

AMERICAN JOINT REPLACEMENT REGISTRY: 2024 ANNUAL REPORT HIGHLIGHTS

www.aaos.org/registries/ajrr

OUR SPEAKERS TODAY

- **James A. Browne, MD, FAAOS**
 - University of Virginia
 - AJRR Publications Subcommittee Chair; Outgoing AJRR Annual Report Editor
- **Richard L. Ilgen, II, MD, FAAOS**
 - University of Wisconsin
 - AJRR Research Subcommittee Chair; Incoming AJRR Annual Report Editor

DISCLOSURES: JAMES A. BROWNE, MD, FAAOS

No financial conflicts of interest relevant to this presentation

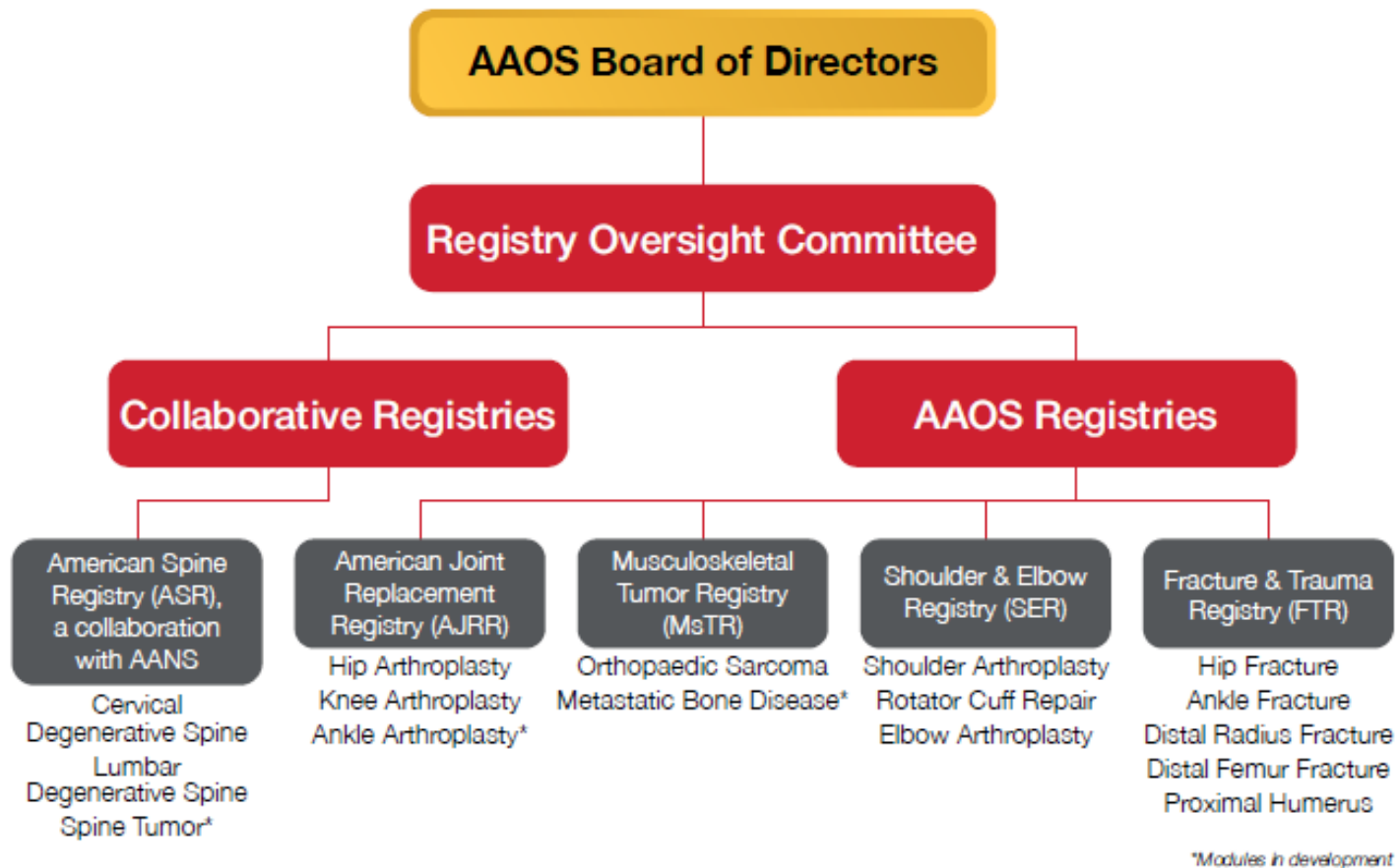
- American Association of Hip and Knee Surgeons: Board or committee member
- American Joint Replacement Registry (AAOS): Board or committee member
- Enovis: IP royalties; Paid consultant
- Hip Society: Board or committee member
- Journal of Arthroplasty: Editorial or governing board; Publishing royalties, financial or material support
- Journal of Bone and Joint Surgery - American: Publishing royalties, financial or material support
- Kinamed: Paid consultant
- Knee Society: Board or committee member
- Ortho-DX: Paid consultant; Stock or stock Options
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DISCLOSURES: RICHARD L. ILLGEN, II, MD, FAAOS

No financial conflicts of interest relevant to this presentation

- AAOS: Board or committee member
- Hereaus Medical: Paid consultant
- Stryker: IP royalties; Paid consultant

AAOS FAMILY OF REGISTRIES



Why Do Sites Participate?

Compare your practice to **national performance** benchmarks

Access to on-demand practice specific **quality reports and dashboards**

Facilitate tracking and monitoring of **longitudinal** patient outcomes

Improve the **value of care** delivered to Patients

Facilitate site, practice-specific, **payer-incentivized performance improvement** programs such as Blue Distinction & Centers of Excellence

Qualify for **national distinction programs** such as the Joint Commission Advanced Certification & AAAHC

Use for reporting to **quality improvement programs** such as MIPS, BPCI-A, ABOS MOC & ABNS CC

Early access to **surveillance alerts** for poorly performing implants

DATA REUSE OPPORTUNITIES

Participation in the American Academy of Orthopaedic Surgeons (AAOS) Registry Program offers a wide variety of data reuse opportunities including requirements for quality initiatives and state collaboratives.

The Ability to Reuse Registry Data to enable performance measurement as well as facilitate national registry-driven quality improvement programs has been a focus of the Registry over the past few years. Now, AJRR data can be reused toward:

- The Joint Commission (TJC) Advanced Certification for Total Hip and Total Knee Replacement
- American Board of Orthopaedic Surgery (ABOS) Maintenance of Certification (MOC) program for Part II Self-Assessment Examination (SAE) credit
- Centers for Medicare & Medicaid Services (CMS) Inpatient Quality Reporting Program (IQR) THA/TKA Patient-Reported Outcome Performance Measure (PRO-PM)
- CMS Comprehensive Care for Joint Replacement (CJR) Model
- CMS Merit-based Incentive Payment System (MIPS) Promoting Interoperability (PI) and Quality Payment Program (QPP)
- Accreditation Association for Ambulatory HealthCare (AAAHC) Advanced Orthopaedic Certification
- Aetna Institutes of Quality (IOQ) Orthopaedic Surgery
- BlueCross BlueShield Blue Distinction Specialty Care
- Blue Shield of California waiver of prior authorization for their patients' hip or knee replacement procedures
- Bree Collaborative
- Cigna Pathwell Bone & Joint SM
- Det Norske Veritas & Germanischer Lloyd (DNV GL) Orthopaedic Center of Excellence
- The Alliance QualityPath

Decrease Data Collection Burden



AAOS Registry Program
Authorized Vendor

American Joint Replacement Registry
Shoulder & Elbow Registry

AAOS
American Academy of
Orthopaedic Surgeons

Registry Program
Improving Orthopaedic Care Through Data

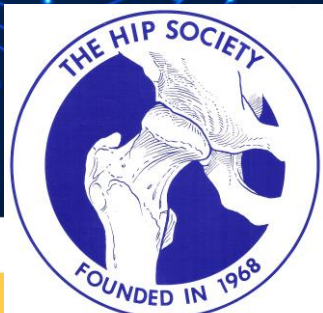


AAOS
AMERICAN ACADEMY OF
ORTHOPAEDIC SURGEONS

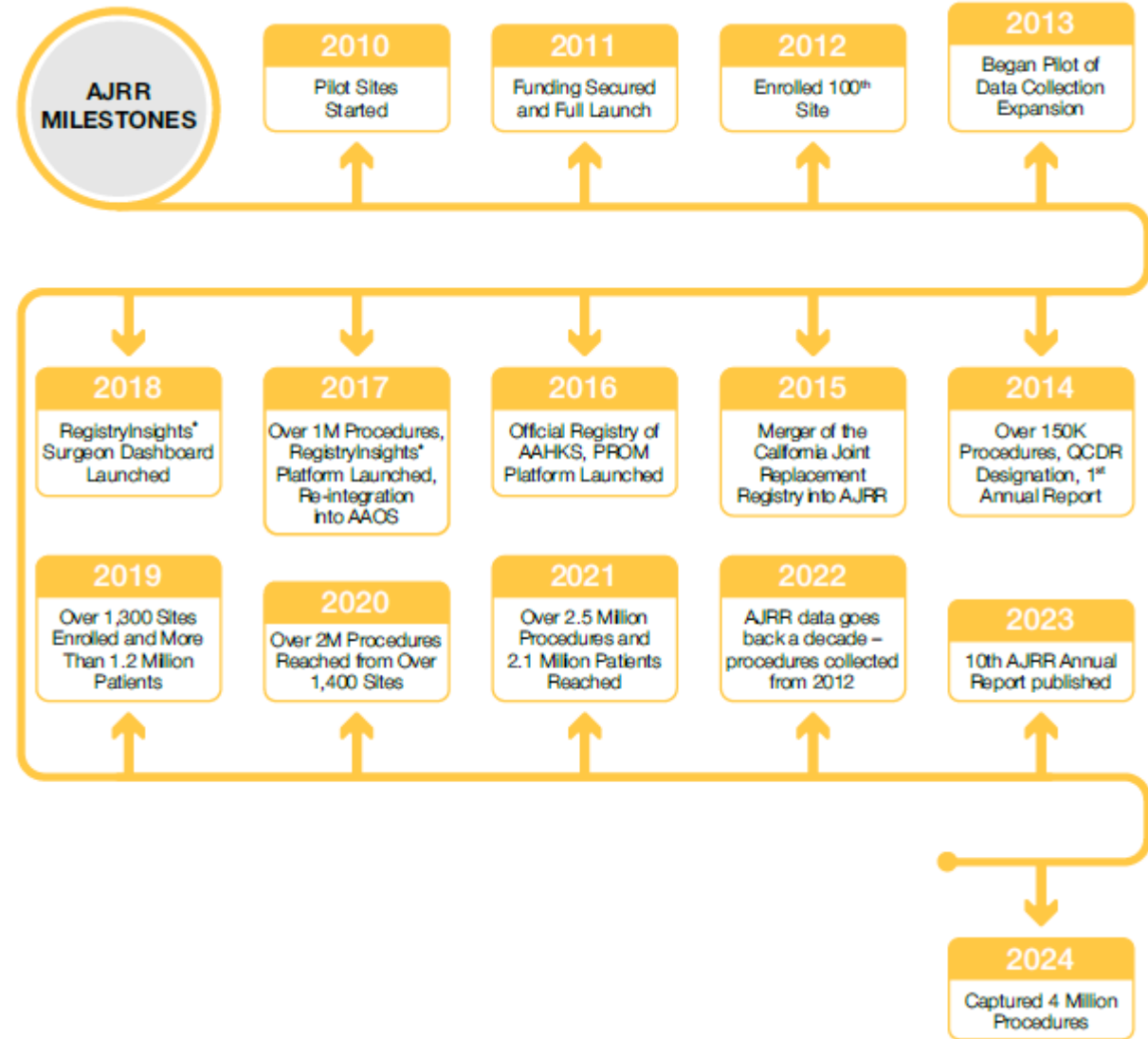
AJRR
AMERICAN
JOINT REPLACEMENT
REGISTRY

- AAOS has partnered with technology vendors to facilitate the data submission process
- Re-use data that already exists in medical record, practice management and PRO systems
- Direct data submission and management can be handled by a technology provider with sites able to fix rejected files

AMERICAN JOINT REPLACEMENT REGISTRY



AJRR'S HISTORY



AJRR STEERING COMMITTEE

- **James I. Huddleston, III, MD, FAAOS – Chair**
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OrthoCarolina
- **Jeffrey B. Stambough, MD, FAAOS**
University of Arkansas

AJRR Data Element Overview

Two Modules: Hip Arthroplasty & Knee Arthroplasty

Procedure

Patient

- Name, Date of Birth, SSN
- Diagnosis (ICD-9/10, CPT)
- Gender
- Race/Ethnicity
- Height + Weight/BMI
- Payer Status

Site of Service

- Name and Address (TIN, NPI)

Surgeon

- Name (NPI)
- Trainee

Procedure

- Type (ICD-9/10, CPT)
- Date of Surgery, Length of Stay
- Surgical Approach
- Surgical Technique
- Laterality
- Implants (Manufacturer, Lot #)
- Anesthesia

Comorbidities and Complications

- Comorbidities (ICD-9/10, CPT)
- CJR Risk Variables
- Height + Weight/Body Mass Index
- Length of Stay
- American Society of Anesthesiologists Score
- Charlson Index
- Operative and Post-operative Complications

Patient-reported Outcomes

Recommended:

- PROMIS-10 Global
- VR-12
- HOOS Jr. /KOOS, Jr.

Also Accepted:

- SF-36 v1
- HOOS/KOOS
- Oxford Hip and Knee Scores
- Knee Society Knee Scoring System
- Harris Hip Score
- WOMAC (Modified via HOOS and KOOS)
- SF-12, EQ-5D, WOMAC (only accepting final scores)

INTEGRATION OF MEDICARE DATA

- Access to **Medicare claims** linked by full identifiers for longitudinal tracking
- Follow outcomes of AJRR patients occurring at non-AJRR participating institutions
- 2012-2023 Medicare data for all patients represented in Registry



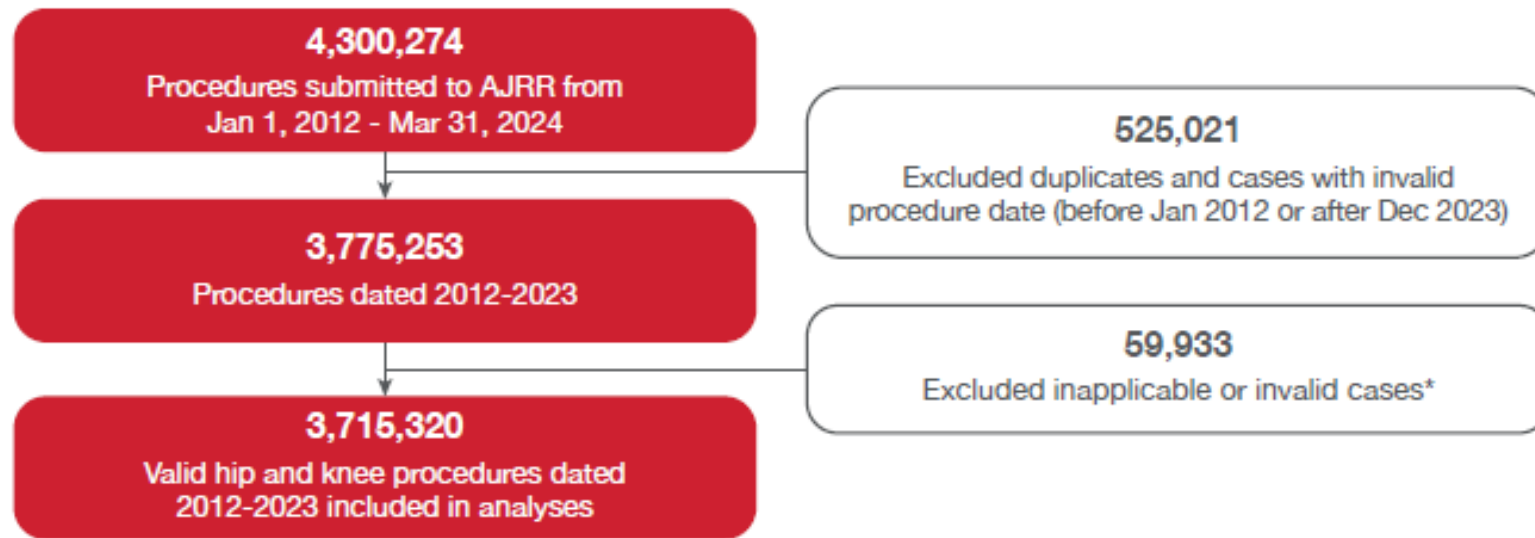
2024 AJRR ANNUAL REPORT

- Summary Statistics
 - Procedure, institution, and patient distributions
- Data Completeness
- Hip/Knee Arthroplasty
- Revision Procedures
- Implant Utilization and Survivorship
- Patient Reported Outcome Measures (PROMs)
- Recent publications and presentations

*Download the 2024 Annual Report and
Annual Report Supplement: www.aaos.org/registries/publications*



AJRR ANNUAL REPORT OVERVIEW



**Invalid data=joint procedures not in the hip or knee, procedure codes outside of approved AJRR data specifications, and hemiarthroplasty procedures without a diagnosis of femoral neck fracture.*

- Data submitted to AJRR across all 50 states and the District of Columbia
- Supplementary Medicare and American Hospital Association datasets utilized where appropriate for descriptive and longitudinal analysis

AJRR DATA COMPLETENESS

Similar to last year, key demographic and procedural information such as date of birth, gender, admission date, discharge date, procedure, and diagnosis information all exceed 95% completeness. Most of the elements described have remained stable compared to the previous Annual Reports.

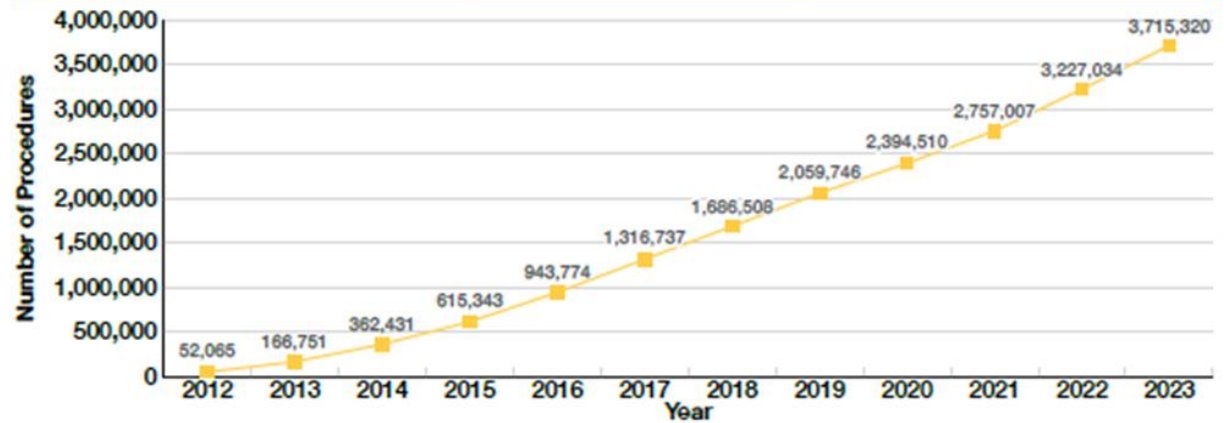
Element	N Total	Percent Reported	Percent NR	Percent Invalid
Surgeon Information	4096022	91.1	0	8.9
Principal Procedure Code	4096022	99.9	0	<0.1
Principal Diagnosis Code	4096022	96.3	0	3.7
First Implant Catalog # Listed	4096022	90.8	0	9.2
First Implant Lot # Listed	4096022	87.7	0	12.3
Incision Start Time (Procedure Start Time)	4096022	74.9	24.3	0.8
Skin Closure Time (Procedure End Time)	4096022	78.7	22.5	0.8
Surgical Approach (Hip/Knee)	4096022	10.0	82.9	7.1
Ethnicity	4096022	84.3	15.7	<0.1
Race	4096022	86.3	13.7	<0.1
Date of Birth	4096022	100.0	0	0
Gender	4096022	99.6	0.4	0
City	4096022	95.3	4.7	0
State	4096022	94.0	6.0	0
Zip Code	4096022	96.8	0	3.2

CUMULATIVE PROCEDURAL VOLUME

AJRR captured over 4 million procedures in 2023

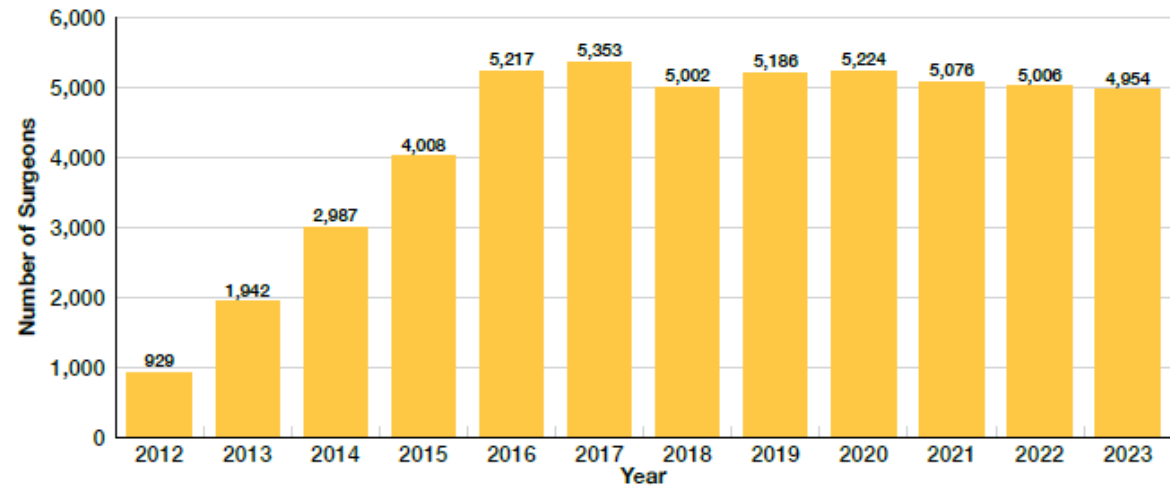
- ✓ Utilized 3,715,320 valid cases used in 2023 Report
 - An increase of 566,278 procedures from the 2022 report
- ✓ 1,899,847 Total Knee Arthroplasty Procedures
- ✓ 1,204,324 Total Hip Arthroplasty Procedures
- ✓ Data from 1,447 institutions
 - 312 Ambulatory Surgical Centers
- ✓ 4,954 surgeons submitted at least one procedure in 2023
- ✓ 23 AJRR Institutions Audited
 - The overall record agreement rate was 93.1% (Median 98%)

Figure 1.1 Cumulative Procedural Volume, By Year 2012-2023 (N=3,715,320)



CUMULATIVE NUMBER OF SURGEONS REPRESENTED

In 2023 alone, there were 4,954 surgeons represented with at least one procedure in the AJRR. AJRR participating institutions are required to submit data from all surgeons performing hip or knee arthroplasty procedures at their facility.



PROCEDURAL TRENDS (KNEE)

- **LOS decreased from 2.9 days to 1.1 days for TKA** from 2012 to 2023
- **Cementless fixation increasing in TKA** to reach 22% in 2023
- **Utilization of robotics in TKA has increased over 6-fold** over the last 6 years and is now reported in over 15.9% of procedures

Figure 3.16 Rate of Technology Use for Assistance in Total Knee Arthroplasty, 2017-2023

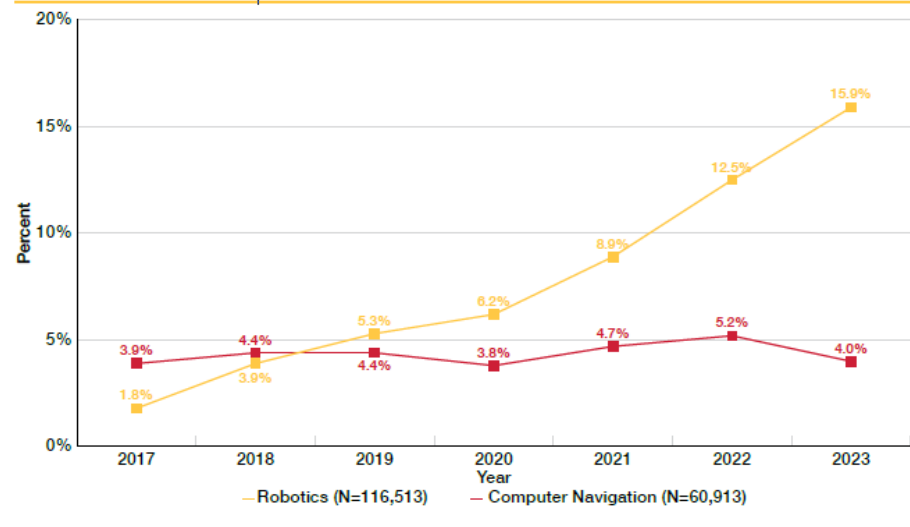


Figure 3.10 Distribution of Hybrid and Cementless Fixation Utilization for Primary Total Knee Arthroplasty, 2012-2023 (N=1,341,438)

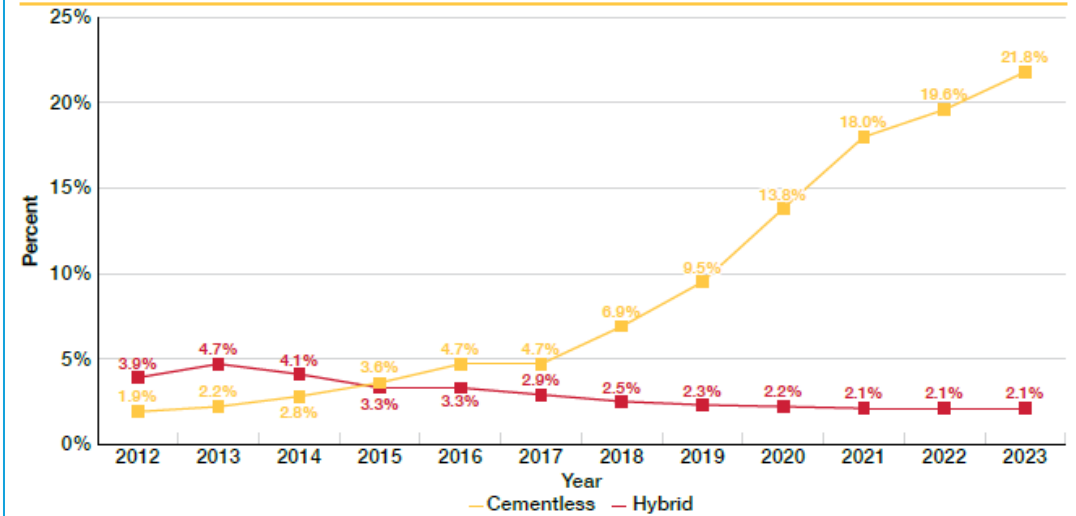
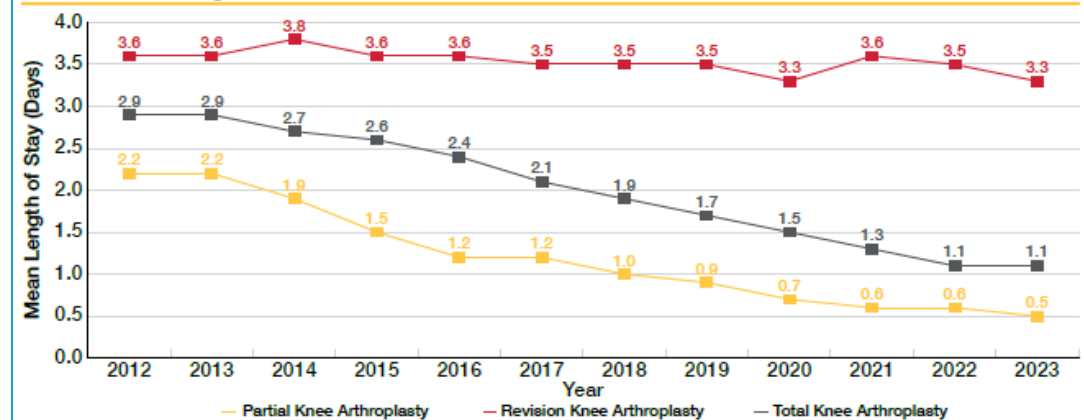


Figure 3.2 Mean Length of Stay for Knee Arthroplasty Procedures, 2012-2023 (N=1,483,055)



PROCEDURAL TRENDS (HIP)

- Increased THA for femoral neck fracture trend continues
- Robotic use in THA has almost tripled since 2017 (2.1% to 6.6%) and computer navigation appears to be on the decline.
- General anesthesia use decreasing over time for THA cases

Figure 2.4a Total Hip Arthroplasty and Hemiarthroplasty Procedures Performed for Femoral Neck Fracture, 2012-2023 (N=175,732)

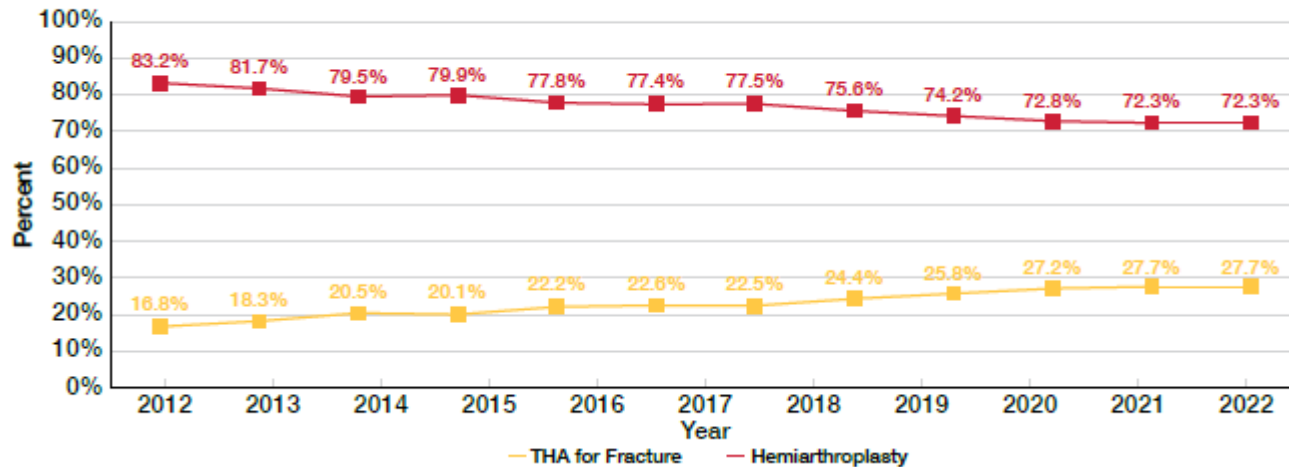
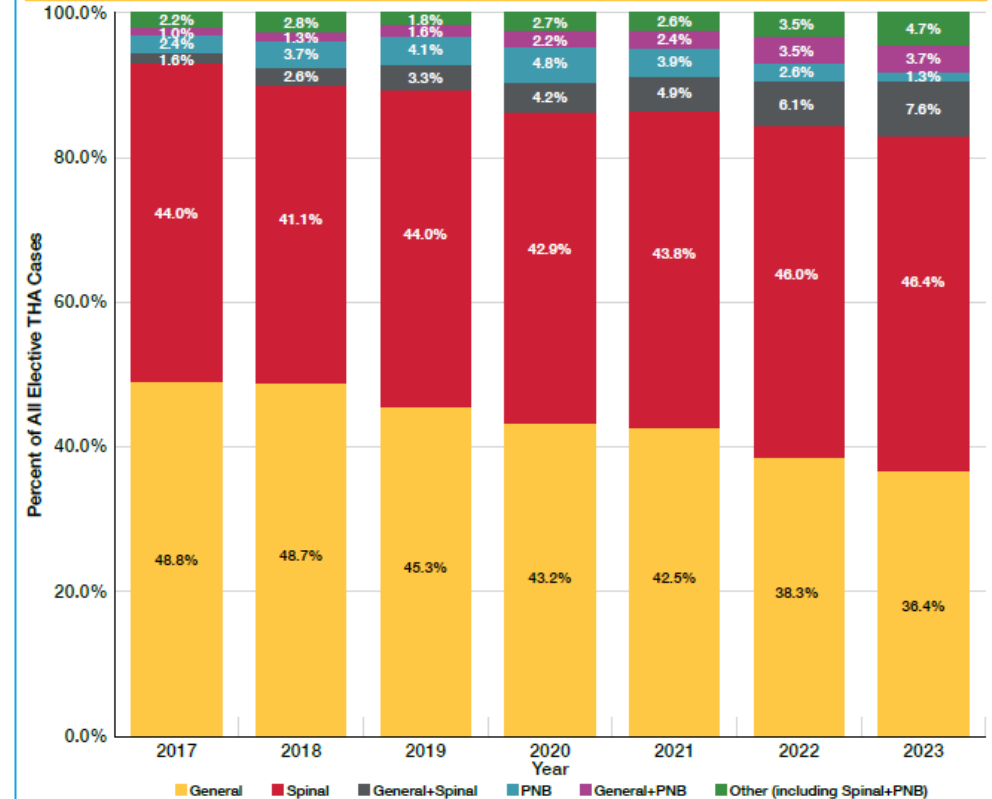
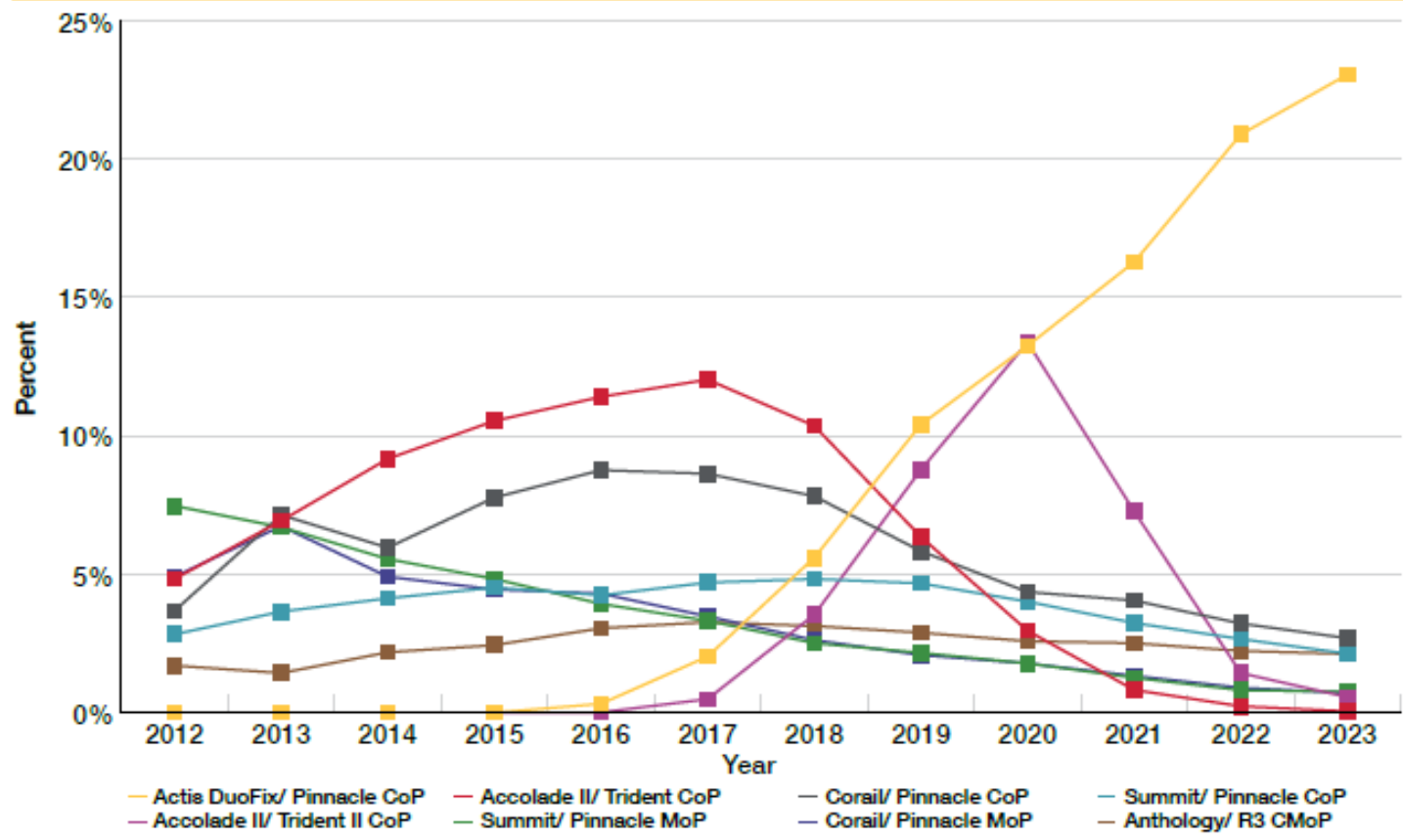


Figure 2.28 Elective Primary Total Hip Arthroplasty Anesthesia Technique by Year, 2017-2023 (N=546,787)



IMPLANT UTILIZATION

Figure 2.29 Elective Primary Total Hip Arthroplasty Femoral Stem/Acetabular Component Combinations by Year, 2012-2023 (N=887,970)

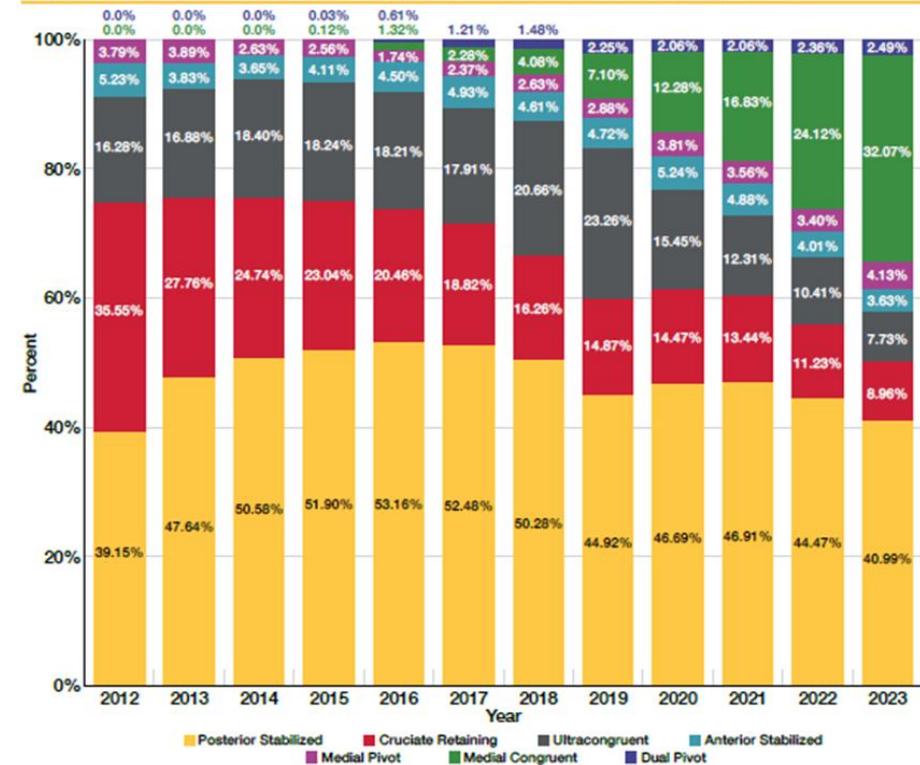


DISTRIBUTION OF PRIMARY TKA IMPLANT DESIGNS

Key Highlights

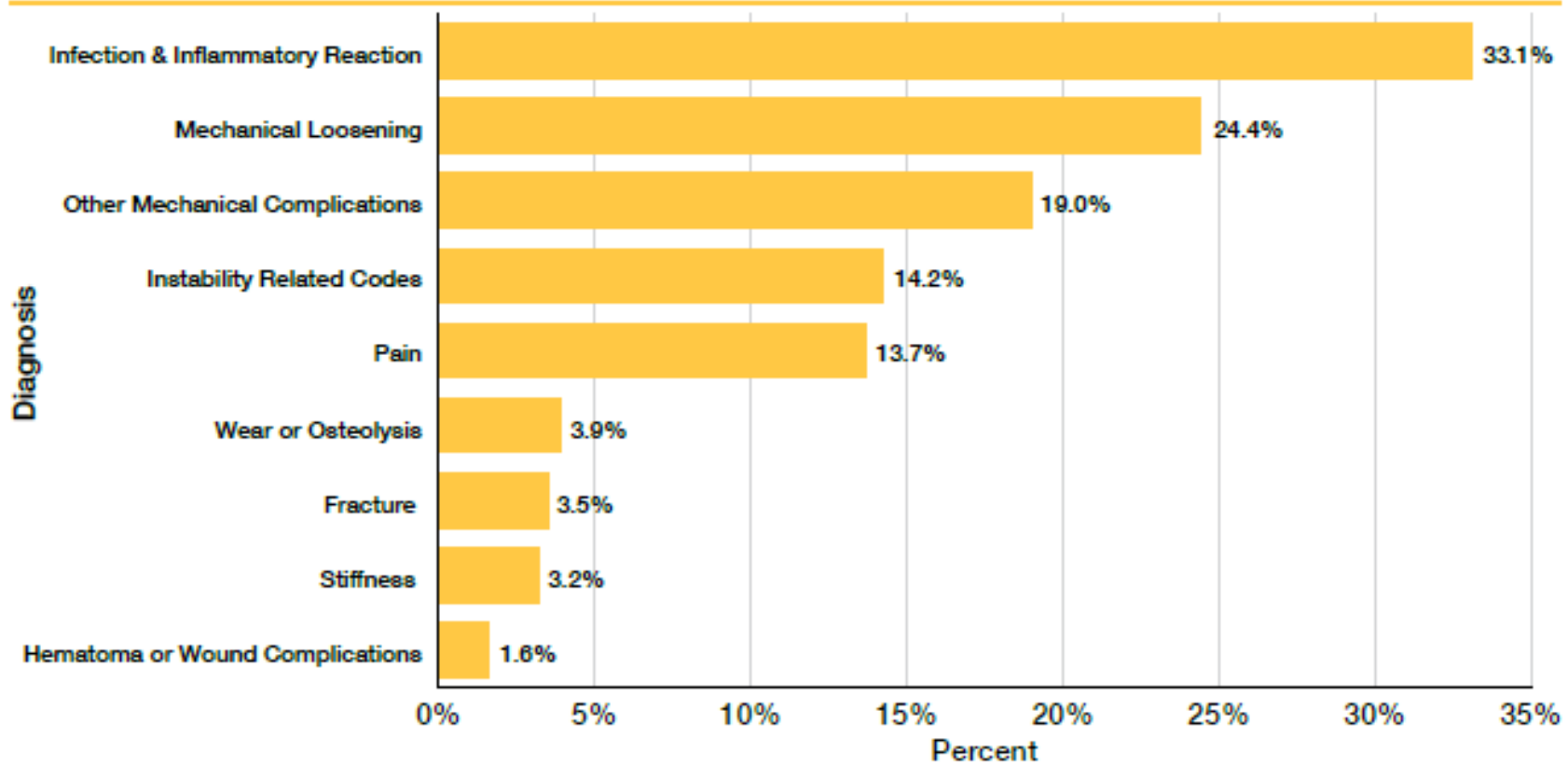
- ✓ New TKA constraint categories from last year
- ✓ These categories were determined with help from our industry partners

Figure 3.4 Distribution of Primary Total Knee Arthroplasty Implant Designs, 2012-2022 (N=1,245,884)



REVISION PROCEDURES

Figure 3.25 Distribution of Diagnosis Associated with All Knee Revisions, 2012-2023 (N=168,933)



CUMULATIVE PERCENT REVISION

Compared to cemented fixation, cementless fixation for primary total knee arthroplasty is associated with a reduced rate of cumulative percent revision in all-age men but a significantly increased rate in women aged 65 and older.

Figure 3.11 Cumulative Percent Revision for Cemented Versus Cementless Fixation Primary Total Knee Arthroplasty in Male Medicare Patients 65 Years of Age and older with Primary Osteoarthritis, 2012-2023

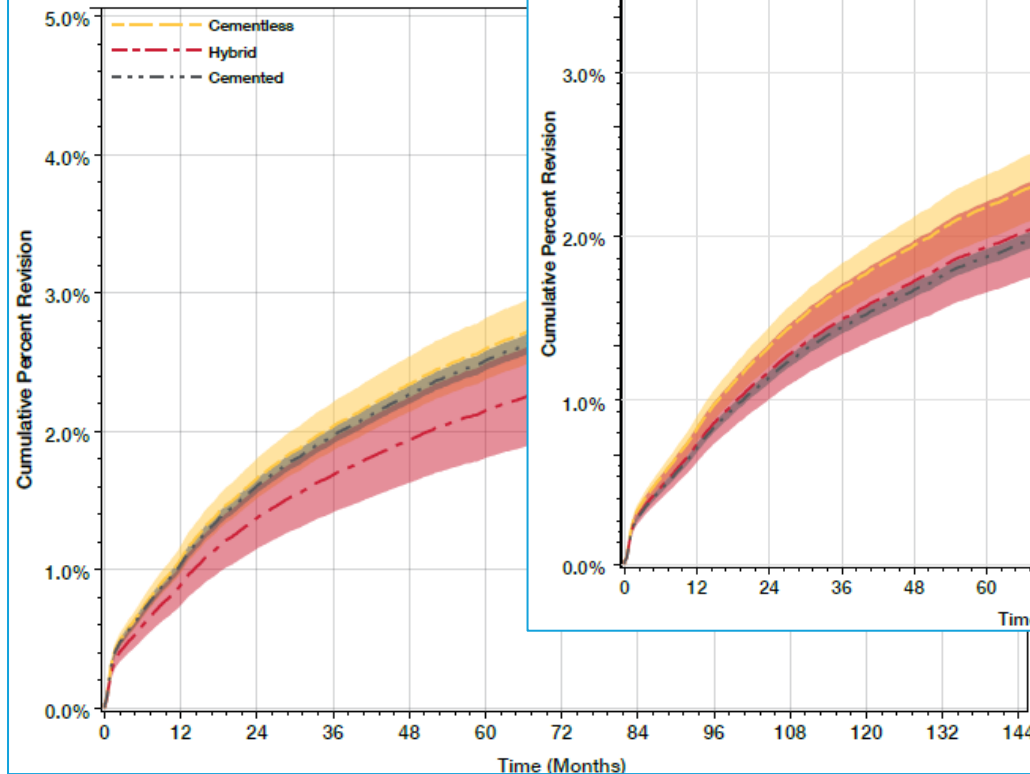
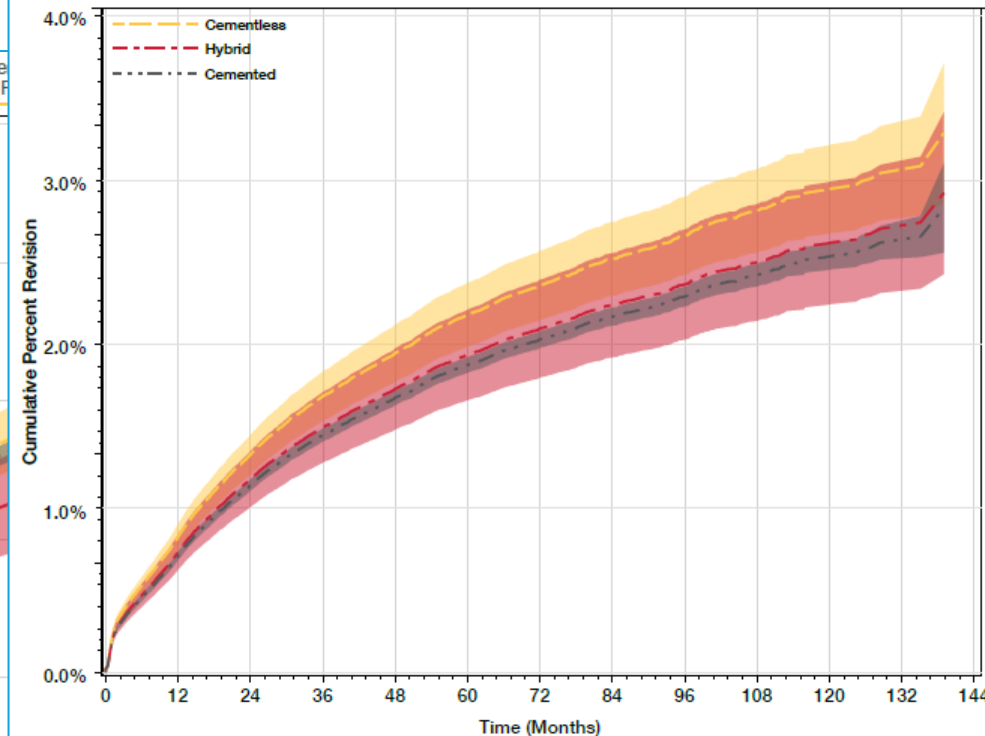


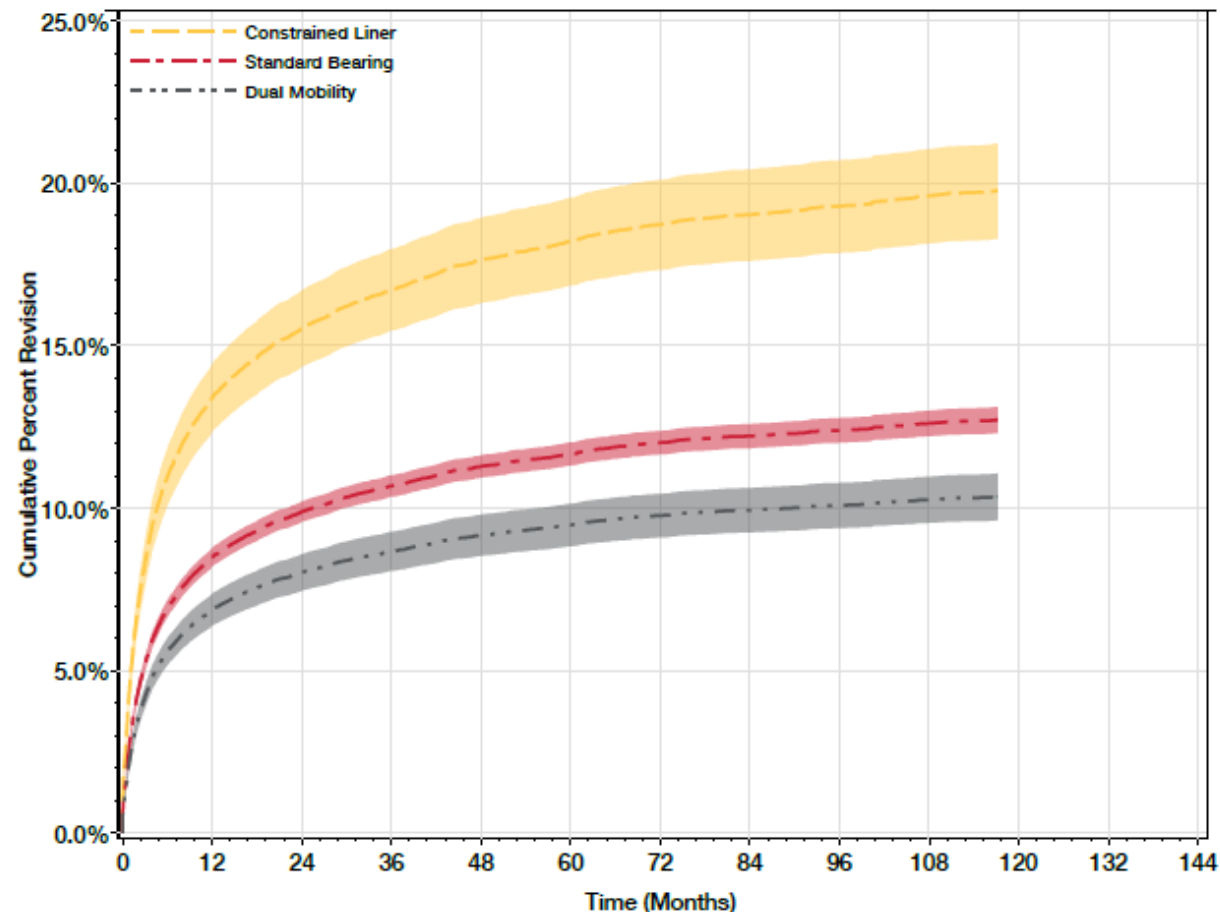
Figure 3.12 Cumulative Percent Revision for Cemented Versus Cementless Fixation Primary Total Knee Arthroplasty in Female Medicare Patients 65 Years of Age and older with Primary Osteoarthritis, 2012-2023



CUMULATIVE PERCENT RE-REVISION

After adjusting for age, sex, and CCI, dual mobility cases were found to have a significantly reduced cumulative percent re-revision compared to standard and constrained lined cases in Medicare patients aged 65 and older.

Figure 2.44 Cumulative Percent Re-Revision after Revision Total Hip Arthroplasty for Dual Mobility by liner type in Medicare Patients 65 Years of Age and Older, 2012-2023



DEVICE-SPECIFIC CUMULATIVE REVISION

The ability to look at revision rates for implants is one of the great strengths of the AJRR. The 2024 report (Tables 3.3-3.5) display cumulative percent revision stratified by knee constructs as well as bearing and fixation types with 95% confidence intervals. Unlike the hip device-specific survivorship curves which showed some divergence in the first year, the knee-device curves showed very little divergence for both posterior stabilized and minimally stabilized (cruciate retaining) constructs. Revision rates for cemented knee arthroplasty constructs in patients aged 65 and older generally range between 2% and 3% at 10 years, with overall revisions increasing from 0.83% at 1 year to 2.60% at 10 years. (Table 3.3).

Table 3.5 Unadjusted Cumulative Percent Revision of Cementless Knee Arthroplasty Construct Combinations for Primary Total Knee Arthroplasty in Patients ≥65 Years of Age with Primary Osteoarthritis, 2012-2023*

Group Name	N Total	N Revised	1-Yr	3-Yrs	5-Yrs	7-Yrs	10-Yrs
Triathlon/ Triathlon CR Cementless	47,883	741	1.00 (0.91, 1.09)	1.64 (1.51, 1.77)	1.99 (1.83, 2.15)	2.21 (2.01, 2.41)	2.32 (2.09, 2.57)
Triathlon/ Triathlon PS Cementless	8,355	180	1.37 (1.14, 1.64)	2.19 (1.88, 2.55)	2.52 (2.16, 2.93)	2.71 (2.29, 3.17)	2.71 (2.29, 3.17)
Persona/ Persona CR Cementless	2,881	53	0.99 (0.67, 1.41)	2.29 (1.69, 3.02)	2.71 (1.79, 3.93)	2.71 (1.79, 3.93)	4.29 (1.81, 8.43)
Attune/ Attune PS Cementless	1,478	28	1.31 (0.82, 2)	2.31 (1.54, 3.33)	2.31 (1.54, 3.33)	—	—
Attune/ Attune CR Cementless	805	27	2.51 (1.59, 3.78)	3.48 (2.32, 4.99)	3.93 (2.55, 5.75)	3.93 (2.55, 5.75)	—
Natural-Knee II GS/ Natural-Knee II CR Cementless	659	10	0.46 (0.13, 1.27)	1.10 (0.49, 2.17)	1.69 (0.86, 3)	1.69 (0.86, 3)	1.69 (0.86, 3)
Vanguard/ Regenerex CR Cementless	505	8	0.59 (0.17, 1.64)	1.58 (0.75, 2.99)	1.58 (0.75, 2.99)	1.58 (0.75, 2.99)	1.58 (0.75, 2.99)
Sigma/ MBT CR Cementless	502	8	0.81 (0.27, 1.95)	1.63 (0.77, 3.07)	1.63 (0.77, 3.07)	1.63 (0.77, 3.07)	1.63 (0.77, 3.07)
Overall	63,048	1,055	1.07 (0.99, 1.15)	1.78 (1.67, 1.89)	2.11 (1.97, 2.25)	2.30 (2.14, 2.47)	2.40 (2.21, 2.59)

*The 95% confidence intervals are included in parenthesis.

PATIENT REPORTED OUTCOME MEASURES

- AAOS has launched a PROMs in Practice initiative that aims to influence the active clinical use of PROMs at the point of musculoskeletal care. More information about this can be found on the AAOS website at www.aaos.org/proms
- As of December 31, 2023, 631 sites out of 1,447 (44%) have submitted PROMs, which is a 27% increase in sites compared to the previous 2023 AJRR Annual Report.
- The completion rate for “linked” outcomes (those where both a preoperative and one-year postoperative PROM is available on the same procedure) varies between 24-30%

Table 3.9 Overall Change Between Preoperative and 1-Year Postoperative PROM Scores after Primary Knee Arthroplasty by PROM, 2012-2023

Patient-Reported Outcome Measure (PROM)	PROM Component	Patients with Preoperative Score	Patients with Linked Postoperative Score	Response Rate, Percentage of Patients Who Completed a Preoperative and 1-Year Score	Patients with Meaningful Improvement*	MCID
KOOS, JR. (Knee Disability and Osteoarthritis Outcome Score)	Score	198,091	52,834	26.7%	87.2%	7.5
PROMIS-10 (Patient-Reported Outcomes Measurement Information System 10)	Mental T	153,161	39,252	25.6%	31.0%	4.9
	Physical T	153,158	39,252	25.6%	63.9%	4.3
VR-12 (The Veterans RAND 12 Item Health Survey)	Mental Health Component	39,424	12,450	31.6%	33.1%	5.8
	Physical Health Component	39,222	12,456	31.8%	73.0%	4.8

*Meaningful improvement was calculated by minimal clinical important difference (MCID). MCID was determined to be a positive change score of half the pooled standard deviation.

RECENT PUBLICATIONS AND PRESENTATIONS

The goal of the AAOS Registry Analytics Institute® (RAI) is to provide a resource to the scientific community to further understand and improve orthopaedic and musculoskeletal care by making data analyses available. RAI also provides physicians and clinician-scientists access to information beyond what is already published in the AJRR Annual report.

- Over 30 publications utilizing AJRR data in 2024
- Review Appendix A for a list of relevant publications

Appendix A

Recent AJRR Publications and Presentations

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