	0.67	0.73
32	CC	3,308	20,685.0	120	0.58	0.48	0.69
32	CP	7,366	24,419.3	131	0.54	0.45	0.64
32	MM	481	3,606.3	35	0.97	0.66	1.33
32	MP	20,475	74,067.0	464	0.63	0.57	0.69
36	CC	5,856	27,731.3	169	0.61	0.52	0.71
36	CM	443	2,458.7	19	0.77	0.47	1.21
36	CP	3,266	9,777.6	57	0.58	0.44	0.76
36	MM	1,002	7,979.0	101	1.27	1.03	1.53
36	MP	2,433	7,341.8	54	0.74	0.55	0.96
>36	CC	1,337	4,119.8	21	0.51	0.32	0.78
>36	CM	7	41.5	0	0.00	0.00	8.88
>36	CP	4	8.2	0	0.00	0.00	45.26
>36	MM	1,649	11,668.1	429	3.68	3.34	4.04
>36	MP	34	143.2	1	0.70	0.00	3.89

Summary Revision Rates vs Head Size

Size	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
<=28	58,484	478,449.6	3,359	0.70	0.68	0.73
32	31,630	122,777.6	750	0.61	0.57	0.66
36	13,000	55,288.3	400	0.72	0.65	0.80
>36	3,031	15,980.8	451	2.82	2.56	3.09

Head size > 36mm has a significantly higher revision rate compared to the other 3 sizes and the 36mm head size has a significantly higher revision rate than 32mm head size. As can be seen, this is unduly influenced by the MM articulation.

Revision Comparison Standard vs Cross linked Polyethylene

Surfaces	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
CC	11,235	58,591.1	355	0.61	0.54	0.67
CM	474	2,601.6	21	0.81	0.50	1.23
CP	21,242	118,266.3	769	0.65	0.61	0.70
PS	6,833	65,690.0	486	0.74	0.68	0.81
PX	14,382	52,521.9	283	0.54	0.48	0.61
MM	5,989	55,702.6	797	1.43	1.33	1.53
MP	67,226	437,443.2	3,018	0.69	0.67	0.71
PS	35,647	295,137.1	2,143	0.73	0.70	0.76
PX	31,579	142,306.0	875	0.61	0.57	0.66

PS = standard polyethylene PX = cross linked polyethylene

CP (PX) has a significantly lower revision rate compared to the PS combination and the MP (PS).

Revision vs Bearing Surfaces of Uncemented Prostheses

Surfaces	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
CC	8,855	46,837.9	299	0.64	0.57	0.71
CM	467	2,592.1	20	0.77	0.47	1.19
CP	13,886	71,941.6	472	0.66	0.60	0.72
MM	5,382	49,703.0	728	1.46	1.36	1.58
MP	12,910	70,711.3	581	0.82	0.76	0.89

The MM articulation has a significantly higher revision rate than all the others. CC and CP have significantly lower revision rates than MP.

Revision vs Bearing Surfaces of Fully Cemented Prostheses

Surfaces	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
CP	641	4,565.2	34	0.74	0.52	1.04
MM	7	50.7	2	3.95	0.48	14.26
MP	23,027	171,629.7	1,078	0.63	0.59	0.67

There is no significant difference between CP and MP bearing surfaces.

Revision vs Bearing Surfaces of Hybrid Prostheses

Surfaces	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
CC	2,380	11,753.3	56	0.48	0.36	0.61
CM	7	9.4	1	10.60	0.27	59.06
CP	6,715	41,759.5	263	0.63	0.56	0.71
MM	600	5,949.0	67	1.13	0.87	1.42
MP	31,289	195,102.2	1,359	0.70	0.66	0.73

The CC has a significantly lower revision rate than the MP and MM bearing surfaces.

Summary for Revision vs Bearing Surfaces

Surfaces	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
CC	11,235	58,591.1	355	0.61	0.54	0.67
CM	474	2,601.6	21	0.81	0.50	1.23
CP	21,242	118,266.3	769	0.65	0.60	0.70
MM	5,989	55,702.6	797	1.43	1.33	1.53
MP	67,226	437,443.2	3,018	0.69	0.67	0.71

The MM articulation has a significantly higher revision rate than CC, CP and MP. CC has a significantly lower revision rate than MP.

Revision vs Prosthesis vs Bearing Surfaces

		No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
RM Pressfit cup	M	333	2,416.9	17	0.70	0.41	1.13
	P	8,457	35,610.3	197	0.55	0.48	0.64
	PS	5,479	28,297.8	159	0.56	0.48	0.66
	PX	2,978	7,312.6	38	0.52	0.37	0.71
Pinnacle	C	2,538	11,098.7	62	0.56	0.43	0.72
	M	1,524	11,344.4	131	1.15	0.97	1.37
	P	7,968	27,642.4	169	0.61	0.52	0.71
R3 porous	C	759	2,458.9	8	0.33	0.14	0.64
	M	110	640.1	39	6.09	4.33	8.33
	P	2,217	4,905.8	37	0.75	0.53	1.04
Trident	C	2,366	17,997.2	90	0.50	0.40	0.61
	M	24	31.7	1	3.15	0.08	17.57
	P	8,600	49,638.2	258	0.52	0.46	0.59
Tritanium	C	72	273.6	1	0.37	0.01	2.04
	M	50	97.0	1	1.03	0.03	5.75
	P	2,707	6,945.6	61	0.88	0.67	1.13
Trilogy	C	69	707.3	5	0.71	0.23	1.65
	M	5	47.1	0	0.00	0.00	7.84
	P	5,411	34,840.9	200	0.57	0.50	0.66

C ceramic, M metal, P polyethylene, PS standard polyethylene, PX crosslinked polyethylene. (There were relatively too few PS in the 5 other groups to split PS from PX).

The metal bearing surfaces have a significantly higher revision rate for the Pinnacle and R3 porous and although higher for RM pressfit, Trident and Tritanium do not reach statistical significance due to their relatively small numbers.

Revision vs Monoblock Femoral Stems

No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
1,297	13,577.8	64	0.47	0.36	0.60

Revision vs Acetabulum types

Acetabulum type	No. Ops.	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Uncemented No Liner	17,128	114,097.2	986	0.86	0.81	0.92
Cemented	24,157	179,402.0	1,139	0.63	0.60	0.67
Uncemented Liner	64,881	379,105.7	2,835	0.75	0.72	0.78

The fully cemented acetabulum has a significantly lower revision rate than the other two types.

Revision vs Age Bands

Age Bands	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
<10	1,293	9,387.2	95	1.01	0.82	1.24
10_25	11,720	75,620.2	610	0.81	0.74	0.87
25_50	46,364	296,694.2	2,309	0.78	0.75	0.81
50_75	26,645	165,187.0	1,014	0.61	0.58	0.65
75_100	11,454	65,901.3	445	0.68	0.61	0.74
>100	11,137	83,089.3	619	0.74	0.69	0.81

Each age band has a significantly lower revision rate than the preceding one.

Revision vs Age Bands vs Bearing Surfaces

Bearing Surface	Age Bands	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
CC	<55	4,328	22,830.5	159	0.70	0.59	0.81
	55_64	4,574	24,622.4	125	0.51	0.42	0.60
	65_74	2,124	10,319.7	66	0.64	0.49	0.81
	>75	209	818.3	5	0.61	0.20	1.43
CM	<55	180	991.6	8	0.81	0.35	1.59
	55_64	211	1,165.3	10	0.86	0.41	1.58
	65_74	72	399.9	3	0.75	0.15	2.19
	>75	11	44.6	0	0.00	0.00	8.26
CP	<55	4,120	26,025.0	217	0.83	0.72	0.95
	55_64	7,515	43,255.6	289	0.67	0.59	0.75
	65_74	6,972	37,126.9	199	0.54	0.46	0.62
	>75	2,635	11,858.6	64	0.54	0.42	0.69
MM	<55	2,884	28,661.0	384	1.34	1.21	1.48
	55_64	2,373	21,482.0	339	1.58	1.41	1.76
	65_74	657	5,229.3	68	1.30	1.01	1.65
	>75	75	330.2	6	1.82	0.67	3.96
MP	<55	4,308	33,584.0	425	1.27	1.15	1.39
	55_64	12,031	90,723.3	828	0.91	0.85	0.98
	65_74	25,620	173,292.2	1,127	0.65	0.61	0.69
	>75	25,267	139,843.4	638	0.46	0.42	0.49

Overall the CP and CC are performing the best and the MM the worst of the bearing surfaces over all the age groups. This is further illustrated in the KM curve for uncemented components.

Revision vs Gender

Gender	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
F	57,879	370,430.0	2,427	0.66	0.63	0.68
M	50,734	325,449.2	2,665	0.82	0.79	0.85

Males have a significantly higher revision rate than females.

Revision vs Surgeon Annual Workload

Operations per Year	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
<10	1,293	9,387.2	95	1.01	0.82	1.24
10_25	11,720	75,620.2	610	0.81	0.74	0.87
26_50	46,364	296,694.2	2,309	0.78	0.75	0.81
51_75	26,645	165,187.0	1,014	0.61	0.58	0.65
75_100	11,454	65,901.3	445	0.68	0.61	0.74
>100	11,137	83,089.3	619	0.74	0.69	0.81

Those surgeons performing 51-75 arthroplasties a year have a significantly lower revision rate than those in the three lower and the highest categories.

Revision vs Approach

Approach	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Anterior	3,899	30,750.2	239	0.78	0.68	0.88
Posterior	69,567	435,025.3	3,238	0.74	0.72	0.77
Lateral	28,234	188,438.0	1,261	0.67	0.63	0.71
Troch	128	801.6	13	1.62	0.82	2.69

The posterior approach has a significantly higher revision rate than the lateral approach.

Revision vs Arthroplasty Fixation

Fixation	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Cemented	25,150	191,154.7	1,191	0.62	0.59	0.66
Uncemented	41,922	245,039.5	2,121	0.87	0.83	0.90
Hybrid	41,541	259,685.0	1,780	0.69	0.65	0.72

Uncemented hips have a significantly higher revision rate than either fully cemented or hybrid hips.

Revision for Dislocation vs Approach

Fixation	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Anterior	3899	30750.2	41	0.13	0.09	0.18
Posterior	69567	435025.3	894	0.21	0.19	0.22
Lateral	28234	188438.0	174	0.09	0.08	0.11
Troch	128	801.6	2	0.25	0.03	0.90

The posterior approach has a significantly higher revision rate for dislocation than the lateral and anterior approaches.

Revision by Arthroplasty Fixation vs Age Bands

Age Bands	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
<55						
Cemented	695	6,366.1	118	1.85	1.53	2.22
Uncemented	11,838	79,635.8	764	0.96	0.89	1.03
Hybrid	3,530	28,754.2	337	1.17	1.05	1.30
55_64						
Cemented	2,462	23,245.5	258	1.11	0.98	1.25
Uncemented	15,206	92,768.8	831	0.90	0.84	0.96
Hybrid	9,485	69,954.1	532	0.76	0.70	0.83
65_74						
Cemented	8,820	76,374.8	499	0.65	0.60	0.71
Uncemented	10,832	55,569.6	391	0.70	0.63	0.78
Hybrid	16,706	103,640.9	620	0.60	0.55	0.65
>75						
Cemented	13,173	85,168.3	316	0.37	0.33	0.41
Uncemented	4,046	17,065.3	135	0.79	0.66	0.93
Hybrid	11,820	57,335.8	291	0.51	0.45	0.57

For the <55 age band, uncemented hips have a significantly lower revision rate than both hybrid and cemented hips and hybrid a significantly lower revision rate than cemented.

For the 55-64 age band, hybrid hips have a significantly lower revision rate than cemented and uncemented hips and uncemented hips have a significantly lower revision rate than cemented.

For the 65-74 age band there is no significant difference in the revision rates among the 3 groups

For the >74 age band, cemented hips have a significantly lower revision rate than uncemented and hybrid hips and the latter has a significantly lower revision rate than uncemented hips.

Revision vs ASA Status

ASA Class	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
1	12,454	61,429.1	495	0.81	0.74	0.88
2	44,493	204,171.4	1,409	0.69	0.65	0.73
3	17,393	71,720.5	482	0.67	0.61	0.73
4	642	1,986.8	20	1.01	0.61	1.55

ASA 1 has a significantly higher revision rate than ASA 2 and 3.

Revision vs BMI Status

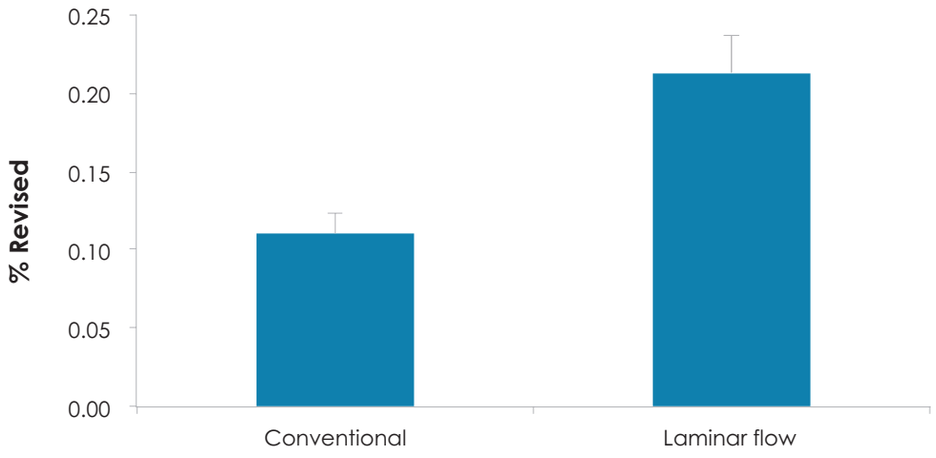
BMI	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
< 19	230	545.0	2	0.37	0.04	1.33
19 - 24	6,196	15,095.0	106	0.70	0.57	0.85
25 - 29	10,895	26,888.4	164	0.61	0.52	0.71
30 - 39	9,727	23,413.9	171	0.73	0.62	0.85
40+	1,218	2,820.1	38	1.35	0.94	1.83

The 40+ group has a significantly higher revision rate than all the others except for <19.

Revision for Deep Infection within 6 months vs Theatre Environment

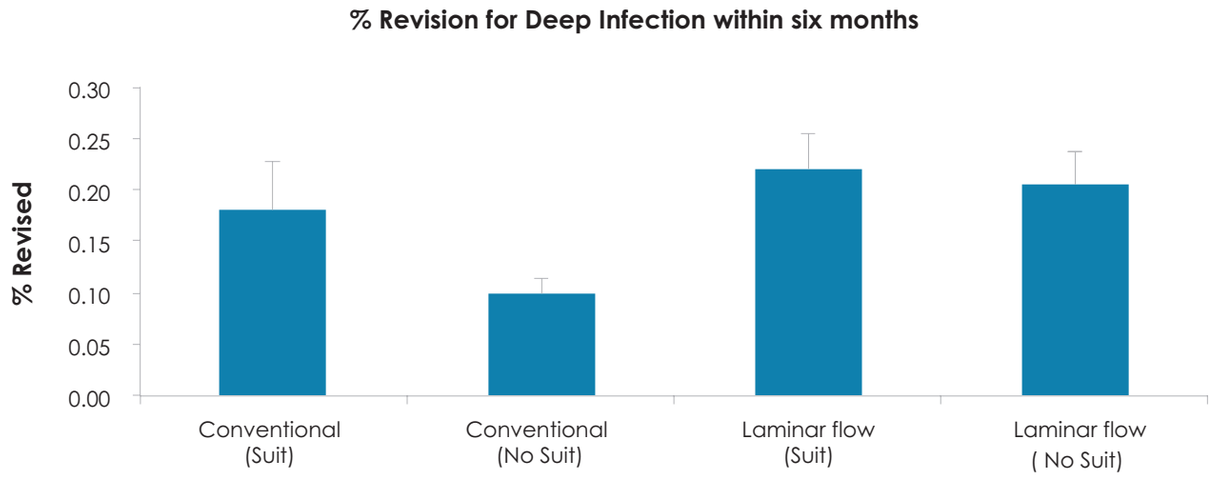
Theatre	Total Number	Number revised	%	Std Error
Conventional	62,652	69	0.110	0.0132
Laminar flow	38,936	83	0.213	0.0234

% Revision for Deep Infection within six months



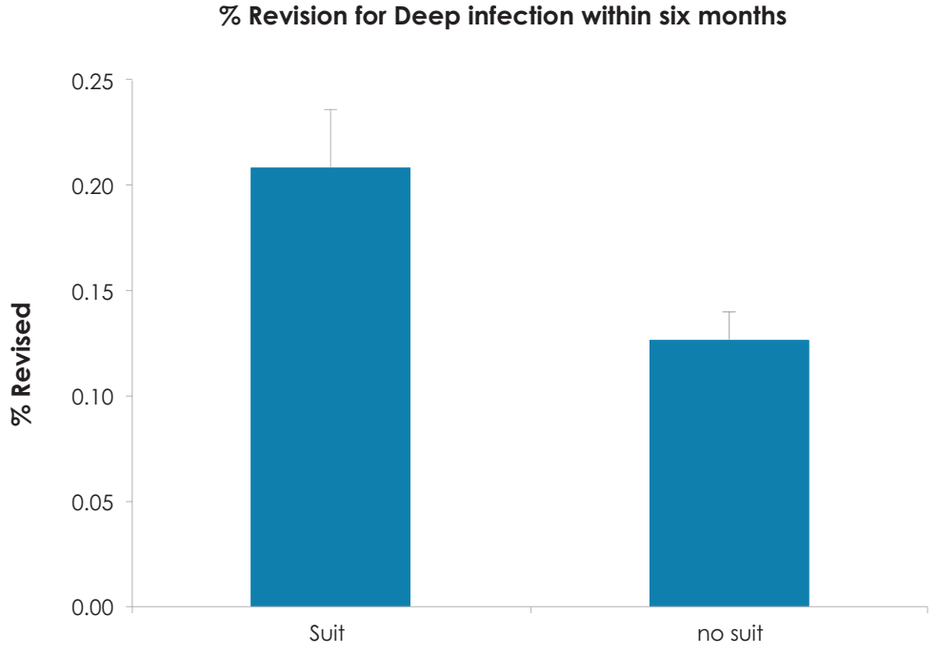
There is a significant difference in revision rates (x2) for deep infection within six months of surgery between conventional and laminar flow theatres.

		Total Number	Number revised	%	Std Error
Conventional	Suit	8,326	15	0.180	0.047
	No suit	54,326	54	0.099	0.014
Laminar flow	Suit	19,966	44	0.220	0.033
	No suit	18,970	39	0.206	0.033



There is a significant difference in revision rates (2.4x) for laminar flow/suit compared to conventional/no suit environments.

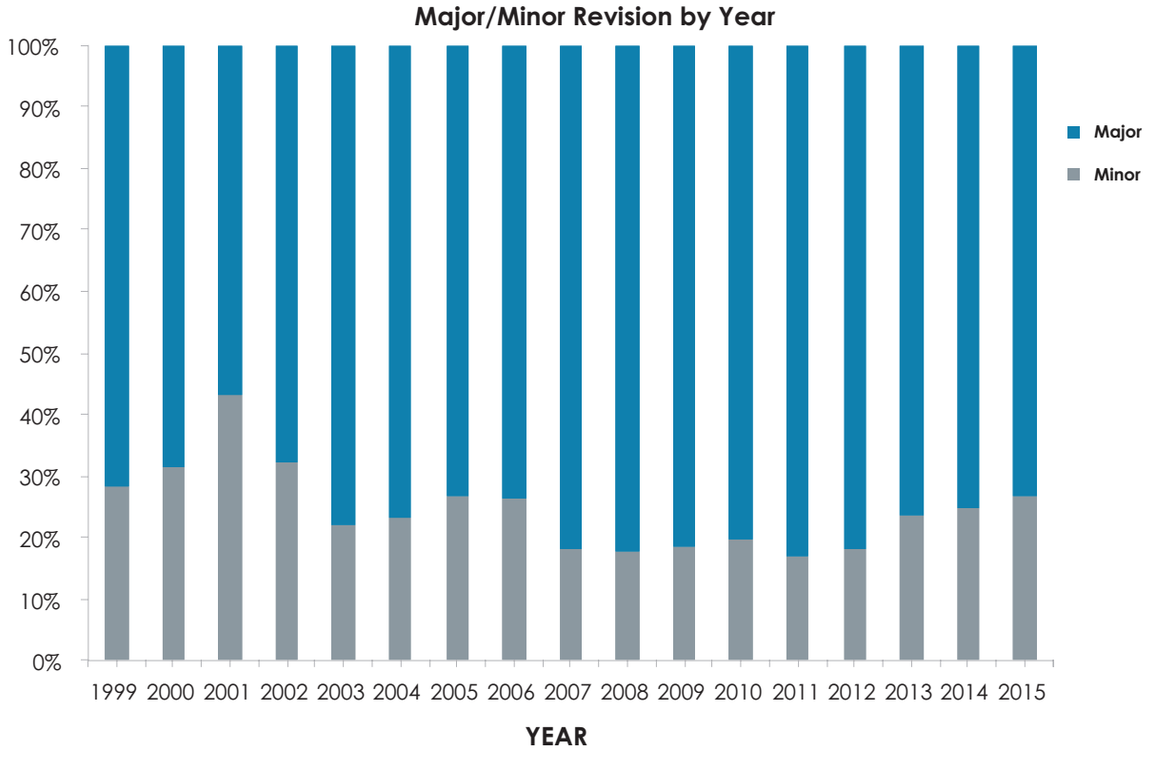
	Total Number	Number revised	%	Std Error
Suit	28,292	59	0.208	0.027
no suit	73,296	93	0.127	0.013



Furthermore, there is a significant increase in revision rates (2.1 x) when suits are used in either conventional or laminar flow theatres.

From the above data it would appear that the use of space suits in either theatre environment significantly increases the risk of deep infection within the first six months following hip arthroplasty and that there is no advantage to using laminar flow theatres for primary hip arthroplasty.

Comparison of Major vs Minor Revisions by Year



A major revision is defined as revision of acetabulum and/or femur including any of minor components and minor revision as change of head and/or liner only.

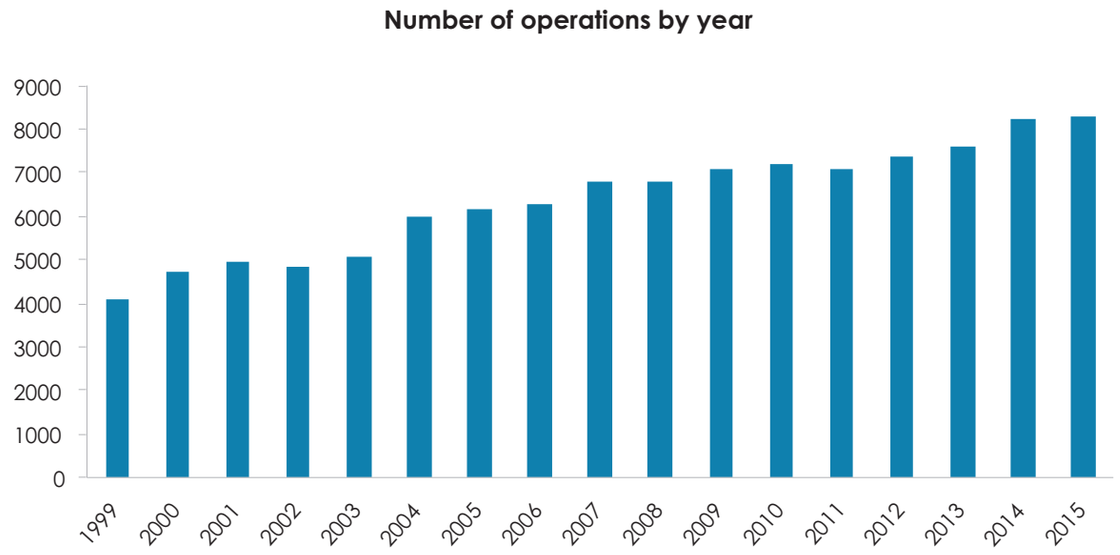
Re Revisions for Major vs Minor Revisions

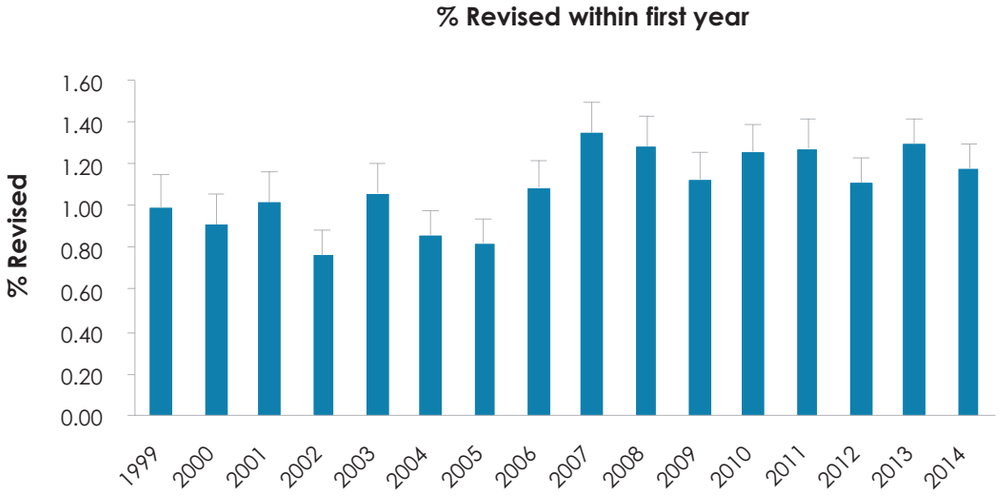
	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Minor	1,125	4,620.4	187	4.05	3.49	4.67
Major	3,930	16,122.5	499	3.10	2.83	3.38

There is a significantly higher re-revision rate for minor compared to major revisions.

Percentage of hips revised in the first year

The following two bar graphs show that the percentage of hips revised in the first year after primary arthroplasty in 2014 dropped slightly to 1.2% from 1.3% in 2013.





Resurfacing Arthroplasty
All Patients

No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
1,595	9,515.0	119	1.25	1.04	1.50

There is a significantly higher revision rate compared to conventional hip arthroplasty (0.73/100 comp yrs.).

Resurfacing Prosthesis vs Revision Rate

Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Adept	4	31.1	0	0	0	11.86
ASR	132	1,085.4	33	3.04	2.09	4.27
BHR	1,412	8,134.1	81	1.00	0.79	1.24
BMHR	28	137.3	1	0.73	0.02	4.06
Conserve Superfinish	3	19.6	0	0	0	18.83
Durom	4	46.3	0	0	0	7.97
Mitch TRH Resurfacing Head	12	61.2	4	6.54	1.78	16.73

The Mitch TRH and ASR have very significantly higher revision rates but none have been implanted since 2010.

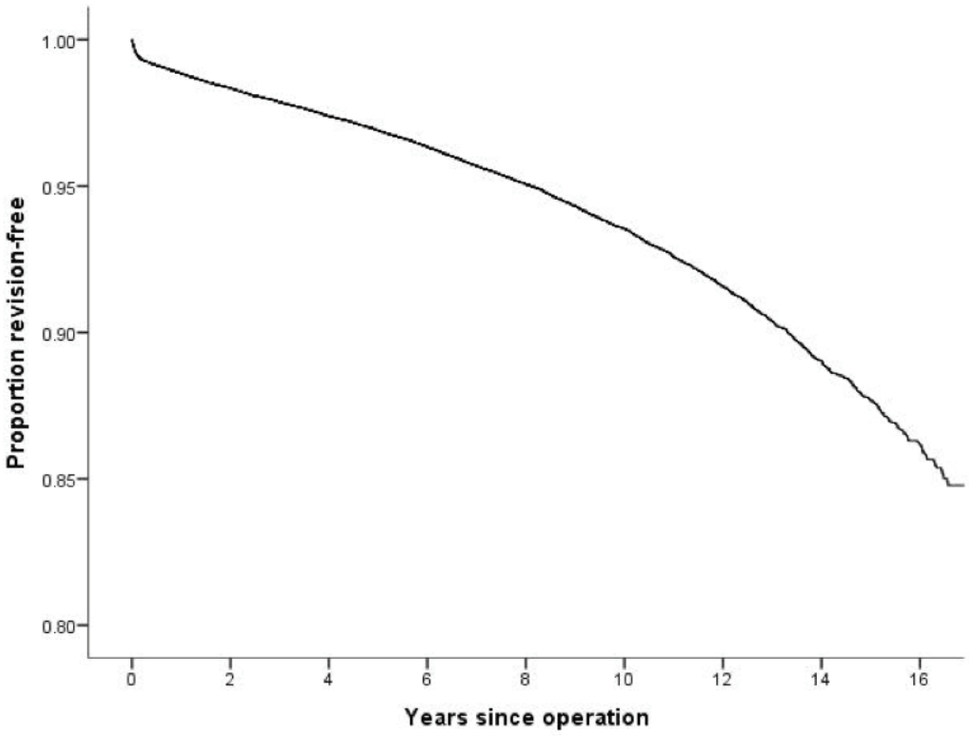
Head size vs Revision Rate

Hips resurfacing head size	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
<=44	99	629.8	29	4.60	3.02	6.52
45-49	330	2,145.7	37	1.72	1.19	2.35
50-54	1,080	6,096.8	45	0.74	0.54	0.99
>=55	86	642.7	8	1.24	0.54	2.45
ALL	1,595	9,515.0	119	1.25	1.04	1.50

The <=44 mm head has a significantly higher revision rate than the 45-49mm head size, which in turn has a significantly higher revision rate than the 50-54mm head size.

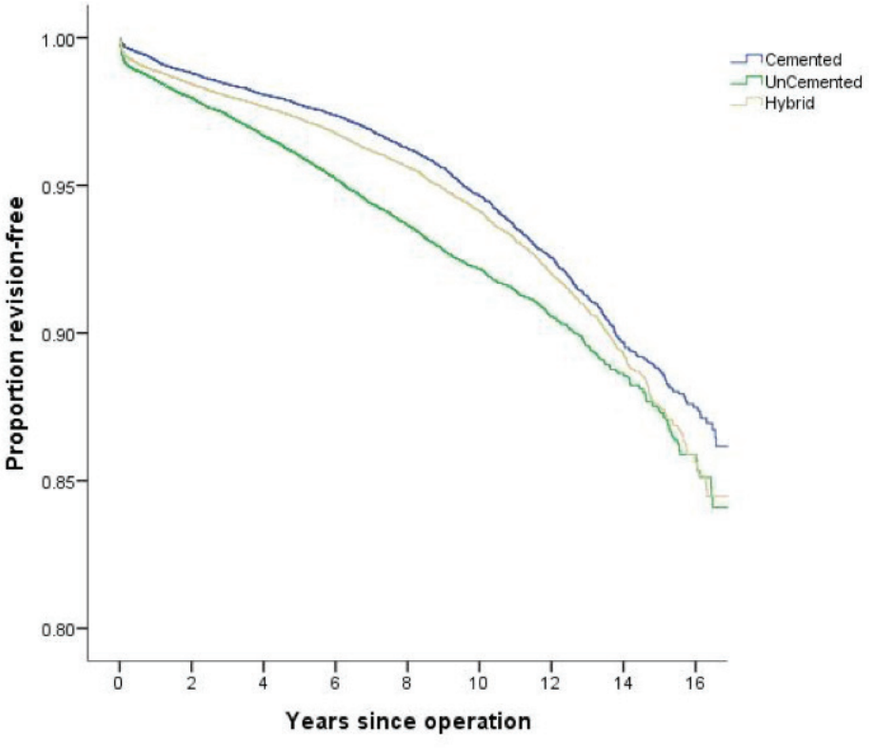
KAPLAN MEIER CURVES

The following Kaplan Meier survival analyses are for the years 1999 – 2015 with deceased patients censored at time of death.



Years	% Revision-free	No in each year
1	98.80	97,433
2	98.30	87,511
3	97.90	78,283
4	97.40	69,391
5	96.90	60,946
6	96.30	52,651
7	95.70	44,810
8	95.10	37,668
9	94.30	31,018
10	93.50	25,124
11	92.60	19,668
12	91.60	14,694
13	90.40	10,657
14	89.00	7,222
15	87.70	4,295
16	86.20	1,853

The KM analysis is to16 years rather than 17 as too few registered hips were revised in 2015



Cemented

Years	% Revision-free	No in each year
1	99.20	23,215
2	98.80	21,559
3	98.40	19,945
4	98.10	18,184
5	97.70	16,523
6	97.40	14,920
7	96.90	13,355
8	96.20	11,730
9	95.60	10,106
10	94.60	8,437
11	93.60	6,758
12	92.60	5,146
13	91.20	3,842
14	89.70	2,692
15	88.70	1,648
16	87.50	791

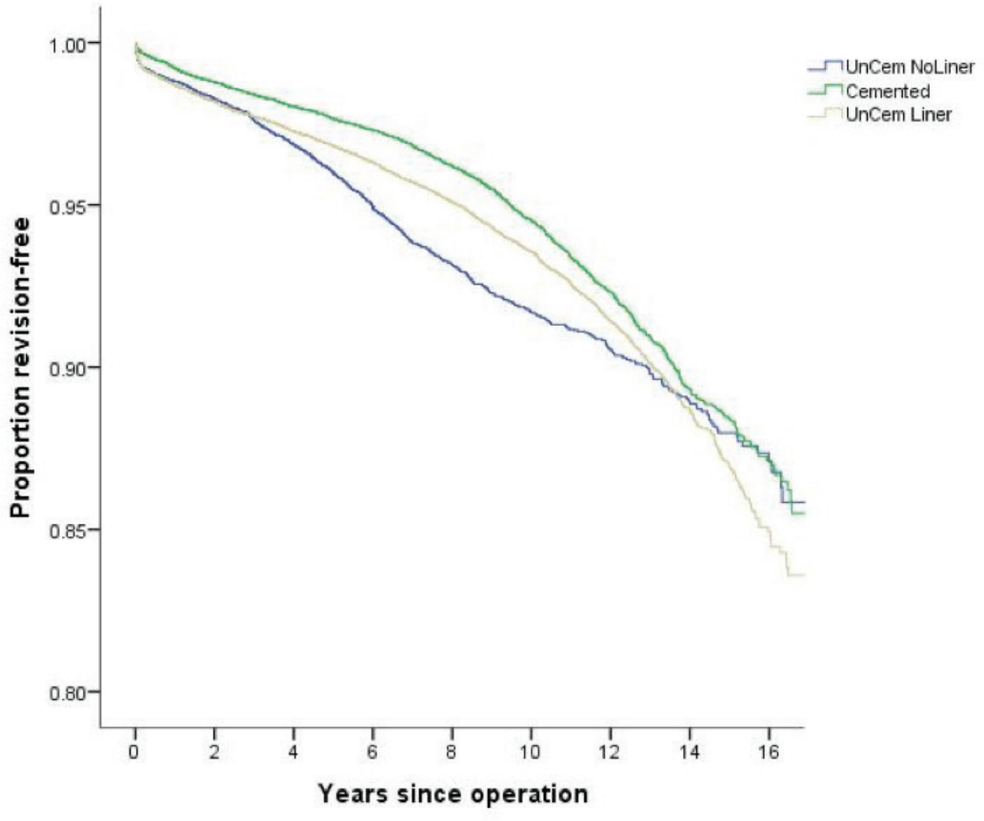
Uncemented

Years	% Revision-free	No in each year
1	98.60	37,333
2	98.00	33,234
3	97.40	29,391
4	96.70	25,753
5	96.00	22,177
6	95.20	18,353
7	94.40	14,762
8	93.70	11,766
9	92.80	9,233
10	92.20	7,136
11	91.50	5,461
12	90.50	4,011
13	89.60	2,827
14	88.60	1,876
15	87.40	1,105
16	85.90	465

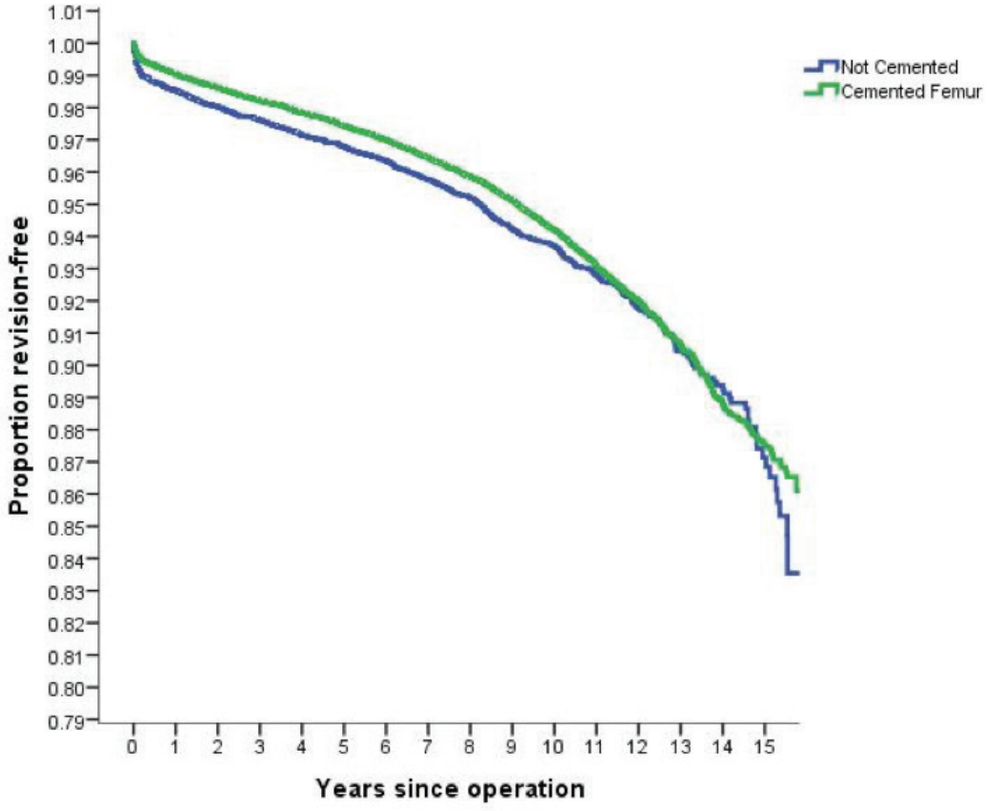
Hybrid

Years	% Revision-free	No in each year
1	98.90	36,885
2	98.40	32,718
3	98.00	28,947
4	97.70	25,443
5	97.30	22,246
6	96.80	19,378
7	96.20	16,693
8	95.60	14,172
9	94.90	11,679
10	94.10	9,551
11	93.10	7,449
12	92.00	5,537
13	90.80	3,988
14	89.30	2,654
15	87.50	1,542
16	85.60	597

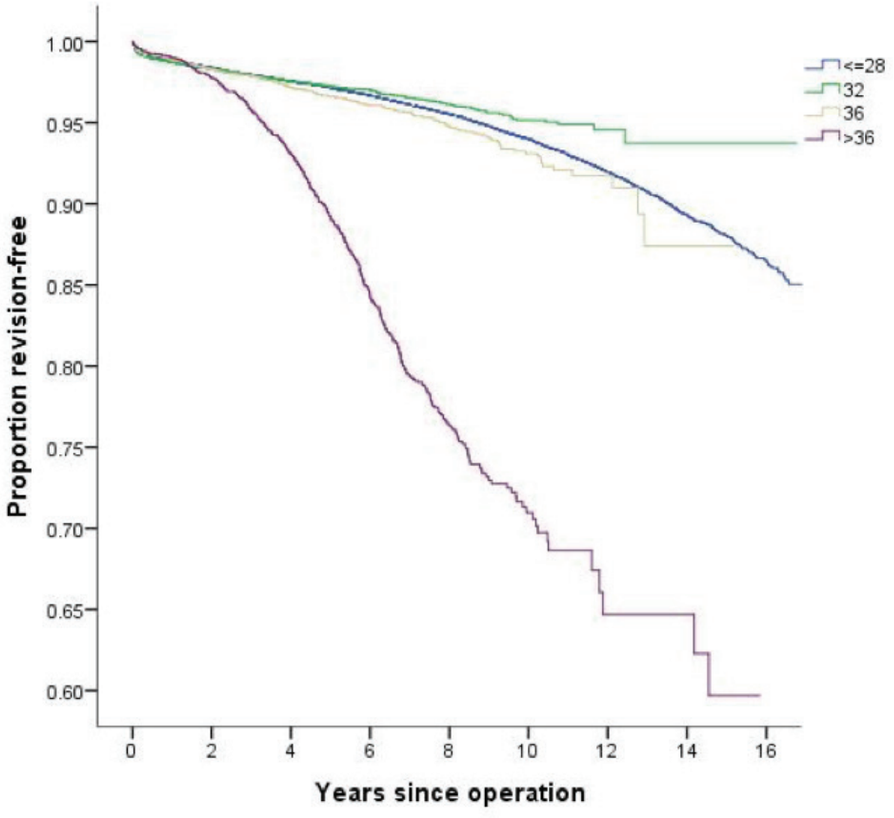
Survival vs Cemented vs Uncemented no Liner vs Uncemented with Liner, Acetabular Components



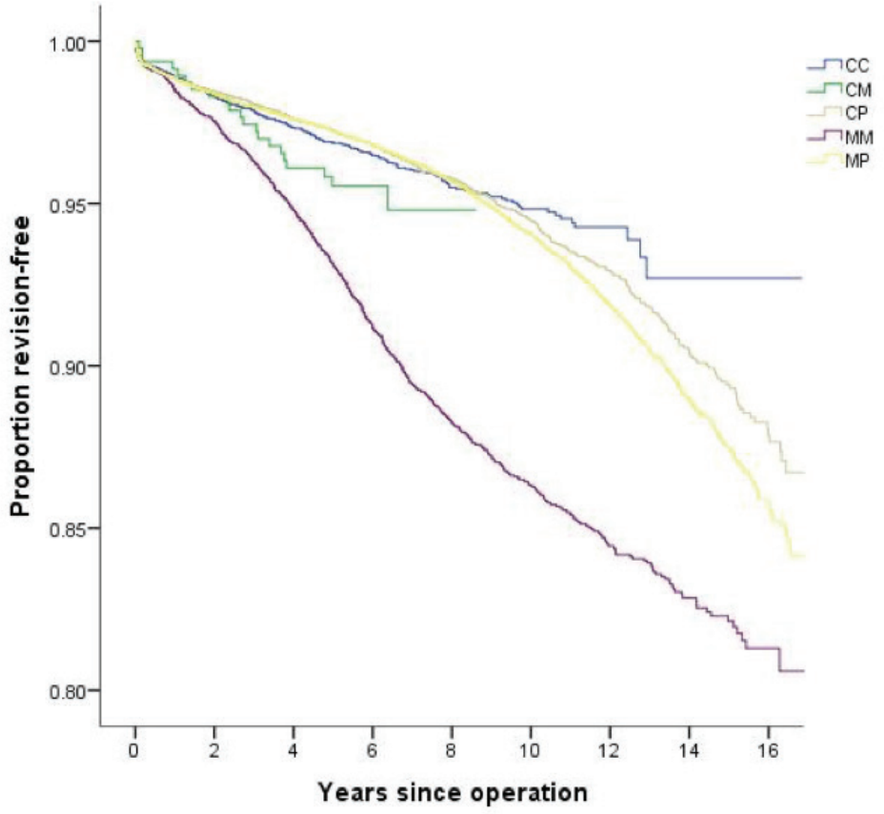
Survival vs cemented and uncemented femoral components



Survival versus Head Size

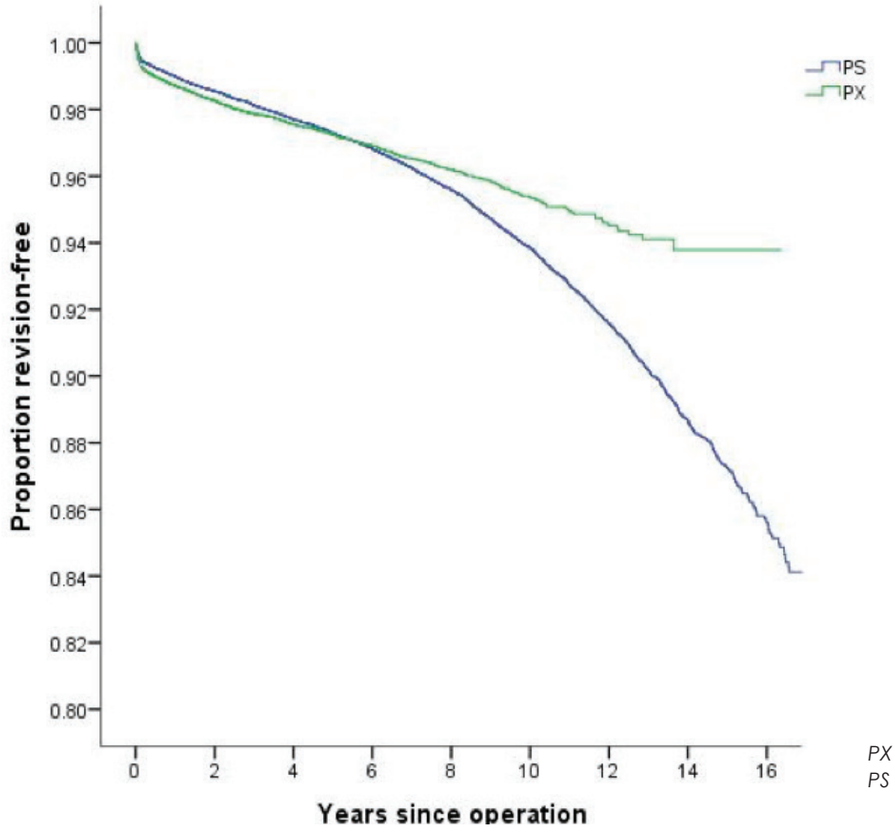


Survival vs Bearing Surface



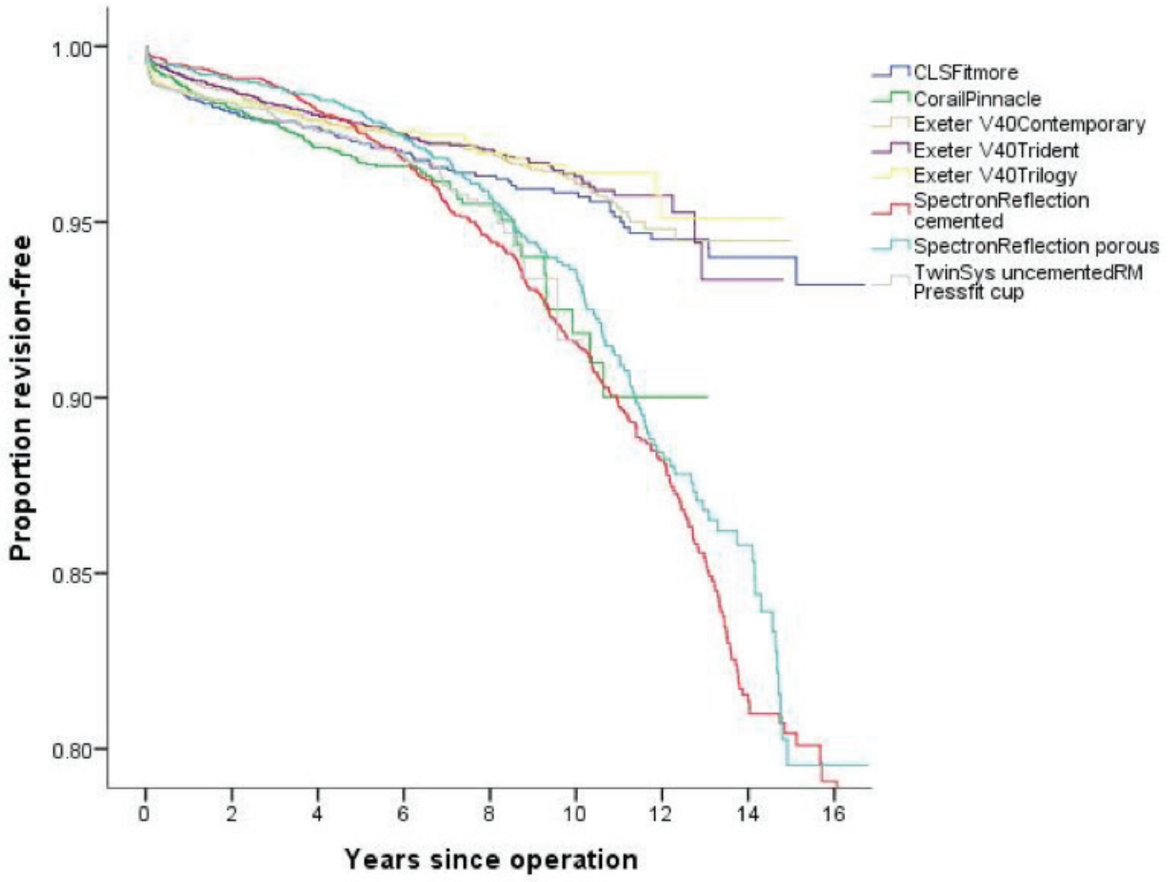
CC = ceramic/ceramic, CM = ceramic/metal, CP = ceramic/plastic, MM = metal/metal, MP = metal/plastic

Survival of Crosslinked vs Standard polyethylene

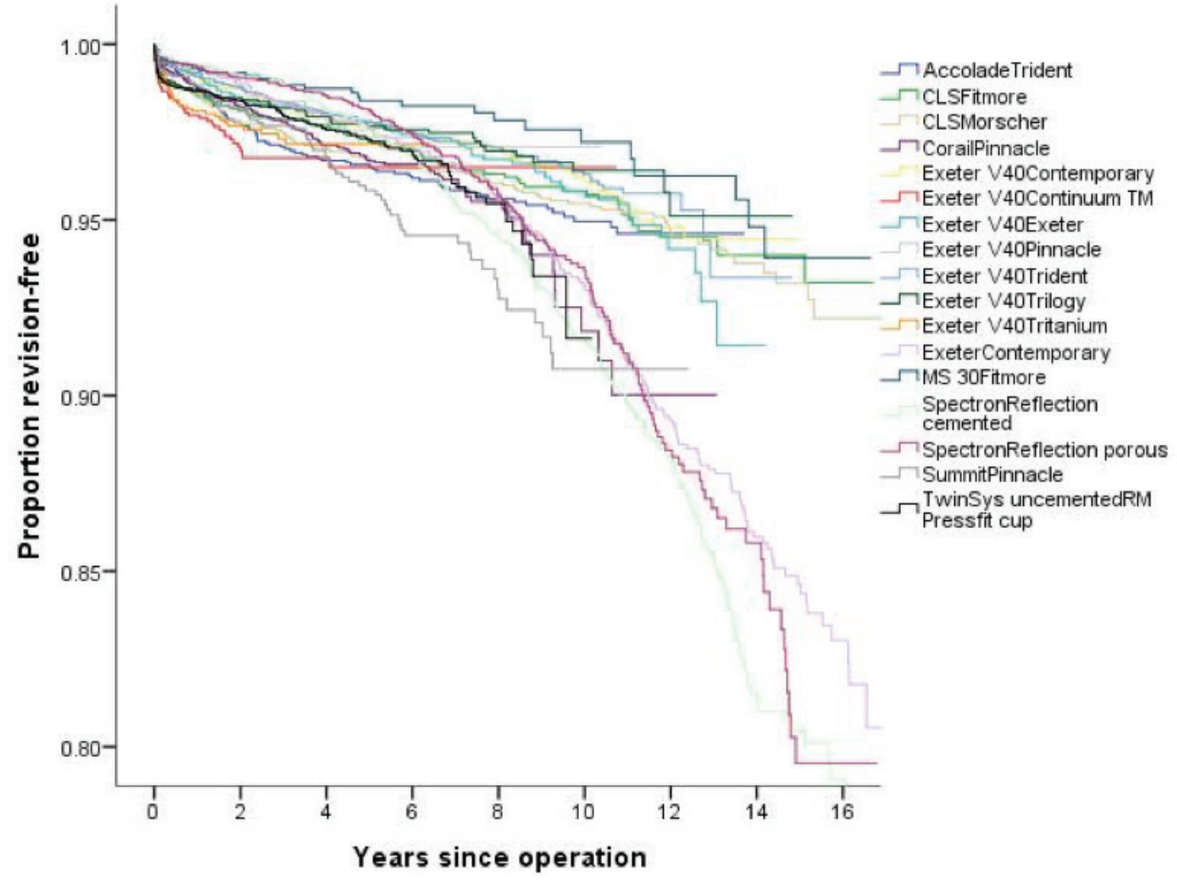


PX = cross linked and
PS = standard polyethylene

Survival of combinations with > 2000 procedures

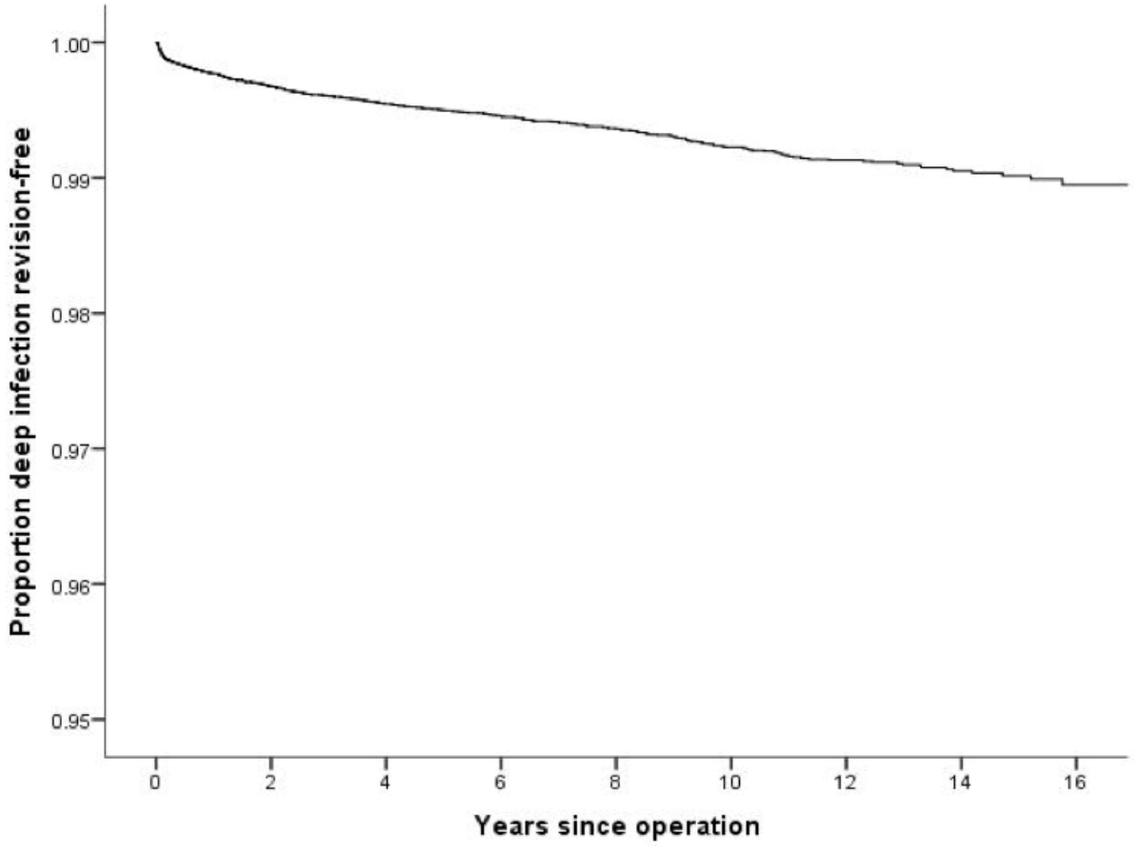


Survival of combinations with > 1500 procedures

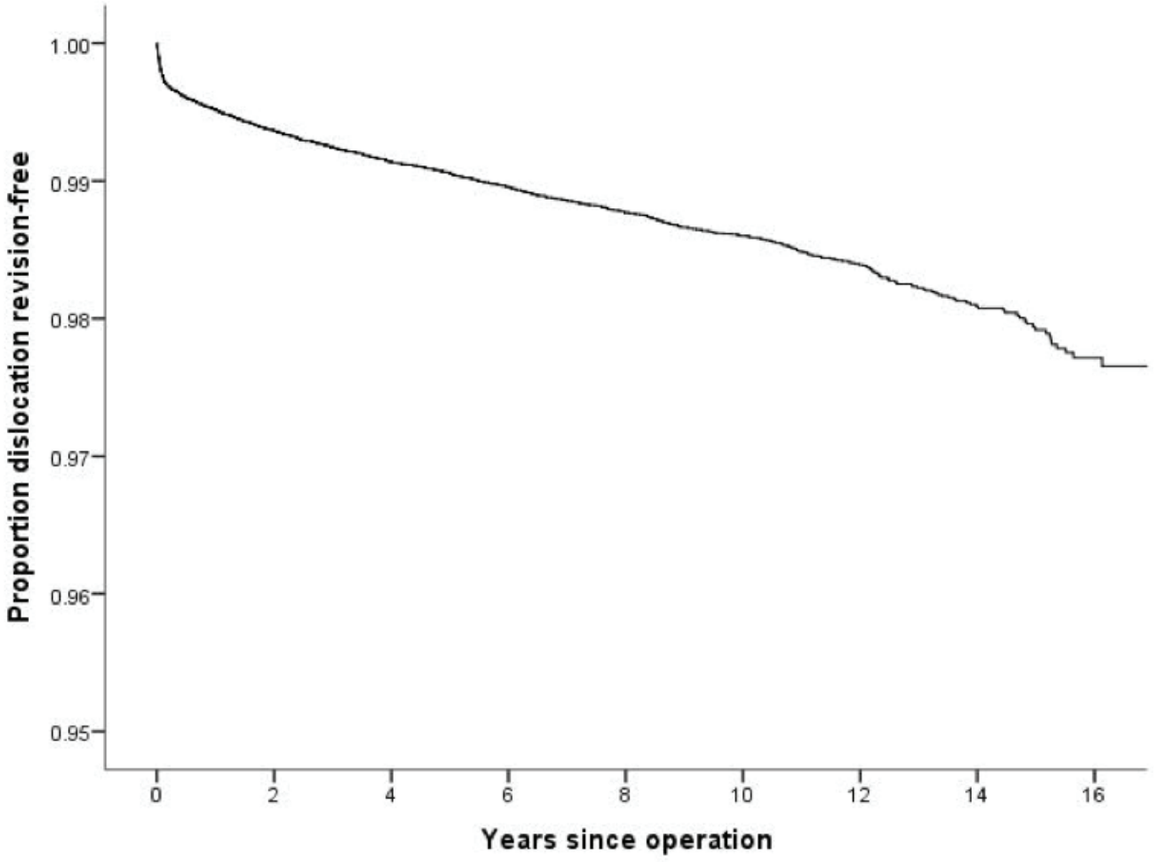


The following K M graphs are for the six main individual reasons for revision:

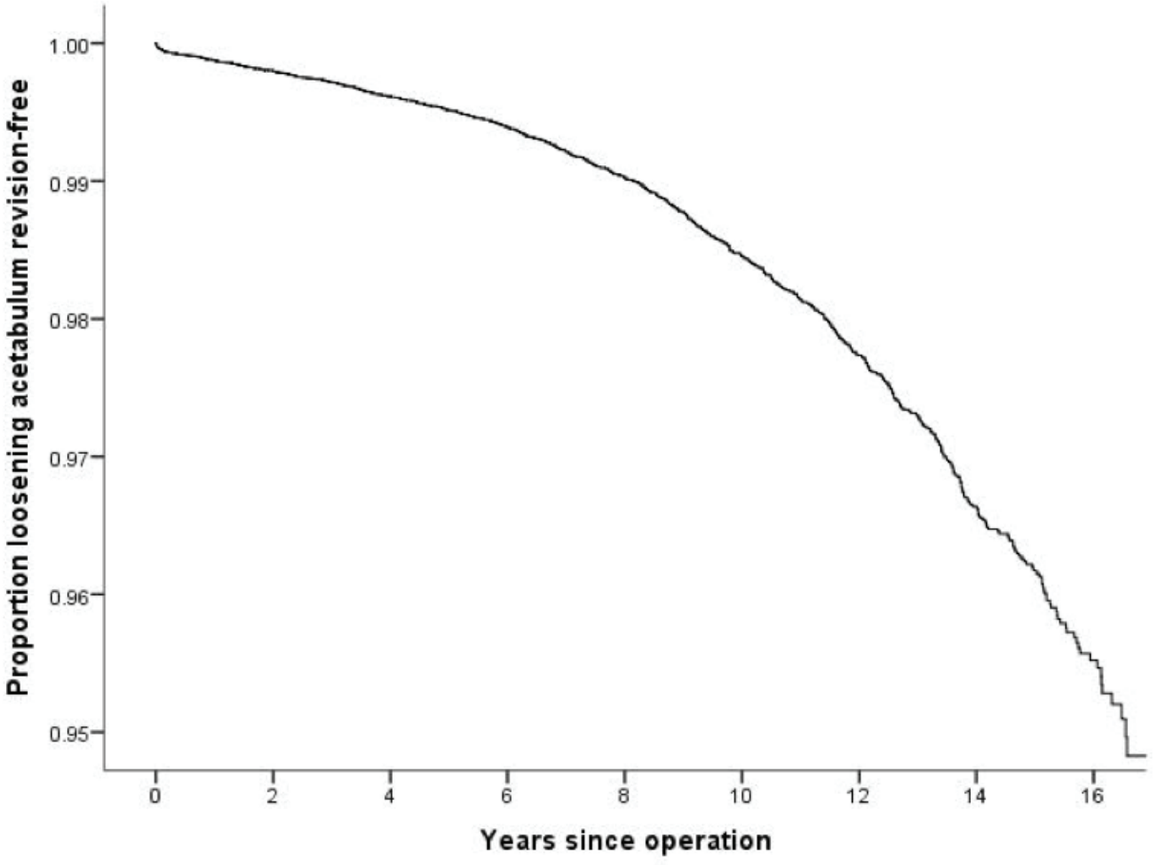
Deep infection



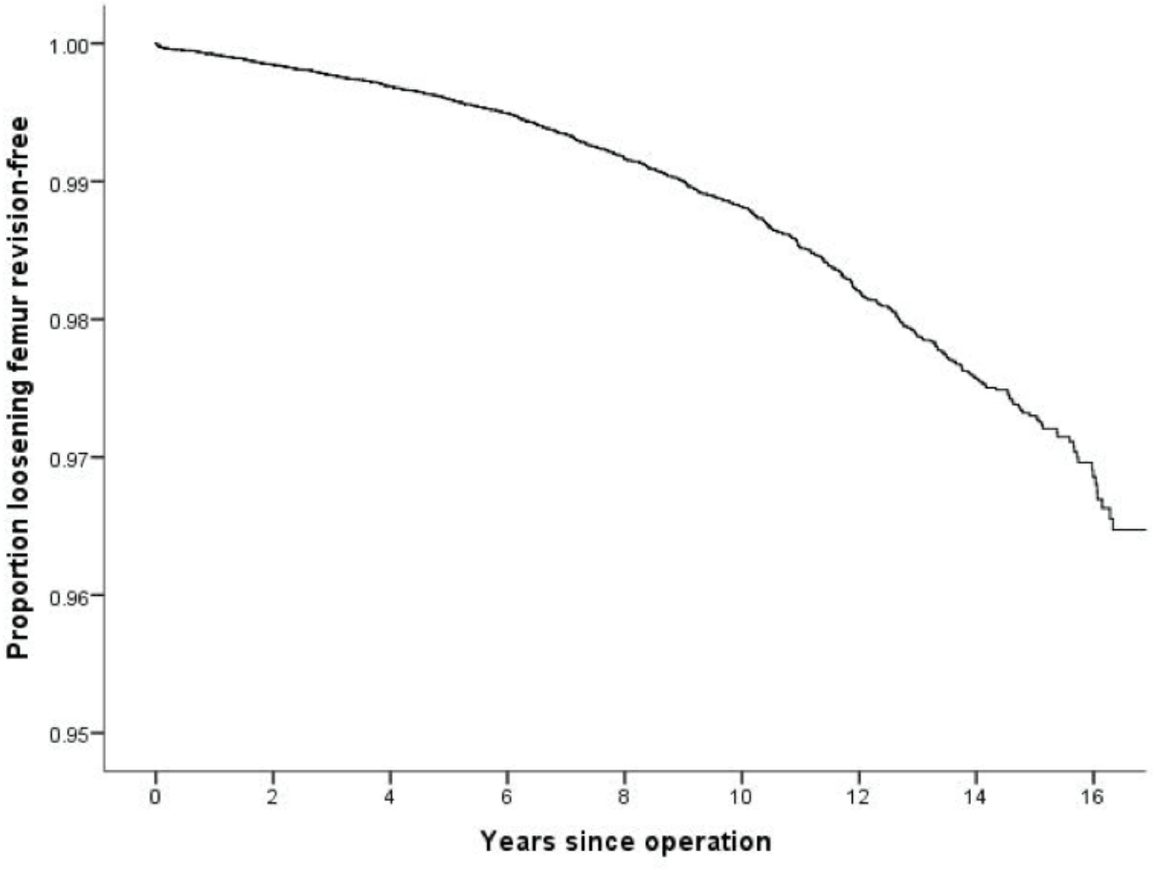
Dislocation



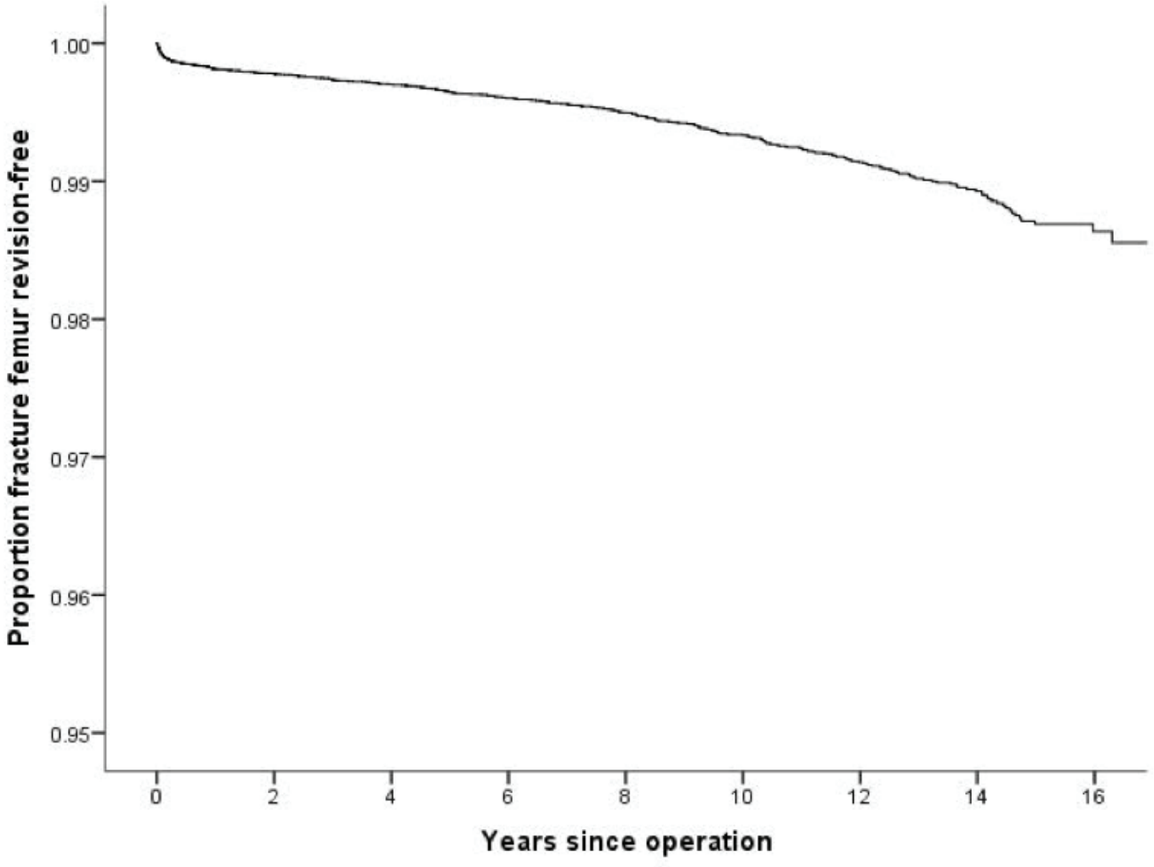
Loosening acetabular component



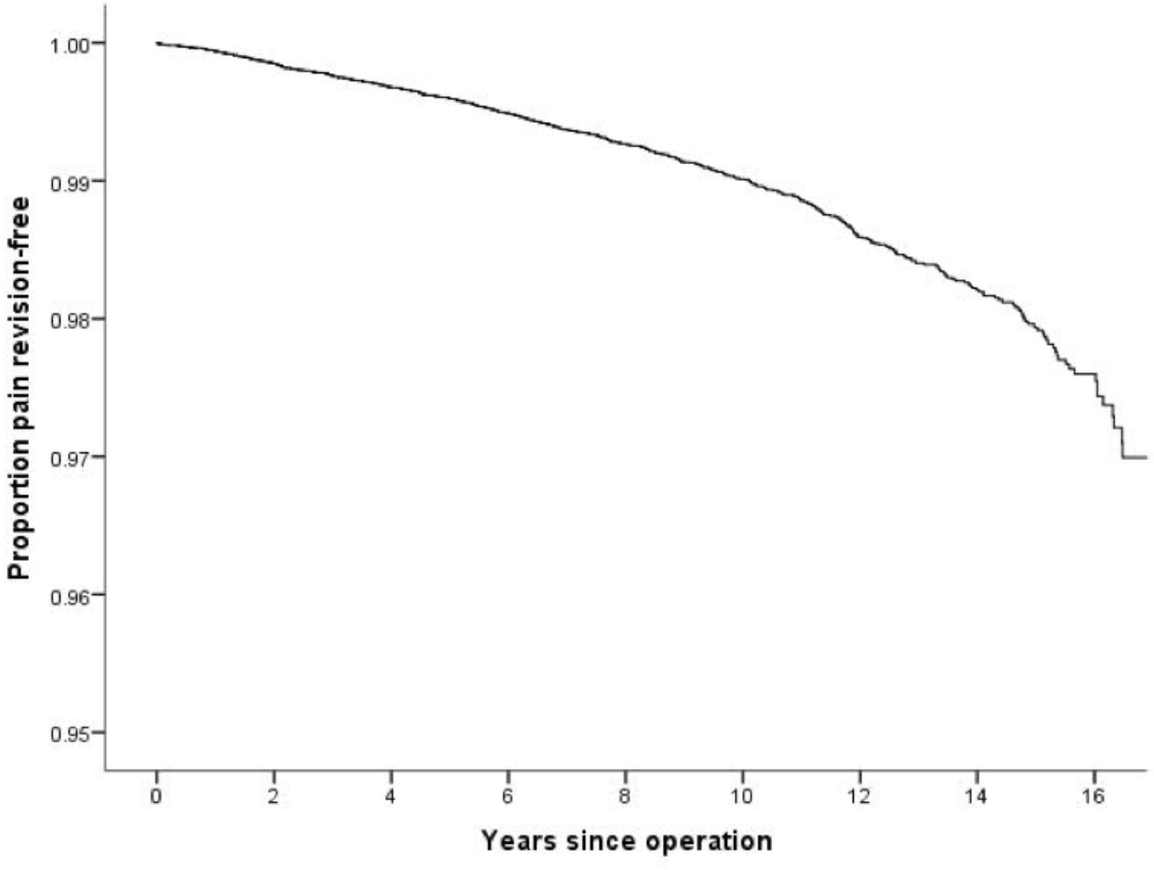
Loosening femoral component



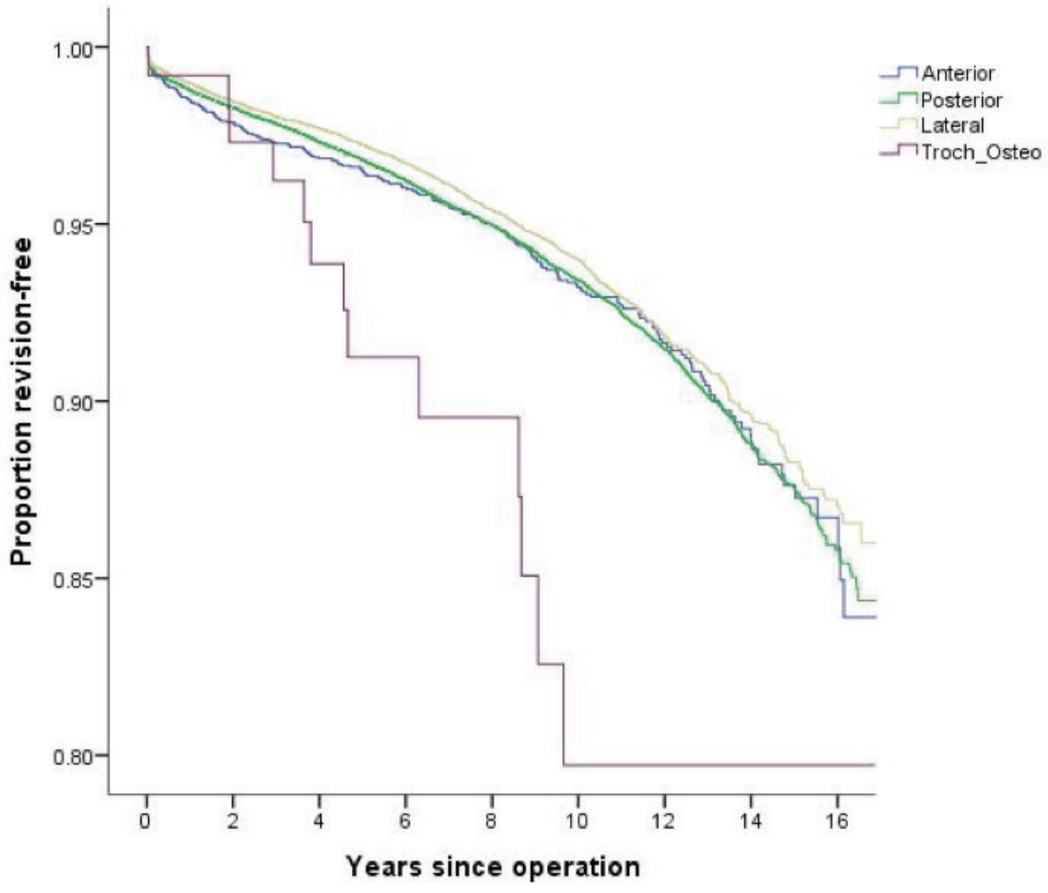
Fracture of femur



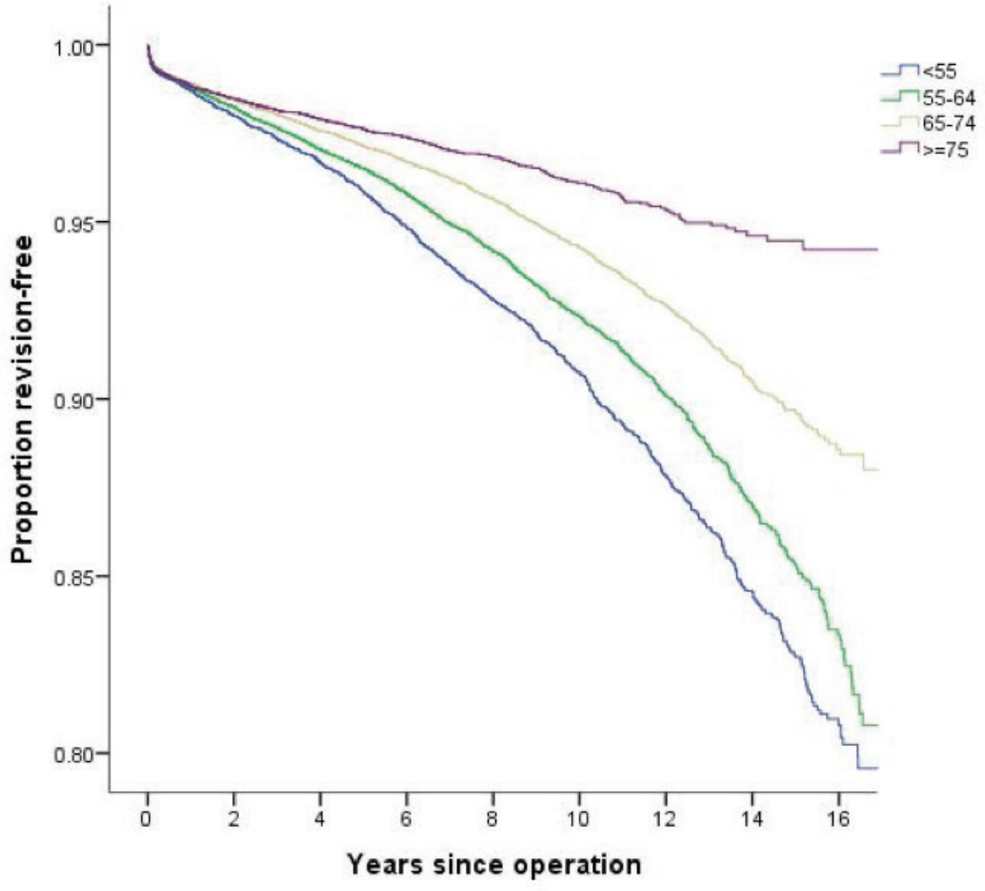
Pain



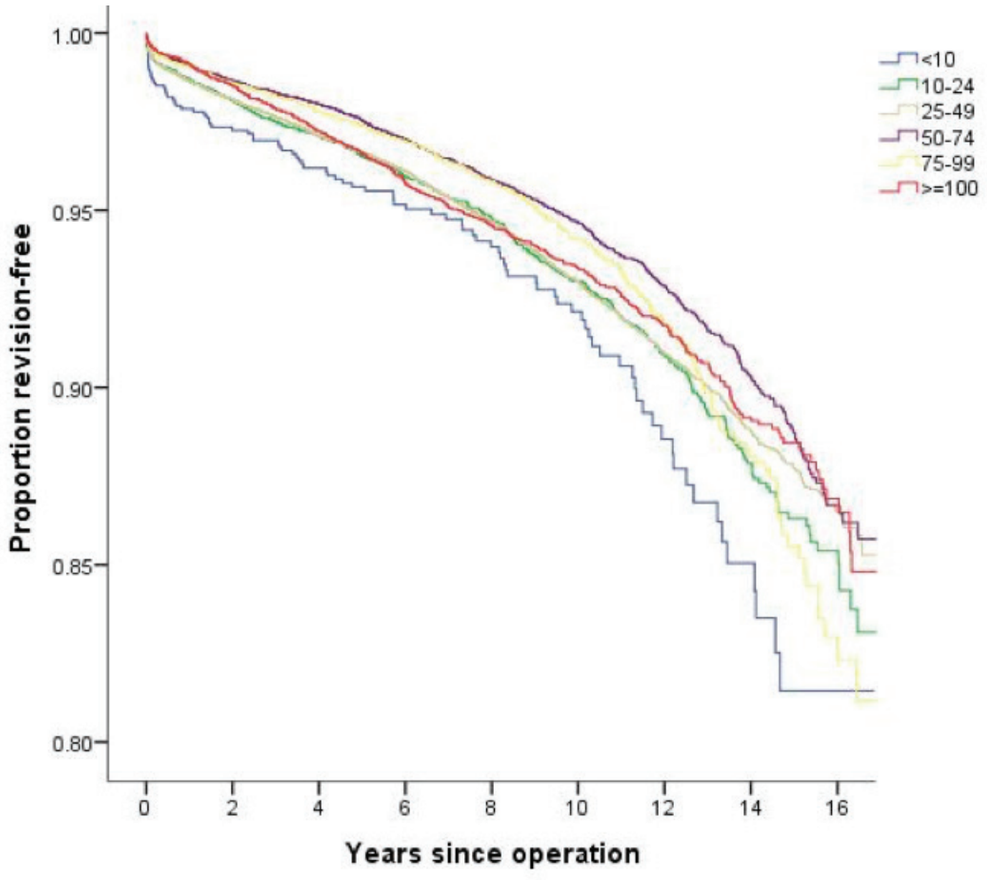
Survival for surgical approach



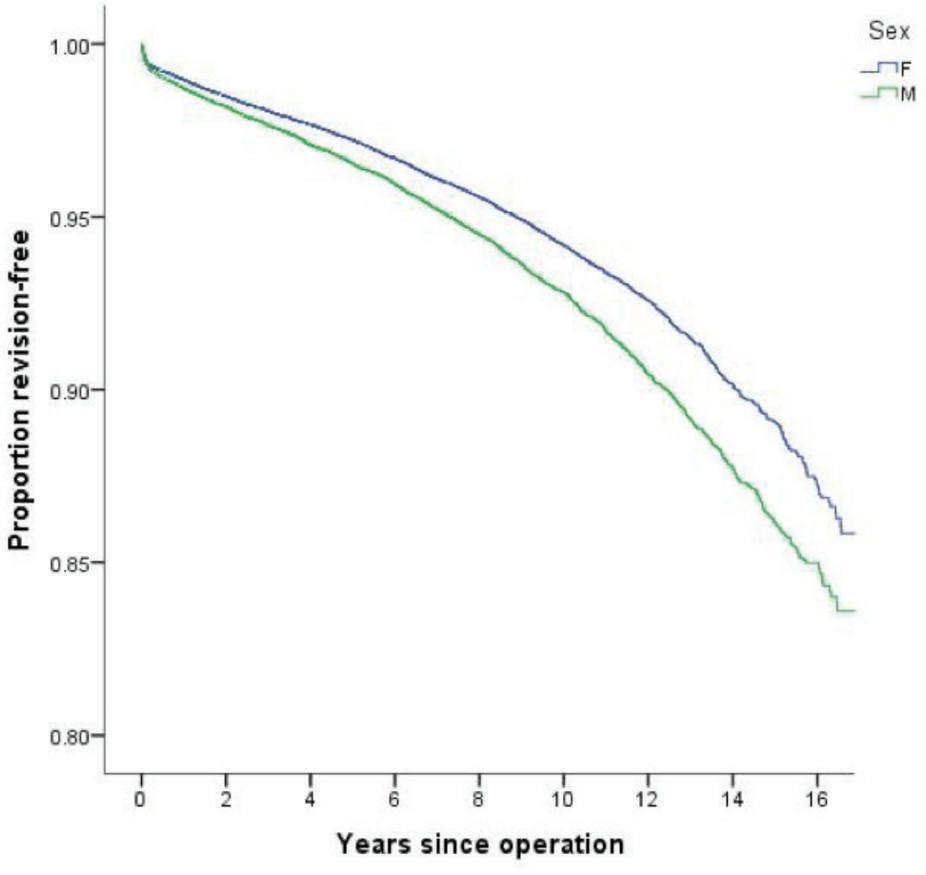
Survival for age bands



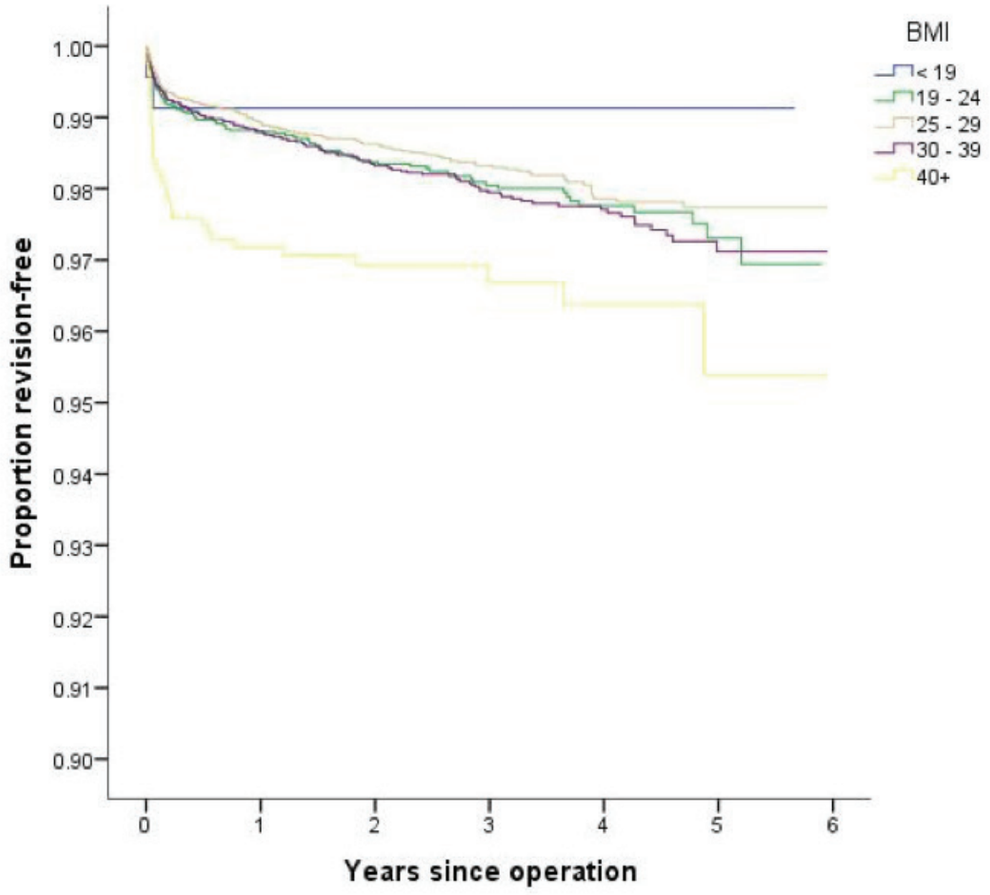
Survival for surgeon annual output



Survival male vs female



Survival vs BMI



Re-revisions of conventional hips

Analysis was undertaken of hip re-revisions.

There were 690 registered conventional hip replacements that had been revised twice, 148 that had been revised three times, 36 that had been revised four times, six that had been revised five times and three that had been revised six times. There was one each revised seven times, eight times and nine times.

Second revision

Time between the first and second revisions averaged 778 days, with a range of 1 – 5,510 and a standard deviation of 1,004. This compares to an average of 1,869 days between the primary and first revision.

Reason for revision

Dislocation	211
Deep infection	194
Loosening femoral component	94
Loosening acetabulum component	75
Pain	76
Fracture femur	46

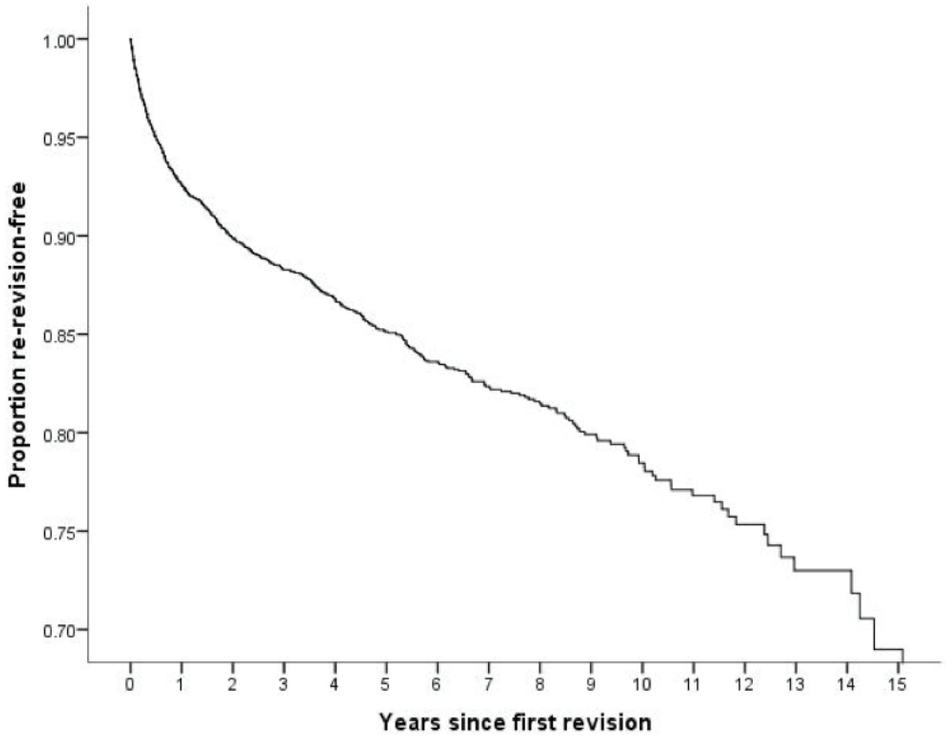
Revision

Change of head	462
Change of acetabulum	214
Change of liner	322
Change of femoral	196
Change of all	174

Re-revisions

No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
5,088	20,957.0	690	3.29	3.05	3.55

The re- revision rate is highly significant when compared to the primary revision rate of 0.70 /100 component years.



Years	% re-revision free
1	92.60
2	89.90
3	88.30
4	86.80
5	85.10
6	83.60
7	82.40
8	81.50
9	79.90
10	78.50
11	76.80

Third revision

The average time between second and third revisions for the 148 arthroplasties was 630 days with a range of 1 – 4,451 and a standard deviation of 774.

Fourth revision

The average time between the third and fourth revisions for the 36 arthroplasties was 402 days, with a range of 7 – 3,111 and a standard deviation of 676 days.

Fifth revision

There were six registered, with an average time to revision of 490 days.

Sixth revision

There were three registered with a time to revision of 246 days.

Seventh revision

One patient has had 7 revisions.

Eighth revision

One patient has had 8 revisions.

Ninth revision

One patient has had 9 revisions.

Overall it can be noted that the time between successive revisions steadily decreases.

Re- revisions of resurfacing hip replacements

There have been 23 re-revisions.

The average time between the first and second revisions was 663 days, with a range of 11 – 3,036 and a standard deviation of 882. This compares with an average of 1,724 days between the primary resurfacing and the first revision.

PATIENT BASED QUESTIONNAIRE OUTCOMES AT SIX MONTHS, FIVE YEARS, TEN YEARS AND 15 YEARS POST-SURGERY

Questionnaires at six months post-surgery

At six months post-surgery a random selection of patients are sent the Oxford-12 questionnaire in order to achieve a response rate of 20% of the total which is deemed to be ample to provide powerful statistical analyses.

The new scoring system as recommended by the original authors has been adopted (see appendix 1).

There are 12 questions with the scores now ranging from 4 to 0. A score of 48 is the best, indicating normal function. A score of 0 is the worst, indicating the most severe disability.

In addition we have grouped the questionnaire responses according to the classification system published by Kalairajah et al, 2005 (see appendix 1).

This groups each score into four categories:

Category 1	>41	excellent
Category 2	34 – 41	good
Category 3	27 – 33	fair
Category 4	< 27	poor

For the seventeen-year period, and as at July 2016, there were 29,273 primary hip questionnaire responses registered six months post-surgery. The mean hip score was 40.43 (standard deviation 7.62, range 48 – 2).

Scoring	> 41	16,596
Scoring	34 -41	7,992
Scoring	27 -33	2,782
Scoring	< 27	1,903

At six months post-surgery, 84% had an excellent or good score.

Questionnaires at five years post-surgery

All patients who had a six month registered questionnaire, and who had not had revision surgery were sent a further questionnaire at five years post-surgery.

This dataset represents sequential Oxford hip scores for 9,974 individual patients.

At five years post-surgery, 89% of these patients achieved an excellent or good score and had a mean of 42.43.

Questionnaires at ten years post-surgery

All patients who had a six month registered questionnaire, and who had not had revision surgery were sent a further questionnaire at ten years post-surgery.

This dataset represents sequential Oxford hip scores for 6,273 individual patients.

At ten years post-surgery, 87% of these patients achieved an excellent or good score and had a mean of 41.91.

Questionnaires at fifteen years post-surgery

All patients who had a six month registered questionnaire, and who had not had revision surgery were sent a further questionnaire at 15 years post-surgery.

This dataset represents sequential Oxford hip scores for 1,538 individual patients.

At fifteen years post-surgery, 86% of these patients achieved an excellent or good score and had a mean of 41.349

Analysis of the individual questions at six months, five years, ten years and 15 years post-surgery

Analysis of the individual questions showed that the most common persisting six month problems were pain (Q1) and limping (Q10). However, for the five, ten and fifteen year analyses the most common persisting problem was pain (Q1).

Percentage scoring 0 or 1 (worst categories) for each question at six months, five, ten and fifteen years post-surgery.

		6m %	5y %	10y %	15y %
1	Moderate or severe pain from the operated hip	13	13	16	16
2	Only able to walk around the house or unable to walk before pain becomes severe	4	3	4	4
3	Extreme difficulty or impossible to get in and out of a car or public transport	2	2	3	3
4	Extreme difficulty or impossible to put on a pair of socks	9	5	6	9
5	Extreme difficulty or impossible to do the household shopping on your own	4	2	3	4
6	Extreme difficulty or impossible to wash and dry yourself	2	1	1	1
7	Pain interfering greatly or totally with your work	4	3	3	4
8	Very painful or unbearable to stand up from a chair after a meal	2	1	1	2
9	Sudden severe pain most or all of the time	2	2	2	2
10	Limping most or every day	12	8	8	9
11	Extreme difficulty or impossible to climb a flight of stairs	4	3	5	6
12	Pain from your hip in bed most (or every) nights	5	3	4	4

As noted in previous years there is little significant change between the six month, five, ten and now fifteen year scores which means the six month score is indicative of the longer term outcome.

Oxford Scores vs BMI Status

BMI	Mean	Std. Error of Mean	No
< 19	38.23	1.338	40
19 - 24	40.90	0.206	1,193
25 - 29	40.78	0.159	1,985
30 - 39	39.36	0.196	1,560
40+	36.33	0.716	166
Total	**40.19**	**0.106**	**4,944**

The 40+ group have a significantly lower (worse) score than all the other groups except for the < 19

Revision hip questionnaire responses

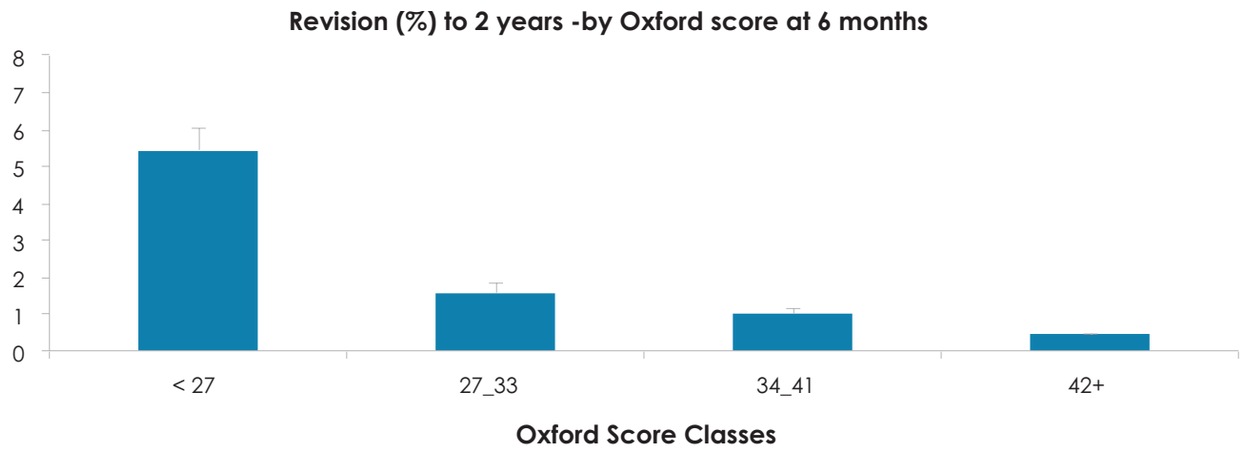
There were 8,910 revision hip responses with 63% achieving an excellent or good score. This group includes all revision hip procedures including revisions of primary arthroplasties performed prior to 1999. The mean revision hip score was 35.16 (standard deviation 9.81, range 48 – 2).

OXFORD 12 SCORE AS A PREDICTOR OF HIP ARTHROPLASTY REVISION

A statistically significant relationship has been confirmed between the Oxford scores at six months, five and ten years post-surgery and arthroplasty revision within two years of the Oxford 12 questionnaire date.

Six month score and revision arthroplasty

By plotting the patients' six month scores in the Kalairajah groupings against the proportion of hips revised for that same group it demonstrates that there is an incremental increase in risk during the next two years related to the Oxford score. A patient with a score below 27 has 13 times the risk of a revision within two years compared to a person with a score >41.

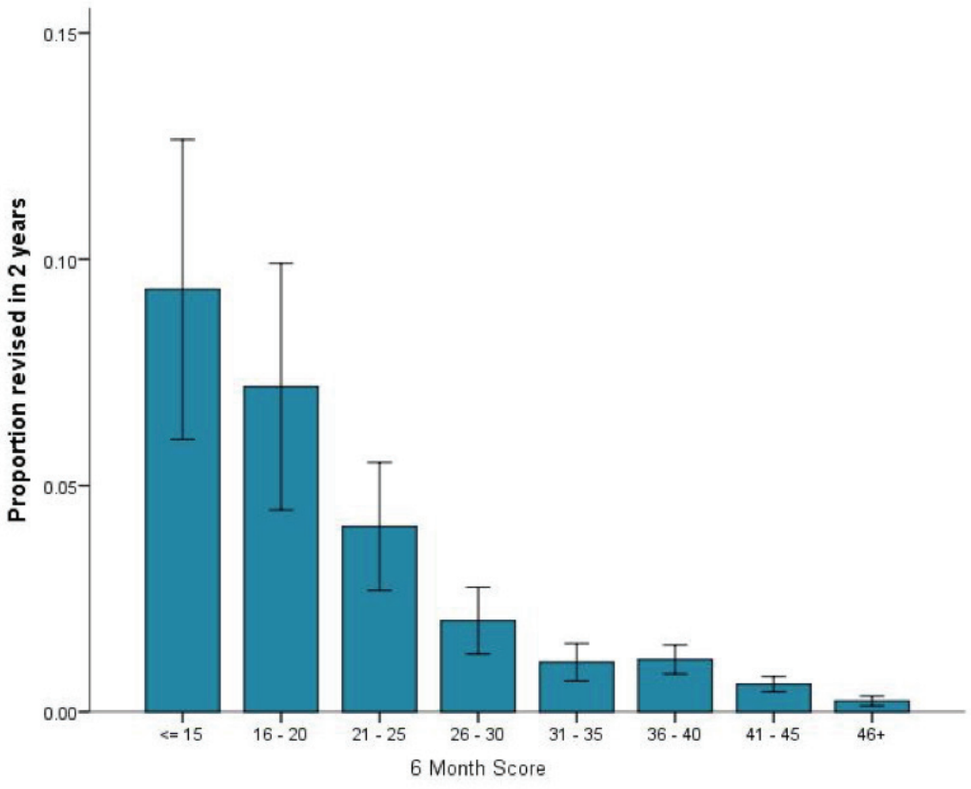


Revision risk versus Kalairajah groupings of Oxford scores within two years of the six month score date.

Kalairajah Group	No in Group	No. revised	%	Std error
< 27	1,616	88	5.45	0.56
27_33	2,412	38	1.58	0.25
34_41	6,903	69	1.00	0.12
42+	14,700	63	0.43	0.05

A person with a six month Oxford score >41 has a 0.43% risk of revision within two years compared to a 5.45% risk with a score of < 27.

In view of the large number of six month Oxford scores it is possible with statistical significance to further break down the score groupings to demonstrate an even more convincing relationship between score and risk of revision within two years.



Revision risk versus groupings of Oxford scores within two years of the six month score date.

			Revision in 2 yrs		Total
			No	Yes	
Score 6 months	<= 15	Count	267	28	**295**
		%	90.50%	9.50%	
	16 - 20	Count	320	25	**345**
		%	92.80%	7.20%	
	21 - 25	Count	718	29	**747**
		%	96.10%	3.90%	
	26 - 30	Count	1,349	27	**1,376**
		%	98.00%	2.00%	
	31 - 35	Count	2,404	27	**2,431**
		%	98.90%	1.10%	
	36 - 40	Count	4,194	48	**4,242**
		%	98.90%	1.10%	
	41 - 45	Count	7,941	48	**7,989**
		%	99.40%	0.60%	
	46+	Count	7,625	18	**7,643**
		%	99.80%	0.20%	
Total		**Count**	**24,818**	**250**	**25,068**
		%	**99.00%**	**1.00%**	

A person with a six month Oxford score >45 has a 0.20% risk of revision within two years compared to a 9.50% (47.5x) risk with a score of <16.

Five year score and revision arthroplasty

As with the six month scores, plotting the patients' five year scores in the Kalairajah groupings against the proportion of hips revised for that same group demonstrates that there is an incremental increase in risk during the next two years related to the Oxford score. A patient with a score below 27 has 10 times the risk of a revision within two years compared to a person with a score >41.

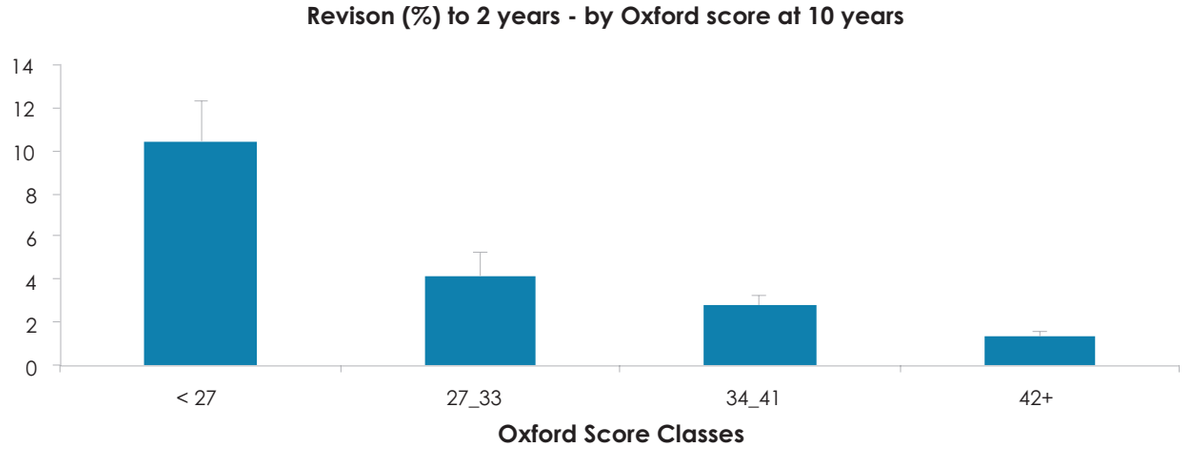
Revision risk versus Kalairajah groupings of Oxford scores within two years of the five year score date.

Kalairajah Group	No in Group	No. revised	%	Std error
< 27	312	16	5.13	1.25
27_33	444	15	3.38	0.86
34_41	1,329	13	0.98	0.27
42+	5,031	26	0.52	0.10

A person with a five year Oxford score >41 has a 0.52% risk of revision within two years compared to a 5.13% risk with a score <27.

Ten year score and revision arthroplasty

As with the six month and five year scores, plotting the patients' ten year scores in the Kalairajah groupings against the proportion of hips revised for that same group demonstrates that there is an incremental increase in risk during the next two years related to the Oxford score. A patient with a score below 27 has eight times the risk of a revision within two years compared to a person with a score >41.



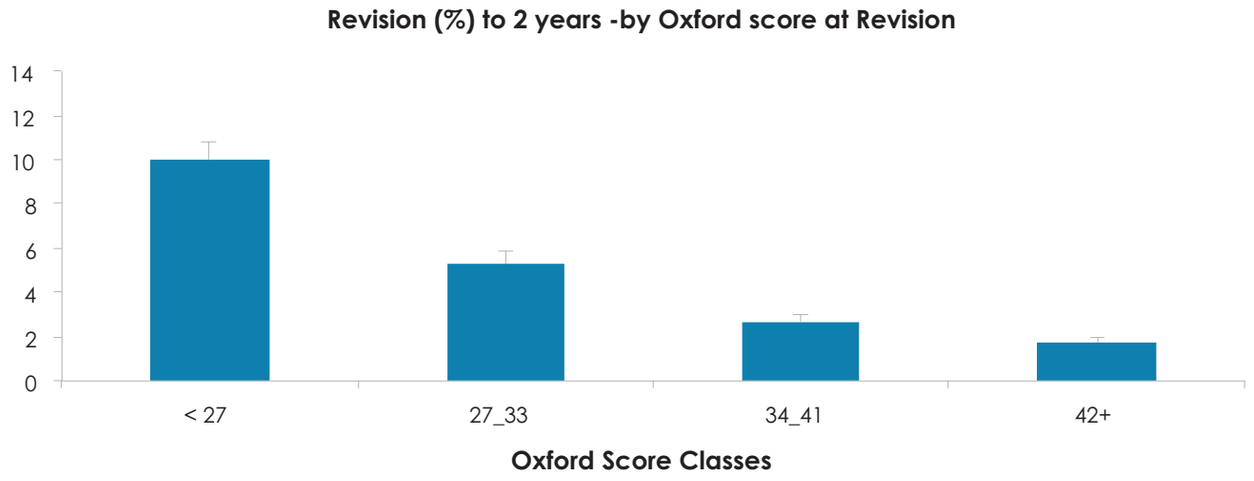
Revision risk versus Kalairajah groupings of Oxford scores within two years of the ten year score date.

Kalairajah Group	No in Group	No. revised	%	Std error
< 27	259	27	10.42	1.90
27_33	335	14	4.18	1.09
34_41	937	26	2.77	0.54
42+	3,131	43	1.37	0.21

A person with a 10 year Oxford score >41 has a 1.37% risk of revision within two years compared to a10.42% risk with a score < 27.

Prediction of second revision from six month score following first revision

Plotting the patients' six month scores, following their first revision in the Kalairajah groupings, against the proportion of hips revised for that same group, again demonstrates that there is an incremental increase in risk during the next two years related to the Oxford score. A patient with a score below 27 has six times the risk of a revision within two years compared to a person with a score >41.

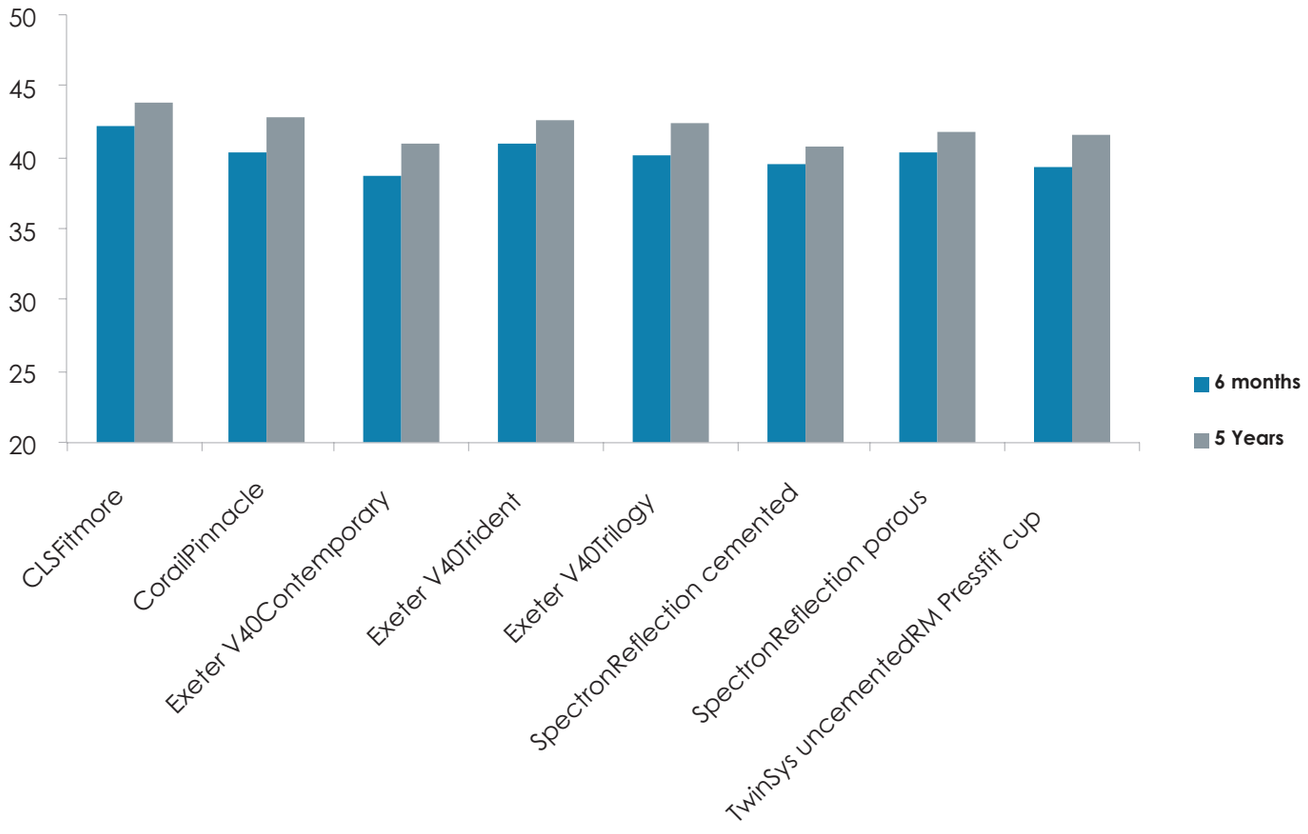


Second revision risk versus Kalairajah groupings of Oxford scores within two years of the six month post- first revision score date.

Kalairajah Group	Revision to 2 yrs.	No. revised	%	Std error
< 27	1,211	121	9.99	0.86
27_33	1,196	63	5.27	0.65
34_41	2,152	57	2.65	0.35
42+	2308	40	1.73	0.27

A person with a six month Oxford score >42 has a 1.73% risk of revision within two years compared to a 9.99% risk with a score < 27.

Mean Oxford scores at 6 months and 5 years for 8 hip combinations with > 2000 registrations.



		CLS Fitmore	Corail Pinnacle	Ex-V40 Contem-porary	Ex-V40 Trident	ExV40 Trilogy	Spectron Reflect cement	Spectron Reflect porous	TwinSys unce-mented RM Pressfit cup
6 mnths	Ox Mean	42.2	40.4	38.6	41.0	40.2	39.4	40.3	39.4
	Std. Error	0.3	0.2	0.3	0.2	0.4	0.2	0.3	0.3
	No.	618	1,270	1,046	1,366	379	1,293	817	996
5 years	Ox Mean	43.8	42.7	41.0	42.6	42.5	40.7	41.7	41.7
	Std. Error	0.4	0.3	0.4	0.3	0.5	0.4	0.4	0.4
	No.	261	467	480	562	155	375	380	390

KNEE ARTHROPLASTY

PRIMARY KNEE ARTHROPLASTY

The **seventeen-year** report analyses data for the period January 1999 – December 2015. There were 86,186 primary knee procedures registered, an additional 7,260 compared to last year's report and representing a 2.1% decrease over registrations in 2014. This is the first annual decrease since 2008.

The 86,186 includes 417 patello-femoral prostheses with 61 registered in 2015.

1999	2,429
2000	3,014
2001	3,059
2002	2,896
2003	3,046
2004	4,102
2005	5,024
2006	5,154
2007	5,762
2008	5,604
2009	6,015
2010	6,088
2011	6,255
2012	6,364
2013	6,694
2014	7,420
2015	7,260

Data Analysis

Age and sex distribution

The average age for a knee replacement was 68.26 years, with a range of 8.19 – 100.49 years.

All knee arthroplasty

	Female	Male
Number	44,492	41,694
Percentage	51.62	48.38
Mean age	68.60	67.90
Maximum age	100.49	98.68
Minimum age	10.17	8.19
Standard dev.	9.79	9.34

Conventional knee arthroplasty

	Female	Male
Number	44,185	41,584
Percentage	51.52	48.48
Mean age	68.66	67.93
Maximum age	100.49	98.68
Minimum age	10.17	8.19
Standard dev.	9.80	9.35

Patello-femoral arthroplasty

	Female	Male
Number	307	110
Percentage	73.62	26.38
Mean age	60.46	59.16
Maximum age	89.39	83.70
Minimum age	31.15	31.25
Standard dev.	11.51	10.98

Body Mass Index

For the six-year period 2010 - 2015, there were 24,398 BMI registrations for primary knee replacements. The average was 31.17 (obese) with a range of 15 – 68.7 and a standard deviation of 6.00.

Previous operation

None	72,112
Menisectomy	8,844
Osteotomy	1,360
Ligament reconstruction	1,087
Internal fixation for juxtarticular fracture	666
Synovectomy	150

Diagnosis

Osteoarthritis	81,443
Rheumatoid arthritis	2,038
Post fracture	888
Other inflammatory	721
Post ligament disruption/reconstruction	615
Avascular necrosis	308
Tumour	85

Approach

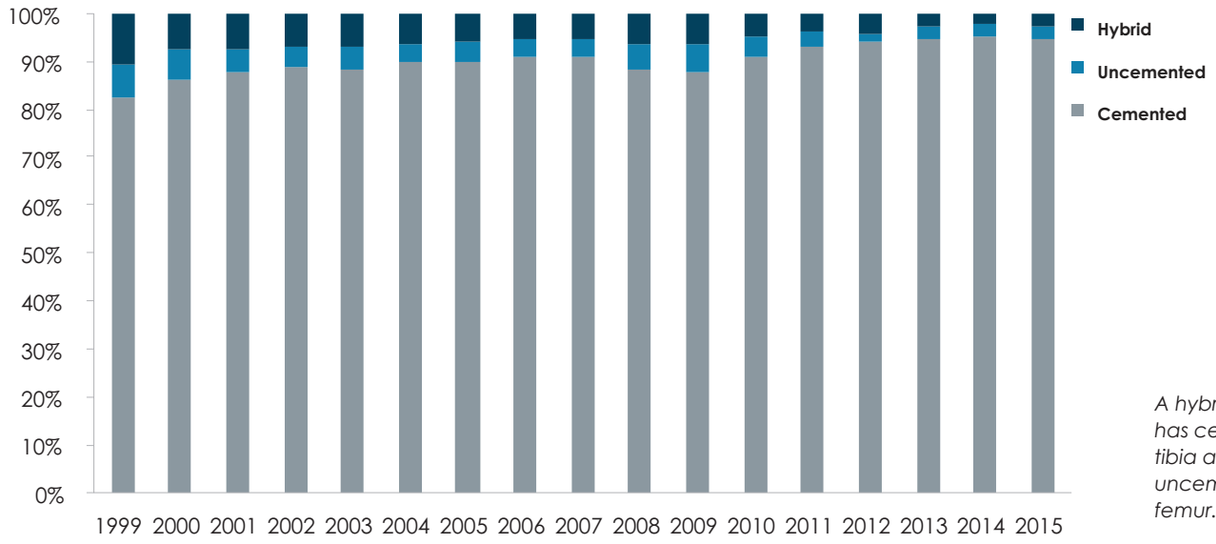
Medial parapatellar	77,780
Other	2,110
Lateral parapatellar	1,208
Image guided surgery	9,029
Minimally invasive surgery	177

Image guided surgery was added to the updated forms at the beginning of 2005.

Bone graft

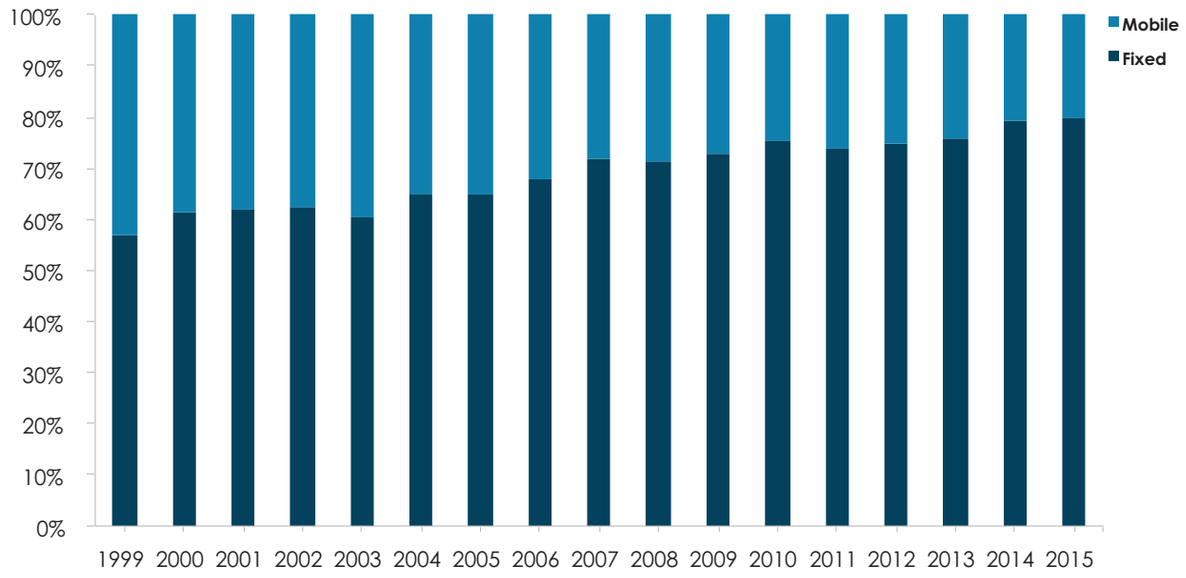
Femoral autograft	196
Femoral allograft	12
Femoral synthetic	8
Tibial autograft	196
Tibial allograft	21
Tibial synthetic	3

Comparison of proportions of cemented vs uncemented vs hybrid by year

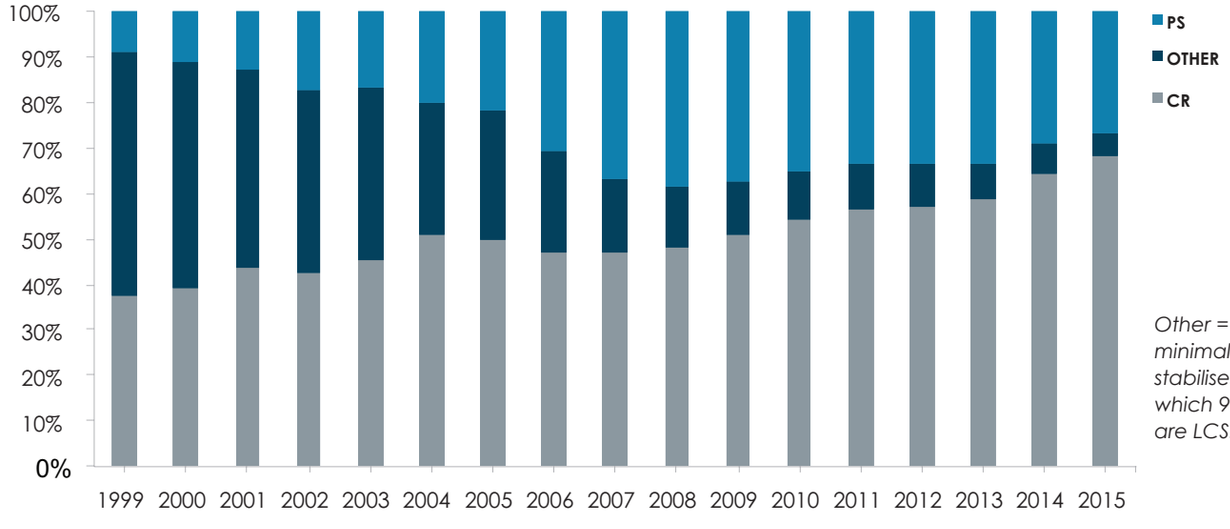


A hybrid knee has cemented tibia and uncemented femur.

Proportion of fixed vs mobile knees by year



Proportion of posterior stabilized vs cruciate retaining vs minimally stabilized knees by year



Other = minimally stabilised of which 98% are LCS.

Cement

Femur cemented	78,922	92%
Antibiotic in cement	53,502	68%
Tibia cemented	81,997	95%
Antibiotic in cement	55,048	67%

Systemic antibiotic prophylaxis

Patient number receiving at least one

systemic antibiotic	81,626	95%

A cephalosporin was used in 86% of arthroplasties.

Operating theatre

Conventional	47,402
Laminar flow	38,154
Space suits	28,602

In 2015, 47% of knee arthroplasties were performed in laminar flow theatres, down 3% from 2014 and space suits were used in 39%, up 3% from 2014.

ASA Class

This was introduced with the updated forms at the beginning of 2005. For the eleven-year period 2005 – 2015, there were 63,990 (95%) primary knee procedures with the ASA class recorded.

Definitions

ASA class 1: A healthy patient

ASA class 2: A patient with mild systemic disease

ASA class 3: A patient with severe systemic disease that limits activity but is not incapacitating

ASA class 4: A patient with an incapacitating disease that is a constant threat to life

ASA	Number	Percentage
1	7,326	11
2	40,870	64
3	15,515	24
4	279	1

Operative time (skin to skin in minutes)

Mean	83mins

Surgeon grade

The updated forms introduced in 2005 have separated advanced trainee into supervised and unsupervised. The following figures are for the eleven-year period 2005 – 2015.

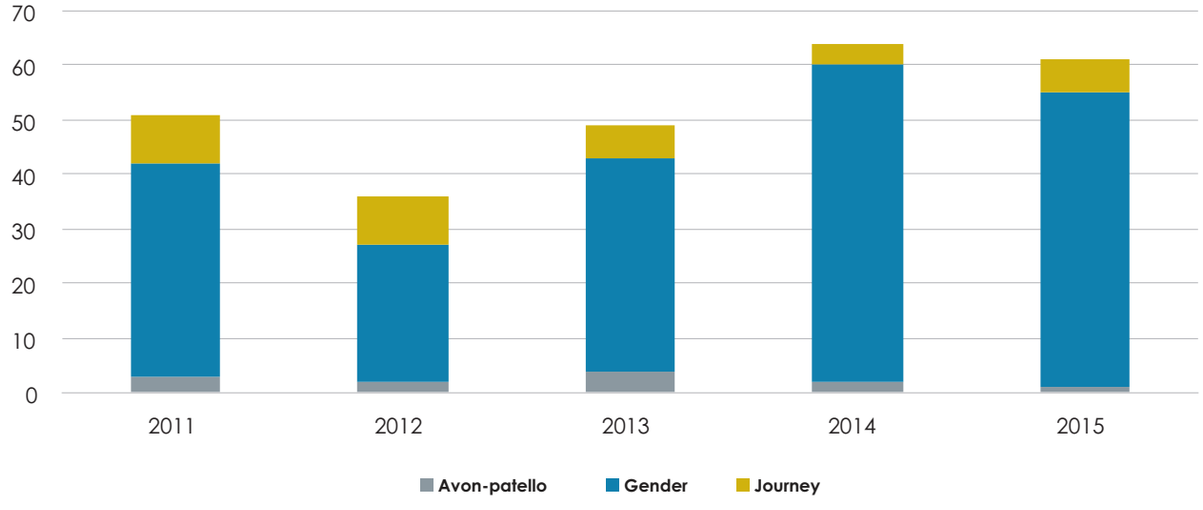
Consultant	59,414
Advanced trainee supervised	5,362
Basic trainee	1,385
Advanced trainee unsupervised	1,383

Prosthesis usage

Patello-femoral prostheses used in 2015

Gender	54
Journey	6
Avon patello	1

Patello- femoral prostheses used for five years (2011-2015)



There are 417 patello-femoral procedures registered to 52 surgeons.

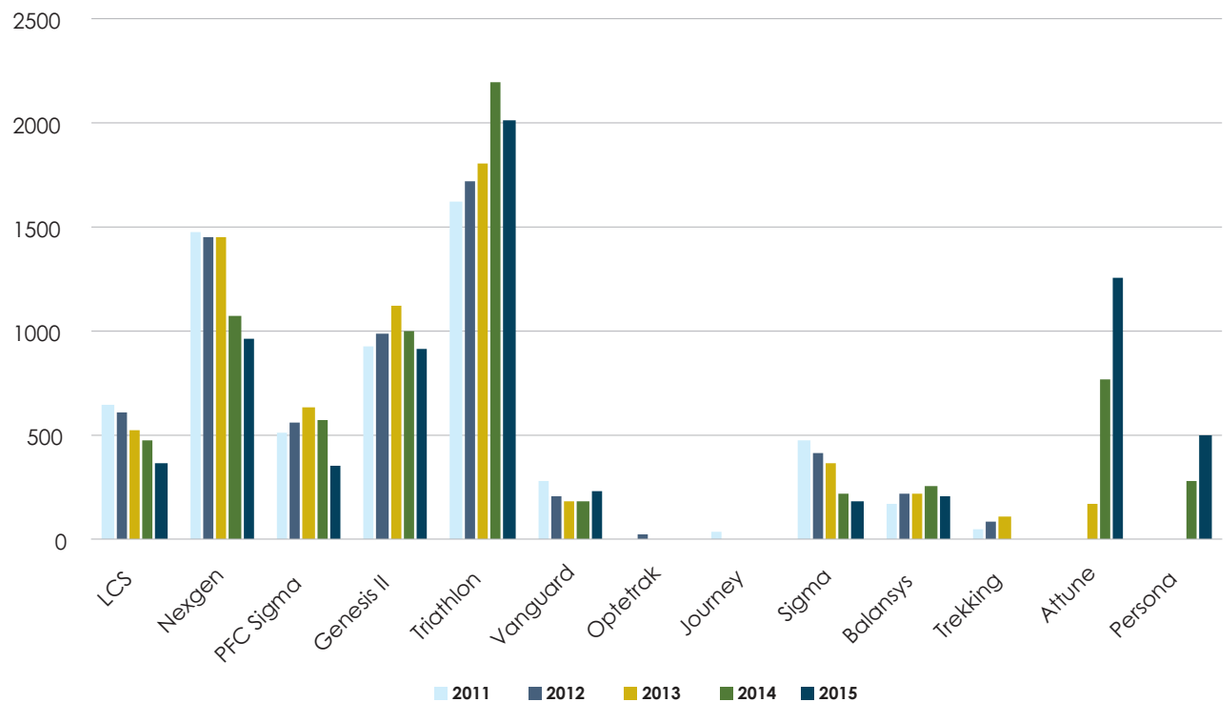
Conventional primary knees

Top ten knee prostheses used in 2015

Triathlon	2014
Attune	1258
Nexgen	968
Genesis II	908
Persona	499
LCS	363
PFC Sigma	356
Vanguard	225
Balansys	211
Sigma	180

There has been no change in the top ten, apart from an order reshuffle with Attune the big mover once again.

Most Used Knee Prostheses per year for five years (2011 – 2015)



Surgeon and hospital workload

Surgeons

In 2015, 208 surgeons performed 7,260 total knee replacements, an average of 35 procedures per surgeon.

33 surgeons performed less than ten procedures and 63 performed more than 40.

Hospitals

In 2015 primary knee replacement was performed in 52 hospitals. 27 were public hospitals and 25 were private.

For 2015, the average number of total knee replacements per hospital was 140.

REVISION KNEE ARTHROPLASTY

Revision is defined by the Registry as a new operation in a previously replaced knee joint, during which one or more of the components is exchanged, removed, manipulated or added. It includes arthrodesis or amputation, but not soft tissue procedures. A two or more staged procedure is registered as one revision.

Data analysis

For the seventeen-year period January 1999 – December 2015, there were 6,739 revision knee procedures registered. This is an additional 615 compared to last year's report.

The average age for a revision knee replacement was 69.57 years, with a range of 10.57 – 98.39 years.

Revision knees

	Female	Male
Number	3,212	3,527
Percentage	47.66	52.34
Mean age	69.94	69.23
Maximum age	95.80	98.39
Minimum age	10.57	15.49
Standard dev.	10.38	10.15

The percentage of revision knees to primary knees is 7% and the ratio1:13.

Body Mass Index

For the six-year period 2010 - 2015, there were 1,048 BMI registrations for revision knee replacements. The average BMI was 31.26(obese) with a range of 15 – 65 and a standard deviation of 6.09.

REVISION OF REGISTERED PRIMARY KNEE ARTHROPLASTIES

This section analyses data for revisions of the primary registered knee arthroplasties for the seventeen-year period.

There were 2,569 revisions of the 85,769 primary conventional knee replacements (2.9%) and 36 revisions of the 417 patello-femoral prostheses (8.6%).

Conventional knee replacement analysis

Time to revision

Mean	1,320 days
Maximum	5,939 days
Minimum	1 day
Standard deviation	1,237 days

Reason for revision

Pain	768
Deep infection	670
Loosening tibial component	576
Patellar resurfacing	615
Loosening femoral component	282
Loosening patellar component	43
Fracture femur	42
Fracture tibia	33

There is often more than one listed reason for revision and all are entered.

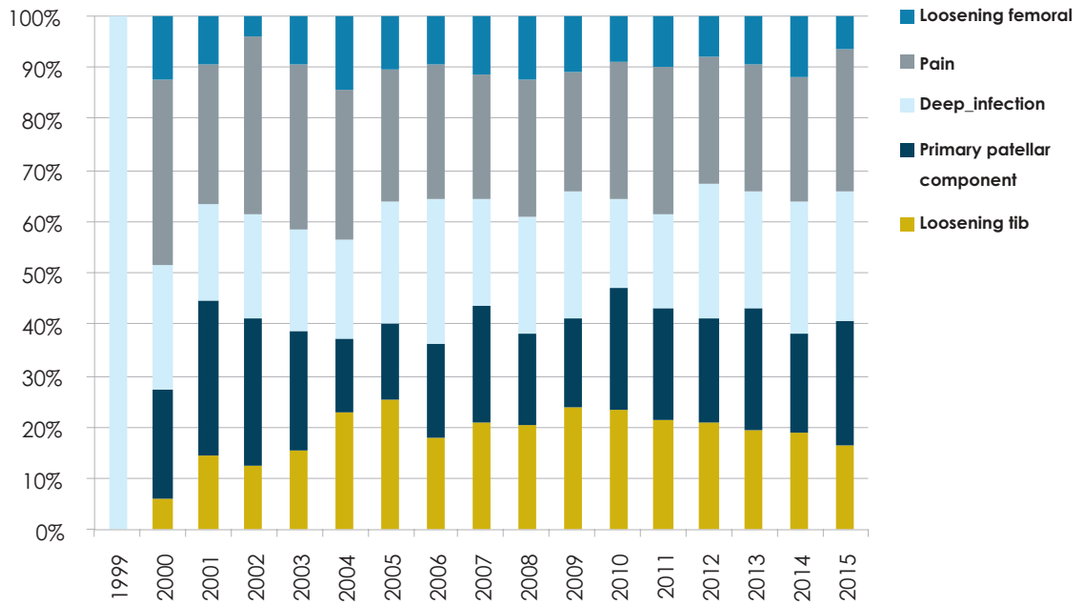
Analysis by time of the 5 main reasons for revision

	Loosening tibial component		Primary patellar component		Deep infection		Pain		Loosening femoral component	
Years	Count	%	Count	%	Count	%	Count	%	Count	%
0	35	6.08	89	14.47	266	39.70	113	14.71	14	4.96
1	63	10.94	183	29.76	131	19.55	211	27.47	33	11.70
2	79	13.72	107	17.40	72	10.75	132	17.19	26	9.22
3	73	12.67	70	11.38	66	9.85	80	10.42	24	8.51
4	61	10.59	41	6.67	30	4.48	54	7.03	34	12.06
5	50	8.68	22	3.58	24	3.58	38	4.95	22	7.80
6	52	9.03	21	3.41	24	3.58	25	3.26	24	8.51
7	40	6.94	16	2.60	16	2.39	22	2.86	24	8.51
8	25	4.34	13	2.11	9	1.34	22	2.86	17	6.03
9	33	5.73	12	1.95	12	1.79	16	2.08	20	7.09
10	20	3.47	14	2.28	7	1.04	21	2.73	11	3.90
11	19	3.30	14	2.28	8	1.19	9	1.17	16	5.67
12	12	2.08	7	1.14	3	0.45	10	1.30	7	2.48
13	4	0.69	2	0.33	1	0.15	4	0.52	4	1.42
14	7	1.22	3	0.49	0	0.00	8	1.04	3	1.06
15	3	0.52	1	0.16	1	0.15	3	0.39	3	1.06
	576	**100**	**615**	**100**	**670**	**100**	**768**	**100**	**282**	**100**

Analyses of percentages of the 5 main reasons for revision by year

	Loosening tibial component	Primary patellar component	Deep infection	Pain	Loosening femoral component
Years	**%**	**%**	**%**	**%**	**%**
1999	0.00	0.00	50.00	0.00	0.00
2000	6.45	22.58	25.81	38.71	12.90
2001	16.07	33.93	21.43	30.36	10.71
2002	16.67	38.33	26.67	46.67	5.00
2003	20.00	29.33	25.33	41.33	12.00
2004	26.19	16.67	22.62	33.33	16.67
2005	27.62	16.19	25.71	27.62	11.43
2006	19.27	20.18	30.28	28.44	10.09
2007	24.24	25.76	24.24	28.03	12.88
2008	22.70	20.00	25.41	29.73	13.51
2009	27.23	20.42	28.27	26.70	12.57
2010	26.11	26.60	19.70	30.05	9.85
2011	24.19	24.65	20.47	32.56	11.16
2012	23.18	22.32	29.18	27.04	9.01
2013	23.31	27.82	27.44	29.32	11.28
2014	21.65	21.99	29.21	27.84	13.40
2015	17.74	25.69	27.52	29.36	7.03

NB each year column does not add up to 100% as often more than one cause for revision is listed and there are other reasons for revision other than the five above listed in the registry.



Patello-Femoral Arthroplasty

Revision of patello-femoral knees

Of the 417 registered, 36 have been revised.

Time to revision

Mean	1,612 days
Maximum	4,344 days
Minimum	108 days
Standard deviation	1,251 days

Reason for revision

Pain	13
Loosening patellar	3
Deep infection	2

Patellar resurfacing

66 % of the 85,769 registered conventional primary knees did not have the patella resurfaced and 34% did have the patella resurfaced. Of the group that was not resurfaced, 612 (11%) subsequently had the patella resurfaced.

Statistical note

In the table below there are two statistical terms readers may not be familiar with:

i) Observed component years

This is the number of registered primary procedures multiplied by the number of years each component has been in situ.

ii) Rate/100 component years

This is equivalent to the yearly revision rate expressed as a percent and is derived by dividing the number of prostheses revised by the observed component years multiplied by 100. It therefore allows for the number of years of post-operative follow up in calculating the revision rate. These rates are usually very low, hence it is expressed per 100 component years rather than per component year. Statisticians consider that this is a more accurate way of deriving a revision rate for comparison when analysing data with widely varying follow up times. It is also important to note the confidence intervals. The closer they are to the estimated revision rate/100 component years, the more precise the estimate is.

Statistical Significance

Where it is stated that a difference among results is significant the p value is 0.05 or less. In most of these situations this is because there is no overlap of the confidence intervals (CIs) but sometimes significance can apply in the presence of CI overlap.

All Primary Total Knee Arthroplasties

No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
85,769	521,420.9	2,569	0.49	0.47	0.51

Revision Rate of Individual Knee Prostheses Sorted by Number of Arthroplasties

(Minimum of 50 arthroplasties)

Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Nexgen	17,919	111,817.7	589	0.53	0.49	0.57
Triathlon	15,695	63,947.5	278	0.43	0.38	0.49
LCS	13,733	111,461.0	565	0.51	0.47	0.55
Genesis II	11,995	69,178.1	337	0.49	0.44	0.54
PFC Sigma	9,845	67,609.9	265	0.39	0.35	0.44
Duracon	4,213	42,051.0	128	0.30	0.25	0.36
Attune	2,207	2,061.9	16	0.78	0.44	1.26
Vanguard	1,626	6,049.2	40	0.66	0.47	0.89
Sigma	1,138	3,240.3	21	0.65	0.39	0.97
Balansys	1,119	2,721.9	25	0.92	0.59	1.36
Sigma CR150	937	3,484.2	16	0.46	0.26	0.75
Scorpio	852	8,113.8	57	0.70	0.53	0.90
Maxim	822	8,411.5	48	0.57	0.42	0.75
Persona	794	638.7	7	1.10	0.39	2.15
Optetrak	661	4,383.8	40	1.00	0.65	1.24
Trekking	474	1,010.7	10	0.99	0.47	1.82
AGC	376	4,051.2	15	0.37	0.21	0.61

Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
MBK	256	3,029.9	18	0.59	0.35	0.94
Insall/Burstein	249	2,742.7	46	1.68	1.21	2.22
Journey	204	783.9	7	0.89	0.32	1.75
Advance	157	1,574.5	5	0.32	0.10	0.74
Legion	138	262.9	5	1.90	0.62	4.44
AMK	95	1,169.5	2	0.17	0.02	0.62
ROCC	66	499.5	5	1.00	0.32	2.34

There are 59 (11 more than last year) different types of knee prostheses in the Registry with 30 (50%) with less than 10 registrations.

Revision Rate of Individual Knee Prostheses Sorted by Revision Rate

Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
*#Legion	138	262.9	5	1.90	0.62	4.44
*Insall/Burstein	249	2,742.7	46	1.68	1.21	2.22
Persona	794	638.7	7	1.10	0.39	2.15
ROCC	66	499.5	5	1.00	0.32	2.34
*Optetrak	661	4,383.8	40	1.00	0.65	1.24
Trekking	474	1,010.7	10	0.99	0.47	1.82
*#Balansys	1,119	2,721.9	25	0.92	0.59	1.36
Journey	204	783.9	7	0.89	0.32	1.75
Attune	2,207	2,061.9	16	0.78	0.44	1.26
*Scorpio	852	8,113.8	57	0.70	0.53	0.90
Vanguard	1,626	6,049.2	40	0.66	0.47	0.89
Sigma	1,138	3,240.3	21	0.65	0.39	0.97
MBK	256	3,029.9	18	0.59	0.35	0.94
Maxim	822	8,411.5	48	0.57	0.42	0.75
Nexgen	17,919	111,817.7	589	0.53	0.49	0.57
LCS	13,733	111,461.0	565	0.51	0.47	0.55
Genesis II	11,995	69,178.1	337	0.49	0.44	0.54
Sigma CR150	937	3,484.2	16	0.46	0.26	0.75
Triathlon	15,695	63,947.5	278	0.43	0.38	0.49
PFC Sigma	9,845	67,609.9	265	0.39	0.35	0.44
AGC	376	4,051.2	15	0.37	0.21	0.61
Advance	157	1,574.5	5	0.32	0.10	0.74
Duracon	4,213	42,051.0	128	0.30	0.25	0.36
AMK	95	1,169.5	2	0.17	0.02	0.62

*Those marked with an * in the above table have revision rates significantly higher than the overall rate of 0.49 /100 ocys @ the 95% confidence interval. There are several other combinations with high revision rates but without statistical significance because of the wide CIs. Those marked with a # as well as an * indicate those combinations used during 2015*

It is to be noted several variants of basically the same knee prosthesis type, e.g. Nexgen, LCS, which are registered separately have been merged into the one group to enable comparable statistical analyses with other prostheses which may also have more than one variant but are registered as one or two prostheses.

Revision vs Arthroplasty Fixation for Fully Cemented Prostheses Sorted by Revision Rate

(Minimum of 50 primary registered arthroplasties)

Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
*Oxford Tricomp. Femoral	38	423.7	9	2.12	0.97	4.03
*#Legion	137	262.0	5	1.91	0.62	4.45
*Insall/Burstein	249	2,742.7	46	1.68	1.21	2.22
*Optetrak	281	1,944.2	23	1.18	0.73	1.74
Persona	794	638.7	7	1.10	0.39	2.15
Trekking	474	1,010.7	10	0.99	0.47	1.82
*#Balansys	1,119	2,721.9	25	0.92	0.59	1.36
Journey	204	783.9	7	0.89	0.32	1.75
Attune	2,207	2,061.9	16	0.78	0.44	1.26
*Scorpio	852	8,113.8	57	0.70	0.53	0.90
Vanguard	1,603	5,984.7	39	0.65	0.46	0.88
MBK	247	2,933.4	18	0.61	0.36	0.97
Sigma	1,059	2,862.7	17	0.59	0.33	0.93
Maxim	822	8,411.5	48	0.57	0.42	0.75
Nexgen	17,093	106,403.8	567	0.53	0.49	0.58
Genesis II	11,941	68,645.4	333	0.49	0.43	0.54
Sigma CR150	935	3,482.0	16	0.46	0.26	0.75
Triathlon	15,523	62,959.5	271	0.43	0.38	0.48
LCS	9,148	78,366.4	319	0.41	0.36	0.45
PFC Sigma	9,174	64,015.5	242	0.38	0.33	0.43
AGC	376	4,051.2	15	0.37	0.21	0.61
Advance	157	1,574.5	5	0.32	0.10	0.74
Duracon	3,432	33,883.2	105	0.31	0.25	0.37
AMK	95	1,169.5	2	0.17	0.02	0.62

*Those marked with an * in the above table have revision rates significantly higher than the overall rate of 0.49 /100 ocys @ the 95% confidence interval. There are several other combinations with high revision rates but without statistical significance because of the wide CIs. Those marked with a # as well as an * indicate those combinations used during 2015.*

Revision vs Arthroplasty for Hybrid Fixation of Prostheses Sorted by Revision Rate

(Minimum of 50 primary registered arthroplasties)

Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Sigma	79	377.6	4	1.06	0.29	2.71
Triathlon	170	975.3	7	0.72	0.29	1.48
Optetrak	380	2,439.6	17	0.70	0.41	1.12
PFC Sigma	660	3,544.4	23	0.65	0.41	0.97
Genesis II	52	526.3	3	0.57	0.08	1.52
LCS	2,021	15,858.2	80	0.50	0.40	0.63
Duracon	321	3,736.0	14	0.37	0.20	0.61
Nexgen	575	4,038.4	15	0.37	0.21	0.61

There are no significantly higher revision rates than the overall rate of 0.49 /100 ocys at the 95% confidence.

Revision vs Arthroplasty Fixation for Fully Uncemented Prostheses Sorted by Revision Rate

(Minimum of 50 primary registered arthroplasties)

Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
LCS	2,565	17,236.6	166	0.96	0.82	1.12
Nexgen	251	1,375.5	7	0.51	0.20	1.05
Duracon	460	4,431.8	9	0.20	0.09	0.37

The uncemented LCS prosthesis (185 implanted in 2015) has a significantly higher revision rate than the overall rate of 0.49/100 ocys at the 95% confidence.

Revision Rates for Fixed vs Mobile Bearing Knees

Prosthesis	Fixed/ Mobile	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
AGC	Fixed	376	4,051.2	15	0.37	0.21	0.61
AMK	Fixed	95	1,169.5	2	0.17	0.02	0.62
Balansys	Fixed	1,112	2,713.9	24	0.88	0.57	1.32
Duracon	Fixed	4,207	41,980.6	127	0.30	0.25	0.36
Genesis II	Fixed	11,968	69,171.7	337	0.49	0.44	0.54
Insall/Burstein	Fixed	249	2,742.7	46	1.68	1.21	2.22
Journey	Fixed	204	783.9	7	0.89	0.32	1.75
LCS	Mobile	13,732	111,460.8	565	0.51	0.47	0.55
Maxim	Fixed	822	8,411.5	48	0.57	0.42	0.75
MBK	Mobile	256	3,029.9	18	0.59	0.35	0.94
Trekking	Mobile	474	1,010.7	10	0.99	0.47	1.82
Persona	Fixed	790	637.5	7	1.10	0.39	2.16
Nexgen	Fixed	14,989	94,837.6	511	0.54	0.49	0.59
	Mobile	2,715	15,973.0	71	0.44	0.35	0.56
PFC Sigma	Fixed	5,618	41,742.6	164	0.39	0.34	0.46
	Mobile	3,430	24,440.4	95	0.39	0.31	0.48
Scorpio	Fixed	737	7,043.8	49	0.70	0.51	0.92
	Mobile	104	1,004.0	5	0.50	0.13	1.09
Sigma	Fixed	254	897.7	7	0.78	0.31	1.61
	Mobile	719	2,067.0	13	0.63	0.33	1.08
Sigma CR150	Fixed	172	717.2	7	0.98	0.39	2.01
	Mobile	749	2,741.3	9	0.33	0.14	0.60
Triathlon	Fixed	15,240	62,012.8	268	0.43	0.38	0.49
	Mobile	385	1,753.0	9	0.51	0.23	0.97
Attune	Fixed	1,094	993.5	9	0.91	0.38	1.65
	Mobile	1,109	1,065.3	7	0.66	0.26	1.35

The Balansys, Insall/Burstein and the fixed version of the Scorpio have significantly higher revision rates than the overall rate of 0.49/100 ocys at the 95% confidence.

Overall Revision Rates for Fixed vs Mobile Bearing Knees

Prosthe Fixed/Mobile	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Fixed	57,938	339,951.9	1,629	0.48	0.46	0.50
Mobile	23,684	164,579.3	802	0.49	0.45	0.52

For the second year in a row there is not a significantly higher revision rate for mobile bearing knees when compared to fixed bearing knees. It was not possible to determine fixed or mobile categories for all registered knees, which accounts for the 4,147 shortfall in the total number.

Revision Rates for Cruciate Retaining (CR) vs Posterior Stabilised (PS)

Prosthesis	CR/PS	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
AGC	PS	28	334.6	3	0.90	0.18	2.62
Insall/Burstein	PS	249	2,742.7	46	1.68	1.21	2.22
LCS	PS	68	300.9	0	0.00	0.00	1.23
Legion	PS	74	149.7	2	1.34	0.16	4.83
Sigma CR150	CR	937	3,484.2	16	0.46	0.26	0.75
Attune	CR	1,510	1,490.1	12	0.81	0.42	1.41
	PS	697	571.8	4	0.70	0.19	1.79
Balansys	CR	1,035	2,582.2	21	0.81	0.50	1.24
	PS	77	131.6	3	2.28	0.47	6.66
Genesis II	CR	6,352	42,770.0	155	0.36	0.31	0.42
	PS	5,612	26,369.9	182	0.69	0.59	0.80
Maxim	CR	657	6,664.3	34	0.51	0.35	0.71
	PS	165	1,747.2	14	0.80	0.44	1.34
Nexgen	CR	8,111	52,768.3	223	0.42	0.37	0.48
	PS	9,558	58,198.6	353	0.61	0.54	0.67
Optetrak	CR	437	2,893.3	17	0.59	0.34	0.94
	PS	224	1,490.5	23	1.54	0.98	2.32
Persona	CR	464	294.4	4	1.36	0.37	3.48
	PS	328	344.2	3	0.87	0.12	2.33
PFC Sigma	CR	7,890	53,182.0	183	0.34	0.30	0.40
	PS	1,888	14,037.4	80	0.57	0.45	0.71
Scorpio	CR	739	7,164.1	48	0.67	0.49	0.89
	PS	111	936.6	9	0.96	0.44	1.82
Sigma	CR	163	392.0	0	0.00	0.00	0.94
	PS	971	2,844.7	21	0.74	0.44	1.11
Trekking	CR	185	396.9	6	1.51	0.55	3.29
	PS	289	613.8	4	0.65	0.14	1.55
Triathlon	CR	13,116	51,613.1	219	0.42	0.37	0.48
	PS	2,574	12,320.1	59	0.48	0.36	0.62
Vanguard	CR	1,128	4,448.4	23	0.52	0.32	0.76
	PS	492	1,583.3	17	1.07	0.63	1.72

The Insall/Burstein, Nexgen PS, Genesis11 PS, Optetrak PS, Vangard PS and the Trekking CR have significantly higher revision rates than the overall rate of 0.49/100 ocys at the 95% confidence.

Overall Revision Rates for Cruciate Retaining vs Posterior Stabilised vs Minimally Stabilised Knees

Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
CR	42,724	230,143.3	961	0.42	0.39	0.44
MS	13,985	114,687.2	588	0.51	0.47	0.56
PS	23,410	124,747.0	823	0.66	0.62	0.71

The LCS prostheses account for 98% of the minimally stabilised. There is a significantly higher revision rate for posterior and minimally stabilised compared to cruciate retaining knee prostheses.

Revision vs Arthroplasty Fixation

Fixation	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Cemented	78,118	466,265.8	2,213	0.47	0.45	0.49
Uncemented	3,348	23,432.0	189	0.81	0.70	0.93
Hybrid	4,303	31,723.1	167	0.53	0.45	0.61

Uncemented knees have a significantly higher revision rate than either cemented or hybrid knees. Further analyses have shown that it is loosening of the uncemented tibial component that is responsible for the higher revision rate.

There is a significantly higher revision rate for uncemented knees when compared to the other two categories.

Revision vs Age Bands

Age Bands	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
<55	7,229	46,156.9	446	0.97	0.88	1.06
55_64	23,643	147,103.6	932	0.63	0.59	0.68
65_74	32,807	200,691.0	865	0.43	0.40	0.46
>75	22,090	127,469.4	326	0.26	0.23	0.28

Each successive age band in ascending order has a significantly lower revision rate.

Revision vs Gender

Gender	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Female	44,185	273,836.8	1,225	0.45	0.42	0.47
Male	41,584	247,584.1	1,344	0.54	0.51	0.57

The revision rate for males is significantly higher than for females.

Revision by Age Bands vs Arthroplasty Fixation

Cemented	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
<55	6,133	37,598.3	339	0.90	0.81	1.00
55_64	21,131	128,193.5	789	0.62	0.57	0.66
65_74	30,258	182,469.8	791	0.43	0.40	0.46
>75	20,596	118,004.2	294	0.25	0.22	0.28

Each successive age band in ascending order has a significantly lower revision rate.

Revision by Age Bands vs Arthroplasty Fixation

Uncemented	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
<55	565	4,719.6	69	1.46	1.14	1.85
55_64	1,158	8,579.4	78	0.91	0.71	1.13
65_74	1,066	7,007.5	33	0.47	0.32	0.66
>75	559	3,125.6	9	0.29	0.12	0.53

The lowest age band has a significantly higher revision rate than the three highest bands and the 55-64 age band has a significantly higher revision rate than the highest two age bands.

Hybrid	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
<55	531	3,839.1	38	0.99	0.70	1.36
55_64	1,354	10,330.7	65	0.63	0.49	0.80
65_74	1,483	11,213.7	41	0.37	0.26	0.50
>75	935	6,339.7	23	0.36	0.23	0.54

The lowest age band has a significantly higher revision rate than the two highest bands.

Revision vs Approach

Approach	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Medial	77,257	467,326.3	2,262	0.48	0.46	0.50
Lateral	1,185	8,477.8	62	0.73	0.56	0.93
Other	1,954	13,429.7	60	0.45	0.34	0.57

The Lateral approach has a significantly higher revision rate than the other two approaches.

Revision vs Image Guidance

Image Guided	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
No	76,744	484,252.9	2,383	0.49	0.47	0.51
Yes	9,025	37,168.0	186	0.50	0.43	0.58

There is no significant difference between the two groups.

Revision vs Surgeon Annual Output

Operations per year	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
<10	1,858	13,293.8	67	0.50	0.39	0.64
10_25	18,563	120,029.7	617	0.51	0.47	0.56
25_50	39,894	244,219.1	1,203	0.49	0.46	0.52
50_75	15,262	86,161.3	420	0.49	0.44	0.54
75_100	6,387	35,393.0	153	0.43	0.37	0.50
>100	3,805	22,324.1	109	0.49	0.40	0.59

There is no significant difference among the groups.

Revision vs ASA Status

ASA Class	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
1	7,222	34,092.7	184	0.54	0.46	0.62
2	40,643	186,539.3	962	0.52	0.48	0.55
3	15,474	67,770.4	379	0.56	0.50	0.62
4	279	1,065.4	7	0.66	0.26	1.35

There is no significant difference among the four classes.

Revision vs BMI

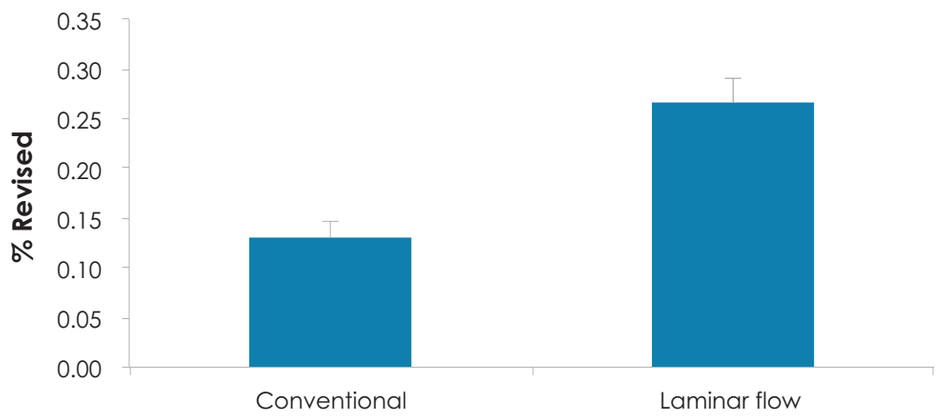
BMI	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
< 19	60	146.3	0	0.00	0.00	2.52
19 - 24	2,723	6,491.0	43	0.66	0.48	0.89
25 - 29	8,049	19,523.2	125	0.64	0.53	0.76
30 - 39	11,132	26,501.6	178	0.67	0.58	0.78
40+	2,228	5,403.6	49	0.91	0.67	1.20

There is no significant difference among the five groups.

Revision for Deep Infection within 6months versus Theatre Environment

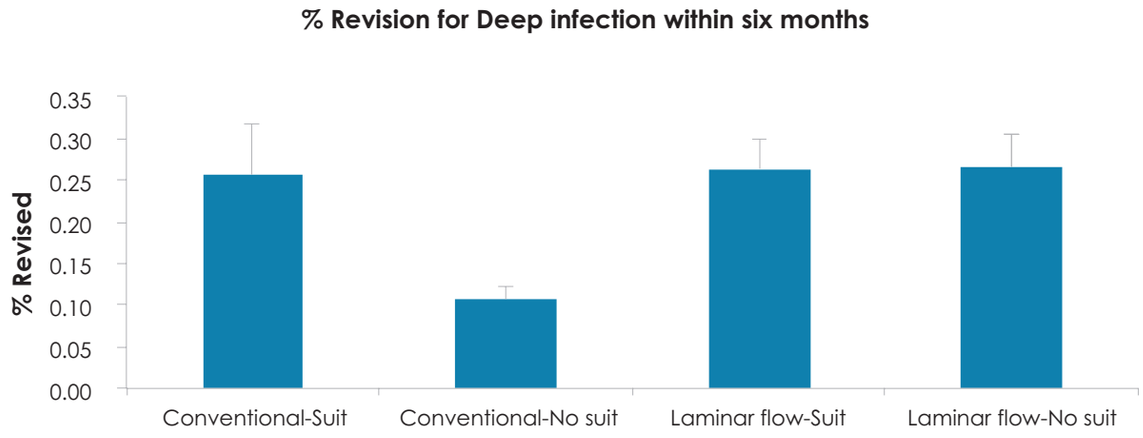
Theatre Environment	Total Number	Number Revised	%	Std Error
Conventional	44,791	58	0.129	0.017
Laminar flow	36,214	96	0.265	0.027

% Revision for Deep infection within six months



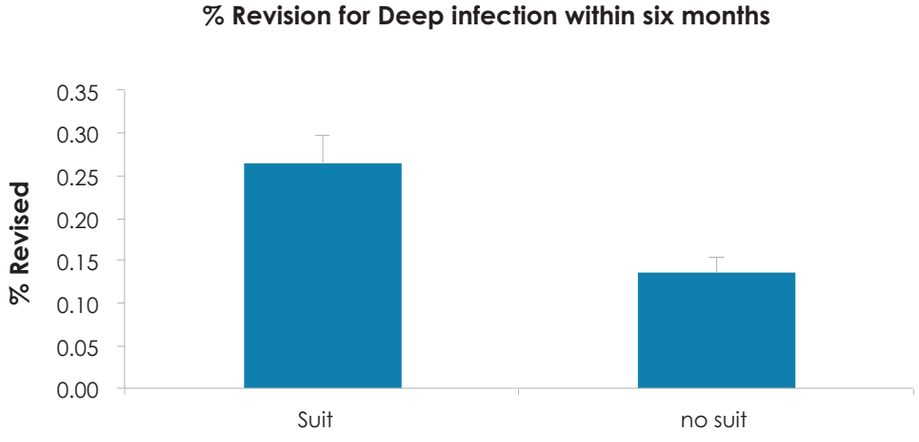
As with hip arthroplasty there is a significant difference in knee revision rates (2x) for deep infection within six months of surgery between conventional and laminar flow theatres.

Theatre Environment	Suit/No Suit	Total Number	Number	%	Std Error
Conventional	Suit	7,030	18	0.256	0.060
	No suit	37,761	40	0.106	0.017
Laminar flow	Suit	19,709	52	0.264	0.036
	No suit	16,505	44	0.267	0.040



There is a significant difference in the revision rates between conventional/no suit and the conventional/suit (2.5x) and laminar /suit (2.5x) environments.

	Total Number	Number Revised	%	Std Error
Suit	26,739	70	0.262	0.031
no suit	54,266	84	0.155	0.017

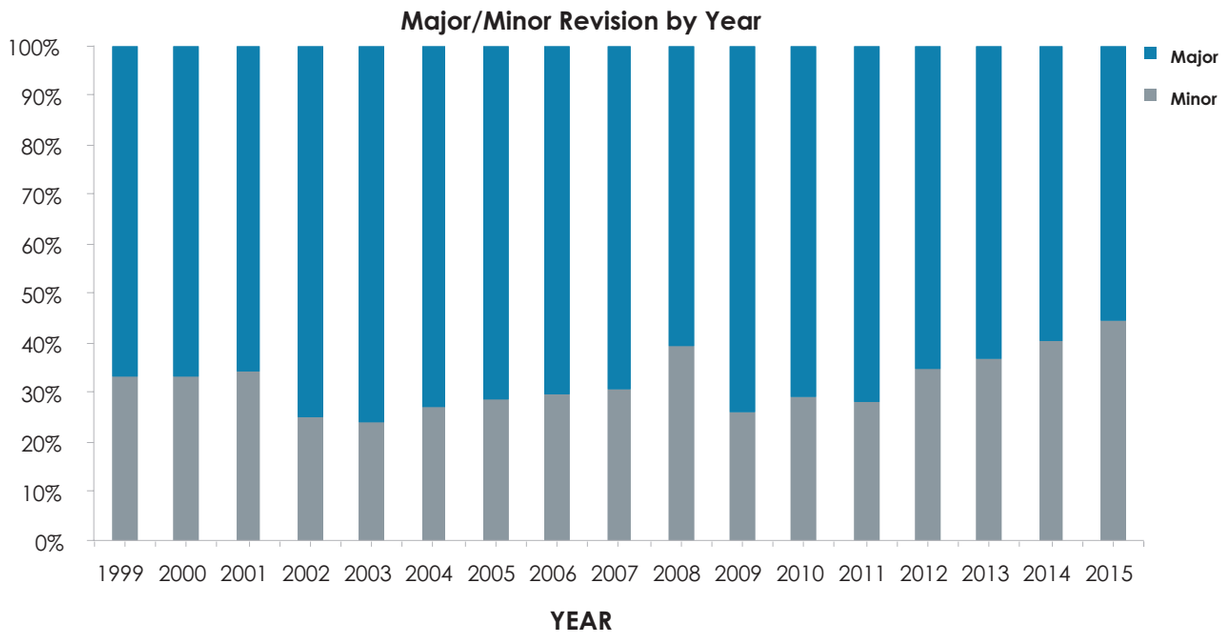


Furthermore there is a significant increase in revision rates (1.7x) when suits are used in either conventional or laminar flow theatres.

From the above data it would seem that, similar to hip arthroplasty, the use of space suits significantly increases the risk of deep infection within the first six months following the arthroplasty and that there is no advantage to using laminar flow theatres.

Comparison of Major vs Minor Revisions by Year

A major revision is defined as revision of tibial and/or femoral components, including any of minor components and minor revision as change of bearing and/or patellar components only.



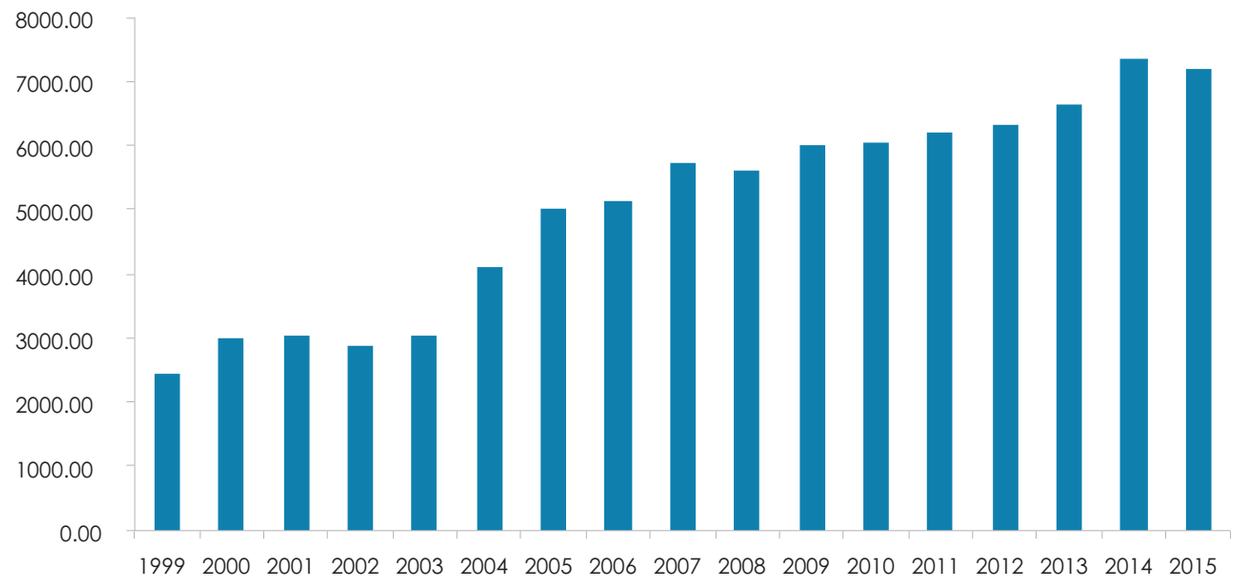
Re-revisions for major vs minor knee revisions

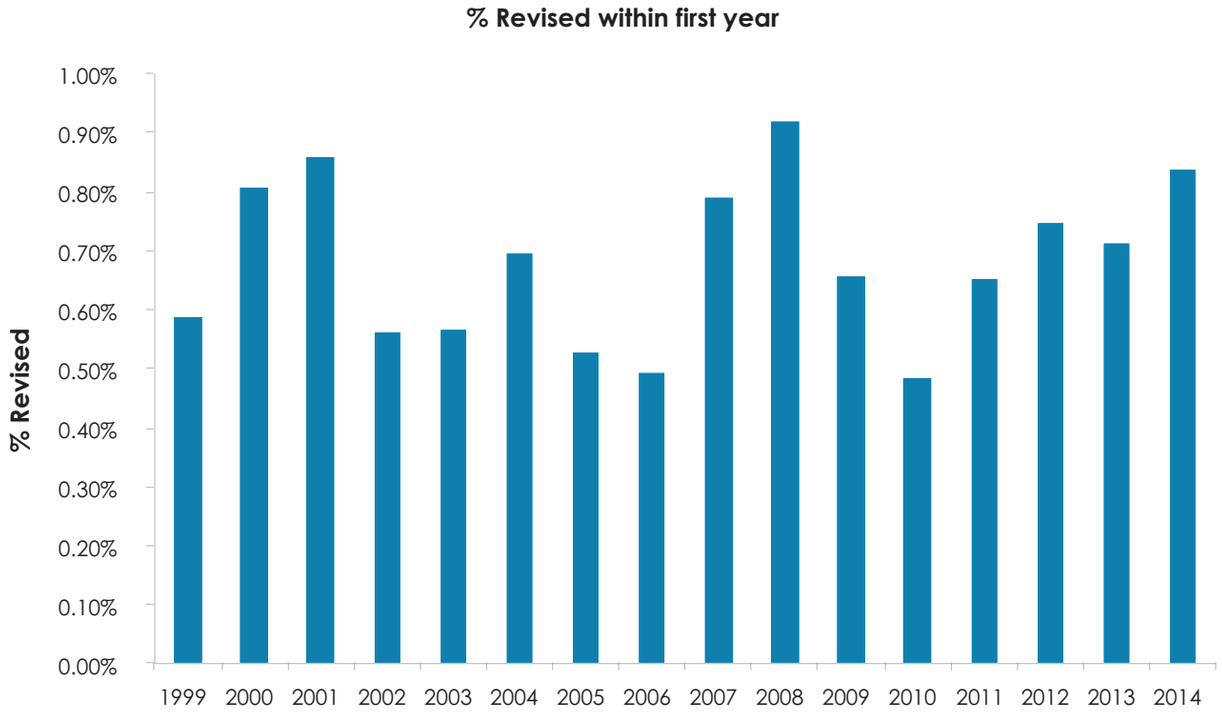
Major/Minor	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Minor	708	2,683.8	121	4.51	3.74	5.39
Major	1,382	6,287.4	187	2.97	2.56	3.43

There is a significantly higher re-revision rate for minor compared to major revisions.

Percentage of Knees Revised in the First Year

The following two bar graphs show that the percentage of knees revised in the first year after primary arthroplasty in 2014 rose slightly to 0.8% from 0.7% in 2013.





Patello-Femoral Arthroplasty

No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
417	1,753.5	36	2.05	1.44	2.84

The revision rate is over four times that for total knee arthroplasty.

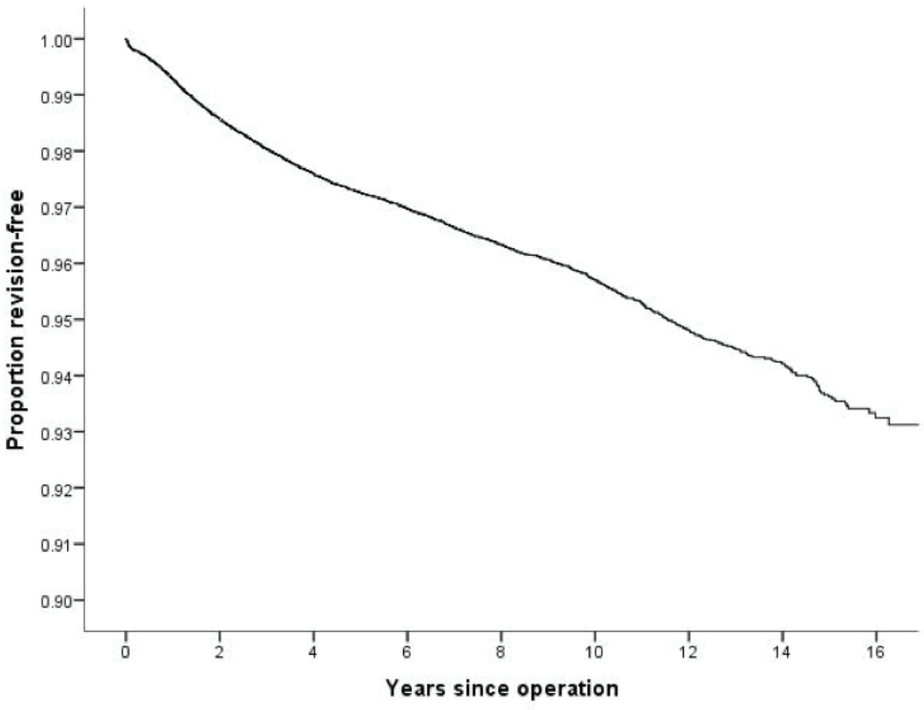
Revised to:

Total	31
Patello Femoral	3
Uniknee	2

KAPLAN MEIER CURVES

The following Kaplan Meier survival analyses are for years 1999 – 2015 with deceased patients censored at time of death.

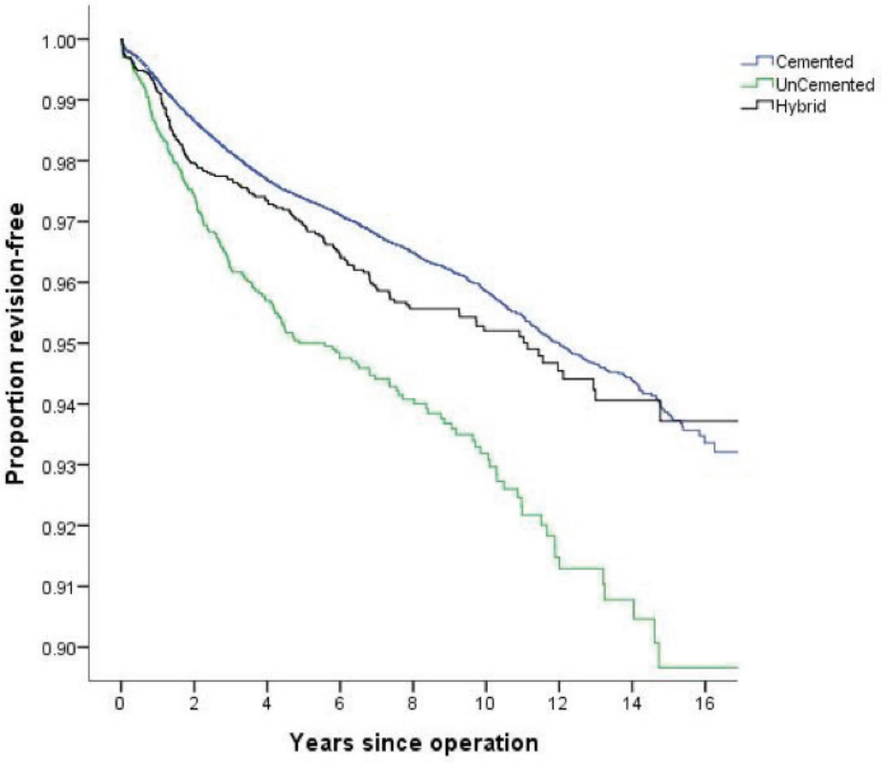
All Knees



Years	% Revision-free	No in each year
1	99.30	77,245
2	98.60	68,605
3	98.00	60,745
4	97.60	53,396
5	97.30	46,303
6	97.00	39,450
7	96.60	33,009
8	96.30	27,103
9	96.10	21,405
10	95.70	16,477
11	95.30	12,172
12	94.80	8,880
13	94.50	6,445
14	94.20	4,443
15	93.60	2,583
16	93.20	1,037

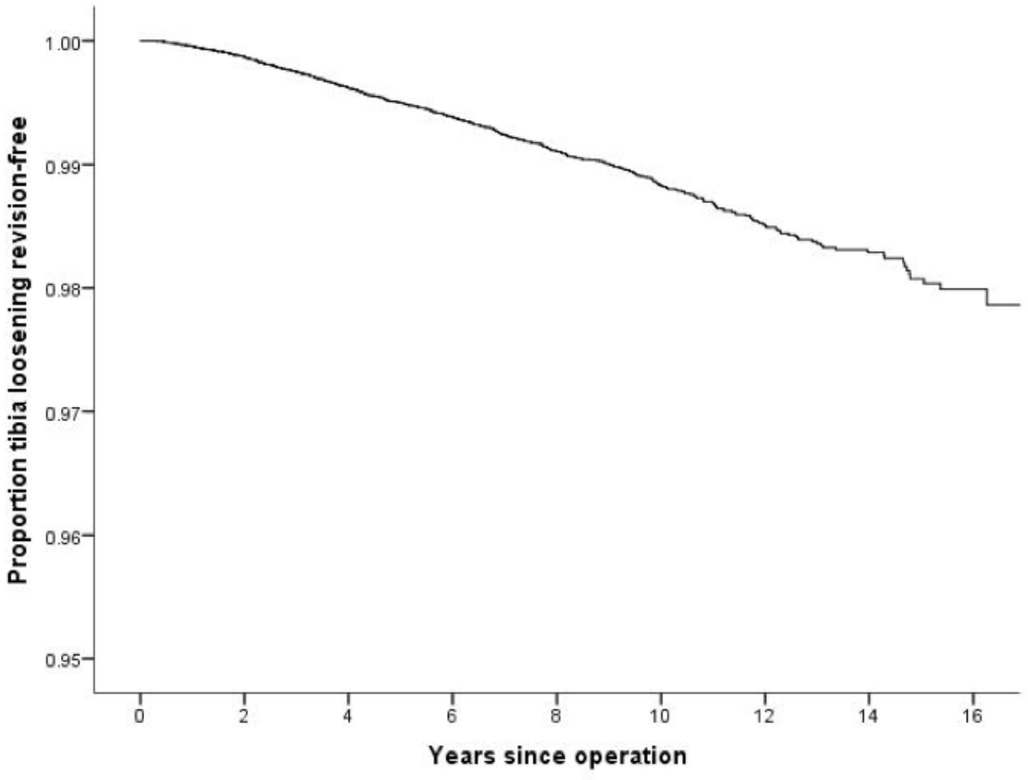
The KM analysis is to 16 years rather than 17 as too few registered knees were revised in 2015.

Cemented vs Uncemented vs Hybrid

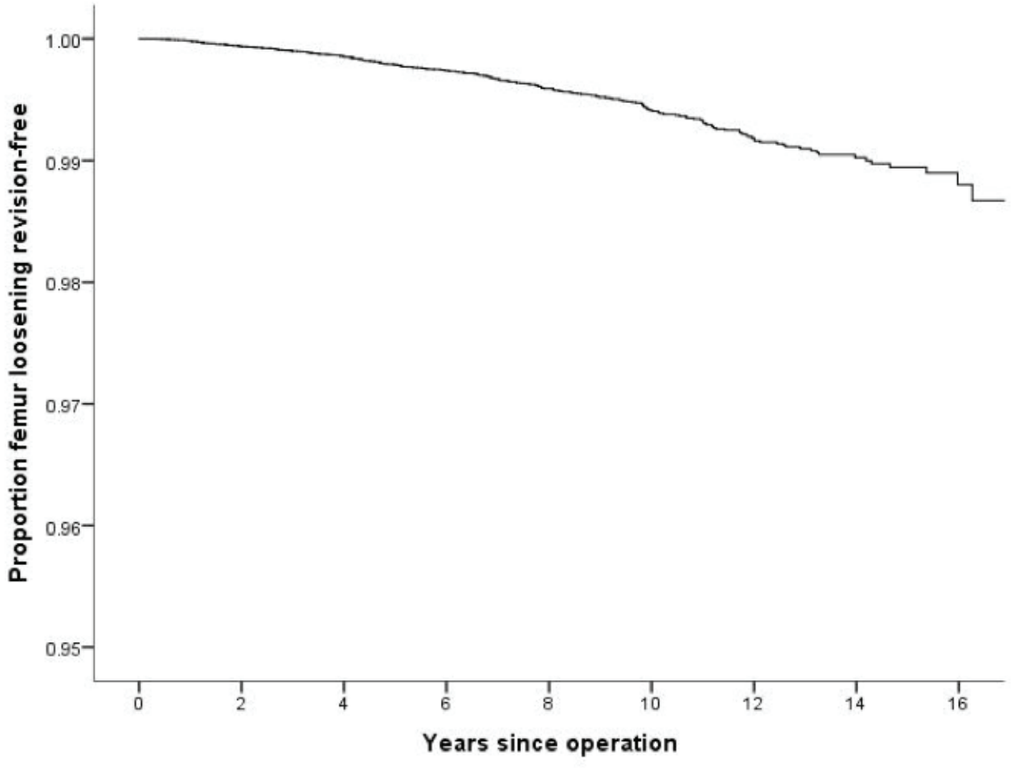


The following KM graphs are for the five main individual reasons for revision.

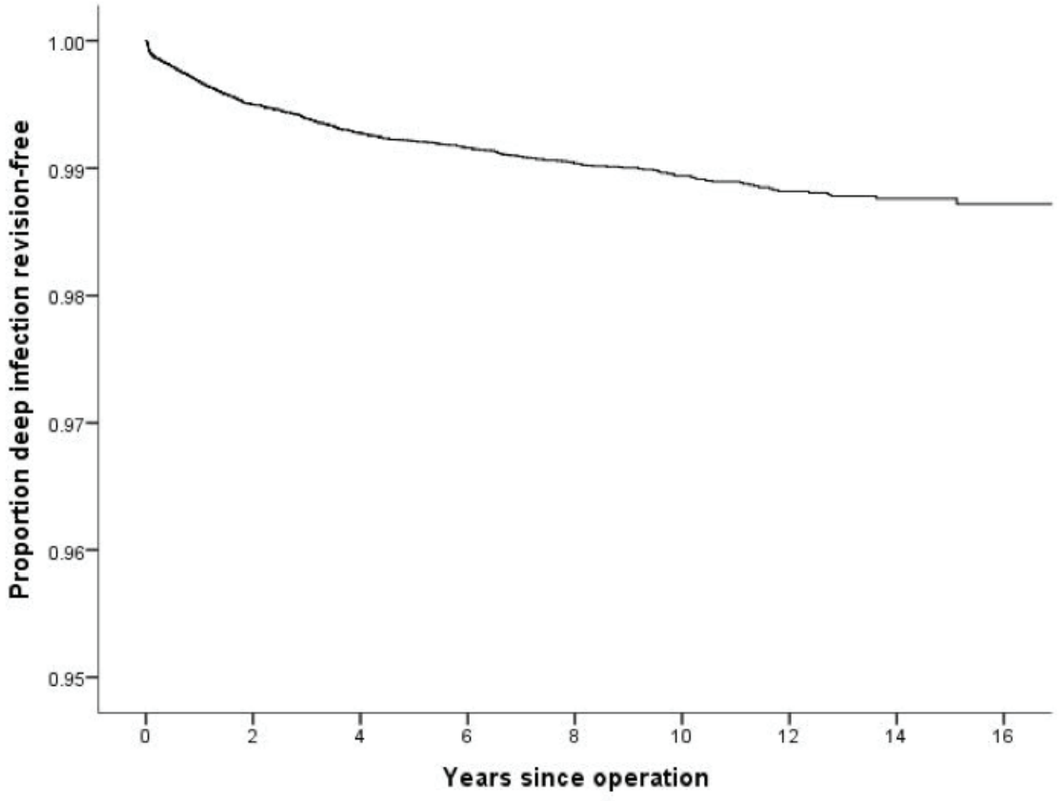
1. Tibial loosening



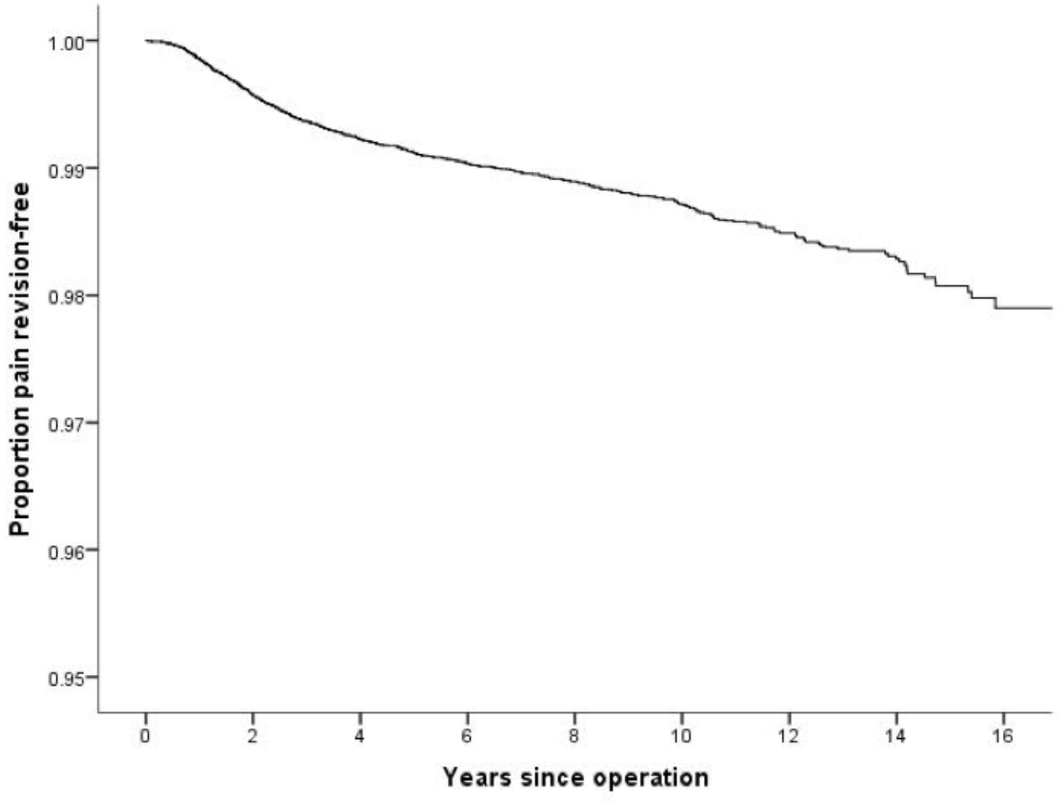
2. Femoral loosening



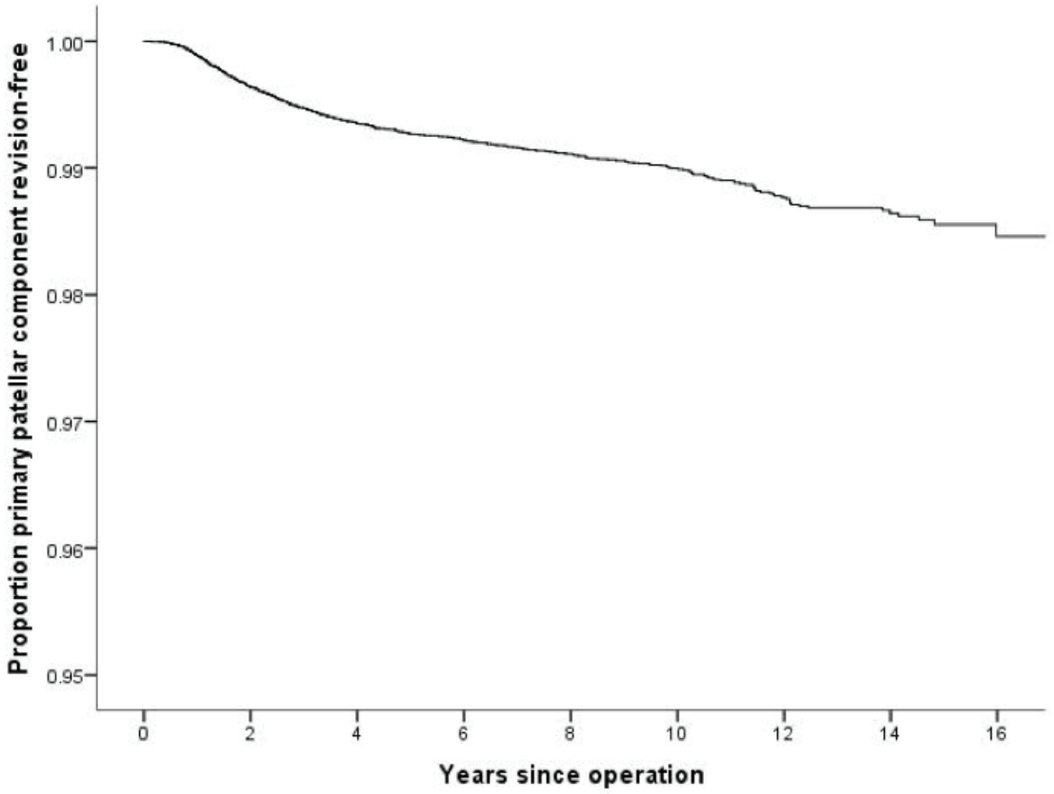
3. Deep infection



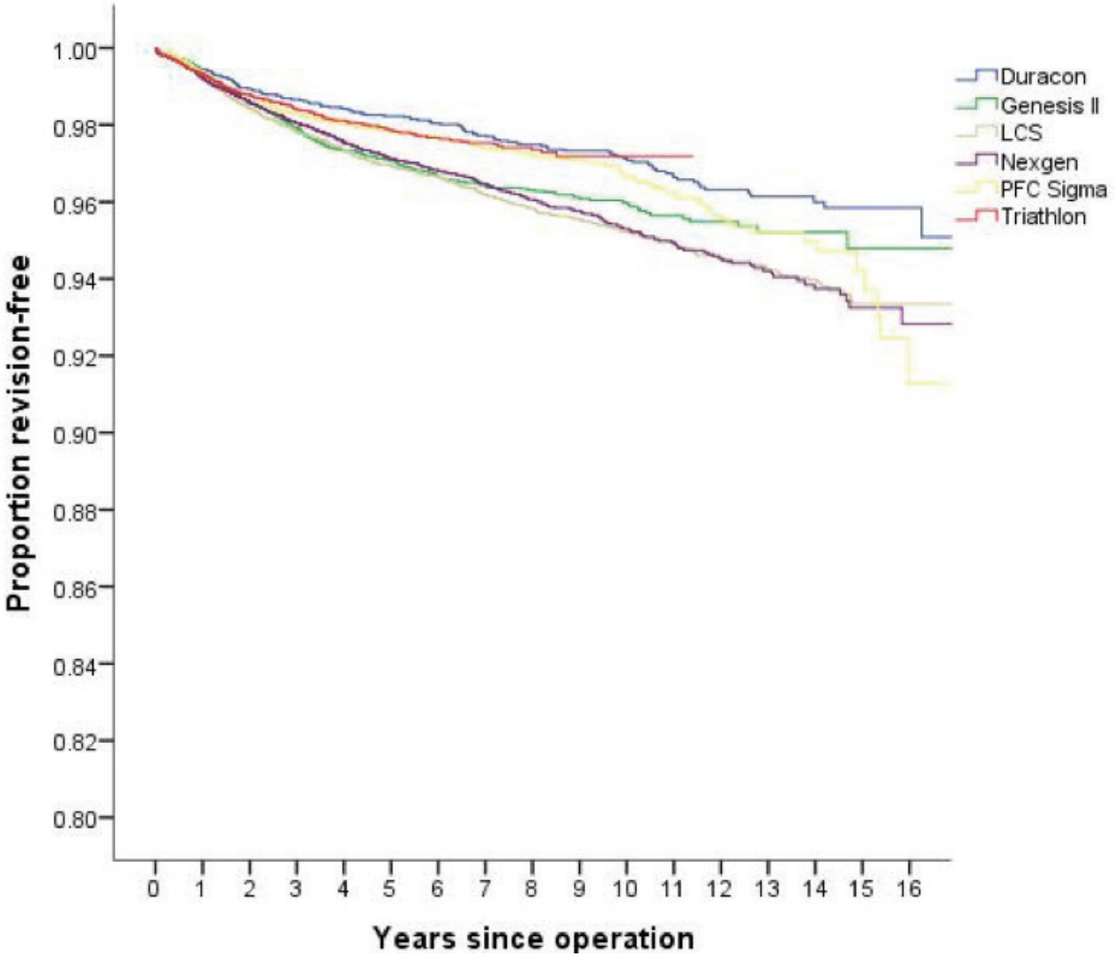
4. Pain



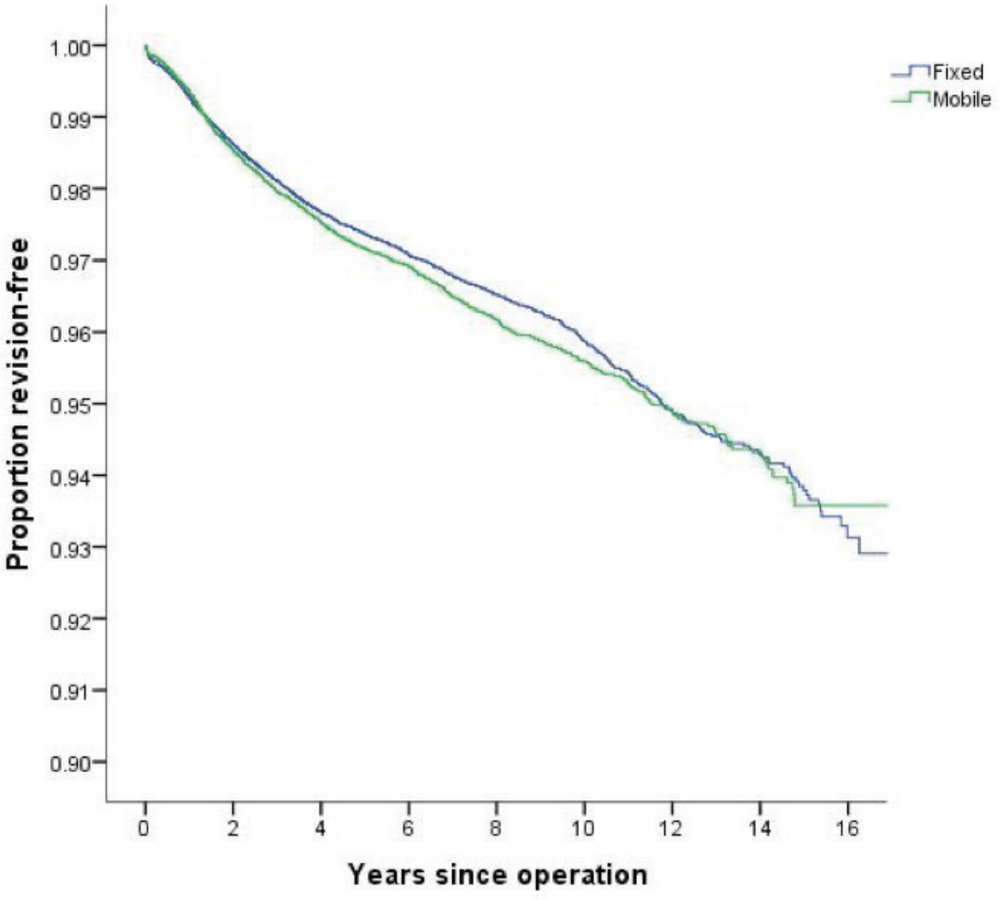
5. Patellar revision



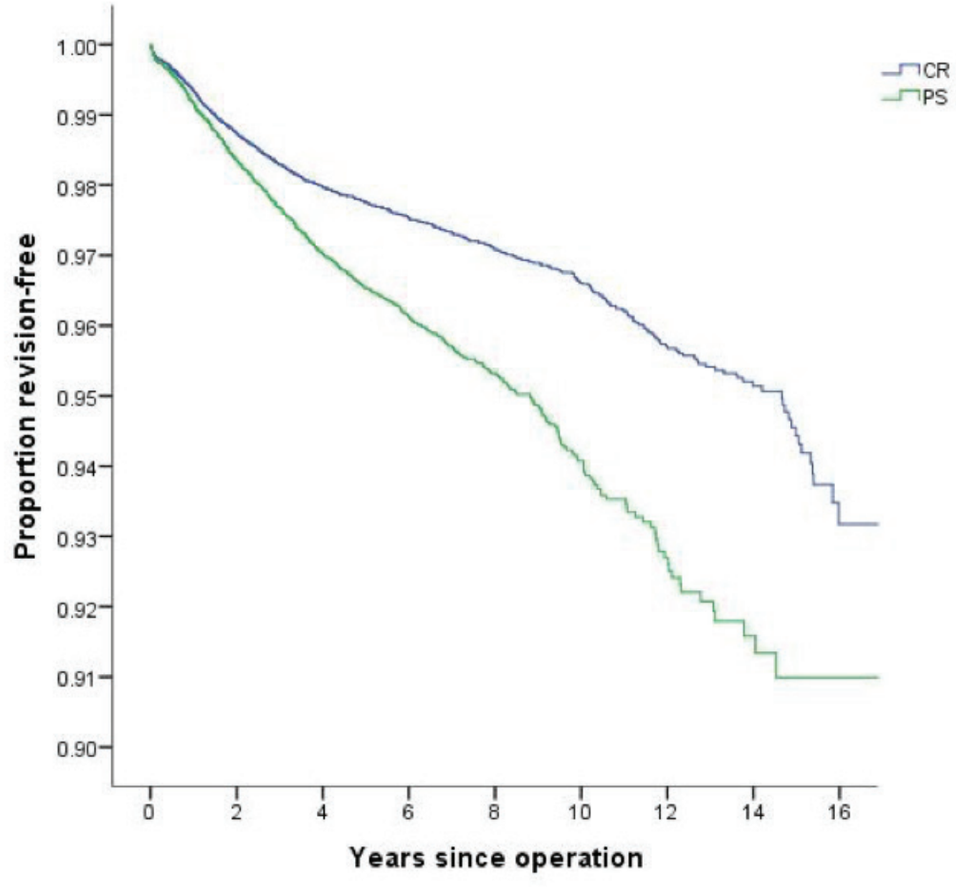
Survival Curve to 16 years for 6 knee prostheses



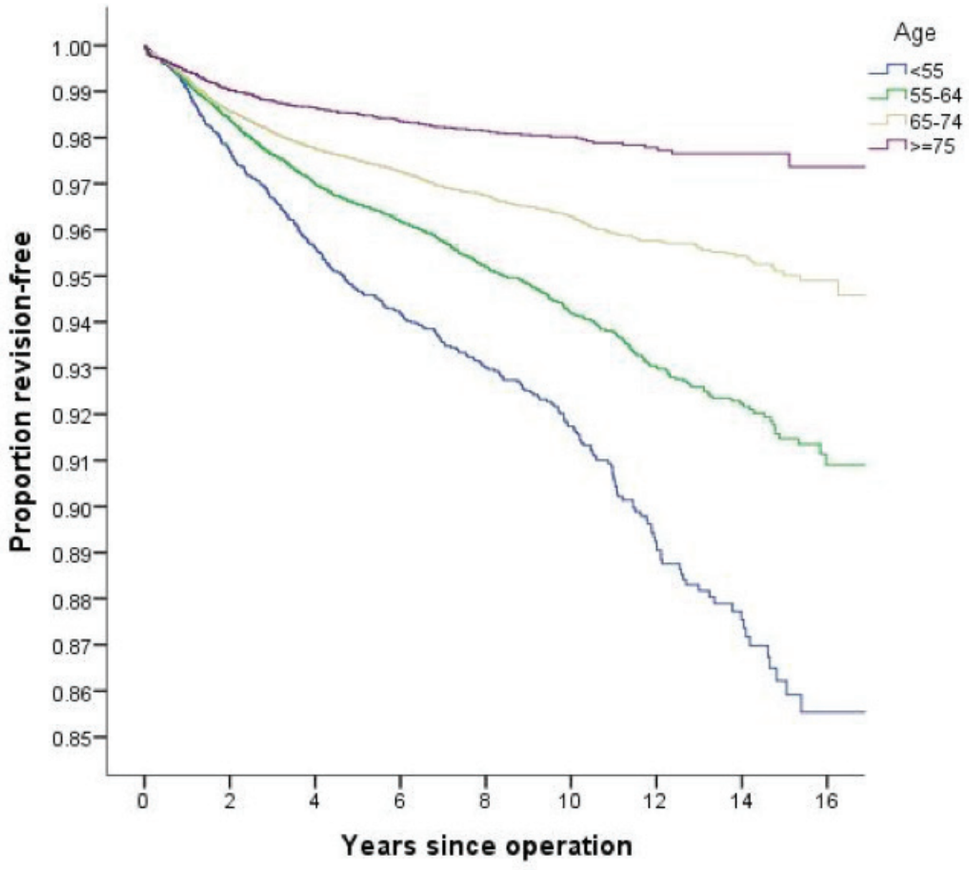
Fixed vs Mobile knees



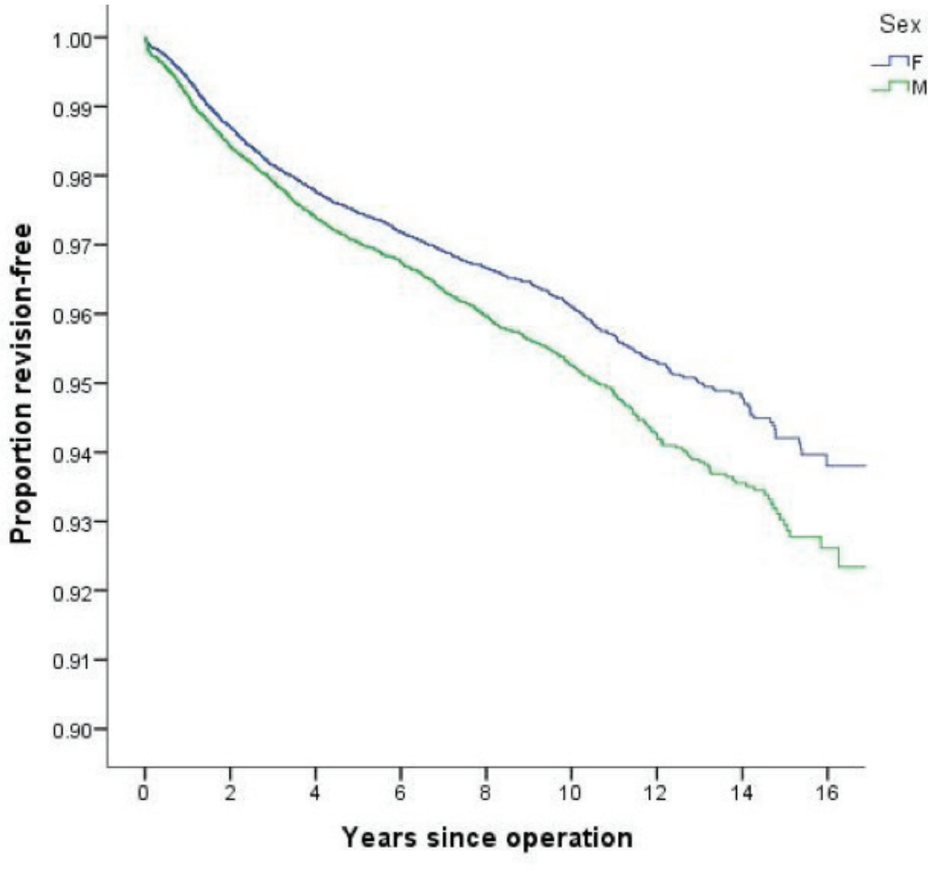
Posterior Stabilised vs Cruciate Retaining



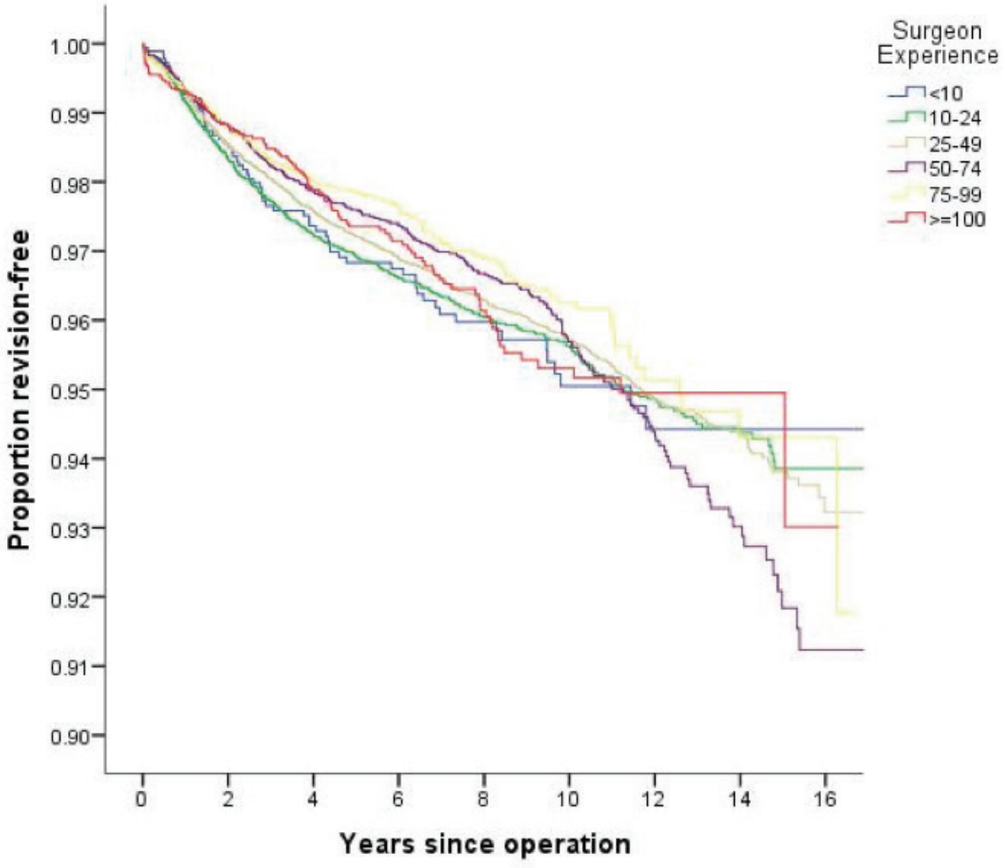
Survival for age bands



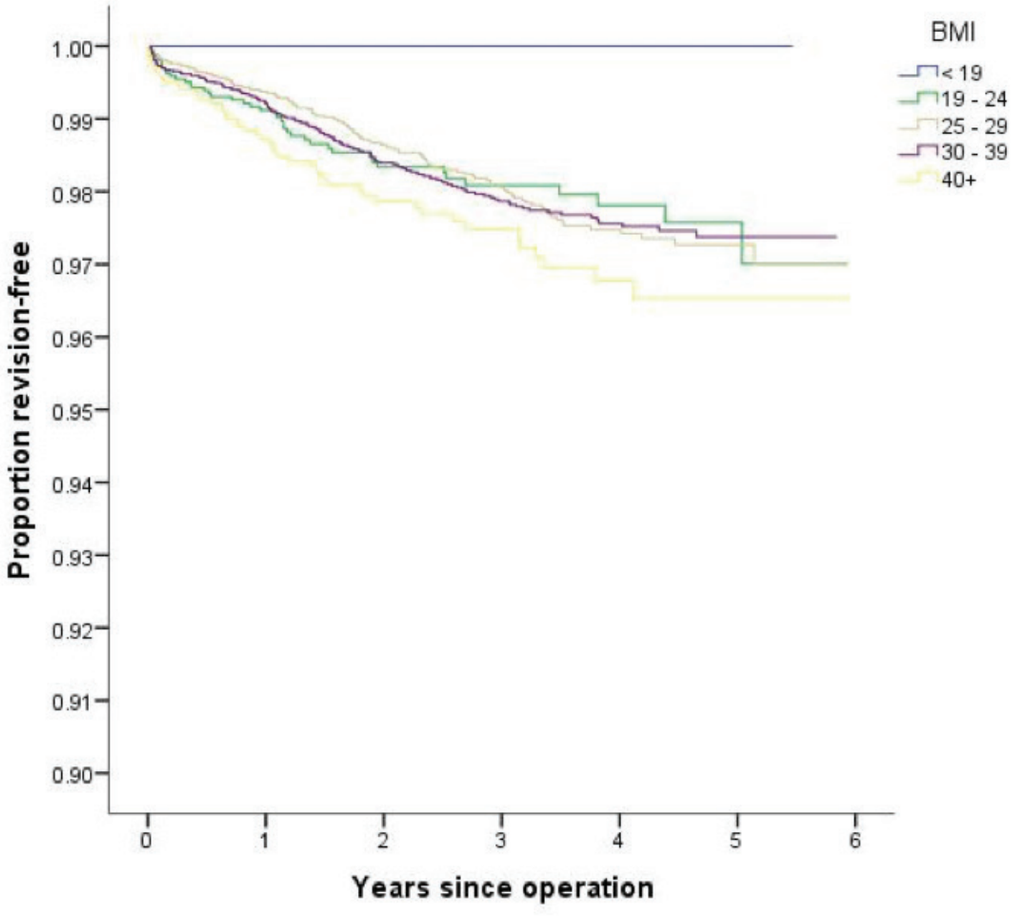
Survival for male vs female



Survival for for surgeon annual output



Survival for BMI groups



KNEE RE-REVISIONS

Analyses were undertaken of re-revisions. There were 314 registered primary knee revisions that had been revised twice, 56 that had been revised three times, 13 that had been revised four times, three that had been revised five times and one that had been revised six times.

Second revision

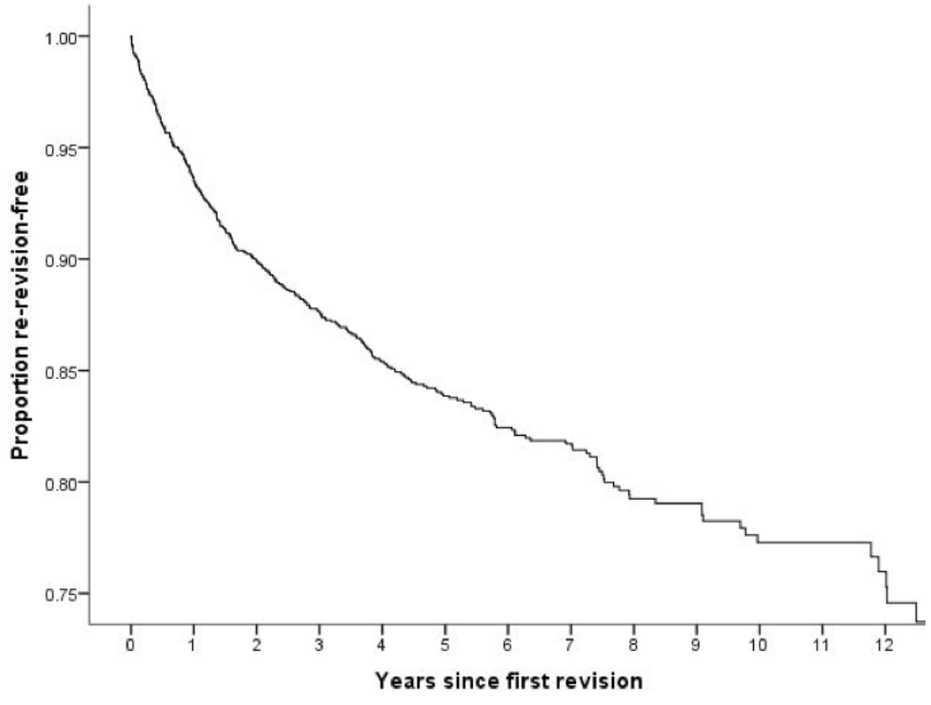
Time between the first and second revision for the 314 knee arthroplasties averaged 783 days, with a range of 2 – 4,654 and a standard deviation of 858 days. This compares to an average of 1,260 days between primary and first revision arthroplasty.

Reason for revision	
Deep infection	148
Pain	69
Loosening tibial component	49
Loosening femoral component	39
Loosening patellar component	5
Fracture femur	1

Second Revisions

Number of primary revisions	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
2,569	11,139.8	371	3.33	3.00	3.69

Kaplan Meier survival curve for first revision knee arthroplasties



Years	Percentage re-revision free	No in year
1	93.50	2,059
2	90.00	1,702
3	87.60	1,405
4	85.40	1,155
5	83.90	938
6	82.40	735
7	81.70	579
8	79.20	416
9	79.00	309
10	77.30	232

Third revision

The average time between second and third revisions for the 56 knee arthroplasties was 658 days, with a range of 14 – 2,212 and a standard deviation of 580 days.

Fourth revision

The average time between third and fourth revisions for the 13 knee arthroplasties was 418 days, with a range of 23 – 1,454 and a standard deviation of 432 days.

Fifth revision

The average time between fourth and fifth revisions for the three knee arthroplasties was 631 days.

Sixth revision

The time between fifth and sixth revision for the one knee arthroplasty was 162 days.

PATIENT BASED QUESTIONNAIRE OUTCOMES AT SIX MONTHS, FIVE YEARS, TEN YEARS AND FIFTEEN YEARS POST-SURGERY

Questionnaires at six months post-surgery

At six months post-surgery a random selection of patients are sent the Oxford-12 questionnaire in order to achieve a response rate of 20% of the total which is deemed to be ample to provide powerful statistical analysis.

The new scoring system as recommended by the original authors has been adopted. (See appendix 1).

The scores now range from 4 to 0. A score of 48 is the best, indicating normal function. A score of 0 is the worst, indicating the most severe disability.

In addition we have grouped the questionnaire responses according to the classification system published by Kalairajah et al in 2005. (See appendix 1).

This groups each score into four categories:

Category 1	>41	excellent
Category 2	34 – 41	good
Category 3	27 – 33	fair
Category 4	< 27	poor

For the seventeen-year period and as at July 2016, there were 25,792 primary knee questionnaire responses registered at six months post-surgery.

The mean knee score was 37.52 (standard deviation 8.10, range 48 – 1).

Scoring	> 41	9,930
Scoring	34 – 41	9,128
Scoring	27 – 33	3,913
Scoring	< 27	2,820

At six months post-surgery, 74% had an excellent or good score.

Questionnaires at five years post surgery

All patients who had a six month registered questionnaire, and who had not had revision surgery were sent a further questionnaire at five years post-surgery.

This dataset represents sequential Oxford knee scores for 9,820 individual patients.

At five years post-surgery, 83% of patients achieved an excellent or good score and had a mean of 40.36.

Questionnaires at ten years post surgery

All patients who had a six month registered questionnaire, and who had not had revision surgery were sent a further questionnaire at ten years post-surgery.

This dataset represents sequential Oxford knee scores for 4,774 individual patients.

At ten years post-surgery, 82% of patients achieved an excellent or good score and had a mean of 39.88.

Questionnaires at fifteen years post-surgery

All patients who had a six month registered questionnaire, and who had not had revision surgery were sent a further questionnaire at fifteen years post-surgery.

This dataset represents sequential Oxford knee scores for 1,113 individual patients.

At fifteen years post-surgery, 79% of patients achieved an excellent or good score and had a mean of 39.12.

Analysis of the individual questions at six months, five years and ten years post-surgery

Analysis of the individual questions showed that the most common persisting problem was difficulty with kneeling (Q4).

Percentage scoring 0 or 1(worst categories) for each question out of the group of primary knee responses at six months, five ten and fifteen years.

		6m %	5y %	10y %	15y %
1	Moderate or severe pain from the operated knee	3	8	8	11
2	Only able to walk around the house or unable to walk before pain becomes severe	4	3	4	6
3	Extreme difficulty or impossible to get in and out of a car or public transport	4	3	4	5
4	Extreme difficulty or impossible to kneel down and get up afterwards	41	37	42	44
5	Extreme difficulty or impossible to do the household shopping on your own	4	4	5	7
6	Extreme difficulty or impossible to wash and dry yourself	1	1	2	2
7	Pain interfering greatly or totally with your work	5	4	3	5
8	Very painful or unbearable to stand up from a chair after a meal	3	2	2	3
9	Most of the time or always feeling that the knee might suddenly “give way”	2	2	2	4
10	Limping most or every day	10	7	7	8
11	Extreme difficulty or impossible to walk down a flight of stairs	7	6	8	10
12	Pain from your knee in bed most or every nights	10	4	4	7

As noted in previous years there is little significant change between the six month, five, ten and now fifteen year scores which means the six month score is indicative of the longer term outcome.

BMI vs Oxford score at six months

BMI	Mean	Std. Error of Mean	No
< 19	40.22	2.602	9
19 - 24	39.68	0.272	716
25 - 29	39.28	0.160	2,012
30 - 39	37.72	0.159	2,393
40+	36.29	0.407	397
Total	**38.44**	**0.102**	**5,527**

The 40+ group have a significantly lower (worse) score than all the other groups

Revision hip questionnaire responses

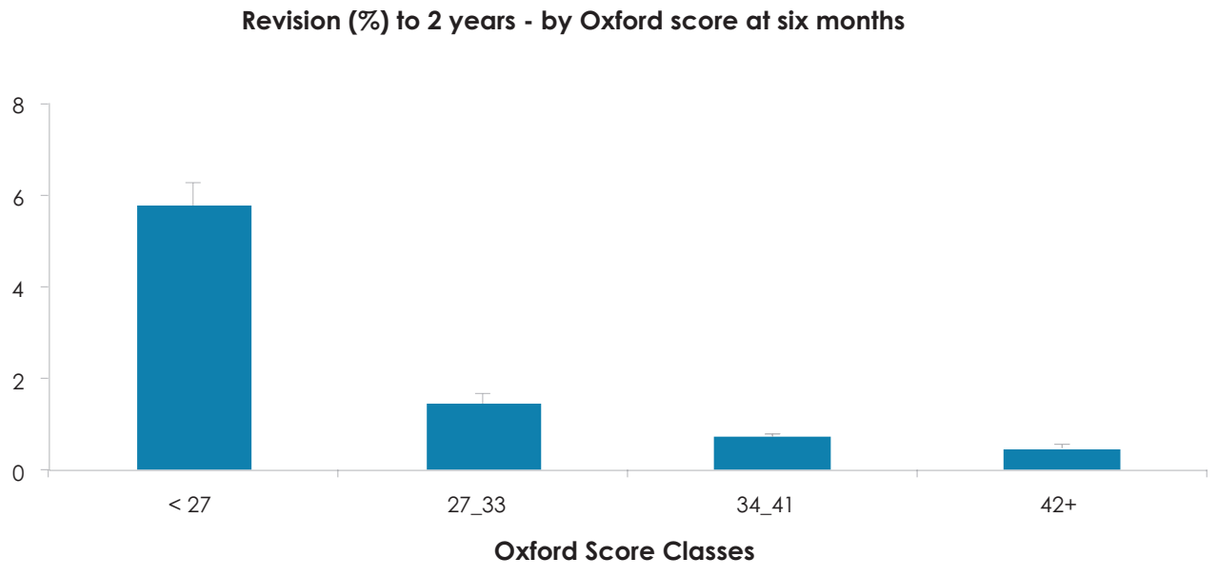
There were 3,857 revision hip responses with 53% achieving an excellent or good score. This group includes all revision knee procedures. The mean revision hip score was 32.86 (standard deviation 10.18, range 2 – 48).

OXFORD 12 SCORE AS A PREDICTOR OF KNEE ARTHROPLASTY REVISION

A statistically significant relationship has been confirmed between the Oxford scores at six months, five and ten years post-surgery and arthroplasty revision within two years of the Oxford 12 questionnaire date.

Six month score and revision arthroplasty

Plotting the patients' six month scores in the Kalairajah groupings against the proportion of knees revised for that same group demonstrates that there is an incremental increase in risk during the next two years related to the Oxford score. A patient with a score below 27 has 12 times the risk of a revision within two years compared to a person with a score >41.

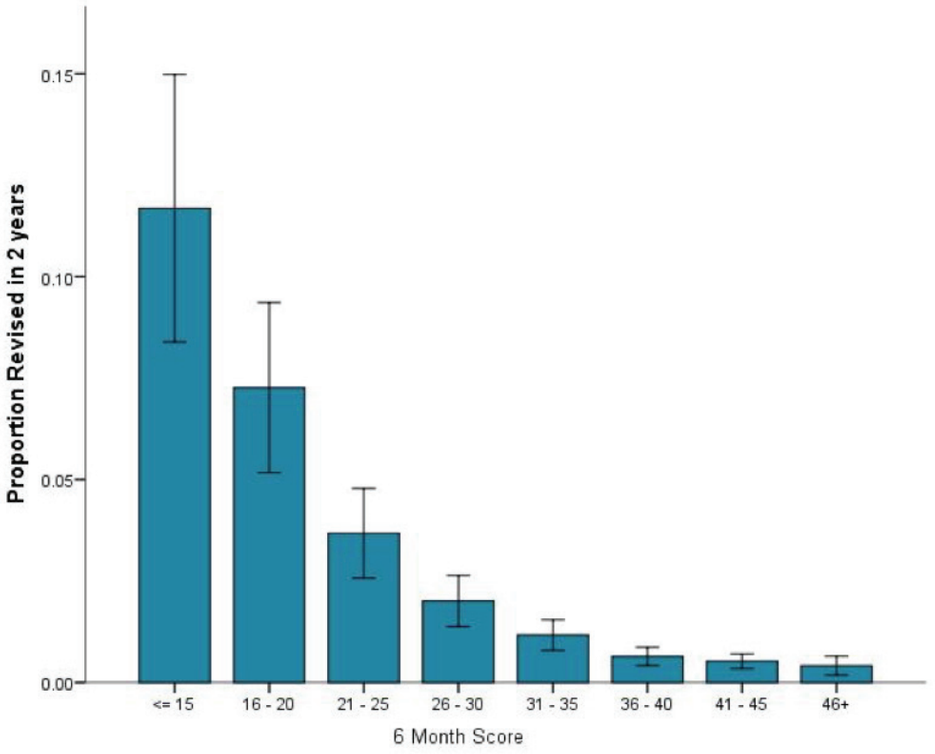


Revision risk versus Kalairajah groupings of Oxford scores within two years of the six month score date

Kalairajah group	No in group	No. revised	%	Std error
< 27	2,392	138	5.77	0.48
27_33	3,248	47	1.45	0.21
34_41	7,425	53	0.71	0.10
42+	7,828	38	0.49	0.08

A person with an Oxford score >42 has a 0.49% risk of revision within two years compared to a 5.77% risk with a score of 27 or less.

In view of the large number of six month Oxford scores it is possible with statistical significance to further break down the score groupings to demonstrate an even more convincing relationship between score and risk of revision within two years.



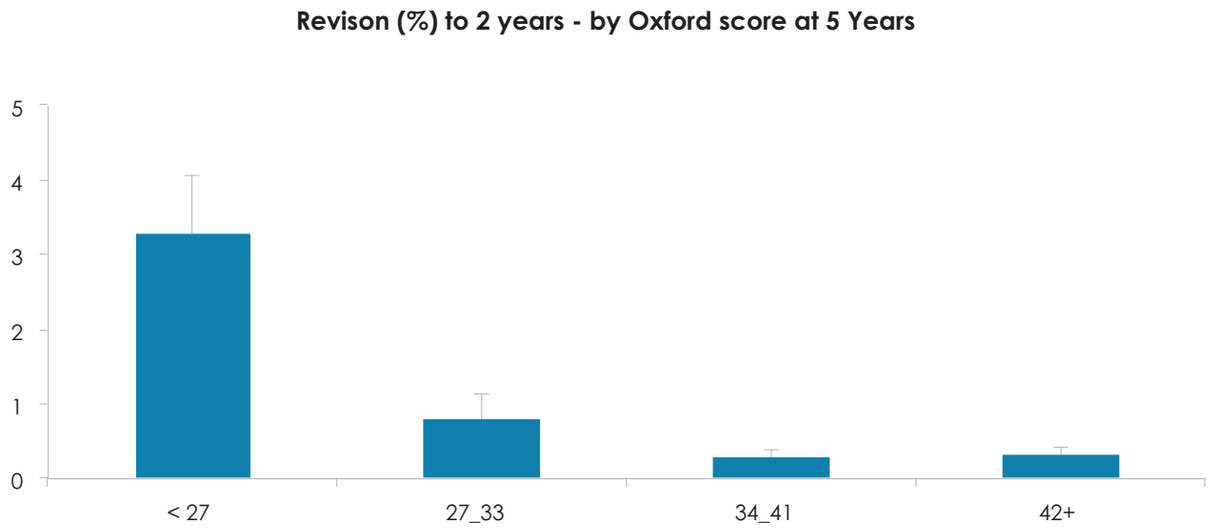
Revision risk versus groupings of Oxford scores within two years of the 6 month score date.

			Revision in 2 yrs		Total
			No	Yes	
Score 6 months	<= 15	Count	323	43	**366**
			88.30	11.70	
	16 - 20	Count	546	42	**588**
			92.90	7.10	
	21 - 25	Count	1,069	41	**1,110**
			96.30	3.70	
	26 - 30	Count	1,851	38	**1,889**
			98.00	2.00	
	31 - 35	Count	3,042	36	**3,078**
			98.80	1.20	
	36 - 40	Count	4,761	31	**4,792**
			99.40	0.60	
	41 - 45	Count	6,060	32	**6,092**
			99.50	0.50	
	46+	Count	2,890	12	**2,902**
			99.60	0.40	
Total		**Count**	**20,542**	**275**	**20,817**
		%	**98.70**	**1.30**	

A person with a six month Oxford score >45 has a 0.40 % risk of revision within two years compared to an 11.7% (29x) risk with a score of <16.

Five year score and revision arthroplasty

As with the six month scores, plotting the patients' five year scores in the Kalairajah groupings against the proportion of knees revised for that same group demonstrates that there is an incremental increase in risk during the next two years related to the Oxford score. A patient with a score below 27 has 12 times the risk of a revision within two years compared to a person with a score 34-41 and 10 times with a score > 41.



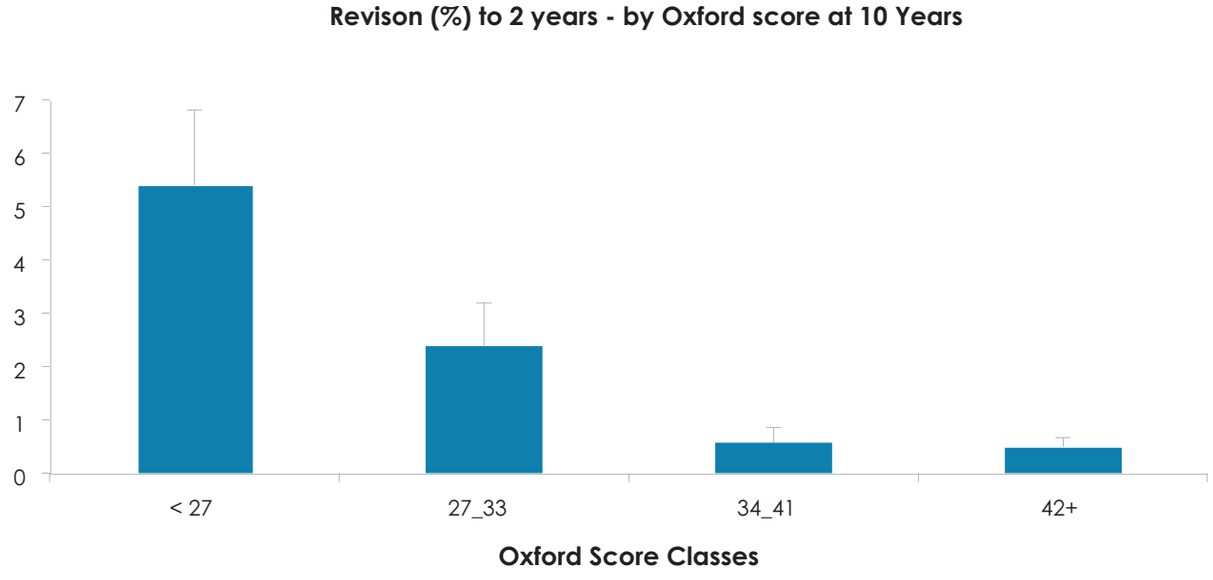
Revision risk versus Kalairajah groupings of Oxford scores within two years of the five year score date.

Kalairajah group	No in group	No. revised	%	Std error
< 27	518	17	3.28	0.78
27_33	639	5	0.78	0.35
34_41	1,784	5	0.28	0.13
42+	3,997	13	0.33	0.09

A person with an Oxford score 34-41 has a 0.28% risk of revision within two years compared to a 3.28% risk with a score of 27 or less.

Ten year score and revision arthroplasty

As with the six month and five year scores, plotting the patients' ten year scores in the Kalairajah groupings against the proportion of knees revised for that same group demonstrates that there is an incremental increase in risk during the next two years related to the Oxford score. A patient with a score below 27 has 10 times the risk of a revision within two years compared to a person with a score >41.



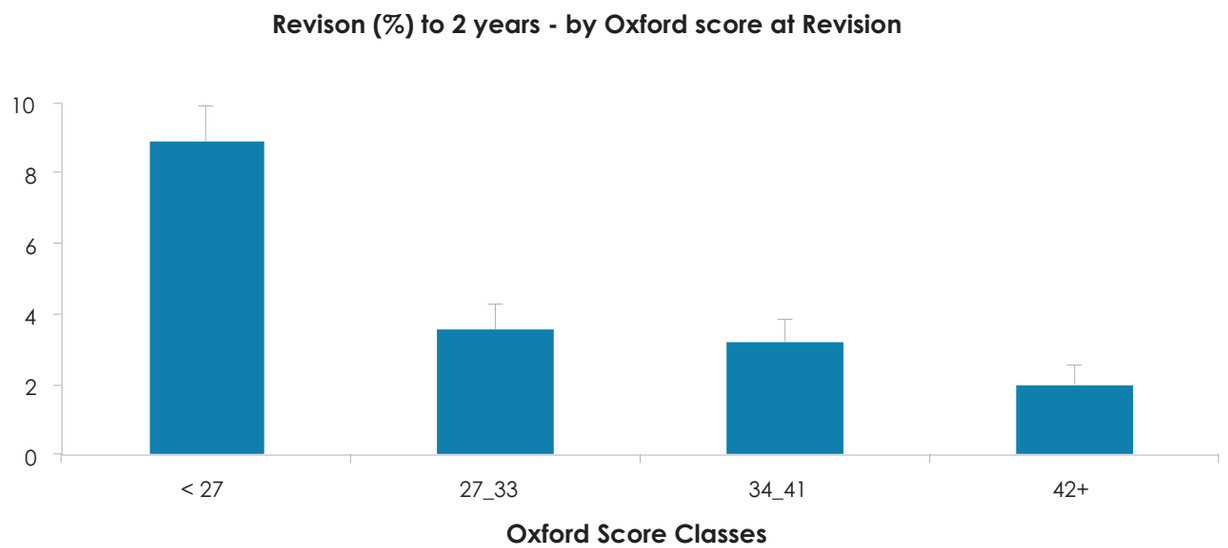
Revision risk versus Kalairajah groupings of Oxford scores within two years of the 10 year score date.

Kalairajah group	No in group	No. revised	%	Std error
< 27	258	14	5.43	1.41
27_33	336	8	2.38	0.83
34_41	829	5	0.60	0.27
42+	1,727	9	0.52	0.17

A person with an Oxford score >41 has a 0.52% risk of revision within two years compared to a 5.43% risk with a score of 27 or less.

Prediction of second revision from six month score following first revision

Plotting the patients six month scores following their first revision in the Kalairajah groupings against the proportion of knees revised for that same group again demonstrates that there is an incremental increase in risk during the next two years related to the Oxford score. A patient with a score below 27 has a 4.5 times the risk of a revision within two years compared to a person with a score >41.

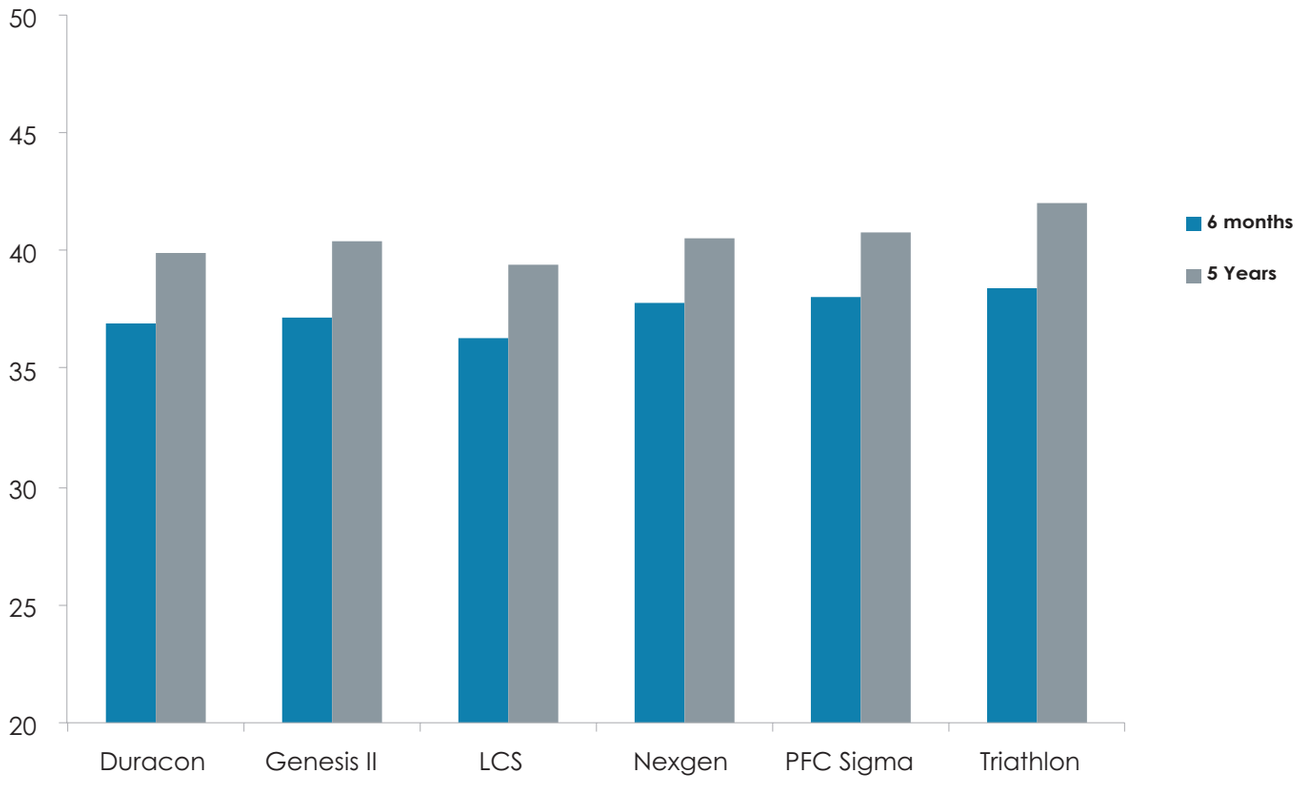


Second revision risk versus Kalairajah groupings of Oxford scores within two years of the six month post- first revision score date.

Kalairajah groups	No in group	No. revised	%	Std error
< 27	767	68	8.87	1.03
27_33	567	20	3.53	0.77
34_41	836	27	3.23	0.61
42+	699	14	2.00	0.53

A person with a six month Oxford score >42 has a 2.00% risk of revision within two years compared to an 8.87% risk with a score < 27.

Mean Oxford scores at six months and five years for six knee prostheses with > 2000 registrations



Oxford Score		Duracon	Genesis II	LCS	Nexgen	PFC Sigma	Triathlon
6 mnths	Ox Mean	36.9	37.1	36.3	37.9	38.1	38.4
	Std. Error	0.2	0.2	0.1	0.1	0.1	0.2
	No.	1800	2795	5344	4467	2665	2528
5 year	Ox Mean	40.0	40.4	39.4	40.6	40.8	42.1
	Std. Error	0.3	0.2	0.2	0.2	0.2	0.2
	No.	780	1316	2331	1955	1383	1131

UNICOMPARTMENTAL KNEE ARTHROPLASTY

PRIMARY UNICOMPARTMENTAL KNEE ARTHROPLASTY

The **sixteen-year** report analyses data for the period January 2000 – December 2015. There were 9,635 unicompartmental knee procedures registered with an additional 809 for 2015 representing a 14% increase over 2014.

2000	340
2001	430
2002	533
2003	634
2004	634
2005	558
2006	584
2007	576
2008	540
2009	628
2010	602
2011	609
2012	720
2013	726
2014	712
2015	809

Data Analysis

Age and sex distribution

The average age for a unicompartmental knee replacement was 66.28 years, with a range of 18.28 – 94.71 years.

	Female	Male
Number	4,475	5,160
Percentage	46.44	53.56
Mean age	66.02	66.30
Maximum age	94.71	94.55
Minimum age	18.28	31.62
Standard dev.	10.14	9.13

Body Mass Index

For the six year period 2010 - 2015, there were 3,132 BMI registrations for unicompartmental knee replacements. The average was 29.71 with a range of 16.60 – 59.50 and a standard deviation of 5.02.

Previous operation

None	7,724
Menisectomy	1,465
Ligament reconstruction	49
Osteotomy	32
Internal fixation	27
Synovectomy	4

Diagnosis

Osteoarthritis	9,426
Avascular necrosis	74
Post ligament disruption	45
Other inflammatory	22
Rheumatoid arthritis	19
Post fracture	16
Tumour	2

Approach

Medial	7,199
Minimally invasive surgery	2,381
Other	207
Lateral	202
Image guided surgery	69

Image guided surgery was added to the updated forms at the beginning of 2005, but unlike the total knee arthroplasty, has never become popular.

Cement

Femur cemented	6,954	72%
Antibiotic in cement	4,486	65%
Tibia cemented	7,203	75%
Antibiotic in cement	4,675	65%

Systemic antibiotic prophylaxis

Patient number receiving at least one systemic antibiotic	9,283	96%

Operating theatre

Conventional	6,750
Laminar flow	2,785
Space suits	2,289

ASA Class

This was introduced with the updated forms at the beginning of 2005.

For the eleven- year period 2005 – 2015, there were 6,729 (95%) unicompartmental knee procedures with the ASA class recorded.

Definitions

ASA class 1: A healthy patient
ASA class 2: A patient with mild systemic disease
ASA class 3: A patient with severe systemic disease that limits activity but is not incapacitating
ASA class 4: A patient with an incapacitating disease that is a constant threat to life

ASA	Number	Percentage
1	1,304	19
2	4,353	65
3	1,058	15
4	14	1

Operative time (skin to skin)

Mean	75 minutes

Surgeon grade

The updated forms introduced in 2005 have separated advanced trainee into supervised and unsupervised.

The following figures are for the eleven- year period 2005 – 2015.

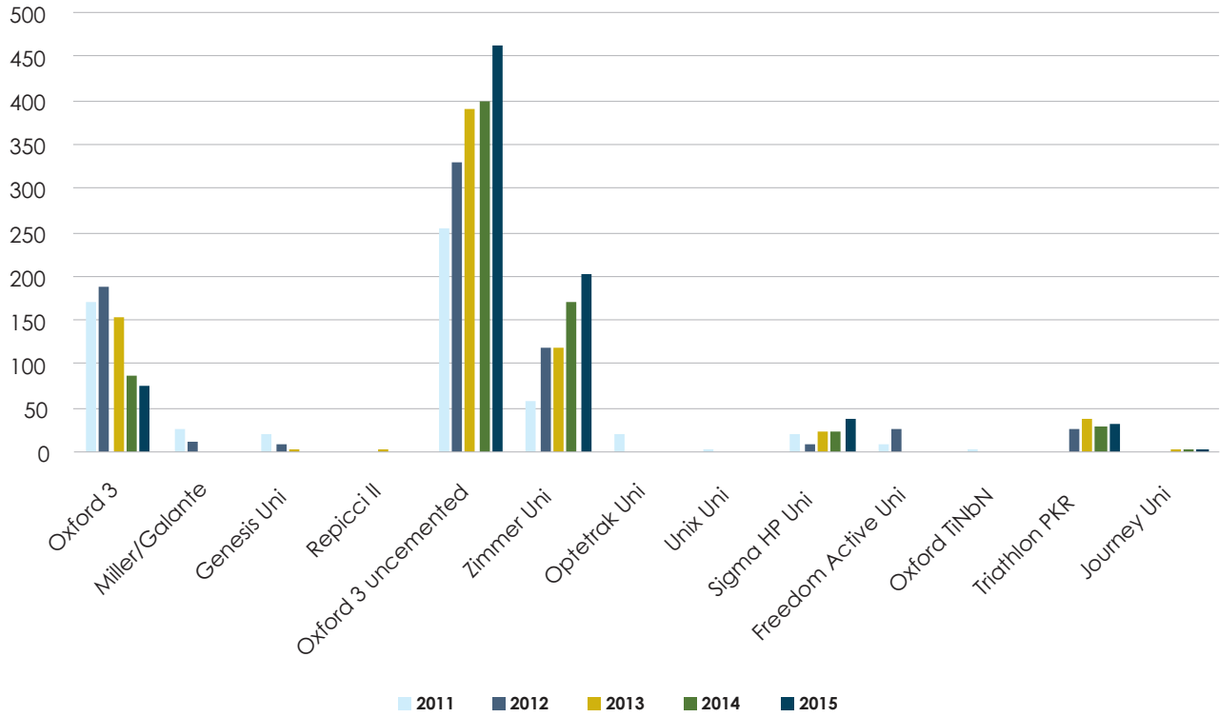
Consultant	6,719
Advanced trainee supervised	307
Advanced trainee unsupervised	16
Basic trainee	12

Prosthesis usage

Unicompartmental knee prostheses used in 2015

Oxford 3 uncemented	463
Zimmer Uni	201
Oxford 3	75
Sigma HP Uni	37
Triathlon PKR	32
Journey Uni	1

Most used Unicompartmental Prostheses per year for 5 years (2011 – 2015)



Surgeon and hospital workload

Surgeons

In 2015, 73 surgeons performed 809 unicompartmental knee replacements, an average of 11 procedures per surgeon. 33 surgeons performed less than five procedures and 11 performed more than 15 procedures.

Hospitals

In 2015, unicompartmental knee replacements were performed in 39 hospitals; 21 were public and 18 were private.

For 2015, the average number of unicompartmental knee replacements per hospital was 21.

REVISION OF REGISTERED PRIMARY UNICOMPARTMENTAL ARTHROPLASTIES

This section analyses the data for revision of unicompartmental knee replacement over the sixteen-year period.

Revision is defined by the Registry as a new operation in a previously partially replaced knee joint during which one or more of the components are exchanged, removed, manipulated or added. It includes arthrodesis or amputation, but not soft tissue procedures. A two or more staged procedure is registered as one revision.

There were 757 revisions of the 9,635 registered unicompartmental knee replacements (7.9%). A further 81 had a second revision, 11 a third revision and one had a fourth revision.

628 of the 757 (83%) were revised to total knee replacements and 129 (17%) were revised to further unicompartmental replacements.

Time to revision

Mean	1,686 days
Maximum	5,598 days
Minimum	10 days
Standard deviation	1,391 days

Reason for revision

Pain	251
Loosening tibial component	137
Loosening femoral component	103
Deep infection	29
Fracture tibia	23
Fracture femur	3

There is sometimes more than one reason listed for revision and all are registered.

Analysis by time of the three main reasons for revision

	Loosening femoral component		Loosening tibial component		Pain	
Years	Count	Pain	Count	%	Count	%
0	12	11.65	28	20.44	39	15.54
1	22	21.36	34	24.82	61	24.30
2	9	8.74	10	7.30	34	13.55
3	15	14.56	10	7.30	16	6.37
4	5	4.85	9	6.57	25	9.96
5	7	6.80	5	3.65	13	5.18
6	3	2.91	11	8.03	12	4.78
7	9	8.74	9	6.57	14	5.58
8	5	4.85	3	2.19	9	3.59
9	3	2.91	8	5.84	8	3.19
10	4	3.88	2	1.46	10	3.98
11	4	3.88	4	2.92	4	1.59
12	5	4.85	3	2.19	4	1.59
13	0	0.00	0	0.00	1	0.40
14	0	0.00	1	0.73	1	0.40
Total	**103**	-	**137**	-	**251**	-

Statistical note

In the table below there are two statistical terms readers may not be familiar with:

i) Observed component years

This is the number of registered primary procedures multiplied by the number of years each component has been in place.

ii) Rate/100 component years

This is equivalent to the yearly revision rate expressed as a percent and is derived by dividing the number of prostheses revised by the observed component years multiplied by 100. It therefore allows for the number of years of post-operative follow-up in calculating the revision rate. These rates are usually very low, hence are expressed per 100 component years rather than per component year. Statisticians consider that this is a more accurate way of deriving a revision rate for comparison when analysing data with widely varying follow-up times. It is also important to

note the confidence intervals. The closer they are to the estimated revision rate/100 component years, the more precise the estimate is.

Statistical significance

Where it is stated that a difference among results is significant the p value is 0.05 or less. In most of these situations this is because there is no overlap of the confidence intervals (CIs) but sometimes significance can apply in the presence of CI overlap.

All Primary Unicompartmental Knee Arthroplasties

No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
9,635	60,707.4	757	1.25	1.16	1.34

Revision Rate of Individual Unicompartmental Knee Prostheses Sorted Alphabetically

Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
EIUS Uni Knee	22	185.9	0	0.00	0.00	1.98
Freedom Active Uni	36	117.6	6	5.10	1.87	11.11
Genesis Uni	359	3,068.7	43	1.40	1.01	1.89
HLS Uni Evolution	1	0.5	1	193.25	4.89	1,076.74
Journey Uni	7	11.0	1	9.05	0.23	50.43
LCS Uni	6	57.7	2	3.47	0.42	12.53
Miller/Galante	710	6,676.2	66	0.99	0.76	1.26
Optetrak Unicondylar Cemented	101	592.4	7	1.18	0.42	2.32
Oxford 3	3,940	31,742.4	444	1.40	1.27	1.54
Oxford 3 uncemented	2,630	9,146.1	64	0.70	0.53	0.89
Oxford TiNbN coated	1	4.5	0	0.00	0.00	82.86
Oxinium Uni	33	223.2	11	4.93	2.30	8.53
Preservation	484	4,231.4	65	1.54	1.19	1.96
Repicci II	98	1,074.8	20	1.86	1.14	2.87
Sigma HP Uni	117	252.7	1	0.40	0.01	2.20
Triathlon PKR	171	451.3	8	1.77	0.77	3.49
Unix Uni	14	66.7	3	4.50	0.93	13.14
Zimmer Unicompartmental Knee	905	2,804.1	15	0.53	0.30	0.88

The Oxinium and the Freedom Active Unis all have significantly higher revision rates but, despite widely varying revision rates for the other prostheses, there are no significant differences because of the relatively small numbers and wide CIs. No Oxinium or Freedom Active unis have been registered for several years.

The uncemented Oxford and the Zimmer Unis have significantly lower revision rates than the overall mean of 1.25 /100ocys.

Revision vs Arthroplasty Fixation

Fixation	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Cemented	6,917	51,046.7	682	1.34	1.24	1.44
Uncemented	2,395	8,445.9	58	0.69	0.52	0.89
Hybrid	323	1,214.8	17	1.40	0.82	2.24

The uncemented unis have a significantly lower revision rate than cemented unis.

Revision vs Age Bands

Age Bands	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
LT55	1,190	7,550.9	130	1.72	1.44	2.04
55_64	3,346	21,390.7	345	1.61	1.44	1.79
65_74	3,224	20,863.0	197	0.94	0.82	1.09
GE75	1,875	10,902.8	85	0.78	0.62	0.96

There are statistically significant higher revision rates for the two lower age groups compared to the higher two.

Revision vs Gender

Gender	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
F	4,475	28,720.5	394	1.37	1.24	1.51
M	5,160	31,986.9	363	1.13	1.02	1.26

There is no significant difference in revision rates between males and females.

Revision vs Surgeon Annual Workload

Consultant Number of ops/yr	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
<10	4,555	31,359.1	449	1.43	1.30	1.57
>=10	5,078	29,339.9	307	1.05	0.93	1.17

Those surgeons performing <10 per year have a significantly higher revision rate.

Revision vs Surgical Approach

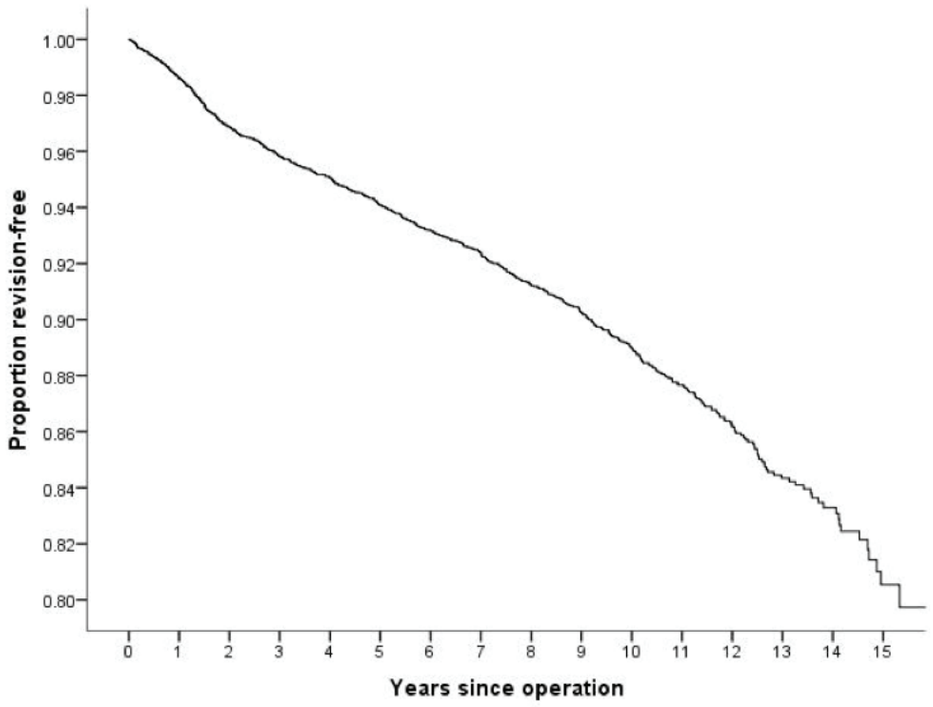
Approach	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Standard Parapatellar	7,254	47,436.5	630	1.33	1.23	1.44
Minimally Invasive	2,381	13,270.9	127	0.96	0.79	1.13

The minimally invasive technique has a significantly lower revision rate.

KAPLAN MEIER CURVES

The following Kaplan Meier survival analyses are for the 16 years from 2000 to 2015, with deceased patients censored at time of death.

Unicompartmental Knees



Years	% Revision-free	Number
1	98.59	8.653
2	96.88	7,747
3	95.83	6,874
4	95.07	6,048
5	94.09	5,348
6	93.17	4,656
7	92.38	3,979
8	91.21	3,392
9	90.26	2,796
10	88.99	2,235
11	87.66	1,720
12	86.24	1,205
13	84.34	756
14	83.29	411

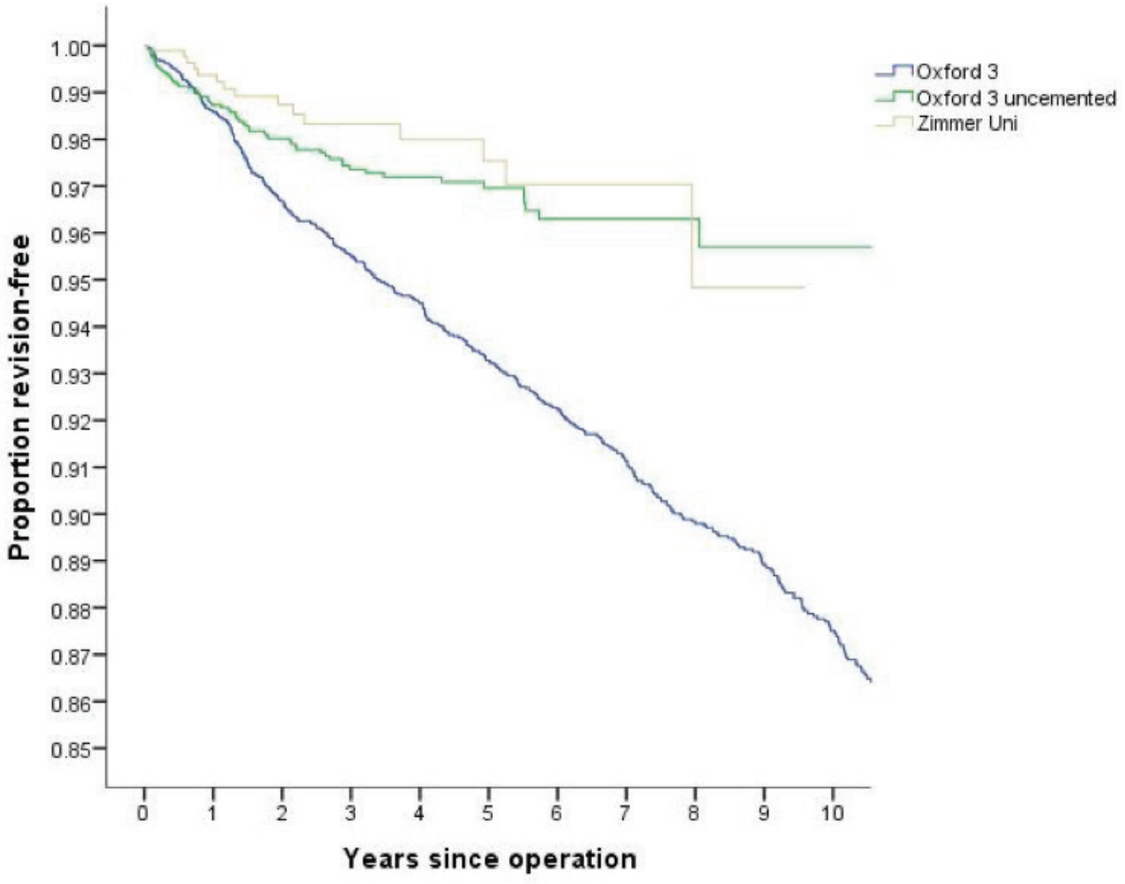
Note: Numbers too few for accurate percentage survival beyond 14 years.

Revision Rate for Re-revisions

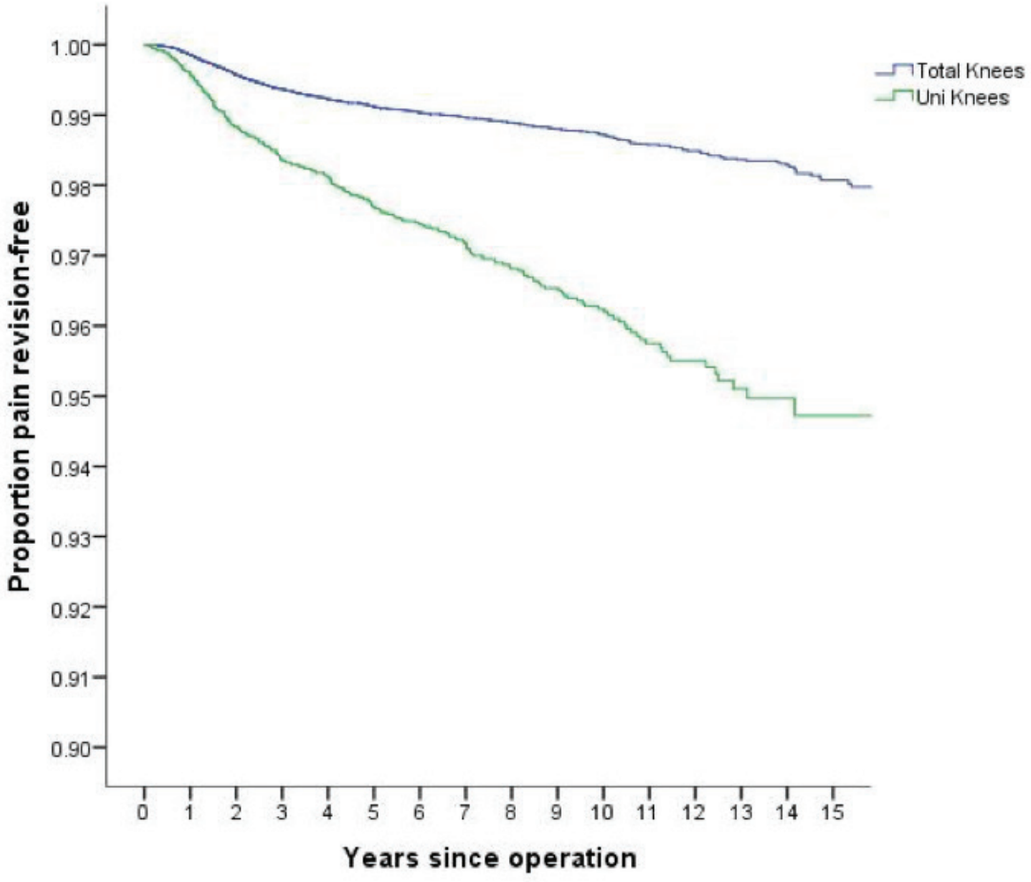
Re Revisions	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Revised to full	628	3,175.4	53	1.67	1.25	2.18
Revised to Uni	129	514.2	28	5.45	3.62	7.87
ALL	757	3,689.6	81	2.20	1.74	2.73

When compared to the primary total knee arthroplasty revision rate of 0.49 at the 95% confidence interval there is a significantly increased revision rate (3.4x) when a unicompartmental arthroplasty is converted to a total knee arthroplasty. This statistic is even more significant following revision of a unicompartmental to a further unicompartmental arthroplasty (11x). Further evidence is that the average six month Oxford score following conversion of a unicompartmental to total arthroplasty is similar to that for a revised primary total knee arthroplasty.

Survival curves for the 3 unicompartmental knees with the biggest number of implantations



Survivorship of Uniknee revised to Total Knee for pain alone vs revised Total Knee (also revised for pain alone)



PATIENT BASED QUESTIONNAIRE OUTCOMES AT SIX MONTHS, FIVE YEARS AND TEN YEARS POST-SURGERY

At six months post-surgery all patients are sent the Oxford-12 questionnaire.

The new scoring system as recommended by the original authors has been adopted (See appendix 1).

There are 12 questions, with the scores now ranging from 4 to 0. A score of 48 is the best, indicating normal function. A score of 0 is the worst, indicating the most severe disability.

In addition we have grouped the questionnaire responses according to the classification system published by Kalairajah et al, 2005 (See appendix 1). This groups each score into four categories:

Category 1	>41	excellent
Category 2	34 – 41	good
Category 3	27 – 33	fair
Category 4	< 27	poor

For the sixteen- year period and as at July 2016, there were 6,438 unicompartmental knee questionnaire responses registered at six months post-surgery. The mean unicompartmental knee score was 39.61 (standard deviation 7.24, range 3 – 48).

Scoring	> 41	3,241
Scoring	34 -41	2,071
Scoring	27 -33	719
Scoring	< 27	407

At six months post-surgery, 83% had an excellent or good score.

Questionnaires at five years post surgery

Patients who had a registered six month questionnaire and who had not had revision surgery were sent a further questionnaire at five years post-surgery.

This dataset represents sequential Oxford knee scores for 2,588 individual patients.

At five years post-surgery, 88 % of patients had achieved an excellent or good score and had a mean of 41.56.

Questionnaires at ten years post-surgery

All patients who had a six-month registered questionnaire, and who had not had revision surgery were sent a further questionnaire at ten years post-surgery.

This dataset represents sequential Oxford knee scores for 953 individual patients.

At ten years post-surgery, 82% of patients achieved an excellent or good score and had a mean of 40.25.

Analysis of the individual questions at six months, five years and ten years post-surgery

Analysis of the individual questions showed that the most common persisting problem was kneeling (Q4).

Percentage scoring 0 or 1 for each question out of the group at six months, five years and ten years post- surgery.

		6m%	5y%	10y%
1	Moderate or severe pain from the operated knee	10	8	11
2	Only able to walk around the house or unable to walk before pain becomes severe	3	2	3
3	Extreme difficulty or impossible to get in and out of a car or public transport	1	1	3
4	Extreme difficulty or impossible to kneel down and get up afterwards	29	27	30
5	Extreme difficulty or impossible to do the household shopping on your own	1	1	3
6	Extreme difficulty or impossible to wash and dry yourself	0.1	0.3	0.6
7	Pain interfering greatly or totally with your work	3	3	4
8	Very painful or unbearable to stand up from a chair after a meal	3	2	3
9	Most of the time or always feeling that the knee might suddenly "give way"	1	1	2
10	Limping most or every day	7	5	6
11	Extreme difficulty or impossible to walk down a flight of stairs	3	3	5
12	Pain from your knee in bed most or every nights	7	4	6

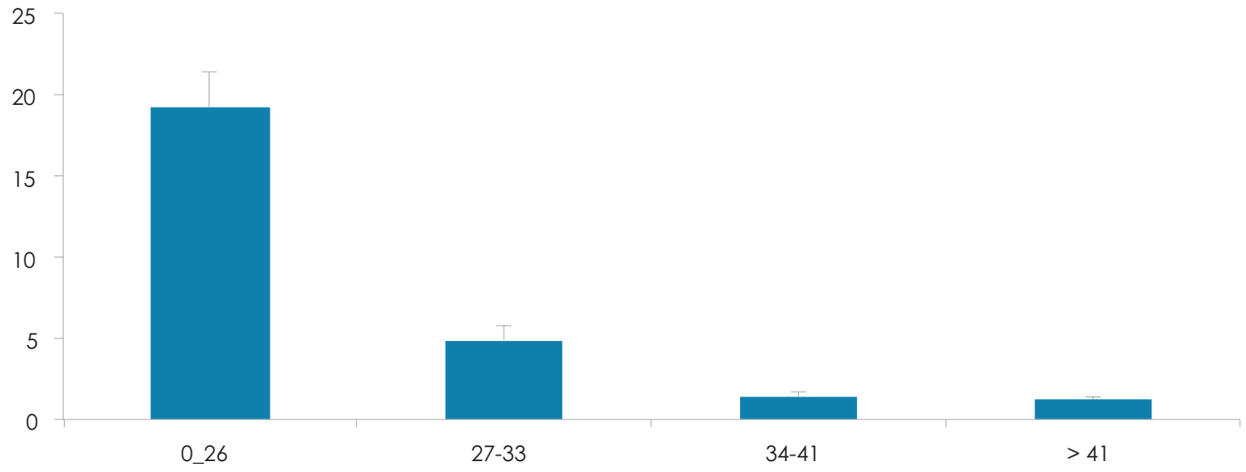
OXFORD 12 SCORE AS A PREDICTOR OF KNEE ARTHROPLASTY REVISION

A statistically significant relationship has been confirmed between the Oxford scores at six months, five years and ten years and arthroplasty revision within two years of the Oxford 12 questionnaire date.

Six month score and revision arthroplasty

Plotting the patients' six month scores in the Kalairajah groupings against the proportion of knees revised for that same group demonstrates that there is an incremental increase in risk during the next two years related to the Oxford score. A patient with a score below 27 has 17 times the risk of a revision within two years compared to a person with a score of >41

Revision (%) to 2 years - by Oxford score at six months



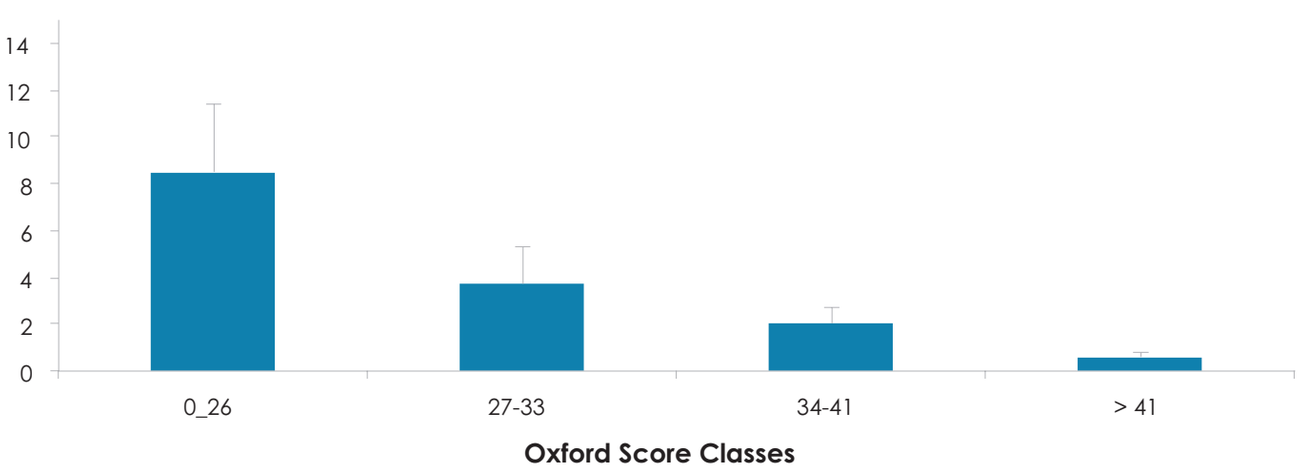
Kalairajah group	Revision to 2 yrs	No. revised	%	Std error
0_26	343	66	19.24	2.13
27-33	596	29	4.87	0.88
34-41	1,712	24	1.40	0.28
> 41	2,579	30	1.16	0.21

A person with an Oxford score >41 has a 1.16% risk of revision within two years compared to a 19.24% risk with a score of < 27.

Five year score and revision arthroplasty

Plotting the patients' five year scores in the Kalairajah groupings against the proportion of knees revised for that same group demonstrates that there is an incremental increase in risk during the next two years related to the Oxford score. A patient with a score below 27 has 14 times the risk of a revision within two years compared to a person with a score of >41.

Revision (%) to 2 years - by Oxford score at 5 Years

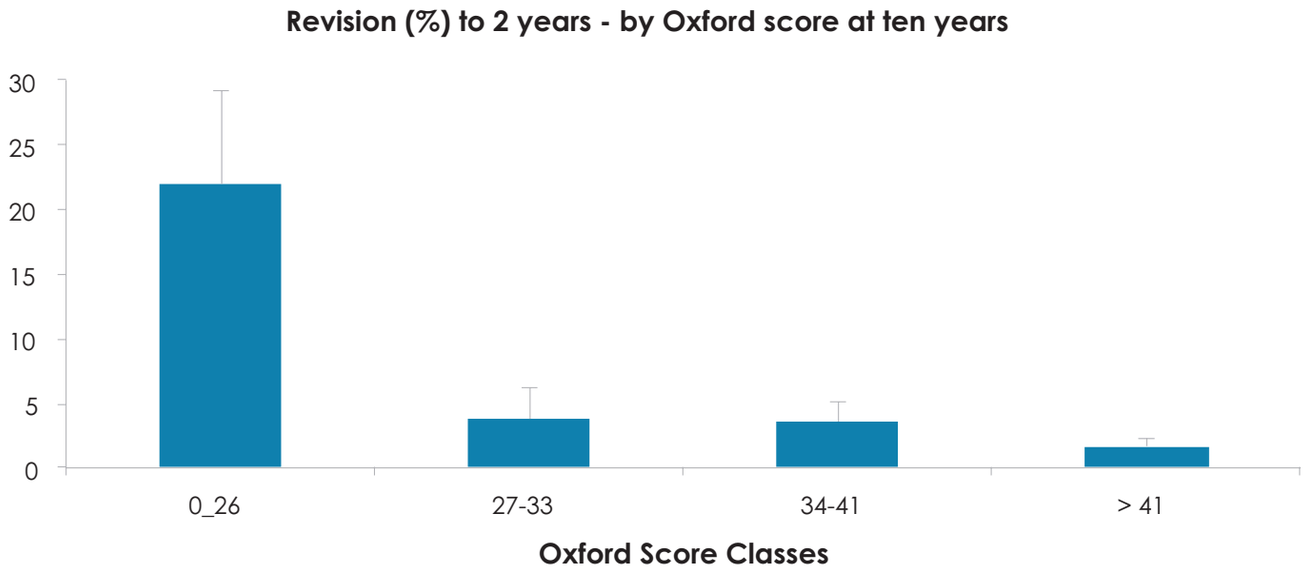


Kalairajah group	Revision to 2 yrs	No. revised	%	Std error
0_26	94	8	8.51	2.88
27-33	134	5	3.73	1.64
34-41	446	9	2.02	0.67
> 41	1,157	7	0.61	0.23

A person with an Oxford score >41 has a 0.61% risk of revision within two years compared to an 8.51% risk with a score of < 27.

Ten year score and revision arthroplasty

Plotting the patients' ten scores in the Kalairajah groupings against the proportion of knees revised for that same group demonstrates that there is an incremental increase in risk during the next two years related to the Oxford score. A patient with a score below 27 has 13 times the risk of a revision within two years compared to a person with a score of >41.



Kalairajah group	Revision to 2 yrs	No. revised	%	Std error
0_26	32	7	21.88	7.31
27-33	54	2	3.70	2.57
34-41	143	5	3.50	1.54
> 41	355	6	1.69	0.68

A person with an Oxford score >41 has a 1.69% risk of revision within two years compared to a 21.88% risk with a score of < 27.

ANKLE ARTHROPLASTY

PRIMARY ANKLE ARTHROPLASTY

The **sixteen-year** report analyses data for the period January 2000 – December 2015. There were 1,261 primary ankle procedures registered, an additional 101 compared to last year's report.

2000	17
2001	28
2002	28
2003	26
2004	48
2005	70
2006	81
2007	79
2008	107
2009	119
2010	125
2011	109
2012	108
2013	113
2014	102
2015	101

Data Analysis

Age and sex distribution

The average age for an ankle replacement was 65.69 years, with a range of 32.32 – 95.52 years.

	Female	Male
Number	491	770
Percentage	38.94	61.06
Mean age	63.26	67.20
Maximum age	95.52	90.26
Minimum age	32.32	34.15
Standard dev.	9.81	8.50

Body Mass Index

For the six-year period 2010 - 2015, there were 361 BMI registrations for primary ankle replacements. The average was 28.29 with a range of 17 – 43 and a standard deviation of 4.36.

Previous operation

None	991
Internal fixation for juxtaarticular fracture	126
Arthrodesis	41
Osteotomy	22

Diagnosis

Osteoarthritis	935
Post trauma	210
Rheumatoid arthritis	117
Other inflammatory	18
Avascular necrosis	4

Approach

Anterior	1,092
Anterolateral	34
Other	13

Bone graft

Tibia autograft	40
Tibia allograft	3
Tibia synthetic	1
Talus autograft	10
Talus allograft	3

Cement

Tibia cemented	13
Antibiotic in cement	7
Talus cemented	7
Antibiotic in cement	3

Systemic antibiotic prophylaxis

Patient number receiving at least one systemic antibiotic	1,213 (96%)

Operating theatre

Conventional	630
Laminar flow	616
Space suits	233

ASA Class

This was introduced with the updated forms at the beginning of 2005.

For the eleven-year period 2005 -2015, there were 993 (89%) primary ankle procedures with the ASA class recorded.

Definitions

ASA class 1: A healthy patient
ASA class 2: A patient with mild systemic disease
ASA class 3: A patient with severe systemic disease that limits activity but is not incapacitating
ASA class 4: A patient with an incapacitating disease that is a constant threat to life

ASA	Number
1	185
2	622
3	182
4	4

Operative time (skin to skin)

Mean	121 minutes

Surgeon grade

The updated forms introduced in 2005 have separated advanced trainee into supervised and unsupervised. The following figures are for the eleven-year period 2005 -2015.

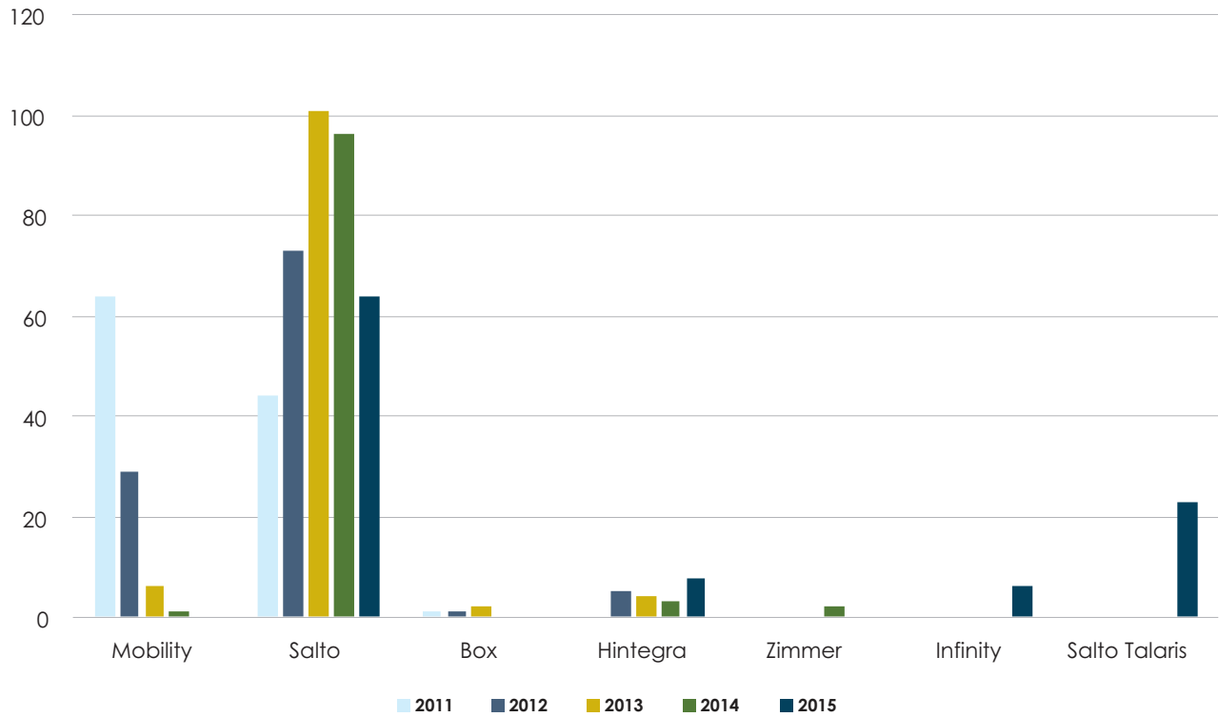
Consultant	1,108
Advanced trainee supervised	7

Prosthesis usage

Ankle prostheses used in 2015

Salto	64
Salto Talaris	23
Hintegra	8
Infinity	6

Most used Ankle Prostheses per year for five years (2011-2015)



Surgeon and hospital workload

Surgeons

In 2015, 17 surgeons performed 101 primary ankle procedures, an average of six procedures per surgeon. Two surgeons performed more than 15 procedures and five performed one procedure.

Hospitals

In 2015, primary ankle replacement was performed in 21 hospitals. 10 were public and 11 were private.

REVISION ANKLE ARTHROPLASTY

Revision is defined by the Registry as a new operation in a previously replaced ankle joint, during which one or more of the components are exchanged, removed, manipulated or added. It includes arthrodesis or amputation, but not soft tissue procedures. A two or more staged procedure is registered as one revision.

Data Analysis

For the sixteen-year period January 2000– December 2015, there were 179 revision ankle procedures registered.

The average age for an ankle revision was 65.39 years, with a range of 34.55 – 83.06.

	Female	Male
Number	68	111
Percentage	37.99	62.01
Mean	64.10	66.17
Maximum age	81.68	83.06
Minimum age	42.13	34.55
Standard dev.	9.33	8.42

REVISION OF REGISTERED PRIMARY ANKLE ARTHROPLASTIES

This section analyses data for revisions of primary ankle procedures for the sixteen-year period 2000 – 2015.

There were 134 revisions of the primary total ankle procedures of 1,261 (10.26%).

Time to revision

MMean	1,505 days
Maximum	4,814 days
Minimum	21 days
Standard deviation	1,154 days

Reason for revision

Pain	62
Loosening talar component	42
Loosening tibial component	31
Deep infection	16
Dislocation	3
Fracture talus	1

Ankle re-revisions

There were 13 registered primary ankle procedures that were revised twice and two procedures that were revised three times.

Analysis by time of the 3 main reasons for revision

	Loosening talar component		Loosening tibial component		Pain	
Years	**Count**	**%**	**Count**	**%**	**Count**	**%**
0	3	7.14	1	3.23	4	6.45
1	4	9.52	8	25.81	15	24.19
2	7	16.67	3	9.68	10	16.13
3	6	14.29	3	9.68	8	12.90
4	7	16.67	4	12.90	9	14.52
5	4	9.5	1	3.23	4	6.45
6	2	4.76	2	6.45	3	4.84
7	1	2.38	1	3.23	2	3.23
8	2	4.76	3	9.68	3	4.84
9	3	7.14	2	6.45	1	1.61
10	1	2.38	1	3.23	3	4.84
11	1	2.38	1	3.23	0	0.00
12	0	0.00	1	3.23	0	0.00
13	1	2.38	0	0.00	0	0.00
Total	**42**	**100**	**31**	**100**	**62**	**100**

Statistical note

In the table below there are two statistical terms readers may not be familiar with:

i) Observed component years

This is the number of registered primary procedures multiplied by the number of years each component has been in place.

ii) Rate/100 component years

This is equivalent to the yearly revision rate expressed as a percent and is derived by dividing the number of prostheses revised by the observed component years multiplied by 100. It therefore allows for the number of years of post-operative follow up in calculating the revision rate.

These rates are usually very low, hence it is expressed per 100 component years rather than per component year. Statisticians consider that this is a more accurate way of deriving a revision rate for comparison when analysing data with widely varying follow-up times. It is also important to note the confidence intervals. The closer they are to the estimated revision rate/100 component years, the more precise the estimate is.

Statistical significance

Where it is stated that a difference among results is significant the p value is 0.05 or less. In most of these situations this is because there is no overlap of the confidence intervals (CIs) but sometimes significance can apply in the presence of CI overlap.

All Primary Ankle Arthroplasties

No. Ops.	Observed comp. Yrs	Number Revised	Rate/100-component-years	Exact 95% confidence interval	
1,261	6,590.0	134	2.03	1.70	2.41

Revision vs Prosthesis Type Sorted in Alphabetical Order

Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Agility	119	1,125.3	33	2.93	2.02	4.12
Box	6	24.5	2	8.17	0.99	29.51
Hintegra	20	36.9	2	5.43	0.66	19.60
Infinity	6	2.2	0	0.00	0.00	165.12
Mobility	450	2,676.6	56	2.09	1.56	2.70
Ramses	11	82.7	5	6.04	1.96	14.10
Salto	600	2,224.4	24	1.08	0.69	1.61
STAR	47	414.8	12	2.89	1.41	4.90
Zimmer Trabecular Metal	2	2.6	0	0.00	0.00	139.48

The Salto continues to greatly outperform all the other prostheses with respect to revision rate.

Revision vs Gender

Gender	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Females	491	2,578.6	54	2.09	1.56	2.71
Males	770	4,011.5	80	1.99	1.58	2.48

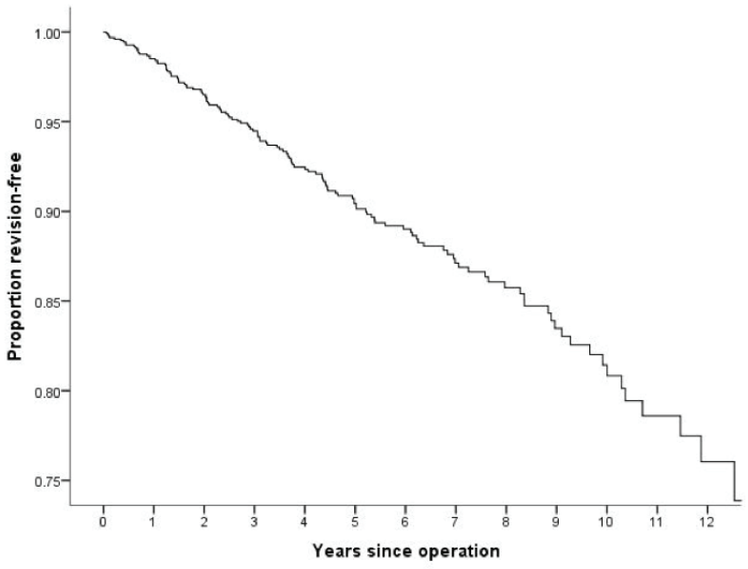
Revision vs Age Bands

Age Bands	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
<55	146	765.1	26	3.40	2.17	4.90
55_64	421	2,407.8	58	2.41	1.83	3.11
65_74	493	2,522.0	43	1.70	1.23	2.30
>75	201	895.1	7	0.78	0.31	1.61

The highest age band has a significantly lower revision rate than the lowest two.

KAPLAN MEIER CURVES

The following Kaplan Meier survival analyses are for the 16 years from 2000 to 2015, with deceased patients censored at time of death.



Years	% Revision-free	No in each year N
1	98.50	1,131
2	96.51	1,001
3	94.48	858
4	92.47	731
5	90.43	616
6	89.02	492
7	87.12	363
8	85.74	268
9	83.48	195
10	81.43	135

There are insufficient numbers to give an accurate revision- free percentage beyond ten years.

PATIENT BASED QUESTIONNAIRE OUTCOMES AT SIX MONTHS AND FIVE YEARS POST-SURGERY

At six months post-surgery patients are sent an outcome questionnaire.

The non -validated ankle questionnaire used previously by the Registry was replaced by the validated Manchester-Oxford Foot Questionnaire towards the end of 2015 (see page 174).

This has 16 questions answered on a 5 point Likert scale, with each item scoring from 0 – 4, with 4 denoting "most severe".

There is insufficient data for analyses this year.

SHOULDER ARTHROPLASTY

PRIMARY SHOULDER ARTHROPLASTY

The **sixteen-year** report analyses data for the period January 2000 – December 2015. There were 7,305 primary shoulder procedures registered with an additional 974 registered in 2015, 22% more than registered in 2014.

2000	122
2001	162
2002	193
2003	225
2004	280
2005	293
2006	366
2007	400
2008	457
2009	514
2010	494
2011	579
2012	698
2013	747
2014	801
2015	974

Of the 7,305 shoulder registrations, 1,647 are hemi shoulder replacements, 2,681 are conventional total shoulder replacements, 2,621 are reverse shoulder replacements, 215 are partial resurfacing shoulder replacements, 140 are total resurfacing replacements and one is a humeral sphere.

Data Analysis

Age and sex distribution

The average age for all patients with a shoulder arthroplasty was 71.05 years, with a range of 15.63 – 99.36 years.

All shoulder arthroplasty

	Female	Male
Number	4,640	2,665
Percentage	63.52	36.48
Mean age	72.58	68.39
Maximum age	97.71	99.36
Minimum age	15.63	21.83
Standard dev.	9.51	10.18

Hemiarthroplasty

	Female	Male
Number	1,088	559
Percentage	66.06	33.94
Mean age	71.58	65.73
Maximum age	97.71	99.36
Minimum age	15.63	25.83
Standard dev.	11.01	12.13

Conventional total shoulder arthroplasty

	Female	Male
Number	1,702	979
Percentage	63.48	36.52
Mean age	70.75	67.11
Maximum age	94.62	89.11
Minimum age	26.64	29.38
Standard dev.	8.77	8.61

Reverse shoulder arthroplasty

	Female	Male
Number	1,684	937
Percentage	64.25	35.75
Mean age	75.80	73.27
Maximum age	96.82	92.65
Minimum age	36.17	47.00
Standard dev.	7.58	7.40

Partial resurfacing arthroplasty

	Female	Male
Number	75	140
Percentage	34.88	65.12
Mean age	58.73	55.90
Maximum age	87.06	86.12
Minimum age	20.70	21.83
Standard dev.	14.33	11.01

Total resurfacing arthroplasty

	Female	Male
Number	90	50
Percentage	64.29	35.71
Mean age	71.02	66.77
Maximum age	86.79	81.51
Minimum age	47.24	45.16
Standard dev.	8.32	8.68

Humeral sphere

One female patient aged 50.11 years.

Previous operation

None	6,152
Internal fixation for juxtarticular fracture	183
Previous stabilisation	144
Osteotomy	4
Arthrodesis	1

Diagnosis

Osteoarthritis	3,912
Cuff tear arthropathy	1,506
Acute fracture prox. humeru	730
Rheumatoid arthritis	556
Post old trauma	425
Avascular necrosis	217
Post recurrent dislocation	96
Other inflammatory	67

Approach

Deltopectoral	6,428
Other including deltoid split	227

Bone graft

Humeral autograft	104
Humeral allograft	20
Humeral synthetic	3
Glenoid autograft	90
Glenoid allograft	12

Cement

Humerus cemented	1,572
Antibiotic in cement	969
Glenoid cemented	1,861
Antibiotic in cement	1,306

Systemic antibiotic prophylaxis

Patient number receiving at least one systemic antibiotic	6,851 (94%)

Operating theatre

Conventional	4,373
Laminar flow	2,824
Space suits	1,262

ASA Class

This was introduced with the updated forms at the beginning This was introduced with the updated forms at the beginning of 2005.

For the eleven-year period 2005 – 2015 there were 6,049 (96%) shoulder procedures with the ASA class recorded.

Definitions

ASA class 1: A healthy patient
ASA class 2: A patient with mild systemic disease
ASA class 3: A patient with severe systemic disease that limits activity but is not incapacitating
ASA class 4: A patient with an incapacitating disease that is a constant threat to life

ASA	Number	Percentage
1	530	9
2	3,372	56
3	2,076	34
4	71	1

Operative time (skin to skin in minutes)

	Mean
Hemi Arthroplasty	110
Conventional Total	128
Partial Resurfacing	94
Total Resurfacing	124
Reverse Arthroplasty	116

Surgeon grade

The updated forms introduced in 2005 have separated advanced trainee into supervised and unsupervised.

The following figures are for the eleven-year period 2005 – 2015.

Consultant	6,035
Advanced trainee supervised	301
Advanced trainee unsupervised	14
Basic trainee	1

Top 10 shoulder prostheses 2015

SMR Reverse	272
Delta Xtend Reverse	214
Aequalis Reverse	91
SMR Conventional	73
Aequalis Conventional	66
Global A P Conventional	66
Global Unite Conventional	34
Comprehensive Conventional	26
Aequalis Hemi	20
Epoca Partial Resurfacing	16

The Comprehensive is a new addition to the list and has replaced the Global Cap Resurfacing from the 2013 list.

Surgeon and hospital workload

Surgeons

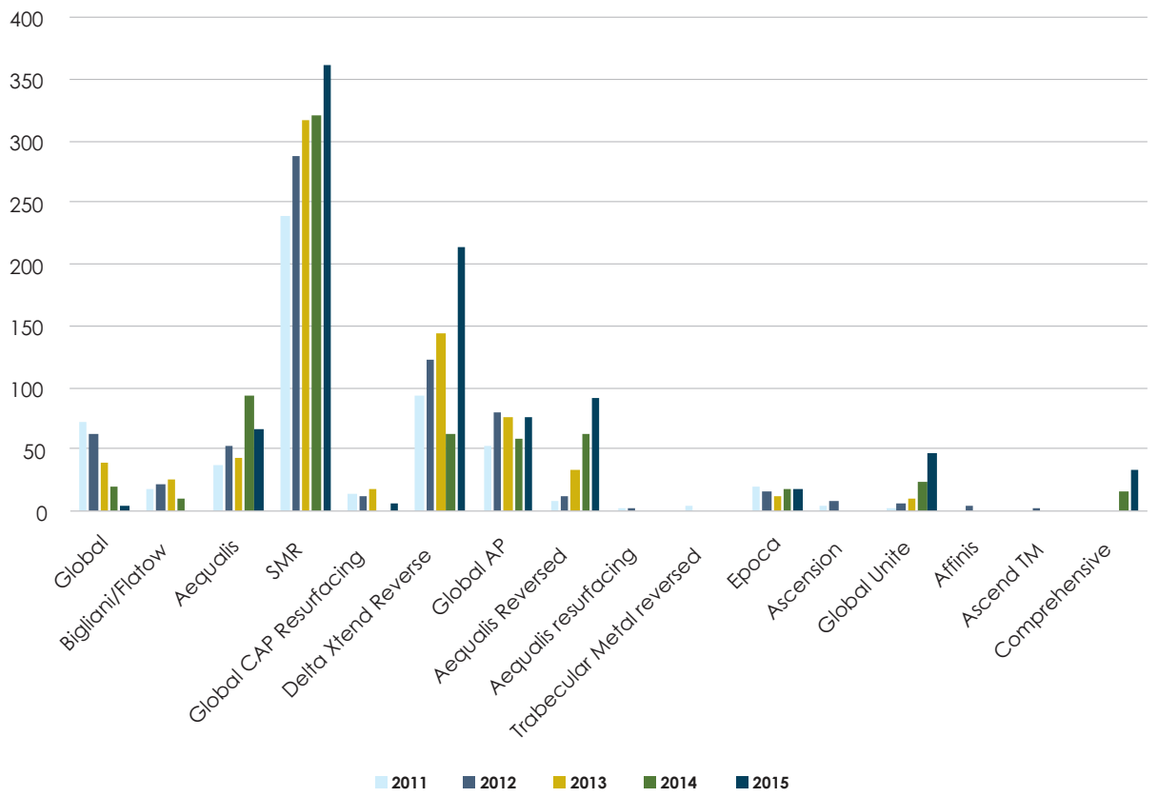
In 2015, 77 surgeons performed 974 shoulder procedures, an average of 13 procedures per surgeon. 17 surgeons performed more than 20 procedures and 12 surgeons each performed one procedure.

Hospitals

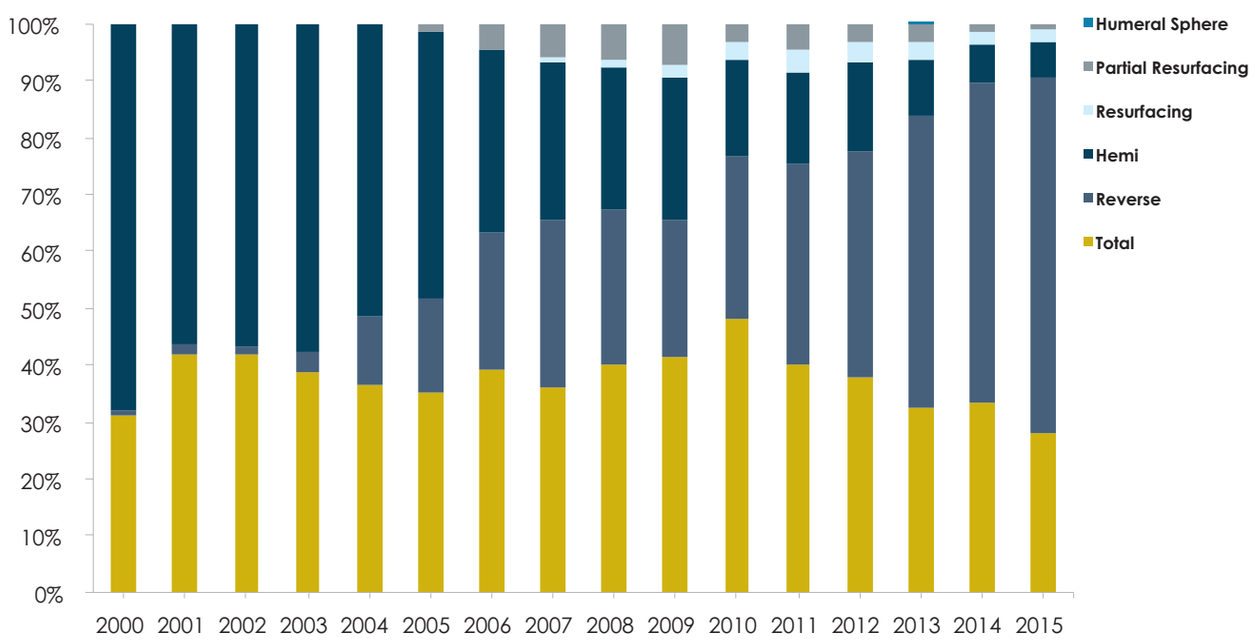
In 2015, shoulder replacement was performed in 49 hospitals. 27 were public and 22 were private.

For 2015, the average number of shoulder replacements per hospital was 20.

Most used Shoulder Prostheses per year for five years (2011 – 2015)



Percentages of the different types of shoulder prostheses used by year



The Reverse shoulder prostheses continue to dominate and in 2014 accounted for 56% of shoulder arthroplasties.

REVISION SHOULDER ARTHROPLASTY

Revision is defined by the Registry as a new operation in a previously replaced shoulder joint during which one or more of the components are exchanged, removed, manipulated or added. It includes excision, arthrodesis or amputation, but not soft tissue procedures. A two or more staged procedure is registered as one revision.

Data Analysis

For the sixteen- year period January 2000 – December 2015, there were 571 revision shoulder procedures registered.

The average age for a shoulder revision was 68.51 years with a range of 24.05 – 89.95 years.

	Female	Male
Number	328	243
Percentage	57.44	42.56
Mean	70.27	66.14
Maximum age	89.95	88.46
Minimum age	33.20	24.05
Standard dev.	10.54	10.68

REVISION OF REGISTERED PRIMARY SHOULDER ARTHROPLASTIES

This section analyses data for revisions of primary shoulder procedures for the sixteen-year period January 2000 – December 2015.

There were 356 revisions of the primary group of 7,305 (4.9%). There were 38 procedures that had been revised twice and eight that had been revised three times.

Time to revision

Mean	968 days
Maximum	5,208 days
Minimum	0 days
Standard deviation	965 days

Reason for revision

Pain	81
Dislocation/instability anterior	65
Sub acromial cuff impingement	60
Loosening glenoid	44
Deep infection	23
Loosening humeral	15
Instability posterior	11
Sub acromial tuberosity impingement.	7
Fracture humerus	5
Loosening both components	2

Analysis by time for the 6 main reasons for revision

	Loosening glenoid		Dislocation		Deep infection		Pain		Sub acromial Cuff		Loosening Humeral	
Years	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
0	12	27.27	40	61.54	8	34.78	19	23.46	12	20.00	2	13.33
1	10	22.73	11	16.92	8	34.78	21	25.93	16	26.67	1	6.67
2	5	11.36	3	4.62	4	17.39	12	14.81	12	20.00	1	6.67
3	2	4.55	2	3.08	2	8.70	7	8.64	3	5.00	3	20.00
4	1	2.27	3	4.62	1	4.35	6	7.41	4	6.67	2	13.33
5	4	9.09	4	6.15	0	0.00	2	2.47	5	8.33	3	20.00
6	3	6.82	0	0.00	0	0.00	4	4.94	2	3.33	0	0.00
7	0	0.00	0	0.00	0	0.00	2	2.47	2	3.33	0	0.00
8	1	2.27	1	1.54	0	0.00	2	2.47	0	0.00	0	0.00
9	4	9.09	0	0.00	0	0.00	3	3.70	2	3.33	1	6.67
10	2	4.55	0	0.00	0	0.00	1	1.23	2	3.33	1	6.67
11	0	0.00	0	0.00	0	0.00	1	1.23	0	0.00	0	0.00
12	0	0.00	1	1.54	0	0.00	1	1.23	0	0.00	1	6.67
Total	**44**	**-**	**65**	**-**	**23**	**-**	**81**	**-**	**60**	**-**	**15**	**-**

Statistical note

In the table below there are two statistical terms readers may not be familiar with:

i) Observed component years

This is the number of registered primary procedures multiplied by the number of years each component has been in place.

ii) Rate/100 component years

This is equivalent to the yearly revision rate expressed as a percent and is derived by dividing the number of prostheses revised by the observed component years multiplied by 100. It therefore allows for the number of years of post-operative follow up in calculating the revision rate. These rates are usually very low, hence are expressed per 100 component years rather than per component year.

Statisticians consider that this is a more accurate way of deriving a revision rate for comparison when analysing data with widely varying follow up times. It is also important to note the confidence intervals. The closer they are to the estimated revision rate/100 component years, the more precise the estimate is.

Statistical significance

Where it is stated that a difference among results is significant the p value is 0.05 or less. In most of these situations this is because there is no overlap of the confidence intervals (CIs) but sometimes significance can apply in the presence of CI overlap.

All Total Shoulder Arthroplasties

No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
7,305	34,369	356	1.04	0.93	1.15

Revision rate of Shoulder Prostheses vs Arthroplasty Type

Operation Type	No. Ops.	Observed	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Conventional Total	2,681	13,810.8	134	0.97	0.81	1.15
Reverse	2,621	8,038.3	71	0.88	0.69	1.11
Hemi	1,647	10,951.6	122	1.11	0.92	1.33
Resurfacing	140	461.6	2	0.43	0.05	1.57
Partial Resurfacing	215	1,104.7	27	2.44	1.61	3.56
Humeral Sphere	1	2.1	0	0.00	0.00	178.22

There is a significantly higher revision rate for Partial Resurfacing compared to all the other types.

Revision Rate of Individual Shoulder Prostheses Sorted on Alphabetical Order

Prothesis		No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Conventional Total	Aequalis	142	1,619.9	8	0.49	0.19	0.93
	Ascend Flex Stem	276	257.0	4	1.56	0.42	3.99
	Affinis	12	12.0	0	0.00	0.00	30.64
	Anatomical	35	384.9	0	0.00	0.00	0.96
	Arthrex Eclipse	1	3.1	0	0.00	0.00	117.47
	Ascend TM	2	5.6	0	0.00	0.00	65.41
	Bi-Angular	8	52.2	0	0.00	0.00	7.06
	Bigliani/Flatow	273	2,072.6	7	0.34	0.14	0.70
	Cofield 2	21	218.7	0	0.00	0.00	1.69
	Comprehensive	13	12.2	0	0.00	0.00	30.26
	Delta Xtend Reverse	1	1.7	0	0.00	0.00	218.73
	Epoca Humeral stem	4	21.6	0	0.00	0.00	17.06
	Global	512	3,497.4	14	0.40	0.22	0.67
	Global AP	396	1,287.0	3	0.23	0.03	0.62
	Global Unite	47	32.6	0	0.00	0.00	11.32
	Humeral stem	1	3.3	0	0.00	0.00	110.35
	Neer 3	2	25.4	0	0.00	0.00	14.52
	Neer II	12	145.6	0	0.00	0.00	2.53
	Osteonics humeral component	49	448.5	6	1.34	0.43	2.76

Prothesis		No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Conventional Total, *continued*	Sidus	1	1.3	0	0.00	0.00	278.38
	Simpliciti TM	13	18.8	0	0.00	0.00	19.61
	SMR with L1 glenoid	612	2,637.3	45	1.71	1.24	2.28
	SMR with L2 glenoid	243	1,028.6	47	4.57	3.36	6.08
	Univers 3D	5	23.3	0	0.00	0.00	15.8
Reverse	Aequalis	123	95.8	4	4.17	1.14	10.69
	Aequalis Reversed	79	268.8	2	0.74	0.09	2.69
	Aequalis Reversed Fracture	26	43.8	0	0.00	0.00	8.42
	Affinis	5	9.7	0	0.00	0.00	37.88
	Comprehensive	39	26.9	0	0.00	0.00	13.70
	Delta	55	448.6	2	0.45	0.05	1.61
	Delta Xtend Reverse	944	2,671.4	30	1.12	0.76	1.60
	SMR	1,321	4,407.1	33	0.75	0.51	1.04
	Trabecular Metal Reverse	28	61.4	0	0.00	0.00	6.01
	Vaios	1	4.7	0	0.00	0.00	78.52
Hemi	Aequalis	172	946.3	9	0.95	0.40	1.74
	Aequalis Reversed	1	2.4	0	0.00	0.00	153.46
	Affinis	5	8.8	1	11.42	0.29	63.65
	Anatomical	19	217.6	0	0.00	0.00	1.69
	Arthrex Eclipse	2	14.2	0	0.00	0.00	25.98
	Ascend TM	1	3.6	0	0.00	0.00	103.33
	Bi-Angular	19	199.9	2	1.00	0.12	3.61
	Bigliani/Flatow	137	1,132.1	14	1.24	0.68	2.07
	Bio-modular	1	7.1	1	14.00	0.35	78.03
	Cofield 2	50	520.8	1	0.19	0.00	1.07
	Delta	1	8.8	0	0.00	0.00	42.08
	Delta Xtend Reverse	21	62.3	3	4.81	0.99	14.07
	Global	723	5,333.7	51	0.96	0.71	1.26
	Global AP	76	264.6	2	0.76	0.09	2.73
	Global Unite	42	70.6	5	7.08	2.30	16.52
	MRS Humeral	4	15.9	0	0.00	0.00	23.14
	Neer II	24	203.0	0	0.00	0.00	1.82
	Osteonics humeral component	43	372.2	2	0.54	0.07	1.94
	Randelli	1	8.2	0	0.00	0.00	44.82
	Simpliciti TM	1	0.4	0	0.00	0.00	836.87
	SMR	302	1,548.9	31	2.00	1.33	2.80
	Trabecular Metal Reverse	1	6.2	0	0.00	0.00	59.20
	Univers 3D	1	3.8	0	0.00	0.00	96.59

Prothesis		No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Total Resurfacing	Aequalis Resurfacing Head	10	44.8	0	0.00	0.00	8.24
	Affiniti	1	0.8	0	0.00	0.00	447.63
	Epoca Head	78	218.6	1	0.46	0.01	2.55
	Global CAP Resurfacing	48	188.0	1	0.53	0.01	2.96
	Global Unite	1	0.1	0	0.00	0.00	3062.19
	SMR Resurfacing	2	9.3	0	0.00	0.00	39.58
Partial resurfacing	Aequalis Resurfacing Head	1	3.0	0	0.00	0.00	121.06
	Arthrex Eclipse	3	8.9	2	22.39	2.71	80.90
	Ascension	20	66.1	1	1.51	0.04	8.43
	Copeland Resurfacing	19	122.9	3	2.44	0.50	7.13
	Custom Global Cap	1	4.4	0	0.00	0.00	83.64
	Epoca Head	17	55.2	1	1.81	0.05	10.10
	Global CAP Resurfacing	95	576.6	11	1.91	0.89	3.30
	Global Humeral Head	1	3.2	0	0.00	0.00	113.99
	Hemicap Resurfacing	6	40.8	1	2.45	0.06	13.67
	SMR Resurfacing	45	194.1	6	3.09	1.13	6.73
	SMR Resurfacing CTA	7	29.4	2	6.79	0.82	24.54

There are widely varying revision rates, most of which do not reach statistical significance. The stand out is SMR Conventional (73 implanted in 2015) which continues to have a significantly higher revision rate than the other main Conventional prostheses even when those matched with the withdrawn L2 glenoid are separated off.

Revision vs Glenoid Fixation
(Conventional Total arthroplasties only)

	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Uncemented	901	3,997.5	90	2.25	1.81	2.77
Cemented	1,780	9,813.3	44	0.45	0.33	0.60

The uncemented glenoids have a significantly higher revision rate. However, the fact that a glenoid component had been entered as revised does not necessarily mean it had failed or had to be replaced.

Revision vs Age Bands

Age Bands	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
<55	447	2,538.8	52	2.05	1.53	2.69
55_64	1,317	6,780.1	108	1.59	1.31	1.92
65_74	2,769	13,077.0	125	0.96	0.80	1.14
>75	2,772	11,973.1	71	0.59	0.46	0.75

The lower two age bands have a significantly higher revision rate than the higher two and the >75 has a significantly lower revision rate than the 65-74 age group.

Revision vs Prosthesis Group vs Age Bands

Prosthesis	Age Bands	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Conventional Total	<55	141	708.0	17	2.40	1.35	3.76
	55_64	630	3,191.3	42	1.32	0.95	1.78
	65_74	1,180	6,167.2	55	0.89	0.67	1.16
	>75	730	3,744.2	20	0.53	0.33	0.82
Reverse	<55	22	45.1	3	6.66	1.37	19.46
	55_64	259	816.3	15	1.84	1.03	3.03
	65_74	971	2,890.6	27	0.93	0.62	1.36
	>75	1,369	4,286.3	26	0.61	0.40	0.89
Hemi	<55	190	1,307.5	19	1.45	0.87	2.27
	55_64	325	2,270.1	44	1.94	1.41	2.60
	65_74	509	3,600.0	35	0.97	0.68	1.35
	>75	623	3,774.1	24	0.64	0.41	0.95
Resurfacing	<55	5	18.1	1	5.52	0.14	30.78
	55_64	34	131.4	0	0.00	0.00	2.81
	65_74	63	204.9	1	0.49	0.01	2.72
	>75	38	107.2	0	0.00	0.00	3.44
Partial resurfacing	<55	88	458.1	12	2.62	1.35	4.58
	55_64	69	371.1	7	1.89	0.67	3.70
	65_74	46	214.3	7	3.27	1.31	6.73
	>75	12	61.3	1	1.63	0.04	9.10

There is a definite trend for lower revision rates for each ascending age group although often not statistically significant due to small numbers and wide CIs.

Revision vs Gender

Gender	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
F	4,640	22,115.3	211	0.95	0.83	1.09
M	2,665	12,253.8	145	1.18	0.99	1.39

There is no significant difference between the two genders.

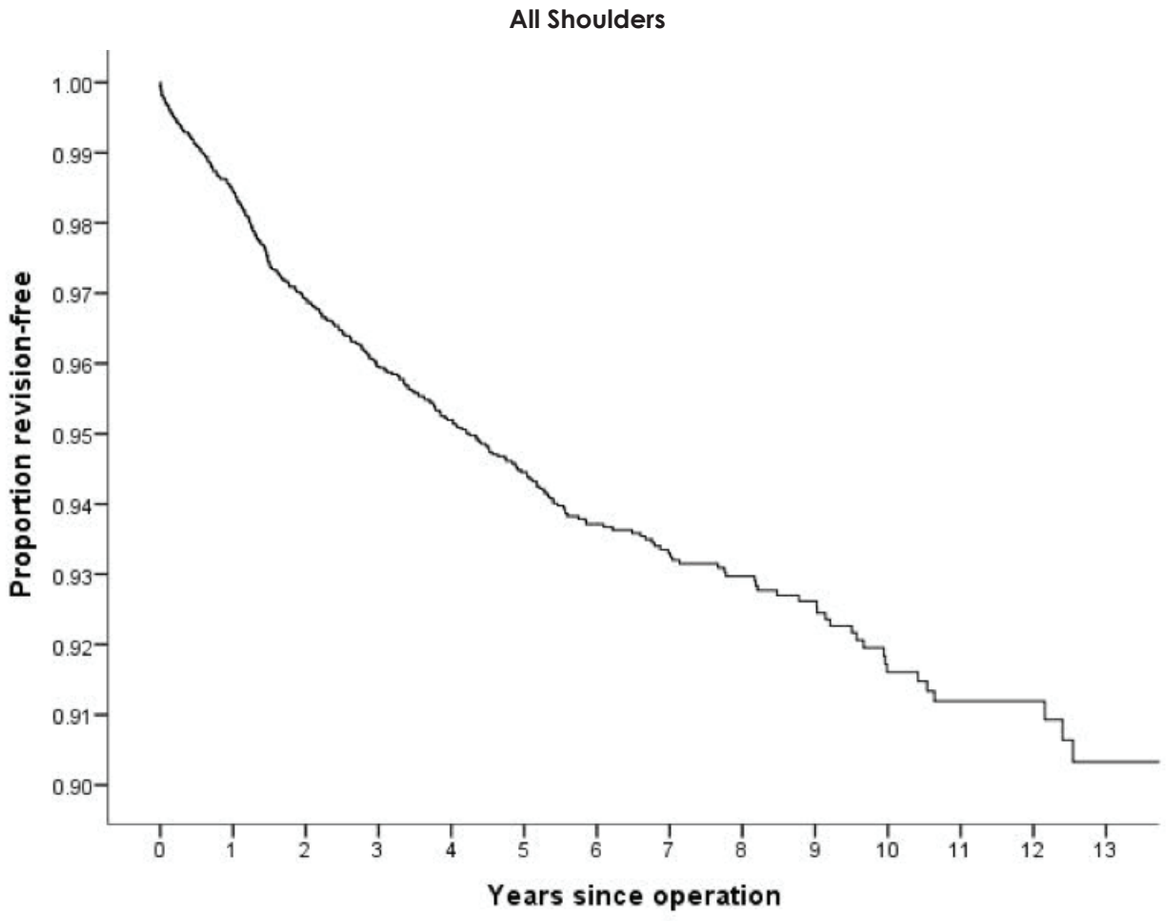
Revision vs Surgeon Annual Workload

Consultant Number of ops/yr	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
<10	2,942	14,378.5	156	1.08	0.92	1.27
>=10	4,363	19,990.6	200	1.00	0.86	1.15

There is no significant difference between the two groups.

KAPLAN MEIER CURVES

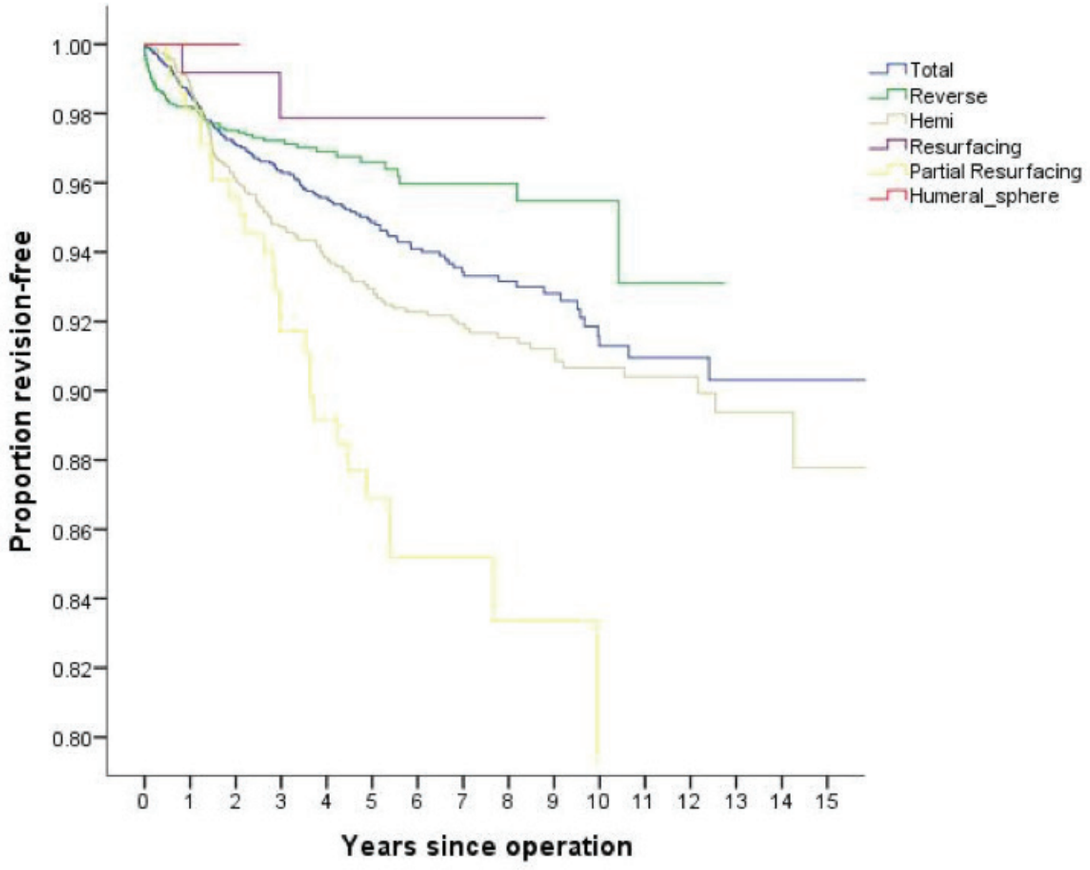
The following Kaplan Meier survival analyses are for the 16 years from 2000 to 2015, with deceased patients censored at time of death.



Years	% Revision-free	N
1	98.45	6,132
2	96.92	5,165
3	95.96	4,297
4	95.20	3,506
5	94.45	2,887
6	93.71	2,364
7	93.30	1,874
8	92.97	1,454
9	92.62	1,081
10	91.61	783
11	91.19	565
12	91.19	369

There are insufficient numbers to give an accurate revision free percentage beyond twelve years.

Survival curves for different shoulder categories



PATIENT BASED QUESTIONNAIRE OUTCOMES AT SIX MONTH, FIVE YEARS AND TEN YEARS POST-SURGERY

Questionnaires at six months post-surgery

The new scoring system has been adopted as recommended by the original authors.

The scores now range from 4 to 0. A score of 48 is the best, indicating normal function. A score of 0 is the worst, indicating the most severe disability.

We have grouped the questionnaire responses based on the scoring system as published by Kalairajah et al, in 2005 (See appendix 1) This groups each score into four categories:

Category 1	>41	excellent
Category 2	34 – 41	good
Category 3	27 – 33	fair
Category 4	< 27	poor

For the sixteen-year period and as at July 2016, there were 4,834 shoulder questionnaire responses registered at six months post-surgery.

The mean shoulder score was 36.39 (standard deviation 9.46, range 2 – 48)

Scoring	> 41	1,798
Scoring	34 - 41	1,518
Scoring	27 - 33	741
Scoring	<27	777

At six months post-surgery, 69% had an excellent or good score.

Questionnaires at five years post-surgery

All patients who had a six month registered questionnaire, and who had not had revision surgery, were sent a further questionnaire at five years post-surgery.

This dataset represents sequential Oxford shoulder scores for 1,436 individual patients.

At five years post-surgery, 78% of these patients achieved an excellent or good score and had a mean of 39.601

Questionnaires at ten years post-surgery

All patients who had a six month registered questionnaire, and who had not had revision surgery, were sent a further questionnaire at ten years post-surgery.

This dataset represents sequential Oxford shoulder scores for 345 individual patients.

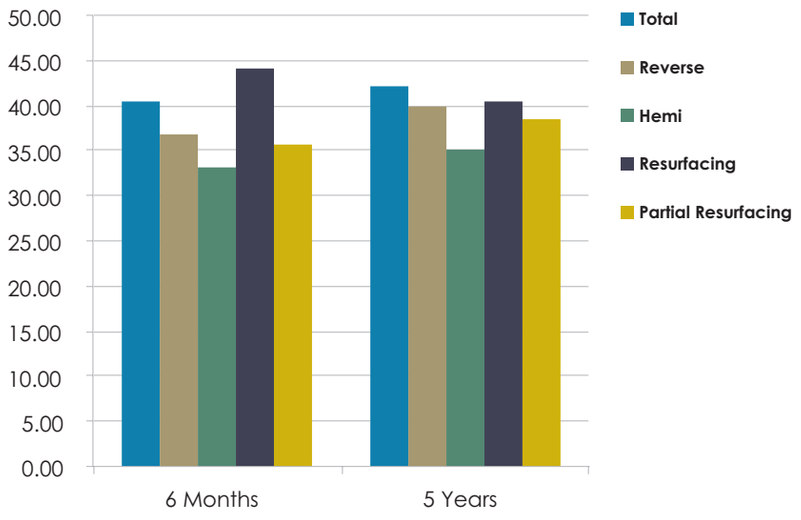
At ten years post-surgery, 73% of these patients achieved an excellent or good score and had a mean of 38.64.

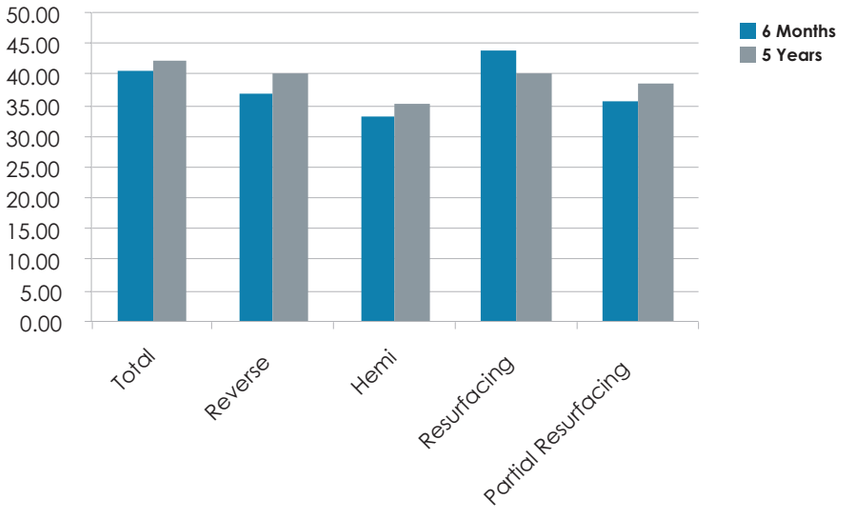
Six Month and Five Year Oxford Scores for the different arthroplasty types

Prosthesis type	Time Post-Surgery	Mean Score	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Conventional Total	6 Months	39.45	0.21	39.05	39.85
	5 Years	42.04	0.33	41.40	42.68
Reverse	6 Months	35.44	0.22	35.01	35.86
	5 Years	39.65	0.48	38.72	40.59
Hemi	6 Months	31.81	0.28	31.25	32.36
	5 Years	35.45	0.43	34.62	36.29
Resurfacing	6 Months	41.79	0.87	40.08	43.50
	5 Years	43.00	1.89	39.29	46.71
Partial Resurfacing	6 Months	35.29	0.86	33.61	36.98
	5 Years	37.52	1.47	34.63	40.40

Conventional Total and Resurfacing types have significantly higher six month and five year scores.

Comparison of 6 month and 5 year scores for different arthroplasty types





Analysis of the individual questions

Analysis of the individual questions showed that there were persisting concerns with pain, brushing hair (Q7).

Percentage scoring 0 or 1 for each question out of the group at six-months and five-years.

		6mth %	5yr %
1	The worst pain from the shoulder is severe or unbearable	16	10
2	Usually have moderate or severe pain from the operated shoulder	19	11
3	Extreme difficulty or impossible to get in and out of a car or public transport	3	2
4	Extreme difficulty or impossible to use a knife and fork at the same time	4	2
5	Extreme difficulty or impossible to do the household shopping on your own	6	6
6	Extreme difficulty or impossible to carry a tray containing a plate of food across a room	8	6
7	Extreme difficulty or impossible to brush or comb hair with the operated arm	16	10
8	Extreme difficulty or impossible to dress yourself because of your operated shoulder	6	3
9	Extreme difficulty or impossible to hang clothes in a wardrobe using operated arm	15	11
10	Extreme difficulty or impossible to wash and dry under both arms	8	5
11	Pain from operated shoulder greatly or totally interfering with usual work	12	10
12	Pain from shoulder in bed most or every night(s)	15	9

Revision shoulder questionnaire responses

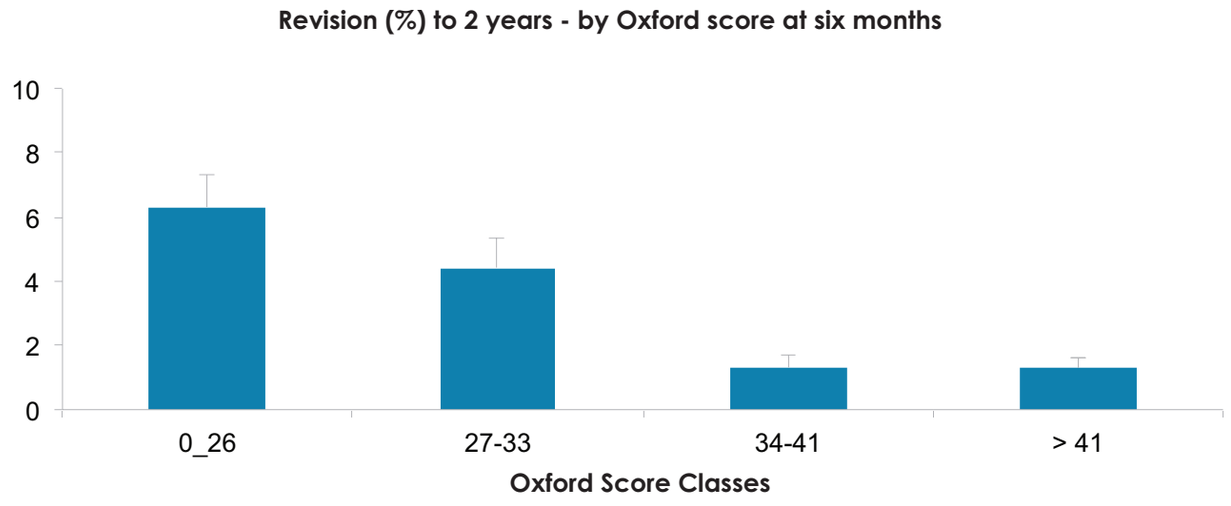
There were 335 revision shoulder responses with 46% achieving an excellent or good score. This group includes all revision shoulder responses. The mean revision shoulder score was 31.02 (standard deviation 10.33 range 3 – 48).

OXFORD 12 SCORE AS A PREDICTOR OF SHOULDER ARTHROPLASTY REVISION

A statistically significant relationship has been confirmed between the Oxford scores at six months and five years and arthroplasty revision within two years of the Oxford 12 questionnaire date.

Six month score and revision arthroplasty

Plotting the patients' six month scores in the Kalairajah groupings against the proportion of shoulders revised for that same group demonstrates that there is an incremental increase in risk during the next two years related to the Oxford score. A patient with a score below 27 has 5 times the risk of a revision within two years compared to a person with a score of 34-41.



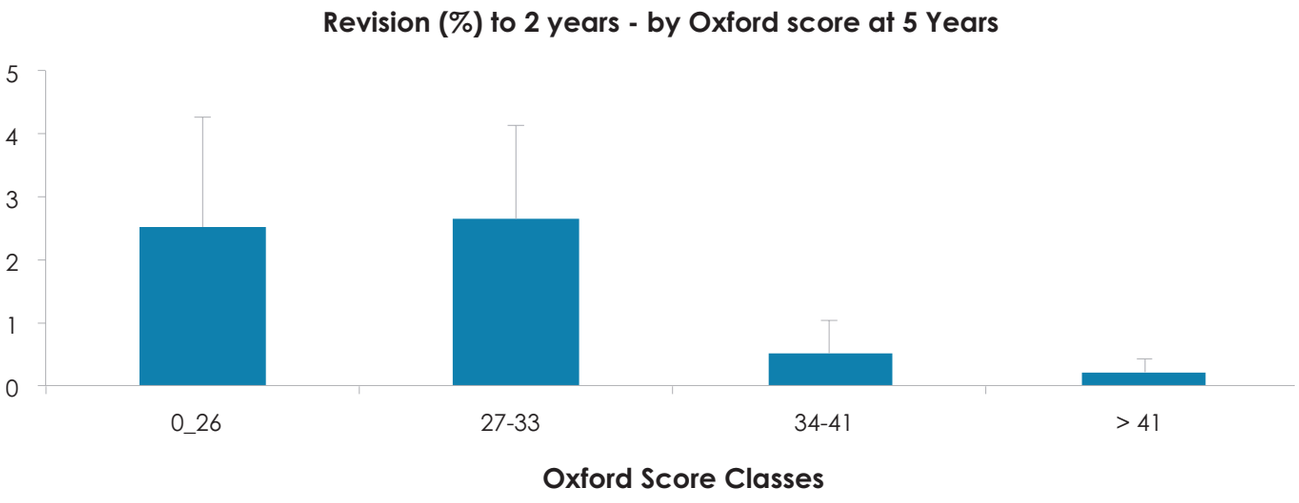
Revision risk versus Kalairajah groupings of Oxford scores within two years of the six month score date

Kalairajah group	No in group	No. revised	%	Std error
0_26	554	35	6.32	1.03
27-33	519	23	4.43	0.90
34-41	1,064	14	1.32	0.35
> 41	1,239	16	1.29	0.32

A person with an Oxford score >41 has a 1.29% risk of revision within two years compared to a 6.32 % risk with a score <27.

Five year score and revision arthroplasty

Plotting the patients' five year scores in the Kalairajah groupings against the proportion of shoulders revised for that same group demonstrates that there is an incremental increase in risk during the next two years related to the Oxford score, although it is not as clear cut as for the hips and knees. A patient with a score below 33 has 12 times the risk of a revision within two years compared to a person with a score of >41.



Revision risk versus Kalairajah groupings of Oxford scores within two years of the 5 year score date

Kalairajah group	No in group	No. revised	%	Std error
0_26	80	2	2.50	1.75
27-33	114	3	2.63	1.50
34-41	197	1	0.51	0.51
> 41	470	1	0.21	0.21

A person with an Oxford score >41 has a 0.21% risk of revision within two years compared to a 2.50% risk with a score <27.

ELBOW ARTHROPLASTY

PRIMARY ELBOW ARTHROPLASTY

The **sixteen-year** report analyses data for the period January 2000 – December 2015. There were 476 primary elbow procedures registered with an additional 41 registered in 2015, 54% more than registered in 2014.

2000	17
2001	29
2002	32
2003	23
2004	28
2005	30
2006	31
2007	36
2008	40
2009	34
2010	30
2011	33
2012	24
2013	22
2014	26
2015	41

Data Analysis

Age and sex distribution

The average age for an elbow replacement was 67.14 years, with range of 15.16 – 92.41 years.

	Female	Male
Number	368	108
Percentage	77.31	22.69
Mean age	67.44	66.13
Maximum age	92.41	91.73
Minimum age	36.38	15.16
Standard dev.	11.73	13.53

Previous operation

None	401
Internal fixation for juxtarticular fracture	22
Synovectomy+-removal radial head	16
Debridement	12
Osteotomy	2
Ligament reconstruction	3
Interposition arthroplasty	1

Diagnosis

Rheumatoid arthritis	257
Post fracture	138
Osteoarthritis	64
Other inflammatory	8
Post dislocation	8
Post ligament disruption	6

Approach

Posterior	299
Medial	93
Lateral	29

Bone graft

Humeral autograft	33	
Humeral allograft	3	
Humeral synthetic	1	
Ulnar autograft	2	

Cement

Humerus cemented	440	
Antibiotic in cement	329	(75%)
Ulna cemented	415	
Antibiotic in cement	305	(74%)
Radius cemented	23	
Antibiotic in cement	22	(96%)

Systemic antibiotic prophylaxis

Patient number receiving at least one systemic antibiotic	444	(93%)

Operating theatre

Conventional	321
Laminar flow	150
Space suits	71

ASA Class

This was introduced with the updated forms at the beginning of 2005.

For the eleven-year period 2005 – 2015, there were 324 (93%) primary elbow procedures with the ASA class recorded.

Definitions

ASA class 1: A healthy patient

ASA class 2: A patient with mild systemic disease

ASA class 3: A patient with severe systemic disease that limits activity but is not incapacitating

ASA class 4: A patient with an incapacitating disease that is a constant threat to life

ASA	Number
1	9
2	142
3	166
4	7

Operative time (skin to skin)

Mean	142 minutes

Surgeon grade

The updated forms introduced in 2005 have separated advanced trainee into supervised and unsupervised.

The following figures are for the eleven- year period 2005 – 2015.

Consultant	341
Advanced trainee supervised	7
Advanced trainee unsupervised	3

Surgeon and hospital workload

In 2015, 18 surgeons performed 41 primary elbow procedures. These ranged from one to six per surgeon, with eight performing one elbow procedure.

Hospitals

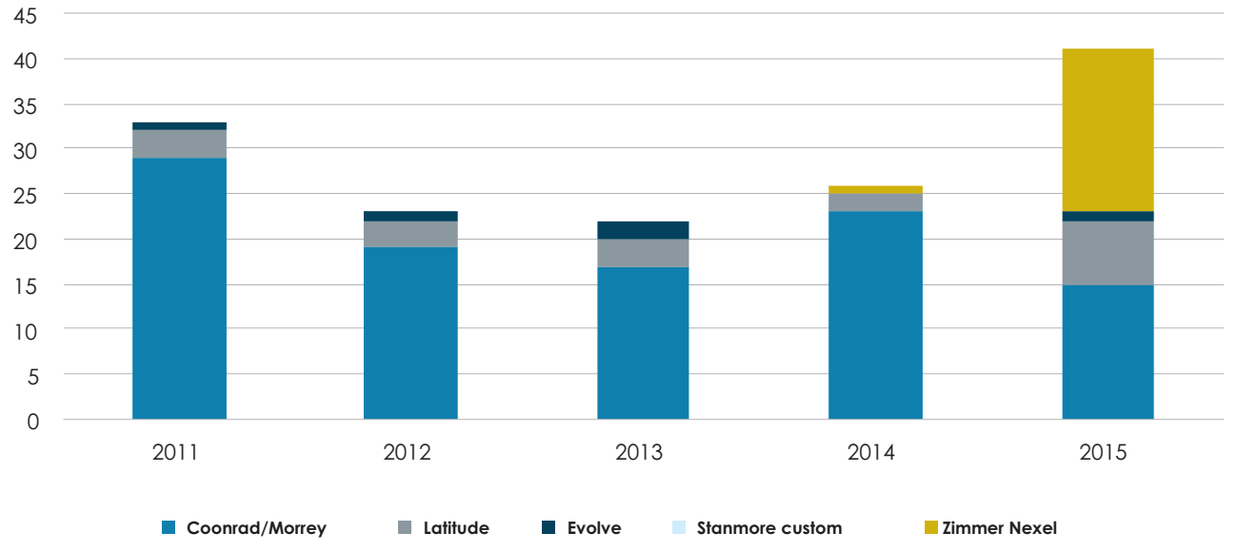
In 2015, primary elbow replacement was performed in 15 hospitals, of which ten were public and five were private.

Prosthesis usage

Elbow prostheses used in 2015

Zimmer Nexel	18
Coonrad/Morrey	15
Latitude	7
Evolve	1

Most used Elbow Prostheses per year for five years (2011- 2015)



REVISION ELBOW ARTHROPLASTY

Revision is defined by the Registry as a new operation in a previously replaced elbow joint during which one or more of the components are exchanged, removed, manipulated or added. It includes arthrodesis or amputation, but not soft tissue procedures. A two or more staged procedure is registered as one revision.

Data Analysis

For the sixteen-year period January 2000 – December 2015, there were 81 revision elbow procedures registered.

The average age for a revision elbow replacement was 66.05 years, with a range of 30.97 – 90.50 years

	Female	Male
Number	58	23
Percentage	71.60	28.40
Mean	66.12	65.85
Maximum age	88.95	90.50
Minimum age	42.23	30.97
Standard dev.	9.32	13.22

REVISION OF REGISTERED PRIMARY ELBOW ARTHROPLASTIES

This section analyses data for revisions of primary elbow procedures for the sixteen-year period January 2000 – December 2015.

There were 29 revisions of the primary group of 476 (6.1%).

There were five that had been revised twice and one that had been revised three times.

Time to revision

Mean	1,201 days
Maximum	3,988 days
Minimum	62 days
Standard deviation	1,033 days

Reason for revision

Loosening humeral component	10
Deep infection	8
Loosening ulnar component	7
Pain	3
Fracture humerus	3
Loosening radial head component	3
Dislocation	2
Fracture ulna	1

Analysis by time for the 3 main reasons for revision

	Loosening humeral component		Loosening Ulnar component		Deep infection	
Years	**Count**	**%**	**Count**	**%**	**Count**	**%**
0	0	0.00	0	0.00	0	0.00
1	0	0.00	0	0.00	0	0.00
2	2	25.00	0	0.00	3	50.00
3	3	37.50	3	50.00	1	16.70
4	2	25.00	2	33.30	0	0.00
5	0	0.00	0	0.00	0	0.00
6	0	0.00	0	0.00	0	0.00
7	0	0.00	0	0.00	1	16.70
8	0	0.00	0	0.00	0	0.00
9	0	0.00	0	0.00	1	16.70
10	0	0.00	0	0.00	0	0.00
11	1	12.50	1	16.70	0	0.00
Total	**8**	**100.00%**	**6**	**100.00%**	**6**	**100.00%**

Statistical note

In the table below there are two statistical terms readers may not be familiar with:

i) Observed component years

This is the number of registered primary procedures multiplied by the number of years each component has been in place.

ii) Rate/100 component years

This is equivalent to the yearly revision rate expressed as a percent and is derived by dividing the number of prostheses revised by the observed component years multiplied by 100. It therefore allows for the number of years of post-operative follow up in calculating the revision rate. These rates are usually very low, hence it is expressed per 100 component years rather than per component year. Statisticians consider that this is a more accurate way of deriving a revision rate for comparison when analysing data with widely varying follow-up times. It is also important to note the confidence intervals. The closer they are to the estimated revision rate/100 component years, the more precise the estimate is.

Statistical Significance

Where it is stated that a difference among results is significant the p value is 0.05 or less. In most of these situations this is because there is no overlap of the confidence intervals (CIs) but sometimes significance can apply in the presence of CI overlap.

All Primary Total Elbow Replacements

No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
476	2,810.7	29	1.03	0.68	1.46

Revision Rate of Individual Prostheses Sorted in Alphabetic Order

Prosthesis	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Acclaim	16	132.5	5	3.77	1.23	8.80
Coonrad/Morrey	332	2,063.3	14	0.68	0.35	1.11
Evolve Stem	11	53.9	0	0.00	0.00	6.84
Kudo	18	147.8	3	2.03	0.42	5.93
Latitude	78	393.5	7	1.78	0.72	3.67
Sorbie Questor	1	6.8	0	0.00	0.00	54.09
Stanmore custom implant	1	5.4	0	0.00	0.00	67.91
Zimmer Nexel	19	7.48	0	0.00	0.00	49.34

Although not statistically significant, except for the Acclaim, the Coonrad Morrey has a much lower revision rate than most of the other prostheses.

Revision vs Gender

Gender	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
Females	368	2,293.6	19	0.83	0.50	1.29
Males	108	517.2	10	1.93	0.93	3.56

There is no statistically significant difference because of the wide CIs for males.

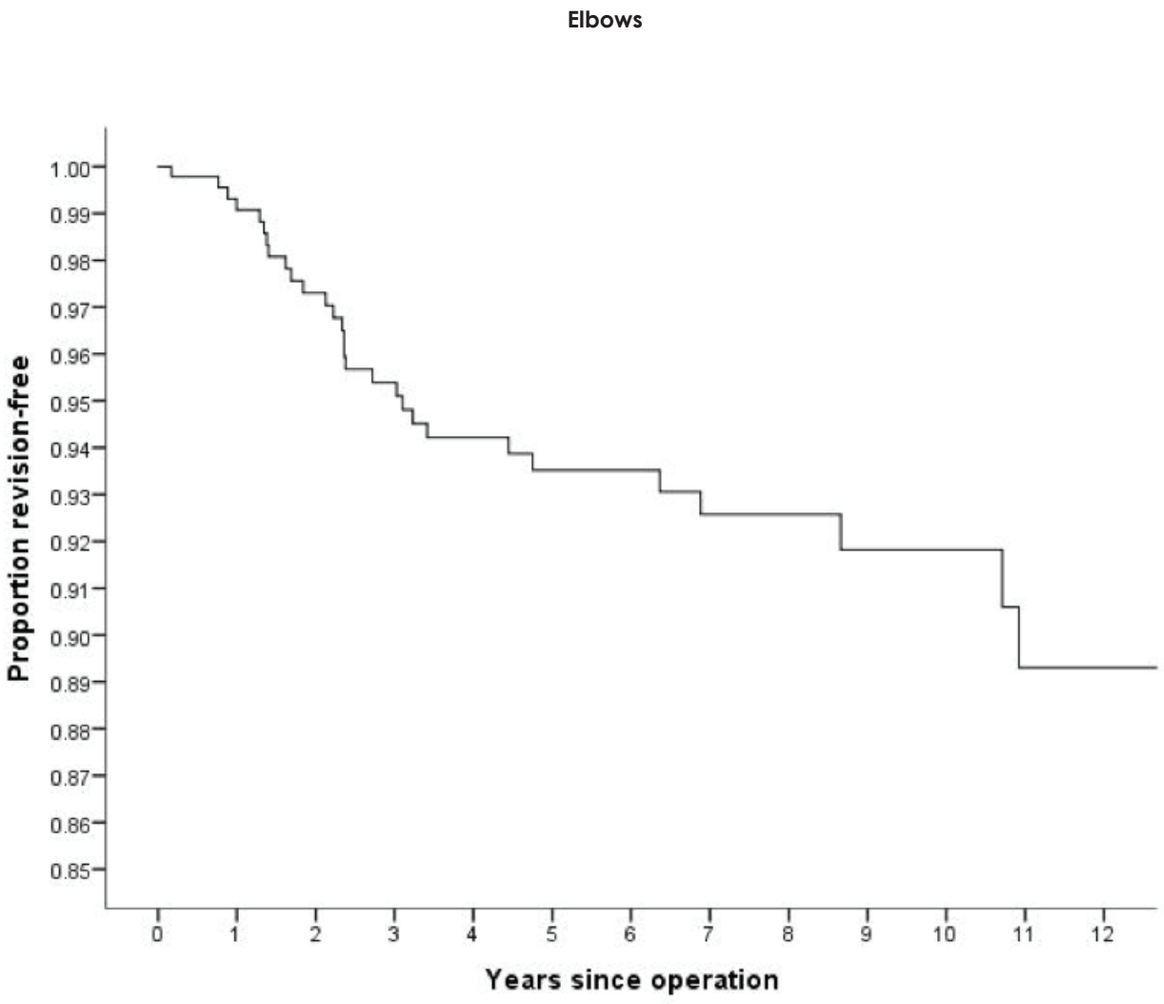
Revision vs Age Bands

Age Bands	No. Ops	Observed comp. Yrs	Number Revised	Rate/100 component-years	Exact 95% confidence interval	
LT55	82	596.1	5	0.84	0.23	1.84
55_64	118	813.2	10	1.23	0.59	2.26
65_74	137	741.0	9	1.21	0.56	2.31
GE75	139	660.3	5	0.76	0.25	1.77

There is no statistically significant difference among the 4 age bands.

KAPLAN MEIER CURVES

The following Kaplan Meier survival analyses are for the 16 years from 2000 to 2015, with deceased patients censored at time of death.



Years	% Revision-free	N
1	99.10%	412
2	97.30%	371
3	95.40%	332
4	94.20%	293
5	93.50%	250
6	93.50%	223
7	92.60%	188
8	92.60%	145
9	91.80%	115

There are insufficient numbers to give an accurate revision-free percentage beyond nine years.

PATIENT BASED QUESTIONNAIRE OUTCOMES AT SIX-MONTHS POST SURGERY

Questionnaires at six months post-surgery

At six months post-surgery patients are sent an outcome questionnaire.

This was replaced by the validated Oxford Elbow score at the end of 2015 (see p178).

There are 12 questions and each response is scores from 4-0 with 0 representing greater severity.

There is insufficient data for analysis this year.

LUMBAR DISC REPLACEMENT

PRIMARY LUMBAR DISC REPLACEMENT

This report analyses data for the fourteen-year period January 2002 – December 2015. There were 153 lumbar disc replacements registered, an additional two compared to last year's report.

Data Analysis

The average age for a lumbar disc replacement was 40.61 years, with a range of 24.07 – 84.09 years.

	Female	Male
Number	72	81
Percentage	47.06	52.94
Mean age	40.45	40.75
Maximum age	62.19	84.09
Minimum age	24.07	27.19
Standard dev.	8.60	8.72

Disc replacement levels

L3/4	20
L4/5	103
L5/S1	32

Fusion levels

L3/4	2
L4/5	13
L5/S1	58

Previous operation

Discectomy	29
L3/4	0
L4/5	15
L5/S1	19

Diagnosis

Degenerative disc disease

L3/4	11
L4/5	61
L5/S1	83
Other	4

Annular tear MRI scan

L3/4	13
L4/5	67
L5/S1	26
Other	1

Discogenic pain on discography

L3/4	20
L4/5	85
L5/S1	63
Other	1

Approach

Retroperitoneal midline	138
Retroperitoneal lateral	3
Transperitoneal	2
Other- mini open horizontal	3

Intraoperative complications

Damage to major veins	13
Subsidence	1

Systemic antibiotic prophylaxis

Patient number receiving systemic antibiotic prophylaxis	125

Operating theatre

Conventional	87
Laminar flow	65
Spacesuits	2

Operative time (skin to skin)

Mean	138 minutes

Surgeon grade

Consultant	153

REVISION OF REGISTERED PRIMARY LUMBAR DISC REPLACEMENTS

This section analyses data for revisions of primary lumbar disc replacements for the 14-year period.

There were three revisions of the primary group of 153 lumbar disc replacements and one re-revision.

Time to revision

Mean	1,841 days
Maximum	4,528 days
Minimum	242 days

Reason for revision

Pain	2
Loss of spinal alignment	1

Oswestry Disability Index

There are 10 sections. For each section, the total score is 5: if the first statement is marked the score = 0; if the last statement is marked, the score = 5. Intervening statements are scored according to rank.

If more than one box is marked in each section, take the highest score.

If all 10 sections are completed, the score is calculated as follows:

Example:
16 (total scored)/50(total possible score) x 100 = 32%

Pre operative scores

Modified Roland and Morris	119
Mean	15
Maximum	66
Minimum	1
Standard deviation	7
Oswestry Disability Index	49
Mean	56
Maximum	82
Minimum	30
Standard deviation	13

Post operative score

Oswestry Disability Index	32
Mean	22
Maximum	58
Minimum	0
Standard deviation	16

CERVICAL DISC REPLACEMENT

This report analyses data for the twelve-year period January 2004 – December 2015. There were 314 primary cervical disc replacements, an increase of 46 from the previous year.

Data Analysis

The average age for a cervical disc replacement was 44.42 years, with a range of 23.26 – 65.79 years.

	Female	Male
Number	130	184
Percentage	41.40	58.60
Mean age	45.23	43.84
Maximum age	65.79	63.00
Minimum age	22.26	24.92
Standard dev.	8.10	8.10

Disc replacement levels

C3/4	10
C4/5	31
C5/6	176
C6/7	143
C7T1	4
Other	4

Previous operation

Foraminotomy	8
Adjacent level fusion	16
Adjacent level disc arthroplast y	2
Other	13

Diagnosis

Acute disc prolapse	223
Chronic spondylosis	27
Neck pain	16
Other	31

Approach

Anterior right	187
Anterior left	62
Other	1

Intra operative complications

Equipment failure	1
Removal of implant	1
Tear jugular vein	1

Systemic antibiotic prophylaxis

Patient number receiving systemic antibiotic prophylaxis	260

Operating theatre

Conventional	181
Laminar flow	130
Spacesuits	1

Operative time (skin to skin)

Mean	118 minutes

Surgeon grade

Consultant	313
Advanced trainee supervised	1

Revision Cervical disc replacement

There was no change from the previous year, with one revision cervical disc replacement registered.

Neck Disability Index Scoring

There are 10 sections. For each section, the total score is 5: if the first statement is marked the score = 0; if the last statement is marked, the score = 5. Intervening statements are scored according to rank.

If more than one box is marked in each section, take the highest score.

If all 10 sections are completed, the score is calculated as follows:

Example: 16 (total scored)/50(total possible score) x 100 = 32%

If one section is missed (or not applicable) the score is calculated:

Example: 16 (total scored)/45(total possible score) x 100 = 35.5%

0 is the best score and 100 is the worst score.

Pre-operative score

Neck Disability Index	169
Mean	46

Post-operative score

Neck Disability Index	146
Mean	20

APPENDIX 1 - OXFORD 12 QUESTIONNAIRE REFERENCES

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APPENDIX 3 - PROSTHESIS INVENTORY

Hips		
	Stems	Cups
Stryker	Accolade	Trident
	Accolade II	Tritanium
	Exeter V40	Contemporary
	ABG II	Exeter X3
		Osteolock
DePuy	Elite plus	Charnley
	Summit	Duraloc
	Charnley	Pinnacle
	Corail	ASR
	C-stem AMT	Marathon
	Trilock	Elite Plus
	S-rom	
	ASR	
Zimmer	ML Taper	Fitek
	Avenir Muller	Fitmore
	CLS	Morscher
	CPT	ZCA
	MS30	Trilogy
	Versys	Continuum
	Muller	CLS Expansion
		Muller
		Mallory Head
		ZCA
Smith & Nephew	Polarstem	
	Synergy Porous	Reflection
	Spectron	Reflection porous
	BHR resurfacing	R3 porous
	CPCS	BHR
Mathys	TwinSys	RM
	CCA	CCB
	CCB	Selexys
Lima	H Max S Friendly	Delta TT

	H Max C	Delta PF
		Fixa Ti Por Agilis
E. B.	Stemsys	Ti-por
Knees		
Stryker	Duracon	
	Scorpio	
	Triathlon	
	Avon PF	
Zimmer-Biomet	Maxim	
	Insall Burnstein	
	Nexgen	
	Persona	
DePuy	LCS	
	Sigma	
	Attune	
Global Ortho	MBK	
Smith & Nephew	Genesis II	
	Genesis Oxinium	
	Journey	
	Legion	
Orthotec	Optetrak	
	Themis	
Mathys	Balansys	
Unicompartmental Knees		
Stryker	EIUS	
	Unix Uni Freedom	
	Triathlon PKR	
	Active Uni	
Zimmer-Biomet	Oxford cemented	
	Oxford cementless	

	Repecci II
	Miller Galanti
	Zimmer Uni-Zuc
DePuy	Preservation
	Sigma partial
	LCS Uni
Smith & Nephew	Genesis Uni
	Oxinium Uni
	Journey Uni
Orthotec	Optetrak Unicondylar
Shoulders	
DePuy	Global
	Delta
	Epoca
Lima	SMR
Orthotec	Hemicap resurfacing
Rem Systems	Aequalis
Zimmer-Biomet	Bigliani/Flatow
	Neer
	Comprehensive
	Copeland Resurfacing
Ankles	
DePuy	Agility
	Mobility
Orthotec	Ramses
REM Systems	Salto
Stryker	Star
Zimmer-Biomet	Zimmer Trabecular
	Metal ankle
LifeSciences	Hintegra
Wright Medical	Infinity

Elbows	
Zimmer	Coonrad/Morrey
	Nexel
DePuy	Acclaim
Biomet	Kudo
	Discovery Elbow
REM Systems	Latitude

DO NOT PLACE IN PATIENT NOTES TO BE RETAINED IN THEATRE SUITE

NEW ZEALAND JOINT REGISTRY
Primary Replacement Hip
Free Phone 0800-274-989 Total Hip Arthroplasty θ Resurfacing Arthroplasty θ
31.05.2010

Date: .....

Patient Name:

Address:

Consultant: .....

BMI:.....

[If different from patient label]

Side:..... **

Hospital: .....

Town/City

Tick Appropriate Boxes

PREVIOUS OPERATION ON INDEX JOINT

θ None
θ Internal fixation for juxtarticular fractures
θ Osteotomy
θ Arthrodesis
θ Other: .....

DIAGNOSIS

θ Osteoarthritis
θ Rheumatoid arthritis
θ Other inflammatory
θ Acute fracture NOF
θ Developmental dysplasia/dislocation
θ Old fracture NOF
θ Post-acute dislocation
θ Avascular necrosis
θ Tumour
θ Other: Name: .....

APPROACH θ Image guided surgery θ Minimally invasive surgery
θ Anterior θ Posterior θ Lateral θ Trochanteric osteotomy

FEMUR

Please do not fold

ACETABULUM

Please do not fold

STICK EXTRA LABELS ON REVERSE SIDE

BONE GRAFT - FEMUR

θ Allograft
θ Autograft
θ Synthetic

BONE GRAFT - ACETABULUM

θ Allograft
θ Autograft
θ Synthetic

FEMORAL HEAD

Please do not fold

AUGMENTS

Please do not fold

STICK EXTRA LABELS ON REVERSE SIDE

CEMENT

θ Femur θ Acetabulum θ Antibiotic brand: .....

θ **SYSTEMIC ANTIBIOTIC PROPHYLAXIS**

Name: .....ASA Class: 1 2 3 4 (please circle one)

OPERATING THEATRE

θ Conventional θ Laminar flow or similar θ Space suits

SKIN TO SKIN TIME *mins* **Start skin.....** **Finish skin.....**

PRIMARY OPERATING SURGEON

θ Consultant θ Adv Trainee Supervised θ Adv Trainee Unsupervised **Year.....** θ Basic Trainee

NB** ***If bilateral procedure two completed forms are required

DO NOT PLACE IN PATIENT NOTES TO BE RETAINED IN THEATRE SUITE

NEW ZEALAND JOINT REGISTRY
Revision Hip Joint

Free Phone 0800-274-989
07.04.2005

Date: .....

Side:..... **

Patient Name:

Address:

Consultant: .....
m patient label]
Hospital: .....
Town/City: .....

Tick Appropriate Boxes

REASON FOR REVISION

- θ **Loosening acetabular component**
- θ **Loosening femoral component**
- θ **Dislocation**
- θ **Pain**
- θ **Previous hemiarthroplasty**
- θ **Deep infection**
- θ **Fracture femur**
- θ **Removal of components**
- θ **Other: Name:** .....

Date Index Operation: .....

If re-revision - Date previous revision: .....

REVISION

- θ **Change of femoral component**
- θ **Change of acetabular component**
- θ **Change of head**
- θ **Change of liner**
- θ **Change of all components**

APPROACH θ **Image guided surgery** θ **Minimally invasive surgery**
θ **Anterior** θ **Posterior** θ **Lateral** θ **Trochanteric osteotomy**

FEMUR

Please do not fold

bar-coded label

ACETABULUM

Please do not fold

bar-coded label

STICK EXTRA LABELS ON REVERSE SIDE

BONE GRAFT - FEMUR
θ **Allograft** θ **Synthetic**
θ **Autograft**

BONE GRAFT - ACETABULUM
θ **Allograft** θ **Synthetic**
θ **Autograft**

FEMORAL HEAD

Please do not fold

AUGMENTS

Please do not fold

STICK EXTRA LABELS ON REVERSE SIDE

CEMENT
θ **Femur** θ **Acetabulum** θ **Antibiotic brand:** .....

θ **SYSTEMIC ANTIBIOTIC PROPHYLAXIS**
Name ..... **ASA Class: 1 2 3 4 (please circle one)**

OPERATING THEATRE
θ **Conventional** θ **Laminar flow or similar** θ **Space suits**

SKIN TO SKIN TIME ***mins*** **Start skin**..... **Finish skin**.....

PRIMARY OPERATING SURGEON
θ **Adv Trainee Supervised**
θ **Consultant** θ **Adv Trainee Supervised** **Year**..... θ **Basic Trainee**

NB** ***If bilateral procedure two completed forms are required

DO NOT PLACE IN PATIENT NOTES TO BE RETAINED IN THEATRE SUITE

NEW ZEALAND JOINT REGISTRY
Primary Replacement Knee
Free Phone 0800-274-989 θ Total Knee Arthroplasty θ Unicompartmental θ Patellofemoral
31.05.2010

Date: .....
BMI:.....
Side:..... **

Patient Name:

Address:

Consultant: .....
[If different from patient label]
Hospital: .....
Town/City:.....

Tick Appropriate Boxes

PREVIOUS OPERATION ON INDEX JOINT

θ None
θ Internal fixation for juxtarticular fracture
θ Ligament reconstruction
θ Menisectomy
θ Synovectomy
θ Osteotomy
θ Other: Name: .....
.....

DIAGNOSIS

θ Osteoarthritis
θ Rheumatoid arthritis
θ Other inflammatory
θ Tumour
θ Post fracture
θ Post ligament disruption/reconstruction
θ Avascular necrosis
θ Other: Name:
.....

APPROACH θ Image guided surgery θ Minimally invasive surgery
θ Medial parapatellar θ Lateral parapatellar θ Other

FEMUR

Please do not fold

TIBIA

Please do not fold

STICK EXTRA LABELS ON REVERSE SIDE

BONE GRAFT - FEMUR

θ Allograft
θ Autograft
θ Synthetic

BONE GRAFT - TIBIA

θ Allograft
θ Autograft
θ Synthetic

PATELLA

Please do not fold

AUGMENTS

Please do not fold

STICK EXTRA LABELS ON REVERSE SIDE

CEMENT

θ Femur θ Tibia θ Patella θ Antibiotic brand: .....

θ **SYSTEMIC ANTIBIOTIC PROPHYLAXIS**
Name ..... **ASA Class:** 1 2 3 4 **(please circle one)**

OPERATING THEATRE
θ Conventional θ Laminar flow or similar θ Space suits

SKIN TO SKIN TIME *mins* **Start skin**..... **Finish skin**.....

PRIMARY OPERATING SURGEON
θ Consultant θ Adv Trainee Unsupervised θ Adv Trainee Supervised **Year**..... θ Basic Trainee

NB** ***If bilateral procedure two completed forms are required

DO NOT PLACE IN PATIENT NOTES **TO BE RETAINED IN THEATRE SUITE**

NEW ZEALAND JOINT REGISTRY
Revision Knee Joint

Free Phone 0800-274-989

07.04.2005

Date: .....

Side:..... **

Patient Name:

Address:

Consultant: .....
[If different from patient label]

Hospital: .....

Town/City:.....

Tick Appropriate Boxes

REASON FOR REVISION

- θ Loosening femoral component
- θ Loosening tibial component
- θ Loosening patellar component
- θ Pain
- θ Previous Unicompartmental
- θ Deep infection
- θ Fracture femur
- θ Fracture tibia
- θ Other details: .....

Date Index Operation: .....

If re-revision - Date previous revision: .....

REVISION

- θ Change of femoral component
- θ Change of tibial component
- θ Change of patellar component
- θ Addition of patellar component
- θ Change of tibial polyethylene only
- θ Change of all components
- θ Removal of components
- θ Other

APPROACH θ Image guided surgery θ Minimally invasive surgery

θ Medial parapatellar θ Lateral parapatellar θ Other

FEMUR

Please do not fold

TIBIA

Please do not fold

STICK EXTRA LABELS ON REVERSE SIDE

BONE GRAFT – FEMUR

θ Allograft
θ Autograft θ Synthetic

BONE GRAFT – TIBIA

θ Allograft
θ Autograft θ Synthetic

PATELLA

Please do not fold

AUGMENTS

Please do not fold

STICK EXTRA LABELS ON REVERSE SIDE

CEMENT

θ Femur θ Tibia θ Patella θ Antibiotic brand: .....

θ SYSTEMIC ANTIBIOTIC PROPHYLAXIS

Name ..... ASA Class: 1 2 3 4 (please circle one)

OPERATING THEATRE

θ Conventional θ Laminar flow or similar θ Space suits

SKIN TO SKIN TIME *mins* Start skin..... Finish skin.....

PRIMARY OPERATING SURGEON

θ Adv Trainee Unsupervised

θ Consultant θ Adv Trainee Supervised Year..... θ Basic Trainee

*****NB If bilateral procedure two completed forms are required***

NEW ZEALAND JOINT REGISTRY

Primary Replacement Shoulder

θ Total shoulder Arthroplasty θ Hemiarthroplasty θ Reverse Shoulder 24.03.2016

Date:..... **Consultant:** .....

Patient Name:

Address:

[If different from patient label]

BMI:.....

Hospital:.....

Side:..... **

Town/City:

.....

Tick Appropriate Boxes

PREVIOUS OPERATION ON INDEX JOINT

θ	None	θ	Osteotomy
θ	Internal fixation for juxtarticular fracture	θ	Arthrodesis
θ	Previous stabilisation	θ	Arthroscopic debridement/compression
θ	Rotator Cuff Repair	θ	Other: Name: .....

DIAGNOSIS

θ	Rheumatoid arthritis	θ	Post recurrent dislocation
θ	Osteoarthritis	θ	Avascular necrosis
θ	Other inflammatory	θ	Cuff tear arthropathy
θ	Acute fracture proximal humerus	θ	Post old trauma
		θ	Other: Name:

.....

APPROACH

θ Deltopectoral θ Other : specify

HUMERUS	GLENOID
Please do not fold bar-coded label	Please do not fold bar-coded label

STICK EXTRA LABELS ON REVERSE SIDE

BONE GRAFT - HUMERUS	**BONE GRAFT - GLENOID**
θ **Allograft** θ **Autograft** θ **Synthetic**	θ **Allograft** θ **Autograft** θ **Synthetic**
HUMERAL HEAD **Please do not fold bar-coded label**	**AUGMENTS** **Please do not fold bar-coded label**

STICK ALL LABELS ON REVERSE SIDE

CEMENT

θ **Humerus** θ **Glenoid** θ **Antibiotic brand: .....**

θ **SYSTEMIC ANTIBIOTIC PROPHYLAXIS**

Name: ..... **ASA Class: 1 2 3 4 (please circle one)**

OPERATING THEATRE

θ **Conventional** θ **Laminar flow or similar** θ **Space suits**

SKIN TO SKIN TIME *mins* **Start skin.....** **Finish skin.....**

*****NB*** ***If bilateral procedure two completed forms are required***

DO NOT PLACE IN PATIENT NOTES TO BE RETAINED IN THEATRE SUITE

NEW ZEALAND JOINT REGISTRY
Revision Shoulder

Free Phone 0800-274-989
07.04.2005

Date: .....

Side:..... **

Tick Appropriate Boxes

Patient Name:

Address:

Consultant: .....
[If different from patient label]
Hospital: .....
Town/City:.....

REASON FOR REVISION

- θ **Loosening glenoid component**
- θ **Loosening humeral component**
- θ **Loosening both components**
- θ **Dislocation/instability anterior**
- θ **Instability posterior**
- θ **Subacromial tuberosity impingement**
- θ **Subacromial cuff impingement/tear**
- θ **Fracture humerus**
- θ **Deep infection**
- θ **Pain**
- θ **Other: Name:** .....

Date Index Operation: .....
If re-revision - Date previous revision: .....

REVISION

- θ **Change of head only**
- θ **Change of humeral component**
- θ **Change of glenoid component**
- θ **Change of liner (glenoid non cemented)**
- θ **Change of all components**
- θ **Remove glenoid**
- θ **Remove humerus**
- θ **Removal of components**
- θ **Other Specify:** .....

APPROACH

θ **Deltopectoral** θ **Other: specify**

HUMERUS

Please do not fold

GLENOID

Please do not fold

STICK EXTRA LABELS ON REVERSE SIDE

BONE GRAFT - HUMERUS

θ **Allograft** θ **Synthetic**
θ **Autograft**

BONE GRAFT - GLENOID

θ **Allograft** θ **Synthetic**
θ **Autograft**

HUMERAL HEAD

Please do not fold

AUGMENTS

Please do not fold

STICK EXTRA LABELS ON REVERSE SIDE

CEMENT

θ **Humerus** θ **Glenoid** θ **Antibiotic brand:** .....

θ **SYSTEMIC ANTIBIOTIC PROPHYLAXIS**

Name ..... **ASA Class: 1 2 3 4 (please circle one)**

OPERATING THEATRE

θ **Conventional** θ **Laminar flow or similar** θ **Space suits**

SKIN TO SKIN TIME *mins* **Start skin**..... **Finish skin**.....

PRIMARY OPERATING SURGEON

θ **Adv Trainee Unsupervised** θ **Consultant** θ **Adv Trainee Supervised Year**..... θ **Basic Trainee**

NB** ***If bilateral procedure two completed forms are required

DO NOT PLACE IN PATIENT NOTES TO BE RETAINED IN THEATRE SUITE

NEW ZEALAND JOINT REGISTRY
Primary Replacement Ankle

Free Phone 0800-274-989
31.05.2010

Date: .....

BMI:.....

Side:..... **

Tick Appropriate Boxes

Patient Name:

Address:

Consultant: .....
[If different from patient label]
Hospital: .....
Town/City.....

PREVIOUS OPERATION ON INDEX JOINT

θ None
θ Internal fixation for juxtarticular fractures
θ Osteotomy
θ Arthrodesis
θ Other: Name: .....

DIAGNOSIS

θ Osteoarthritis
θ Rheumatoid arthritis
θ Other inflammatory
θ Post trauma
θ Avascular necrosis talus
θ Other: Name:
.....

APPROACH

θ Anterior θ Anterio-lateral θ Other

TIBIA

Please do not fold

TALUS

Please do not fold

STICK EXTRA LABELS ON REVERSE SIDE

BONE GRAFT - TIBIA

θ Allograft
θ Autograft θ Synthetic

BONE GRAFT - TALUS

θ Allograft
θ Autograft θ Synthetic

AUGMENTS

Please do not fold

FUSION DISTAL TFJ

STICK ALL LABELS ON REVERSE SIDE

CEMENT

θ Tibia θ Talus θ Antibiotic Brand: .....

θ **SYSTEMIC ANTIBIOTIC PROPHYLAXIS**

Name: ..... **ASA Class: 1 2 3 4 (please circle one)**

OPERATING THEATRE

θ Conventional θ Laminar flow or similar θ Space suits

SKIN TO SKIN TIME *mins* **Start skin**..... **Finish skin**.....

PRIMARY OPERATING SURGEON

θ Consultant Trainee
θ Adv Trainee Unsupervised
θ Adv Trainee Supervised
Year..... θ Basic

NB** ***If bilateral procedure two completed forms are required

DO NOT PLACE IN PATIENT NOTES **TO BE RETAINED IN THEATRE SUITE**

NEW ZEALAND JOINT REGISTRY
Revision Ankle Joint

Free Phone 0800-274-989 **07.04.2005**

Date: .....

Side:..... **

Patient Name:

Address:

Consultant: .....
[If different from patient label]
Hospital:.....
Town/City: .....

Tick Appropriate Boxes

REASON FOR REVISION

- θ **Loosening talar component**
- θ **Loosening tibial component**
- θ **Dislocation**
- θ **Pain**
- θ **Deep infection**
- θ **Fracture talus**
- θ **Fracture tibia**
- θ **Dislocations**
- θ **Other details:** .....

Date Index Operation: ..... **If re-revision - Date previous revision:** .....

REVISION

- θ **Change of talar component**
- θ **Change of tibial component**
- θ **Change of polyethylene only**
- θ **Change of all components**
- θ **Removal of components**
- θ **Other Name:** .....

APPROACH

θ **Anterior** θ **Anterio-lateral** θ **Posterior**

TIBIA

Please do not fold

TALUS

Please do not fold

STICK ALL LABELS ON REVERSE SIDE

BONE GRAFT - TIBIA

θ **Allograft**
θ **Autograft** θ **Synthetic**

BONE GRAFT - TALUS

θ **Allograft**
θ **Autograft** θ **Synthetic**

AUGUMENTS

Please do not fold

FUSION DISTAL TFJ

Yes θ No θ

STICK EXTRA LABELS ON REVERSE SIDE

CEMENT

θ **Talus** θ **Tibia** θ **Antibiotic brand:** .....

θ **SYSTEMIC ANTIBIOTIC PROPHYLAXIS**

Name ..... **ASA Class: 1 2 3 4 (please circle one)**

OPERATING THEATRE

θ **Conventional** θ **Laminar flow or similar** θ **Space suits**

SKIN TO SKIN TIME *mins* **Start skin**..... **Finish skin**.....

PRIMARY OPERATING SURGEON

θ **Adv Trainee Unsupervised**
θ **Consultant** θ **Adv Trainee Supervised Year**..... θ **Basic Trainee**

NB** ***If bilateral procedure two completed forms are required

DO NOT PLACE IN PATIENT NOTES TO BE RETAINED IN THEATRE SUITE

NEW ZEALAND JOINT REGISTRY
Primary Replacement Elbow

Free Phone 0800-274-989
07.04.2005

Date: .....

Patient Name:

Address:

Consultant: .....
[If different from patient label]
Hospital: .....
Town/City:.....

Side:..... **

Tick Appropriate Boxes

PREVIOUS OPERATION ON INDEX JOINT

θ None
θ Internal fixation for juxtarticular fracture
θ Ligament reconstruction
θ Interposition arthroplasty
θ Debridement
θ Synovectomy ± removal radial head
θ Osteotomy
θ Other: Name: .....

DIAGNOSIS

θ Rheumatoid arthritis
θ Osteoarthritis
θ Other inflammatory
θ Post dislocation
θ Post fracture
θ Post ligament disruption
θ Other: Name: .....

APPROACH

θ Medial θ Lateral θ Posterior

HUMERUS

Please do not fold

ULNA

Please do not fold

STICK EXTRA LABELS ON REVERSE SIDE

BONE GRAFT - HUMERUS

θ Allograft
θ Autograft θ Synthetic

BONE GRAFT - ULNA

θ Allograft
θ Autograft θ Synthetic

RADIAL HEAD

Please do not fold

AUGMENTS

Please do not fold

STICK EXTRA LABELS ON REVERSE SIDE

CEMENT

θ Humerus θ Ulna θ Radius θ Antibiotic brand: .....

θ SYSTEMIC ANTIBIOTIC PROPHYLAXIS

Name ..... ASA Class: 1 2 3 4 (please circle one)

OPERATING THEATRE

θ Conventional θ Laminar flow or similar θ Space suits

SKIN TO SKIN TIME *mins* Start skin..... Finish skin.....

PRIMARY OPERATING SURGEON

θ Consultant
θ Adv Trainee Unsupervised
θ Adv Trainee Supervised Year.....
θ Basic Trainee

***NB** *If bilateral procedure two completed forms are required*

DO NOT PLACE IN PATIENT NOTES **TO BE RETAINED IN THEATRE SUITE**

NEW ZEALAND JOINT REGISTRY
Revision Elbow Joint

Free Phone 0800-274-989 **07.04.2005**

Date: .....

Patient Name:

Address:

Consultant: .....
[If different from patient label]
Hospital: .....
Town/City: .....

Side:..... **

Tick Appropriate Boxes

REASON FOR REVISION

- θ **Loosening humeral component**
- θ **Loosening ulnar component**
- θ **Loosening radial head component**
- θ **Pain**
- θ **Deep infection**
- θ **Fracture humerus**
- θ **Fracture ulna**
- θ **Dislocations**
- θ **Other Name:** .....

Date Index Operation: ..... **If re-revision - Date previous revision:** .....

REVISION

- θ **Change of humeral component**
- θ **Change of ulnar component**
- θ **Change of radial head component**
- θ **Change of all components**
- θ **Removal of components**
- θ **Other Name:** .....

APPROACH

θ **Medial** θ **Lateral** θ **Posterior**

HU

Please do not fold

UL

Please do not fold

STICK EXTRA LABELS ON REVERSE SIDE

BONE GRAFT - HUMERUS

θ **Allograft**
θ **Autograft** θ **Synthetic**

BONE GRAFT - ULNA

θ **Allograft**
θ **Autograft** θ **Synthetic**

RADIAL HEAD

Please do not fold

AUGMENTS

Please do not fold

STICK EXTRA LABELS ON REVERSE SIDE

CEMENT

θ **Humerus** θ **Ulna** θ **Radius** θ **Antibiotic brand:** .....

θ **SYSTEMIC ANTIBIOTIC PROPHYLAXIS**

Name ..... **ASA Class: 1 2 3 4 (please circle one)**

OPERATING THEATRE

θ **Conventional** θ **Laminar flow or similar** θ **Space suits**

SKIN TO SKIN TIME *mins* **Start skin**..... **Finish skin**.....

PRIMARY OPERATING SURGEON

θ **Consultant** θ **Adv Trainee Supervised** θ **Adv Trainee Unsupervised** **Year**..... θ **Basic Trainee**

NB** ***If bilateral procedure two completed forms are required

DO NOT PLACE IN PATIENT NOTES TO BE RETAINED IN THEATRE SUITE

NEW ZEALAND JOINT REGISTRY
Primary Cervical Disc Replacement
Free Phone 0800-274-989 **14.08.2008**

Date: .....

Patient Name:

Address:

Consultant: .....
[If different from patient label]
Hospital: .....
Town/City:.....

Tick Appropriate Boxes

ACC ☐ **ACC Claim**

No: .....

LEVELS OF DISC REPLACEMENT

.....

θ **C3/4** θ **C6/7**
θ **C4/5** θ **C7/T1**
θ **C5/6** **Other .....**

PRE OP PATIENT SCORE
(NECK DISABILITY INDEX)

PREVIOUS OPERATION

θ **Foreminotomy** θ **Adjacent Level Disc Arthroplasty**
θ **Adjacent Level Fusion** θ **Other.....**

DIAGNOSIS

θ **Acute Disc Prolapse**
θ **Chronic Spondylosis**
θ **Neck Pain**
θ **Other .....**

APPROACH

θ **Anterior Right** θ **Anterior Left** θ **Other**
.....

IMPLANTS

Affix Supplier Label

Affix Supplier Label

STICK EXTRA LABELS ON REVERSE SIDE

Affix Supplier Label

Affix Supplier Label

STICK EXTRA LABELS ON REVERSE SIDE

INTRAOPERATIVE COMPLICATIONS

.....
.....

SYSTEMIC ANTIBIOTIC PROPHYLAXIS

θ **Yes** θ **No**

OPERATIVE THEATRE

θ **Conventional** θ **Laminar flow or similar** θ **Space suits**

SKIN TO SKIN TIME *mins* **Start skin.....** **Finish skin.....**

PRIMARY OPERATING SURGEON

θ **Adv Trainee Unsupervised**
θ **Consultant** θ **Adv Trainee Supervised** **Year .....** θ **Basic Trainee**

DO NOT PLACE IN PATIENT NOTES TO BE RETAINED IN THEATRE SUITE

NEW ZEALAND JOINT REGISTRY
Revision Cervical Disc Replacement

Free Phone 0800-274-989
14.08.2008

Date: .....

Patient Name:

Address:

Consultant: .....
[If different from patient label]
Hospital:

LEVEL OF REVISION
.....

θ **C3/4** θ **C6/7**
θ **C4/5** θ **C7/T1**
θ **C5/6** θ **Other:**

Town/City: .....

Tick Appropriate Boxes

ACC ☐ **ACC Claim No:** .....

REASON FOR REVISION

θ **Dislocation of component**
θ **Failure of component**
θ **Infection**
θ **Pain (Neck)**
θ **Adjacent level surgery**
θ **Additional decompression required**
θ **Heterotopic calcification**
θ **Other: Name:** .....

Date Index Operation: .....
If re-revision - Date previous revision: ...

REVISION

θ **Replace disc prosthesis (same)**
θ **Replace disc prosthesis (different)**
θ **Fuse**
θ **Removal only**
θ **Other:** .....

APPROACH θ **Image guided surgery** θ **Minimally invasive surgery**
θ **Anterior** θ **Posterior** θ **Lateral** θ **Trochanteric Osteotomy**

IMPLANTS

Please do not fold

Please do not fold

STICK EXTRA LABELS ON REVERSE SIDE

Please do not fold

Please do not fold

STICK EXTRA LABELS ON REVERSE SIDE

SYSTEMIC ANTIBIOTIC PROPHYLAXIS
Name .....

OPERATING THEATRE

θ **Conventional** θ **Laminar flow or similar** θ **Space suits**

SKIN TO SKIN TIME *mins* **Start skin**..... **Finish skin**.....

PRIMARY OPERATING SURGEON

θ **Consultant** θ **Adv Trainee Unsupervised** θ **Adv Trainee Supervised** **Year**..... θ **Basic Trainee**

DO NOT PLACE IN PATIENT NOTES TO BE RETAINED IN THEATRE SUITE

NEW ZEALAND JOINT REGISTRY
Primary Lumbar Disc Replacement

Free Phone 0800-274-989
14.08.2008

Date: .....

Patient Name:

Address:

Consultant: .....
[If different from patient label]
Hospital: .....

Town/City.....

Tick Appropriate Boxes **ACC** ☐ **ACC Claim No.** .....

DISC REPLACEMENT Levels **FUSION Levels** **PRE OP PATIENT SCORE**

Modified Roland and Morris

θ **L3/4** θ **L3/4** **Total number of "Yes" responses**.....

θ **L4/5** θ **L4/5** ***Oswestry Score*** θ **L5/S1**

θ **L5/S1** **Percentage score** **Other** .....

PREVIOUS OPERATION

θ **Discectomy** θ **L3/4** θ **L4/5** θ **L5/S1** θ **Other** .....

θ **Other** ..... θ **L3/4** θ **L4/5** θ **L5/S1**

DIAGNOSIS

1. Degenerative Disc disease (plain x-ray changes present) θ **L3/4** θ **L4/5** θ **L5/S1** θ **Other** .....

2. Annular tear MRI scan (normal plain x-ray) θ **L3/4** θ **L4/5** θ **L5/S1** θ **Other** .....

3. Discogenic pain on discography θ **L3/4** θ **L4/5** θ **L5/S1** θ **Other** .....

APPROACH

θ **Retroperitoneal midline abdominal wall incision** θ **Transperitoneal**

θ **Retroperitoneal lateral abdominal wall incision** θ **Other** .....

IMPLANTS

Affix Supplier Label

Affix Supplier Label

STICK EXTRA LABELS ON REVERSE SIDE

Affix Supplier Label

Affix Supplier Label

STICK EXTRA LABELS ON REVERSE SIDE

INTRAOPERATIVE COMPLICATIONS

.....

θ **SYSTEMIC ANTIBIOTIC PROPHYLAXIS**

Yes θ **No** θ

OPERATIVE THEATRE

θ **Conventional** θ **Laminar flow or similar** θ **Space suits**

SKIN TO SKIN TIME ***mins*** **Start skin** ..... **Finish skin** .....

PRIMARY OPERATING SURGEON

θ **Consultant** θ **Adv Trainee** **Year**..... θ **Basic Trainee**

DO NOT PLACE IN PATIENT NOTES TO BE RETAINED IN THEATRE SUITE

NEW ZEALAND JOINT REGISTRY
Revision Lumbar Disc Replacement
Free Phone 0800-274-989
14.08.2008

Date: .....

Patient Name:

Address:

Consultant: .....
[If different from patient label]
Hospital: .....
Town/City: .....

Tick Appropriate Boxes **ACC** ☐ **ACC Claim No:** .....

REASON FOR REVISION

- θ **Loosening of components**
- θ **Dislocation of articulating core**
- θ **Loss of spinal alignment**
- θ **Pain**
- θ **Deep infection**
- θ **Fracture of vertebra**
- θ **Removal of components**
- θ **Other: Name:** .....

Date Index Operation: ..... **If re-revision - Date previous revision:** .....

REVISION

- θ **Change of TDR components**
- θ **Change to Anterior Fusion**
- θ **Change of articulating core**
- θ **In-situ posterior instrumented fusion**

APPROACH

- θ **Retroperitoneal midline abdominal wall incision**
- θ **Retroperitoneal lateral abdominal wall incision**
- θ **Transperitoneal**
- θ **Other** .....
- θ **Posterior Approach for in-situ fusion**

NEW DISC REPLACEMENT Levels	**NEW FUSION Levels**	**PRE OP PATIENT SCORE**
		Modified Roland and Morris
θ **L3/4**	θ **L3/4**	**Total number of "Yes" responses.....**
θ **L4/5**	θ **L4/5**	***Oswestry Score***
θ **L5/S1**	θ **L5/S1**	**Percentage score**

Other .....

IMPLANTS

Affix Supplier Label

Affix Supplier Label

STICK EXTRA LABELS ON REVERSE SIDE

Affix Supplier Label

Affix Supplier Label

STICK EXTRA LABELS ON REVERSE SIDE

INTRAOPERATIVE COMPLICATIONS

.....

.....

θ **SYSTEMIC ANTIBIOTIC PROPHYLAXIS**
Yes θ **No** θ

OPERATIVE THEATRE
θ **Conventional** θ **Laminar flow or similar** θ **Space suits**

SKIN TO SKIN TIME *mins* **Start skin** ..... **Finish skin** .....

PRIMARY OPERATING SURGEON
θ **Consultant** θ **Adv Trainee** **Year**..... θ **Basic Trainee**

TOTAL HIP REPLACEMENT - QUESTIONNAIRE

Patient Name: ..... **Date of Birth:** .....
Patient Address: ..... **Operating Surgeon:**.....
..... **Date of Surgery**.....

We would like you to score yourself on the following 12 questions. Each question is scored from 4 to 0, from least to most difficulty or severity: 4 being the least difficult/severe and 0 being the most difficult/severe. Please circle the number which best describes yourself **OVER THE LAST 4 WEEKS**

Please circle the SIDE on which you had your surgery performed Left Right

1 How would you describe the pain you usually had from your operated on hip?
- 4 None
- 3 Very mild
- 2 Mild
- 1 Moderate
- 0 Severe

2 For how long have you been able to walk before the pain from your operated on hip becomes severe? (with or without a stick)
- 4 No pain/more than 30 minutes
- 3 16 to 30 minutes
- 2 5 to 15 minutes
- 1 Around the house only
- 0 Unable to walk because of severe pain

3 Have you had any trouble getting in and out of a car or using public transport because of your operated on hip?
- 4 No trouble at all
- 3 Very little trouble
- 2 Moderate trouble
- 1 Extreme difficulty
- 0 Impossible to do

4 Have you been able to put on a pair of socks, stockings or tights?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, impossible

5 Could you do the household shopping on your own?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, impossible

6 Have you had any trouble with washing and drying yourself (all over) because of your operated on hip?
- 4 No trouble at all
- 3 Very little trouble
- 2 Moderate trouble
- 1 Extreme difficulty
- 0 Impossible to do

7 How much has pain from your operated on hip interfered with your usual work (including housework)?
- 4 Not at all
- 3 A little bit
- 2 Moderately
- 1 Greatly
- 0 Totally

8 After a meal (sat at a table), how painful has it been for you to stand up from a chair because of your operated on hip?
- 4 Not at all painful
- 3 Slightly painful
- 2 Moderately painful
- 1 Very painful
- 0 Unbearable

9 Have you had any sudden, severe pain - 'shooting', 'stabbing' or 'spasms' - from the affected operated on hip?
- 4 No days
- 3 Only 1 or 2 days
- 2 Some days
- 1 Most days
- 0 Every day

10 Have you been limping when walking, because of your operated on hip?
- 4 Rarely/never
- 3 Sometimes or just at first
- 2 Often, not just at first
- 1 Most of the time
- 0 All of the time

11 Have you been able to climb a flight of stairs?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, impossible

12 Have you been troubled by pain from your operated on hip in bed at night?
- 4 No nights
- 3 Only 1 or 2 nights
- 2 Some nights
- 1 Most nights
- 0 Every night

□ I wish to receive a progress report on the study. **NB:** If there are reasons other than the operation which would stop you doing one of the tasks listed; try to answer the question from the joint replacement aspect alone.

REVISION HIP REPLACEMENT - QUESTIONNAIRE

Patient Name: ..... **Date of Birth:** .....

Patient Address: ..... **Operating Surgeon:**.....

..... **Date of Surgery:**.....

We would like you to score yourself on the following 12 questions. Each question is scored from 4 to 0, from least to most difficulty or severity: 4 being the least difficult/severe and 0 being the most difficult/severe. Please circle the number which best describes yourself **OVER THE LAST 4 WEEKS**

Please circle the SIDE on which you had your surgery performed Left Right

1 How would you describe the pain you usually had from your operated on hip?
- 4 None
- 3 Very mild
- 2 Mild
- 1 Moderate
- 0 Severe

2 For how long have you been able to walk before the pain from your operated on hip becomes severe? (with or without a stick)
- 4 No pain/more than 30 minutes
- 3 16 to 30 minutes
- 2 5 to 15 minutes
- 1 Around the house only
- 0 Unable to walk because of severe pain

3 Have you had any trouble getting in and out of a car or using public transport because of your operated on hip?
- 4 No trouble at all
- 3 Very little trouble
- 2 Moderate trouble
- 1 Extreme difficulty
- 0 Impossible to do

4 Have you been able to put on a pair of socks, stockings or tights?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, impossible

5 Could you do the household shopping on your own?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, impossible

6 Have you had any trouble with washing and drying yourself (all over) because of your operated on hip?
- 4 No trouble at all
- 3 Very little trouble
- 2 Moderate trouble
- 1 Extreme difficulty
- 0 Impossible to do

7 How much has pain from your operated on hip interfered with your usual work (including housework)?
- 4 Not at all
- 3 A little bit
- 2 Moderately
- 1 Greatly
- 0 Totally

8 After a meal (sat at a table), how painful has it been for you to stand up from a chair because of your operated on hip?
- 4 Not at all painful
- 3 Slightly painful
- 2 Moderately painful
- 1 Very painful
- 0 Unbearable

9 Have you had any sudden, severe pain - 'shooting', 'stabbing' or 'spasms' - from the affected operated on hip?
- 4 No days
- 3 Only 1 or 2 days
- 2 Some days
- 1 Most days
- 0 Every day

10 Have you been limping when walking, because of your operated on hip?
- 4 Rarely/never
- 3 Sometimes, or just at first
- 2 Often, not just at first
- 1 Most of the time
- 0 All of the time

11 Have you been able to climb a flight of stairs?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, impossible

12 Have you been troubled by pain from your operated on hip in bed at night?
- 4 No nights
- 3 Only 1 or 2 nights
- 2 Some nights
- 1 Most nights
- 0 Every night

□ I wish to receive a progress report on the study. **NB:** If there are reasons other than the operation which would stop you doing one of the tasks listed; try to answer the question from the joint replacement aspect alone.

TOTAL KNEE REPLACEMENT - QUESTIONNAIRE

Patient Name: ..... **Date of Birth:** .....

Patient Address: ..... **Operating Surgeon:**.....

..... **Date of Surgery:** .....

We would like you to score yourself on the following 12 questions. Each question is scored from 4 to 0, from least to most difficulty or severity: 4 being the least difficult/severe and 0 being the most difficult/severe. Please circle the number which best describes yourself **OVER THE LAST 4 WEEKS**

Please circle the SIDE on which you had your surgery performed Left Right

1 How would you describe the pain you usually have from your operated on knee?
- 4 None
- 3 Very mild
- 2 Mild
- 1 Moderate
- 0 Severe

2 For how long have you been able to walk before the pain from your operated on knee becomes severe? (with or without a stick)
- 4 No pain/more than 30 minutes
- 3 16 to 30 minutes
- 2 5 to 15 minutes
- 1 Around the house only
- 0 Unable to walk because of severe pain

3 Have you had any trouble getting in and out of a car or using public transport because of your operated on knee?
- 4 No trouble at all
- 3 Very little trouble
- 2 Moderate trouble
- 1 Extreme difficulty
- 0 Impossible to do

4 Could you kneel down and get up again afterwards on your operated knee?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, impossible

5 Could you do the household shopping on your own?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, impossible

6 Have you had any trouble with washing and drying yourself (all over) because of your operated on knee?
- 4 No trouble at all
- 3 Very little trouble
- 2 Moderate trouble
- 1 Extreme difficulty
- 0 Impossible to do

7 How much has pain from your operated on knee interfered with your usual work (including housework)?
- 4 Not at all
- 3 A little bit
- 2 Moderately
- 1 Greatly
- 0 Totally

8 After a meal (sat at a table), how painful has it been for you to stand up from a chair because of your operated on knee?
- 4 Not at all painful
- 3 Slightly painful
- 2 Moderately painful
- 1 Very painful
- 0 Unbearable

9 Have you felt that your operated on knee might suddenly "give way" or let you down?
- 4 Rarely/never
- 3 Sometimes, or just at first
- 2 Often, not just at first
- 1 Most of the time
- 0 All of the time

10 Have you been limping when walking, because of your operated on knee?
- 4 Rarely/never
- 3 Sometimes, or just at first
- 2 Often, not just at first
- 1 Most of the time
- 0 All of the time

11 Could you walk down one flight of stairs?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, impossible

12 Have you been troubled by pain from your operated on knee in bed at night?
- 4 No nights
- 3 Only 1 or 2 nights
- 2 Some nights
- 1 Most nights
- 0 Every night

.....

□ I wish to receive a progress report on the study. **NB:** If there are reasons other than the operation which would stop you doing one of the tasks listed; try to answer the question from the joint replacement aspect alone.

REVISION KNEE REPLACEMENT - QUESTIONNAIRE

Patient Name: ..... **Date of Birth:** .....

Patient Address: ..... **Operating Surgeon:**.....

..... **Date of Surgery:**.....

We would like you to score yourself on the following 12 questions. Each question is scored from 4 to 0, from least to most difficulty or severity: 4 being the least difficult/severe and 0 being the most difficult/severe. Please circle the number which best describes yourself **OVER THE LAST 4 WEEKS**

Please circle the SIDE on which you had your surgery performed Left Right

1 How would you describe the pain you usually have from your operated on knee?
- 4 None
- 3 Very mild
- 2 Mild
- 1 Moderate
- 0 Severe

2 For how long have you been able to walk before the pain from your operated on knee becomes severe? (with or without a stick)
- 4 No pain/more than 30 minutes
- 3 16 to 30 minutes
- 2 5 to 15 minutes
- 1 Around the house only
- 0 Unable to walk because of severe pain

3 Have you had any trouble getting in and out of a car or using public transport because of your operated on knee?
- 4 No trouble at all
- 3 Very little trouble
- 2 Moderate trouble
- 1 Extreme difficulty
- 0 Impossible to do

4 Could you kneel down and get up again afterwards?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, impossible

5 Could you do the household shopping on your own?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, impossible

6 Have you had any trouble with washing and drying yourself (all over) because of your operated on knee?
- 4 No trouble at all
- 3 Very little trouble
- 2 Moderate trouble
- 1 Extreme difficulty
- 0 Impossible to do

7 How much has pain from your operated on knee interfered with your usual work (including housework)?
- 4 Not at all
- 3 A little bit
- 2 Moderately
- 1 Greatly
- 0 Totally

8 After a meal (sat at a table), how painful has it been for you to stand up from a chair because of your operated on knee?
- 4 Not at all painful
- 3 Slightly painful
- 2 Moderately painful
- 1 Very painful
- 0 Unbearable

9 Have you felt that your operated on knee might suddenly "give way" or let you down?
- 4 Rarely/never
- 3 Sometimes, or just at first
- 2 Often, not just at first
- 1 Most of the time
- 0 All of the time

10 Have you been limping when walking, because of your operated on knee?
- 4 Rarely/never
- 3 Sometimes, or just at first
- 2 Often, not just at first
- 1 Most of the time
- 0 All of the time

11 Could you walk down one flight of stairs?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, impossible

12 Have you been troubled by pain from your operated on knee in bed at night?
- 4 No nights
- 3 Only 1 or 2 nights
- 2 Some nights
- 1 Most nights
- 0 Every night

Additional Information

□ I wish to receive a progress report on the study. **NB:** If there are reasons other than the operation which would stop you doing one of the tasks listed; try to answer the question from the joint replacement aspect alone.

Manchester-Oxford Foot Questionnaire (MOxFQ)

Circle as appropriate Right / Left **Full Name_____**

Please tick (√) one for each statement

1. I have pain in my foot/ankle

None of the time ☐ Rarely ☐ Some of the time ☐ Most of the time ☐ All of the time ☐

2. During the past 4 weeks this has applied to me:
I avoid walking long distances because of pain in my foot/ankle

None of the time ☐ Rarely ☐ Some of the time ☐ Most of the time ☐ All of the time ☐

3. During the past 4 weeks this has applied to me:
I change the way I walk due to pain in my foot/ankle

None of the time ☐ Rarely ☐ Some of the time ☐ Most of the time ☐ All of the time ☐

4. During the past 4 weeks this has applied to me:
I walk slowly because of pain in my foot/ankle

None of the time ☐ Rarely ☐ Some of the time ☐ Most of the time ☐ All of the time ☐

5. During the past 4 weeks this has applied to me:
I have to stop and rest my foot/ankle because of pain

None of the time ☐ Rarely ☐ Some of the time ☐ Most of the time ☐ All of the time ☐

6. During the past 4 weeks this has applied to me:
I avoid some hard or rough surfaces because of pain in my foot/ankle

None of the time ☐ Rarely ☐ Some of the time ☐ Most of the time ☐ All of the time ☐

7. During the past 4 weeks this has applied to me:
I avoid standing for a long time because of pain in my foot/ankle

None of the time ☐ Rarely ☐ Some of the time ☐ Most of the time ☐ All of the time ☐

8. During the past 4 weeks this has applied to me:
I catch the bus or use the car instead of walking, because of pain in my foot/ankle

None of the time ☐ Rarely ☐ Some of the time ☐ Most of the time ☐ All of the time ☐

9. During the past 4 weeks this has applied to me:
I feel self-conscious about my foot/ankle

None of the time ☐ Rarely ☐ Some of the time ☐ Most of the time ☐ All of the time ☐

10. During the past 4 weeks this has applied to me:
I feel self-conscious about the shoes I have to wear

None of the time ☐ Rarely ☐ Some of the time ☐ Most of the time ☐ All of the time ☐

11. During the past 4 weeks this has applied to me:
The pain in my foot/ankle is more painful in the evening

None of the time ☐ Rarely ☐ Some of the time ☐ Most of the time ☐ All of the time ☐

12. During the past 4 weeks this has applied to me:
I get shooting pains in my foot/ankle

None of the time ☐ Rarely ☐ Some of the time ☐ Most of the time ☐ All of the time ☐

13. During the past 4 weeks this has applied to me:
The pain in my foot/ankle prevents me from carrying out my work/everyday activities

None of the time ☐ Rarely ☐ Some of the time ☐ Most of the time ☐ All of the time ☐

14. During the past 4 weeks this has applied to me:
I am unable to do all my social or recreational activities because of pain in my foot/ankle

None of the time ☐ Rarely ☐ Some of the time ☐ Most of the time ☐ All of the time ☐

15. During the past 4 weeks…..
How would you describe the pain you usually have in your foot/ankle?

None ☐ Very mild ☐ Mild ☐ Moderate ☐ Severe ☐

16. During the past 4 weeks….
Have you been troubled by pain from your foot/ankle in bed at night?

No nights ☐ Only 1 or 2 nights ☐ Some nights ☐ Most nights ☐ Every night ☐

TOTAL SHOULDER REPLACEMENT - QUESTIONNAIRE

Patient Name: ..... **Date of Birth:** .....
Patient Address: ..... **Operating Surgeon:**.....
..... **Date of Surgery:**.....

We would like you to score yourself on the following 12 questions. Each question is scored from 4 to 0, from least to most difficulty or severity: 4 being the least difficult/severe and 0 being the most difficult/severe. Please **circle the number** which best describes yourself **OVER THE LAST 4 WEEKS** **Which is your dominant arm?** **Left** **Right**

Please circle the SIDE on which you had your surgery performed **Left** **Right**

1 How would you describe the ***worst*** pain you have had from your operated on shoulder?
- 4 None
- 3 Mild
- 2 Moderate
- 1 Severe
- 0 Unbearable

2 How would you describe the pain you ***usually*** have from your operated on shoulder?
- 4 None
- 3 Very mild
- 2 Mild
- 1 Moderate
- 0 Severe

3 Have you had any trouble getting in and out of a car or using public transport because of your operated on shoulder?
- 4 No trouble at all
- 3 A little bit of trouble
- 2 Moderate trouble
- 1 Extreme difficulty
- 0 Impossible to do

4 Have you been able to use a knife and fork at the same time?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, impossible

5 Could you do the household shopping on your own?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, impossible

6 Could you carry a tray containing a plate of food across a room?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, impossible

7 Could you brush/comb your hair with the operated on arm?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, Impossible

8 Have you had any trouble dressing yourself because of your operated on shoulder?
- 4 No trouble at all
- 3 A little bit of trouble
- 2 Moderate trouble
- 1 Extreme difficulty
- 0 Impossible to do

9 Could you hang your clothes up in a wardrobe – using the operated on arm?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, impossible

10 Have you been able to wash and dry yourself under both arms?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, impossible

11 How much has pain from your operated on shoulder interfered with your usual work hobbies or recreational activities (including housework)?
- 4 Not at all
- 3 A little bit
- 2 Moderately
- 1 Greatly
- 0 Totally

12 Have you been troubled by pain from your operated on shoulder in bed at night?
- 4 No nights
- 3 Only 1 or 2 nights
- 2 Some nights
- 1 Most nights
- 0 Every night

.....

□ I wish to receive a progress report on the study. **NB:** If there are reasons other than the operation which would stop you doing one of the tasks listed; try to answer the question from the joint replacement aspect alone.

REVISION SHOULDER REPLACEMENT - QUESTIONNAIRE

Patient Name: ..... **Date of Birth:** .....
Patient Address: ..... **Operating urgeon:**.....
..... **Date of Surgery:**.....

We would like you to score yourself on the following 12 questions. Each question is scored from 4 to 0, from least to most difficulty or severity: 4 being the least difficult/severe and 0 being the most difficult/severe. Please circle the number which best describes yourself **OVER THE LAST 4 WEEKS** **Which is your dominant arm?** **Left** **Right**

Please circle the SIDE on which you had your surgery performed **Left** **Right**

1 How would you describe the ***worst*** pain you have had from your operated on shoulder?
- 4 None
- 3 Mild
- 2 Moderate
- 1 Severe
- 0 Unbearable

2 How would you describe the pain you ***usually*** have from your operated on shoulder?
- 4 None
- 3 Very mild
- 2 Mild
- 1 Moderate
- 0 Severe

3 Have you had any trouble getting in and out of a car or using public transport because of your operated on shoulder?
- 4 No trouble at all
- 3 A little bit of trouble
- 2 Moderate trouble
- 1 Extreme difficulty
- 0 Impossible to do

4 Have you been able to use a knife and fork at the same time?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, impossible

5 Could you do the household shopping on your own?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, impossible

6 Could you carry a tray containing a plate of food across a room?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, impossible

7 Could you brush/comb your hair with the operated on arm?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, Impossible

8 Have you had any trouble dressing yourself because of your operated on shoulder?
- 4 No trouble at all
- 3 A little bit of trouble
- 2 Moderate trouble
- 1 Extreme difficulty
- 0 Impossible to do

9 Could you hang your clothes up in a wardrobe – using the operated on arm?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, impossible

10 Have you been able to wash and dry yourself under both arms?
- 4 Yes, easily
- 3 With little difficulty
- 2 With moderate difficulty
- 1 With extreme difficulty
- 0 No, impossible

11 How much has pain from your operated on shoulder interfered with your usual work hobbies or recreational activities (including housework)?
- 4 Not at all
- 3 A little bit
- 2 Moderately
- 1 Greatly
- 0 Totally

12 Have you been troubled by pain from your operated on shoulder in bed at night?
- 4 No nights
- 3 Only 1 or 2 nights
- 2 Some nights
- 1 Most nights
- 0 Every night

.....

□ I wish to receive a progress report on the study. **NB:** If there are reasons other than the operation which would stop you doing one of the tasks listed; try to answer the question from the joint replacement aspect alone.

Oxford Elbow Score (OES)

Problems with your elbow **Full Name**_____

Circle as appropriate **Right / Left** **Please tick (√) one box for every question**

1. During the past 4 weeks:
   Have you had difficulty lifting things in your home, such as putting out the rubbish, because of your elbow problem?

No difficulty	A little bit of difficulty	Moderate difficulty	Extreme difficulty	Impossible to do
☐	☐	☐	☐	☐

2. During the past 4 weeks:
   Have you had difficulty carrying bags of shopping, because of your elbow problem?

No difficulty	A little bit of difficulty	Moderate difficulty	Extreme difficulty	Impossible to do
☐	☐	☐	☐	☐

3. During the past 4 weeks:
   Have you had any difficulty washing yourself all over, because of your elbow problem?

No difficulty	A little bit of difficulty	Moderate difficulty	Extreme difficulty	Impossible to do
☐	☐	☐	☐	☐

4. During the past 4 weeks:
   Have you had any difficulty dressing yourself, because of your elbow problem?

No difficulty	A little bit of difficulty	Moderate difficulty	Extreme difficulty	Impossible to do
☐	☐	☐	☐	☐

5. During the past 4 weeks:
   Have you felt that your elbow problem is “controlling your life”?

No, not at all	Occasionally	Some days	Most days	Every day
☐	☐	☐	☐	☐

6. During the past 4 weeks:
   How much has your elbow problem “been on your mind"?

Not at all	A little of the time	Some of the time	Most of the time	All of the time
☐	☐	☐	☐	☐

7. During the past 4 weeks:
   Have you been troubled by pain from your elbow in bed at night?

Not at all	1 or 2 nights	Some nights	Most nights	Every night
☐	☐	☐	☐	☐

8. During the past 4 weeks:
How often has your elbow pain interfered with your sleeping?

Not at all ☐ Occasionally ☐ Some of the time ☐ Most of the time ☐ All of the time ☐

9. During the past 4 weeks:
How much has your elbow problem interfered with your usual work or everyday activities?

Not at all ☐ A little bit ☐ Moderately ☐ Greatly ☐ Totally ☐

10. During the past 4 weeks:

Has your elbow problem limited your ability to take part in leisure activities that you enjoy doing?

No, not at all ☐ Occasionally ☐ Some of the time ☐ Most of the time ☐ All of the time ☐

11. During the past 4 weeks:
How would you describe the worst pain you have from your elbow?

No pain ☐ Mild pain ☐ Moderate pain ☐ Severe pain ☐ Unbearable ☐

12. During the past 4 weeks:
How would you describe the pain you usually have from your elbow?

No pain ☐ Mild pain ☐ Moderate pain ☐ Severe pain ☐ Unbearable ☐

The New Zealand Joint Registry Seventeen Year Report (January 1999 - December 2015)

www.nzoa.org.nz