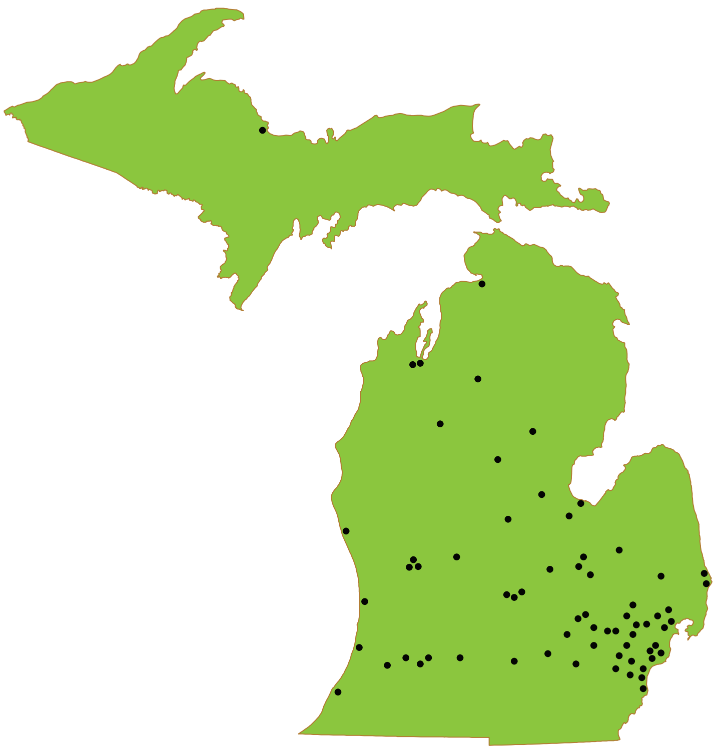
2021 Michigan Arthroplasty Registry Collaborative Quality Initiative (MARCQI) Annual Report

December 2021

MARCQI Sites



Ascension Borgess Hospital, Kalamazoo
Ascension Genesys Hospital, Grand Blanc
Ascension Macomb-Oakland Hospital, Warren
Ascension Providence Hospital, Southfield/Novi
Ascension Providence Rochester Hospital, Rochester
Ascension St. John Hospital, Detroit
Ascension St. Mary's Hospital, Saginaw
Beaumont Hospital - Dearborn
Beaumont Hospital - Farmington Hills
Beaumont Hospital - Grosse Pointe
Beaumont Hospital - Royal Oak
Beaumont Hospital - Taylor
Beaumont Hospital - Trenton
Beaumont Hospital - Troy
Brighton Center for Surgical Care, Brighton
Brighton Surgery Center (SJMH), Brighton
Bronson Battle Creek Hospital, Battle Creek
Bronson Lakeview Hospital, Paw Paw
Bronson Methodist Hospital, Kalamazoo
Covenant Medical Center, Saginaw
DMC Harper University Hospital, Detroit
DMC Huron Valley-Sinai, Commerce Township
DMC Sinai Grace Hospital, Detroit
Garden City Hospital, Garden City
Grand Rapids Surgical Center, Grand Rapids
Henry Ford Allegiance Health, Jackson
Henry Ford Cottage, Grosse Pointe
Henry Ford Hospital, Detroit
Henry Ford Health, West Bloomfield
Henry Ford Health, Wyandotte
Henry Ford Macomb Hospital, Clinton Township
Holland Hospital, Holland
Hurley Medical Center, Flint
Lake Huron Medical Center, Port Huron
Lakes Surgery Center, West Bloomfield
McLaren Bay Region, Bay City
McLaren Central Michigan Hospital, Mt. Pleasant
McLaren Flint Hospital, Flint
McLaren Greater Lansing Hospital, Lansing
McLaren Lapeer Region Hospital, Lapeer
McLaren Macomb Hospital, Mt. Clemens
McLaren Northern Michigan Hospital, Petoskey
McLaren Oakland Hospital, Pontiac
McLaren Port Huron Hospital, Port Huron
Memorial Healthcare, Owosso
Mercy Health Partners, Muskegon
Mercy Health St. Mary's, Grand Rapids
Michigan Medicine, Ann Arbor
MidMichigan Health, Alpena
MidMichigan Health, Clare
MidMichigan Health, Gratiot
MidMichigan Health, Midland
MidMichigan Health, West Branch
Munson Medical Center, Traverse City
Munson Healthcare, Cadillac
Munson Healthcare, Grayling
Muskegon Surgery Center, Muskegon
OAM Surgery Center at MidTowne, Grand Rapids
Precision Surgery Center, Macomb Township
Premier Surgical Center, Clinton Township
Red Cedar Surgery Center, Haslett
Sparrow Hospital, Lansing
Sparrow Ionia Hospital, Ionia
Spectrum Health, Grand Rapids
Spectrum Health Lakeland, St. Joseph/Niles & Watervliet
St. Joseph Mercy Health, Ann Arbor
St. Joseph Mercy Health, Chelsea
St. Joseph Mercy Health Livingston, Howell
St. Joseph Mercy Health Oakland, Pontiac
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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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We thank all members of MARCQI, including clinical data abstractors, clinical champions, hospital quality leads, and orthopaedic surgeons across the state. Without their participation, MARCQI would not exist. We also thank specific MARCQI staff for helping produce this report: Qi Zhu (database management), and Anne Kagay-Lidster (cover design).

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Contents

Preface

MARCQI has remained strong and active during the COVID-19 pandemic. The pandemic had a profound effect on the care of arthroplasty patients in Michigan by affecting case volumes, surgical wait times and dramatically accelerated the shift of cases to ambulatory surgery centers (ASCs) and hospital outpatient departments (HOPDs). The pandemic also impacted the hard-working team that ensures that MARCQI continues to collect high quality data and do the work of continuous quality improvement. Many of our data abstractors were recruited to direct patient care roles to help care for COVID-19 patients. Our coordinating center team was pulled to assist with the administration and analytics for the new COVID-19 registry.

As a result, the abstraction and analysis of cases from 2019 and 2020 was significantly delayed as team member tried to catch up after, sometimes, months away from their work. We had to make the hard decision in 2020 not to produce an annual report. We made this choice rather than produce a report with incomplete data.

During this time, the day-to-day work of MARCQI has continued. We have transitioned our collaborative meetings to a virtual platform and, although it is not ideal, With thanks to our patients and all those who worked to make this possible we have learned how to continue to work together while apart. We have hired new team members and others have moved on to other opportunities. Sites have developed and accomplished amazing quality improvement projects. These have been presented to the Collaborative to share those ideas and innovations. A lot has happened since our last report. This update will highlight some of the progress we have made during this time and map out where we hope to go in the future.

The pandemic has continued longer than any of us ever could have imaging, but through the diligence of our team across the state and the herculean effort of our coordinating center team, we are proud to release the MARCQI 2021 Annual Report. The report contains three important new sections:

1. Effect of cementing stems in conventional THA cases on revision (section 2.2.1),

2. Effect of stability in TKA on revision (section 3.2.4), and

3. Effect of resurfacing the patella in TKA on revision (section 3.2.5).

With thanks to our patients and all those who worked to make this possible,

Richard E. Hughes, Ph.D.
MARCQI Co-Director

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

Chapter 1

Quality improvement in MARCQI

MARCQI Quality Improvement Progress

Since the last MARCQI annual report, we have focused on numerous state-wide quality improvement projects. These have included improved pain management and reduction in unnecessary opioid prescribing, reducing early revisions, prevention of venous thromboembolism, improving patient reported outcomes, and ensuring the safety of patients during the transition to outpatient arthroplasty. In addition, the participating sites have been working on site-based QI projects and have shared some of their results at the collaborative meeting. This summary will highlight some of the projects over the last 2 years.

Pain Optimization Protocol (POP) and Opioid Prescribing

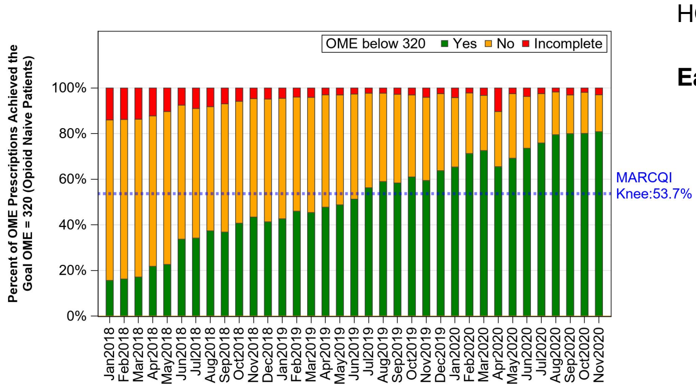

Figure 1: MARCQI overall performance for primary knee cases (opioid naïve patients).

MARCQI developed and distributed patient education materials to support the MARCQI Pain Optimization Protocol (POP). Since the start of this program, sites and surgeons in Michigan have made great progress in reducing opioid prescribing after hip and knee replacement. Smaller post-op prescriptions have been shown to reduce total opioid dose taken, prolonged opioid use, and diversion of unused opioids into the community without increasing refills (Howard *et al.*, 2018; Sekhri *et al.*, 2018; Sabatino *et al.*, 2018).

The POP detailed specific goals for prescribing based on an analysis of actual patient opioid usage in Michigan (Roberts *et al.*, 2020). The percentage of cases meeting the goals in the MARCQI POP has risen to 80% for TKA (figure 1) and over 70% for THA patients.

In order to ensure that this decrease in prescribing is not leading to increased pain, decreased function or problems such as emergency department visits and readmissions, MARCQI is also performing regular surveillance. This program has found that with continued reductions in opioid prescribing ED visits and readmissions have not changed and patients are still improving. Improvement in general health and joint specific PROS scores (PROMIS pain and HOOS JR/KOOS JR) has not changed.

Early Hip Revision

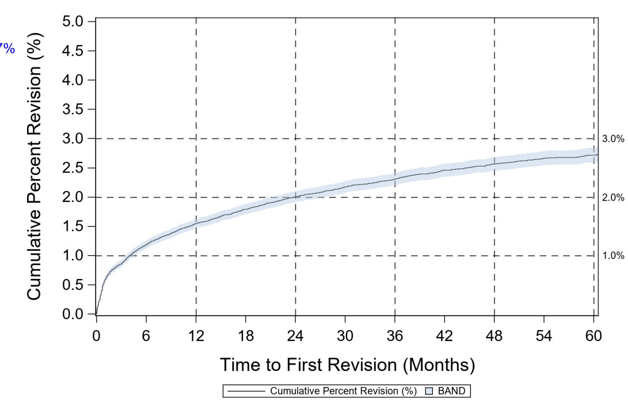

Figure 2: Cumulative percent revision for primary conventional THA.

While total hip arthroplasty is a life changing, durable procedure for most patients, MARCQI has found that almost

2.7% of primary total hip arthroplasties in Michigan have been revised in the first 5 years after surgery (figure 2). The majority of those failures occur in the first 6 months after surgery. There is also good evidence that patients that are revised early are at higher risk for infection and reduced longevity of the subsequent surgery (Shen *et al.*, 2021; Quinlan *et al.*, 2020).

The most common reason for these early failures is fracture. While some of these fractures may not be avoidable, recent analyses of early revisions in the United States found that the majority of early revisions were potentially avoidable (Novikov *et al.*, 2019; Brown *et al.*, 2021). This offers an opportunity for MARCQI surgeons and hospitals to improve care and avoid these early failures. MARCQI has been focused on reducing these early revisions by encouraging surgeons to review their surgeon level results and consider the implant selection and fixation they choose for their patients.

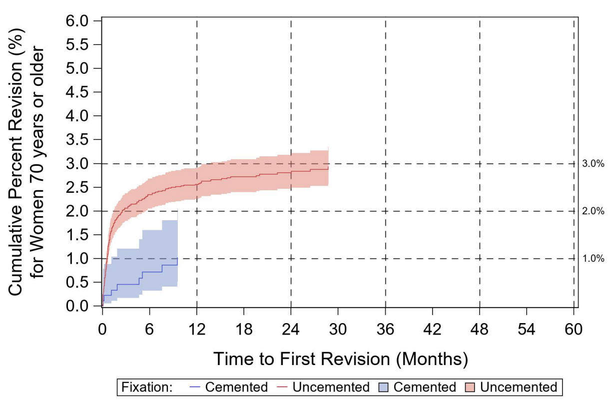

Figure 3: Cumulative percent revision for primary conventional THA for women 70 years and older.

The patient group at highest risk for fracture and early revision is elderly women, likely due to the bone loss that occurs after menopause. One technique that has been associated with fewer early revisions in multiple studies and registries is cementing the femoral stem, especially in patients at increased risk for fracture. (Scanelli *et al.*, 2019) In the MARCQI data, women at least 70 years old with a cemented femoral stem had fewer than half the revisions in the first year as those with an uncemented stem. (Figure 3) Despite this, cementing is unusual in the United States and in Michigan 4.6% of patients had a cement femoral stem and only 13.1% of women over 75 were cemented. MARCQI has made reduction of fractures and early revisions a QI priority.

Prevention of Venous Thromboembolism (VTE)

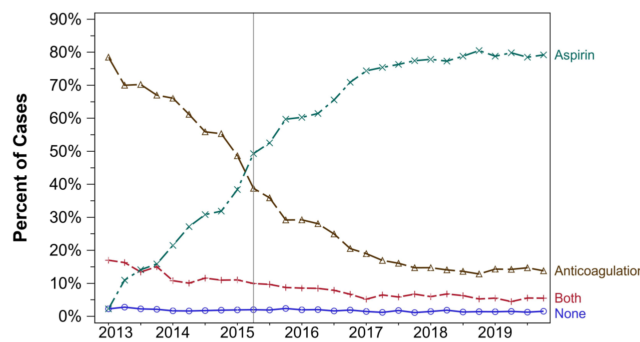

Figure 4: Percent of primary conventional THA patients (first case) by thrombosis prophylaxis.

In 2020, MARCQI completed analysis of data on the prevention of VTE after total hip arthroplasty, presented this data to the collaborative and published the results. (Musacatelli *et al.*, 2021) This was in follow-up to a similar study on TKA patients publish in 2019. (Hood *et al.*, 2018) Over the life of MARCQI, the practice of VTE prophylaxis has changed dramatically with a wholesale shift to the use of aspirin (ASA) for most patients and a continued reduction in VTE events (figure 4).

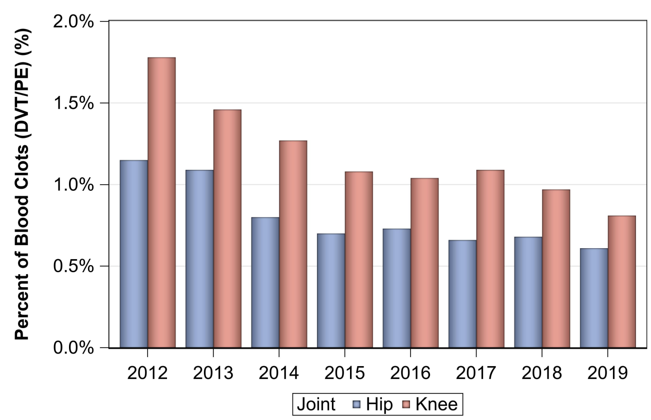

Figure 5: VTE risk by over time.

Our analysis of THA patients found that aspirin (ASA) was non-inferior to other anticoagulants as a group. There was no increase in VTE events in patients given ASA compared to all anticoagulants and bleeding events were lower in ASA patients. Patients who received no ASA or other anticoagulant had a significantly higher risk of VTE events. When broken down by specific drug, ASA was found to be non-inferior to low molecular weight heparin and warfarin but not factor X inhibitors. It was, however, associated with significantly fewer bleeding events. Further study of factor X inhibitors will need to be done going forward but, at this time, the use of aspirin for most patients seems to be safe and effective with fewer bleeding complications. As aspirin use has increased over time, risk of VTE has not increased (figure 5).

Patient Reported Outcomes

While registries have historically reported on survivorship of surgical procedures, using revision as the primary end point, this is only part of the story. The patient experience is critically important in determining the success or failure of a surgery. Assessing patient experience is difficult and most often done with standardized patient reported outcome surveys (PROS). MARCQI has been collecting patient reported outcomes since its inception. This has taken extraordinary efforts from our sites, surgeons, abstractors, and patients. In 2020 MARCQI collected complete pre-operative and post-operative PROS on 52.6% (19,494/37,054) of patients having primary hip or knee arthroplasty in Michigan.

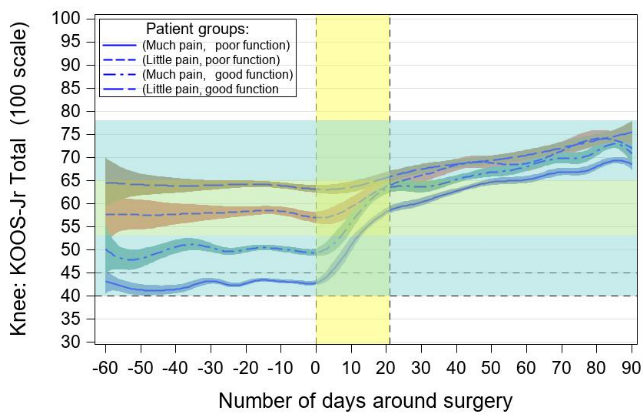

Figure 6: Cumulative percent revision for primary conventional THA for women 70 years and older.

MARCQI is using the PROMIS-10 survey as a general health assessment and the HOOS JR or KOOS JR for joint specific scores. A recent review of the MARCQI data assessed the likelihood of patients improving in pain, function, or both (figure 6). We found that for total hip arthroplasty, 78% of patients improved, 20% remained in the same category for pain and/or function and 6% got worse. Total knee patients got better 67% of the time, remained in the same group 27% of the time and got worse 6% of the time. As you would expect, patients with worse pain and function before surgery were much more likely to have a clinically significant improvement. There was also considerable variation between MARCQI sites. This provides us opportunities to improve outcomes by improving patient experience and reducing variations in care across the state.

Future efforts are directed at using PROS for a variety of quality improvement efforts. Further work will help to determine what percentage of patients reach a patient acceptable symptom state (PASS). MARCQI has made the PROS accessible for use with patients in the clinic to assist in medical decision making. PROS outcome variations between surgeons, hospitals, implants, and techniques are all potential future projects.

The Shift to Outpatient Arthroplasty and the Influence of COVID-19

As more and more patients are being cared for in ambulatory surgery centers (ASCs) or hospital outpatient departments (HOPDs) MARCQI has been tracking the effect of this on outcomes. The concern of some is that performing these surgeries in the outpatient setting will lead to increased complications. (Bordoni *et al.*, 2020; Arshi *et al.*, 2017)

To address this concern, MARCQI instituted a state-wide surveillance program of ambulatory cases to determine if there was an increase in ED visits, readmissions, or VTE events. This is an ongoing program which is monitoring the safety of these patients. There are significant differences between the patients being operated on in the hospital versus those being operated on in the outpatient setting. In general, patients having surgery outside the traditional hospital setting in Michigan are about 8 years younger, have a lower BMI, are more likely to be male, have an ASA score less than three, and haver fewer comorbidities such as diabetes and smoking. For this reason, the MARCQI surveillance program utilizes propensity score matching to ensure that we are making equivalent comparisons. Without this, we could miss a situation where the same rate of complications between the two groups actually represents an increased risk in the lower risk group.

This monitoring process has so far not detected an increase in complications for patients having surgery outside the hospital. This is reassuring, but the pressure to move patients out of the hospital has risen with the COVID-19 pandemic. The volume of cases at ASC/HOPDs increased dramatically: THA by 84% and TKA by 125%. Correspondingly, hospital volumes decreased by 9% and 17% respectively.

A comparison of patients between the second half of 2019 and the second half of 2020 has shown significant changes in the types of patients having ambulatory procedures. The average age of ambulatory knee and hip arthroplasty patients increased by 2 and 4 years respectively. The proportion of females having THA increased in the ASC/HOPD. Pre-op pain scores increased for all patients suggesting patients have put off surgery or been delayed by the pandemic. The proportion of patients with an ASA >2

increased at ASC/HOPDs (THA from 5.5% to 12.1%, TKA from 8.3% to 15.2%).

MARCQI will continue to track these trends and monitor patient outcomes to ensure that the quality of care is not being affected by these changes. Future QI efforts will focus on determining patient characteristics that will predict success in the ambulatory setting and which patients are best served in the hospital. The collaborative nature of MARCQI will also allow sites to work together to identify best practices and protocols going forward.

Chapter 2

Total hip arthroplasty statistics, devices, and revisions

Selection of the most suitable implant is a critical component of providing high quality hip arthroplasty care. Since revision is an undesirable outcome and is widely reported across arthroplasty registries, chapters on revision risk have been included. Chapter 2 reports on hips; chapter 3 on knees. These data are based on primary cases performed from 2/15/2012 to 12/31/2019. For detailed information on each figure and table (date ranges and inclusion/exclusion criteria), see the online supplement *2021 MARCQI annual report specifications document* available at MARCQI annual reports web page.

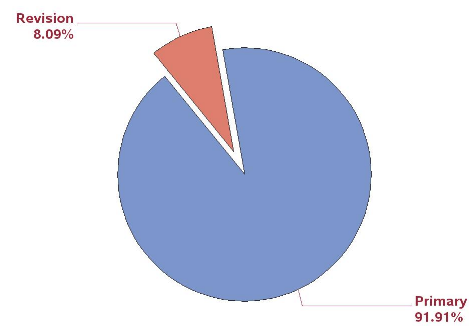

Figure 8: Percent of THA cases by primary or revision.

2.1 All THA cases

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

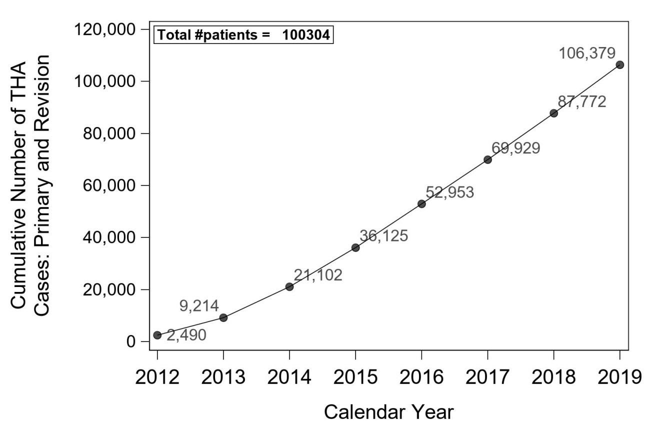

Figure 7: THA cases over time.

Table 1: Descriptive statistics of THA cases.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	58098	54.6	
Age (yrs)	106379	65.1(11.3)	65(15)
Height (cm)	105682	169.8(10.5)	170(15.2)
Weight (kg)	105683	88.3(21.3)	86.2(28.4)
BMI(kg/m^2)	105679	30.5(6.4)	29.8(8.3)
Smoking - never (%)	50326	47.3	
Smoking - previous (%)	40941	38.5	
Smoking - current (%)	14652	13.8	
Smoking - unknown (%)	460	0.4	

2.1.1 Primary THA cases

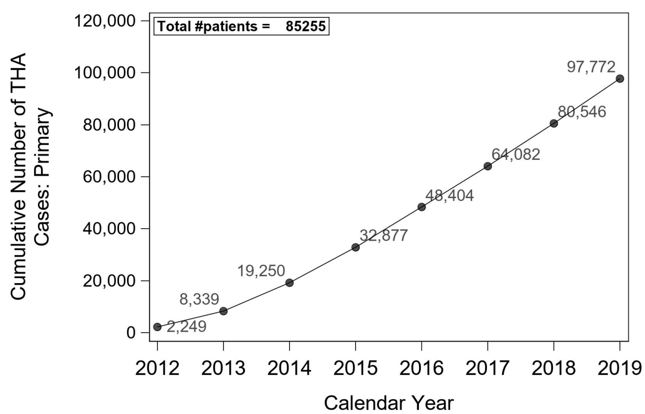

Figure 9: THA cases over time.

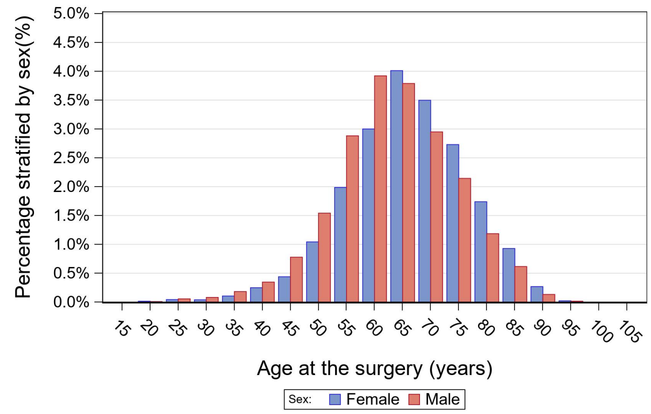

Figure 11: Age distribution of primary THA cases by sex.

Table 2: Descriptive statistics of primary THA cases.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	53299	54.5	
Age (yrs)	97772	64.9(11.2)	65(15)
Height (cm)	97113	169.8(10.5)	170(15.2)
Weight (kg)	97113	88.4(21.2)	86.4(28.6)
BMI(kg/m^2)	97111	30.5(6.3)	29.8(8.2)
Smoking - never (%)	46580	47.6	
Smoking - previous (%)	37398	38.3	
Smoking - current (%)	13390	13.7	
Smoking - unknown (%)	404	0.4	

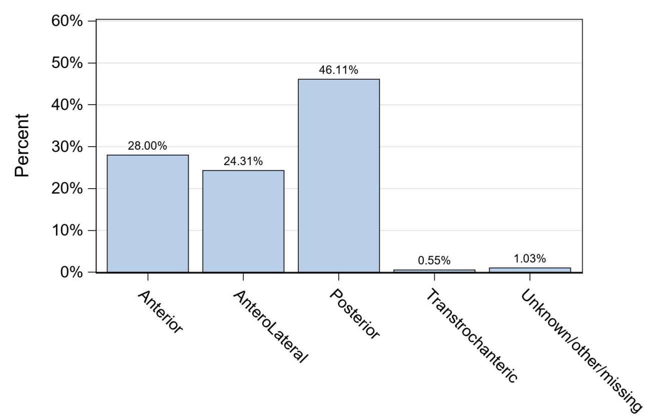

Figure 12: Percent of primary THA cases by approach.

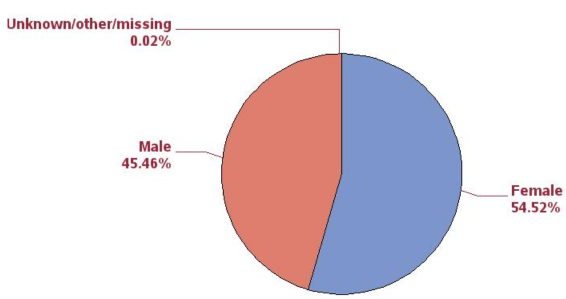

Figure 10: Percent of primary THA cases by sex.

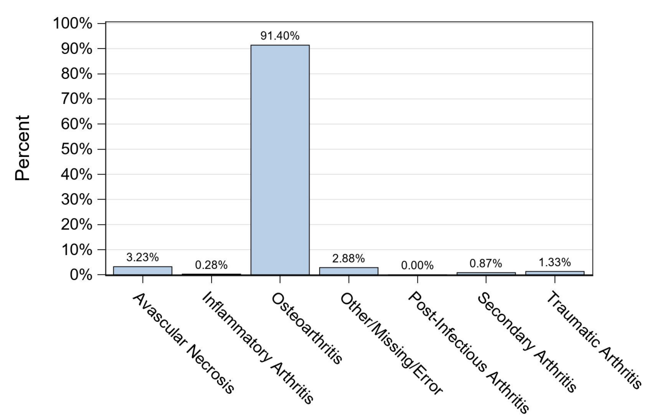

Figure 13: Percent of primary THA cases by diagnosis.

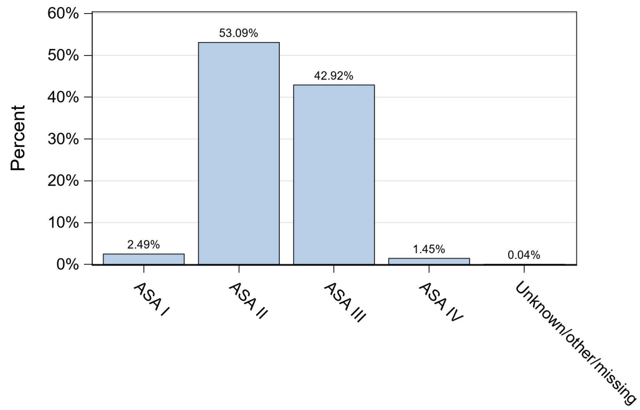

Figure 14: Percent of primary THA cases by ASA class.

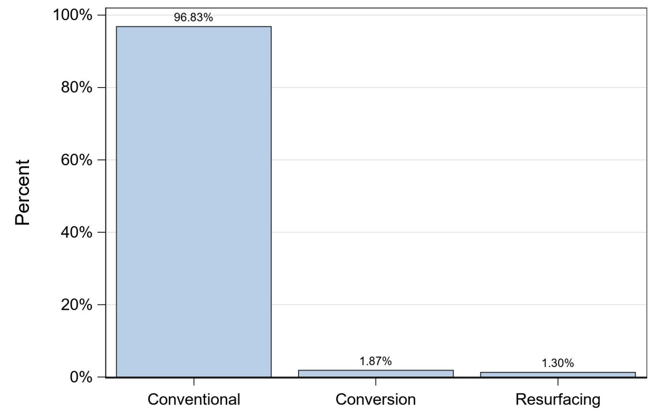

Figure 16: Percent of primary THA cases by procedure.

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 cases

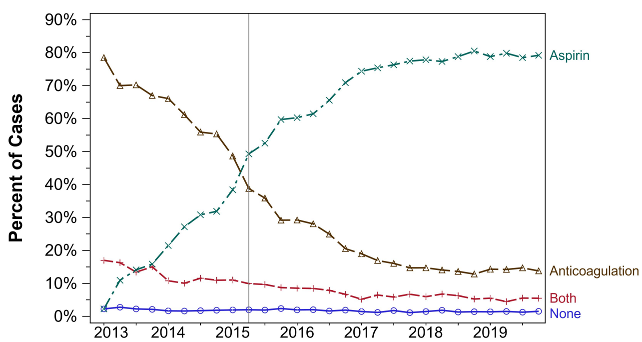

Figure 15: Percent of primary THA patients (first case) by thrombosis prophylaxis.

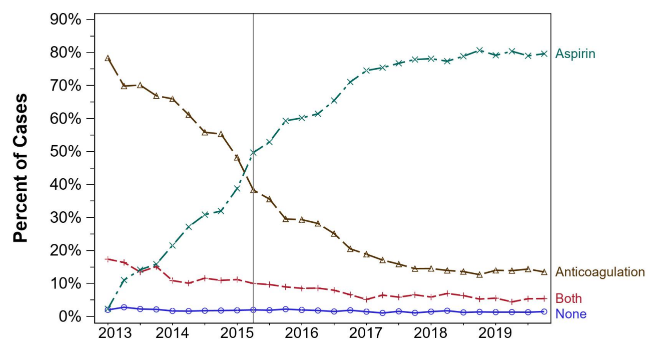

Figure 17: Percent of primary conventional THA patients (first case) by thrombosis prophylaxis.

2.2.1 Conventional THA stem fixation

MARCQI began abstracting which components were cemented as of 1/1/2017, so the analyses presented in this section are based on cases performed between 1/1/2017 and 12/31/2019.

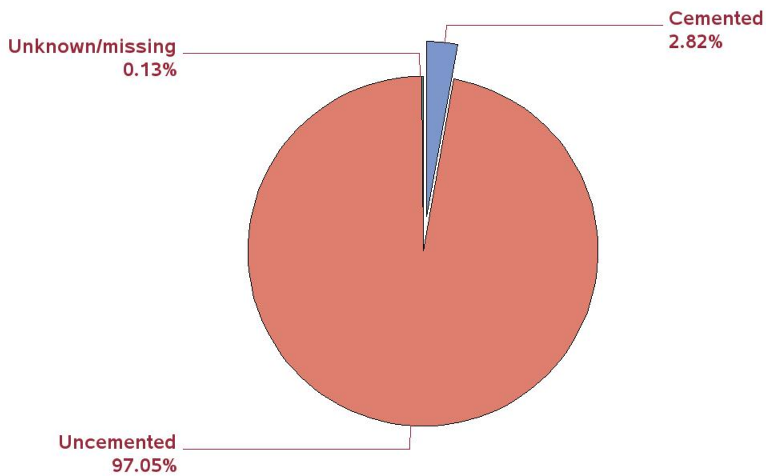

Figure 18: Distribution of stem fixation in primary conventional THA cases.

Table 3: 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 (%)	1074	80.6		24793	54.1	
Age (yrs)	1332	77.1(9.3)	78(12)	45822	64.9(10.5)	65(14)
Height (cm)	1308	163.4(9.7)	162.6(11.6)	45207	170(10.4)	170.2(15.2)
Weight (kg)	1308	76.1(18.8)	73(24.4)	45207	89.3(21)	87.5(28.1)
BMI(kg/m^2)	1308	28.4(6.1)	27.5(8.3)	45207	30.8(6.3)	30.1(8.3)
Smoking - never (%)	685	51.4		22029	48.1	
Smoking - previous (%)	543	40.8		17449	38.1	
Smoking - current (%)	98	7.4		6253	13.7	
Smoking - unknown (%)	6	0.5		91	0.2	

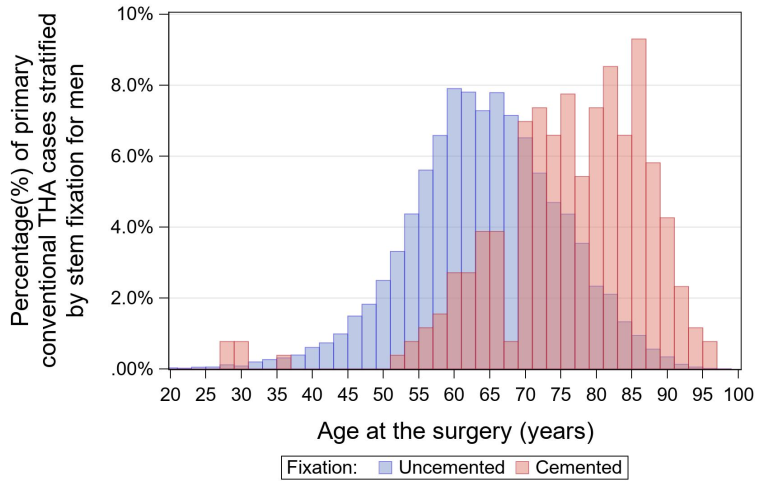

Figure 19: Histogram of age for primary conventional THA cases by stem fixation for men.

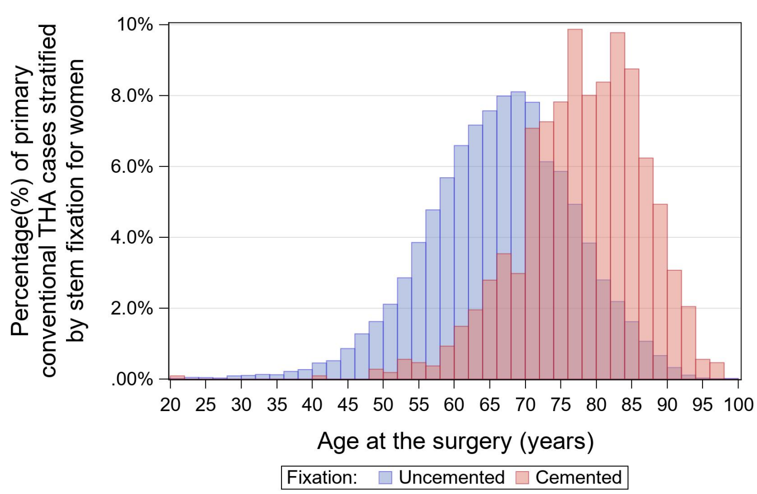

Figure 20: Histogram of age for primary conventional THA cases by stem fixation for women.

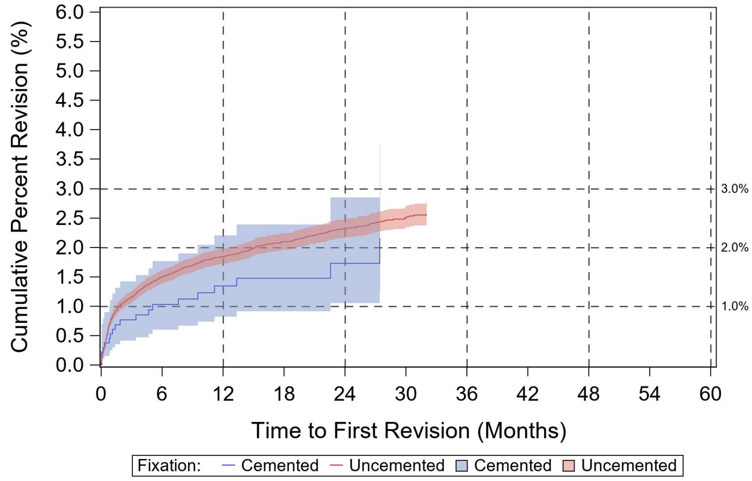

Figure 21: Cumulative percent revision for primary conventional THA by stem fixation.

Table 4: Cumulative percent revision for primary conventional THA by stem fixation (numerical values).

	N	1 year	2 years	3 years	4 years	5 years
Cemented stem	1332	1.35 (0.82,2.20)	1.73 (1.05,2.85)	N/A	N/A	N/A
Uncemented stem	45822	1.84 (1.72,1.98)	2.32 (2.17,2.48)	2.57 (2.39,2.77)	N/A	N/A
Unknown/missing	61					

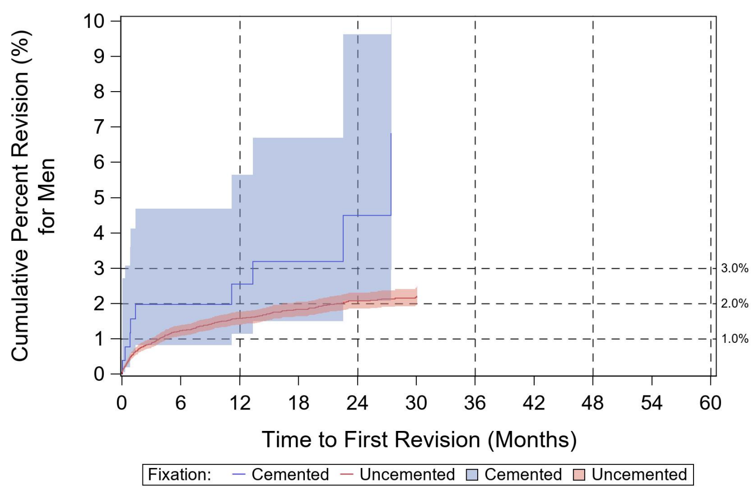

Figure 22: Cumulative percent revision for primary conventional THA by stem fixation for men.

Table 5: Cumulative percent revision for primary conventional THA by stem fixation for men (numerical values).

	N	1 year	2 years	3 years	4 years	5 years
Cemented stem	258	2.55 (1.14,5.64)	4.50 (2.07,9.63)	N/A	N/A	N/A
Uncemented stem	21024	1.57 (1.40,1.76)	2.07 (1.86,2.31)	2.21 (1.97,2.48)	N/A	N/A
Unknown/missing	32					

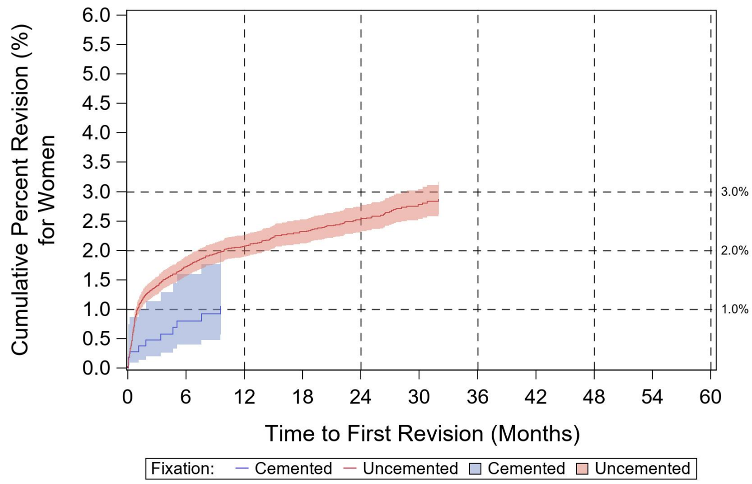

Figure 23: Cumulative percent revision for primary conventional THA by stem fixation for women.

Table 6: Cumulative percent revision for primary conventional THA by stem fixation for women (numerical values).

	N	1 year	2 years	3 years	4 years	5 years
Cemented stem	1074	1.06 (0.57,1.96)	1.06 (0.57,1.96)	N/A	N/A	N/A
Uncemented stem	24793	2.07 (1.90,2.27)	2.53 (2.32,2.76)	2.87 (2.61,3.17)	N/A	N/A
Unknown/missing	29					

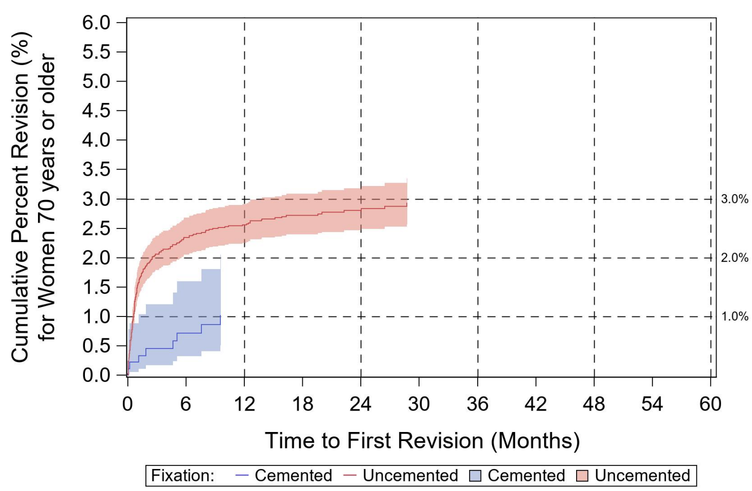

Figure 24: Cumulative percent revision for primary conventional THA by stem fixation for women 70 years or older.

Table 7: Cumulative percent revision for primary conventional THA by stem fixation for women 70 years or older (numerical values).

	N	1 year	2 years	3 years	4 years	5 years
Cemented stem	905	1.02 (0.51,2.05)	1.02 (0.51,2.05)	N/A	N/A	N/A
Uncemented stem	9281	2.56 (2.25,2.91)	2.80 (2.46,3.18)	2.93 (2.57,3.35)	N/A	N/A
Unknown/missing	9					

Table 8: Reasons for revision following primary cemented stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	6	40.0
2	Peri-prosthetic fracture - Femur	5	33.3
3	Aseptic Loosening	2	13.3
4	Joint Infection	1	6.7
5	Component fracture/failure	1	6.7

Table 9: Reasons for revision following primary cemented stem cases in first year post-operatively.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	6	50.0
2	Peri-prosthetic fracture - Femur	3	25.0
3	Aseptic Loosening	1	8.3
4	Joint Infection	1	8.3
5	Component fracture/failure	1	8.3

Table 10: Reasons for revision following primary cemented stem cases in second year post-operatively.

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

Table 11: Reasons for revision following primary cemented stem cases in third year post-operatively.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	1	100.0

Table 12: Reasons for revision following primary uncemented stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	260	30.9
2	Dislocation/Instability	193	22.9
3	Joint Infection	156	18.6
4	Aseptic Loosening	126	15.0
5	Component fracture/failure	38	4.5
6	Malalignment	38	4.5
7	Peri-prosthetic fracture - Acetabulum	16	1.9
8	Pain	11	1.3
9	Osteolysis	1	0.1
10	Poly liner wear	1	0.1
11	Metal reaction/Metallosis	1	0.1

Table 13: Reasons for revision following primary uncemented stem cases in first year post-operatively.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	253	35.6
2	Dislocation/Instability	167	23.5
3	Joint Infection	126	17.8
4	Aseptic Loosening	79	11.1
5	Component fracture/failure	34	4.8
6	Malalignment	25	3.5
7	Peri-prosthetic fracture - Acetabulum	16	2.3
8	Pain	9	1.3
9	Poly liner wear	1	0.1

Table 14: Reasons for revision following primary uncemented stem cases in second year post-operatively.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	38	35.5
2	Joint Infection	27	25.2
3	Dislocation/Instability	20	18.7
4	Malalignment	11	10.3
5	Peri-prosthetic fracture - Femur	5	4.7
6	Component fracture/failure	3	2.8
7	Osteolysis	1	0.9
8	Metal reaction/Metallosis	1	0.9
9	Pain	1	0.9

Table 15: Reasons for revision following primary uncemented stem cases in third year post-operatively.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	9	37.5
2	Dislocation/Instability	6	25.0
3	Joint Infection	3	12.5
4	Peri-prosthetic fracture - Femur	2	8.3
5	Malalignment	2	8.3
6	Component fracture/failure	1	4.2
7	Pain	1	4.2

Table 16: Reasons for revision following primary cemented stem cases in women at least 70 years of age.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	6	42.9
2	Peri-prosthetic fracture - Femur	5	35.7
3	Aseptic Loosening	2	14.3
4	Joint Infection	1	7.1

Table 17: Reasons for 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	5	62.5
2	Peri-prosthetic fracture - Femur	3	37.5

There were no revisions in years 2 and 3 for women at least 70 years of age who had primary cemented stems.

Table 18: Reasons for 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	147	44.0
2	Dislocation/Instability	77	23.1
3	Aseptic Loosening	42	12.6
4	Joint Infection	34	10.2
5	Component fracture/failure	16	4.8
6	Peri-prosthetic fracture - Acetabulum	10	3.0
7	Malalignment	7	2.1
8	Pain	1	0.3

2.2.2 Most commonly used conventional THA implants

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

Table 22: Ten most commonly used femoral components in primary total conventional THA.

Rank	Stem	N	Percent
1	Accolade II	24903	25.8
2	M/L Taper	11323	11.7
3	Taperloc 133	8715	9.0
4	Summit	5957	6.2
5	Fitmore	4695	4.9
6	Anthology	3520	3.6
7	Tri-Lock BPS	3056	3.2
8	Taperloc 133 Microplasty	3004	3.1
9	Secur-Fit Max	2643	2.7
10	Corail	2542	2.6
11	Others	26140	27.1

Table 19: Reasons for 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	110	53.9
2	Dislocation/Instability	44	21.6
3	Aseptic Loosening	16	7.8
4	Joint Infection	12	5.9
5	Component fracture/failure	11	5.4
6	Peri-prosthetic fracture - Acetabulum	7	3.4
7	Malalignment	4	2.0

Table 20: Reasons for 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	8	66.7
2	Aseptic Loosening	3	25.0
3	Peri-prosthetic fracture - Femur	1	8.3

Table 21: Reasons for 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	Aseptic Loosening	1	33.3
2	Dislocation/Instability	1	33.3
3	Peri-prosthetic fracture - Femur	1	33.3

Table 23: Ten most commonly used acetabular components in primary total conventional THA.

Rank	Cup	N	Percent
1	Trident	28743	29.8
2	G7	15243	15.8
3	Pinnacle	15179	15.7
4	Continuum	13456	13.9
5	Reflection 3	6371	6.6
6	Trident II	4562	4.7
7	RingLoc+	2589	2.7
8	Trilogy	1791	1.9
9	Trabecular Metal	1709	1.8
10	Regenerex RingLoc	1023	1.1
11	Others	5832	6.0

Table 24: Ten most commonly used femoral/acetabular component combinations used in primary total conventional THA.

Rank	Stem/cup combination	N	Percent
1	Accolade II / Trident	20245	21.0
2	M/L Taper / Continuum	6856	7.1
3	Summit / Pinnacle	5930	6.2
4	Taperloc 133 / G7	5095	5.3
5	Accolade II / Trident II	4068	4.2
6	Anthology / Reflection 3	3019	3.1
7	Fitmore / Continuum	2743	2.8
8	Tri-Lock BPS / Pinnacle	2609	2.7
9	Secur-Fit Max / Trident	2581	2.7
10	Corail / Pinnacle	2538	2.6
11	Others	40814	42.0

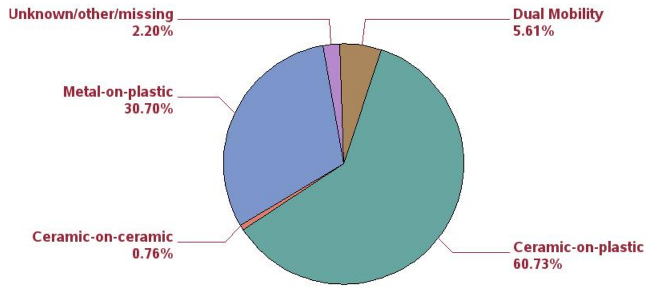

Figure 26: Percentage by bearing surface couple for primary conventional THA.

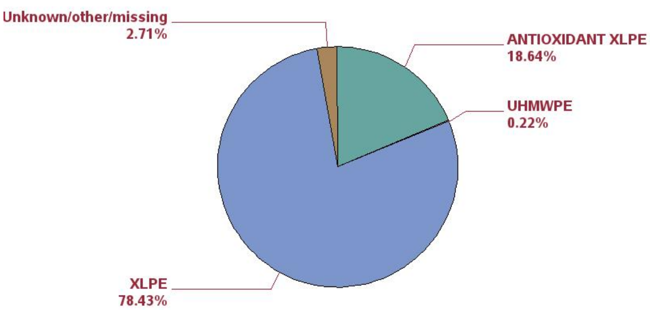

Figure 25: Percentage of polyethylene liners by type of polyethylene for primary conventional THA.

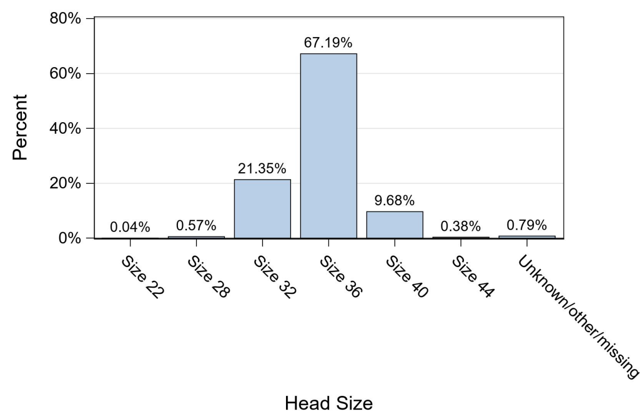

Figure 27: Distribution of head sizes for primary conventional THA, excluding dual mobility cases.

2.2.3 Conventional THA revision risk summary

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 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 reason 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 reasons for revision tables and figures differ from the time window used for other figures because 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.

Table 25: Reasons for revision following primary conventional THA.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	461	23.7
2	Dislocation/Instability	456	23.4
3	Joint Infection	346	17.8
4	Aseptic Loosening	344	17.7
5	Pain	106	5.5
6	Component fracture/failure	91	4.7
7	Malalignment	72	3.7
8	Peri-prosthetic fracture - Acetabulum	35	1.8
9	Metal reaction/Metallosis	28	1.4
10	Poly liner wear	5	0.3
11	Osteolysis	2	0.1

Table 26: Reasons for revision following primary conventional THA in first year post-operatively.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	410	31.9
2	Dislocation/Instability	322	25.1
3	Joint Infection	230	17.9
4	Aseptic Loosening	137	10.7
5	Component fracture/failure	64	5.0
6	Pain	52	4.0
7	Malalignment	38	3.0
8	Peri-prosthetic fracture - Acetabulum	29	2.3
9	Poly liner wear	2	0.2

Table 27: Reasons for revision following primary conventional THA in second year post-operatively.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	106	34.5
2	Joint Infection	62	20.2
3	Dislocation/Instability	59	19.2
4	Pain	32	10.4
5	Peri-prosthetic fracture - Femur	15	4.9
6	Malalignment	15	4.9
7	Component fracture/failure	11	3.6
8	Peri-prosthetic fracture - Acetabulum	3	1.0
9	Metal reaction/Metallosis	3	1.0
10	Osteolysis	1	0.3

Table 28: Reasons for revision following primary conventional THA in third year post-operatively.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	55	32.9
2	Dislocation/Instability	33	19.8
3	Joint Infection	30	18.0
4	Pain	18	10.8
5	Peri-prosthetic fracture - Femur	12	7.2
6	Malalignment	7	4.2
7	Component fracture/failure	6	3.6
8	Metal reaction/Metallosis	3	1.8
9	Osteolysis	1	0.6
10	Poly liner wear	1	0.6
11	Peri-prosthetic fracture - Acetabulum	1	0.6

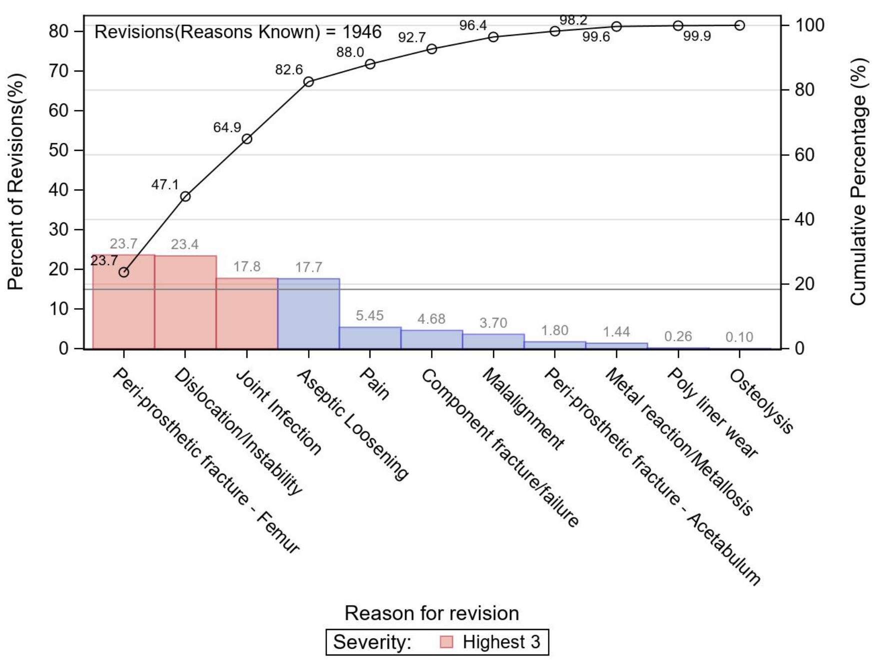

Figure 28: Reasons for revision following primary conventional THA (Pareto chart).

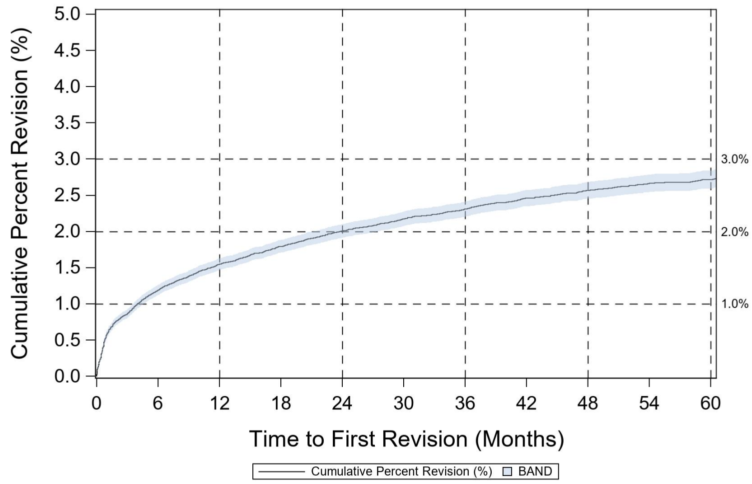

Figure 29: Cumulative percent revision for primary conventional THA.

Table 29: Cumulative percent revision and number at risk for primary conventional THA (numerical values).

	1 year	2 years	3 years	4 years	5 years
CPR	1.55 (1.47,1.63)	2.00 (1.91,2.10)	2.31 (2.21,2.41)	2.57 (2.45,2.68)	2.71 (2.59,2.84)
Number at risk	78119	61897	46653	31703	18677

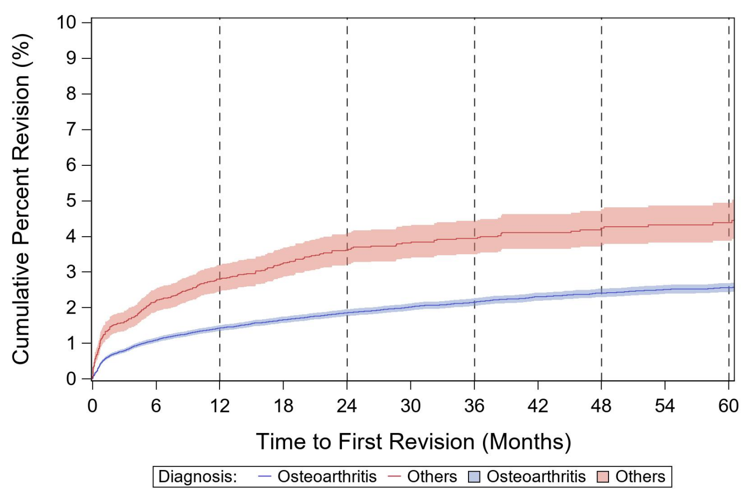

Figure 30: Cumulative percent revision for primary conventional THA by diagnosis.

Table 30: Cumulative percent revision for primary conventional THA by diagnosis (numerical values).

	N	1 year	2 years	3 years	4 years	5 years
Osteoarthritis	88014	1.43 (1.35,1.51)	1.85 (1.76,1.95)	2.16 (2.05,2.27)	2.41 (2.30,2.53)	2.56 (2.44,2.69)
Others	8240	2.80 (2.45,3.19)	3.62 (3.21,4.08)	3.94 (3.50,4.43)	4.23 (3.76,4.76)	4.39 (3.88,4.95)
Unknown/Missing	69					

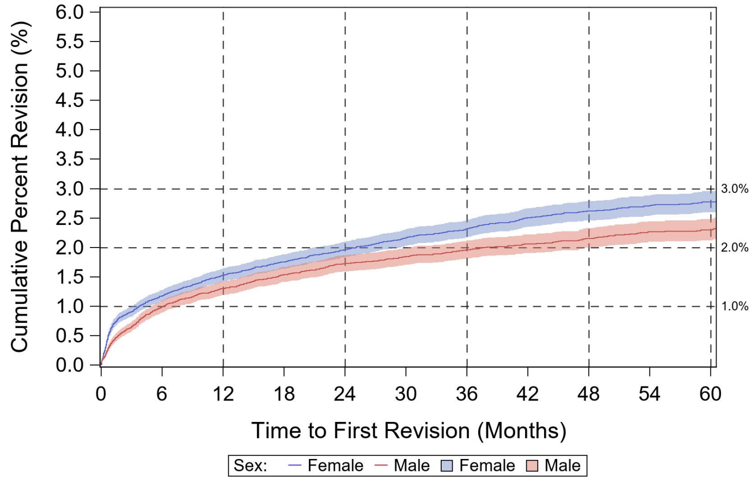

Figure 31: Cumulative percent revision for primary conventional THA by sex for osteoarthritis diagnosis.

Table 31: Cumulative percent revision for primary conventional THA by sex for osteoarthritis diagnosis (numerical values).

	N	1 year	2 years	3 years	4 years	5 years
Female	48876	1.53 (1.42,1.64)	1.96 (1.84,2.10)	2.31 (2.17,2.47)	2.62 (2.46,2.79)	2.77 (2.60,2.96)
Male	39119	1.30 (1.19,1.42)	1.72 (1.59,1.87)	1.96 (1.82,2.12)	2.15 (1.99,2.33)	2.30 (2.13,2.49)
Missing	19					

2.2.4 Revision risk for conventional THA stem/cup implant combinations

There is variation in revision risk across implants. The following section of this chapter provides revision risk data by stem/cup implant combination. The reader should be cautious in interpreting implant cumulative percent revision (CPR) data because there are many other factors that can affect CPR such as the characteristics of the patients who receive the implants, the volume of procedures done by the surgeons using the implant, and the volume of procedures done using that specific implant. Both mean and median volume numbers are provided for surgeons and hospitals because the distributions are skewed. Bearing surface couple, head size, and approach can also vary across implant combinations and affect CPR. Text and tables have been included to provide this information for each implant combination so the reader can make decisions based on a comprehensive view of how the implant combination is used. Note that sample size differs for CPR reporting and descriptive statistics provided in tables: the difference is due to excluding death from the CPR calculations.

The online supplement *2021 MARCQI Annual Report Specifications* describes inclusion and exclusion criteria for each table. It also contains catalog numbers for all implants included in the analyses. The numbers in the implant-specific tables may appear to be inconsistent, but they can be understood by studying the online supplement. For example, the number of cases listed in demographic tables often are greater than the total number of implants listed in the CPR table. The explanation for this is that the CPR estimates exclude patients who died. While the reader is encouraged to read the details of each stem/cup implant combination, the following table summarizes the five-year CPR values.

Table 32: 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	2 years	3 years	4 years	5 years
Accolade II / Trident	20225	1.19 (1.05,1.35)	1.66 (1.48,1.85)	2.04 (1.84,2.27)	2.34 (2.11,2.60)	2.47 (2.22,2.75)
Accolade II / Trident II	4064	1.92 (1.47,2.50)	*1.92 (1.47,2.50)*	*1.92 (1.47,2.50)*	N/A	N/A
Accolade TMZF / Trident	913	0.88 (0.44,1.74)	1.54 (0.91,2.58)	1.98 (1.25,3.13)	2.70 (1.82,4.01)	*2.70 (1.82,4.01)*
Actis DuoFix / Pinnacle	1617	0.17 (0.04,0.70)	0.37 (0.11,1.30)	N/A	N/A	N/A
AML / Pinnacle	619	1.53 (0.80,2.91)	1.96 (1.09,3.54)	2.55 (1.46,4.41)	2.98 (1.72,5.14)	3.63 (2.05,6.39)
Anthology / Reflection 3	3009	2.31 (1.81,2.94)	2.97 (2.38,3.70)	3.22 (2.59,4.00)	3.39 (2.73,4.21)	3.68 (2.93,4.61)
Avenir Muller / Continuum	521	1.16 (0.52,2.56)	1.35 (0.65,2.82)	1.77 (0.93,3.39)	2.04 (1.10,3.77)	*2.04 (1.10,3.77)*
Corail / Pinnacle	2531	1.11 (0.76,1.61)	1.50 (1.07,2.08)	1.82 (1.33,2.49)	*1.82 (1.33,2.49)*	*1.82 (1.33,2.49)*
Corail Coxa Vara / Pinnacle	534	0.20 (0.03,1.39)	0.67 (0.22,2.07)	0.67 (0.22,2.07)	1.18 (0.41,3.40)	*1.18 (0.41,3.40)*
Echo Bi-Metric / G7	1184	2.86 (2.03,4.03)	3.32 (2.38,4.63)	3.68 (2.58,5.25)	*3.68 (2.58,5.25)*	*3.68 (2.58,5.25)*
Echo Bi-Metric Microplasty / G7	950	1.93 (1.20,3.09)	2.34 (1.48,3.69)	2.70 (1.68,4.33)	*2.70 (1.68,4.33)*	N/A
Fitmore / Continuum	2742	1.29 (0.93,1.79)	1.64 (1.22,2.19)	1.95 (1.49,2.56)	2.12 (1.62,2.77)	2.34 (1.78,3.08)
Fitmore / G7	1544	1.29 (0.83,2.03)	1.80 (1.14,2.84)	2.05 (1.29,3.27)	2.05 (1.29,3.27)	N/A
M/L Taper** / Continuum	6848	1.60 (1.33,1.93)	1.88 (1.58,2.24)	2.22 (1.88,2.61)	2.51 (2.14,2.94)	2.68 (2.29,3.13)
M/L Taper** / G7	2023	1.89 (1.36,2.61)	2.69 (2.01,3.61)	2.93 (2.19,3.91)	2.93 (2.19,3.91)	N/A
M/L Taper** / Trabecular Metal	833	1.87 (1.13,3.09)	2.45 (1.57,3.82)	2.79 (1.82,4.26)	3.01 (1.98,4.56)	*3.01 (1.98,4.56)*
M/L Taper**/ Trilogy	1489	1.46 (0.95,2.22)	2.28 (1.61,3.21)	2.68 (1.95,3.69)	2.68 (1.95,3.69)	2.90 (2.12,3.96)
Polarstem / Reflection 3	1465	1.73 (1.15,2.59)	2.10 (1.42,3.11)	2.28 (1.54,3.37)	*2.28 (1.54,3.37)*	*2.28 (1.54,3.37)*
Secur-Fit / Trident	1092	3.68 (2.71,4.98)	4.46 (3.38,5.88)	4.95 (3.79,6.45)	5.12 (3.92,6.66)	5.51 (4.15,7.29)
Secur-Fit Max / Trident	2579	1.93 (1.46,2.54)	2.44 (1.90,3.14)	2.73 (2.14,3.47)	3.11 (2.45,3.94)	*3.11 (2.45,3.94)*
Secur-Fit Plus Max / Trident	2010	1.64 (1.17,2.30)	1.90 (1.39,2.60)	2.01 (1.48,2.74)	2.15 (1.59,2.90)	2.34 (1.74,3.15)
SROM / Pinnacle	1067	1.35 (0.80,2.26)	2.28 (1.52,3.41)	2.63 (1.80,3.85)	3.06 (2.13,4.39)	3.40 (2.39,4.83)
Summit / Pinnacle	5922	1.31 (1.04,1.64)	1.61 (1.31,1.97)	1.75 (1.43,2.13)	1.84 (1.51,2.24)	1.89 (1.55,2.31)
Synergy / Reflection 3	987	2.31 (1.52,3.48)	3.04 (2.11,4.38)	3.46 (2.44,4.89)	3.88 (2.75,5.47)	*3.88 (2.75,5.47)*
Taperloc 133 / Continuum	720	2.71 (1.74,4.21)	3.24 (2.14,4.89)	4.02 (2.70,5.96)	5.07 (3.31,7.73)	N/A
Taperloc 133 / G7	5085	1.78 (1.44,2.21)	2.30 (1.87,2.82)	2.42 (1.97,2.98)	2.63 (2.11,3.27)	*2.63 (2.11,3.27)*
Taperloc 133 / Regenerex RingLoc+	501	1.60 (0.80,3.17)	2.21 (1.23,3.95)	2.21 (1.23,3.95)	2.46 (1.40,4.31)	2.86 (1.64,4.95)
Taperloc 133 / RingLoc+	1668	1.59 (1.08,2.32)	2.19 (1.58,3.04)	2.42 (1.76,3.31)	2.59 (1.90,3.52)	*2.59 (1.90,3.52)*
Taperloc 133 Microplasty / G7	2171	1.18 (0.79,1.75)	1.47 (1.01,2.14)	1.56 (1.08,2.26)	1.75 (1.18,2.59)	*1.75 (1.18,2.59)*
Trabecular Metal / Continuum	670	2.41 (1.48,3.90)	2.56 (1.60,4.09)	2.92 (1.87,4.55)	*2.92 (1.87,4.55)*	*2.92 (1.87,4.55)*
Tri-Lock BPS / Pinnacle	2603	0.59 (0.35,0.99)	0.75 (0.46,1.20)	1.19 (0.78,1.81)	1.48 (0.99,2.21)	*1.48 (0.99,2.21)*

Notes:

* Number of patients that contribute to survival analysis used to compute cumulative percent revision.
** M/L Taper does not include M/L Taper Kinectiv.
A revision risk in *italics* indicates it is the same as it was at the time of the last revision.

Table 33: Summary of cumulative percent revision following primary THA for stem/cup combinations having at least 500 cases, sorted by 5-year cpr.

Stem/cup combination	N*	1 year	2 years	3 years	4 years	5 years
Corail Coxa Vara / Pinnacle	534	0.20 (0.03,1.39)	0.67 (0.22,2.07)	0.67 (0.22,2.07)	1.18 (0.41,3.40)	*1.18 (0.41,3.40)*
Tri-Lock BPS / Pinnacle	2603	0.59 (0.35,0.99)	0.75 (0.46,1.20)	1.19 (0.78,1.81)	1.48 (0.99,2.21)	*1.48 (0.99,2.21)*
Taperloc 133 Microplasty / G7	2171	1.18 (0.79,1.75)	1.47 (1.01,2.14)	1.56 (1.08,2.26)	1.75 (1.18,2.59)	*1.75 (1.18,2.59)*
Corail / Pinnacle	2531	1.11 (0.76,1.61)	1.50 (1.07,2.08)	1.82 (1.33,2.49)	*1.82 (1.33,2.49)*	*1.82 (1.33,2.49)*
Summit / Pinnacle	5922	1.31 (1.04,1.64)	1.61 (1.31,1.97)	1.75 (1.43,2.13)	1.84 (1.51,2.24)	1.89 (1.55,2.31)
Avenir Muller / Continuum	521	1.16 (0.52,2.56)	1.35 (0.65,2.82)	1.77 (0.93,3.39)	2.04 (1.10,3.77)	*2.04 (1.10,3.77)*
Polarstem / Reflection 3	1465	1.73 (1.15,2.59)	2.10 (1.42,3.11)	2.28 (1.54,3.37)	*2.28 (1.54,3.37)*	*2.28 (1.54,3.37)*
Secur-Fit Plus Max / Trident	2010	1.64 (1.17,2.30)	1.90 (1.39,2.60)	2.01 (1.48,2.74)	2.15 (1.59,2.90)	2.34 (1.74,3.15)
Fitmore / Continuum	2742	1.29 (0.93,1.79)	1.64 (1.22,2.19)	1.95 (1.49,2.56)	2.12 (1.62,2.77)	2.34 (1.78,3.08)
Accolade II / Trident	20225	1.19 (1.05,1.35)	1.66 (1.48,1.85)	2.04 (1.84,2.27)	2.34 (2.11,2.60)	2.47 (2.22,2.75)
Taperloc 133 / RingLoc+	1668	1.59 (1.08,2.32)	2.19 (1.58,3.04)	2.42 (1.76,3.31)	2.59 (1.90,3.52)	*2.59 (1.90,3.52)*
Taperloc 133 / G7	5085	1.78 (1.44,2.21)	2.30 (1.87,2.82)	2.42 (1.97,2.98)	2.63 (2.11,3.27)	*2.63 (2.11,3.27)*
M/L Taper** / Continuum	6848	1.60 (1.33,1.93)	1.88 (1.58,2.24)	2.22 (1.88,2.61)	2.51 (2.14,2.94)	2.68 (2.29,3.13)
Accolade TMZF / Trident	913	0.88 (0.44,1.74)	1.54 (0.91,2.58)	1.98 (1.25,3.13)	2.70 (1.82,4.01)	*2.70 (1.82,4.01)*
Taperloc 133 / Regenerex RingLoc	501	1.60 (0.80,3.17)	2.21 (1.23,3.95)	2.21 (1.23,3.95)	2.46 (1.40,4.31)	2.86 (1.64,4.95)
M/L Taper**/ Trilogy	1489	1.46 (0.95,2.22)	2.28 (1.61,3.21)	2.68 (1.95,3.69)	2.68 (1.95,3.69)	2.90 (2.12,3.96)
Trabecular Metal / Continuum	670	2.41 (1.48,3.90)	2.56 (1.60,4.09)	2.92 (1.87,4.55)	*2.92 (1.87,4.55)*	*2.92 (1.87,4.55)*
M/L Taper** / Trabecular Metal	833	1.87 (1.13,3.09)	2.45 (1.57,3.82)	2.79 (1.82,4.26)	3.01 (1.98,4.56)	*3.01 (1.98,4.56)*
Secur-Fit Max / Trident	2579	1.93 (1.46,2.54)	2.44 (1.90,3.14)	2.73 (2.14,3.47)	3.11 (2.45,3.94)	*3.11 (2.45,3.94)*
SROM / Pinnacle	1067	1.35 (0.80,2.26)	2.28 (1.52,3.41)	2.63 (1.80,3.85)	3.06 (2.13,4.39)	3.40 (2.39,4.83)
AML / Pinnacle	619	1.53 (0.80,2.91)	1.96 (1.09,3.54)	2.55 (1.46,4.41)	2.98 (1.72,5.14)	3.63 (2.05,6.39)
Echo Bi-Metric / G7	1184	2.86 (2.03,4.03)	3.32 (2.38,4.63)	3.68 (2.58,5.25)	*3.68 (2.58,5.25)*	*3.68 (2.58,5.25)*
Anthology / Reflection 3	3009	2.31 (1.81,2.94)	2.97 (2.38,3.70)	3.22 (2.59,4.00)	3.39 (2.73,4.21)	3.68 (2.93,4.61)
Synergy / Reflection 3	987	2.31 (1.52,3.48)	3.04 (2.11,4.38)	3.46 (2.44,4.89)	3.88 (2.75,5.47)	*3.88 (2.75,5.47)*
Secur-Fit / Trident	1092	3.68 (2.71,4.98)	4.46 (3.38,5.88)	4.95 (3.79,6.45)	5.12 (3.92,6.66)	5.51 (4.15,7.29)

Notes:

* Number of patients that contribute to survival analysis used to compute cumulative percent revision.
** M/L Taper does not include M/L Taper Kinectiv.
A revision risk in *italics* indicates it is the same as it was at the time of the last revision.

We remind readers to be cautious in interpreting CPR values when the number at risk is low.

Accolade II/Trident
N=20245

125 surgeons across 48 sites use this implant combination in primary THA.

Table 34: Volume of cases by surgeon and site for the Accolade II/Trident combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	162.0 (277.2)	24 (197)
Cases per site	421.8 (665.4)	115 (612.5)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 35: Descriptive statistics of cases receiving the Accolade II/Trident combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	10904	53.86	
Age (yrs)	20245	64.18(11.02)	65.00(15.00)
Height (cm)	20245	170.11(10.29)	170.18(15.24)
Weight (kg)	20245	88.34(20.94)	86.36(28.00)
BMI(kg/m^2)	20245	30.41(6.23)	29.68(8.24)
Smoking - never (%)	9768	48.25	
Smoking - previous (%)	7672	37.9	
Smoking - current (%)	2710	13.39	
Smoking - unknown (%)	95	0.47	

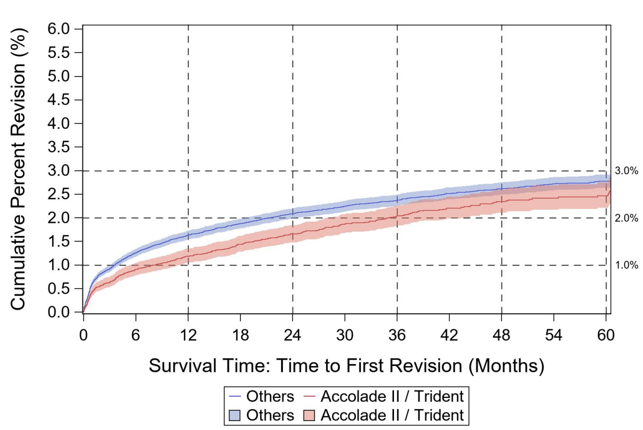

Figure 32: Cumulative percent revision curve for the Accolade II/Trident combination compared to all other implant combinations in conventional primary THA.

Table 36: Cumulative percent revision and number at risk for Accolade II/Trident combination in primary THA cases.

Year	Number at risk	CPR
0	20225	0.00 (0.00,0.00)
1	17715	1.19 (1.05,1.35)
2	13982	1.66 (1.48,1.85)
3	9780	2.04 (1.84,2.27)
4	5814	2.34 (2.11,2.60)
5	3036	2.47 (2.22,2.75)

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 37: Reasons for revision following primary THA for Accolade II/Trident combination cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	94	24.3
2	Peri-prosthetic fracture - Femur	92	23.8
3	Joint Infection	71	18.3
4	Dislocation/Instability	56	14.5
5	Pain	26	6.7
6	Component fracture/failure	18	4.7
7	Metal reaction/Metallosis	14	3.6
8	Malalignment	8	2.1
9	Peri-prosthetic fracture - Acetabulum	7	1.8
10	Osteolysis	1	0.3

Table 38: Reasons for revision in first 90 days following primary THA for Accolade II/Trident combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	68	54.8
2	Dislocation/Instability	16	12.9
3	Joint Infection	13	10.5
4	Aseptic Loosening	11	8.9
5	Component fracture/failure	8	6.5
6	Pain	3	2.4
7	Malalignment	3	2.4
8	Peri-prosthetic fracture - Acetabulum	2	1.6

Table 39: Reasons for revision between 91 and 365 days following primary THA for Accolade II/Trident combination cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	29	29.6
2	Dislocation/Instability	21	21.4
3	Aseptic Loosening	18	18.4
4	Pain	13	13.3
5	Peri-prosthetic fracture - Femur	12	12.2
6	Component fracture/failure	2	2.0
7	Peri-prosthetic fracture - Acetabulum	2	2.0
8	Malalignment	1	1.0

Table 40: Distribution of approach used for Accolade II/Trident combination in primary THA cases.

Approach	N	Percent
Anterior	6407	31.6
Anterolateral	3324	16.4
Posterior	10451	51.6
Transtrochanteric	18	0.1
Missing/unknown/other	45	0.2

Table 41: Distribution of head size for Accolade II/Trident combination in primary THA cases.

Size (mm)	N	Percent
22	10	0.1
28	34	0.2
32	3523	19.1
36	13690	74.1
40	1079	5.8
44	95	0.5
Missing/unknown/other	51	0.3

Table 42: Distribution of bearing surface for Accolade II/Trident combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	3460	17.1
Ceramic-on-plastic	14958	73.9
Ceramic-on-ceramic	11	0.1
Metal-on-metal	0	0.0
Dual mobility	1722	8.5
Missing/unknown/other	94	0.5

Table 43: Distribution of polyethylene used for Accolade II/Trident combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	20173	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	2	0.0

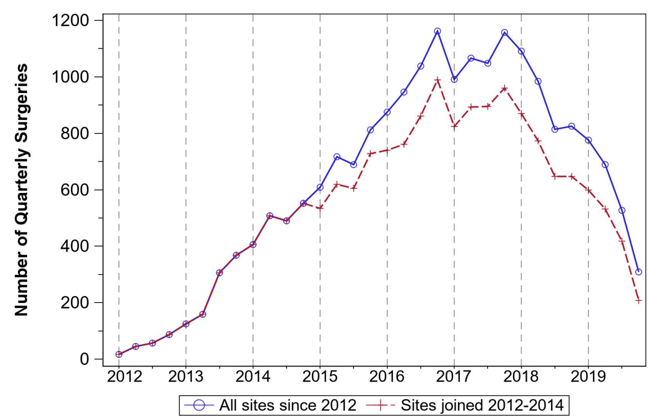

Figure 33: Utilization of the Accolade II/Trident combination in primary THA.

Accolade II/Trident II
N=4068

85 surgeons across 37 sites use this implant combination in primary THA.

Table 44: Volume of cases by surgeon and site for the Accolade II/Trident II combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	47.9 (74.2)	21 (47)
Cases per site	110.0 (166.3)	57 (111)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 45: Descriptive statistics of cases receiving the Accolade II/Trident II combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	2236	54.97	
Age (yrs)	4068	64.95(10.70)	65.00(14.00)
Height (cm)	4068	170.12(10.56)	170.18(15.24)
Weight (kg)	4068	88.18(20.53)	86.18(28.50)
BMI(kg/m^2)	4068	30.36(6.06)	29.59(8.00)
Smoking - never (%)	2093	51.45	
Smoking - previous (%)	1432	35.2	
Smoking - current (%)	542	13.32	
Smoking - unknown (%)	1	0.02	

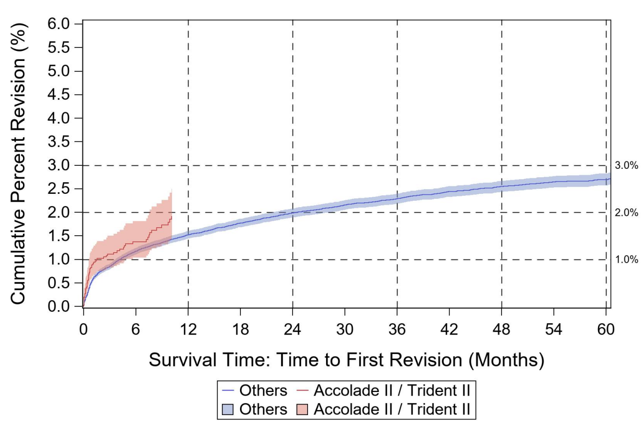

Figure 34: Cumulative percent revision curve for the Accolade II/Trident II combination compared to all other implant combinations in conventional primary THA.

Table 46: Cumulative percent revision and number at risk for Accolade II/Trident II combination in primary THA cases.

Year	Number at risk	CPR
0	4064	0.00 (0.00,0.00)
1*	1221	1.92 (1.47,2.50)
2*	178	1.92 (1.47,2.50)
3*	13	1.92 (1.47,2.50)
4	0	N/A
5	0	N/A

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 47: Reasons for revision following primary THA for Accolade II/Trident II combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	26	43.3
2	Dislocation/Instability	11	18.3
3	Joint Infection	9	15.0
4	Aseptic Loosening	4	6.7
5	Component fracture/failure	3	5.0
6	Peri-prosthetic fracture - Acetabulum	3	5.0
7	Malalignment	3	5.0
8	Poly liner wear	1	1.7

Table 48: Reasons for revision in first 90 days following primary THA for Accolade II/Trident II combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	24	55.8
2	Dislocation/Instability	7	16.3
3	Joint Infection	3	7.0
4	Component fracture/failure	3	7.0
5	Malalignment	3	7.0
6	Peri-prosthetic fracture - Acetabulum	2	4.7
7	Aseptic Loosening	1	2.3

Table 49: Reasons for revision between 91 and 365 days following primary THA for Accolade II/Trident II combination cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	6	35.3
2	Dislocation/Instability	4	23.5
3	Aseptic Loosening	3	17.6
4	Peri-prosthetic fracture - Femur	2	11.8
5	Poly liner wear	1	5.9
6	Peri-prosthetic fracture - Acetabulum	1	5.9

Table 50: Distribution of approach used for Accolade II/Trident II combination in primary THA cases.

Approach	N	Percent
Anterior	1469	36.1
Anterolateral	292	7.2
Posterior	2289	56.3
Transtrochanteric	1	0.0
Missing/unknown/other	17	0.4

Table 51: Distribution of head size for Accolade II/Trident II combination in primary THA cases.

Size (mm)	N	Percent
22	1	0.0
28	3	0.1
32	486	14.0
36	2754	79.5
40	200	5.8
44	11	0.3
Missing/unknown/other	9	0.3

Table 52: Distribution of bearing surface for Accolade II/Trident II combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	236	5.8
Ceramic-on-plastic	3219	79.1
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	602	14.8
Missing/unknown/other	11	0.3

Table 53: Distribution of polyethylene used for Accolade II/Trident II combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	4062	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

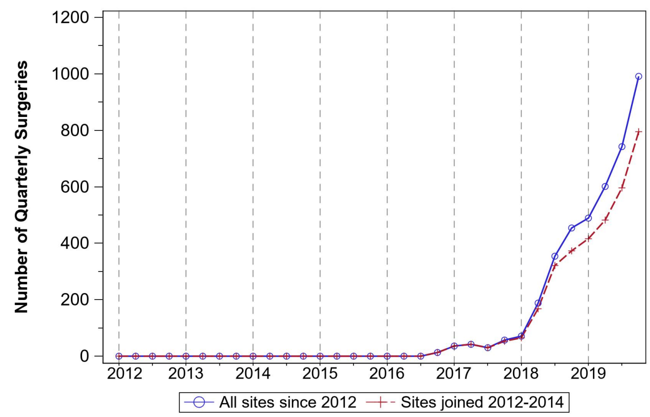

Figure 35: Utilization of the Accolade II/Trident II combination in primary THA.

Accolade TMZF/Trident
N=915

16 surgeons across 12 sites use this implant combination in primary THA.

Table 54: Volume of cases by surgeon and site for the Accolade TMZF/Trident combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	57.2 (134.9)	5 (14)
Cases per site	76.3 (107.3)	16.5 (162.5)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 55: Descriptive statistics of cases receiving the Accolade TMZF/Trident combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	509	55.63	
Age (yrs)	915	63.29(11.20)	63.00(16.00)
Height (cm)	915	169.96(10.57)	170.00(15.24)
Weight (kg)	915	90.26(21.34)	89.40(29.33)
BMI(kg/m^2)	915	31.09(6.17)	30.49(8.32)
Smoking - never (%)	418	45.68	
Smoking - previous (%)	353	38.58	
Smoking - current (%)	128	13.99	
Smoking - unknown (%)	16	1.75	

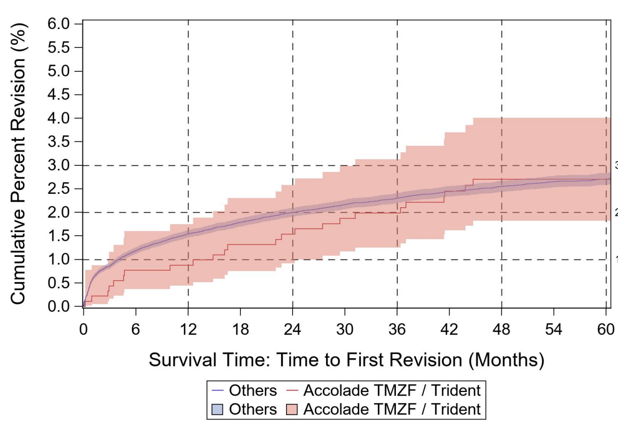

Figure 36: Cumulative percent revision curve for the Accolade TMZF/Trident combination compared to all other implant combinations in conventional primary THA.

Table 56: Cumulative percent revision and number at risk for Accolade TMZF/Trident combination in primary THA cases.

Year	Number at risk	CPR
0	913	0.00 (0.00,0.00)
1	904	0.88 (0.44,1.74)
2	887	1.54 (0.91,2.58)
3	850	1.98 (1.25,3.13)
4	723	2.70 (1.82,4.01)
5	441	2.70 (1.82,4.01)

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.946 (0.59,1.517). It was 1.231 (1.127,1.346) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 57: Reasons for revision following primary THA for Accolade TMZF/Trident combination cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	8	42.1
2	Joint Infection	4	21.1
3	Metal reaction/Metallosis	3	15.8
4	Dislocation/Instability	2	10.5
5	Peri-prosthetic fracture - Femur	2	10.5

Table 58: Reasons for revision in first 90 days following primary THA for Accolade TMZF/Trident combination cases.

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

Table 59: Reasons for revision between 91 and 365 days following primary THA for Accolade TMZF/Trident combination cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	1	100.0

Table 60: Distribution of approach used for Accolade TMZF/Trident combination in primary THA cases.

Approach	N	Percent
Anterior	8	0.9
Anterolateral	138	15.1
Posterior	759	83.0
Transtrochanteric	3	0.3
Missing/unknown/other	7	0.8

Table 61: Distribution of head size for Accolade TMZF/Trident combination in primary THA cases.

Size (mm)	N	Percent
28	1	0.1
32	98	10.9
36	694	77.5
40	96	10.7
Missing/unknown/other	7	0.8

Table 62: Distribution of bearing surface for Accolade TMZF/Trident combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	497	54.3
Ceramic-on-plastic	389	42.5
Ceramic-on-ceramic	2	0.2
Metal-on-metal	0	0.0
Dual mobility	18	2.0
Missing/unknown/other	9	1.0

Table 63: Distribution of polyethylene used for Accolade TMZF/Trident combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	908	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

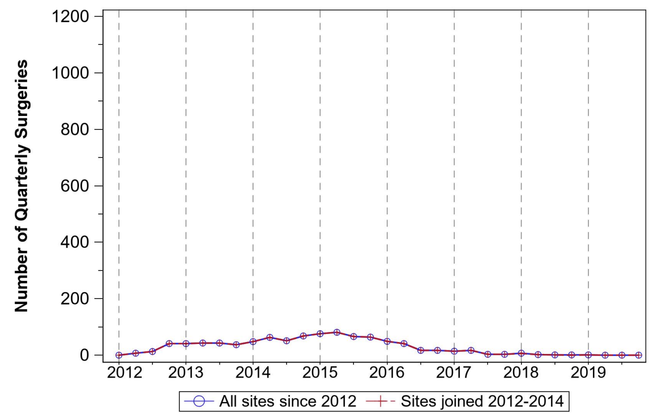

Figure 37: Utilization of the Accolade TMZF/Trident combination in primary THA.

Actis DuoFix/Pinnacle
N=1624

28 surgeons across 25 sites use this implant combination in primary THA.

Table 64: Volume of cases by surgeon and site for the Actis DuoFix/Pinnacle combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	58 (86.5)	10.5 (113)
Cases per site	65.0 (107.5)	5 (41)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 65: Descriptive statistics of cases receiving the Actis DuoFix/Pinnacle combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	1050	64.66	
Age (yrs)	1624	67.18(9.53)	67.00(13.00)
Height (cm)	1624	168.30(10.19)	167.64(15.24)
Weight (kg)	1624	86.55(20.95)	84.86(28.58)
BMI(kg/m^2)	1624	30.39(6.10)	29.72(8.78)
Smoking - never (%)	797	49.08	
Smoking - previous (%)	620	38.18	
Smoking - current (%)	206	12.68	
Smoking - unknown (%)	1	0.06	

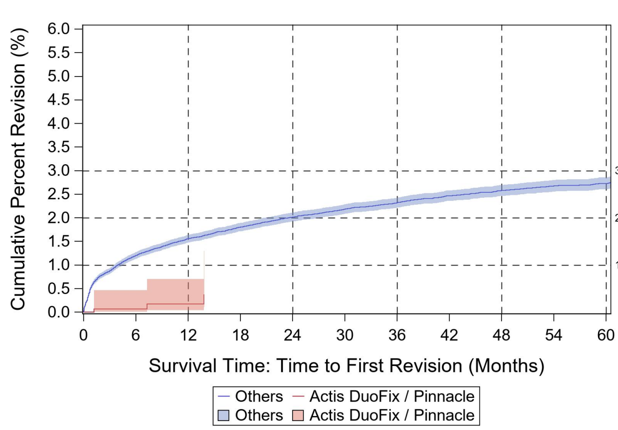

Figure 38: Cumulative percent revision curve for the Actis DuoFix/Pinnacle combination compared to all other implant combinations in conventional primary THA.

Table 66: Cumulative percent revision and number at risk for Actis DuoFix/Pinnacle combination in primary THA cases.

Year	Number at risk	CPR
0	1617	0.00 (0.00,0.00)
1	612	0.17 (0.04,0.70)
2*	40	0.37 (0.11,1.30)
3	0	N/A
4	0	N/A
5	0	N/A

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.154 (0.049,0.485). It was 1.235 (1.13,1.35) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 67: Reasons for revision following primary THA for Actis DuoFix/Pinnacle combination cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	1	33.3
2	Dislocation/Instability	1	33.3
3	Peri-prosthetic fracture - Femur	1	33.3

Table 68: Reasons for revision in first 90 days following primary THA for Actis DuoFix/Pinnacle combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	1	100.0

Table 69: Reasons for revision between 91 and 365 days following primary THA for Actis DuoFix/Pinnacle combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	1	100.0

Table 70: Distribution of approach used for Actis DuoFix/Pinnacle combination in primary THA cases.

Approach	N	Percent
Anterior	1176	72.4
Anterolateral	235	14.5
Posterior	212	13.1
Transtrochanteric	0	0.0
Missing/unknown/other	1	0.1

Table 71: Distribution of head size for Actis DuoFix/Pinnacle combination in primary THA cases.

Size (mm)	N	Percent
28	6	0.4
32	416	25.6
36	1143	70.4
40	56	3.5
Missing/unknown/other	2	0.1

Table 72: Distribution of bearing surface for Actis DuoFix/Pinnacle combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	285	17.6
Ceramic-on-plastic	1335	82.2
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	4	0.3

Table 73: Distribution of polyethylene used for Actis DuoFix/Pinnacle combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	1622	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

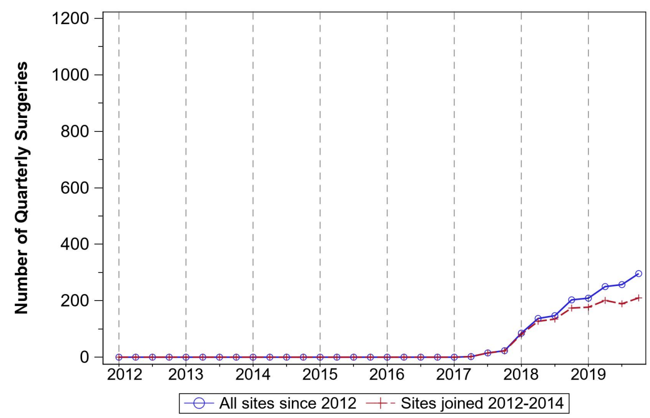

Figure 39: Utilization of the Actis DuoFix/Pinnacle combination in primary THA.

AML/Pinnacle
N=620

13 surgeons across 12 sites use this implant combination in primary THA.

Table 74: Volume of cases by surgeon and site for the AML/Pinnacle combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	47.7 (103.6)	7 (16)
Cases per site	51.7 (122.2)	7.5 (36)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 75: Descriptive statistics of cases receiving the AML/Pinnacle combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	354	57.1	
Age (yrs)	620	66.60(10.80)	67.00(15.00)
Height (cm)	620	169.46(10.32)	168.00(15.24)
Weight (kg)	620	89.71(20.60)	87.75(27.51)
BMI(kg/m^2)	620	31.18(6.44)	30.51(8.30)
Smoking - never (%)	286	46.13	
Smoking - previous (%)	234	37.74	
Smoking - current (%)	100	16.13	
Smoking - unknown (%)	0	0.0	

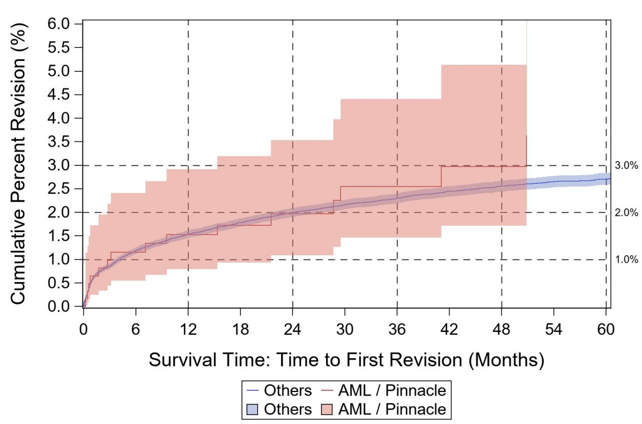

Figure 40: Cumulative percent revision curve for the AML/Pinnacle combination compared to all other implant combinations in conventional primary THA.

Table 76: Cumulative percent revision and number at risk for AML/Pinnacle combination in primary THA cases.

Year	Number at risk	CPR
0	619	0.00 (0.00,0.00)
1	517	1.53 (0.80,2.91)
2	380	1.96 (1.09,3.54)
3	274	2.55 (1.46,4.41)
4	175	2.98 (1.72,5.14)
5*	92	3.63 (2.05,6.39)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.989 (0.474,2.066). It was 1.231 (1.127,1.346) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 77: Reasons for revision following primary THA for AML/Pinnacle combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	6	40.0
2	Joint Infection	5	33.3
3	Poly liner wear	1	6.7
4	Peri-prosthetic fracture - Acetabulum	1	6.7
5	Pain	1	6.7
6	Malalignment	1	6.7

Table 78: Reasons for revision in first 90 days following primary THA for AML/Pinnacle combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	3	50.0
2	Joint Infection	1	16.7
3	Peri-prosthetic fracture - Acetabulum	1	16.7
4	Malalignment	1	16.7

Table 79: Reasons for revision between 91 and 365 days following primary THA for AML/Pinnacle combination cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	2	66.7
2	Dislocation/Instability	1	33.3

Table 80: Distribution of approach used for AML/Pinnacle combination in primary THA cases.

Approach	N	Percent
Anterior	8	1.3
Anterolateral	511	82.4
Posterior	99	16.0
Transtrochanteric	0	0.0
Missing/unknown/other	2	0.3

Table 81: Distribution of head size for AML/Pinnacle combination in primary THA cases.

Size (mm)	N	Percent
28	2	0.3
32	144	23.4
36	407	66.2
40	61	9.9
Missing/unknown/other	1	0.2

Table 82: Distribution of bearing surface for AML/Pinnacle combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	591	95.3
Ceramic-on-plastic	24	3.9
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	5	0.8

Table 83: Distribution of polyethylene used for AML/Pinnacle combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	615	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

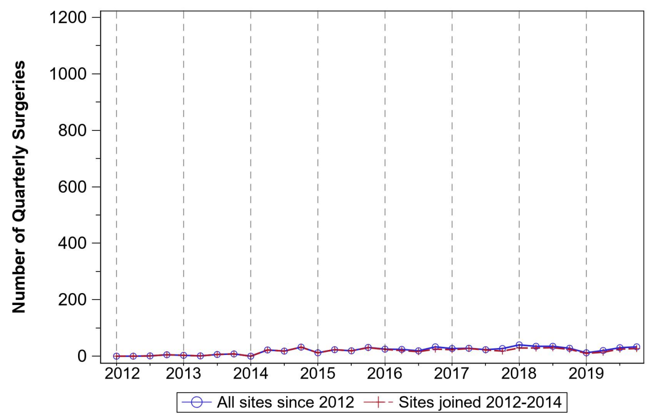

Figure 41: Utilization of the AML/Pinnacle combination in primary THA.

Anthology/Reflection 3

N=3019

54 surgeons across 33 sites use this implant combination in primary THA.

Table 84: Volume of cases by surgeon and site for the Anthology/Reflection 3 combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	55.9 (99)	12 (64)
Cases per site	91.5 (123.0)	48 (122)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 85: Descriptive statistics of cases receiving the Anthology/Reflection 3 combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	1671	55.35	
Age (yrs)	3019	64.80(11.20)	65.00(14.00)
Height (cm)	3019	169.38(10.34)	168.00(15.30)
Weight (kg)	3019	91.20(22.94)	88.50(29.33)
BMI(kg/m^2)	3019	31.67(6.96)	30.57(8.89)
Smoking - never (%)	1411	46.74	
Smoking - previous (%)	1131	37.46	
Smoking - current (%)	467	15.47	
Smoking - unknown (%)	10	0.33	

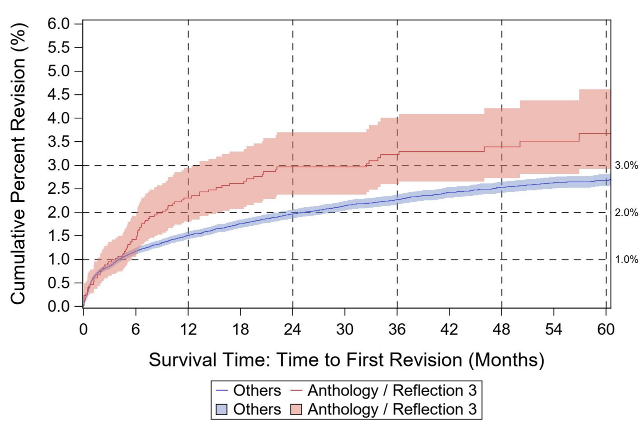

Figure 42: Cumulative percent revision curve for the Anthology/Reflection 3 combination compared to all other implant combinations in conventional primary THA.

Table 86: Cumulative percent revision and number at risk for Anthology/Reflection 3 combination in primary THA cases.

Year	Number at risk	CPR
0	3009	0.00 (0.00,0.00)
1	2347	2.31 (1.81,2.94)
2	1811	2.97 (2.38,3.70)
3	1403	3.22 (2.59,4.00)
4	901	3.39 (2.73,4.21)
5	470	3.68 (2.93,4.61)

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.431 (1.082,1.894). It was 1.231 (1.127,1.346) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 87: Reasons for revision following primary THA for Anthology/Reflection 3 combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	21	25.3
2	Joint Infection	17	20.5
3	Aseptic Loosening	16	19.3
4	Peri-prosthetic fracture - Femur	14	16.9
5	Component fracture/failure	6	7.2
6	Pain	3	3.6
7	Malalignment	3	3.6
8	Peri-prosthetic fracture - Acetabulum	2	2.4
9	Metal reaction/Metallosis	1	1.2

Table 88: Reasons for revision in first 90 days following primary THA for Anthology/Reflection 3 combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	11	42.3
2	Dislocation/Instability	4	15.4
3	Joint Infection	3	11.5
4	Component fracture/failure	3	11.5
5	Aseptic Loosening	2	7.7
6	Peri-prosthetic fracture - Acetabulum	2	7.7
7	Malalignment	1	3.9

Table 89: Reasons for revision between 91 and 365 days following primary THA for Anthology/Reflection 3 combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	11	33.3
2	Joint Infection	9	27.3
3	Aseptic Loosening	7	21.2
4	Pain	3	9.1
5	Peri-prosthetic fracture - Femur	2	6.1
6	Component fracture/failure	1	3.0

Table 90: Distribution of approach used for Anthology/Reflection 3 combination in primary THA cases.

Approach	N	Percent
Anterior	1261	41.8
Anterolateral	1093	36.2
Posterior	646	21.4
Transtrochanteric	15	0.5
Missing/unknown/other	4	0.1

Table 91: Distribution of head size for Anthology/Reflection 3 combination in primary THA cases.

Size (mm)	N	Percent
22	3	0.1
28	25	0.8
32	797	26.4
36	1947	64.5
40	216	7.2
44	13	0.4
Missing/unknown/other	16	0.5

Table 92: Distribution of bearing surface for Anthology/Reflection 3 combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	704	23.3
Ceramic-on-plastic	2297	76.1
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	18	0.6

Table 93: Distribution of polyethylene used for Anthology/Reflection 3 combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	1	0.0
XLPE	3015	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

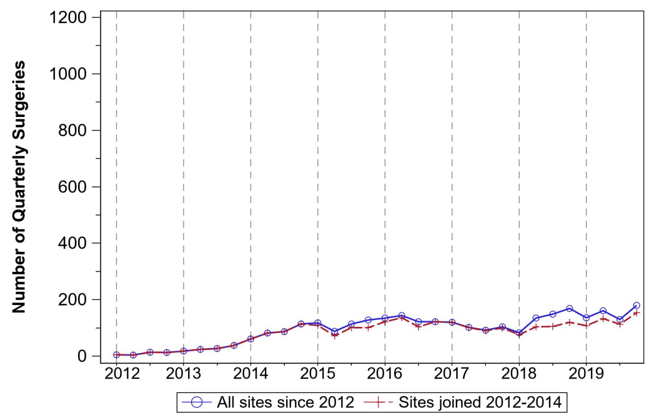

Figure 43: Utilization of the Anthology/Reflection 3 combination in primary THA.

Avenir Muller/Continuum
N=521

16 surgeons across 14 sites use this implant combination in primary THA.

Table 94: Volume of cases by surgeon and site for the Avenir Muller/Continuum combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	32.6 (54.5)	7.5 (25)
Cases per site	37.2 (62.3)	5 (31)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 95: Descriptive statistics of cases receiving the Avenir Muller/Continuum combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	302	57.97	
Age (yrs)	521	65.69(10.90)	66.00(14.00)
Height (cm)	509	169.26(10.49)	168.00(16.80)
Weight (kg)	509	86.27(20.79)	84.00(27.43)
BMI(kg/m^2)	509	29.91(5.77)	29.38(7.37)
Smoking - never (%)	258	49.52	
Smoking - previous (%)	193	37.04	
Smoking - current (%)	70	13.44	
Smoking - unknown (%)	0	0.0	

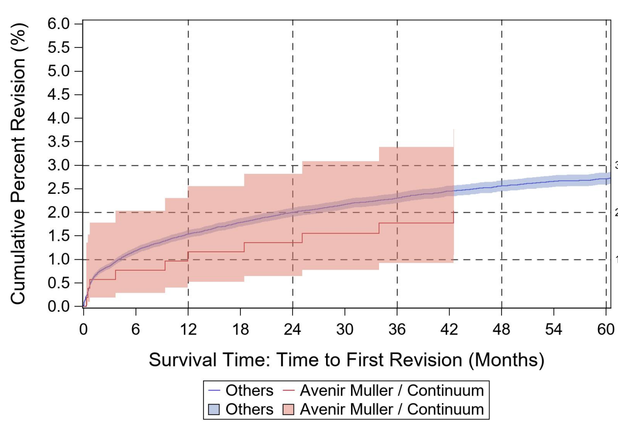

Figure 44: Cumulative percent revision curve for the Avenir Muller/Continuum combination compared to all other implant combinations in conventional primary THA.

Table 96: Cumulative percent revision and number at risk for Avenir Muller/Continuum combination in primary THA cases.

Year	Number at risk	CPR
0	521	0.00 (0.00,0.00)
1	509	1.16 (0.52,2.56)
2	493	1.35 (0.65,2.82)
3	424	1.77 (0.93,3.39)
4*	329	2.04 (1.10,3.77)
5*	197	2.04 (1.10,3.77)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.782 (0.393,1.561). It was 1.231 (1.127,1.346) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 97: Reasons for revision following primary THA for Avenir Muller/Continuum combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	3	33.3
2	Peri-prosthetic fracture - Femur	3	33.3
3	Pain	2	22.2
4	Joint Infection	1	11.1

Table 98: Reasons for revision in first 90 days following primary THA for Avenir Muller/Continuum combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	2	66.7
2	Dislocation/Instability	1	33.3

Table 99: Reasons for revision between 91 and 365 days following primary THA for Avenir Muller/Continuum combination cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	1	50.0
2	Pain	1	50.0

Table 100: Distribution of approach used for Avenir Muller/Continuum combination in primary THA cases.

Approach	N	Percent
Anterior	123	23.6
Anterolateral	126	24.2
Posterior	260	49.9
Transtrochanteric	0	0.0
Missing/unknown/other	12	2.3

Table 101: Distribution of head size for Avenir Muller/Continuum combination in primary THA cases.

Size (mm)	N	Percent
28	4	0.8
32	114	22.0
36	354	68.2
40	44	8.5
Missing/unknown/other	3	0.6

Table 102: Distribution of bearing surface for Avenir Muller/Continuum combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	284	54.5
Ceramic-on-plastic	232	44.5
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	5	1.0

Table 103: Distribution of polyethylene used for Avenir Muller/Continuum combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	317	61.1
Antioxidant XLPE	202	38.9
Missing/unknown/other	0	0.0

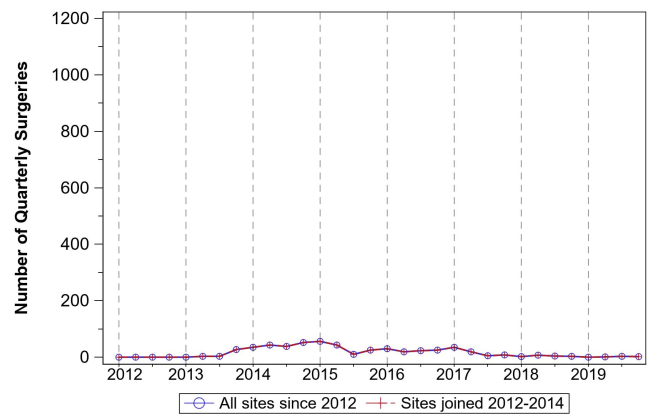

Figure 45: Utilization of the Avenir Muller/Continuum combination in primary THA.

Corail/Pinnacle
N=2538

39 surgeons across 23 sites use this implant combination in primary THA.

Table 104: Volume of cases by surgeon and site for the Corail/Pinnacle combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	65.1 (94.2)	7 (105)
Cases per site	110.4 (160.0)	26 (219)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 105: Descriptive statistics of cases receiving the Corail/Pinnacle combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	1529	60.24	
Age (yrs)	2538	65.87(10.35)	66.00(14.00)
Height (cm)	2382	168.86(10.20)	168.00(15.00)
Weight (kg)	2382	87.18(19.93)	85.60(26.97)
BMI(kg/m^2)	2382	30.48(6.04)	29.76(7.89)
Smoking - never (%)	1155	45.51	
Smoking - previous (%)	977	38.49	
Smoking - current (%)	403	15.88	
Smoking - unknown (%)	3	0.12	

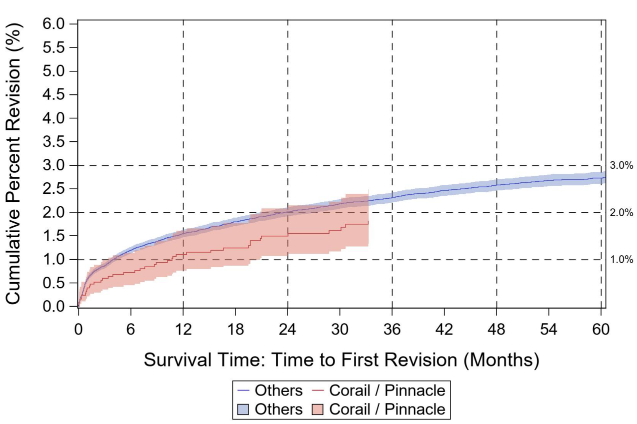

Figure 46: Cumulative percent revision curve for the Corail/Pinnacle combination compared to all other implant combinations in conventional primary THA.

Table 106: Cumulative percent revision and number at risk for Corail/Pinnacle combination in primary THA cases.

Year	Number at risk	CPR
0	2531	0.00 (0.00,0.00)
1	2236	1.11 (0.76,1.61)
2	1796	1.50 (1.07,2.08)
3*	1192	1.82 (1.33,2.49)
4*	711	1.82 (1.33,2.49)
5*	363	1.82 (1.33,2.49)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.799 (0.553,1.155). It was 1.232 (1.127,1.347) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 107: Reasons for revision following primary THA for Corail/Pinnacle combination cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	11	27.5
2	Dislocation/Instability	9	22.5
3	Joint Infection	9	22.5
4	Peri-prosthetic fracture - Femur	6	15.0
5	Component fracture/failure	3	7.5
6	Malalignment	2	5.0

Table 108: Reasons for revision in first 90 days following primary THA for Corail/Pinnacle combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	5	33.3
2	Aseptic Loosening	3	20.0
3	Dislocation/Instability	3	20.0
4	Joint Infection	2	13.3
5	Component fracture/failure	2	13.3

Table 109: Reasons for revision between 91 and 365 days following primary THA for Corail/Pinnacle combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	4	33.3
2	Joint Infection	4	33.3
3	Aseptic Loosening	3	25.0
4	Malalignment	1	8.3

Table 110: Distribution of approach used for Corail/Pinnacle combination in primary THA cases.

Approach	N	Percent
Anterior	1757	69.2
Anterolateral	379	14.9
Posterior	239	9.4
Transtrochanteric	3	0.1
Missing/unknown/other	160	6.3

Table 111: Distribution of head size for Corail/Pinnacle combination in primary THA cases.

Size (mm)	N	Percent
28	7	0.3
32	570	22.6
36	1759	69.8
40	165	6.5
44	15	0.6
Missing/unknown/other	6	0.2

Table 112: Distribution of bearing surface for Corail/Pinnacle combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	1138	44.8
Ceramic-on-plastic	1372	54.1
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	28	1.1

Table 113: Distribution of polyethylene used for Corail/Pinnacle combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	2515	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

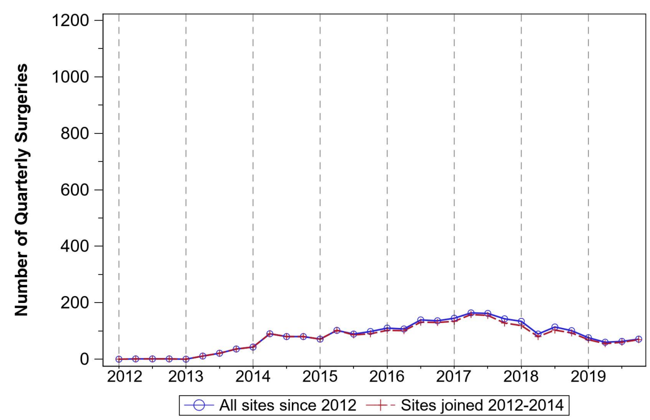

Figure 47: Utilization of the Corail/Pinnacle combination in primary THA.

Corail Coxa Vara/Pinnacle
N=534

24 surgeons across 18 sites use this implant combination in primary THA.

Table 114: Volume of cases by surgeon and site for the Corail Coxa Vara/Pinnacle combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	22.3 (25.6)	13.5 (32.5)
Cases per site	29.7 (31.5)	17 (51)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 115: Descriptive statistics of cases receiving the Corail Coxa Vara/Pinnacle combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	299	55.99	
Age (yrs)	534	64.81(10.06)	65.00(14.00)
Height (cm)	531	170.65(10.72)	170.18(15.24)
Weight (kg)	531	88.63(20.64)	86.82(24.71)
BMI(kg/m^2)	531	30.30(5.83)	29.29(7.38)
Smoking - never (%)	243	45.51	
Smoking - previous (%)	216	40.45	
Smoking - current (%)	75	14.04	
Smoking - unknown (%)	0	0.0	

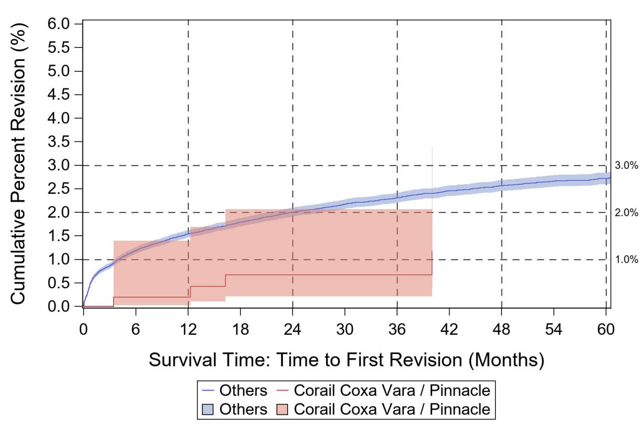

Figure 48: Cumulative percent revision curve for the Corail Coxa Vara/Pinnacle combination compared to all other implant combinations in conventional primary THA.

Table 116: Cumulative percent revision and number at risk for Corail Coxa Vara/Pinnacle combination in primary THA cases.

Year	Number at risk	CPR
0	534	0.00 (0.00,0.00)
1	442	0.20 (0.03,1.39)
2	348	0.67 (0.22,2.07)
3	228	0.67 (0.22,2.07)
4*	136	1.18 (0.41,3.40)
5*	65	1.18 (0.41,3.40)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.41 (0.151,1.115). It was 1.231 (1.127,1.346) and 0.999 (0.996,1.004) for sex (female) and age, respectively.

Table 117: Reasons for revision following primary THA for Corail Coxa Vara/Pinnacle combination cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	3	75.0
2	Dislocation/Instability	1	25.0

There were no revisions between day 91 and day 365 so no table of reasons for revisions during this time period is included.

Table 118: Reasons for revision between 91 and 365 days following primary THA for Corail Coxa Vara/Pinnacle combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	1	100.0

Table 119: Distribution of approach used for Corail Coxa Vara/Pinnacle combination in primary THA cases.

Approach	N	Percent
Anterior	417	78.1
Anterolateral	80	15.0
Posterior	32	6.0
Transtrochanteric	0	0.0
Missing/unknown/other	5	0.9

Table 120: Distribution of head size for Corail Coxa Vara/Pinnacle combination in primary THA cases.

Size (mm)	N	Percent
28	9	1.7
32	147	27.6
36	360	67.7
40	11	2.1
44	1	0.2
Missing/unknown/other	4	0.8

Table 121: Distribution of bearing surface for Corail Coxa Vara/Pinnacle combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	175	32.8
Ceramic-on-plastic	350	65.5
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	9	1.7

Table 122: Distribution of polyethylene used for Corail Coxa Vara/Pinnacle combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	529	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

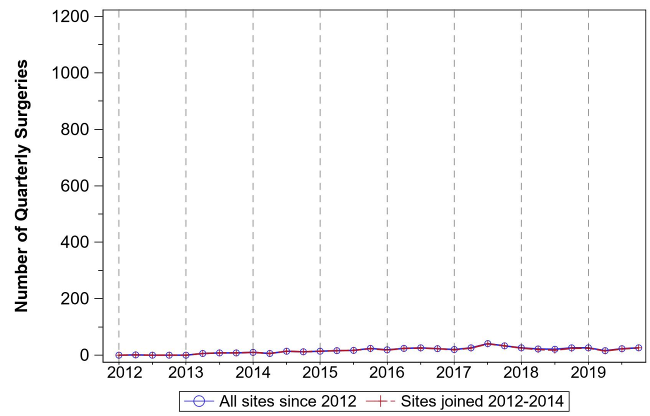

Figure 49: Utilization of the Corail Coxa Vara/Pinnacle combination in primary THA.

Echo Bi-Metric/G7

N=1184

26 surgeons across 24 sites use this implant combination in primary THA.

Table 123: Volume of cases by surgeon and site for the Echo Bi-Metric/G7 combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	45.5 (132.5)	4 (23)
Cases per site	49.3 (139.2)	10.5 (30.5)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 124: Descriptive statistics of cases receiving the Echo Bi-Metric/G7 combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	663	56	
Age (yrs)	1184	66.45(10.50)	67.00(14.00)
Height (cm)	1184	169.63(10.35)	168.91(15.24)
Weight (kg)	1184	89.07(22.15)	87.19(29.64)
BMI(kg/m^2)	1184	30.80(6.55)	29.90(8.50)
Smoking - never (%)	578	48.82	
Smoking - previous (%)	435	36.74	
Smoking - current (%)	171	14.44	
Smoking - unknown (%)	0	0.0	

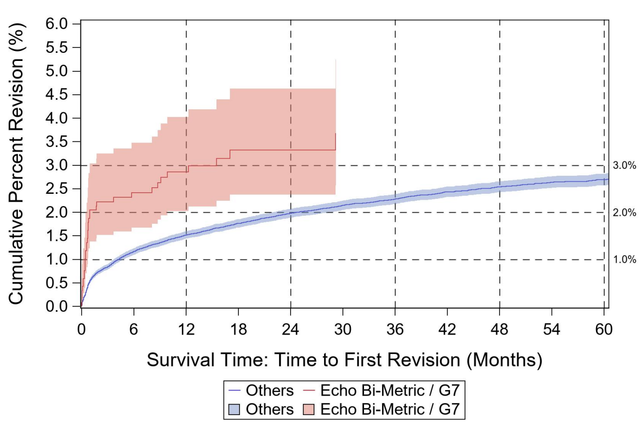

Figure 50: Cumulative percent revision curve for the Echo Bi-Metric/G7 combination compared to all other implant combinations in conventional primary THA.

Table 125: Cumulative percent revision and number at risk for Echo Bi-Metric/G7 combination in primary THA cases.

Year	Number at risk	CPR
0	1184	0.00 (0.00,0.00)
1	761	2.86 (2.03,4.03)
2	370	3.32 (2.38,4.63)
3*	153	3.68 (2.58,5.25)
4*	44	3.68 (2.58,5.25)
5*	3	3.68 (2.58,5.25)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 126: Reasons for revision following primary THA for Echo Bi-Metric/G7 combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	16	44.4
2	Joint Infection	7	19.4
3	Aseptic Loosening	4	11.1
4	Dislocation/Instability	4	11.1
5	Component fracture/failure	2	5.6
6	Malalignment	2	5.6
7	Peri-prosthetic fracture - Acetabulum	1	2.8

Table 127: Reasons for revision in first 90 days following primary THA for Echo Bi-Metric/G7 combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	15	57.7
2	Dislocation/Instability	3	11.5
3	Aseptic Loosening	2	7.7
4	Joint Infection	2	7.7
5	Malalignment	2	7.7
6	Component fracture/failure	1	3.9
7	Peri-prosthetic fracture - Acetabulum	1	3.9

Table 128: Reasons for revision between 91 and 365 days following primary THA for Echo Bi-Metric/G7 combination cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	2	33.3
2	Joint Infection	2	33.3
3	Component fracture/failure	1	16.7
4	Peri-prosthetic fracture - Femur	1	16.7

Table 129: Distribution of approach used for Echo Bi-Metric/G7 combination in primary THA cases.

Approach	N	Percent
Anterior	105	8.9
Anterolateral	41	3.5
Posterior	1037	87.6
Transtrochanteric	1	0.1
Missing/unknown/other	0	0.0

Table 130: Distribution of head size for Echo Bi-Metric/G7 combination in primary THA cases.

Size (mm)	N	Percent
28	2	0.2
32	205	18.8
36	577	53.0
40	303	27.8
Missing/unknown/other	2	0.2

Table 131: Distribution of bearing surface for Echo Bi-Metric/G7 combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	104	8.8
Ceramic-on-plastic	983	83.0
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	93	7.8
Missing/unknown/other	4	0.3

Table 132: Distribution of polyethylene used for Echo Bi-Metric/G7 combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	914	77.4
Antioxidant XLPE	267	22.6
Missing/unknown/other	0	0.0

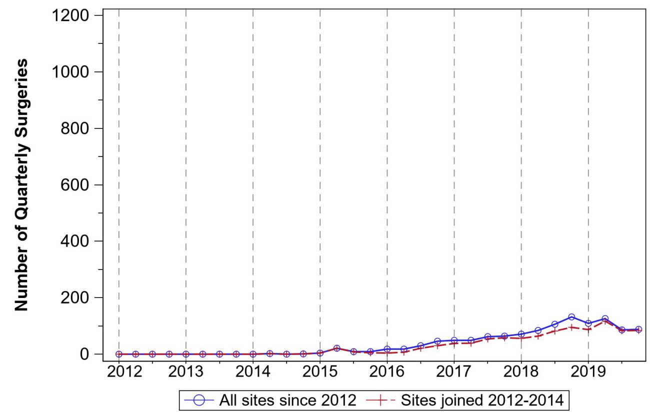

Figure 51: Utilization of the Echo Bi-Metric/G7 combination in primary THA.

Echo Bi-Metric Microplasty/G7
N=950

14 surgeons across 15 sites use this implant combination in primary THA.

Table 133: Volume of cases by surgeon and site for the Echo Bi-Metric Microplasty/G7 combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	67.9 (99.5)	16.5 (78)
Cases per site	63.3 (106.2)	9 (44)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 134: Descriptive statistics of cases receiving the Echo Bi-Metric Microplasty/G7 combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	492	51.79	
Age (yrs)	950	64.40(10.31)	65.00(14.00)
Height (cm)	950	170.58(10.64)	170.20(15.20)
Weight (kg)	950	89.44(20.07)	88.60(26.40)
BMI(kg/m^2)	950	30.69(6.58)	30.12(7.87)
Smoking - never (%)	454	47.79	
Smoking - previous (%)	358	37.68	
Smoking - current (%)	137	14.42	
Smoking - unknown (%)	1	0.11	

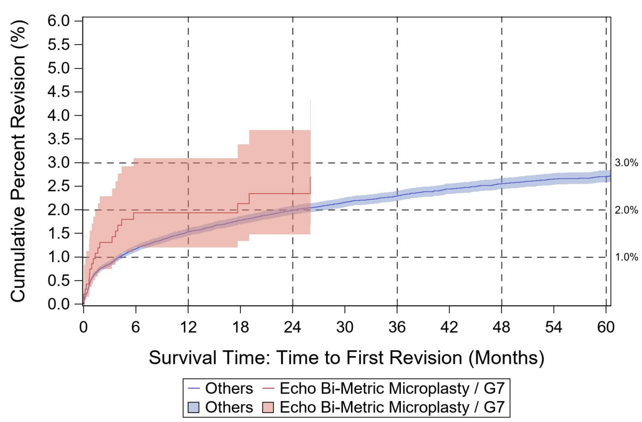

Figure 52: Cumulative percent revision curve for the Echo Bi-Metric Microplasty/G7 combination compared to all other implant combinations in conventional primary THA.

Table 135: Cumulative percent revision and number at risk for Echo Bi-Metric Microplasty/G7 combination in primary THA cases.

Year	Number at risk	CPR
0	950	0.00 (0.00,0.00)
1	587	1.93 (1.20,3.09)
2	331	2.34 (1.48,3.69)
3*	85	2.70 (1.68,4.33)
4*	3	2.70 (1.68,4.33)
5	0	N/A

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.698 (1.013,2.849). It was 1.231 (1.127,1.346) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 136: Reasons for revision following primary THA for Echo Bi-Metric Microplasty/G7 combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	10	50.0
2	Joint Infection	3	15.0
3	Aseptic Loosening	2	10.0
4	Dislocation/Instability	2	10.0
5	Component fracture/failure	1	5.0
6	Pain	1	5.0
7	Malalignment	1	5.0

Table 137: Reasons for revision in first 90 days following primary THA for Echo Bi-Metric Microplasty/G7 combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	9	75.0
2	Aseptic Loosening	1	8.3
3	Dislocation/Instability	1	8.3
4	Malalignment	1	8.3

Table 138: Reasons for revision between 91 and 365 days following primary THA for Echo Bi-Metric Microplasty/G7 combination cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	2	40.0
2	Aseptic Loosening	1	20.0
3	Dislocation/Instability	1	20.0
4	Component fracture/failure	1	20.0

Table 139: Distribution of approach used for Echo Bi-Metric Microplasty/G7 combination in primary THA cases.

Approach	N	Percent
Anterior	643	67.7
Anterolateral	11	1.2
Posterior	292	30.7
Transtrochanteric	3	0.3
Missing/unknown/other	1	0.1

Table 140: Distribution of head size for Echo Bi-Metric Microplasty/G7 combination in primary THA cases.

Size (mm)	N	Percent
28	1	0.1
32	204	23.8
36	588	68.5
40	61	7.1
Missing/unknown/other	4	0.5

Table 141: Distribution of bearing surface for Echo Bi-Metric Microplasty/G7 combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	145	15.3
Ceramic-on-plastic	709	74.6
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	88	9.3
Missing/unknown/other	8	0.8

Table 142: Distribution of polyethylene used for Echo Bi-Metric Microplasty/G7 combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	341	36.0
Antioxidant XLPE	605	64.0
Missing/unknown/other	0	0.0

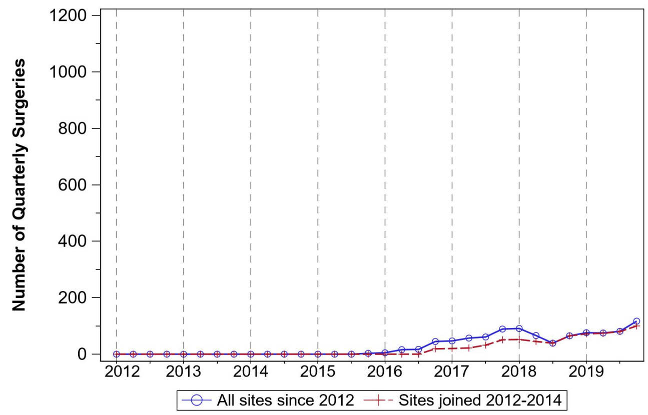

Figure 53: Utilization of the Echo Bi-Metric Microplasty/G7 combination in primary THA.

Fitmore/Continuum
N=2743

37 surgeons across 17 sites use this implant combination in primary THA.

Table 143: Volume of cases by surgeon and site for the Fitmore/Continuum combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	74.1 (237.0)	5 (24)
Cases per site	161.4 (266.1)	33 (196)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 144: Descriptive statistics of cases receiving the Fitmore/Continuum combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	1232	44.91	
Age (yrs)	2743	63.71(10.19)	63.00(14.00)
Height (cm)	2659	171.62(10.18)	172.70(14.17)
Weight (kg)	2659	89.38(21.48)	87.50(28.70)
BMI(kg/m^2)	2659	30.19(6.17)	29.30(7.93)
Smoking - never (%)	1320	48.12	
Smoking - previous (%)	1071	39.04	
Smoking - current (%)	348	12.69	
Smoking - unknown (%)	4	0.15	

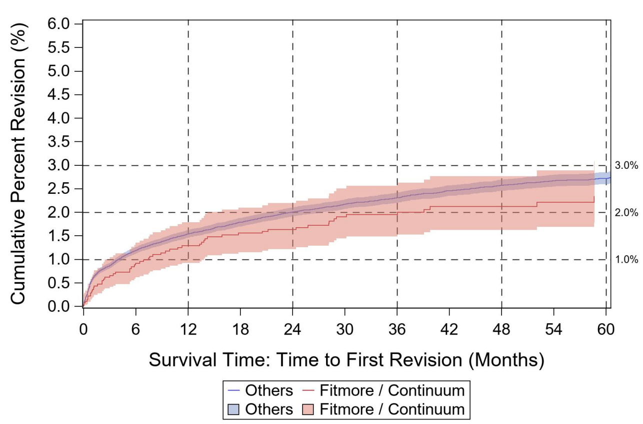

Figure 54: Cumulative percent revision curve for the Fitmore/Continuum combination compared to all other implant combinations in conventional primary THA.

Table 145: Cumulative percent revision and number at risk for Fitmore/Continuum combination in primary THA cases.

Year	Number at risk	CPR
0	2742	0.00 (0.00,0.00)
1	2621	1.29 (0.93,1.79)
2	2364	1.64 (1.22,2.19)
3	1852	1.95 (1.49,2.56)
4	1334	2.12 (1.62,2.77)
5*	664	2.34 (1.78,3.08)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.193 (0.849,1.677). It was 1.232 (1.128,1.348) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 146: Reasons for revision following primary THA for Fitmore/Continuum combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	13	23.6
2	Aseptic Loosening	11	20.0
3	Dislocation/Instability	11	20.0
4	Joint Infection	7	12.7
5	Pain	7	12.7
6	Component fracture/failure	3	5.5
7	Malalignment	3	5.5

Table 147: Reasons for revision in first 90 days following primary THA for Fitmore/Continuum combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	10	62.5
2	Dislocation/Instability	5	31.3
3	Component fracture/failure	1	6.3

Table 148: Reasons for revision between 91 and 365 days following primary THA for Fitmore/Continuum combination cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	5	27.8
2	Pain	4	22.2
3	Dislocation/Instability	3	16.7
4	Component fracture/failure	2	11.1
5	Peri-prosthetic fracture - Femur	2	11.1
6	Joint Infection	1	5.6
7	Malalignment	1	5.6

Table 149: Distribution of approach used for Fitmore/Continuum combination in primary THA cases.

Approach	N	Percent
Anterior	2337	85.2
Anterolateral	23	0.8
Posterior	299	10.9
Transtrochanteric	0	0.0
Missing/unknown/other	84	3.1

Table 150: Distribution of head size for Fitmore/Continuum combination in primary THA cases.

Size (mm)	N	Percent
28	3	0.1
32	524	19.2
36	1989	72.7
40	200	7.3
Missing/unknown/other	19	0.7

Table 151: Distribution of bearing surface for Fitmore/Continuum combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	553	20.2
Ceramic-on-plastic	2163	78.9
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	27	1.0

Table 152: Distribution of polyethylene used for Fitmore/Continuum combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	1	0.0
XLPE	1045	38.2
Antioxidant XLPE	1689	61.8
Missing/unknown/other	0	0.0

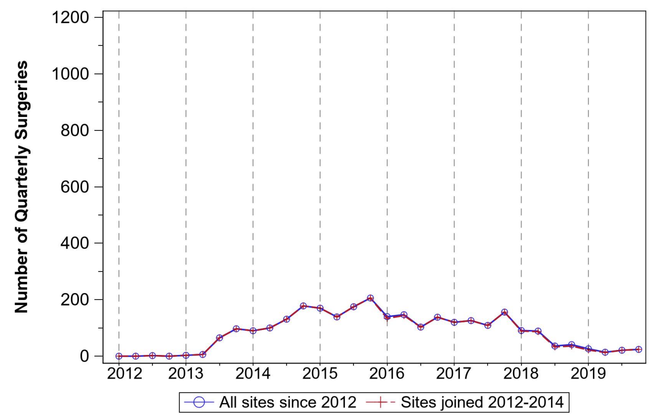

Figure 55: Utilization of the Fitmore/Continuum combination in primary THA.

Fitmore/G7
N=1545

26 surgeons across 19 sites use this implant combination in primary THA.

Table 153: Volume of cases by surgeon and site for the Fitmore/G7 combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	59.4 (148.3)	5 (37)
Cases per site	81.3 (148.5)	12 (73)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 154: Descriptive statistics of cases receiving the Fitmore/G7 combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	852	55.15	
Age (yrs)	1545	63.57(10.07)	64.00(13.00)
Height (cm)	1502	170.32(10.62)	170.18(15.24)
Weight (kg)	1502	88.16(20.28)	86.62(26.56)
BMI(kg/m^2)	1502	30.30(6.06)	29.42(8.11)
Smoking - never (%)	757	49	
Smoking - previous (%)	570	36.89	
Smoking - current (%)	216	13.98	
Smoking - unknown (%)	2	0.13	

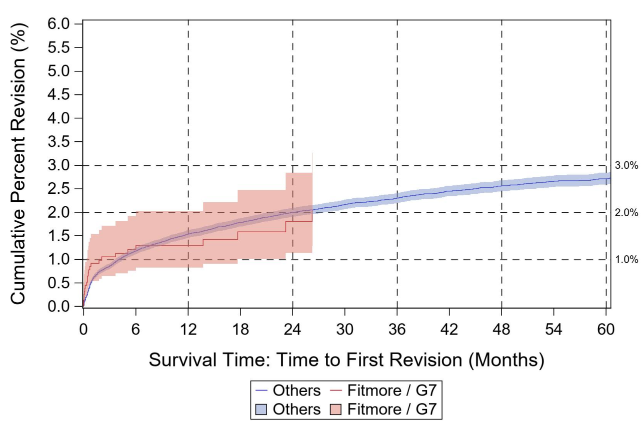

Figure 56: Cumulative percent revision curve for the Fitmore/G7 combination compared to all other implant combinations in conventional primary THA.

Table 155: Cumulative percent revision and number at risk for Fitmore/G7 combination in primary THA cases.

Year	Number at risk	CPR
0	1544	0.00 (0.00,0.00)
1	861	1.29 (0.83,2.03)
2	440	1.80 (1.14,2.84)
3*	203	2.05 (1.29,3.27)
4*	40	2.05 (1.29,3.27)
5	0	N/A

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.017 (0.635,1.629). It was 1.231 (1.127,1.346) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 156: Reasons for revision following primary THA for Fitmore/G7 combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	9	39.1
2	Dislocation/Instability	5	21.7
3	Aseptic Loosening	3	13.0
4	Component fracture/failure	2	8.7
5	Joint Infection	1	4.3
6	Peri-prosthetic fracture - Acetabulum	1	4.3
7	Pain	1	4.3
8	Malalignment	1	4.3

Table 157: Reasons for revision in first 90 days following primary THA for Fitmore/G7 combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	8	50.0
2	Dislocation/Instability	4	25.0
3	Component fracture/failure	2	12.5
4	Peri-prosthetic fracture - Acetabulum	1	6.3
5	Malalignment	1	6.3

Table 158: Reasons for revision between 91 and 365 days following primary THA for Fitmore/G7 combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	1	33.3
2	Joint Infection	1	33.3
3	Pain	1	33.3

Table 159: Distribution of approach used for Fitmore/G7 combination in primary THA cases.

Approach	N	Percent
Anterior	1313	85.0
Anterolateral	10	0.7
Posterior	178	11.5
Transtrochanteric	0	0.0
Missing/unknown/other	44	2.9

Table 160: Distribution of head size for Fitmore/G7 combination in primary THA cases.

Size (mm)	N	Percent
32	143	9.8
36	936	64.3
40	366	25.1
Missing/unknown/other	11	0.8

Table 161: Distribution of bearing surface for Fitmore/G7 combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	223	14.4
Ceramic-on-plastic	1222	79.1
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	75	4.8
Missing/unknown/other	25	1.6

Table 162: Distribution of polyethylene used for Fitmore/G7 combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	274	17.9
Antioxidant XLPE	1255	82.1
Missing/unknown/other	0	0.0

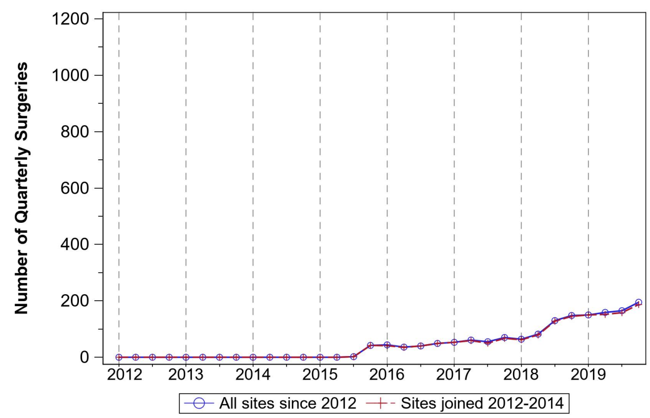

Figure 57: Utilization of the Fitmore/G7 combination in primary THA.

M/L Taper/Continuum
N=6856

This analysis excludes M/L Taper Kinectiv. 68 surgeons across 31 sites use this implant combination in primary THA.

Table 163: Volume of cases by surgeon and site for the M/L Taper/Continuum combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	100.8 (220.5)	30.5 (84)
Cases per site	221.2 (518.5)	41 (222)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 164: Descriptive statistics of cases receiving the M/L Taper/Continuum combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	3647	53.19	
Age (yrs)	6856	64.71(10.56)	65.00(14.00)
Height (cm)	6847	170.18(10.39)	170.00(15.20)
Weight (kg)	6846	87.41(20.11)	86.00(26.80)
BMI(kg/m^2)	6846	30.05(5.84)	29.38(7.55)
Smoking - never (%)	3431	50.04	
Smoking - previous (%)	2623	38.26	
Smoking - current (%)	781	11.39	
Smoking - unknown (%)	21	0.31	

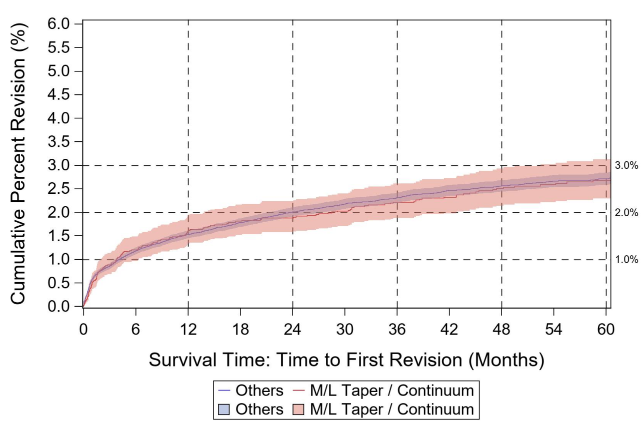

Figure 58: Cumulative percent revision curve for the M/L Taper/Continuum combination compared to all other implant combinations in conventional primary THA.

Table 165: Cumulative percent revision and number at risk for M/L Taper/Continuum combination in primary THA cases.

Year	Number at risk	CPR
0	6848	0.00 (0.00,0.00)
1	6205	1.60 (1.33,1.93)
2	5579	1.88 (1.58,2.24)
3	4878	2.22 (1.88,2.61)
4	3934	2.51 (2.14,2.94)
5	2721	2.68 (2.29,3.13)

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.896 (0.727,1.105). It was 1.23 (1.126,1.345) and 0.999 (0.996,1.004) for sex (female) and age, respectively.

Table 166: Reasons for revision following primary THA for M/L Taper/Continuum combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	38	27.3
2	Dislocation/Instability	36	25.9
3	Aseptic Loosening	23	16.5
4	Joint Infection	20	14.4
5	Pain	6	4.3
6	Component fracture/failure	5	3.6
7	Malalignment	5	3.6
8	Peri-prosthetic fracture - Acetabulum	4	2.9
9	Metal reaction/Metallosis	2	1.4

Table 167: Reasons for revision in first 90 days following primary THA for M/L Taper/Continuum combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	28	50.0
2	Dislocation/Instability	13	23.2
3	Aseptic Loosening	4	7.1
4	Joint Infection	4	7.1
5	Peri-prosthetic fracture - Acetabulum	3	5.4
6	Malalignment	3	5.4
7	Component fracture/failure	1	1.8

Table 168: Reasons for revision between 91 and 365 days following primary THA for M/L Taper/Continuum combination cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	10	35.7
2	Dislocation/Instability	6	21.4
3	Aseptic Loosening	5	17.9
4	Pain	3	10.7
5	Component fracture/failure	2	7.1
6	Peri-prosthetic fracture - Femur	2	7.1

Table 169: Distribution of approach used for M/L Taper/Continuum combination in primary THA cases.

Approach	N	Percent
Anterior	1480	21.6
Anterolateral	1180	17.2
Posterior	4096	59.7
Transtrochanteric	61	0.9
Missing/unknown/other	39	0.6

Table 170: Distribution of head size for M/L Taper/Continuum combination in primary THA cases.

Size (mm)	N	Percent
28	24	0.3
32	1552	22.8
36	4671	68.6
40	490	7.2
Missing/unknown/other	70	1.0

Table 171: Distribution of bearing surface for M/L Taper/Continuum combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	2328	34.0
Ceramic-on-plastic	4406	64.3
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	122	1.8

Table 172: Distribution of polyethylene used for M/L Taper/Continuum combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	4909	72.2
Antioxidant XLPE	1895	27.9
Missing/unknown/other	0	0.0

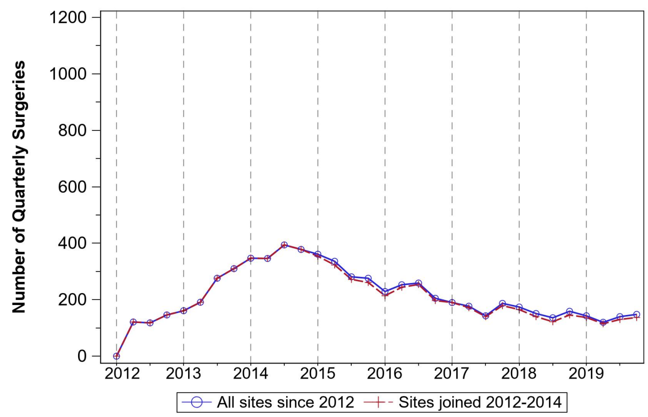

Figure 59: Utilization of the M/L Taper/Continuum combination in primary THA.

M/L Taper/G7
N=2024

This analysis excludes M/L Taper Kinectiv. 27 surgeons across 17 sites use this implant combination in primary THA.

Table 173: Volume of cases by surgeon and site for the M/L Taper/G7 combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	75.0 (150.3)	10 (34)
Cases per site	119.1 (238.6)	14 (129)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 174: Descriptive statistics of cases receiving the M/L Taper/G7 combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	1081	53.41	
Age (yrs)	2024	65.37(9.97)	66.00(13.00)
Height (cm)	2024	170.23(10.34)	170.20(15.20)
Weight (kg)	2024	88.13(20.16)	85.70(27.95)
BMI(kg/m^2)	2024	30.29(5.85)	29.50(8.00)
Smoking - never (%)	987	48.76	
Smoking - previous (%)	828	40.91	
Smoking - current (%)	209	10.33	
Smoking - unknown (%)	0	0.0	

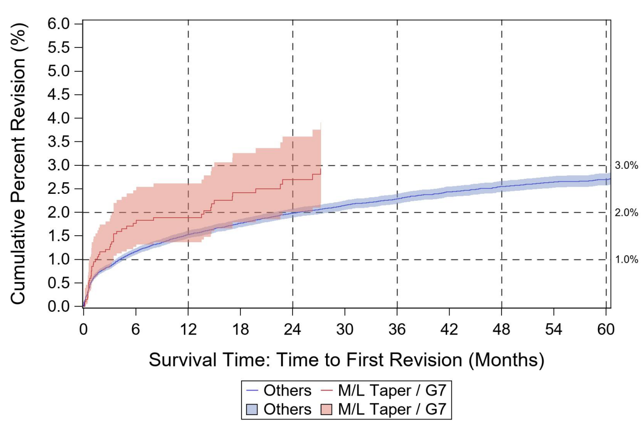

Figure 60: Cumulative percent revision curve for the M/L Taper/G7 combination compared to all other implant combinations in conventional primary THA.

Table 175: Cumulative percent revision and number at risk for M/L Taper/G7 combination in primary THA cases.

Year	Number at risk	CPR
0	2023	0.00 (0.00,0.00)
1	1436	1.89 (1.36,2.61)
2	958	2.69 (2.01,3.61)
3*	461	2.93 (2.19,3.91)
4*	78	2.93 (2.19,3.91)
5	0	N/A

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.38 (0.948,2.01). It was 1.231 (1.127,1.347) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 176: Reasons for revision following primary THA for M/L Taper/G7 combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	14	29.2
2	Dislocation/Instability	12	25.0
3	Aseptic Loosening	8	16.7
4	Joint Infection	8	16.7
5	Component fracture/failure	3	6.3
6	Pain	2	4.2
7	Malalignment	1	2.1

Table 177: Reasons for revision in first 90 days following primary THA for M/L Taper/G7 combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	13	54.2
2	Dislocation/Instability	5	20.8
3	Component fracture/failure	3	12.5
4	Joint Infection	2	8.3
5	Aseptic Loosening	1	4.2

Table 178: Reasons for revision between 91 and 365 days following primary THA for M/L Taper/G7 combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	6	50.0
2	Joint Infection	4	33.3
3	Aseptic Loosening	1	8.3
4	Peri-prosthetic fracture - Femur	1	8.3

Table 179: Distribution of approach used for M/L Taper/G7 combination in primary THA cases.

Approach	N	Percent
Anterior	689	34.0
Anterolateral	65	3.2
Posterior	1268	62.6
Transtrochanteric	2	0.1
Missing/unknown/other	0	0.0

Table 180: Distribution of head size for M/L Taper/G7 combination in primary THA cases.

Size (mm)	N	Percent
28	2	0.1
32	159	8.1
36	1609	81.6
40	197	10.0
Missing/unknown/other	4	0.2

Table 181: Distribution of bearing surface for M/L Taper/G7 combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	316	15.6
Ceramic-on-plastic	1651	81.6
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	51	2.5
Missing/unknown/other	6	0.3

Table 182: Distribution of polyethylene used for M/L Taper/G7 combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	704	34.9
Antioxidant XLPE	1316	65.2
Missing/unknown/other	0	0.0

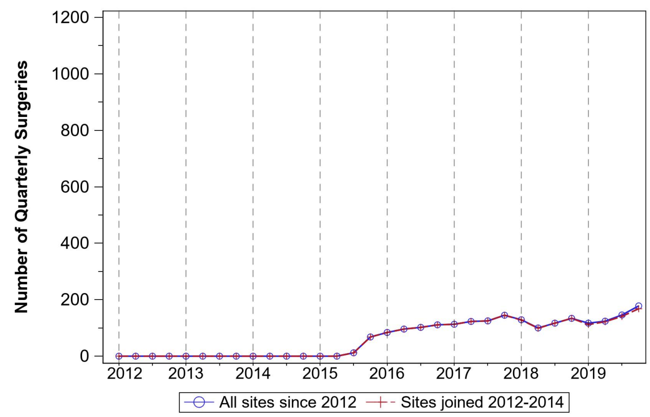

Figure 61: Utilization of the M/L Taper/G7 combination in primary THA.

M/L Taper/Trabecular Metal
N=835

This analysis excludes M/L Taper Kinectiv. 21 surgeons across 14 sites use this implant combination in primary THA.

Table 183: Volume of cases by surgeon and site for the M/L Taper/Trabecular Metal combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	39.8 (102.2)	2 (5)
Cases per site	59.6 (121.5)	5.5 (59)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 184: Descriptive statistics of cases receiving the M/L Taper/Trabecular Metal combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	455	54.49	
Age (yrs)	835	63.23(10.63)	63.00(13.00)
Height (cm)	835	169.55(10.99)	170.00(15.80)
Weight (kg)	834	90.91(22.39)	89.10(29.94)
BMI(kg/m^2)	834	31.77(9.07)	30.49(9.78)
Smoking - never (%)	288	34.49	
Smoking - previous (%)	300	35.93	
Smoking - current (%)	246	29.46	
Smoking - unknown (%)	1	0.12	

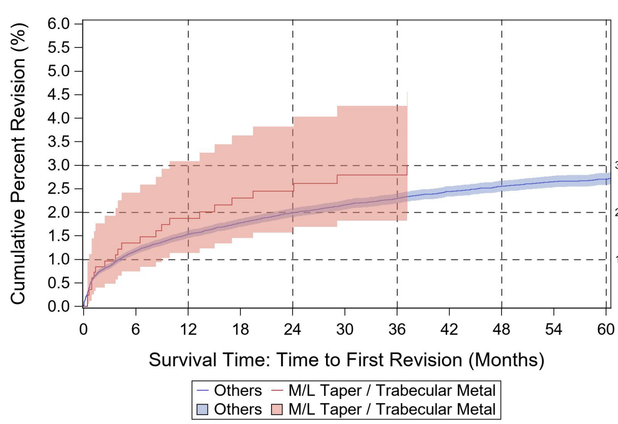

Figure 62: Cumulative percent revision curve for the M/L Taper/Trabecular Metal combination compared to all other implant combinations in conventional primary THA.

Table 185: Cumulative percent revision and number at risk for M/L Taper/Trabecular Metal combination in primary THA cases.

Year	Number at risk	CPR
0	833	0.00 (0.00,0.00)
1	717	1.87 (1.13,3.09)
2	604	2.45 (1.57,3.82)
3	476	2.79 (1.82,4.26)
4*	272	3.01 (1.98,4.56)
5*	186	3.01 (1.98,4.56)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.014 (0.556,1.852). It was 1.231 (1.127,1.346) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 186: Reasons for revision following primary THA for M/L Taper/Trabecular Metal combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	7	31.8
2	Aseptic Loosening	4	18.2
3	Dislocation/Instability	3	13.6
4	Joint Infection	3	13.6
5	Component fracture/failure	3	13.6
6	Pain	1	4.5
7	Malalignment	1	4.5

Table 187: Reasons for revision in first 90 days following primary THA for M/L Taper/Trabecular Metal combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	5	62.5
2	Dislocation/Instability	3	37.5

Table 188: Reasons for revision between 91 and 365 days following primary THA for M/L Taper/Trabecular Metal combination cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	2	28.6
2	Component fracture/failure	2	28.6
3	Joint Infection	1	14.3
4	Pain	1	14.3
5	Malalignment	1	14.3

Table 189: Distribution of approach used for M/L Taper/Trabecular Metal combination in primary THA cases.

Approach	N	Percent
Anterior	6	0.7
Anterolateral	381	45.6
Posterior	422	50.5
Transtrochanteric	23	2.8
Missing/unknown/other	3	0.4

Table 190: Distribution of head size for M/L Taper/Trabecular Metal combination in primary THA cases.

Size (mm)	N	Percent
28	32	3.8
32	477	57.3
36	291	34.9
40	22	2.6
Missing/unknown/other	11	1.3

Table 191: Distribution of bearing surface for M/L Taper/Trabecular Metal combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	415	49.7
Ceramic-on-plastic	407	48.7
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	13	1.6

Table 192: Distribution of polyethylene used for M/L Taper/Trabecular Metal combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	1	0.1
XLPE	831	99.8
Antioxidant XLPE	1	0.1
Missing/unknown/other	0	0.0

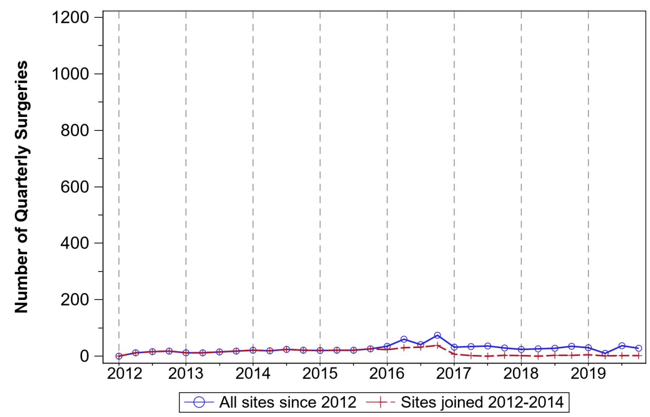

Figure 63: Utilization of the M/L Taper/Trabecular Metal combination in primary THA.

M/L Taper/Trilogy
N=1492

This analysis excludes M/L Taper Kinectiv. 17 surgeons across 11 sites use this implant combination in primary THA.

Table 193: Volume of cases by surgeon and site for the M/L Taper/Trilogy combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	87.8 (134.6)	14 (125)
Cases per site	135.6 (229.5)	13 (274)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 194: Descriptive statistics of cases receiving the M/L Taper/Trilogy combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	806	54.02	
Age (yrs)	1492	67.80(9.81)	67.00(14.00)
Height (cm)	1492	169.39(10.40)	167.95(15.80)
Weight (kg)	1492	86.60(19.64)	84.70(27.12)
BMI(kg/m^2)	1492	30.06(5.76)	29.45(7.47)
Smoking - never (%)	671	44.97	
Smoking - previous (%)	633	42.43	
Smoking - current (%)	187	12.53	
Smoking - unknown (%)	1	0.07	

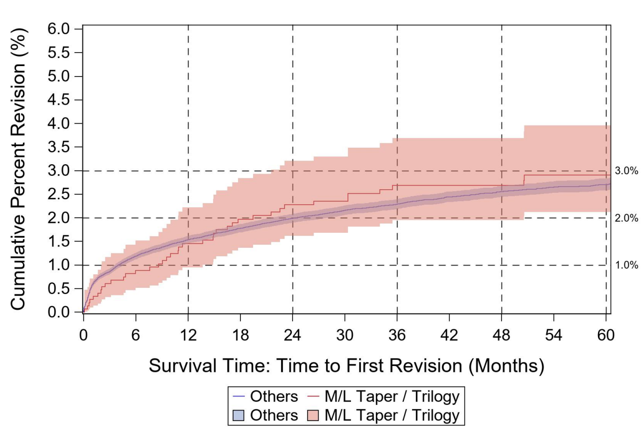

Figure 64: Cumulative percent revision curve for the M/L Taper/Trilogy combination compared to all other implant combinations in conventional primary THA.

Table 195: Cumulative percent revision and number at risk for M/L Taper/Trilogy combination in primary THA cases.

Year	Number at risk	CPR
0	1489	0.00 (0.00,0.00)
1	1364	1.46 (0.95,2.22)
2	1264	2.28 (1.61,3.21)
3	1153	2.68 (1.95,3.69)
4	942	2.68 (1.95,3.69)
5	677	2.90 (2.12,3.96)

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 196: Reasons for revision following primary THA for M/L Taper/Trilogy combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	12	30.0
2	Aseptic Loosening	8	20.0
3	Peri-prosthetic fracture - Femur	6	15.0
4	Metal reaction/Metallosis	4	10.0
5	Joint Infection	3	7.5
6	Malalignment	3	7.5
7	Peri-prosthetic fracture - Acetabulum	2	5.0
8	Component fracture/failure	1	2.5
9	Pain	1	2.5

Table 197: Reasons for revision in first 90 days following primary THA for M/L Taper/Trilogy combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	5	62.5
2	Dislocation/Instability	2	25.0
3	Peri-prosthetic fracture - Acetabulum	1	12.5

Table 198: Reasons for revision between 91 and 365 days following primary THA for M/L Taper/Trilogy combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	4	44.4
2	Aseptic Loosening	2	22.2
3	Joint Infection	1	11.1
4	Peri-prosthetic fracture - Acetabulum	1	11.1
5	Peri-prosthetic fracture - Femur	1	11.1

Table 199: Distribution of approach used for M/L Taper/Trilogy combination in primary THA cases.

Approach	N	Percent
Anterior	15	1.0
Anterolateral	973	65.2
Posterior	478	32.0
Transtrochanteric	24	1.6
Missing/unknown/other	2	0.1

Table 200: Distribution of head size for M/L Taper/Trilogy combination in primary THA cases.

Size (mm)	N	Percent
28	37	2.5
32	868	58.4
36	555	37.3
40	15	1.0
Missing/unknown/other	12	0.8

Table 201: Distribution of bearing surface for M/L Taper/Trilogy combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	1199	80.4
Ceramic-on-plastic	276	18.5
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	17	1.1

Table 202: Distribution of polyethylene used for M/L Taper/Trilogy combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	1487	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

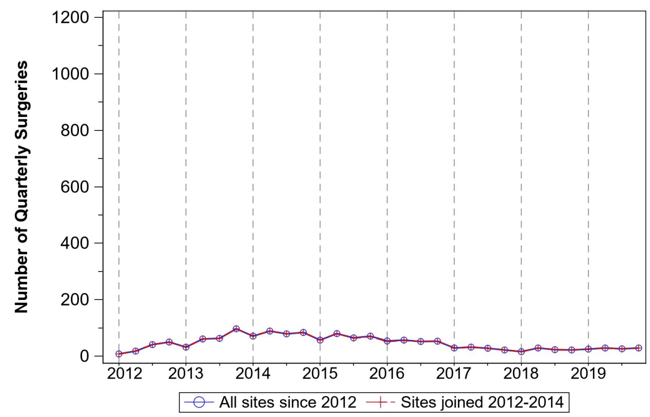

Figure 65: Utilization of the M/L Taper/Trilogy combination in primary THA.

Polarstem/Reflection 3
N=1469

31 surgeons across 21 sites use this implant combination in primary THA.

Table 203: Volume of cases by surgeon and site for the Polarstem/Reflection 3 combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	47.4 (106.7)	9 (36)
Cases per site	70.0 (131.7)	16 (47)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 204: Descriptive statistics of cases receiving the Polarstem/Reflection 3 combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	625	42.55	
Age (yrs)	1469	63.84(11.00)	64.00(14.00)
Height (cm)	1469	171.69(10.64)	172.72(17.30)
Weight (kg)	1469	91.30(21.96)	89.81(28.58)
BMI(kg/m^2)	1469	30.85(6.37)	30.13(8.38)
Smoking - never (%)	624	42.48	
Smoking - previous (%)	563	38.33	
Smoking - current (%)	276	18.79	
Smoking - unknown (%)	6	0.41	

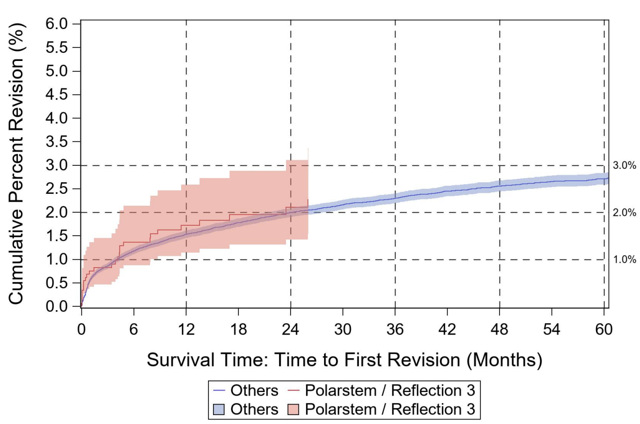

Figure 66: Cumulative percent revision curve for the Polarstem/Reflection 3 combination compared to all other implant combinations in conventional primary THA.

Table 205: Cumulative percent revision and number at risk for Polarstem/Reflection 3 combination in primary THA cases.

Year	Number at risk	CPR
0	1465	0.00 (0.00,0.00)
1	996	1.73 (1.15,2.59)
2	614	2.10 (1.42,3.11)
3*	319	2.28 (1.54,3.37)
4*	48	2.28 (1.54,3.37)
5*	6	2.28 (1.54,3.37)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.105 (0.719,1.701). It was 1.232 (1.127,1.347) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 206: Reasons for revision following primary THA for Polarstem/Reflection 3 combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	11	40.7
2	Joint Infection	7	25.9
3	Dislocation/Instability	4	14.8
4	Aseptic Loosening	3	11.1
5	Pain	1	3.7
6	Malalignment	1	3.7

Table 207: Reasons for revision in first 90 days following primary THA for Polarstem/Reflection 3 combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	10	83.3
2	Dislocation/Instability	2	16.7

Table 208: Reasons for revision between 91 and 365 days following primary THA for Polarstem/Reflection 3 combination cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	5	45.5
2	Aseptic Loosening	2	18.2
3	Dislocation/Instability	2	18.2
4	Peri-prosthetic fracture - Femur	1	9.1
5	Malalignment	1	9.1

Table 209: Distribution of approach used for Polarstem/Reflection 3 combination in primary THA cases.

Approach	N	Percent
Anterior	1175	80.0
Anterolateral	82	5.6
Posterior	210	14.3
Transtrochanteric	1	0.1
Missing/unknown/other	1	0.1

Table 210: Distribution of head size for Polarstem/Reflection 3 combination in primary THA cases.

Size (mm)	N	Percent
22	1	0.1
32	243	16.6
36	1156	78.9
40	60	4.1
Missing/unknown/other	5	0.3

Table 211: Distribution of bearing surface for Polarstem/Reflection 3 combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	64	4.4
Ceramic-on-plastic	1396	95.0
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	9	0.6

Table 212: Distribution of polyethylene used for Polarstem/Reflection 3 combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	1	0.1
XLPE	1464	99.9
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

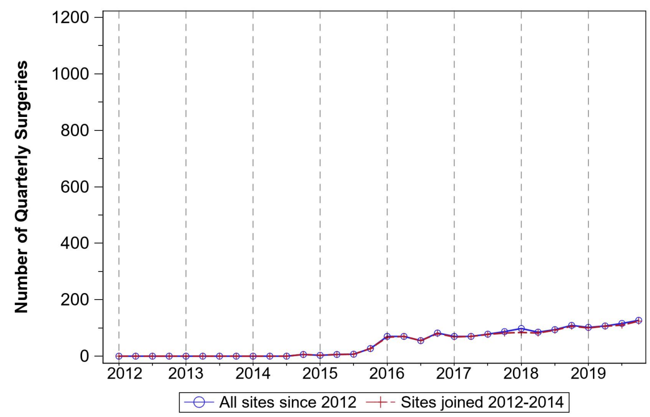

Figure 67: Utilization of the Polarstem/Reflection 3 combination in primary THA.

Secur-Fit/Trident
N=1097

34 surgeons across 21 sites use this implant combination in primary THA.

Table 213: Volume of cases by surgeon and site for the Secur-Fit/Trident combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	32.3 (68.2)	4 (21)
Cases per site	52.2 (87.6)	13 (56)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 214: Descriptive statistics of cases receiving the Secur-Fit/Trident combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	633	57.7	
Age (yrs)	1097	64.69(10.48)	65.00(13.00)
Height (cm)	1097	169.55(10.30)	170.00(15.30)
Weight (kg)	1097	90.45(21.80)	88.00(29.00)
BMI(kg/m^2)	1097	31.36(6.60)	30.52(9.17)
Smoking - never (%)	504	45.94	
Smoking - previous (%)	396	36.1	
Smoking - current (%)	187	17.05	
Smoking - unknown (%)	10	0.91	

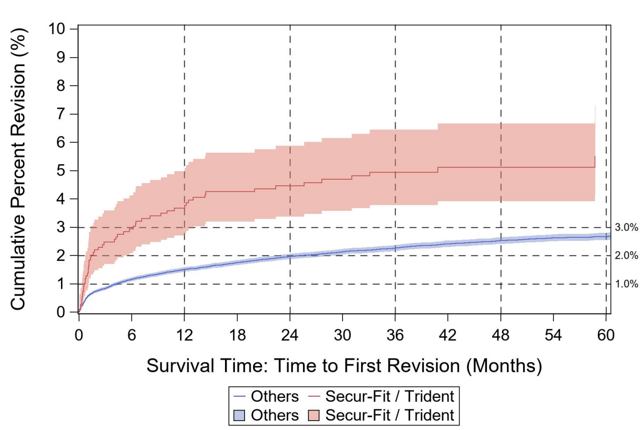

Figure 68: Cumulative percent revision curve for the Secur-Fit/Trident combination compared to all other implant combinations in conventional primary THA.

Table 215: Cumulative percent revision and number at risk for Secur-Fit/Trident combination in primary THA cases.

Year	Number at risk	CPR
0	1092	0.00 (0.00,0.00)
1	1017	3.68 (2.71,4.98)
2	873	4.46 (3.38,5.88)
3	669	4.95 (3.79,6.45)
4	424	5.12 (3.92,6.66)
5*	221	5.51 (4.15,7.29)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.981 (1.36,2.888). It was 1.231 (1.126,1.346) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 216: Reasons for revision following primary THA for Secur-Fit/Trident combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	16	31.4
2	Aseptic Loosening	10	19.6
3	Joint Infection	10	19.6
4	Dislocation/Instability	9	17.6
5	Component fracture/failure	4	7.8
6	Peri-prosthetic fracture - Acetabulum	1	2.0
7	Malalignment	1	2.0

Table 217: Reasons for revision in first 90 days following primary THA for Secur-Fit/Trident combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	14	53.9
2	Dislocation/Instability	8	30.8
3	Joint Infection	3	11.5
4	Aseptic Loosening	1	3.9

Table 218: Reasons for revision between 91 and 365 days following primary THA for Secur-Fit/Trident combination cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	5	45.5
2	Aseptic Loosening	2	18.2
3	Component fracture/failure	2	18.2
4	Dislocation/Instability	1	9.1
5	Malalignment	1	9.1

Table 219: Distribution of approach used for Secur-Fit/Trident combination in primary THA cases.

Approach	N	Percent
Anterior	2	0.2
Anterolateral	510	46.5
Posterior	581	53.0
Transtrochanteric	1	0.1
Missing/unknown/other	3	0.3

Table 220: Distribution of head size for Secur-Fit/Trident combination in primary THA cases.

Size (mm)	N	Percent
28	1	0.1
32	150	16.1
36	536	57.5
40	237	25.4
Missing/unknown/other	8	0.9

Table 221: Distribution of bearing surface for Secur-Fit/Trident combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	271	24.7
Ceramic-on-plastic	653	59.5
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	161	14.7
Missing/unknown/other	12	1.1

Table 222: Distribution of polyethylene used for Secur-Fit/Trident combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	1093	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

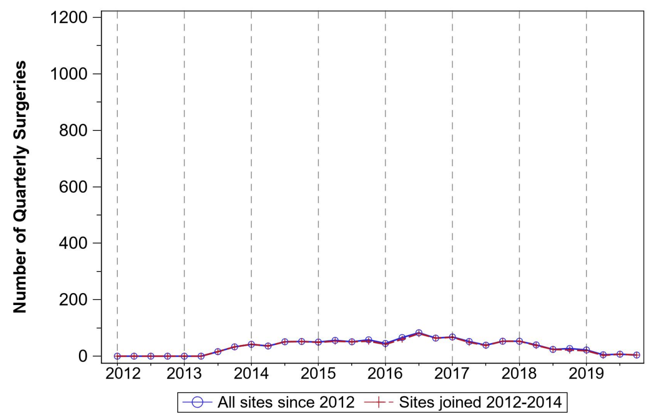

Figure 69: Utilization of the Secur-Fit/Trident combination in primary THA.

Secur-Fit Max/Trident

N=2581

56 surgeons across 24 sites use this implant combination in primary THA.

Table 223: Volume of cases by surgeon and site for the Secur-Fit Max/Trident combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	46.1 (112.5)	8.5 (44)
Cases per site	107.5 (173.5)	20 (123)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 224: Descriptive statistics of cases receiving the Secur-Fit Max/Trident combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	1294	50.14	
Age (yrs)	2581	63.93(11.31)	65.00(15.00)
Height (cm)	2581	170.35(10.22)	170.18(15.20)
Weight (kg)	2581	91.40(21.44)	89.36(27.40)
BMI(kg/m^2)	2581	31.38(6.34)	30.80(8.30)
Smoking - never (%)	1172	45.41	
Smoking - previous (%)	1035	40.1	
Smoking - current (%)	365	14.14	
Smoking - unknown (%)	9	0.35	

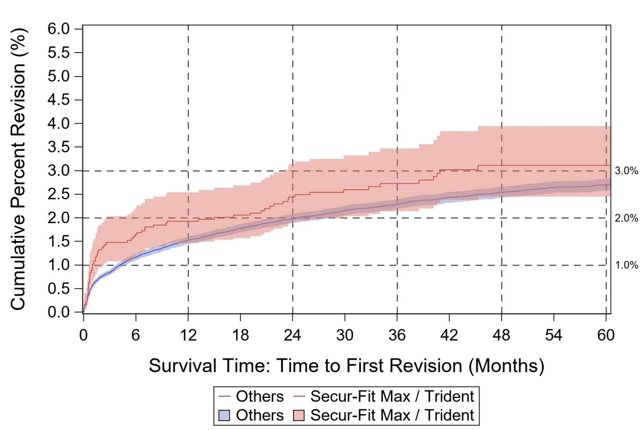

Figure 70: Cumulative percent revision curve for the Secur-Fit Max/Trident combination compared to all other implant combinations in conventional primary THA.

Table 225: Cumulative percent revision and number at risk for Secur-Fit Max/Trident combination in primary THA cases.

Year	Number at risk	CPR
0	2579	0.00 (0.00,0.00)
1	2344	1.93 (1.46,2.54)
2	1941	2.44 (1.90,3.14)
3	1465	2.73 (2.14,3.47)
4	1014	3.11 (2.45,3.94)
5	619	3.11 (2.45,3.94)

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 226: Reasons for revision following primary THA for Secur-Fit Max/Trident combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	31	45.6
2	Aseptic Loosening	11	16.2
3	Joint Infection	10	14.7
4	Dislocation/Instability	7	10.3
5	Malalignment	4	5.9
6	Peri-prosthetic fracture - Acetabulum	3	4.4
7	Component fracture/failure	1	1.5
8	Pain	1	1.5

Table 227: Reasons for revision in first 90 days following primary THA for Secur-Fit Max/Trident combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	25	67.6
2	Joint Infection	5	13.5
3	Dislocation/Instability	3	8.1
4	Aseptic Loosening	2	5.4
5	Peri-prosthetic fracture - Acetabulum	1	2.7
6	Pain	1	2.7

Table 228: Reasons for revision between 91 and 365 days following primary THA for Secur-Fit Max/Trident combination cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	3	33.3
2	Aseptic Loosening	2	22.2
3	Peri-prosthetic fracture - Femur	2	22.2
4	Dislocation/Instability	1	11.1
5	Peri-prosthetic fracture - Acetabulum	1	11.1

Table 229: Distribution of approach used for Secur-Fit Max/Trident combination in primary THA cases.

Approach	N	Percent
Anterior	14	0.5
Anterolateral	1262	48.9
Posterior	1263	48.9
Transtrochanteric	22	0.8
Missing/unknown/other	20	0.8

Table 230: Distribution of head size for Secur-Fit Max/Trident combination in primary THA cases.

Size (mm)	N	Percent
22	3	0.1
28	27	1.1
32	640	27.1
36	1515	64.3
40	161	6.8
44	2	0.1
Missing/unknown/other	9	0.4

Table 231: Distribution of bearing surface for Secur-Fit Max/Trident combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	1049	40.6
Ceramic-on-plastic	572	22.2
Ceramic-on-ceramic	717	27.8
Metal-on-metal	0	0.0
Dual mobility	184	7.1
Missing/unknown/other	59	2.3

Table 232: Distribution of polyethylene used for Secur-Fit Max/Trident combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	1807	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

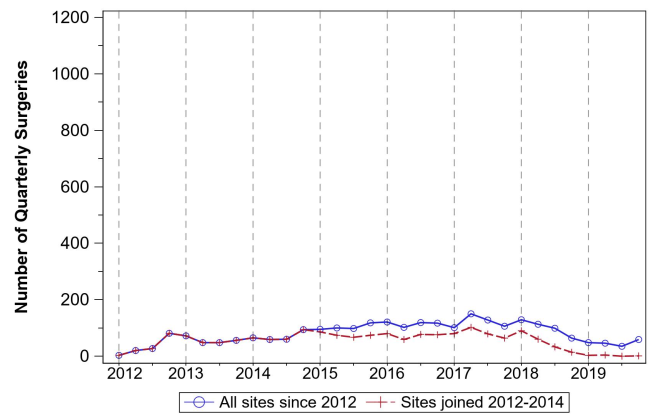

Figure 71: Utilization of the Secur-Fit Max/Trident combination in primary THA.

Secur-Fit Plus Max/Trident

N=2017

31 surgeons across 18 sites use this implant combination in primary THA.

Table 233: Volume of cases by surgeon and site for the Secur-Fit Plus Max/Trident combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	65.1 (192.8)	8 (67)
Cases per site	112.1 (270.3)	34 (100)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 234: Descriptive statistics of cases receiving the Secur-Fit Plus Max/Trident combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	1002	49.68	
Age (yrs)	2017	62.20(13.18)	63.00(16.00)
Height (cm)	2017	169.84(10.68)	170.00(15.24)
Weight (kg)	2017	87.18(19.81)	86.00(26.40)
BMI(kg/m^2)	2017	30.12(6.13)	29.54(7.21)
Smoking - never (%)	958	47.5	
Smoking - previous (%)	740	36.69	
Smoking - current (%)	277	13.73	
Smoking - unknown (%)	42	2.08	

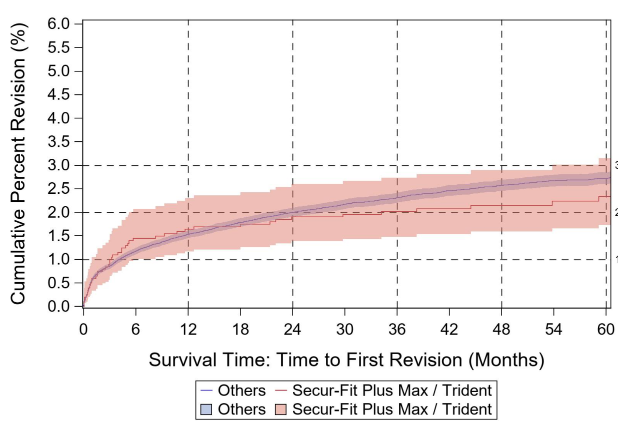

Figure 72: Cumulative percent revision curve for the Secur-Fit Plus Max/Trident combination compared to all other implant combinations in conventional primary THA.

Table 235: Cumulative percent revision and number at risk for Secur-Fit Plus Max/Trident combination in primary THA cases.

Year	Number at risk	CPR
0	2010	0.00 (0.00,0.00)
1	1962	1.64 (1.17,2.30)
2	1867	1.90 (1.39,2.60)
3	1648	2.01 (1.48,2.74)
4	1281	2.15 (1.59,2.90)
5	918	2.34 (1.74,3.15)

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 236: Reasons for revision following primary THA for Secur-Fit Plus Max/Trident combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	11	31.4
2	Peri-prosthetic fracture - Femur	10	28.6
3	Joint Infection	6	17.1
4	Aseptic Loosening	5	14.3
5	Component fracture/failure	2	5.7
6	Pain	1	2.9

Table 237: Reasons for revision in first 90 days following primary THA for Secur-Fit Plus Max/Trident combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	7	41.2
2	Dislocation/Instability	5	29.4
3	Joint Infection	3	17.6
4	Aseptic Loosening	1	5.9
5	Component fracture/failure	1	5.9

Table 238: Reasons for revision between 91 and 365 days following primary THA for Secur-Fit Plus Max/Trident combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	3	50.0
2	Joint Infection	2	33.3
3	Aseptic Loosening	1	16.7

Table 239: Distribution of approach used for Secur-Fit Plus Max/Trident combination in primary THA cases.

Approach	N	Percent
Anterior	4	0.2
Anterolateral	132	6.5
Posterior	1871	92.8
Transtrochanteric	4	0.2
Missing/unknown/other	6	0.3

Table 240: Distribution of head size for Secur-Fit Plus Max/Trident combination in primary THA cases.

Size (mm)	N	Percent
28	1	0.1
32	154	7.9
36	1461	74.9
40	286	14.7
44	44	2.3
Missing/unknown/other	4	0.2

Table 241: Distribution of bearing surface for Secur-Fit Plus Max/Trident combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	1176	58.3
Ceramic-on-plastic	770	38.2
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	57	2.8
Missing/unknown/other	14	0.7

Table 242: Distribution of polyethylene used for Secur-Fit Plus Max/Trident combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	2006	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

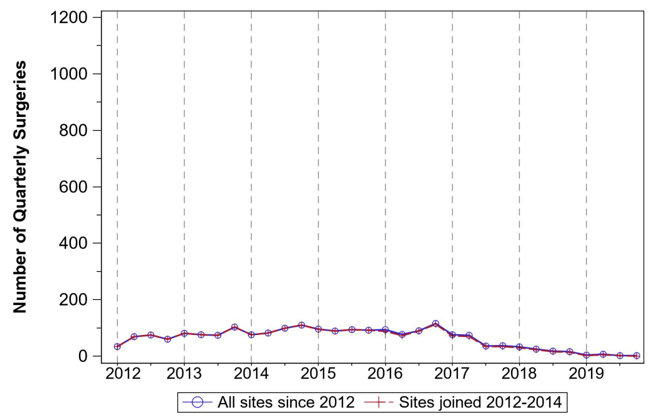

Figure 73: Utilization of the Secur-Fit Plus Max/Trident combination in primary THA.

SROM/Pinnacle
N=1067

43 surgeons across 23 sites use this implant combination in primary THA.

Table 243: Volume of cases by surgeon and site for the SROM/Pinnacle combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	24.8 (51.3)	3 (14)
Cases per site	46.4 (139.0)	5 (13)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 244: Descriptive statistics of cases receiving the SROM/Pinnacle combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	552	51.73	
Age (yrs)	1067	61.26(12.33)	62.00(16.00)
Height (cm)	1067	170.45(11.61)	170.18(17.44)
Weight (kg)	1067	89.66(22.23)	88.45(30.89)
BMI(kg/m^2)	1067	30.72(6.48)	30.03(8.74)
Smoking - never (%)	520	48.73	
Smoking - previous (%)	377	35.33	
Smoking - current (%)	168	15.75	
Smoking - unknown (%)	2	0.19	

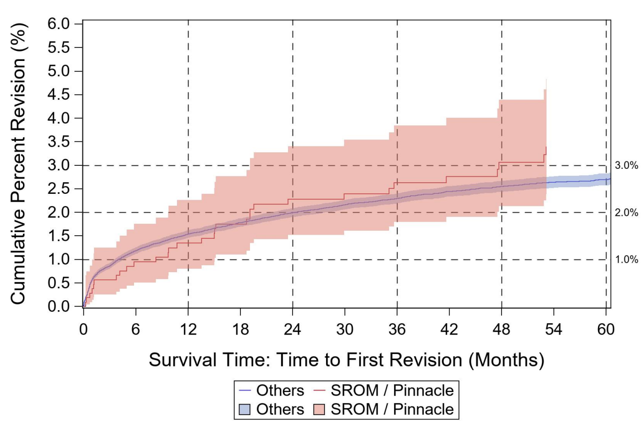

Figure 74: Cumulative percent revision curve for the SROM/Pinnacle combination compared to all other implant combinations in conventional primary THA.

Table 245: Cumulative percent revision and number at risk for SROM/Pinnacle combination in primary THA cases.

Year	Number at risk	CPR
0	1067	0.00 (0.00,0.00)
1	983	1.35 (0.80,2.26)
2	906	2.28 (1.52,3.41)
3	795	2.63 (1.80,3.85)
4	648	3.06 (2.13,4.39)
5*	441	3.40 (2.39,4.83)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.47 (0.97,2.23). It was 1.232 (1.127,1.347) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 246: Reasons for revision following primary THA for SROM/Pinnacle combination cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	12	42.9
2	Aseptic Loosening	7	25.0
3	Dislocation/Instability	4	14.3
4	Component fracture/failure	3	10.7
5	Peri-prosthetic fracture - Femur	1	3.6
6	Pain	1	3.6

Table 247: Reasons for revision in first 90 days following primary THA for SROM/Pinnacle combination cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	3	50.0
2	Dislocation/Instability	2	33.3
3	Peri-prosthetic fracture - Femur	1	16.7

Table 248: Reasons for revision between 91 and 365 days following primary THA for SROM/Pinnacle combination cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	3	60.0
2	Dislocation/Instability	1	20.0
3	Component fracture/failure	1	20.0

Table 249: Distribution of approach used for SROM/Pinnacle combination in primary THA cases.

Approach	N	Percent
Anterior	11	1.0
Anterolateral	577	54.1
Posterior	460	43.1
Transtrochanteric	12	1.1
Missing/unknown/other	7	0.7

Table 250: Distribution of head size for SROM/Pinnacle combination in primary THA cases.

Size (mm)	N	Percent
22	5	0.5
28	32	3.0
32	248	23.3
36	748	70.2
40	25	2.4
44	2	0.2
Missing/unknown/other	5	0.5

Table 251: Distribution of bearing surface for SROM/Pinnacle combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	312	29.2
Ceramic-on-plastic	747	70.0
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	8	0.8

Table 252: Distribution of polyethylene used for SROM/Pinnacle combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	1064	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

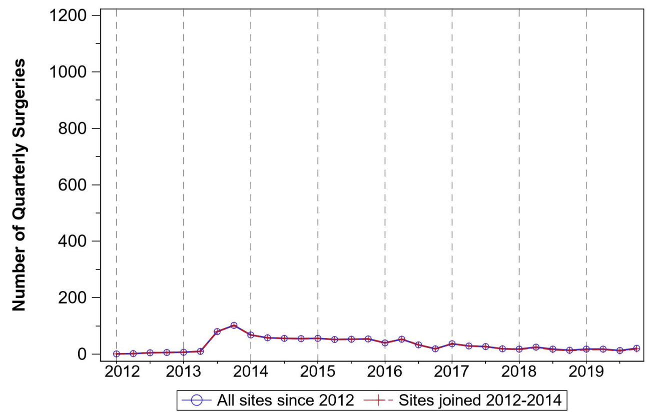

Figure 75: Utilization of the SROM/Pinnacle combination in primary THA.

Summit/Pinnacle
N=5930

69 surgeons across 31 sites use this implant combination in primary THA.

Table 253: Volume of cases by surgeon and site for the Summit/Pinnacle combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	85.9 (184.7)	11 (117)
Cases per site	191.3 (303.8)	49 (281)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 254: Descriptive statistics of cases receiving the Summit/Pinnacle combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	3409	57.49	
Age (yrs)	5930	65.65(11.04)	66.00(14.00)
Height (cm)	5827	169.31(10.36)	168.00(15.25)
Weight (kg)	5828	89.49(22.22)	87.10(29.94)
BMI(kg/m^2)	5827	31.08(6.70)	30.15(8.65)
Smoking - never (%)	2663	44.91	
Smoking - previous (%)	2390	40.3	
Smoking - current (%)	858	14.47	
Smoking - unknown (%)	19	0.32	

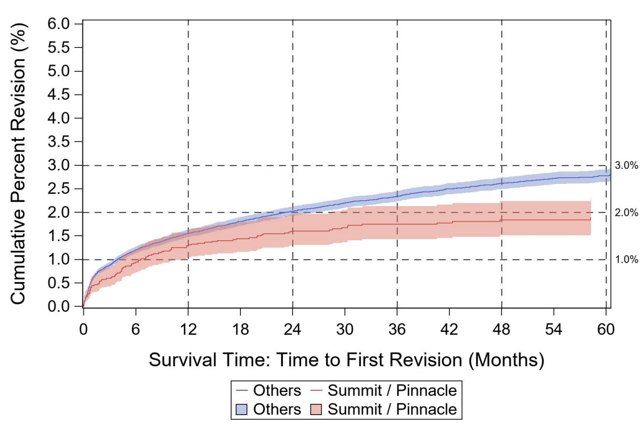

Figure 76: Cumulative percent revision curve for the Summit/Pinnacle combination compared to all other implant combinations in conventional primary THA.

Table 255: Cumulative percent revision and number at risk for Summit/Pinnacle combination in primary THA cases.

Year	Number at risk	CPR
0	5922	0.00 (0.00,0.00)
1	5294	1.31 (1.04,1.64)
2	4617	1.61 (1.31,1.97)
3	3765	1.75 (1.43,2.13)
4	2775	1.84 (1.51,2.24)
5*	1735	1.89 (1.55,2.31)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 256: Reasons for revision following primary THA for Summit/Pinnacle combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	29	32.6
2	Peri-prosthetic fracture - Femur	22	24.7
3	Joint Infection	16	18.0
4	Aseptic Loosening	9	10.1
5	Pain	8	9.0
6	Peri-prosthetic fracture - Acetabulum	3	3.4
7	Metal reaction/Metallosis	1	1.1
8	Malalignment	1	1.1

Table 257: Reasons for revision in first 90 days following primary THA for Summit/Pinnacle combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	21	67.7
2	Dislocation/Instability	6	19.4
3	Aseptic Loosening	3	9.7
4	Peri-prosthetic fracture - Acetabulum	1	3.2

Table 258: Reasons for revision between 91 and 365 days following primary THA for Summit/Pinnacle combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	13	39.4
2	Joint Infection	12	36.4
3	Aseptic Loosening	3	9.1
4	Pain	3	9.1
5	Peri-prosthetic fracture - Acetabulum	2	6.1

Table 259: Distribution of approach used for Summit/Pinnacle combination in primary THA cases.

Approach	N	Percent
Anterior	156	2.6
Anterolateral	2542	42.9
Posterior	3070	51.8
Transtrochanteric	35	0.6
Missing/unknown/other	127	2.1

Table 260: Distribution of head size for Summit/Pinnacle combination in primary THA cases.

Size (mm)	N	Percent
28	55	0.9
32	1427	24.2
36	3967	67.3
40	395	6.7
44	24	0.4
Missing/unknown/other	28	0.5

Table 261: Distribution of bearing surface for Summit/Pinnacle combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	2736	46.1
Ceramic-on-plastic	3081	52.0
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	113	1.9

Table 262: Distribution of polyethylene used for Summit/Pinnacle combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	5841	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

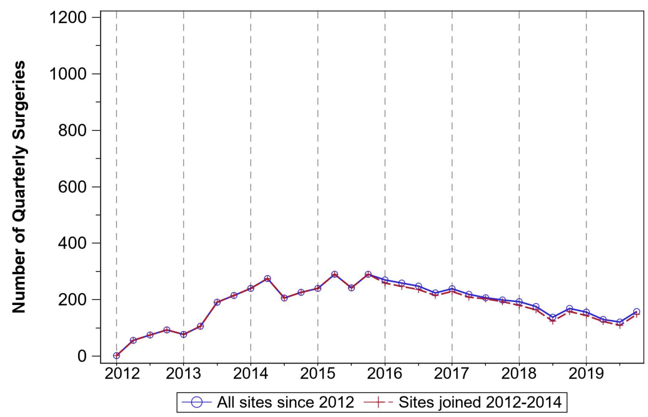

Figure 77: Utilization of the Summit/Pinnacle combination in primary THA.

Synergy/Reflection 3
N=989

33 surgeons across 25 sites use this implant combination in primary THA.

Table 263: Volume of cases by surgeon and site for the Synergy/Reflection 3 combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	30.0 (52.1)	3 (12)
Cases per site	39.6 (78.8)	6 (23)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 264: Descriptive statistics of cases receiving the Synergy/Reflection 3 combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	547	55.31	
Age (yrs)	989	67.45(10.62)	68.00(15.00)
Height (cm)	989	168.92(10.82)	168.00(17.78)
Weight (kg)	989	89.43(21.09)	88.45(29.20)
BMI(kg/m^2)	989	31.19(6.10)	30.80(8.40)
Smoking - never (%)	414	41.86	
Smoking - previous (%)	415	41.96	
Smoking - current (%)	157	15.87	
Smoking - unknown (%)	3	0.3	

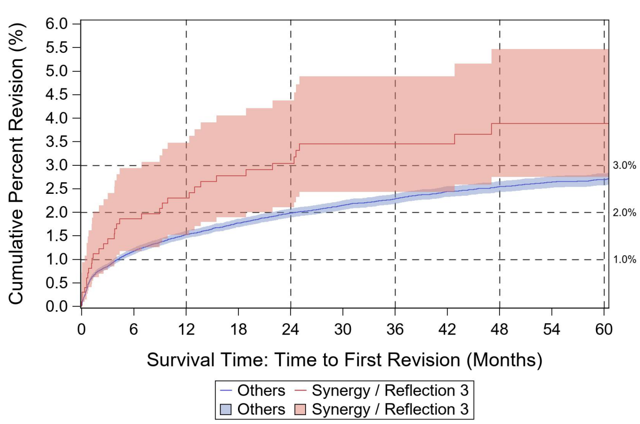

Figure 78: Cumulative percent revision curve for the Synergy/Reflection 3 combination compared to all other implant combinations in conventional primary THA.

Table 265: Cumulative percent revision and number at risk for Synergy/Reflection 3 combination in primary THA cases.

Year	Number at risk	CPR
0	987	0.00 (0.00,0.00)
1	849	2.31 (1.52,3.48)
2	707	3.04 (2.11,4.38)
3	561	3.46 (2.44,4.89)
4	413	3.88 (2.75,5.47)
5	265	3.88 (2.75,5.47)

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.237 (0.796,1.924). It was 1.231 (1.127,1.346) and 0.999 (0.996,1.004) for sex (female) and age, respectively.

Table 266: Reasons for revision following primary THA for Synergy/Reflection 3 combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	16	57.1
2	Joint Infection	5	17.9
3	Peri-prosthetic fracture - Femur	2	7.1
4	Pain	2	7.1
5	Aseptic Loosening	1	3.6
6	Component fracture/failure	1	3.6
7	Malalignment	1	3.6

Table 267: Reasons for revision in first 90 days following primary THA for Synergy/Reflection 3 combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	7	63.6
2	Joint Infection	1	9.1
3	Component fracture/failure	1	9.1
4	Peri-prosthetic fracture - Femur	1	9.1
5	Malalignment	1	9.1

Table 268: Reasons for revision between 91 and 365 days following primary THA for Synergy/Reflection 3 combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	5	71.4
2	Aseptic Loosening	1	14.3
3	Joint Infection	1	14.3

Table 269: Distribution of approach used for Synergy/Reflection 3 combination in primary THA cases.

Approach	N	Percent
Anterior	35	3.5
Anterolateral	344	34.8
Posterior	601	60.8
Transtrochanteric	3	0.3
Missing/unknown/other	6	0.6

Table 270: Distribution of head size for Synergy/Reflection 3 combination in primary THA cases.

Size (mm)	N	Percent
22	1	0.1
28	11	1.1
32	249	25.2
36	657	66.4
40	65	6.6
44	4	0.4
Missing/unknown/other	2	0.2

Table 271: Distribution of bearing surface for Synergy/Reflection 3 combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	467	47.2
Ceramic-on-plastic	520	52.6
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	2	0.2

Table 272: Distribution of polyethylene used for Synergy/Reflection 3 combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	2	0.2
XLPE	987	99.8
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

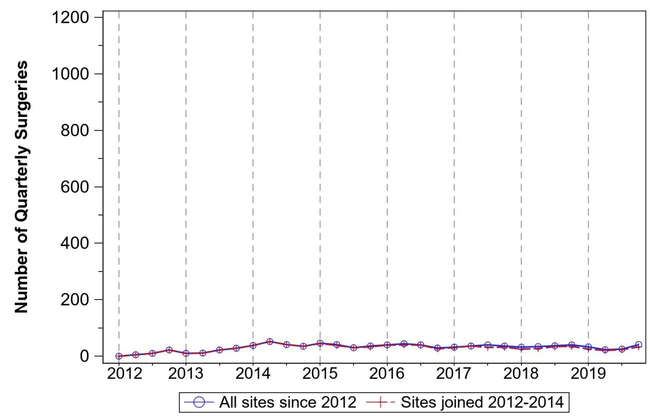

Figure 79: Utilization of the Synergy/Reflection 3 combination in primary THA.

Taperloc 133/Continuum
N=720

15 surgeons across 11 sites use this implant combination in primary THA.

Table 273: Volume of cases by surgeon and site for the Taperloc 133/Continuum combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	48 (119.8)	2 (40)
Cases per site	65.5 (139.1)	10 (57)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 274: Descriptive statistics of cases receiving the Taperloc 133/Continuum combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	384	53.33	
Age (yrs)	720	65.53(10.17)	66.00(13.00)
Height (cm)	720	170.21(10.34)	170.18(15.24)
Weight (kg)	720	91.12(21.60)	89.10(29.12)
BMI(kg/m^2)	720	31.37(6.61)	30.46(8.64)
Smoking - never (%)	348	48.33	
Smoking - previous (%)	283	39.31	
Smoking - current (%)	89	12.36	
Smoking - unknown (%)	0	0.0	

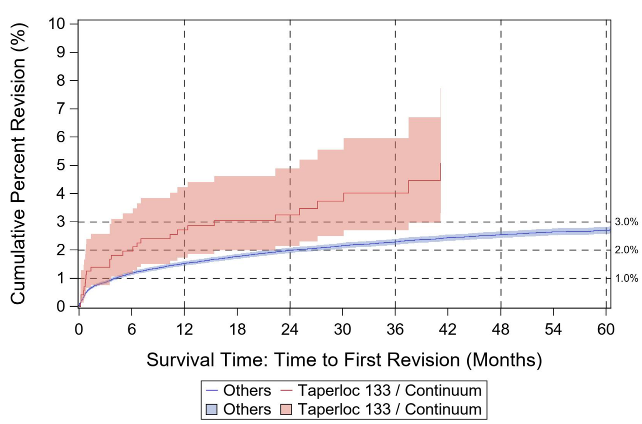

Figure 80: Cumulative percent revision curve for the Taperloc 133/Continuum combination compared to all other implant combinations in conventional primary THA.

Table 275: Cumulative percent revision and number at risk for Taperloc 133/Continuum combination in primary THA cases.

Year	Number at risk	CPR
0	720	0.00 (0.00,0.00)
1	615	2.71 (1.74,4.21)
2	450	3.24 (2.14,4.89)
3	235	4.02 (2.70,5.96)
4*	63	5.07 (3.31,7.73)
5	0	N/A

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.113 (0.693,1.789). It was 1.231 (1.127,1.346) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 276: Reasons for revision following primary THA for Taperloc 133/Continuum combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	16	59.3
2	Peri-prosthetic fracture - Femur	4	14.8
3	Joint Infection	2	7.4
4	Pain	2	7.4
5	Malalignment	2	7.4
6	Poly liner wear	1	3.7

Table 277: Reasons for revision in first 90 days following primary THA for Taperloc 133/Continuum combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	5	50.0
2	Peri-prosthetic fracture - Femur	4	40.0
3	Joint Infection	1	10.0

Table 278: Reasons for revision between 91 and 365 days following primary THA for Taperloc 133/Continuum combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	6	66.7
2	Malalignment	2	22.2
3	Joint Infection	1	11.1

Table 279: Distribution of approach used for Taperloc 133/Continuum combination in primary THA cases.

Approach	N	Percent
Anterior	15	2.1
Anterolateral	43	6.0
Posterior	653	90.7
Transtrochanteric	1	0.1
Missing/unknown/other	8	1.1

Table 280: Distribution of head size for Taperloc 133/Continuum combination in primary THA cases.

Size (mm)	N	Percent
28	2	0.3
32	118	16.4
36	585	81.5
40	5	0.7
Missing/unknown/other	8	1.1

Table 281: Distribution of bearing surface for Taperloc 133/Continuum combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	117	16.3
Ceramic-on-plastic	593	82.4
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	10	1.4

Table 282: Distribution of polyethylene used for Taperloc 133/Continuum combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	362	50.4
Antioxidant XLPE	356	49.6
Missing/unknown/other	0	0.0

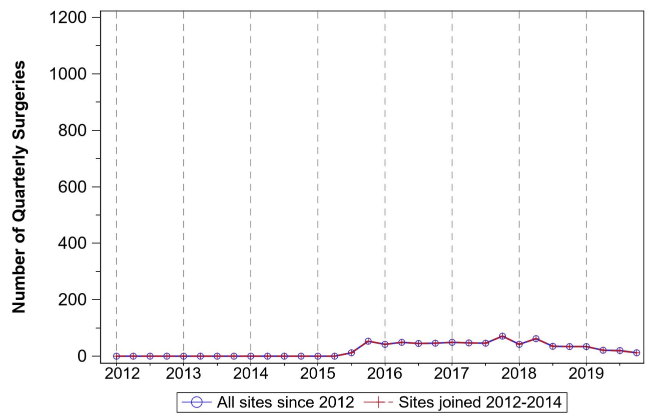

Figure 81: Utilization of the Taperloc 133/Continuum combination in primary THA.

Taperloc 133/G7
N=5095

75 surgeons across 38 sites use this implant combination in primary THA.

Table 283: Volume of cases by surgeon and site for the Taperloc 133/G7 combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	67.9 (112.1)	17 (76)
Cases per site	134.1 (168.5)	57.5 (134)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 284: Descriptive statistics of cases receiving the Taperloc 133/G7 combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	2774	54.45	
Age (yrs)	5095	63.99(10.65)	64.00(14.00)
Height (cm)	5095	169.69(10.41)	170.00(15.24)
Weight (kg)	5095	90.55(20.81)	89.30(27.88)
BMI(kg/m^2)	5095	31.36(6.29)	30.75(8.65)
Smoking - never (%)	2344	46.01	
Smoking - previous (%)	1953	38.33	
Smoking - current (%)	769	15.09	
Smoking - unknown (%)	29	0.57	

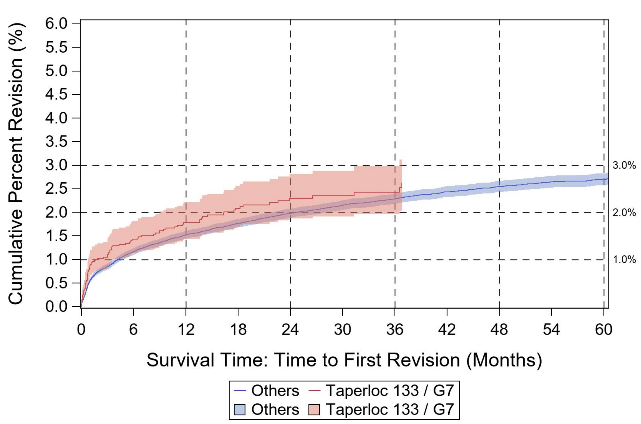

Figure 82: Cumulative percent revision curve for the Taperloc 133/G7 combination compared to all other implant combinations in conventional primary THA.

Table 285: Cumulative percent revision and number at risk for Taperloc 133/G7 combination in primary THA cases.

Year	Number at risk	CPR
0	5085	0.00 (0.00,0.00)
1	3328	1.78 (1.44,2.21)
2	2026	2.30 (1.87,2.82)
3	985	2.42 (1.97,2.98)
4*	370	2.63 (2.11,3.27)
5*	111	2.63 (2.11,3.27)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.064 (0.836,1.355). It was 1.23 (1.126,1.345) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 286: Reasons for revision following primary THA for Taperloc 133/G7 combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	29	29.0
2	Dislocation/Instability	28	28.0
3	Joint Infection	17	17.0
4	Aseptic Loosening	13	13.0
5	Pain	5	5.0
6	Component fracture/failure	4	4.0
7	Peri-prosthetic fracture - Acetabulum	2	2.0
8	Malalignment	2	2.0

Table 287: Reasons for revision in first 90 days following primary THA for Taperloc 133/G7 combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	28	53.9
2	Dislocation/Instability	9	17.3
3	Joint Infection	6	11.5
4	Component fracture/failure	4	7.7
5	Aseptic Loosening	2	3.9
6	Peri-prosthetic fracture - Acetabulum	2	3.9
7	Malalignment	1	1.9

Table 288: Reasons for revision between 91 and 365 days following primary THA for Taperloc 133/G7 combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	12	40.0
2	Joint Infection	8	26.7
3	Aseptic Loosening	5	16.7
4	Pain	4	13.3
5	Peri-prosthetic fracture - Femur	1	3.3

Table 289: Distribution of approach used for Taperloc 133/G7 combination in primary THA cases.

Approach	N	Percent
Anterior	820	16.1
Anterolateral	1653	32.4
Posterior	2605	51.1
Transtrochanteric	9	0.2
Missing/unknown/other	8	0.2

Table 290: Distribution of head size for Taperloc 133/G7 combination in primary THA cases.

Size (mm)	N	Percent
28	5	0.1
32	245	5.0
36	3059	62.6
40	1559	31.9
44	2	0.0
Missing/unknown/other	15	0.3

Table 291: Distribution of bearing surface for Taperloc 133/G7 combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	1408	27.6
Ceramic-on-plastic	3462	68.0
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	185	3.6
Missing/unknown/other	40	0.8

Table 292: Distribution of polyethylene used for Taperloc 133/G7 combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	2194	43.3
Antioxidant XLPE	2875	56.7
Missing/unknown/other	0	0.0

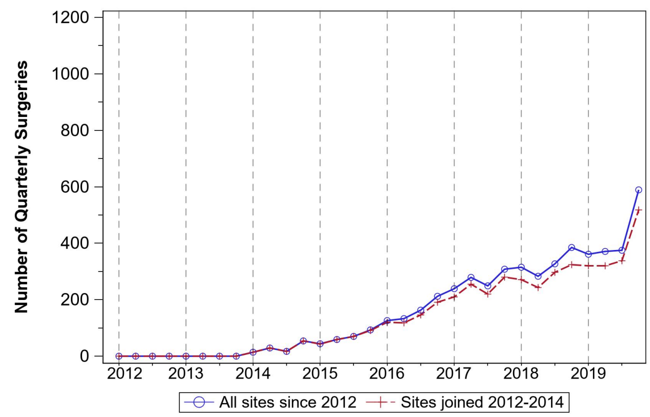

Figure 83: Utilization of the Taperloc 133/G7 combination in primary THA.

Taperloc 133/Regenerex RingLoc+
N=505

19 surgeons across 16 sites use this implant combination in primary THA.

Table 293: Volume of cases by surgeon and site for the Taperloc 133/Regenerex RingLoc+ combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	26.6 (53.0)	4 (12)
Cases per site	31.6 (54.7)	6 (16.5)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 294: Descriptive statistics of cases receiving the Taperloc 133/Regenerex RingLoc+ combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	272	53.86	
Age (yrs)	505	63.26(11.40)	63.00(15.00)
Height (cm)	505	170.15(10.48)	170.00(15.44)
Weight (kg)	505	90.63(22.26)	89.00(29.16)
BMI(kg/m^2)	505	31.21(6.89)	29.84(9.11)
Smoking - never (%)	217	42.97	
Smoking - previous (%)	163	32.28	
Smoking - current (%)	122	24.16	
Smoking - unknown (%)	3	0.59	

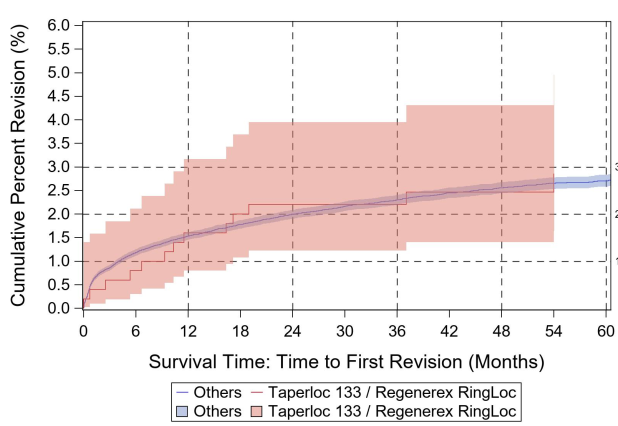

Figure 84: Cumulative percent revision curve for the Taperloc 133/Regenerex RingLoc+ combination compared to all other implant combinations in conventional primary THA.

Table 295: Cumulative percent revision and number at risk for Taperloc 133/Regenerex RingLoc+ combination in primary THA cases.

Year	Number at risk	CPR
0	501	0.00 (0.00,0.00)
1	491	1.60 (0.80,3.17)
2	465	2.21 (1.23,3.95)
3	383	2.21 (1.23,3.95)
4	307	2.46 (1.40,4.31)
5*	167	2.86 (1.64,4.95)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.855 (0.442,1.657). It was 1.231 (1.127,1.346) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 296: Reasons for revision following primary THA for Taperloc 133/Regenerex RingLoc+ combination cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	4	30.8
2	Joint Infection	3	23.1
3	Pain	2	15.4
4	Malalignment	2	15.4
5	Dislocation/Instability	1	7.7
6	Peri-prosthetic fracture - Femur	1	7.7

Table 297: Reasons for revision in first 90 days following primary THA for Taperloc 133/Regenerex RingLoc+ combination cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	1	33.3
2	Peri-prosthetic fracture - Femur	1	33.3
3	Malalignment	1	33.3

Table 298: Reasons for revision between 91 and 365 days following primary THA for Taperloc 133/Regenerex RingLoc+ combination cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	2	40.0
2	Aseptic Loosening	1	20.0
3	Dislocation/Instability	1	20.0
4	Pain	1	20.0

Table 299: Distribution of approach used for Taperloc 133/Regenerex RingLoc+ combination in primary THA cases.

Approach	N	Percent
Anterior	52	10.3
Anterolateral	350	69.3
Posterior	99	19.6
Transtrochanteric	2	0.4
Missing/unknown/other	2	0.4

Table 300: Distribution of head size for Taperloc 133/Regenerex RingLoc+ combination in primary THA cases.

Size (mm)	N	Percent
28	1	0.2
32	66	13.1
36	308	61.2
40	121	24.1
Missing/unknown/other	7	1.4

Table 301: Distribution of bearing surface for Taperloc 133/Regenerex RingLoc+ combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	322	63.8
Ceramic-on-plastic	174	34.5
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	9	1.8

Table 302: Distribution of polyethylene used for Taperloc 133/Regenerex RingLoc+ combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	1	0.2
XLPE	203	40.4
Antioxidant XLPE	299	59.4
Missing/unknown/other	0	0.0

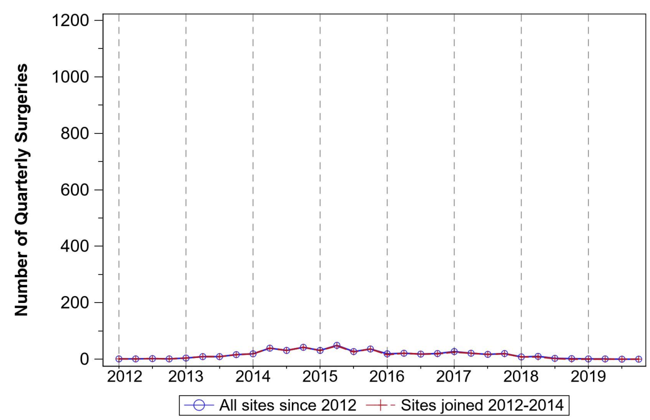

Figure 85: Utilization of the Taperloc 133/Regenerex RingLoc+ combination in primary THA.

Taperloc 133/RingLoc+
N=1673

24 surgeons across 19 sites use this implant combination in primary THA.

Table 303: Volume of cases by surgeon and site for the Taperloc 133/RingLoc+ combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	69.7 (90)	14.5 (140)
Cases per site	88.1 (118.9)	22 (137)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 304: Descriptive statistics of cases receiving the Taperloc 133/RingLoc+ combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	949	56.72	
Age (yrs)	1673	66.15(10.55)	67.00(14.00)
Height (cm)	1673	169.50(10.46)	170.00(15.24)
Weight (kg)	1673	90.46(22.08)	88.00(29.00)
BMI(kg/m^2)	1673	31.37(6.63)	30.51(9.00)
Smoking - never (%)	790	47.22	
Smoking - previous (%)	650	38.85	
Smoking - current (%)	216	12.91	
Smoking - unknown (%)	17	1.02	

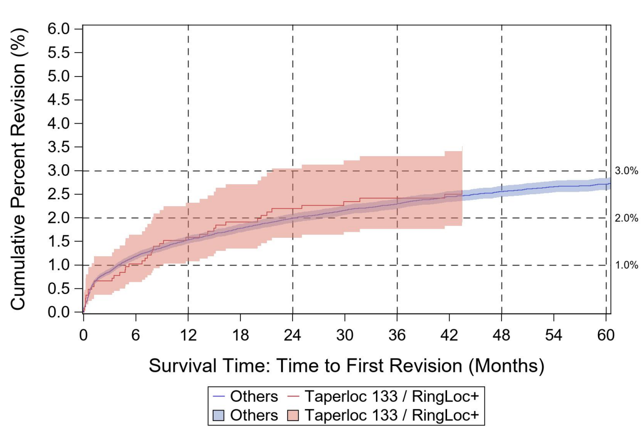

Figure 86: Cumulative percent revision curve for the Taperloc 133/RingLoc+ combination compared to all other implant combinations in conventional primary THA.

Table 305: Cumulative percent revision and number at risk for Taperloc 133/RingLoc+ combination in primary THA cases.

Year	Number at risk	CPR
0	1668	0.00 (0.00,0.00)
1	1526	1.59 (1.08,2.32)
2	1378	2.19 (1.58,3.04)
3	1230	2.42 (1.76,3.31)
4*	996	2.59 (1.90,3.52)
5*	581	2.59 (1.90,3.52)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.842 (0.578,1.228). It was 1.231 (1.127,1.346) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 306: Reasons for revision following primary THA for Taperloc 133/RingLoc+ combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	10	30.3
2	Joint Infection	9	27.3
3	Peri-prosthetic fracture - Femur	5	15.2
4	Aseptic Loosening	3	9.1
5	Component fracture/failure	3	9.1
6	Pain	3	9.1

Table 307: Reasons for revision in first 90 days following primary THA for Taperloc 133/RingLoc+ combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	5	50.0
2	Aseptic Loosening	1	10.0
3	Dislocation/Instability	1	10.0
4	Joint Infection	1	10.0
5	Component fracture/failure	1	10.0
6	Pain	1	10.0

Table 308: Reasons for revision between 91 and 365 days following primary THA for Taperloc 133/RingLoc+ combination cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	5	55.6
2	Dislocation/Instability	3	33.3
3	Component fracture/failure	1	11.1

Table 309: Distribution of approach used for Taperloc 133/RingLoc+ combination in primary THA cases.

Approach	N	Percent
Anterior	93	5.6
Anterolateral	725	43.3
Posterior	841	50.3
Transtrochanteric	7	0.4
Missing/unknown/other	7	0.4

Table 310: Distribution of head size for Taperloc 133/RingLoc+ combination in primary THA cases.

Size (mm)	N	Percent
32	110	6.6
36	939	56.3
40	527	31.6
44	70	4.2
Missing/unknown/other	22	1.3

Table 311: Distribution of bearing surface for Taperloc 133/RingLoc+ combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	1006	60.1
Ceramic-on-plastic	640	38.3
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	27	1.6

Table 312: Distribution of polyethylene used for Taperloc 133/RingLoc+ combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	10	0.6
XLPE	171	10.3
Antioxidant XLPE	1487	89.2
Missing/unknown/other	0	0.0

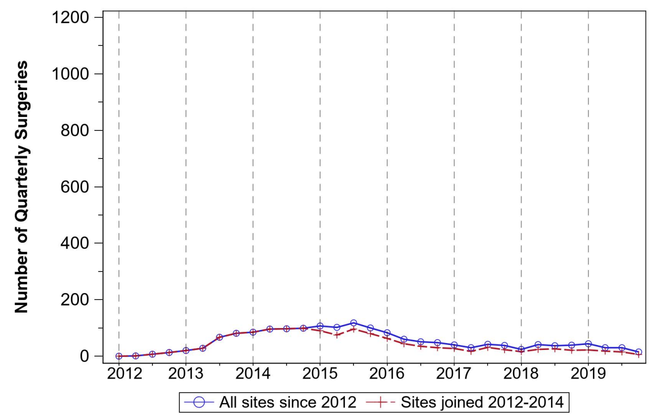

Figure 87: Utilization of the Taperloc 133/RingLoc+ combination in primary THA.

Taperloc 133 Microplasty/G7
N=2172

44 surgeons across 31 sites use this implant combination in primary THA.

Table 313: Volume of cases by surgeon and site for the Taperloc 133 Microplasty/G7 combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	49.4 (91.7)	7 (42)
Cases per site	70.1 (117.4)	17 (49)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 314: Descriptive statistics of cases receiving the Taperloc 133 Microplasty/G7 combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	988	45.49	
Age (yrs)	2172	61.29(10.77)	61.00(13.00)
Height (cm)	2172	171.59(10.30)	172.70(15.00)
Weight (kg)	2172	89.95(20.31)	88.64(27.97)
BMI(kg/m^2)	2172	30.41(5.70)	30.08(7.39)
Smoking - never (%)	1114	51.29	
Smoking - previous (%)	751	34.58	
Smoking - current (%)	298	13.72	
Smoking - unknown (%)	9	0.41	

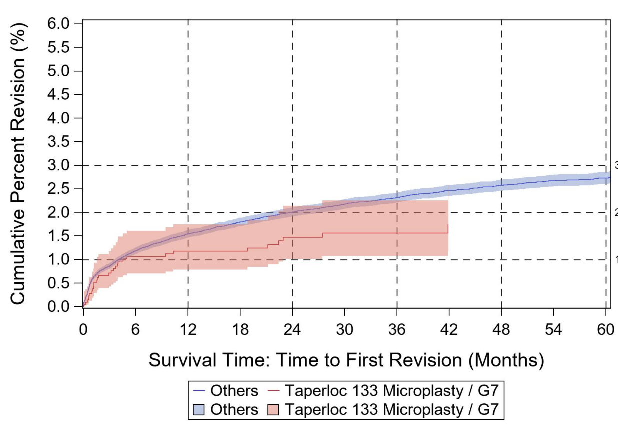

Figure 88: Cumulative percent revision curve for the Taperloc 133 Microplasty/G7 combination compared to all other implant combinations in conventional primary THA.

Table 315: Cumulative percent revision and number at risk for Taperloc 133 Microplasty/G7 combination in primary THA cases.

Year	Number at risk	CPR
0	2171	0.00 (0.00,0.00)
1	1698	1.18 (0.79,1.75)
2	1234	1.47 (1.01,2.14)
3	755	1.56 (1.08,2.26)
4*	337	1.75 (1.18,2.59)
5*	93	1.75 (1.18,2.59)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.75 (0.507,1.112). It was 1.229 (1.125,1.344) and 0.999 (0.996,1.004) for sex (female) and age, respectively.

Table 316: Reasons for revision following primary THA for Taperloc 133 Microplasty/G7 combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	8	28.6
2	Joint Infection	6	21.4
3	Aseptic Loosening	4	14.3
4	Component fracture/failure	4	14.3
5	Peri-prosthetic fracture - Femur	3	10.7
6	Malalignment	2	7.1
7	Pain	1	3.6

Table 317: Reasons for revision in first 90 days following primary THA for Taperloc 133 Microplasty/G7 combination cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	4	30.8
2	Component fracture/failure	4	30.8
3	Peri-prosthetic fracture - Femur	2	15.4
4	Aseptic Loosening	1	7.7
5	Dislocation/Instability	1	7.7
6	Malalignment	1	7.7

Table 318: Reasons for revision between 91 and 365 days following primary THA for Taperloc 133 Microplasty/G7 combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	6	66.7
2	Aseptic Loosening	2	22.2
3	Joint Infection	1	11.1

Table 319: Distribution of approach used for Taperloc 133 Microplasty/G7 combination in primary THA cases.

Approach	N	Percent
Anterior	1283	59.1
Anterolateral	78	3.6
Posterior	809	37.3
Transtrochanteric	0	0.0
Missing/unknown/other	2	0.1

Table 320: Distribution of head size for Taperloc 133 Microplasty/G7 combination in primary THA cases.

Size (mm)	N	Percent
28	4	0.2
32	336	15.8
36	1638	77.1
40	134	6.3
44	1	0.1
Missing/unknown/other	12	0.6

Table 321: Distribution of bearing surface for Taperloc 133 Microplasty/G7 combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	235	10.8
Ceramic-on-plastic	1878	86.5
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	31	1.4
Missing/unknown/other	28	1.3

Table 322: Distribution of polyethylene used for Taperloc 133 Microplasty/G7 combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	572	26.5
Antioxidant XLPE	1584	73.5
Missing/unknown/other	0	0.0

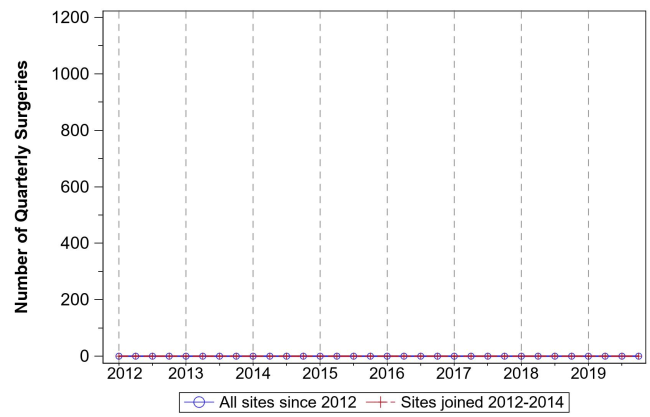

Figure 89: Utilization of the Taperloc 133 Microplasty/G7 combination in primary THA.

Trabecular Metal/Continuum
N=671

14 surgeons across 13 sites use this implant combination in primary THA.

Table 323: Volume of cases by surgeon and site for the Trabecular Metal/Continuum combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	47.9 (76.7)	5.5 (66)
Cases per site	51.6 (77.5)	6 (86)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 324: Descriptive statistics of cases receiving the Trabecular Metal/Continuum combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	365	54.4	
Age (yrs)	671	65.93(10.87)	66.00(15.00)
Height (cm)	671	169.73(10.81)	170.00(16.51)
Weight (kg)	671	89.96(22.07)	88.00(27.60)
BMI(kg/m^2)	671	31.06(6.33)	29.95(8.39)
Smoking - never (%)	273	40.69	
Smoking - previous (%)	292	43.52	
Smoking - current (%)	105	15.65	
Smoking - unknown (%)	1	0.15	

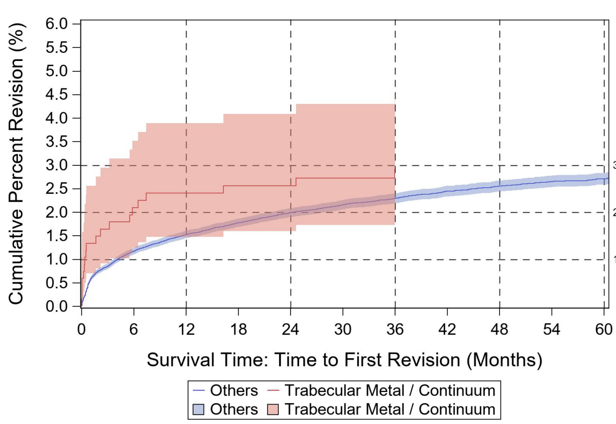

Figure 90: Cumulative percent revision curve for the Trabecular Metal/Continuum combination compared to all other implant combinations in conventional primary THA.

Table 325: Cumulative percent revision and number at risk for Trabecular Metal/Continuum combination in primary THA cases.

Year	Number at risk	CPR
0	670	0.00 (0.00,0.00)
1	629	2.41 (1.48,3.90)
2	582	2.56 (1.60,4.09)
3	507	2.92 (1.87,4.55)
4*	393	2.92 (1.87,4.55)
5*	224	2.92 (1.87,4.55)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 326: Reasons for revision following primary THA for Trabecular Metal/Continuum combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	7	43.8
2	Pain	5	31.3
3	Aseptic Loosening	2	12.5
4	Peri-prosthetic fracture - Femur	2	12.5

Table 327: Reasons for revision in first 90 days following primary THA for Trabecular Metal/Continuum combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	4	40.0
2	Pain	4	40.0
3	Peri-prosthetic fracture - Femur	2	20.0

Table 328: Reasons for revision between 91 and 365 days following primary THA for Trabecular Metal/Continuum combination cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	2	66.7
2	Aseptic Loosening	1	33.3

Table 329: Distribution of approach used for Trabecular Metal/Continuum combination in primary THA cases.

Approach	N	Percent
Anterior	3	0.5
Anterolateral	583	86.9
Posterior	83	12.4
Transtrochanteric	1	0.1
Missing/unknown/other	1	0.1

Table 330: Distribution of head size for Trabecular Metal/Continuum combination in primary THA cases.

Size (mm)	N	Percent
28	9	1.3
32	288	43.0
36	348	51.9
40	22	3.3
Missing/unknown/other	3	0.5

Table 331: Distribution of bearing surface for Trabecular Metal/Continuum combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	357	53.2
Ceramic-on-plastic	310	46.2
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	4	0.6

Table 332: Distribution of polyethylene used for Trabecular Metal/Continuum combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	599	89.4
Antioxidant XLPE	71	10.6
Missing/unknown/other	0	0.0

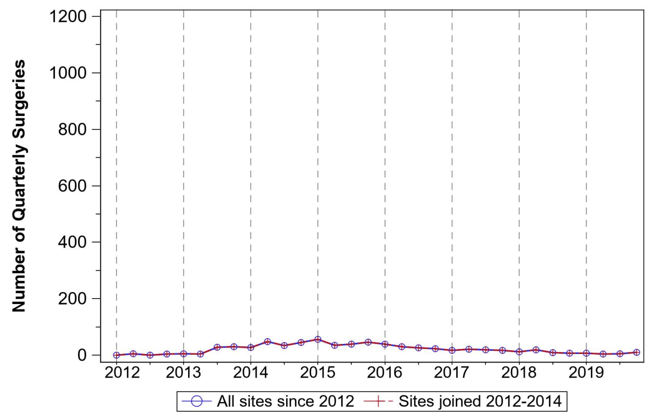

Figure 91: Utilization of the Trabecular Metal/Continuum combination in primary THA.

Tri-Lock BPS/Pinnacle
N=2609

43 surgeons across 22 sites use this implant combination in primary THA.

Table 333: Volume of cases by surgeon and site for the Tri-Lock BPS/Pinnacle combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	60.7 (155.6)	11 (57)
Cases per site	118.6 (296.4)	14.5 (119)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 334: Descriptive statistics of cases receiving the Tri-Lock BPS/Pinnacle combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	1404	53.81	
Age (yrs)	2609	64.85(10.31)	65.00(13.00)
Height (cm)	2584	170.51(10.17)	170.00(15.00)
Weight (kg)	2585	88.12(19.63)	86.30(27.00)
BMI(kg/m^2)	2584	30.19(5.68)	29.52(8.01)
Smoking - never (%)	1271	48.72	
Smoking - previous (%)	1026	39.33	
Smoking - current (%)	301	11.54	
Smoking - unknown (%)	11	0.42	

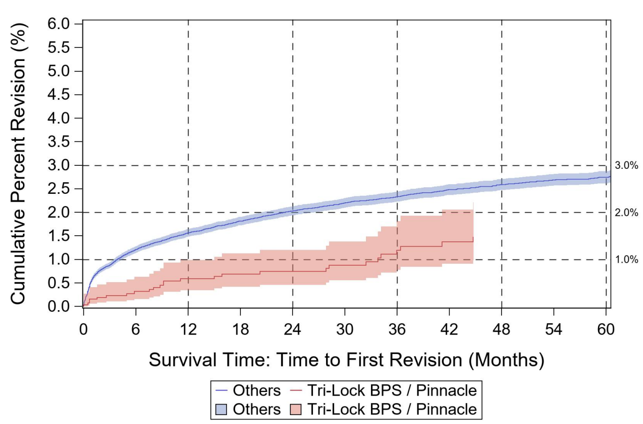

Figure 92: Cumulative percent revision curve for the Tri-Lock BPS/Pinnacle combination compared to all other implant combinations in conventional primary THA.

Table 335: Cumulative percent revision and number at risk for Tri-Lock BPS/Pinnacle combination in primary THA cases.

Year	Number at risk	CPR
0	2603	0.00 (0.00,0.00)
1	2085	0.59 (0.35,0.99)
2	1624	0.75 (0.46,1.20)
3	1198	1.19 (0.78,1.81)
4*	812	1.48 (0.99,2.21)
5*	376	1.48 (0.99,2.21)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 336: Reasons for revision following primary THA for Tri-Lock BPS/Pinnacle combination cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	8	32.0
2	Joint Infection	6	24.0
3	Dislocation/Instability	5	20.0
4	Peri-prosthetic fracture - Femur	4	16.0
5	Pain	1	4.0
6	Malalignment	1	4.0

Table 337: Reasons for revision in first 90 days following primary THA for Tri-Lock BPS/Pinnacle combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	3	60.0
2	Dislocation/Instability	2	40.0

Table 338: Reasons for revision between 91 and 365 days following primary THA for Tri-Lock BPS/Pinnacle combination cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	3	37.5
2	Joint Infection	3	37.5
3	Dislocation/Instability	2	25.0

Table 339: Distribution of approach used for Tri-Lock BPS/Pinnacle combination in primary THA cases.

Approach	N	Percent
Anterior	1405	53.9
Anterolateral	449	17.2
Posterior	726	27.8
Transtrochanteric	2	0.1
Missing/unknown/other	27	1.0

Table 340: Distribution of head size for Tri-Lock BPS/Pinnacle combination in primary THA cases.

Size (mm)	N	Percent
28	12	0.5
32	1007	38.8
36	1447	55.8
40	118	4.5
Missing/unknown/other	10	0.4

Table 341: Distribution of bearing surface for Tri-Lock BPS/Pinnacle combination in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	1272	48.8
Ceramic-on-plastic	1263	48.4
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	74	2.8

Table 342: Distribution of polyethylene used for Tri-Lock BPS/Pinnacle combination cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	2545	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

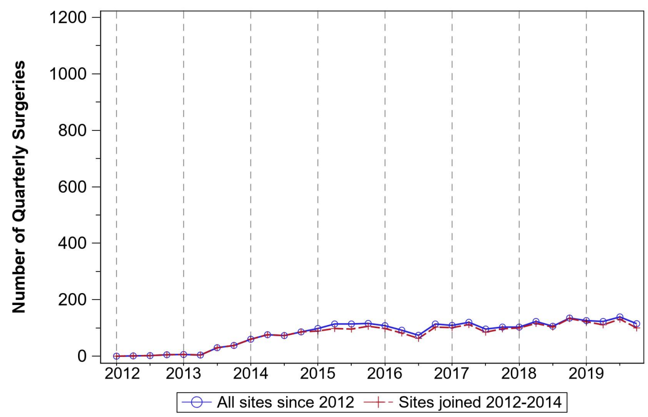

Figure 93: Utilization of the Tri-Lock BPS/Pinnacle combination in primary THA.

2.2.5 Revision risk for commonly used THA stems

Table 343: Summary of cumulative percent revision following primary THA for stems having at least 500 cases, sorted alphabetically.

Stem	N*	1 year	2 years	3 years	4 years	5 years
Accolade II	24877	1.28 (1.15,1.44)	1.74 (1.58,1.93)	2.12 (1.92,2.33)	2.41 (2.19,2.66)	2.59 (2.34,2.86)
Accolade TMZF	915	0.87 (0.44,1.74)	1.53 (0.91,2.58)	1.98 (1.25,3.12)	2.70 (1.82,4.00)	*2.70 (1.82,4.00)*
Actis DuoFix	1636	0.24 (0.08,0.77)	0.45 (0.15,1.33)	N/A	N/A	N/A
AML	622	1.52 (0.79,2.90)	1.95 (1.08,3.52)	2.53 (1.46,4.38)	2.95 (1.71,5.10)	3.60 (2.04,6.33)
Anthology	3510	2.10 (1.66,2.66)	2.74 (2.22,3.39)	3.01 (2.45,3.71)	3.16 (2.56,3.89)	3.55 (2.84,4.43)
Avenir Muller	990	1.36 (0.79,2.34)	1.49 (0.89,2.52)	1.81 (1.11,2.97)	2.05 (1.25,3.35)	*2.05 (1.25,3.35)*
Corail	2535	1.10 (0.76,1.61)	1.49 (1.07,2.08)	1.82 (1.33,2.48)	1.82 (1.33,2.48)	*1.82 (1.33,2.48)*
Corail Coxa Vara	536	0.20 (0.03,1.39)	0.67 (0.22,2.07)	0.67 (0.22,2.07)	1.18 (0.41,3.39)	*1.18 (0.41,3.39)*
Echo Bi-Metric	1523	2.67 (1.96,3.64)	3.06 (2.27,4.12)	3.40 (2.51,4.58)	3.60 (2.66,4.88)	*3.60 (2.66,4.88)*
Echo Bi-Metric Microplasty	952	1.93 (1.20,3.09)	2.34 (1.48,3.69)	2.70 (1.68,4.32)	*2.70 (1.68,4.32)*	N/A
Fitmore	4692	1.30 (1.00,1.68)	1.74 (1.38,2.18)	2.04 (1.65,2.54)	2.22 (1.79,2.74)	2.46 (1.97,3.07)
M/L Taper**	11308	1.66 (1.44,1.92)	2.12 (1.86,2.41)	2.46 (2.17,2.78)	2.68 (2.37,3.02)	2.85 (2.52,3.21)
M/L Taper Kinectiv	779	1.75 (1.02,3.00)	3.16 (2.09,4.77)	3.72 (2.52,5.47)	3.95 (2.69,5.77)	4.27 (2.91,6.24)
Polarstem	1485	1.78 (1.19,2.65)	2.15 (1.46,3.15)	2.32 (1.58,3.40)	*2.32 (1.58,3.40)*	*2.32 (1.58,3.40)*
Secur-Fit	1327	3.43 (2.56,4.59)	4.18 (3.20,5.46)	4.67 (3.60,6.04)	4.84 (3.73,6.26)	5.23 (3.95,6.91)
Secur-Fit Max	2641	1.96 (1.50,2.58)	2.48 (1.93,3.17)	2.76 (2.17,3.50)	3.14 (2.49,3.97)	*3.14 (2.49,3.97)*
Secur-Fit Plus Max	2059	1.71 (1.23,2.37)	1.96 (1.44,2.67)	2.08 (1.54,2.80)	2.21 (1.65,2.96)	2.40 (1.79,3.21)
SROM	1107	1.30 (0.77,2.18)	2.30 (1.55,3.41)	2.64 (1.82,3.83)	3.17 (2.23,4.50)	3.50 (2.48,4.92)
Summit	5949	1.30 (1.04,1.63)	1.62 (1.32,1.98)	1.78 (1.46,2.17)	1.87 (1.54,2.28)	1.92 (1.58,2.34)
Synergy	1189	1.99 (1.33,2.98)	2.79 (1.96,3.94)	3.12 (2.23,4.34)	3.45 (2.48,4.79)	3.66 (2.64,5.08)
Taperloc	524	1.53 (0.77,3.04)	1.53 (0.77,3.04)	1.97 (1.06,3.64)	2.46 (1.40,4.30)	*2.46 (1.40,4.30)*
Taperloc 133	8696	1.81 (1.54,2.12)	2.35 (2.03,2.72)	2.56 (2.22,2.96)	2.84 (2.45,3.29)	2.96 (2.54,3.45)
Taperloc 133 Microplasty	3002	1.33 (0.96,1.83)	1.64 (1.22,2.22)	1.71 (1.27,2.30)	1.82 (1.34,2.47)	*1.82 (1.34,2.47)*
Trabecular Metal	1078	1.80 (1.15,2.81)	1.91 (1.23,2.94)	2.17 (1.43,3.29)	2.17 (1.43,3.29)	*2.17 (1.43,3.29)*
Tri-Lock BPS	3050	0.60 (0.37,0.97)	0.87 (0.58,1.31)	1.24 (0.85,1.80)	1.47 (1.02,2.11)	*1.47 (1.02,2.11)*

Notes:

* Number of patients that contribute to survival analysis used to compute cumulative percent revision.
** M/L Taper does not include M/L Taper Kinectiv.
A revision risk in *italics* indicates it is the same as it was at the time of the last revision.

We remind readers to be cautious in interpreting CPR values when the number at risk is low.

Table 344: Summary of cumulative percent revision following primary THA for stems having at least 500 cases, sorted by 5-year cpr.

Stem	N*	1 year	2 years	3 years	4 years	5 years
Corail Coxa Vara	536	0.20 (0.03,1.39)	0.67 (0.22,2.07)	0.67 (0.22,2.07)	1.18 (0.41,3.39)	*1.18 (0.41,3.39)*
Tri-Lock BPS	3050	0.60 (0.37,0.97)	0.87 (0.58,1.31)	1.24 (0.85,1.80)	1.47 (1.02,2.11)	*1.47 (1.02,2.11)*
Corail	2535	1.10 (0.76,1.61)	1.49 (1.07,2.08)	1.82 (1.33,2.48)	*1.82 (1.33,2.48)*	*1.82 (1.33,2.48)*
Taperloc 133 Microplasty	3002	1.33 (0.96,1.83)	1.64 (1.22,2.22)	1.71 (1.27,2.30)	1.82 (1.34,2.47)	*1.82 (1.34,2.47)*
Summit	5949	1.30 (1.04,1.63)	1.62 (1.32,1.98)	1.78 (1.46,2.17)	1.87 (1.54,2.28)	1.92 (1.58,2.34)
Avenir Muller	990	1.36 (0.79,2.34)	1.49 (0.89,2.52)	1.81 (1.11,2.97)	2.05 (1.25,3.35)	*2.05 (1.25,3.35)*
Trabecular Metal	1078	1.80 (1.15,2.81)	1.91 (1.23,2.94)	2.17 (1.43,3.29)	*2.17 (1.43,3.29)*	*2.17 (1.43,3.29)*
Polarstem	1485	1.78 (1.19,2.65)	2.15 (1.46,3.15)	2.32 (1.58,3.40)	*2.32 (1.58,3.40)*	*2.32 (1.58,3.40)*
Secur-Fit Plus Max	2059	1.71 (1.23,2.37)	1.96 (1.44,2.67)	2.08 (1.54,2.80)	2.21 (1.65,2.96)	2.40 (1.79,3.21)
Taperloc	524	1.53 (0.77,3.04)	1.53 (0.77,3.04)	1.97 (1.06,3.64)	2.46 (1.40,4.30)	*2.46 (1.40,4.30)*
Fitmore	4692	1.30 (1.00,1.68)	1.74 (1.38,2.18)	2.04 (1.65,2.54)	2.22 (1.79,2.74)	2.46 (1.97,3.07)
Accolade II	24877	1.28 (1.15,1.44)	1.74 (1.58,1.93)	2.12 (1.92,2.33)	2.41 (2.19,2.66)	2.59 (2.34,2.86)
Accolade TMZF	915	0.87 (0.44,1.74)	1.53 (0.91,2.58)	1.98 (1.25,3.12)	2.70 (1.82,4.00)	*2.70 (1.82,4.00)*
M/L Taper**	11308	1.66 (1.44,1.92)	2.12 (1.86,2.41)	2.46 (2.17,2.78)	2.68 (2.37,3.02)	2.85 (2.52,3.21)
Taperloc 133	8696	1.81 (1.54,2.12)	2.35 (2.03,2.72)	2.56 (2.22,2.96)	2.84 (2.45,3.29)	2.96 (2.54,3.45)
Secur-Fit Max	2641	1.96 (1.50,2.58)	2.48 (1.93,3.17)	2.76 (2.17,3.50)	3.14 (2.49,3.97)	*3.14 (2.49,3.97)*
SROM	1107	1.30 (0.77,2.18)	2.30 (1.55,3.41)	2.64 (1.82,3.83)	3.17 (2.23,4.50)	3.50 (2.48,4.92)
Anthology	3510	2.10 (1.66,2.66)	2.74 (2.22,3.39)	3.01 (2.45,3.71)	3.16 (2.56,3.89)	3.55 (2.84,4.43)
AML	622	1.52 (0.79,2.90)	1.95 (1.08,3.52)	2.53 (1.46,4.38)	2.95 (1.71,5.10)	3.60 (2.04,6.33)
Echo Bi-Metric	1523	2.67 (1.96,3.64)	3.06 (2.27,4.12)	3.40 (2.51,4.58)	3.60 (2.66,4.88)	*3.60 (2.66,4.88)*
Synergy	1189	1.99 (1.33,2.98)	2.79 (1.96,3.94)	3.12 (2.23,4.34)	3.45 (2.48,4.79)	3.66 (2.64,5.08)
M/L Taper Kinectiv	779	1.75 (1.02,3.00)	3.16 (2.09,4.77)	3.72 (2.52,5.47)	3.95 (2.69,5.77)	4.27 (2.91,6.24)
Secur-Fit	1327	3.43 (2.56,4.59)	4.18 (3.20,5.46)	4.67 (3.60,6.04)	4.84 (3.73,6.26)	5.23 (3.95,6.91)

Notes:

* Number of patients that contribute to survival analysis used to compute cumulative percent revision.
** M/L Taper does not include M/L Taper Kinectiv.
A revision risk in *italics* indicates it is the same as it was at the time of the last revision.

We remind readers to be cautious in interpreting CPR values when the number at risk is low.

Accolade II
N=24903

140 surgeons across 50 sites use this implant in primary THA.

Table 345: Volume of cases by surgeon and site for the Accolade II stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	177.9 (304.6)	38 (192)
Cases per site	498.1 (777.4)	147.5 (709)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 346: Descriptive statistics of cases receiving the Accolade II stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	13451	54.01	
Age (yrs)	24903	64.30(10.98)	65.00(14.00)
Height (cm)	24903	170.10(10.33)	170.18(15.24)
Weight (kg)	24903	88.37(20.92)	86.36(28.15)
BMI(kg/m^2)	24903	30.42(6.22)	29.69(8.20)
Smoking - never (%)	12130	48.71	
Smoking - previous (%)	9366	37.61	
Smoking - current (%)	3311	13.3	
Smoking - unknown (%)	96	0.39	

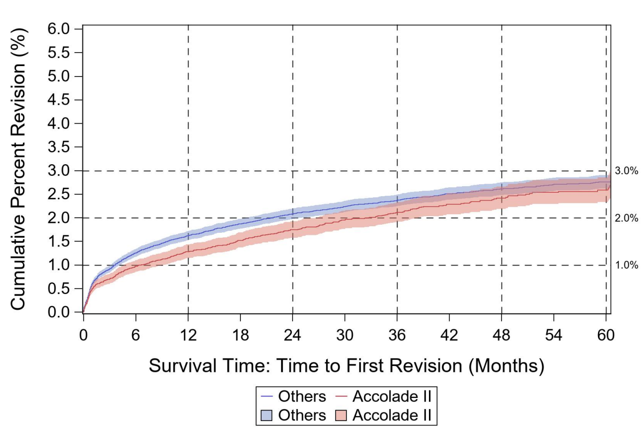

Figure 94: Cumulative percent revision curve for the Accolade II stem compared to all other stems in conventional primary THA.

Table 347: Cumulative percent revision and number at risk for Accolade II stem in primary THA cases.

Year	Number at risk	CPR
0	24877	0.00 (0.00,0.00)
1	19505	1.28 (1.15,1.44)
2	14710	1.74 (1.58,1.93)
3	10251	2.12 (1.92,2.33)
4	6155	2.41 (2.19,2.66)
5	3246	2.59 (2.34,2.86)

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 348: Reasons for revision following primary THA for Accolade II stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	118	25.7
2	Aseptic Loosening	101	22.0
3	Joint Infection	85	18.5
4	Dislocation/Instability	69	15.0
5	Pain	26	5.7
6	Component fracture/failure	21	4.6
7	Metal reaction/Metallosis	14	3.0
8	Malalignment	13	2.8
9	Peri-prosthetic fracture - Acetabulum	10	2.2
10	Poly liner wear	2	0.4
11	Osteolysis	1	0.2

Table 349: Reasons for revision in first 90 days following primary THA for Accolade II stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	92	54.4
2	Dislocation/Instability	23	13.6
3	Joint Infection	18	10.7
4	Aseptic Loosening	12	7.1
5	Component fracture/failure	11	6.5
6	Malalignment	6	3.5
7	Peri-prosthetic fracture - Acetabulum	4	2.4
8	Pain	3	1.8

Table 350: Reasons for revision between 91 and 365 days following primary THA for Accolade II stem cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	36	30.8
2	Dislocation/Instability	26	22.2
3	Aseptic Loosening	21	17.9
4	Peri-prosthetic fracture - Femur	14	12.0
5	Pain	13	11.1
6	Peri-prosthetic fracture - Acetabulum	3	2.6
7	Component fracture/failure	2	1.7
8	Poly liner wear	1	0.8
9	Malalignment	1	0.8

Table 351: Distribution of approach used for Accolade II stem in primary THA cases.

Approach	N	Percent
Anterior	7892	31.7
Anterolateral	3677	14.8
Posterior	13253	53.2
Transtrochanteric	19	0.1
Missing/unknown/other	62	0.3

Table 352: Distribution of head size for Accolade II stem in primary THA cases.

Size (mm)	N	Percent
22	12	0.1
28	39	0.2
32	4041	18.3
36	16531	74.9
40	1288	5.8
44	106	0.5
Missing/unknown/other	60	0.3

Table 353: Distribution of bearing surface for Accolade II stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	3758	15.1
Ceramic-on-plastic	18247	73.3
Ceramic-on-ceramic	11	0.0
Metal-on-metal	0	0.0
Dual mobility	2777	11.2
Missing/unknown/other	110	0.4

Table 354: Distribution of polyethylene used for Accolade II stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	3	0.0
XLPE	24769	99.8
Antioxidant XLPE	47	0.2
Missing/unknown/other	3	0.0

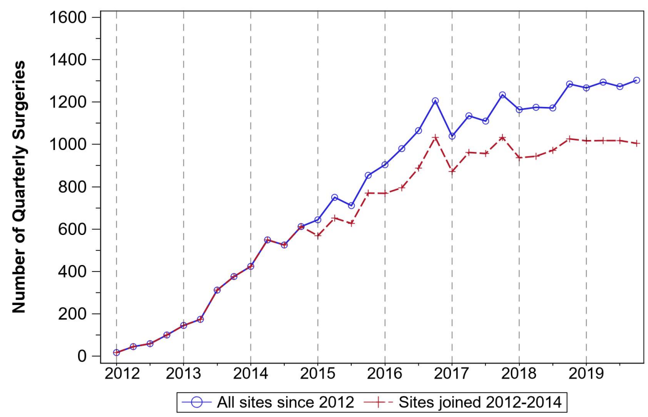

Figure 95: Utilization of the Accolade II stem in primary THA.

Accolade TMZF
N=917

16 surgeons across 12 sites use this implant in primary THA.

Table 355: Volume of cases by surgeon and site for the Accolade TMZF stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	57.3 (135.4)	5 (14)
Cases per site	76.4 (107.6)	16.5 (162.5)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 356: Descriptive statistics of cases receiving the Accolade TMZF stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	509	55.51	
Age (yrs)	917	63.29(11.19)	63.00(16.00)
Height (cm)	917	169.96(10.56)	170.00(15.24)
Weight (kg)	917	90.31(21.35)	89.55(29.33)
BMI(kg/m^2)	917	31.11(6.18)	30.49(8.30)
Smoking - never (%)	420	45.8	
Smoking - previous (%)	353	38.5	
Smoking - current (%)	128	13.96	
Smoking - unknown (%)	16	1.74	

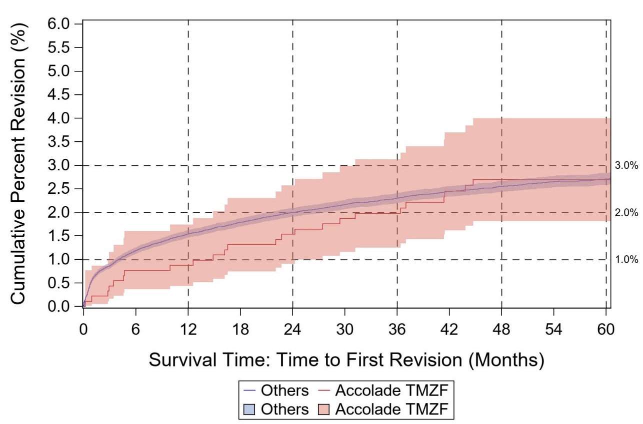

Figure 96: Cumulative percent revision curve for the Accolade TMZF stem compared to all other stems in conventional primary THA.

Table 357: Cumulative percent revision and number at risk for Accolade TMZF stem in primary THA cases.

Year	Number at risk	CPR
0	915	0.00 (0.00,0.00)
1	906	0.87 (0.44,1.74)
2	888	1.53 (0.91,2.58)
3	851	1.98 (1.25,3.12)
4	724	2.70 (1.82,4.00)
5	442	2.70 (1.82,4.00)

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.944 (0.589,1.514). It was 1.231 (1.127,1.346) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 358: Reasons for revision following primary THA for Accolade TMZF stem cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	8	42.1
2	Joint Infection	4	21.1
3	Metal reaction/Metallosis	3	15.8
4	Dislocation/Instability	2	10.5
5	Peri-prosthetic fracture - Femur	2	10.5

Table 359: Reasons for revision in first 90 days following primary THA for Accolade TMZF stem cases.

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

Table 360: Reasons for revision between 91 and 365 days following primary THA for Accolade TMZF stem cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	1	100.0

Table 361: Distribution of approach used for Accolade TMZF stem in primary THA cases.

Approach	N	Percent
Anterior	8	0.9
Anterolateral	138	15.1
Posterior	759	82.8
Transtrochanteric	3	0.3
Missing/unknown/other	9	1.0

Table 362: Distribution of head size for Accolade TMZF stem in primary THA cases.

Size (mm)	N	Percent
28	1	0.1
32	98	10.9
36	695	77.4
40	97	10.8
Missing/unknown/other	7	0.8

Table 363: Distribution of bearing surface for Accolade TMZF stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	499	54.4
Ceramic-on-plastic	389	42.4
Ceramic-on-ceramic	2	0.2
Metal-on-metal	0	0.0
Dual mobility	18	2.0
Missing/unknown/other	9	1.0

Table 364: Distribution of polyethylene used for Accolade TMZF stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	909	99.9
Antioxidant XLPE	1	0.1
Missing/unknown/other	0	0.0

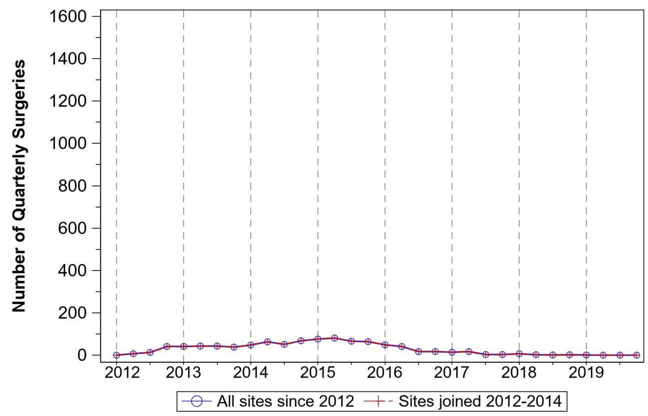

Figure 97: Utilization of the Accolade TMZF stem in primary THA.

Actis DuoFix

N=1643

28 surgeons across 26 sites use this implant in primary THA.

Table 365: Volume of cases by surgeon and site for the Actis DuoFix stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	58.7 (86.2)	11 (113)
Cases per site	63.2 (105.8)	7 (41)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 366: Descriptive statistics of cases receiving the Actis DuoFix stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	1066	64.88	
Age (yrs)	1643	67.25(9.55)	67.00(13.00)
Height (cm)	1643	168.24(10.18)	167.64(15.24)
Weight (kg)	1643	86.37(20.97)	84.70(28.79)
BMI(kg/m^2)	1643	30.34(6.11)	29.65(8.77)
Smoking - never (%)	807	49.12	
Smoking - previous (%)	626	38.1	
Smoking - current (%)	209	12.72	
Smoking - unknown (%)	1	0.06	

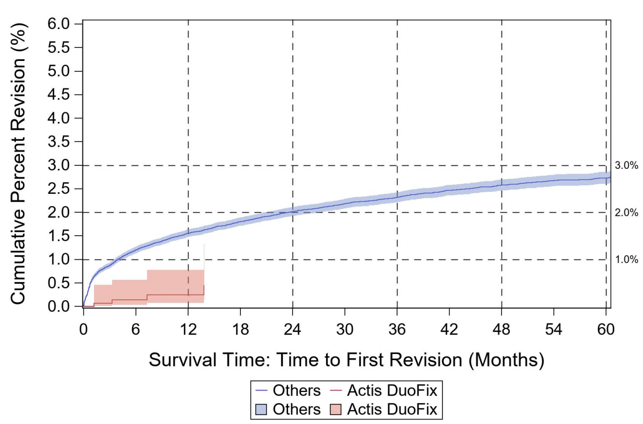

Figure 98: Cumulative percent revision curve for the Actis DuoFix stem compared to all other stems in conventional primary THA.

Table 367: Cumulative percent revision and number at risk for Actis DuoFix stem in primary THA cases.

Year	Number at risk	CPR
0	1636	0.00 (0.00,0.00)
1	612	0.24 (0.08,0.77)
2*	40	0.45 (0.15,1.33)
3	0	N/A
4	0	N/A
5	0	N/A

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.205 (0.076,0.554). It was 1.234 (1.13,1.35) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 368: Reasons for revision following primary THA for Actis DuoFix stem cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	1	25.0
2	Dislocation/Instability	1	25.0
3	Peri-prosthetic fracture - Femur	1	25.0
4	Malalignment	1	25.0

Table 369: Reasons for revision in first 90 days following primary THA for Actis DuoFix stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	1	100.0

Table 370: Reasons for revision between 91 and 365 days following primary THA for Actis DuoFix stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	1	50.0
2	Malalignment	1	50.0

Table 371: Distribution of approach used for Actis DuoFix stem in primary THA cases.

Approach	N	Percent
Anterior	1182	71.9
Anterolateral	237	14.4
Posterior	223	13.6
Transtrochanteric	0	0.0
Missing/unknown/other	1	0.1

Table 372: Distribution of head size for Actis DuoFix stem in primary THA cases.

Size (mm)	N	Percent
28	6	0.4
32	418	25.5
36	1155	70.6
40	56	3.4
Missing/unknown/other	2	0.1

Table 373: Distribution of bearing surface for Actis DuoFix stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	287	17.5
Ceramic-on-plastic	1347	82.0
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	5	0.3
Missing/unknown/other	4	0.2

Table 374: Distribution of polyethylene used for Actis DuoFix stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	1639	99.9
Antioxidant XLPE	2	0.1
Missing/unknown/other	0	0.0

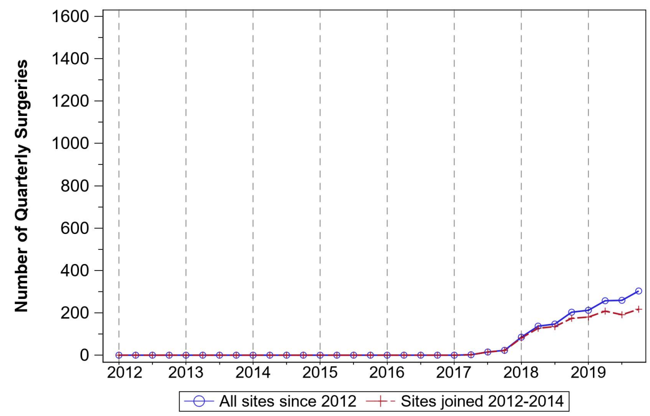

Figure 99: Utilization of the Actis DuoFix stem in primary THA.

AML
N=623

13 surgeons across 12 sites use this implant in primary THA.

Table 375: Volume of cases by surgeon and site for the AML stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	47.9 (103.5)	7 (16)
Cases per site	51.9 (122.1)	7.5 (35.5)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 376: Descriptive statistics of cases receiving the AML stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	356	57.14	
Age (yrs)	623	66.64(10.82)	67.00(15.00)
Height (cm)	623	169.44(10.31)	168.00(15.24)
Weight (kg)	623	89.69(20.69)	87.80(27.51)
BMI(kg/m^2)	623	31.18(6.46)	30.51(8.33)
Smoking - never (%)	288	46.23	
Smoking - previous (%)	235	37.72	
Smoking - current (%)	100	16.05	
Smoking - unknown (%)	0	0.0	

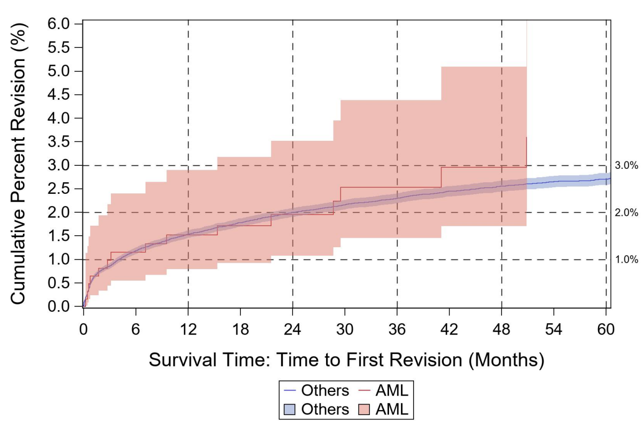

Figure 100: Cumulative percent revision curve for the AML stem compared to all other stems in conventional primary THA.

Table 377: Cumulative percent revision and number at risk for AML stem in primary THA cases.

Year	Number at risk	CPR
0	622	0.00 (0.00,0.00)
1	520	1.52 (0.79,2.90)
2	383	1.95 (1.08,3.52)
3	277	2.53 (1.46,4.38)
4	177	2.95 (1.71,5.10)
5*	93	3.60 (2.04,6.33)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.98 (0.471,2.042). It was 1.231 (1.127,1.346) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 378: Reasons for revision following primary THA for AML stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	6	40.0
2	Joint Infection	5	33.3
3	Poly liner wear	1	6.7
4	Peri-prosthetic fracture - Acetabulum	1	6.7
5	Pain	1	6.7
6	Malalignment	1	6.7

Table 379: Reasons for revision in first 90 days following primary THA for AML stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	3	50.0
2	Joint Infection	1	16.7
3	Peri-prosthetic fracture - Acetabulum	1	16.7
4	Malalignment	1	16.7

Table 380: Reasons for revision between 91 and 365 days following primary THA for AML stem cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	2	66.7
2	Dislocation/Instability	1	33.3

Table 381: Distribution of approach used for AML stem in primary THA cases.

Approach	N	Percent
Anterior	8	1.3
Anterolateral	512	82.2
Posterior	101	16.2
Transtrochanteric	0	0.0
Missing/unknown/other	2	0.3

Table 382: Distribution of head size for AML stem in primary THA cases.

Size (mm)	N	Percent
28	2	0.3
32	145	23.5
36	408	66.1
40	61	9.9
Missing/unknown/other	1	0.2

Table 383: Distribution of bearing surface for AML stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	592	95.0
Ceramic-on-plastic	24	3.9
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	7	1.1

Table 384: Distribution of polyethylene used for AML stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	616	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

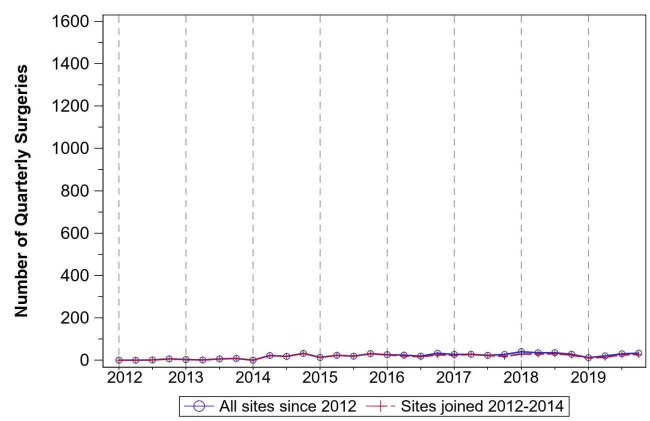

Figure 101: Utilization of the AML stem in primary THA.

Anthology
N=3520

54 surgeons across 33 sites use this implant in primary THA.

Table 385: Volume of cases by surgeon and site for the Anthology stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	65.2 (114.9)	14 (70)
Cases per site	106.7 (140.1)	53 (150)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 386: Descriptive statistics of cases receiving the Anthology stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	2033	57.76	
Age (yrs)	3520	64.45(11.28)	65.00(15.00)
Height (cm)	3520	169.06(10.18)	168.00(15.00)
Weight (kg)	3520	90.51(22.94)	87.50(29.50)
BMI(kg/m^2)	3520	31.55(7.03)	30.47(8.97)
Smoking - never (%)	1663	47.24	
Smoking - previous (%)	1332	37.84	
Smoking - current (%)	515	14.63	
Smoking - unknown (%)	10	0.28	

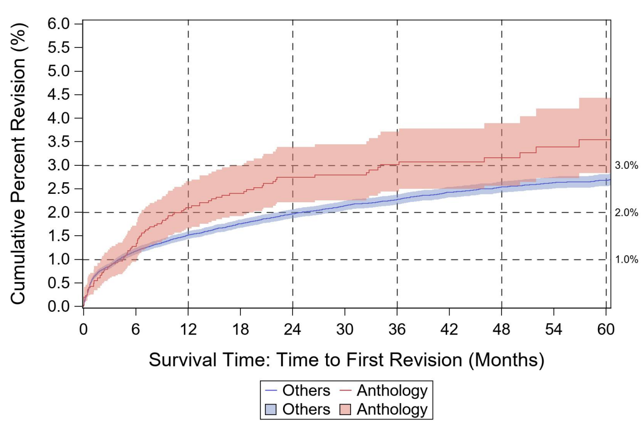

Figure 102: Cumulative percent revision curve for the Anthology stem compared to all other stems in conventional primary THA.

Table 387: Cumulative percent revision and number at risk for Anthology stem in primary THA cases.

Year	Number at risk	CPR
0	3510	0.00 (0.00,0.00)
1	2768	2.10 (1.66,2.66)
2	2138	2.74 (2.22,3.39)
3	1617	3.01 (2.45,3.71)
4	1001	3.16 (2.56,3.89)
5	483	3.55 (2.84,4.43)

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 388: Reasons for revision following primary THA for Anthology stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	21	23.1
2	Aseptic Loosening	20	22.0
3	Joint Infection	19	20.9
4	Peri-prosthetic fracture - Femur	14	15.4
5	Component fracture/failure	6	6.6
6	Peri-prosthetic fracture - Acetabulum	3	3.3
7	Pain	3	3.3
8	Malalignment	3	3.3
9	Metal reaction/Metallosis	2	2.2

Table 389: Reasons for revision in first 90 days following primary THA for Anthology stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	11	40.7
2	Dislocation/Instability	4	14.8
3	Joint Infection	3	11.1
4	Component fracture/failure	3	11.1
5	Peri-prosthetic fracture - Acetabulum	3	11.1
6	Aseptic Loosening	2	7.4
7	Malalignment	1	3.7

Table 390: Reasons for revision between 91 and 365 days following primary THA for Anthology stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	11	30.6
2	Joint Infection	11	30.6
3	Aseptic Loosening	8	22.2
4	Pain	3	8.3
5	Peri-prosthetic fracture - Femur	2	5.6
6	Component fracture/failure	1	2.8

Table 391: Distribution of approach used for Anthology stem in primary THA cases.

Approach	N	Percent
Anterior	1263	35.9
Anterolateral	1499	42.6
Posterior	671	19.1
Transtrochanteric	83	2.4
Missing/unknown/other	4	0.1

Table 392: Distribution of head size for Anthology stem in primary THA cases.

Size (mm)	N	Percent
22	4	0.1
28	28	0.9
32	819	26.9
36	1948	64.0
40	217	7.1
44	13	0.4
Missing/unknown/other	16	0.5

Table 393: Distribution of bearing surface for Anthology stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	730	20.7
Ceramic-on-plastic	2299	65.3
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	464	13.2
Missing/unknown/other	27	0.8

Table 394: Distribution of polyethylene used for Anthology stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	4	0.1
XLPE	3504	99.9
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

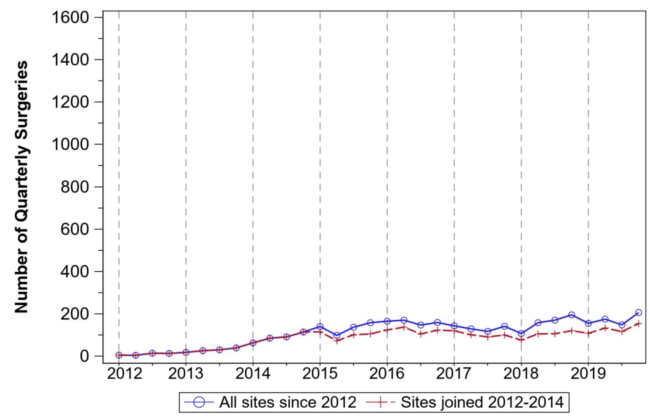

Figure 103: Utilization of the Anthology stem in primary THA.

Avenir Muller
N=991

23 surgeons across 16 sites use this implant in primary THA.

Table 395: Volume of cases by surgeon and site for the Avenir Muller stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	43.1 (99.8)	8 (13)
Cases per site	61.9 (128.1)	5.5 (37.5)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 396: Descriptive statistics of cases receiving the Avenir Muller stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	577	58.22	
Age (yrs)	991	65.99(10.92)	66.00(14.00)
Height (cm)	813	169.09(10.29)	168.00(15.53)
Weight (kg)	813	85.39(19.91)	83.60(26.94)
BMI(kg/m^2)	813	29.70(5.62)	29.30(7.17)
Smoking - never (%)	491	49.55	
Smoking - previous (%)	390	39.35	
Smoking - current (%)	110	11.1	
Smoking - unknown (%)	0	0.0	

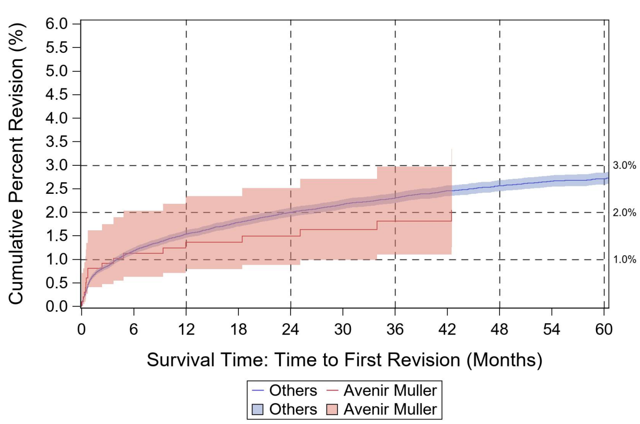

Figure 104: Cumulative percent revision curve for the Avenir Muller stem compared to all other stems in conventional primary THA.

Table 397: Cumulative percent revision and number at risk for Avenir Muller stem in primary THA cases.

Year	Number at risk	CPR
0	990	0.00 (0.00,0.00)
1	829	1.36 (0.79,2.34)
2	697	1.49 (0.89,2.52)
3	520	1.81 (1.11,2.97)
4*	338	2.05 (1.25,3.35)
5*	200	2.05 (1.25,3.35)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.838 (0.475,1.482). It was 1.231 (1.127,1.346) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 398: Reasons for revision following primary THA for Avenir Muller stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	6	40.0
2	Dislocation/Instability	4	26.7
3	Aseptic Loosening	2	13.3
4	Pain	2	13.3
5	Joint Infection	1	6.7

Table 399: Reasons for revision in first 90 days following primary THA for Avenir Muller stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	5	55.6
2	Aseptic Loosening	2	22.2
3	Dislocation/Instability	2	22.2

Table 400: Reasons for revision between 91 and 365 days following primary THA for Avenir Muller stem cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	1	50.0
2	Pain	1	50.0

Table 401: Distribution of approach used for Avenir Muller stem in primary THA cases.

Approach	N	Percent
Anterior	235	23.7
Anterolateral	140	14.1
Posterior	438	44.2
Transtrochanteric	0	0.0
Missing/unknown/other	178	18.0

Table 402: Distribution of head size for Avenir Muller stem in primary THA cases.

Size (mm)	N	Percent
28	4	0.4
32	161	16.3
36	762	77.3
40	56	5.7
Missing/unknown/other	3	0.3

Table 403: Distribution of bearing surface for Avenir Muller stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	382	38.5
Ceramic-on-plastic	601	60.6
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	2	0.2
Missing/unknown/other	6	0.6

Table 404: Distribution of polyethylene used for Avenir Muller stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	726	73.5
Antioxidant XLPE	262	26.5
Missing/unknown/other	0	0.0

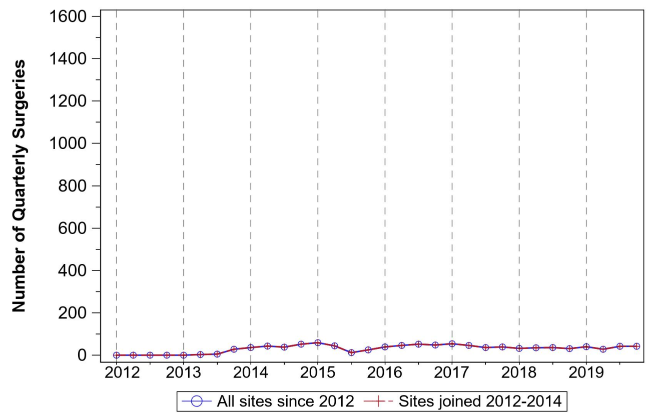

Figure 105: Utilization of the Avenir Muller stem in primary THA.

Corail

N=2542

40 surgeons across 24 sites use this implant in primary THA.

Table 405: Volume of cases by surgeon and site for the Corail stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	63.6 (93.6)	7 (103)
Cases per site	105.9 (158.1)	24 (183.5)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 406: Descriptive statistics of cases receiving the Corail stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	1532	60.27	
Age (yrs)	2542	65.88(10.36)	66.00(14.00)
Height (cm)	2386	168.86(10.19)	168.00(14.53)
Weight (kg)	2386	87.18(19.92)	85.60(26.97)
BMI(kg/m^2)	2386	30.48(6.03)	29.76(7.89)
Smoking - never (%)	1158	45.55	
Smoking - previous (%)	977	38.43	
Smoking - current (%)	404	15.89	
Smoking - unknown (%)	3	0.12	

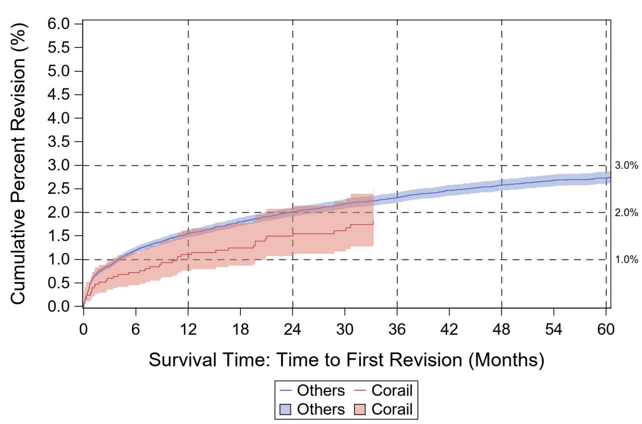

Figure 106: Cumulative percent revision curve for the Corail stem compared to all other stems in conventional primary THA.

Table 407: Cumulative percent revision and number at risk for Corail stem in primary THA cases.

Year	Number at risk	CPR
0	2535	0.00 (0.00,0.00)
1	2239	1.10 (0.76,1.61)
2	1799	1.49 (1.07,2.08)
3*	1194	1.82 (1.33,2.48)
4*	712	1.82 (1.33,2.48)
5*	364	1.82 (1.33,2.48)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.797 (0.552,1.153). It was 1.232 (1.127,1.347) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 408: Reasons for revision following primary THA for Corail stem cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	11	27.5
2	Dislocation/Instability	9	22.5
3	Joint Infection	9	22.5
4	Peri-prosthetic fracture - Femur	6	15.0
5	Component fracture/failure	3	7.5
6	Malalignment	2	5.0

Table 409: Reasons for revision in first 90 days following primary THA for Corail stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	5	33.3
2	Aseptic Loosening	3	20.0
3	Dislocation/Instability	3	20.0
4	Joint Infection	2	13.3
5	Component fracture/failure	2	13.3

Table 410: Reasons for revision between 91 and 365 days following primary THA for Corail stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	4	33.3
2	Joint Infection	4	33.3
3	Aseptic Loosening	3	25.0
4	Malalignment	1	8.3

Table 411: Distribution of approach used for Corail stem in primary THA cases.

Approach	N	Percent
Anterior	1758	69.2
Anterolateral	380	14.9
Posterior	241	9.5
Transtrochanteric	3	0.1
Missing/unknown/other	160	6.3

Table 412: Distribution of head size for Corail stem in primary THA cases.

Size (mm)	N	Percent
28	7	0.3
32	570	22.6
36	1760	69.7
40	166	6.6
44	15	0.6
Missing/unknown/other	6	0.2

Table 413: Distribution of bearing surface for Corail stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	1139	44.8
Ceramic-on-plastic	1373	54.0
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	2	0.1
Missing/unknown/other	28	1.1

Table 414: Distribution of polyethylene used for Corail stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	2518	100.0
Antioxidant XLPE	1	0.0
Missing/unknown/other	0	0.0

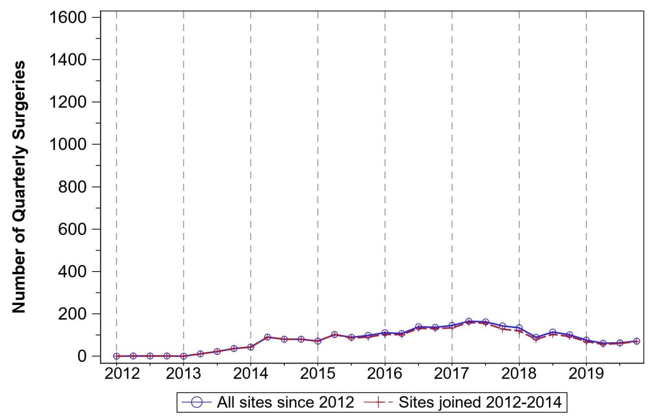

Figure 107: Utilization of the Corail stem in primary THA.

Corail Coxa Vara

N=536

25 surgeons across 19 sites use this implant in primary THA.

Table 415: Volume of cases by surgeon and site for the Corail Coxa Vara stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	21.4 (25.6)	13 (28)
Cases per site	28.2 (31.4)	14 (54)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 416: Descriptive statistics of cases receiving the Corail Coxa Vara stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	300	55.97	
Age (yrs)	536	64.80(10.05)	65.00(14.00)
Height (cm)	533	170.68(10.74)	170.18(15.24)
Weight (kg)	533	88.74(20.83)	86.82(24.71)
BMI(kg/m^2)	533	30.33(5.85)	29.41(7.35)
Smoking - never (%)	245	45.71	
Smoking - previous (%)	216	40.3	
Smoking - current (%)	75	13.99	
Smoking - unknown (%)	0	0.0	

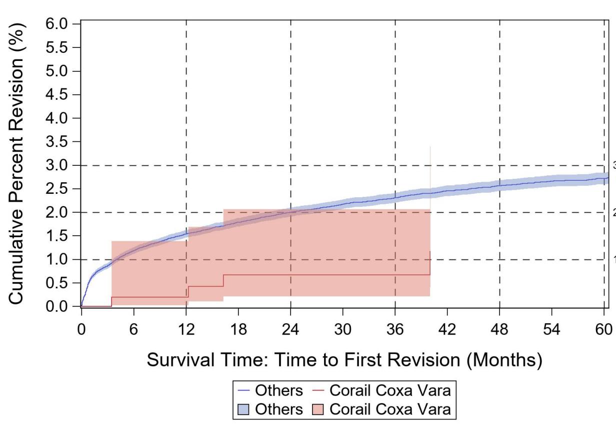

Figure 108: Cumulative percent revision curve for the Corail Coxa Vara stem compared to all other stems in conventional primary THA.

Table 417: Cumulative percent revision and number at risk for Corail Coxa Vara stem in primary THA cases.

Year	Number at risk	CPR
0	536	0.00 (0.00,0.00)
1	442	0.20 (0.03,1.39)
2	348	0.67 (0.22,2.07)
3	228	0.67 (0.22,2.07)
4*	136	1.18 (0.41,3.39)
5*	65	1.18 (0.41,3.39)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.409 (0.151,1.111). It was 1.231 (1.127,1.346) and 0.999 (0.996,1.004) for sex (female) and age, respectively.

Table 418: Reasons for revision following primary THA for Corail Coxa Vara stem cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	3	75.0
2	Dislocation/Instability	1	25.0

There were no revisions between day 91 and day 365 so no table of reasons for revisions during this time period is included.

Table 419: Reasons for revision between 91 and 365 days following primary THA for Corail Coxa Vara stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	1	100.0

Table 420: Distribution of approach used for Corail Coxa Vara stem in primary THA cases.

Approach	N	Percent
Anterior	419	78.2
Anterolateral	80	14.9
Posterior	32	6.0
Transtrochanteric	0	0.0
Missing/unknown/other	5	0.9

Table 421: Distribution of head size for Corail Coxa Vara stem in primary THA cases.

Size (mm)	N	Percent
28	9	1.7
32	147	27.6
36	360	67.7
40	11	2.1
44	1	0.2
Missing/unknown/other	4	0.8

Table 422: Distribution of bearing surface for Corail Coxa Vara stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	175	32.6
Ceramic-on-plastic	350	65.3
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	2	0.4
Missing/unknown/other	9	1.7

Table 423: Distribution of polyethylene used for Corail Coxa Vara stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	529	99.6
Antioxidant XLPE	2	0.4
Missing/unknown/other	0	0.0

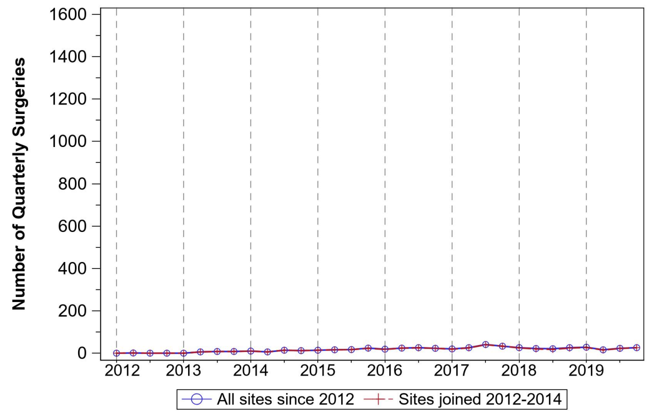

Figure 109: Utilization of the Corail Coxa Vara stem in primary THA.

Echo Bi-Metric

N=1524

32 surgeons across 26 sites use this implant in primary THA.

Table 424: Volume of cases by surgeon and site for the Echo Bi-Metric stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	47.6 (123.9)	4.5 (27.5)
Cases per site	58.6 (140.3)	11.5 (55)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 425: Descriptive statistics of cases receiving the Echo Bi-Metric stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	854	56.04	
Age (yrs)	1524	66.20(10.75)	66.00(15.00)
Height (cm)	1524	169.46(10.46)	168.91(15.80)
Weight (kg)	1524	89.10(22.37)	87.09(29.66)
BMI(kg/m^2)	1524	30.88(6.70)	29.97(8.74)
Smoking - never (%)	696	45.67	
Smoking - previous (%)	580	38.06	
Smoking - current (%)	246	16.14	
Smoking - unknown (%)	2	0.13	

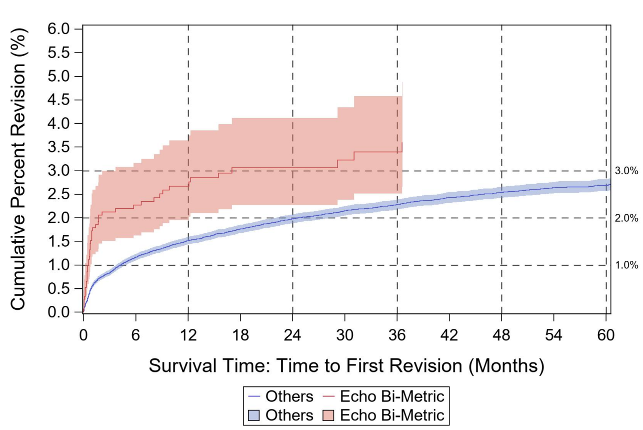

Figure 110: Cumulative percent revision curve for the Echo Bi-Metric stem compared to all other stems in conventional primary THA.

Table 426: Cumulative percent revision and number at risk for Echo Bi-Metric stem in primary THA cases.

Year	Number at risk	CPR
0	1523	0.00 (0.00,0.00)
1	1092	2.67 (1.96,3.64)
2	700	3.06 (2.27,4.12)
3	477	3.40 (2.51,4.58)
4*	227	3.60 (2.66,4.88)
5*	72	3.60 (2.66,4.88)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 427: Reasons for revision following primary THA for Echo Bi-Metric stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	20	43.5
2	Aseptic Loosening	7	15.2
3	Joint Infection	7	15.2
4	Dislocation/Instability	6	13.0
5	Component fracture/failure	3	6.5
6	Malalignment	2	4.3
7	Peri-prosthetic fracture - Acetabulum	1	2.2

Table 428: Reasons for revision in first 90 days following primary THA for Echo Bi-Metric stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	19	59.4
2	Dislocation/Instability	4	12.5
3	Aseptic Loosening	3	9.4
4	Joint Infection	2	6.3
5	Malalignment	2	6.3
6	Component fracture/failure	1	3.1
7	Peri-prosthetic fracture - Acetabulum	1	3.1

Table 429: Reasons for revision between 91 and 365 days following primary THA for Echo Bi-Metric stem cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	3	42.9
2	Joint Infection	2	28.6
3	Component fracture/failure	1	14.3
4	Peri-prosthetic fracture - Femur	1	14.3

Table 430: Distribution of approach used for Echo Bi-Metric stem in primary THA cases.

Approach	N	Percent
Anterior	106	7.0
Anterolateral	51	3.4
Posterior	1363	89.4
Transtrochanteric	1	0.1
Missing/unknown/other	3	0.2

Table 431: Distribution of head size for Echo Bi-Metric stem in primary THA cases.

Size (mm)	N	Percent
28	6	0.4
32	241	16.9
36	745	52.2
40	431	30.2
Missing/unknown/other	5	0.3

Table 432: Distribution of bearing surface for Echo Bi-Metric stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	310	20.3
Ceramic-on-plastic	1113	73.0
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	93	6.1
Missing/unknown/other	8	0.5

Table 433: Distribution of polyethylene used for Echo Bi-Metric stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	6	0.4
XLPE	932	61.3
Antioxidant XLPE	582	38.3
Missing/unknown/other	0	0.0

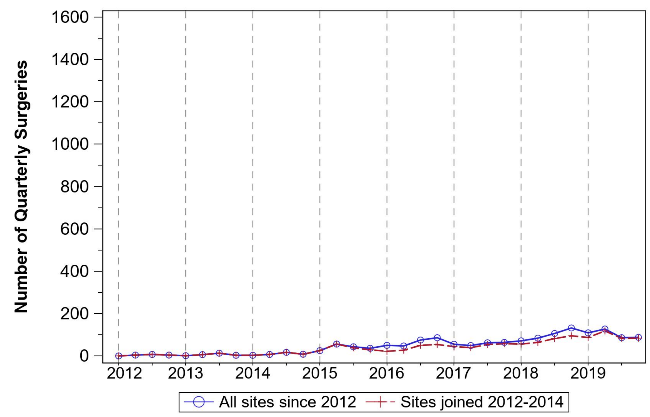

Figure 111: Utilization of the Echo Bi-Metric stem in primary THA.

Echo Bi-Metric Microplasty
N=952

15 surgeons across 16 sites use this implant in primary THA.

Table 434: Volume of cases by surgeon and site for the Echo Bi-Metric Microplasty stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	63.5 (97.5)	15 (79)
Cases per site	59.5 (103.9)	8.5 (40.5)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 435: Descriptive statistics of cases receiving the Echo Bi-Metric Microplasty stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	493	51.79	
Age (yrs)	952	64.43(10.33)	65.00(14.00)
Height (cm)	952	170.56(10.65)	170.20(15.20)
Weight (kg)	952	89.44(20.05)	88.60(26.35)
BMI(kg/m^2)	952	30.70(6.58)	30.12(7.88)
Smoking - never (%)	454	47.69	
Smoking - previous (%)	360	37.82	
Smoking - current (%)	137	14.39	
Smoking - unknown (%)	1	0.11	

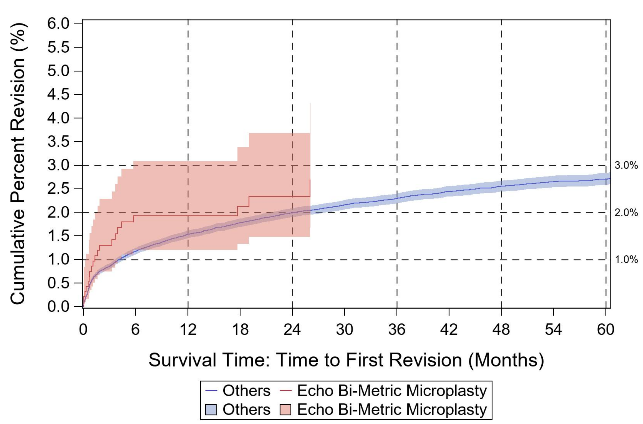

Figure 112: Cumulative percent revision curve for the Echo Bi-Metric Microplasty stem compared to all other stems in conventional primary THA.

Table 436: Cumulative percent revision and number at risk for Echo Bi-Metric Microplasty stem in primary THA cases.

Year	Number at risk	CPR
0	952	0.00 (0.00,0.00)
1	588	1.93 (1.20,3.09)
2	332	2.34 (1.48,3.69)
3*	86	2.70 (1.68,4.32)
4*	3	2.70 (1.68,4.32)
5	0	N/A

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.69 (1.008,2.834). It was 1.231 (1.127,1.346) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 437: Reasons for revision following primary THA for Echo Bi-Metric Microplasty stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	10	50.0
2	Joint Infection	3	15.0
3	Aseptic Loosening	2	10.0
4	Dislocation/Instability	2	10.0
5	Component fracture/failure	1	5.0
6	Pain	1	5.0
7	Malalignment	1	5.0

Table 438: Reasons for revision in first 90 days following primary THA for Echo Bi-Metric Microplasty stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	9	75.0
2	Aseptic Loosening	1	8.3
3	Dislocation/Instability	1	8.3
4	Malalignment	1	8.3

Table 439: Reasons for revision between 91 and 365 days following primary THA for Echo Bi-Metric Microplasty stem cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	2	40.0
2	Aseptic Loosening	1	20.0
3	Dislocation/Instability	1	20.0
4	Component fracture/failure	1	20.0

Table 440: Distribution of approach used for Echo Bi-Metric Microplasty stem in primary THA cases.

Approach	N	Percent
Anterior	643	67.5
Anterolateral	11	1.2
Posterior	294	30.9
Transtrochanteric	3	0.3
Missing/unknown/other	1	0.1

Table 441: Distribution of head size for Echo Bi-Metric Microplasty stem in primary THA cases.

Size (mm)	N	Percent
28	1	0.1
32	204	23.8
36	589	68.6
40	61	7.1
Missing/unknown/other	4	0.5

Table 442: Distribution of bearing surface for Echo Bi-Metric Microplasty stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	146	15.3
Ceramic-on-plastic	709	74.5
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	89	9.3
Missing/unknown/other	8	0.8

Table 443: Distribution of polyethylene used for Echo Bi-Metric Microplasty stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	343	36.2
Antioxidant XLPE	605	63.8
Missing/unknown/other	0	0.0

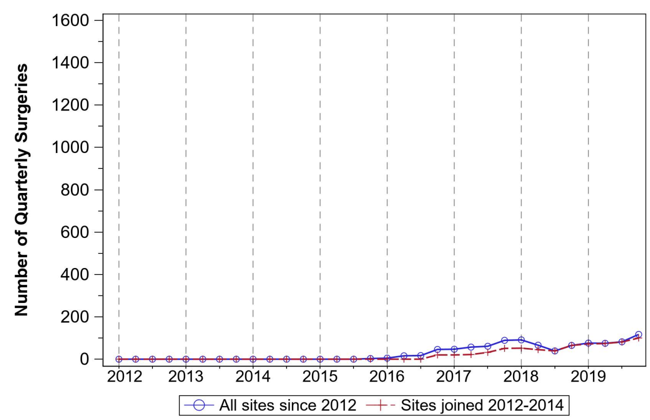

Figure 113: Utilization of the Echo Bi-Metric Microplasty stem in primary THA.

Fitmore
N=4695

48 surgeons across 24 sites use this implant in primary THA.

Table 444: Volume of cases by surgeon and site for the Fitmore stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	97.8 (316.3)	6.5 (39.5)
Cases per site	195.6 (362.8)	29.5 (240.5)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 445: Descriptive statistics of cases receiving the Fitmore stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	2314	49.29	
Age (yrs)	4695	63.91(10.14)	64.00(13.00)
Height (cm)	4565	170.92(10.35)	170.20(15.20)
Weight (kg)	4565	88.65(20.92)	86.80(28.06)
BMI(kg/m^2)	4565	30.22(6.11)	29.34(8.00)
Smoking - never (%)	2291	48.8	
Smoking - previous (%)	1806	38.47	
Smoking - current (%)	589	12.55	
Smoking - unknown (%)	9	0.19	

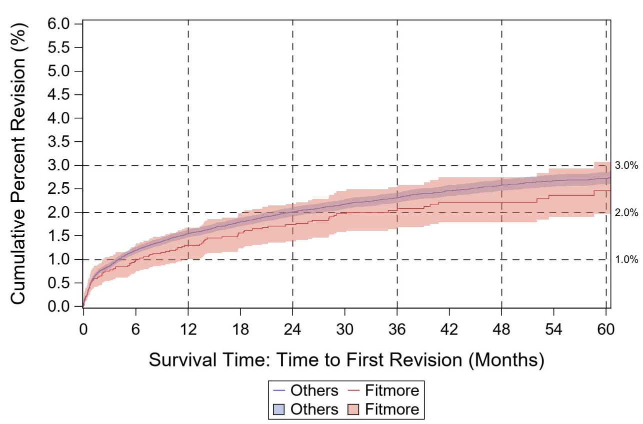

Figure 114: Cumulative percent revision curve for the Fitmore stem compared to all other stems in conventional primary THA.

Table 446: Cumulative percent revision and number at risk for Fitmore stem in primary THA cases.

Year	Number at risk	CPR
0	4692	0.00 (0.00,0.00)
1	3883	1.30 (1.00,1.68)
2	3200	1.74 (1.38,2.18)
3	2440	2.04 (1.65,2.54)
4	1689	2.22 (1.79,2.74)
5	947	2.46 (1.97,3.07)

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.105 (0.816,1.498). It was 1.232 (1.127,1.347) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 447: Reasons for revision following primary THA for Fitmore stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	24	27.6
2	Dislocation/Instability	18	20.7
3	Aseptic Loosening	15	17.2
4	Joint Infection	9	10.3
5	Pain	9	10.3
6	Component fracture/failure	7	8.0
7	Malalignment	4	4.6
8	Peri-prosthetic fracture - Acetabulum	1	1.1

Table 448: Reasons for revision in first 90 days following primary THA for Fitmore stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	19	55.9
2	Dislocation/Instability	10	29.4
3	Component fracture/failure	3	8.8
4	Peri-prosthetic fracture - Acetabulum	1	2.9
5	Malalignment	1	2.9

Table 449: Reasons for revision between 91 and 365 days following primary THA for Fitmore stem cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	6	26.1
2	Pain	5	21.7
3	Dislocation/Instability	4	17.4
4	Component fracture/failure	3	13.0
5	Joint Infection	2	8.7
6	Peri-prosthetic fracture - Femur	2	8.7
7	Malalignment	1	4.3

Table 450: Distribution of approach used for Fitmore stem in primary THA cases.

Approach	N	Percent
Anterior	3721	79.3
Anterolateral	37	0.8
Posterior	801	17.1
Transtrochanteric	4	0.1
Missing/unknown/other	132	2.8

Table 451: Distribution of head size for Fitmore stem in primary THA cases.

Size (mm)	N	Percent
22	1	0.0
28	8	0.2
32	716	15.6
36	3266	71.2
40	568	12.4
Missing/unknown/other	31	0.7

Table 452: Distribution of bearing surface for Fitmore stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	1071	22.8
Ceramic-on-plastic	3488	74.3
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	78	1.7
Missing/unknown/other	58	1.2

Table 453: Distribution of polyethylene used for Fitmore stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	2	0.0
XLPE	1719	36.8
Antioxidant XLPE	2945	63.1
Missing/unknown/other	0	0.0

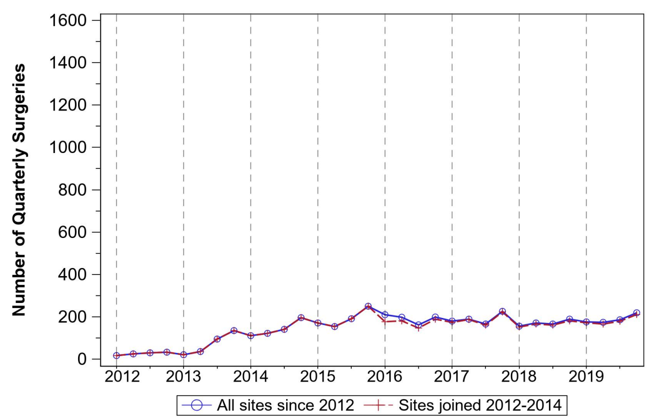

Figure 115: Utilization of the Fitmore stem in primary THA.

M/L Taper
N=11323

This analysis excludes M/L Taper Kinectiv. 77 surgeons across 35 sites use this implant in primary THA.

Table 454: Volume of cases by surgeon and site for the M/L Taper stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	147.1 (252.2)	38 (189)
Cases per site	323.5 (606.7)	93 (302)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 455: Descriptive statistics of cases receiving the M/L Taper stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	6058	53.5	
Age (yrs)	11323	65.13(10.42)	65.00(14.00)
Height (cm)	11314	170.03(10.44)	170.00(15.24)
Weight (kg)	11312	87.68(20.27)	86.00(27.50)
BMI(kg/m^2)	11312	30.22(6.15)	29.49(7.81)
Smoking - never (%)	5432	47.97	
Smoking - previous (%)	4432	39.14	
Smoking - current (%)	1436	12.68	
Smoking - unknown (%)	23	0.2	

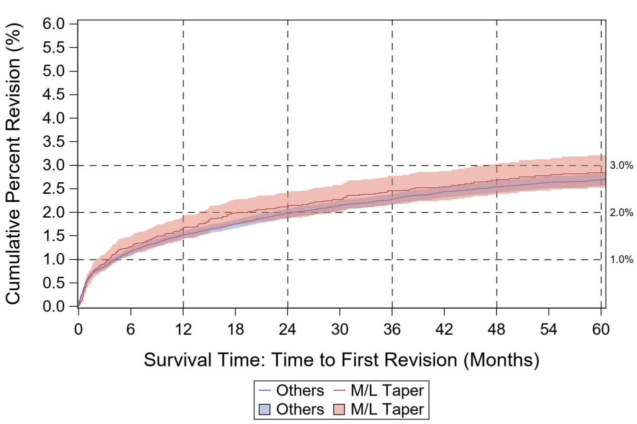

Figure 116: Cumulative percent revision curve for the M/L Taper stem compared to all other stems in conventional primary THA.

Table 456: Cumulative percent revision and number at risk for M/L Taper stem in primary THA cases.

Year	Number at risk	CPR
0	11308	0.00 (0.00,0.00)
1	9822	1.66 (1.44,1.92)
2	8504	2.12 (1.86,2.41)
3	7063	2.46 (2.17,2.78)
4	5316	2.68 (2.37,3.02)
5	3615	2.85 (2.52,3.21)

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.961 (0.803,1.151). It was 1.231 (1.126,1.346) and 0.999 (0.996,1.004) for sex (female) and age, respectively.

Table 457: Reasons for revision following primary THA for M/L Taper stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	65	26.0
2	Dislocation/Instability	64	25.6
3	Aseptic Loosening	43	17.2
4	Joint Infection	34	13.6
5	Component fracture/failure	12	4.8
6	Pain	10	4.0
7	Malalignment	10	4.0
8	Peri-prosthetic fracture - Acetabulum	6	2.4
9	Metal reaction/Metallosis	6	2.4

Table 458: Reasons for revision in first 90 days following primary THA for M/L Taper stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	51	53.1
2	Dislocation/Instability	23	24.0
3	Joint Infection	6	6.3
4	Aseptic Loosening	5	5.2
5	Component fracture/failure	4	4.2
6	Peri-prosthetic fracture - Acetabulum	4	4.2
7	Malalignment	3	3.1

Table 459: Reasons for revision between 91 and 365 days following primary THA for M/L Taper stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	16	28.6
2	Joint Infection	16	28.6
3	Aseptic Loosening	10	17.9
4	Component fracture/failure	4	7.1
5	Peri-prosthetic fracture - Femur	4	7.1
6	Pain	4	7.1
7	Peri-prosthetic fracture - Acetabulum	1	1.8
8	Malalignment	1	1.8

Table 460: Distribution of approach used for M/L Taper stem in primary THA cases.

Approach	N	Percent
Anterior	2193	19.4
Anterolateral	2607	23.0
Posterior	6368	56.2
Transtrochanteric	110	1.0
Missing/unknown/other	45	0.4

Table 461: Distribution of head size for M/L Taper stem in primary THA cases.

Size (mm)	N	Percent
28	97	0.9
32	3107	27.7
36	7147	63.7
40	729	6.5
44	4	0.0
Missing/unknown/other	130	1.2

Table 462: Distribution of bearing surface for M/L Taper stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	4314	38.1
Ceramic-on-plastic	6799	60.0
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	51	0.5
Missing/unknown/other	159	1.4

Table 463: Distribution of polyethylene used for M/L Taper stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	2	0.0
XLPE	8046	71.5
Antioxidant XLPE	3212	28.5
Missing/unknown/other	0	0.0

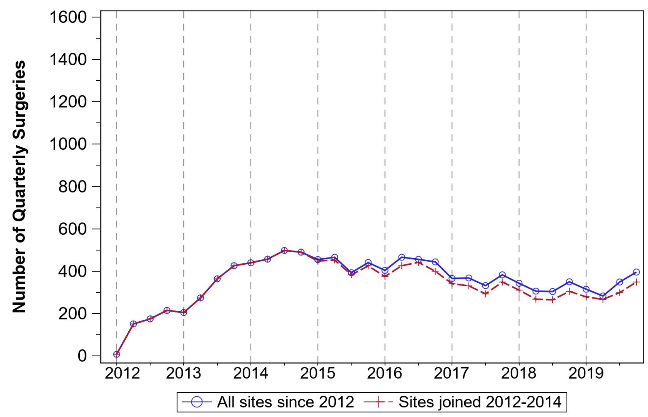

Figure 117: Utilization of the M/L Taper stem in primary THA.

M/L Taper Kinectiv
N=779

13 surgeons across 12 sites use this implant in primary THA.

Table 464: Volume of cases by surgeon and site for the M/L Taper Kinectiv stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	59.9 (82.2)	11 (83)
Cases per site	64.9 (115.5)	9.5 (89.5)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 465: Descriptive statistics of cases receiving the M/L Taper Kinectiv stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	442	56.74	
Age (yrs)	779	67.24(10.02)	67.00(14.00)
Height (cm)	779	169.03(10.42)	168.00(17.78)
Weight (kg)	779	88.65(20.60)	86.80(28.42)
BMI(kg/m^2)	779	30.89(6.08)	30.31(8.52)
Smoking - never (%)	322	41.34	
Smoking - previous (%)	342	43.9	
Smoking - current (%)	114	14.63	
Smoking - unknown (%)	1	0.13	

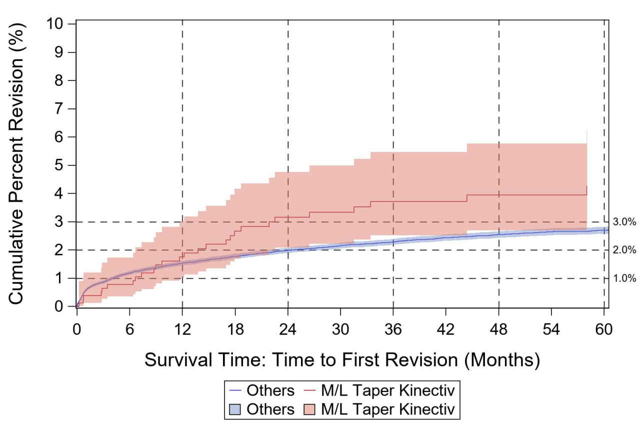

Figure 118: Cumulative percent revision curve for the M/L Taper Kinectiv stem compared to all other stems in conventional primary THA.

Table 466: Cumulative percent revision and number at risk for M/L Taper Kinectiv stem in primary THA cases.

Year	Number at risk	CPR
0	779	0.00 (0.00,0.00)
1	673	1.75 (1.02,3.00)
2	569	3.16 (2.09,4.77)
3	481	3.72 (2.52,5.47)
4	390	3.95 (2.69,5.77)
5*	279	4.27 (2.91,6.24)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 467: Reasons for revision following primary THA for M/L Taper Kinectiv stem cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	6	25.0
2	Aseptic Loosening	5	20.8
3	Malalignment	4	16.7
4	Dislocation/Instability	3	12.5
5	Pain	3	12.5
6	Osteolysis	1	4.2
7	Component fracture/failure	1	4.2
8	Peri-prosthetic fracture - Femur	1	4.2

Table 468: Reasons for revision in first 90 days following primary THA for M/L Taper Kinectiv stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	1	25.0
2	Joint Infection	1	25.0
3	Component fracture/failure	1	25.0
4	Peri-prosthetic fracture - Femur	1	25.0

Table 469: Reasons for revision between 91 and 365 days following primary THA for M/L Taper Kinectiv stem cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	3	42.9
2	Aseptic Loosening	2	28.6
3	Malalignment	2	28.6

Table 470: Distribution of approach used for M/L Taper Kinectiv stem in primary THA cases.

Approach	N	Percent
Anterior	21	2.7
Anterolateral	691	88.7
Posterior	20	2.6
Transtrochanteric	38	4.9
Missing/unknown/other	9	1.2

Table 471: Distribution of head size for M/L Taper Kinectiv stem in primary THA cases.

Size (mm)	N	Percent
28	2	0.3
32	196	25.7
36	277	36.4
40	258	33.9
Missing/unknown/other	29	3.8

Table 472: Distribution of bearing surface for M/L Taper Kinectiv stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	357	45.8
Ceramic-on-plastic	398	51.1
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	2	0.3
Missing/unknown/other	22	2.8

Table 473: Distribution of polyethylene used for M/L Taper Kinectiv stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	500	65.5
Antioxidant XLPE	264	34.5
Missing/unknown/other	0	0.0

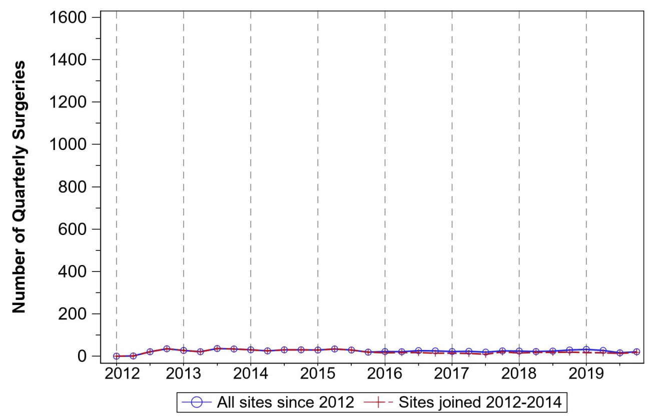

Figure 119: Utilization of the M/L Taper Kinectiv stem in primary THA.

Polarstem
N=1489

32 surgeons across 21 sites use this implant in primary THA.

Table 474: Volume of cases by surgeon and site for the Polarstem stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	46.5 (105.7)	10 (36)
Cases per site	70.9 (132.3)	17 (46)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 475: Descriptive statistics of cases receiving the Polarstem stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	640	42.98	
Age (yrs)	1489	63.83(10.94)	64.00(14.00)
Height (cm)	1489	171.67(10.61)	172.72(17.00)
Weight (kg)	1489	91.16(22.01)	89.70(28.93)
BMI(kg/m^2)	1489	30.81(6.41)	30.11(8.40)
Smoking - never (%)	631	42.38	
Smoking - previous (%)	569	38.21	
Smoking - current (%)	283	19.01	
Smoking - unknown (%)	6	0.4	

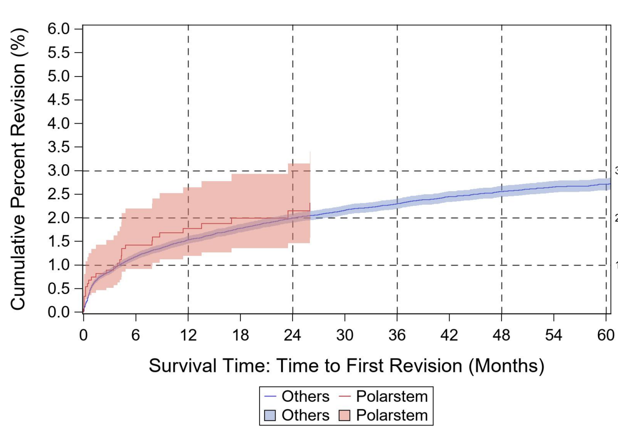

Figure 120: Cumulative percent revision curve for the Polarstem stem compared to all other stems in conventional primary THA.

Table 476: Cumulative percent revision and number at risk for Polarstem stem in primary THA cases.

Year	Number at risk	CPR
0	1485	0.00 (0.00,0.00)
1	1008	1.78 (1.19,2.65)
2	624	2.15 (1.46,3.15)
3*	328	2.32 (1.58,3.40)
4*	54	2.32 (1.58,3.40)
5*	6	2.32 (1.58,3.40)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.136 (0.744,1.736). It was 1.232 (1.127,1.347) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 477: Reasons for revision following primary THA for Polarstem stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	11	39.3
2	Joint Infection	7	25.0
3	Dislocation/Instability	5	17.9
4	Aseptic Loosening	3	10.7
5	Pain	1	3.6
6	Malalignment	1	3.6

Table 478: Reasons for revision in first 90 days following primary THA for Polarstem stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	10	76.9
2	Dislocation/Instability	3	23.1

Table 479: Reasons for revision between 91 and 365 days following primary THA for Polarstem stem cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	5	45.5
2	Aseptic Loosening	2	18.2
3	Dislocation/Instability	2	18.2
4	Peri-prosthetic fracture - Femur	1	9.1
5	Malalignment	1	9.1

Table 480: Distribution of approach used for Polarstem stem in primary THA cases.

Approach	N	Percent
Anterior	1184	79.5
Anterolateral	82	5.5
Posterior	221	14.8
Transtrochanteric	1	0.1
Missing/unknown/other	1	0.1

Table 481: Distribution of head size for Polarstem stem in primary THA cases.

Size (mm)	N	Percent
22	1	0.1
28	2	0.1
32	250	16.9
36	1158	78.5
40	60	4.1
Missing/unknown/other	5	0.3

Table 482: Distribution of bearing surface for Polarstem stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	74	5.0
Ceramic-on-plastic	1398	93.9
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	8	0.5
Missing/unknown/other	9	0.6

Table 483: Distribution of polyethylene used for Polarstem stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	1	0.1
XLPE	1478	99.5
Antioxidant XLPE	5	0.3
Missing/unknown/other	1	0.1

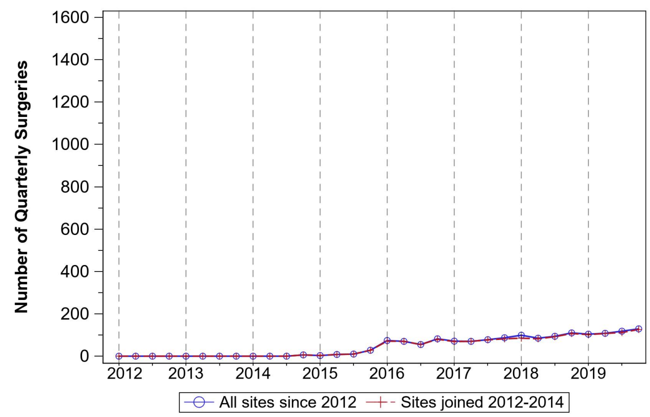

Figure 121: Utilization of the Polarstem stem in primary THA.

Secur-Fit
N=1332

39 surgeons across 25 sites use this implant in primary THA.

Table 484: Volume of cases by surgeon and site for the Secur-Fit stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	34.2 (79.4)	4 (21)
Cases per site	53.3 (101.2)	13 (42)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 485: Descriptive statistics of cases receiving the Secur-Fit stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	762	57.21	
Age (yrs)	1332	64.63(10.59)	65.00(13.00)
Height (cm)	1332	169.62(10.34)	170.00(15.30)
Weight (kg)	1332	90.81(22.27)	88.40(29.00)
BMI(kg/m^2)	1332	31.47(6.81)	30.48(9.33)
Smoking - never (%)	614	46.1	
Smoking - previous (%)	476	35.74	
Smoking - current (%)	231	17.34	
Smoking - unknown (%)	11	0.83	

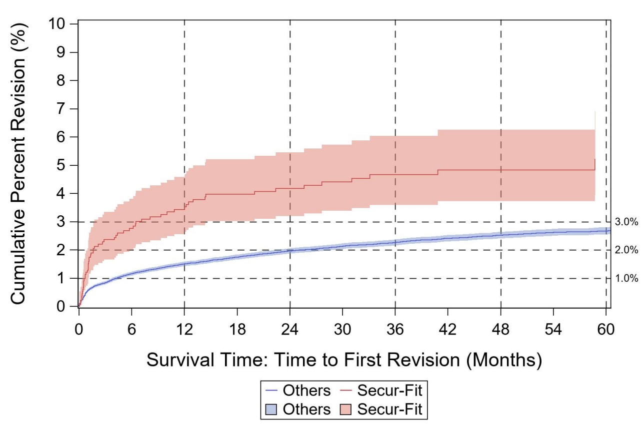

Figure 122: Cumulative percent revision curve for the Secur-Fit stem compared to all other stems in conventional primary THA.

Table 486: Cumulative percent revision and number at risk for Secur-Fit stem in primary THA cases.

Year	Number at risk	CPR
0	1327	0.00 (0.00,0.00)
1	1086	3.43 (2.56,4.59)
2	877	4.18 (3.20,5.46)
3	672	4.67 (3.60,6.04)
4	425	4.84 (3.73,6.26)
5*	222	5.23 (3.95,6.91)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.92 (1.323,2.786). It was 1.231 (1.127,1.346) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 487: Reasons for revision following primary THA for Secur-Fit stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	19	34.5
2	Aseptic Loosening	10	18.2
3	Dislocation/Instability	10	18.2
4	Joint Infection	10	18.2
5	Component fracture/failure	4	7.3
6	Peri-prosthetic fracture - Acetabulum	1	1.8
7	Malalignment	1	1.8

Table 488: Reasons for revision in first 90 days following primary THA for Secur-Fit stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	17	56.7
2	Dislocation/Instability	9	30.0
3	Joint Infection	3	10.0
4	Aseptic Loosening	1	3.3

Table 489: Reasons for revision between 91 and 365 days following primary THA for Secur-Fit stem cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	5	45.5
2	Aseptic Loosening	2	18.2
3	Component fracture/failure	2	18.2
4	Dislocation/Instability	1	9.1
5	Malalignment	1	9.1

Table 490: Distribution of approach used for Secur-Fit stem in primary THA cases.

Approach	N	Percent
Anterior	4	0.3
Anterolateral	685	51.4
Posterior	633	47.5
Transtrochanteric	1	0.1
Missing/unknown/other	9	0.7

Table 491: Distribution of head size for Secur-Fit stem in primary THA cases.

Size (mm)	N	Percent
28	2	0.2
32	169	14.8
36	657	57.4
40	307	26.8
Missing/unknown/other	10	0.9

Table 492: Distribution of bearing surface for Secur-Fit stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	277	20.8
Ceramic-on-plastic	858	64.4
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	183	13.7
Missing/unknown/other	14	1.1

Table 493: Distribution of polyethylene used for Secur-Fit stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	1328	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

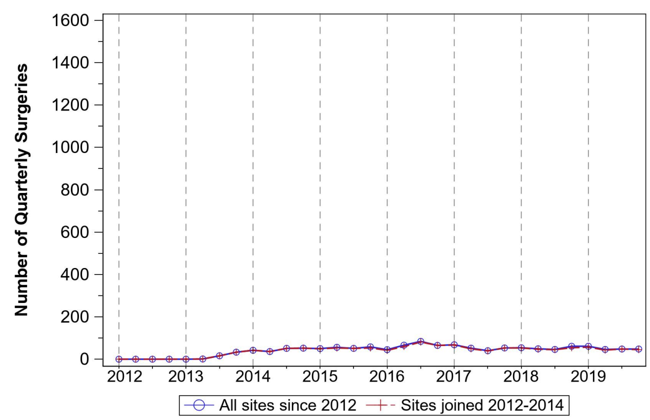

Figure 123: Utilization of the Secur-Fit stem in primary THA.

Secur-Fit Max
N=2643

58 surgeons across 24 sites use this implant in primary THA.

Table 494: Volume of cases by surgeon and site for the Secur-Fit Max stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	45.6 (111)	8 (43)
Cases per site	110.1 (175.6)	21.5 (134)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 495: Descriptive statistics of cases receiving the Secur-Fit Max stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	1321	49.98	
Age (yrs)	2643	63.91(11.34)	65.00(15.00)
Height (cm)	2643	170.36(10.25)	170.18(15.20)
Weight (kg)	2643	91.38(21.44)	89.40(27.40)
BMI(kg/m^2)	2643	31.37(6.34)	30.80(8.33)
Smoking - never (%)	1199	45.37	
Smoking - previous (%)	1061	40.14	
Smoking - current (%)	374	14.15	
Smoking - unknown (%)	9	0.34	

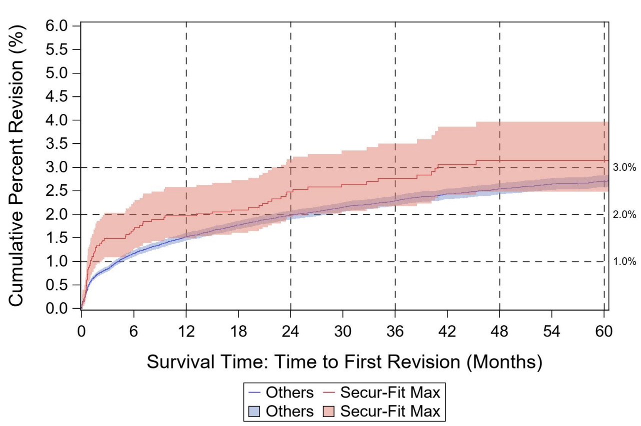

Figure 124: Cumulative percent revision curve for the Secur-Fit Max stem compared to all other stems in conventional primary THA.

Table 496: Cumulative percent revision and number at risk for Secur-Fit Max stem in primary THA cases.

Year	Number at risk	CPR
0	2641	0.00 (0.00,0.00)
1	2364	1.96 (1.50,2.58)
2	1948	2.48 (1.93,3.17)
3	1471	2.76 (2.17,3.50)
4	1020	3.14 (2.49,3.97)
5	624	3.14 (2.49,3.97)

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 497: Reasons for revision following primary THA for Secur-Fit Max stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	32	45.7
2	Aseptic Loosening	11	15.7
3	Joint Infection	10	14.3
4	Dislocation/Instability	8	11.4
5	Malalignment	4	5.7
6	Peri-prosthetic fracture - Acetabulum	3	4.3
7	Component fracture/failure	1	1.4
8	Pain	1	1.4

Table 498: Reasons for revision in first 90 days following primary THA for Secur-Fit Max stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	26	68.4
2	Joint Infection	5	13.2
3	Dislocation/Instability	3	7.9
4	Aseptic Loosening	2	5.3
5	Peri-prosthetic fracture - Acetabulum	1	2.6
6	Pain	1	2.6

Table 499: Reasons for revision between 91 and 365 days following primary THA for Secur-Fit Max stem cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	3	30.0
2	Aseptic Loosening	2	20.0
3	Dislocation/Instability	2	20.0
4	Peri-prosthetic fracture - Femur	2	20.0
5	Peri-prosthetic fracture - Acetabulum	1	10.0

Table 500: Distribution of approach used for Secur-Fit Max stem in primary THA cases.

Approach	N	Percent
Anterior	16	0.6
Anterolateral	1274	48.2
Posterior	1303	49.3
Transtrochanteric	23	0.9
Missing/unknown/other	27	1.0

Table 501: Distribution of head size for Secur-Fit Max stem in primary THA cases.

Size (mm)	N	Percent
22	3	0.1
28	27	1.1
32	643	26.9
36	1546	64.7
40	161	6.7
44	2	0.1
Missing/unknown/other	9	0.4

Table 502: Distribution of bearing surface for Secur-Fit Max stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	1062	40.2
Ceramic-on-plastic	593	22.4
Ceramic-on-ceramic	717	27.1
Metal-on-metal	0	0.0
Dual mobility	212	8.0
Missing/unknown/other	59	2.2

Table 503: Distribution of polyethylene used for Secur-Fit Max stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	1868	100.0
Antioxidant XLPE	1	0.1
Missing/unknown/other	0	0.0

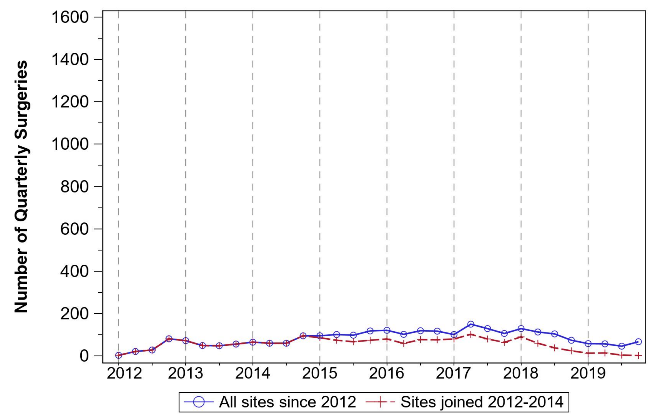

Figure 125: Utilization of the Secur-Fit Max stem in primary THA.

Secur-Fit Plus Max
N=2066

33 surgeons across 18 sites use this implant in primary THA.

Table 504: Volume of cases by surgeon and site for the Secur-Fit Plus Max stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	62.6 (188.1)	7 (45)
Cases per site	114.8 (271.2)	36 (108)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 505: Descriptive statistics of cases receiving the Secur-Fit Plus Max stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	1031	49.9	
Age (yrs)	2066	62.31(13.16)	63.00(16.00)
Height (cm)	2066	169.82(10.68)	170.00(15.24)
Weight (kg)	2066	87.27(19.85)	86.18(26.50)
BMI(kg/m^2)	2066	30.16(6.15)	29.62(7.33)
Smoking - never (%)	979	47.39	
Smoking - previous (%)	761	36.83	
Smoking - current (%)	284	13.75	
Smoking - unknown (%)	42	2.03	

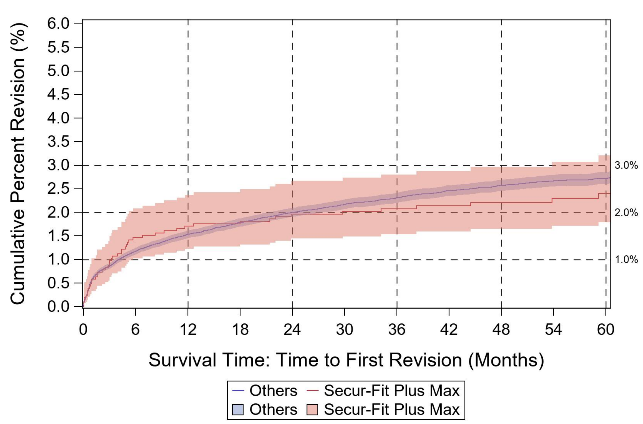

Figure 126: Cumulative percent revision curve for the Secur-Fit Plus Max stem compared to all other stems in conventional primary THA.

Table 506: Cumulative percent revision and number at risk for Secur-Fit Plus Max stem in primary THA cases.

Year	Number at risk	CPR
0	2059	0.00 (0.00,0.00)
1	1986	1.71 (1.23,2.37)
2	1873	1.96 (1.44,2.67)
3	1654	2.08 (1.54,2.80)
4	1286	2.21 (1.65,2.96)
5	922	2.40 (1.79,3.21)

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 507: Reasons for revision following primary THA for Secur-Fit Plus Max stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	11	29.7
2	Peri-prosthetic fracture - Femur	10	27.0
3	Joint Infection	8	21.6
4	Aseptic Loosening	5	13.5
5	Component fracture/failure	2	5.4
6	Pain	1	2.7

Table 508: Reasons for revision in first 90 days following primary THA for Secur-Fit Plus Max stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	7	41.2
2	Dislocation/Instability	5	29.4
3	Joint Infection	3	17.6
4	Aseptic Loosening	1	5.9
5	Component fracture/failure	1	5.9

Table 509: Reasons for revision between 91 and 365 days following primary THA for Secur-Fit Plus Max stem cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	4	50.0
2	Dislocation/Instability	3	37.5
3	Aseptic Loosening	1	12.5

Table 510: Distribution of approach used for Secur-Fit Plus Max stem in primary THA cases.

Approach	N	Percent
Anterior	4	0.2
Anterolateral	140	6.8
Posterior	1902	92.1
Transtrochanteric	4	0.2
Missing/unknown/other	16	0.8

Table 511: Distribution of head size for Secur-Fit Plus Max stem in primary THA cases.

Size (mm)	N	Percent
28	1	0.1
32	158	8.0
36	1489	74.9
40	290	14.6
44	46	2.3
Missing/unknown/other	4	0.2

Table 512: Distribution of bearing surface for Secur-Fit Plus Max stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	1192	57.7
Ceramic-on-plastic	792	38.3
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	68	3.3
Missing/unknown/other	14	0.7

Table 513: Distribution of polyethylene used for Secur-Fit Plus Max stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	2054	100.0
Antioxidant XLPE	1	0.1
Missing/unknown/other	0	0.0

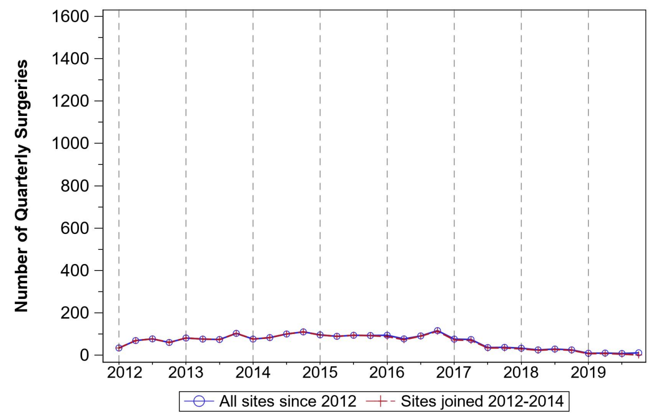

Figure 127: Utilization of the Secur-Fit Plus Max stem in primary THA.

SROM
N=1107

55 surgeons across 32 sites use this implant in primary THA.

Table 514: Volume of cases by surgeon and site for the SROM stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	20.1 (46.3)	3 (13)
Cases per site	34.6 (120.3)	3.5 (10)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 515: Descriptive statistics of cases receiving the SROM stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	581	52.48	
Age (yrs)	1107	61.00(12.54)	62.00(16.00)
Height (cm)	1106	170.24(11.60)	170.18(17.44)
Weight (kg)	1106	89.39(22.27)	88.00(29.91)
BMI(kg/m^2)	1106	30.71(6.54)	29.95(8.75)
Smoking - never (%)	543	49.05	
Smoking - previous (%)	387	34.96	
Smoking - current (%)	174	15.72	
Smoking - unknown (%)	3	0.27	

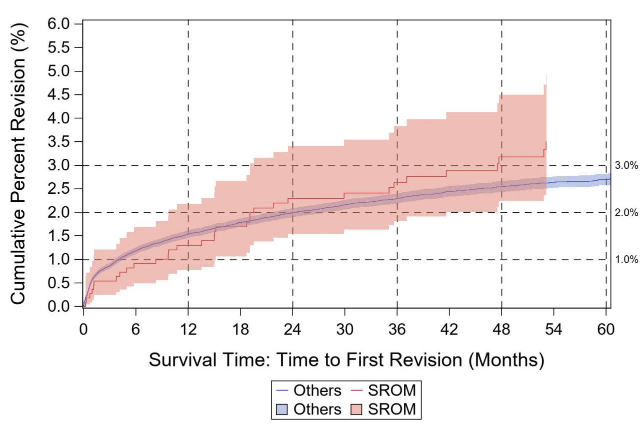

Figure 128: Cumulative percent revision curve for the SROM stem compared to all other stems in conventional primary THA.

Table 516: Cumulative percent revision and number at risk for SROM stem in primary THA cases.

Year	Number at risk	CPR
0	1107	0.00 (0.00,0.00)
1	1021	1.30 (0.77,2.18)
2	938	2.30 (1.55,3.41)
3	824	2.64 (1.82,3.83)
4	670	3.17 (2.23,4.50)
5*	453	3.50 (2.48,4.92)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.519 (1.017,2.27). It was 1.231 (1.127,1.347) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 517: Reasons for revision following primary THA for SROM stem cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	12	41.4
2	Aseptic Loosening	7	24.1
3	Dislocation/Instability	4	13.8
4	Component fracture/failure	3	10.3
5	Peri-prosthetic fracture - Femur	1	3.4
6	Pain	1	3.4
7	Malalignment	1	3.4

Table 518: Reasons for revision in first 90 days following primary THA for SROM stem cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	3	50.0
2	Dislocation/Instability	2	33.3
3	Peri-prosthetic fracture - Femur	1	16.7

Table 519: Reasons for revision between 91 and 365 days following primary THA for SROM stem cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	3	60.0
2	Dislocation/Instability	1	20.0
3	Component fracture/failure	1	20.0

Table 520: Distribution of approach used for SROM stem in primary THA cases.

Approach	N	Percent
Anterior	12	1.1
Anterolateral	589	53.2
Posterior	485	43.8
Transtrochanteric	13	1.2
Missing/unknown/other	8	0.7

Table 521: Distribution of head size for SROM stem in primary THA cases.

Size (mm)	N	Percent
22	6	0.5
28	34	3.1
32	257	23.3
36	772	70.0
40	25	2.3
44	2	0.2
Missing/unknown/other	6	0.5

Table 522: Distribution of bearing surface for SROM stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	329	29.7
Ceramic-on-plastic	766	69.2
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	2	0.2
Missing/unknown/other	10	0.9

Table 523: Distribution of polyethylene used for SROM stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	1095	99.3
Antioxidant XLPE	8	0.7
Missing/unknown/other	0	0.0

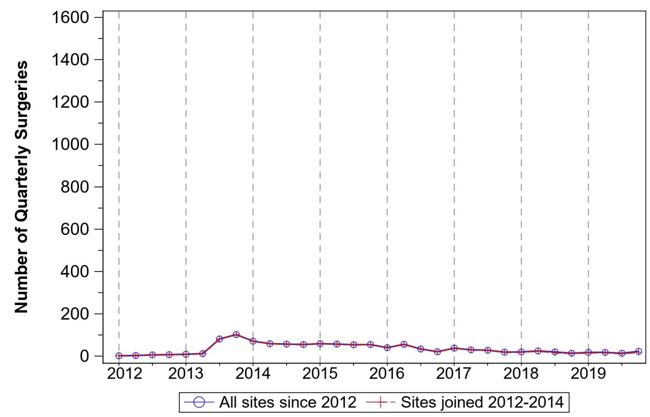

Figure 129: Utilization of the SROM stem in primary THA.

Summit
N=5957

70 surgeons across 31 sites use this implant in primary THA.

Table 524: Volume of cases by surgeon and site for the Summit stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	85.1 (183.8)	11 (117)
Cases per site	192.2 (304.3)	49 (281)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 525: Descriptive statistics of cases receiving the Summit stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	3421	57.43	
Age (yrs)	5957	65.64(11.03)	66.00(14.00)
Height (cm)	5854	169.33(10.37)	168.00(15.24)
Weight (kg)	5855	89.51(22.25)	87.10(29.94)
BMI(kg/m^2)	5854	31.09(6.70)	30.15(8.64)
Smoking - never (%)	2676	44.92	
Smoking - previous (%)	2398	40.26	
Smoking - current (%)	863	14.49	
Smoking - unknown (%)	20	0.34	

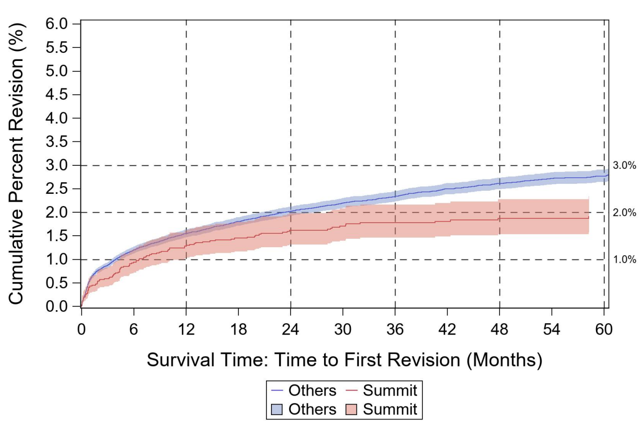

Figure 130: Cumulative percent revision curve for the Summit stem compared to all other stems in conventional primary THA.

Table 526: Cumulative percent revision and number at risk for Summit stem in primary THA cases.

Year	Number at risk	CPR
0	5949	0.00 (0.00,0.00)
1	5318	1.30 (1.04,1.63)
2	4640	1.62 (1.32,1.98)
3	3787	1.78 (1.46,2.17)
4	2793	1.87 (1.54,2.28)
5*	1749	1.92 (1.58,2.34)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.691 (0.539,0.889). It was 1.232 (1.128,1.348) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 527: Reasons for revision following primary THA for Summit stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	30	33.0
2	Peri-prosthetic fracture - Femur	22	24.2
3	Joint Infection	16	17.6
4	Aseptic Loosening	9	9.9
5	Pain	9	9.9
6	Peri-prosthetic fracture - Acetabulum	3	3.3
7	Metal reaction/Metallosis	1	1.1
8	Malalignment	1	1.1

Table 528: Reasons for revision in first 90 days following primary THA for Summit stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	21	67.7
2	Dislocation/Instability	6	19.4
3	Aseptic Loosening	3	9.7
4	Peri-prosthetic fracture - Acetabulum	1	3.2

Table 529: Reasons for revision between 91 and 365 days following primary THA for Summit stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	13	39.4
2	Joint Infection	12	36.4
3	Aseptic Loosening	3	9.1
4	Pain	3	9.1
5	Peri-prosthetic fracture - Acetabulum	2	6.1

Table 530: Distribution of approach used for Summit stem in primary THA cases.

Approach	N	Percent
Anterior	159	2.7
Anterolateral	2548	42.8
Posterior	3088	51.8
Transtrochanteric	35	0.6
Missing/unknown/other	127	2.1

Table 531: Distribution of head size for Summit stem in primary THA cases.

Size (mm)	N	Percent
28	55	0.9
32	1436	24.3
36	3982	67.3
40	396	6.7
44	24	0.4
Missing/unknown/other	28	0.5

Table 532: Distribution of bearing surface for Summit stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	2753	46.2
Ceramic-on-plastic	3089	51.9
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	1	0.0
Missing/unknown/other	114	1.9

Table 533: Distribution of polyethylene used for Summit stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	5867	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

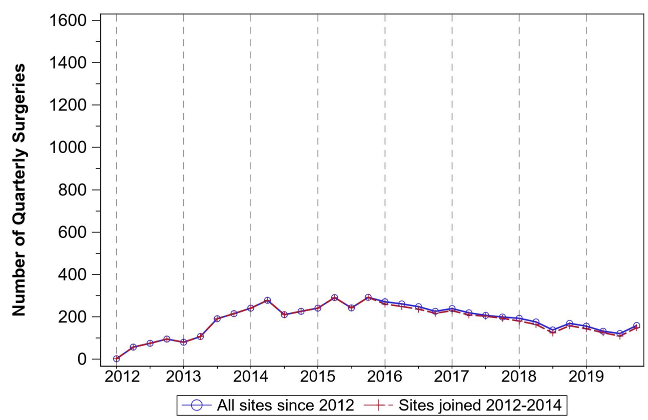

Figure 131: Utilization of the Summit stem in primary THA.

Synergy
N=1191

39 surgeons across 29 sites use this implant in primary THA.

Table 534: Volume of cases by surgeon and site for the Synergy stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	30.5 (50.6)	6 (39)
Cases per site	41.1 (76.9)	8 (59)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 535: Descriptive statistics of cases receiving the Synergy stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	646	54.24	
Age (yrs)	1191	66.94(10.69)	67.00(16.00)
Height (cm)	1191	169.17(10.71)	168.00(17.78)
Weight (kg)	1191	89.61(21.31)	88.50(29.00)
BMI(kg/m^2)	1191	31.17(6.18)	30.69(8.28)
Smoking - never (%)	505	42.4	
Smoking - previous (%)	491	41.23	
Smoking - current (%)	192	16.12	
Smoking - unknown (%)	3	0.25	

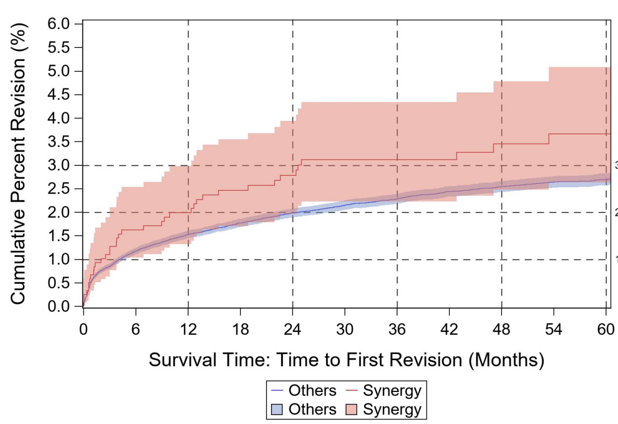

Figure 132: Cumulative percent revision curve for the Synergy stem compared to all other stems in conventional primary THA.

Table 536: Cumulative percent revision and number at risk for Synergy stem in primary THA cases.

Year	Number at risk	CPR
0	1189	0.00 (0.00,0.00)
1	1046	1.99 (1.33,2.98)
2	889	2.79 (1.96,3.94)
3	720	3.12 (2.23,4.34)
4	535	3.45 (2.48,4.79)
5	343	3.66 (2.64,5.08)

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.105 (0.733,1.669). It was 1.231 (1.127,1.346) and 0.999 (0.996,1.004) for sex (female) and age, respectively.

Table 537: Reasons for revision following primary THA for Synergy stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	16	53.3
2	Joint Infection	5	16.7
3	Peri-prosthetic fracture - Femur	3	10.0
4	Aseptic Loosening	2	6.7
5	Pain	2	6.7
6	Component fracture/failure	1	3.3
7	Malalignment	1	3.3

Table 538: Reasons for revision in first 90 days following primary THA for Synergy stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	7	63.6
2	Joint Infection	1	9.1
3	Component fracture/failure	1	9.1
4	Peri-prosthetic fracture - Femur	1	9.1
5	Malalignment	1	9.1

Table 539: Reasons for revision between 91 and 365 days following primary THA for Synergy stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	5	71.4
2	Aseptic Loosening	1	14.3
3	Joint Infection	1	14.3

Table 540: Distribution of approach used for Synergy stem in primary THA cases.

Approach	N	Percent
Anterior	44	3.7
Anterolateral	364	30.6
Posterior	769	64.6
Transtrochanteric	8	0.7
Missing/unknown/other	6	0.5

Table 541: Distribution of head size for Synergy stem in primary THA cases.

Size (mm)	N	Percent
22	1	0.1
28	16	1.4
32	380	32.5
36	699	59.9
40	65	5.6
44	4	0.3
Missing/unknown/other	3	0.3

Table 542: Distribution of bearing surface for Synergy stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	586	49.2
Ceramic-on-plastic	585	49.1
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	13	1.1
Missing/unknown/other	7	0.6

Table 543: Distribution of polyethylene used for Synergy stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	9	0.8
XLPE	1149	96.7
Antioxidant XLPE	0	0.0
Missing/unknown/other	30	2.5

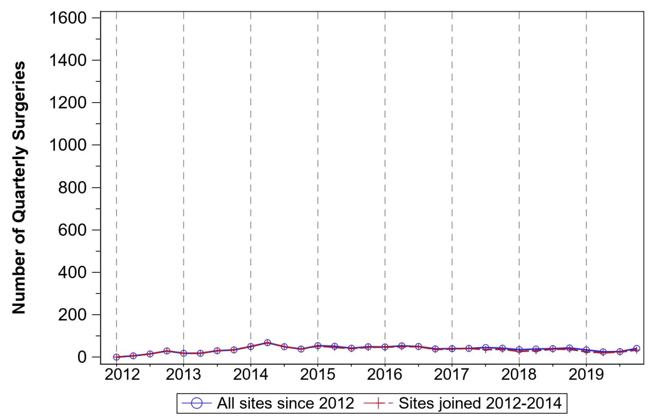

Figure 133: Utilization of the Synergy stem in primary THA.

Taperloc
N=525

19 surgeons across 10 sites use this implant in primary THA.

Table 544: Volume of cases by surgeon and site for the Taperloc stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	27.6 (42.8)	8 (22)
Cases per site	52.5 (80.2)	10.5 (94)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 545: Descriptive statistics of cases receiving the Taperloc stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	285	54.29	
Age (yrs)	525	67.28(10.39)	67.00(15.00)
Height (cm)	525	169.93(10.61)	170.00(15.30)
Weight (kg)	525	88.25(20.49)	86.20(27.40)
BMI(kg/m^2)	525	30.40(5.76)	29.65(7.42)
Smoking - never (%)	239	45.52	
Smoking - previous (%)	219	41.71	
Smoking - current (%)	65	12.38	
Smoking - unknown (%)	2	0.38	

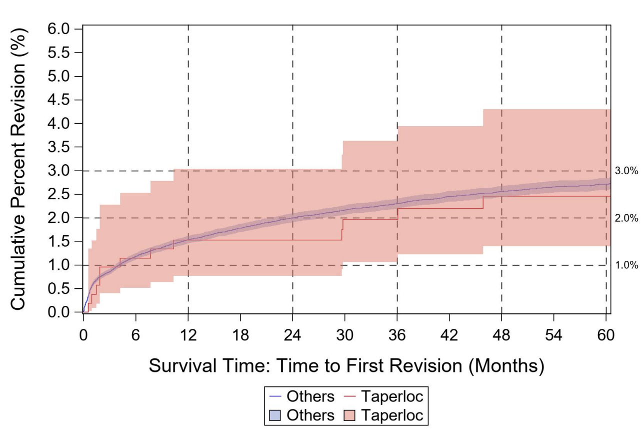

Figure 134: Cumulative percent revision curve for the Taperloc stem compared to all other stems in conventional primary THA.

Table 546: Cumulative percent revision and number at risk for Taperloc stem in primary THA cases.

Year	Number at risk	CPR
0	524	0.00 (0.00,0.00)
1	505	1.53 (0.77,3.04)
2	468	1.53 (0.77,3.04)
3	429	1.97 (1.06,3.64)
4	360	2.46 (1.40,4.30)
5	280	2.46 (1.40,4.30)

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.055 (0.566,1.967). It was 1.231 (1.127,1.346) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 547: Reasons for revision following primary THA for Taperloc stem cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	2	18.2
2	Dislocation/Instability	2	18.2
3	Joint Infection	2	18.2
4	Component fracture/failure	2	18.2
5	Peri-prosthetic fracture - Femur	2	18.2
6	Metal reaction/Metallosis	1	9.1

Table 548: Reasons for revision in first 90 days following primary THA for Taperloc stem cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	1	25.0
2	Dislocation/Instability	1	25.0
3	Joint Infection	1	25.0
4	Component fracture/failure	1	25.0

Table 549: Reasons for revision between 91 and 365 days following primary THA for Taperloc stem cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	1	50.0
2	Component fracture/failure	1	50.0

Table 550: Distribution of approach used for Taperloc stem in primary THA cases.

Approach	N	Percent
Anterior	3	0.6
Anterolateral	242	46.1
Posterior	278	53.0
Transtrochanteric	0	0.0
Missing/unknown/other	2	0.4

Table 551: Distribution of head size for Taperloc stem in primary THA cases.

Size (mm)	N	Percent
28	6	1.4
32	94	21.9
36	221	51.5
40	80	18.6
44	26	6.1
Missing/unknown/other	2	0.5

Table 552: Distribution of bearing surface for Taperloc stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	297	56.6
Ceramic-on-plastic	129	24.6
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	78	14.9
Missing/unknown/other	21	4.0

Table 553: Distribution of polyethylene used for Taperloc stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	3	0.6
XLPE	173	34.1
Antioxidant XLPE	331	65.3
Missing/unknown/other	0	0.0

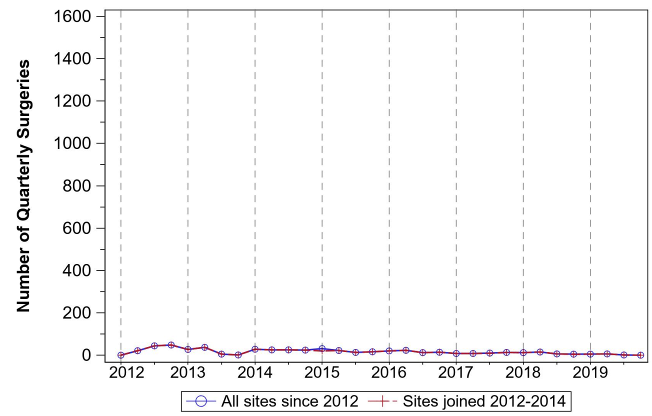

Figure 135: Utilization of the Taperloc stem in primary THA.

Taperloc 133
N=8715

94 surgeons across 44 sites use this implant in primary THA.

Table 554: Volume of cases by surgeon and site for the Taperloc 133 stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	92.7 (142.3)	26.5 (112)
Cases per site	198.1 (238.4)	88 (294)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 555: Descriptive statistics of cases receiving the Taperloc 133 stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	4764	54.66	
Age (yrs)	8715	64.56(10.71)	65.00(14.00)
Height (cm)	8715	169.73(10.44)	170.00(15.24)
Weight (kg)	8715	90.44(21.16)	88.81(28.71)
BMI(kg/m^2)	8715	31.30(6.40)	30.58(8.74)
Smoking - never (%)	4063	46.62	
Smoking - previous (%)	3302	37.89	
Smoking - current (%)	1298	14.89	
Smoking - unknown (%)	52	0.6	

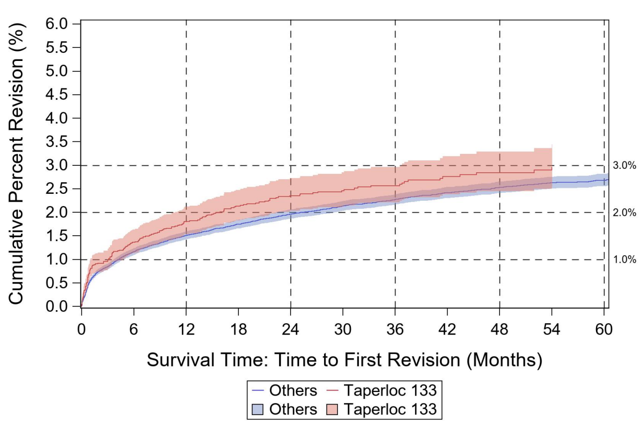

Figure 136: Cumulative percent revision curve for the Taperloc 133 stem compared to all other stems in conventional primary THA.

Table 556: Cumulative percent revision and number at risk for Taperloc 133 stem in primary THA cases.

Year	Number at risk	CPR
0	8696	0.00 (0.00,0.00)
1	6585	1.81 (1.54,2.12)
2	4853	2.35 (2.03,2.72)
3	3268	2.56 (2.22,2.96)
4	2056	2.84 (2.45,3.29)
5*	1074	2.96 (2.54,3.45)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.027 (0.849,1.245). It was 1.231 (1.126,1.346) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 557: Reasons for revision following primary THA for Taperloc 133 stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	60	31.7
2	Peri-prosthetic fracture - Femur	41	21.7
3	Joint Infection	37	19.6
4	Aseptic Loosening	22	11.6
5	Pain	12	6.3
6	Component fracture/failure	8	4.2
7	Malalignment	6	3.2
8	Peri-prosthetic fracture - Acetabulum	2	1.1
9	Poly liner wear	1	0.5

Table 558: Reasons for revision in first 90 days following primary THA for Taperloc 133 stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	40	50.0
2	Dislocation/Instability	16	20.0
3	Joint Infection	9	11.3
4	Component fracture/failure	6	7.5
5	Aseptic Loosening	4	5.0
6	Peri-prosthetic fracture - Acetabulum	2	2.5
7	Malalignment	2	2.5
8	Pain	1	1.3

Table 559: Reasons for revision between 91 and 365 days following primary THA for Taperloc 133 stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	23	39.7
2	Joint Infection	20	34.5
3	Aseptic Loosening	6	10.3
4	Pain	5	8.6
5	Malalignment	2	3.5
6	Component fracture/failure	1	1.7
7	Peri-prosthetic fracture - Femur	1	1.7

Table 560: Distribution of approach used for Taperloc 133 stem in primary THA cases.

Approach	N	Percent
Anterior	1038	11.9
Anterolateral	3051	35.0
Posterior	4577	52.5
Transtrochanteric	19	0.2
Missing/unknown/other	30	0.3

Table 561: Distribution of head size for Taperloc 133 stem in primary THA cases.

Size (mm)	N	Percent
28	10	0.1
32	674	8.1
36	5115	61.8
40	2357	28.5
44	72	0.9
Missing/unknown/other	55	0.7

Table 562: Distribution of bearing surface for Taperloc 133 stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	3076	35.3
Ceramic-on-plastic	5152	59.1
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	388	4.5
Missing/unknown/other	99	1.1

Table 563: Distribution of polyethylene used for Taperloc 133 stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	19	0.2
XLPE	3151	36.3
Antioxidant XLPE	5500	63.4
Missing/unknown/other	0	0.0

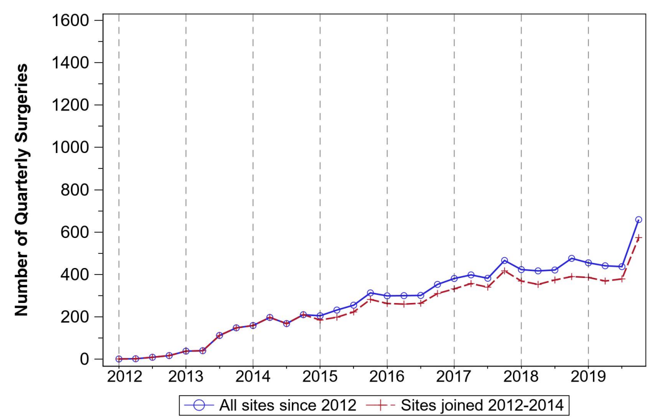

Figure 137: Utilization of the Taperloc 133 stem in primary THA.

Taperloc 133 Microplasty
N=3004

49 surgeons across 32 sites use this implant in primary THA.

Table 564: Volume of cases by surgeon and site for the Taperloc 133 Microplasty stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	61.3 (106.9)	8 (55)
Cases per site	93.9 (132.8)	31.5 (149)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 565: Descriptive statistics of cases receiving the Taperloc 133 Microplasty stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	1360	45.27	
Age (yrs)	3004	62.16(10.67)	62.00(13.00)
Height (cm)	3004	171.58(10.19)	172.70(15.00)
Weight (kg)	3004	89.32(20.06)	88.00(27.16)
BMI(kg/m^2)	3004	30.20(5.61)	29.74(7.35)
Smoking - never (%)	1544	51.4	
Smoking - previous (%)	1073	35.72	
Smoking - current (%)	371	12.35	
Smoking - unknown (%)	16	0.53	

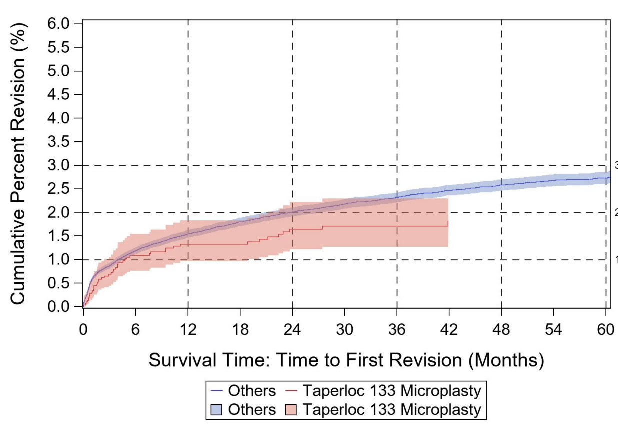

Figure 138: Cumulative percent revision curve for the Taperloc 133 Microplasty stem compared to all other stems in conventional primary THA.

Table 566: Cumulative percent revision and number at risk for Taperloc 133 Microplasty stem in primary THA cases.

Year	Number at risk	CPR
0	3002	0.00 (0.00,0.00)
1	2333	1.33 (0.96,1.83)
2	1748	1.64 (1.22,2.22)
3	1156	1.71 (1.27,2.30)
4*	635	1.82 (1.34,2.47)
5*	248	1.82 (1.34,2.47)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.741 (0.535,1.028). It was 1.227 (1.123,1.342) and 0.999 (0.996,1.004) for sex (female) and age, respectively.

Table 567: Reasons for revision following primary THA for Taperloc 133 Microplasty stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	11	25.6
2	Aseptic Loosening	9	20.9
3	Joint Infection	9	20.9
4	Peri-prosthetic fracture - Femur	6	14.0
5	Component fracture/failure	4	9.3
6	Malalignment	3	7.0
7	Pain	1	2.3

Table 568: Reasons for revision in first 90 days following primary THA for Taperloc 133 Microplasty stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	5	27.8
2	Joint Infection	4	22.2
3	Component fracture/failure	4	22.2
4	Aseptic Loosening	3	16.7
5	Dislocation/Instability	1	5.6
6	Malalignment	1	5.6

Table 569: Reasons for revision between 91 and 365 days following primary THA for Taperloc 133 Microplasty stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	9	52.9
2	Joint Infection	4	23.5
3	Aseptic Loosening	3	17.6
4	Malalignment	1	5.9

Table 570: Distribution of approach used for Taperloc 133 Microplasty stem in primary THA cases.

Approach	N	Percent
Anterior	1951	65.0
Anterolateral	114	3.8
Posterior	933	31.1
Transtrochanteric	0	0.0
Missing/unknown/other	6	0.2

Table 571: Distribution of head size for Taperloc 133 Microplasty stem in primary THA cases.

Size (mm)	N	Percent
28	9	0.3
32	507	17.3
36	2193	74.8
40	201	6.9
44	3	0.1
Missing/unknown/other	19	0.7

Table 572: Distribution of bearing surface for Taperloc 133 Microplasty stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	495	16.5
Ceramic-on-plastic	2418	80.5
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	52	1.7
Missing/unknown/other	39	1.3

Table 573: Distribution of polyethylene used for Taperloc 133 Microplasty stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	9	0.3
XLPE	658	22.1
Antioxidant XLPE	2317	77.7
Missing/unknown/other	0	0.0

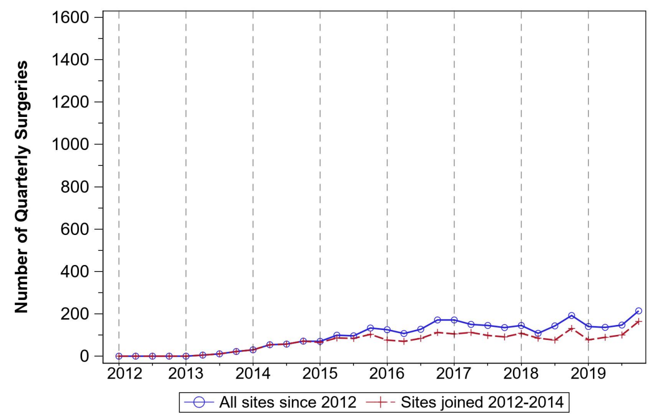

Figure 139: Utilization of the Taperloc 133 Microplasty stem in primary THA.

Trabecular Metal

N=1080

24 surgeons across 15 sites use this implant in primary THA.

Table 574: Volume of cases by surgeon and site for the Trabecular Metal stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	45 (91.0)	3 (42)
Cases per site	72 (125)	7 (93)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 575: Descriptive statistics of cases receiving the Trabecular Metal stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	602	55.74	
Age (yrs)	1080	66.96(10.85)	67.00(14.00)
Height (cm)	1080	169.28(10.63)	167.64(17.78)
Weight (kg)	1080	88.13(21.93)	86.18(29.08)
BMI(kg/m^2)	1080	30.57(6.29)	29.61(8.19)
Smoking - never (%)	475	43.98	
Smoking - previous (%)	467	43.24	
Smoking - current (%)	137	12.69	
Smoking - unknown (%)	1	0.09	

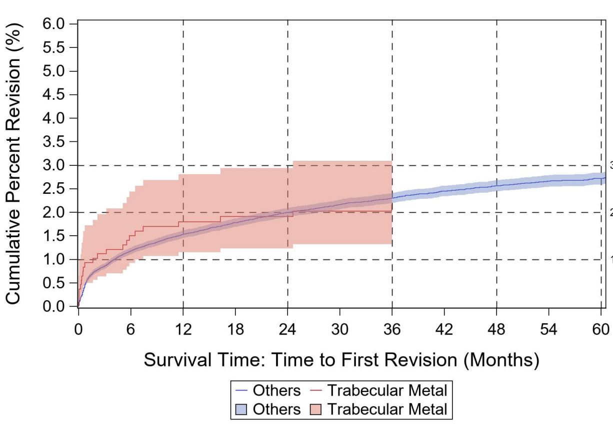

Figure 140: Cumulative percent revision curve for the Trabecular Metal stem compared to all other stems in conventional primary THA.

Table 576: Cumulative percent revision and number at risk for Trabecular Metal stem in primary THA cases.

Year	Number at risk	CPR
0	1078	0.00 (0.00,0.00)
1	956	1.80 (1.15,2.81)
2	826	1.91 (1.23,2.94)
3	662	2.17 (1.43,3.29)
4*	451	2.17 (1.43,3.29)
5*	241	2.17 (1.43,3.29)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.9 (0.537,1.508). It was 1.231 (1.127,1.346) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 577: Reasons for revision following primary THA for Trabecular Metal stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	9	50.0
2	Pain	5	27.8
3	Aseptic Loosening	2	11.1
4	Peri-prosthetic fracture - Femur	2	11.1

Table 578: Reasons for revision in first 90 days following primary THA for Trabecular Metal stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	5	45.5
2	Pain	4	36.4
3	Peri-prosthetic fracture - Femur	2	18.2

Table 579: Reasons for revision between 91 and 365 days following primary THA for Trabecular Metal stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	3	75.0
2	Aseptic Loosening	1	25.0

Table 580: Distribution of approach used for Trabecular Metal stem in primary THA cases.

Approach	N	Percent
Anterior	9	0.8
Anterolateral	952	88.2
Posterior	112	10.4
Transtrochanteric	6	0.6
Missing/unknown/other	1	0.1

Table 581: Distribution of head size for Trabecular Metal stem in primary THA cases.

Size (mm)	N	Percent
28	10	0.9
32	468	43.9
36	512	48.1
40	44	4.1
44	1	0.1
Missing/unknown/other	30	2.8

Table 582: Distribution of bearing surface for Trabecular Metal stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	420	38.9
Ceramic-on-plastic	641	59.4
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	12	1.1
Missing/unknown/other	7	0.7

Table 583: Distribution of polyethylene used for Trabecular Metal stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	944	87.7
Antioxidant XLPE	133	12.3
Missing/unknown/other	0	0.0

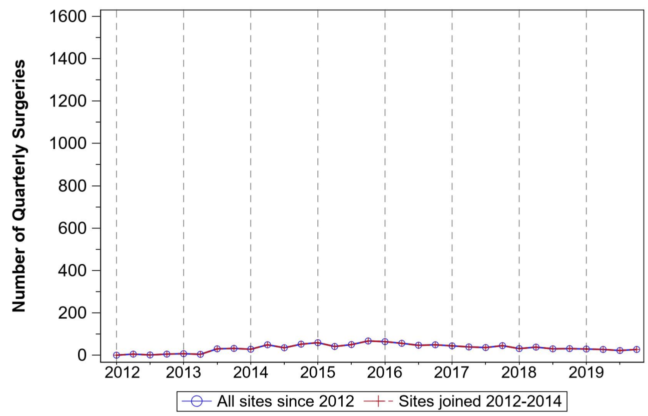

Figure 141: Utilization of the Trabecular Metal stem in primary THA.

Tri-Lock BPS
N=3056

44 surgeons across 23 sites use this implant in primary THA.

Table 584: Volume of cases by surgeon and site for the Tri-Lock BPS stem in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	69.5 (177.2)	12 (55)
Cases per site	132.9 (312.2)	14 (119)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 585: Descriptive statistics of cases receiving the Tri-Lock BPS stem in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	1772	57.98	
Age (yrs)	3056	65.53(10.37)	66.00(13.00)
Height (cm)	3031	169.43(10.29)	168.00(15.30)
Weight (kg)	3032	86.83(19.94)	85.45(27.55)
BMI(kg/m^2)	3031	30.13(5.86)	29.42(8.24)
Smoking - never (%)	1488	48.69	
Smoking - previous (%)	1190	38.94	
Smoking - current (%)	354	11.58	
Smoking - unknown (%)	24	0.79	

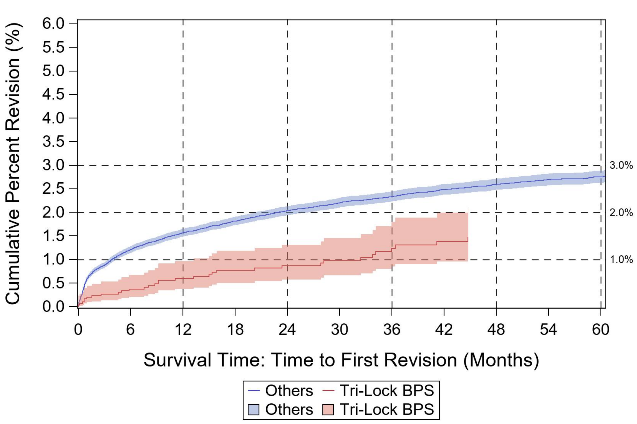

Figure 142: Cumulative percent revision curve for the Tri-Lock BPS stem compared to all other stems in conventional primary THA.

Table 586: Cumulative percent revision and number at risk for Tri-Lock BPS stem in primary THA cases.

Year	Number at risk	CPR
0	3050	0.00 (0.00,0.00)
1	2460	0.60 (0.37,0.97)
2	1939	0.87 (0.58,1.31)
3	1464	1.24 (0.85,1.80)
4*	1007	1.47 (1.02,2.11)
5*	493	1.47 (1.02,2.11)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 587: Reasons for revision following primary THA for Tri-Lock BPS stem cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	10	32.3
2	Aseptic Loosening	8	25.8
3	Joint Infection	6	19.4
4	Peri-prosthetic fracture - Femur	5	16.1
5	Pain	1	3.2
6	Malalignment	1	3.2

Table 588: Reasons for revision in first 90 days following primary THA for Tri-Lock BPS stem cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	4	57.1
2	Dislocation/Instability	3	42.9

Table 589: Reasons for revision between 91 and 365 days following primary THA for Tri-Lock BPS stem cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	3	33.3
2	Dislocation/Instability	3	33.3
3	Joint Infection	3	33.3

Table 590: Distribution of approach used for Tri-Lock BPS stem in primary THA cases.

Approach	N	Percent
Anterior	1412	46.2
Anterolateral	459	15.0
Posterior	1155	37.8
Transtrochanteric	2	0.1
Missing/unknown/other	28	0.9

Table 591: Distribution of head size for Tri-Lock BPS stem in primary THA cases.

Size (mm)	N	Percent
28	12	0.4
32	1355	44.7
36	1531	50.5
40	120	4.0
Missing/unknown/other	11	0.4

Table 592: Distribution of bearing surface for Tri-Lock BPS stem in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	1544	50.5
Ceramic-on-plastic	1425	46.6
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	12	0.4
Missing/unknown/other	75	2.5

Table 593: Distribution of polyethylene used for Tri-Lock BPS stem cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	2992	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

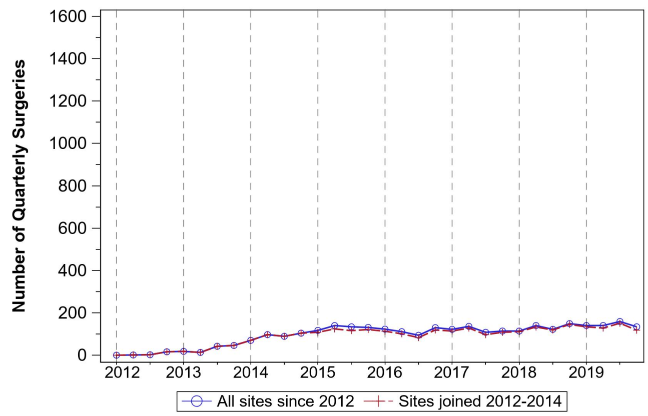

Figure 143: Utilization of the Tri-Lock BPS stem in primary THA.

2.2.6 Revision risk for commonly used cups

Table 594: Summary of cumulative percent revision following primary THA for cups having at least 500 cases, sorted alphabetically.

Cup	N*	1 year	2 years	3 years	4 years	5 years
Continuum	13438	1.71 (1.50,1.95)	2.08 (1.85,2.35)	2.45 (2.19,2.74)	2.76 (2.48,3.08)	2.93 (2.63,3.26)
Converge	532	0.94 (0.39,2.24)	1.32 (0.63,2.74)	1.52 (0.76,3.02)	1.52 (0.76,3.02)	*1.52 (0.76,3.02)*
G7	15220	1.75 (1.55,1.99)	2.23 (1.99,2.52)	2.43 (2.16,2.74)	2.63 (2.30,3.01)	*2.63 (2.30,3.01)*
Pinnacle	15150	1.01 (0.86,1.19)	1.37 (1.18,1.58)	1.63 (1.42,1.87)	1.81 (1.57,2.07)	1.90 (1.65,2.18)
Reflection	547	1.65 (0.86,3.14)	2.21 (1.26,3.87)	2.43 (1.42,4.14)	2.43 (1.42,4.14)	3.08 (1.84,5.12)
Reflection 3	6354	2.24 (1.89,2.66)	2.81 (2.40,3.28)	3.19 (2.74,3.71)	3.42 (2.93,3.99)	3.65 (3.11,4.29)
Regenerex RingLoc+	1017	1.67 (1.04,2.68)	2.07 (1.35,3.16)	2.18 (1.44,3.29)	2.41 (1.62,3.57)	2.61 (1.76,3.88)
RingLoc+	2581	1.62 (1.19,2.19)	2.20 (1.68,2.86)	2.34 (1.81,3.03)	2.57 (2.00,3.30)	*2.57 (2.00,3.30)*
Trabecular Metal	1705	1.63 (1.12,2.36)	2.57 (1.90,3.48)	2.95 (2.21,3.92)	3.22 (2.44,4.25)	3.46 (2.62,4.55)
Trident	28700	1.41 (1.27,1.55)	1.90 (1.74,2.07)	2.24 (2.07,2.43)	2.56 (2.37,2.78)	2.68 (2.47,2.91)
Trident II	4555	2.01 (1.57,2.56)	*2.01 (1.57,2.56)*	*2.01 (1.57,2.56)*	N/A	N/A
Trilogy	1788	1.72 (1.21,2.45)	2.52 (1.87,3.38)	2.86 (2.16,3.78)	2.93 (2.22,3.87)	3.20 (2.44,4.19)

Notes:

* Number of patients that contribute to survival analysis used to compute cumulative percent revision.
** M/L Taper does not include M/L Taper Kinectiv.
A revision risk in *italics* indicates it is the same as it was at the time of the last revision.

Table 595: Summary of cumulative percent revision following primary THA for cups having at least 500 cases, sorted by 5-year cpr.

Cup	N*	1 year	2 years	3 years	4 years	5 years
Converge	532	0.94 (0.39,2.24)	1.32 (0.63,2.74)	1.52 (0.76,3.02)	1.52 (0.76,3.02)	*1.52 (0.76,3.02)*
Pinnacle	15150	1.01 (0.86,1.19)	1.37 (1.18,1.58)	1.63 (1.42,1.87)	1.81 (1.57,2.07)	1.90 (1.65,2.18)
RingLoc+	2581	1.62 (1.19,2.19)	2.20 (1.68,2.86)	2.34 (1.81,3.03)	2.57 (2.00,3.30)	*2.57 (2.00,3.30)*
Regenerex RingLoc+	1017	1.67 (1.04,2.68)	2.07 (1.35,3.16)	2.18 (1.44,3.29)	2.41 (1.62,3.57)	2.61 (1.76,3.88)
G7	15220	1.75 (1.55,1.99)	2.23 (1.99,2.52)	2.43 (2.16,2.74)	2.63 (2.30,3.01)	*2.63 (2.30,3.01)*
Trident	28700	1.41 (1.27,1.55)	1.90 (1.74,2.07)	2.24 (2.07,2.43)	2.56 (2.37,2.78)	2.68 (2.47,2.91)
Continuum	13438	1.71 (1.50,1.95)	2.08 (1.85,2.35)	2.45 (2.19,2.74)	2.76 (2.48,3.08)	2.93 (2.63,3.26)
Reflection	547	1.65 (0.86,3.14)	2.21 (1.26,3.87)	2.43 (1.42,4.14)	2.43 (1.42,4.14)	3.08 (1.84,5.12)
Trilogy	1788	1.72 (1.21,2.45)	2.52 (1.87,3.38)	2.86 (2.16,3.78)	2.93 (2.22,3.87)	3.20 (2.44,4.19)
Trabecular Metal	1705	1.63 (1.12,2.36)	2.57 (1.90,3.48)	2.95 (2.21,3.92)	3.22 (2.44,4.25)	3.46 (2.62,4.55)
Reflection 3	6354	2.24 (1.89,2.66)	2.81 (2.40,3.28)	3.19 (2.74,3.71)	3.42 (2.93,3.99)	3.65 (3.11,4.29)

Notes:

* Number of patients that contribute to survival analysis used to compute cumulative percent revision.
** M/L Taper does not include M/L Taper Kinectiv.
A revision risk in *italics* indicates it is the same as it was at the time of the last revision.

We remind readers to be cautious in interpreting CPR values when the number at risk is low.

Continuum
N=13456

115 surgeons across 39 sites use this implant in primary THA.

Table 596: Volume of cases by surgeon and site for the Continuum cup in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	117.0 (263.0)	23 (81)
Cases per site	345.0 (609.7)	96 (364)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 597: Descriptive statistics of cases receiving the Continuum cup in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	7165	53.25	
Age (yrs)	13456	64.94(10.97)	65.00(15.00)
Height (cm)	13335	170.02(10.49)	170.00(15.24)
Weight (kg)	13334	87.59(20.80)	86.00(27.50)
BMI(kg/m^2)	13334	30.16(6.05)	29.42(7.84)
Smoking - never (%)	6627	49.25	
Smoking - previous (%)	5201	38.65	
Smoking - current (%)	1601	11.9	
Smoking - unknown (%)	27	0.2	

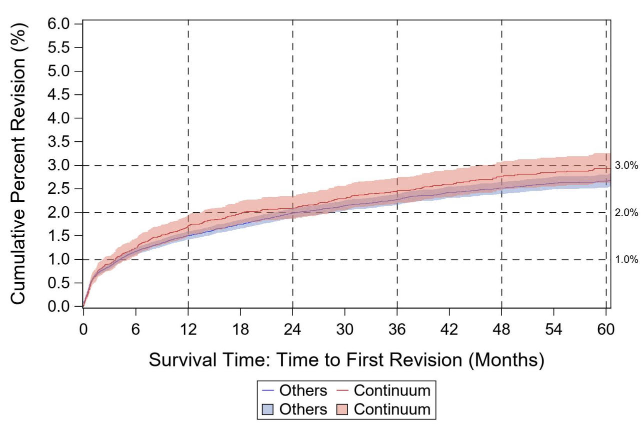

Figure 144: Cumulative percent revision curve for the Continuum cup compared to all other cups in conventional primary THA.

Table 598: Cumulative percent revision and number at risk for Continuum cup in primary THA cases.

Year	Number at risk	CPR
0	13438	0.00 (0.00,0.00)
1	12199	1.71 (1.50,1.95)
2	10889	2.08 (1.85,2.35)
3	9151	2.45 (2.19,2.74)
4	7115	2.76 (2.48,3.08)
5	4614	2.93 (2.63,3.26)

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.062 (0.897,1.259). It was 1.231 (1.127,1.347) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 599: Reasons for revision following primary THA for Continuum cup cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	87	28.3
2	Peri-prosthetic fracture - Femur	65	21.2
3	Aseptic Loosening	51	16.6
4	Joint Infection	46	15.0
5	Pain	28	9.1
6	Malalignment	13	4.2
7	Component fracture/failure	10	3.3
8	Peri-prosthetic fracture - Acetabulum	4	1.3
9	Metal reaction/Metallosis	2	0.7
10	Poly liner wear	1	0.3

Table 600: Reasons for revision in first 90 days following primary THA for Continuum cup cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	50	46.3
2	Dislocation/Instability	30	27.8
3	Joint Infection	9	8.3
4	Aseptic Loosening	6	5.6
5	Pain	4	3.7
6	Component fracture/failure	3	2.8
7	Peri-prosthetic fracture - Acetabulum	3	2.8
8	Malalignment	3	2.8

Table 601: Reasons for revision between 91 and 365 days following primary THA for Continuum cup cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	23	29.1
2	Joint Infection	19	24.1
3	Aseptic Loosening	15	19.0
4	Pain	9	11.4
5	Malalignment	5	6.3
6	Component fracture/failure	4	5.1
7	Peri-prosthetic fracture - Femur	4	5.1

Table 602: Distribution of approach used for Continuum cup in primary THA cases.

Approach	N	Percent
Anterior	4189	31.1
Anterolateral	2516	18.7
Posterior	6489	48.2
Transtrochanteric	84	0.6
Missing/unknown/other	178	1.3

Table 603: Distribution of head size for Continuum cup in primary THA cases.

Size (mm)	N	Percent
28	58	0.4
32	3044	22.8
36	9123	68.2
40	1027	7.7
Missing/unknown/other	123	0.9

Table 604: Distribution of bearing surface for Continuum cup in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	4593	34.1
Ceramic-on-plastic	8656	64.3
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	207	1.5

Table 605: Distribution of polyethylene used for Continuum cup cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	1	0.0
XLPE	8612	64.4
Antioxidant XLPE	4759	35.6
Missing/unknown/other	0	0.0

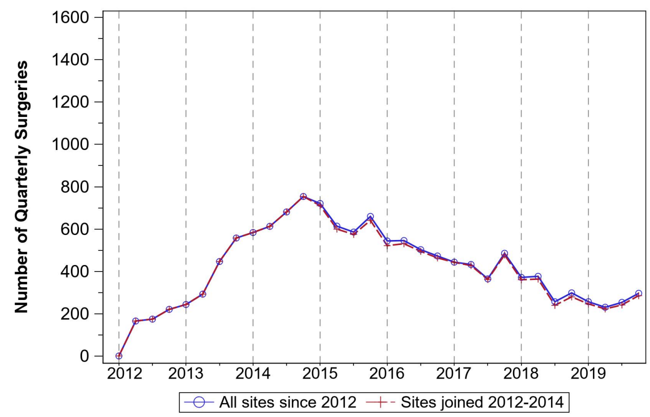

Figure 145: Utilization of the Continuum cup in primary THA.

Converge
N=534

Fewer then 10 surgeons use this this implant at fewer than ten 10 sites in primary THA.

Table 606: Volume of cases by surgeon and site for the Converge cup in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	59.3 (96.5)	37 (45)
Cases per site	66.8 (85.4)	33 (126.5)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 607: Descriptive statistics of cases receiving the Converge cup in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	309	57.87	
Age (yrs)	534	67.63(11.19)	67.00(16.00)
Height (cm)	534	168.72(10.23)	167.64(16.51)
Weight (kg)	534	86.59(20.88)	83.91(28.70)
BMI(kg/m^2)	534	30.26(6.06)	29.57(8.47)
Smoking - never (%)	246	46.07	
Smoking - previous (%)	232	43.45	
Smoking - current (%)	56	10.49	
Smoking - unknown (%)	0	0.0	

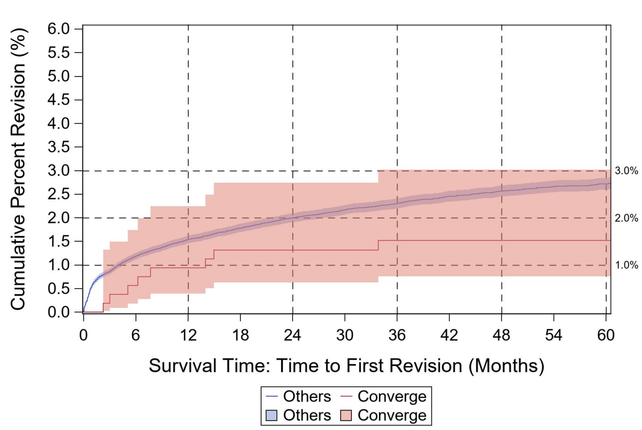

Figure 146: Cumulative percent revision curve for the Converge cup compared to all other cups in conventional primary THA.

Table 608: Cumulative percent revision and number at risk for Converge cup in primary THA cases.

Year	Number at risk	CPR
0	532	0.00 (0.00,0.00)
1	527	0.94 (0.39,2.24)
2	525	1.32 (0.63,2.74)
3	461	1.52 (0.76,3.02)
4	336	1.52 (0.76,3.02)
5	190	1.52 (0.76,3.02)

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.708 (0.333,1.506). It was 1.231 (1.127,1.346) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 609: Reasons for revision following primary THA for Converge cup cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	3	42.9
2	Joint Infection	3	42.9
3	Aseptic Loosening	1	14.3

Table 610: Reasons for revision in first 90 days following primary THA for Converge cup cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	1	100.0

Table 611: Reasons for revision between 91 and 365 days following primary THA for Converge cup cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	1	50.0
2	Joint Infection	1	50.0

Table 612: Distribution of approach used for Converge cup in primary THA cases.

Approach	N	Percent
Anterior	4	0.8
Anterolateral	403	75.5
Posterior	120	22.5
Transtrochanteric	4	0.8
Missing/unknown/other	3	0.6

Table 613: Distribution of head size for Converge cup in primary THA cases.

Size (mm)	N	Percent
28	3	0.6
32	393	73.9
44	13	2.4
Missing/unknown/other	123	23.1

Table 614: Distribution of bearing surface for Converge cup in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	249	46.6
Ceramic-on-plastic	281	52.6
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	4	0.8

Table 615: Distribution of polyethylene used for Converge cup cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	532	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

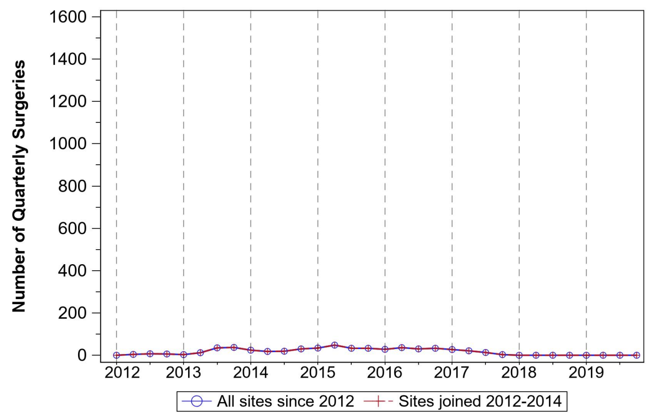

Figure 147: Utilization of the Converge cup in primary THA.

G7

N=15243

134 surgeons across 54 sites use this implant in primary THA.

Table 616: Volume of cases by surgeon and site for the G7 cup in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	113.8 (181.9)	24 (142)
Cases per site	282.3 (315.5)	134 (494)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 617: Descriptive statistics of cases receiving the G7 cup in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	8333	54.67	
Age (yrs)	15243	64.77(11.02)	65.00(14.00)
Height (cm)	15000	169.73(10.57)	170.00(15.24)
Weight (kg)	15000	88.59(20.79)	87.00(28.00)
BMI(kg/m^2)	15000	30.63(6.19)	29.95(8.24)
Smoking - never (%)	7317	48	
Smoking - previous (%)	5815	38.15	
Smoking - current (%)	2068	13.57	
Smoking - unknown (%)	43	0.28	

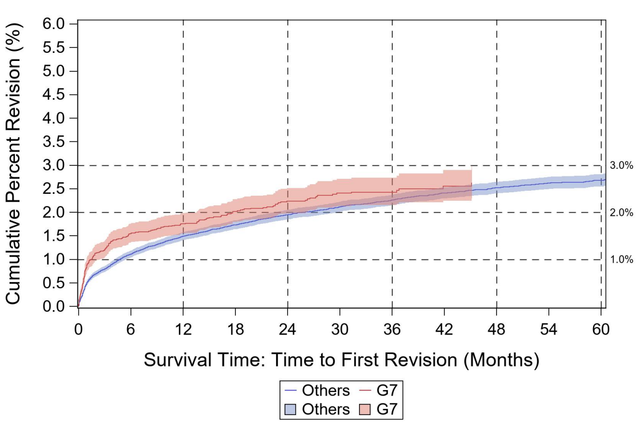

Figure 148: Cumulative percent revision curve for the G7 cup compared to all other cups in conventional primary THA.

Table 618: Cumulative percent revision and number at risk for G7 cup in primary THA cases.

Year	Number at risk	CPR
0	15220	0.00 (0.00,0.00)
1	10099	1.75 (1.55,1.99)
2	6142	2.23 (1.99,2.52)
3	2972	2.43 (2.16,2.74)
4*	924	2.63 (2.30,3.01)
5*	221	2.63 (2.30,3.01)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 619: Reasons for revision following primary THA for G7 cup cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	93	31.1
2	Dislocation/Instability	74	24.7
3	Joint Infection	44	14.7
4	Aseptic Loosening	41	13.7
5	Component fracture/failure	20	6.7
6	Pain	13	4.3
7	Malalignment	10	3.3
8	Peri-prosthetic fracture - Acetabulum	4	1.3

Table 620: Reasons for revision in first 90 days following primary THA for G7 cup cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	87	49.7
2	Dislocation/Instability	34	19.4
3	Component fracture/failure	17	9.7
4	Joint Infection	15	8.6
5	Aseptic Loosening	10	5.7
6	Malalignment	6	3.4
7	Peri-prosthetic fracture - Acetabulum	4	2.3
8	Pain	2	1.1

Table 621: Reasons for revision between 91 and 365 days following primary THA for G7 cup cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	28	39.4
2	Joint Infection	19	26.8
3	Aseptic Loosening	12	16.9
4	Pain	5	7.0
5	Component fracture/failure	3	4.2
6	Peri-prosthetic fracture - Femur	3	4.2
7	Malalignment	1	1.4

Table 622: Distribution of approach used for G7 cup in primary THA cases.

Approach	N	Percent
Anterior	5238	34.4
Anterolateral	2501	16.4
Posterior	7216	47.3
Transtrochanteric	22	0.1
Missing/unknown/other	266	1.8

Table 623: Distribution of head size for G7 cup in primary THA cases.

Size (mm)	N	Percent
28	19	0.1
32	1466	10.2
36	9920	69.1
40	2878	20.1
44	4	0.0
Missing/unknown/other	67	0.5

Table 624: Distribution of bearing surface for G7 cup in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	3020	19.8
Ceramic-on-plastic	11268	73.9
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	813	5.3
Missing/unknown/other	142	0.9

Table 625: Distribution of polyethylene used for G7 cup cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	5990	39.5
Antioxidant XLPE	9168	60.5
Missing/unknown/other	0	0.0

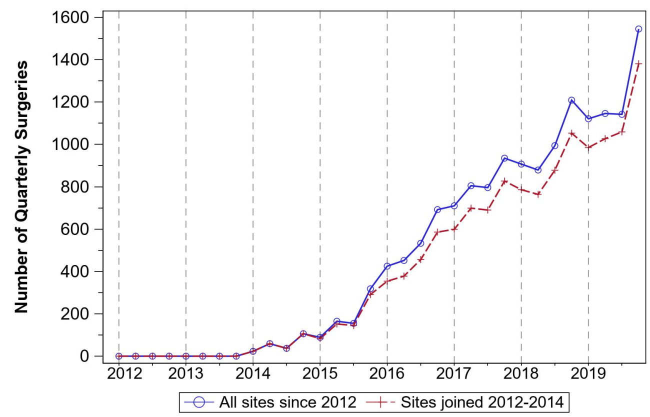

Figure 149: Utilization of the G7 cup in primary THA.

Pinnacle
N=15179

131 surgeons across 44 sites use this implant in primary THA.

Table 626: Volume of cases by surgeon and site for the Pinnacle cup in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	115.9 (221.1)	18 (158)
Cases per site	345.0 (551.6)	78 (369.5)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 627: Descriptive statistics of cases receiving the Pinnacle cup in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	8801	57.98	
Age (yrs)	15179	65.56(10.87)	66.00(14.00)
Height (cm)	14892	169.40(10.42)	168.00(15.24)
Weight (kg)	14894	88.31(21.20)	86.18(28.60)
BMI(kg/m^2)	14892	30.65(6.31)	29.86(8.34)
Smoking - never (%)	7067	46.56	
Smoking - previous (%)	5936	39.11	
Smoking - current (%)	2140	14.1	
Smoking - unknown (%)	36	0.24	

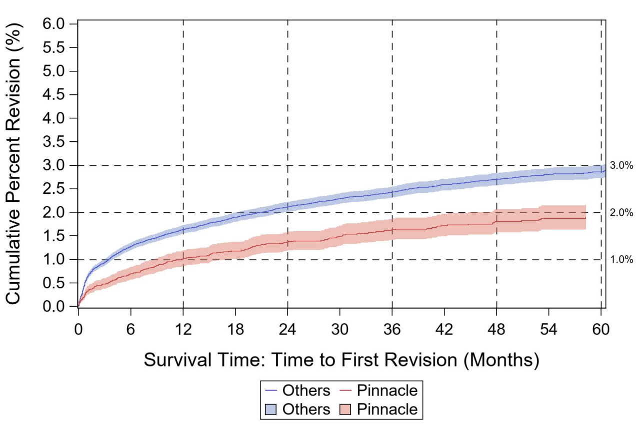

Figure 150: Cumulative percent revision curve for the Pinnacle cup compared to all other cups in conventional primary THA.

Table 628: Cumulative percent revision and number at risk for Pinnacle cup in primary THA cases.

Year	Number at risk	CPR
0	15150	0.00 (0.00,0.00)
1	12378	1.01 (0.86,1.19)
2	9873	1.37 (1.18,1.58)
3	7554	1.63 (1.42,1.87)
4	5310	1.81 (1.57,2.07)
5*	3098	1.90 (1.65,2.18)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.615 (0.51,0.742). It was 1.238 (1.133,1.353) and 0.999 (0.996,1.004) for sex (female) and age, respectively.

Table 629: Reasons for revision following primary THA for Pinnacle cup cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	55	26.6
2	Joint Infection	49	23.7
3	Aseptic Loosening	40	19.3
4	Peri-prosthetic fracture - Femur	34	16.4
5	Pain	11	5.3
6	Component fracture/failure	7	3.4
7	Malalignment	5	2.4
8	Peri-prosthetic fracture - Acetabulum	4	1.9
9	Poly liner wear	1	0.5
10	Metal reaction/Metallosis	1	0.5

Table 630: Reasons for revision in first 90 days following primary THA for Pinnacle cup cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	30	45.5
2	Dislocation/Instability	17	25.8
3	Joint Infection	7	10.6
4	Aseptic Loosening	6	9.1
5	Component fracture/failure	3	4.5
6	Peri-prosthetic fracture - Acetabulum	2	3.0
7	Malalignment	1	1.5

Table 631: Reasons for revision between 91 and 365 days following primary THA for Pinnacle cup cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	24	38.1
2	Dislocation/Instability	22	34.9
3	Aseptic Loosening	9	14.3
4	Pain	3	4.8
5	Peri-prosthetic fracture - Acetabulum	2	3.2
6	Component fracture/failure	1	1.6
7	Peri-prosthetic fracture - Femur	1	1.6
8	Malalignment	1	1.6

Table 632: Distribution of approach used for Pinnacle cup in primary THA cases.

Approach	N	Percent
Anterior	5077	33.5
Anterolateral	4868	32.1
Posterior	4850	31.9
Transtrochanteric	54	0.4
Missing/unknown/other	330	2.2

Table 633: Distribution of head size for Pinnacle cup in primary THA cases.

Size (mm)	N	Percent
22	5	0.0
28	123	0.8
32	4156	27.5
36	9888	65.5
40	832	5.5
44	43	0.3
Missing/unknown/other	57	0.4

Table 634: Distribution of bearing surface for Pinnacle cup in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	6727	44.3
Ceramic-on-plastic	8209	54.1
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	243	1.6

Table 635: Distribution of polyethylene used for Pinnacle cup cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	14988	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

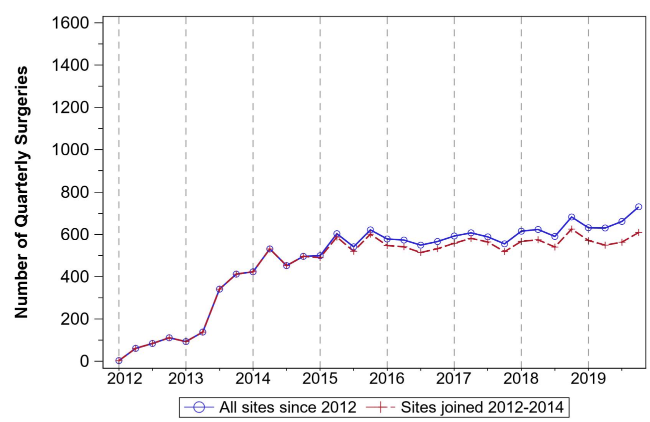

Figure 151: Utilization of the Pinnacle cup in primary THA.

Reflection

N=548

Fewer then 10 surgeons use this this implant at fewer than ten 10 sites in primary THA.

Table 636: Volume of cases by surgeon and site for the Reflection cup in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	60.9 (68.9)	19 (99)
Cases per site	91.3 (138.8)	12.5 (188)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 637: Descriptive statistics of cases receiving the Reflection cup in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	324	59.12	
Age (yrs)	548	68.65(10.88)	69.00(17.00)
Height (cm)	548	168.56(10.41)	167.64(15.24)
Weight (kg)	548	86.90(21.53)	84.60(27.80)
BMI(kg/m^2)	548	30.44(6.44)	29.89(7.84)
Smoking - never (%)	271	49.45	
Smoking - previous (%)	211	38.5	
Smoking - current (%)	64	11.68	
Smoking - unknown (%)	2	0.36	

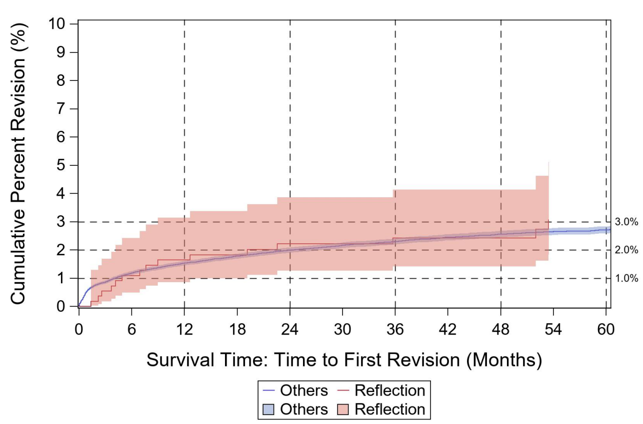

Figure 152: Cumulative percent revision curve for the Reflection cup compared to all other cups in conventional primary THA.

Table 638: Cumulative percent revision and number at risk for Reflection cup in primary THA cases.

Year	Number at risk	CPR
0	547	0.00 (0.00,0.00)
1	531	1.65 (0.86,3.14)
2	507	2.21 (1.26,3.87)
3	459	2.43 (1.42,4.14)
4	355	2.43 (1.42,4.14)
5*	225	3.08 (1.84,5.12)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.908 (0.468,1.766). It was 1.231 (1.127,1.346) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 639: Reasons for revision following primary THA for Reflection cup cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	6	46.2
2	Aseptic Loosening	3	23.1
3	Pain	2	15.4
4	Joint Infection	1	7.7
5	Peri-prosthetic fracture - Femur	1	7.7

Table 640: Reasons for revision in first 90 days following primary THA for Reflection cup cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	3	100.0

Table 641: Reasons for revision between 91 and 365 days following primary THA for Reflection cup cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	3	60.0
2	Joint Infection	1	20.0
3	Pain	1	20.0

Table 642: Distribution of approach used for Reflection cup in primary THA cases.

Approach	N	Percent
Anterior	11	2.0
Anterolateral	10	1.8
Posterior	524	95.6
Transtrochanteric	1	0.2
Missing/unknown/other	2	0.4

Table 643: Distribution of head size for Reflection cup in primary THA cases.

Size (mm)	N	Percent
28	18	3.4
32	357	66.6
36	154	28.7
Missing/unknown/other	7	1.3

Table 644: Distribution of bearing surface for Reflection cup in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	333	60.8
Ceramic-on-plastic	203	37.0
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	12	2.2

Table 645: Distribution of polyethylene used for Reflection cup cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	48	8.8
XLPE	344	63.2
Antioxidant XLPE	0	0.0
Missing/unknown/other	152	27.9

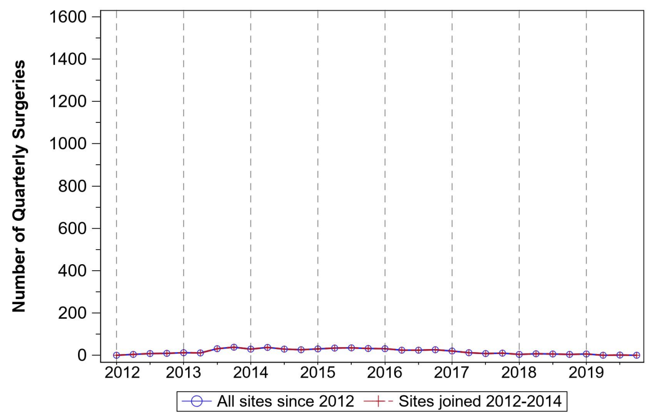

Figure 153: Utilization of the Reflection cup in primary THA.

Reflection 3

N=6371

79 surgeons across 43 sites use this implant in primary THA.

Table 646: Volume of cases by surgeon and site for the Reflection 3 cup in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	80.7 (120.4)	30 (98)
Cases per site	148.2 (192.8)	62 (167)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 647: Descriptive statistics of cases receiving the Reflection 3 cup in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	3355	52.66	
Age (yrs)	6371	64.99(11.12)	65.00(15.00)
Height (cm)	6370	169.76(10.50)	170.00(15.24)
Weight (kg)	6370	90.80(22.41)	88.50(29.46)
BMI(kg/m^2)	6370	31.38(6.69)	30.49(8.75)
Smoking - never (%)	2875	45.13	
Smoking - previous (%)	2442	38.33	
Smoking - current (%)	1032	16.2	
Smoking - unknown (%)	22	0.35	

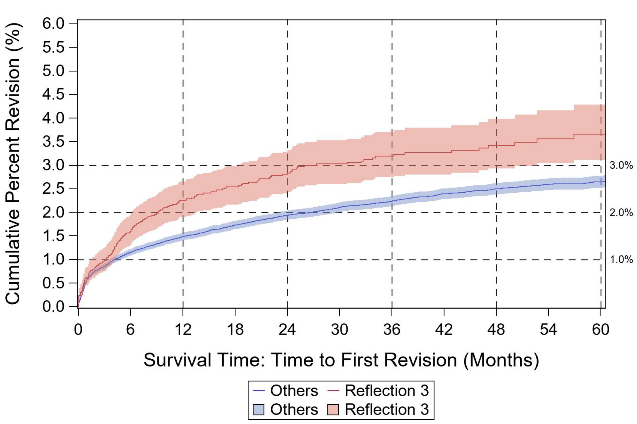

Figure 154: Cumulative percent revision curve for the Reflection 3 cup compared to all other cups in conventional primary THA.

Table 648: Cumulative percent revision and number at risk for Reflection 3 cup in primary THA cases.

Year	Number at risk	CPR
0	6354	0.00 (0.00,0.00)
1	4903	2.24 (1.89,2.66)
2	3692	2.81 (2.40,3.28)
3	2711	3.19 (2.74,3.71)
4	1599	3.42 (2.93,3.99)
5	868	3.65 (3.11,4.29)

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.387 (1.128,1.707). It was 1.233 (1.129,1.349) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 649: Reasons for revision following primary THA for Reflection 3 cup cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	51	30.7
2	Joint Infection	33	19.9
3	Peri-prosthetic fracture - Femur	31	18.7
4	Aseptic Loosening	24	14.5
5	Component fracture/failure	9	5.4
6	Malalignment	8	4.8
7	Pain	7	4.2
8	Peri-prosthetic fracture - Acetabulum	2	1.2
9	Metal reaction/Metallosis	1	0.6

Table 650: Reasons for revision in first 90 days following primary THA for Reflection 3 cup cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	26	46.4
2	Dislocation/Instability	14	25.0
3	Component fracture/failure	5	8.9
4	Joint Infection	4	7.1
5	Malalignment	3	5.4
6	Aseptic Loosening	2	3.6
7	Peri-prosthetic fracture - Acetabulum	2	3.6

Table 651: Reasons for revision between 91 and 365 days following primary THA for Reflection 3 cup cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	24	37.5
2	Joint Infection	19	29.7
3	Aseptic Loosening	11	17.2
4	Pain	4	6.3
5	Peri-prosthetic fracture - Femur	3	4.7
6	Component fracture/failure	2	3.1
7	Malalignment	1	1.6

Table 652: Distribution of approach used for Reflection 3 cup in primary THA cases.

Approach	N	Percent
Anterior	2706	42.5
Anterolateral	1791	28.1
Posterior	1839	28.9
Transtrochanteric	19	0.3
Missing/unknown/other	16	0.3

Table 653: Distribution of head size for Reflection 3 cup in primary THA cases.

Size (mm)	N	Percent
22	7	0.1
28	77	1.2
32	1548	24.3
36	4310	67.8
40	372	5.8
44	17	0.3
Missing/unknown/other	30	0.5

Table 654: Distribution of bearing surface for Reflection 3 cup in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	1492	23.4
Ceramic-on-plastic	4840	76.0
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	39	0.6

Table 655: Distribution of polyethylene used for Reflection 3 cup cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	6	0.1
XLPE	6354	99.9
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

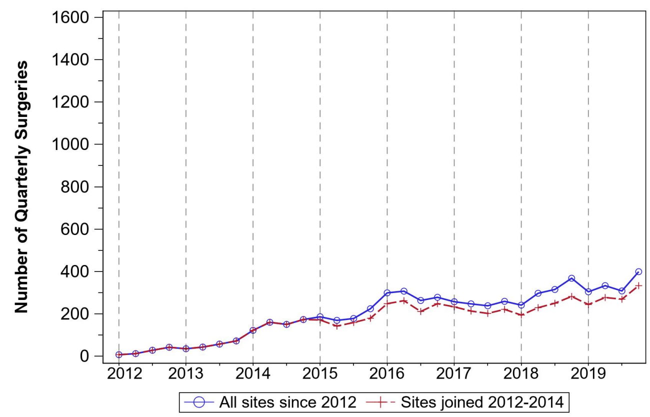

Figure 155: Utilization of the Reflection 3 cup in primary THA.

Regenerex RingLoc+
N=1023

30 surgeons across 21 sites use this implant in primary THA.

Table 656: Volume of cases by surgeon and site for the Regenerex RingLoc+ cup in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	34.1 (56.2)	5 (40)
Cases per site	48.7 (78.6)	16 (26)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 657: Descriptive statistics of cases receiving the Regenerex RingLoc+ cup in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	546	53.37	
Age (yrs)	1023	64.32(11.47)	64.00(15.00)
Height (cm)	1023	169.92(10.58)	170.18(15.50)
Weight (kg)	1023	90.41(22.51)	88.50(29.70)
BMI(kg/m^2)	1023	31.23(7.05)	30.39(9.19)
Smoking - never (%)	395	38.61	
Smoking - previous (%)	386	37.73	
Smoking - current (%)	238	23.26	
Smoking - unknown (%)	4	0.39	

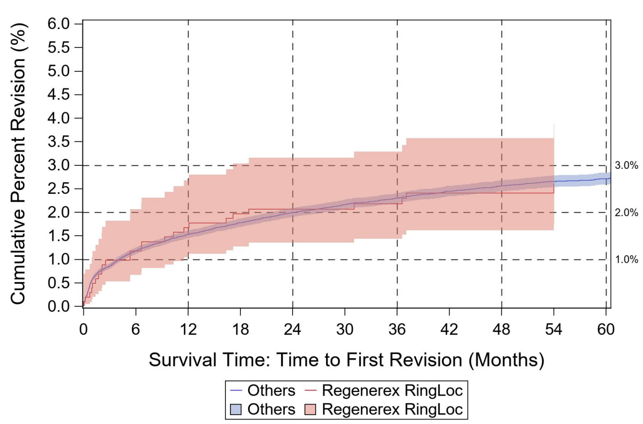

Figure 156: Cumulative percent revision curve for the Regenerex RingLoc+ cup compared to all other cups in conventional primary THA.

Table 658: Cumulative percent revision and number at risk for Regenerex RingLoc+ cup in primary THA cases.

Year	Number at risk	CPR
0	1017	0.00 (0.00,0.00)
1	995	1.67 (1.04,2.68)
2	963	2.07 (1.35,3.16)
3	858	2.18 (1.44,3.29)
4	616	2.41 (1.62,3.57)
5*	308	2.61 (1.76,3.88)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.819 (0.51,1.316). It was 1.231 (1.127,1.346) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 659: Reasons for revision following primary THA for Regenerex RingLoc+ cup cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	7	28.0
2	Peri-prosthetic fracture - Femur	6	24.0
3	Dislocation/Instability	4	16.0
4	Joint Infection	3	12.0
5	Pain	2	8.0
6	Malalignment	2	8.0
7	Component fracture/failure	1	4.0

Table 660: Reasons for revision in first 90 days following primary THA for Regenerex RingLoc+ cup cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	6	60.0
2	Aseptic Loosening	2	20.0
3	Dislocation/Instability	1	10.0
4	Malalignment	1	10.0

Table 661: Reasons for revision between 91 and 365 days following primary THA for Regenerex RingLoc+ cup cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	2	28.6
2	Dislocation/Instability	2	28.6
3	Joint Infection	2	28.6
4	Pain	1	14.3

Table 662: Distribution of approach used for Regenerex RingLoc+ cup in primary THA cases.

Approach	N	Percent
Anterior	101	9.9
Anterolateral	449	43.9
Posterior	466	45.5
Transtrochanteric	2	0.2
Missing/unknown/other	5	0.5

Table 663: Distribution of head size for Regenerex RingLoc+ cup in primary THA cases.

Size (mm)	N	Percent
28	7	0.7
32	111	10.9
36	593	58.3
40	295	29.0
44	1	0.1
Missing/unknown/other	11	1.1

Table 664: Distribution of bearing surface for Regenerex RingLoc+ cup in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	648	63.3
Ceramic-on-plastic	359	35.1
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	16	1.6

Table 665: Distribution of polyethylene used for Regenerex RingLoc+ cup cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	6	0.6
XLPE	286	28.1
Antioxidant XLPE	726	71.3
Missing/unknown/other	0	0.0

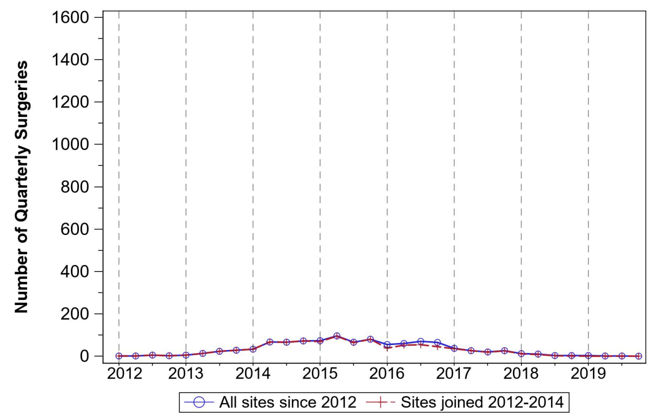

Figure 157: Utilization of the Regenerex RingLoc+ cup in primary THA.

RingLoc+
N=2589

43 surgeons across 23 sites use this implant in primary THA.

Table 666: Volume of cases by surgeon and site for the RingLoc+ cup in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	60.2 (104.4)	4 (93)
Cases per site	112.6 (144.5)	33 (164)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 667: Descriptive statistics of cases receiving the RingLoc+ cup in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	1383	53.42	
Age (yrs)	2589	65.91(10.55)	66.00(14.00)
Height (cm)	2589	170.12(10.42)	170.00(15.24)
Weight (kg)	2589	89.79(21.47)	87.70(27.69)
BMI(kg/m^2)	2589	30.90(6.35)	30.12(8.39)
Smoking - never (%)	1225	47.32	
Smoking - previous (%)	1010	39.01	
Smoking - current (%)	322	12.44	
Smoking - unknown (%)	32	1.24	

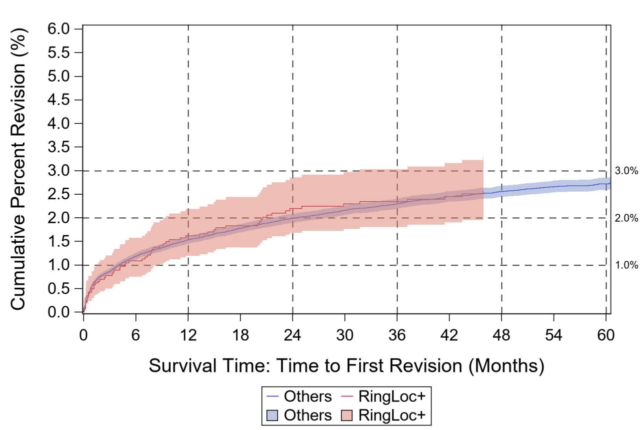

Figure 158: Cumulative percent revision curve for the RingLoc+ cup compared to all other cups in conventional primary THA.

Table 668: Cumulative percent revision and number at risk for RingLoc+ cup in primary THA cases.

Year	Number at risk	CPR
0	2581	0.00 (0.00,0.00)
1	2347	1.62 (1.19,2.19)
2	2112	2.20 (1.68,2.86)
3	1855	2.34 (1.81,3.03)
4*	1508	2.57 (2.00,3.30)
5*	838	2.57 (2.00,3.30)

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 0.802 (0.585,1.101). It was 1.23 (1.126,1.345) and 1.0 (0.996,1.004) for sex (female) and age, respectively.

Table 669: Reasons for revision following primary THA for RingLoc+ cup cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	15	28.8
2	Joint Infection	14	26.9
3	Peri-prosthetic fracture - Femur	9	17.3
4	Aseptic Loosening	6	11.5
5	Component fracture/failure	4	7.7
6	Pain	4	7.7

Table 670: Reasons for revision in first 90 days following primary THA for RingLoc+ cup cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	8	47.1
2	Dislocation/Instability	4	23.5
3	Aseptic Loosening	2	11.8
4	Joint Infection	1	5.9
5	Component fracture/failure	1	5.9
6	Pain	1	5.9

Table 671: Reasons for revision between 91 and 365 days following primary THA for RingLoc+ cup cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	9	60.0
2	Dislocation/Instability	3	20.0
3	Component fracture/failure	2	13.3
4	Pain	1	6.7

Table 672: Distribution of approach used for RingLoc+ cup in primary THA cases.

Approach	N	Percent
Anterior	521	20.1
Anterolateral	817	31.6
Posterior	1228	47.4
Transtrochanteric	10	0.4
Missing/unknown/other	13	0.5

Table 673: Distribution of head size for RingLoc+ cup in primary THA cases.

Size (mm)	N	Percent
32	258	10.0
36	1535	59.7
40	650	25.3
44	101	3.9
Missing/unknown/other	29	1.1

Table 674: Distribution of bearing surface for RingLoc+ cup in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	1444	55.8
Ceramic-on-plastic	1099	42.5
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	46	1.8

Table 675: Distribution of polyethylene used for RingLoc+ cup cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	27	1.1
XLPE	220	8.6
Antioxidant XLPE	2326	90.4
Missing/unknown/other	0	0.0

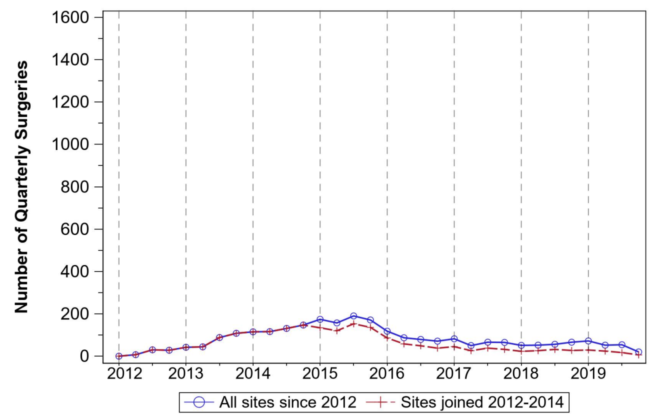

Figure 159: Utilization of the RingLoc+ cup in primary THA.

Trabecular Metal
N=1709

52 surgeons across 22 sites use this implant in primary THA.

Table 676: Volume of cases by surgeon and site for the Trabecular Metal cup in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	32.9 (86.6)	2 (11)
Cases per site	77.7 (124.9)	18.5 (59)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 677: Descriptive statistics of cases receiving the Trabecular Metal cup in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	967	56.58	
Age (yrs)	1709	65.13(11.16)	65.00(15.00)
Height (cm)	1704	168.92(10.80)	168.00(17.78)
Weight (kg)	1703	88.22(21.67)	86.64(29.49)
BMI(kg/m^2)	1703	30.91(7.78)	29.76(9.07)
Smoking - never (%)	701	41.02	
Smoking - previous (%)	658	38.5	
Smoking - current (%)	346	20.25	
Smoking - unknown (%)	4	0.23	

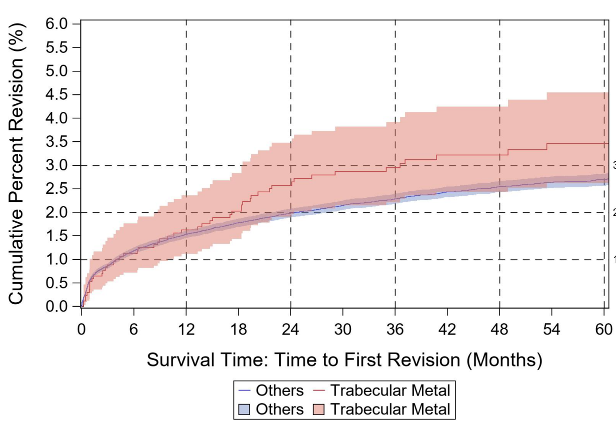

Figure 160: Cumulative percent revision curve for the Trabecular Metal cup compared to all other cups in conventional primary THA.

Table 678: Cumulative percent revision and number at risk for Trabecular Metal cup in primary THA cases.

Year	Number at risk	CPR
0	1705	0.00 (0.00,0.00)
1	1535	1.63 (1.12,2.36)
2	1359	2.57 (1.90,3.48)
3	1154	2.95 (2.21,3.92)
4	853	3.22 (2.44,4.25)
5	670	3.46 (2.62,4.55)

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.177 (0.805,1.723). It was 1.231 (1.126,1.346) and 0.999 (0.996,1.004) for sex (female) and age, respectively.

Table 679: Reasons for revision following primary THA for Trabecular Metal cup cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	10	22.2
2	Peri-prosthetic fracture - Femur	9	20.0
3	Aseptic Loosening	7	15.6
4	Joint Infection	5	11.1
5	Component fracture/failure	5	11.1
6	Pain	4	8.9
7	Malalignment	3	6.7
8	Osteolysis	1	2.2
9	Metal reaction/Metallosis	1	2.2

Table 680: Reasons for revision in first 90 days following primary THA for Trabecular Metal cup cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	7	50.0
2	Peri-prosthetic fracture - Femur	6	42.9
3	Aseptic Loosening	1	7.1

Table 681: Reasons for revision between 91 and 365 days following primary THA for Trabecular Metal cup cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	3	33.3
2	Joint Infection	2	22.2
3	Component fracture/failure	2	22.2
4	Pain	1	11.1
5	Malalignment	1	11.1

Table 682: Distribution of approach used for Trabecular Metal cup in primary THA cases.

Approach	N	Percent
Anterior	28	1.6
Anterolateral	713	41.7
Posterior	896	52.4
Transtrochanteric	53	3.1
Missing/unknown/other	19	1.1

Table 683: Distribution of head size for Trabecular Metal cup in primary THA cases.

Size (mm)	N	Percent
22	3	0.2
28	47	2.8
32	741	43.8
36	808	47.8
40	70	4.1
Missing/unknown/other	22	1.3

Table 684: Distribution of bearing surface for Trabecular Metal cup in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	1020	59.7
Ceramic-on-plastic	649	38.0
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	1	0.1
Missing/unknown/other	39	2.3

Table 685: Distribution of polyethylene used for Trabecular Metal cup cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	3	0.2
XLPE	1685	99.6
Antioxidant XLPE	4	0.2
Missing/unknown/other	0	0.0

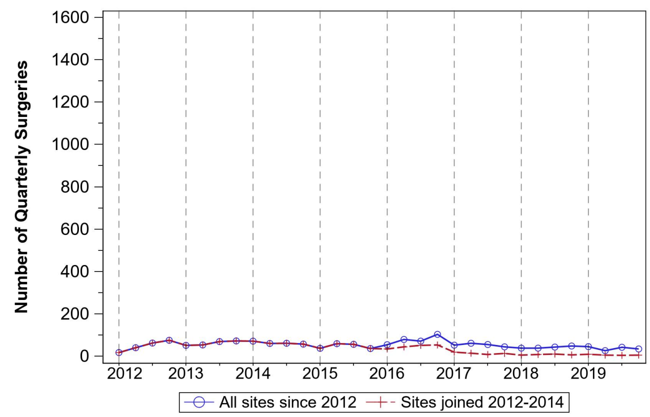

Figure 161: Utilization of the Trabecular Metal cup in primary THA.

Trident
N=28743

167 surgeons across 54 sites use this implant in primary THA.

Table 686: Volume of cases by surgeon and site for the Trident cup in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	172.1 (309.4)	35 (183)
Cases per site	532.3 (805.7)	153 (687)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 687: Descriptive statistics of cases receiving the Trident cup in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	15705	54.64	
Age (yrs)	28743	64.53(11.43)	65.00(15.00)
Height (cm)	28743	169.75(10.40)	170.00(15.24)
Weight (kg)	28743	88.01(21.09)	86.18(28.18)
BMI(kg/m^2)	28743	30.42(6.28)	29.74(8.26)
Smoking - never (%)	13758	47.87	
Smoking - previous (%)	10923	38	
Smoking - current (%)	3865	13.45	
Smoking - unknown (%)	197	0.69	

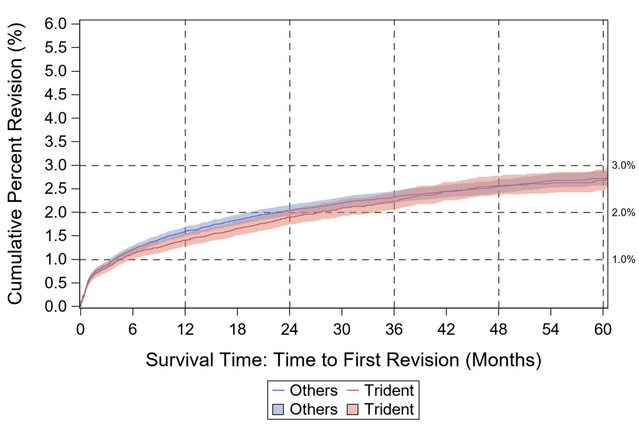

Figure 162: Cumulative percent revision curve for the Trident cup compared to all other cups in conventional primary THA.

Table 688: Cumulative percent revision and number at risk for Trident cup in primary THA cases.

Year	Number at risk	CPR
0	28700	0.00 (0.00,0.00)
1	25567	1.41 (1.27,1.55)
2	20912	1.90 (1.74,2.07)
3	15522	2.24 (2.07,2.43)
4	10089	2.56 (2.37,2.78)
5	5746	2.68 (2.47,2.91)

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 689: Reasons for revision following primary THA for Trident cup cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	159	26.2
2	Aseptic Loosening	136	22.4
3	Joint Infection	109	17.9
4	Dislocation/Instability	100	16.4
5	Pain	31	5.1
6	Component fracture/failure	26	4.3
7	Metal reaction/Metallosis	17	2.8
8	Malalignment	16	2.6
9	Peri-prosthetic fracture - Acetabulum	13	2.1
10	Osteolysis	1	0.2

Table 690: Reasons for revision in first 90 days following primary THA for Trident cup cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	122	54.5
2	Dislocation/Instability	37	16.5
3	Joint Infection	25	11.2
4	Aseptic Loosening	17	7.6
5	Component fracture/failure	10	4.5
6	Peri-prosthetic fracture - Acetabulum	5	2.2
7	Pain	4	1.8
8	Malalignment	4	1.8

Table 691: Reasons for revision between 91 and 365 days following primary THA for Trident cup cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	43	31.6
2	Dislocation/Instability	31	22.8
3	Aseptic Loosening	23	16.9
4	Peri-prosthetic fracture - Femur	14	10.3
5	Pain	14	10.3
6	Component fracture/failure	4	2.9
7	Malalignment	4	2.9
8	Peri-prosthetic fracture - Acetabulum	3	2.2

Table 692: Distribution of approach used for Trident cup in primary THA cases.

Approach	N	Percent
Anterior	6641	23.1
Anterolateral	5909	20.6
Posterior	16055	55.9
Transtrochanteric	49	0.2
Missing/unknown/other	89	0.3

Table 693: Distribution of head size for Trident cup in primary THA cases.

Size (mm)	N	Percent
22	17	0.1
28	70	0.3
32	5048	19.2
36	19020	72.2
40	1954	7.4
44	149	0.6
Missing/unknown/other	93	0.3

Table 694: Distribution of bearing surface for Trident cup in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	7481	26.0
Ceramic-on-plastic	18075	62.9
Ceramic-on-ceramic	731	2.5
Metal-on-metal	0	0.0
Dual mobility	2247	7.8
Missing/unknown/other	209	0.7

Table 695: Distribution of polyethylene used for Trident cup cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	1	0.0
XLPE	27823	99.8
Antioxidant XLPE	0	0.0
Missing/unknown/other	44	0.2

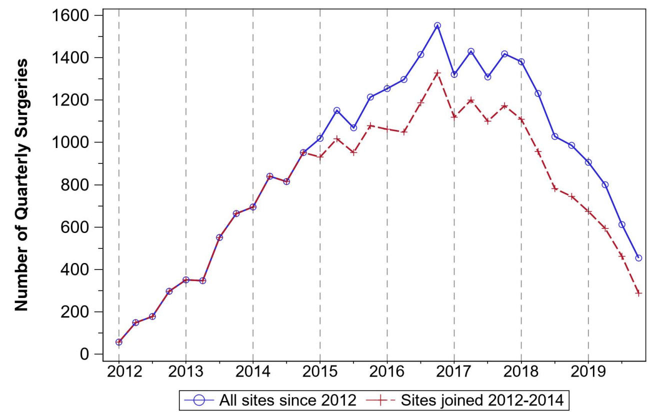

Figure 163: Utilization of the Trident cup in primary THA.

Trident II
N=4562

97 surgeons across 41 sites use this implant in primary THA.

Table 696: Volume of cases by surgeon and site for the Trident II cup in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	47.0 (73.6)	21 (49)
Cases per site	111.3 (170.2)	52 (126)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 697: Descriptive statistics of cases receiving the Trident II cup in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	2532	55.5	
Age (yrs)	4562	65.20(10.93)	65.00(14.00)
Height (cm)	4562	169.94(10.60)	170.18(15.24)
Weight (kg)	4562	88.14(21.00)	86.18(29.03)
BMI(kg/m^2)	4562	30.40(6.24)	29.58(8.24)
Smoking - never (%)	2328	51.03	
Smoking - previous (%)	1610	35.29	
Smoking - current (%)	622	13.63	
Smoking - unknown (%)	2	0.04	

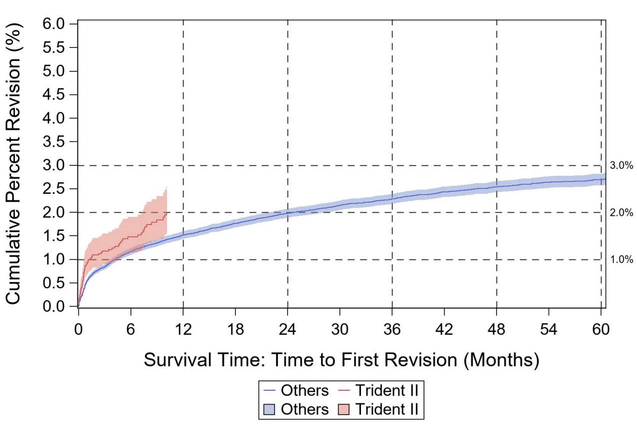

Figure 164: Cumulative percent revision curve for the Trident II cup compared to all other cups in conventional primary THA.

Table 698: Cumulative percent revision and number at risk for Trident II cup in primary THA cases.

Year	Number at risk	CPR
0	4555	0.00 (0.00,0.00)
1*	1356	2.01 (1.57,2.56)
2*	185	2.01 (1.57,2.56)
3*	13	2.01 (1.57,2.56)
4	0	N/A
5	0	N/A

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 699: Reasons for revision following primary THA for Trident II cup cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	30	42.3
2	Dislocation/Instability	13	18.3
3	Joint Infection	11	15.5
4	Aseptic Loosening	4	5.6
5	Component fracture/failure	4	5.6
6	Peri-prosthetic fracture - Acetabulum	4	5.6
7	Malalignment	4	5.6
8	Poly liner wear	1	1.4

Table 700: Reasons for revision in first 90 days following primary THA for Trident II cup cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	28	54.9
2	Dislocation/Instability	8	15.7
3	Component fracture/failure	4	7.8
4	Malalignment	4	7.8
5	Joint Infection	3	5.9
6	Peri-prosthetic fracture - Acetabulum	3	5.9
7	Aseptic Loosening	1	2.0

Table 701: Reasons for revision between 91 and 365 days following primary THA for Trident II cup cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	8	40.0
2	Dislocation/Instability	5	25.0
3	Aseptic Loosening	3	15.0
4	Peri-prosthetic fracture - Femur	2	10.0
5	Poly liner wear	1	5.0
6	Peri-prosthetic fracture - Acetabulum	1	5.0

Table 702: Distribution of approach used for Trident II cup in primary THA cases.

Approach	N	Percent
Anterior	1507	33.0
Anterolateral	508	11.1
Posterior	2504	54.9
Transtrochanteric	1	0.0
Missing/unknown/other	42	0.9

Table 703: Distribution of head size for Trident II cup in primary THA cases.

Size (mm)	N	Percent
22	1	0.0
28	4	0.1
32	530	13.8
36	3016	78.2
40	278	7.2
44	15	0.4
Missing/unknown/other	11	0.3

Table 704: Distribution of bearing surface for Trident II cup in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	280	6.1
Ceramic-on-plastic	3564	78.1
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	705	15.4
Missing/unknown/other	13	0.3

Table 705: Distribution of polyethylene used for Trident II cup cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	4556	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

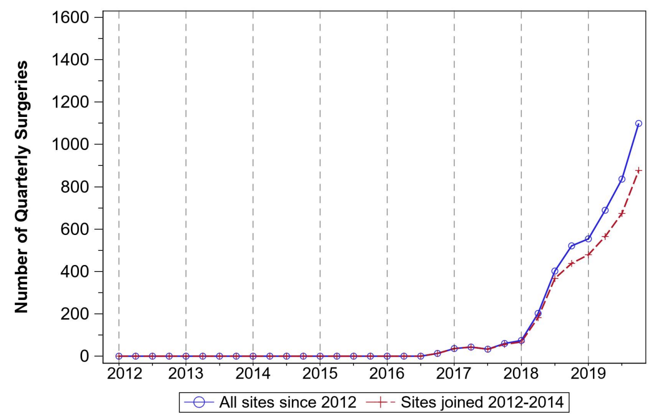

Figure 165: Utilization of the Trident II cup in primary THA.

Trilogy
N=1791

25 surgeons across 13 sites use this implant in primary THA.

Table 706: Volume of cases by surgeon and site for the Trilogy cup in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	71.6 (127.6)	9 (68)
Cases per site	137.8 (229.3)	17 (66)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 707: Descriptive statistics of cases receiving the Trilogy cup in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	973	54.33	
Age (yrs)	1791	68.16(10.01)	68.00(15.00)
Height (cm)	1791	169.29(10.50)	167.64(15.80)
Weight (kg)	1791	86.13(19.63)	84.30(27.06)
BMI(kg/m^2)	1791	29.92(5.71)	29.35(7.42)
Smoking - never (%)	803	44.84	
Smoking - previous (%)	763	42.6	
Smoking - current (%)	222	12.4	
Smoking - unknown (%)	3	0.17	

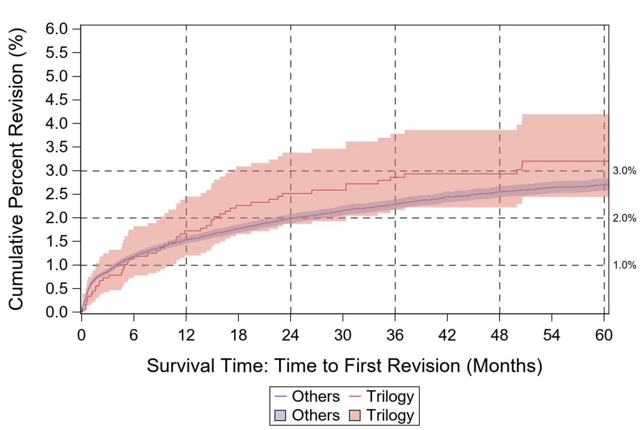

Figure 166: Cumulative percent revision curve for the Trilogy cup compared to all other cups in conventional primary THA.

Table 708: Cumulative percent revision and number at risk for Trilogy cup in primary THA cases.

Year	Number at risk	CPR
0	1788	0.00 (0.00,0.00)
1	1648	1.72 (1.21,2.45)
2	1513	2.52 (1.87,3.38)
3	1369	2.86 (2.16,3.78)
4	1138	2.93 (2.22,3.87)
5	824	3.20 (2.44,4.19)

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.049 (0.735,1.499). It was 1.231 (1.127,1.346) and 0.999 (0.996,1.004) for sex (female) and age, respectively.

Table 709: Reasons for revision following primary THA for Trilogy cup cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	15	28.8
2	Aseptic Loosening	9	17.3
3	Joint Infection	7	13.5
4	Peri-prosthetic fracture - Femur	7	13.5
5	Malalignment	5	9.6
6	Metal reaction/Metallosis	4	7.7
7	Component fracture/failure	2	3.8
8	Peri-prosthetic fracture - Acetabulum	2	3.8
9	Pain	1	1.9

Table 710: Reasons for revision in first 90 days following primary THA for Trilogy cup cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	6	60.0
2	Dislocation/Instability	3	30.0
3	Peri-prosthetic fracture - Acetabulum	1	10.0

Table 711: Reasons for revision between 91 and 365 days following primary THA for Trilogy cup cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	5	35.7
2	Joint Infection	4	28.6
3	Aseptic Loosening	2	14.3
4	Component fracture/failure	1	7.1
5	Peri-prosthetic fracture - Acetabulum	1	7.1
6	Peri-prosthetic fracture - Femur	1	7.1

Table 712: Distribution of approach used for Trilogy cup in primary THA cases.

Approach	N	Percent
Anterior	16	0.9
Anterolateral	1095	61.1
Posterior	653	36.5
Transtrochanteric	24	1.3
Missing/unknown/other	3	0.2

Table 713: Distribution of head size for Trilogy cup in primary THA cases.

Size (mm)	N	Percent
28	38	2.1
32	1080	60.5
36	633	35.5
40	17	0.9
Missing/unknown/other	16	0.9

Table 714: Distribution of bearing surface for Trilogy cup in primary THA cases.

Bearing	N	Percent
Metal-on-plastic	1413	78.9
Ceramic-on-plastic	355	19.8
Ceramic-on-ceramic	0	0.0
Metal-on-metal	0	0.0
Dual mobility	0	0.0
Missing/unknown/other	23	1.3

Table 715: Distribution of polyethylene used for Trilogy cup cases in which polyethylene liners were used in primary THA.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	1784	100.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

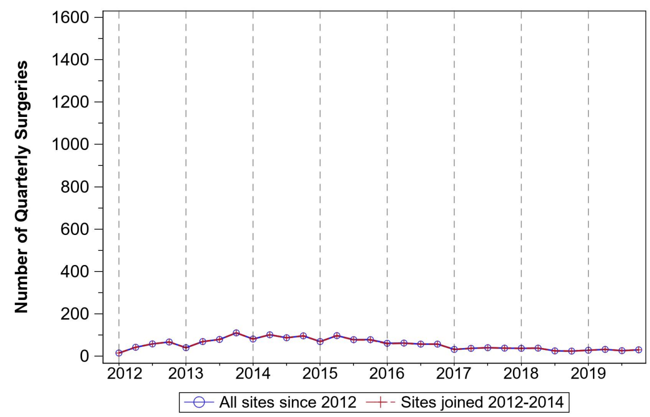

Figure 167: Utilization of the Trilogy cup in primary THA.

2.3 Resurfacing THA cases

2.3.1 VTE prophylaxis

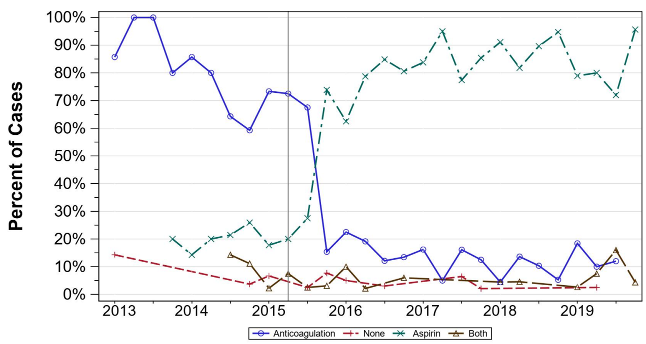

Figure 168: Percent of primary resurfacing THA patients (first case) by thrombosis prophylaxis.

2.3.2 Most commonly used resurfacing THA implants

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

Table 716: Most commonly used femoral components in primary resurfacing THA.

Rank	Stem	N	Percent
1	BHR	1041	100.0

Table 717: Most commonly used acetabular components in primary resurfacing THA.

Rank	Cup	N	Percent
1	BHR	1041	100.0

Table 718: Most commonly used femoral/acetabular component combinations used in primary resurfacing THA.

Rank	Stem/cup combination	N	Percent
1	BHR / BHR	1041	100.0

2.3.3 Resurfacing THA revision risk summary

Table 719: Reasons for revision following primary resurfacing THA.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	11	47.8
2	Aseptic Loosening	4	17.4
3	Component fracture/failure	3	13.0
4	Dislocation/Instability	2	8.7
5	Metal reaction/Metallosis	1	4.3
6	Pain	1	4.3
7	Malalignment	1	4.3

Table 720: Reasons for revision following primary resurfacing THA in first year post-operatively.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	9	64.3
2	Dislocation/Instability	2	14.3
3	Component fracture/failure	2	14.3
4	Aseptic Loosening	1	7.1

Table 721: Reasons for revision following primary resurfacing THA in second year post-operatively.

Rank	Reason for revision	N	Percent
1	Component fracture/failure	1	33.3
2	Metal reaction/Metallosis	1	33.3
3	Malalignment	1	33.3

Table 722: Reasons for revision following primary resurfacing THA in third year post-operatively.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	1	33.3
2	Peri-prosthetic fracture - Femur	1	33.3
3	Pain	1	33.3

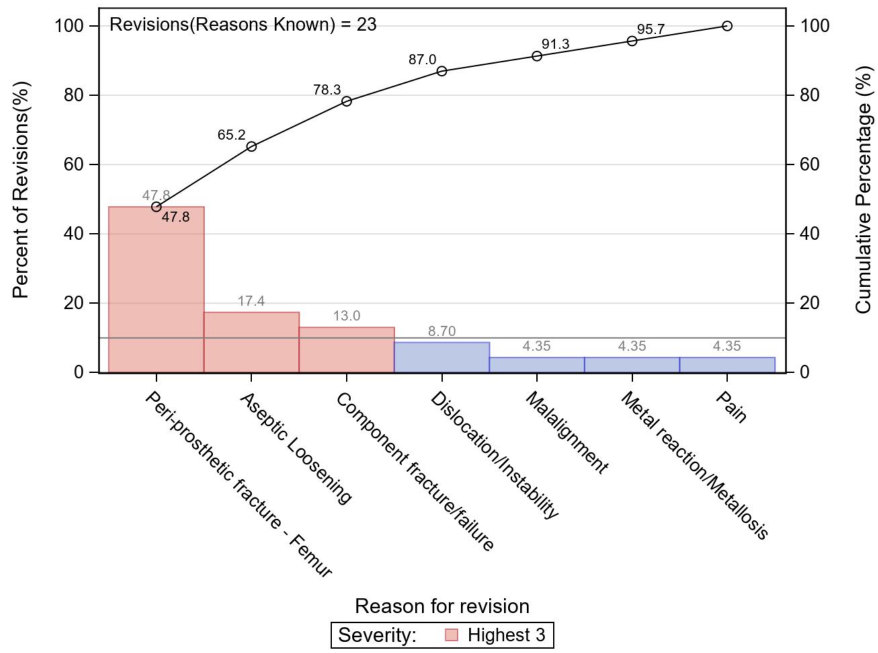

Figure 169: Reasons for revision following primary resurfacing THA (Pareto chart).

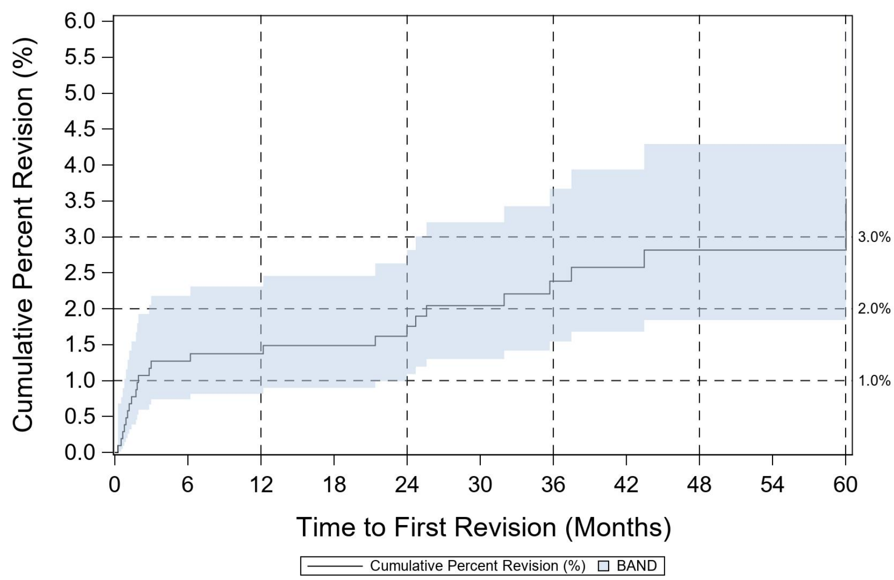

Figure 170: Cumulative percent revision for primary resurfacing THA.

We remind readers to be cautious in interpreting CPR values when the number at risk is low.

Table 723: Cumulative percent revision and number at risk for primary resurfacing THA (numerical values).

	1 year	2 years	3 years	4 years	5 years
CPR	1.37 (0.82,2.31)	1.76 (1.09,2.82)	2.38 (1.54,3.67)	2.82 (1.84,4.29)	*2.82 (1.84,4.29)*
Number at risk	871	709	547	338	136

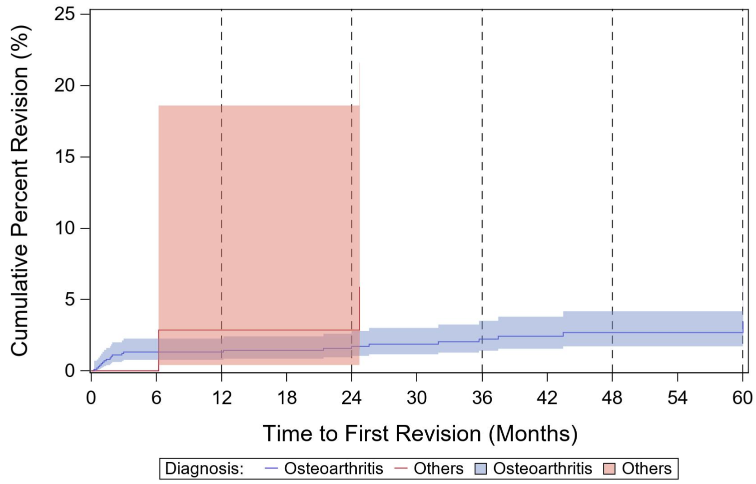

Figure 171: Cumulative percent revision for primary resurfacing THA by diagnosis.

Table 724: Cumulative percent revision for primary resurfacing THA by diagnosis (numerical values).

	N	1 year	2 years	3 years	4 years	5 years
Osteoarthritis	1004	1.32 (0.77,2.26)	1.72 (1.05,2.80)	2.23 (1.41,3.51)	2.68 (1.72,4.18)	2.68 (1.72,4.18)
Others	35	2.86 (0.41,18.60)	2.86 (0.41,18.60)	5.89 (1.51,21.59)	5.89 (1.51,21.59)	5.89 (1.51,21.59)
Unknown/Missing	1					

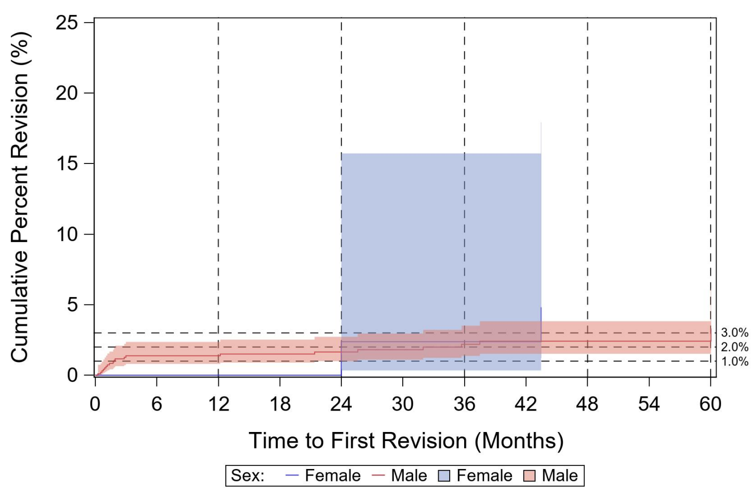

Figure 172: Cumulative percent revision for primary resurfacing THA by sex for osteoarthritis diagnosis.

Table 725: Cumulative percent revision for primary resurfacing THA by sex for osteoarthritis diagnosis (numerical values).

	N	1 year	2 years	3 years	4 years	5 years
Female	45	0.00 (0.00,0.00)	2.38 (0.34,15.72)	2.38 (0.34,15.72)	4.82 (1.23,17.94)	4.82 (1.23,17.94)
Male	959	1.38 (0.80,2.36)	1.65 (0.99,2.72)	2.20 (1.37,3.51)	2.42 (1.52,3.83)	2.42 (1.52,3.83)
Missing	0					

2.3.4 Revision risk for resurfacing THA implant combinations

The numbers in the implant-specific tables may appear to be inconsistent, but they can be understood by studying the online supplement *2021 MARCQI Annual Report Specifications* that describes inclusion and exclusion criteria for each table. For example, the number of cases listed in demographic tables often are greater than the total number of implants listed in the CPR table. The explanation for this is that the CPR estimates exclude patients who died.

While the reader is encouraged to read the details of each stem/cup implant combination, the following table summarizes the five-year CPR values. Catalog numbers included in each of these implant combinations can be found in *2021 MARCQI Annual Report Specifications*.

We remind readers to be cautious in interpreting CPR values when the number at risk is low.

Table 726: Summary of cumulative percent revision following primary THA for stem/cup combinations having at least 500 cases, sorted alphabetically.

Implant	N*	1 year	2 years	3 years	4 years	5 years
BHR / BHR	1040	1.37 (0.82,2.31)	1.76 (1.09,2.82)	2.38 (1.54,3.67)	2.82 (1.84,4.29)	*2.82 (1.84,4.29)*

Notes:

* Number of patients that contribute to survival analysis used to compute cumulative percent revision.
A revision risk in *italics* indicates it is the same as it was at the time of the last revision.

BHR/BHR
N=1041

24 surgeons across 21 sites use this implant combination in primary THA.

Table 727: Volume of cases by surgeon and site for the BHR/BHR combination in primary THA.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	43.4 (117.3)	7.5 (24.5)
Cases per site	49.6 (124.7)	10 (28)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 728: Descriptive statistics of cases receiving the BHR/BHR combination in primary THA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	46	4.42	
Age (yrs)	1041	54.37(8.86)	55.00(11.00)
Height (cm)	1041	179.00(7.43)	180.00(9.00)
Weight (kg)	1041	98.77(19.40)	96.00(24.40)
BMI(kg/m^2)	1041	30.73(5.24)	29.80(6.61)
Smoking - never (%)	644	61.86	
Smoking - previous (%)	258	24.78	
Smoking - current (%)	138	13.26	
Smoking - unknown (%)	1	0.1	

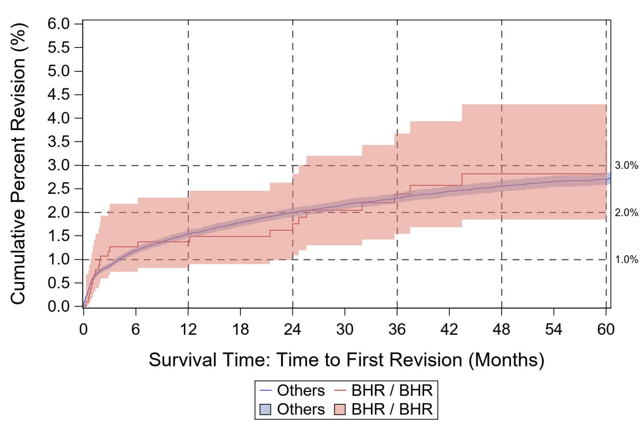

Figure 173: Cumulative percent revision curve for the BHR/BHR combination compared to all other implant combinations in conventional primary THA.

Table 729: Cumulative percent revision and number at risk for BHR/BHR combination in primary THA cases.

Year	Number at risk	CPR
0	1040	0.00 (0.00,0.00)
1	871	1.37 (0.82,2.31)
2	709	1.76 (1.09,2.82)
3	547	2.38 (1.54,3.67)
4	338	2.82 (1.84,4.29)
5	136	2.82 (1.84,4.29)

Adjusting for sex and age, the hazard ratio for the implant compared to all other conventional implants was 1.26 (0.79,2.01). It was 1.233 (1.128,1.348) and 0.999 (0.996,1.004) for sex (female) and age, respectively.

Table 730: Reasons for revision following primary THA for BHR/BHR combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	11	47.8
2	Aseptic Loosening	4	17.4
3	Component fracture/failure	3	13.0
4	Dislocation/Instability	2	8.7
5	Metal reaction/Metallosis	1	4.3
6	Pain	1	4.3
7	Malalignment	1	4.3

Table 731: Reasons for revision in first 90 days following primary THA for BHR/BHR combination cases.

Rank	Reason for revision	N	Percent
1	Peri-prosthetic fracture - Femur	8	66.7
2	Dislocation/Instability	2	16.7
3	Component fracture/failure	2	16.7

Table 732: Reasons for revision between 91 and 365 days following primary THA for BHR/BHR combination cases.

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

Table 733: Distribution of approach used for BHR/BHR combination in primary THA cases.

Approach	N	Percent
Anterior	12	1.1
Anterolateral	591	56.8
Posterior	319	30.6
Transtrochanteric	117	11.2
Missing/unknown/other	2	0.2

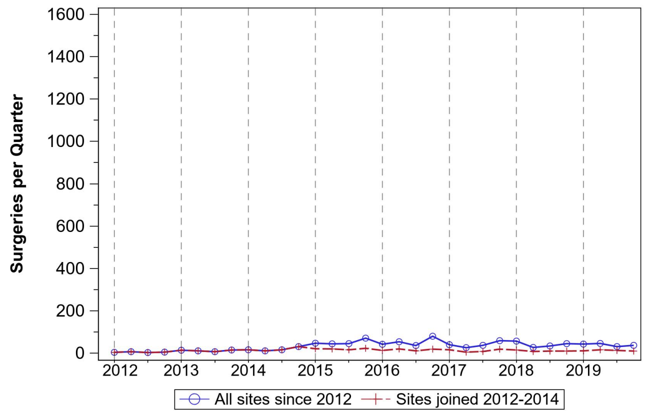

Figure 174: Utilization of the BHR/BHR combination in primary THA.

Chapter 3

Total knee arthroplasty statistics, devices, and revisions

The data reported in this chapter is based on primary knee cases performed from 2/15/2012 to 12/31/2019. For detailed information on each figure and table (date ranges and inclusion/exclusion criteria), see the online supplement *2021 MARCQI annual report specifications document* available at MARCQI annual reports web page.

3.1 All total knee arthroplasty cases

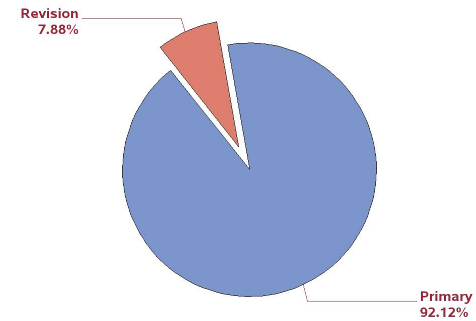

Figure 176: Percent of knee arthroplasty cases by primary or revision.

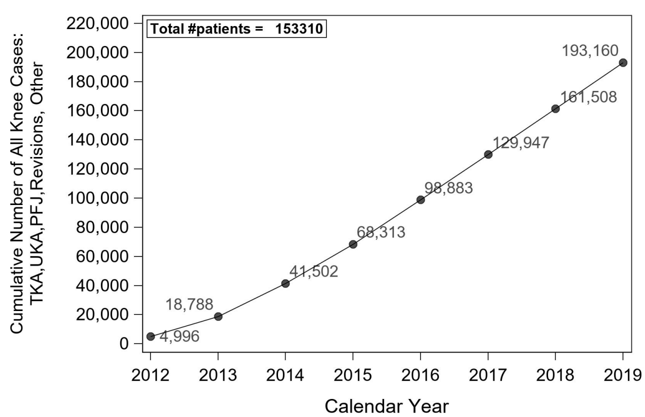

Figure 175: All knee cases over time.

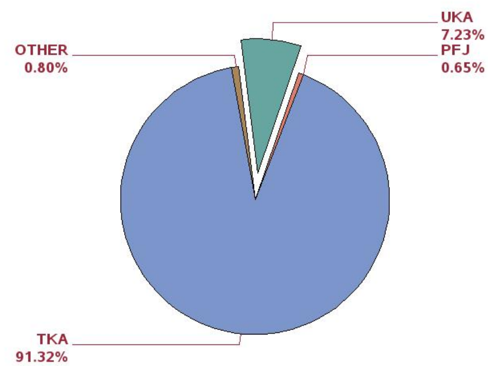

Figure 177: Percent of primary knee arthroplasty cases performed as TKA, UKA, and PFJ.

3.2 Primary TKA cases

3.2.1 Descriptive statistics

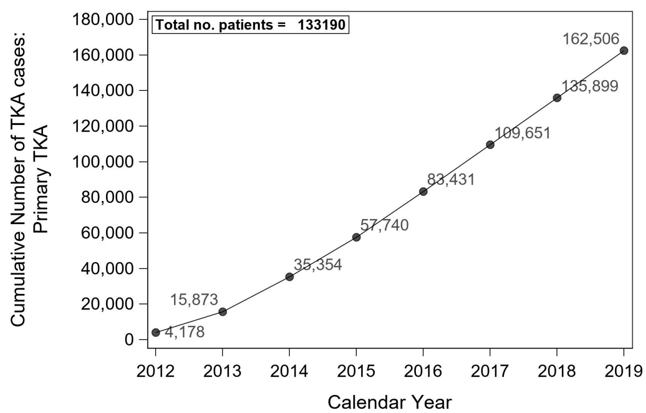

Figure 178: Primary TKA cases over time.

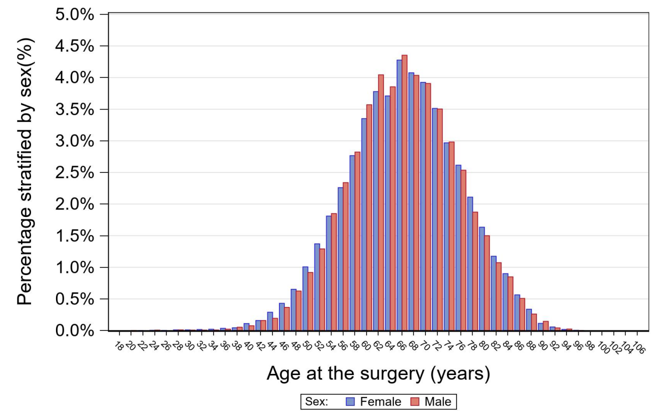

Figure 180: Age distribution of primary TKA cases by sex.

Table 734: Descriptive statistics of primary TKA cases.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	101818	62.7	
Age (yrs)	162506	66.3(9.4)	66(13)
Height (cm)	161373	168.4(10.5)	167.6(15.3)
Weight (kg)	161373	94.6(21.6)	92.9(28.6)
BMI(kg/m^2)	161371	33.3(6.9)	32.5(9.2)
Smoking - never (%)	84315	51.9	
Smoking - previous (%)	62433	38.4	
Smoking - current (%)	14910	9.2	
Smoking - unknown (%)	848	0.5	

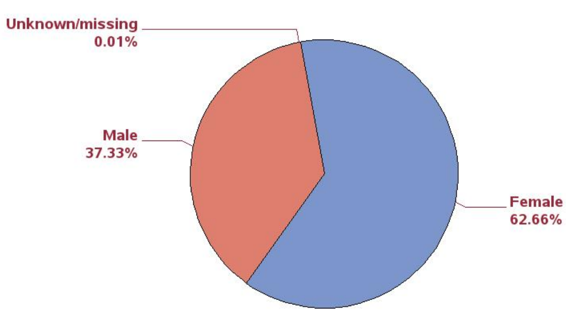

Figure 179: Percent of primary TKA cases by sex.

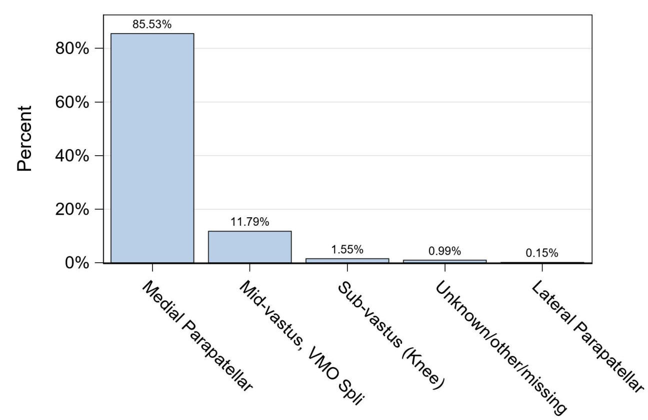

Figure 181: Percent of primary TKA cases by approach.

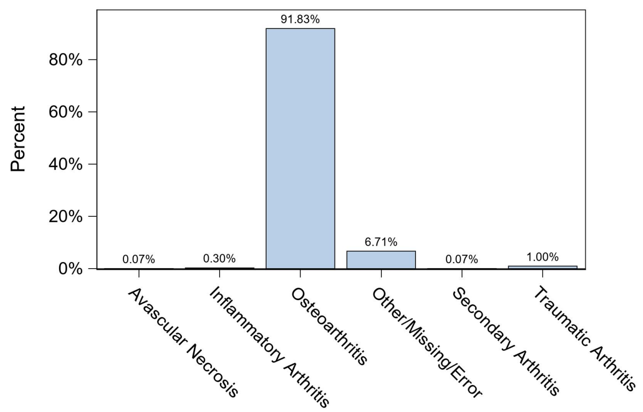

Figure 182: Percent of primary TKA cases by diagnosis.

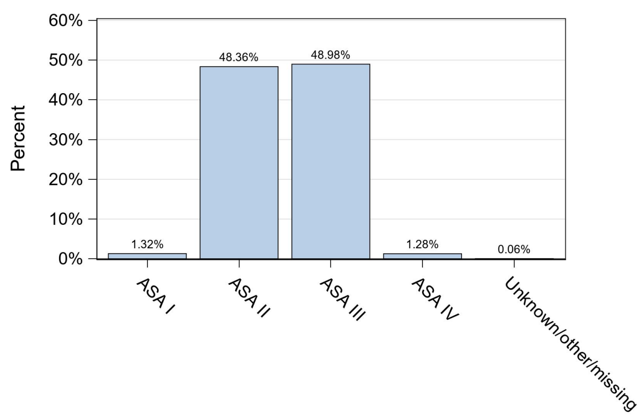

Figure 183: Percent of primary TKA cases by ASA class.

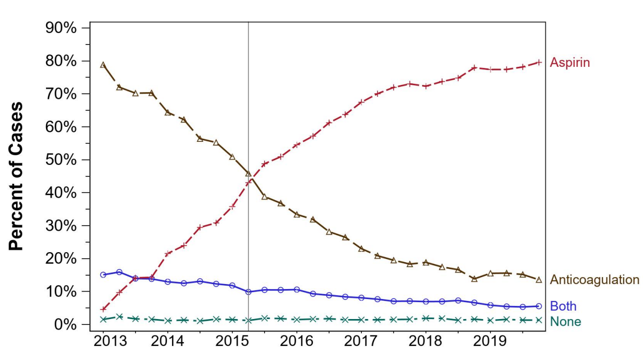

Figure 184: Percent of primary TKA patients (first case) by thrombosis prophylaxis.

3.2.2 Most commonly used TKA implants

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

Table 735: Ten most commonly used femoral components in primary TKA.

Rank	Femoral component	N	Percent
1	Triathlon	45575	28.1
2	Persona	41073	25.3
3	Vanguard	20966	12.9
4	Attune	9654	5.9
5	Legion	9627	5.9
6	Journey II	4451	2.7
7	Sigma PFC	4187	2.6
8	NK II GS	3062	1.9
9	Evolution MP	2928	1.8
10	Sigma	2416	1.5
11	Others	18567	11.4

Table 736: Ten most commonly used tibial components in primary TKA

Rank	Tibial component	N	Percent
1	Persona	40518	24.9
2	Triathlon	24820	15.3
3	Triathlon TS	20979	12.9
4	Maxim	19565	12.0
5	Genesis II	10837	6.7
6	Attune	9638	5.9
7	Journey	4929	3.0
8	Sigma	4793	3.0
9	NK II	4040	2.5
10	NexGen Precoat	3218	2.0
11	Others	19169	11.8

Table 737: Ten most commonly used femoral/tibial component combinations in primary TKA.

Rank	Femural/tibial component combination	N	Percent
1	Persona / Persona	40510	24.9
2	Triathlon / Triathlon	24801	15.3
3	Triathlon / Triathlon TS	20689	12.7
4	Vanguard / Maxim	19536	12.0
5	Attune / Attune	9638	5.9
6	Legion / Genesis II	9464	5.8
7	Journey II / Journey	4290	2.6
8	Sigma PFC / Sigma	3281	2.0
9	NK II GS / NK II	3040	1.9
10	Evolution MP / Evolution MP	2642	1.6
11	Others	24615	14.9

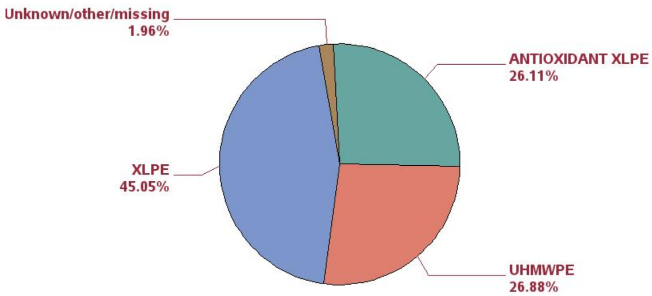

Figure 185: Percent of polyethylene inserts by type of polyethylene in primary TKA.

Table 738: Reasons for first revision following primary TKA.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	947	28.6
2	Joint Infection	775	23.4
3	Aseptic Loosening	643	19.4
4	Pain	297	9.0
5	Arthrofibrosis	233	7.0
6	Component fracture/failure	154	4.6
7	Malalignment	69	2.1
8	Peri-prosthetic fracture - Femur	60	1.8
9	Metal reaction/Metallosis	33	1.0
10	Poly liner wear	31	0.9
11	Extensor mechanism failure	27	0.8
12	Peri-prosthetic fracture - Tibia	24	0.7
13	Patellofemoral Joint	13	0.4
14	Osteolysis	8	0.2

3.2.3 TKA revision risk summary

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 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 reason 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 reasons for revision tables and figures differ from the time window used for other figures because 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. Also note that for knees instability/dislocation should be interpreted as instability.

Table 739: Reasons for first revision following primary TKA in first year post-operatively.

Rank	Reason for revision	N	Percent
1	Joint Infection	348	30.7
2	Dislocation/Instability	292	25.8
3	Arthrofibrosis	117	10.3
4	Pain	106	9.4
5	Aseptic Loosening	98	8.7
6	Component fracture/failure	45	4.0
7	Peri-prosthetic fracture - Femur	42	3.7
8	Malalignment	27	2.4
9	Peri-prosthetic fracture - Tibia	20	1.8
10	Extensor mechanism failure	19	1.7
11	Metal reaction/Metallosis	8	0.7
12	Poly liner wear	7	0.6
13	Patellofemoral Joint	2	0.2
14	Osteolysis	1	0.1

Table 740: Reasons for first revision following primary TKA in second year post-operatively.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	337	31.8
2	Aseptic Loosening	218	20.6
3	Joint Infection	202	19.1
4	Pain	120	11.3
5	Arthrofibrosis	64	6.0
6	Component fracture/failure	48	4.5
7	Malalignment	25	2.4
8	Metal reaction/Metallosis	11	1.0
9	Poly liner wear	10	0.9
10	Peri-prosthetic fracture - Femur	7	0.7
11	Extensor mechanism failure	6	0.6
12	Osteolysis	5	0.5
13	Patellofemoral Joint	5	0.5
14	Peri-prosthetic fracture - Tibia	2	0.2

Table 741: Reasons for first revision following primary TKA in third year post-operatively.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	168	29.6
2	Aseptic Loosening	150	26.5
3	Joint Infection	121	21.3
4	Pain	48	8.5
5	Component fracture/failure	30	5.3
6	Arthrofibrosis	23	4.1
7	Metal reaction/Metallosis	9	1.6
8	Malalignment	8	1.4
9	Poly liner wear	5	0.9
10	Patellofemoral Joint	3	0.5
11	Peri-prosthetic fracture - Femur	2	0.4

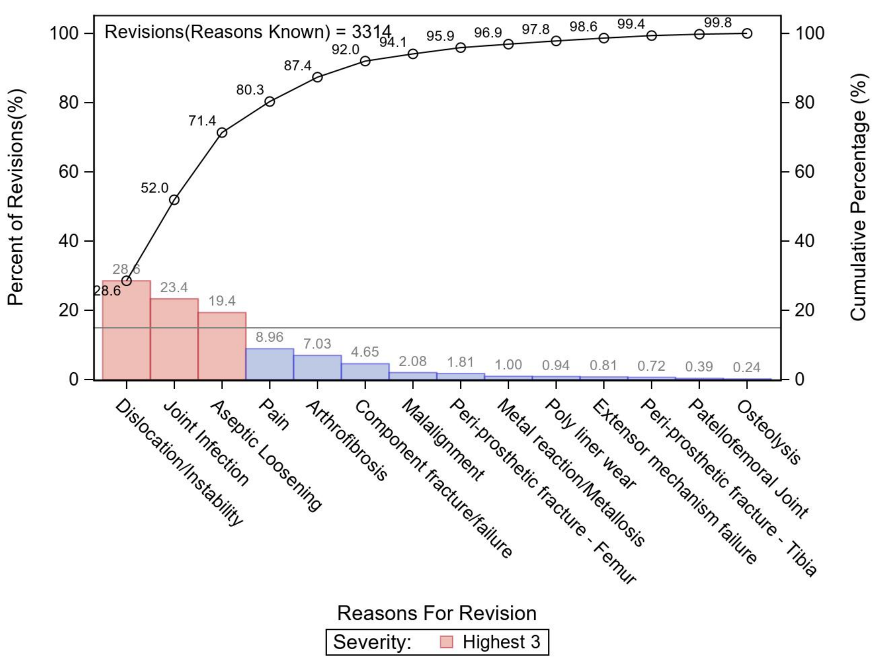

Figure 186: Most common reasons for first revision following primary TKA (Pareto chart).

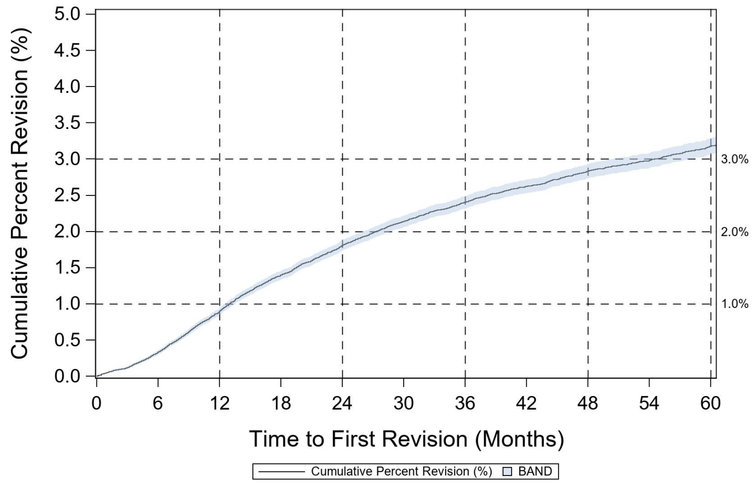

Figure 187: Cumulative percent revision for primary TKA.

Table 742: Cumulative percent revision for primary TKA (numerical values).

	1 year	2 years	3 years	4 years	5 years
CPR	0.89 (0.85,0.94)	1.80 (1.73,1.88)	2.40 (2.32,2.49)	2.83 (2.74,2.93)	3.18 (3.07,3.29)
Number at risk	134612	107637	81373	56054	34235

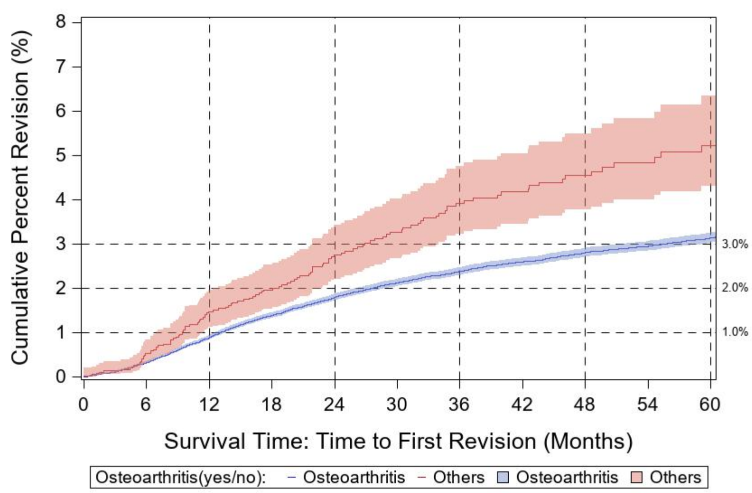

Figure 188: Cumulative percent revision for primary TKA by diagnosis.

Table 743: Cumulative percent revision for primary TKA by diagnosis (numerical values).

Diagnosis	N	1 year	2 years	3 years	4 years	5 years
Osteoarthritis	149045	0.89 (0.84,0.94)	1.80 (1.73,1.87)	2.38 (2.30,2.47)	2.81 (2.71,2.91)	3.14 (3.03,3.26)
Others	3565	1.48 (1.12,1.96)	2.76 (2.22,3.42)	3.93 (3.23,4.76)	4.56 (3.77,5.50)	5.23 (4.30,6.34)
Unknown/Missing	9688					

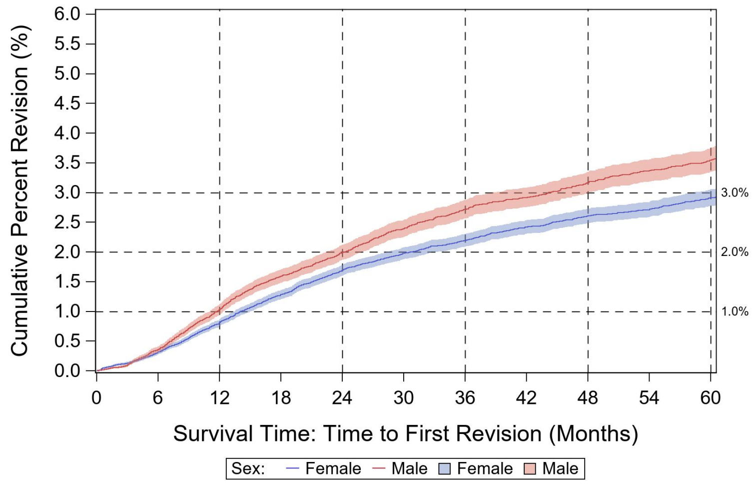

Figure 189: Cumulative percent revision for primary TKA by sex for osteoarthritis diagnosis.

Table 744: Cumulative percent revision for primary TKA by sex for osteoarthritis diagnosis (numerical values).

Sex	N	1 year	2 years	3 years	4 years	5 years
Female	94053	0.81 (0.75,0.87)	1.69 (1.60,1.78)	2.19 (2.09,2.30)	2.61 (2.49,2.73)	2.91 (2.78,3.06)
Male	54971	1.03 (0.95,1.12)	1.99 (1.87,2.12)	2.72 (2.56,2.88)	3.16 (2.99,3.35)	3.54 (3.35,3.75)
Unknown/Missing	21					

3.2.4 Analysis of TKA stability

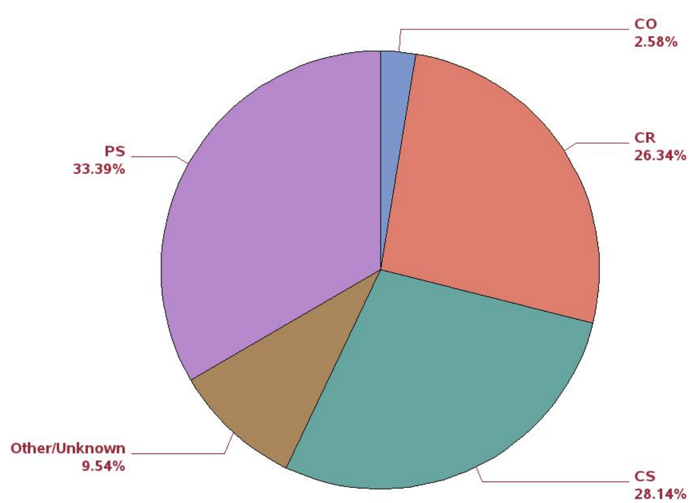

Figure 190: Distribution of stability in primary TKA.

Table 745: Descriptive statistics of primary TKA by stability.

Quantity	CR N	CR Mean (SD)	CR Median (IQR)	PS N	PS Mean (SD)	PS Median (IQR)
Female (%)	26492	61.9		34280	63.2	
Age (yrs)	42806	66.3(9.2)	66(13)	54266	66.3(9.5)	66(13)
Height (cm)	42333	168.5(10.5)	167.6(16)	53863	168.3(10.6)	167.6(15.3)
Weight (kg)	42332	94.4(21.2)	92.7(28.1)	53864	94.7(21.7)	93(28.9)
BMI(kg/m^2)	42332	33.2(6.6)	32.4(8.9)	53863	33.4(7)	32.6(9.3)
Smoking - never (%)	21933	51.2		28417	52.4	
Smoking - previous (%)	16776	39.2		20572	37.9	
Smoking - current (%)	3880	9.1		5010	9.2	
Smoking - unknown (%)	217	0.5		267	0.5	

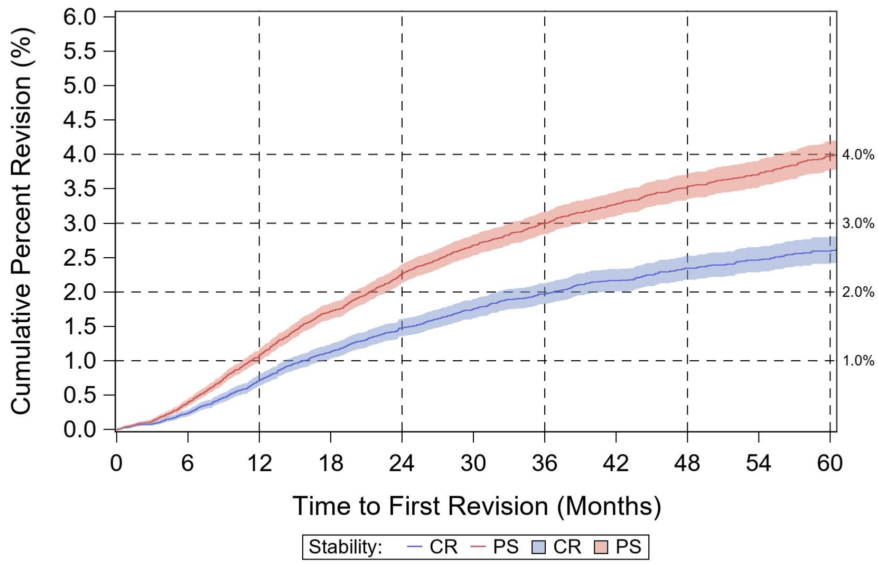

Figure 191: Cumulative percent revision curve for CR and PS stability in primary TKA.

Table 746: Cumulative percent revision for CR and PS stability in primary TKA (numerical values).

	N	1 year	2 years	3 years	4 years	5 years
CR	42762	0.72 (0.64,0.80)	1.48 (1.36,1.61)	1.97 (1.82,2.13)	2.35 (2.18,2.53)	2.59 (2.41,2.80)
PS	54194	1.08 (0.99,1.17)	2.26 (2.13,2.40)	3.00 (2.84,3.17)	3.53 (3.35,3.72)	3.98 (3.77,4.20)
Unknown/missing	0					

Table 747: Reasons for first revision following primary TKA for CR cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	212	29.5
2	Joint Infection	166	23.1
3	Aseptic Loosening	140	19.5
4	Pain	62	8.6
5	Arthrofibrosis	53	7.4
6	Component fracture/failure	34	4.7
7	Malalignment	22	3.1
8	Metal reaction/Metallosis	9	1.3
9	Peri-prosthetic fracture - Femur	6	0.8
10	Poly liner wear	5	0.7
11	Extensor mechanism failure	5	0.7
12	Osteolysis	2	0.3
13	Patellofemoral Joint	2	0.3

Table 748: Reasons for first revision following primary TKA for CR cases in first year post-operatively.

Rank	Reason for revision	N	Percent
1	Joint Infection	74	31.8
2	Dislocation/Instability	64	27.5
3	Arthrofibrosis	28	12.0
4	Pain	26	11.2
5	Aseptic Loosening	18	7.7
6	Component fracture/failure	7	3.0
7	Malalignment	7	3.0
8	Extensor mechanism failure	4	1.7
9	Metal reaction/Metallosis	2	0.9
10	Osteolysis	1	0.4
11	Poly liner wear	1	0.4
12	Patellofemoral Joint	1	0.4

Table 749: Reasons for first revision following primary TKA for CR cases in second year post-operatively.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	73	31.1
2	Joint Infection	49	20.9
3	Aseptic Loosening	41	17.4
4	Pain	24	10.2
5	Arthrofibrosis	17	7.2
6	Component fracture/failure	12	5.1
7	Malalignment	7	3.0
8	Metal reaction/Metallosis	4	1.7
9	Poly liner wear	3	1.3
10	Peri-prosthetic fracture - Femur	2	0.8
11	Osteolysis	1	0.4
12	Extensor mechanism failure	1	0.4
13	Patellofemoral Joint	1	0.4

Table 750: Reasons for first revision following primary TKA for CR cases in third year post-operatively.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	40	32.8
2	Aseptic Loosening	37	30.3
3	Joint Infection	24	19.7
4	Pain	8	6.6
5	Component fracture/failure	6	4.9
6	Malalignment	3	2.5
7	Arthrofibrosis	2	1.6
8	Poly liner wear	1	0.8
9	Metal reaction/Metallosis	1	0.8

Table 751: Reasons for first revision following primary TKA for PS cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	418	29.7
2	Joint Infection	325	23.1
3	Aseptic Loosening	294	20.9
4	Pain	116	8.2
5	Arthrofibrosis	83	5.9
6	Component fracture/failure	56	4.0
7	Peri-prosthetic fracture - Femur	35	2.5
8	Malalignment	29	2.1
9	Poly liner wear	13	0.9
10	Metal reaction/Metallosis	11	0.8
11	Peri-prosthetic fracture - Tibia	10	0.7
12	Extensor mechanism failure	9	0.6
13	Osteolysis	4	0.3
14	Patellofemoral Joint	4	0.3

Table 752: Reasons for first revision following primary TKA for PS cases in first year post-operatively.

Rank	Reason for revision	N	Percent
1	Joint Infection	137	30.7
2	Dislocation/Instability	119	26.7
3	Arthrofibrosis	44	9.9
4	Pain	36	8.1
5	Aseptic Loosening	34	7.6
6	Peri-prosthetic fracture - Femur	28	6.3
7	Component fracture/failure	17	3.8
8	Malalignment	11	2.5
9	Peri-prosthetic fracture - Tibia	8	1.8
10	Extensor mechanism failure	7	1.6
11	Poly liner wear	3	0.7
12	Metal reaction/Metallosis	2	0.5

Table 753: Reasons for first revision following primary TKA for PS cases in second year post-operatively.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	149	32.0
2	Aseptic Loosening	118	25.4
3	Joint Infection	82	17.6
4	Pain	49	10.5
5	Arthrofibrosis	20	4.3
6	Component fracture/failure	19	4.1
7	Malalignment	11	2.4
8	Metal reaction/Metallosis	5	1.1
9	Poly liner wear	3	0.7
10	Peri-prosthetic fracture - Femur	3	0.7
11	Osteolysis	2	0.4
12	Extensor mechanism failure	2	0.4
13	Peri-prosthetic fracture - Tibia	1	0.2
14	Patellofemoral Joint	1	0.2

Table 754: Reasons for first revision following primary TKA for PS cases in third year post-operatively.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	83	33.3
2	Aseptic Loosening	63	25.3
3	Joint Infection	54	21.7
4	Pain	20	8.0
5	Arthrofibrosis	9	3.6
6	Component fracture/failure	8	3.2
7	Metal reaction/Metallosis	3	1.2
8	Malalignment	3	1.2
9	Poly liner wear	2	0.8
10	Peri-prosthetic fracture - Femur	2	0.8
11	Patellofemoral Joint	2	0.8

3.2.5 Analysis of the effect of patella resurfacing on revision risk.

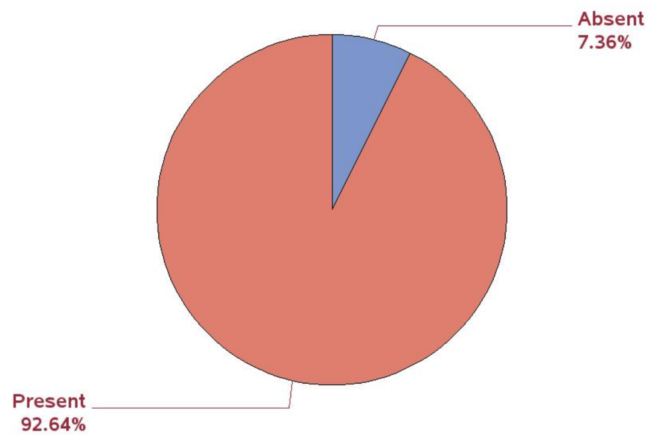

Figure 192: Percent of primary TKA cases performed with (present) and without (absent) patella resurfacing.

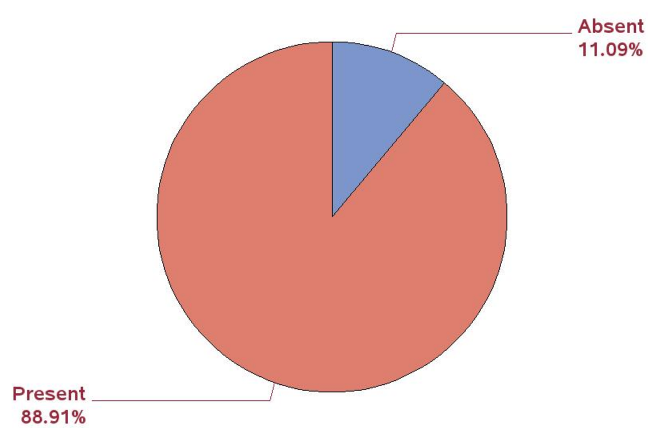

Figure 193: Percent of primary TKA CR cases performed with (present) and without (absent) patella resurfacing.

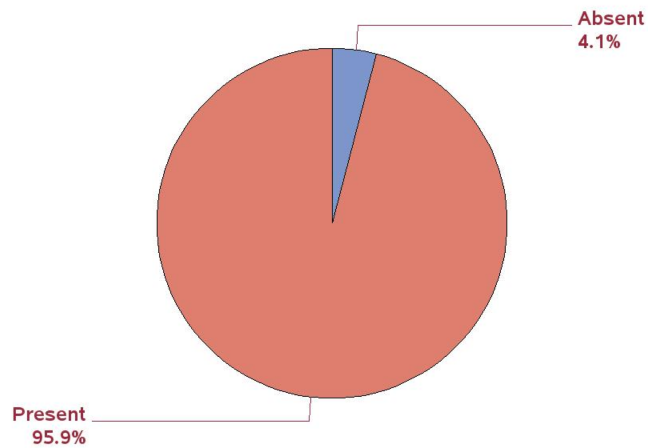

Figure 194: Percent of primary TKA PS cases performed with (present) and without (absent) patella resurfacing.

Table 755: 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 (%)	94815	63		6997	58.5	
Age (yrs)	150541	66.4(9.4)	66(13)	11959	65.9(9.7)	66(12)
Height (cm)	149411	168.3(10.5)	167.6(15.3)	11956	168.6(10.8)	167.6(17.8)
Weight (kg)	149411	94.6(21.6)	92.8(28.7)	11956	95.2(22)	93.4(29.5)
BMI(kg/m^2)	149409	33.3(6.9)	32.5(9.2)	11956	33.4(6.9)	32.5(9.2)
Smoking - never (%)	78243	52		6068	50.7	
Smoking - previous (%)	57685	38.3		4746	39.7	
Smoking - current (%)	13792	9.2		1118	9.4	
Smoking - unknown (%)	821	0.6		27	0.2	

Table 756: Descriptive statistics of primary TKA cases having TKA CR 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 (%)	23924	62.9		2568	54.1	
Age (yrs)	38060	66.3(9.2)	66(13)	4746	66.5(9.1)	66(13)
Height (cm)	37588	168.4(10.4)	167.6(15.3)	4745	169.4(10.7)	168.3(16.6)
Weight (kg)	37587	94.2(21.1)	92.4(27.9)	4745	95.7(21.8)	94.1(28.9)
BMI(kg/m^2)	37587	33.2(6.6)	32.4(8.9)	4745	33.3(6.7)	32.4(8.8)
Smoking - never (%)	19455	51.1		2478	52.2	
Smoking - previous (%)	14872	39.1		1904	40.1	
Smoking - current (%)	3522	9.3		358	7.5	
Smoking - unknown (%)	211	0.6		6	0.1	

Table 757: Descriptive statistics of primary TKA cases having TKA PS 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 (%)	32951	63.3		1329	59.7	
Age (yrs)	52041	66.4(9.5)	66(13)	2225	65(10.2)	65(14)
Height (cm)	51638	168.3(10.6)	167.6(15.3)	2225	168.2(11.2)	167.6(17.8)
Weight (kg)	51639	94.6(21.7)	92.9(28.9)	2225	95.3(22.1)	93.6(29.3)
BMI(kg/m^2)	51638	33.4(7)	32.5(9.3)	2225	33.7(7.1)	32.9(9.4)
Smoking - never (%)	27341	52.5		1076	48.4	
Smoking - previous (%)	19709	37.9		863	38.8	
Smoking - current (%)	4725	9.1		285	12.8	
Smoking - unknown (%)	266	0.5		1	0	

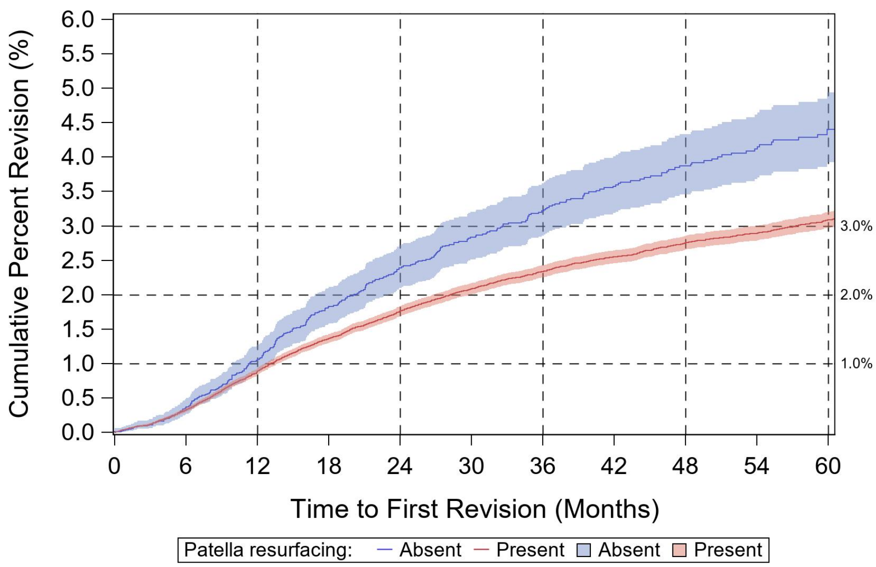

Figure 195: Cumulative percent revision curve for primary TKA cases performed with (present) and without (absent) patella resurfacing.

Table 758: Cumulative percent revision curve for primary TKA cases performed with and without patella resurfacing (numerical values).

	N	1 year	2 years	3 years	4 years	5 years
Patella not resurfaced	11945	1.06 (0.88,1.28)	2.39 (2.10,2.72)	3.22 (2.86,3.62)	3.87 (3.46,4.33)	4.40 (3.93,4.94)
Patella resurfaced	150347	0.88 (0.83,0.93)	1.76 (1.69,1.83)	2.34 (2.25,2.43)	2.75 (2.66,2.86)	3.09 (2.97,3.20)
Unknown/missing	0					

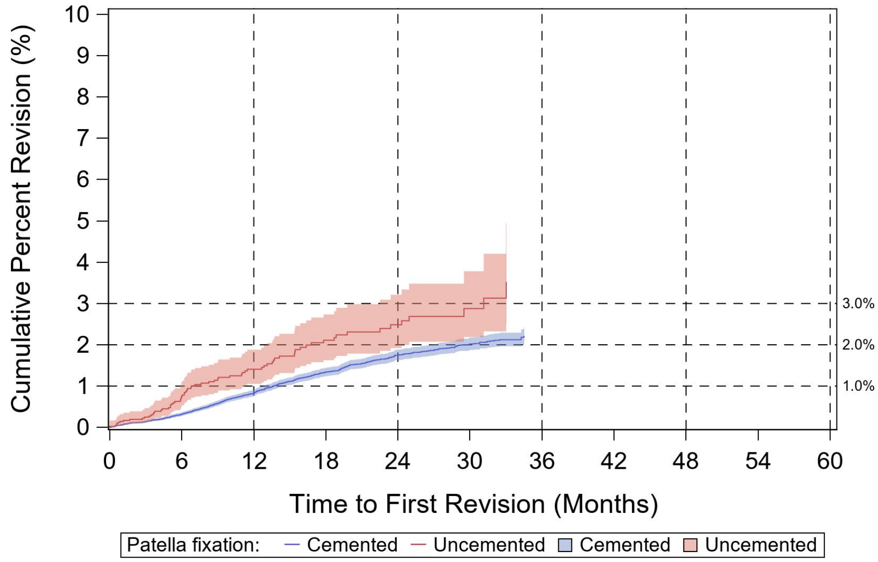

Figure 196: Cumulative percent revision curve for primary TKA cases performed with patella resurfacing by fixation.

Table 759: Cumulative percent revision curve for primary TKA cases performed with patella resurfacing by fixation (numerical values).

	N	1 year	2 years	3 years	4 years	5 years
Cemented	68179	0.83 (0.76,0.91)	1.75 (1.63,1.88)	2.22 (2.03,2.42)	2.22 (2.03,2.42)	N/A
Uncemented	4224	1.41 (1.05,1.88)	2.48 (1.92,3.21)	3.52 (2.50,4.95)	N/A	N/A
Unknown/missing	317					

Table 760: Reasons for first revision following primary TKA CR with patella resurfacing.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	193	30.3
2	Joint Infection	148	23.2
3	Aseptic Loosening	120	18.8
4	Pain	52	8.2
5	Arthrofibrosis	48	7.5
6	Component fracture/failure	30	4.7
7	Malalignment	21	3.3
8	Metal reaction/Metallosis	9	1.4
9	Poly liner wear	5	0.8
10	Peri-prosthetic fracture - Femur	5	0.8
11	Extensor mechanism failure	5	0.8
12	Osteolysis	1	0.2

Table 761: Reasons for first revision following primary TKA CR with patella resurfacing in first year post-operatively.

Rank	Reason for revision	N	Percent
1	Joint Infection	64	30.8
2	Dislocation/Instability	61	29.3
3	Arthrofibrosis	24	11.5
4	Pain	23	11.1
5	Aseptic Loosening	14	6.7
6	Component fracture/failure	7	3.4
7	Malalignment	7	3.4
8	Extensor mechanism failure	4	1.9
9	Metal reaction/Metallosis	2	1.0
10	Osteolysis	1	0.5
11	Poly liner wear	1	0.5

Table 762: Reasons for first revision following primary TKA CR with patella resurfacing in second year post-operatively.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	64	31.4
2	Joint Infection	45	22.1
3	Aseptic Loosening	32	15.7
4	Pain	19	9.3
5	Arthrofibrosis	17	8.3
6	Component fracture/failure	11	5.4
7	Malalignment	7	3.4
8	Metal reaction/Metallosis	4	2.0
9	Poly liner wear	3	1.5
10	Peri-prosthetic fracture - Femur	1	0.5
11	Extensor mechanism failure	1	0.5

Table 763: Reasons for first revision following primary TKA CR with patella resurfacing in third year post-operatively.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	36	33.6
2	Aseptic Loosening	33	30.8
3	Joint Infection	21	19.6
4	Pain	7	6.5
5	Component fracture/failure	4	3.7
6	Malalignment	2	1.9
7	Arthrofibrosis	2	1.9
8	Poly liner wear	1	0.9
9	Metal reaction/Metallosis	1	0.9

Table 764: Reasons for first revision following primary TKA CR without patella resurfacing.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	20	24.7
2	Dislocation/Instability	19	23.5
3	Joint Infection	18	22.2
4	Pain	10	12.3
5	Arthrofibrosis	5	6.2
6	Component fracture/failure	4	4.9
7	Patellofemoral Joint	2	2.5
8	Osteolysis	1	1.2
9	Peri-prosthetic fracture - Femur	1	1.2
10	Malalignment	1	1.2

Table 765: Reasons for first revision following primary TKA CR without patella resurfacing in first year post-operatively.

Rank	Reason for revision	N	Percent
1	Joint Infection	10	40.0
2	Aseptic Loosening	4	16.0
3	Arthrofibrosis	4	16.0
4	Dislocation/Instability	3	12.0
5	Pain	3	12.0
6	Patellofemoral Joint	1	4.0

Table 766: Reasons for first revision following primary TKA CR without patella resurfacing in second year post-operatively.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	9	29.0
2	Dislocation/Instability	9	29.0
3	Pain	5	16.1
4	Joint Infection	4	12.9
5	Osteolysis	1	3.2
6	Component fracture/failure	1	3.2
7	Peri-prosthetic fracture - Femur	1	3.2
8	Patellofemoral Joint	1	3.2

Table 767: Reasons for first revision following primary TKA CR without patella resurfacing in third year post-operatively.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	4	26.7
2	Dislocation/Instability	4	26.7
3	Joint Infection	3	20.0
4	Component fracture/failure	2	13.3
5	Pain	1	6.7
6	Malalignment	1	6.7

Table 768: Reasons for first revision following primary TKA PS with patella resurfacing.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	395	29.9
2	Joint Infection	310	23.4
3	Aseptic Loosening	276	20.9
4	Pain	101	7.6
5	Arthrofibrosis	81	6.1
6	Component fracture/failure	55	4.2
7	Peri-prosthetic fracture - Femur	31	2.3
8	Malalignment	27	2.0
9	Poly liner wear	11	0.8
10	Metal reaction/Metallosis	11	0.8
11	Peri-prosthetic fracture - Tibia	10	0.8
12	Extensor mechanism failure	9	0.7
13	Osteolysis	4	0.3
14	Patellofemoral Joint	2	0.1

Table 769: Reasons for first revision following primary TKA PS with patella resurfacing in first year post-operatively.

Rank	Reason for revision	N	Percent
1	Joint Infection	130	31.0
2	Dislocation/Instability	112	26.7
3	Arthrofibrosis	43	10.3
4	Aseptic Loosening	32	7.6
5	Pain	32	7.6
6	Peri-prosthetic fracture - Femur	25	6.0
7	Component fracture/failure	17	4.1
8	Malalignment	10	2.4
9	Peri-prosthetic fracture - Tibia	8	1.9
10	Extensor mechanism failure	7	1.7
11	Metal reaction/Metallosis	2	0.5
12	Poly liner wear	1	0.2

Table 770: Reasons for first revision following primary TKA PS with patella resurfacing in second year post-operatively.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	138	31.7
2	Aseptic Loosening	111	25.5
3	Joint Infection	79	18.2
4	Pain	43	9.9
5	Arthrofibrosis	20	4.6
6	Component fracture/failure	18	4.1
7	Malalignment	10	2.3
8	Metal reaction/Metallosis	5	1.1
9	Poly liner wear	3	0.7
10	Peri-prosthetic fracture - Femur	3	0.7
11	Osteolysis	2	0.5
12	Extensor mechanism failure	2	0.5
13	Peri-prosthetic fracture - Tibia	1	0.2

Table 771: Reasons for first revision following primary TKA PS with patella resurfacing in third year post-operatively.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	81	34.2
2	Aseptic Loosening	58	24.5
3	Joint Infection	52	21.9
4	Pain	18	7.6
5	Arthrofibrosis	9	3.8
6	Component fracture/failure	8	3.4
7	Metal reaction/Metallosis	3	1.3
8	Malalignment	3	1.3
9	Poly liner wear	2	0.8
10	Peri-prosthetic fracture - Femur	2	0.8
11	Patellofemoral Joint	1	0.4

Table 772: Reasons for first revision following primary TKA PS without patella resurfacing.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	23	27.4
2	Aseptic Loosening	18	21.4
3	Joint Infection	15	17.9
4	Pain	15	17.9
5	Peri-prosthetic fracture - Femur	4	4.8
6	Poly liner wear	2	2.4
7	Malalignment	2	2.4
8	Arthrofibrosis	2	2.4
9	Patellofemoral Joint	2	2.4
10	Component fracture/failure	1	1.2

Table 773: Reasons for first revision following primary TKA PS without patella resurfacing in first year post-operatively.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	7	25.9
2	Joint Infection	7	25.9
3	Pain	4	14.8
4	Peri-prosthetic fracture - Femur	3	11.1
5	Aseptic Loosening	2	7.4
6	Poly liner wear	2	7.4
7	Malalignment	1	3.7
8	Arthrofibrosis	1	3.7

Table 774: Reasons for first revision following primary TKA PS without patella resurfacing in second year post-operatively.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	11	36.7
2	Aseptic Loosening	7	23.3
3	Pain	6	20.0
4	Joint Infection	3	10.0
5	Component fracture/failure	1	3.3
6	Malalignment	1	3.3
7	Patellofemoral Joint	1	3.3

Table 775: Reasons for first revision following primary TKA PS without patella resurfacing in third year post-operatively.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	5	41.7
2	Dislocation/Instability	2	16.7
3	Joint Infection	2	16.7
4	Pain	2	16.7
5	Patellofemoral Joint	1	8.3

3.2.6 Revision risk for TKA implant combinations

As with hip implants, there is substantial variation in revision risk across TKA implants. The same caveats about interpreting CPR data provided in chapter 2 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. The reader can go to the online supplement describing each table and figure to understand inclusion and exclusion criteria. Catalog numbers included in each of these implant combinations can be found at *2021 MARCQI Annual Report Specifications*. While the reader is encouraged to read the details of each femur/tibia implant combination, the following table summarizes the five-year CPR values.

The cumulative percent revision summary tables below use *italics* to indicate a revision risk is the same as it was at the time of last revision. The N listed is the number of cases used for the survival analysis. The stability-specific tables (CR and PS) are based on the type of insert used, with the exception of monoblock tibial designs.

Table 776: Summary of cumulative percent revision for femoral/tibial combinations in primary TKA having at least 500 cases, sorted alphabetically.

Femoral/tibial combination	N	1 year	2 years	3 years	4 years	5 years
Attune / Attune	9630	0.67 (0.52,0.87)	1.66 (1.40,1.97)	2.35 (2.02,2.73)	3.13 (2.71,3.60)	3.54 (3.05,4.09)
Evolution MP / Evolution MP	2642	1.30 (0.90,1.88)	2.57 (1.92,3.43)	3.43 (2.58,4.55)	3.70 (2.74,4.99)	4.03 (2.93,5.53)
Genesis II / Genesis II	1365	1.19 (0.73,1.94)	1.82 (1.22,2.71)	2.50 (1.77,3.52)	3.41 (2.52,4.62)	4.02 (2.99,5.40)
Genesis II (CoCr) / Genesis II	683	0.74 (0.31,1.78)	1.23 (0.62,2.45)	1.98 (1.12,3.47)	2.64 (1.59,4.36)	3.21 (1.98,5.18)
Genesis II (Oxinium) / Genesis II	682	1.63 (0.91,2.92)	2.39 (1.47,3.87)	3.02 (1.96,4.64)	4.15 (2.84,6.05)	4.80 (3.29,6.98)
iTotal	715	1.51 (0.82,2.80)	3.06 (1.96,4.77)	4.45 (3.01,6.57)	5.74 (3.95,8.29)	*5.74* *(3.95,8.29)*
iTotal G2+	692	1.57 (0.85,2.90)	3.01 (1.90,4.74)	4.48 (3.00,6.66)	5.12 (3.46,7.53)	*5.12* *(3.46,7.53)*
Journey II / Journey	4283	1.57 (1.21,2.04)	3.25 (2.67,3.95)	4.09 (3.40,4.91)	4.90 (4.02,5.97)	5.24 (4.27,6.43)
Journey II (Oxinium) / Journey	3830	1.66 (1.28,2.17)	3.41 (2.79,4.16)	4.28 (3.55,5.15)	5.10 (4.19,6.21)	5.44 (4.44,6.65)
Journey II BCS (Oxinium) / Journey	624	1.47 (0.74,2.93)	3.70 (2.30,5.92)	4.70 (3.02,7.29)	5.19 (3.34,8.01)	*5.19* *(3.34,8.01)*
LCS Complete / M.B.T.	1285	1.44 (0.90,2.30)	2.93 (2.09,4.10)	4.29 (3.19,5.75)	5.25 (3.94,6.99)	5.78 (4.33,7.71)
Legion / Genesis II	9445	1.09 (0.89,1.33)	2.38 (2.06,2.74)	3.24 (2.84,3.68)	3.66 (3.22,4.15)	4.01 (3.52,4.57)
NexGen GS / NexGen Pegged	684	1.04 (0.50,2.16)	1.68 (0.93,3.02)	2.08 (1.21,3.56)	2.83 (1.72,4.64)	3.19 (1.95,5.19)
NexGen GS / NexGen Precoat	528	0.62 (0.20,1.91)	1.49 (0.71,3.11)	1.49 (0.71,3.11)	2.21 (1.13,4.30)	*2.21* *(1.13,4.30)*
NexGen LPS GS / NexGen Precoat	533	0.38 (0.09,1.50)	1.34 (0.64,2.79)	1.93 (1.04,3.56)	2.13 (1.19,3.82)	2.34 (1.34,4.09)
NexGen LPS Option / NexGen Precoat	733	0.70 (0.29,1.68)	1.45 (0.78,2.67)	1.61 (0.89,2.89)	2.16 (1.28,3.62)	2.37 (1.43,3.93)
NexGen LPS Option / NexGen TM	1177	0.44 (0.18,1.05)	0.63 (0.30,1.31)	0.92 (0.49,1.70)	1.12 (0.64,1.96)	1.39 (0.82,2.34)
NexGen Option / NexGen Option	1184	0.36 (0.13,0.95)	0.75 (0.37,1.49)	1.16 (0.66,2.04)	1.28 (0.74,2.20)	*1.28* *(0.74,2.20)*
NexGen Option / NexGen Pegged	622	0.80 (0.34,1.92)	1.77 (0.98,3.18)	2.47 (1.49,4.06)	3.06 (1.94,4.82)	*3.06* *(1.94,4.82)*
NK II / NK II	999	0.20 (0.05,0.80)	0.71 (0.34,1.48)	1.13 (0.63,2.04)	1.48 (0.88,2.50)	*1.48* *(0.88,2.50)*
NK II GS / NK II	3035	0.53 (0.32,0.88)	0.82 (0.54,1.24)	1.21 (0.83,1.74)	1.51 (1.06,2.14)	1.83 (1.28,2.61)
Persona / Persona	40462	0.76 (0.67,0.85)	1.71 (1.57,1.86)	2.30 (2.13,2.48)	2.72 (2.53,2.93)	3.10 (2.88,3.35)
Scorpio / Series 7000	654	1.38 (0.72,2.63)	2.99 (1.91,4.64)	4.12 (2.80,6.05)	4.36 (2.98,6.35)	6.18 (4.17,9.11)
Sigma / M.B.T.	880	1.69 (1.01,2.84)	2.91 (1.94,4.35)	3.35 (2.29,4.90)	4.28 (3.01,6.06)	4.52 (3.19,6.38)
Sigma / Sigma	1499	1.62 (1.09,2.41)	2.68 (1.96,3.65)	3.21 (2.41,4.26)	3.46 (2.63,4.56)	3.79 (2.89,4.96)
Sigma PFC / Sigma	3276	0.61 (0.39,0.96)	1.19 (0.86,1.65)	1.70 (1.29,2.24)	1.92 (1.47,2.50)	2.14 (1.65,2.77)
Sigma PFC / Sigma PFC	510	0.60 (0.19,1.85)	0.84 (0.32,2.23)	1.14 (0.47,2.76)	1.14 (0.47,2.76)	*1.14* *(0.47,2.76)*
Triathlon / Triathlon	24765	0.85 (0.74,0.98)	1.52 (1.36,1.70)	1.97 (1.77,2.19)	2.23 (2.01,2.48)	2.54 (2.28,2.84)
Triathlon / Triathlon TS	20670	0.89 (0.77,1.04)	1.70 (1.51,1.90)	2.14 (1.92,2.38)	2.50 (2.26,2.78)	2.91 (2.61,3.24)
Vanguard / Maxim	19517	0.82 (0.70,0.96)	1.59 (1.42,1.79)	2.22 (2.00,2.46)	2.60 (2.36,2.87)	2.93 (2.65,3.24)
Vanguard / Maxim Mono-Lock	1054	0.51 (0.21,1.23)	1.59 (0.94,2.68)	2.04 (1.27,3.29)	2.64 (1.69,4.12)	2.95 (1.88,4.60)
Vanguard XP / Vanguard XP	547	2.62 (1.56,4.38)	7.99 (5.90,10.79)	10.53 (8.04,13.73)	11.38 (8.76,14.72)	12.36 (9.58,15.88)

Table 777: Summary of cumulative percent revision for PS femoral/tibial combinations in primary TKA having at least 500 cases, sorted by 5-year cpr.

Femoral/tibial combination	N	1 year	2 years	3 years	4 years	5 years
Sigma PFC / Sigma PFC	510	0.60 (0.19,1.85)	0.84 (0.32,2.23)	1.14 (0.47,2.76)	1.14 (0.47,2.76)	*1.14 (0.47,2.76)*
NexGen Option / NexGen Option	1184	0.36 (0.13,0.95)	0.75 (0.37,1.49)	1.16 (0.66,2.04)	1.28 (0.74,2.20)	*1.28 (0.74,2.20)*
NexGen LPS Option / NexGen TM	1177	0.44 (0.18,1.05)	0.63 (0.30,1.31)	0.92 (0.49,1.70)	1.12 (0.64,1.96)	1.39 (0.82,2.34)
NK II / NK II	999	0.20 (0.05,0.80)	0.71 (0.34,1.48)	1.13 (0.63,2.04)	1.48 (0.88,2.50)	*1.48 (0.88,2.50)*
NK II GS / NK II	3035	0.53 (0.32,0.88)	0.82 (0.54,1.24)	1.21 (0.83,1.74)	1.51 (1.06,2.14)	1.83 (1.28,2.61)
Vanguard XP / Vanguard XP	547	2.62 (1.56,4.38)	7.99 (5.90,10.79)	10.53 (8.04,13.73)	11.38 (8.76,14.72)	12.36 (9.58,15.88)
Sigma PFC / Sigma	3276	0.61 (0.39,0.96)	1.19 (0.86,1.65)	1.70 (1.29,2.24)	1.92 (1.47,2.50)	2.14 (1.65,2.77)
NexGen GS / NexGen Precoat	528	0.62 (0.20,1.91)	1.49 (0.71,3.11)	1.49 (0.71,3.11)	2.21 (1.13,4.30)	*2.21 (1.13,4.30)*
NexGen LPS GS / NexGen Precoat	533	0.38 (0.09,1.50)	1.34 (0.64,2.79)	1.93 (1.04,3.56)	2.13 (1.19,3.82)	2.34 (1.34,4.09)
NexGen LPS Option / NexGen Precoat	733	0.70 (0.29,1.68)	1.45 (0.78,2.67)	1.61 (0.89,2.89)	2.16 (1.28,3.62)	2.37 (1.43,3.93)
Triathlon / Triathlon	24765	0.85 (0.74,0.98)	1.52 (1.36,1.70)	1.97 (1.77,2.19)	2.23 (2.01,2.48)	2.54 (2.28,2.84)
Triathlon / Triathlon TS	20670	0.89 (0.77,1.04)	1.70 (1.51,1.90)	2.14 (1.92,2.38)	2.50 (2.26,2.78)	2.91 (2.61,3.24)
Vanguard / Maxim	19517	0.82 (0.70,0.96)	1.59 (1.42,1.79)	2.22 (2.00,2.46)	2.60 (2.36,2.87)	2.93 (2.65,3.24)
Vanguard / Maxim Mono-Lock	1054	0.51 (0.21,1.23)	1.59 (0.94,2.68)	2.04 (1.27,3.29)	2.64 (1.69,4.12)	2.95 (1.88,4.60)
NexGen Option / NexGen Pegged	622	0.80 (0.34,1.92)	1.77 (0.98,3.18)	2.47 (1.49,4.06)	3.06 (1.94,4.82)	*3.06 (1.94,4.82)*
Persona / Persona	40462	0.76 (0.67,0.85)	1.71 (1.57,1.86)	2.30 (2.13,2.48)	2.72 (2.53,2.93)	3.10 (2.88,3.35)
NexGen GS / NexGen Pegged	684	1.04 (0.50,2.16)	1.68 (0.93,3.02)	2.08 (1.21,3.56)	2.83 (1.72,4.64)	3.19 (1.95,5.19)
Genesis II (CoCr) / Genesis II	683	0.74 (0.31,1.78)	1.23 (0.62,2.45)	1.98 (1.12,3.47)	2.64 (1.59,4.36)	3.21 (1.98,5.18)
Attune / Attune	9630	0.67 (0.52,0.87)	1.66 (1.40,1.97)	2.35 (2.02,2.73)	3.13 (2.71,3.60)	3.54 (3.05,4.09)
Sigma / Sigma	1499	1.62 (1.09,2.41)	2.68 (1.96,3.65)	3.21 (2.41,4.26)	3.46 (2.63,4.56)	3.79 (2.89,4.96)
Legion / Genesis II	9445	1.09 (0.89,1.33)	2.38 (2.06,2.74)	3.24 (2.84,3.68)	3.66 (3.22,4.15)	4.01 (3.52,4.57)
Genesis II / Genesis II	1365	1.19 (0.73,1.94)	1.82 (1.22,2.71)	2.50 (1.77,3.52)	3.41 (2.52,4.62)	4.02 (2.99,5.40)
Evolution MP / Evolution MP	2642	1.30 (0.90,1.88)	2.57 (1.92,3.43)	3.43 (2.58,4.55)	3.70 (2.74,4.99)	4.03 (2.93,5.53)
Sigma / M.B.T.	880	1.69 (1.01,2.84)	2.91 (1.94,4.35)	3.35 (2.29,4.90)	4.28 (3.01,6.06)	4.52 (3.19,6.38)
Genesis II (Oxinium) / Genesis II	682	1.63 (0.91,2.92)	2.39 (1.47,3.87)	3.02 (1.96,4.64)	4.15 (2.84,6.05)	4.80 (3.29,6.98)
iTotal G2+	692	1.57 (0.85,2.90)	3.01 (1.90,4.74)	4.48 (3.00,6.66)	5.12 (3.46,7.53)	*5.12 (3.46,7.53)*
Journey II BCS (Oxinium) / Journey	624	1.47 (0.74,2.93)	3.70 (2.30,5.92)	4.70 (3.02,7.29)	5.19 (3.34,8.01)	*5.19 (3.34,8.01)*
Journey II / Journey	4283	1.57 (1.21,2.04)	3.25 (2.67,3.95)	4.09 (3.40,4.91)	4.90 (4.02,5.97)	5.24 (4.27,6.43)
Journey II (Oxinium) / Journey	3830	1.66 (1.28,2.17)	3.41 (2.79,4.16)	4.28 (3.55,5.15)	5.10 (4.19,6.21)	5.44 (4.44,6.65)
iTotal	715	1.51 (0.82,2.80)	3.06 (1.96,4.77)	4.45 (3.01,6.57)	5.74 (3.95,8.29)	*5.74 (3.95,8.29)*
LCS Complete / M.B.T.	1285	1.44 (0.90,2.30)	2.93 (2.09,4.10)	4.29 (3.19,5.75)	5.25 (3.94,6.99)	5.78 (4.33,7.71)
Scorpio / Series 7000	654	1.38 (0.72,2.63)	2.99 (1.91,4.64)	4.12 (2.80,6.05)	4.36 (2.98,6.35)	6.18 (4.17,9.11)

Table 778: Summary of cumulative percent revision for CR femoral/tibial combinations in primary TKA having at least 500 cases, sorted alphabetically.

Femoral/tibial combination	N	1 year	2 years	3 years	4 years	5 years
Attune / Attune	5023	0.88 (0.65,1.19)	1.74 (1.39,2.18)	2.33 (1.90,2.84)	2.93 (2.42,3.55)	3.22 (2.65,3.90)
Genesis II / Genesis II	546	0.94 (0.39,2.24)	1.36 (0.65,2.83)	2.11 (1.13,3.91)	2.99 (1.73,5.14)	3.38 (1.98,5.74)
Journey II / Journey	605	1.56 (0.78,3.11)	4.33 (2.72,6.85)	4.33 (2.72,6.85)	4.33 (2.72,6.85)	*4.33 (2.72,6.85)*
NK II / NK II	872	0.11 (0.02,0.81)	0.70 (0.31,1.54)	1.18 (0.64,2.19)	1.59 (0.93,2.73)	*1.59 (0.93,2.73)*
Persona / Persona	18716	0.53 (0.42,0.65)	1.16 (0.99,1.36)	1.61 (1.39,1.85)	1.83 (1.59,2.11)	2.14 (1.84,2.48)
Sigma PFC / Sigma	3265	0.61 (0.39,0.96)	1.20 (0.87,1.66)	1.67 (1.26,2.21)	1.89 (1.44,2.47)	2.11 (1.63,2.74)
Triathlon / Triathlon	2366	0.80 (0.49,1.28)	1.52 (1.06,2.17)	1.87 (1.34,2.60)	2.17 (1.56,3.00)	2.62 (1.88,3.66)
Triathlon / Triathlon TS	637	0.81 (0.34,1.93)	1.69 (0.91,3.13)	2.26 (1.32,3.87)	2.53 (1.50,4.26)	2.81 (1.69,4.67)
Vanguard / Maxim	7117	0.79 (0.60,1.03)	1.72 (1.43,2.06)	2.23 (1.90,2.63)	2.63 (2.25,3.07)	2.85 (2.44,3.32)

Table 779: Summary of cumulative percent revision for CR femoral/tibial combinations in primary TKA having at least 500 cases, sorted by 5-year cpr.

Femoral/tibial combination	N	1 year	2 years	3 years	4 years	5 years
NK II / NK II	872	0.11 (0.02,0.81)	0.70 (0.31,1.54)	1.18 (0.64,2.19)	1.59 (0.93,2.73)	*1.59 (0.93,2.73)*
Sigma PFC / Sigma	3265	0.61 (0.39,0.96)	1.20 (0.87,1.66)	1.67 (1.26,2.21)	1.89 (1.44,2.47)	2.11 (1.63,2.74)
Persona / Persona	18716	0.53 (0.42,0.65)	1.16 (0.99,1.36)	1.61 (1.39,1.85)	1.83 (1.59,2.11)	2.14 (1.84,2.48)
Triathlon / Triathlon	2366	0.80 (0.49,1.28)	1.52 (1.06,2.17)	1.87 (1.34,2.60)	2.17 (1.56,3.00)	2.62 (1.88,3.66)
Triathlon / Triathlon TS	637	0.81 (0.34,1.93)	1.69 (0.91,3.13)	2.26 (1.32,3.87)	2.53 (1.50,4.26)	2.81 (1.69,4.67)
Vanguard / Maxim	7117	0.79 (0.60,1.03)	1.72 (1.43,2.06)	2.23 (1.90,2.63)	2.63 (2.25,3.07)	2.85 (2.44,3.32)
Attune / Attune	5023	0.88 (0.65,1.19)	1.74 (1.39,2.18)	2.33 (1.90,2.84)	2.93 (2.42,3.55)	3.22 (2.65,3.90)
Genesis II / Genesis II	546	0.94 (0.39,2.24)	1.36 (0.65,2.83)	2.11 (1.13,3.91)	2.99 (1.73,5.14)	3.38 (1.98,5.74)
Journey II / Journey	605	1.56 (0.78,3.11)	4.33 (2.72,6.85)	4.33 (2.72,6.85)	4.33 (2.72,6.85)	*4.33 (2.72,6.85)*

Table 780: Summary of cumulative percent revision for PS femoral/tibial combinations in primary TKA having at least 500 cases, sorted alphabetically.

Femoral/tibial combination	N	1 year	2 years	3 years	4 years	5 years
Attune / Attune	4544	0.45 (0.28,0.71)	1.59 (1.22,2.07)	2.41 (1.92,3.02)	3.47 (2.80,4.29)	4.13 (3.28,5.19)
Journey II / Journey	3299	1.42 (1.04,1.94)	2.84 (2.24,3.61)	3.84 (3.09,4.78)	4.68 (3.72,5.89)	5.10 (4.01,6.47)
Journey II BCS (Oxinium) / Journey	599	1.53 (0.77,3.04)	3.82 (2.38,6.11)	4.86 (3.13,7.53)	5.38 (3.46,8.30)	*5.38* *(3.46,8.30)*
Legion / Genesis II	3994	1.56 (1.21,2.02)	3.42 (2.86,4.08)	4.57 (3.90,5.36)	5.19 (4.45,6.05)	5.69 (4.88,6.64)
NexGen LPS GS / NexGen Precoat	525	0.38 (0.10,1.52)	1.36 (0.65,2.84)	1.96 (1.06,3.61)	2.17 (1.21,3.88)	2.38 (1.36,4.15)
NexGen LPS Option / NexGen Precoat	719	0.71 (0.30,1.71)	1.47 (0.79,2.72)	1.64 (0.91,2.94)	2.19 (1.30,3.68)	2.41 (1.45,3.99)
NexGen LPS Option / NexGen TM	1177	0.44 (0.18,1.05)	0.63 (0.30,1.31)	0.92 (0.49,1.70)	1.12 (0.64,1.96)	1.39 (0.82,2.34)
Persona / Persona	14039	1.02 (0.86,1.22)	2.36 (2.10,2.66)	3.10 (2.78,3.45)	3.64 (3.28,4.04)	4.10 (3.69,4.56)
Sigma / M.B.T.	869	1.71 (1.02,2.87)	2.95 (1.97,4.40)	3.40 (2.32,4.95)	4.33 (3.05,6.13)	4.57 (3.23,6.46)
Sigma / Sigma	1098	0.84 (0.44,1.60)	2.00 (1.31,3.05)	2.41 (1.63,3.54)	2.63 (1.81,3.81)	2.90 (2.02,4.16)
Triathlon / Triathlon	5503	1.24 (0.97,1.58)	2.18 (1.79,2.64)	2.74 (2.29,3.29)	3.01 (2.51,3.61)	3.40 (2.81,4.11)
Triathlon / Triathlon TS	9460	0.90 (0.72,1.12)	1.89 (1.62,2.21)	2.53 (2.20,2.91)	2.99 (2.61,3.42)	3.38 (2.95,3.88)
Vanguard / Maxim	5545	1.07 (0.82,1.39)	1.93 (1.58,2.35)	2.57 (2.16,3.07)	2.96 (2.50,3.51)	3.45 (2.91,4.08)

Table 781: Summary of cumulative percent revision for PS femoral/tibial combinations in primary TKA having at least 500 cases, sorted by 5-year cpr.

Femoral/tibial combination	N	1 year	2 years	3 years	4 years	5 years
NexGen LPS Option / NexGen TM	1177	0.44 (0.18,1.05)	0.63 (0.30,1.31)	0.92 (0.49,1.70)	1.12 (0.64,1.96)	1.39 (0.82,2.34)
NexGen LPS GS / NexGen Precoat	525	0.38 (0.10,1.52)	1.36 (0.65,2.84)	1.96 (1.06,3.61)	2.17 (1.21,3.88)	2.38 (1.36,4.15)
NexGen LPS Option / NexGen Precoat	719	0.71 (0.30,1.71)	1.47 (0.79,2.72)	1.64 (0.91,2.94)	2.19 (1.30,3.68)	2.41 (1.45,3.99)
Sigma / Sigma	1098	0.84 (0.44,1.60)	2.00 (1.31,3.05)	2.41 (1.63,3.54)	2.63 (1.81,3.81)	2.90 (2.02,4.16)
Triathlon / Triathlon TS	9460	0.90 (0.72,1.12)	1.89 (1.62,2.21)	2.53 (2.20,2.91)	2.99 (2.61,3.42)	3.38 (2.95,3.88)
Triathlon / Triathlon	5503	1.24 (0.97,1.58)	2.18 (1.79,2.64)	2.74 (2.29,3.29)	3.01 (2.51,3.61)	3.40 (2.81,4.11)
Vanguard / Maxim	5545	1.07 (0.82,1.39)	1.93 (1.58,2.35)	2.57 (2.16,3.07)	2.96 (2.50,3.51)	3.45 (2.91,4.08)
Persona / Persona	14039	1.02 (0.86,1.22)	2.36 (2.10,2.66)	3.10 (2.78,3.45)	3.64 (3.28,4.04)	4.10 (3.69,4.56)
Attune / Attune	4544	0.45 (0.28,0.71)	1.59 (1.22,2.07)	2.41 (1.92,3.02)	3.47 (2.80,4.29)	4.13 (3.28,5.19)
Sigma / M.B.T.	869	1.71 (1.02,2.87)	2.95 (1.97,4.40)	3.40 (2.32,4.95)	4.33 (3.05,6.13)	4.57 (3.23,6.46)
Journey II / Journey	3299	1.42 (1.04,1.94)	2.84 (2.24,3.61)	3.84 (3.09,4.78)	4.68 (3.72,5.89)	5.10 (4.01,6.47)
Journey II BCS (Oxinium) / Journey	599	1.53 (0.77,3.04)	3.82 (2.38,6.11)	4.86 (3.13,7.53)	5.38 (3.46,8.30)	*5.38* *(3.46,8.30)*
Legion / Genesis II	3994	1.56 (1.21,2.02)	3.42 (2.86,4.08)	4.57 (3.90,5.36)	5.19 (4.45,6.05)	5.69 (4.88,6.64)

Attune/Attune

N=9638

80 surgeons across 35 sites use this implant combination.

Table 782: Volume of primary cases by surgeon and site for the Attune/Attune combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	120.5 (196.4)	18.5 (188.5)
Cases per site	275.4 (419.7)	51 (438)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 783: Descriptive statistics of cases receiving the Attune/Attune combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	5791	60.1	
Age (yrs)	9638	66(9.2)	66(12)
Height (cm)	9237	168.9(10.6)	168(17.8)
Weight (kg)	9237	95.9(21.1)	94.6(27.9)
BMI(kg/m^2)	9237	33.6(6.6)	32.9(9)
Smoking - never (%)	4895	50.8	
Smoking - previous (%)	3704	38.4	
Smoking - current (%)	992	10.3	
Smoking - unknown (%)	47	0.5	

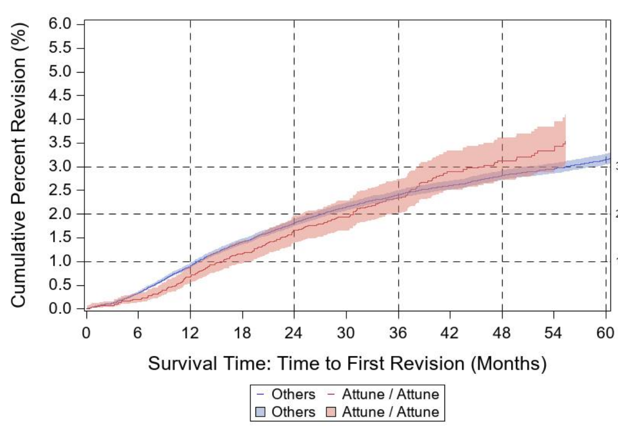

Figure 197: Cumulative percent revision curve for the Attune/Attune combination compared to all other implant combinations in primary TKA cases.

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Table 784: Cumulative percent revision and number at risk for Attune/Attune combination in primary TKA cases.

Year	Number at risk	CPR
0	9630	0.00 (0.00,0.00)
1	8160	0.67 (0.52,0.87)
2	6493	1.66 (1.40,1.97)
3	4760	2.35 (2.02,2.73)
4	2898	3.13 (2.71,3.60)
5*	1119	3.54 (3.05,4.09)

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 785: Reasons for revision following primary TKA for Attune/Attune cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	69	33.3
2	Dislocation/Instability	54	26.1
3	Joint Infection	45	21.7
4	Arthrofibrosis	11	5.3
5	Component fracture/failure	9	4.3
6	Pain	8	3.9
7	Malalignment	5	2.4
8	Metal reaction/Metallosis	2	1.0
9	Extensor mechanism failure	1	0.5
10	Patellofemoral Joint	1	0.5
11	Peri-prosthetic fracture - Femur	1	0.5
12	Poly liner wear	1	0.5

Table 786: Distribution of approach used for Attune/Attune combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	8438	87.5
Mid-vastus	769	8.0
Sub-vastus	9	0.1
Lateral parapatellar	7	0.1
Missing/unknown/other	415	4.3

Table 787: Distribution of polyethylene used for Attune/Attune combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	1	0.0
XLPE	0	0.0
Antioxidant XLPE	9605	99.7
Missing/unknown/other	32	0.3

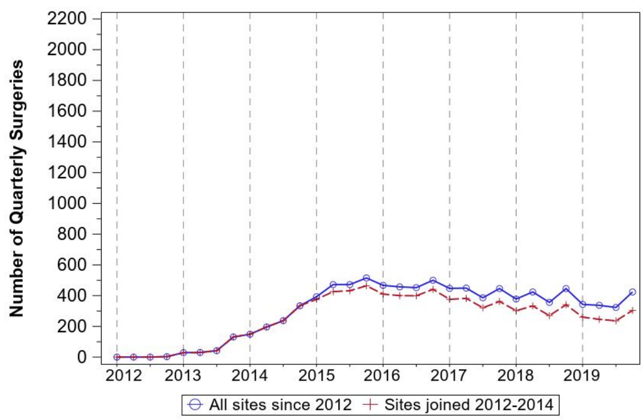

Figure 198: Utilization of the Attune/Attune combination in primary TKA cases.

Evolution MP/Evolution MP

N=2642

26 surgeons across 20 sites use this implant combination.

Table 788: Volume of primary cases by surgeon and site for the Evolution MP/Evolution MP combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	101.6 (132.6)	43 (162)
Cases per site	132.1 (143.7)	63 (149)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 789: Descriptive statistics of cases receiving the Evolution MP/Evolution MP combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	1570	59.4	
Age (yrs)	2642	65.5(9.2)	66(13)
Height (cm)	2642	169.2(10.9)	167.6(17.8)
Weight (kg)	2642	95.4(21.8)	93.2(28.8)
BMI(kg/m^2)	2642	33.3(6.9)	32.5(9.1)
Smoking - never (%)	1416	53.6	
Smoking - previous (%)	1004	38	
Smoking - current (%)	212	8	
Smoking - unknown (%)	10	0.4	

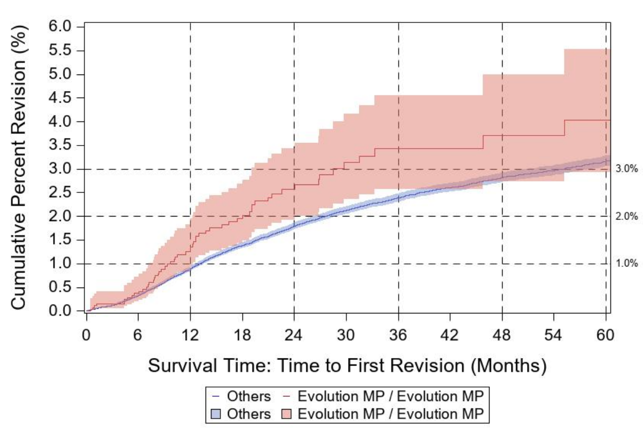

Figure 199: Cumulative percent revision curve for the Evolution MP/Evolution MP combination compared to all other implant combinations in primary TKA cases.

Table 790: Cumulative percent revision and number at risk for Evolution MP/Evolution MP combination in primary TKA cases.

Year	Number at risk	CPR
0	2642	0.00 (0.00,0.00)
1	1791	1.30 (0.90,1.88)
2	1023	2.57 (1.92,3.43)
3	558	3.43 (2.58,4.55)
4	346	3.70 (2.74,4.99)
5	254	4.03 (2.93,5.53)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 0.955 (0.712,1.282). It was 0.808 (0.756,0.864) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 791: Reasons for revision following primary TKA for Evolution MP/Evolution MP cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	24	42.1
2	Joint Infection	12	21.1
3	Aseptic Loosening	10	17.5
4	Component fracture/failure	4	7.0
5	Arthrofibrosis	2	3.5
6	Pain	2	3.5
7	Extensor mechanism failure	1	1.8
8	Malalignment	1	1.8
9	Metal reaction/Metallosis	1	1.8

Table 792: Distribution of approach used for Evolution MP/Evolution MP combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	2625	99.4
Mid-vastus	10	0.4
Sub-vastus	1	0.0
Lateral parapatellar	4	0.2
Missing/unknown/other	2	0.1

Table 793: Distribution of polyethylene used for Evolution MP/Evolution MP combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	2619	99.1
XLPE	0	0.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	23	0.9

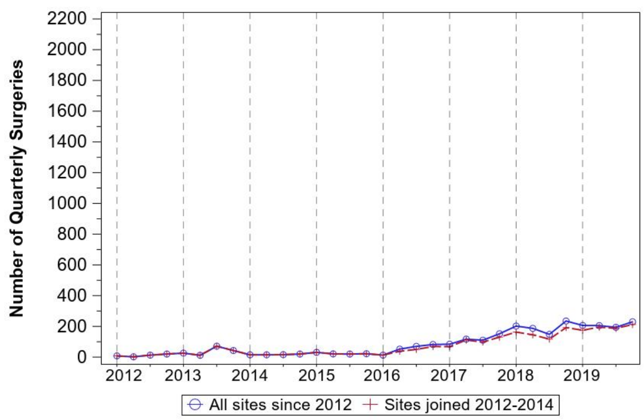

Figure 200: Utilization of the Evolution MP/Evolution MP combination in primary TKA cases.

Genesis II/Genesis II
N=1369

22 surgeons across 12 sites use this implant combination.

Table 794: Volume of primary cases by surgeon and site for the Genesis II/Genesis II combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	62.2 (94.2)	6 (131)
Cases per site	114.1 (154.8)	46 (160)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 795: Descriptive statistics of cases receiving the Genesis II/Genesis II combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	848	61.9	
Age (yrs)	1369	66.8(9.8)	67(14)
Height (cm)	1369	168.2(10.6)	167.6(15.3)
Weight (kg)	1369	94.8(21.3)	92.5(27.4)
BMI(kg/m^2)	1369	33.5(6.8)	32.7(9)
Smoking - never (%)	735	53.7	
Smoking - previous (%)	512	37.4	
Smoking - current (%)	114	8.3	
Smoking - unknown (%)	8	0.6	

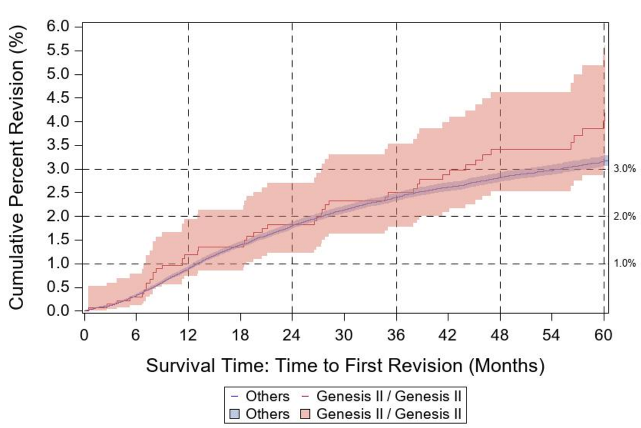

Figure 201: Cumulative percent revision curve for the Genesis II/Genesis II combination compared to all other implant combinations in primary TKA cases.

Table 796: Cumulative percent revision and number at risk for Genesis II/Genesis II combination in primary TKA cases.

Year	Number at risk	CPR
0	1365	0.00 (0.00,0.00)
1	1299	1.19 (0.73,1.94)
2	1210	1.82 (1.22,2.71)
3	1073	2.50 (1.77,3.52)
4	846	3.41 (2.52,4.62)
5	577	4.02 (2.99,5.40)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 0.996 (0.639,1.553). It was 0.808 (0.756,0.864) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 797: Reasons for revision following primary TKA for Genesis II/Genesis II cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	9	22.5
2	Joint Infection	8	20.0
3	Dislocation/Instability	7	17.5
4	Pain	7	17.5
5	Arthrofibrosis	5	12.5
6	Component fracture/failure	2	5.0
7	Malalignment	1	2.5
8	Poly liner wear	1	2.5

Table 798: Distribution of approach used for Genesis II/Genesis II combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	1168	85.3
Mid-vastus	194	14.2
Sub-vastus	0	0.0
Lateral parapatellar	3	0.2
Missing/unknown/other	4	0.3

Table 799: Distribution of polyethylene used for Genesis II/Genesis II combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	662	48.4
XLPE	705	51.5
Antioxidant XLPE	0	0.0
Missing/unknown/other	2	0.1

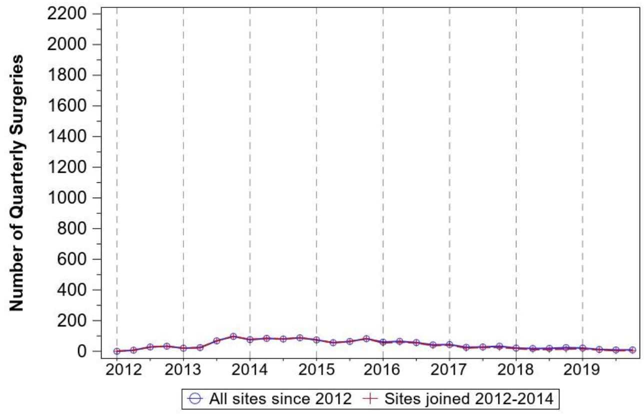

Figure 202: Utilization of the Genesis II/Genesis II combination in primary TKA cases.

Genesis II (CoCr)/Genesis II
N=686

14 surgeons use this implant combination at fewer than 10 sites.

Table 800: Volume of primary cases by surgeon and site for the Genesis II (CoCr)/Genesis II combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	49 (78.2)	13 (73)
Cases per site	76.2 (94.4)	42 (91)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 801: Descriptive statistics of cases receiving the Genesis II (CoCr)/Genesis II combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	428	62.4	
Age (yrs)	686	71.9(8.4)	72(11)
Height (cm)	686	167.1(10.1)	165.6(15.3)
Weight (kg)	686	90(19.2)	88.4(25.8)
BMI(kg/m^2)	686	32.2(6.3)	31.7(8.3)
Smoking - never (%)	354	51.6	
Smoking - previous (%)	280	40.8	
Smoking - current (%)	47	6.9	
Smoking - unknown (%)	5	0.7	

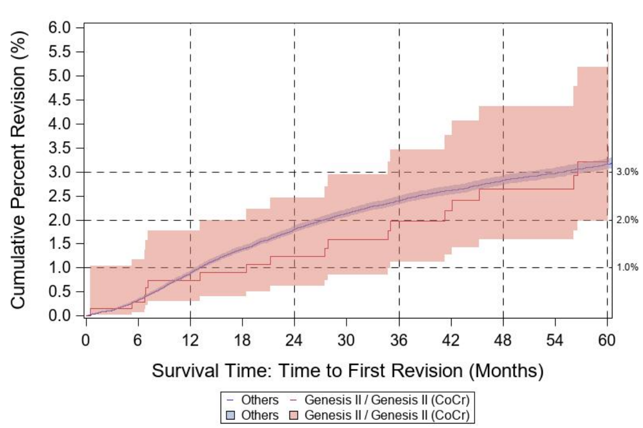

Figure 203: Cumulative percent revision curve for the Genesis II (CoCr)/Genesis II combination compared to all other implant combinations in primary TKA cases.

Table 802: Cumulative percent revision and number at risk for Genesis II (CoCr)/Genesis II combination in primary TKA cases.

Year	Number at risk	CPR
0	683	0.00 (0.00,0.00)
1	640	0.74 (0.31,1.78)
2	575	1.23 (0.62,2.45)
3	494	1.98 (1.12,3.47)
4	405	2.64 (1.59,4.36)
5	304	3.21 (1.98,5.18)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 0.946 (0.498,1.796). It was 0.809 (0.757,0.865) and 0.963 (0.96,0.966) for sex (female) and age, respectively.

Table 803: Reasons for revision following primary TKA for Genesis II (CoCr)/Genesis II cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	5	31.3
2	Pain	4	25.0
3	Dislocation/Instability	3	18.8
4	Aseptic Loosening	2	12.5
5	Malalignment	1	6.3
6	Poly liner wear	1	6.3

Table 804: Distribution of approach used for Genesis II (CoCr)/Genesis II combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	640	93.3
Mid-vastus	44	6.4
Sub-vastus	0	0.0
Lateral parapatellar	2	0.3
Missing/unknown/other	0	0.0

Table 805: Distribution of polyethylene used for Genesis II (CoCr)/Genesis II combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	576	84.0
XLPE	109	15.9
Antioxidant XLPE	0	0.0
Missing/unknown/other	1	0.1

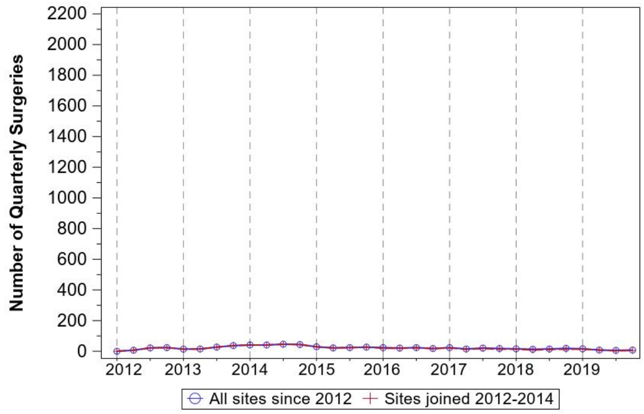

Figure 204: Utilization of the Genesis II (CoCr)/Genesis II combination in primary TKA cases.

Genesis II (Oxinium)/Genesis II
N=683

21 surgeons across 12 sites use this implant combination.

Table 806: Volume of primary cases by surgeon and site for the Genesis II (Oxinium)/Genesis II combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	32.5 (52.4)	4 (50)
Cases per site	56.9 (100.6)	7.5 (71)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 807: Descriptive statistics of cases receiving the Genesis II (Oxinium)/Genesis II combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	420	61.5	
Age (yrs)	683	61.6(8.3)	62(10)
Height (cm)	683	169.3(11)	168(17.8)
Weight (kg)	683	99.7(22.2)	97.5(29.1)
BMI(kg/m^2)	683	34.8(7.2)	33.8(9.3)
Smoking - never (%)	381	55.8	
Smoking - previous (%)	232	34	
Smoking - current (%)	67	9.8	
Smoking - unknown (%)	3	0.4	

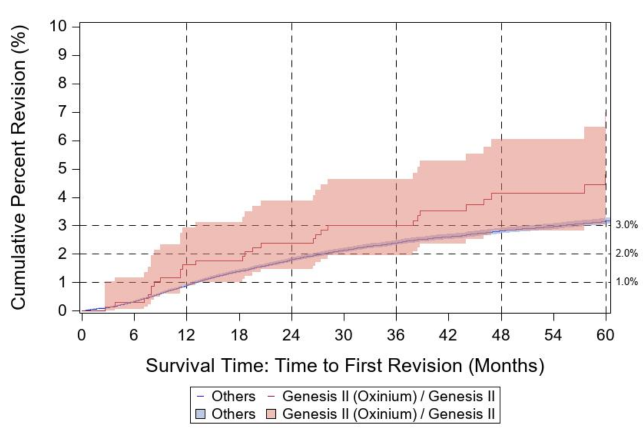

Figure 205: Cumulative percent revision curve for the Genesis II (Oxinium)/Genesis II combination compared to all other implant combinations in primary TKA cases.

Table 808: Cumulative percent revision and number at risk for Genesis II (Oxinium)/Genesis II combination in primary TKA cases.

Year	Number at risk	CPR
0	682	0.00 (0.00,0.00)
1	659	1.63 (0.91,2.92)
2	635	2.39 (1.47,3.87)
3	579	3.02 (1.96,4.64)
4	441	4.15 (2.84,6.05)
5	273	4.80 (3.29,6.98)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 0.989 (0.588,1.667). It was 0.808 (0.756,0.865) and 0.962 (0.96,0.966) for sex (female) and age, respectively.

Table 809: Reasons for revision following primary TKA for Genesis II (Oxinium)/Genesis II cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	7	29.2
2	Arthrofibrosis	5	20.8
3	Dislocation/Instability	4	16.7
4	Joint Infection	3	12.5
5	Pain	3	12.5
6	Component fracture/failure	2	8.3

Table 810: Distribution of approach used for Genesis II (Oxinium)/Genesis II combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	528	77.3
Mid-vastus	150	22.0
Sub-vastus	0	0.0
Lateral parapatellar	1	0.1
Missing/unknown/other	4	0.6

Table 811: Distribution of polyethylene used for Genesis II (Oxinium)/Genesis II combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	86	12.6
XLPE	596	87.3
Antioxidant XLPE	0	0.0
Missing/unknown/other	1	0.1

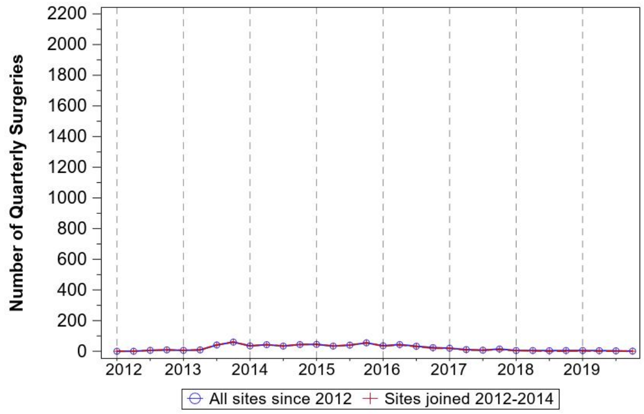

Figure 206: Utilization of the Genesis II (Oxinium)/Genesis II combination in primary TKA cases.

iTotal
N=715

15 surgeons across 12 sites use this implant.

Table 812: Volume of primary cases by surgeon and site for the iTotal.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	47.7 (78.0)	8 (54)
Cases per site	59.6 (86.5)	18 (79)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 813: Descriptive statistics of cases receiving the iTotalin primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	480	67.1	
Age (yrs)	715	64.2(9.1)	64(11)
Height (cm)	715	168.1(10.2)	167.6(15.3)
Weight (kg)	715	93.1(22.5)	90.4(28)
BMI(kg/m^2)	715	32.9(7)	32(8.7)
Smoking - never (%)	387	54.1	
Smoking - previous (%)	270	37.8	
Smoking - current (%)	57	8	
Smoking - unknown (%)	0	0.0	

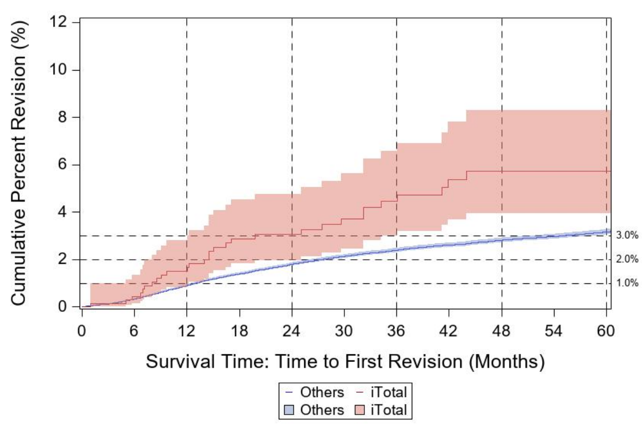

Figure 207: Cumulative percent revision curve for the iTotal compared to all implants other than the iTotal in primary TKA cases.

Table 814: Cumulative percent revision and number at risk for iTotal in primary TKA cases.

Year	Number at risk	CPR
0	715	0.00 (0.00,0.00)
1	604	1.51 (0.82,2.80)
2	471	3.06 (1.96,4.77)
3	365	4.45 (3.01,6.57)
4	201	5.74 (3.95,8.29)
5	91	5.74 (3.95,8.29)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 1.15 (0.754,1.755). It was 0.808 (0.756,0.864) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 815: Reasons for revision following primary TKA for iTotal cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	14	46.7
2	Aseptic Loosening	9	30.0
3	Component fracture/failure	2	6.7
4	Pain	2	6.7
5	Arthrofibrosis	1	3.3
6	Malalignment	1	3.3
7	Metal reaction/Metallosis	1	3.3

Table 816: Distribution of approach used for iTotal in primary TKA cases.

Approach	N	Percent
Medial parapatellar	491	68.7
Mid-vastus	211	29.5
Sub-vastus	0	0.0
Lateral parapatellar	0	0.0
Missing/unknown/other	13	1.8

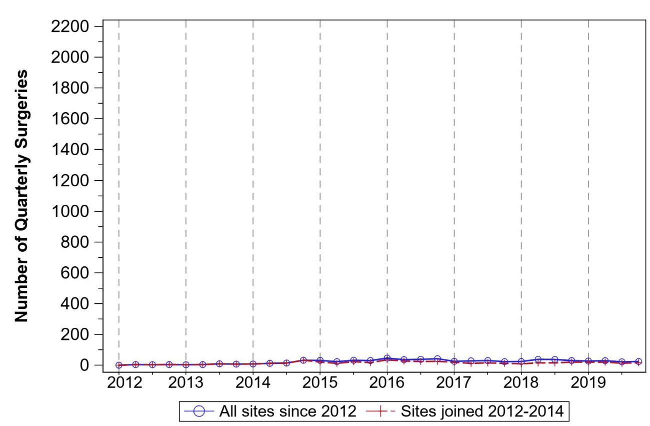

Figure 208: Utilization of the iTotal in primary TKA cases.

iTotal G2+

N=692

13 surgeons across 12 sites use this implant.

Table 817: Volume of primary cases by surgeon and site for the iTotal G2+.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	53.2 (81.9)	8 (53)
Cases per site	57.7 (86.9)	13.5 (77)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 818: Descriptive statistics of cases receiving the iTotal G2+in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	468	67.6	
Age (yrs)	692	64.3(9.1)	65(11)
Height (cm)	692	168(10.2)	167.6(15.3)
Weight (kg)	692	93(22.6)	90.1(28.4)
BMI(kg/m^2)	692	32.8(7)	31.9(8.6)
Smoking - never (%)	373	53.9	
Smoking - previous (%)	263	38	
Smoking - current (%)	55	8	
Smoking - unknown (%)	0	0.0	

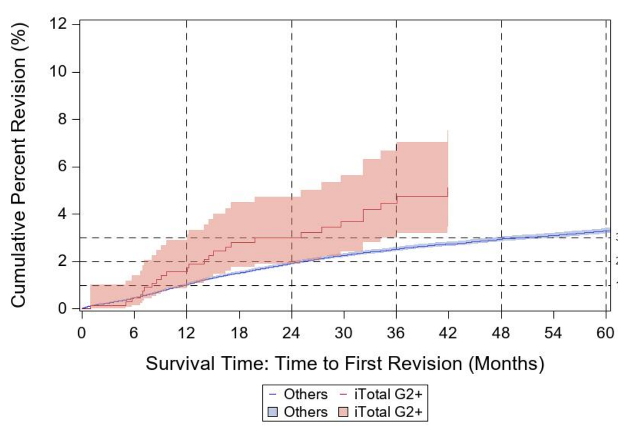

Figure 209: Cumulative percent revision curve for the iTotal G2+ compared to all implants other than the iTotal in primary TKA cases.

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Table 819: Cumulative percent revision and number at risk for iTotal G2+ in primary TKA cases.

Year	Number at risk	CPR
0	692	0.00 (0.00,0.00)
1	581	1.57 (0.85,2.90)
2	449	3.01 (1.90,4.74)
3	343	4.48 (3.00,6.66)
4*	181	5.12 (3.46,7.53)
5*	71	5.12 (3.46,7.53)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 1.001 (0.636,1.576). It was 0.802 (0.752,0.856) and 0.968 (0.965,0.972) for sex (female) and age, respectively.

Table 820: Reasons for revision following primary TKA for iTotal G2+ cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	13	50.0
2	Aseptic Loosening	8	30.8
3	Arthrofibrosis	1	3.8
4	Component fracture/failure	1	3.8
5	Malalignment	1	3.8
6	Metal reaction/Metallosis	1	3.8
7	Pain	1	3.8

Table 821: Distribution of approach used for iTotal G2+ in primary TKA cases.

Approach	N	Percent
Medial parapatellar	475	68.6
Mid-vastus	206	29.8
Sub-vastus	0	0.0
Lateral parapatellar	0	0.0
Missing/unknown/other	11	1.6

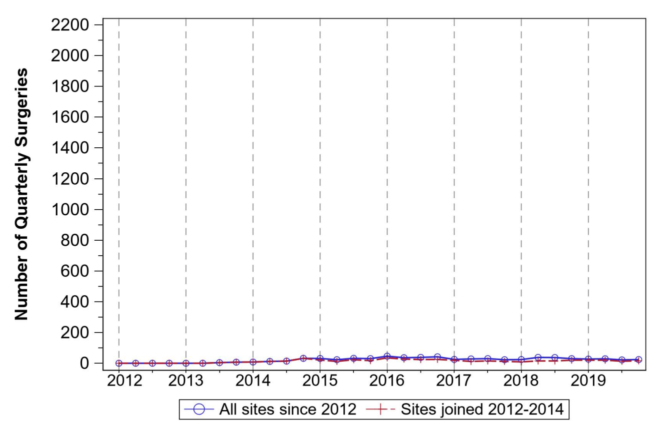

Figure 210: Utilization of the iTotal G2+ in primary TKA cases.

Journey II/Journey
N=4290

107 surgeons across 48 sites use this implant combination.

Table 822: Volume of primary cases by surgeon and site for the Journey II/Journey combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	40.1 (78.0)	7 (37)
Cases per site	89.4 (122.4)	36 (155)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 823: Descriptive statistics of cases receiving the Journey II/Journey combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	2610	60.8	
Age (yrs)	4290	65(9.3)	65(12)
Height (cm)	4289	168.9(10.7)	167.6(17.8)
Weight (kg)	4289	97.3(22.1)	96(30)
BMI(kg/m^2)	4289	34.1(7)	33.3(9.5)
Smoking - never (%)	2131	49.7	
Smoking - previous (%)	1618	37.7	
Smoking - current (%)	501	11.7	
Smoking - unknown (%)	40	0.9	

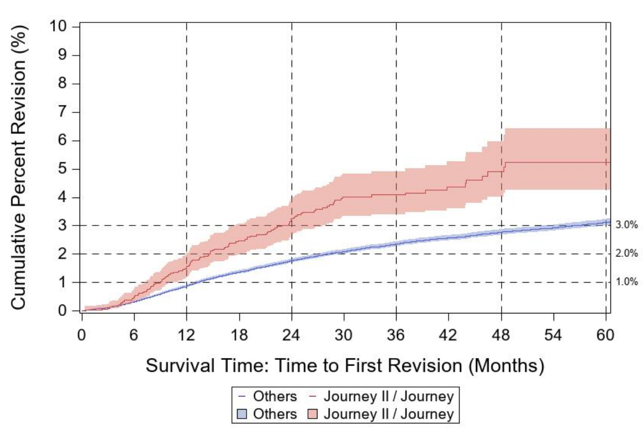

Figure 211: Cumulative percent revision curve for the Journey II/Journey combination compared to all other implant combinations in primary TKA cases.

Table 824: Cumulative percent revision and number at risk for Journey II/Journey combination in primary TKA cases.

Year	Number at risk	CPR
0	4283	0.00 (0.00,0.00)
1	3065	1.57 (1.21,2.04)
2	2091	3.25 (2.67,3.95)
3	1282	4.09 (3.40,4.91)
4	573	4.90 (4.02,5.97)
5	209	5.24 (4.27,6.43)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 1.401 (1.134,1.733). It was 0.811 (0.759,0.868) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 825: Reasons for revision following primary TKA for Journey II/Journey cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	50	40.3
2	Joint Infection	19	15.3
3	Arthrofibrosis	18	14.5
4	Aseptic Loosening	16	12.9
5	Pain	9	7.3
6	Peri-prosthetic fracture - Femur	3	2.4
7	Poly liner wear	3	2.4
8	Component fracture/failure	2	1.6
9	Malalignment	2	1.6
10	Extensor mechanism failure	1	0.8
11	Metal reaction/Metallosis	1	0.8

Table 826: Distribution of approach used for Journey II/Journey combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	3903	91.0
Mid-vastus	368	8.6
Sub-vastus	4	0.1
Lateral parapatellar	4	0.1
Missing/unknown/other	11	0.3

Table 827: Distribution of polyethylene used for Journey II/Journey combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	4128	96.2
Antioxidant XLPE	0	0.0
Missing/unknown/other	162	3.8

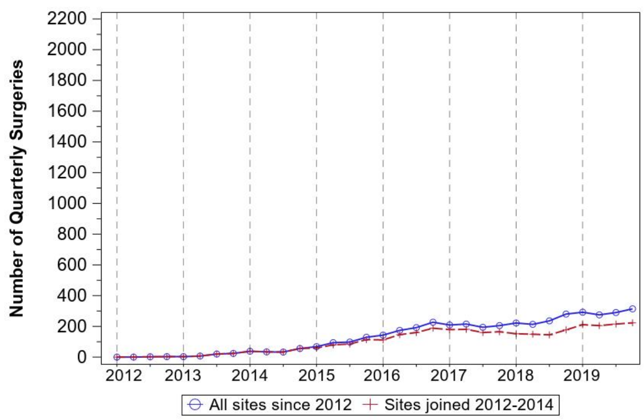

Figure 212: Utilization of the Journey II/Journey combination in primary TKA cases.

Journey II (Oxinium)/Journey
N=3836

107 surgeons across 48 sites use this implant combination.

Table 828: Volume of primary cases by surgeon and site for the Journey II (Oxinium)/Journey combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	35.9 (62.5)	6 (35)
Cases per site	79.9 (96.7)	36 (138.5)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 829: Descriptive statistics of cases receiving the Journey II (Oxinium)/Journey combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	2309	60.2	
Age (yrs)	3836	64.2(9.3)	64(12)
Height (cm)	3835	169.2(10.7)	167.6(17.8)
Weight (kg)	3835	97.5(22.1)	96.3(29.6)
BMI(kg/m^2)	3835	34(7)	33.3(9.4)
Smoking - never (%)	1888	49.2	
Smoking - previous (%)	1430	37.3	
Smoking - current (%)	479	12.5	
Smoking - unknown (%)	39	1	

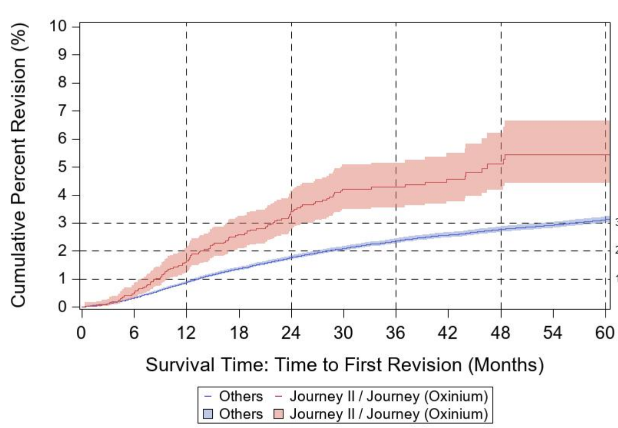

Figure 213: Cumulative percent revision curve for the Journey II (Oxinium)/Journey combination compared to all other implant combinations in primary TKA cases.

Table 830: Cumulative percent revision and number at risk for Journey II (Oxinium)/Journey combination in primary TKA cases.

Year	Number at risk	CPR
0	3830	0.00 (0.00,0.00)
1	2831	1.66 (1.28,2.17)
2	1995	3.41 (2.79,4.16)
3	1246	4.28 (3.55,5.15)
4	573	5.10 (4.19,6.21)
5	209	5.44 (4.44,6.65)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 1.429 (1.155,1.768). It was 0.811 (0.759,0.868) and 0.962 (0.96,0.966) for sex (female) and age, respectively.

Table 831: Reasons for revision following primary TKA for Journey II (Oxinium)/Journey cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	50	41.3
2	Joint Infection	18	14.9
3	Arthrofibrosis	17	14.0
4	Aseptic Loosening	15	12.4
5	Pain	9	7.4
6	Peri-prosthetic fracture - Femur	3	2.5
7	Poly liner wear	3	2.5
8	Component fracture/failure	2	1.7
9	Malalignment	2	1.7
10	Extensor mechanism failure	1	0.8
11	Metal reaction/Metallosis	1	0.8

Table 832: Distribution of approach used for Journey II (Oxinium)/Journey combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	3455	90.1
Mid-vastus	363	9.5
Sub-vastus	4	0.1
Lateral parapatellar	4	0.1
Missing/unknown/other	10	0.3

Table 833: Distribution of polyethylene used for Journey II (Oxinium)/Journey combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	3690	96.2
Antioxidant XLPE	0	0.0
Missing/unknown/other	146	3.8

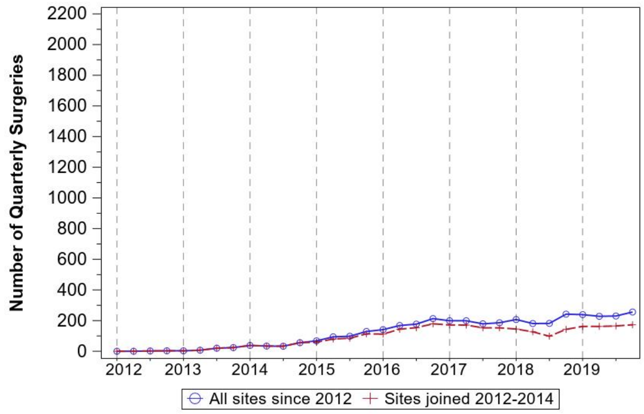

Figure 214: Utilization of the Journey II (Oxinium)/Journey combination in primary TKA cases.

Journey II BCS (Oxinium)/Journey
N=625

55 surgeons across 36 sites use this implant combination.

Table 834: Volume of primary cases by surgeon and site for the Journey II BCS (Oxinium)/Journey combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	11.4 (15.1)	3 (16)
Cases per site	17.4 (19.1)	12 (21.5)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 835: Descriptive statistics of cases receiving the Journey II BCS (Oxinium)/Journey combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	550	88	
Age (yrs)	625	64.6(9.9)	65(14)
Height (cm)	625	163.1(7.1)	162.6(10.1)
Weight (kg)	625	92(20.9)	89.9(30.2)
BMI(kg/m^2)	625	34.6(7.7)	33.7(11.1)
Smoking - never (%)	321	51.4	
Smoking - previous (%)	225	36	
Smoking - current (%)	78	12.5	
Smoking - unknown (%)	1	0.2	

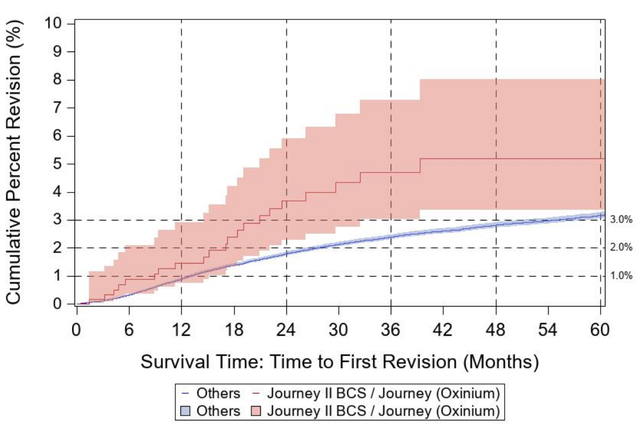

Figure 215: Cumulative percent revision curve for the Journey II BCS (Oxinium)/Journey combination compared to all other implant combinations in primary TKA cases.

Table 836: Cumulative percent revision and number at risk for Journey II BCS (Oxinium)/Journey combination in primary TKA cases.

Year	Number at risk	CPR
0	624	0.00 (0.00,0.00)
1	470	1.47 (0.74,2.93)
2	341	3.70 (2.30,5.92)
3	231	4.70 (3.02,7.29)
4	107	5.19 (3.34,8.01)
5	42	5.19 (3.34,8.01)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 1.415 (0.916,2.186). It was 0.806 (0.754,0.863) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 837: Reasons for revision following primary TKA for Journey II BCS (Oxinium)/Journey cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	7	31.8
2	Aseptic Loosening	6	27.3
3	Joint Infection	4	18.2
4	Pain	2	9.1
5	Arthrofibrosis	1	4.5
6	Component fracture/failure	1	4.5
7	Malalignment	1	4.5

Table 838: Distribution of approach used for Journey II BCS (Oxinium)/Journey combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	553	88.5
Mid-vastus	68	10.9
Sub-vastus	0	0.0
Lateral parapatellar	0	0.0
Missing/unknown/other	4	0.6

Table 839: Distribution of polyethylene used for Journey II BCS (Oxinium)/Journey combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	600	96.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	25	4.0

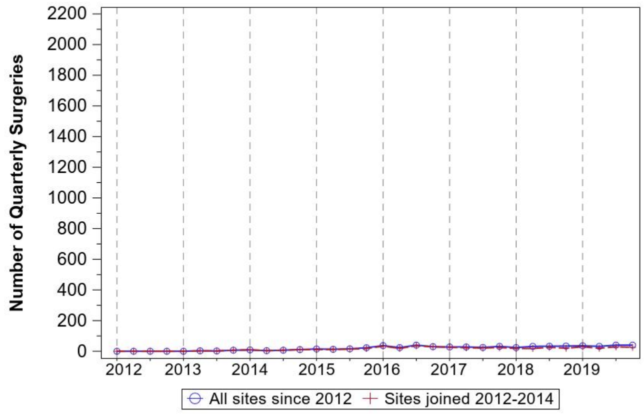

Figure 216: Utilization of the Journey II BCS (Oxinium)/Journey combination in primary TKA cases.

LCS Complete/M.B.T
N=1287

Fewer than 10 surgeons across 10 sites use this implant combination.

Table 840: Volume of primary cases by surgeon and site for the LCS Complete/M.B.T combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	183.9 (334.2)	23 (297)
Cases per site	128.7 (286.9)	9 (40)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 841: Descriptive statistics of cases receiving the LCS Complete/M.B.T combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	808	62.8	
Age (yrs)	1287	67.4(9.6)	68(14)
Height (cm)	1287	167.8(10.1)	167.6(15.2)
Weight (kg)	1287	95.2(20.8)	93(27.6)
BMI(kg/m^2)	1287	33.8(6.7)	33.2(8.7)
Smoking - never (%)	696	54.1	
Smoking - previous (%)	416	32.3	
Smoking - current (%)	118	9.2	
Smoking - unknown (%)	57	4.4	

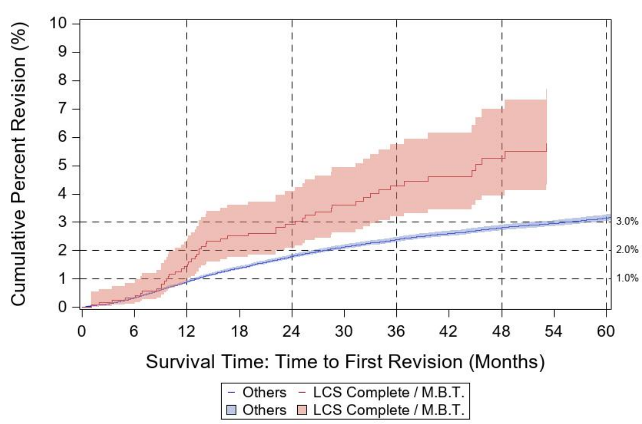

Figure 217: Cumulative percent revision curve for the LCS Complete/M.B.T combination compared to all other implant combinations in primary TKA cases.

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Table 842: Cumulative percent revision and number at risk for LCS Complete/M.B.T combination in primary TKA cases.

Year	Number at risk	CPR
0	1285	0.00 (0.00,0.00)
1	1117	1.44 (0.90,2.30)
2	911	2.93 (2.09,4.10)
3	637	4.29 (3.19,5.75)
4	394	5.25 (3.94,6.99)
5*	233	5.78 (4.33,7.71)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 1.529 (0.816,2.868). It was 0.808 (0.756,0.864) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 843: Reasons for revision following primary TKA for LCS Complete/M.B.T cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	17	37.0
2	Aseptic Loosening	13	28.3
3	Pain	8	17.4
4	Joint Infection	5	10.9
5	Component fracture/failure	3	6.5

Table 844: Distribution of approach used for LCS Complete/M.B.T combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	1282	99.6
Mid-vastus	1	0.1
Sub-vastus	0	0.0
Lateral parapatellar	1	0.1
Missing/unknown/other	3	0.2

Table 845: Distribution of polyethylene used for LCS Complete/M.B.T combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	1286	99.9
XLPE	0	0.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	1	0.1

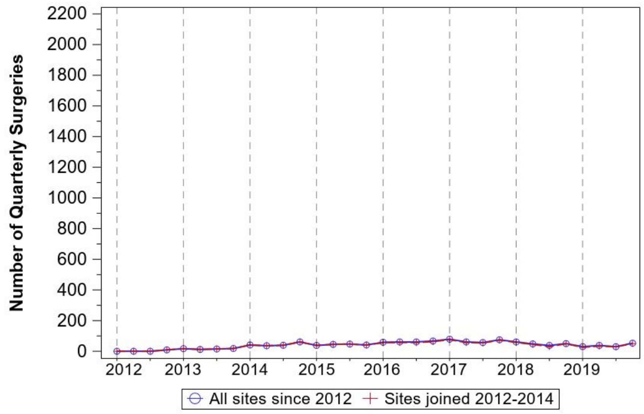

Figure 218: Utilization of the LCS Complete/M.B.T combination in primary TKA cases.

Legion/Genesis II

N=9464

183 surgeons across 60 sites use this implant combination.

Table 846: Volume of primary cases by surgeon and site for the Legion/Genesis II combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	51.7 (100.5)	8 (45)
Cases per site	157.7 (276.7)	39.5 (164.5)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 847: Descriptive statistics of cases receiving the Legion/Genesis II combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	6333	66.9	
Age (yrs)	9464	65.9(9.3)	66(12)
Height (cm)	9464	167.8(10.3)	167.6(15.3)
Weight (kg)	9464	95(21.6)	93.3(28.4)
BMI(kg/m^2)	9464	33.7(7)	32.9(9.5)
Smoking - never (%)	4745	50.1	
Smoking - previous (%)	3763	39.8	
Smoking - current (%)	925	9.8	
Smoking - unknown (%)	31	0.3	

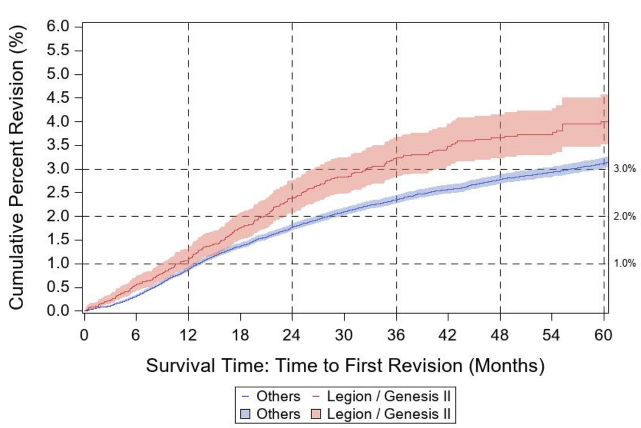

Figure 219: Cumulative percent revision curve for the Legion/Genesis II combination compared to all other implant combinations in primary TKA cases.

Table 848: Cumulative percent revision and number at risk for Legion/Genesis II combination in primary TKA cases.

Year	Number at risk	CPR
0	9445	0.00 (0.00,0.00)
1	7814	1.09 (0.89,1.33)
2	6127	2.38 (2.06,2.74)
3	4431	3.24 (2.84,3.68)
4	2859	3.66 (3.22,4.15)
5	1689	4.01 (3.52,4.57)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 1.047 (0.885,1.238). It was 0.807 (0.756,0.864) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 849: Reasons for revision following primary TKA for Legion/Genesis II cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	76	31.7
2	Aseptic Loosening	52	21.7
3	Joint Infection	45	18.8
4	Pain	23	9.6
5	Arthrofibrosis	17	7.1
6	Component fracture/failure	13	5.4
7	Malalignment	4	1.7
8	Peri-prosthetic fracture - Femur	4	1.7
9	Patellofemoral Joint	3	1.3
10	Extensor mechanism failure	1	0.4
11	Osteolysis	1	0.4
12	Poly liner wear	1	0.4

Table 850: Distribution of approach used for Legion/Genesis II combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	8450	89.3
Mid-vastus	968	10.2
Sub-vastus	12	0.1
Lateral parapatellar	12	0.1
Missing/unknown/other	22	0.2

Table 851: Distribution of polyethylene used for Legion/Genesis II combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	966	10.2
XLPE	8220	86.9
Antioxidant XLPE	0	0.0
Missing/unknown/other	278	2.9

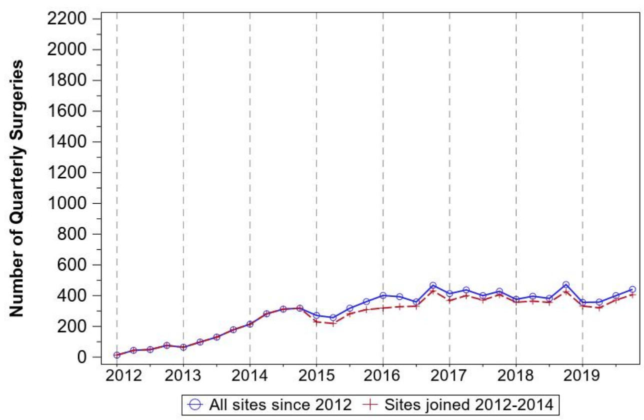

Figure 220: Utilization of the Legion/Genesis II combination in primary TKA cases.

NexGen GS/NexGen Pegged
N=685

17 surgeons across 11 sites use this implant combination.

Table 852: Volume of primary cases by surgeon and site for the NexGen GS/NexGen Pegged combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	40.3 (110.4)	6 (11)
Cases per site	62.3 (134.7)	13 (40)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 853: Descriptive statistics of cases receiving the NexGen GS/NexGen Pegged combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	570	83.2	
Age (yrs)	685	68.2(9.2)	68(13)
Height (cm)	685	165.3(8.7)	165(10)
Weight (kg)	685	85.2(18.3)	83.8(25.6)
BMI(kg/m^2)	685	31.2(6.3)	30.7(8.8)
Smoking - never (%)	401	58.5	
Smoking - previous (%)	252	36.8	
Smoking - current (%)	31	4.5	
Smoking - unknown (%)	1	0.2	

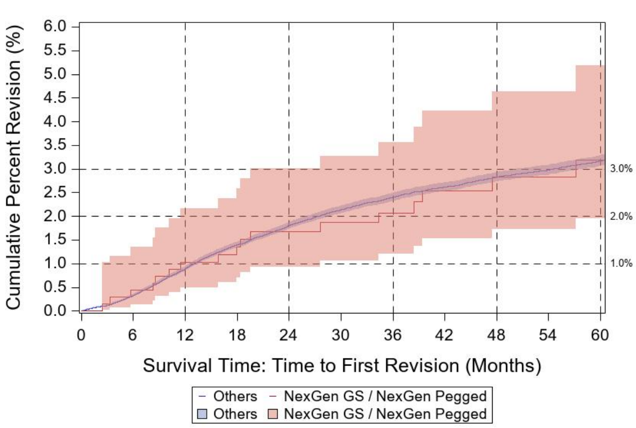

Figure 221: Cumulative percent revision curve for the NexGen GS/NexGen Pegged combination compared to all other implant combinations in primary TKA cases.

Table 854: Cumulative percent revision and number at risk for NexGen GS/NexGen Pegged combination in primary TKA cases.

Year	Number at risk	CPR
0	684	0.00 (0.00,0.00)
1	646	1.04 (0.50,2.16)
2	566	1.68 (0.93,3.02)
3	443	2.08 (1.21,3.56)
4	336	2.83 (1.72,4.64)
5	253	3.19 (1.95,5.19)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 1.512 (0.855,2.676). It was 0.806 (0.754,0.862) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 855: Reasons for revision following primary TKA for NexGen GS/NexGen Pegged cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	4	30.8
2	Dislocation/Instability	4	30.8
3	Poly liner wear	2	15.4
4	Joint Infection	1	7.7
5	Malalignment	1	7.7
6	Pain	1	7.7

Table 856: Distribution of approach used for NexGen GS/NexGen Pegged combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	659	96.2
Mid-vastus	19	2.8
Sub-vastus	2	0.3
Lateral parapatellar	2	0.3
Missing/unknown/other	3	0.4

Table 857: Distribution of polyethylene used for NexGen GS/NexGen Pegged combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	51	7.4
XLPE	628	91.7
Antioxidant XLPE	0	0.0
Missing/unknown/other	6	0.9

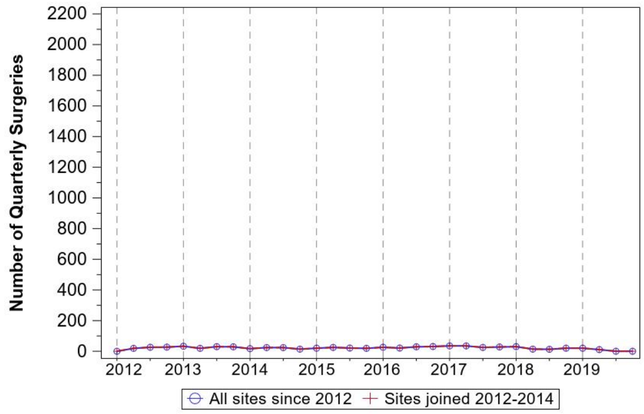

Figure 222: Utilization of the NexGen GS/NexGen Pegged combination in primary TKA cases.

NexGen GS/NexGen Precoat
N=528

19 surgeons across 16 sites use this implant combination.

Table 858: Volume of primary cases by surgeon and site for the NexGen GS/NexGen Precoat combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	27.8 (38.7)	8 (50)
Cases per site	33 (50.8)	15.5 (46)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 859: Descriptive statistics of cases receiving the NexGen GS/NexGen Precoat combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	521	98.7	
Age (yrs)	528	66.1(9.6)	66(13)
Height (cm)	527	162.1(7.4)	162.6(10.1)
Weight (kg)	528	87.8(19.1)	86.2(26.2)
BMI(kg/m^2)	527	33.4(6.7)	32.9(9.7)
Smoking - never (%)	299	56.6	
Smoking - previous (%)	161	30.5	
Smoking - current (%)	66	12.5	
Smoking - unknown (%)	2	0.4	

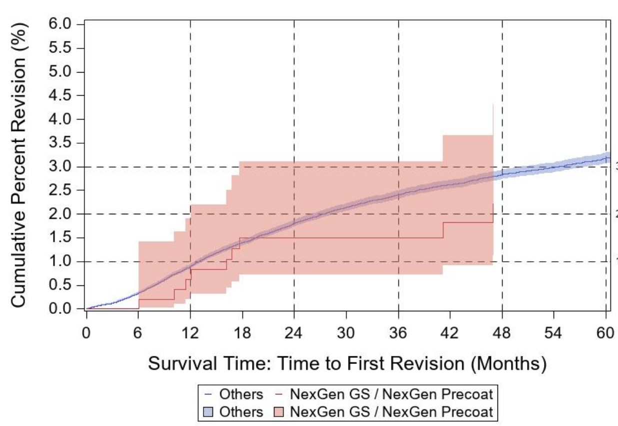

Figure 223: Cumulative percent revision curve for the NexGen GS/NexGen Precoat combination compared to all other implant combinations in primary TKA cases.

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Table 860: Cumulative percent revision and number at risk for NexGen GS/NexGen Precoat combination in primary TKA cases.

Year	Number at risk	CPR
0	528	0.00 (0.00,0.00)
1	471	0.62 (0.20,1.91)
2	410	1.49 (0.71,3.11)
3	330	1.49 (0.71,3.11)
4*	242	2.21 (1.13,4.30)
5*	207	2.21 (1.13,4.30)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 0.76 (0.378,1.529). It was 0.809 (0.757,0.865) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 861: Reasons for revision following primary TKA for NexGen GS/NexGen Precoat cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	2	25.0
2	Metal reaction/Metallosis	2	25.0
3	Arthrofibrosis	1	12.5
4	Aseptic Loosening	1	12.5
5	Pain	1	12.5
6	Peri-prosthetic fracture - Femur	1	12.5

Table 862: Distribution of approach used for NexGen GS/NexGen Precoat combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	504	95.5
Mid-vastus	11	2.1
Sub-vastus	3	0.6
Lateral parapatellar	1	0.2
Missing/unknown/other	9	1.7

Table 863: Distribution of polyethylene used for NexGen GS/NexGen Precoat combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	63	11.9
XLPE	454	86.0
Antioxidant XLPE	0	0.0
Missing/unknown/other	11	2.1

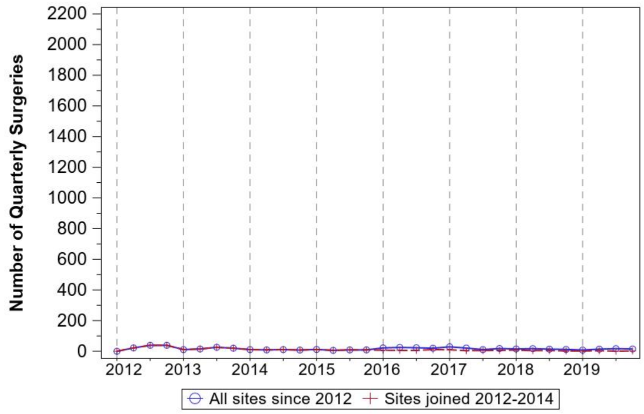

Figure 224: Utilization of the NexGen GS/NexGen Precoat combination in primary TKA cases.

NexGen LPS GS/NexGen Precoat

N=534

38 surgeons across 18 sites use this implant combination.

Table 864: Volume of primary cases by surgeon and site for the NexGen LPS GS/NexGen Precoat combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	14.1 (18.9)	6.5 (19)
Cases per site	29.7 (76.2)	6.5 (15)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 865: Descriptive statistics of cases receiving the NexGen LPS GS/NexGen Precoat combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	523	97.9	
Age (yrs)	534	65.5(9.7)	65(14)
Height (cm)	533	162.4(7.6)	162.6(10.2)
Weight (kg)	534	90.6(21.1)	88.9(29.8)
BMI(kg/m^2)	533	34.3(7.4)	33.8(11)
Smoking - never (%)	317	59.4	
Smoking - previous (%)	180	33.7	
Smoking - current (%)	36	6.7	
Smoking - unknown (%)	1	0.2	

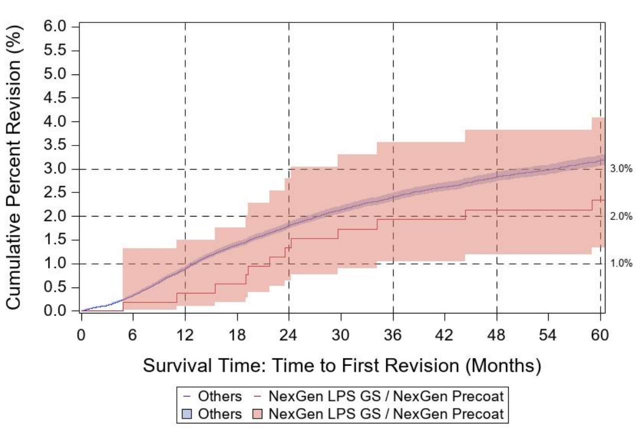

Figure 225: Cumulative percent revision curve for the NexGen LPS GS/NexGen Precoat combination compared to all other implant combinations in primary TKA cases.

Table 866: Cumulative percent revision and number at risk for NexGen LPS GS/NexGen Precoat combination in primary TKA cases.

Year	Number at risk	CPR
0	533	0.00 (0.00,0.00)
1	525	0.38 (0.09,1.50)
2	507	1.34 (0.64,2.79)
3	495	1.93 (1.04,3.56)
4	480	2.13 (1.19,3.82)
5	469	2.34 (1.34,4.09)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 0.652 (0.373,1.143). It was 0.81 (0.758,0.867) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 867: Reasons for revision following primary TKA for NexGen LPS GS/NexGen Precoat cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	3	50.0
2	Aseptic Loosening	2	33.3
3	Pain	1	16.7

Table 868: Distribution of approach used for NexGen LPS GS/NexGen Precoat combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	518	97.0
Mid-vastus	5	0.9
Sub-vastus	0	0.0
Lateral parapatellar	4	0.7
Missing/unknown/other	7	1.3

Table 869: Distribution of polyethylene used for NexGen LPS GS/NexGen Precoat combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	452	84.6
XLPE	74	13.9
Antioxidant XLPE	0	0.0
Missing/unknown/other	8	1.5

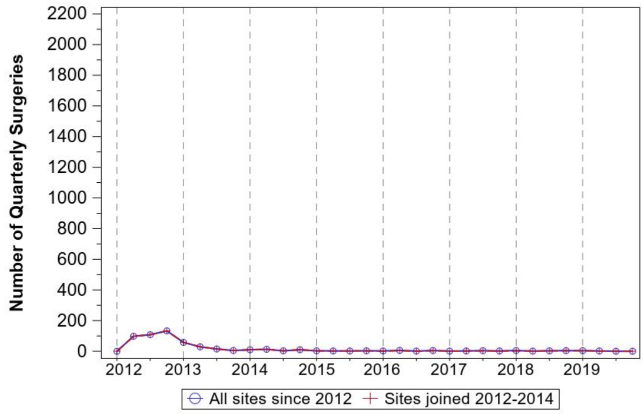

Figure 226: Utilization of the NexGen LPS GS/NexGen Precoat combination in primary TKA cases.

NexGen LPS Option/NexGen Precoat
N=735

58 surgeons across 27 sites use this implant combination.

Table 870: Volume of primary cases by surgeon and site for the NexGen LPS Option/NexGen Precoat combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	12.7 (19.5)	6 (12)
Cases per site	27.2 (39.5)	17 (34)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 871: Descriptive statistics of cases receiving the NexGen LPS Option/NexGen Precoat combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	334	45.4	
Age (yrs)	735	66.8(10.5)	67(14)
Height (cm)	735	170.2(10.7)	170.2(16)
Weight (kg)	735	95.4(20.1)	93.7(28.6)
BMI(kg/m^2)	735	33(6.7)	32.3(8.9)
Smoking - never (%)	332	45.2	
Smoking - previous (%)	312	42.5	
Smoking - current (%)	88	12	
Smoking - unknown (%)	3	0.4	

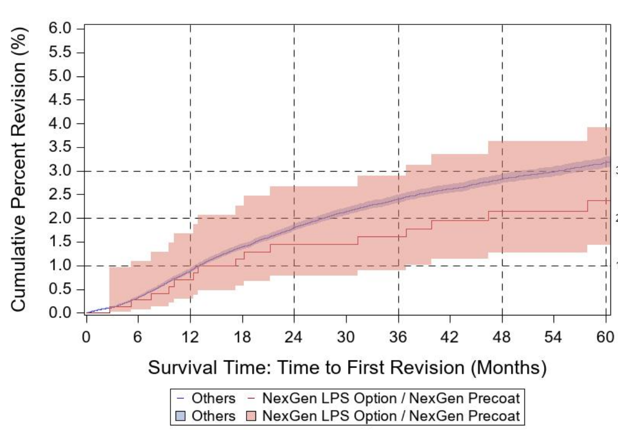

Figure 227: Cumulative percent revision curve for the NexGen LPS Option/NexGen Precoat combination compared to all other implant combinations in primary TKA cases.

Table 872: Cumulative percent revision and number at risk for NexGen LPS Option/NexGen Precoat combination in primary TKA cases.

Year	Number at risk	CPR
0	733	0.00 (0.00,0.00)
1	687	0.70 (0.29,1.68)
2	635	1.45 (0.78,2.67)
3	577	1.61 (0.89,2.89)
4	489	2.16 (1.28,3.62)
5	441	2.37 (1.43,3.93)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 0.814 (0.508,1.304). It was 0.807 (0.755,0.863) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 873: Reasons for revision following primary TKA for NexGen LPS Option/NexGen Precoat cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	4	30.8
2	Component fracture/failure	2	15.4
3	Dislocation/Instability	2	15.4
4	Arthrofibrosis	1	7.7
5	Aseptic Loosening	1	7.7
6	Metal reaction/Metallosis	1	7.7
7	Pain	1	7.7
8	Patellofemoral Joint	1	7.7

Table 874: Distribution of approach used for NexGen LPS Option/NexGen Precoat combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	709	96.5
Mid-vastus	18	2.4
Sub-vastus	2	0.3
Lateral parapatellar	2	0.3
Missing/unknown/other	4	0.5

Table 875: Distribution of polyethylene used for NexGen LPS Option/NexGen Precoat combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	601	81.8
XLPE	120	16.3
Antioxidant XLPE	0	0.0
Missing/unknown/other	14	1.9

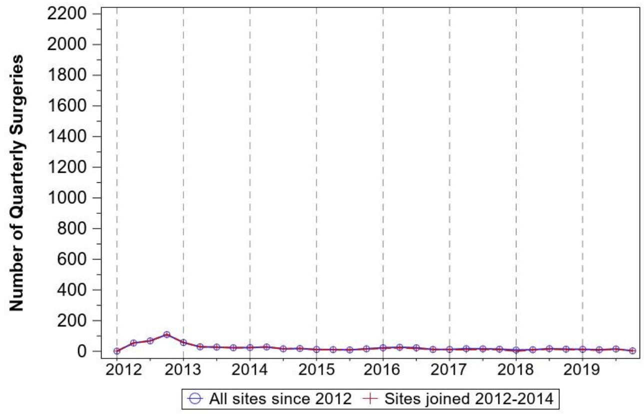

Figure 228: Utilization of the NexGen LPS Option/NexGen Precoat combination in primary TKA cases.

NexGen LPS Option/NexGen TM
N=1178

Fewer then 10 surgeons use this this implant combination at fewer than ten 10 sites

Table 876: Volume of primary cases by surgeon and site for the NexGen LPS Option/NexGen TM combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	147.3 (248.9)	24 (237.5)
Cases per site	168.3 (291.0)	6 (433)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 877: Descriptive statistics of cases receiving the NexGen LPS Option/NexGen TM combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	610	51.8	
Age (yrs)	1178	66.4(8.4)	67(11)
Height (cm)	1178	170.3(10.3)	170.2(15.2)
Weight (kg)	1178	93.6(20)	93(25.9)
BMI(kg/m^2)	1178	32.2(6.1)	31.6(7.6)
Smoking - never (%)	638	54.2	
Smoking - previous (%)	485	41.2	
Smoking - current (%)	53	4.5	
Smoking - unknown (%)	2	0.2	

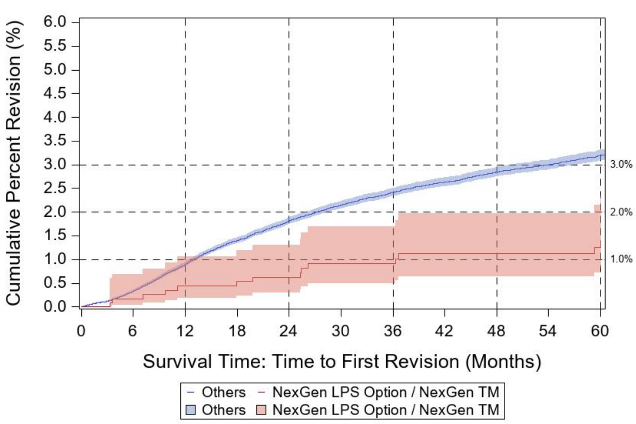

Figure 229: Cumulative percent revision curve for the NexGen LPS Option/NexGen TM combination compared to all other implant combinations in primary TKA cases.

Table 878: Cumulative percent revision and number at risk for NexGen LPS Option/NexGen TM combination in primary TKA cases.

Year	Number at risk	CPR
0	1177	0.00 (0.00,0.00)
1	1105	0.44 (0.18,1.05)
2	1041	0.63 (0.30,1.31)
3	976	0.92 (0.49,1.70)
4	901	1.12 (0.64,1.96)
5	738	1.39 (0.82,2.34)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 0.558 (0.286,1.09). It was 0.807 (0.755,0.863) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 879: Reasons for revision following primary TKA for NexGen LPS Option/NexGen TM cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	4	44.4
2	Arthrofibrosis	2	22.2
3	Joint Infection	2	22.2
4	Aseptic Loosening	1	11.1

Table 880: Distribution of approach used for NexGen LPS Option/NexGen TM combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	534	45.3
Mid-vastus	633	53.7
Sub-vastus	4	0.3
Lateral parapatellar	2	0.2
Missing/unknown/other	5	0.4

Table 881: Distribution of polyethylene used for NexGen LPS Option/NexGen TM combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	1177	99.9
XLPE	1	0.1
Antioxidant XLPE	0	0.0
Missing/unknown/other	0	0.0

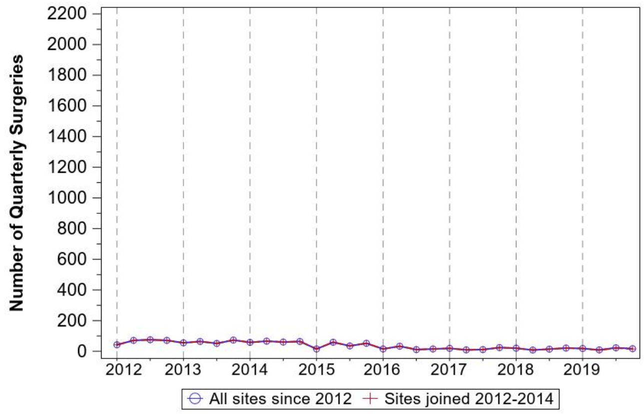

Figure 230: Utilization of the NexGen LPS Option/NexGen TM combination in primary TKA cases.

NexGen Option/NexGen Option
N=1187

11 surgeons use this implant combination at fewer than 10 sites.

Table 882: Volume of primary cases by surgeon and site for the NexGen Option/NexGen Option combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	107.9 (131.2)	49 (141)
Cases per site	296.8 (450.1)	105 (525.5)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 883: Descriptive statistics of cases receiving the NexGen Option/NexGen Option combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	599	50.5	
Age (yrs)	1187	69.4(8.4)	70(11)
Height (cm)	1187	170(10.2)	170.2(15.2)
Weight (kg)	1187	93.1(19.3)	91.9(24.3)
BMI(kg/m^2)	1187	32.2(5.9)	31.5(8)
Smoking - never (%)	560	47.2	
Smoking - previous (%)	540	45.5	
Smoking - current (%)	87	7.3	
Smoking - unknown (%)	0	0.0	

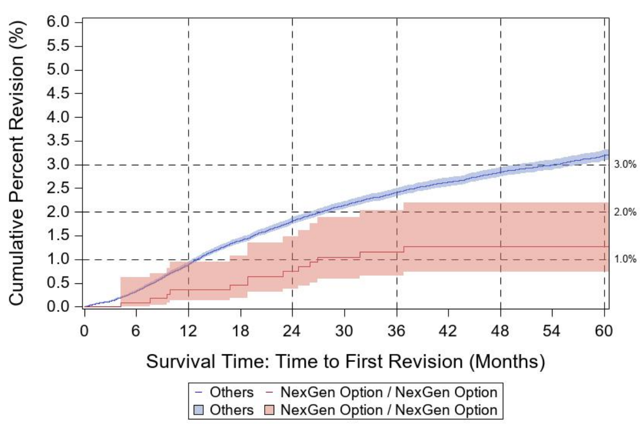

Figure 231: Cumulative percent revision curve for the NexGen Option/NexGen Option combination compared to all other implant combinations in primary TKA cases.

Table 884: Cumulative percent revision and number at risk for NexGen Option/NexGen Option combination in primary TKA cases.

Year	Number at risk	CPR
0	1184	0.00 (0.00,0.00)
1	1094	0.36 (0.13,0.95)
2	987	0.75 (0.37,1.49)
3	850	1.16 (0.66,2.04)
4	647	1.28 (0.74,2.20)
5	414	1.28 (0.74,2.20)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 0.632 (0.358,1.117). It was 0.807 (0.755,0.863) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 885: Reasons for revision following primary TKA for NexGen Option/NexGen Option cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	4	30.8
2	Dislocation/Instability	4	30.8
3	Joint Infection	2	15.4
4	Pain	2	15.4
5	Arthrofibrosis	1	7.7

Table 886: Distribution of approach used for NexGen Option/NexGen Option combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	1171	98.7
Mid-vastus	12	1.0
Sub-vastus	0	0.0
Lateral parapatellar	4	0.3
Missing/unknown/other	0	0.0

Table 887: Distribution of polyethylene used for NexGen Option/NexGen Option combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	154	13.0
XLPE	1029	86.7
Antioxidant XLPE	0	0.0
Missing/unknown/other	4	0.3

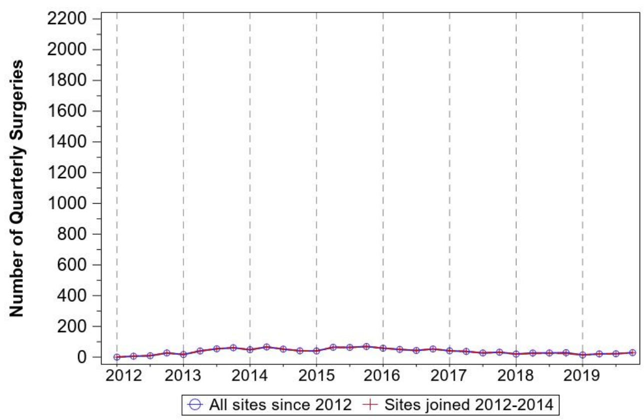

Figure 232: Utilization of the NexGen Option/NexGen Option combination in primary TKA cases.

NexGen Option/NexGen Pegged
N=625

Fewer then 10 surgeons use this this implant combination at fewer than ten 10 sites

Table 888: Volume of primary cases by surgeon and site for the NexGen Option/NexGen Pegged combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	78.1 (130.5)	43 (33.5)
Cases per site	125 (191.4)	25 (109)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 889: Descriptive statistics of cases receiving the NexGen Option/NexGen Pegged combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	315	50.4	
Age (yrs)	625	67.1(8.9)	67(12)
Height (cm)	625	169.9(10.5)	170(16)
Weight (kg)	625	95.7(19.7)	94.7(28.4)
BMI(kg/m^2)	625	33.1(5.8)	32.4(8.8)
Smoking - never (%)	279	44.6	
Smoking - previous (%)	275	44	
Smoking - current (%)	68	10.9	
Smoking - unknown (%)	3	0.5	

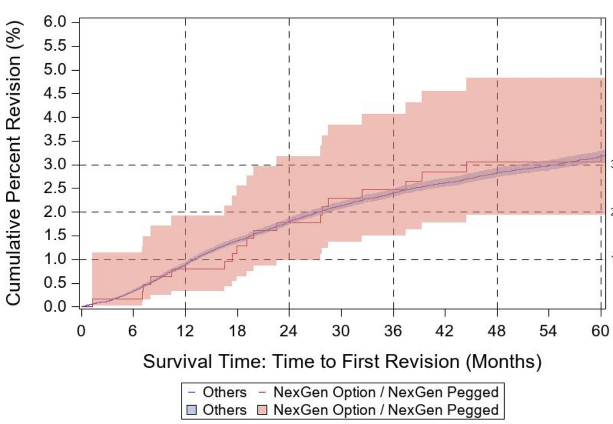

Figure 233: Cumulative percent revision curve for the NexGen Option/NexGen Pegged combination compared to all other implant combinations in primary TKA cases.

Table 890: Cumulative percent revision and number at risk for NexGen Option/NexGen Pegged combination in primary TKA cases.

Year	Number at risk	CPR
0	622	0.00 (0.00,0.00)
1	617	0.80 (0.34,1.92)
2	592	1.77 (0.98,3.18)
3	515	2.47 (1.49,4.06)
4	449	3.06 (1.94,4.82)
5	323	3.06 (1.94,4.82)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 1.584 (0.904,2.775). It was 0.809 (0.757,0.865) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 891: Reasons for revision following primary TKA for NexGen Option/NexGen Pegged cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	6	40.0
2	Pain	3	20.0
3	Dislocation/Instability	2	13.3
4	Arthrofibrosis	1	6.7
5	Component fracture/failure	1	6.7
6	Joint Infection	1	6.7
7	Peri-prosthetic fracture - Tibia	1	6.7

Table 892: Distribution of approach used for NexGen Option/NexGen Pegged combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	613	98.1
Mid-vastus	2	0.3
Sub-vastus	0	0.0
Lateral parapatellar	10	1.6
Missing/unknown/other	0	0.0

Table 893: Distribution of polyethylene used for NexGen Option/NexGen Pegged combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	1	0.2
XLPE	623	99.7
Antioxidant XLPE	0	0.0
Missing/unknown/other	1	0.2

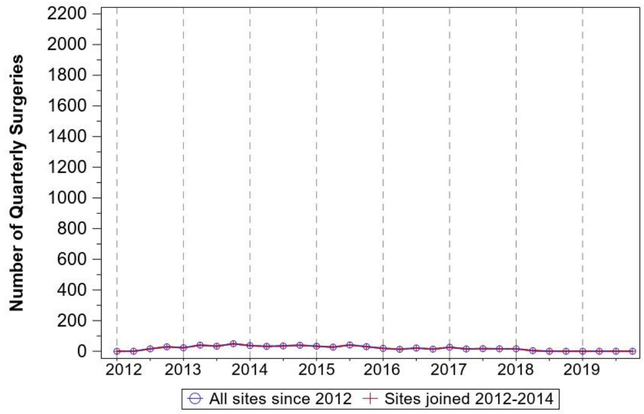

Figure 234: Utilization of the NexGen Option/NexGen Pegged combination in primary TKA cases.

NK II/NK II

N=999

10 surgeons use this implant combination at fewer than 10 sites.

Table 894: Volume of primary cases by surgeon and site for the NK II/NK II combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	99.9 (174.8)	6.5 (106)
Cases per site	166.5 (169.8)	118.5 (343)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 895: Descriptive statistics of cases receiving the NK II/NK II combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	647	64.8	
Age (yrs)	999	66.9(9.3)	67(14)
Height (cm)	996	168.2(10.2)	167.6(15.2)
Weight (kg)	996	93.6(21.4)	90.7(28.5)
BMI(kg/m^2)	996	33(6.8)	32.1(8.8)
Smoking - never (%)	543	54.4	
Smoking - previous (%)	376	37.6	
Smoking - current (%)	76	7.6	
Smoking - unknown (%)	4	0.4	

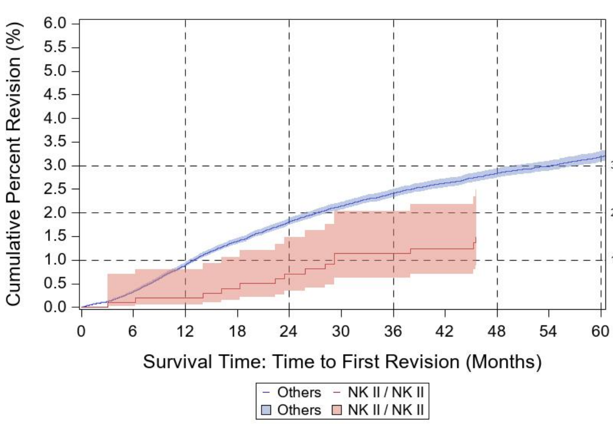

Figure 235: Cumulative percent revision curve for the NK II/NK II combination compared to all other implant combinations in primary TKA cases.

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Table 896: Cumulative percent revision and number at risk for NK II/NK II combination in primary TKA cases.

Year	Number at risk	CPR
0	999	0.00 (0.00,0.00)
1	994	0.20 (0.05,0.80)
2	954	0.71 (0.34,1.48)
3	893	1.13 (0.63,2.04)
4*	800	1.48 (0.88,2.50)
5*	559	1.48 (0.88,2.50)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 0.515 (0.266,1.0). It was 0.808 (0.756,0.864) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 897: Reasons for revision following primary TKA for NK II/NK II cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	6	50.0
2	Joint Infection	2	16.7
3	Pain	2	16.7
4	Aseptic Loosening	1	8.3
5	Component fracture/failure	1	8.3

Table 898: Distribution of approach used for NK II/NK II combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	928	92.9
Mid-vastus	40	4.0
Sub-vastus	12	1.2
Lateral parapatellar	5	0.5
Missing/unknown/other	14	1.4

Table 899: Distribution of polyethylene used for NK II/NK II combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	503	50.4
XLPE	488	48.8
Antioxidant XLPE	0	0.0
Missing/unknown/other	8	0.8

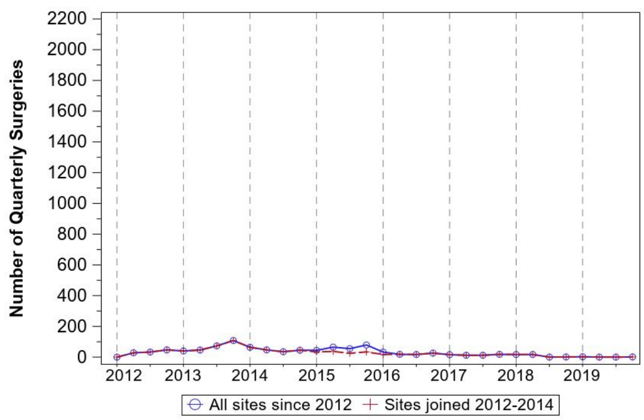

Figure 236: Utilization of the NK II/NK II combination in primary TKA cases.

NK II GS/NK II
N=3040

11 surgeons across 10 sites use this implant combination.

Table 900: Volume of primary cases by surgeon and site for the NK II GS/NK II combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	276.4 (370.4)	74 (735)
Cases per site	304 (344.0)	162 (707)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 901: Descriptive statistics of cases receiving the NK II GS/NK II combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	1806	59.4	
Age (yrs)	3040	67.7(9)	68(13)
Height (cm)	3039	169.2(10.7)	167.6(16.8)
Weight (kg)	3038	93.5(21.3)	91.1(28.1)
BMI(kg/m^2)	3038	32.5(6.3)	31.9(8.8)
Smoking - never (%)	1589	52.3	
Smoking - previous (%)	1229	40.4	
Smoking - current (%)	220	7.2	
Smoking - unknown (%)	2	0.1	

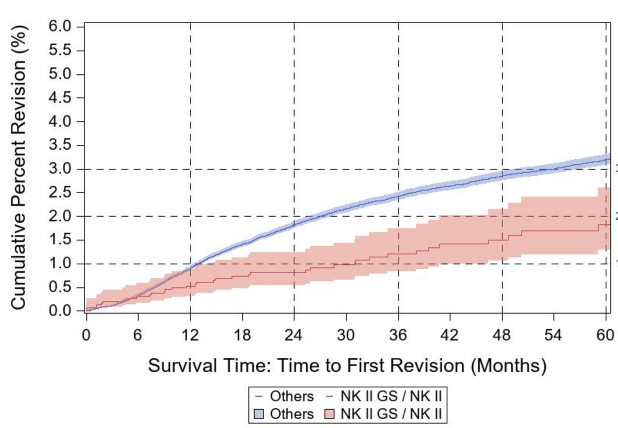

Figure 237: Cumulative percent revision curve for the NK II GS/NK II combination compared to all other implant combinations in primary TKA cases.

Table 902: Cumulative percent revision and number at risk for NK II GS/NK II combination in primary TKA cases.

Year	Number at risk	CPR
0	3035	0.00 (0.00,0.00)
1	2553	0.53 (0.32,0.88)
2	2054	0.82 (0.54,1.24)
3	1555	1.21 (0.83,1.74)
4	1082	1.51 (1.06,2.14)
5	695	1.83 (1.28,2.61)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 0.739 (0.452,1.21). It was 0.808 (0.756,0.864) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 903: Reasons for revision following primary TKA for NK II GS/NK II cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	8	21.1
2	Joint Infection	7	18.4
3	Pain	6	15.8
4	Component fracture/failure	5	13.2
5	Dislocation/Instability	5	13.2
6	Malalignment	2	5.3
7	Arthrofibrosis	1	2.6
8	Metal reaction/Metallosis	1	2.6
9	Peri-prosthetic fracture - Femur	1	2.6
10	Peri-prosthetic fracture - Tibia	1	2.6
11	Poly liner wear	1	2.6

Table 904: Distribution of approach used for NK II GS/NK II combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	2851	93.8
Mid-vastus	65	2.1
Sub-vastus	108	3.6
Lateral parapatellar	5	0.2
Missing/unknown/other	11	0.4

Table 905: Distribution of polyethylene used for NK II GS/NK II combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	3012	99.1
Antioxidant XLPE	0	0.0
Missing/unknown/other	28	0.9

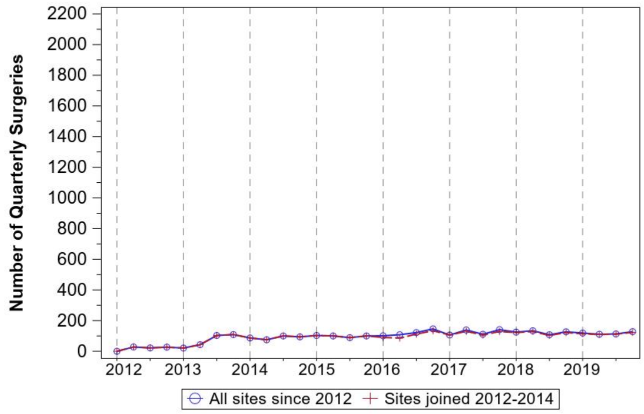

Figure 238: Utilization of the NK II GS/NK II combination in primary TKA cases.

Persona/Persona
N=40510

196 surgeons across 54 sites use this implant combination.

Table 906: Volume of primary cases by surgeon and site for the Persona/Persona combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	206.7 (356.0)	69.5 (236.5)
Cases per site	750.2 (982.4)	390.5 (1042)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 907: Descriptive statistics of cases receiving the Persona/Persona combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	25538	63	
Age (yrs)	40510	66.5(9.2)	66(13)
Height (cm)	39982	168.4(10.5)	167.6(15.3)
Weight (kg)	39982	94.2(21.2)	92.5(27.9)
BMI(kg/m^2)	39982	33.2(6.7)	32.4(9)
Smoking - never (%)	21023	51.9	
Smoking - previous (%)	15904	39.3	
Smoking - current (%)	3438	8.5	
Smoking - unknown (%)	145	0.4	

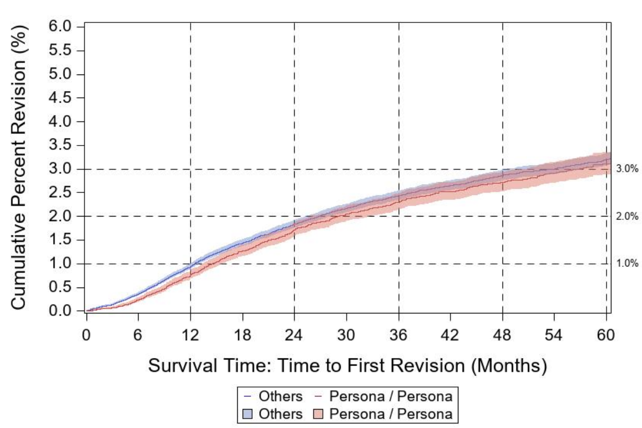

Figure 239: Cumulative percent revision curve for the Persona/Persona combination compared to all other implant combinations in primary TKA cases.

Table 908: Cumulative percent revision and number at risk for Persona/Persona combination in primary TKA cases.

Year	Number at risk	CPR
0	40462	0.00 (0.00,0.00)
1	32407	0.76 (0.67,0.85)
2	24925	1.71 (1.57,1.86)
3	18243	2.30 (2.13,2.48)
4	11964	2.72 (2.53,2.93)
5	6526	3.10 (2.88,3.35)

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 909: Reasons for revision following primary TKA for Persona/Persona cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	247	32.5
2	Joint Infection	171	22.5
3	Aseptic Loosening	148	19.5
4	Pain	73	9.6
5	Arthrofibrosis	46	6.1
6	Component fracture/failure	21	2.8
7	Malalignment	14	1.8
8	Poly liner wear	12	1.6
9	Peri-prosthetic fracture - Femur	11	1.4
10	Extensor mechanism failure	5	0.7
11	Metal reaction/Metallosis	4	0.5
12	Osteolysis	3	0.4
13	Patellofemoral Joint	2	0.3
14	Peri-prosthetic fracture - Tibia	2	0.3

Table 910: Distribution of approach used for Persona/Persona combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	35932	88.7
Mid-vastus	3067	7.6
Sub-vastus	875	2.2
Lateral parapatellar	37	0.1
Missing/unknown/other	599	1.5

Table 911: Distribution of polyethylene used for Persona/Persona combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	18211	45.0
XLPE	1	0.0
Antioxidant XLPE	22046	54.4
Missing/unknown/other	252	0.6

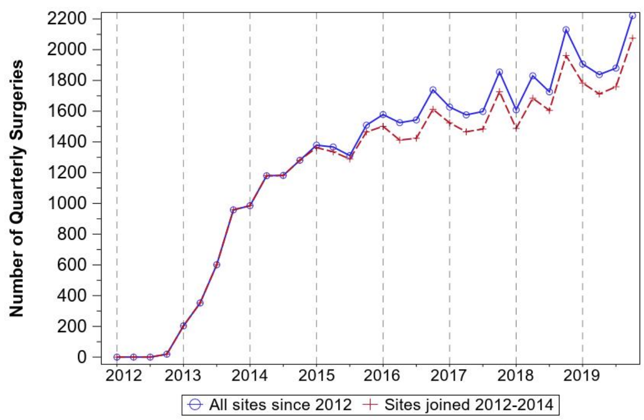

Figure 240: Utilization of the Persona/Persona combination in primary TKA cases.

Scorpio/Series 7000
N=656

Fewer then 10 surgeons use this this implant combination at fewer than ten 10 sites

Table 912: Volume of primary cases by surgeon and site for the Scorpio/Series 7000 combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	93.7 (190.6)	13 (80)
Cases per site	164 (195.9)	75 (215)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 913: Descriptive statistics of cases receiving the Scorpio/Series 7000 combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	340	51.8	
Age (yrs)	656	66(9.5)	65(14)
Height (cm)	656	169.8(10.5)	170(15.4)
Weight (kg)	656	97.4(21.3)	96(28)
BMI(kg/m^2)	656	33.8(7)	32.7(9.5)
Smoking - never (%)	350	53.4	
Smoking - previous (%)	251	38.3	
Smoking - current (%)	53	8.1	
Smoking - unknown (%)	2	0.3	

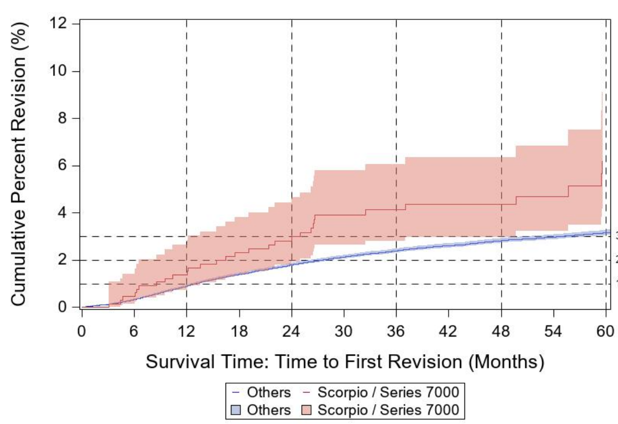

Figure 241: Cumulative percent revision curve for the Scorpio/Series 7000 combination compared to all other implant combinations in primary TKA cases.

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Table 914: Cumulative percent revision and number at risk for Scorpio/Series 7000 combination in primary TKA cases.

Year	Number at risk	CPR
0	654	0.00 (0.00,0.00)
1	645	1.38 (0.72,2.63)
2	555	2.99 (1.91,4.64)
3	422	4.12 (2.80,6.05)
4	289	4.36 (2.98,6.35)
5*	174	6.18 (4.17,9.11)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 2.062 (1.126,3.779). It was 0.81 (0.758,0.867) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 915: Reasons for revision following primary TKA for Scorpio/Series 7000 cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	9	31.0
2	Aseptic Loosening	5	17.2
3	Dislocation/Instability	4	13.8
4	Pain	4	13.8
5	Arthrofibrosis	3	10.3
6	Poly liner wear	2	6.9
7	Component fracture/failure	1	3.4
8	Peri-prosthetic fracture - Tibia	1	3.4

Table 916: Distribution of approach used for Scorpio/Series 7000 combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	13	2.0
Mid-vastus	643	98.0
Sub-vastus	0	0.0
Lateral parapatellar	0	0.0
Missing/unknown/other	0	0.0

Table 917: Distribution of polyethylene used for Scorpio/Series 7000 combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	653	99.5
Antioxidant XLPE	0	0.0
Missing/unknown/other	3	0.5

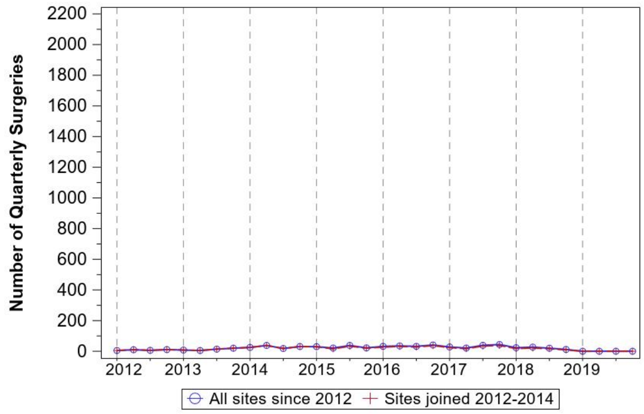

Figure 242: Utilization of the Scorpio/Series 7000 combination in primary TKA cases.

Sigma/M.B.T
N=880

43 surgeons across 28 sites use this implant combination.

Table 918: Volume of primary cases by surgeon and site for the Sigma/M.B.T combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	20.5 (37.7)	4 (20)
Cases per site	31.4 (38.0)	17 (35.5)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 919: Descriptive statistics of cases receiving the Sigma/M.B.T combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	557	63.3	
Age (yrs)	880	64.2(10.1)	64(13)
Height (cm)	880	168.4(10.7)	167.6(17)
Weight (kg)	880	98.8(22.8)	97.7(32)
BMI(kg/m^2)	880	34.8(7.4)	34.4(9.8)
Smoking - never (%)	427	48.5	
Smoking - previous (%)	319	36.3	
Smoking - current (%)	98	11.1	
Smoking - unknown (%)	36	4.1	

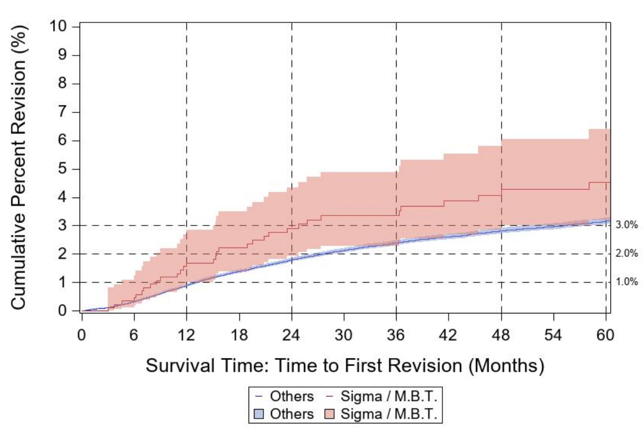

Figure 243: Cumulative percent revision curve for the Sigma/M.B.T combination compared to all other implant combinations in primary TKA cases.

Table 920: Cumulative percent revision and number at risk for Sigma/M.B.T combination in primary TKA cases.

Year	Number at risk	CPR
0	880	0.00 (0.00,0.00)
1	786	1.69 (1.01,2.84)
2	675	2.91 (1.94,4.35)
3	579	3.35 (2.29,4.90)
4	460	4.28 (3.01,6.06)
5	367	4.52 (3.19,6.38)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 1.183 (0.796,1.759). It was 0.808 (0.756,0.864) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 921: Reasons for revision following primary TKA for Sigma/M.B.T cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	7	26.9
2	Aseptic Loosening	5	19.2
3	Pain	5	19.2
4	Malalignment	3	11.5
5	Dislocation/Instability	2	7.7
6	Arthrofibrosis	1	3.8
7	Component fracture/failure	1	3.8
8	Extensor mechanism failure	1	3.8
9	Metal reaction/Metallosis	1	3.8

Table 922: Distribution of approach used for Sigma/M.B.T combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	699	79.4
Mid-vastus	168	19.1
Sub-vastus	1	0.1
Lateral parapatellar	1	0.1
Missing/unknown/other	11	1.3

Table 923: Distribution of polyethylene used for Sigma/M.B.T combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	633	71.9
XLPE	11	1.3
Antioxidant XLPE	232	26.4
Missing/unknown/other	4	0.5

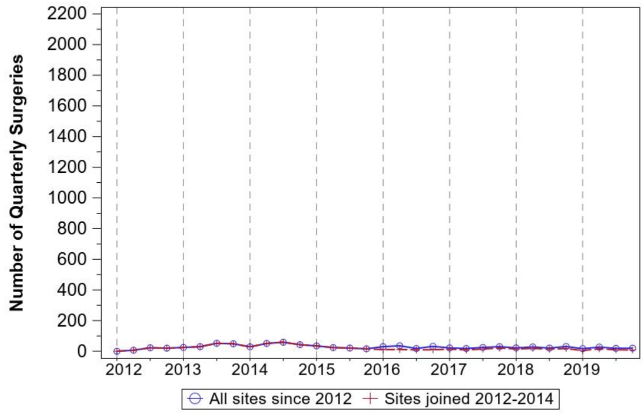

Figure 244: Utilization of the Sigma/M.B.T combination in primary TKA cases.

Sigma/Sigma
N=1501

37 surgeons across 23 sites use this implant combination.

Table 924: Volume of primary cases by surgeon and site for the Sigma/Sigma combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	40.6 (73.7)	4 (37)
Cases per site	65.3 (140.9)	20 (39)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 925: Descriptive statistics of cases receiving the Sigma/Sigma combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	948	63.2	
Age (yrs)	1501	67.6(10.2)	68(15)
Height (cm)	1464	167.7(10.5)	167.6(15.3)
Weight (kg)	1464	89.9(20.4)	87.5(27)
BMI(kg/m^2)	1464	31.9(6.2)	31.2(8.6)
Smoking - never (%)	782	52.1	
Smoking - previous (%)	598	39.8	
Smoking - current (%)	117	7.8	
Smoking - unknown (%)	4	0.3	

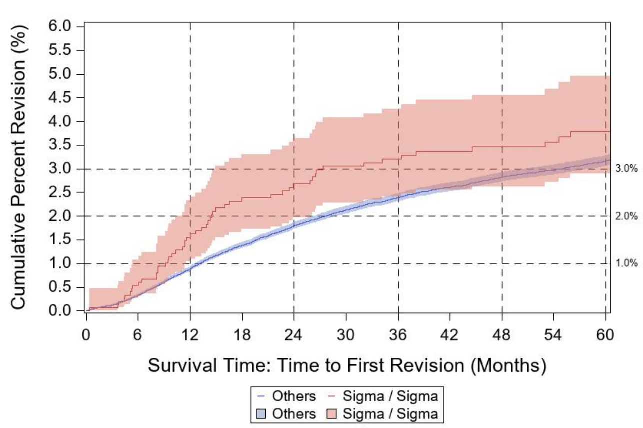

Figure 245: Cumulative percent revision curve for the Sigma/Sigma combination compared to all other implant combinations in primary TKA cases.

Table 926: Cumulative percent revision and number at risk for Sigma/Sigma combination in primary TKA cases.

Year	Number at risk	CPR
0	1499	0.00 (0.00,0.00)
1	1436	1.62 (1.09,2.41)
2	1326	2.68 (1.96,3.65)
3	1207	3.21 (2.41,4.26)
4	982	3.46 (2.63,4.56)
5	795	3.79 (2.89,4.96)

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 927: Reasons for revision following primary TKA for Sigma/Sigma cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	15	30.6
2	Dislocation/Instability	12	24.5
3	Aseptic Loosening	8	16.3
4	Pain	5	10.2
5	Arthrofibrosis	4	8.2
6	Component fracture/failure	3	6.1
7	Extensor mechanism failure	1	2.0
8	Malalignment	1	2.0

Table 928: Distribution of approach used for Sigma/Sigma combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	1417	94.4
Mid-vastus	32	2.1
Sub-vastus	0	0.0
Lateral parapatellar	1	0.1
Missing/unknown/other	51	3.4

Table 929: Distribution of polyethylene used for Sigma/Sigma combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	518	34.5
XLPE	972	64.8
Antioxidant XLPE	0	0.0
Missing/unknown/other	11	0.7

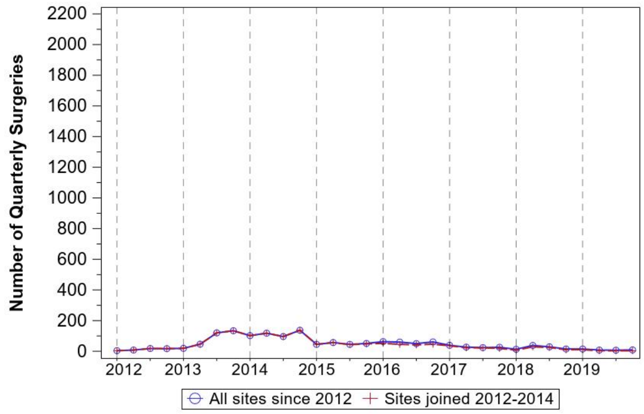

Figure 246: Utilization of the Sigma/Sigma combination in primary TKA cases.

Sigma PFC/Sigma
N=3281

49 surgeons across 24 sites use this implant combination.

Table 930: Volume of primary cases by surgeon and site for the Sigma PFC/Sigma combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	67.0 (128.8)	14 (60)
Cases per site	136.7 (225.9)	30 (87.5)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 931: Descriptive statistics of cases receiving the Sigma PFC/Sigma combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	2008	61.2	
Age (yrs)	3281	66.8(9.1)	67(12)
Height (cm)	3143	168.3(10.5)	167.6(16.5)
Weight (kg)	3142	93.8(21.1)	92.1(28.1)
BMI(kg/m^2)	3142	33.1(6.6)	32.2(8.6)
Smoking - never (%)	1618	49.3	
Smoking - previous (%)	1332	40.6	
Smoking - current (%)	318	9.7	
Smoking - unknown (%)	13	0.4	

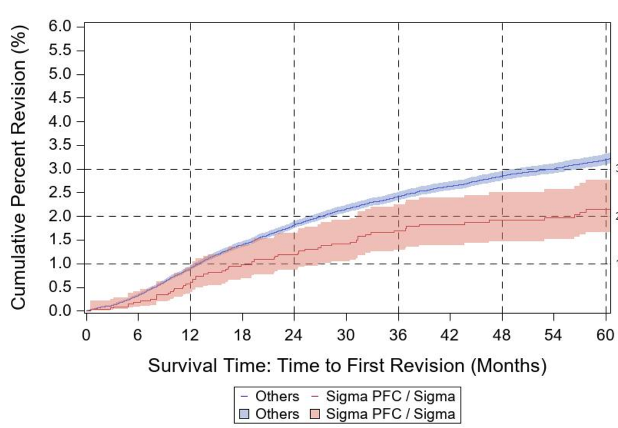

Figure 247: Cumulative percent revision curve for the Sigma PFC/Sigma combination compared to all other implant combinations in primary TKA cases.

Table 932: Cumulative percent revision and number at risk for Sigma PFC/Sigma combination in primary TKA cases.

Year	Number at risk	CPR
0	3276	0.00 (0.00,0.00)
1	3006	0.61 (0.39,0.96)
2	2708	1.19 (0.86,1.65)
3	2349	1.70 (1.29,2.24)
4	2019	1.92 (1.47,2.50)
5	1643	2.14 (1.65,2.77)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 0.623 (0.455,0.853). It was 0.808 (0.756,0.864) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 933: Reasons for revision following primary TKA for Sigma PFC/Sigma cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	17	29.3
2	Aseptic Loosening	12	20.7
3	Dislocation/Instability	12	20.7
4	Arthrofibrosis	5	8.6
5	Pain	5	8.6
6	Component fracture/failure	2	3.4
7	Malalignment	2	3.4
8	Peri-prosthetic fracture - Femur	2	3.4
9	Metal reaction/Metallosis	1	1.7

Table 934: Distribution of approach used for Sigma PFC/Sigma combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	3001	91.5
Mid-vastus	134	4.1
Sub-vastus	1	0.0
Lateral parapatellar	2	0.1
Missing/unknown/other	143	4.4

Table 935: Distribution of polyethylene used for Sigma PFC/Sigma combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	250	7.6
XLPE	3022	92.1
Antioxidant XLPE	0	0.0
Missing/unknown/other	9	0.3

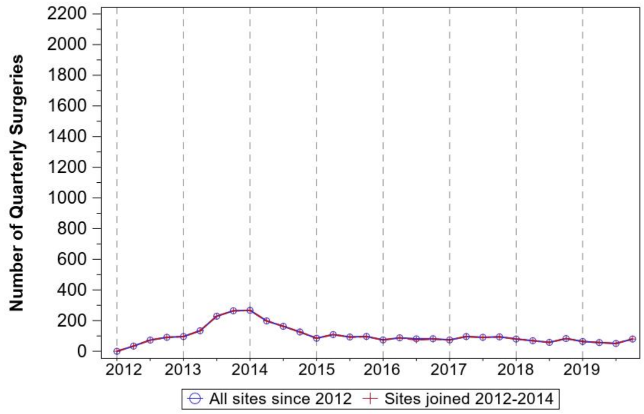

Figure 248: Utilization of the Sigma PFC/Sigma combination in primary TKA cases.

Sigma PFC/Sigma PFC
N=510

Fewer then 10 surgeons use this this implant combination at fewer than ten 10 sites

Table 936: Volume of primary cases by surgeon and site for the Sigma PFC/Sigma PFC combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	56.7 (151.1)	1 (1)
Cases per site	63.8 (152)	1.5 (32)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 937: Descriptive statistics of cases receiving the Sigma PFC/Sigma PFC combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	467	91.6	
Age (yrs)	510	78.6(5.4)	78(7)
Height (cm)	510	161.4(7.5)	160(7.6)
Weight (kg)	510	78.8(16.2)	77.3(23)
BMI(kg/m^2)	510	30.3(5.9)	29.8(8.4)
Smoking - never (%)	297	58.2	
Smoking - previous (%)	180	35.3	
Smoking - current (%)	11	2.2	
Smoking - unknown (%)	22	4.3	

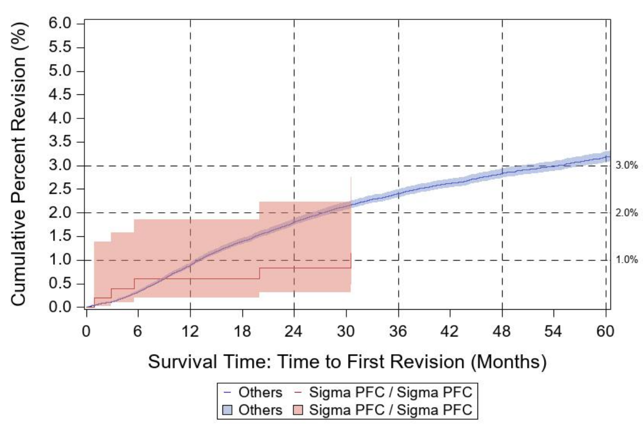

Figure 249: Cumulative percent revision curve for the Sigma PFC/Sigma PFC combination compared to all other implant combinations in primary TKA cases.

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Table 938: Cumulative percent revision and number at risk for Sigma PFC/Sigma PFC combination in primary TKA cases.

Year	Number at risk	CPR
0	510	0.00 (0.00,0.00)
1	464	0.60 (0.19,1.85)
2	383	0.84 (0.32,2.23)
3*	281	1.14 (0.47,2.76)
4*	193	1.14 (0.47,2.76)
5*	116	1.14 (0.47,2.76)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 1.184 (0.471,2.979). It was 0.808 (0.756,0.864) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 939: Reasons for revision following primary TKA for Sigma PFC/Sigma PFC cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	3	60.0
2	Aseptic Loosening	1	20.0
3	Peri-prosthetic fracture - Tibia	1	20.0

Table 940: Distribution of approach used for Sigma PFC/Sigma PFC combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	59	11.6
Mid-vastus	449	88.0
Sub-vastus	1	0.2
Lateral parapatellar	0	0.0
Missing/unknown/other	1	0.2

Table 941: Distribution of polyethylene used for Sigma PFC/Sigma PFC combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	3	0.6
XLPE	4	0.8
Antioxidant XLPE	0	0.0
Missing/unknown/other	503	98.6

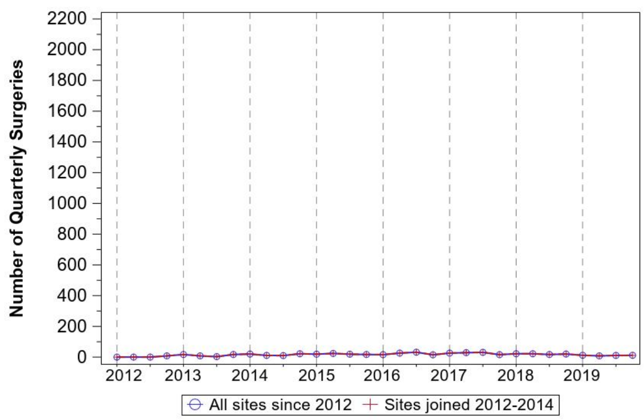

Figure 250: Utilization of the Sigma PFC/Sigma PFC combination in primary TKA cases.

Triathlon/Triathlon
N=24801

154 surgeons across 50 sites use this implant combination.

Table 942: Volume of primary cases by surgeon and site for the Triathlon/Triathlon combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	161.1 (299.0)	36.5 (153)
Cases per site	496.0 (752.2)	167.5 (718)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 943: Descriptive statistics of cases receiving the Triathlon/Triathlon combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	14664	59.1	
Age (yrs)	24801	65.5(9.6)	65(13)
Height (cm)	24801	169(10.5)	168(17.8)
Weight (kg)	24801	96(21.6)	94(28)
BMI(kg/m^2)	24801	33.6(6.8)	32.8(9.1)
Smoking - never (%)	12866	51.9	
Smoking - previous (%)	9237	37.2	
Smoking - current (%)	2585	10.4	
Smoking - unknown (%)	113	0.5	

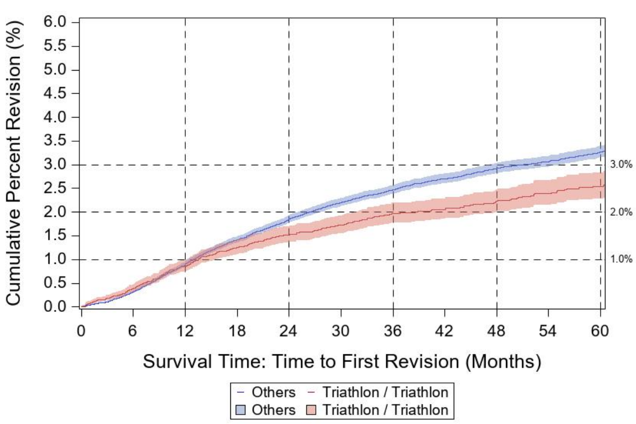

Figure 251: Cumulative percent revision curve for the Triathlon/Triathlon combination compared to all other implant combinations in primary TKA cases.

Table 944: Cumulative percent revision and number at risk for Triathlon/Triathlon combination in primary TKA cases.

Year	Number at risk	CPR
0	24765	0.00 (0.00,0.00)
1	18900	0.85 (0.74,0.98)
2	14630	1.52 (1.36,1.70)
3	10386	1.97 (1.77,2.19)
4	6674	2.23 (2.01,2.48)
5	3781	2.54 (2.28,2.84)

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 945: Reasons for revision following primary TKA for Triathlon/Triathlon cases.

Rank	Reason for revision	N	Percent
1	Joint Infection	102	27.0
2	Dislocation/Instability	80	21.2
3	Aseptic Loosening	69	18.3
4	Arthrofibrosis	28	7.4
5	Component fracture/failure	24	6.3
6	Pain	24	6.3
7	Peri-prosthetic fracture - Tibia	16	4.2
8	Peri-prosthetic fracture - Femur	11	2.9
9	Malalignment	9	2.4
10	Extensor mechanism failure	4	1.1
11	Metal reaction/Metallosis	4	1.1
12	Poly liner wear	3	0.8
13	Osteolysis	2	0.5
14	Patellofemoral Joint	2	0.5

Table 946: Distribution of approach used for Triathlon/Triathlon combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	20606	83.1
Mid-vastus	3106	12.5
Sub-vastus	972	3.9
Lateral parapatellar	29	0.1
Missing/unknown/other	88	0.4

Table 947: Distribution of polyethylene used for Triathlon/Triathlon combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	24354	98.2
Antioxidant XLPE	0	0.0
Missing/unknown/other	447	1.8

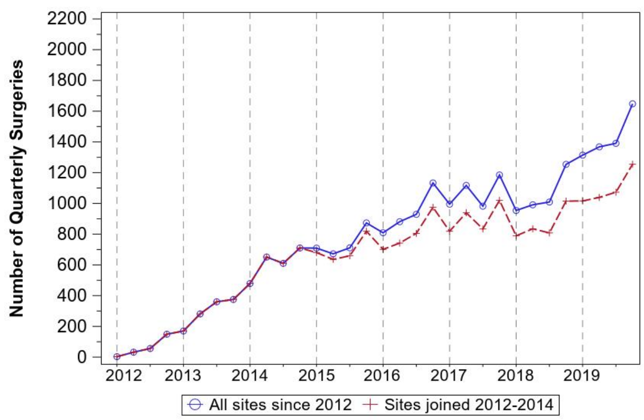

Figure 252: Utilization of the Triathlon/Triathlon combination in primary TKA cases.

Triathlon/Triathlon TS
N=20689

172 surgeons across 48 sites use this implant combination.

Table 948: Volume of primary cases by surgeon and site for the Triathlon/Triathlon TS combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	120.3 (283.8)	20 (112.5)
Cases per site	431.0 (1029.5)	117.5 (307)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 949: Descriptive statistics of cases receiving the Triathlon/Triathlon TS combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	13487	65.2	
Age (yrs)	20689	66.9(9.6)	67(13)
Height (cm)	20688	167.8(10.6)	167.6(15.2)
Weight (kg)	20688	93.5(22)	91.2(29.7)
BMI(kg/m^2)	20688	33.1(7)	32.3(9.4)
Smoking - never (%)	11303	54.6	
Smoking - previous (%)	7715	37.3	
Smoking - current (%)	1636	7.9	
Smoking - unknown (%)	35	0.2	

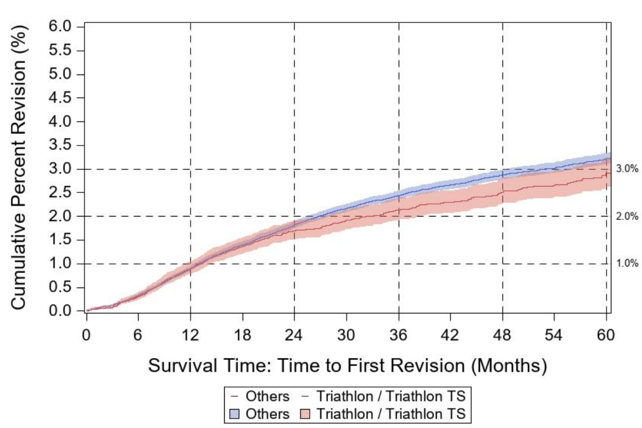

Figure 253: Cumulative percent revision curve for the Triathlon/Triathlon TS combination compared to all other implant combinations in primary TKA cases.

Table 950: Cumulative percent revision and number at risk for Triathlon/Triathlon TS combination in primary TKA cases.

Year	Number at risk	CPR
0	20670	0.00 (0.00,0.00)
1	17206	0.89 (0.77,1.04)
2	13488	1.70 (1.51,1.90)
3	10053	2.14 (1.92,2.38)
4	6801	2.50 (2.26,2.78)
5	4200	2.91 (2.61,3.24)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 0.953 (0.816,1.114). It was 0.808 (0.756,0.864) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 951: Reasons for revision following primary TKA for Triathlon/Triathlon TS cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	127	32.2
2	Joint Infection	120	30.4
3	Aseptic Loosening	42	10.6
4	Arthrofibrosis	36	9.1
5	Pain	27	6.8
6	Component fracture/failure	16	4.1
7	Peri-prosthetic fracture - Femur	10	2.5
8	Malalignment	5	1.3
9	Extensor mechanism failure	4	1.0
10	Metal reaction/Metallosis	2	0.5
11	Osteolysis	2	0.5
12	Patellofemoral Joint	2	0.5
13	Peri-prosthetic fracture - Tibia	1	0.3
14	Poly liner wear	1	0.3

Table 952: Distribution of approach used for Triathlon/Triathlon TS combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	15618	75.5
Mid-vastus	4903	23.7
Sub-vastus	87	0.4
Lateral parapatellar	24	0.1
Missing/unknown/other	57	0.3

Table 953: Distribution of polyethylene used for Triathlon/Triathlon TS combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	20600	99.6
Antioxidant XLPE	0	0.0
Missing/unknown/other	89	0.4

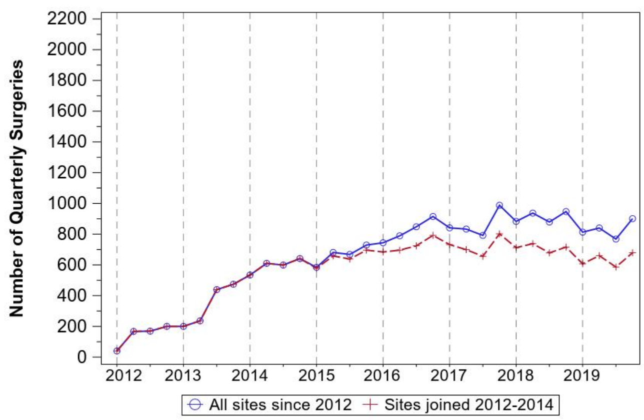

Figure 254: Utilization of the Triathlon/Triathlon TS combination in primary TKA cases.

Vanguard/Maxim
N=19536

106 surgeons across 47 sites use this implant combination.

Table 954: Volume of primary cases by surgeon and site for the Vanguard/Maxim combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	184.3 (314.0)	52 (191)
Cases per site	415.7 (589.5)	156 (623)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 955: Descriptive statistics of cases receiving the Vanguard/Maxim combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	12114	62	
Age (yrs)	19536	66.5(9.5)	66(13)
Height (cm)	19536	168.5(10.5)	167.6(16)
Weight (kg)	19536	95.3(22)	93(29.5)
BMI(kg/m^2)	19536	33.5(7.1)	32.7(9.4)
Smoking - never (%)	9998	51.2	
Smoking - previous (%)	7519	38.5	
Smoking - current (%)	1804	9.2	
Smoking - unknown (%)	215	1.1	

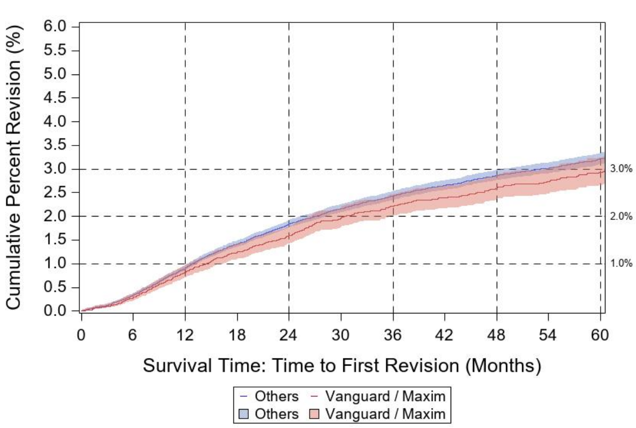

Figure 255: Cumulative percent revision curve for the Vanguard/Maxim combination compared to all other implant combinations in primary TKA cases.

Table 956: Cumulative percent revision and number at risk for Vanguard/Maxim combination in primary TKA cases.

Year	Number at risk	CPR
0	19517	0.00 (0.00,0.00)
1	17572	0.82 (0.70,0.96)
2	14911	1.59 (1.42,1.79)
3	11782	2.22 (2.00,2.46)
4	8283	2.60 (2.36,2.87)
5	5141	2.93 (2.65,3.24)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 0.731 (0.629,0.852). It was 0.806 (0.754,0.862) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 957: Reasons for revision following primary TKA for Vanguard/Maxim cases.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	111	28.5
2	Joint Infection	89	22.9
3	Aseptic Loosening	70	18.0
4	Pain	35	9.0
5	Component fracture/failure	29	7.5
6	Arthrofibrosis	22	5.7
7	Peri-prosthetic fracture - Femur	10	2.6
8	Malalignment	9	2.3
9	Metal reaction/Metallosis	8	2.1
10	Extensor mechanism failure	3	0.8
11	Poly liner wear	3	0.8

Table 958: Distribution of approach used for Vanguard/Maxim combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	17556	89.9
Mid-vastus	1693	8.7
Sub-vastus	181	0.9
Lateral parapatellar	50	0.3
Missing/unknown/other	56	0.3

Table 959: Distribution of polyethylene used for Vanguard/Maxim combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	10656	54.5
XLPE	0	0.0
Antioxidant XLPE	8747	44.8
Missing/unknown/other	133	0.7

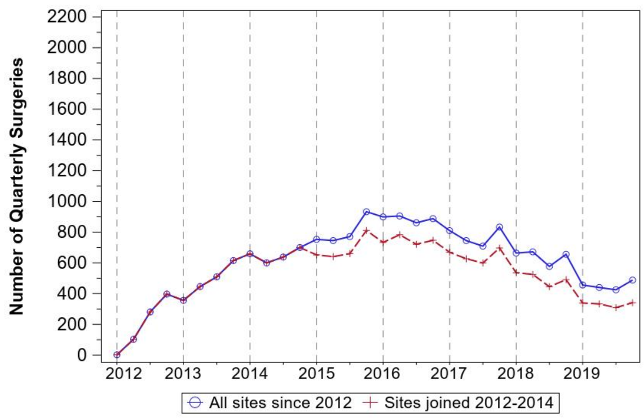

Figure 256: Utilization of the Vanguard/Maxim combination in primary TKA cases.

Vanguard/Maxim Mono-Lock
N=1057

62 surgeons across 32 sites use this implant combination.

Table 960: Volume of primary cases by surgeon and site for the Vanguard/Maxim Mono-Lock combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	17.1 (32.9)	4 (10)
Cases per site	33.0 (62.8)	7.5 (17.5)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 961: Descriptive statistics of cases receiving the Vanguard/Maxim Mono-Lock combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	932	88.2	
Age (yrs)	1057	64.8(9.3)	65(12)
Height (cm)	1057	164.7(8.6)	163(10)
Weight (kg)	1057	93.7(22.8)	90.7(30.9)
BMI(kg/m^2)	1057	34.5(7.6)	33.7(10.4)
Smoking - never (%)	514	48.6	
Smoking - previous (%)	408	38.6	
Smoking - current (%)	133	12.6	
Smoking - unknown (%)	2	0.2	

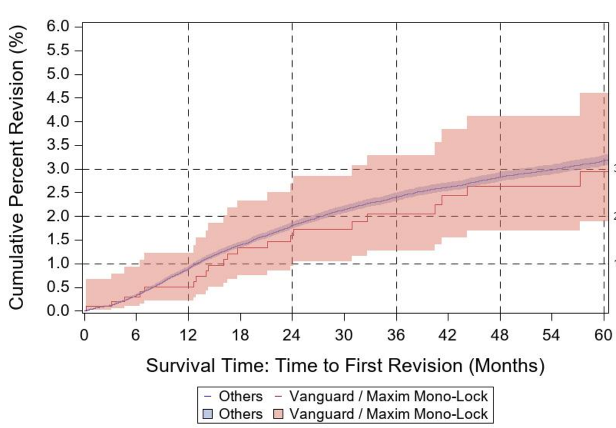

Figure 257: Cumulative percent revision curve for the Vanguard/Maxim Mono-Lock combination compared to all other implant combinations in primary TKA cases.

Table 962: Cumulative percent revision and number at risk for Vanguard/Maxim Mono-Lock combination in primary TKA cases.

Year	Number at risk	CPR
0	1054	0.00 (0.00,0.00)
1	885	0.51 (0.21,1.23)
2	735	1.59 (0.94,2.68)
3	564	2.04 (1.27,3.29)
4	428	2.64 (1.69,4.12)
5	282	2.95 (1.88,4.60)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 0.765 (0.495,1.185). It was 0.81 (0.758,0.866) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 963: Reasons for revision following primary TKA for Vanguard/Maxim Mono-Lock cases.

Rank	Reason for revision	N	Percent
1	Aseptic Loosening	5	26.3
2	Pain	5	26.3
3	Dislocation/Instability	4	21.1
4	Joint Infection	2	10.5
5	Component fracture/failure	1	5.3
6	Metal reaction/Metallosis	1	5.3
7	Poly liner wear	1	5.3

Table 964: Distribution of approach used for Vanguard/Maxim Mono-Lock combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	942	89.1
Mid-vastus	112	10.6
Sub-vastus	1	0.1
Lateral parapatellar	2	0.2
Missing/unknown/other	0	0.0

Table 965: Distribution of polyethylene used for Vanguard/Maxim Mono-Lock combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	541	51.2
XLPE	0	0.0
Antioxidant XLPE	504	47.7
Missing/unknown/other	12	1.1

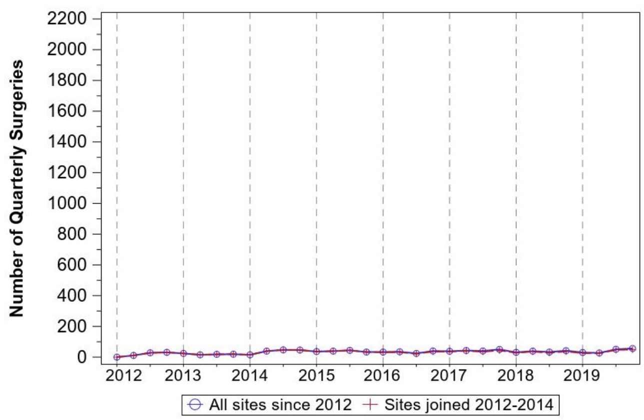

Figure 258: Utilization of the Vanguard/Maxim Mono-Lock combination in primary TKA cases.

Vanguard XP/Vanguard XP
N=547

13 surgeons across 13 sites use this implant combination.

Table 966: Volume of primary cases by surgeon and site for the Vanguard XP/Vanguard XP combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	42.1 (123.1)	4 (12)
Cases per site	42.1 (121.9)	5 (9)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 967: Descriptive statistics of cases receiving the Vanguard XP/Vanguard XP combination in primary TKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	324	59.2	
Age (yrs)	547	66.3(9.1)	67(12)
Height (cm)	547	169.2(9.8)	168(12.7)
Weight (kg)	547	88.5(18.9)	86.4(24.3)
BMI(kg/m^2)	547	30.8(5.7)	29.8(7.9)
Smoking - never (%)	273	49.9	
Smoking - previous (%)	220	40.2	
Smoking - current (%)	52	9.5	
Smoking - unknown (%)	2	0.4	

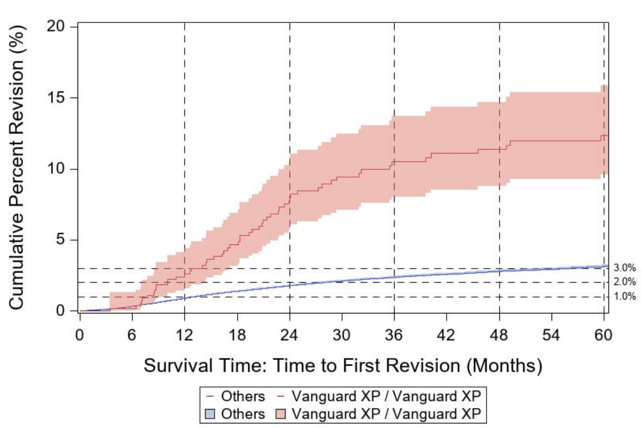

Figure 259: Cumulative percent revision curve for the Vanguard XP/Vanguard XP combination compared to all other implant combinations in primary TKA cases.

Table 968: Cumulative percent revision and number at risk for Vanguard XP/Vanguard XP combination in primary TKA cases.

Year	Number at risk	CPR
0	547	0.00 (0.00,0.00)
1	495	2.62 (1.56,4.38)
2	401	7.99 (5.90,10.79)
3	323	10.53 (8.04,13.73)
4	297	11.38 (8.76,14.72)
5	223	12.36 (9.58,15.88)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 2.565 (1.879,3.502). It was 0.807 (0.755,0.863) and 0.962 (0.959,0.966) for sex (female) and age, respectively.

Table 969: Reasons for revision following primary TKA for Vanguard XP/Vanguard XP cases.

Rank	Reason for revision	N	Percent
1	Pain	16	31.4
2	Arthrofibrosis	12	23.5
3	Aseptic Loosening	8	15.7
4	Dislocation/Instability	8	15.7
5	Joint Infection	5	9.8
6	Component fracture/failure	1	2.0
7	Extensor mechanism failure	1	2.0

Table 970: Distribution of approach used for Vanguard XP/Vanguard XP combination in primary TKA cases.

Approach	N	Percent
Medial parapatellar	345	63.1
Mid-vastus	1	0.2
Sub-vastus	201	36.7
Lateral parapatellar	0	0.0
Missing/unknown/other	0	0.0

Table 971: Distribution of polyethylene used for Vanguard XP/Vanguard XP combination in primary TKA cases.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	0	0.0
Antioxidant XLPE	547	100.0
Missing/unknown/other	0	0.0

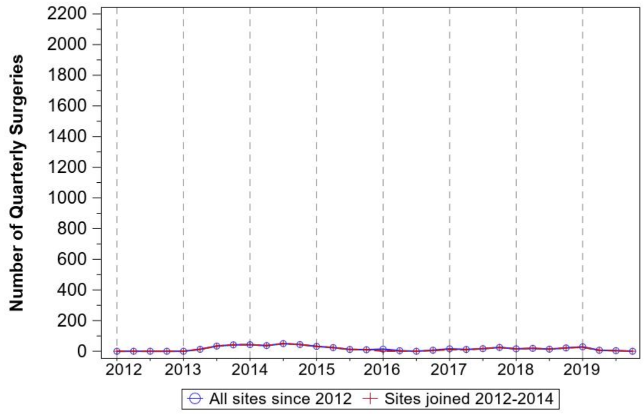

Figure 260: Utilization of the Vanguard XP/Vanguard XP combination in primary TKA cases.

3.3 UKA cases

3.3.1 UKA descriptive statistics

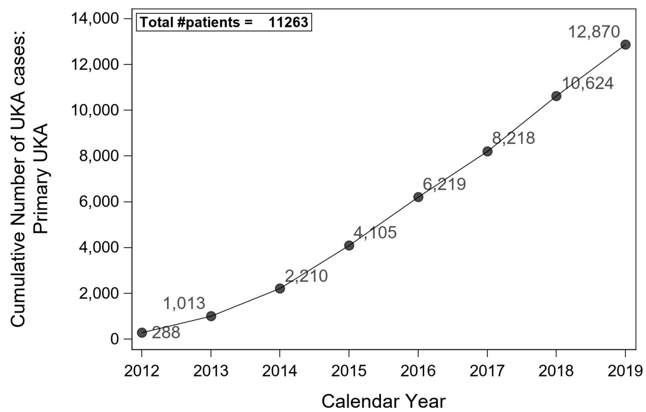

Figure 261: Primary UKA cases over time.

Table 972: Descriptive statistics of primary UKA cases.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	6456	50.2	
Age (yrs)	12870	64(10.2)	64(14)
Height (cm)	12846	170(10.4)	170(15.2)
Weight (kg)	12846	91(19.6)	89.7(25.9)
BMI(kg/m^2)	12845	31.4(5.9)	30.7(7.5)
Smoking - never (%)	6433	50	
Smoking - previous (%)	5073	39.4	
Smoking - current (%)	1273	9.9	
Smoking - unknown (%)	91	0.7	

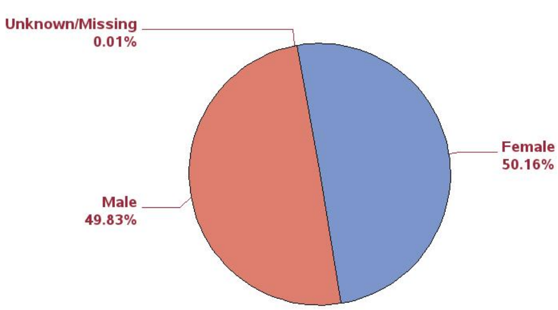

Figure 262: Percent of primary UKA cases by sex.

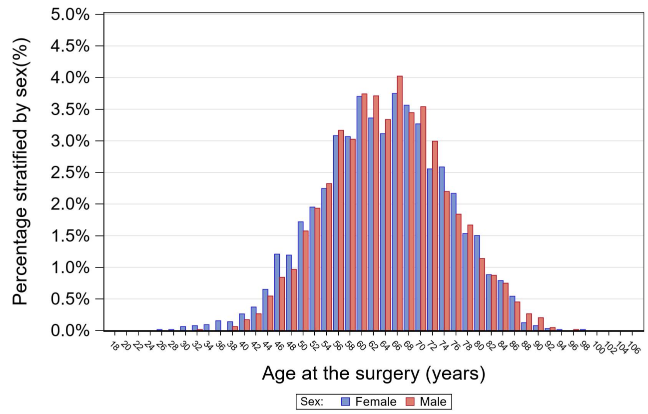

Figure 263: Age distribution of primary UKA cases by sex.

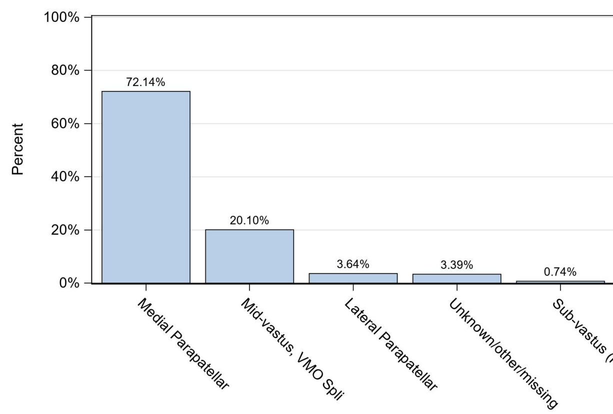

Figure 264: Percent of primary UKA cases by approach.

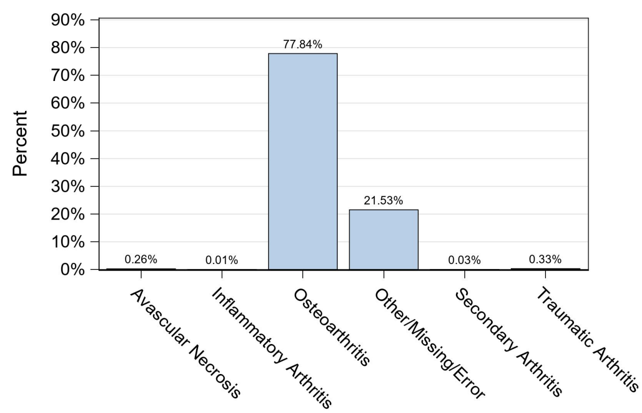

Figure 265: Percent of primary UKA cases by diagnosis.

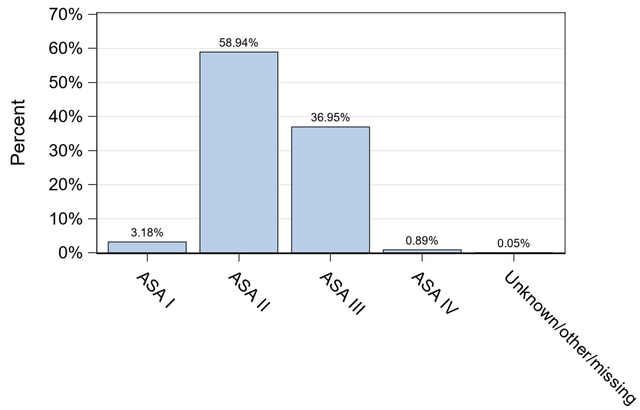

Figure 266: Percent of primary UKA cases by ASA class.

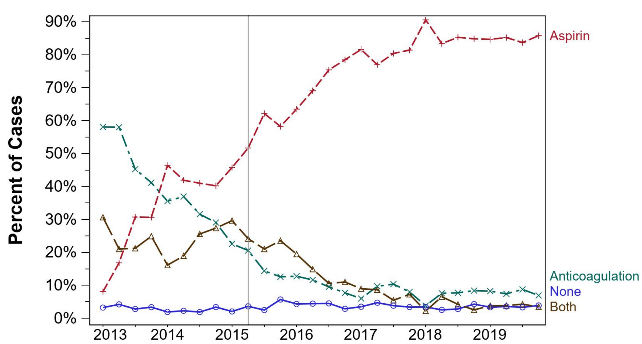

Figure 267: Percent of primary UKA patients (first case) by thrombosis prophylaxis.

3.3.2 Most commonly used UKA implants

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

Table 973: Ten most commonly used femoral components in primary UKA.

Rank	Femoral component	N	Percent
1	Restoris MCK	4492	34.9
2	ZUK	2897	22.5
3	Oxford	2808	21.8
4	Persona	1295	10.1
5	Journey	371	2.9
6	Triathlon PKR	363	2.8
7	iBalance	222	1.7
8	Sigma HP	188	1.5
9	Stride	111	0.9
10	iUni G2	46	0.4
11	Others	77	0.6

Table 974: Ten most commonly used tibial components in primary UKA

Rank	Tibial component	N	Percent
1	Restoris MCK	4477	34.8
2	ZUK	3120	24.2
3	Oxford	2731	21.2
4	Persona	1289	10.0
5	Triathlon PKR	361	2.8
6	iBalance	220	1.7
7	Sigma HP	187	1.4
8	Journey	113	0.9
9	Stride	111	0.9
10	Vanguard M	64	0.5
11	Others	197	1.5

Table 975: Ten most commonly used femoral/tibial component combinations in primary UKA.

Rank	Femoral/tibial component combination	N	Percent
1	Restoris MCK / Restoris MCK	4477	34.8
2	ZUK / ZUK	2867	22.3
3	Oxford / Oxford	2731	21.2
4	Persona / Persona	1288	10.0
5	Triathlon PKR / Triathlon PKR	361	2.8
6	Journey / Zimmer High Flex	252	2.0
7	iBalance / iBalance	220	1.7
8	Sigma HP / Sigma HP	187	1.4
9	Journey / Journey	113	0.9
10	Stride / Stride	111	0.9
11	Others	263	2.1

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

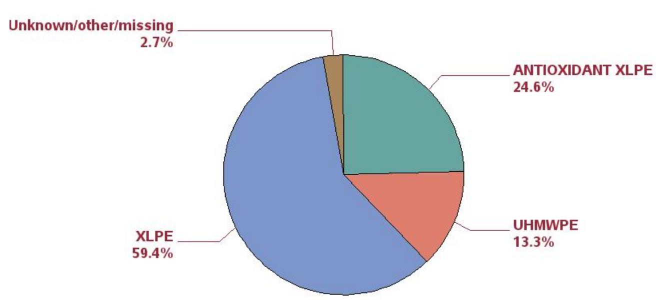

Figure 268: Percentage of polyethylene inserts by type of polyethylene in primary UKA.

3.3.3 UKA revision risk summary

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 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. The causes corresponding to each bar are numbered and a key at the bottom links the numbers to text descriptions.

In addition to an overall summary of reason 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 reasons for revision tables and figures differ from the time window used for other figures because 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. Also note that for knees instability/dislocation should be interpreted as instability.

Table 976: Reasons for first revision following primary UKA.

Rank	Reason for revision	N	Percent
1	Conversion of UKA	187	38.8
2	Aseptic Loosening	103	21.4
3	Pain	50	10.4
4	Dislocation/Instability	43	8.9
5	Component fracture/failure	33	6.8
6	Joint Infection	25	5.2
7	Peri-prosthetic fracture - Tibia	15	3.1
8	Osteolysis	4	0.8
9	Metal reaction/Metallosis	4	0.8
10	Arthrofibrosis	4	0.8
11	Extensor mechanism failure	4	0.8
12	Poly liner wear	3	0.6
13	Malalignment	3	0.6
14	Patellofemoral Joint	3	0.6
15	Peri-prosthetic fracture - Femur	1	0.2

Table 977: Reasons for first revision following primary UKA in first year post-operatively.

Rank	Reason for revision	N	Percent
1	Conversion of UKA	39	25.8
2	Aseptic Loosening	23	15.2
3	Joint Infection	17	11.3
4	Pain	16	10.6
5	Dislocation/Instability	15	9.9
6	Peri-prosthetic fracture - Tibia	13	8.6
7	Component fracture/failure	11	7.3
8	Metal reaction/Metallosis	4	2.6
9	Extensor mechanism failure	4	2.6
10	Arthrofibrosis	3	2.0
11	Osteolysis	2	1.3
12	Patellofemoral Joint	2	1.3
13	Peri-prosthetic fracture - Femur	1	0.7
14	Malalignment	1	0.7

Table 978: Reasons for first revision following primary UKA in second year post-operatively.

Rank	Reason for revision	N	Percent
1	Conversion of UKA	61	39.9
2	Aseptic Loosening	41	26.8
3	Pain	19	12.4
4	Dislocation/Instability	14	9.2
5	Component fracture/failure	11	7.2
6	Joint Infection	3	2.0
7	Osteolysis	2	1.3
8	Poly liner wear	1	0.7
9	Malalignment	1	0.7

Table 979: Reasons for first revision following primary UKA in third year post-operatively.

Rank	Reason for revision	N	Percent
1	Conversion of UKA	31	39.2
2	Aseptic Loosening	18	22.8
3	Pain	12	15.2
4	Dislocation/Instability	7	8.9
5	Component fracture/failure	5	6.3
6	Joint Infection	3	3.8
7	Poly liner wear	1	1.3
8	Malalignment	1	1.3
9	Arthrofibrosis	1	1.3

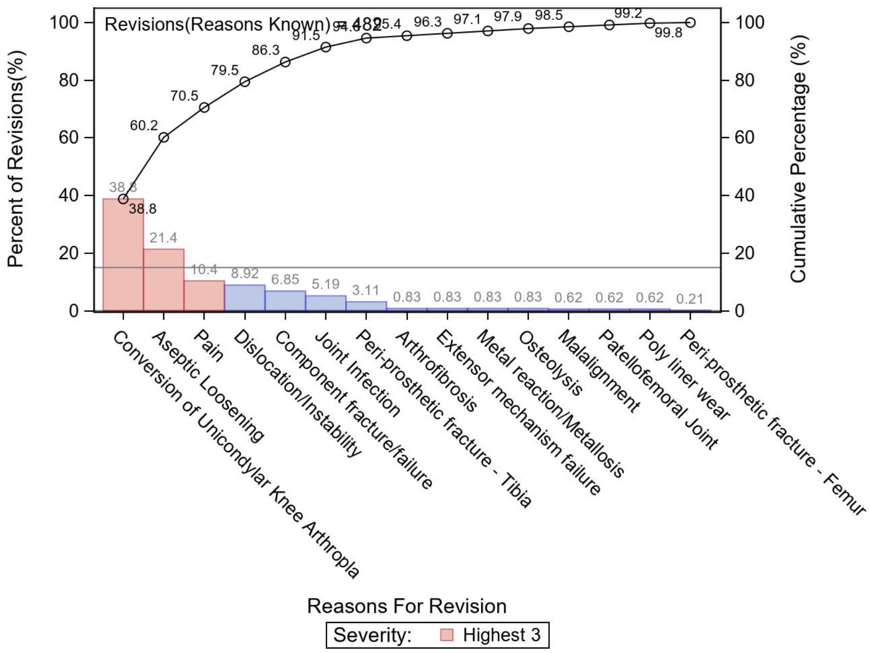

Figure 269: Most common reasons for first revision following primary UKA (Pareto chart).

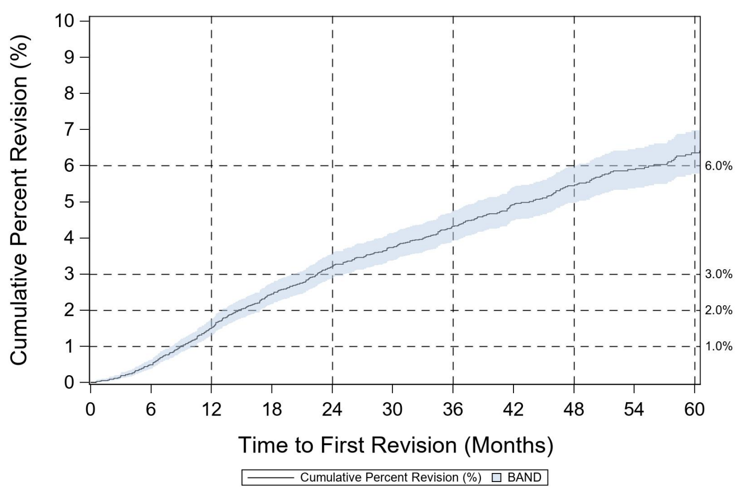

Figure 270: Cumulative percent revision for primary UKA.

Table 980: Cumulative percent revision for primary UKA (numerical values).

	1 year	2 years	3 years	4 years	5 years
CPR	1.51 (1.30,1.75)	3.20 (2.88,3.56)	4.32 (3.92,4.75)	5.45 (4.97,5.97)	6.35 (5.78,6.99)
Number at risk	10471	7955	5947	3891	2077

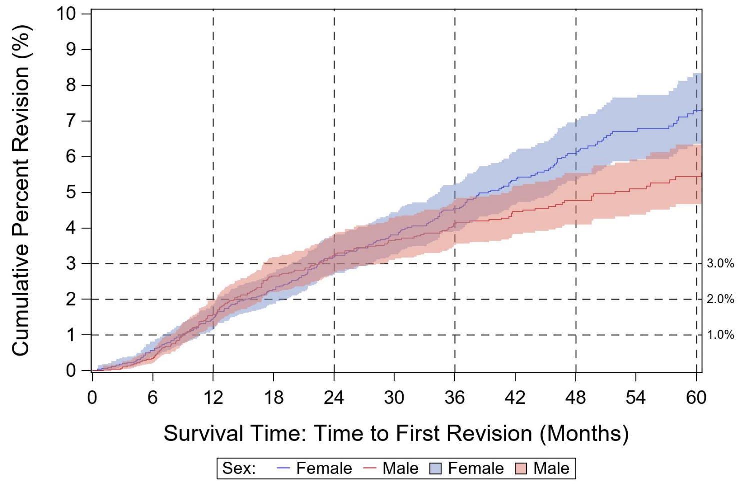

Figure 271: Cumulative percent revision for primary UKA by sex for osteoarthritis diagnosis.

Table 981: Cumulative percent revision for primary UKA by sex for osteoarthritis diagnosis (numerical values).

Sex	N	1 year	2 years	3 years	4 years	5 years
Female	5094	1.46 (1.15,1.85)	3.18 (2.69,3.75)	4.53 (3.92,5.24)	6.09 (5.32,6.96)	7.29 (6.36,8.34)
Male	4920	1.58 (1.25,1.99)	3.22 (2.72,3.80)	4.12 (3.53,4.80)	4.76 (4.10,5.54)	5.44 (4.66,6.34)
Unknown/Missing	0					

3.3.4 Revision risk for UKA implant combinations

Similar to previous sections on implant-specific revision, the reader should go to the online supplement describing each table and figure to understand inclusion and exclusion criteria when there are questions about the total number of cases reported. Catalog numbers included in each of these implant combinations can be found at *2021 MARCQI Annual Report Specifications*. While the reader is encouraged to read the details of each femur/tibia implant combination, the following table summarizes the five-year CPR values.

Table 982: Cumulative percent revision following primary UKA for femoral/tibial combinations having at least 500 primary cases, sorted alphabetically.

Femoral/tibial combination	N*	1 year	2 years	3 years	4 years	5 years
Oxford / Oxford	2729	1.85 (1.39,2.45)	3.83 (3.13,4.69)	5.14 (4.30,6.14)	6.60 (5.58,7.80)	7.53 (6.35,8.91)
Persona / Persona	1287	1.01 (0.52,1.95)	2.11 (1.20,3.67)	N/A	N/A	N/A
Restoris MCK / Restoris MCK	4476	1.37 (1.05,1.78)	2.93 (2.41,3.55)	3.86 (3.22,4.62)	5.29 (4.42,6.31)	5.96 (4.89,7.24)
ZUK / ZUK	2865	1.11 (0.78,1.58)	2.29 (1.78,2.94)	3.08 (2.47,3.85)	3.65 (2.96,4.50)	4.45 (3.63,5.46)

Notes:

* 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.

We remind readers to be cautious in interpreting CPR values when the number at risk is low.

Table 983: Cumulative percent revision following primary UKA for femoral/tibial combinations having at least 500 primary cases, sorted sorted by 5-year cpr

Femoral/tibial combination	N*	1 year	2 years	3 years	4 years	5 years
ZUK / ZUK	2865	1.11 (0.78,1.58)	2.29 (1.78,2.94)	3.08 (2.47,3.85)	3.65 (2.96,4.50)	4.45 (3.63,5.46)
Restoris MCK / Restoris MCK	4476	1.37 (1.05,1.78)	2.93 (2.41,3.55)	3.86 (3.22,4.62)	5.29 (4.42,6.31)	5.96 (4.89,7.24)
Oxford / Oxford	2729	1.85 (1.39,2.45)	3.83 (3.13,4.69)	5.14 (4.30,6.14)	6.60 (5.58,7.80)	7.53 (6.35,8.91)

Notes:

* 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.

We remind readers to be cautious in interpreting CPR values when the number at risk is low.

Oxford/Oxford

N=2731

77 surgeons across 44 sites use this implant combination.

Table 984: Volume of primary cases by surgeon and site for the Oxford/Oxford combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	35.5 (90.5)	14 (29)
Cases per site	62.1 (116.8)	17 (71)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 985: Descriptive statistics of cases receiving the Oxford/Oxford combination in primary UKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	1328	48.6	
Age (yrs)	2731	64.1(10.2)	64(14)
Height (cm)	2731	170.3(10.3)	170.2(15.4)
Weight (kg)	2731	92.2(19.7)	90.7(25.8)
BMI(kg/m^2)	2731	31.7(5.8)	30.9(7.5)
Smoking - never (%)	1324	48.5	
Smoking - previous (%)	1098	40.2	
Smoking - current (%)	287	10.5	
Smoking - unknown (%)	22	0.8	

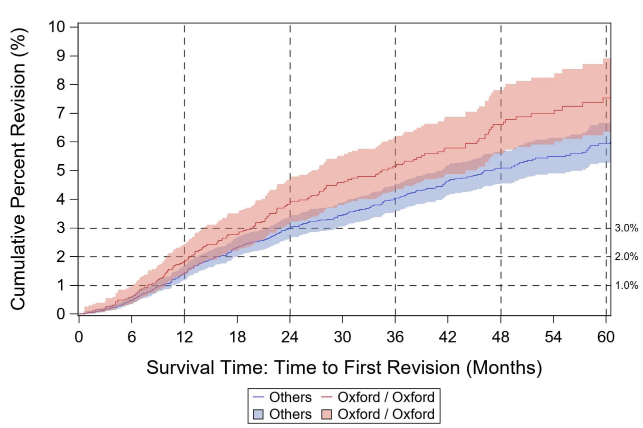

Figure 272: Cumulative percent revision curve for the Oxford/Oxford combination compared to all other implant combinations in primary UKA cases.

Table 986: Cumulative percent revision and number at risk for Oxford/Oxford combination in primary UKA cases.

Year	Number at risk	CPR
0	2729	0.00 (0.00,0.00)
1	2391	1.85 (1.39,2.45)
2	2009	3.83 (3.13,4.69)
3	1597	5.14 (4.30,6.14)
4	1063	6.60 (5.58,7.80)
5	564	7.53 (6.35,8.91)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 1.272 (0.993,1.63). It was 1.146 (0.961,1.368) and 0.966 (0.959,0.975) for sex (female) and age, respectively.

Table 987: Reasons for revision following primary UKA for Oxford/Oxford cases.

Rank	Reason for revision	N	Percent
1	Conversion of UKA	47	32.6
2	Aseptic Loosening	38	26.4
3	Dislocation/Instability	20	13.9
4	Pain	11	7.6
5	Component fracture/failure	10	6.9
6	Joint Infection	7	4.9
7	Extensor mechanism failure	3	2.1
8	Peri-prosthetic fracture - Tibia	3	2.1
9	Patellofemoral Joint	2	1.4
10	Arthrofibrosis	1	0.7
11	Osteolysis	1	0.7
12	Poly liner wear	1	0.7

Table 988: Distribution of approach used for Oxford/Oxford combination in primary UKA cases.

Approach	N	Percent
Medial parapatellar	2466	90.3
Mid-vastus	163	6.0
Sub-vastus	25	0.9
Lateral parapatellar	8	0.3
Missing/unknown/other	69	2.5

Table 989: Distribution of polyethylene used for Oxford/Oxford combination in primary UKA cases.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	2694	98.6
Antioxidant XLPE	0	0.0
Missing/unknown/other	37	1.4

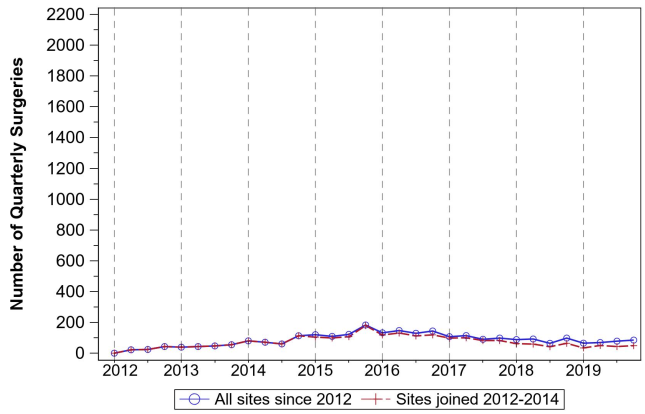

Figure 273: Utilization of the Oxford/Oxford combination in primary UKA cases.

Persona/Persona
N=1288

60 surgeons across 33 sites use this implant combination.

Table 990: Volume of primary cases by surgeon and site for the Persona/Persona combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	21.5 (58.1)	5.5 (10)
Cases per site	39.0 (65.6)	14 (41)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 991: Descriptive statistics of cases receiving the Persona/Persona combination in primary UKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	592	46	
Age (yrs)	1288	64.1(10)	64(14)
Height (cm)	1281	170.5(10.5)	170.2(15.2)
Weight (kg)	1281	91.9(18.9)	90.7(24)
BMI(kg/m^2)	1281	31.6(5.5)	31.1(7.4)
Smoking - never (%)	679	52.7	
Smoking - previous (%)	480	37.3	
Smoking - current (%)	126	9.8	
Smoking - unknown (%)	3	0.2	

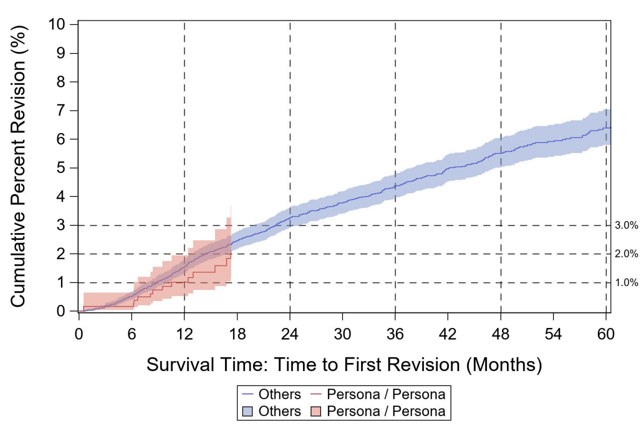

Figure 274: Cumulative percent revision curve for the Persona/Persona combination compared to all other implant combinations in primary UKA cases.

* No revision occurred after the termination of the red curve in figure above; therefore, numerical revision risk at this time point is the same as it was at the time of the last revision.

Table 992: Cumulative percent revision and number at risk for Persona/Persona combination in primary UKA cases.

Year	Number at risk	CPR*
0	1287	0.00 (0.00,0.00)
1	612	1.01 (0.52,1.95)
2*	111	2.11 (1.20,3.67)
3	0	N/A
4	0	N/A
5	0	N/A

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 0.969 (0.549,1.713). It was 1.145 (0.96,1.367) and 0.967 (0.959,0.976) for sex (female) and age, respectively.

Table 993: Reasons for revision following primary UKA for Persona/Persona cases.

Rank	Reason for revision	N	Percent
1	Conversion of UKA	8	57.1
2	Peri-prosthetic fracture - Tibia	3	21.4
3	Aseptic Loosening	1	7.1
4	Dislocation/Instability	1	7.1
5	Pain	1	7.1

Table 994: Distribution of approach used for Persona/Persona combination in primary UKA cases.

Approach	N	Percent
Medial parapatellar	672	52.2
Mid-vastus	606	47.0
Sub-vastus	1	0.1
Lateral parapatellar	1	0.1
Missing/unknown/other	8	0.6

Table 995: Distribution of polyethylene used for Persona/Persona combination in primary UKA cases.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	0	0.0
Antioxidant XLPE	1285	99.8
Missing/unknown/other	3	0.2

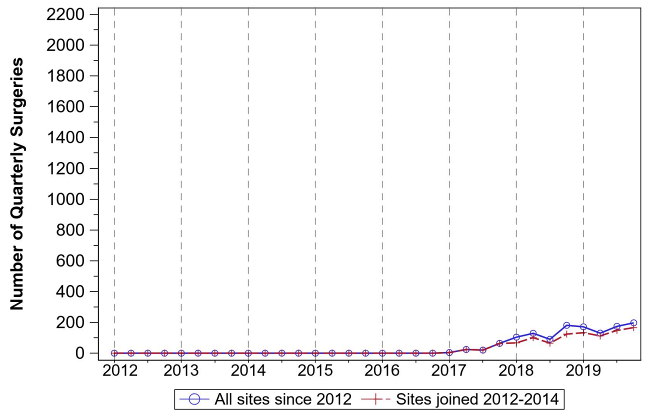

Figure 275: Utilization of the Persona/Persona combination in primary UKA cases.

Restoris MCK/Restoris MCK
N=4477

84 surgeons across 20 sites use this implant combination.

Table 996: Volume of primary cases by surgeon and site for the Restoris MCK/Restoris MCK combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	53.3 (98.1)	19.5 (45.5)
Cases per site	223.9 (347.9)	94.5 (215.5)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 997: Descriptive statistics of cases receiving the Restoris MCK/Restoris MCK combination in primary UKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	2286	51.1	
Age (yrs)	4477	64.5(9.7)	65(13)
Height (cm)	4477	170(10.5)	170(15.3)
Weight (kg)	4477	91.4(19.6)	90(26.4)
BMI(kg/m^2)	4477	31.6(5.9)	30.8(7.6)
Smoking - never (%)	2330	52	
Smoking - previous (%)	1760	39.3	
Smoking - current (%)	381	8.5	
Smoking - unknown (%)	6	0.1	

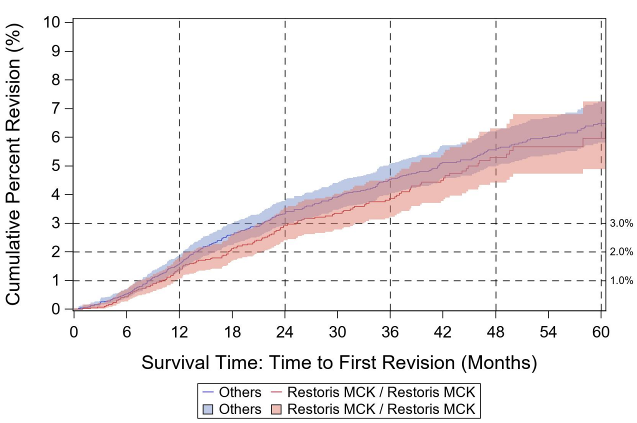

Figure 276: Cumulative percent revision curve for the Restoris MCK/Restoris MCK combination compared to all other implant combinations in primary UKA cases.

Table 998: Cumulative percent revision and number at risk for Restoris MCK/Restoris MCK combination in primary UKA cases.

Year	Number at risk	CPR
0	4476	0.00 (0.00,0.00)
1	3582	1.37 (1.05,1.78)
2	2518	2.93 (2.41,3.55)
3	1665	3.86 (3.22,4.62)
4	853	5.29 (4.42,6.31)
5	264	5.96 (4.89,7.24)

Adjusting for sex and age, the hazard ratio for the implant compared to all other implants was 0.846 (0.64,1.119). It was 1.146 (0.96,1.368) and 0.967 (0.959,0.976) for sex (female) and age, respectively.

Table 999: Reasons for revision following primary UKA for Restoris MCK/Restoris MCK cases.

Rank	Reason for revision	N	Percent
1	Conversion of UKA	53	36.1
2	Aseptic Loosening	32	21.8
3	Dislocation/Instability	16	10.9
4	Pain	13	8.8
5	Joint Infection	10	6.8
6	Component fracture/failure	9	6.1
7	Peri-prosthetic fracture - Tibia	6	4.1
8	Arthrofibrosis	3	2.0
9	Osteolysis	2	1.4
10	Malalignment	1	0.7
11	Metal reaction/Metallosis	1	0.7
12	Poly liner wear	1	0.7

Table 1000: Distribution of approach used for Restoris MCK/Restoris MCK combination in primary UKA cases.

Approach	N	Percent
Medial parapatellar	3259	72.8
Mid-vastus	761	17.0
Sub-vastus	13	0.3
Lateral parapatellar	246	5.5
Missing/unknown/other	198	4.4

Table 1001: Distribution of polyethylene used for Restoris MCK/Restoris MCK combination in primary UKA cases.

Polyethylene type	N	Percent
UHMWPE	1160	25.9
XLPE	3297	73.6
Antioxidant XLPE	0	0.0
Missing/unknown/other	20	0.4

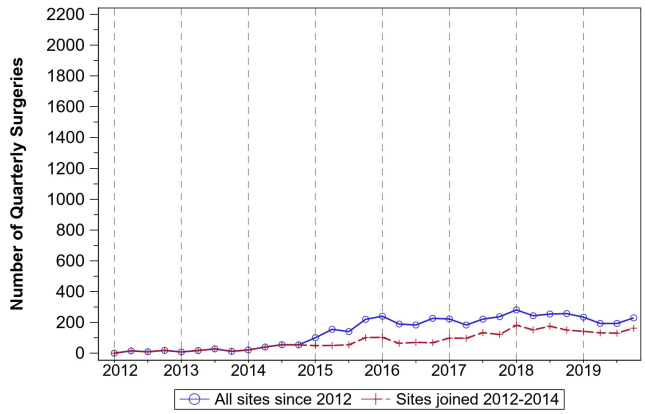

Figure 277: Utilization of the Restoris MCK/Restoris MCK combination in primary UKA cases.

ZUK/ZUK
N=2867

This implant (Zimmer Unicondylar Knee) was formerly known as the Zimmer High Flex Knee. 115 surgeons across 42 sites use this implant combination.

Table 1002: Volume of primary cases by surgeon and site for the ZUK/ZUK combination.

Quantity	Mean (SD)	Median (IQR)
Cases per surgeon	24.9 (50.7)	7 (18)
Cases per site	68.3 (88.4)	27.5 (93)

Note: The mean is substantially greater than median, which suggests there are some high volume surgeons who skew this distribution.

Table 1003: Descriptive statistics of cases receiving the ZUK/ZUK combination in primary UKA.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	1426	49.7	
Age (yrs)	2867	64.7(10.7)	65(15)
Height (cm)	2850	169.9(10.5)	170(15.2)
Weight (kg)	2851	89.1(19.3)	88(26.6)
BMI(kg/m^2)	2850	30.8(5.8)	30(7.6)
Smoking - never (%)	1396	48.7	
Smoking - previous (%)	1161	40.5	
Smoking - current (%)	285	9.9	
Smoking - unknown (%)	25	0.9	

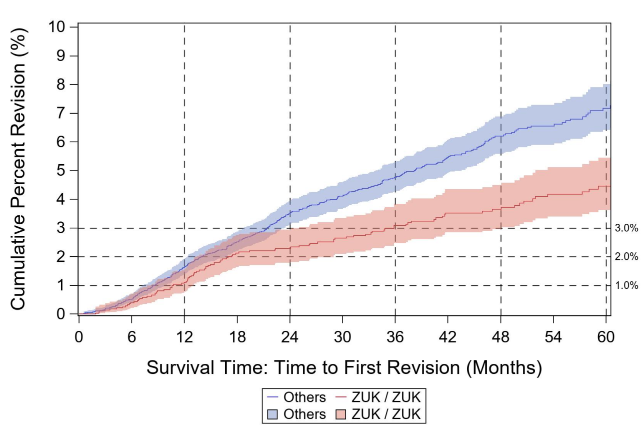

Figure 278: Cumulative percent revision curve for the ZUK/ZUK combination compared to all other implant combinations in primary UKA cases.

Table 1004: Cumulative percent revision and number at risk for ZUK/ZUK combination in primary UKA cases.

Year	Number at risk	CPR
0	2865	0.00 (0.00,0.00)
1	2587	1.11 (0.78,1.58)
2	2281	2.29 (1.78,2.94)
3	1922	3.08 (2.47,3.85)
4	1444	3.65 (2.96,4.50)
5	947	4.45 (3.63,5.46)

The proportional-hazards assumption of the Cox model is not satisfied, so hazard ratios are not reported.

Table 1005: Reasons for revision following primary UKA for ZUK/ZUK cases.

Rank	Reason for revision	N	Percent
1	Conversion of UKA	48	55.8
2	Aseptic Loosening	10	11.6
3	Pain	9	10.5
4	Component fracture/failure	8	9.3
5	Joint Infection	4	4.7
6	Dislocation/Instability	2	2.3
7	Extensor mechanism failure	1	1.2
8	Osteolysis	1	1.2
9	Peri-prosthetic fracture - Femur	1	1.2
10	Peri-prosthetic fracture - Tibia	1	1.2
11	Poly liner wear	1	1.2

Table 1006: Distribution of approach used for ZUK/ZUK combination in primary UKA cases.

Approach	N	Percent
Medial parapatellar	1802	62.9
Mid-vastus	830	29.0
Sub-vastus	50	1.7
Lateral parapatellar	137	4.8
Missing/unknown/other	48	1.7

Table 1007: Distribution of polyethylene used for ZUK/ZUK combination in primary UKA cases.

Polyethylene type	N	Percent
UHMWPE	0	0.0
XLPE	1236	43.1
Antioxidant XLPE	1602	55.9
Missing/unknown/other	29	1.0

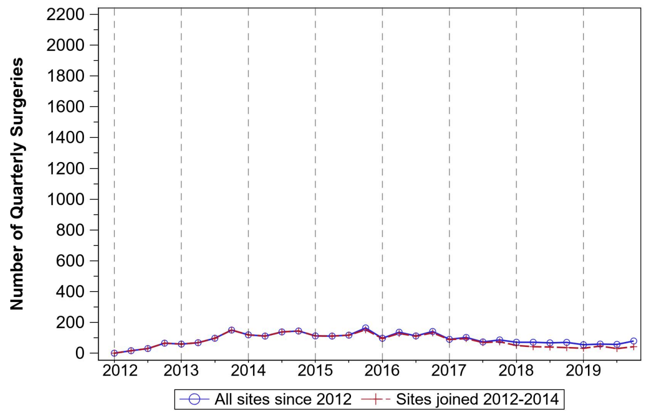

Figure 279: Utilization of the ZUK/ZUK combination in primary UKA cases.

3.4 PFJ cases

3.4.1 PFJ descriptive statistics

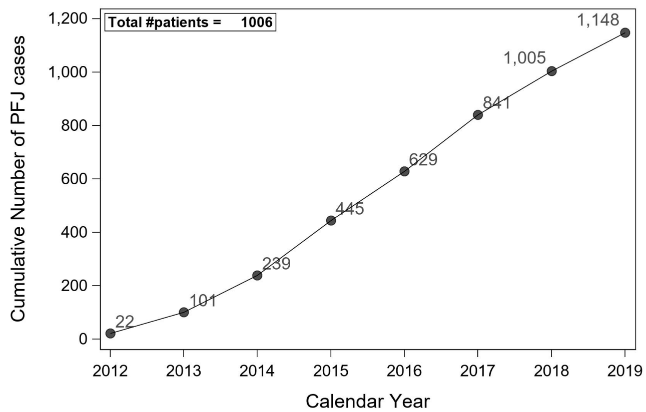

Figure 280: Primary PFJ cases over time.

Table 1008: Descriptive statistics of primary PFJ cases.

Quantity	N	Mean (SD)	Median (IQR)
Female (%)	871	75.9	
Age (yrs)	1148	53.6(12.6)	53(18)
Height (cm)	1146	168.4(9.9)	167.6(12.5)
Weight (kg)	1146	87.6(19.8)	86(27.8)
BMI(kg/m^2)	1146	30.8(6.1)	30.2(8)
Smoking - never (%)	554	48.3	
Smoking - previous (%)	351	30.6	
Smoking - current (%)	186	16.2	
Smoking - unknown (%)	57	5	

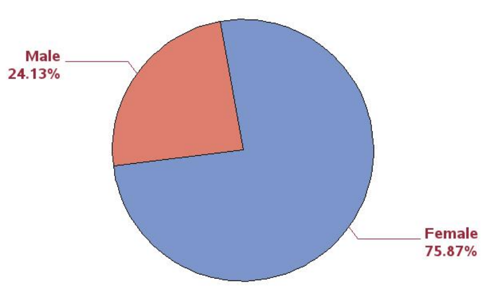

Figure 281: Percent of primary PFJ cases by sex.

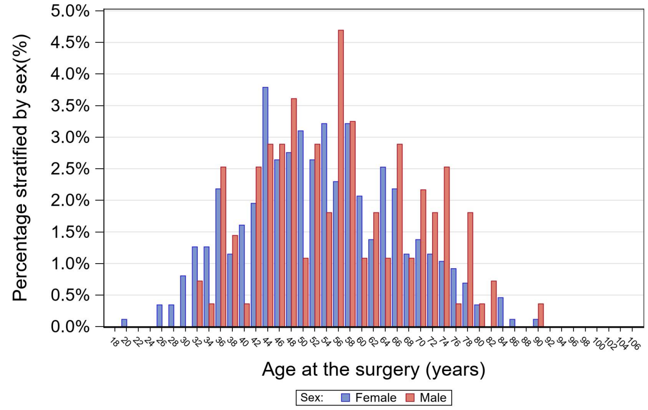

Figure 282: Age distribution of primary PFJ cases by sex.

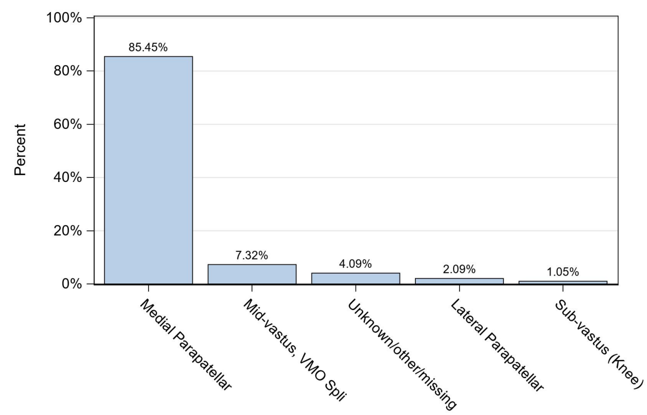

Figure 283: Percent of primary PFJ cases by approach.

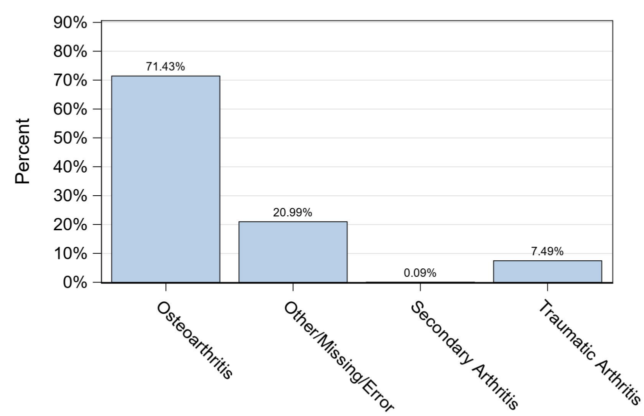

Figure 284: Percent of primary PFJ cases by diagnosis.

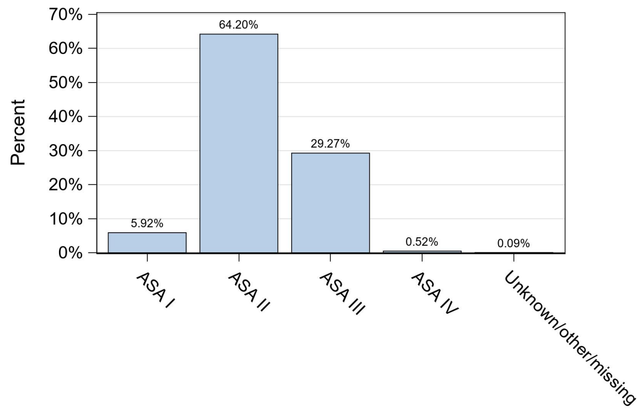

Figure 285: Percent of primary PFJ cases by ASA class.

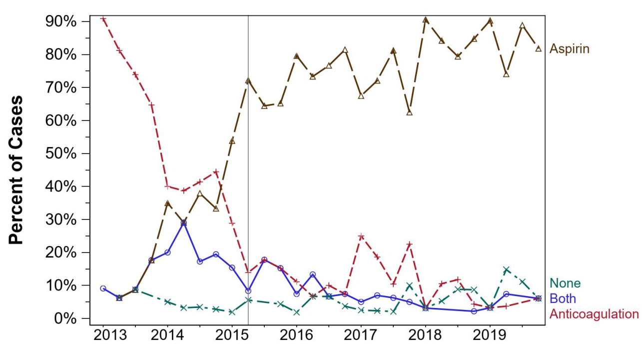

Figure 286: Percent of primary PFJ patients (first case) by thrombosis prophylaxis.

3.4.2 Most commonly used PFJ implants

Table 1009: Ten most commonly used trochlear components in primary PFJ.

Rank	Femoral component	N	Percent
1	Gender Solutions PFJ	333	29.0
2	Restoris MCK	263	22.9
3	iBalance	250	21.8
4	HemiCAP	113	9.8
5	Competitor PFJ	72	6.3
6	Avon	41	3.6
7	Sigma HP	38	3.3
8	Prelude PF	20	1.7
9	Vanguard PFR	16	1.4
10	KineMatch	2	0.2

3.4.3 PFJ revision risk summary

Since no implant combination exceeds 500 cases, no implant-specific CPR data are presented.

Table 1010: Reasons for first revision following primary PFJ.

Rank	Reason for revision	N	Percent
1	Patellofemoral Joint	25	22.1
2	Conversion of UKA	20	17.7
3	Dislocation/Instability	17	15.0
4	Pain	13	11.5
5	Component fracture/failure	10	8.8
6	Joint Infection	8	7.1
7	Aseptic Loosening	7	6.2
8	Metal reaction/Metallosis	7	6.2
9	Malalignment	4	3.5
10	Poly liner wear	1	0.9
11	Arthrofibrosis	1	0.9

Table 1011: Reasons for first revision following primary PFJ in first year post-operatively.

Rank	Reason for revision	N	Percent
1	Patellofemoral Joint	6	20.0
2	Dislocation/Instability	4	13.3
3	Aseptic Loosening	3	10.0
4	Component fracture/failure	3	10.0
5	Pain	3	10.0
6	Malalignment	3	10.0
7	Conversion of UKA	3	10.0
8	Joint Infection	2	6.7
9	Metal reaction/Metallosis	2	6.7
10	Arthrofibrosis	1	3.3

Table 1012: Reasons for first revision following primary PFJ in second year post-operatively.

Rank	Reason for revision	N	Percent
1	Pain	7	23.3
2	Conversion of UKA	6	20.0
3	Patellofemoral Joint	6	20.0
4	Dislocation/Instability	3	10.0
5	Joint Infection	3	10.0
6	Component fracture/failure	2	6.7
7	Metal reaction/Metallosis	2	6.7
8	Malalignment	1	3.3

Table 1013: Reasons for first revision following primary PFJ in third year post-operatively.

Rank	Reason for revision	N	Percent
1	Dislocation/Instability	4	17.4
2	Conversion of UKA	4	17.4
3	Patellofemoral Joint	4	17.4
4	Component fracture/failure	3	13.0
5	Metal reaction/Metallosis	3	13.0
6	Joint Infection	2	8.7
7	Pain	2	8.7
8	Aseptic Loosening	1	4.3

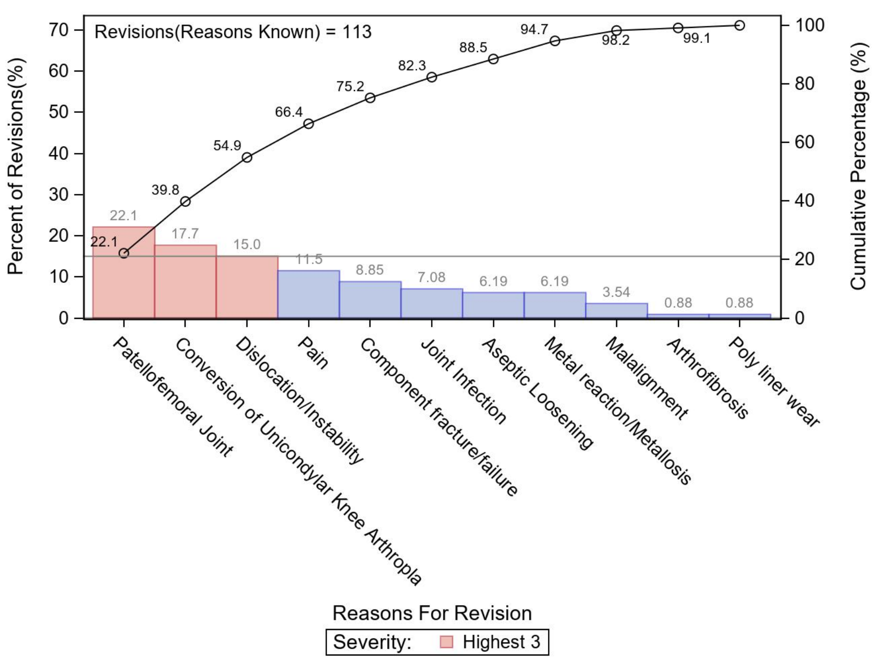

Figure 287: Most common reasons for first revision following primary PFJ (Pareto chart).

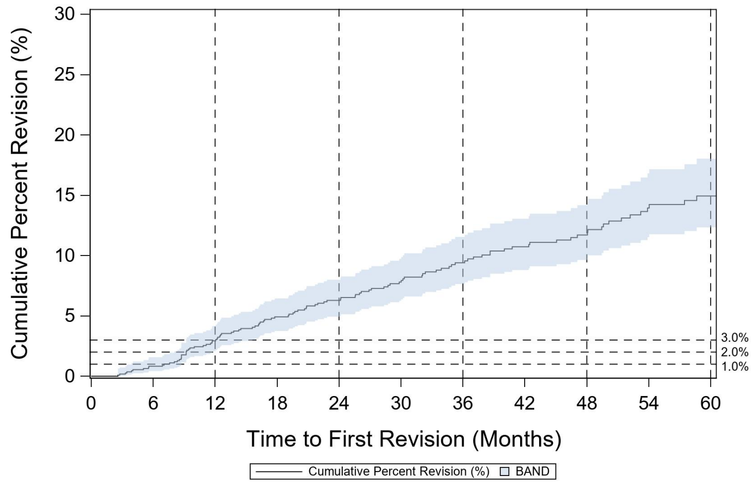

Figure 288: Cumulative percent revision for primary PFJ.

We remind readers to be cautious in interpreting CPR values when the number at risk is low.

Table 1014: Cumulative percent revision for primary PFJ (numerical values).

	1 year	2 years	3 years	4 years	5 years
CPR	2.94 (2.08,4.16)	6.29 (4.93,8.00)	9.40 (7.65,11.54)	11.71 (9.64,14.18)	14.94 (12.33,18.03)
Number at risk	978	785	571	397	208

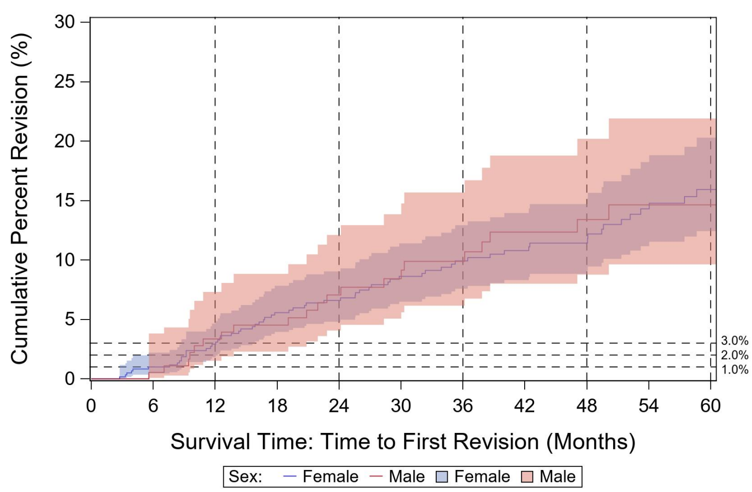

Figure 289: Cumulative percent revision for primary PFJ by sex for osteoarthritis diagnosis.

Table 1015: Cumulative percent revision for primary PFJ by sex for osteoarthritis diagnosis (numerical values).

Sex	N	1 year	2 years	3 years	4 years	5 years
Female	626	2.91 (1.82,4.64)	6.60 (4.80,9.04)	9.92 (7.58,12.92)	11.42 (8.83,14.70)	15.93 (12.43,20.29)
Male	193	3.35 (1.52,7.31)	7.05 (4.06,12.10)	9.88 (6.15,15.68)	13.40 (8.76,20.19)	14.63 (9.63,21.90)
Unknown/Missing	0					

Appendices

Appendix A

Statistical methods

This appendix is intended to provide a clear and precise description of the analytical methods used to generate figures, tables, and text in this report. It is written primarily for registry methodologists. It can be used as a reference for readers most interested in clinical aspects of arthroplasty.

A.1 MARCQI cohort: Qualifying patients

MARCQI was designed to improve quality of care for elective primary total hip and knee arthroplasty and associated revisions, excluding treatment for trauma cases. Therefore, MARCQI includes:

1. *Elective primary*. All primary hip and knee joint replacements for which the procedure has been planned and the patient undergoes the surgery for a non-emergent condition.
2. *Urgent/emergent*. Rare situations may occur when the patient has a scheduled elective primary procedure but enters the hospital through the emergency room or clinic. These cases are occasionally classified or scheduled by the hospital as urgent or emergent. If the case proceeds under this designation and the original diagnosis and plan are otherwise unchanged then they may be included. This situation is very uncommon.
3. *Revision*. All revision hip and knee replacements regardless of diagnosis are included.
4. *Trauma*. Primary trauma cases do not qualify. The CDA reviews the case to determine if an urgent/emergent qualifying revision of a knee or hip was performed.

A.2 Time window, inclusion and exclusion criteria for the hip and knee chapters

This report covers MARCQI activities from 02/15/2012 to 12/31/2019, and includes both primary and revision(s) cases. The inclusion and exclusion criteria for each table and figure in the hip and knee chapters are provided in an online supplement *2021 MARCQI Annual Report Specifications* available at the MARCQI annual reports web page.

A.3 Events for descriptive statistics and implant survival analysis

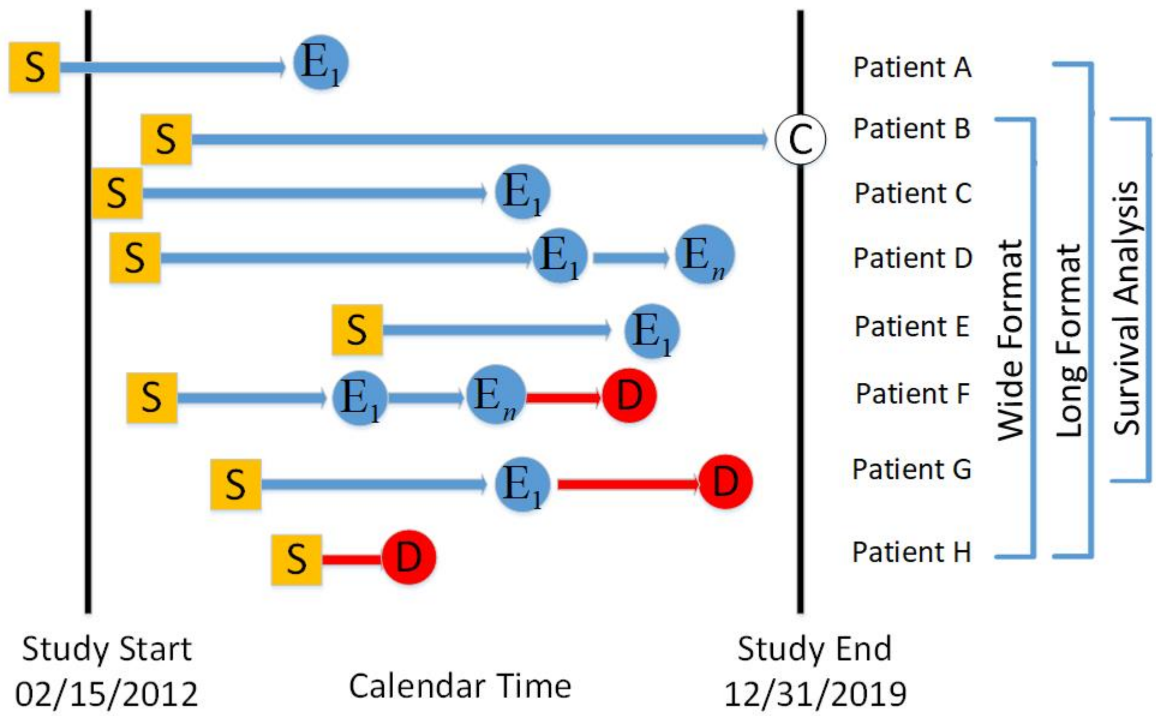

Figure 290: Illustration of event flow and eight types of patients in MARCQI database.

There are many different combination of events that can occur for each patient within and outside the 2/15/2012 - 12/31/2019 time window. For example, a patient could have a primary and revision, have a primary and then die, or have a primary and have no revision before 12/31/2019 but remain alive. It is important to understand each when interpreting data in this report, especially time-to-revision and the resulting cumulative percent revision curves and numbers. Figure 290 illustrates the possible events (*e.g.*, revision) for the report window using eight types of patients. Symbols in the figure represent start of a primary surgery (S), single event (E_1) and/or multiple events (E_n), death (D), and censoring (C). The figure helps define important concepts used in MARCQI analyses:

1. *Study time window*. All primary and revision surgeries performed between 02/15/2012 to 12/31/2019 are included. The revision event might be registered after 12/31/2019 in the database, but those post-study end event(s) do NOT qualify for implant survival analysis and were censored at the end of the study. In addition, primary surgeries performed prior to 02/15/2012 are not included in the revision analysis.
2. *Qualified patients*. All eight types of patients qualify for volume reporting, including patient A and patient H. Patient B through patient G qualified for implant survival analysis (thus patients A and H are disqualified). Patient C and patient E are of same type, even though starting time varies. Deaths are addressed in (7) below. Patient type A included in long format dataset is only qualified to calculate total volumes over time. Patient types B through H are included in the wide format dataset as primary surgery cases.
3. *Censoring*. The patients who did not have the event as of the study-end are considered right-censored. These patients provide some information, but not complete information, *e.g.*, Patient B. Patient A is excluded in implant survival analysis because the surgery occurred prior to the onset of the MARCQI registry; thus no left-censoring is considered in this report.
4. *Time-to-event*. Number of days elapsed from primary surgery to the event of interest (*e.g.* first revision following surgery).

5. *Qualified revision events for implant survival analysis.* First event E_1 after primary surgery (thus events E_2, E_3, $\ldots$, E_n disqualified). However, E_2, E_3, $\ldots$, E_n are counted in the total volume calculations.

6. *Lost-to-follow-up (LTFU).* This report does not consider LTFU (*e.g.*, due to geographical relocation of patient) as an event of interest. Instead, if MARCQI has no follow-up or death information until study-end, that patient is treated as a right-censoring at the study-end.

7. *Handling of deaths.* The MARCQI data abstractor records deaths within 90 days of surgery. National death indexes are not used to identify deaths after 90 days. In the time window used for this report, the 90-day death rate after primary THA surgeries is about 0.23%, including patient types F, G, and H. The death rate without any event(s) after primary surgery is approximately 0.18%, like patient type H. Following primary TKA cases, death rate is 0.15% and 0.12% with and without any revision event(s), respectively. Patients A and H are treated as qualified patients (in the denominator) in calculating descriptive statistics, implant combinations, surgeon and site volumes, but are excluded in implant survival analysis. Patients that die after a revision event (like patient F and G) are included in the implant survival analysis since those patients contributed information of time-to-first revision. This strategy ensures a minimal information loss. Kandala *et al.* (2015) showed that low death rate does not substantially affect the implant survival analysis. Thus in the report, the patient type A and H are excluded in the implant survival analysis without conducting competing risk analysis and left censoring.

Finally, for purposes of this report, “unit” is a general term and context specific and may refer to the surgeon, hospital, or implant that a patient is embedded.

A.4 MARCQI definition of revision

For the purposes of MARCQI revision analyses, a revision is defined to be a procedure that involves either (a) removing and replacing some, or all, of the joint replacement components or (b) adding a component. This applies to all MARCQI qualifying cases. There are two situations likely to cause confusion that need to be clarified: (1) adding a cup after a hemi-arthroplasty is a conversion, which is a primary case according to MARCQI criteria; and (2) adding a unicompartmental knee to another compartment of a knee having pre-existing unicompartmental components is considered another primary case rather than a revision.

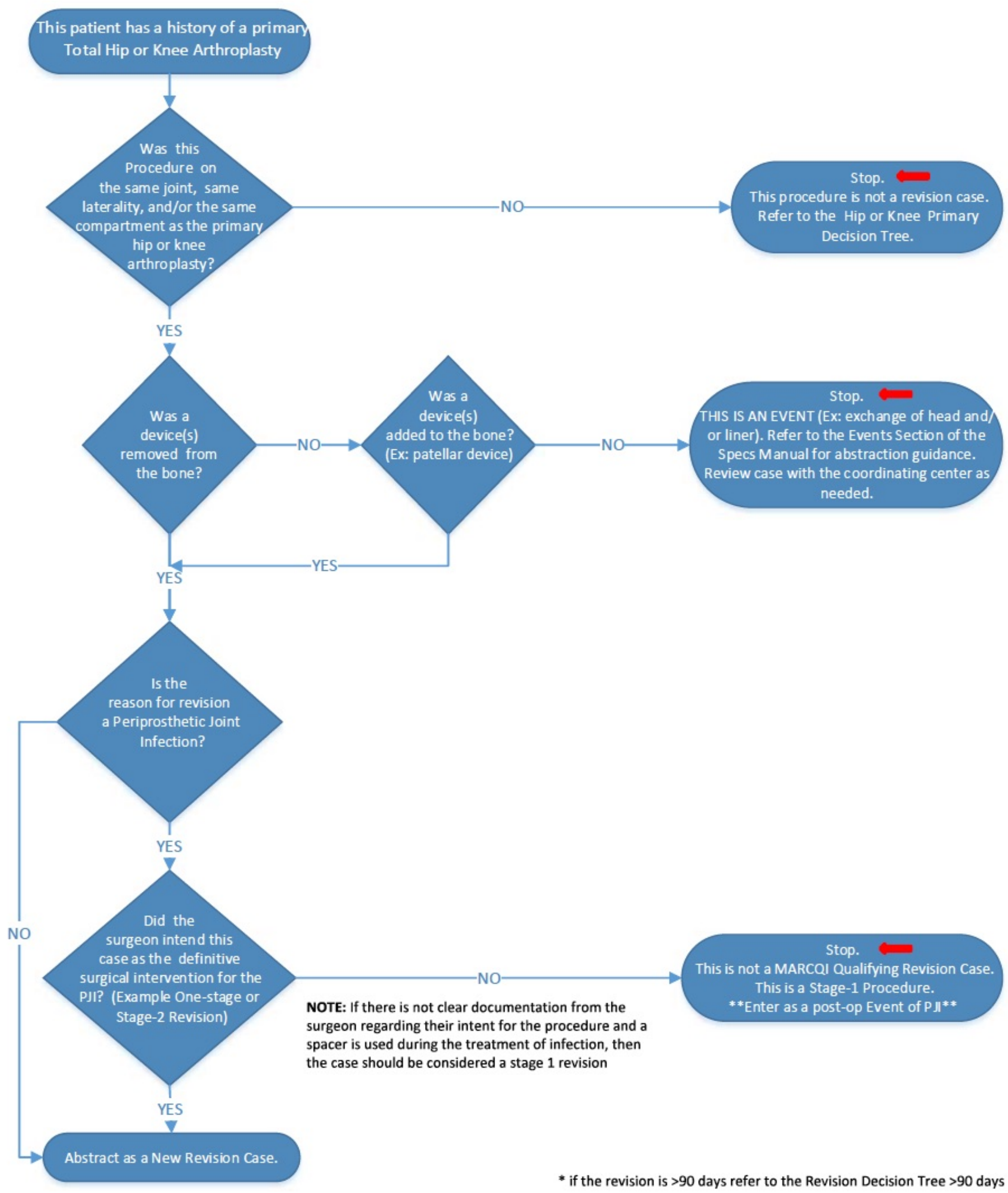

Figure 291: Flowchart of method used to identify revisions within 90 days of surgery.

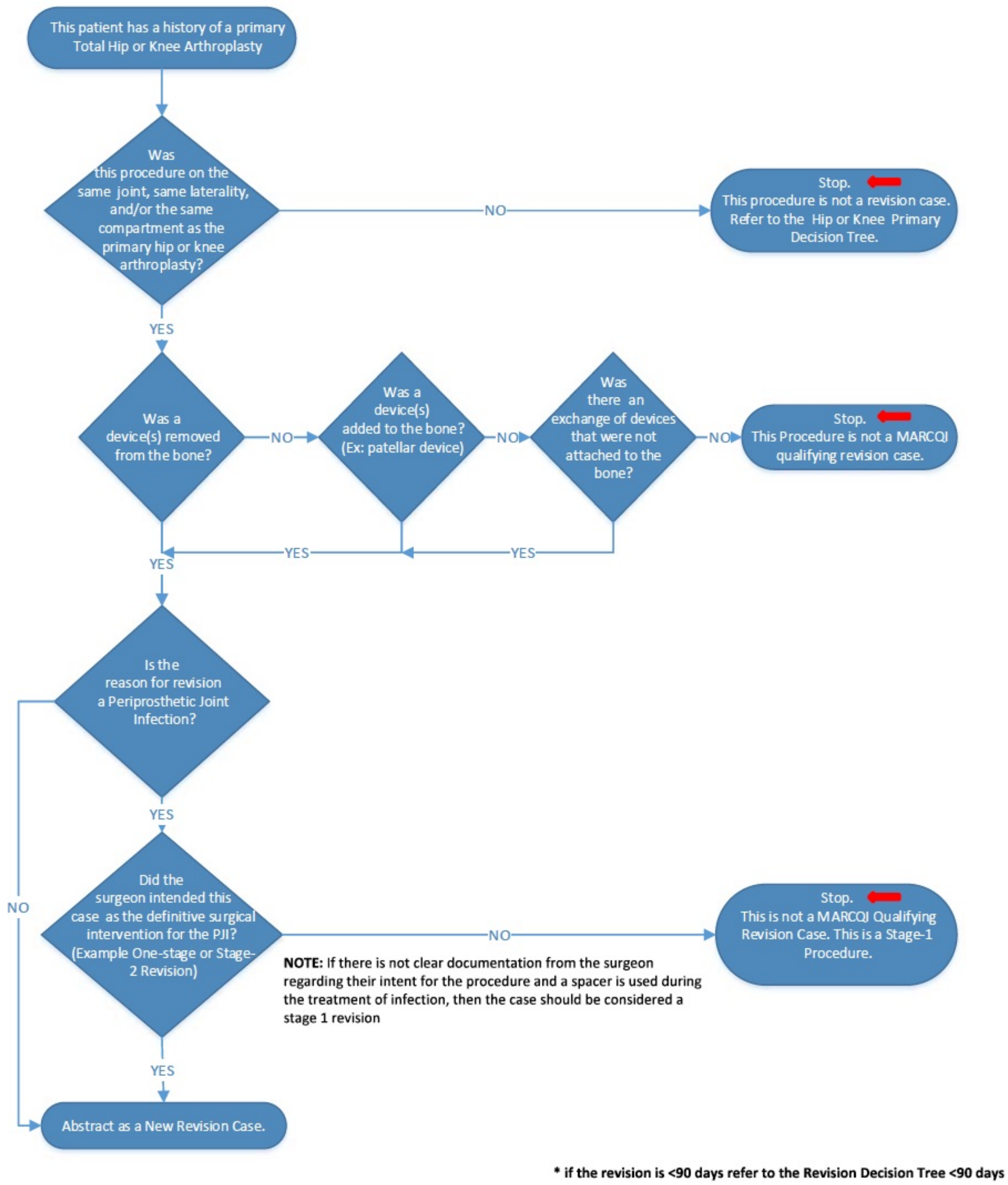

Figure 292: Flowchart of method used to identify revisions more than 90 days of surgery.

MARCQI uses a multi-faceted methodology for identifying revisions for two reasons: (1) revision data comes from both abstracted and administrative data sources, and (2) hospitals switched from ICD-9 to ICD-10 coding in 2015. Figures 291 and 292 illustrates the process used to identify revisions for this report. The process is different within 90 days and beyond 90 days because MARCQI was designed to focus primarily on reduction in 90-day events. For surgeries occurring on or after October 1, 2015, a registry-based MARCQI revision is a case identified by ICD-10 code and confirmed by a CDA. For surgeries occurring prior to October 1, 2015, a revision surgery was identified by the ICD-9 procedure recorded for the case and confirmed by a CDA. MARCQI qualifying revisions are identified by:

1. Did the patient have a primary procedure?

2. Determine, if possible, if the revision was performed less than or greater than 90 days from the primary.

3. Determine what devices were removed or implanted by using the surgeon's narrative (operative note) and the device record.

4. IDC 10 codes may be used as validation.

A common question is how MARCQI handles staged revisions for the treatment of infection. MARCQI data abstractors are taught the following logic, which is included in the MARCQI data manual:

1. A *stage-one revision* is performed to treat the infection and may involve removal of all or some devices. It often involves debridement of tissues (I&D) and treatment with antibiotics via a functional spacer (static or articulating), cement antibiotic beads, IVs or an intra-articular catheter. The intent is to perform a second procedure to replace the devices. If performed $\leq$ 90 days of the associated case, the stage one would be an event of prosthetic joint infection. If performed $>$ 90 days, it is not a qualifying case. Note: if the case is within 90 days of surgery performed at another site, this is a new revision case.

2. A *stage-two revision* is performed to insert new devices after an infection is treated. Typically, this includes removal of the spacer, beads, or intra-articular catheter and insertion of the new permanent devices. This procedure is intended as the final stage in treating the infection or the definitive surgical intervention. This qualifies as a new revision case (new devices were implanted into bone).

3. A *one-stage revision* treats infection and replace the devices during the same operative encounter. There is no intent for another procedure; therefore, these are considered a definitive surgical intervention and a new revision case (new devices were implanted into bone).

Procedures performed within 90 days of surgery that involve an exchange of a device(s) not attached to bone, are events. These procedures may also be called an incision and drainage (I&D) or washout. For a hip case, it may involve the femoral head and acetabular liner. For a knee case, it may involve the tibial insert. Note: If the case is within 90 days of a surgery performed at another site, this is a new revision case.

A.5 Data structure for analytics

Two formats of data sets are used for this report, called “long” format and “wide” format.

1. The “long” format has a record (or row) for each case, *i.e.*, an individual record for each primary and revision case. Some patients may have multiple records indicating they have had multiple hip or knee replacement procedures over time. There may be a few patients with primary cases before 02/15/2012, and revision after 02/15/2012 (but before the end of the study 12/31/2019). This dataset is used to calculate statistics for total number of performed cases, overall and per calendar year.

2. In contrast, the “wide” format has one record (or row) for each primary case because a patient can only have one primary surgery per joint; subsequent procedures on the same joint would indicate revisions. There are no stand-alone records dedicated to revision(s). Rather, in the wide format the existence of a first revision is indicated as a dummy variable (1 means having a revision, 0 means not having a revision). Time to first revision in days was calculated for implant survival analysis. No revisions beyond first revision are coded in the wide data format. Some patients may have multiple records (or rows) if this patient had more than one primary surgery on different joints and/or lateralities. In this report, each primary surgery was treated as a new case. The date of primary cases must fall within the study window. This dataset is used to calculate descriptive statistics for primary cases, overall and breakdown by sex, diagnosis, and type of implant. It is also used for implant survival analysis.

A.6 Multi-level closed-loop data quality QC/QA

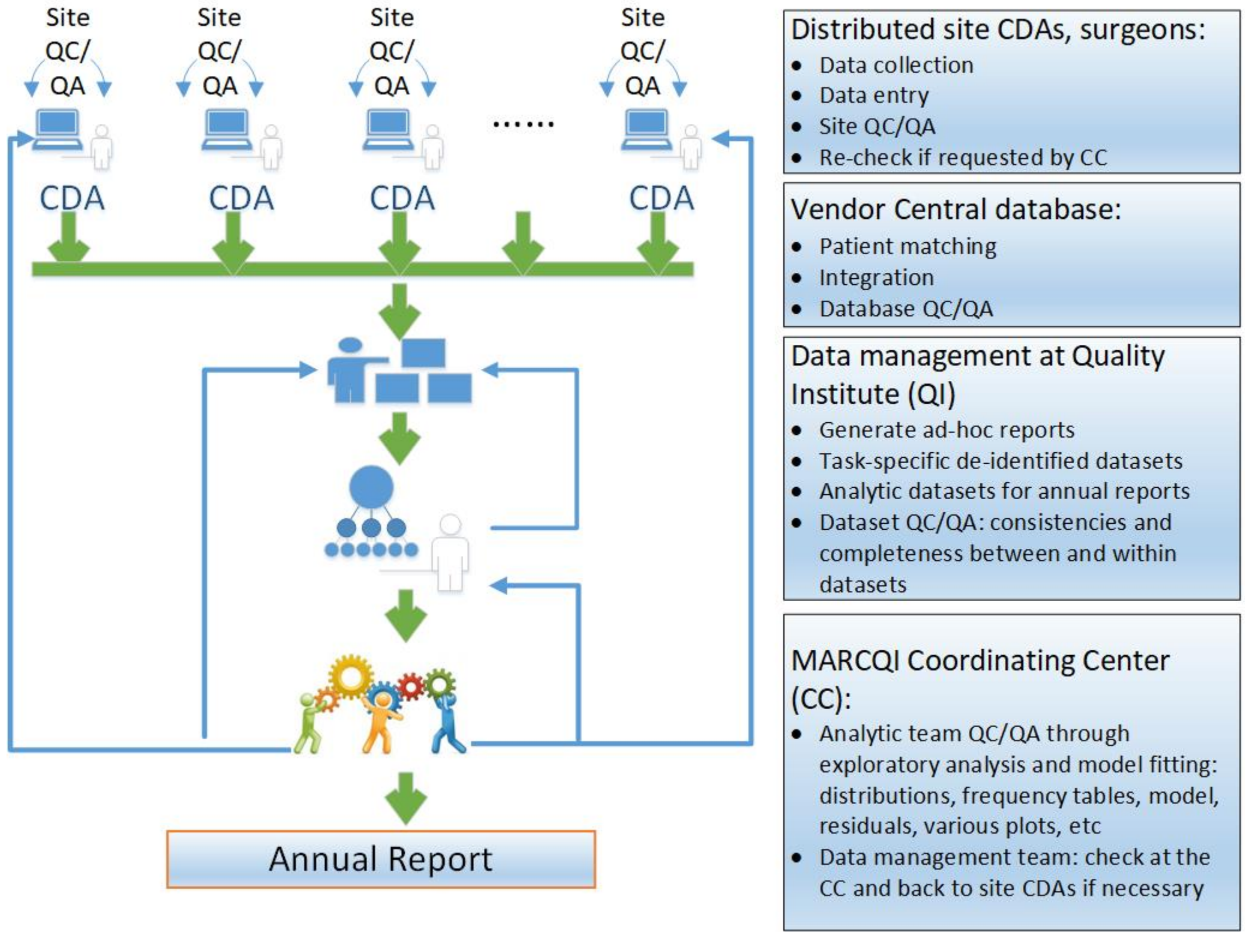

Figure 293: Flowchart of MARCQI four-level QC/QA process.

Data quality is critical in MARCQI. In order to meet quality dimensions, including accuracy/validity, reliability/consistency, completeness, precision, timeliness, confidentiality, and integrity (Sheppard and Terveen, 2011), MARCQI data has been checked and validated on four levels: (1) hospital, (2) vendor database, (3) data management, and (4) analytical. At the analytical level, the measures were further checked through distributions, frequency tables, model fittings, residuals, and other visualization tools. The questionable measures were directed to the coordinating center data management team and then returned to site clinical data abstractors (CDAs) if necessary. The CDAs validated data and made necessary corrections in the database if a measure was found to be in error. Figure 293 is the flowchart of four-level QC/QA process.

The following goals are the focus of data quality in MARCQI:

1. *Accuracy/validity*. MARCQI data accuracy is validated based on the definitions and medical domain knowledge to ensure that data is entered correctly and appropriately into the domain. At the data entry stage, validation messages are created and a warning message window will pop-up if a value is out of normal range as pre-defined by the domain experts. This helps filter out potential data collection errors and allows confirmation of out-of-range but accurate values.

2. *Reliability/consistency*. The coordinating center staff ensures that the definition of measures is consistent over time and across sites. They assure data collection processes are consistent over time, across distributed sites, and between collection systems through MARCQI CDA training, Collaborative meetings, and consultation with the sites.

3. *Completeness*. Data are fully inclusive, *e.g.*, complete list of eligible implant names, device materials, patient demographics, etc. Missing data, invalid data, and/or incomplete data are checked.

4. *Precision*. MARCQI data are detailed and includes demographics, lab, OR log, implant, etc.
5. *Timeliness*. MARCQI data are up-to-date and available quickly and frequently. Data reports are updated monthly, and the analytical datasets are updated quarterly.
6. *Integrity*. MARCQI maintains the accuracy, validity, and consistency of data over whole data lifecycle, within and between data tables so that data is recoverable, searchable, traceable, and stable.
7. *Confidentiality*. MARCQI data are maintained according to national/international standards for data. All MARCQI data are protected and used appropriately.

This entire process guarantees the MARCQI data quality ranging from protocol, data collection, data entry, patient matching, data merging, data transfer, data storage, and data analysis to decision making.

A.7 Descriptive statistics and visualization

For this report continuous measures were checked for normality and skewness. Categorical variables were checked for cell sizes and questionable category values. If any potential issues were found and confirmed by the MARCQI data management team, then the data quality checking/correction was directed to a different level accordingly.

Univariate analyses are performed to compute descriptive statistics for this report, including frequency tables for smoking, both mean and standard deviation (SD), median and interquartile range (IQR) for age, weight, height, body mass index (BMI), and surgeon volumes (overall and device-specific). Frequency tables and various visualization tools, including pie charts, bar charts, Pareto charts (Montgomery, 2009; Tague, 2004), and line plots are employed to present data for sex, approach, diagnosis, distribution of primary vs. revision cases, venous thrombosis prophylaxis, polyethylene type, procedure type, bearing surface couple, head size, reason for revision, and American Society of Anesthesiologists (ASA) class.

A.8 Kaplan-Meier: Unadjusted survival probabilities and cumulative percent revision (CPR)

MARCQI presents revision risk for implants using a curve called the “cumulative percent revision,” which is abbreviated CPR and inspired by the Australian Orthopaedic Association National Joint Replacement Registry. Obviously, lower revision risk is preferred to higher risk.

The CPR is constructed starting with the time a primary joint replacement is performed, with the endpoint of interest being revision surgery on that joint. MARCQI computes the time to first revision since the primary procedure for those patients having revision surgery, which is the X-axis in the CPR curve. The Y-axis is the percent of patients who have had a revision among patients with the joint replacement by the corresponding X-axis time.

Computationally, the CPR curve is derived from unadjusted survival probabilities, $\hat{S}(t)$, which is calculated using the Kaplan-Meier product-limit estimator (Kaplan and Meier, 1958; Rich *et al.*, 2010), and corresponding standard errors are calculated with Greenwood's formula (Kalbfleisch and Prentice, 2002). Then the overall, stratified, and implant-specific CPRs are expressed as percentages and calculated by $C\hat{P}R = (1 - \hat{S}(t)) \times 100$. The log-rank test is used to compare survival curves between groups at the $\alpha = 0.05$. There is a significant difference in the survival time between groups if the *p*-value is less than 0.05.

A.9 Cox proportional-hazards model

The Cox proportional-hazards model (Cox, 1972) is commonly used for investigating the association between the survival time of patients and one or more predictor variables. Specifically, the Cox proportional-hazard model formulates the hazard function for individual as $h_i(t, \mathbf{x}_i) = h_0(t, 0)e^{\mathbf{x}_i^T \boldsymbol{\beta}}$, where $h_i(t, \mathbf{x}_i)$ is the hazard at time t for the i^{th} case, $h_i(t, 0)$ is the baseline hazard function with all covariates being 0, $\boldsymbol{\beta}$ is a column vector of regression coefficients, and $\mathbf{x}_i$ is a column vector of covariates for the i^{th} case. The measures of association given by the Cox model as *hazard ratio (HR)* is used to explain the risk of event for certain categories of covariates or exposure of interest. The hazard ratio is obtained by taking the ratio of the hazards of two cases who have different values of the covariates, $\mathbf{x}$:

$$HR = \frac{h_i(t,\mathbf{x}_i)}{h_j(t,\mathbf{x}_j)} = \frac{h_0(t,0)e^{\mathbf{x}_i^T \boldsymbol{\beta}}}{h_0(t,0)e^{\mathbf{x}_j^T \boldsymbol{\beta}}} = e^{(\mathbf{x}_i - \mathbf{x}_j)^T \boldsymbol{\beta}}$$

The model includes surgeons as a random effect to account for within-subject correlation of the observed outcomes (Zhao *et al.*, 2005).

Parameters in a Cox model and HR are estimated using partial likelihood (Cox, 1975; Verweij and van Houwelingen, 1994). The proportional hazards assumption is assessed following Lin *et al.* (1993), i.e. graphical and numerical methods for model assessment based on the cumulative sums of martingale residuals. Basically, the distributions of the stochastic processes under the assumed model are approximated by the distributions of zero-mean Gaussian processes. The 1000 realizations are generated by simulation. Each observed residual pattern was compared, both graphically and numerically, with simulated realizations from the null distribution. In this report, the risk-adjusted (age and sex) hazard ratio and 95% confidence interval are reported for each specific implant if the proportional-hazards assumption is met according to the supremum test.

A.10 Database and software platform

The raw data sources are securely transported to MARCQI by the data vendor (Ortech) in MS SQL format. All the data management, exploratory data analysis, descriptive statistics, graphs, statistical modeling are performed using SAS 9.4 (SAS® Institute Inc., Cary, North Carolina)[1], SAS / Interactive Matrix Language (IML)[2], and SAS Macro Language. [3]

[1] SAS® 9.4 Product Documentation
[2] SAS/IML® 14.2: User's Guide, Copyright © 2016, SAS Institute Inc., Cary, NC, USA.
[3] SAS® 9.4 Macro Language: Reference, Fifth Edition.

Appendix B

Awards and publications

B.1 Awards

2016 Current Concepts in Joint Replacement/Orthopaedic Research and Education Foundation - Clinical Practice Award Paper, *No difference in dislocation seen in anterior vs posterior approach total hip arthroplasty* by J.D. Maratt, J.J. Gagnier, P.D. Butler, B.R. Hallstrom, A.G. Urquhart, and K.C. Roberts.

B.2 Journal publications

Franklin, P.D., Lewallen, D., Bozic, K., Hallstrom, B., Jiranek, W., and Ayers, D.C. (2014) Implementation of patient-reported outcome measures in U.S. total joint replacement registries: rationale, status, and plans. *Journal of Bone and Joint Surgery - American Volume*, 96 Suppl 1:104-109.

Hughes, R.E. Hallstrom, B.R., Cowen, M.E., Igrisan, R.M., Singal, B.M., and Share, D.A. (2015) Michigan Arthroplasty Collaborative Quality Initiative (MARCQI) as a model for regional registries in the United States. *Orthopaedic Research and Reviews*, 7:47-56.

Ellimoottil, C., Ryan, A.M., Hou, H., Dupree, J., Hallstrom, B., and Miller, D.C. (2016) Medicare's new bundled payment for joint replacement may penalize hospitals that treat medically complex patients. *Health Affairs*, 35(9):1651-1657.

Hallstrom, B.R., Singal, B., Cowen, M.E., Roberts, K.C., and Hughes, R.E. (2016) The Michigan experience with safety and effectiveness of tranexamic acid use in hip and knee arthroplasty. *Journal of Bone and Joint Surgery - American Volume*, 98:1646-1655.

Maratt, J.D., Gagnier, J.J., Butler, P.D., Hallstrom, B.R., Urquhart, A.G., and Roberts, K.C. (2016) No difference in dislocation seen in anterior vs posterior approach total hip arthroplasty. *Journal of Arthroplasty*, 31(9 Suppl):S127-S130.

Markel, D.C., Allen, M.W., and Zappa, N.M. (2016) Can an arthroplasty registry help decrease transfusions in primary total joint replacement? A quality initiative. *Clinical Orthopaedics and Related Research*, 474:126-131.

Hughes, R.E., Batra, A., and Hallstrom, B.R. (2017) Arthroplasty registries around the world: valuable sources of hip implant revision risk data. *Current Reviews in Musculoskeletal Medicine*, 10:240-252.

Courtney, P.M., Huddleston, J.I., Iorio, R., and Markel, D.C. (2017) Socioeconomic risk adjustment models for reimbursement are necessary in primary total joint arthroplasty. *Journal of Arthroplasty*, 32:1-5.

Courtney, P.M. and Markel, D.C. (2017) Arthroplasty registries: Improving clinical and economic outcomes. *Journal of Knee Surgery*, 30(1):7-11.

Omari. A., Hughes, R.E., Hallstrom, B.R., Singal, B.M., Igrisan, R.M., and McCardel, B.R. (2017) Using device data to improve identification of intraoperative femur fractures in total hip arthroplasty. *Michigan Journal of Medicine*, 2(1).

Charles, R.J., Singal, B.M., Urquhart, A.G., Masini, M.A., and Hallstrom, B.R. (2017) Data sharing between providers and quality initiatives eliminate unnecessary nursing home admissions. *Journal of Arthroplasty*, 32(5):1418-1425.

Markel, D.C., Allen, M., Hughes, R., Singal, B., and Hallstrom, B. (2017) Quality initiative programs can decrease total joint arthroplasty transfusion rates - A multicenter study utilizing the MARCQI total joint registry database. *Journal of Arthroplasty*, 32(11):3292-3297.

Cheek, C., Zheng, H., Hallstrom, B.R. and Hughes, R.E. (2018) Application of a causal discovery algorithm to the analysis of arthroplasty registry data. *Biomedical Engineering and Computational Biology*, 9:1-9.

Hughes, R.E., Zheng, H., Igrisan, R.I., Cowen, M.E., Markel, D.C., and Hallstrom, B.R. (2018) The Michigan Arthroplasty Registry Collaborative Quality Initiative (MARCQI) experience improving the quality of care in Michigan. *Journal of Bone and Joint Surgery – American* 100(22):e143.

Charpentier, P.M., Srivastava, A.K., Zheng, H., Ostrander, J.D., and Hughes, R.E. (2018) Readmission rates for single midnight versus two midnight length of stay in primary total knee arthroplasty: Analysis of the MARCQI Database. *Journal of Bone and Joint Surgery – American*, 100:1757-64.

Hughes, R.E., Zheng, H., Igrisan, R.M., Cowen, M.E., Markel, D.C., and Hallstrom, B.R. (2018) The Michigan Arthroplasty Registry Collaborative Quality Initiative Experience: Improving the quality of care in Michigan. *Journal of Bone and Joint Surgery – American* 100(22):e143.

Hood, B.R., Cowen, M.E., Zheng, H., Hughes, R.E., Singal, B. and Hallstrom, B.R. (2019) Aspirin compared with other anticoagulants for prevention of venous thromboembolism in patients after total knee arthroplasty: A non-inferiority analysis. *Journal of the American Medical Association – Surgery*, 154(1):65-72.

Foster, C., Posada, C., Pack, B., Hallstrom, B.R., and Hughes, R.E. (2020) Summary of knee implant one, three, five and 10-year revision risk reported by national and regional arthroplasty registries: A valuable source of evidence for clinical decision-making. *EFORT Open Reviews* 5:268-272.

Hallstrom, B.R. and Hughes, R.E. (2020) Controversies in hip arthroplasty: Using registries to answer difficult questions (Editorial). *Journal of the American Medical Association* 323:1046-1048.

Knapp, P., Weishuhn, L., Pizzimenti, N., and Markel, D.C. (2020) Risk factors for manipulation under anaesthesia after total knee arthroplasty. *Bone & Joint Journal* 102-B(6 Supple A):66-72.

Hughes, R.E, Zheng, H., and Hallstrom, B.R. (2020) Why registries are important: The example of the Michigan Arthroplasty Registry Collaborative Quality Initiative (MARCQI) (Viewpoint). *Arthroplasty Today* 6:747-748.

Hughes, R., Hallstrom, B., Schemanske, C., Howard, P.W., Wilton, T. (2020) Returning to operating following COVID-19 shutdown: what can human factors tell us? (Editorial) *Bone & Joint Journal* 102-B(10):1277-1278.

Muscatelli, S., Zheng, H., Hughes, R.E., Cowen, M.E., and Hallstrom, B.R. (2021) Non-inferiority of aspirin for venous thromboembolism prophylaxis after hip arthroplasty in a statewide registry. *Journal of Arthroplasty* 36(6):2068-2075.

Chubb, H.A., Cornish, E.R., Hallstrom, B.R., and Hughes, R.E. (2021) Early benchmarking total hip arthroplasty implants using data from the Michigan Arthroplasty Registry Collaborative Quality Initiative (MARCQI). *Orthopaedic Research and Reviews* 13:215-228.

B.3 Conference abstracts

Hughes, R.E., Igrisan, R., and Hallstrom, B. (2014) Designing pay-for-performance incentives for an arthroplasty quality improvement collaborative. *3rd International Congress of Arthroplasty Registeries*, May 31-June 2, Cambridge, MA, 2014.

Hughes, R. (2015) Development and operation of a regional arthroplasty quality improvement collaborative. *Healthcare Systems Process Improvement Conference 2015*, February 18-20, Orlando, FL, 2015.

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