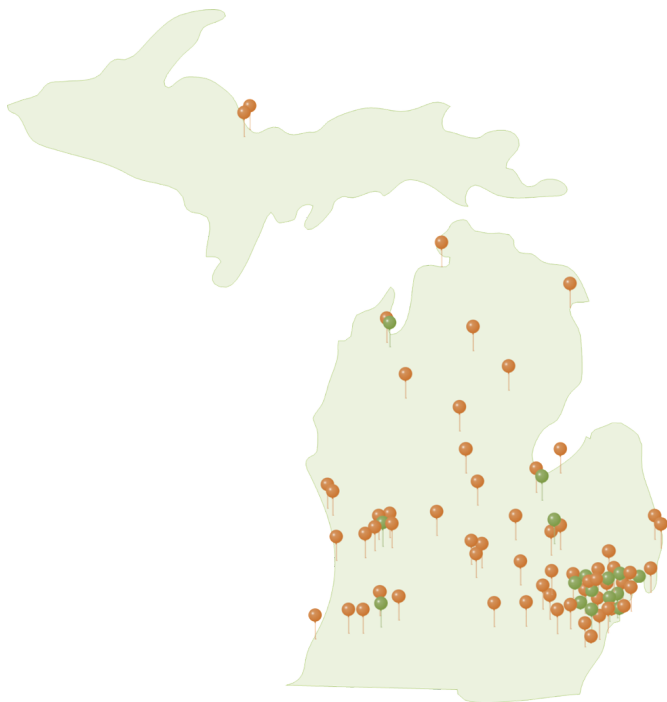


***2024 Michigan Arthroplasty Registry  
Collaborative Quality Initiative  
(MARCQI)  
Annual Report***



# MARCQI Sites



Alliance Surgery Center, Traverse City  
 Ascension Borgess Medical Center, Kalamazoo  
 Bronson Battle Creek  
 Bronson Lakeview Hospital, Paw Paw  
 Bronson Methodist Hospital, Kalamazoo  
 Bronson Orthopedic Surgery Center, Kalamazoo  
 Corewell Health Beaumont Grosse Pointe Hospital  
 Corewell Health Beaumont Troy Hospital  
 Corewell Health Dearborn Hospital  
 Corewell Health Farmington Hills Hospital  
 Corewell Health Gerber Hospital  
 Corewell Health Grand Haven Center  
 Corewell Health Grand Rapids Hospitals Blodgett  
 Corewell Health Greenville Hospital  
 Corewell Health Lake Drive Surgery Center, Grand Rapids  
 Corewell Health Lakeland Hospitals - Niles  
 Corewell Health Lakeland Hospitals - St. Joseph  
 Corewell Health Ludington Hospital  
 Corewell Health Pennock Hospital  
 Corewell Health Taylor Hospital  
 Corewell Health Watervliet Hospital  
 Corewell Health Zeeland Hospital  
 Corewell Health William Beaumont University Hospital  
 Covenant Medical Center, Saginaw  
 DMC Harper University Hospital, Detroit  
 DMC Huron Valley-Sinai Hospital, Commerce Township  
 DMC Sinai-Grace Hospital, Detroit  
 Garden City Hospital  
 Grand Rapids Surgical Suites  
 Henry Ford - Cottage  
 Henry Ford - Jackson  
 Henry Ford - Macomb  
 Henry Ford - Royal Oak  
 Henry Ford - Warren & Madison Heights  
 Henry Ford - West Bloomfield  
 Henry Ford - Wyandotte

Henry Ford Genesys Hospital, Grand Blanc  
 Henry Ford Hospital - Detroit  
 Henry Ford Providence Novi Hospital  
 Henry Ford Providence Southfield Hospital  
 Henry Ford Rochester Hospital  
 Henry Ford St. John Hospital  
 Holland Hospital  
 Hurley Medical Center, Flint  
 Lake Huron Medical Center, Port Huron  
 Lakes Surgery Center, West Bloomfield  
 Mackinac Straits Health System  
 McLaren - Bay Region, Bay City  
 McLaren - Central Michigan, Mt. Pleasant  
 McLaren - Flint  
 McLaren - Greater Lansing  
 McLaren - Lapeer Region  
 McLaren - Macomb, Mt. Clemens  
 McLaren - Northern Michigan, Petoskey  
 McLaren - Oakland, Pontiac  
 McLaren - Port Huron  
 Memorial Healthcare, Owosso  
 Michigan Institute for Advanced Surgery, Lake Orion  
 Michigan Medicine - Brighton Center for Speciality Care  
 Michigan Medicine, Ann Arbor  
 MiOrtho Surgery Center, Southfield  
 Munson Health Cadillac  
 Munson Health Grayling  
 Munson Healthcare Manistee Hospital  
 Munson Medical Center, Traverse City  
 Muskegon Surgery Center  
 MyMichigan Health - Alpena  
 MyMichigan Health - Midland  
 MyMichigan Health - West Branch  
 MyMichigan Medical Center, Saginaw  
 OAM Surgery Center, Grand Rapids  
 Precision Surgery Center, Macomb Township  
 Red Cedar Surgery Center, Haslett  
 Southwest Surgical Center, Bryon Center  
 Sparrow Ionia Hospital  
 Straith Hospital for Special Surgery, Southfield  
 Trinity Health Ann Arbor  
 Trinity Health Brighton Surgery Center  
 Trinity Health Chelsea Hospital  
 Trinity Health Grand Haven  
 Trinity Health Grand Rapids  
 Trinity Health Livingston  
 Trinity Health Livonia  
 Trinity Health Muskegon  
 Trinity Health Oakland  
 UnaSource Surgery Center, Troy  
 University of Michigan Health - Sparrow Lansing  
 University of Michigan Health-West, Wyoming  
 Upper Peninsula Health - Marquette  
 Upper Peninsular Surgery Center, Marquette

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**Conflict of interest disclosure**

None of the authors have financial relationships with the pharmaceutical or medical device industries.

**Disclaimer**

Although Blue Cross Blue Shield of Michigan/Blue Care Network (BCBSM/BCN) and the Michigan Arthroplasty Registry Collaborative Quality Initiative work collaboratively, the opinions, beliefs, and viewpoints expressed by the authors do not necessarily reflect the opinions, beliefs, and viewpoints of BCBSM/BCN or any of its employees.

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# Preface

There are six changes to the annual report this year:

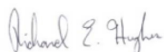
1. Two versions of the report are produced this year: abridged and comprehensive. The abridged version, which you are reading, contains an overview of hip and knee arthroplasty data. While it does contain summary tables of cumulative percent revision (CPR) data for individual implants, it does not contain the extensive CPR curves and data that were in earlier annual reports. Instead, these data are included in the comprehensive version of the report.
2. Cumulative percent revision is broken down by age (under 65 years vs. 65 years and older) and sex (male vs. female) for each implant in the comprehensive version of this report. This was done due to confusion about the age- and sex-adjusted hazard ratios. Presenting CPR curves by age and sex was felt to be much more intuitive and have a greater impact. The age cutoff of 65 was chosen to correspond to the Medicare age threshold and the American Joint Replacement Registry (AJRR) CPR estimates.
3. Selected high-volume knee implants that have both cemented and uncemented versions are broken down by constraint and fixation. This was driven by MARCQI quality improvement efforts focused on reducing knee revisions. This analysis required manually identifying catalog numbers of cruciate retaining/posterior stabilized and cemented/uncemented versions because the implant library we utilize does not contain these characteristics.
4. Eight additional implants have met the 500-case threshold for inclusion this year. There are two THA stem/cup combinations, two stems, three cups, and one patellofemoral joint (PFJ) implant. This is the first year that an individual PFJ implant has met the threshold for inclusion.
5. The format has been changed to a one-column format. This change was made because the two-column format made the type-font small and difficult to read. This adds clarity but also considerable length to the document.
6. Implant-specific pages have been made into sub-subsections to take advantage of the LaTeX book template used for this report. This links sub-subsections in the table of contents to corresponding pages in the document. Readers will be able to find implant-specific data by going to the table of contents and clicking on the appropriate hyperlink.

We hope readers will find this an informative document and reflect on opportunities to improve the quality of care for arthroplasty patients in Michigan, the United States, and globally.

Sincerely,



Brian R. Hallstrom, M.D., MARCQI Director



Richard E. Hughes, Ph.D., MARCQI Senior Advisor

# Chapter 1

## Quality Improvement Update

The last year of quality improvement at MARCQI has included many projects. There is a continuous evolution of practice, implants and regulatory requirements. As MARCQI works to improve the quality of hip and knee replacement care in Michigan, we also strive to meet the needs of our members, answering questions about the latest technologies and helping them meet regulatory requirements like the new Center for Medicare and Medicaid Services (CMS) Patient Reported Outcome Performance Measure (PRO-PM). This chapter is a summary and sample of MARCQI efforts this year.

### 1.1 Patient Reported Outcomes (PROs)

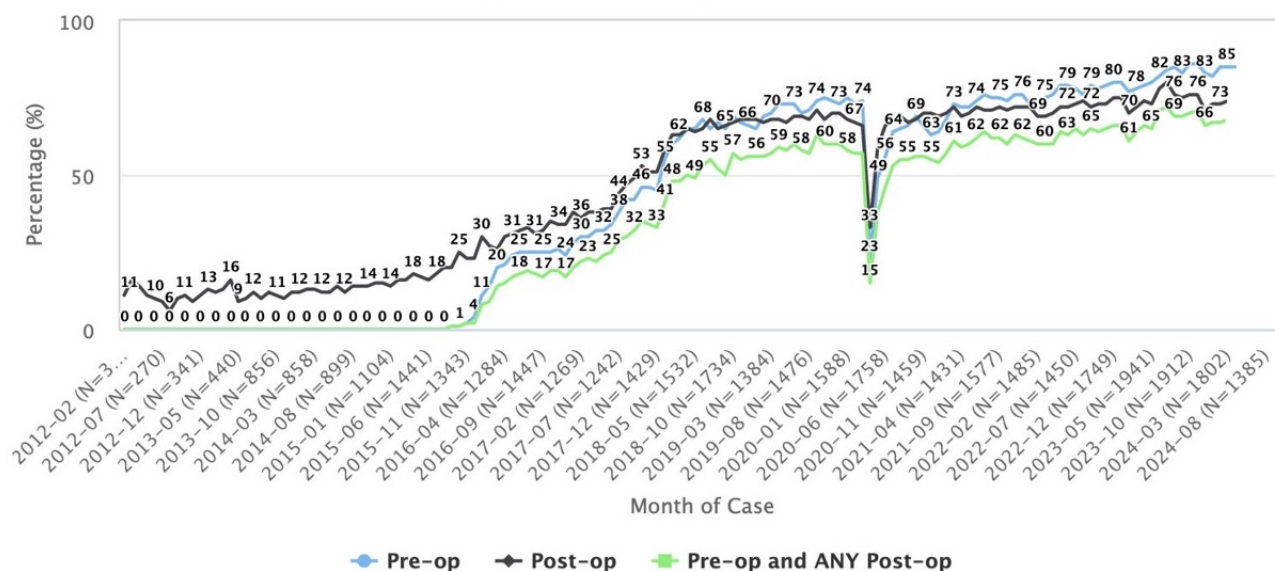


Figure 1. HOOS JR Collection Rates Since the Start of MARCQI in 2012

MARCQI participants have been collecting a variety of patient reported outcome measures (PROMs) since the beginning of MARCQI in 2012. As news of a possible CMS PROs measure began circulating in 2016, MARCQI focused on collecting the HOOS JR, KOOS JR, and the PROMIS Global surveys to help prepare our participating sites for the impending requirements. After considerable work on the part of members, PROMs are being collected before surgery on more than 85% of all cases, and 66% have a pre-op and a post-operative score in the registry (Figure 1).

The CMS requirement is for the post-operative score to be collected between ten and 14 months after surgery (called the

one-year score). It has proven more difficult to capture PROMs scores a year after surgery. Most patients are feeling recovered, have resumed their activities, and are reluctant to return to clinic or complete surveys. For operations in the first half of 2023, MARCQI sites have collected one-year surveys from approximately 42% of all patients. The CMS requirement is submission of surveys from at least 50% of inpatients for cases performed on or after July 1, 2024. With the current trajectory of increasing PROMs collection, MARCQI efforts over the last decade have prepared Michigan hospitals well to meet this requirement.

For clinicians, the goal of collecting PROMs is to use them to improve care. This information can be used to help with shared decision-making with patients, assessing appropriateness of surgical expectations, predicting recovery and tracking post-operative progress. A previous MARCQI analysis (Cowen *et al.*, 2023) showed that patients with a low pain score and a HOOS JR or KOOS JR function score of greater than 55 points had a higher risk of being worse off after surgery: 24% for knee replacement patients and 14% for hips. Improved shared surgical decision-making is made possible by comparing a patient's preoperative function and pain scores and sharing this information with them.

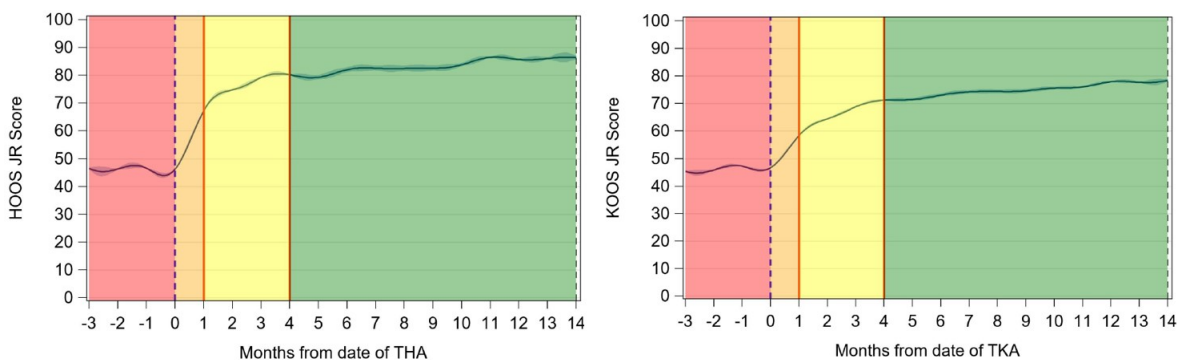


Figure 2. Average HOOS JR and KOOS JR Scores Over Time Relative to Surgical Date

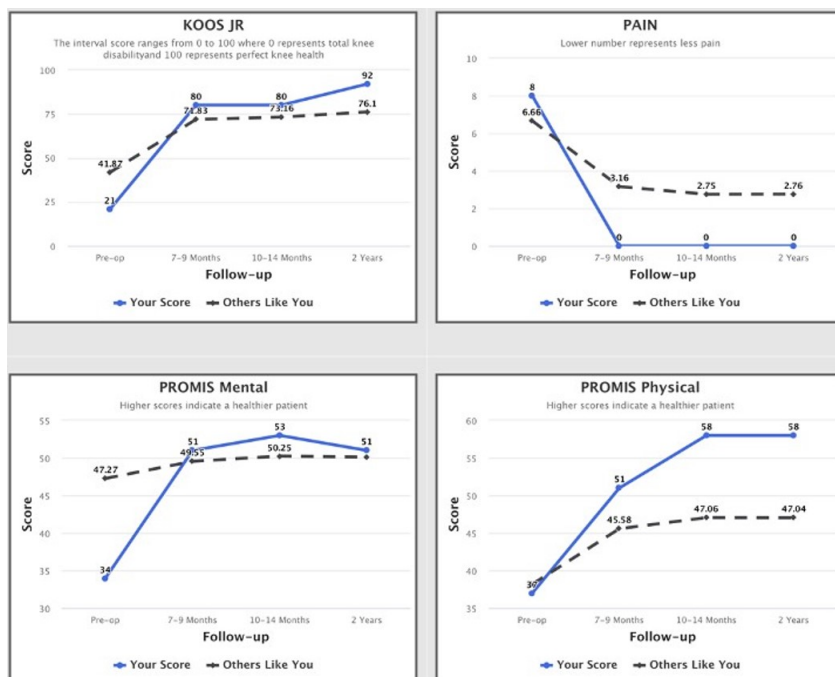
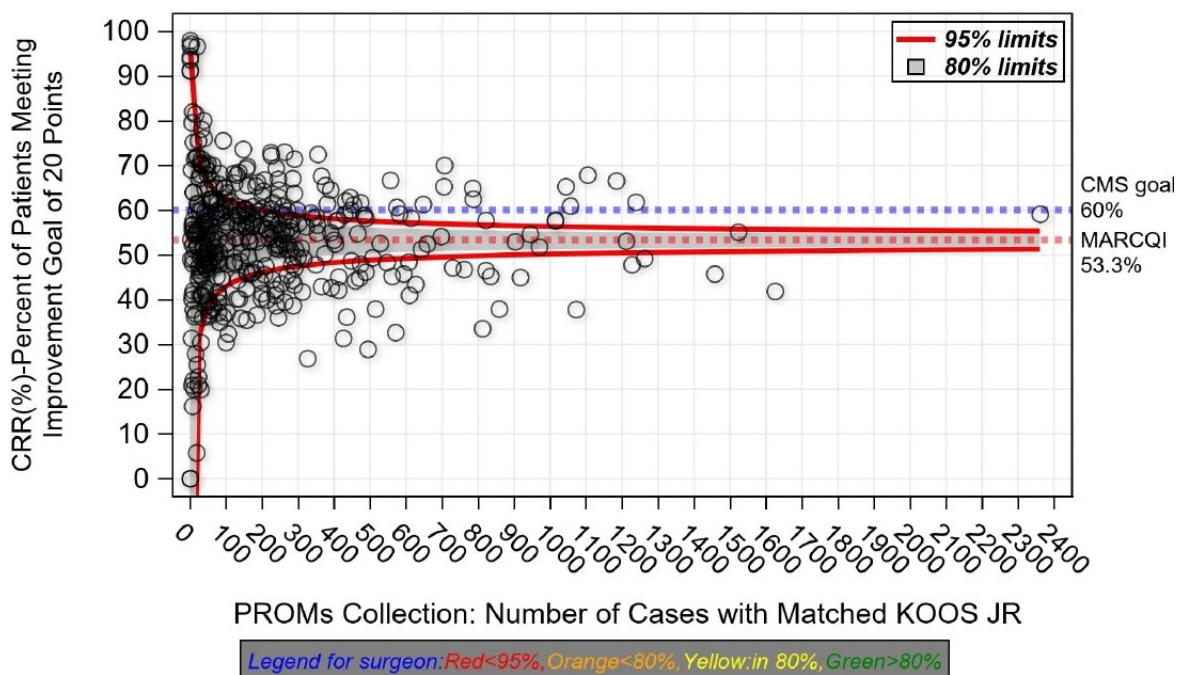


Figure 3. Individual Patient PROMs Progress Report



PROMs scores can be used to set patient expectations and track their progress over time. The data from the entire registry shows the difference between the rapid improvement that THA patients have in the first few months after surgery and the more gradual progress that TKA patients report over the first year (Figure 2).

Patients are especially interested in how they are progressing, and PROMs can provide them a frame of reference. MARCQI now has a resource available to all MARCQI-participating surgeons that they can share with patients showing how their PROMs scores are progressing relative to other patients their age and sex (Figure 3). These reports can reassure patients about their progress, show them how events in their recovery have affected their scores, and illustrate the improvement from their pre-operative score. Patients in the middle of a rehabilitation program often forget how limited they were prior to surgery.



**Figure 4. Percent of Patients Achieving 20-point Improvement in KOOS JR Score After TKA by Surgeon**

Surgeons can also use PROM scores to develop a sense of their overall patient population and how they are progressing. The average PROM score of a group of patients is not particularly meaningful since it can hide low and high scoring patients. A measure of how many patients achieve a certain threshold of improvement may be a better metric for quality. When comparing PROMs improvement after surgery by surgeon, there is considerable variability between surgeons (Figure 4). While PROM results can be affected by the timing of the PROM collection, patient and surgical factors, and other confounders, this comparison may provide an opportunity for improvement and sharing of best practices between surgeons and MARCQI sites. This information is provided to surgeons in MARCQI through their individual surgeon reports (Mesko *et al.*, 2024).

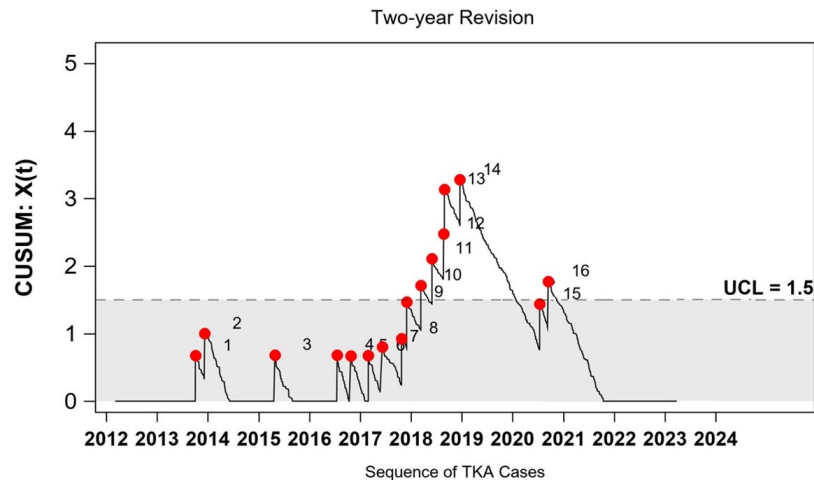
Going forward, MARCQI will continue to incorporate PROMs into quality improvement projects and analytic models, exploring the effect of different techniques, implants, and optimization strategies on PROMs and how these can be used to inform decision-making and surgical timing.

## 1.2 Individual Surgeon Reports

Since 2018, MARCQI has produced individual surgeon reports for MARCQI surgeons. Over the years, we have worked to improve the reports so that they are more useful to surgeons to help them improve the care of their patients and understand the impact of their practice changes. This year we published a paper in the *Journal of Bone and Joint Surgery* on the

progress we have made with these reports (Mesko *et al.*, 2024).

The reports provide surgeons with their revision and infection rates for TKA and UKA and revision, infection, dislocation, and fracture rates for THA. In addition, the results of patient reported outcomes on their patients are included and surgeons can see how their patients are responding compared with their peers.



**Figure 5. A Sample CUSUM Chart Demonstrating a Practice Change in 2016 Followed by an Adjustment in 2019**

The reports include funnel plots that show the surgeon their results compared with their peers around the state. In addition, cumulative sum (CUSUM) graphs provide a timeline of results so that the surgeon can see the effect of changes that they make in their practice. There are many examples that surgeons have shared of a practice change resulting in an improvement or worsening of results. The CUSUM graphs allow surgeons to see the results of changes they have made and then make adjustments. One example that was seen by a number of surgeons in MARCQI was the broad adoption of uncemented knee replacements. Several surgeons saw an increase in early knee revisions and adjusted their practice to use them more selectively. An example is shown in Figure 5.

Through the value-based reimbursement program, surgeons are also incentivized to download their report and share it with their colleagues. These conversations happen around the state and have led to insights and practice changes. For the last two years, about 60% of active MARCQI surgeons in Michigan downloaded their reports, providing them with information about their practice that was previously unavailable and is unique in Michigan.

### 1.3 Revision Total Joint Replacement in MARCQI

MARCQI conducted an analysis of revision cases for the first time this year. For the 468,791 cases through July 31, 2023, there were 36,794 revision cases: 13,103 hip revisions and 23,691 knee revisions. Of the revision cases, 11,845 were the first revision of a matched MARCQI primary hip or knee replacement. Revision cases without a linked primary procedure in the database fit into three categories: the primary case was performed in Michigan before the registry was started in 2012, the primary case was performed in a surgical site that was not part of MARCQI at the time, or the primary case was performed outside the state of Michigan but revised in Michigan. Of the 11,845 matched first revision cases, 86.9% were only revised once, 10.6% were revised twice, 1.9% were revised three times, and 0.6% were revised more than three times. Two MARCQI cases had nine revisions each.

As expected, revision cases were more likely to return to the emergency department within 30 days of surgery and much more likely to be readmitted. The 90-day dislocation rate after revision THA was 5.21%, compared with 0.76% for primary THA. Revision patients were much more likely to receive a blood transfusion at 21.84% vs. 2.46% for hips and 4.51% vs.

0.92% for knees. Revision patients also had a higher 90-day infection rate: 3.78% and 1.79% vs. 0.59% and 0.40% respectively.

The top three reasons for revision after TKA were instability, infection, and loosening while for THA they were peri-prosthetic femur fracture, dislocation and infection. Broken down by femoral stem fixation, uncemented stems were revised for peri-prosthetic fracture 28.8% of the time, for dislocation in 21.1% and infection in 20.1% of revisions. Cemented stems were revised less often, and the three most common reasons were dislocation in 34.1%, infection in 22.7%, and loosening in 18.2%.

The CPR for knees with a resurfaced patella was statistically lower, with a revision rate of 4.02% (3.86, 4.18) compared to those with an unresurfaced patella at 4.57% (4.16, 5.02). For patients with an unresurfaced patella who underwent a revision, 25.6% of those revisions were just to resurface the patella, and 21.8% of revisions involved revising the femur and tibia and resurfacing the patella.

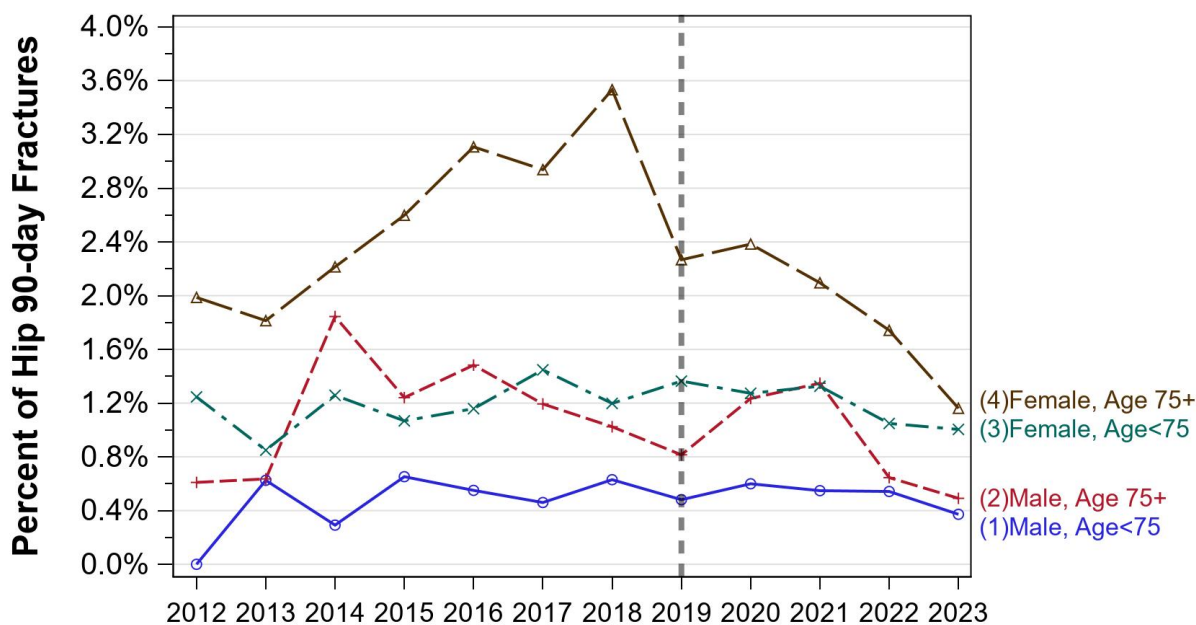


Figure 6. Rate of 90-day Peri-prosthetic Femur Fracture by Age and Sex Over Time

This information will be used in MARCQI to target quality improvement efforts. The goal is to continue reducing revisions by preventing the complications that most often lead to revision. The quality improvement project, started in 2019, on reducing early femur fracture and revision has been associated with a 248% increase in cementing the stem for women 75 and older and a 51% reduction in early post-operative hip fractures in the same group (Figure 6). The next target is reducing dislocations, the second most common reason for revision.

### 1.4 Infection Prevention, Irrigation, and Antibiotic Powders

In 2019, MARCQI began collecting detailed information about the use of irrigants and antibiotic powders in hip and knee replacement. This included normal saline, antibiotic solutions, chlorhexidine-containing solutions, povidone-iodine solutions, and others. An analysis was done of 68,000 primary hip cases and 106,156 primary knee cases performed between January 2019 and December 2022.

During this time, the use of additives to the irrigation solution increased to over 60% of cases. The 90-day infection rate for hip and knee replacement remained stable, with 0.62% infections in hips and 0.40% in knees. There was no demonstrated

time trend.

For hip replacement, the use of normal saline alone was associated with a statistically lower infection rate compared with cases using other irrigation solution, and in knees there were no statistically significant differences. The addition of antibiotic powder to the wound was also not associated with fewer infections. While this data can be influenced by selection bias in the use of irrigation additives by surgeons or surgical sites, these results remained when controlled for surgical site and surgeon.

Regardless of the irrigant used, higher infection rates were associated with higher body mass index (BMI), higher American Society of Anesthesiologists (ASA) score, the use of assistive devices pre-op, the use of pre-operative opioids and longer surgical times. This allows MARCQI surgeons to focus on efforts to improve patient selection and optimization, room traffic, surgical efficiency and other factors known to be associated with reduced infections as they continue to work to reduce post-operative infections.

## 1.5 Summary

The ability of surgeons across Michigan to collaborate, share results, discuss best practices, and work together is the great strength of MARCQI. Many hip and knee replacements are done out of necessity by surgeons with relatively low volumes. Half of the hip surgeons in MARCQI do fewer than 30 THA a year and the median number of cases for TKA is 72. In Michigan, 5.7% of the knee replacements and 12.2% of the hip replacements are done by surgeons who do fewer than three each month ( $\leq 35$  per year). By working together, sharing reports, and collaborating, MARCQI surgeons can improve as a group. Low-volume surgeons and sites can benefit from the ideas and expertise of other successful low-volume surgeons and high-volume surgeons. Collaboration is the key to improvement.

# Chapter 2

## Hip Overview

These data are based on cases performed from 2/15/2012 to 12/31/2023.

### 2.1 Descriptive Statistics of All Total Hip Arthroplasty (THA) Cases

This section presents data on all THA cases, including primary and revision cases.

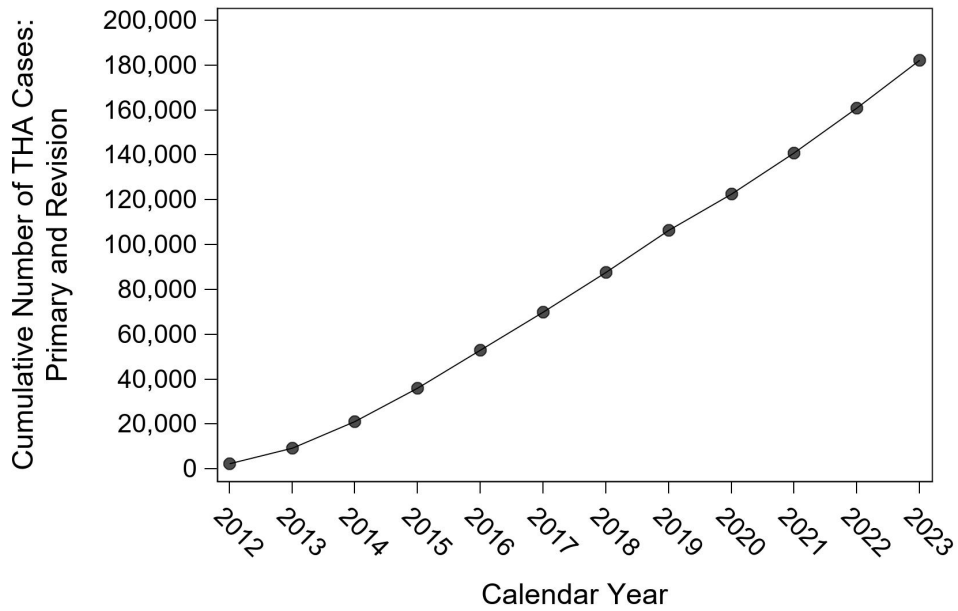
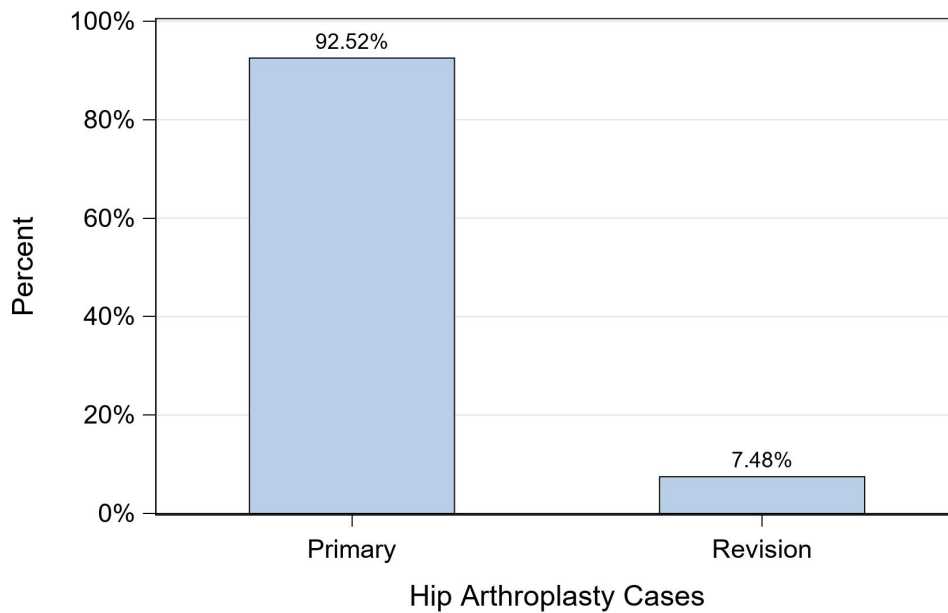


Figure 7. THA Cases Over Time (in 171,868 Patients)

**Table 1. THA Cases Over Time (Numerical Values)**

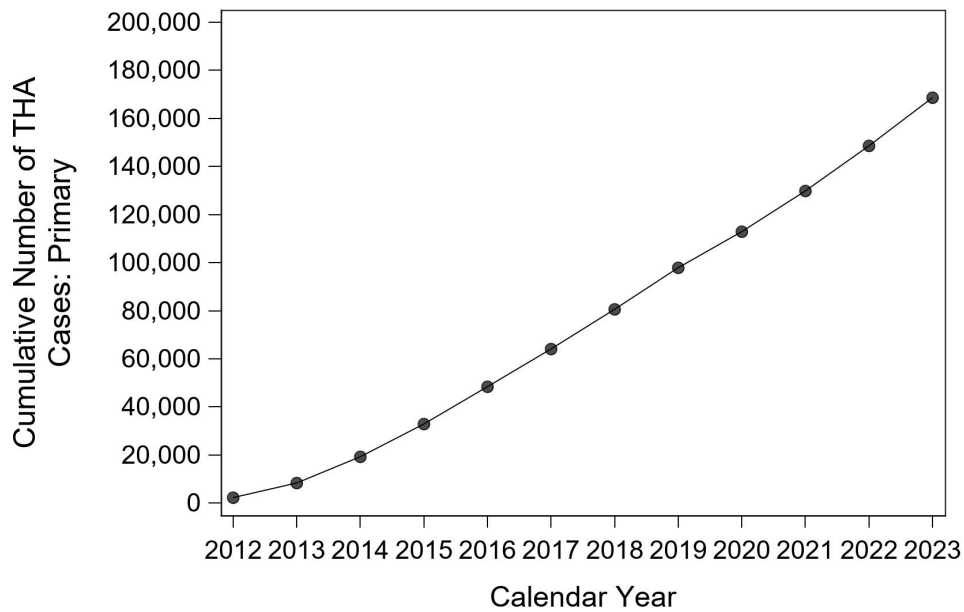
Year	Annual cases	Cumulative cases
2012	2,490	2,490
2013	6,724	9,214
2014	11,886	21,100
2015	15,019	36,119
2016	16,821	52,940
2017	16,979	69,919
2018	17,889	87,808
2019	18,679	106,487
2020	16,190	122,677
2021	18,259	140,936
2022	20,011	160,947
2023	21,308	182,255



**Figure 8. Percent of THA Cases by Primary or Revision**

**Table 2. Descriptive Statistics of THA Cases**

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	99,629	54.7	
Age (years)	182,255	65.5 (11.1)	66 (14)
Height (cm)	181,559	169.8 (10.5)	170 (15.2)
Weight (kg)	181,559	88.5 (21.3)	86.5 (28.8)
BMI (kg/m <sup>2</sup> )	181,556	30.5 (6.3)	29.8 (8.3)
Smoker - Never (%)	88,260	48.4	
Smoker - Previous (%)	68,380	37.5	
Smoker - Current (%)	24,943	13.7	
Smoker - Unknown (%)	672	0.4	



**Figure 9. Primary THA Cases Over Time (in 141,908 Patients)**

**Table 3. Primary THA Cases Over Time (Numerical Values)**

Year	Annual cases	Cumulative cases
2012	2,249	2,249
2013	6,090	8,339
2014	10,911	19,250
2015	13,625	32,875
2016	15,523	48,398
2017	15,682	64,080
2018	16,506	80,586
2019	17,293	97,879
2020	15,019	112,898
2021	16,925	129,823
2022	18,765	148,588
2023	20,035	168,623

**Table 4. Descriptive Statistics of Primary THA Cases**

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	91,995	54.6	
Age (years)	168,623	65.3 (11)	66 (15)
Height (cm)	167,964	169.9 (10.5)	170 (15.2)
Weight (kg)	167,964	88.6 (21.1)	86.8 (28.7)
BMI (kg/m <sup>2</sup> )	167,962	30.6 (6.3)	29.9 (8.3)
Smoker - Never (%)	82,211	48.8	
Smoker - Previous (%)	62,908	37.3	
Smoker - Current (%)	22,913	13.6	
Smoker - Unknown (%)	591	0.4	

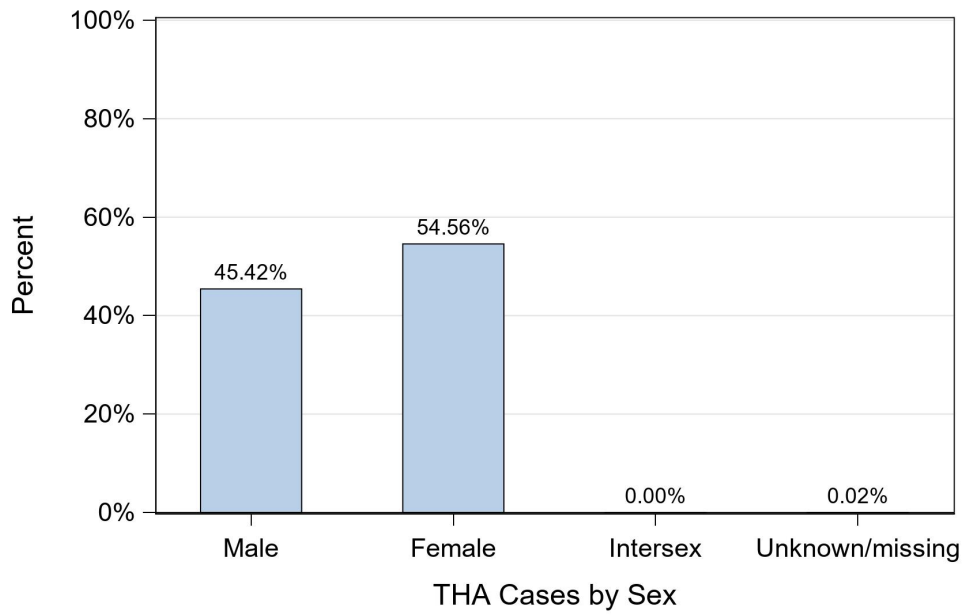


Figure 10. Percent of Primary THA Cases by Sex

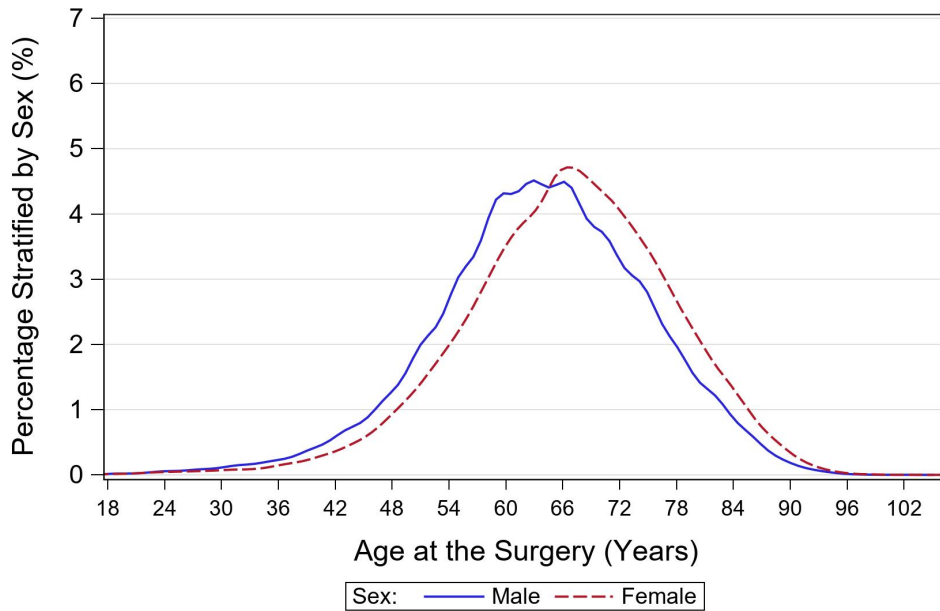
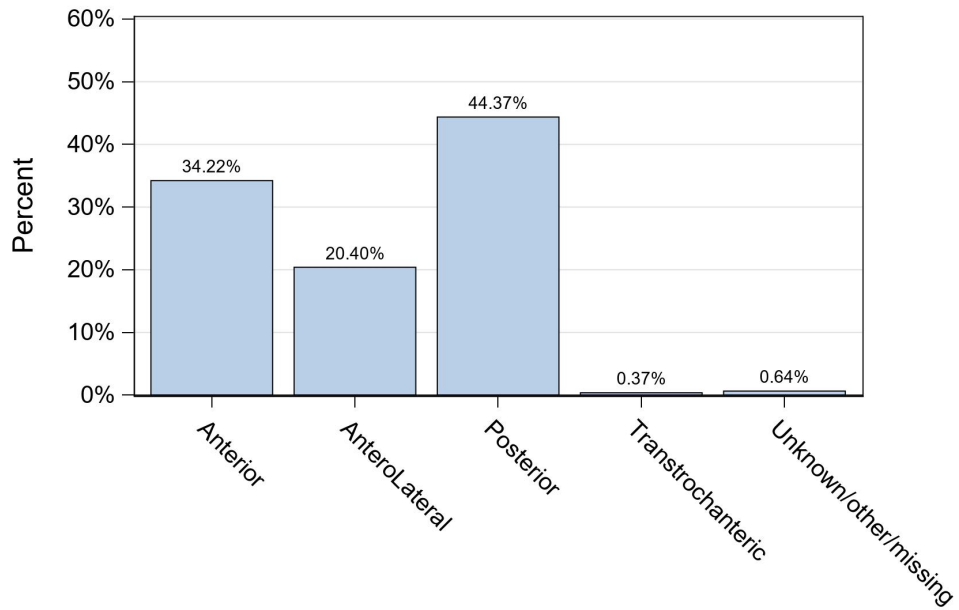
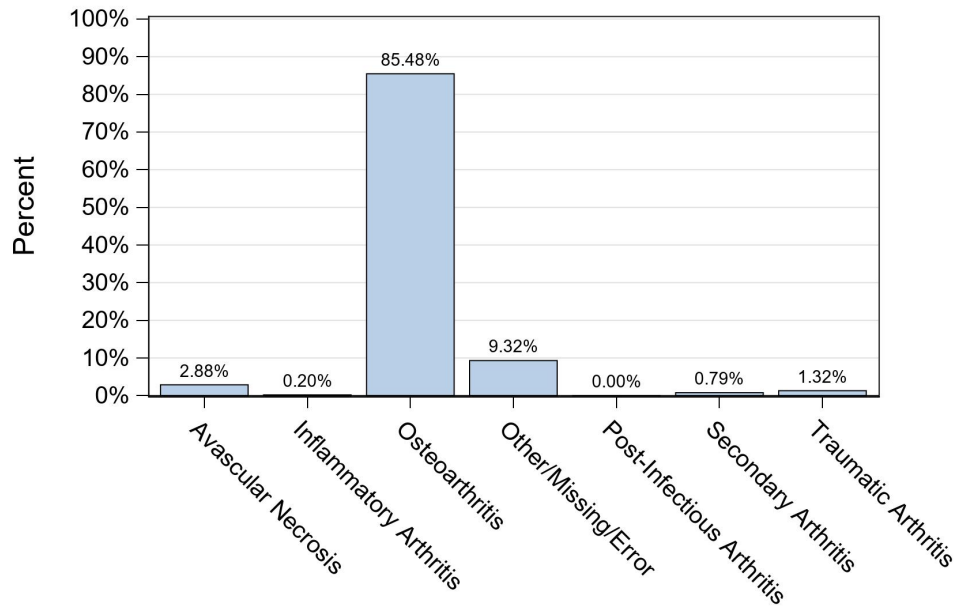


Figure 11. Age Distribution of Primary THA Cases by Sex





**Figure 12. Percent of Primary THA Cases by Approach**



**Figure 13. Percent of Primary THA Cases by Diagnosis**

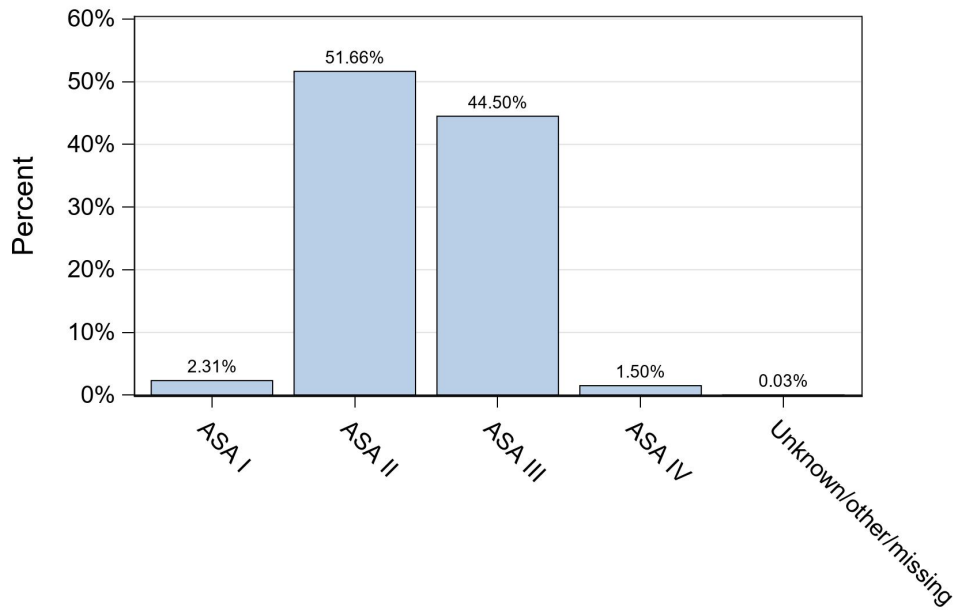


Figure 14. Percent of Primary THA Cases by ASA Class

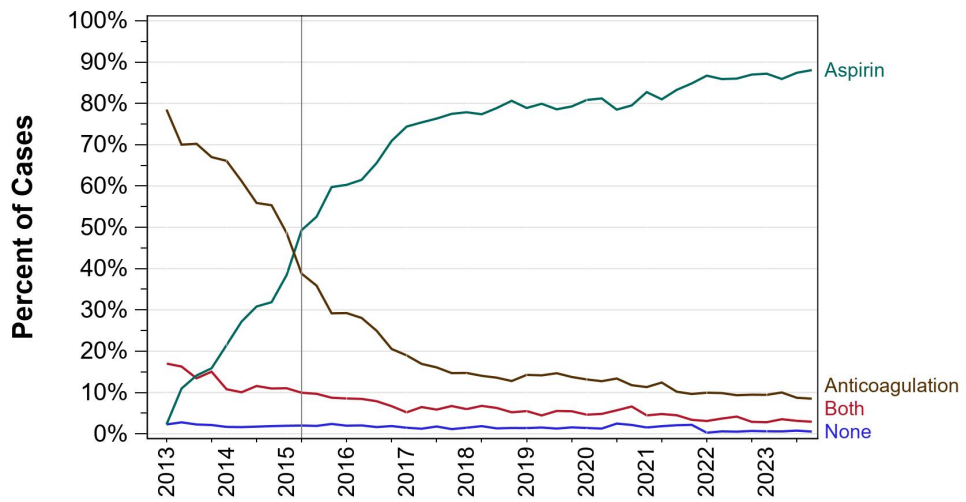
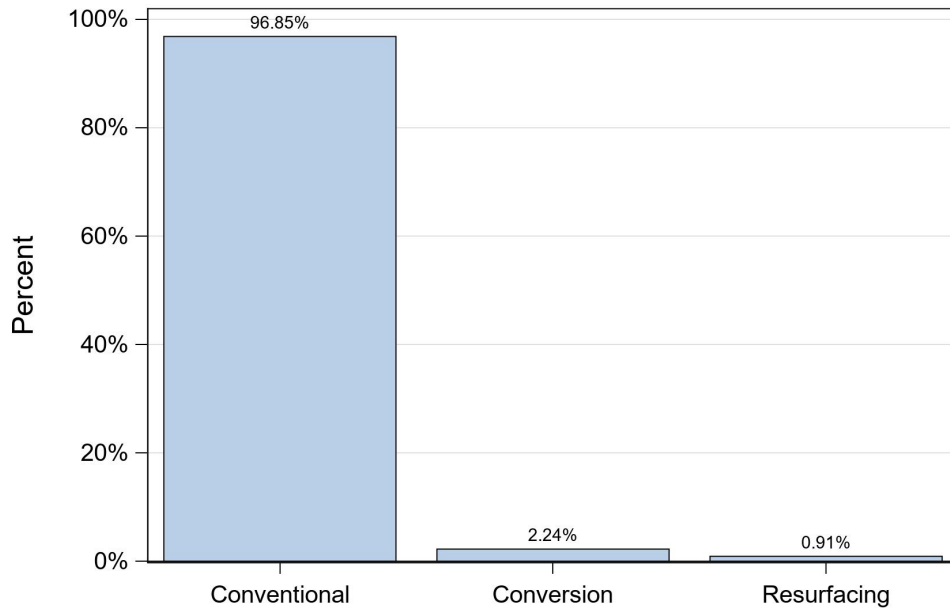


Figure 15. Percent of Primary THA Patients (First Case) by Thrombosis Prophylaxis

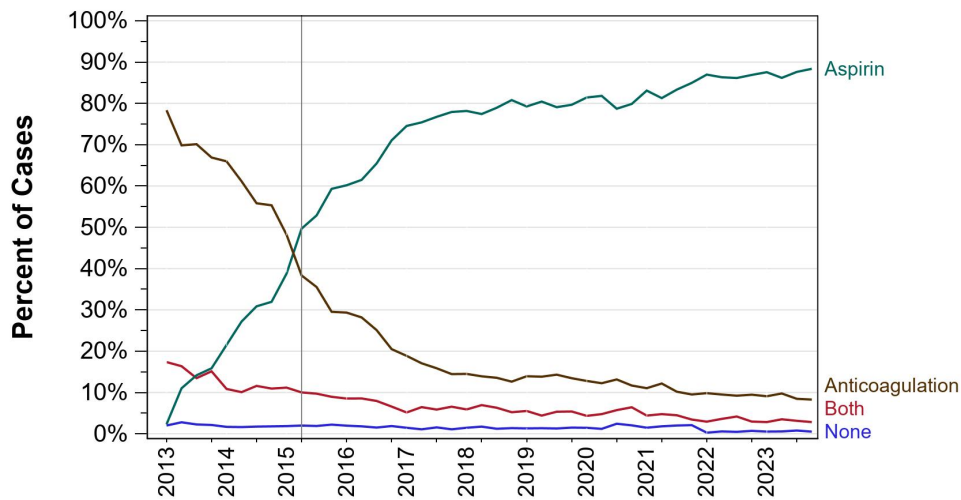


**Figure 16. Percent of Primary THA Cases by Procedure**

Note the data element for procedure, which was used to create the figure above, was changed in January of 2015 to include conversion.

## 2.2 Conventional THA

### 2.2.1 Descriptive Statistics



**Figure 17. Percent of Primary Conventional THA Patients (First Case) by Thrombosis Prophylaxis**

### 2.2.2 Revision Risk (Overall, by Sex, and by Diagnosis)

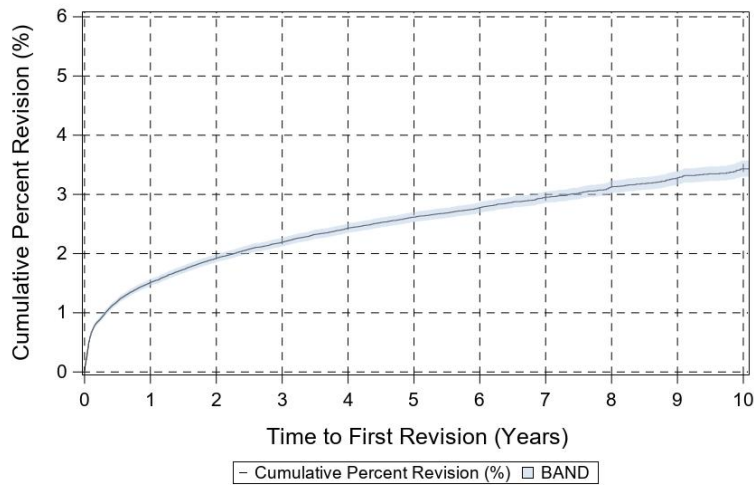


Figure 18. Cumulative Percent Revision for Primary Conventional THA

Table 5. Cumulative Percent Revision and Number at Risk for Primary Conventional THA (Numerical Values)

	1 year	3 years	5 years	7 years	10 years
CPR	1.51 (1.45,1.57)	2.19 (2.12,2.27)	2.61 (2.53,2.70)	2.95 (2.86,3.05)	3.43 (3.30,3.57)
Number at risk	143,879	108,155	76,570	45,733	7,806

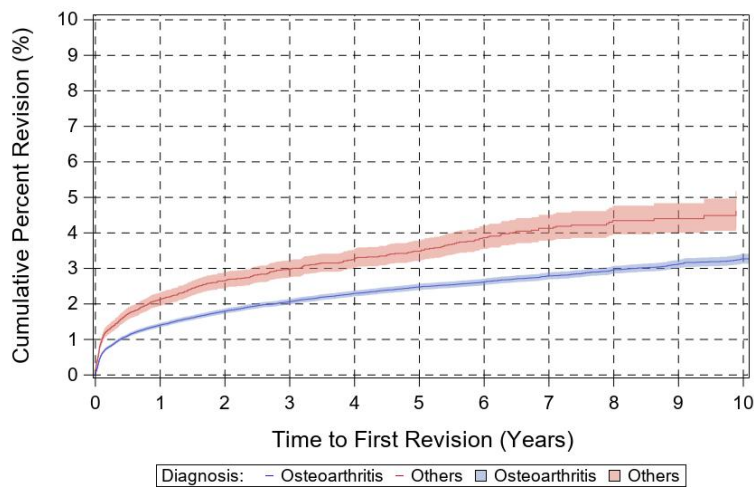
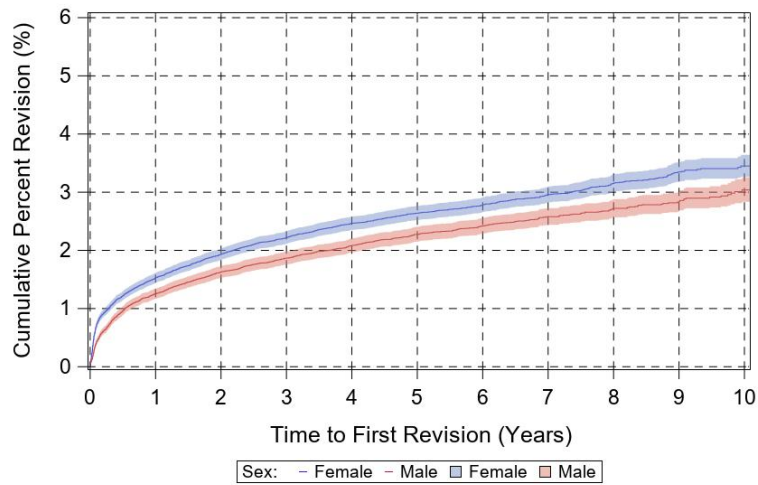


Figure 19. Cumulative Percent Revision for Primary Conventional THA by Diagnosis

Table 6. Cumulative Percent Revision for Primary Conventional THA by Diagnosis (Numerical Values)

	N	1 year	3 years	5 years	7 years	10 years
Osteoarthritis	141,838	1.41 (1.35,1.47)	2.06 (1.99,2.14)	2.48 (2.39,2.57)	2.79 ( 2.69, 2.89)	3.27 ( 3.13, 3.41)
Others	23,746	2.13 (1.94,2.32)	2.97 (2.74,3.23)	3.48 (3.21,3.78)	4.13 ( 3.78, 4.51)	4.62 ( 4.13, 5.17)
Unknown/Missing	453					



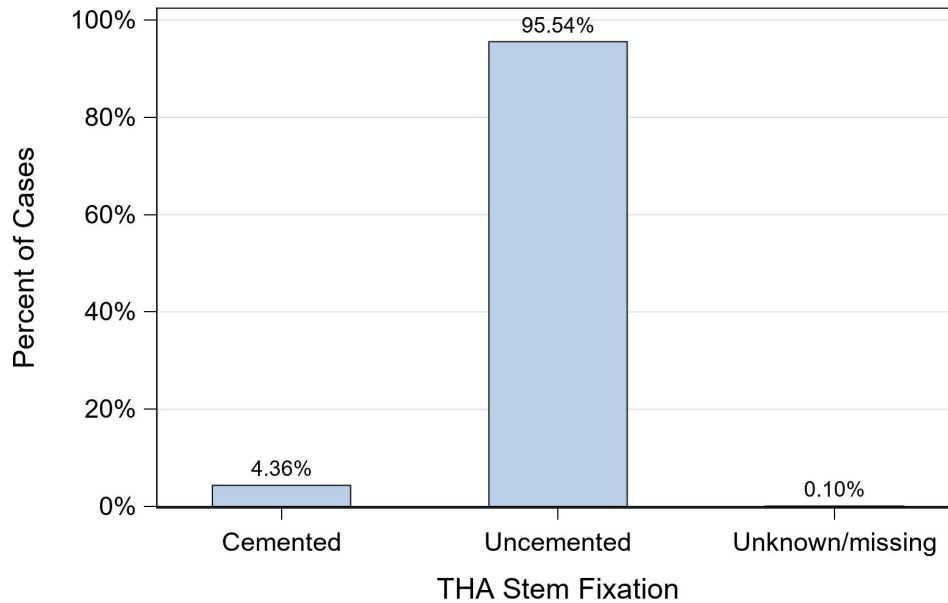
**Figure 20. Cumulative Percent Revision for Primary Conventional THA by Sex for Osteoarthritis Diagnosis**

**Table 7. Cumulative Percent Revision for Primary Conventional THA by Sex for Osteoarthritis Diagnosis (Numerical Values)**

	N	1 year	3 years	5 years	7 years	10 years
Female	78,845	1.53 (1.44,1.62)	2.22 (2.11,2.33)	2.64 (2.52,2.76)	2.96 ( 2.82, 3.10)	3.45 ( 3.27, 3.64)
Male	62,962	1.25 (1.17,1.35)	1.87 (1.76,1.98)	2.27 (2.15,2.41)	2.58 ( 2.44, 2.73)	3.04 ( 2.83, 3.26)
Missing	31					

### 2.2.3 Effect of Stem Fixation on Revision Risk

MARCQI began abstracting component fixation as of 1/1/2017, so the analyses presented in this section are based on cases performed between 1/1/2017 and 12/31/2023.



**Figure 21. Distribution of Stem Fixation in Primary Conventional THA Cases**

**Table 8. Descriptive Statistics of Primary Conventional THA Cases by Stem Fixation**

Quantity	Cemented N	Cemented Mean (SD)	Cemented Median (IQR)	Uncemented N	Uncemented Mean (SD)	Uncemented Median (IQR)
Female (%)	4,113	81.7		58,926	53.5	
Age (years)	5,033	77.1 (8.5)	78 (11)	110,170	65.1 (10.4)	66 (13)
Height (cm)	5,009	163.5 (9.3)	162.6 (11.4)	109,555	170.2 (10.4)	170.2 (15.2)
Weight (kg)	5,009	75.5 (17.5)	73 (23.4)	109,555	89.6 (21)	88 (27.9)
BMI (kg/m <sup>2</sup> )	5,009	28.1 (5.8)	27.4 (7.7)	109,555	30.8 (6.3)	30.1 (8.3)
Smoker - Never (%)	2,715	53.9		54,237	49.2	
Smoker - Previous (%)	1,997	39.7		40,596	36.9	
Smoker - Current (%)	299	5.9		15,084	13.7	
Smoker - Unknown (%)	22	0.4		253	0.2	

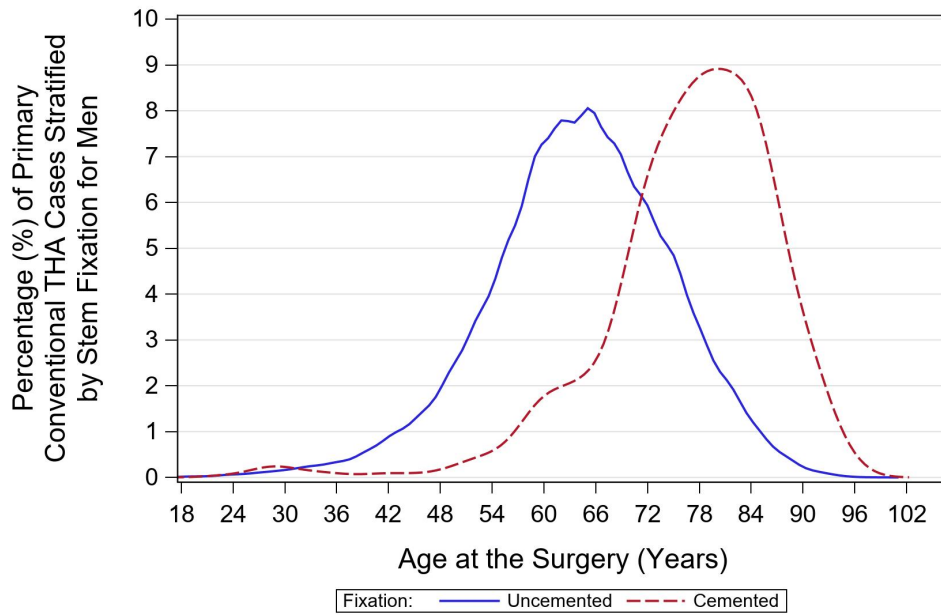


Figure 22. Age Distribution for Primary Conventional THA Cases by Stem Fixation for Men

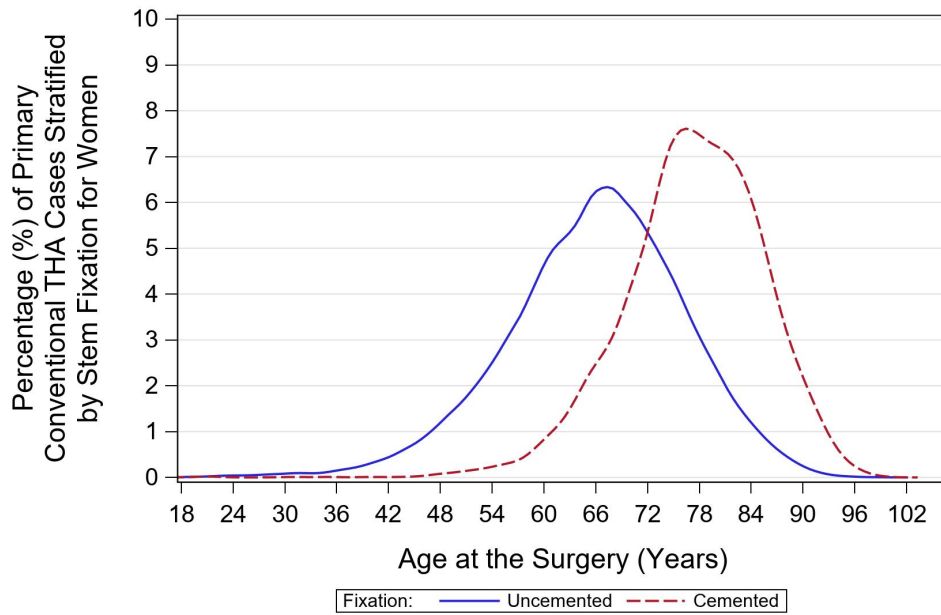
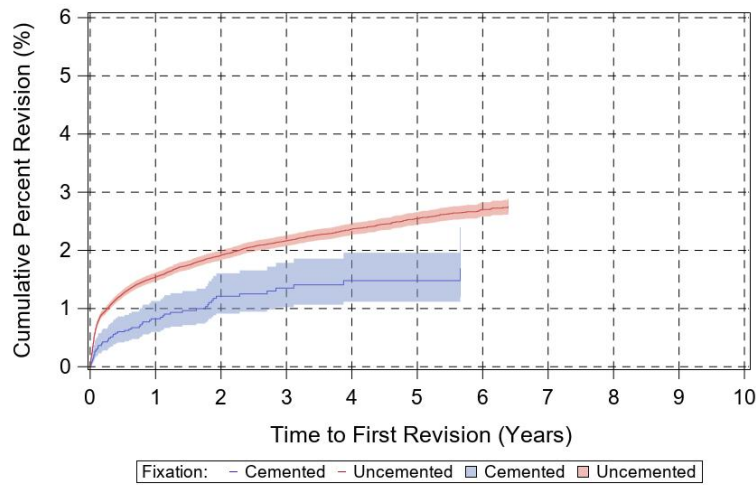


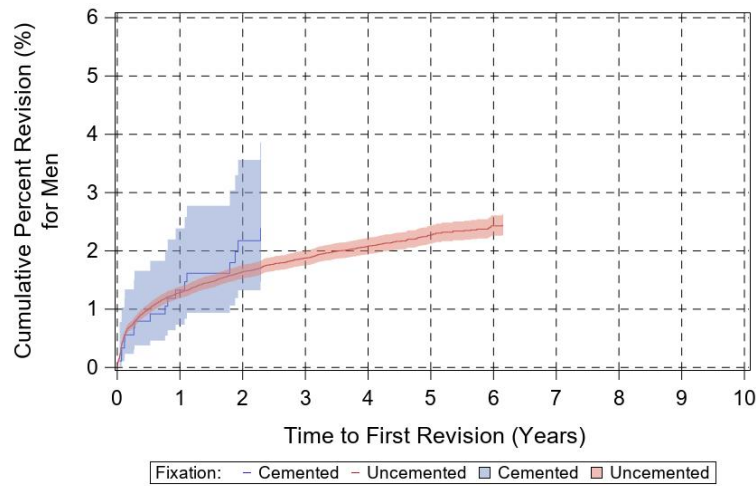
Figure 23. Age Distribution for Primary Conventional THA Cases by Stem Fixation for Women



**Figure 24. Cumulative Percent Revision for Primary Conventional THA by Stem Fixation**

**Table 9. Cumulative Percent Revision for Primary Conventional THA by Stem Fixation (Numerical Values)**

	N	1 year	3 years	5 years	7 years	10 years
Cemented stem	5,002	0.82 (0.60,1.13)	1.35 (1.02,1.79)	1.48 (1.12,1.96)	N/A	N/A
Uncemented stem	109,823	1.54 (1.47,1.62)	2.16 (2.07,2.26)	2.55 (2.44,2.66)	N/A	N/A
Unknown/missing	110					



**Figure 25. Cumulative Percent Revision for Primary Conventional THA by Stem Fixation for Men**

**Table 10. Cumulative Percent Revision for Primary Conventional THA by Stem Fixation for Men (Numerical Values)**

	N	1 year	3 years	5 years	7 years	10 years
Cemented stem	911	1.33 (0.73,2.39)	2.39 (1.47,3.86)	2.39 (1.47,3.86)	N/A	N/A
Uncemented stem	51,043	1.28 (1.19,1.39)	1.88 (1.75,2.01)	2.27 (2.12,2.43)	N/A	N/A
Unknown/missing	57					



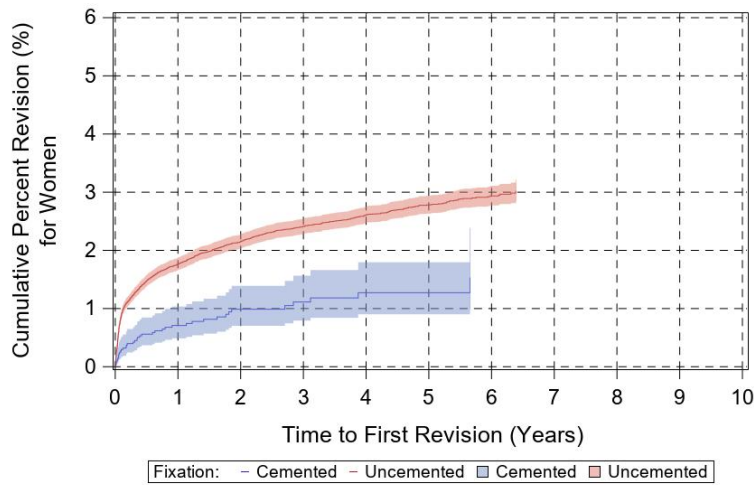


Figure 26. Cumulative Percent Revision for Primary Conventional THA by Stem Fixation for Women

Table 11. Cumulative Percent Revision for Primary Conventional THA by Stem Fixation for Women (Numerical Values)

	N	1 year	3 years	5 years	7 years	10 years
Cemented stem	4,090	0.71 (0.49,1.03)	1.11 (0.79,1.56)	1.27 (0.90,1.80)	N/A	N/A
Uncemented stem	58,759	1.77 (1.66,1.88)	2.41 (2.28,2.55)	2.78 (2.63,2.94)	N/A	N/A
Unknown/missing	53					

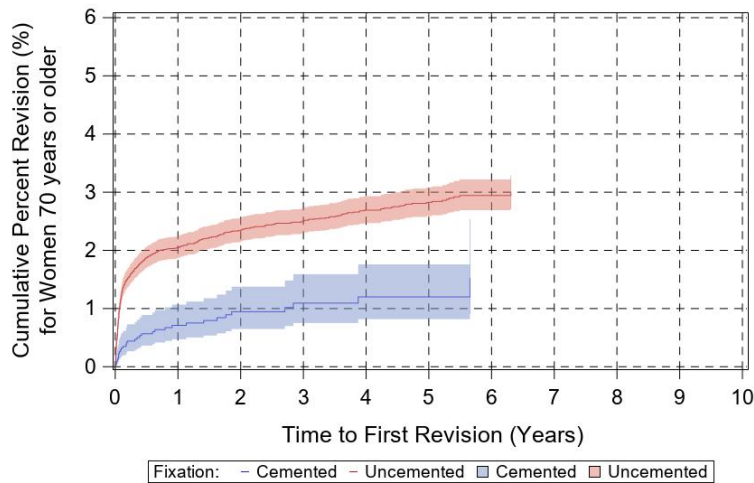


Figure 27. Cumulative Percent Revision for Primary Conventional THA by Stem Fixation for Women 70 Years or Older

Table 12. Cumulative Percent Revision for Primary Conventional THA by Stem Fixation for Women 70 Years or Older (Numerical Values)

	N	1 year	3 years	5 years	7 years	10 years
Cemented stem	3,463	0.71 (0.47,1.07)	1.09 (0.75,1.59)	1.20 (0.82,1.76)	N/A	N/A
Uncemented stem	22,080	2.05 (1.87,2.25)	2.51 (2.30,2.73)	2.82 (2.59,3.08)	N/A	N/A
Unknown/missing	19					

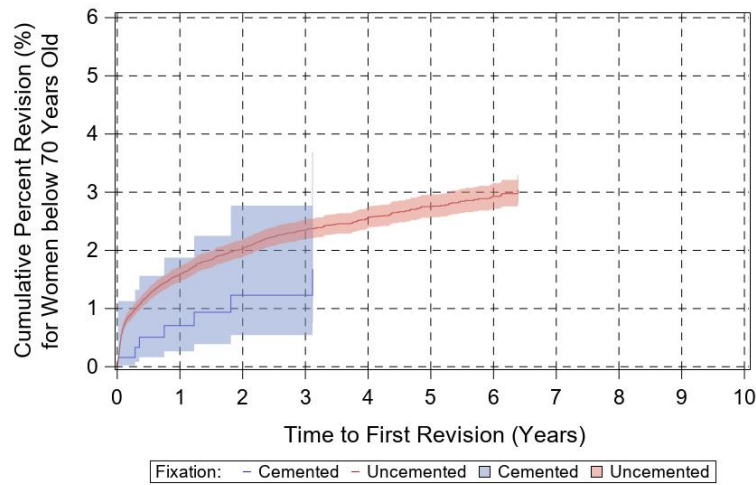


Figure 28. Cumulative Percent Revision for Primary Conventional THA by Stem Fixation for Women Under 70 Years

Table 13. Cumulative Percent Revision for Primary Conventional THA by Stem Fixation for Women Under 70 Years (Numerical Values)

	N	1 year	3 years	5 years	7 years	10 years
Cemented stem	627	0.71 (0.26,1.88)	1.23 (0.54,2.77)	1.68 (0.76,3.69)	N/A	N/A
Uncemented stem	36,679	1.60 (1.47,1.73)	2.35 (2.19,2.52)	2.75 (2.56,2.95)	N/A	N/A
Unknown/missing	34					

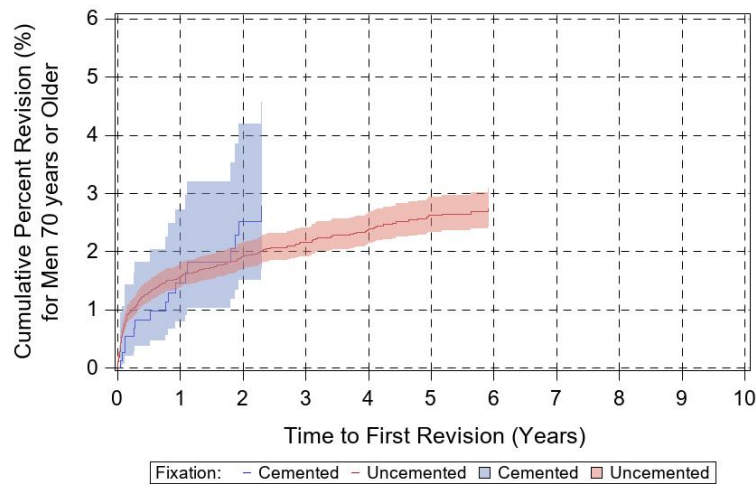
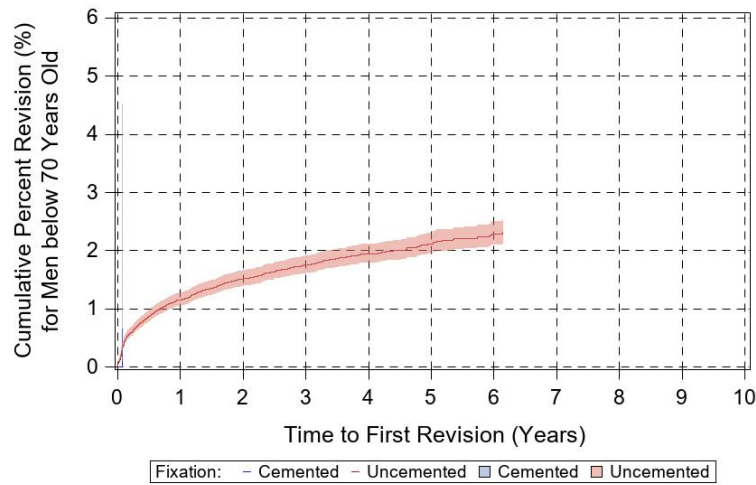


Figure 29. Cumulative Percent Revision for Primary Conventional THA by Stem Fixation for Men 70 Years or Older

Table 14. Cumulative Percent Revision for Primary Conventional THA by Stem Fixation for Men 70 Years or Older (Numerical Values)

	N	1 year	3 years	5 years	7 years	10 years
Cemented stem	754	1.47 (0.79,2.72)	2.79 (1.69,4.58)	2.79 (1.69,4.58)	N/A	N/A
Uncemented stem	15,563	1.58 (1.39,1.79)	2.16 (1.92,2.42)	2.62 (2.34,2.94)	N/A	N/A
Unknown/missing	17					



**Figure 30. Cumulative Percent Revision for Primary Conventional THA by Stem Fixation for Men Under 70 Years**

**Table 15. Cumulative Percent Revision for Primary Conventional THA by Stem Fixation for Men Under 70 Years (Numerical Values)**

	N	1 year	3 years	5 years	7 years	10 years
Cemented stem	157	0.65 (0.09,4.52)	0.65 (0.09,4.52)	0.65 (0.09,4.52)	N/A	N/A
Uncemented stem	35,480	1.16 (1.05,1.28)	1.75 (1.61,1.91)	2.12 (1.95,2.31)	N/A	N/A
Unknown/missing	40					

**Table 16. Reasons for First Revision Following Primary Cemented Stem Cases**

Rank	Reason for Revision	N	Percent
1	Dislocation/Instability	15	26.8
2	Aseptic Loosening	12	21.4
3	Joint Infection	12	21.4
4	Peri-prosthetic fracture - Femur	10	17.9
5	Implant Failure	3	5.4
6	Peri-prosthetic fracture - Acetabulum	3	5.4
7	Metal Reaction/Metallosis	1	1.8

**Table 17. Reasons for First Revision Following Primary Cemented Stem Cases in First Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Dislocation/Instability	14	36.8
2	Joint Infection	11	29.0
3	Peri-prosthetic fracture - Femur	5	13.2
4	Aseptic Loosening	4	10.5
5	Peri-prosthetic fracture - Acetabulum	3	7.9
6	Implant Failure	1	2.6

**Table 18. Reasons for First Revision Following Primary Cemented Stem Cases in Second Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Aseptic Loosening	7	58.3
2	Implant Failure	2	16.7
3	Peri-prosthetic fracture - Femur	2	16.7
4	Joint Infection	1	8.3

**Table 19. Reasons for First Revision Following Primary Cemented Stem Cases in Third Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Peri-prosthetic fracture - Femur	2	66.7
2	Aseptic Loosening	1	33.3

**Table 20. Reasons for First Revision Following Primary Uncemented Stem Cases**

Rank	Reason for Revision	N	Percent
1	Peri-prosthetic fracture - Femur	627	27.0
2	Joint Infection	489	21.1
3	Dislocation/Instability	487	21.0
4	Aseptic Loosening	408	17.6
5	Malalignment	99	4.3
6	Implant Failure	88	3.8
7	Pain	62	2.7
8	Peri-prosthetic fracture - Acetabulum	35	1.5
9	Metal Reaction/Metallosis	16	0.7
10	Osteolysis	4	0.2
	Unknown/missing/other	4	0.2

**Table 21. Reasons for First Revision Following Primary Uncemented Stem Cases in First Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Peri-prosthetic fracture - Femur	576	35.4
2	Dislocation/Instability	346	21.3
3	Joint Infection	323	19.8
4	Aseptic Loosening	191	11.7
5	Implant Failure	65	4.0
6	Malalignment	52	3.2
7	Pain	34	2.1
8	Peri-prosthetic fracture - Acetabulum	32	2.0
9	Poly liner wear	3	0.2
10	Metal Reaction/Metallosis	3	0.2
	Unknown/missing/other	1	0.1

**Table 22. Reasons for First Revision Following Primary Uncemented Stem Cases in Second Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Aseptic Loosening	95	30.4
2	Joint Infection	82	26.3
3	Dislocation/Instability	58	18.6
4	Malalignment	24	7.7
5	Peri-prosthetic fracture - Femur	22	7.0
6	Pain	15	4.8
7	Implant Failure	11	3.5
8	Peri-prosthetic fracture - Acetabulum	2	0.6
9	Metal Reaction/Metallosis	2	0.6
10	Osteolysis	1	0.3

**Table 23. Reasons for First Revision Following Primary Uncemented Stem Cases in Third Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Aseptic Loosening	50	29.6
2	Dislocation/Instability	42	24.8
3	Joint Infection	28	16.6
4	Malalignment	14	8.3
5	Peri-prosthetic fracture - Femur	11	6.5
6	Pain	10	5.9
7	Implant Failure	9	5.3
8	Metal Reaction/Metallosis	3	1.8
9	Poly liner wear	1	0.6
10	Peri-prosthetic fracture - Acetabulum	1	0.6

**Table 24. Reasons for First Revision Following Primary Cemented Stem Cases in Women at Least 70 Years of Age**

Rank	Reason for Revision	N	Percent
1	Joint Infection	12	25.0
2	Aseptic Loosening	11	22.9
3	Dislocation/Instability	11	22.9
4	Peri-prosthetic fracture - Femur	10	20.8
5	Peri-prosthetic fracture - Acetabulum	2	4.2
6	Implant Failure	1	2.1
7	Metal Reaction/Metallosis	1	2.1

**Table 25. Reasons for First Revision Following Primary Cemented Stem Cases in Women at Least 70 Years of Age in First Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Dislocation/Instability	7	30.4
2	Joint Infection	6	26.1
3	Peri-prosthetic fracture - Femur	5	21.7
4	Aseptic Loosening	3	13.0
5	Peri-prosthetic fracture - Acetabulum	2	8.7

**Table 26. Reasons for First Revision Following Primary Cemented Stem cases in Women at Least 70 Years of Age in Second Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Aseptic Loosening	2	40.0
2	Joint Infection	1	20.0
3	Implant Failure	1	20.0
4	Peri-prosthetic fracture - Femur	1	20.0

**Table 27. Reasons for First Revision Following Primary Cemented Stem Cases in Women at Least 70 Years of Age in Third Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Aseptic Loosening	1	50.0
2	Peri-prosthetic fracture - Femur	1	50.0

**Table 28. Reasons for First Revision Following Primary Uncemented Stem Cases in Women at Least 70 Years of Age**

Rank	Reason for Revision	N	Percent
1	Peri-prosthetic fracture - Femur	336	38.4
2	Dislocation/Instability	196	22.4
3	Aseptic Loosening	128	14.6
4	Joint Infection	123	14.0
5	Implant Failure	31	3.5
6	Peri-prosthetic fracture - Acetabulum	24	2.7
7	Malalignment	24	2.7
8	Pain	8	0.9
9	Metal Reaction/Metallosis	5	0.6
10	Poly liner wear	1	0.1

**Table 29. Reasons for First Revision Following Primary Uncemented Stem Cases in Women at Least 70 Years of Age in First Year post-operatively**

Rank	Reason for Revision	N	Percent
1	Peri-prosthetic fracture - Femur	229	51.9
2	Dislocation/Instability	83	18.8
3	Aseptic Loosening	39	8.8
4	Joint Infection	39	8.8
5	Implant Failure	20	4.5
6	Peri-prosthetic fracture - Acetabulum	18	4.1
7	Malalignment	9	2.0
8	Pain	3	0.7
9	Poly liner wear	1	0.2

**Table 30. Reasons for First Revision Following Primary Uncemented Stem Cases in Women at Least 70 Years of Age in Second Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Dislocation/Instability	22	44.9
2	Aseptic Loosening	15	30.6
3	Joint Infection	5	10.2
4	Peri-prosthetic fracture - Femur	2	4.1
5	Pain	2	4.1
6	Malalignment	2	4.1
7	Peri-prosthetic fracture - Acetabulum	1	2.0

**Table 31. Reasons for First Revision Following Primary Uncemented Stem Cases in Women at Least 70 Years of Age in Third Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Dislocation/Instability	10	43.5
2	Joint Infection	5	21.7
3	Aseptic Loosening	3	13.0
4	Implant Failure	2	8.7
5	Malalignment	2	8.7
6	Peri-prosthetic fracture - Femur	1	4.4

## 2.2.4 Reasons for Revision

The reasons for revision are of central importance to quality improvement because it helps focus attention on specific causes that may be addressed. Therefore, the data are presented in two formats below: tabular and Pareto chart. The tabular format is consistent with how other arthroplasty registries report the cause(s) of revision. The Pareto chart figure presents the same data in a format commonly used in quality improvement. The Pareto chart sorts the reasons for revision by frequency (bar chart on the bottom, from left to right) and presents a cumulative percent using a line graph above.

It is important to note that the time window for the cases reported in the reasons for revision tables and figure differs from the time window used for other figures because the reason for revision was added to the database on 1/1/2015. While these data capture revisions for primaries performed back to 2/15/2012, only revisions occurring on or after 1/1/2015 are included in the reasons for revision figure and tables.

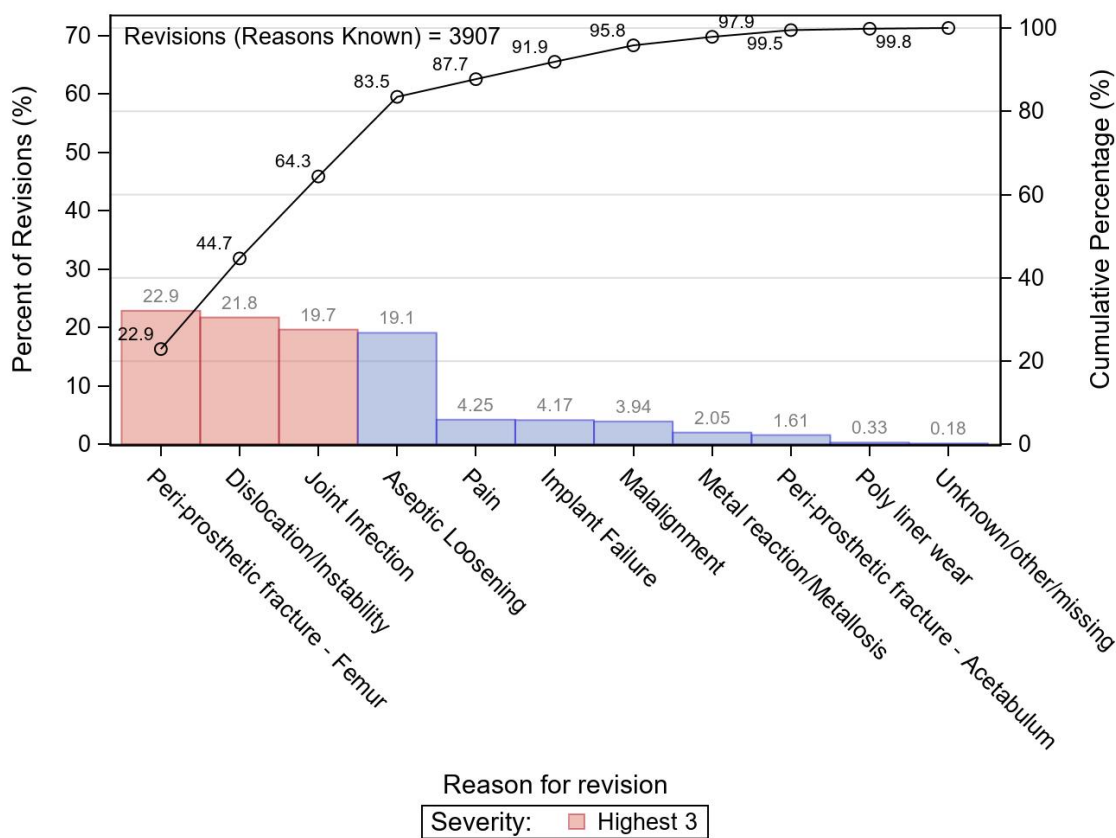


Figure 31. Reasons for First Revision Following Primary Conventional THA (Pareto Chart)

Table 32. Reasons for First Revision Following Primary Conventional THA

Rank	Reason for Revision	N	Percent
1	Peri-prosthetic fracture - Femur	895	22.9
2	Dislocation/Instability	850	21.8
3	Joint Infection	769	19.7
4	Aseptic Loosening	747	19.1
5	Pain	166	4.2
6	Implant Failure	163	4.2
7	Malalignment	154	3.9
8	Metal Reaction/Metallosis	80	2.0
9	Peri-prosthetic fracture - Acetabulum	63	1.6
10	Poly liner wear	13	0.3
	Unknown/missing/other	6	0.2



**Table 33. Reasons for First Revision Following Primary Conventional THA in First Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Peri-prosthetic fracture - Femur	742	32.2
2	Dislocation/Instability	532	23.1
3	Joint Infection	454	19.7
4	Aseptic Loosening	271	11.8
5	Implant Failure	98	4.2
6	Pain	78	3.4
7	Malalignment	68	3.0
8	Peri-prosthetic fracture - Acetabulum	52	2.3
9	Poly liner wear	4	0.2
10	Metal Reaction/Metallosis	3	0.1
	Unknown/missing/other	1	0.1

**Table 34. Reasons for First Revision Following Primary Conventional THA in Second Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Aseptic Loosening	174	32.4
2	Joint Infection	122	22.7
3	Dislocation/Instability	101	18.8
4	Pain	47	8.8
5	Peri-prosthetic fracture - Femur	33	6.2
6	Malalignment	29	5.4
7	Implant Failure	21	3.9
8	Peri-prosthetic fracture - Acetabulum	5	0.9
9	Metal Reaction/Metallosis	4	0.7
10	Osteolysis	1	0.2

**Table 35. Reasons for First Revision Following Primary Conventional THA in Third Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Aseptic Loosening	99	30.6
2	Dislocation/Instability	70	21.6
3	Joint Infection	58	17.9
4	Pain	28	8.6
5	Peri-prosthetic fracture - Femur	23	7.1
6	Malalignment	19	5.9
7	Implant Failure	15	4.6
8	Metal Reaction/Metallosis	6	1.8
9	Peri-prosthetic fracture - Acetabulum	3	0.9
10	Poly liner wear	2	0.6
	Unknown/missing/other	1	0.3

## 2.2.5 Most Commonly Used Implants

**Table 36. Ten Most Commonly Used Femoral Components in Primary Conventional THA**

Rank	Stem	N	Percent
1	Accolade II	41,272	24.7
2	M/L Taper*	16,584	9.9
3	Taperloc 133	15,959	9.6
4	Actis DuoFix	8,070	4.8
5	Summit	8,031	4.8
6	Avenir	6,978	4.2
7	Anthology	6,516	3.9
8	Fitmore	6,201	3.7
9	Taperloc 133 Microplasty	5,210	3.1
10	Tri-Lock BPS	4,789	2.9
11	Others	47,471	28.3

\* M/L Taper does not include M/L Taper Kinectiv

**Table 37. Ten Most Commonly Used Acetabular Components in Primary Conventional THA**

Rank	Cup	N	Percent
1	G7	39,069	23.4
2	Trident	31,060	18.6
3	Pinnacle	27,501	16.5
4	Trident II	25,451	15.2
5	Continuum	16,530	9.9
6	Reflection 3	11,920	7.1
7	RingLoc	2,652	1.6
8	Trabecular Metal	2,051	1.2
9	Trilogy	1,616	1.0
10	Regenerex RingLoc+	1,031	0.6
11	Others	8,200	4.9

**Table 38. Ten Most Commonly Used Femoral/Acetabular Component Combinations Used in Primary Conventional THA**

Rank	Stem/cup combination	N	Percent
1	Accolade II / Trident	21,219	12.7
2	Accolade II / Trident II	19,342	11.6
3	Taperloc 133 / G7	12,112	7.2
4	M/L Taper* / Continuum	8,534	5.1
5	Summit / Pinnacle	7,967	4.8
6	Actis DuoFix / Pinnacle	7,858	4.7
7	Avenir / G7	6,819	4.1
8	Anthology / Reflection 3	5,880	3.5
9	M/L Taper* / G7	4,770	2.9
10	Tri-Lock BPS / Pinnacle	4,197	2.5
11	Others	68,383	40.6

\* M/L Taper does not include M/L Taper Kinectiv

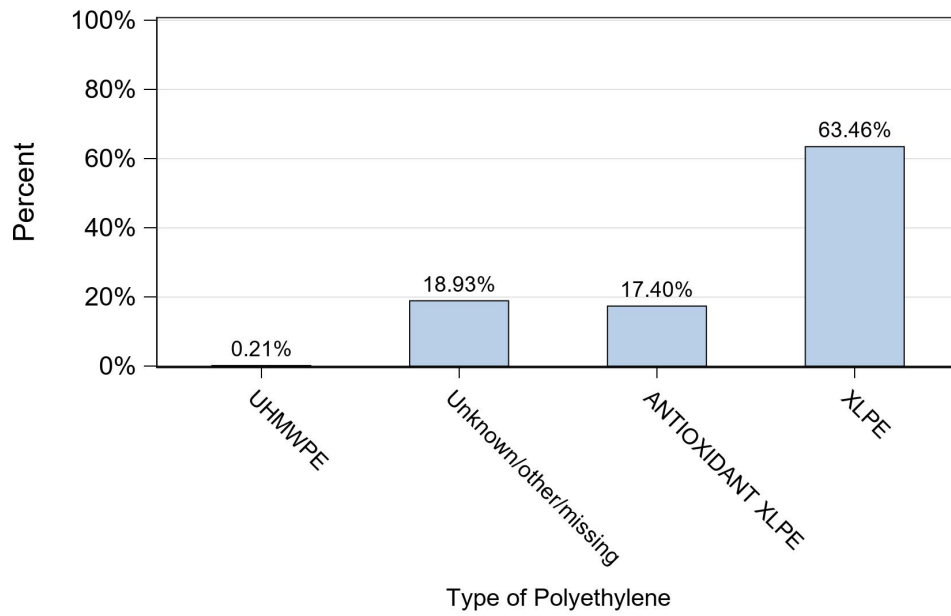


Figure 32. Percentage of Polyethylene Liners by Type of Polyethylene for Primary Conventional THA

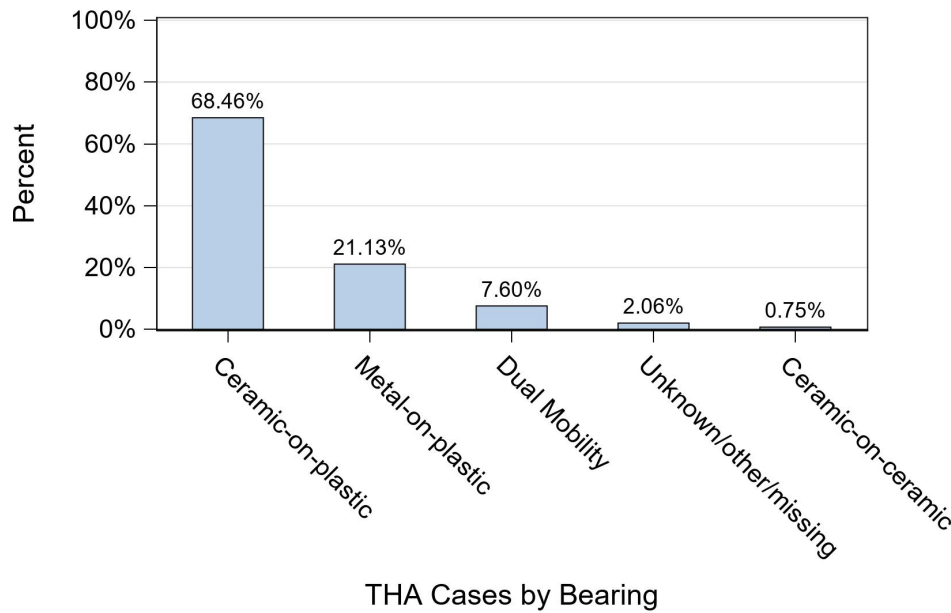
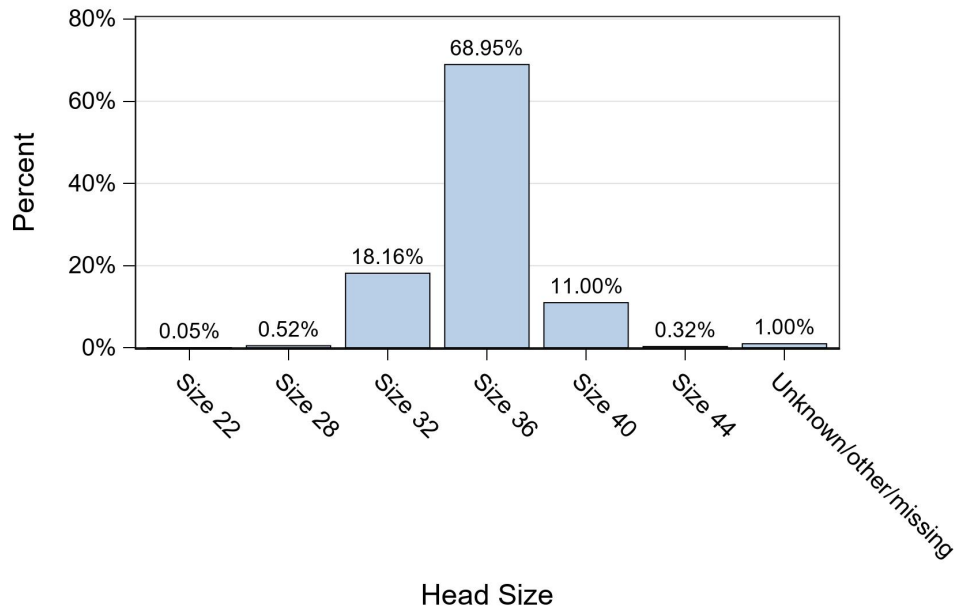


Figure 33. Percentage of Bearing Surface Couple for Primary Conventional THA



**Figure 34. Distribution of Head Sizes for Primary Conventional THA, Excluding Dual Mobility Cases**

## 2.2.6 Revision Risk by Stem/Cup Implant Combination Summary

There is variation in revision risk across implants. This section provides revision risk data by stem/cup implant combination.

**Table 39. Summary of Cumulative Percent Revision Following Primary THA for Stem/Cup Combinations Having at Least 500 Cases, Sorted Alphabetically**

Stem/Cup Combination	N*	1 year	3 years	5 years	7 years	10 years
Accolade II / Trident	21,073	1.18 (1.04,1.33)	1.92 (1.74,2.11)	2.44 (2.24,2.66)	2.88 (2.66,3.13)	3.62 (3.25,4.03)
Accolade II / Trident II	19,297	1.51 (1.34,1.70)	2.09 (1.88,2.32)	2.47 (2.18,2.80)	2.90 (2.35,3.57)	N/A
Accolade C / Trident II	838	0.65 (0.27,1.55)	1.10 (0.51,2.39)	1.10 (0.51,2.39)	N/A	N/A
Accolade TMZF / Trident	891	0.90 (0.45,1.79)	2.02 (1.28,3.19)	2.81 (1.90,4.12)	3.27 (2.28,4.67)	4.38 (3.08,6.22)
Actis DuoFix / Pinnacle	7,835	0.80 (0.62,1.04)	1.11 (0.87,1.41)	1.17 (0.91,1.50)	N/A	N/A
AML / Pinnacle	800	1.38 (0.77,2.47)	2.04 (1.26,3.32)	2.99 (1.97,4.51)	3.41 (2.28,5.07)	3.41 (2.28,5.07)
Anthology / PolarCup	552	0.54 (0.18,1.68)	1.46 (0.73,2.90)	1.89 (1.02,3.49)	2.21 (1.21,4.00)	N/A
Anthology / Reflection 3	5,849	1.92 (1.59,2.31)	2.77 (2.36,3.26)	3.18 (2.71,3.72)	3.60 (3.06,4.22)	3.75 (3.18,4.41)
Avenir (Cemented) / G7	1,371	1.04 (0.60,1.79)	1.30 (0.78,2.18)	1.67 (0.93,3.02)	1.67 (0.93,3.02)	N/A
Avenir (Cementless) / Continuum	521	1.34 (0.64,2.80)	1.92 (1.04,3.54)	2.12 (1.18,3.79)	2.54 (1.48,4.34)	2.54 (1.48,4.34)
Avenir (Cementless) / G7	762	1.73 (1.01,2.96)	1.90 (1.13,3.20)	1.90 (1.13,3.20)	1.90 (1.13,3.20)	N/A
Avenir Complete / G7	5,432	1.04 (0.78,1.38)	1.33 (0.97,1.83)	N/A	N/A	N/A
Corail / Pinnacle	3,829	1.27 (0.95,1.68)	2.00 (1.59,2.53)	2.09 (1.66,2.63)	2.19 (1.74,2.76)	2.53 (1.97,3.24)
Corail Coxa Vara / Pinnacle	820	0.13 (0.02,0.89)	0.70 (0.29,1.67)	0.87 (0.39,1.94)	0.87 (0.39,1.94)	0.87 (0.39,1.94)
Echo Bi-Metric / G7	1,652	2.79 (2.10,3.71)	3.49 (2.70,4.50)	3.80 (2.96,4.85)	4.41 (3.12,6.22)	N/A
Echo Bi-Metric Microplasty / G7	2,097	1.85 (1.35,2.53)	2.49 (1.89,3.29)	2.85 (2.17,3.73)	3.51 (2.45,5.00)	N/A
Fitmore / Continuum	2,801	1.36 (0.99,1.86)	2.04 (1.57,2.63)	2.33 (1.83,2.96)	2.77 (2.21,3.46)	3.04 (2.42,3.82)
Fitmore / G7	2,938	1.35 (0.99,1.84)	1.78 (1.35,2.34)	1.89 (1.44,2.48)	1.89 (1.44,2.48)	N/A
Insignia / Trident II	3,067	0.67 (0.42,1.07)	N/A	N/A	N/A	N/A
M/L Taper** / Continuum	8,462	1.72 (1.46,2.02)	2.38 (2.07,2.73)	2.78 (2.44,3.16)	3.06 (2.70,3.47)	3.49 (3.06,3.98)
M/L Taper** / G7	4,750	1.72 (1.39,2.15)	2.50 (2.06,3.03)	2.73 (2.24,3.31)	2.87 (2.33,3.54)	N/A
M/L Taper** / Trabecular Metal	1,061	2.46 (1.68,3.60)	3.25 (2.33,4.52)	3.73 (2.73,5.10)	4.07 (2.98,5.53)	4.07 (2.98,5.53)
M/L Taper** / Trilogy	1,325	1.58 (1.04,2.42)	3.18 (2.36,4.28)	3.85 (2.93,5.05)	4.73 (3.68,6.08)	4.98 (3.88,6.37)
Polarstem / Reflection 3	3,213	1.41 (1.05,1.89)	1.81 (1.38,2.37)	2.40 (1.84,3.12)	2.55 (1.94,3.35)	N/A
Secur-Fit / Trident	1,093	3.75 (2.78,5.06)	4.94 (3.81,6.41)	5.59 (4.38,7.13)	6.03 (4.76,7.63)	6.62 (5.22,8.39)
Secur-Fit / Trident II	834	2.85 (1.90,4.26)	3.22 (2.18,4.75)	3.54 (2.38,5.24)	N/A	N/A
Secur-Fit Max / Trident	3,059	2.12 (1.67,2.70)	2.89 (2.35,3.55)	3.58 (2.97,4.32)	4.01 (3.34,4.81)	4.35 (3.59,5.27)
Secur-Fit Plus Max / Trident	1,982	1.72 (1.23,2.39)	2.12 (1.57,2.86)	2.52 (1.92,3.32)	2.96 (2.30,3.81)	3.39 (2.66,4.32)
SROM / Pinnacle	1,112	1.26 (0.75,2.12)	2.53 (1.76,3.65)	3.10 (2.23,4.31)	3.76 (2.77,5.10)	4.10 (3.03,5.53)
Summit / Pinnacle	7,876	1.52 (1.27,1.82)	2.11 (1.81,2.46)	2.30 (1.98,2.67)	2.44 (2.10,2.82)	2.77 (2.37,3.25)
Synergy / Reflection 3	1,385	2.34 (1.66,3.30)	3.36 (2.51,4.49)	3.68 (2.77,4.88)	4.38 (3.32,5.75)	4.57 (3.47,6.02)
Taperloc 133 / Continuum	831	2.91 (1.96,4.32)	4.76 (3.48,6.48)	5.74 (4.31,7.62)	5.93 (4.47,7.86)	N/A
Taperloc 133 / G7	12,074	1.63 (1.42,1.88)	2.24 (1.98,2.54)	2.71 (2.39,3.07)	2.79 (2.46,3.17)	N/A
Taperloc 133 / Regenerex RingLoc+	498	1.61 (0.81,3.19)	2.21 (1.23,3.95)	2.81 (1.67,4.70)	2.81 (1.67,4.70)	2.81 (1.67,4.70)
Taperloc 133 / RingLoc	1,678	1.73 (1.20,2.48)	2.50 (1.86,3.37)	2.69 (2.01,3.58)	2.76 (2.07,3.66)	3.02 (2.27,4.02)
Taperloc 133 Microplasty / Continuum	708	2.10 (1.25,3.53)	2.56 (1.56,4.19)	2.91 (1.78,4.74)	2.91 (1.78,4.74)	N/A
Taperloc 133 Microplasty / G7	3,821	1.17 (0.87,1.57)	1.43 (1.09,1.87)	1.93 (1.50,2.48)	2.12 (1.65,2.72)	N/A
Trabecular Metal / Continuum	784	2.17 (1.35,3.46)	2.99 (1.99,4.46)	3.28 (2.23,4.82)	3.46 (2.36,5.05)	4.20 (2.90,6.08)
Tri-Lock BPS / Pinnacle	4,175	0.68 (0.47,0.98)	1.30 (0.98,1.71)	1.64 (1.27,2.12)	1.75 (1.35,2.26)	2.22 (1.66,2.97)

\* Number of patients that contribute to survival analysis used to compute cumulative percent revision

\*\* M/L Taper does not include M/L Taper Kinectiv

**Table 40. Summary of Cumulative Percent Revision Following Primary THA for Stem/Cup Combinations Having at Least 500 Cases, Sorted by Five-year CPR**

Stem/Cup Combination	N*	1 year	3 years	5 years	7 years	10 years
Corail Coxa Vara / Pinnacle	820	0.13 (0.02,0.89)	0.70 (0.29,1.67)	0.87 (0.39,1.94)	0.87 (0.39,1.94)	0.87 (0.39,1.94)
Accolade C / Trident II	838	0.65 (0.27,1.55)	1.10 (0.51,2.39)	1.10 (0.51,2.39)	N/A	N/A
Actis DuoFix / Pinnacle	7,835	0.80 (0.62,1.04)	1.11 (0.87,1.41)	1.17 (0.91,1.50)	N/A	N/A
Tri-Lock BPS / Pinnacle	4,175	0.68 (0.47,0.98)	1.30 (0.98,1.71)	1.64 (1.27,2.12)	1.75 (1.35,2.26)	2.22 (1.66,2.97)
Avenir (Cemented) / G7	1,371	1.04 (0.60,1.79)	1.30 (0.78,2.18)	1.67 (0.93,3.02)	1.67 (0.93,3.02)	N/A
Anthology / PolarCup	552	0.54 (0.18,1.68)	1.46 (0.73,2.90)	1.89 (1.02,3.49)	2.21 (1.21,4.00)	N/A
Fitmore / G7	2,938	1.35 (0.99,1.84)	1.78 (1.35,2.34)	1.89 (1.44,2.48)	1.89 (1.44,2.48)	N/A
Avenir (Cementless) / G7	762	1.73 (1.01,2.96)	1.90 (1.13,3.20)	1.90 (1.13,3.20)	1.90 (1.13,3.20)	N/A
Taperloc 133 Microplasty / G7	3,821	1.17 (0.87,1.57)	1.43 (1.09,1.87)	1.93 (1.50,2.48)	2.12 (1.65,2.72)	N/A
Corail / Pinnacle	3,829	1.27 (0.95,1.68)	2.00 (1.59,2.53)	2.09 (1.66,2.63)	2.19 (1.74,2.76)	2.53 (1.97,3.24)
Avenir (Cementless) / Continuum	521	1.34 (0.64,2.80)	1.92 (1.04,3.54)	2.12 (1.18,3.79)	2.54 (1.48,4.34)	2.54 (1.48,4.34)
Summit / Pinnacle	7,876	1.52 (1.27,1.82)	2.11 (1.81,2.46)	2.30 (1.98,2.67)	2.44 (2.10,2.82)	2.77 (2.37,3.25)
Fitmore / Continuum	2,801	1.36 (0.99,1.86)	2.04 (1.57,2.63)	2.33 (1.83,2.96)	2.77 (2.21,3.46)	3.04 (2.42,3.82)
Polarstem / Reflection 3	3,213	1.41 (1.05,1.89)	1.81 (1.38,2.37)	2.40 (1.84,3.12)	2.55 (1.94,3.35)	N/A
Accolade II / Trident	21,073	1.18 (1.04,1.33)	1.92 (1.74,2.11)	2.44 (2.24,2.66)	2.88 (2.66,3.13)	3.62 (3.25,4.03)
Accolade II / Trident II	19,297	1.51 (1.34,1.70)	2.09 (1.88,2.32)	2.47 (2.18,2.80)	2.90 (2.35,3.57)	N/A
Secur-Fit Plus Max / Trident	1,982	1.72 (1.23,2.39)	2.12 (1.57,2.86)	2.52 (1.92,3.32)	2.96 (2.30,3.81)	3.39 (2.66,4.32)
Taperloc 133 / RingLoc	1,678	1.73 (1.20,2.48)	2.50 (1.86,3.37)	2.69 (2.01,3.58)	2.76 (2.07,3.66)	3.02 (2.27,4.02)
Taperloc 133 / G7	12,074	1.63 (1.42,1.88)	2.24 (1.98,2.54)	2.71 (2.39,3.07)	2.79 (2.46,3.17)	N/A
M/L Taper** / G7	4,750	1.72 (1.39,2.15)	2.50 (2.06,3.03)	2.73 (2.24,3.31)	2.87 (2.33,3.54)	N/A
M/L Taper** / Continuum	8,462	1.72 (1.46,2.02)	2.38 (2.07,2.73)	2.78 (2.44,3.16)	3.06 (2.70,3.47)	3.49 (3.06,3.98)
Taperloc 133 / Regenerex RingLoc+	498	1.61 (0.81,3.19)	2.21 (1.23,3.95)	2.81 (1.67,4.70)	2.81 (1.67,4.70)	2.81 (1.67,4.70)
Accolade TMZF / Trident	891	0.90 (0.45,1.79)	2.02 (1.28,3.19)	2.81 (1.90,4.12)	3.27 (2.28,4.67)	4.38 (3.08,6.22)
Echo Bi-Metric Microplasty / G7	2,097	1.85 (1.35,2.53)	2.49 (1.89,3.29)	2.85 (2.17,3.73)	3.51 (2.45,5.00)	N/A
Taperloc 133 Microplasty / Continuum	708	2.10 (1.25,3.53)	2.56 (1.56,4.19)	2.91 (1.78,4.74)	2.91 (1.78,4.74)	N/A
AML / Pinnacle	800	1.38 (0.77,2.47)	2.04 (1.26,3.32)	2.99 (1.97,4.51)	3.41 (2.28,5.07)	3.41 (2.28,5.07)
SR0M / Pinnacle	1,112	1.26 (0.75,2.12)	2.53 (1.76,3.65)	3.10 (2.23,4.31)	3.76 (2.77,5.10)	4.10 (3.03,5.53)
Anthology / Reflection 3	5,849	1.92 (1.59,2.31)	2.77 (2.36,3.26)	3.18 (2.71,3.72)	3.60 (3.06,4.22)	3.75 (3.18,4.41)
Trabecular Metal / Continuum	784	2.17 (1.35,3.46)	2.99 (1.99,4.46)	3.28 (2.23,4.82)	3.46 (2.36,5.05)	4.20 (2.90,6.08)
Secur-Fit / Trident II	834	2.85 (1.90,4.26)	3.22 (2.18,4.75)	3.54 (2.38,5.24)	N/A	N/A
Secur-Fit Max / Trident	3,059	2.12 (1.67,2.70)	2.89 (2.35,3.55)	3.58 (2.97,4.32)	4.01 (3.34,4.81)	4.35 (3.59,5.27)
Synergy / Reflection 3	1,385	2.34 (1.66,3.30)	3.36 (2.51,4.49)	3.68 (2.77,4.88)	4.38 (3.32,5.75)	4.57 (3.47,6.02)
M/L Taper** / Trabecular Metal	1,061	2.46 (1.68,3.60)	3.25 (2.33,4.52)	3.73 (2.73,5.10)	4.07 (2.98,5.53)	4.07 (2.98,5.53)
Echo Bi-Metric / G7	1,652	2.79 (2.10,3.71)	3.49 (2.70,4.50)	3.80 (2.96,4.85)	4.41 (3.12,6.22)	N/A
M/L Taper** / Trilogly	1,325	1.58 (1.04,2.42)	3.18 (2.36,4.28)	3.85 (2.93,5.05)	4.73 (3.68,6.08)	4.98 (3.88,6.37)
Secur-Fit / Trident	1,093	3.75 (2.78,5.06)	4.94 (3.81,6.41)	5.59 (4.38,7.13)	6.03 (4.76,7.63)	6.62 (5.22,8.39)
Taperloc 133 / Continuum	831	2.91 (1.96,4.32)	4.76 (3.48,6.48)	5.74 (4.31,7.62)	5.93 (4.47,7.86)	N/A

\* Number of patients that contribute to survival analysis used to compute cumulative percent revision

\*\* M/L Taper does not include M/L Taper Kinectiv

**Table 41. Summary of Cumulative Percent Revision Following Primary THA for Stem/Cup Combinations Having at Least 500 Cases, Sorted by Ten-year CPR**

Stem/cup combination	N*	1 year	3 years	5 years	7 years	10 years
Corail Coxa Vara / Pinnacle	820	0.13 (0.02,0.89)	0.70 (0.29,1.67)	0.87 (0.39,1.94)	0.87 (0.39,1.94)	0.87 (0.39,1.94)
Tri-Lock BPS / Pinnacle	4,175	0.68 (0.47,0.98)	1.30 (0.98,1.71)	1.64 (1.27,2.12)	1.75 (1.35,2.26)	2.22 (1.66,2.97)
Corail / Pinnacle	3,829	1.27 (0.95,1.68)	2.00 (1.59,2.53)	2.09 (1.66,2.63)	2.19 (1.74,2.76)	2.53 (1.97,3.24)
Avenir (Cementless) / Continuum	521	1.34 (0.64,2.80)	1.92 (1.04,3.54)	2.12 (1.18,3.79)	2.54 (1.48,4.34)	2.54 (1.48,4.34)
Summit / Pinnacle	7,876	1.52 (1.27,1.82)	2.11 (1.81,2.46)	2.30 (1.98,2.67)	2.44 (2.10,2.82)	2.77 (2.37,3.25)
Taperloc 133 / Regenerex RingLoc+	498	1.61 (0.81,3.19)	2.21 (1.23,3.95)	2.81 (1.67,4.70)	2.81 (1.67,4.70)	2.81 (1.67,4.70)
Taperloc 133 / RingLoc	1,678	1.73 (1.20,2.48)	2.50 (1.86,3.37)	2.69 (2.01,3.58)	2.76 (2.07,3.66)	3.02 (2.27,4.02)
Fitmore / Continuum	2,801	1.36 (0.99,1.86)	2.04 (1.57,2.63)	2.33 (1.83,2.96)	2.77 (2.21,3.46)	3.04 (2.42,3.82)
Secur-Fit Plus Max / Trident	1,982	1.72 (1.23,2.39)	2.12 (1.57,2.86)	2.52 (1.92,3.32)	2.96 (2.30,3.81)	3.39 (2.66,4.32)
AML / Pinnacle	800	1.38 (0.77,2.47)	2.04 (1.26,3.32)	2.99 (1.97,4.51)	3.41 (2.28,5.07)	3.41 (2.28,5.07)
M/L Taper** / Continuum	8,462	1.72 (1.46,2.02)	2.38 (2.07,2.73)	2.78 (2.44,3.16)	3.06 (2.70,3.47)	3.49 (3.06,3.98)
Accolade II / Trident	21,073	1.18 (1.04,1.33)	1.92 (1.74,2.11)	2.44 (2.24,2.66)	2.88 (2.66,3.13)	3.62 (3.25,4.03)
Anthology / Reflection 3	5,849	1.92 (1.59,2.31)	2.77 (2.36,3.26)	3.18 (2.71,3.72)	3.60 (3.06,4.22)	3.75 (3.18,4.41)
M/L Taper** / Trabecular Metal	1,061	2.46 (1.68,3.60)	3.25 (2.33,4.52)	3.73 (2.73,5.10)	4.07 (2.98,5.53)	4.07 (2.98,5.53)
SPROM / Pinnacle	1,112	1.26 (0.75,2.12)	2.53 (1.76,3.65)	3.10 (2.23,4.31)	3.76 (2.77,5.10)	4.10 (3.03,5.53)
Trabecular Metal / Continuum	784	2.17 (1.35,3.46)	2.99 (1.99,4.46)	3.28 (2.23,4.82)	3.46 (2.36,5.05)	4.20 (2.90,6.08)
Secur-Fit Max / Trident	3,059	2.12 (1.67,2.70)	2.89 (2.35,3.55)	3.58 (2.97,4.32)	4.01 (3.34,4.81)	4.35 (3.59,5.27)
Accolade TMZF / Trident	891	0.90 (0.45,1.79)	2.02 (1.28,3.19)	2.81 (1.90,4.12)	3.27 (2.28,4.67)	4.38 (3.08,6.22)
Synergy / Reflection 3	1,385	2.34 (1.66,3.30)	3.36 (2.51,4.49)	3.68 (2.77,4.88)	4.38 (3.32,5.75)	4.57 (3.47,6.02)
M/L Taper** / Trilogy	1,325	1.58 (1.04,2.42)	3.18 (2.36,4.28)	3.85 (2.93,5.05)	4.73 (3.68,6.08)	4.98 (3.88,6.37)
Secur-Fit / Trident	1,093	3.75 (2.78,5.06)	4.94 (3.81,6.41)	5.59 (4.38,7.13)	6.03 (4.76,7.63)	6.62 (5.22,8.39)

\* Number of patients that contribute to survival analysis used to compute cumulative percent revision

\*\* M/L Taper does not include M/L Taper Kinectiv

## 2.2.7 Revision Risk by Stem Implant Summary

**Table 42. Summary of Cumulative Percent Revision Following Primary THA for Stems Having at Least 500 Cases, Sorted Alphabetically**

Stem	N*	1 year	3 years	5 years	7 years	10 years
Accolade II	41,072	1.33 (1.23,1.45)	2.01 (1.88,2.16)	2.52 (2.35,2.69)	2.97 (2.77,3.17)	3.66 (3.33,4.04)
Accolade C	1,132	0.66 (0.31,1.37)	1.08 (0.57,2.02)	1.60 (0.86,2.97)	3.56 (1.50,8.34)	3.56 (1.50,8.34)
Accolade TMZF	893	0.90 (0.45,1.78)	2.02 (1.27,3.18)	2.80 (1.90,4.12)	3.26 (2.28,4.66)	4.37 (3.08,6.20)
Actis DuoFix	8,047	0.83 (0.65,1.07)	1.13 (0.90,1.43)	1.20 (0.94,1.52)	N/A	N/A
AML	803	1.37 (0.76,2.47)	2.04 (1.25,3.30)	2.97 (1.96,4.49)	3.39 (2.27,5.05)	3.39 (2.27,5.05)
Anthology	6,483	1.79 (1.49,2.15)	2.63 (2.25,3.08)	3.07 (2.64,3.57)	3.46 (2.97,4.04)	3.60 (3.08,4.20)
Avenir (Cemented)	1,470	1.04 (0.62,1.76)	1.27 (0.77,2.09)	1.94 (1.09,3.44)	1.94 (1.09,3.44)	N/A
Avenir (Cementless)	1,306	1.71 (1.13,2.59)	2.07 (1.41,3.03)	2.19 (1.50,3.18)	2.51 (1.73,3.64)	2.51 (1.73,3.64)
Avenir Complete	5,491	1.05 (0.79,1.39)	1.34 (0.98,1.83)	N/A	N/A	N/A
Corail	3,845	1.29 (0.97,1.71)	2.02 (1.60,2.55)	2.11 (1.68,2.65)	2.21 (1.76,2.77)	2.54 (1.99,3.26)
Corail Coxa Vara	828	0.13 (0.02,0.89)	0.85 (0.38,1.89)	1.02 (0.49,2.14)	1.02 (0.49,2.14)	1.02 (0.49,2.14)
Echelon	509	2.75 (1.64,4.60)	3.99 (2.59,6.13)	4.24 (2.79,6.44)	4.81 (3.21,7.18)	5.69 (3.61,8.90)
Echo Bi-Metric	1,991	2.67 (2.05,3.48)	3.35 (2.64,4.24)	3.65 (2.90,4.58)	3.95 (3.11,5.00)	4.63 (3.46,6.18)
Echo Bi-Metric Microplasty	2,109	1.84 (1.34,2.51)	2.48 (1.88,3.27)	2.83 (2.16,3.71)	3.48 (2.44,4.96)	N/A
Fitmore	6,171	1.33 (1.07,1.65)	1.94 (1.62,2.32)	2.20 (1.85,2.61)	2.55 (2.16,3.02)	2.94 (2.44,3.54)
Insignia	3,171	0.65 (0.40,1.04)	N/A	N/A	N/A	N/A
Integral X	594	2.70 (1.66,4.36)	3.24 (2.08,5.03)	3.65 (2.39,5.56)	3.65 (2.39,5.56)	5.04 (3.01,8.40)
M/L Taper**	16,464	1.74 (1.55,1.95)	2.54 (2.30,2.80)	2.97 (2.71,3.26)	3.32 (3.03,3.64)	3.70 (3.36,4.08)
M/L Taper Kinectiv	951	2.13 (1.38,3.28)	3.50 (2.49,4.92)	4.18 (3.04,5.73)	4.34 (3.17,5.93)	5.05 (3.59,7.07)
Polarstem	3,294	1.44 (1.08,1.92)	1.83 (1.41,2.39)	2.41 (1.86,3.12)	2.56 (1.95,3.35)	N/A
ProFemur Gladiator	723	0.88 (0.40,1.96)	1.17 (0.54,2.51)	1.17 (0.54,2.51)	N/A	N/A
Restoration Modular	535	4.62 (3.12,6.82)	6.26 (4.44,8.81)	6.54 (4.66,9.15)	7.55 (5.34,10.62)	7.55 (5.34,10.62)
Secur-Fit	1,933	3.37 (2.65,4.29)	4.29 (3.45,5.32)	4.92 (3.99,6.04)	5.35 (4.35,6.57)	5.94 (4.78,7.37)
Secur-Fit Max	3,263	2.11 (1.67,2.67)	2.84 (2.32,3.48)	3.55 (2.95,4.27)	3.98 (3.32,4.76)	4.31 (3.57,5.21)
Secur-Fit Plus Max	2,125	1.89 (1.39,2.56)	2.27 (1.71,3.00)	2.66 (2.06,3.45)	3.10 (2.43,3.94)	3.53 (2.79,4.45)
SRM	1,159	1.30 (0.78,2.14)	2.69 (1.90,3.81)	3.33 (2.43,4.55)	3.97 (2.96,5.30)	4.29 (3.21,5.71)
Summit	7,940	1.53 (1.28,1.83)	2.16 (1.86,2.51)	2.35 (2.03,2.72)	2.49 (2.15,2.87)	2.85 (2.44,3.34)
Synergy	1,616	2.26 (1.63,3.12)	3.25 (2.47,4.27)	3.60 (2.77,4.69)	4.27 (3.31,5.49)	4.42 (3.42,5.69)
Taperloc	518	1.54 (0.78,3.06)	2.12 (1.18,3.80)	2.51 (1.47,4.28)	2.74 (1.63,4.59)	2.74 (1.63,4.59)
Taperloc 133	15,877	1.70 (1.51,1.92)	2.42 (2.18,2.68)	2.88 (2.60,3.18)	2.97 (2.69,3.29)	3.28 (2.89,3.71)
Taperloc 133 Microplasty	5,197	1.32 (1.04,1.68)	1.60 (1.29,2.00)	1.99 (1.62,2.45)	2.13 (1.73,2.62)	5.10 (1.84, 13.73)
Trabecular Metal	1,393	1.81 (1.23,2.67)	2.47 (1.76,3.45)	2.65 (1.90,3.67)	2.77 (2.00,3.84)	3.42 (2.42,4.81)
Tri-Lock BPS	4,765	0.75 (0.54,1.04)	1.37 (1.07,1.76)	1.67 (1.32,2.11)	1.82 (1.44,2.31)	2.20 (1.70,2.85)
Versys Advocate	800	1.72 (1.00,2.95)	1.72 (1.00,2.95)	2.00 (1.17,3.42)	2.00 (1.17,3.42)	2.00 (1.17,3.42)
Versys Heritage	610	1.18 (0.56,2.46)	1.61 (0.84,3.08)	1.89 (1.01,3.54)	1.89 (1.01,3.54)	1.89 (1.01,3.54)
Wagner Cone	725	1.67 (0.95,2.92)	3.55 (2.39,5.26)	4.16 (2.86,6.03)	5.13 (3.55,7.40)	6.09 (3.94,9.37)

\* Number of patients that contribute to survival analysis used to compute cumulative percent revision

\*\* M/L Taper does not include M/L Taper Kinectiv



**Table 43. Summary of Cumulative Percent Revision Following Primary THA for Stems Having at Least 500 Cases, Sorted by Five-year CPR**

Stem	N*	1 year	3 years	5 years	7 years	10 years
Corail Coxa Vara	828	0.13 (0.02,0.89)	0.85 (0.38,1.89)	1.02 (0.49,2.14)	1.02 (0.49,2.14)	1.02 (0.49,2.14)
Actis DuoFix	8,047	0.83 (0.65,1.07)	1.13 (0.90,1.43)	1.20 (0.94,1.52)	N/A	N/A
Accolade C	1,132	0.66 (0.31,1.37)	1.08 (0.57,2.02)	1.60 (0.86,2.97)	3.56 (1.50,8.34)	3.56 (1.50,8.34)
Tri-Lock BPS	4,765	0.75 (0.54,1.04)	1.37 (1.07,1.76)	1.67 (1.32,2.11)	1.82 (1.44,2.31)	2.20 (1.70,2.85)
Versys Heritage	610	1.18 (0.56,2.46)	1.61 (0.84,3.08)	1.89 (1.01,3.54)	1.89 (1.01,3.54)	1.89 (1.01,3.54)
Avenir (Cemented)	1,470	1.04 (0.62,1.76)	1.27 (0.77,2.09)	1.94 (1.09,3.44)	1.94 (1.09,3.44)	N/A
Taperloc 133 Microplasty	5,197	1.32 (1.04,1.68)	1.60 (1.29,2.00)	1.99 (1.62,2.45)	2.13 (1.73,2.62)	5.10 (1.84, 13.73)
Versys Advocate	800	1.72 (1.00,2.95)	1.72 (1.00,2.95)	2.00 (1.17,3.42)	2.00 (1.17,3.42)	2.00 (1.17,3.42)
Corail	3,845	1.29 (0.97,1.71)	2.02 (1.60,2.55)	2.11 (1.68,2.65)	2.21 (1.76,2.77)	2.54 (1.99,3.26)
Avenir (Cementless)	1,306	1.71 (1.13,2.59)	2.07 (1.41,3.03)	2.19 (1.50,3.18)	2.51 (1.73,3.64)	2.51 (1.73,3.64)
Fitmore	6,171	1.33 (1.07,1.65)	1.94 (1.62,2.32)	2.20 (1.85,2.61)	2.55 (2.16,3.02)	2.94 (2.44,3.54)
Summit	7,940	1.53 (1.28,1.83)	2.16 (1.86,2.51)	2.35 (2.03,2.72)	2.49 (2.15,2.87)	2.85 (2.44,3.34)
Polarstem	3,294	1.44 (1.08,1.92)	1.83 (1.41,2.39)	2.41 (1.86,3.12)	2.56 (1.95,3.35)	N/A
Taperloc	518	1.54 (0.78,3.06)	2.12 (1.18,3.80)	2.51 (1.47,4.28)	2.74 (1.63,4.59)	2.74 (1.63,4.59)
Accolade II	41,072	1.33 (1.23,1.45)	2.01 (1.88,2.16)	2.52 (2.35,2.69)	2.97 (2.77,3.17)	3.66 (3.33,4.04)
Trabecular Metal	1,393	1.81 (1.23,2.67)	2.47 (1.76,3.45)	2.65 (1.90,3.67)	2.77 (2.00,3.84)	3.42 (2.42,4.81)
Secur-Fit Plus Max	2,125	1.89 (1.39,2.56)	2.27 (1.71,3.00)	2.66 (2.06,3.45)	3.10 (2.43,3.94)	3.53 (2.79,4.45)
Accolade TMZF	893	0.90 (0.45,1.78)	2.02 (1.27,3.18)	2.80 (1.90,4.12)	3.26 (2.28,4.66)	4.37 (3.08,6.20)
Echo Bi-Metric Microplasty	2,109	1.84 (1.34,2.51)	2.48 (1.88,3.27)	2.83 (2.16,3.71)	3.48 (2.44,4.96)	N/A
Taperloc 133	15,877	1.70 (1.51,1.92)	2.42 (2.18,2.68)	2.88 (2.60,3.18)	2.97 (2.69,3.29)	3.28 (2.89,3.71)
AML	803	1.37 (0.76,2.47)	2.04 (1.25,3.30)	2.97 (1.96,4.49)	3.39 (2.27,5.05)	3.39 (2.27,5.05)
M/L Taper**	16,464	1.74 (1.55,1.95)	2.54 (2.30,2.80)	2.97 (2.71,3.26)	3.32 (3.03,3.64)	3.70 (3.36,4.08)
Anthology	6,483	1.79 (1.49,2.15)	2.63 (2.25,3.08)	3.07 (2.64,3.57)	3.46 (2.97,4.04)	3.60 (3.08,4.20)
SROM	1,159	1.30 (0.78,2.14)	2.69 (1.90,3.81)	3.33 (2.43,4.55)	3.97 (2.96,5.30)	4.29 (3.21,5.71)
Secur-Fit Max	3,263	2.11 (1.67,2.67)	2.84 (2.32,3.48)	3.55 (2.95,4.27)	3.98 (3.32,4.76)	4.31 (3.57,5.21)
Synergy	1,616	2.26 (1.63,3.12)	3.25 (2.47,4.27)	3.60 (2.77,4.69)	4.27 (3.31,5.49)	4.42 (3.42,5.69)
Integral X	594	2.70 (1.66,4.36)	3.24 (2.08,5.03)	3.65 (2.39,5.56)	3.65 (2.39,5.56)	5.04 (3.01,8.40)
Echo Bi-Metric	1,991	2.67 (2.05,3.48)	3.35 (2.64,4.24)	3.65 (2.90,4.58)	3.95 (3.11,5.00)	4.63 (3.46,6.18)
Wagner Cone	725	1.67 (0.95,2.92)	3.55 (2.39,5.26)	4.16 (2.86,6.03)	5.13 (3.55,7.40)	6.09 (3.94,9.37)
M/L Taper Kinectiv	951	2.13 (1.38,3.28)	3.50 (2.49,4.92)	4.18 (3.04,5.73)	4.34 (3.17,5.93)	5.05 (3.59,7.07)
Echelon	509	2.75 (1.64,4.60)	3.99 (2.59,6.13)	4.24 (2.79,6.44)	4.81 (3.21,7.18)	5.69 (3.61,8.90)
Secur-Fit	1,933	3.37 (2.65,4.29)	4.29 (3.45,5.32)	4.92 (3.99,6.04)	5.35 (4.35,6.57)	5.94 (4.78,7.37)
Restoration Modular	535	4.62 (3.12,6.82)	6.26 (4.44,8.81)	6.54 (4.66,9.15)	7.55 (5.34,10.62)	7.55 (5.34,10.62)

\* Number of patients that contribute to survival analysis used to compute cumulative percent revision

\*\* M/L Taper does not include M/L Taper Kinectiv

**Table 44. Summary of Cumulative Percent Revision Following Primary THA for Stems having at Least 500 Cases, Sorted by Ten-year CPR**

Stem	N*	1 year	3 years	5 years	7 years	10 years
Corail Coxa Vara	828	0.13 (0.02,0.89)	0.85 (0.38,1.89)	1.02 (0.49,2.14)	1.02 (0.49,2.14)	1.02 (0.49,2.14)
Versys Heritage	610	1.18 (0.56,2.46)	1.61 (0.84,3.08)	1.89 (1.01,3.54)	1.89 (1.01,3.54)	1.89 (1.01,3.54)
Versys Advocate	800	1.72 (1.00,2.95)	1.72 (1.00,2.95)	2.00 (1.17,3.42)	2.00 (1.17,3.42)	2.00 (1.17,3.42)
Tri-Lock BPS	4,765	0.75 (0.54,1.04)	1.37 (1.07,1.76)	1.67 (1.32,2.11)	1.82 (1.44,2.31)	2.20 (1.70,2.85)
Avenir (Cementless)	1,306	1.71 (1.13,2.59)	2.07 (1.41,3.03)	2.19 (1.50,3.18)	2.51 (1.73,3.64)	2.51 (1.73,3.64)
Corail	3,845	1.29 (0.97,1.71)	2.02 (1.60,2.55)	2.11 (1.68,2.65)	2.21 (1.76,2.77)	2.54 (1.99,3.26)
Taperloc	518	1.54 (0.78,3.06)	2.12 (1.18,3.80)	2.51 (1.47,4.28)	2.74 (1.63,4.59)	2.74 (1.63,4.59)
Summit	7,940	1.53 (1.28,1.83)	2.16 (1.86,2.51)	2.35 (2.03,2.72)	2.49 (2.15,2.87)	2.85 (2.44,3.34)
Fitmore	6,171	1.33 (1.07,1.65)	1.94 (1.62,2.32)	2.20 (1.85,2.61)	2.55 (2.16,3.02)	2.94 (2.44,3.54)
Taperloc 133	15,877	1.70 (1.51,1.92)	2.42 (2.18,2.68)	2.88 (2.60,3.18)	2.97 (2.69,3.29)	3.28 (2.89,3.71)
AML	803	1.37 (0.76,2.47)	2.04 (1.25,3.30)	2.97 (1.96,4.49)	3.39 (2.27,5.05)	3.39 (2.27,5.05)
Trabecular Metal	1,393	1.81 (1.23,2.67)	2.47 (1.76,3.45)	2.65 (1.90,3.67)	2.77 (2.00,3.84)	3.42 (2.42,4.81)
Secur-Fit Plus Max	2,125	1.89 (1.39,2.56)	2.27 (1.71,3.00)	2.66 (2.06,3.45)	3.10 (2.43,3.94)	3.53 (2.79,4.45)
Accolade C	1,132	0.66 (0.31,1.37)	1.08 (0.57,2.02)	1.60 (0.86,2.97)	3.56 (1.50,8.34)	3.56 (1.50,8.34)
Anthology	6,483	1.79 (1.49,2.15)	2.63 (2.25,3.08)	3.07 (2.64,3.57)	3.46 (2.97,4.04)	3.60 (3.08,4.20)
Accolade II	41,072	1.33 (1.23,1.45)	2.01 (1.88,2.16)	2.52 (2.35,2.69)	2.97 (2.77,3.17)	3.66 (3.33,4.04)
M/L Taper**	16,464	1.74 (1.55,1.95)	2.54 (2.30,2.80)	2.97 (2.71,3.26)	3.32 (3.03,3.64)	3.70 (3.36,4.08)
SROM	1,159	1.30 (0.78,2.14)	2.69 (1.90,3.81)	3.33 (2.43,4.55)	3.97 (2.96,5.30)	4.29 (3.21,5.71)
Secur-Fit Max	3,263	2.11 (1.67,2.67)	2.84 (2.32,3.48)	3.55 (2.95,4.27)	3.98 (3.32,4.76)	4.31 (3.57,5.21)
Accolade TMZF	893	0.90 (0.45,1.78)	2.02 (1.27,3.18)	2.80 (1.90,4.12)	3.26 (2.28,4.66)	4.37 (3.08,6.20)
Synergy	1,616	2.26 (1.63,3.12)	3.25 (2.47,4.27)	3.60 (2.77,4.69)	4.27 (3.31,5.49)	4.42 (3.42,5.69)
Echo Bi-Metric	1,991	2.67 (2.05,3.48)	3.35 (2.64,4.24)	3.65 (2.90,4.58)	3.95 (3.11,5.00)	4.63 (3.46,6.18)
Integral X	594	2.70 (1.66,4.36)	3.24 (2.08,5.03)	3.65 (2.39,5.56)	3.65 (2.39,5.56)	5.04 (3.01,8.40)
M/L Taper Kinectiv	951	2.13 (1.38,3.28)	3.50 (2.49,4.92)	4.18 (3.04,5.73)	4.34 (3.17,5.93)	5.05 (3.59,7.07)
Taperloc 133 Microplasty	5,197	1.32 (1.04,1.68)	1.60 (1.29,2.00)	1.99 (1.62,2.45)	2.13 (1.73,2.62)	5.10 (1.84, 13.73)
Echelon	509	2.75 (1.64,4.60)	3.99 (2.59,6.13)	4.24 (2.79,6.44)	4.81 (3.21,7.18)	5.69 (3.61,8.90)
Secur-Fit	1,933	3.37 (2.65,4.29)	4.29 (3.45,5.32)	4.92 (3.99,6.04)	5.35 (4.35,6.57)	5.94 (4.78,7.37)
Wagner Cone	725	1.67 (0.95,2.92)	3.55 (2.39,5.26)	4.16 (2.86,6.03)	5.13 (3.55,7.40)	6.09 (3.94,9.37)
Restoration Modular	535	4.62 (3.12,6.82)	6.26 (4.44,8.81)	6.54 (4.66,9.15)	7.55 ( 5.34,10.62)	7.55 ( 5.34,10.62)

\* Number of patients that contribute to survival analysis used to compute cumulative percent revision

\*\* M/L Taper does not include M/L Taper Kinectiv

## 2.2.8 Revision Risk by Cup Implant Summary

**Table 45. Summary of Cumulative Percent Revision Following Primary THA for Cups Having at Least 500 Cases, Sorted Alphabetically**

Cup	N*	1 year	3 years	5 years	7 years	10 years
BiMobile	603	0.75 (0.28,1.99)	1.01 (0.42,2.44)	1.01 (0.42,2.44)	N/A	N/A
Continuum	16,412	1.82 (1.63,2.04)	2.61 (2.37,2.87)	3.05 (2.79,3.33)	3.35 (3.07,3.65)	3.76 (3.43,4.11)
Converge	574	0.87 (0.36,2.08)	1.39 (0.70,2.77)	1.57 (0.82,2.99)	1.74 (0.94,3.21)	1.99 (1.10,3.59)
G7	38,944	1.60 (1.47,1.73)	2.15 (2.00,2.31)	2.50 (2.32,2.69)	2.69 (2.48,2.91)	N/A
Mpact	514	2.14 (1.19,3.83)	2.73 (1.62,4.56)	2.73 (1.62,4.56)	2.73 (1.62,4.56)	N/A
Pinnacle	27,295	1.07 (0.96,1.21)	1.67 (1.52,1.84)	1.93 (1.75,2.12)	2.11 (1.92,2.32)	2.46 (2.20,2.74)
PolarCup	610	0.83 (0.35,1.98)	1.69 (0.91,3.12)	2.10 (1.19,3.67)	2.40 (1.39,4.14)	2.40 (1.39,4.14)
Procotyl Prime	829	1.49 (0.85,2.61)	1.64 (0.95,2.81)	2.35 (1.34,4.11)	N/A	N/A
Reflection	549	1.64 (0.86,3.13)	2.55 (1.52,4.27)	2.92 (1.80,4.72)	3.68 (2.39,5.65)	4.12 (2.66,6.35)
Reflection 3	11,831	1.88 (1.64,2.14)	2.72 (2.42,3.04)	3.14 (2.81,3.51)	3.52 (3.14,3.94)	3.71 (3.29,4.18)
Regenerex RingLoc+	1,014	1.68 (1.05,2.68)	2.17 (1.43,3.28)	2.56 (1.75,3.74)	2.66 (1.83,3.86)	2.91 (2.03,4.17)
Restoration ADM	526	0.57 (0.18,1.76)	1.33 (0.64,2.77)	2.12 (1.18,3.80)	2.61 (1.52,4.47)	2.90 (1.72,4.88)
RingLoc	2,614	1.72 (1.29,2.30)	2.41 (1.89,3.08)	2.61 (2.06,3.29)	2.70 (2.14,3.41)	3.43 (2.60,4.51)
Trabecular Metal	2,026	2.13 (1.59,2.87)	3.26 (2.57,4.14)	3.95 (3.17,4.92)	4.37 (3.54,5.40)	4.93 (3.96,6.14)
Trident	30,778	1.44 (1.31,1.58)	2.20 (2.04,2.37)	2.74 (2.56,2.93)	3.20 (3.00,3.41)	3.83 (3.56,4.13)
Trident II	25,379	1.48 (1.34,1.64)	2.08 (1.88,2.29)	2.46 (2.20,2.76)	2.86 (2.35,3.48)	N/A
Trilogy	1,602	1.81 (1.26,2.59)	3.25 (2.49,4.25)	3.93 (3.08,5.01)	4.73 (3.76,5.92)	4.92 (3.93,6.16)

\* Number of patients that contribute to survival analysis used to compute cumulative percent revision.

**Table 46. Summary of Cumulative Percent Revision Following Primary THA for Cups Having at Least 500 Cases, Sorted by Five-year CPR**

Cup	N*	1 year	3 years	5 years	7 years	10 years
BiMobile	603	0.75 (0.28,1.99)	1.01 (0.42,2.44)	1.01 (0.42,2.44)	N/A	N/A
Converge	574	0.87 (0.36,2.08)	1.39 (0.70,2.77)	1.57 (0.82,2.99)	1.74 (0.94,3.21)	1.99 (1.10,3.59)
Pinnacle	27,295	1.07 (0.96,1.21)	1.67 (1.52,1.84)	1.93 (1.75,2.12)	2.11 (1.92,2.32)	2.46 (2.20,2.74)
PolarCup	610	0.83 (0.35,1.98)	1.69 (0.91,3.12)	2.10 (1.19,3.67)	2.40 (1.39,4.14)	2.40 (1.39,4.14)
Restoration ADM	526	0.57 (0.18,1.76)	1.33 (0.64,2.77)	2.12 (1.18,3.80)	2.61 (1.52,4.47)	2.90 (1.72,4.88)
Procotyl Prime	829	1.49 (0.85,2.61)	1.64 (0.95,2.81)	2.35 (1.34,4.11)	N/A	N/A
Trident II	25,379	1.48 (1.34,1.64)	2.08 (1.88,2.29)	2.46 (2.20,2.76)	2.86 (2.35,3.48)	N/A
G7	38,944	1.60 (1.47,1.73)	2.15 (2.00,2.31)	2.50 (2.32,2.69)	2.69 (2.48,2.91)	N/A
Regenerex RingLoc+	1,014	1.68 (1.05,2.68)	2.17 (1.43,3.28)	2.56 (1.75,3.74)	2.66 (1.83,3.86)	2.91 (2.03,4.17)
RingLoc	2,614	1.72 (1.29,2.30)	2.41 (1.89,3.08)	2.61 (2.06,3.29)	2.70 (2.14,3.41)	3.43 (2.60,4.51)
Mpact	514	2.14 (1.19,3.83)	2.73 (1.62,4.56)	2.73 (1.62,4.56)	2.73 (1.62,4.56)	N/A
Trident	30,778	1.44 (1.31,1.58)	2.20 (2.04,2.37)	2.74 (2.56,2.93)	3.20 (3.00,3.41)	3.83 (3.56,4.13)
Reflection	549	1.64 (0.86,3.13)	2.55 (1.52,4.27)	2.92 (1.80,4.72)	3.68 (2.39,5.65)	4.12 (2.66,6.35)
Continuum	16,412	1.82 (1.63,2.04)	2.61 (2.37,2.87)	3.05 (2.79,3.33)	3.35 (3.07,3.65)	3.76 (3.43,4.11)
Reflection 3	11,831	1.88 (1.64,2.14)	2.72 (2.42,3.04)	3.14 (2.81,3.51)	3.52 (3.14,3.94)	3.71 (3.29,4.18)
Trilogy	1,602	1.81 (1.26,2.59)	3.25 (2.49,4.25)	3.93 (3.08,5.01)	4.73 (3.76,5.92)	4.92 (3.93,6.16)
Trabecular Metal	2,026	2.13 (1.59,2.87)	3.26 (2.57,4.14)	3.95 (3.17,4.92)	4.37 (3.54,5.40)	4.93 (3.96,6.14)

\* Number of patients that contribute to survival analysis used to compute cumulative percent revision

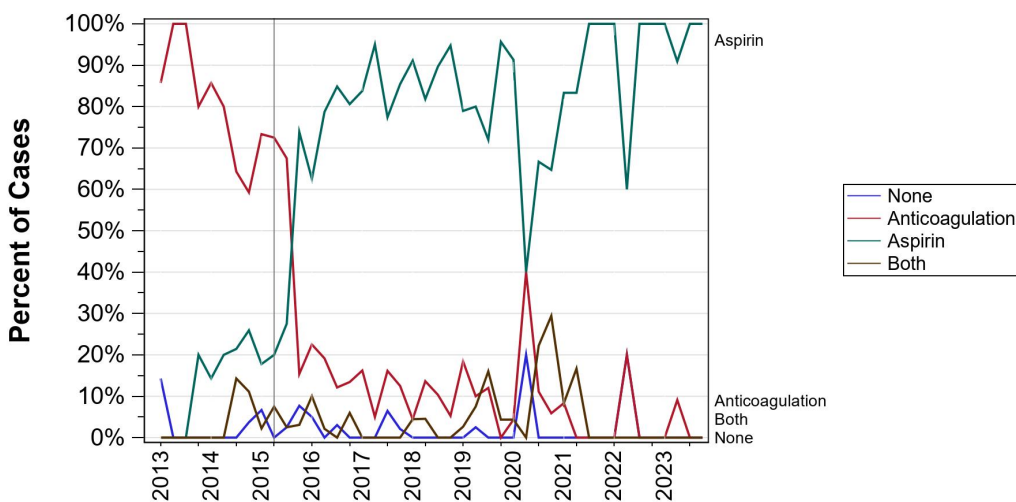
**Table 47. Summary of Cumulative Percent Revision Following Primary THA for Cups Having at Least 500 Cases, Sorted by Ten-year CPR**

Cup	N*	1 year	3 years	5 years	7 years	10 years
Converge	574	0.87 (0.36,2.08)	1.39 (0.70,2.77)	1.57 (0.82,2.99)	1.74 (0.94,3.21)	1.99 (1.10,3.59)
PolarCup	610	0.83 (0.35,1.98)	1.69 (0.91,3.12)	2.10 (1.19,3.67)	2.40 (1.39,4.14)	2.40 (1.39,4.14)
Pinnacle	27,295	1.07 (0.96,1.21)	1.67 (1.52,1.84)	1.93 (1.75,2.12)	2.11 (1.92,2.32)	2.46 (2.20,2.74)
Restoration ADM	526	0.57 (0.18,1.76)	1.33 (0.64,2.77)	2.12 (1.18,3.80)	2.61 (1.52,4.47)	2.90 (1.72,4.88)
Regenerex RingLoc+	1,014	1.68 (1.05,2.68)	2.17 (1.43,3.28)	2.56 (1.75,3.74)	2.66 (1.83,3.86)	2.91 (2.03,4.17)
RingLoc	2,614	1.72 (1.29,2.30)	2.41 (1.89,3.08)	2.61 (2.06,3.29)	2.70 (2.14,3.41)	3.43 (2.60,4.51)
Reflection 3	11,831	1.88 (1.64,2.14)	2.72 (2.42,3.04)	3.14 (2.81,3.51)	3.52 (3.14,3.94)	3.71 (3.29,4.18)
Continuum	16,412	1.82 (1.63,2.04)	2.61 (2.37,2.87)	3.05 (2.79,3.33)	3.35 (3.07,3.65)	3.76 (3.43,4.11)
Trident	30,778	1.44 (1.31,1.58)	2.20 (2.04,2.37)	2.74 (2.56,2.93)	3.20 (3.00,3.41)	3.83 (3.56,4.13)
Reflection	549	1.64 (0.86,3.13)	2.55 (1.52,4.27)	2.92 (1.80,4.72)	3.68 (2.39,5.65)	4.12 (2.66,6.35)
Trilogy	1,602	1.81 (1.26,2.59)	3.25 (2.49,4.25)	3.93 (3.08,5.01)	4.73 (3.76,5.92)	4.92 (3.93,6.16)
Trabecular Metal	2,026	2.13 (1.59,2.87)	3.26 (2.57,4.14)	3.95 (3.17,4.92)	4.37 (3.54,5.40)	4.93 (3.96,6.14)

\* Number of patients that contribute to survival analysis used to compute cumulative percent revision

## 2.3 Resurfacing THA

### 2.3.1 Descriptive Statistics



**Figure 35. Percent of Primary Resurfacing THA patients (first case) by Thrombosis Prophylaxis**

### 2.3.2 Reasons for Revision

The reason for revision is of central importance to quality improvement because it helps focus attention on specific causes that may be addressed. Therefore, the data are presented in two formats below: tabular and Pareto chart. The tabular format is consistent with how other arthroplasty registries report the cause of revision. The Pareto chart figure presents the same data in a format commonly used in quality improvement. The Pareto chart sorts the reasons for revision by frequency (bar chart on bottom, from left to right) and presents a cumulative percent using a line graph above.

In addition to an overall summary of the reasons for revision, tables showing reason for revision for the first, second, and third year post-operatively are provided because the reasons change over this time horizon. It is important to note that the time window for the cases reported in the reasons for revision tables and figures differs from the time window used for other figures because the reason for revision was added to the database on 1/1/2015. While these data capture revisions for

primaries performed back to 2/15/2012, only revisions occurring on or after 1/1/2015 are included in the reasons for revision figure and tables.

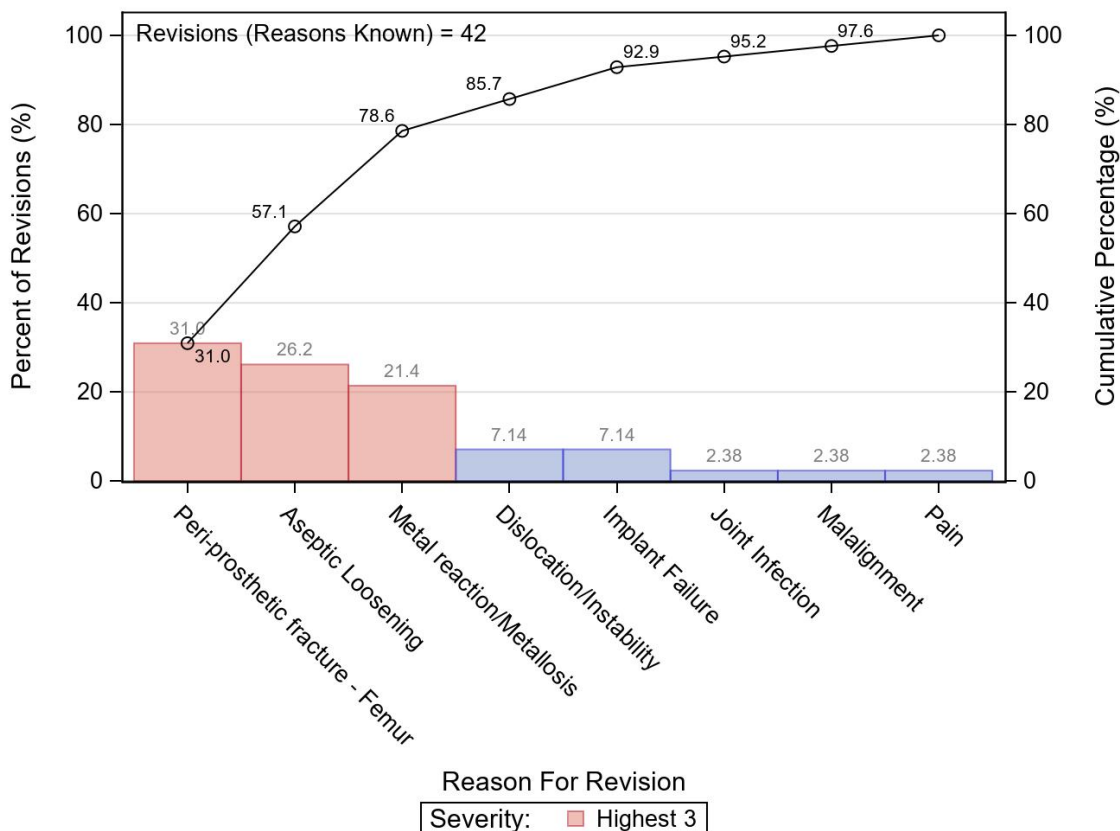


Figure 36. Reasons for First Revision Following Primary Resurfacing THA (Pareto Chart)

Table 48. Reasons for First Revision Following Primary Resurfacing THA

Rank	Reason for Revision	N	Percent
1	Peri-prosthetic fracture - Femur	13	31.0
2	Aseptic Loosening	11	26.2
3	Metal Reaction/Metallosis	9	21.4
4	Dislocation/Instability	3	7.1
5	Implant Failure	3	7.1
6	Joint Infection	1	2.4
7	Pain	1	2.4
8	Malalignment	1	2.4

**Table 49. Reasons for First Revision Following Primary Resurfacing THA in First Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Peri-prosthetic fracture - Femur	11	68.8
2	Dislocation/Instability	2	12.5
3	Implant Failure	2	12.5
4	Aseptic Loosening	1	6.2

**Table 50. Reasons for First Revision Following Primary Resurfacing THA in Second Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Metal Reaction/Metallosis	2	50.0
2	Implant Failure	1	25.0
3	Malalignment	1	25.0

**Table 51. Reasons for First Revision Following Primary Resurfacing THA in Third Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Aseptic Loosening	1	20.0
2	Joint Infection	1	20.0
3	Peri-prosthetic fracture - Femur	1	20.0
4	Metal Reaction/Metallosis	1	20.0
5	Pain	1	20.0

### 2.3.3 Most Commonly Used Implants

The following three tables provide utilization data of implants used in primary resurfacing THA

**Table 52. Most Commonly Used Femoral Components in Primary Resurfacing THA**

Rank	Stem	N	Percent
1	BHR	1,259	100.0

**Table 53. Most Commonly Used Acetabular Components in Primary Resurfacing THA**

Rank	Cup	N	Percent
1	BHR	1,259	100.0

**Table 54. Most Commonly Used Femoral/Acetabular Component Combinations in Primary Resurfacing THA**

Rank	Stem/cup combination	N	Percent
1	BHR / BHR	1,259	100.0

### 2.3.4 Revision Risk by Implant Summary

**Table 55. Summary of Cumulative Percent Revision Following Primary THA for Stem/Cup Combinations Having at Least 500 Cases**

Implant	N*	1 year	3 years	5 years	7 years	10 years
BHR / BHR	1,257	1.28 (0.79,2.08)	2.14 (1.46,3.13)	2.88 (2.07,4.01)	3.57 (2.60,4.89)	5.45 (3.45,8.55)

\* Number of patients that contribute to survival analysis used to compute cumulative percent revision

# Chapter 3

## Knee Overview

The data reported in this chapter is based on primary knee cases performed from 2/15/2012 to 12/31/2023.

### 3.1 Descriptive Statistics of All Knee Arthroplasty Cases

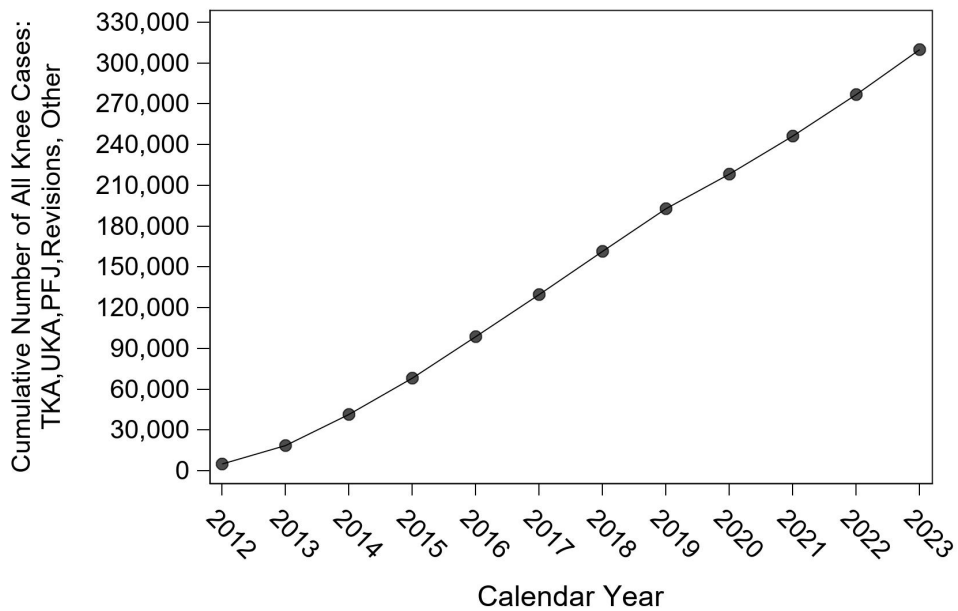
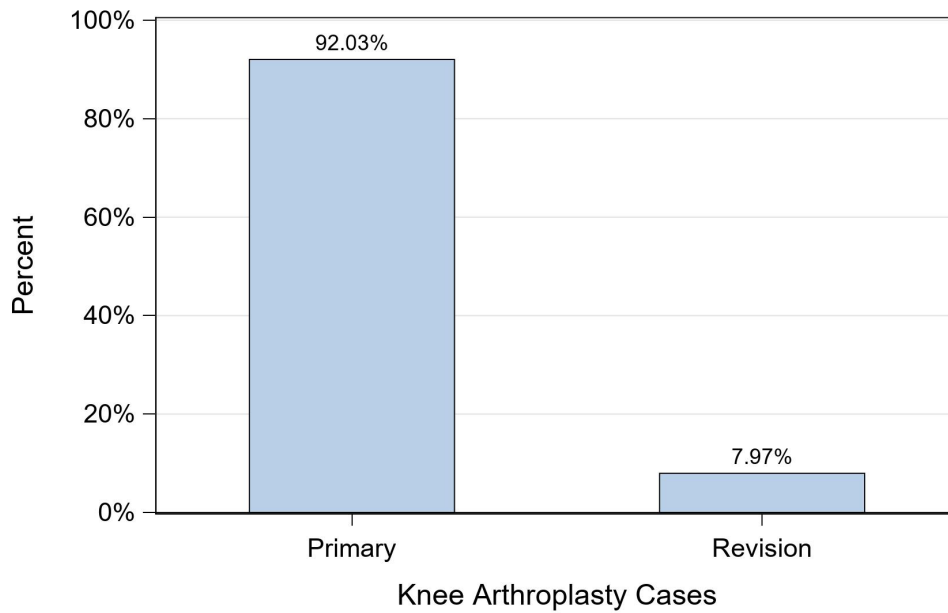


Figure 37. All Knee Cases Over Time (in 208,539 Patients)



**Table 56. All Knee Cases Over Time (Numerical Values)**

Year	Annual cases	Cumulative cases
2012	4,994	4,994
2013	13,778	18,772
2014	22,701	41,473
2015	26,805	68,278
2016	30,562	98,840
2017	31,089	129,929
2018	31,555	161,484
2019	31,640	193,124
2020	25,213	218,337
2021	27,968	246,305
2022	30,815	277,120
2023	33,091	310,211



**Figure 38. Percent of Knee Arthroplasty Cases by Primary or Revision**

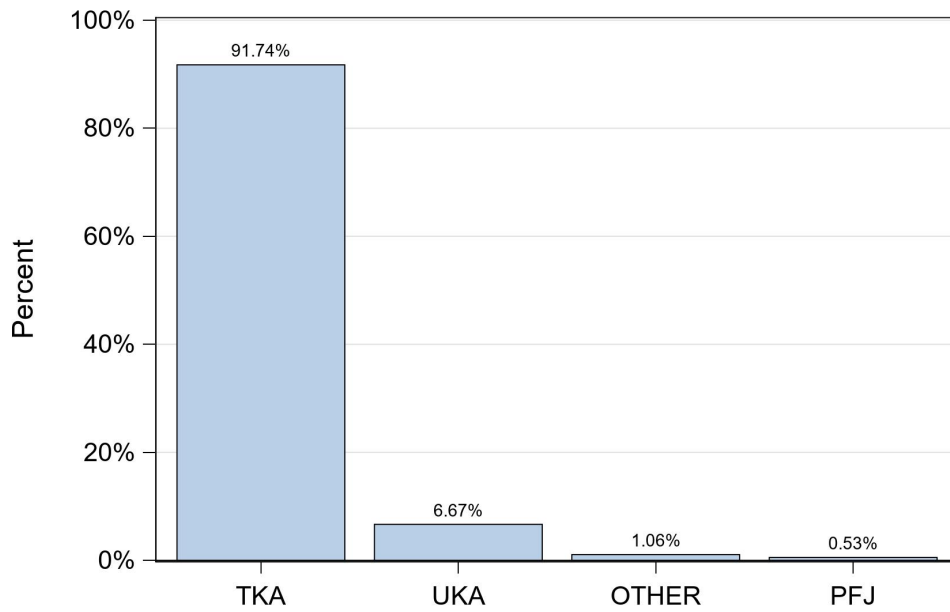


Figure 39. Percent of Primary Knee Arthroplasty Cases Performed as TKA, UKA, PFJ, and Other

## 3.2 Total Knee Arthroplasty (TKA)

### 3.2.1 Descriptive Statistics

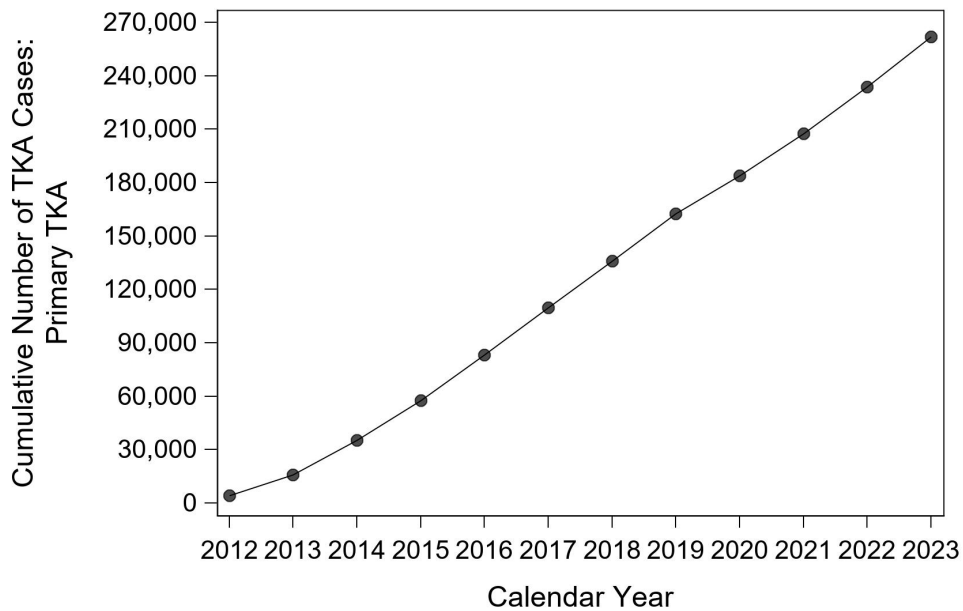
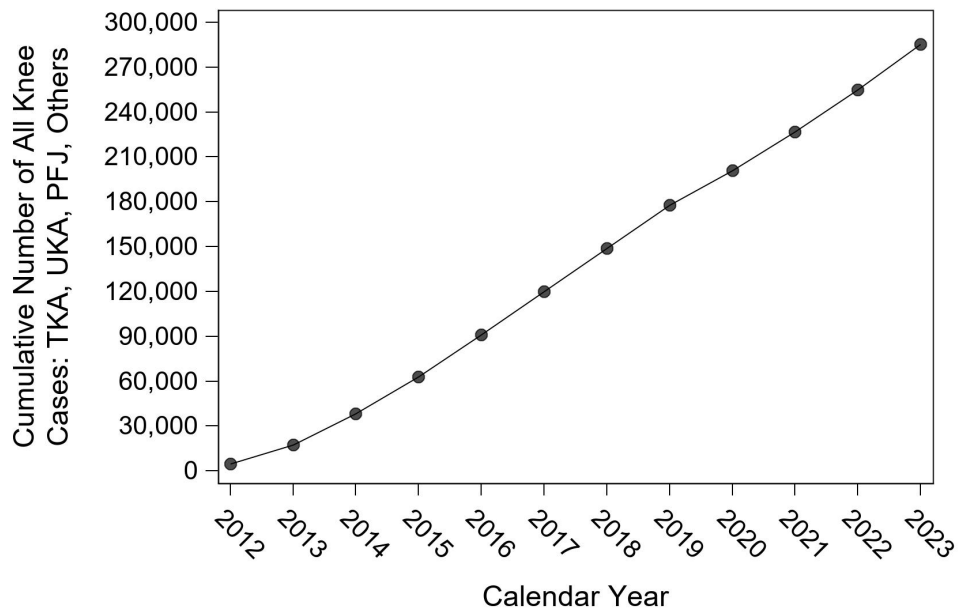


Figure 40. TKA Cases Over Time (in 187,442 Patients)

**Table 57. TKA Cases Over Time (Numerical Values)**

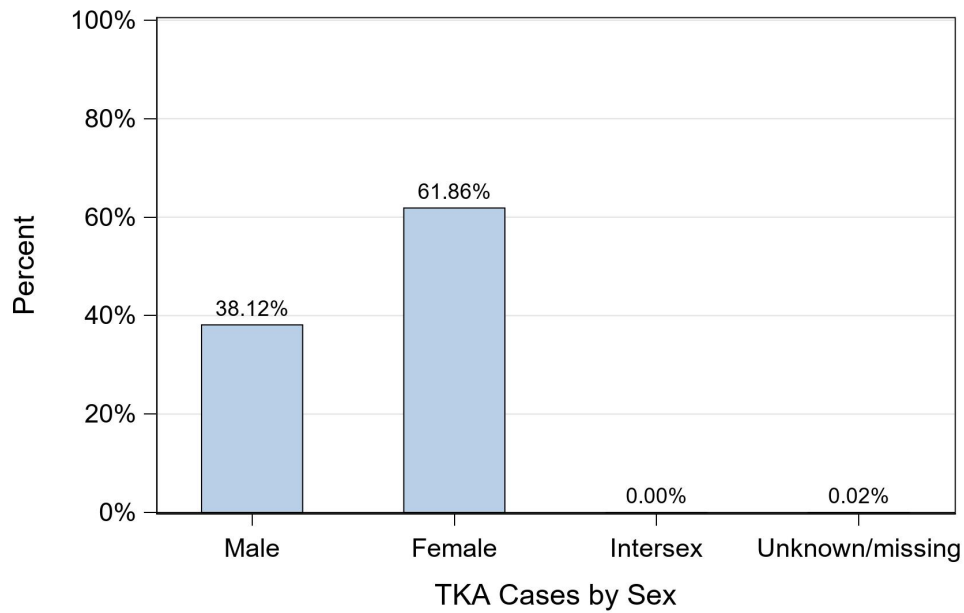
Year	Annual cases	Cumulative cases
2012	4,166	4,166
2013	11,672	15,838
2014	19,476	35,314
2015	22,382	57,696
2016	25,690	83,386
2017	26,248	109,634
2018	26,243	135,877
2019	26,605	162,482
2020	21,297	183,779
2021	23,808	207,587
2022	26,188	233,775
2023	28,145	261,920



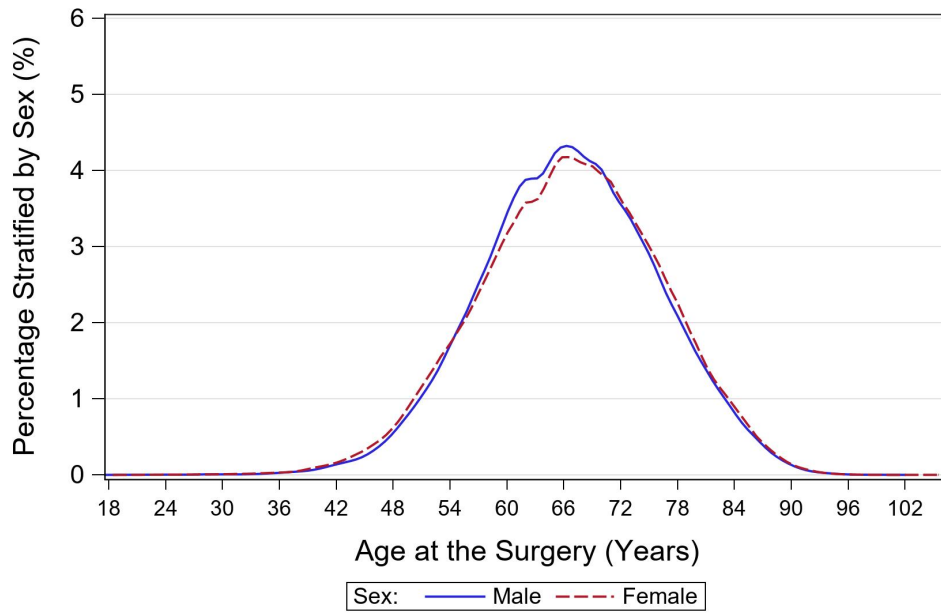
**Figure 41. Primary TKA Cases Over Time**

**Table 58. Primary TKA Cases Over Time (Numerical Values)**

Year	Annual cases	Cumulative cases
2012	4,613	4,613
2013	12,658	17,271
2014	21,012	38,283
2015	24,740	63,023
2016	28,221	91,244
2017	28,664	119,908
2018	28,966	148,874
2019	29,106	177,980
2020	23,003	200,983
2021	25,695	226,678
2022	28,360	255,038
2023	30,462	285,500



**Figure 42. Percent of Primary TKA Cases by Sex**



**Figure 43. Age Distribution of Primary TKA Cases by Sex**

**Table 59. Descriptive Statistics of Primary TKA Cases**

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	162,031	61.9	
Age (years)	261,919	66.7 (9.4)	67 (13)
Height (cm)	260,786	168.6 (10.5)	167.6 (16.5)
Weight (kg)	260,786	94.5 (21.5)	92.9 (28.4)
BMI (kg/m <sup>2</sup> )	260,784	33.2 (6.8)	32.5 (9.1)
Smoker - Never (%)	139,053	53.1	
Smoker - Previous (%)	98,255	37.5	
Smoker - Current (%)	23,508	9	
Smoker - Unknown (%)	1,104	0.4	

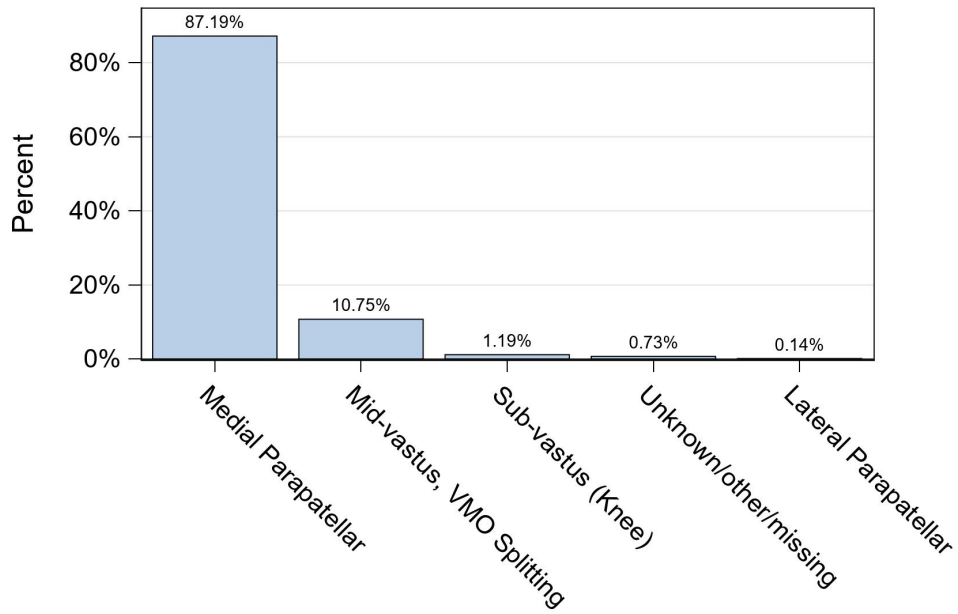


Figure 44. Percent of Primary TKA Cases by Approach

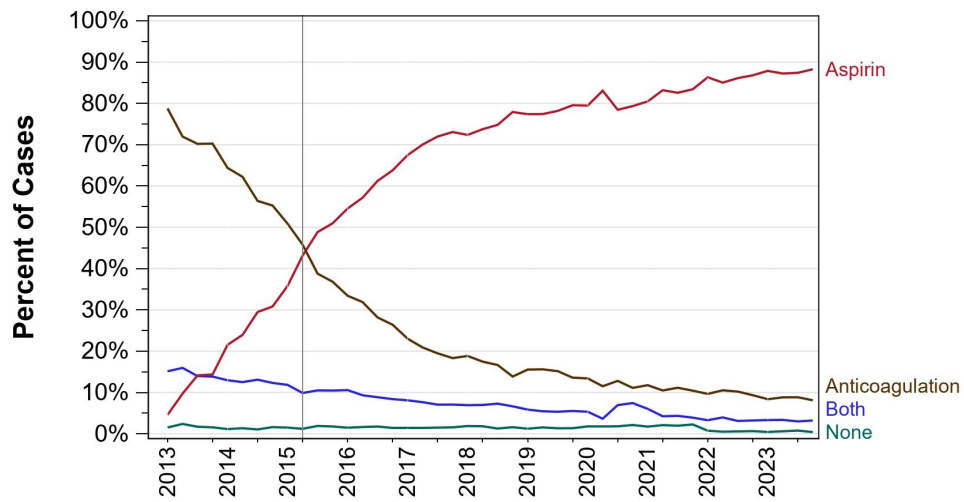


Figure 45. Percent of Primary TKA Patients (First Case) by Thrombosis Prophylaxis

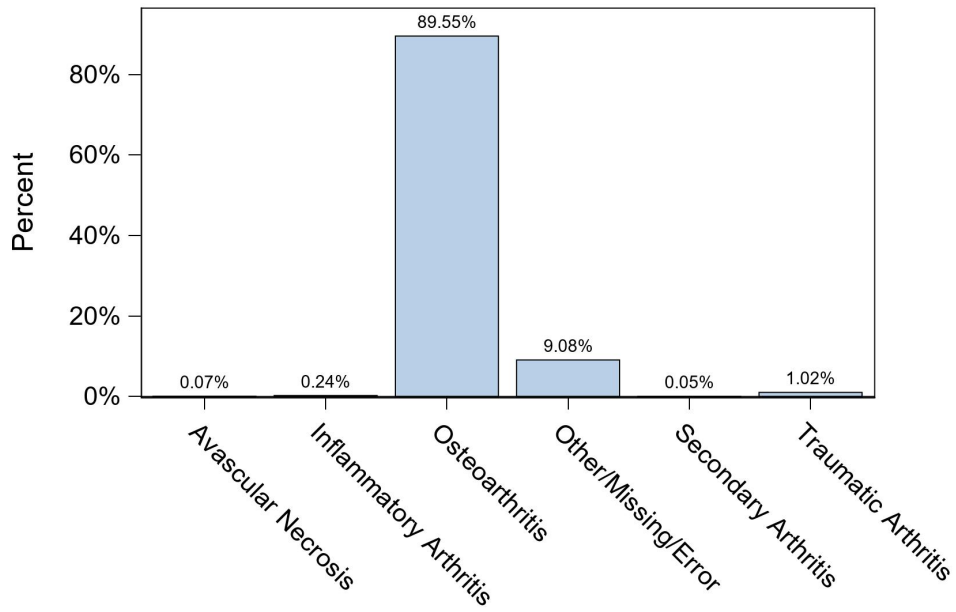


Figure 46. Percent of Primary TKA Cases by Diagnosis

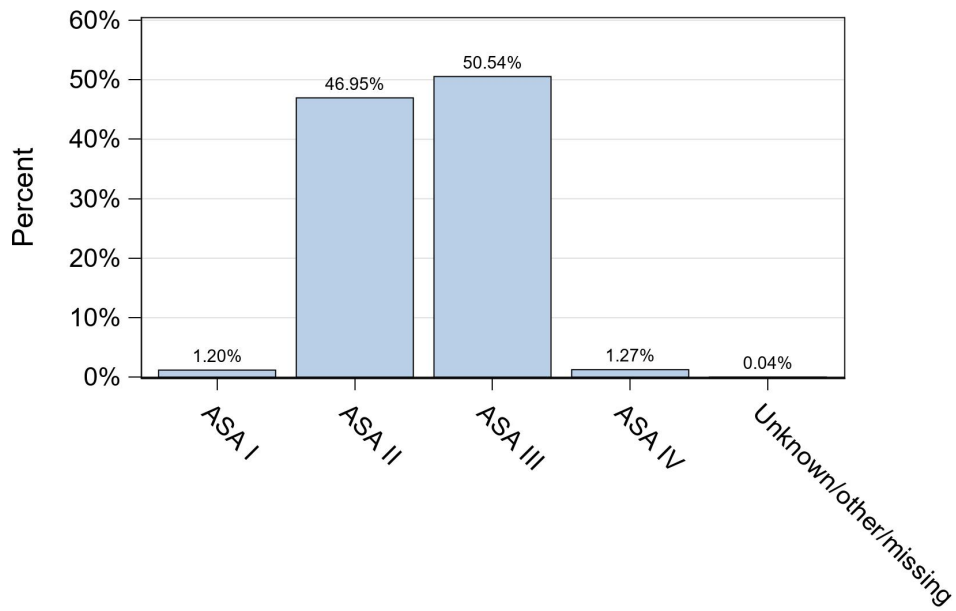
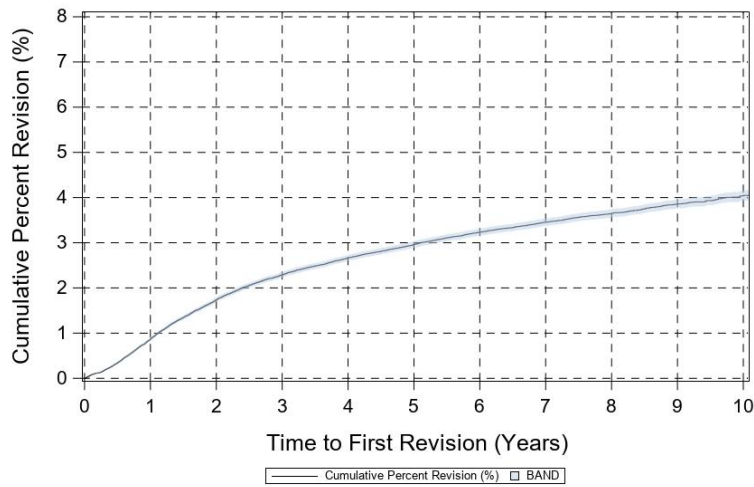


Figure 47. Percent of Primary TKA Cases by ASA Class

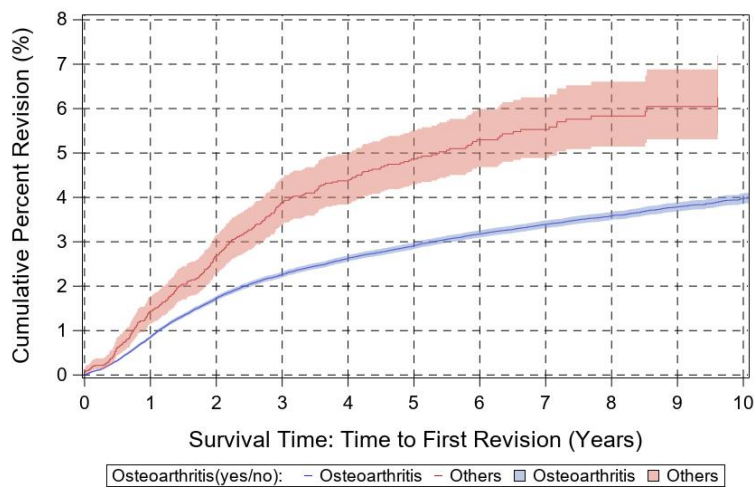
### 3.2.2 Revision Risk (Overall, by Sex, and by Diagnosis)



**Figure 48. Cumulative Percent Revision for Primary TKA**

**Table 60. Cumulative Percent Revision for Primary TKA (Numerical Values)**

	1 year	3 years	5 years	7 years	10 years
CPR	0.87 (0.83,0.90)	2.29 (2.23,2.35)	2.96 (2.89,3.04)	3.45 (3.37,3.54)	4.04 (3.93,4.16)
Number at risk	230,128	178,066	130,435	79,322	14,816

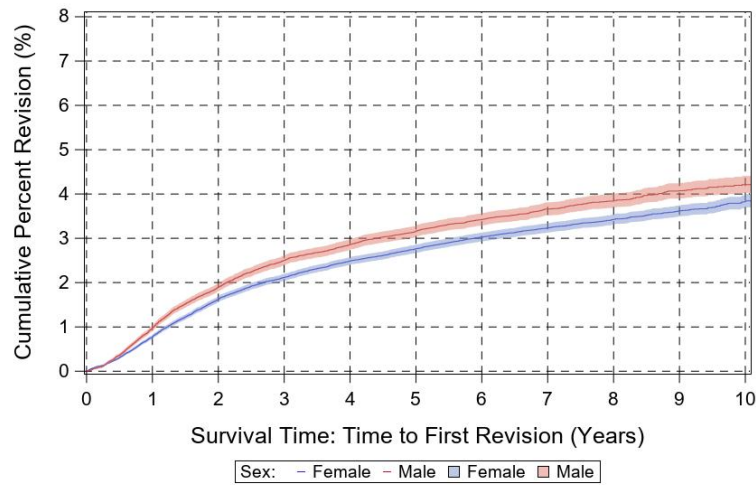


**Figure 49. Cumulative Percent Revision for Primary TKA by Diagnosis**

**Table 61. Cumulative Percent Revision for Primary TKA by Diagnosis (Numerical Values)**

	N	1 year	3 years	5 years	7 years	10 years
Osteoarthritis	232,977	0.85 (0.81,0.89)	2.26 (2.20,2.32)	2.91 (2.84,2.99)	3.39 (3.31,3.48)	3.97 (3.86,4.09)
Others	6,023	1.44 (1.16,1.78)	3.87 (3.37,4.43)	4.87 (4.29,5.51)	5.53 (4.89,6.25)	6.25 (5.43,7.20)
Unknown/Missing	21,239					



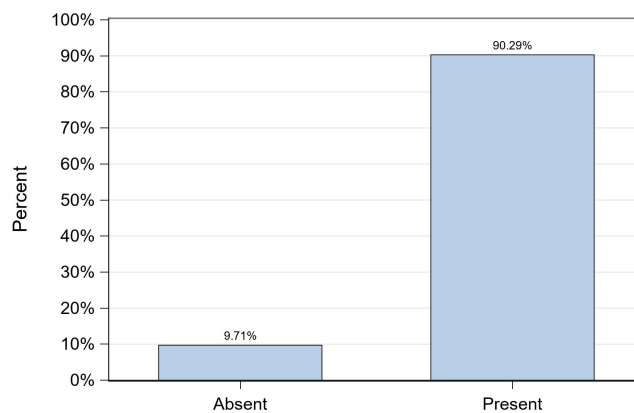


**Figure 50. Cumulative Percent Revision for Primary TKA by Sex for Osteoarthritis Diagnosis**

**Table 62. Cumulative Percent Revision for Primary TKA by Sex for Osteoarthritis Diagnosis (Numerical Values)**

	N	1 year	3 years	5 years	7 years	10 years
Female	145,885	0.78 (0.73,0.82)	2.12 (2.04,2.20)	2.76 (2.67,2.86)	3.23 (3.13,3.34)	3.83 (3.69,3.98)
Male	87,053	0.98 (0.92,1.05)	2.50 (2.39,2.61)	3.16 (3.03,3.29)	3.66 (3.52,3.81)	4.21 (4.03,4.41)
Unknown/Missing	39					

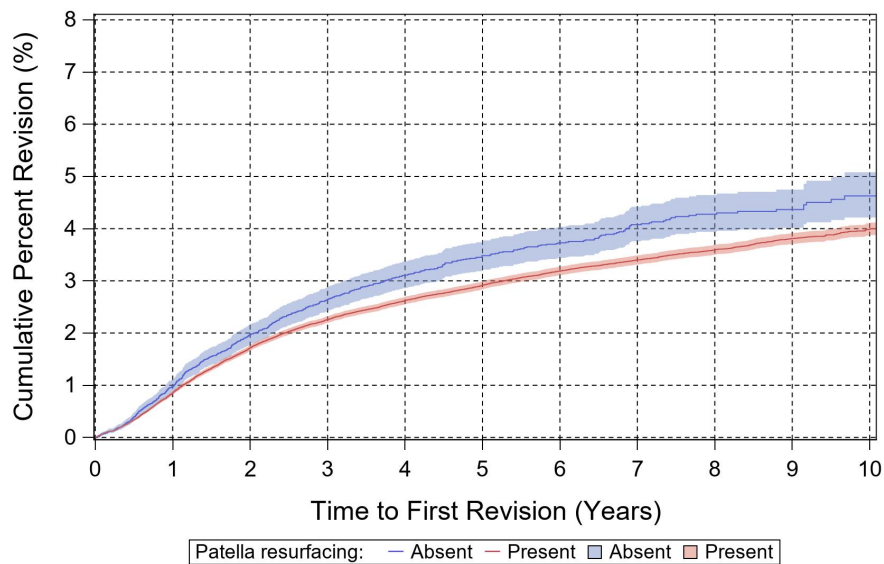
### 3.2.3 Effect of Patella Resurfacing on Revision Risk



**Figure 51. Percent of Primary TKA Cases Performed With (Present) and Without (Absent) Patella Resurfacing**

**Table 63. Descriptive Statistics of Primary TKA Cases Having TKA With and Without Patella Resurfacing**

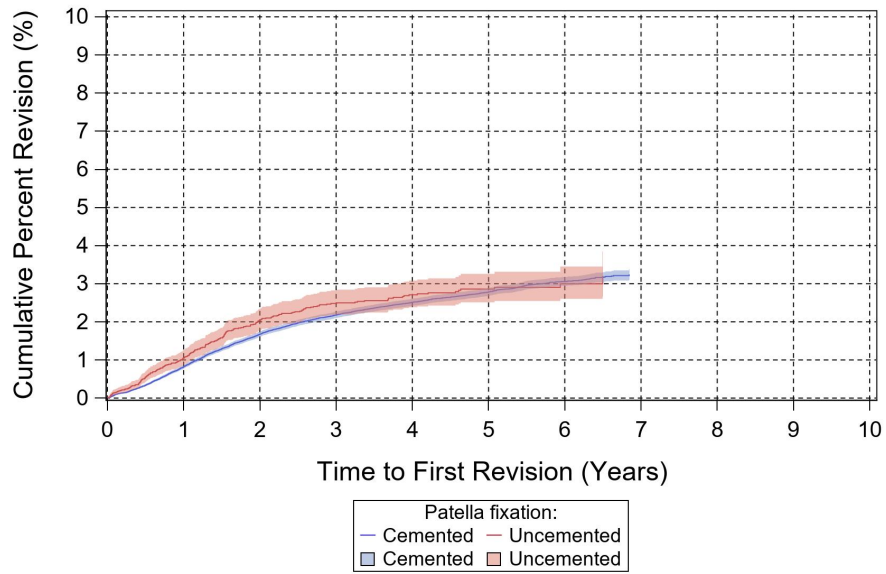
Quantity	Resurfaced N	Resurfaced Mean (SD)	Resurfaced Median (IQR)	Without patella resurfaced N	Without patella resurfaced Mean (SD)	Without patella resurfaced Median (IQR)
Female (%)	147,099	62.2		14,925	58.7	
Age (years)	236,488	66.7 (9.3)	67 (13)	25,424	66.6 (9.6)	67 (13)
Height (cm)	235,358	168.6 (10.5)	167.6 (16.3)	25,421	168.7 (10.7)	167.6 (17.8)
Weight (kg)	235,358	94.5 (21.4)	92.8 (28.4)	25,421	94.6 (21.7)	93 (28.7)
BMI (kg/m <sup>2</sup> )	235,356	33.2 (6.8)	32.5 (9.1)	25,421	33.2 (6.8)	32.4 (9.1)
Smoker - Never (%)	125,678	53.1		13,371	52.6	
Smoker - Previous (%)	88,552	37.4		9,700	38.2	
Smoker - Current (%)	21,198	9		2,310	9.1	
Smoker - Unknown (%)	1,061	0.5		43	0.2	



**Figure 52. Cumulative Percent Revision Curve for Primary TKA Cases Performed With (Present) and Without (Absent) Patella Resurfacing**

**Table 64. Cumulative Percent Revision Curve for Primary TKA Cases Performed With and Without Patella Resurfacing (Numerical Values)**

	N	1 year	3 years	5 years	7 years	10 years
Patella not resurfaced	25,293	0.98 (0.86,1.12)	2.64 (2.42,2.88)	3.48 (3.21,3.77)	4.08 ( 3.76, 4.42)	4.63 ( 4.21, 5.08)
Patella resurfaced	234,939	0.85 (0.82,0.89)	2.26 (2.19,2.32)	2.91 (2.84,2.99)	3.40 ( 3.31, 3.49)	3.99 ( 3.87, 4.11)
Unknown/missing	0					



**Figure 53. Cumulative Percent Revision Curve for Primary TKA Cases Performed With Patella Resurfacing by Fixation**

**Table 65. Cumulative Percent Revision Curve for Primary TKA Cases Performed with Patella Resurfacing by Fixation (Numerical Values)**

	N	1 year	3 years	5 years	7 years	10 years
Cemented	146,051	0.82 (0.77,0.87)	2.18 (2.09,2.26)	2.79 (2.68,2.89)	N/A	N/A
Uncemented	11,842	1.05 (0.88,1.27)	2.48 (2.18,2.83)	2.86 (2.51,3.26)	N/A	N/A
Unknown/missing	479					

### 3.2.4 Reasons for Revision

The reasons for revision are of central importance to quality improvement because it helps focus attention on specific causes that may be addressed. Therefore, the data are presented in two formats below: tabular and Pareto chart. The tabular format is consistent with how other arthroplasty registries report the cause(s) of revision. The Pareto chart figure presents the same data in a format commonly used in quality improvement. The Pareto chart sorts the reasons for revision by frequency (bar chart on the bottom, from left to right) and presents a cumulative percent using a line graph above.

It is important to note that the time window for the cases reported in the reasons for revision tables and figure differs from the time window used for other figures because the reason for revision was added to the database on 1/1/2015. While these data capture revisions for primaries performed back to 2/15/2012, only revisions occurring on or after 1/1/2015 are included in the reasons for revision figure and tables. Note that for knees, instability/dislocation should be interpreted as instability.

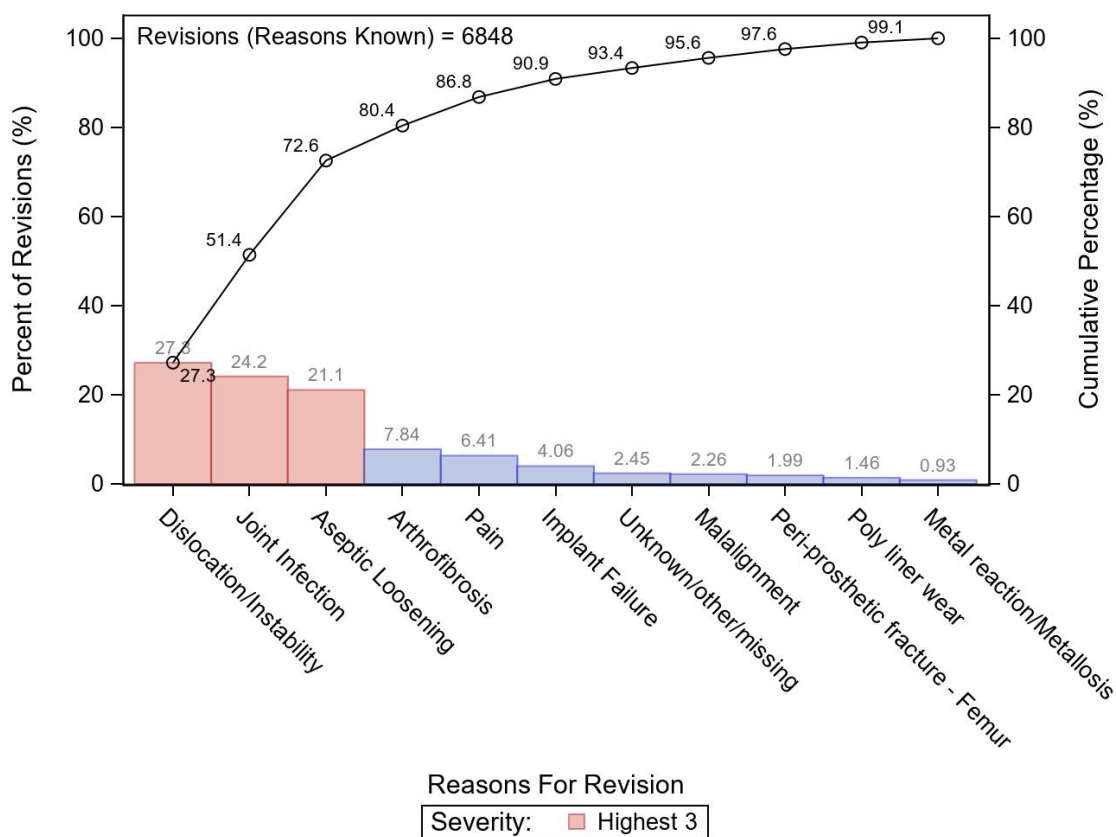


Figure 54. Most Common Reasons for First Revision Following Primary TKA (Pareto Chart)

**Table 66. Reasons for First Revision Following Primary TKA**

Rank	Reason for Revision	N	Percent
1	Dislocation/Instability	1,867	27.3
2	Joint Infection	1,656	24.2
3	Aseptic Loosening	1,448	21.1
4	Arthrofibrosis	537	7.8
5	Pain	439	6.4
6	Implant Failure	278	4.1
7	Malalignment	155	2.3
8	Peri-prosthetic fracture - Femur	136	2.0
9	Poly liner wear	100	1.5
10	Metal Reaction/Metallosis	64	0.9
	Unknown/missing/other	168	2.5

**Table 67. Reasons for First Revision Following Primary TKA in First Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Joint Infection	669	34.0
2	Dislocation/Instability	462	23.5
3	Arthrofibrosis	202	10.3
4	Aseptic Loosening	198	10.1
5	Pain	142	7.2
6	Peri-prosthetic fracture - Femur	72	3.7
7	Implant Failure	67	3.4
8	Malalignment	52	2.6
9	Peri-prosthetic fracture - Tibia	34	1.7
10	Extensor mechanism failure	33	1.7
	Unknown/missing/other	13	2.0

**Table 68. Reasons for First Revision Following Primary TKA in Second Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Dislocation/Instability	587	31.5
2	Aseptic Loosening	390	20.9
3	Joint Infection	373	20.0
4	Pain	152	8.2
5	Arthrofibrosis	145	7.8
6	Implant Failure	79	4.2
7	Malalignment	44	2.4
8	Poly liner wear	26	1.4
9	Metal Reaction/Metallosis	17	0.9
10	Patellofemoral Joint	16	0.9
	Unknown/missing/other	10	1.8

**Table 69. Reasons for First Revision Following Primary TKA in Third Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Dislocation/Instability	327	30.4
2	Aseptic Loosening	259	24.1
3	Joint Infection	241	22.4
4	Arthrofibrosis	71	6.6
5	Pain	68	6.3
6	Implant Failure	46	4.3
7	Malalignment	23	2.1
8	Metal Reaction/Metallosis	14	1.3
9	Patellofemoral Joint	9	0.8
10	Poly liner wear	8	0.7
	Unknown/missing/other	7	0.9

### 3.2.5 Most Commonly Used Implants

The following three tables provide utilization data of implants used in primary TKA.

**Table 70. Ten Most Commonly Used Femoral Components in Primary TKA**

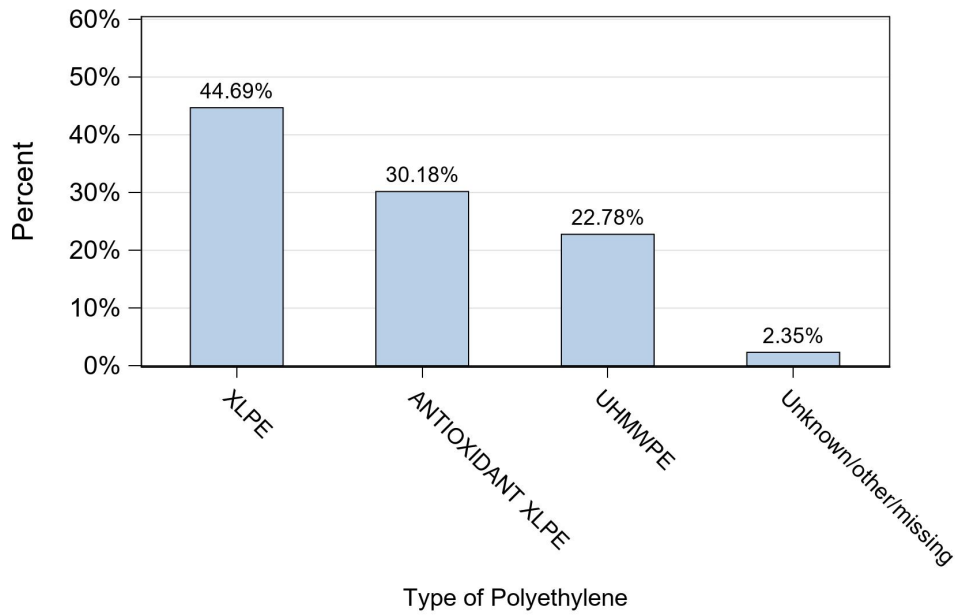
Rank	Component	N	Percent
1	Triathlon	79,240	30.2
2	Persona	77,632	29.6
3	Vanguard	25,263	9.7
4	Attune	17,030	6.5
5	Legion	14,176	5.4
6	Journey II BCS	7,201	2.8
7	Evolution MP	6,029	2.3
8	Sigma PFC	4,850	1.9
9	NK II GS	4,195	1.6
10	Sigma	2,817	1.1
11	Others	23,487	9.0

**Table 71. Ten Most Commonly Used Tibial Components in Primary TKA**

Rank	Component	N	Percent
1	Persona	76,687	29.3
2	Triathlon	46,206	17.6
3	Triathlon TS	33,303	12.7
4	Maxim	23,583	9.0
5	Attune	16,957	6.5
6	Genesis II	15,154	5.8
7	Journey	8,673	3.3
8	Evolution MP	5,769	2.2
9	Sigma	5,674	2.2
10	NK II	5,164	2.0
11	Others	24,750	9.4

**Table 72. Ten Most Commonly Used Femoral/Tibial Component Combinations in Primary TKA**

Rank	Component combination	N	Percent
1	Persona / Persona	76,673	29.3
2	Triathlon / Triathlon	46,181	17.6
3	Triathlon / Triathlon TS	32,910	12.6
4	Vanguard / Maxim	23,556	9.0
5	Attune / Attune	16,956	6.5
6	Legion / Genesis II	13,722	5.2
7	Journey II BCS / Journey	7,115	2.7
8	Evolution MP / Evolution MP	5,734	2.2
9	NK II GS / NK II	4,169	1.6
10	Sigma PFC / Sigma	3,898	1.5
11	Others	31,006	11.8



**Figure 55. Percent of Polyethylene Inserts by Type of Polyethylene in Primary TKA**



### 3.2.6 Revision Risk by Implant Summary

As with hip implants, there is substantial variation in revision risk across TKA implants. The same caveats about interpreting CPR data provided in chapter two also apply to the interpretation of CPR data for knees. Specifically, the reader should be cautious in interpreting CPR values when the number at risk is low. While the reader is encouraged to read the details of each femur/tibia implant combination, the following table summarizes the ten-year CPR values.

**Table 73. Summary of Cumulative Percent Revision for Femoral/Tibial Combinations in Primary TKA Having at Least 500 Cases, Sorted Alphabetically (A-P)**

Femoral/tibial combination	N*	1 year	3 years	5 years	7 years	10 years
Attune / Attune	16,849	0.69 (0.57,0.84)	2.25 (2.01,2.51)	3.22 (2.92,3.55)	3.85 (3.50,4.23)	4.64 (4.10,5.25)
Evolution MP / Evolution MP	5,722	1.16 (0.90,1.50)	3.28 (2.79,3.86)	4.22 (3.62,4.91)	4.85 (4.12,5.69)	5.07 (4.25,6.04)
Genesis II / Genesis II	1,401	1.21 (0.76,1.94)	2.43 (1.74,3.38)	3.62 (2.76,4.75)	4.30 (3.34,5.53)	4.87 (3.81,6.21)
Genesis II (CoCr) / Genesis II	712	0.84 (0.38,1.87)	1.83 (1.07,3.13)	2.73 (1.75,4.25)	3.22 (2.13,4.86)	3.22 (2.13,4.86)
Genesis II (Oxinium) / Genesis II	689	1.60 (0.89,2.86)	3.05 (2.00,4.64)	4.53 (3.21,6.38)	5.34 (3.88,7.33)	6.41 (4.73,8.65)
GMK Sphere / GMK Primary	556	0.97 (0.40,2.31)	2.35 (1.30,4.22)	2.93 (1.59,5.37)	2.93 (1.59,5.37)	N/A
iBalance / iBalance	711	2.91 (1.86,4.52)	9.39 (7.25,12.11)	11.31 (8.80,14.47)	13.43 (10.12,17.72)	N/A
iTotal	754	1.19 (0.62,2.28)	3.05 (2.04,4.56)	4.33 (3.08,6.07)	5.11 (3.70,7.04)	9.28 (5.81,14.66)
iTotal G2+	733	1.23 (0.64,2.35)	3.00 (1.99,4.52)	4.20 (2.96,5.96)	4.98 (3.57,6.93)	9.42 (5.36,16.26)
Journey II / Journey	1,504	1.46 (0.95,2.23)	3.90 (2.97,5.11)	4.65 (3.58,6.03)	5.60 (4.26,7.35)	6.18 (4.54,8.38)
Journey II (Oxinium) / Journey	1,496	1.47 (0.96,2.24)	3.93 (2.99,5.14)	4.68 (3.61,6.07)	5.64 (4.29,7.39)	6.21 (4.57,8.41)
Journey II BCS / Journey	7,088	1.25 (1.01,1.55)	3.45 (3.02,3.94)	4.40 (3.89,4.98)	4.95 (4.36,5.61)	5.80 (4.82,6.97)
Journey II BCS (CoCr) / Journey	1,021	0.43 (0.16,1.14)	1.07 (0.55,2.05)	1.69 (0.86,3.32)	1.69 (0.86,3.32)	N/A
Journey II BCS (Oxinium) / Journey	6,067	1.39 (1.12,1.72)	3.82 (3.34,4.37)	4.82 (4.25,5.47)	5.39 (4.75,6.12)	6.25 (5.23,7.45)
LCS Complete / M.B.T.	1,928	1.07 (0.69,1.66)	3.35 (2.59,4.32)	4.63 (3.68,5.80)	4.77 (3.80,5.99)	5.14 (3.99,6.62)
Legion / Genesis II	13,626	1.01 (0.86,1.20)	2.95 (2.67,3.27)	3.57 (3.25,3.93)	4.16 (3.79,4.57)	5.04 (4.51,5.64)
NexGen GS / NexGen Pegged	675	1.04 (0.50,2.16)	2.07 (1.23,3.48)	2.67 (1.69,4.21)	3.02 (1.96,4.65)	3.61 (2.23,5.81)
NexGen GS / NexGen Precoat	694	0.30 (0.08,1.21)	1.61 (0.87,2.98)	1.99 (1.13,3.48)	1.99 (1.13,3.48)	1.99 (1.13,3.48)
NexGen LPS GS / NexGen Precoat	528	0.38 (0.09,1.51)	1.89 (1.02,3.49)	2.27 (1.30,3.97)	2.87 (1.74,4.71)	3.07 (1.89,4.97)
NexGen LPS Option / NexGen Precoat	726	0.69 (0.29,1.65)	1.52 (0.84,2.72)	2.36 (1.47,3.77)	3.49 (2.35,5.17)	4.15 (2.85,6.04)
NexGen LPS Option / NexGen TM	1,387	0.44 (0.20,0.99)	0.92 (0.52,1.61)	1.27 (0.78,2.07)	1.36 (0.85,2.19)	1.53 (0.95,2.45)
NexGen Option / NexGen Option	1,313	0.30 (0.11,0.81)	0.94 (0.54,1.65)	1.11 (0.66,1.88)	1.32 (0.81,2.16)	2.13 (1.22,3.71)
NexGen Option / NexGen Pegged	616	0.81 (0.34,1.94)	2.44 (1.48,4.01)	2.92 (1.85,4.60)	3.08 (1.98,4.79)	3.32 (2.15,5.12)
NexGen Precoat / NexGen Precoat	640	0.80 (0.33,1.91)	1.92 (1.06,3.44)	2.61 (1.55,4.40)	3.25 (1.97,5.33)	3.25 (1.97,5.33)
NK II / NK II	990	0.20 (0.05,0.81)	1.11 (0.62,2.00)	1.62 (0.99,2.63)	2.04 (1.32,3.14)	2.73 (1.81,4.11)
NK II GS / NK II	4,153	0.41 (0.26,0.66)	0.98 (0.71,1.35)	1.42 (1.08,1.87)	1.88 (1.44,2.44)	2.29 (1.72,3.04)
Persona CR (Cemented) / Persona (Cemented)	47,421	0.61 (0.54,0.68)	1.67 (1.55,1.81)	2.19 (2.04,2.36)	2.59 (2.41,2.79)	3.22 (2.89,3.58)
Persona CR (Cementless) / Persona (Cementless)	1,709	1.55 (1.03,2.33)	3.83 (2.85,5.13)	4.80 (3.52,6.53)	4.80 (3.52,6.53)	4.80 (3.52,6.53)
Persona PS (Cemented) / Persona (Cemented)	26,395	0.94 (0.82,1.06)	2.65 (2.45,2.87)	3.48 (3.23,3.75)	4.07 (3.79,4.38)	4.78 (4.39,5.19)

**Table 74. Summary of Cumulative Percent Revision for Femoral/Tibial Combinations in Primary TKA Having at Least 500 cases, Sorted Alphabetically (Q-Z)**

Femoral/tibial combination	N*	1 year	3 years	5 years	7 years	10 years
Scorpio / Series 7000	650	1.38 (0.72,2.64)	4.00 (2.74,5.82)	4.92 (3.51,6.89)	5.47 (3.95,7.55)	6.55 (4.71,9.08)
Sigma / M.B.T.	1,009	1.42 (0.85,2.39)	3.64 (2.62,5.03)	4.43 (3.29,5.95)	5.01 (3.77,6.65)	7.24 (5.38,9.70)
Sigma / Sigma	1,742	1.42 (0.95,2.11)	2.93 (2.21,3.87)	3.67 (2.86,4.72)	4.19 (3.31,5.31)	4.73 (3.75,5.95)
Sigma PFC / Sigma	3,812	0.72 (0.50,1.05)	2.13 (1.71,2.65)	2.71 (2.23,3.30)	3.08 (2.55,3.72)	3.56 (2.96,4.28)
Sigma PFC / Sigma PFC All-poly	547	0.73 (0.28,1.94)	1.28 (0.61,2.67)	1.28 (0.61,2.67)	1.28 (0.61,2.67)	1.28 (0.61,2.67)
Triathlon CR (Cemented) / Triathlon (Cemented)	19,827	0.57 (0.47,0.69)	1.49 (1.32,1.68)	1.94 (1.74,2.17)	2.20 (1.97,2.45)	2.52 (2.22,2.86)
Triathlon CR (Cemented) / Triathlon TS (Cemented)	15,262	0.81 (0.68,0.98)	1.99 (1.76,2.25)	2.45 (2.18,2.75)	2.90 (2.58,3.27)	3.40 (2.97,3.89)
Triathlon CR (Cementless) / Triathlon (Cemented)	518	1.17 (0.53,2.59)	2.39 (1.37,4.18)	3.25 (2.00,5.25)	3.70 (2.35,5.81)	4.94 (3.08,7.90)
Triathlon CR (Cementless) / Triathlon (Cementless)	17,420	1.08 (0.92,1.25)	2.08 (1.85,2.35)	2.48 (2.19,2.80)	2.74 (2.38,3.16)	3.28 (2.54,4.23)
Triathlon CR (Cementless) / Triathlon TS (Cemented)	525	2.01 (1.01,3.98)	4.94 (2.93,8.27)	7.82 (3.55,16.75)	7.82 (3.55,16.75)	7.82 (3.55,16.75)
Triathlon PS (Cemented) / Triathlon (Cemented)	3,619	1.02 (0.74,1.42)	2.58 (2.10,3.18)	3.36 (2.79,4.03)	3.87 (3.24,4.61)	4.42 (3.67,5.32)
Triathlon PS (Cemented) / Triathlon TS (Cemented)	16,839	1.03 (0.89,1.20)	2.52 (2.28,2.78)	3.23 (2.95,3.53)	3.79 (3.48,4.13)	4.45 (4.04,4.90)
Triathlon PS (Cementless) / Triathlon (Cementless)	4,166	1.12 (0.83,1.50)	2.41 (1.95,2.97)	3.04 (2.49,3.69)	3.54 (2.90,4.32)	3.54 (2.90,4.32)
Vanguard / Maxim	23,417	0.78 (0.68,0.91)	2.04 (1.87,2.24)	2.64 (2.43,2.86)	3.18 (2.94,3.43)	3.58 (3.30,3.89)
Vanguard / Maxim Mono-Lock	1,290	0.55 (0.26,1.14)	1.94 (1.30,2.88)	3.01 (2.17,4.18)	3.52 (2.57,4.81)	4.55 (3.26,6.34)
Vanguard XP / Vanguard XP	547	2.56 (1.52,4.28)	9.87 (7.65,12.69)	11.72 (9.29,14.72)	12.15 (9.67,15.20)	12.44 (9.92,15.55)

\* Number of patients that contribute to survival analysis used to compute cumulative percent revision

**Table 75. Summary of Cumulative Percent Revision for Femoral/Tibial Combinations in Primary TKA having at Least 500 Cases, Sorted by Five-year CPR (part 1)**

Femoral/Tibial Combination	N*	1 year	3 years	5 years	7 years	10 years
NexGen Option / NexGen Option	1,313	0.30 (0.11,0.81)	0.94 (0.54,1.65)	1.11 (0.66,1.88)	1.32 (0.81,2.16)	2.13 (1.22,3.71)
NexGen LPS Option / NexGen TM	1,387	0.44 (0.20,0.99)	0.92 (0.52,1.61)	1.27 (0.78,2.07)	1.36 (0.85,2.19)	1.53 (0.95,2.45)
Sigma PFC / Sigma PFC All-poly	547	0.73 (0.28,1.94)	1.28 (0.61,2.67)	1.28 (0.61,2.67)	1.28 (0.61,2.67)	1.28 (0.61,2.67)
NK II GS / NK II	4,153	0.41 (0.26,0.66)	0.98 (0.71,1.35)	1.42 (1.08,1.87)	1.88 (1.44,2.44)	2.29 (1.72,3.04)
NK II / NK II	990	0.20 (0.05,0.81)	1.11 (0.62,2.00)	1.62 (0.99,2.63)	2.04 (1.32,3.14)	2.73 (1.81,4.11)
Journey II BCS (CoCr) / Journey	1,021	0.43 (0.16,1.14)	1.07 (0.55,2.05)	1.69 (0.86,3.32)	1.69 (0.86,3.32)	N/A
Triathlon CR (Cemented) / Triathlon (Cemented)	19,827	0.57 (0.47,0.69)	1.49 (1.32,1.68)	1.94 (1.74,2.17)	2.20 (1.97,2.45)	2.52 (2.22,2.86)
NexGen GS / NexGen Precoat	694	0.30 (0.08,1.21)	1.61 (0.87,2.98)	1.99 (1.13,3.48)	1.99 (1.13,3.48)	1.99 (1.13,3.48)
Persona CR (Cemented) / Persona (Cemented)	47,421	0.61 (0.54,0.68)	1.67 (1.55,1.81)	2.19 (2.04,2.36)	2.59 (2.41,2.79)	3.22 (2.89,3.58)
NexGen LPS GS / NexGen Precoat	528	0.38 (0.09,1.51)	1.89 (1.02,3.49)	2.27 (1.30,3.97)	2.87 (1.74,4.71)	3.07 (1.89,4.97)
NexGen LPS Option / NexGen Precoat	726	0.69 (0.29,1.65)	1.52 (0.84,2.72)	2.36 (1.47,3.77)	3.49 (2.35,5.17)	4.15 (2.85,6.04)
Triathlon CR (Cemented) / Triathlon TS (Cemented)	15,262	0.81 (0.68,0.98)	1.99 (1.76,2.25)	2.45 (2.18,2.75)	2.90 (2.58,3.27)	3.40 (2.97,3.89)
Triathlon CR (Cementless) / Triathlon (Cementless)	17,420	1.08 (0.92,1.25)	2.08 (1.85,2.35)	2.48 (2.19,2.80)	2.74 (2.38,3.16)	3.28 (2.54,4.23)
NexGen Precoat / NexGen Precoat	640	0.80 (0.33,1.91)	1.92 (1.06,3.44)	2.61 (1.55,4.40)	3.25 (1.97,5.33)	3.25 (1.97,5.33)
Vanguard / Maxim	23,417	0.78 (0.68,0.91)	2.04 (1.87,2.24)	2.64 (2.43,2.86)	3.18 (2.94,3.43)	3.58 (3.30,3.89)
NexGen GS / NexGen Pegged	675	1.04 (0.50,2.16)	2.07 (1.23,3.48)	2.67 (1.69,4.21)	3.02 (1.96,4.65)	3.61 (2.23,5.81)
Sigma PFC / Sigma	3,812	0.72 (0.50,1.05)	2.13 (1.71,2.65)	2.71 (2.23,3.30)	3.08 (2.55,3.72)	3.56 (2.96,4.28)
Genesis II (CoCr) / Genesis II	712	0.84 (0.38,1.87)	1.83 (1.07,3.13)	2.73 (1.75,4.25)	3.22 (2.13,4.86)	3.22 (2.13,4.86)
NexGen Option / NexGen Pegged	616	0.81 (0.34,1.94)	2.44 (1.48,4.01)	2.92 (1.85,4.60)	3.08 (1.98,4.79)	3.32 (2.15,5.12)
GMK Sphere / GMK Primary	556	0.97 (0.40,2.31)	2.35 (1.30,4.22)	2.93 (1.59,5.37)	2.93 (1.59,5.37)	N/A
Vanguard / Maxim Mono-Lock	1,290	0.55 (0.26,1.14)	1.94 (1.30,2.88)	3.01 (2.17,4.18)	3.52 (2.57,4.81)	4.55 (3.26,6.34)
Triathlon PS (Cementless) / Triathlon (Cementless)	4,166	1.12 (0.83,1.50)	2.41 (1.95,2.97)	3.04 (2.49,3.69)	3.54 (2.90,4.32)	3.54 (2.90,4.32)
Attune / Attune	16,849	0.69 (0.57,0.84)	2.25 (2.01,2.51)	3.22 (2.92,3.55)	3.85 (3.50,4.23)	4.64 (4.10,5.25)
Triathlon PS (Cemented) / Triathlon TS (Cemented)	16,839	1.03 (0.89,1.20)	2.52 (2.28,2.78)	3.23 (2.95,3.53)	3.79 (3.48,4.13)	4.45 (4.04,4.90)
Triathlon CR (Cementless) / Triathlon (Cemented)	518	1.17 (0.53,2.59)	2.39 (1.37,4.18)	3.25 (2.00,5.25)	3.70 (2.35,5.81)	4.94 (3.08,7.90)
Triathlon PS (Cemented) / Triathlon (Cemented)	3,619	1.02 (0.74,1.42)	2.58 (2.10,3.18)	3.36 (2.79,4.03)	3.87 (3.24,4.61)	4.42 (3.67,5.32)
Persona PS (Cemented) / Persona (Cemented)	26,395	0.94 (0.82,1.06)	2.65 (2.45,2.87)	3.48 (3.23,3.75)	4.07 (3.79,4.38)	4.78 (4.39,5.19)
Legion / Genesis II	13,626	1.01 (0.86,1.20)	2.95 (2.67,3.27)	3.57 (3.25,3.93)	4.16 (3.79,4.57)	5.04 (4.51,5.64)

**Table 76. Summary of Cumulative Percent Revision for Femoral/Tibial Combinations in Primary TKA Having at Least 500 Cases, Sorted by Five-year CPR (part 2)**

Femoral/Tibial Combination	N*	1 year	3 years	5 years	7 years	10 years
Genesis II / Genesis II	1,401	1.21 (0.76,1.94)	2.43 (1.74,3.38)	3.62 (2.76,4.75)	4.30 (3.34,5.53)	4.87 (3.81,6.21)
Sigma / Sigma	1,742	1.42 (0.95,2.11)	2.93 (2.21,3.87)	3.67 (2.86,4.72)	4.19 (3.31,5.31)	4.73 (3.75,5.95)
iTotal G2+	733	1.23 (0.64,2.35)	3.00 (1.99,4.52)	4.20 (2.96,5.96)	4.98 (3.57,6.93)	9.42 (5.36,16.26)
Evolution MP / Evolution MP	5,722	1.16 (0.90,1.50)	3.28 (2.79,3.86)	4.22 (3.62,4.91)	4.85 (4.12,5.69)	5.07 (4.25,6.04)
iTotal	754	1.19 (0.62,2.28)	3.05 (2.04,4.56)	4.33 (3.08,6.07)	5.11 (3.70,7.04)	9.28 (5.81,14.66)
Journey II BCS / Journey	7,088	1.25 (1.01,1.55)	3.45 (3.02,3.94)	4.40 (3.89,4.98)	4.95 (4.36,5.61)	5.80 (4.82,6.97)
Sigma / M.B.T.	1,009	1.42 (0.85,2.39)	3.64 (2.62,5.03)	4.43 (3.29,5.95)	5.01 (3.77,6.65)	7.24 (5.38,9.70)
Genesis II (Oxinium) / Genesis II	689	1.60 (0.89,2.86)	3.05 (2.00,4.64)	4.53 (3.21,6.38)	5.34 (3.88,7.33)	6.41 (4.73,8.65)
LCS Complete / M.B.T.	1,928	1.07 (0.69,1.66)	3.35 (2.59,4.32)	4.63 (3.68,5.80)	4.77 (3.80,5.99)	5.14 (3.99,6.62)
Journey II / Journey	1,504	1.46 (0.95,2.23)	3.90 (2.97,5.11)	4.65 (3.58,6.03)	5.60 (4.26,7.35)	6.18 (4.54,8.38)
Journey II (Oxinium) / Journey	1,496	1.47 (0.96,2.24)	3.93 (2.99,5.14)	4.68 (3.61,6.07)	5.64 (4.29,7.39)	6.21 (4.57,8.41)
Persona CR (Cementless) / Persona (Cementless)	1,709	1.55 (1.03,2.33)	3.83 (2.85,5.13)	4.80 (3.52,6.53)	4.80 (3.52,6.53)	4.80 (3.52,6.53)
Journey II BCS (Oxinium) / Journey	6,067	1.39 (1.12,1.72)	3.82 (3.34,4.37)	4.82 (4.25,5.47)	5.39 (4.75,6.12)	6.25 (5.23,7.45)
Scorpio / Series 7000	650	1.38 (0.72,2.64)	4.00 (2.74,5.82)	4.92 (3.51,6.89)	5.47 (3.95,7.55)	6.55 (4.71,9.08)
Triathlon CR (Cementless) / Triathlon TS (Cemented)	525	2.01 (1.01,3.98)	4.94 (2.93,8.27)	7.82 (3.55,16.75)	7.82 (3.55,16.75)	7.82 (3.55,16.75)
iBalance / iBalance	711	2.91 (1.86,4.52)	9.39 (7.25,12.11)	11.31 (8.80,14.47)	13.43 (10.12,17.72)	N/A
Vanguard XP / Vanguard XP	547	2.56 (1.52,4.28)	9.87 (7.65,12.69)	11.72 (9.29,14.72)	12.15 (9.67,15.20)	12.44 (9.92,15.55)

\* Number of patients that contribute to survival analysis used to compute cumulative percent revision.

**Table 77. Summary of Cumulative Percent Revision for Femoral/Tibial Combinations in Primary TKA Having at Least 500 Cases, Sorted by Ten-year CPR (part 1)**

Femoral/Tibial Combination	N*	1 year	3 years	5 years	7 years	10 years
Sigma PFC / Sigma PFC All-poly	547	0.73 (0.28,1.94)	1.28 (0.61,2.67)	1.28 (0.61,2.67)	1.28 (0.61,2.67)	1.28 (0.61,2.67)
NexGen LPS Option / NexGen TM	1,387	0.44 (0.20,0.99)	0.92 (0.52,1.61)	1.27 (0.78,2.07)	1.36 (0.85,2.19)	1.53 (0.95,2.45)
NexGen GS / NexGen Precoat	694	0.30 (0.08,1.21)	1.61 (0.87,2.98)	1.99 (1.13,3.48)	1.99 (1.13,3.48)	1.99 (1.13,3.48)
NexGen Option / NexGen Option	1,313	0.30 (0.11,0.81)	0.94 (0.54,1.65)	1.11 (0.66,1.88)	1.32 (0.81,2.16)	2.13 (1.22,3.71)
NK II GS / NK II	4,153	0.41 (0.26,0.66)	0.98 (0.71,1.35)	1.42 (1.08,1.87)	1.88 (1.44,2.44)	2.29 (1.72,3.04)
Triathlon CR (Cemented) / Triathlon (Cemented)	19,827	0.57 (0.47,0.69)	1.49 (1.32,1.68)	1.94 (1.74,2.17)	2.20 (1.97,2.45)	2.52 (2.22,2.86)
NK II / NK II	990	0.20 (0.05,0.81)	1.11 (0.62,2.00)	1.62 (0.99,2.63)	2.04 (1.32,3.14)	2.73 (1.81,4.11)
NexGen LPS GS / NexGen Precoat	528	0.38 (0.09,1.51)	1.89 (1.02,3.49)	2.27 (1.30,3.97)	2.87 (1.74,4.71)	3.07 (1.89,4.97)
Genesis II (CoCr) / Genesis II	712	0.84 (0.38,1.87)	1.83 (1.07,3.13)	2.73 (1.75,4.25)	3.22 (2.13,4.86)	3.22 (2.13,4.86)
Persona CR (Cemented) / Persona (Cemented)	47,421	0.61 (0.54,0.68)	1.67 (1.55,1.81)	2.19 (2.04,2.36)	2.59 (2.41,2.79)	3.22 (2.89,3.58)
NexGen Precoat / NexGen Precoat	640	0.80 (0.33,1.91)	1.92 (1.06,3.44)	2.61 (1.55,4.40)	3.25 (1.97,5.33)	3.25 (1.97,5.33)
Triathlon CR (Cementless) / Triathlon (Cementless)	17,420	1.08 (0.92,1.25)	2.08 (1.85,2.35)	2.48 (2.19,2.80)	2.74 (2.38,3.16)	3.28 (2.54,4.23)
NexGen Option / NexGen Pegged	616	0.81 (0.34,1.94)	2.44 (1.48,4.01)	2.92 (1.85,4.60)	3.08 (1.98,4.79)	3.32 (2.15,5.12)
Triathlon CR (Cemented) / Triathlon TS (Cemented)	15,262	0.81 (0.68,0.98)	1.99 (1.76,2.25)	2.45 (2.18,2.75)	2.90 (2.58,3.27)	3.40 (2.97,3.89)
Triathlon PS (Cementless) / Triathlon (Cementless)	4,166	1.12 (0.83,1.50)	2.41 (1.95,2.97)	3.04 (2.49,3.69)	3.54 (2.90,4.32)	3.54 (2.90,4.32)
Sigma PFC / Sigma	3,812	0.72 (0.50,1.05)	2.13 (1.71,2.65)	2.71 (2.23,3.30)	3.08 (2.55,3.72)	3.56 (2.96,4.28)
Vanguard / Maxim	23,417	0.78 (0.68,0.91)	2.04 (1.87,2.24)	2.64 (2.43,2.86)	3.18 (2.94,3.43)	3.58 (3.30,3.89)
NexGen GS / NexGen Pegged	675	1.04 (0.50,2.16)	2.07 (1.23,3.48)	2.67 (1.69,4.21)	3.02 (1.96,4.65)	3.61 (2.23,5.81)
NexGen LPS Option / NexGen Precoat	726	0.69 (0.29,1.65)	1.52 (0.84,2.72)	2.36 (1.47,3.77)	3.49 (2.35,5.17)	4.15 (2.85,6.04)
Triathlon PS (Cemented) / Triathlon (Cemented)	3,619	1.02 (0.74,1.42)	2.58 (2.10,3.18)	3.36 (2.79,4.03)	3.87 (3.24,4.61)	4.42 (3.67,5.32)
Triathlon PS (Cemented) / Triathlon TS (Cemented)	16,839	1.03 (0.89,1.20)	2.52 (2.28,2.78)	3.23 (2.95,3.53)	3.79 (3.48,4.13)	4.45 (4.04,4.90)
Vanguard / Maxim Mono-Lock	1,290	0.55 (0.26,1.14)	1.94 (1.30,2.88)	3.01 (2.17,4.18)	3.52 (2.57,4.81)	4.55 (3.26,6.34)
Attune / Attune	16,849	0.69 (0.57,0.84)	2.25 (2.01,2.51)	3.22 (2.92,3.55)	3.85 (3.50,4.23)	4.64 (4.10,5.25)
Sigma / Sigma	1,742	1.42 (0.95,2.11)	2.93 (2.21,3.87)	3.67 (2.86,4.72)	4.19 (3.31,5.31)	4.73 (3.75,5.95)
Persona PS (Cemented) / Persona (Cemented)	26,395	0.94 (0.82,1.06)	2.65 (2.45,2.87)	3.48 (3.23,3.75)	4.07 (3.79,4.38)	4.78 (4.39,5.19)
Persona CR (Cementless) / Persona (Cementless)	1,709	1.55 (1.03,2.33)	3.83 (2.85,5.13)	4.80 (3.52,6.53)	4.80 (3.52,6.53)	4.80 (3.52,6.53)
Genesis II / Genesis II	1,401	1.21 (0.76,1.94)	2.43 (1.74,3.38)	3.62 (2.76,4.75)	4.30 (3.34,5.53)	4.87 (3.81,6.21)
Triathlon CR (Cementless) / Triathlon (Cemented)	518	1.17 (0.53,2.59)	2.39 (1.37,4.18)	3.25 (2.00,5.25)	3.70 (2.35,5.81)	4.94 (3.08,7.90)

**Table 78. Summary of Cumulative Percent Revision for Femoral/Tibial Combinations in Primary TKA Having at Least 500 cases, Sorted by Ten-year CPR (part 2)**

Femoral/Tibial Combination	N*	1 year	3 years	5 years	7 years	10 years
Legion / Genesis II	13,626	1.01 (0.86,1.20)	2.95 (2.67,3.27)	3.57 (3.25,3.93)	4.16 (3.79,4.57)	5.04 (4.51,5.64)
Evolution MP / Evolution MP	5,722	1.16 (0.90,1.50)	3.28 (2.79,3.86)	4.22 (3.62,4.91)	4.85 (4.12,5.69)	5.07 (4.25,6.04)
LCS Complete / M.B.T.	1,928	1.07 (0.69,1.66)	3.35 (2.59,4.32)	4.63 (3.68,5.80)	4.77 (3.80,5.99)	5.14 (3.99,6.62)
Journey II BCS / Journey	7,088	1.25 (1.01,1.55)	3.45 (3.02,3.94)	4.40 (3.89,4.98)	4.95 (4.36,5.61)	5.80 (4.82,6.97)
Journey II / Journey	1,504	1.46 (0.95,2.23)	3.90 (2.97,5.11)	4.65 (3.58,6.03)	5.60 (4.26,7.35)	6.18 (4.54,8.38)
Journey II (Oxinium) / Journey	1,496	1.47 (0.96,2.24)	3.93 (2.99,5.14)	4.68 (3.61,6.07)	5.64 (4.29,7.39)	6.21 (4.57,8.41)
Journey II BCS (Oxinium) / Journey	6,067	1.39 (1.12,1.72)	3.82 (3.34,4.37)	4.82 (4.25,5.47)	5.39 (4.75,6.12)	6.25 (5.23,7.45)
Genesis II (Oxinium) / Genesis II	689	1.60 (0.89,2.86)	3.05 (2.00,4.64)	4.53 (3.21,6.38)	5.34 (3.88,7.33)	6.41 (4.73,8.65)
Scorpio / Series 7000	650	1.38 (0.72,2.64)	4.00 (2.74,5.82)	4.92 (3.51,6.89)	5.47 (3.95,7.55)	6.55 (4.71,9.08)
Sigma / M.B.T.	1,009	1.42 (0.85,2.39)	3.64 (2.62,5.03)	4.43 (3.29,5.95)	5.01 (3.77,6.65)	7.24 (5.38,9.70)
Triathlon CR (Cementless) / Triathlon TS (Cemented)	525	2.01 (1.01,3.98)	4.94 (2.93,8.27)	7.82 (3.55,16.75)	7.82 (3.55,16.75)	7.82 (3.55,16.75)
iTotal	754	1.19 (0.62,2.28)	3.05 (2.04,4.56)	4.33 (3.08,6.07)	5.11 (3.70,7.04)	9.28 (5.81,14.66)
iTotal G2+	733	1.23 (0.64,2.35)	3.00 (1.99,4.52)	4.20 (2.96,5.96)	4.98 (3.57,6.93)	9.42 (5.36,16.26)
Vanguard XP / Vanguard XP	547	2.56 (1.52,4.28)	9.87 (7.65,12.69)	11.72 (9.29,14.72)	12.15 (9.67,15.20)	12.44 (9.92,15.55)

\* Number of patients that contribute to survival analysis used to compute cumulative percent revision

### 3.3 Unicompartmental Arthroplasty (UKA)

#### 3.3.1 Descriptive Statistics

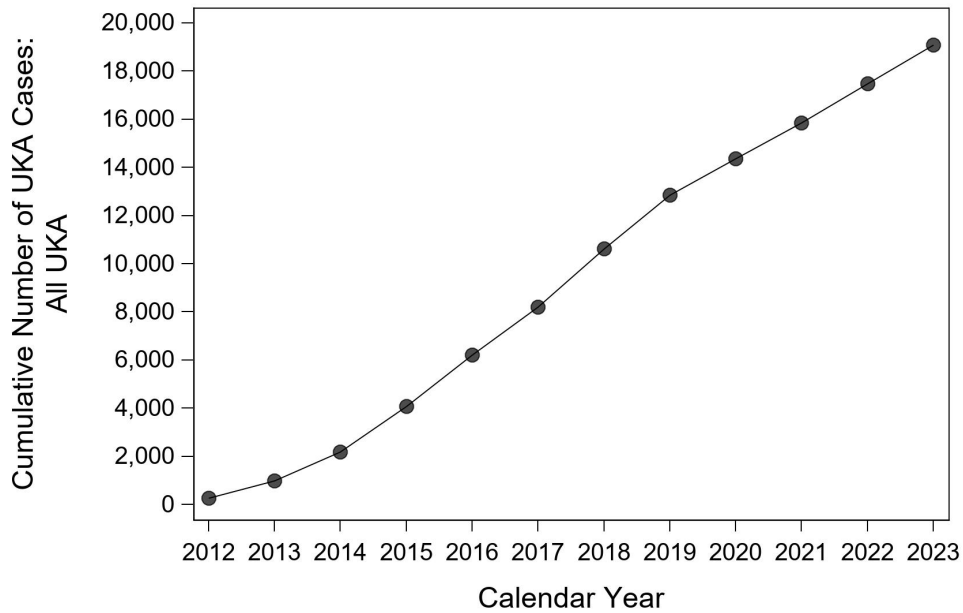


Figure 56. UKA Cases Over Time (in 16,577 Patients)

Table 79. UKA Cases Over Time (Numerical Values)

Year	Annual cases	Cumulative cases
2012	276	276
2013	720	996
2014	1,198	2,194
2015	1,892	4,086
2016	2,117	6,203
2017	2,000	8,203
2018	2,415	10,618
2019	2,247	12,865
2020	1,492	14,357
2021	1,504	15,861
2022	1,615	17,476
2023	1,614	19,090



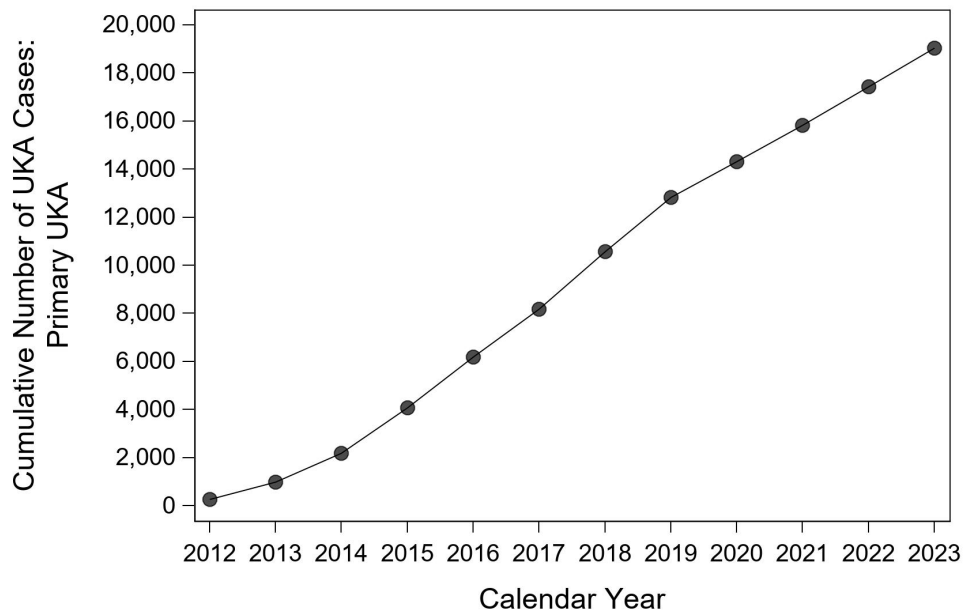


Figure 57. Primary UKA Cases Over Time

Table 80. Primary UKA Cases Over Time (Numerical Values)

Year	Annual cases	Cumulative cases
2012	275	275
2013	717	992
2014	1,193	2,185
2015	1,886	4,071
2016	2,111	6,182
2017	1,995	8,177
2018	2,406	10,583
2019	2,246	12,829
2020	1,491	14,320
2021	1,502	15,822
2022	1,615	17,437
2023	1,610	19,047

Table 81. Descriptive Statistics of Primary UKA Cases

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	9,536	50.1	
Age (years)	19,047	64.2 (10.2)	64 (14)
Height (cm)	19,023	170.1 (10.5)	170.2 (15.2)
Weight (kg)	19,023	90.7 (19.6)	89 (25.4)
BMI (kg/m <sup>2</sup> )	19,022	31.3 (5.8)	30.6 (7.5)
Smoker - Never (%)	9,854	51.7	
Smoker - Previous (%)	7,252	38.1	
Smoker - Current (%)	1,817	9.5	
Smoker - Unknown (%)	124	0.7	

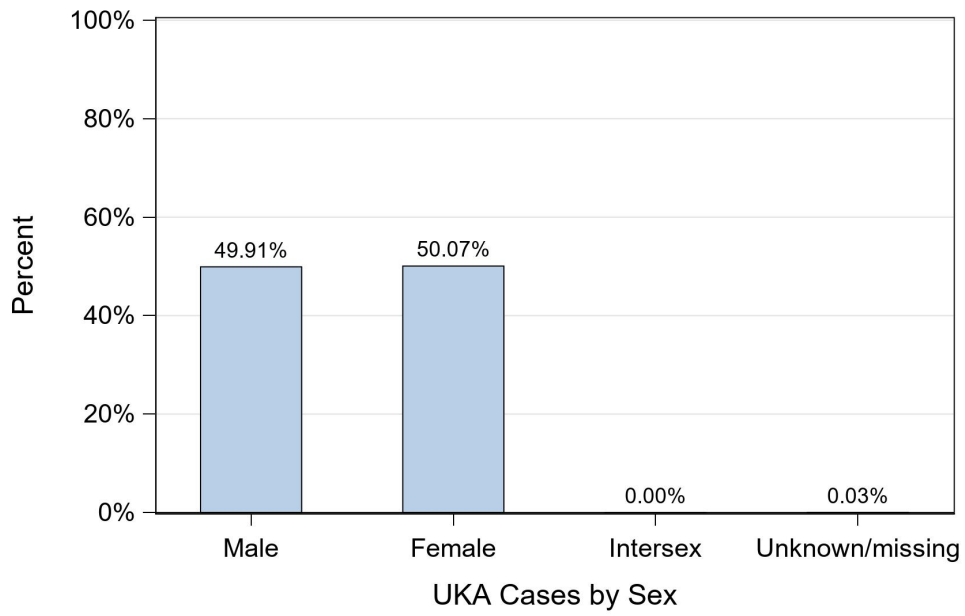


Figure 58. Percent of Primary UKA Cases by Sex

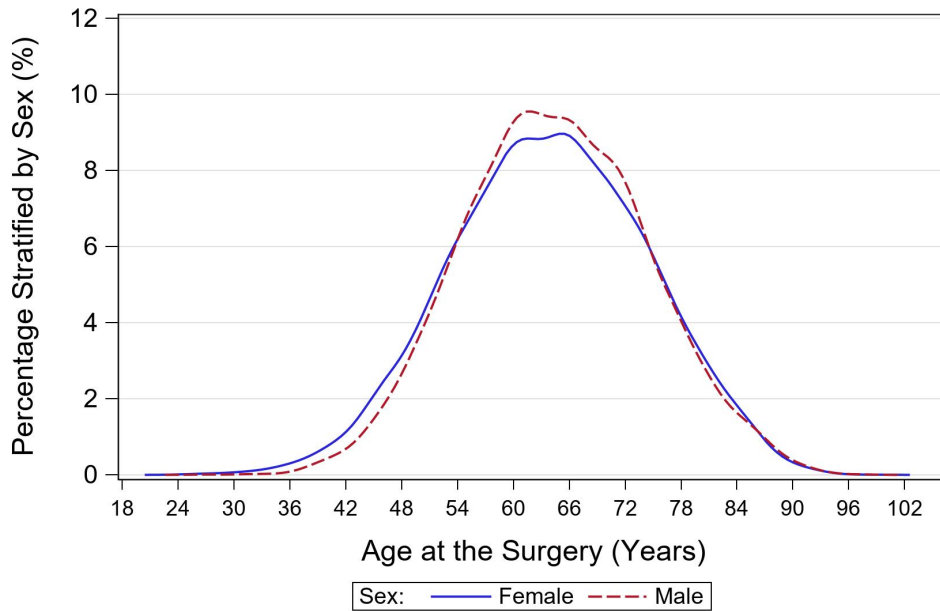
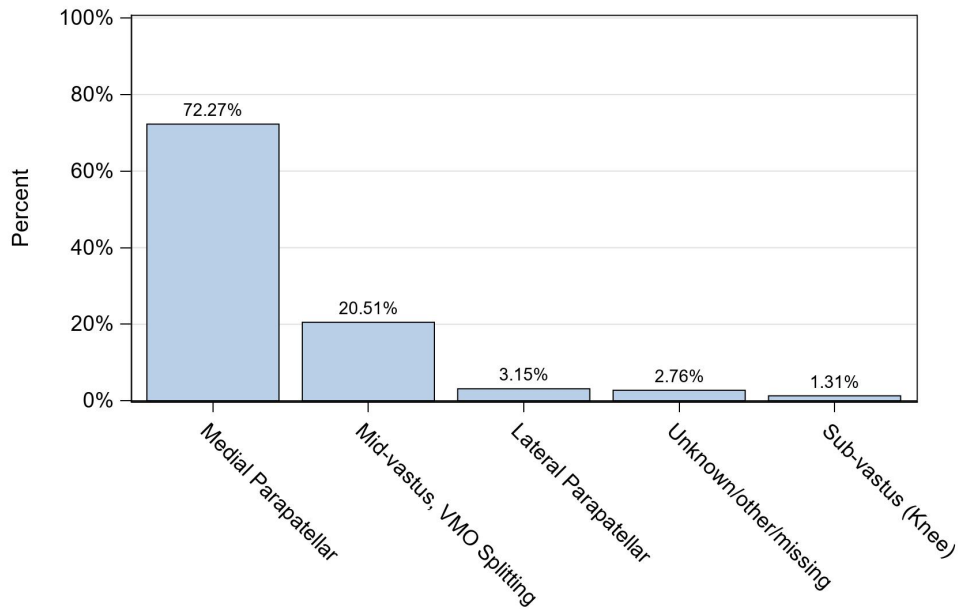
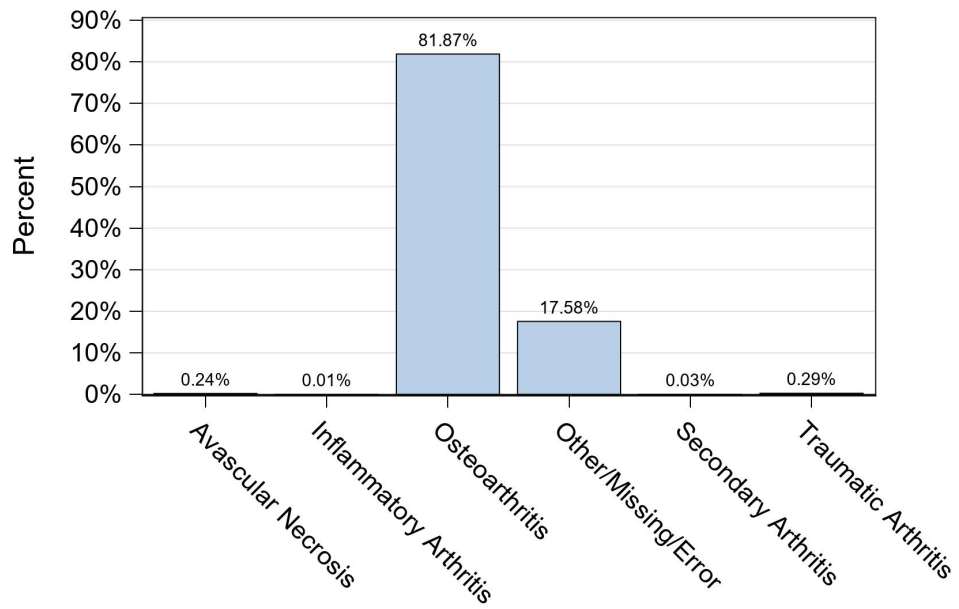


Figure 59. Age Distribution of Primary UKA Cases by Sex



**Figure 60. Percent of Primary UKA Cases by Approach**



**Figure 61. Percent of Primary UKA Cases by Diagnosis**

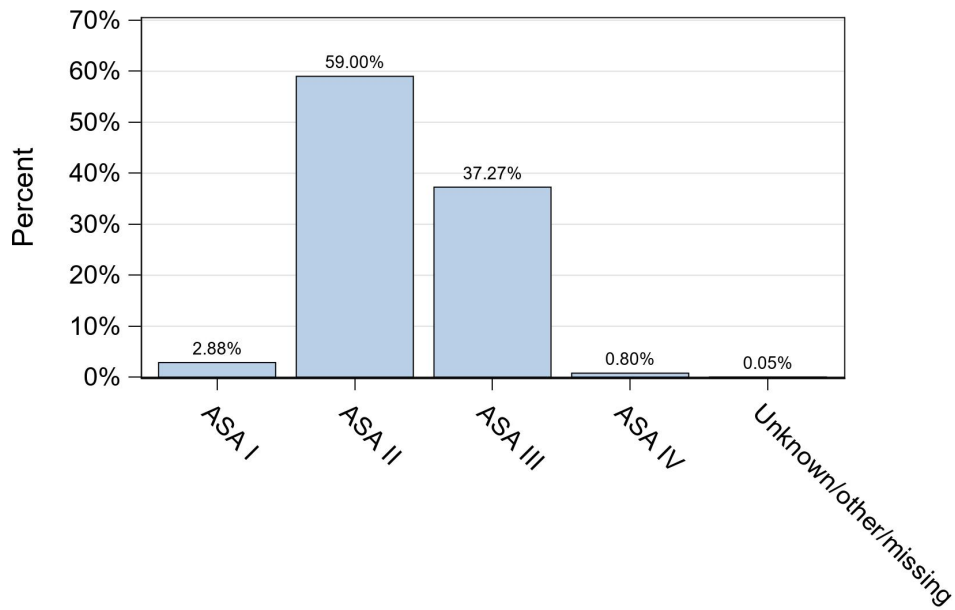


Figure 62. Percent of Primary UKA Cases by ASA Class

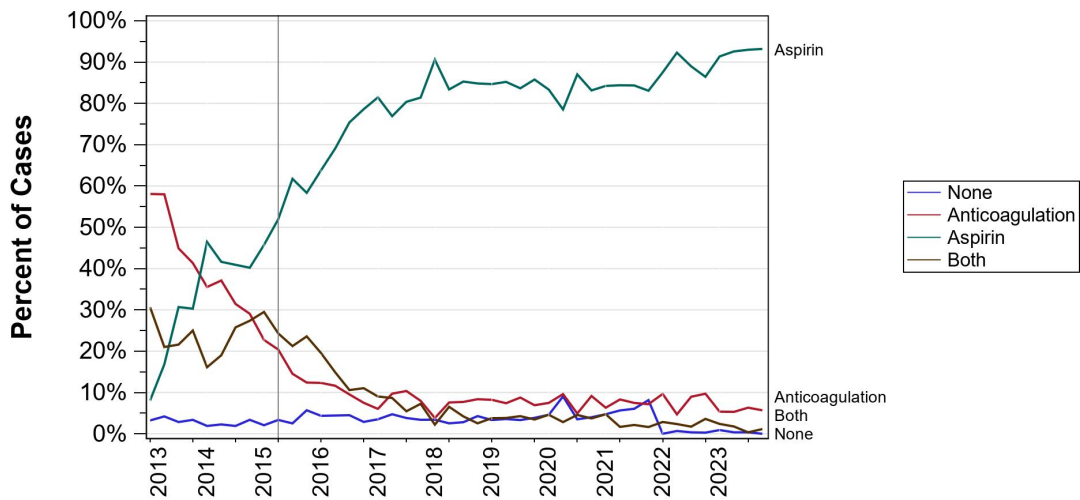


Figure 63. Percent of Primary UKA Patients (First Case) by Thrombosis Prophylaxis

### 3.3.2 Revision Risk (Overall and by Sex)

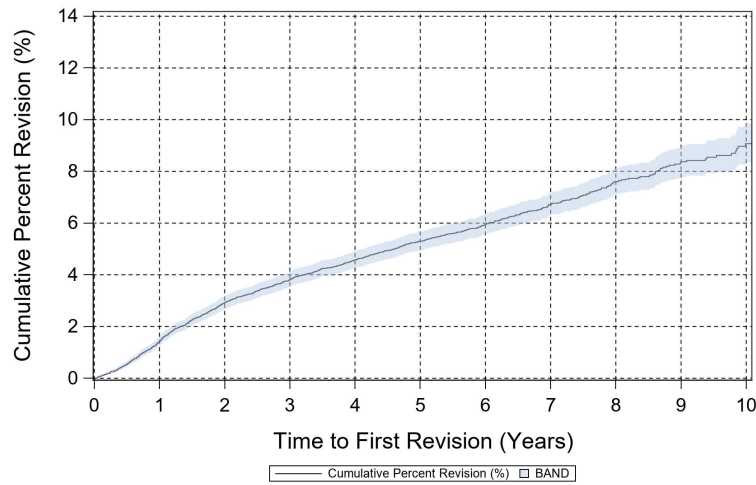


Figure 64. Cumulative Percent Revision for Primary UKA

Table 82. Cumulative Percent Revision for Primary UKA (Numerical Values)

	1 year	3 years	5 years	7 years	10 years
CPR	1.41 (1.25,1.60)	3.81 (3.53,4.11)	5.30 (4.95,5.67)	6.72 (6.29,7.17)	9.07 (8.34,9.86)
Number at risk	17,133	13,709	9,927	5,674	892

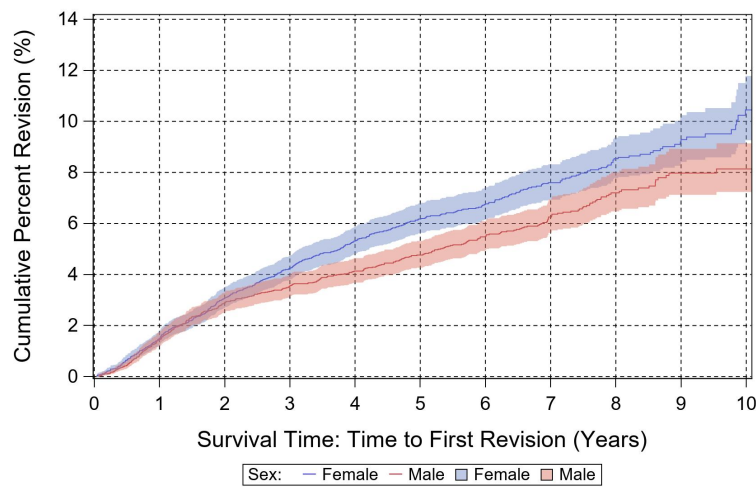


Figure 65. Cumulative Percent Revision for Primary UKA by Sex for Osteoarthritis Diagnosis

Table 83. Cumulative Percent Revision for Primary UKA by Sex for Osteoarthritis Diagnosis (Numerical Values)

	N	1 year	3 years	5 years	7 years	10 years
Female	7,919	1.49 (1.24,1.78)	4.24 (3.80,4.74)	6.17 (5.61,6.79)	7.60 (6.93,8.32)	10.45 (9.26,11.78)
Male	7,615	1.46 (1.20,1.76)	3.55 (3.14,4.02)	4.76 (4.27,5.32)	6.25 (5.63,6.94)	8.13 (7.23,9.14)
Unknown/Missing	4					

### 3.3.3 Reasons for Revision

The reasons for revision are of central importance to quality improvement because it helps focus attention on specific causes that may be addressed. Therefore, the data are presented in two formats below: tabular and Pareto chart. The tabular format is consistent with how other arthroplasty registries report the cause(s) of revision. The Pareto chart figure presents the same data in a format commonly used in quality improvement. The Pareto chart sorts the reasons for revision by frequency (bar chart on the bottom, from left to right) and presents a cumulative percent using a line graph above.

It is important to note that the time window for the cases reported in the reasons for revision tables and figure differs from the time window used for other figures because the reason for revision was added to the database on 1/1/2015. While these data capture revisions for primaries performed back to 2/15/2012, only revisions occurring on or after 1/1/2015 are included in the reasons for revision figure and tables. Note that for knees, instability/dislocation should be interpreted as instability.

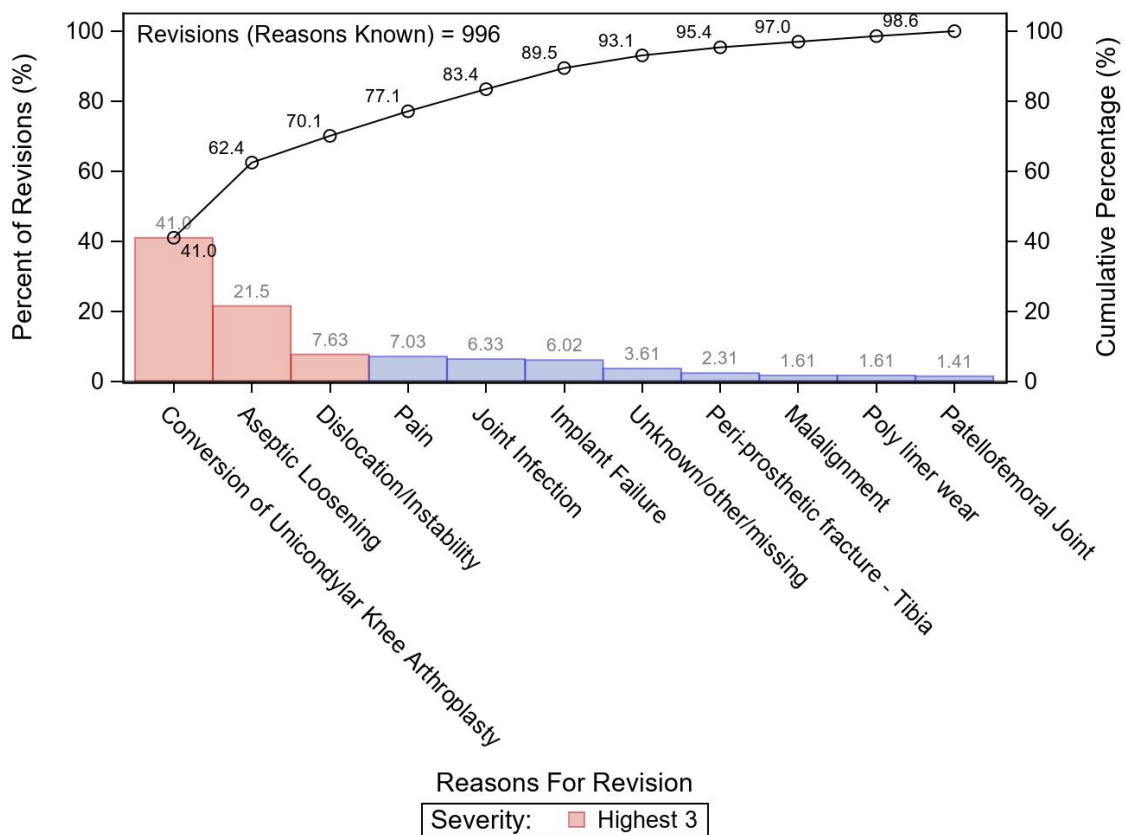


Figure 66. Most Common Reasons for First Revision Following Primary UKA (Pareto Chart)

**Table 84. Reasons for First Revision Following Primary UKA**

Rank	Reason for Revision	N	Percent
1	Conversion of Unicondylar Knee Arthroplasty	408	41.0
2	Aseptic Loosening	214	21.5
3	Dislocation/Instability	76	7.6
4	Pain	70	7.0
5	Joint Infection	63	6.3
6	Implant Failure	60	6.0
7	Peri-prosthetic fracture - Tibia	23	2.3
8	Poly liner wear	16	1.6
9	Malalignment	16	1.6
10	Patellofemoral Joint	14	1.4
	Unknown/missing/other	36	3.6

**Table 85. Reasons for First Revision Following Primary UKA in First Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Conversion of Unicondylar Knee Arthroplasty	60	25.5
2	Aseptic Loosening	39	16.6
3	Joint Infection	37	15.7
4	Implant Failure	20	8.5
5	Peri-prosthetic fracture - Tibia	20	8.5
6	Dislocation/Instability	19	8.1
7	Pain	17	7.2
8	Arthrofibrosis	5	2.1
9	Extensor mechanism failure	5	2.1
10	Metal Reaction/Metallosis	4	1.7
	Unknown/missing/other	3	3.8

**Table 86. Reasons for First Revision Following Primary UKA in Second Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Conversion of Unicondylar Knee Arthroplasty	98	40.5
2	Aseptic Loosening	64	26.4
3	Pain	25	10.3
4	Dislocation/Instability	19	7.9
5	Implant Failure	13	5.4
6	Joint Infection	11	4.5
7	Malalignment	5	2.1
8	Osteolysis	2	0.8
9	Arthrofibrosis	2	0.8
10	Poly liner wear	1	0.4
	Unknown/missing/other	1	0.8

**Table 87. Reasons for First Revision Following Primary UKA in Third Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Conversion of Unicondylar Knee Arthroplasty	61	44.9
2	Aseptic Loosening	31	22.8
3	Pain	14	10.3
4	Dislocation/Instability	9	6.6
5	Implant Failure	7	5.1
6	Joint Infection	5	3.7
7	Malalignment	5	3.7
8	Patellofemoral Joint	2	1.5
9	Poly liner wear	1	0.7
10	Arthrofibrosis	1	0.7

### 3.3.4 Most Commonly Used Implants

The following three tables provide utilization data of implants used in primary UKA.

**Table 88. Ten Most Commonly Used Femoral Components in Primary UKA**

Rank	Component	N	Percent
1	Restoris MCK	7,214	37.9
2	Persona	3,350	17.6
3	Oxford	3,349	17.6
4	ZUK*	3,114	16.4
5	Journey	491	2.6
6	Triathlon PKR	440	2.3
7	Journey II	389	2.0
8	iBalance	245	1.3
9	Sigma HP	239	1.2
10	Stride	111	0.6
11	Others	105	0.6

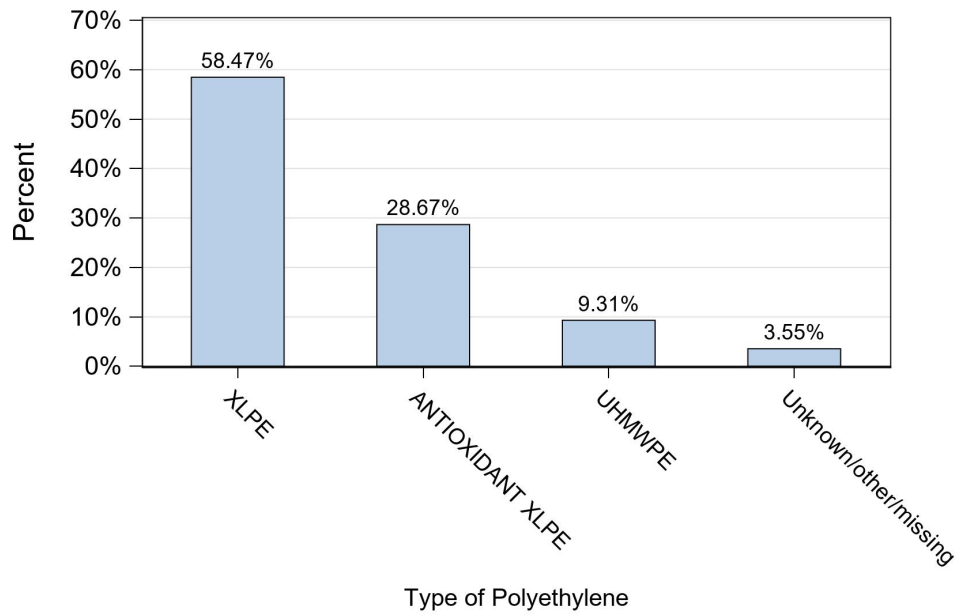
\* ZUK (Zimmer Unicondylar Knee) was formerly known as the Zimmer High Flex Knee.

**Table 89. Ten Most Commonly Used Femoral/Tibial Component Combinations in Primary UKA**

Rank	Component combination	N	Percent
1	Restoris MCK / Restoris MCK	7,190	37.8
2	Persona / Persona	3,338	17.5
3	Oxford / Oxford	3,252	17.1
4	ZUK / ZUK*	3,080	16.2
5	Triathlon PKR / Triathlon PKR	434	2.3
6	Journey / ZUK*	367	1.9
7	Journey II / Journey II	255	1.3
8	Sigma HP / Sigma HP	236	1.2
9	iBalance / iBalance	231	1.2
10	Journey / Journey	113	0.6
11	Others	551	2.9

\* ZUK (Zimmer Unicondylar Knee) was formerly known as the Zimmer High Flex Knee.





**Figure 67. Percentage of Polyethylene Inserts by Type of Polyethylene in Primary UKA**

### 3.3.5 Revision Risk by Implant Summary

While the reader is encouraged to read the details of each femur/tibia implant combination, the following table summarizes the ten-year CPR values.

**Table 90. Cumulative Percent Revision Following Primary UKA for Femoral/Tibial Combinations Having at Least 500 Primary Cases, Sorted Alphabetically**

Femoral/Tibial Combination	N*	1 year	3 years	5 years	7 years	10 years
Oxford / Oxford	3,232	1.80 (1.39,2.32)	4.89 (4.18,5.71)	6.93 (6.07,7.90)	9.03 (7.99,10.18)	12.37 (10.80,14.15)
Persona / Persona	3,335	1.36 (1.01,1.84)	3.12 (2.50,3.88)	3.67 (2.95,4.56)	N/A	N/A
Restoris MCK / Restoris MCK	7,174	1.17 (0.94,1.46)	3.25 (2.83,3.73)	4.78 (4.24,5.38)	5.75 (5.10,6.49)	10.21 (7.48,13.86)
ZUK / ZUK**	3,061	1.08 (0.77,1.51)	3.04 (2.49,3.72)	4.00 (3.35,4.76)	4.83 (4.10,5.69)	6.23 (5.25,7.40)

\* Number of patients that contribute to survival analysis used to compute cumulative percent revision

\*\* This implant (Zimmer Unicondylar Knee) was formerly known as the Zimmer High Flex Knee

**Table 91. Cumulative Percent Revision Following Primary UKA for Femoral/Tibial Combinations Having at Least 500 Primary Cases, Sorted by Ten-year CPR**

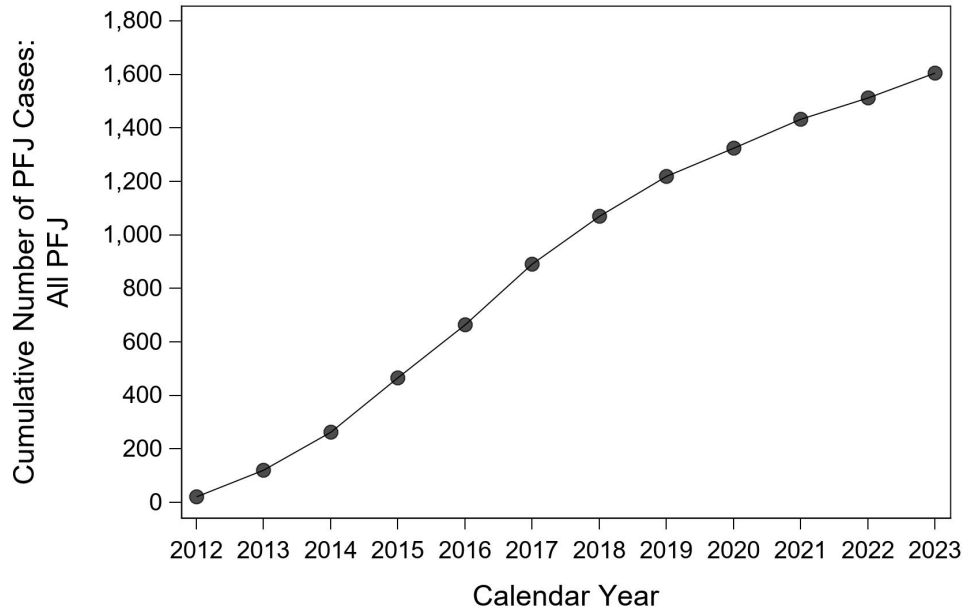
Femoral/Tibial Combination	N*	1 year	3 years	5 years	7 years	10 years
ZUK / ZUK**	3,061	1.08 (0.77,1.51)	3.04 (2.49,3.72)	4.00 (3.35,4.76)	4.83 (4.10,5.69)	6.23 (5.25,7.40)
Restoris MCK / Restoris MCK	7,174	1.17 (0.94,1.46)	3.25 (2.83,3.73)	4.78 (4.24,5.38)	5.75 (5.10,6.49)	10.21 (7.48,13.86)
Oxford / Oxford	3,232	1.80 (1.39,2.32)	4.89 (4.18,5.71)	6.93 (6.07,7.90)	9.03 (7.99,10.18)	12.37 (10.80,14.15)

\* Number of patients that contribute to survival analysis used to compute cumulative percent revision

\*\* This implant (Zimmer Unicondylar Knee) was formerly known as the Zimmer High Flex Knee

### 3.4 Patellofemoral Joint Arthroplasty (PFJ)

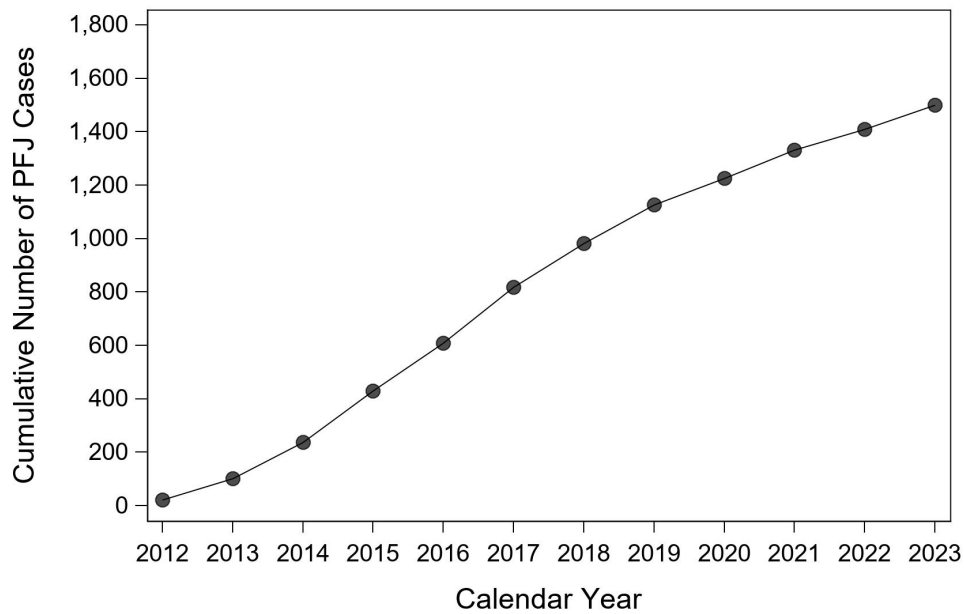
#### 3.4.1 Descriptive Statistics



**Figure 68. PFJ Cases Over Time (in 1,358 Patients)**

**Table 92. PFJ Cases Over Time (Numerical Values)**

Year	Annual cases	Cumulative cases
2012	23	23
2013	98	121
2014	142	263
2015	204	467
2016	198	665
2017	226	891
2018	180	1,071
2019	149	1,220
2020	105	1,325
2021	109	1,434
2022	80	1,514
2023	92	1,606



**Figure 69. Primary PFJ Cases Over Time**

**Table 93. Primary PFJ Cases Over Time (Numerical Values)**

Year	Annual cases	Cumulative cases
2012	22	22
2013	79	101
2014	136	237
2015	192	429
2016	180	609
2017	210	819
2018	164	983
2019	143	1,126
2020	101	1,227
2021	104	1,331
2022	78	1,409
2023	92	1,501

**Table 94. Descriptive Statistics of Primary PFJ Cases**

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	1,127	75.1	
Age (years)	1,501	53.8 (12.5)	54 (18)
Height (cm)	1,499	168.5 (10)	167.6 (13.3)
Weight (kg)	1,499	87.3 (19.9)	85.8 (28.1)
BMI (kg/m <sup>2</sup> )	1,499	30.6 (6.1)	30.1 (8.1)
Smoker - Never (%)	777	51.8	
Smoker - Previous (%)	443	29.5	
Smoker - Current (%)	223	14.9	
Smoker - Unknown (%)	58	3.9	

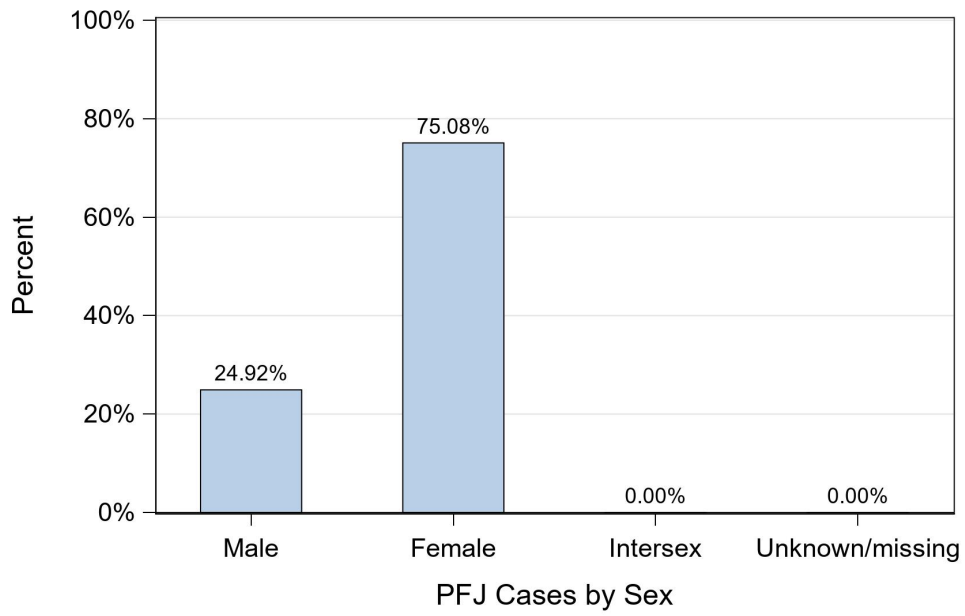
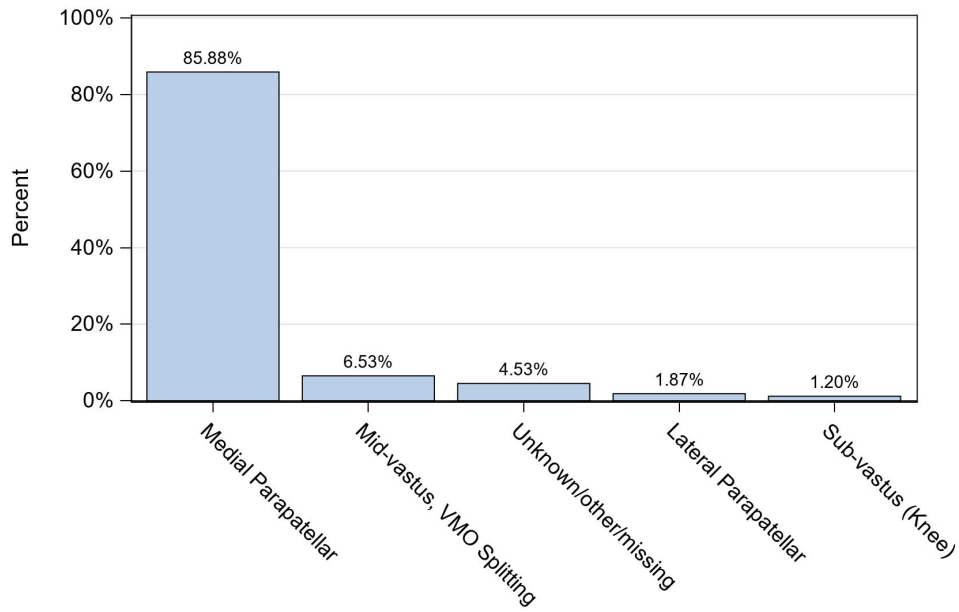


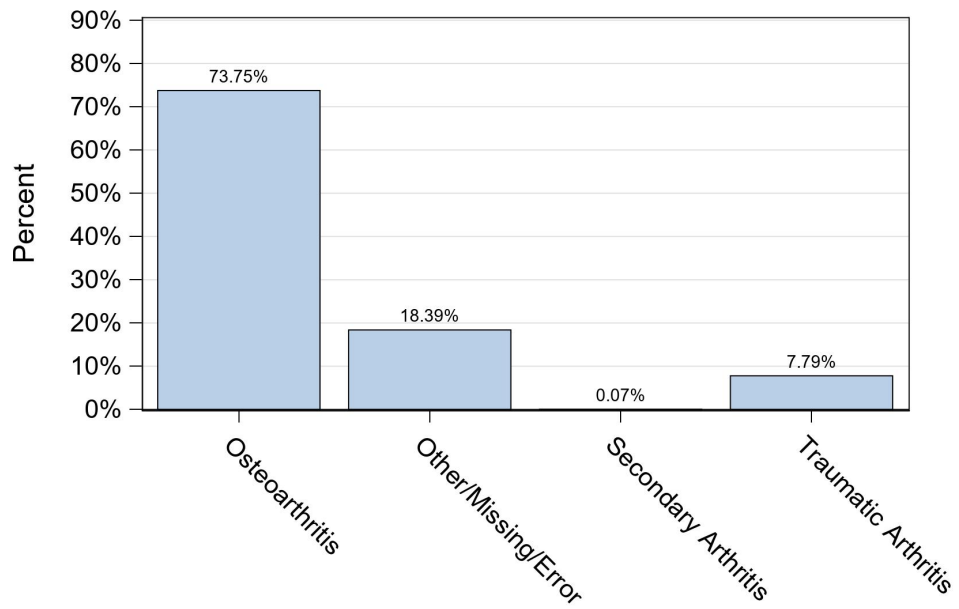
Figure 70. Percent of Primary PFJ Cases by Sex



Figure 71. Age Distribution of Primary PFJ Cases by Sex



**Figure 72. Percent of Primary PFJ Cases by Approach**



**Figure 73. Percent of Primary PFJ Cases by Diagnosis**

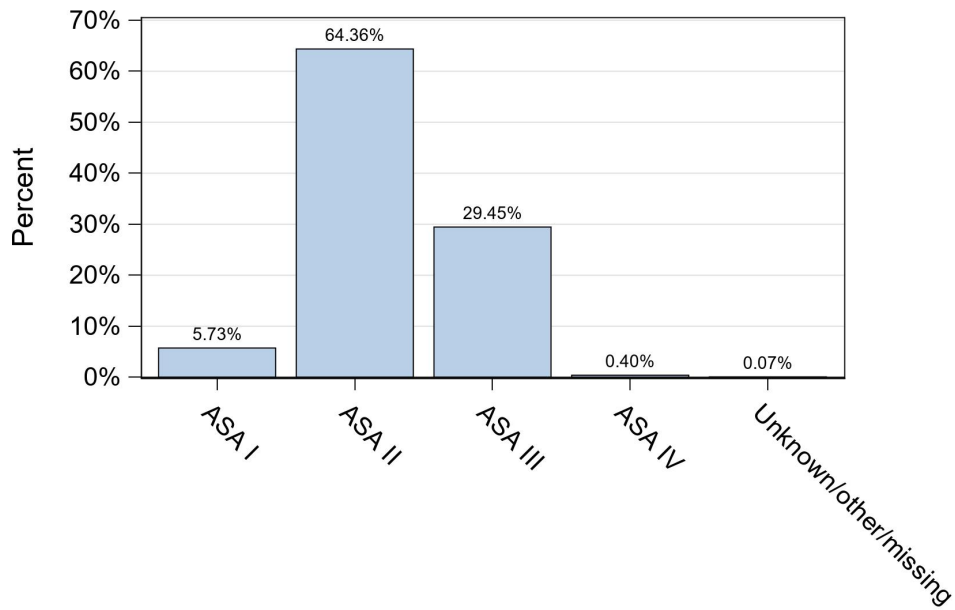


Figure 74. Percent of Primary PFJ Cases by ASA Class

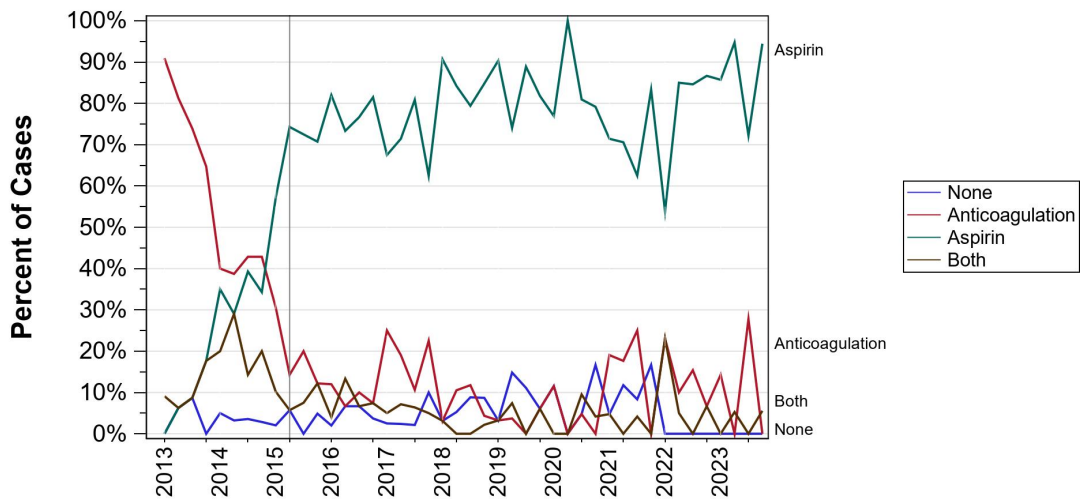


Figure 75. Percent of Primary PFJ Patients (First Case) by Thrombosis Prophylaxis

### 3.4.2 Revision Risk (Overall and by Sex)

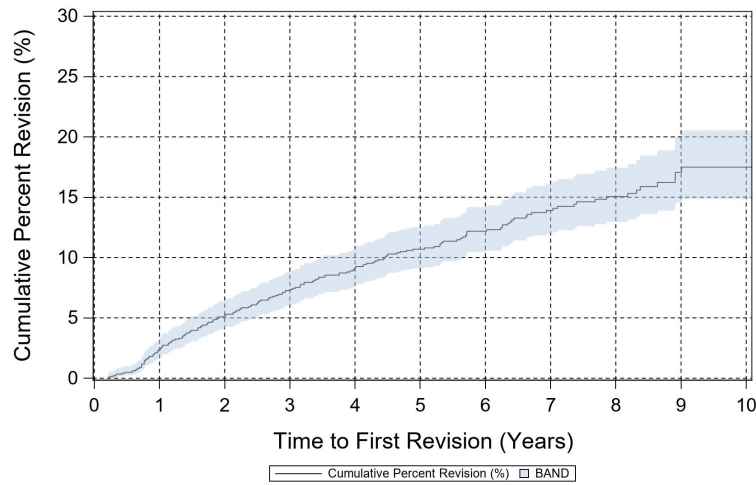


Figure 76. Cumulative Percent Revision for Primary PFJ

Table 95. Cumulative Percent Revision for Primary PFJ (Numerical Values)

	1 year	3 years	5 years	7 years	10 years
CPR	2.31 (1.65,3.23)	7.28 (6.02,8.80)	10.70 (9.11,12.54)	13.90 (11.97,16.11)	17.49 (14.86,20.54)
Number at risk	1,372	1,132	862	506	76

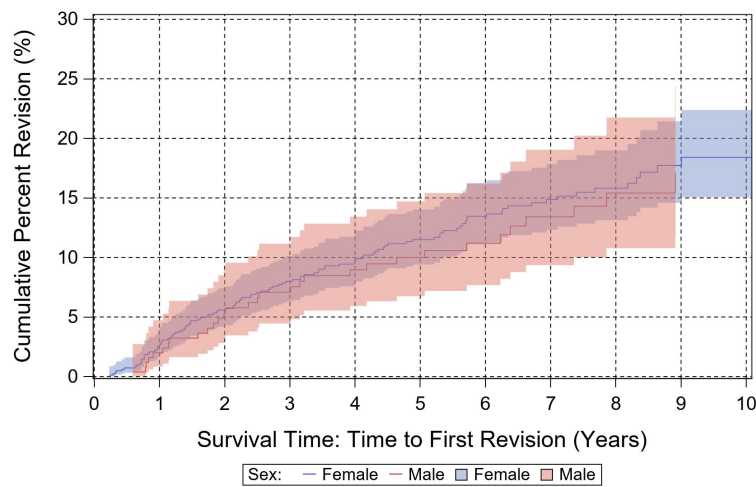


Figure 77. Cumulative Percent Revision for Primary PFJ by Sex for Osteoarthritis Diagnosis

Table 96. Cumulative Percent Revision for Primary PFJ by Sex for Osteoarthritis Diagnosis (Numerical Values)

	N	1 year	3 years	5 years	7 years	10 years
Female	839	2.58 (1.69,3.92)	7.99 (6.30,10.12)	11.51 (9.40,14.04)	14.87 (12.34,17.86)	18.41 (15.08,22.38)
Male	264	2.00 (0.84,4.73)	7.09 (4.46,11.16)	10.00 (6.75,14.70)	13.41 (9.35,19.04)	17.10 (11.80,24.43)
Unknown/Missing	0					



### 3.4.3 Reasons for Revision

The reasons for revision are of central importance to quality improvement because it helps focus attention on specific causes that may be addressed. Therefore, the data are presented in two formats below: tabular and Pareto chart. The tabular format is consistent with how other arthroplasty registries report the cause(s) of revision. The Pareto chart figure presents the same data in a format commonly used in quality improvement. The Pareto chart sorts the reasons for revision by frequency (bar chart on the bottom, from left to right) and presents a cumulative percent using a line graph above.

It is important to note that the time window for the cases reported in the reasons for revision tables and figure differs from the time window used for other figures because the reason for revision was added to the database on 1/1/2015. While these data capture revisions for primaries performed back to 2/15/2012, only revisions occurring on or after 1/1/2015 are included in the reasons for revision figure and tables. Note that for knees, instability/dislocation should be interpreted as instability.

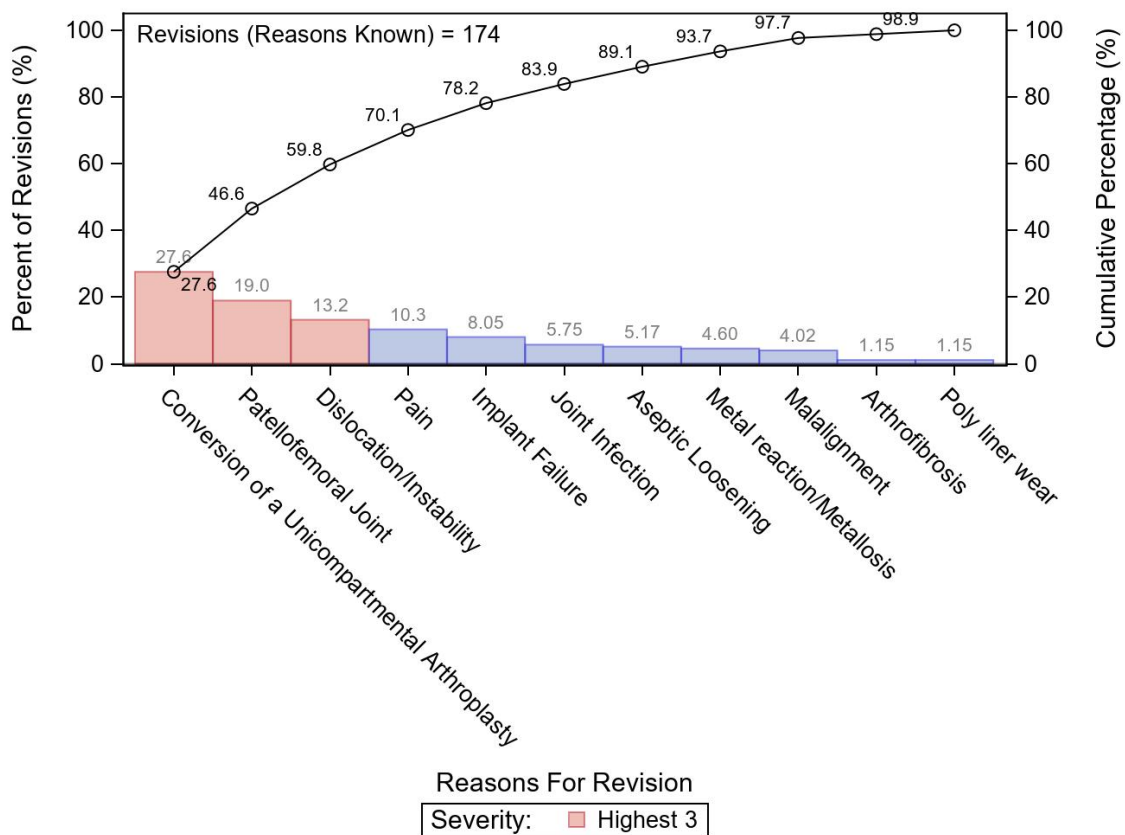


Figure 78. Most Common Reasons for First Revision Following Primary PFJ (Pareto Chart)

**Table 97. Reasons for First Revision Following Primary PFJ**

Rank	Reason for Revision	N	Percent
1	Conversion of a Unicompartmental Arthroplasty	48	27.6
2	Patellofemoral Joint	33	19.0
3	Dislocation/Instability	23	13.2
4	Pain	18	10.3
5	Implant Failure	14	8.0
6	Joint Infection	10	5.7
7	Aseptic Loosening	9	5.2
8	Metal Reaction/Metallosis	8	4.6
9	Malalignment	7	4.0
10	Poly liner wear	2	1.1
	Unknown/missing/other	2	1.1

**Table 98. Reasons for First Revision Following Primary PFJ in First Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Patellofemoral Joint	6	18.8
2	Conversion of a Unicompartmental Arthroplasty	5	15.6
3	Malalignment	4	12.5
4	Aseptic Loosening	3	9.4
5	Dislocation/Instability	3	9.4
6	Implant Failure	3	9.4
7	Pain	3	9.4
8	Joint Infection	2	6.2
9	Metal Reaction/Metallosis	2	6.2
10	Arthrofibrosis	1	3.1

**Table 99. Reasons for First Revision Following Primary PFJ in Second Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Conversion of a Unicompartmental Arthroplasty	9	23.7
2	Pain	8	21.1
3	Patellofemoral Joint	7	18.4
4	Dislocation/Instability	4	10.5
5	Joint Infection	4	10.5
6	Implant Failure	3	7.9
7	Metal Reaction/Metallosis	2	5.3
8	Malalignment	1	2.6

**Table 100. Reasons for First Revision Following Primary PFJ in Third Year Post-operatively**

Rank	Reason for Revision	N	Percent
1	Conversion of a Unicompartmental Arthroplasty	7	25.9
2	Dislocation/Instability	5	18.5
3	Implant Failure	3	11.1
4	Metal Reaction/Metallosis	3	11.1
5	Patellofemoral Joint	3	11.1
6	Joint Infection	2	7.4
7	Pain	2	7.4
8	Aseptic Loosening	1	3.7
9	Malalignment	1	3.7

### 3.4.4 Most Commonly Used Implants

**Table 101. Ten Most Commonly Used Trochlear Components in Primary PFJ**

Rank	Component	N	Percent
1	Gender Solutions PFJ	506	33.7
2	Restoris MCK	396	26.4
3	iBalance	286	19.1
4	HemiCAP	119	7.9
5	Competitor PFJ	94	6.3
6	Avon	46	3.1
7	Sigma HP	38	2.5
8	Vanguard PFR	16	1.1

### 3.4.5 Revision Risk by Implant Summary

**Table 102. Cumulative Percent Revision Following Primary PFJ for Implants Having at Least 500 Primary Cases**

Implant	N*	1 year	3 years	5 years	7 years	10 years
Gender Solutions PFJ	506	1.27 (0.57,2.80)	6.16 (4.26,8.86)	9.74 (7.18,13.14)	14.09 ( 10.60, 18.61)	18.26 (13.41,24.60)

\* Number of patients that contribute to survival analysis used to compute cumulative percent revision.  
include references

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