AAOS
American Academy of Orthopaedic Surgeons

AJRR AMERICAN JOINT REPLACEMENT REGISTRY

ANNUAL REPORT 2024

The Eleventh Annual Report of the
AJRR on Hip and Knee Arthroplasty

Contents

Dedication

The *2024 Annual Report* is dedicated to James A. Browne, MD, FAAOS. Dr. Browne has served as the editor of the AJRR Annual Report for six years. This report serves as our primary means for disseminating the big data that populates the Registry. Dr. Browne has worked tirelessly over the years to build the institutional knowledge needed to create a report of high-value for all our stakeholders. We are tremendously grateful for the passion, expertise, vision, energy, and experience that Dr. Browne brings to the Annual Report.

James I. Huddleston, III, MD, FAAOS
Chair, AJRR Steering Committee

ISSN 2375-9119 (online)

Our Vision

To be the National Registry for orthopaedics through comprehensive data and technology, resulting in optimal patient outcomes.

Foreword

This year marks a significant milestone for the American Joint Replacement Registry (AJRR) as we surpassed 4 million captured hip and knee arthroplasty procedures, solidifying AJRR's status as the largest orthopaedic registry by annual procedure count. This achievement reflects our collective commitment to improving patient care, and the data gathered continues to influence the quality and effectiveness of treatments across the nation.

Beyond this remarkable benchmark, we've made strides in key areas that directly impact the quality of patient care:

- Continuous improvement of RegistryInsights® dashboard visualizations and a new report card feature provides surgeons and sites with actionable outcomes data to refine treatment approaches, reduce complication rates, and ultimately improve patient outcomes.
- The AJRR has expanded its data reuse opportunities for quality programs through the addition of two performance reports and corresponding dashboard visualizations: CMS-specific patient-reported outcome measures (PROMs) performance report and a Blue Cross Blue Shield (BCBS) Blue Distinction® performance report with national registry benchmarks.
- Through the addition of these features, AJRR continues to emphasize the importance of PROMs, which is crucial in evaluating the long-term success of procedures and outcome differences across patient populations.

I want to extend my sincere thanks to the AJRR committee members, staff, and the AAOS Analytics Team for their unwavering dedication and expertise, which are pivotal to our success.

I also want to acknowledge the contributions of our participating sites, surgeons, and industry partners. It's because of you that we are better equipped than ever to analyze trends, identify areas for improvement, and implement best practices across the field.

Together, we are making a meaningful difference in the lives of the patients we serve.

With gratitude and excitement for what's ahead,

James I. Huddleston, III, MD, FAAOS
Chair, AJRR Steering Committee

Executive Summary

The American Joint Replacement Registry (AJRR) joined the AAOS Registry Program as the inaugural Registry in 2017. With oversight from the AAOS Registry Oversight Committee (ROC) and the AJRR Steering Committee, AJRR continues to work toward the AAOS Registry goals. Since then, the AAOS Registry Program has continued to grow, adding registries from other anatomic sites and orthopaedic areas including the Shoulder & Elbow Registry (SER), the Musculoskeletal Tumor Registry (MsTR), the American Spine Registry (ASR) – a collaborative registry with the American Association of Neurological Surgeons (AANS) – and the Fracture & Trauma Registry (FTR).

The past year has been marked by a multitude of successes and growth for AJRR, including surpassing the 4 million procedures milestone. Much attention has been paid to ensuring AJRR maintains its position as the national Registry for total joint arthroplasty.

Additional highlights for the year include the following areas:

AJRR updated its patient-reported outcomes data collection portal and the procedure and PROMs file upload specifications in February 2024 to support data capture and reporting on behalf of sites for the Centers for Medicare & Medicaid Services Hospital Inpatient Quality Reporting (IQR) Patient-Reported Outcome Performance Measure (PRO-PM). AJRR successfully reported for sites participating in the second voluntary IQR PRO-PM reporting window in September 2024.

AJRR continues to support its commitment to facilitating capture of PRO data through providing tools and resources to participants that require support for launching a PRO program. AJRR is closely aligned with the AAOS PROMs Initiative and Workgroup to incentivize the active clinical use of patient reported outcomes measures (PROMs) at the point of musculoskeletal care. By the end of 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.

Ambulatory Surgery Centers (ASCs) have been identified as an important part of the healthcare delivery system, and AJRR has made considerable effort to increase ASC participation in the Registry. AJRR continued to provide ASCs and private practices access to data quality, analysis, and benchmarking. In fact, there are now 62,110 procedural cases reported by ASCs, a 70% increase over the previous year.

Tracking and Monitoring Outcomes continues to be a focus of the AAOS Registry Program. To help sites best utilize Registry data for this purpose, RegistryInsights® enhanced its capabilities and utility for our users by adding a scorecard dashboard view with key outcomes metrics displaying trends over time against national registry benchmarks. This scorecard is available at the site and individual surgeon dashboard level. Additional enhancements to the scorecard are slated to launch in late 2024.

Publications and Presentations based on AJRR data continue to be an important focus of AJRR. AJRR data has been published in several peer-reviewed journals such as the Journal of Arthroplasty (JOA), Journal of American Academy of Orthopaedic Surgeons (JAAOS), and Clinical Orthopaedics and Related Research (CORR). A series of podium presentations and posters have been presented at the following 2023 and 2024 Annual Meetings: AAOS, American Association of Hip and Knee Surgeons (AAHKS), International Society of Arthroplasty Registries (ISAR), The Knee Society, The Hip Society, and Western Orthopaedic Association (WOA). The registry produced over 35 unique abstracts and 18 manuscripts throughout the year. The registry continues to expand areas of research to inform research in ground breaking areas. Topics have included infection, high and low surgeon volumes to predict centers of excellence, arthroplasty for femoral neck fracture, the use of dual mobility articulations, utility of robotics and navigation, comparisons of various component features, and more. Please see Appendix A for a full list of recent publications and presentations utilizing the AJRR database.

2024 AJRR Annual Report Highlights

The 2024 American Joint Replacement Registry (AJRR) Annual Report represents 3,715,320 primary and revision hip and knee arthroplasty cases after limiting to valid procedures dated 2012-2023. Procedure and demographic breakdowns continue to be very consistent over the years. Primary knee (51.1%) and primary hip (32.4%) procedures constituted the majority of patients submitted. Sex breakdown was 58.6% female and 41.4% male for all patients. The average age of a total hip arthroplasty patient was 65.6 years and 67.6 years for total knee arthroplasty patients. While race was unreported in almost 14.0% of AJRR patients, when reported, white was the predominant race (76.6%). Among AJRR surgeons performing either elective primary total hip arthroplasties or total knee arthroplasties, the mean 2023 procedure count was 44.3 and 65.4, respectively, which is an increase from 2022.

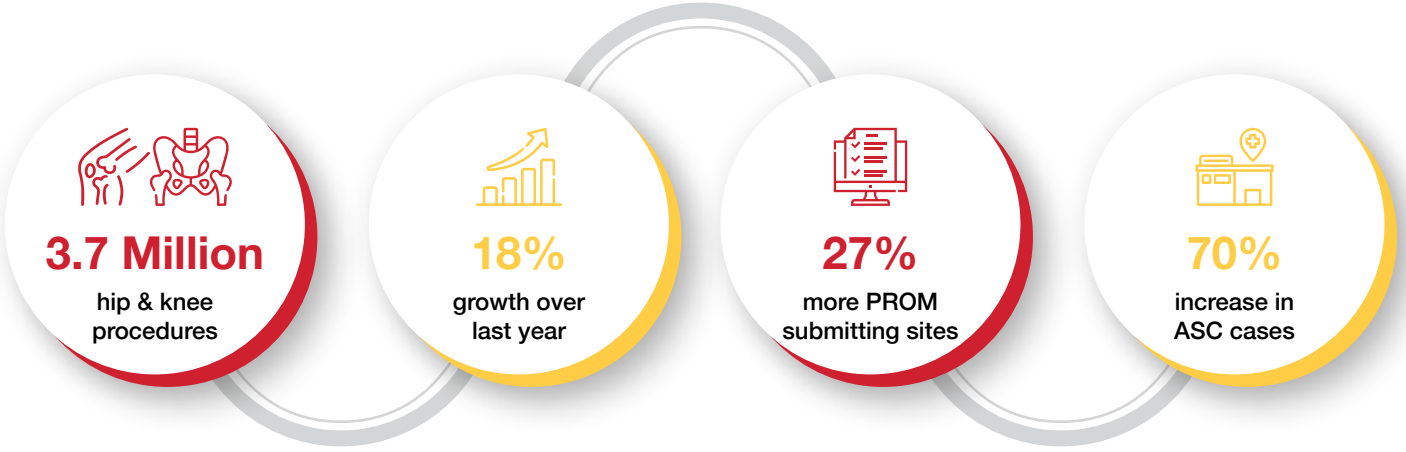
Many trends identified in previous AJRR Annual Reports were also applicable this past year. For hip arthroplasty procedures, there is still a trend towards increased use of ceramic heads. Usage of dual mobility constructs in the primary setting had been increasing for several years but appears to have leveled off. While hemiarthroplasties still predominate for the treatment of femoral neck fractures, total hip arthroplasty usage has increased substantially over the last ten years, however this trend is now stabilizing. The use of cement for femoral component fixation is slowly increasing for both elective primary total hip arthroplasty as well as arthroplasty for femoral neck fracture. Similar to prior reports, postoperative length of stay continues to decrease, and use of general anesthesia appears to be decreasing.

For total knee arthroplasty procedures, updated categories are now used for stability and insert design. This offers more granular information on the types of designs used. Medial congruent design utilization has increased over the past several years at the expense of traditional cruciate retaining designs, the use of which has decreased. Although cemented fixation still predominates, the use of cementless fixation continues to increase and is now used in over 20% of all primary total knee arthroplasty procedures. Use of conventional polyethylene continues to slowly decrease as the usage of highly cross-linked polyethylene and antioxidant polyethylene inserts continues to increase. Partial knee arthroplasties continue to represent a small percentage of knee arthroplasty cases in the Registry, but the decrease in reporting of partial knee arthroplasties has stabilized. Postoperative length of stay continues to decrease, and use of general anesthesia appears to be decreasing.

Finally, enhanced analytics is always the goal of each Annual Report. With the continued growth of AJRR, analyses with Registry data will continue to mature. For the first time this year, we have updated our categories for total knee arthroplasty (TKA) constraints. This offers increased granularity in reviewing trends of insert designs reported to the registry.

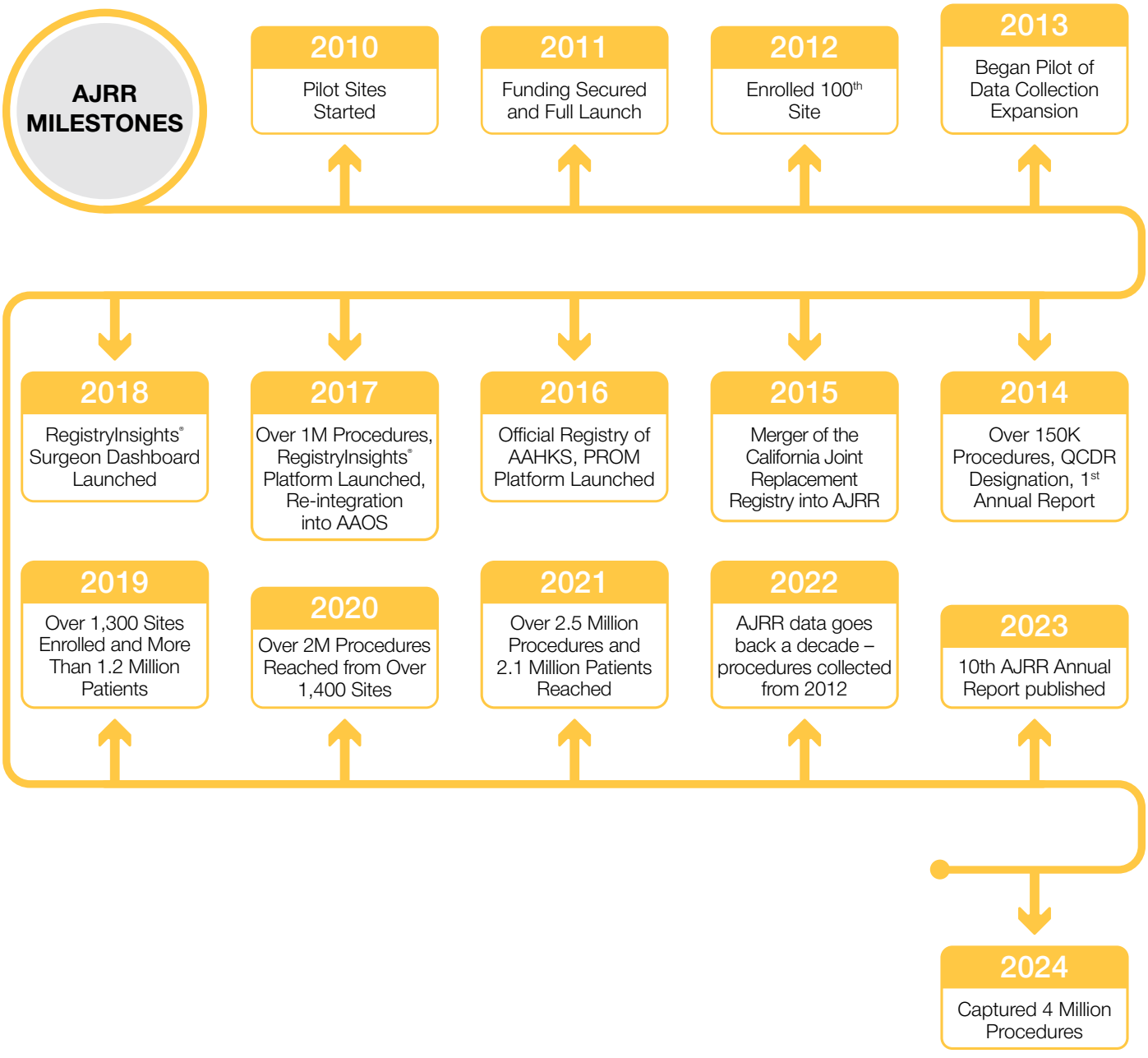
The report also includes a deeper analysis of PROMs submission over time including pre-operative and 1-year post-operative linked PROMs. The report design has also been enhanced with a procedure volume and PROM submission heat maps. A new color design has been used this year and we have edited our curves for easier veiwing.

Much time was spent establishing a consensus-driven methodology determined by multiple stakeholders. This framework provides a foundation ensuring strength in all analyses moving forward, progressing toward more sophisticated and detailed survivorship curves in the future.



About AJRR

The American Joint Replacement Registry (AJRR) is the cornerstone of the AAOS AJRR is overseen by the AJRR Steering Committee which reports to the AAOS Registry Oversight Committee and ultimately the AAOS Board of Directors with many stakeholders involved. By end of 2022, there were 1,447 institutions submitting data to the AJRR from across all 50 states and the District of Columbia; this represents a 6% increase in institutions and a 18% increase in procedures from the previous report.



The Power of Registry Data

Data Reporting and Data Specifications

Since the beginning of AJRR, updating data specifications has been a necessary part of the process. Not only can specification updates improve the quality of data collected, but updates are made to reduce the data entry burden and ensure adaptation to changes in healthcare and the orthopaedic profession. Updates to the data specifications are currently underway to align data collection with healthcare interoperability standards including mapping to SNOMED/ LOINC and support for alignment with FHIR/HL7 data exchange specifications. A review of data elements collected at the time of this report can be found in Appendix B.

With the launch of 2025 data specifications, the AJRR will be including a new module to capture ankle arthroplasty procedures. Stay tuned for the expansion of the capture of joint arthroplasty procedures.

AJRR is committed to updating and refining its data specification when appropriate. The AJRR Steering Committee is charged with determining when new data elements are required and when old data elements should be sunset. In an attempt to improve data completeness, the AJRR is working to better define what constitutes an acceptable minimum data set required for submission.

AJRR Surgeon Leaders and staff evaluated the completeness and coverage rates of all data elements in the AJRR. The evaluation led to the recommendation of a minimum dataset (MDS) to prioritize data submission for sites, give sites real-time visibility into the quality of their data, and enhance the overall health of AJRR data. An MDS is regarded as an acceptable submission containing data that captures the minimum data necessary to identify patient, components, hospital, surgeon, and procedure.

Centers for Medicare and Medicaid Services (CMS)

A long-term priority for AJRR has been to obtain claims data from the CMS to facilitate linkages between AJRR and Medicare to support AJRR's quality improvement and patient safety efforts. These linkages allow AJRR to obtain data including more complete comorbidity information, mortality information, and knowledge of revisions performed in non-AJRR institutions, and to fill-in data gaps where information was not submitted to AJRR. In total, the CMS files include inpatient (148 data elements), outpatient (122 data elements), and the National Death Index data. Twelve of the provided data elements in CMS directly match AJRR data elements and can help fill in gaps in Registry information. Any additional data elements in CMS not in AJRR have been analyzed for completeness to be used in further analyses.

Data in Practice

RegistryInsights® Dashboards provide surgeons with on-demand access to view their individual procedural, post-op, PROMs, and performance measure data benchmarked against national registry data. Together, these dashboards enable data-driven decisions to enhance patient outcomes and procedural effectiveness.

To provide meaningful insight, filters can be applied to the national data set to view comparisons against like surgeon settings such as displaying only other ASC data or only large teaching institution data.

The procedure dashboard highlights metrics such as the total number of hip and knee replacement surgeries performed, procedure types (totals, unicondylar, revisons etc.), length of stay, average operation time, demographic data (age, gender, race), and payer status. This helps identify trends in utilization and patient populations, aiding in resource planning and identifying any gaps in care.

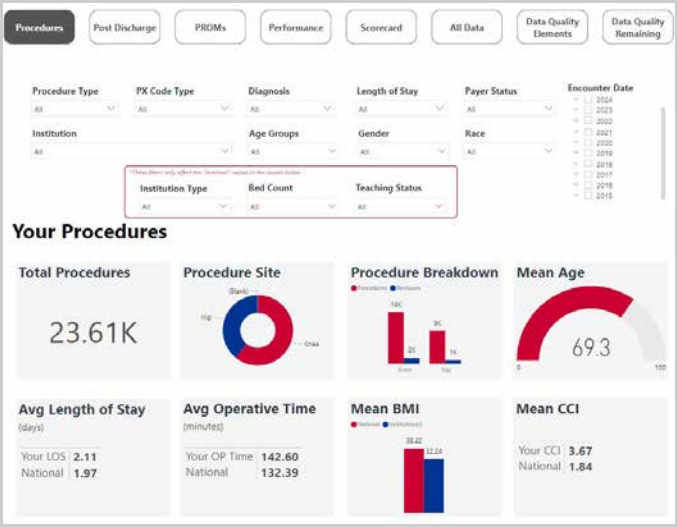
In the post-operative dashboard, data visualizations display 30-day and 90-day surgical outcomes, including complication rates (surgical site infections, DVT, periprosthetic fracture, mechanical complications), unplanned readmissions/admissions, and revision surgeries. This data helps surgeons and their institutions track quality outcomes, identify areas for improvement, and ensure that patients receive optimal peri- and post-operative care.

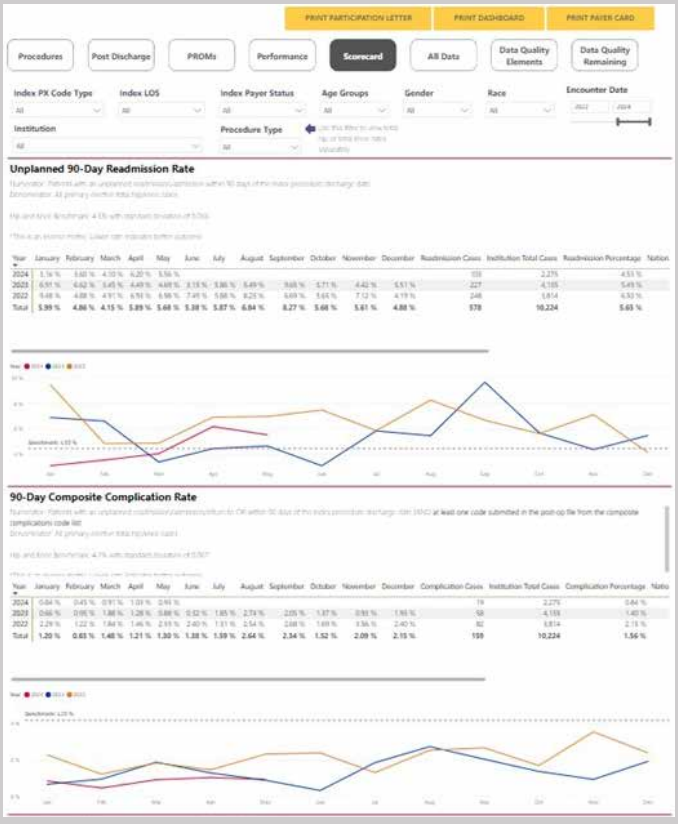
The PROMs dashboard displays general health and functional status patient-reported outcomes including PROMIS-10, VR-12, HOOS JR and KOOS JR. Surgeons can view completion rates and changes in scores over time and compare against national averages. This patient

feedback provides critical insights into long-term recovery and quality of life, helping surgeons and healthcare organizations improve both the procedural and recovery phases of joint replacement.

The performance and scorecard dashboards contain metrics supporting quality program-specific requirements such as TJC Advanced Total Hip and Knee Replacement (THKR) Certification, Blue Cross Blue Shield Association's

Examples of RegistryInsights Dashboard: Authorized User's View for an Institution





Examples of RegistryInsights Dashboard: Authorized User's View for an Institution (continued)

Blue Distinction® Centers, MIPS CQMs, the CMS THKR PRO-PM, and Qualified Clinical Data Registry Measures. These program measures range from process (ambulation day of surgery, completion of pre- and post-op PROMs) to addressing multiple complications outcomes within 90 days of total hip and knee replacement procedures and mortality rates. The scorecard view aligns PROMs requirements with those outlined by the CMS PRO-PMs as well as many of the above-mentioned programs. It also displays a 3-year look back period and updated national benchmarks for each measure for quick insights into outcomes trends over time.

AAOS Authorized Vendor Program

To minimize the data entry burden and enhance ease of data submission, AAOS has partnered with a vetted list of technological vendors through the Authorized Vendor Program. These third-party electronic health record and user interface-based technology vendors have made a commitment to prioritize data collection and submission by aiding sites in data collection, file configuration, and submission of procedural, post-discharge, and patient-reported outcome (PRO) data. As of October, 2023, AAOS is currently engaged with dozens of vendors. For a complete list of authorized vendors please see Appendix C.

"The user-friendly advancements on the RegistryInsights® Surgeon's Dashboard have significantly enhanced my ability to monitor my performance both over time and in comparison to my peers at my institution. These insights have sparked collaborative discussions among colleagues, leading to the adoption of standardized protocols aimed at improving patient outcomes. The accessible and actionable data available through the platform has truly elevated how we approach continuous quality improvement."

Jeffrey B Stambough, MD, FAAOS

University of Arkansas for Medical Sciences

AAOS Registry Program

AAOS remains dedicated to advancing orthopaedic care through the development of a comprehensive family of registries across various specialties. Since launching the American Joint Replacement Registry (AJRR) in 2017, AAOS has expanded its reach with the addition of the Shoulder & Elbow Registry and Musculoskeletal Tumor Registry (MsTR) in 2018. The MsTR completed its pilot in 2019 and became a full registry in 2020, followed by a partnership with the American Association of Neurological Surgeons (AANS) to launch the American Spine Registry (ASR) that same year. In 2021, the Fracture & Trauma Registry (FTR) was introduced, representing a collaborative effort where surgeon leaders from multiple specialties helped develop key modules.

Governed by the Registry Oversight Committee and ultimately reporting to the AAOS Board of Directors, each registry is aligned with AAOS' mission to improve patient care through evidence-based insights. By driving innovation and facilitating data-driven research, AAOS empowers orthopaedic surgeons to enhance clinical decision-making and improve patient outcomes across the full spectrum of musculoskeletal care.

**Modules in development*

Strength Through Collaboration

AJRR was built on the concept of a multi-stakeholder model and a belief in smarter data collection and reuse. If a site or surgeon is using data for one quality use case, it's important to reduce the data burden and use it for another purpose. With these goals in mind, AJRR continues to build and enhance its collaborative relationships through strategic alliances and affiliations with other organizations that contribute to and align with the registry goal of quality improvement, including:

ABOS Maintenance of Certification (MOC)

The AAOS Registry Program has been approved by the American Board of Orthopaedic Surgery (ABOS) to support Maintenance of Certification. As of November 2018, a diplomate can receive Self-Assessment Education (SAE) credits for each year of registry participation as an alternative to 10 scored and recorded SAE credits needed to satisfy ABOS MOC requirements.

Aetna Institutes of Quality (IOQ) Orthopaedic Surgery

Aetna IOQ are healthcare sites that demonstrate high levels of quality and efficiency. Effective January 1, 2020, The Joint Commission started providing the IOQ quality review for Aetna's total hip and knee replacement (THKR) surgery program. Beginning January 1, 2022, sites are required to achieve The Joint Commission Advanced THKR Certification, for which AJRR is the registry requirement. Sites may also obtain DNV Advanced Certification as a pathway to the IOQ designation.

Ambulatory Surgery Center Association (ASCA)

AJRR and ASCA continue to work to partner and collaborate to provide options for ASCs with low-volume and/ or no technical capabilities. As the number of arthroplasty procedures performed in ASCs increases, it is important to capture data to understand efforts to improve quality, enhance practice efficiency, and reduce healthcare costs by groups migrating to this model of practice.

American Alliance of Orthopaedic Executives (AAOE)

AAOE is a premier management association serving orthopaedic practice executives, providing peer to peer networking and education for orthopaedic executives. AAOE provides content and resources for orthopaedic practice executives; encourages competence, excellence, and high standards for orthopaedic practice management; and facilitates connections to and between members, nonmembers, physicians, and affiliated groups. AAOE supports data submission to AAOS registries.

American Association of Hip and Knee Surgeons (AAHKS)

AJRR is the official registry of AAHKS with continued collaboration on numerous initiatives. AAHKS members receive information on joining the Registry, AJRR is given complimentary advertisements in AAHKS publications as well as on their website, and the AAHKS journal, Arthroplasty Today, is AJRR's official journal.

American Hospital Association (AHA)

AHA is the national organization that represents and serves all types of hospitals, healthcare networks, and their patients and communities. Historically, AHA has been a strong collaborative partner with medical associations, aiding in guideline development to improve quality and the level of recommendations provided. The AHA continues to collaborate with AJRR by maintaining a seat on the Steering Committee.

American Joint Replacement Research Collaborative (AJRR-C)

The AAOS Registry Program and Mayo Clinic are collaborating through the AJRR-C center, funded by the National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS) Core Centers for Clinical Research program (P30AR076312). AJRR-C is led by Mayo Clinic surgeons Drs. Daniel J. Berry and David G. Lewallen with the AAOS Registry Program as the resource core for the center. AJRR-C aims to build productive scientific collaborations to enhance national clinical research infrastructure and support the next generation of investigators. The multidisciplinary AJRR-C team provides customized methodology and educational support in areas of epidemiology, biostatistics, health sciences research and medical informatics to interested collaborators. AJRR-C also provides statistical support to AAOS for abstracts, presentations, and publications, including the annual reports. High-priority areas of work include methods for handling bias, confounding, risk adjustment in TJA studies, outlier identification, development and application of TJA-specific natural language processing and computer vision tools for mining the electronic health records, standardization of analyses and reporting of TJA outcomes, and infrastructure efforts for large, multicenter trials.

AJRR Research Fellow

A Fellowship program sponsored by the P30 Grant From Mayo Clinic, awarded our first fellow. This fellowship program focuses on utilizing resources at Mayo Clinic, NativeSurgical site, and AJRR to focus on creating solutions for primary issues such as data collection, data accuracy and reliability, data utility, and data validation. Our primary research focus with our fellow in 2023, was to utilize machine learning to improve clinical data capture of variables not easily queried through electronic health systems. We developed a deep learning model using gold standard operative notes to identify surgical approach, fixation method, use of technology, and bearing surface in total hip arthroplasty. We also focused on indications for revision arthroplasty. The goal is to validate our model at other sites and apply this methodology to the AJRR dataset. We welcomed two new fellows in 2024.

America's Health Insurance Plans (AHIP)

AHIP is the national association whose members provide coverage for healthcare and related services to hundreds of millions of Americans every day. Through these offerings, AHIP improves and protects the health and financial security of consumers, families, businesses, communities, and the nation. They are committed to market-based solutions and public-private partnerships that improve affordability, value, access, and well-being for consumers. AHIP continues to collaborate with AJRR by maintaining a seat on the AJRR Steering Committee.

Blue Cross Blue Shield Blue Distinction® Specialty Care

The AAOS is collaborating with the Blue Cross Blue Shield Association (BCBSA) to allow participating sites who opt-in have their quality outcomes data from the American Joint Replacement Registry (AJRR) be evaluated by BCBSA for current and prospective Blue Distinction Centers.

Cigna Pathwell Bone & Joint SM

As part of its ongoing goal to provide quality care and improve the health and well-being of its customers, Cigna requires that providers who take part in its condition-specific care program also participate in and submit data to the AJRR as a quality metric.

Cohere Health

The partnership between Cohere and AAOS is the first of its kind between a prior authorization vendor and AAOS. Cohere's goals align closely with the AAOS Registry Program's efforts to collect, analyze, and report actionable data for its participants to promote clinical best practices, as well as alignment with AAOS advocacy efforts to reduce prior authorization burden. AJRR participants can opt-in to send a quarterly quality measure report from AJRR to Cohere to qualify for annual greenlighting (full waiver of their prior authorizations).

International Society of Arthroplasty Registries (ISAR)

ISAR is a global consortium of joint replacement registries established by several mature national registries. The society facilitates the development of registry science and observational studies, encourages the development of new national registries around the world, and provides a forum for information sharing to enhance participating countries' ability to meet their own objectives. AJRR is proud to be an associate member of ISAR and the vendor for the International Protheses Library (IPL).

OrthoForum and OrthoConnect

The AAOS Registry Program is the official registry of OrthoForum and OrthoConnect. The OrthoForum and its sister organization, OrthoConnect, are a national specialty physician network whose membership includes many of the largest privately owned orthopaedic practices in the US. Established to meet the unique challenges that independent orthopaedic group practices face in today's musculoskeletal healthcare environment, the OrthoForum selects its members individually to participate in activities that advance each group's presence throughout their markets. These activities include benchmarking, innovation, business ventures, networking, and best practices.

Qualified Clinical Data Registry (QCDR)

The AAOS Registry Program is a CMS-designated QCDR. Participation in the AJRR can help physicians qualify for the Merit-based Incentive Payment System (MIPS) Quality Payment Program (QPP), MIPS Value Pathways (MVP) and MIPS Promoting Interoperability (PI) category (previously known as Meaningful Use).

The Hip Society

Founded in 1968, The Hip Society was created to advance the knowledge and treatment of hip disorders to improve the lives of patients. The Society shares such values as education, innovation and collaboration, integrity, inspiration, and achievement. It supports the discovery and dissemination of information specific to hip disorders. Membership to The Hip Society is through invitation only and several members also serve on AJRR committees.

The Joint Commission Partnership

AAOS and The Joint Commission are in a collaboration to oversee scientific issues, performance measures, quality improvement activities, education, data sharing, and research related to the Advanced Total Hip and Knee Replacement (THKR) Certification. Effective July 1, 2019, AJRR became the sole pathway for meeting the THKR registry requirement.

The Knee Society

The Knee Society was incorporated in 1983 to support the creation of a society for education and research in the area of total knee arthroplasty as well as in the pathogenesis of osteoarthritis and other disease processes that lead to end stage arthritis of the knee. Membership to The Knee Society is by invitation only. Several members of The Knee Society also serve on AJRR committees.

Dedicated to Quality Improvement Initiatives

Advocacy and Quality of Care Improvement

AAOS continues to advocate for policies that incentivize clinician participation in the AAOS Registry Program. In 2024, key advocacy issues include expanding access to Medicare claims data for Qualified Clinical Data Registries (QCDRs) at a reduced cost, aligning quality reporting requirements in the Quality Payment Program (QPP) with specialty-specific needs, and enhancing the use of patient-reported outcome measures (PROMs). AAOS also urges CMS to standardize and streamline the implementation of PROMs while minimizing administrative burdens to improve data collection and support meaningful quality improvements across orthopaedic care.

Medicare Claims Data

Background: The Centers for Medicare & Medicaid Services' (CMS) implementation of the Medicare Access and CHIP Reauthorization Act of 2015 (MACRA) as it relates to QCDRs and clinician-led clinical data registries has been far from satisfactory and has not been per statutory intent. Contrary to Section 105(b) of MACRA, CMS has not provided QCDRs with a meaningful way of accessing Medicare claims data to link to their own data. As an alternative, the AAOS RegistryProgram has been using the Research Data Assistance Center (ResDAC) process to access Medicare claims data for the last several years. The formal process to request ResDAC is very resource intensive and regular data upgrades come at a prohibitive cost. Other alternatives provided by CMS include the CMS Qualified Entity Certification Program wherein QCDRs can apply to be certified as quasi qualified entities (quasi QEs) if they wish to use their own data (combined with the CMS Medicare data) to publicly report. However, this program is limited to data on clinicians that specifically report to the particular QCDR.

Advocacy efforts: Throughout 2024, AAOS staff and AJRR leadership had been drafting letters and meeting regularly with the CMS leadership team to ease access to Medicare claims data and find more cost-effective alternative pathways. AAOS is also advocating on changing data sharing requirements so that Medicare data linked to our own registry data can be used for surgeon-level metric reporting. Such expanded data usage is helpful to track outcomes.

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 Total Hip and Knee Replacement Certification
- 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
- Blue Cross Blue Shield 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 (DNV) Orthopaedic Center of Excellence
- The Alliance QualityPath

To find out more about these and other ways to reuse Registry data please click here.

Quality Measurement and Reporting

Background: The Academy is a Qualified Clinical Data Registry (QCDR). Having this designation allows us to request the CMS data we use to supplement our outcomes for the AJRR. Each year we have to maintain our status as a QCDR. For Performance Year (PY) 2024, CMS finalized a policy that a QCDR measures must be face valid and fully tested for all subsequent MIPS payment years for which it is approved. Measure testing requirements remain challenging for medical specialty societies, and CMS has further increased the data completeness threshold to 75% for eligible cases, adding additional burden. CMS has also continued its efforts to remove topped-out measures from the QPP, which may create difficulties for specialties with fewer approved measures. To preserve access to specialty-specific measures, AAOS tested and submitted nine measures for PY 2024. Seven of the measures used AJRR data. These measures are currently under review with CMS and will be announced in January 2025.

At the time of publication, CMS is proposing to transition from the current Merit-Based Incentive Payment System (MIPS) to a new Model of Patient (MVP) system by CY 2029, focusing on specific measures and performance categories for different specialties. AAOS responds by opposing the mandatory inclusion of MVPs for orthopaedics due to concerns over limited applicability and potential challenges in ensuring relevant measures. Additionally, CMS's proposal includes the Surgical Care MVP, which AAOS finds too narrow and is advocating for a broader scope that includes a wider range of surgical measures relevant to orthopaedics. AAOS also supports CMS's push for integrating patient-reported outcome measures (PROMs) but emphasizes the need for development of orthopaedic-specific tools to better evaluate quality and outcomes in the field.

Advocacy efforts: AAOS provides regular comments on Medicare payment rules and has been successful in delaying the testing requirements at least until the end of the public health emergency. AAOS has raised concern with CMS that when abrupt changes are made, it has a ripple effect which negatively impacts the ability to robustly participate in quality reporting. In this regard, AAOS requested that CMS consider longer intervals between the proposed removal of measures and the finalization of such changes. AAOS continues to work with lawmakers and regulators to urge collaboration with specialty societies like us in measure development and harmonization to utilize our clinical expertise and existing infrastructure.

"At BCBSA, Quality of Care is a priority. National recognitions are given to hospitals and ambulatory surgery centers that meet a series of objective quality measures to be designated for the Blue Distinction Centers for Knee and Hip Replacement and Blue Distinction Centers for Spine Surgery. Our partnership with AAOS enables seamless access to objective performance measure reports from consenting AJRR and ASR registry participants. This data is crucial for identifying top-tier institutions for spine surgery and for total knee and total hip replacement procedures, and guiding patients to higher quality healthcare facilities that best fit their specialty care needs."

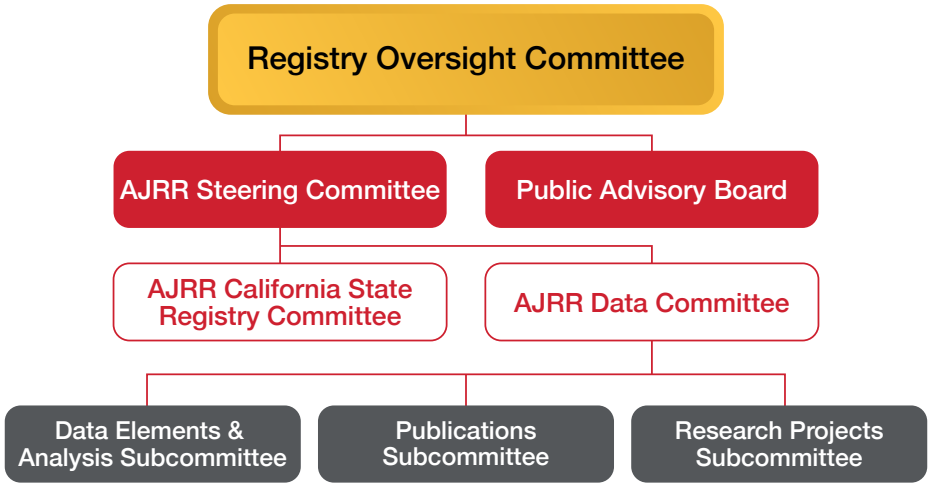
Erin Barney

Vice President of Health Care Solutions at BCBSA

Governance and Structure

AJRR was an independent 501(c)3 non-for-profit corporation with an independent Board of Directors. Once reintegrated, the AJRR Board of Directors was transitioned to the AJRR Steering Committee.

Many of the original surgeon leaders on the Steering Committee have been involved in AJRR since the beginning. Their valuable service provided the knowledge needed to ensure a smooth transition to AAOS and continues to drive the vision and growth of the registry. The AJRR Steering Committee is comprised of stakeholders for various disciplines including representation from AAHKS, The Hip Society and The Knee Society. The addition of members of the public has been pivotal to the success of the Registry. Their voices are included through the Public Advisory Board which allows for the inclusion of the patient perspective in all aspects of Registry governance.



2023 AAOS Registry Oversight Committee

Overseeing the AJRR Steering Committee is the Registry Oversight Committee (ROC). The ROC reports to the AAOS Board of Directors and provides guidance and recommendations for all major Registry initiatives.

The Registry Oversight Committee is led by the following orthopaedic surgeons:

William J. Maloney, MD, FAAOS, Chair
Stanford University School of Medicine (Redwood City, CA)

Antonia F. Chen, MD, MBA, FAAOS
RQC Liaison
University of Texas Southwestern Medical Center (Dallas, TX)

Michael J. Gardner, MD, FAAOS
FTR Representative
Stanford University Surgery (Redwood City, CA)

Grant E. Garrigues, MD, FAAOS, Chair
SER Representative
Midwest Orthopaedics at Rush (Chicago, IL)

Steven D. Glassman, MD, FAAOS
ASR Representative
Norton Leatherman Spine Center (Louisville, KY)

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James I. Huddleston, III, MD, FAAOS
AJRR Representative
Stanford University (Woodside, CA)

Benjamin J. Miller, MD, MS, FAAOS
MsTR Representative
University of Iowa (Iowa City, IA)

Kurt P. Spindler, MD
Cleveland Clinic Foundation (Weston, FL)

Bryan D. Springer, MD, FAAOS
Mayo Clinic Florida (Jacksonville, FL)

2024 AJRR Steering Committee

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Stanford University (Woodside, CA)

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Midwest Orthopaedics at Rush and Central DuPage Hospital (Wheaton, IL)

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The Knee Society Representative
University of Virginia (Charlottesville, VA)

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University of Texas Southwestern Medical Center (Dallas, TX)

Paul J. Duwelius, MD, FAAOS
AAOS Representative
Orthopedic and Fracture Specialists (Portland, OR)

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MARCQI Director
University of Michigan Medical Center

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William A. Jiranek, MD, FACS, FAAOS
AAHKS Representative
Duke University (Durham, NC)

Leslie Klemp, MS, RN, NE-BC, CPHQ
AHA Representative
Rush University Medical Center (Chicago, IL)

William J. Long, MD, FAAOS
Knee Society Representative
Hospital for Special Surgery (New York, NY)

Howard J. Marans, MD
PR Member - Aetna (Santa Ana, CA)

Joshua C. Rozell, MD
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NYU Langone (Brooklyn, NY)

James D. Slover, MD, FAAOS
The Hip Society Representative
Northwell Health (New York, NY)

Bryan D. Springer, MD, FAAOS
AJRR Representative
Mayo Clinic Florida (Jacksonville. FL)

Jeffrey B. Stambough, MD, FAAOS
AAHKS Representative
University of Arkansas for Medical Sciences (Little Rock, AR)

AJRR Committees

Many volunteers contribute to the success of the Registry. These individuals devote countless hours to ensure that the Registry is of the highest possible quality.

Below is a description of all AJRR Registry committees. Full membership can be found in Appendix D.

Young Physicians Committee

The Young Physicians Committee assist in management of the registry science curriculum. Committee members play an integral role in reviewing and authoring AJRR data driven publications and serving as champions for participating institutions and specialties. Their subject-matter expertise in registry data is utilized for a multitude of projects.
Chair: Jeffrey B. Stambough, MD, FAAOS

Data Elements and Analysis Subcommittee

This subcommittee monitors, receive requests, and makes recommendations for additions or deletions to data elements or assessment tools collected by AJRR. The subcommittee makes recommendations to the Data Management Committee for review prior to discussion and final approval by the AJRR Steering Committee. This subcommittee works with staff and statisticians to determine, develop, and oversee the implementation of appropriate data analysis methodology and algorithms. The subcommittee's purview includes risk adjustment, scientific integrity of data, rigor of conclusions drawn from Registry data, and consideration of optimal reporting and data analysis to provide actionable data for the benefit of patients and other AJRR stakeholders.
Chair: Scott M. Sporer, MD, FAAOS

Publications Subcommittee

The Publications Subcommittee representatives review and ensure the integrity of all publications based on Registry data. Publications for review include potential abstracts, manuscripts, custom reports, as well as the Annual Report. The original Annual Report Subcommittee was rolled into the Publications Subcommittee and is one of the final signoffs on the completed Annual Report prior to the document being sent to the Commission and subsequently AJRR's Steering Committee for their review.
Chair: James A. Browne, MD, FAAOS

Our Mission

To improve orthopaedic care through the collection, analysis, and reporting of actionable data.

Research Projects Subcommittee

Members of the Research Projects Subcommittee review incoming external research proposals and requests and make recommendations for project approvals. The committee developed and now maintains the AAOS Registry Analytics Institute®. Members provide guidance for the process and grading of submitted proposals.
Chair: Richard L. Illgen II, MD, FAAOS

Public Advisory Board

The Public Advisory Board (PAB) provides direct input to the Steering Committee from both the patient and public perspective. The PAB members are drawn from a wide variety of public advocacy groups and members of the public who have had joint arthroplasties themselves.

Richard Seiden, Esq., Chair

Chris Michno

William Mulvihill, M.Ed.

JohnMarc Alban, MS, RN, CPHIMS

Outgoing 2022 Volunteers

AJRR would like to express its gratitude and appreciation for the contributions made by all of our volunteers. The Registry would like to specifically recognize the work of the following volunteers whose terms concluded in 2022.

Public Advisory Board

Kristin Veno

"At OrthoVirginia, we rely on the PROMs dashboard to closely monitor and analyze our HOOS JR and KOOS JR scores across pre-operative, 3-month, and 1-year intervals. This capability allows us to compare our outcomes with national benchmarks from 2023 and 2024 within the RegistryInsights® platform, while also ensuring high patient compliance rates by tracking completion metrics. Additionally, we've partnered with the AJRR for our 2024 MIPS annual data submission to CMS, and we're eager to see the future enhancements the RegistryInsights® platform will bring to further optimize care delivery."

April Page, MSN, APRN, FNP-BC
Director of Quality & Patient Safety,
OrthoVirginia

Industry Collaborations

AJRR recognizes the importance of device surveillance and collecting quality data to improve outcomes. The Registry works with sites and manufacturers to understand how implants contribute to patient experience and quality of life. The AJRR allows for collaboration between providers and companies to evaluate the performance of implants based on national trends of longitudinal patient data.

Thank You to AJRR Industry Supporters and Partners

2024 Supporters

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Registry Partners

BlueCross BlueShield | BlueDistinction Specialty Care

The Hip Society Founded in 1968

The Knee Society Founded in 1983

The Joint Commission

AAHKS American Association of Hip and Knee Surgeons

ASCA Ambulatory Surgery Center Association

The OrthoForum Benchmarking. Networking. Innovation.

aetna

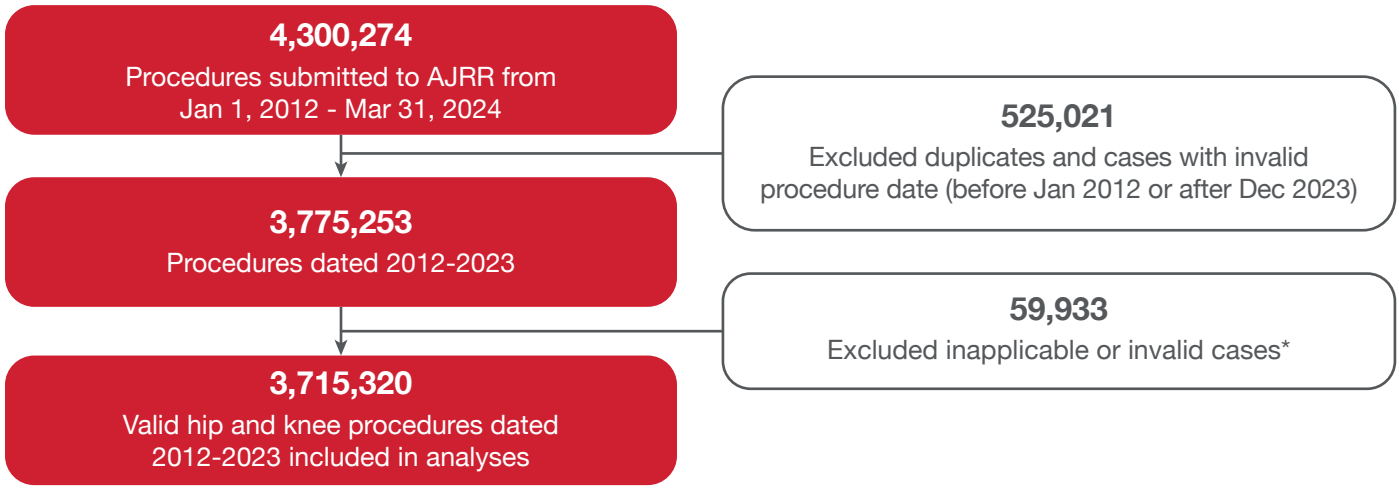
cohere HEALTH

"I remember when the AJRR was merely an idea, a concept discussed in theory. To witness its evolution into one of the largest arthroplasty registries in the world by annual volume over the past 12 years is truly remarkable. The AJRR has become an indispensable tool in monitoring implant performance, and I'm excited about its future potential to provide even more data that will drive further improvements in patient outcomes. Our patients stand to benefit immensely from the continued growth of this program."

Antonia Chen, MD, MBA, FAAOS

University of Texas Southwestern Medical Center

Overall Results



**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.*

Analyses are completed using a core dataset of hip and knee procedures submitted to the AJRR from January 1, 2012 through Mar 31, 2024. Cases with invalid data or procedures dated before January 1, 2012 or after December 31, 2023 were further excluded. Data were considered invalid when procedure codes did not match approved codes listed in the AJRR data specifications as well as cases of hemiarthroplasty procedures without a diagnosis of femoral neck fracture. Data from the American Hospital Association (AHA) and Centers for Medicare & Medicaid Services (CMS) may be merged to supplement AJRR data when applicable, and this will be indicated in table/figure footnotes. Additional inclusion/exclusion criteria for each table or figure will be outlined as needed.

Procedural Data Metrics

The 2024 American Joint Replacement Registry captured 3,715,320 procedures performed between 2012 and 2023 (Figure 1.1).

The highest volume of cases were reported from California on the West coast, and many other regions are represented among the highest volume states including New York (East), Minnesota (Midwest), and Texas (Figure 1.2).

Primary knee (51.1%) and primary hip (32.4%) procedures comprised the majority of submitted cases (Figure 1.3). Sex breakdown was 58.6% female and 41.3% male for all cases (Figure 1.4).

Most of the patients in the database were white (76.6%) although race was not recorded in 14.0% of cases (Figure 1.5). The patient's identified race category is based on the Department of Health and Human Services (HHS) Implementation Guidance, which is in accordance with the Office of Management and Budget Directive on Race and Ethnicity.

AJRR accepts historical data back to 2012. Therefore, annual volumes from prior years are continually being updated. The cumulative procedural volume grew by 18% in 2023 when comparing to the previous Annual Report (566,278 additional cases). The dataset utilized in this Annual Report represents a snapshot of AJRR data taken on Mar 31, 2023.

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

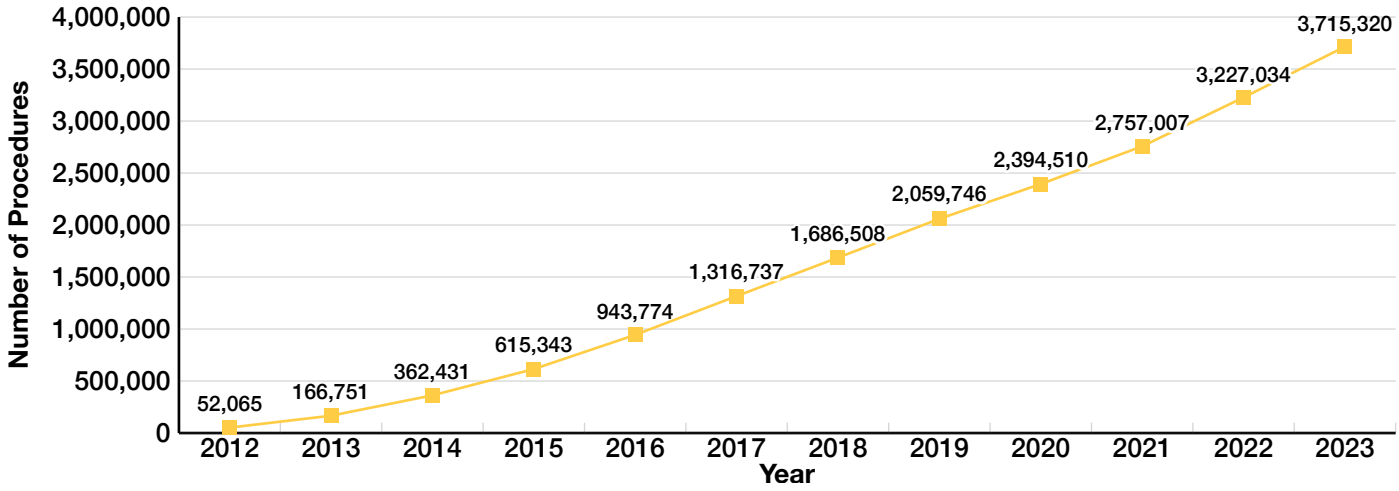


Figure 1.2 Arthroplasty Procedures by State, 2012-2023

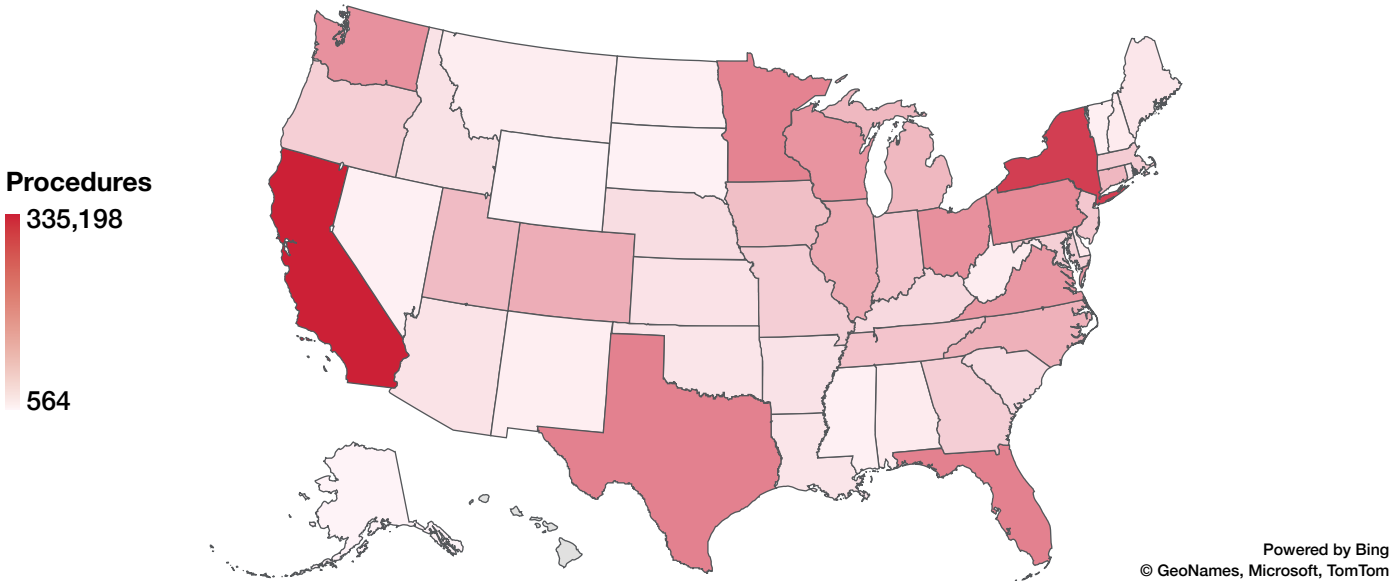


Figure 1.3 Distribution of Arthroplasty Procedures, 2012-2023 (N=3,629,995)

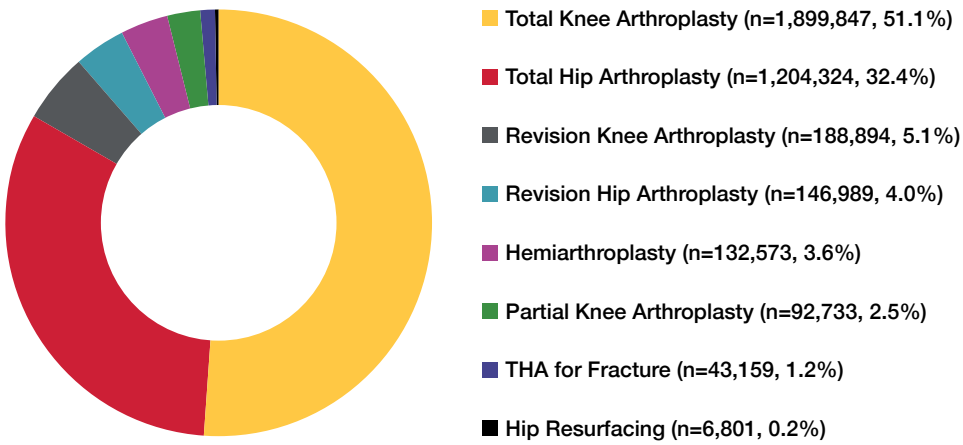


Figure 1.4 Sex of Patients Undergoing Procedures, 2012-2023 (N=3,701,404)

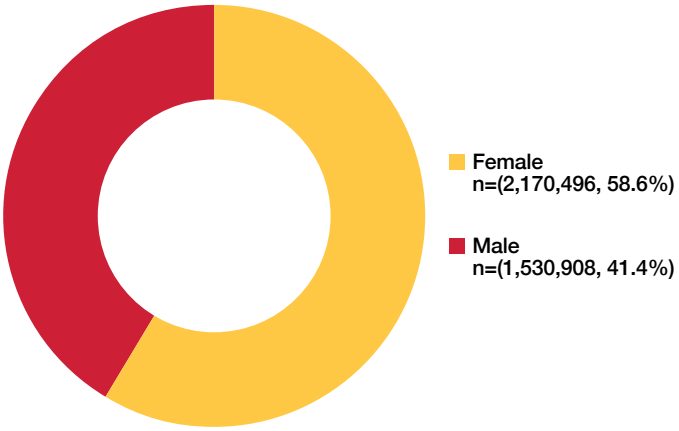
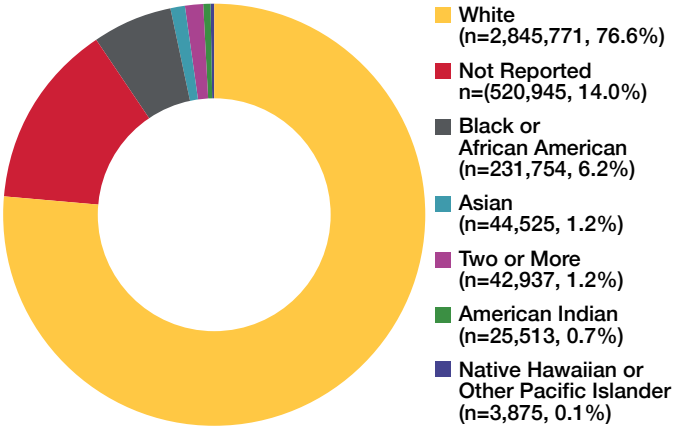


Figure 1.5 Race of Patients Undergoing Procedures, 2012-2023 (N=3,715,320)



Submitting Facilities

Since inception, facility enrollment and data submission have been a major priority including growth in the number of hospitals, ASCs, and private practice groups submitting data to the Registry. By end of 2023, there were 1,447 institutions submitting data to the AJRR from across all 50 states and the District of Columbia; this represents a 6% increase from the previous report. A list of all enrolled facilities and those that submitted data used in the 2024 Annual Report can be found in Appendix E.

The AJRR has no requirements on the frequency of data submission but recommends, as a best practice, at least quarterly. In addition to increasing facility enrollment, the Registry is focused on promoting active data submission. To help with this, the Registry has a Registry Support Team and Support Specialists to expedite submissions and minimize the data submission burden.

Similar to past years, the majority of arthroplasty procedures submitted to the Registry were performed in medium-sized hospitals, defined as 100-399 beds (38.6%) and minor teaching institutions, defined as those with a medical school affiliation or approved internship/residency program (36.1%) (Figures 1.7 and 1.8). This year major teaching instutitions performed fewer procedures than non-teaching institutions at 10.0 and 29.2%, respectively. Major (Hospitals with COTH: The Council of Teaching Hospitals and Health Systems designation) and minor teaching hospitals accounted for 46.2% of all AJRR submitting hospitals with institutional data available in the American Hospital Association (AHA) survey.

Although the AJRR does not capture data on all procedures done each year, a study published in the Journal of the American Academy of Orthopaedic Surgeons found that the distribution of AJRR data across patient age, hospital volume, and geography were proportionally similar to the national experience with hip and knee arthroplasty in the United States.[1]

Only 10% of procedures submitted to the AJRR came from major teaching institutions.

INSIGHTS

Figure 1.6 Cumulative Number of Enrolled Facilities by Year, 2012-2023 (N=1,447)

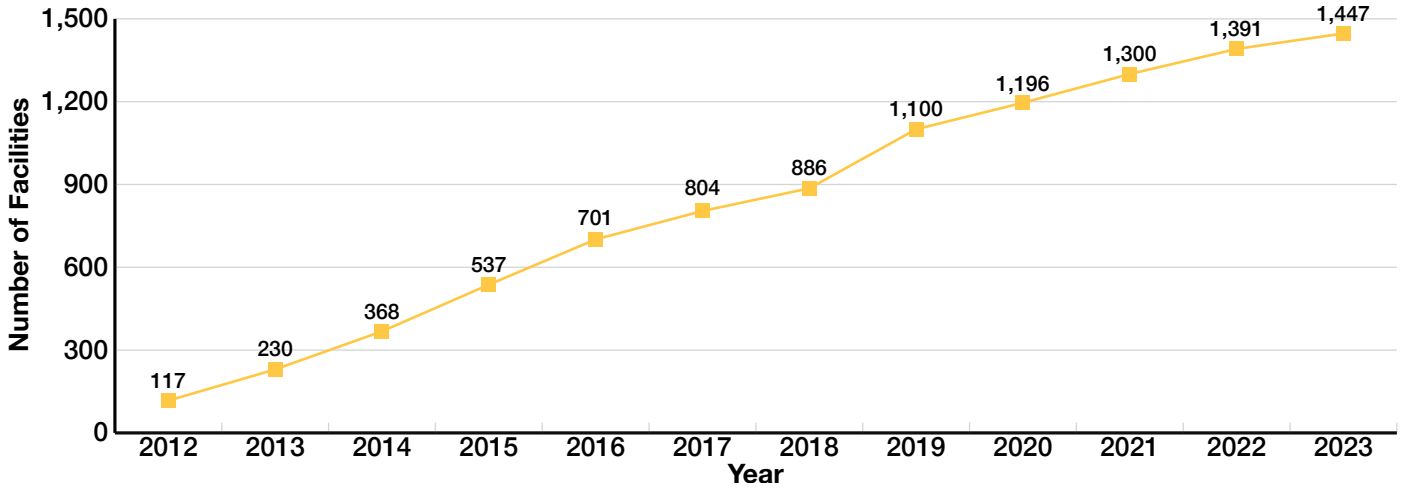


Figure 1.7 Hospital Size (Bed Count) of Submitting Hospitals, 2012-2023 (N=1,447)

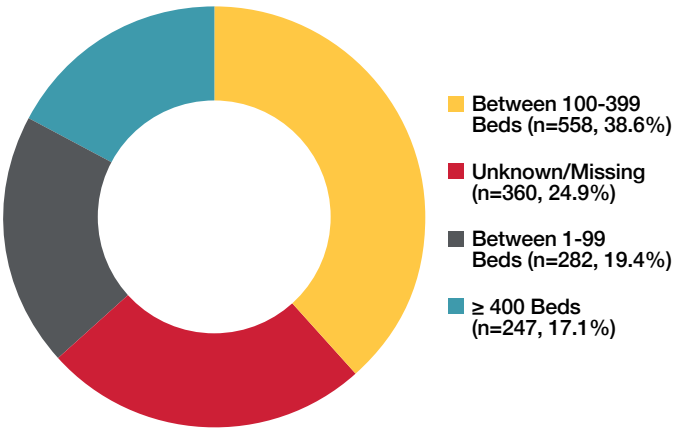
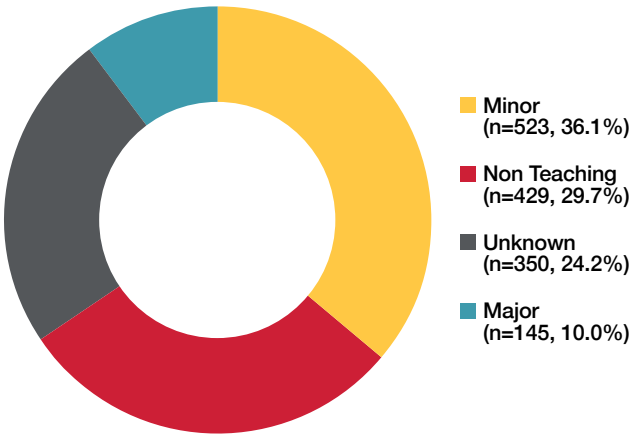


Figure 1.8 Distribution of Submitting Institution Teaching Affiliation, 2012-2023 (N=1,447)



Ambulatory Surgery Centers

Ambulatory surgery centers (ASCs) play an increasingly important role in the delivery of total joint arthroplasty care in the United States. While historically much of the procedural information in the Registry has come from hospitals, the number of arthroplasties performed in outpatient settings continues to rise.[2] In late 2018, AAOS took the first steps toward growing its ASC representation by restructuring the Registry Engagement Team.

An ASC is classified by a submitting institution on their AJRR application and can be either freestanding or affiliated with a hospital. In 2012, only 1 ASC submitted data to the AJRR. In 2023, that number increased to 312 (Figure 1.9). The number of procedures submitted by ASCs has grown dramatically between 2012 (n=5) and 2023 (n=62,110) and has increased by 70% since the 2023 AJRR Annual Report (Figure 1.10).

The number of ASCs submitting procedures to the AJRR has grown from 1 in 2012 to 312 in 2023.

INSIGHTS

Figure 1.9 Cumulative Number of Enrolled Ambulatory Surgery Centers by Year, 2012-2023 (N=312)

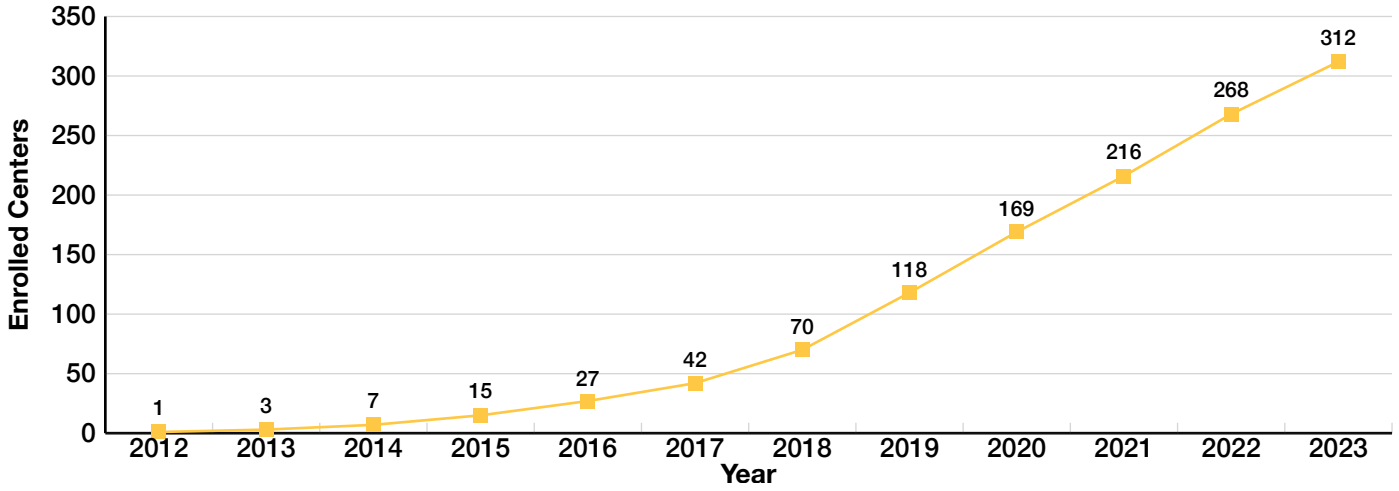
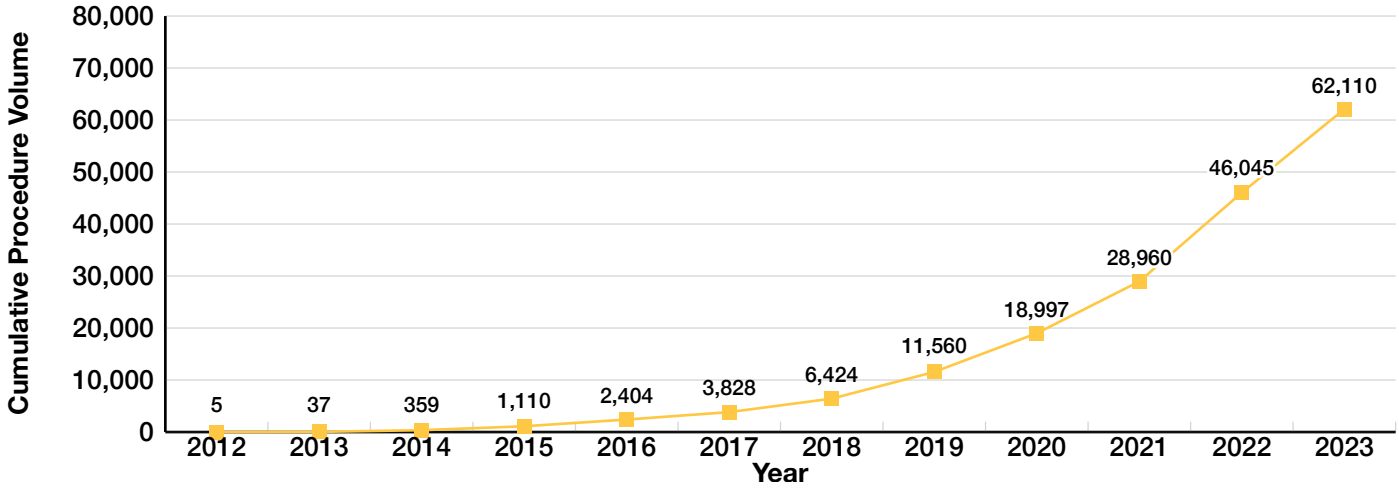


Figure 1.10 Cumulative procedure volume from ambulatory surgery centers by year, 2012-2023 (N=62,110)



Submitting Surgeons

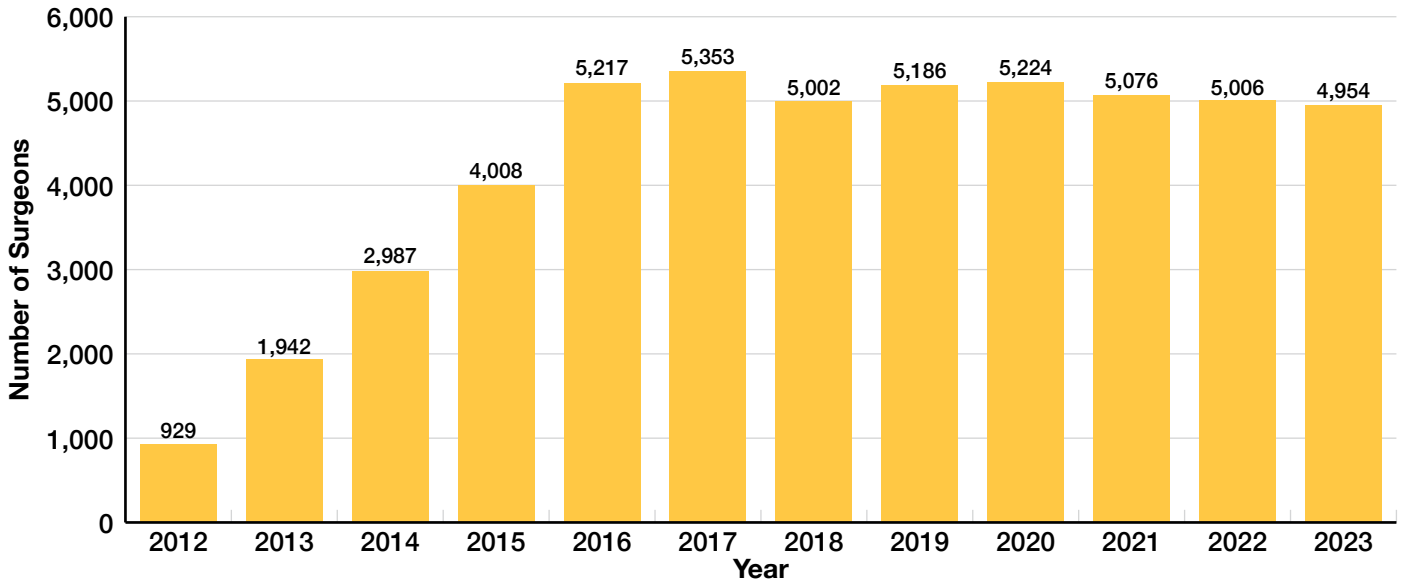
At present, 11,612 surgeons have submitted at least one procedure to the AJRR (Figure 1.11) this is an increase of 6% since the 2023 report. As AJRR accepts historical data and many institutions submit towards the end of the following year, it is anticipated that the number of surgeons with cases submitted to the AJRR in recent years (2018-2023) will continue to increase in future Annual Reports.

In 2023 alone, there were 4,954 surgeons represented with at least one procedure in the AJRR (Figure 1.11). AJRR participating institutions are required to submit data from all surgeons performing hip or knee arthroplasty procedures at their facility. This is validated by annual audits (See Appendix F).

INSIGHTS

11,612 surgeons have submitted at least one procedure to the AJRR, a number which is expected to grow as sites continue to submit data.

Figure 1.11 Cumulative Number of Surgeons Represented in Annual Procedure Submissions, 2012-2023 (N=4,954)



Data Completeness

In February 2017, AJRR significantly expanded data collection on elements in the following areas: procedural data, patient risk factors, comorbidities, and post-discharge complications. To allow time for participants to adjust to the additions, these changes were not made mandatory until June 2018. Elements that can automatically be extracted from an electronic health record (EHR), such as discharge disposition and length of stay, tend to have higher data completeness (Tables 1.1 to 1.3). For many elements, "not reported" or "NR" is an accepted value, so this should be considered when assessing valid entries and utilization of available data. Invalid entries can vary for each element since "NR" can be an acceptable value. However, invalid responses would be those that do not meet the criteria in the data specifications such as the submission of a blank entry for an element.

Other elements that require more manual submission such as anesthesia type or surgical approach are more difficult to submit. The data elements that are collected by AJRR and their completeness are frequently reviewed to ensure relevant data points are being captured. Making updates to a data specification is a lengthy process. Understanding how data is submitted to the Registry and what percentage has acceptable values can help guide these updates. Every year, the Registries program has taken steps to increase transparency of completeness to participating institutions in dashboards to encourage more complete and valid submissions.

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.

Table 1.1 AJRR Data 2012 - 2024Q1 (N=4,096,022)

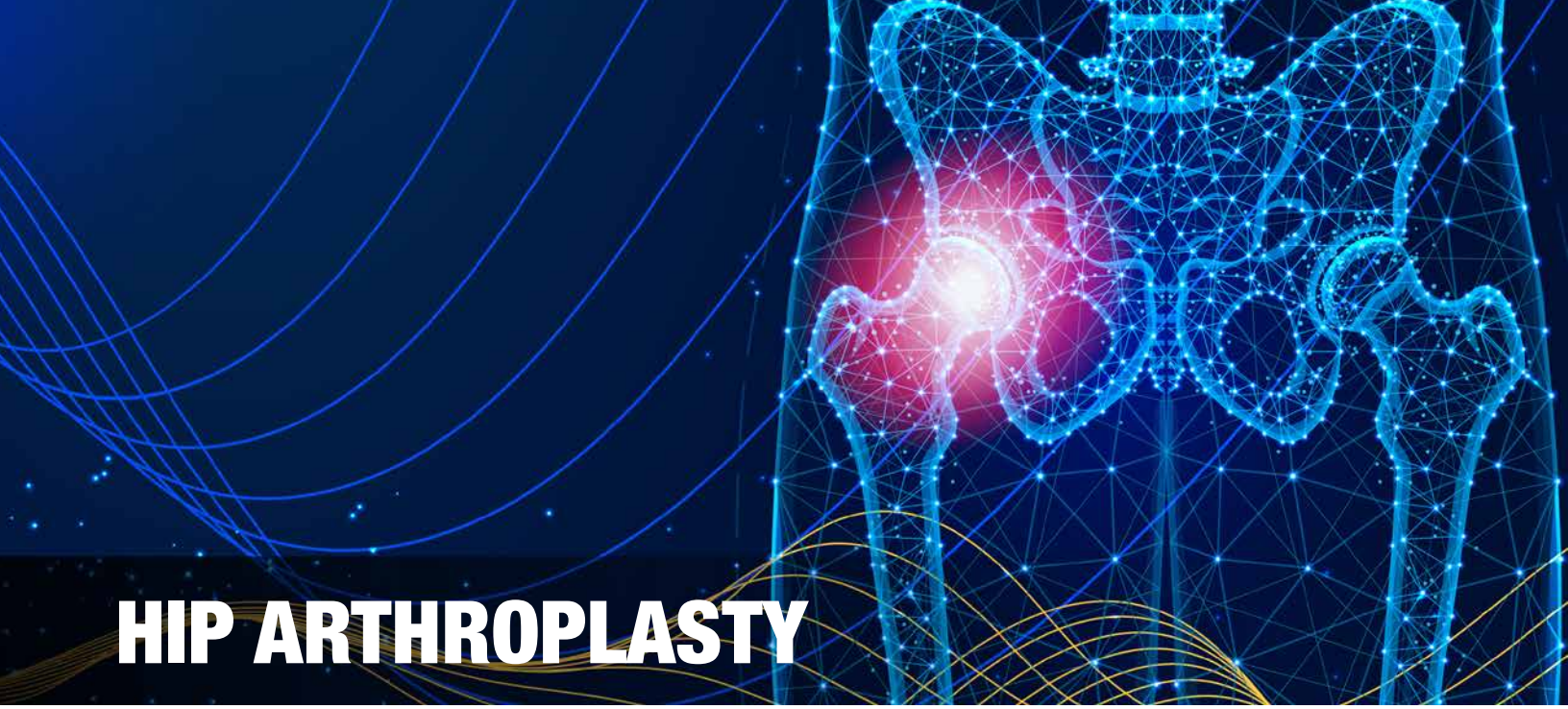
Element	N Total	Percent Reported	Percent NR	Percent Invalid
Surgeon Information	4096022	91.1	0	8.9
Principal Procedure Code	4096022	99.9	0	<0.1
Principal Diagnosis Code	4096022	96.3	0	3.7
First Implant Catalog # Listed	4096022	90.8	0	9.2
First Implant Lot # Listed	4096022	87.7	0	12.3
Incision Start Time (Procedure Start Time)	4096022	74.9	24.3	0.8
Skin Closure Time (Procedure End Time)	4096022	76.7	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

Table 1.2 AJRR Data 2012 - 2024Q1 Using 2017 or Newer Specifications (N=2,721,675)

Element	Percent Reported	Percent NR	Percent Invalid
Comorbidity - at least one code reported	66.2	0	33.9
Body Mass Index (BMI)	91.2	0	8.8
Admission Date	98.8	1.2	0
Discharge Date	98.9	1.2	0
Length of Stay	98.8	0	1.2
Discharge Disposition Code	94.1	5.0	1.0
Computer Navigation	33.8	65.8	0.5
Robotic Assisted	43.6	56.2	0.1
Anesthesia Type	65.9	29.7	4.5
Periarticular Injection	22.7	74.7	2.6
ASA Classification	58.7	40.8	0.5

Table 1.3 AJRR Data 2012 - 2024Q1 Using 2020 or Newer Specifications (N=508,572)

Element	Percent Reported	Percent NR	Percent Invalid
Tourniquet Use (N=286,520- knees only)	44.7	55.3	<0.1
Trainee	7.5	91.6	0.9
Payer Status	44.6	55.3	0.1



HIP ARTHROPLASTY

Hip Overview

Between 2012 and 2023, AJRR has collected data on 1,556,261 Hip Arthroplasty Procedures.

The majority of surgeons with data in AJRR perform both elective primary total hip arthroplasties and hip arthroplasties for fracture. For those surgeons performing elective primary total hip arthroplasty procedures in 2023, the mean procedure count was 44.3 with an interquartile range (25th-75th percentile) of 6-62 procedures. This is slightly higher than 2022 (Table 2.1). This distribution of procedures is consistent with previous studies of hip arthroplasty in the United States.[3] Only surgeons with at least one relevant hip procedure were included.

The types of hip procedures reported remained relatively constant as a percentage of all hip procedures performed in 2023 (Figure 2.1). The “other procedures” category includes procedures such as arthrotomy and conversion from prior hip surgery. The mean age for patients undergoing an elective primary total hip arthroplasty was 65.6 years which was similar to the 2022 report. While hip resurfacing is reported infrequently in the AJRR, this patient population is younger with an average age of 53.4 years (Table 2.2, Figure 2.2).

When evaluating mean length of stay in the AJRR cohort, total hip arthroplasty length of stay has deceased since 2012, with the mean length of stay for 2023 at 1.1 days.

Length of stay in patients with a fracture treated with total hip arthroplasty or hemiarthroplasty has remained relatively constant over time (Figure 2.3). For this analysis, length of stay was calculated by subtracting admission date from discharge date for procedures from all reporting facilities.

INSIGHTS

For elective primary total hip arthroplasty, mean procedure count per surgeon has increased slightly to 44.3, with an interquartile range of 6-62 procedures.

Table 2.1 Average Procedural Volume for Participating Surgeons for 2023

Procedure Type	Surgeons	Procedures	Mean	Median	25th Percentile	75th Percentile
Total Hip Arthroplasty	3,182	140,974	44.30	23	6	62
Hemiarthroplasty	2,464	11,901	4.83	3	1	6
Revision Hip Arthroplasty	2,155	13,365	6.20	3	1	8
THA for Fracture	1,561	4,872	3.12	2	1	4
Other Procedures	913	3,121	3.42	1	1	3
Hip Resurfacing	25	44	1.76	1	1	2

Figure 2.1 Distribution of Procedure Codes for All Hip Arthroplasty Procedures, 2012-2023 (N=1,556,261)

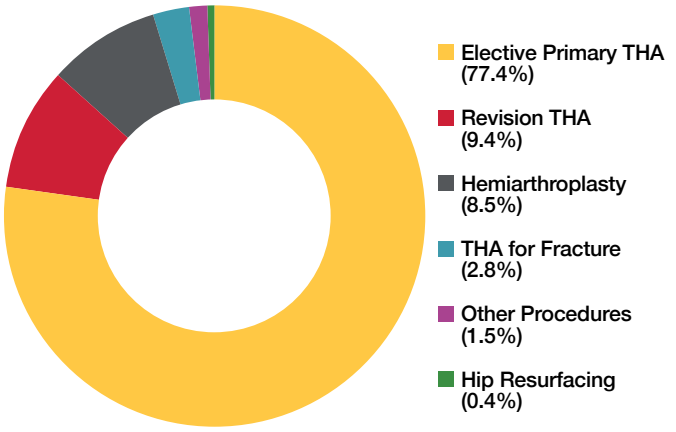


Table 2.2 Mean Age of Patients Undergoing Hip Arthroplasty Procedures, 2012-2021 (N=1,556,261)

Procedure	Total	Mean Age (Yrs)	Standard Deviation
Total Hip Arthroplasty	1,204,305	65.6	11.2
Revision Hip Arthroplasty	146,649	67.2	12.6
Hemiarthroplasty	132,573	81.9	9.6
THA for Fracture	43,159	71.8	11.5
Other Procedures	22,774	67.5	19.3
Hip Resurfacing	6801	53.4	9.5

Figure 2.2 Age Distribution of Hip Arthroplasty Procedures 2012-2023 (N=1,533,846)

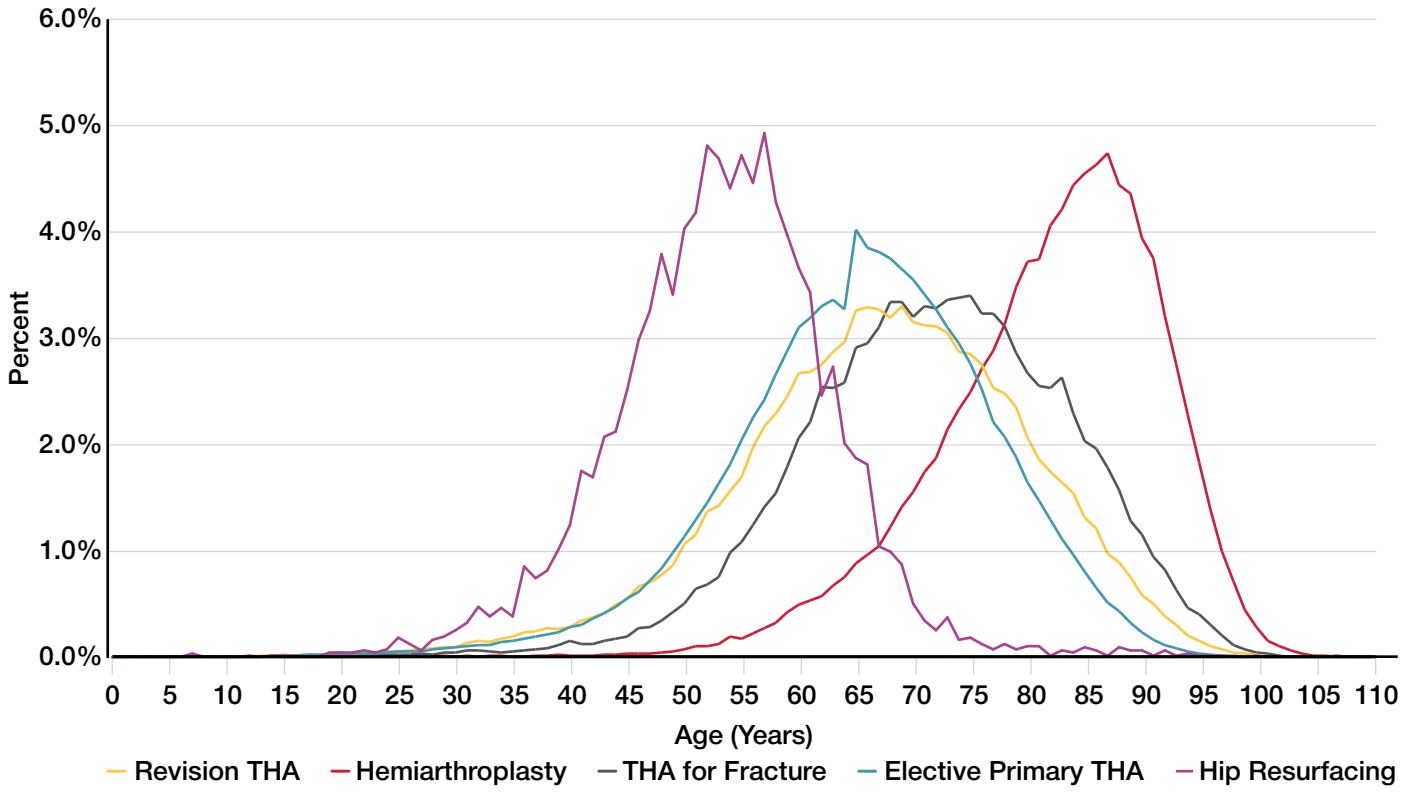
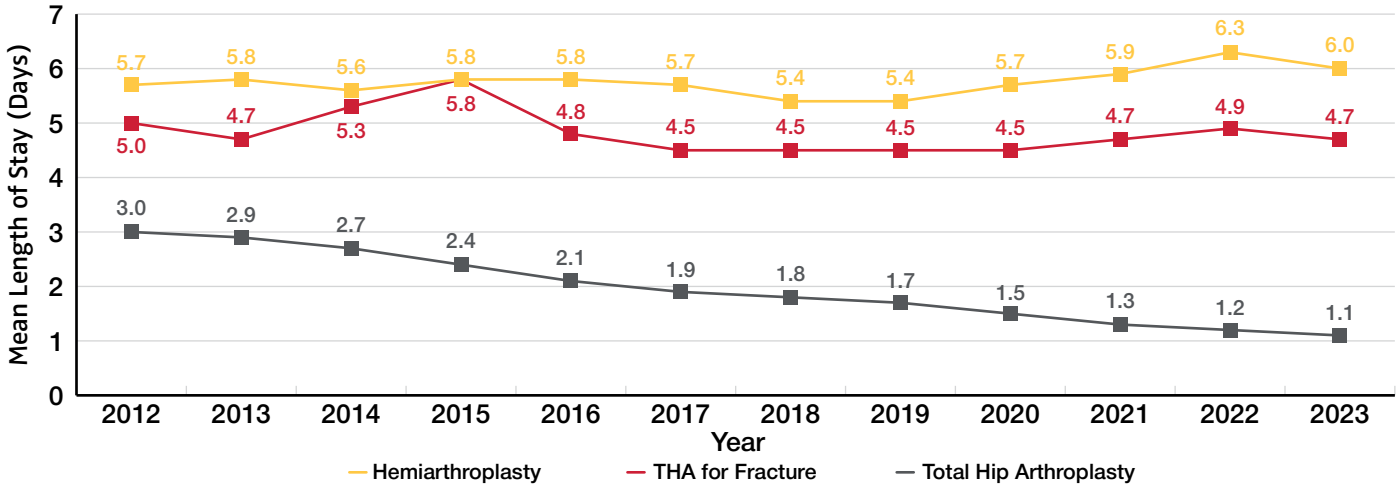


Figure 2.3 Mean Length of Stay for Hip Arthroplasty Procedures, 2012-2023 (N=968,396)



Arthroplasty for Femoral Neck Fracture

Between 2012 and 2023, AJRR has collected data on 175,732 hip arthroplasty procedures for femoral neck fracture

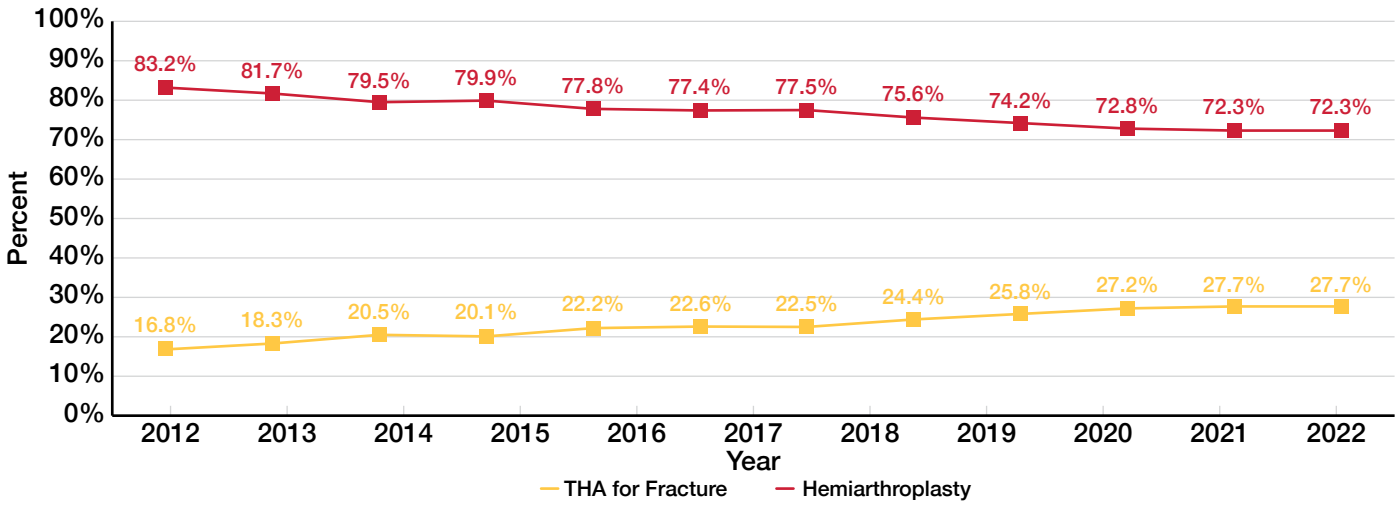
In the AJRR population, displaced femoral neck fractures (FNF) are commonly treated with either hemiarthroplasty or total hip arthroplasty (THA). The optimal treatment for these fractures remains a topic of debate and is typically individualized to the patient.[3] While historically AJRR has seen hemiarthroplasty predominate as the most frequent arthroplasty option for FNF, a trend towards increasing use of total hip arthroplasty had been seen for several years dating back to 2012. However, over the last three years, the use of hemiarthroplasty versus total hip arthroplasty has been stable (Figure 2.4). This finding is consistent with reports from other national registries.[5,6]

In AJRR, for patients <60 years of age, THA was the more common treatment for displaced FNF. There is a relatively even split between THA and hemiarthroplasty between ages 60-69 years, and hemiarthroplasty becomes the predominant option for patients >69 years of age (Figure 2.5). THA for FNF is increasingly more common in females with each decade increase in age with females reaching a majority of cases in groups >50 years of age and over two-thirds of cases aged >69 years (Fig 2.6).

INSIGHTS

The trend of increasing utilization of total hip arthroplasty instead of hemiarthroplasty for femoral neck fractures appears to have leveled off over the past three years.

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

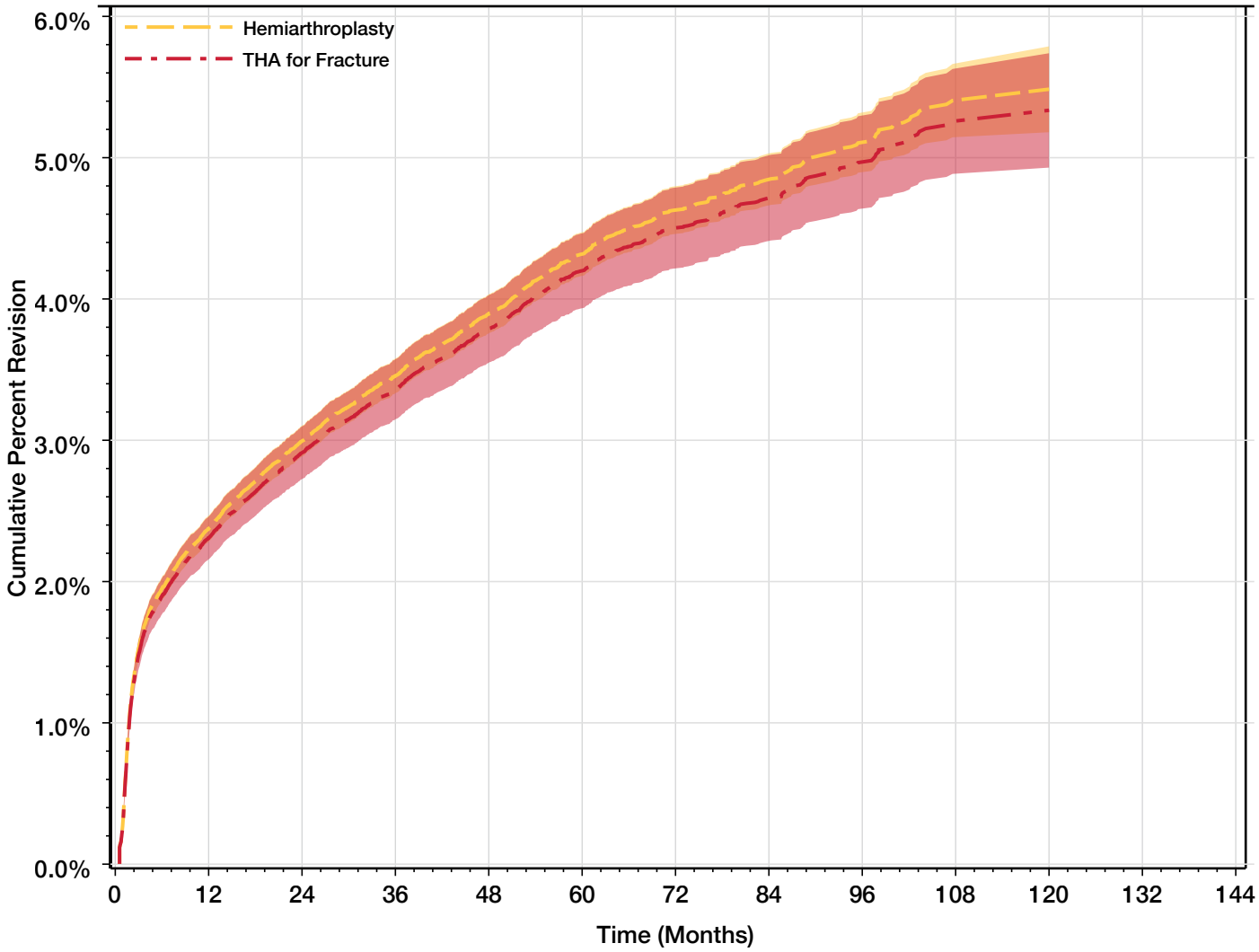


No significant difference was identified comparing cumulative percent revision between THA and hemiarthroplasty for fracture in Medicare patients aged 65 and older.

INSIGHTS

This year's Annual Report analyzed survivorship between THA and hemiarthroplasty for treatment of fracture in Medicare patients. Cumulative percent revision was not found to be significantly different between treatment methods for fracture patients aged 65 and older.

Figure 2.4b Cumulative Percent Revision for Total Hip Arthroplasty Compared to Hemiarthroplasty Used for Treatment of Fracture Medicare Patients 65 Years of Age and Older with Primary Osteoarthritis, 2012-2023



Number at Risk (Months)	0	12	24	36	48	60	72	84	96	108	120	132	144
Hemiarthroplasty	109,972	78,835	60,752	45,864	35,172	26,343	17,632	10,438	5,705	2,908	1,018	232	1
THA for Fracture	28,327	22,447	17,657	13,778	10,479	7,782	5,435	3,338	1,836	962	321	71	1
Total	138,299	101,282	78,409	59,642	45,651	34,125	23,067	13,776	7,541	3,870	1,339	303	2

Age/Sex/CCI adjusted HR (95%CI), p-value
Hemiarthroplasty vs. THA for Fracture:1.029(0.954,1.11), p=0.4596

Figure 2.5 Percent of Total Hip Arthroplasty and Hemiarthroplasty Procedures for Treatment of Femoral Neck Fracture by Age Group, 2012-2023 (N=175,732)

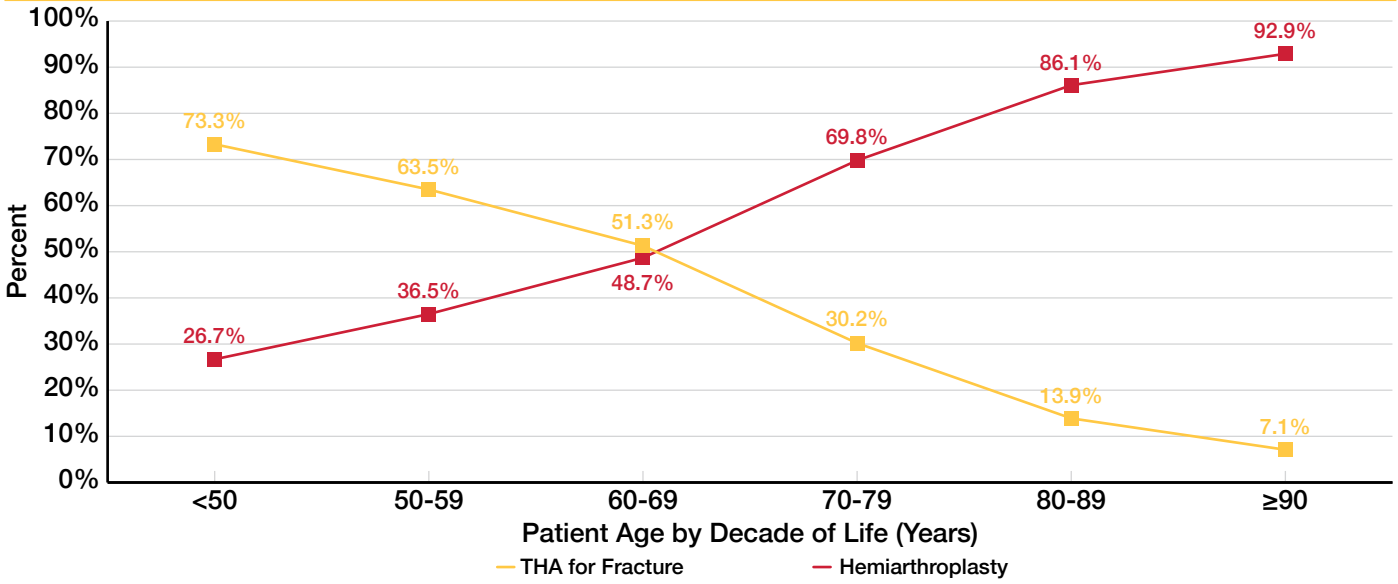
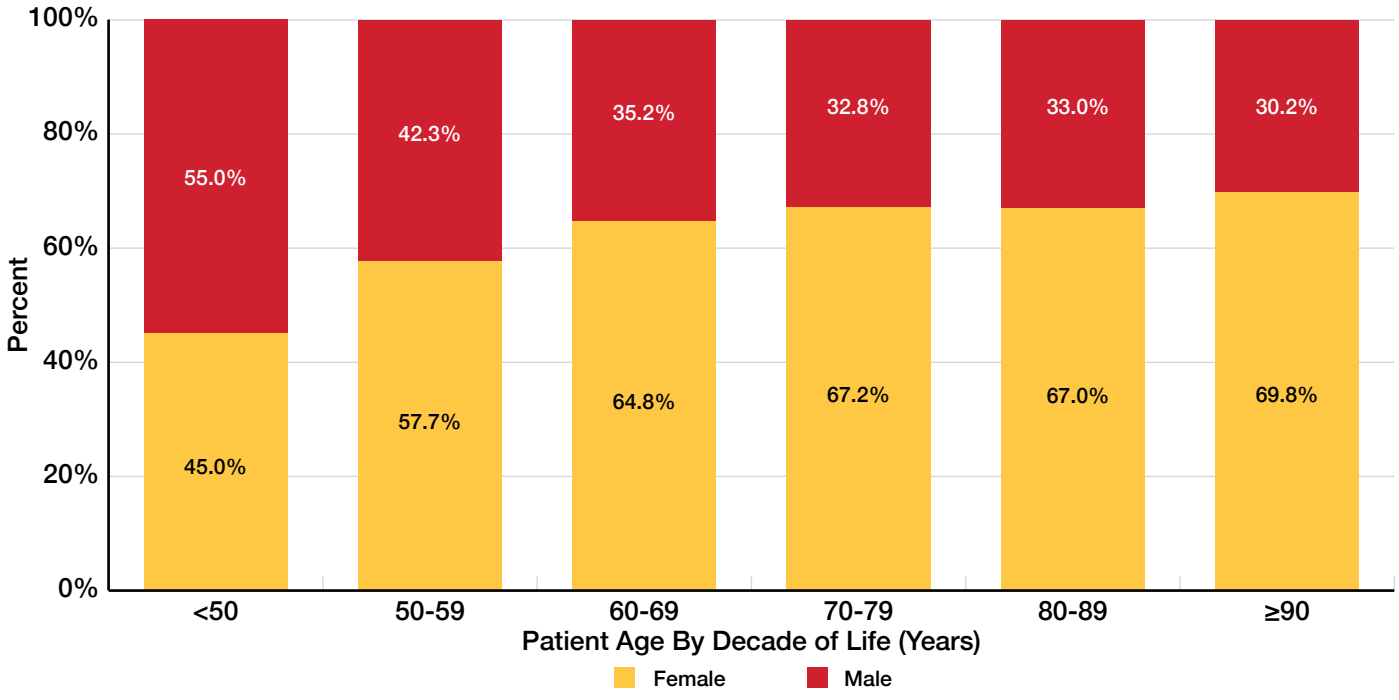


Figure 2.6 Sex Distribution for Total Hip Arthroplasty for Femoral Neck Fracture by Age Group, 2012-2023 (N=43,033)

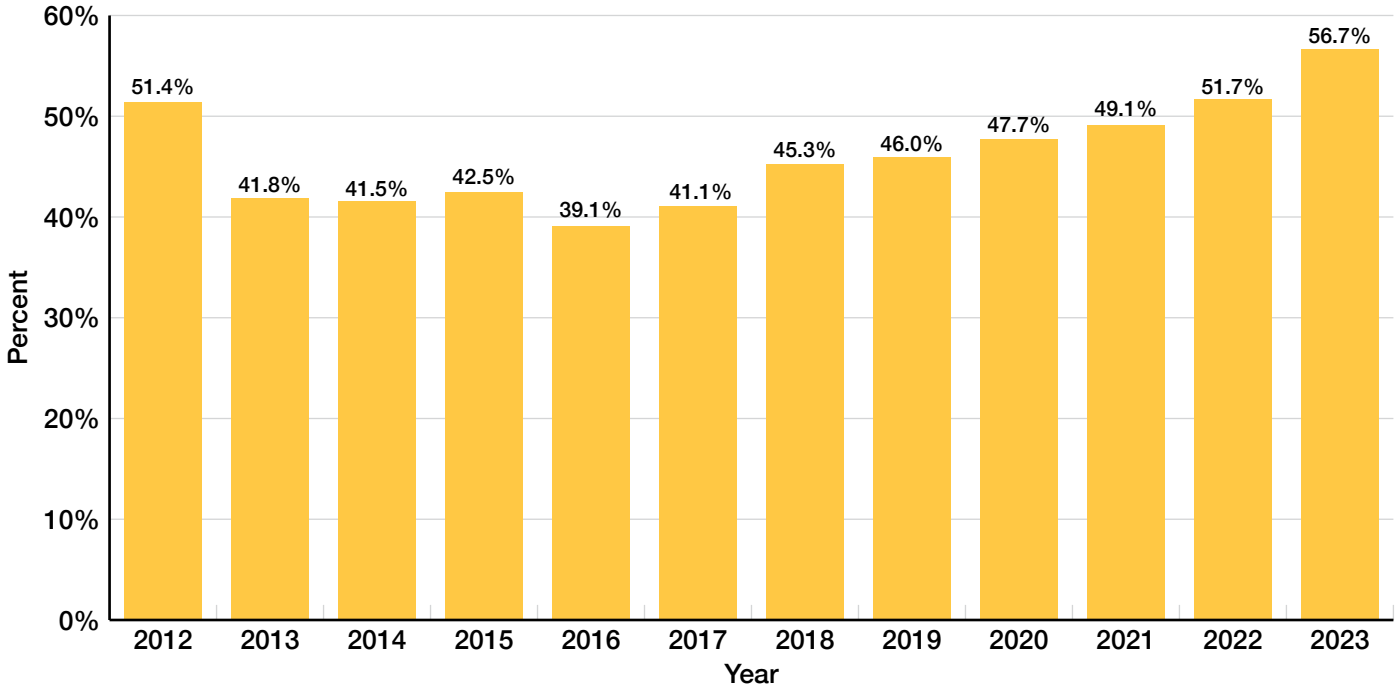


Both cemented and cementless fixation for femoral stems are frequently used in the treatment of femoral neck fractures. Cemented fixation was more commonly utilized for hemiarthroplasty than for total hip arthroplasty. Utilization of cemented fixation for femoral stems has increased for both hemiarthroplasty and total hip arthroplasty for femoral neck fractures over the past seven years.

INSIGHTS

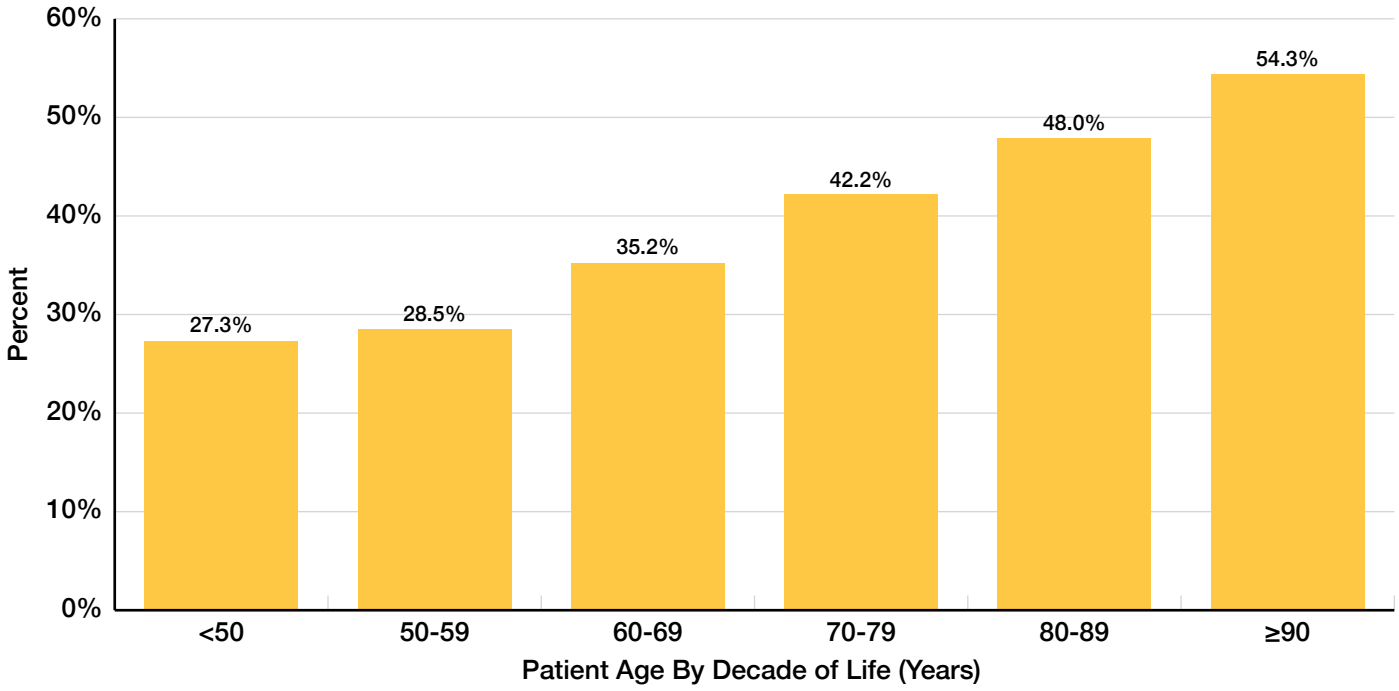
The use of cement for femoral stem fixation in the setting of arthroplasty for femoral neck fracture has continued to increase year after year.

Figure 2.7 Cemented Fixation for Femoral Stems in Total Hip Arthroplasty and Hemiarthroplasty for Femoral Neck Fracture, 2012-2023 (N=52,538)



The trend of cemented femoral component fixation used in hemiarthroplasty for the treatment of FNF has continued to increase in utilization with each advancing decade of life (Figure 2.8). In contrast to the majority of international registries, however, only 52% of the oldest age group received cemented stems.[7-9] Internationally, cemented femoral stem fixation for femoral neck fractures still predominates; in 2022, the U.K. National Joint Registry reported that 81% of all stems used to treat femoral neck fractures were cemented.[8]

Figure 2.8 Percent of Cemented Stem Fixation Used in Hemiarthroplasty for Femoral Neck Fracture by Age Group, 2012-2023 (N=47,188)



Hip Resurfacing

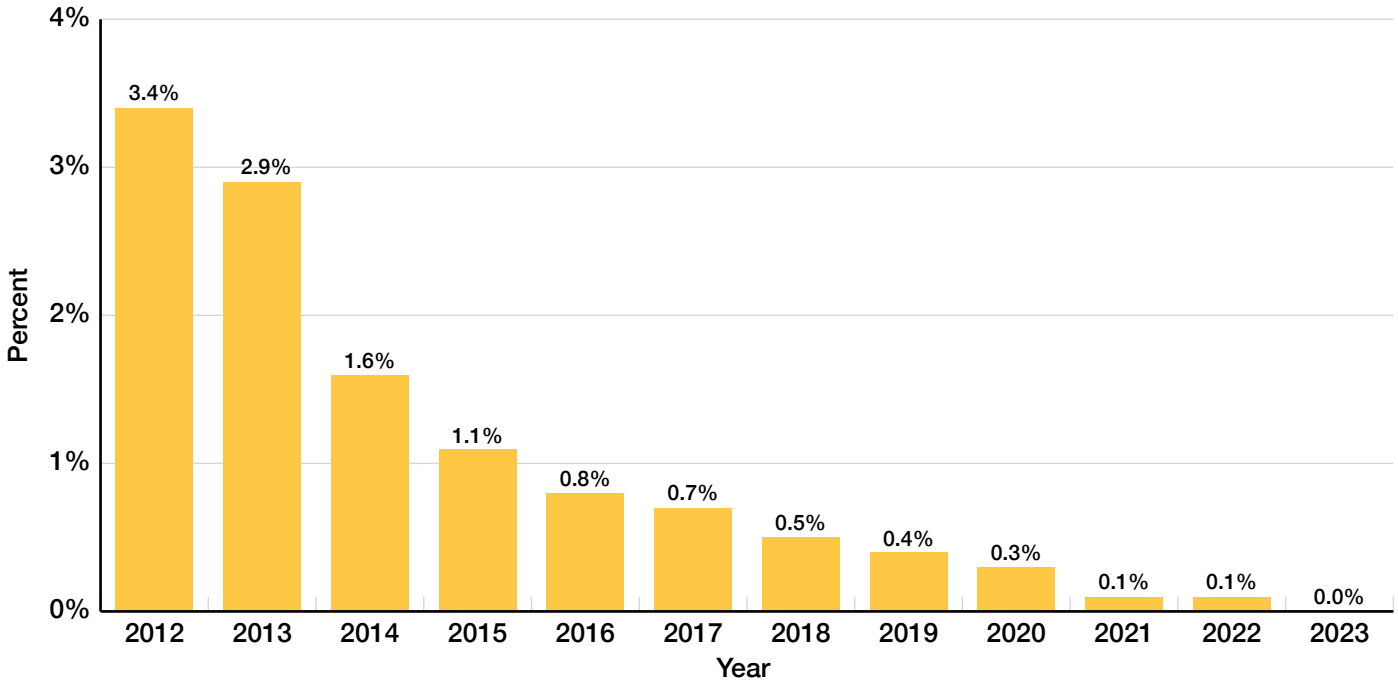
Between 2012 and 2023, AJRR has collected data on 6,756 hip resurfacing procedures.

Hip resurfacing as a percentage of the total number of elective hip arthroplasty procedures submitted to AJRR continues to decline (N=46 in 2022, N=44 in 2023).

Hip resurfacing as a percentage of the total number of elective hip arthroplasty procedures submitted to AJRR continues to decline.

INSIGHTS

Figure 2.9 Hip Resurfacing as a Percentage of Elective Hip Arthroplasty Procedures, 2012-2023 (N=6,756)



Elective Primary Total Hip Arthroplasty

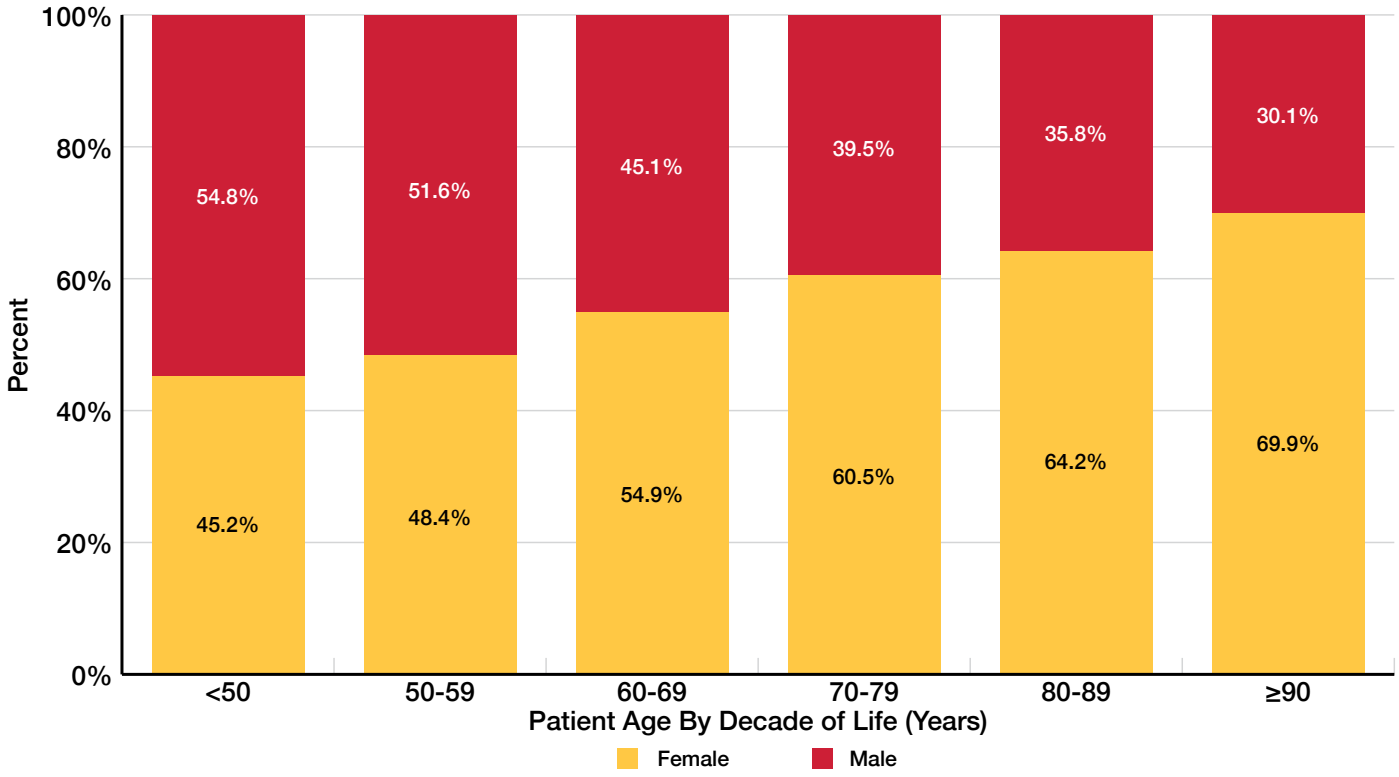
Between 2012 and 2023, AJRR has collected data on 1,199,765 elective primary total hip arthroplasty procedures.

More than half of patients <60 years of age undergoing elective primary total hip arthroplasty were male. After the age of 60, females predominate, and this proportion increases with each additional decade of life (Figure 2.10).

36mm heads continues to be the most used femoral head size which continues the trend since 2012, though this has remained relatively stable over the years. Use of larger (>40mm) head sizes has increased slightly, and smaller (<28mm and 32mm) head sizes have been relatively stable over time.

The use of dual mobility articulations in both primary and revision hip arthroplasty as reported to AJRR increased substantially since 2012 but has seen a slight decrease in utilization from 2021-2022, but has increased in 2023 (Figure 2.11).

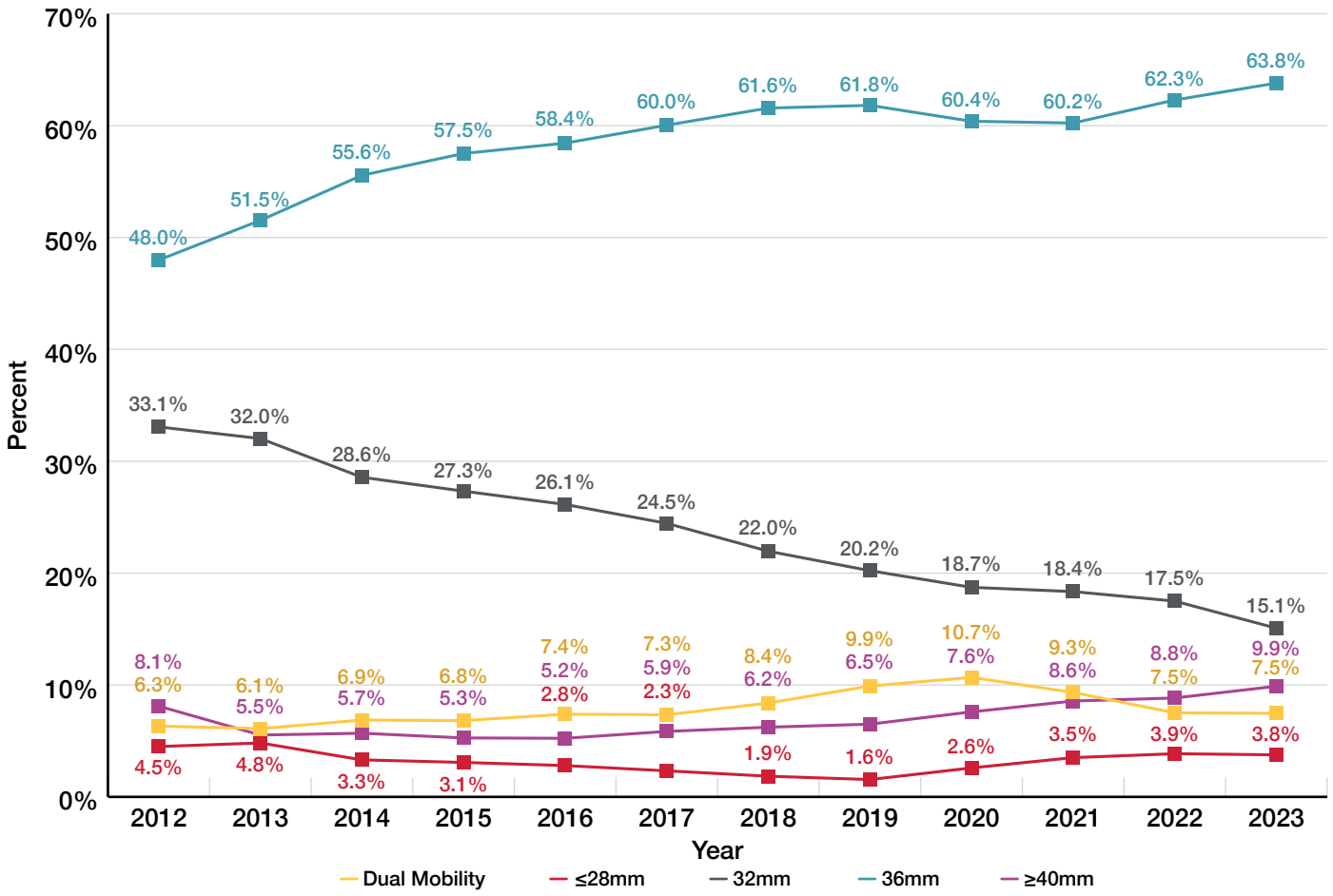
Figure 2.10 Sex Distribution for Elective Primary Total Hip Arthroplasty Procedures by Age Group, 2012-2023 (N=1,199,765)



INSIGHTS

Dual mobility bearing use in elective primary total hip arthroplasty appears to have leveled off whereas large bearings ≥ 40 mm have increased in utilization.

Figure 2.11 Percent Dual Mobility Usage and Femoral Head Sizes Implanted in Elective Primary Total Hip Arthroplasty, 2012-2023 (N=975,075)

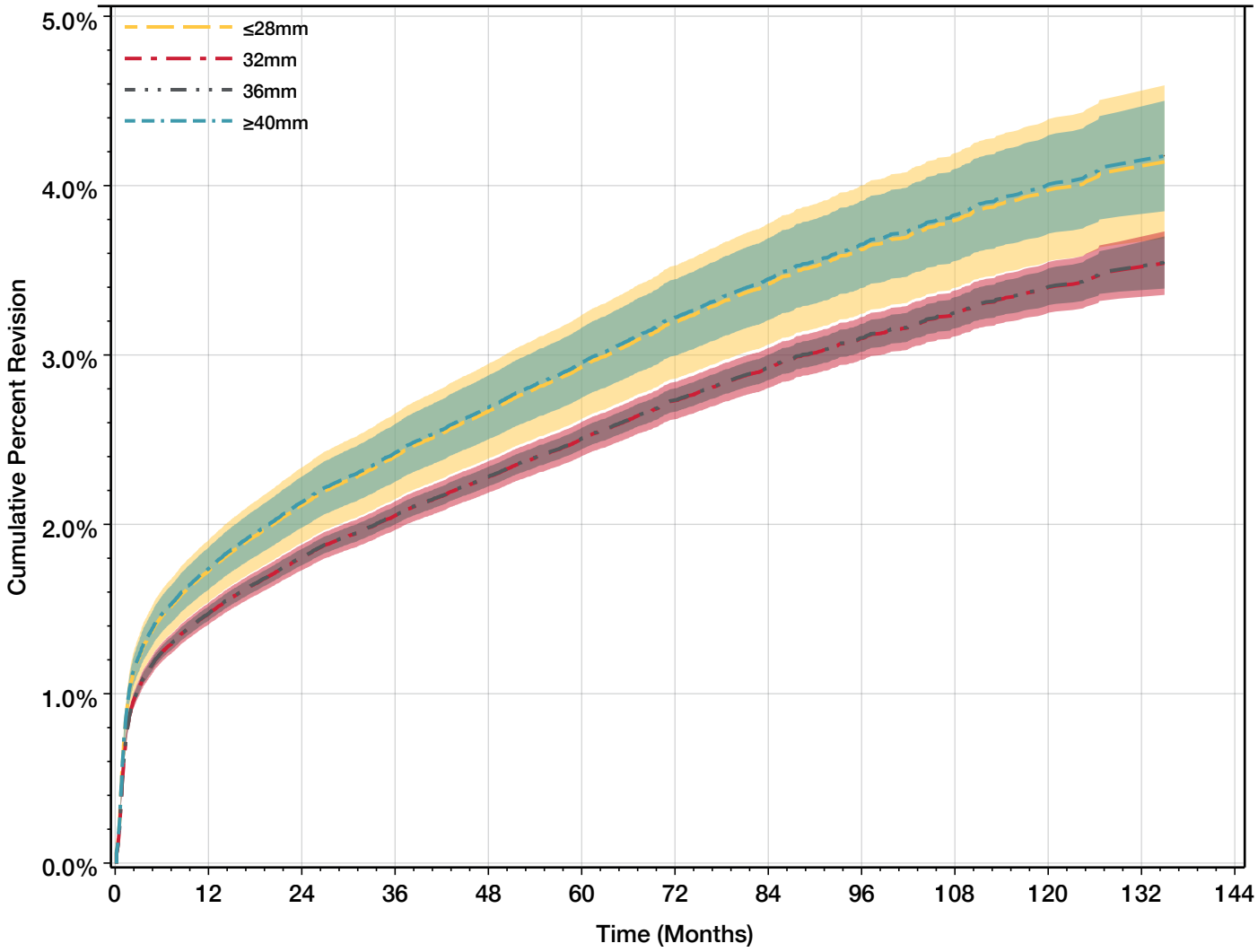


Unless otherwise noted, all survival analyses are limited to Medicare patients aged 65 years and older and merged with available CMS claims data in order to maximize outcome capture of cases performed at non-AJRR reporting institutions. After adjusting for age, sex, and Charlson Comorbidity Index (CCI), the cumulative percent revision rate of elective primary THA cases in patients greater than 65 years of age is higher when utilizing smaller diameter (28mm or less) and larger diameter (40mm and greater) femoral heads compared to those procedures utilizing 36mm femoral heads (Figure 2.12). The 32mm and 36mm heads were not found to be statistically different. These differences may reflect different underlying baseline risk in patients who received smaller or larger diameter heads. The cumulative percent revision rate did not differ between 32 and 36mm heads.

Similar to previous years, the cumulative percent revision rate of elective primary THA cases in patients greater than 65 years of age is higher when utilizing smaller diameter (28mm or less) and larger diameter (40mm and greater) femoral heads compared to those procedures utilizing 36mm femoral heads. The 32mm and 36mm heads were not found to be statistically different.

INSIGHTS

Figure 2.12 Cumulative Percent Revision for Diameter of Femoral Heads for Elective Primary Total Hip Arthroplasty in Medicare Patients 65 Years of Age and Older with Primary Osteoarthritis, 2012-2023



Number at Risk (Months)	0	12	24	36	48	60	72	84	96	108	120	132	144
≤28mm	12,768	10,545	8,401	6,824	5,724	4,936	4,033	2,972	1,965	1,198	619	167	1
32mm	102,943	92,536	81,950	72,724	63,818	52,595	40,886	28,359	17,377	9,818	4,407	1,289	6
36mm	288,180	248,150	211,557	181,459	153,188	119,356	86,938	56,899	32,691	17,213	6,918	1,968	6
≥40mm	32,249	26,517	21,645	17,779	14,466	11,045	7,897	5,139	3,053	1,697	784	302	1
Total	436,140	377,748	323,553	278,786	237,196	187,932	139,754	93,369	55,086	29,926	12,728	3,726	14

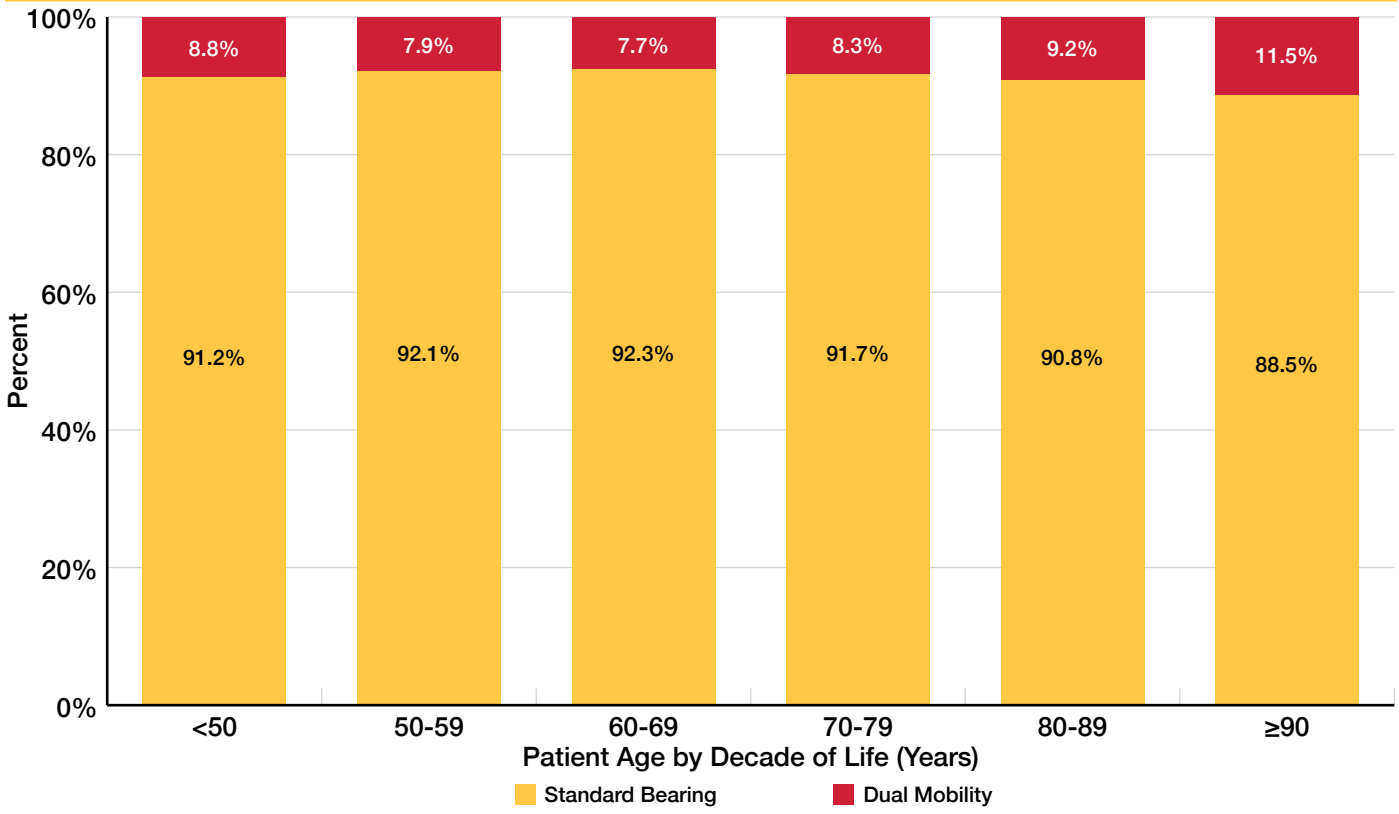
Age/Sex/CCI adjusted HR (95%CI), p-value
32mm vs. 36mm:0.999(0.95,1.05), p=0.9644; ≤28mm vs. 36mm:1.172(1.047,1.311), p=0.0056; ≥40mm vs. 36mm:1.182(1.092,1.278), p<.0001

Dual mobility bearing use in elective primary total hip arthroplasty appears to have leveled off whereas large bearings ≥ 40 mm have increased in utilization. The increase in popularity over time of larger diameter bearings and dual mobility may be explained by the perception of increased stability and reduced risk of dislocation.[11] Dual mobility constructs are used most commonly in the oldest (>90 years) in the older patients (Figure 2.13).

INSIGHTS

As a percentage of overall bearings, dual mobility constructs are used most commonly in older patients.

Figure 2.13 Dual Mobility Usage as a Percent of all Elective Primary Total Hip Arthroplasty Procedures by Age Group, 2012-2023 (N=975,075)

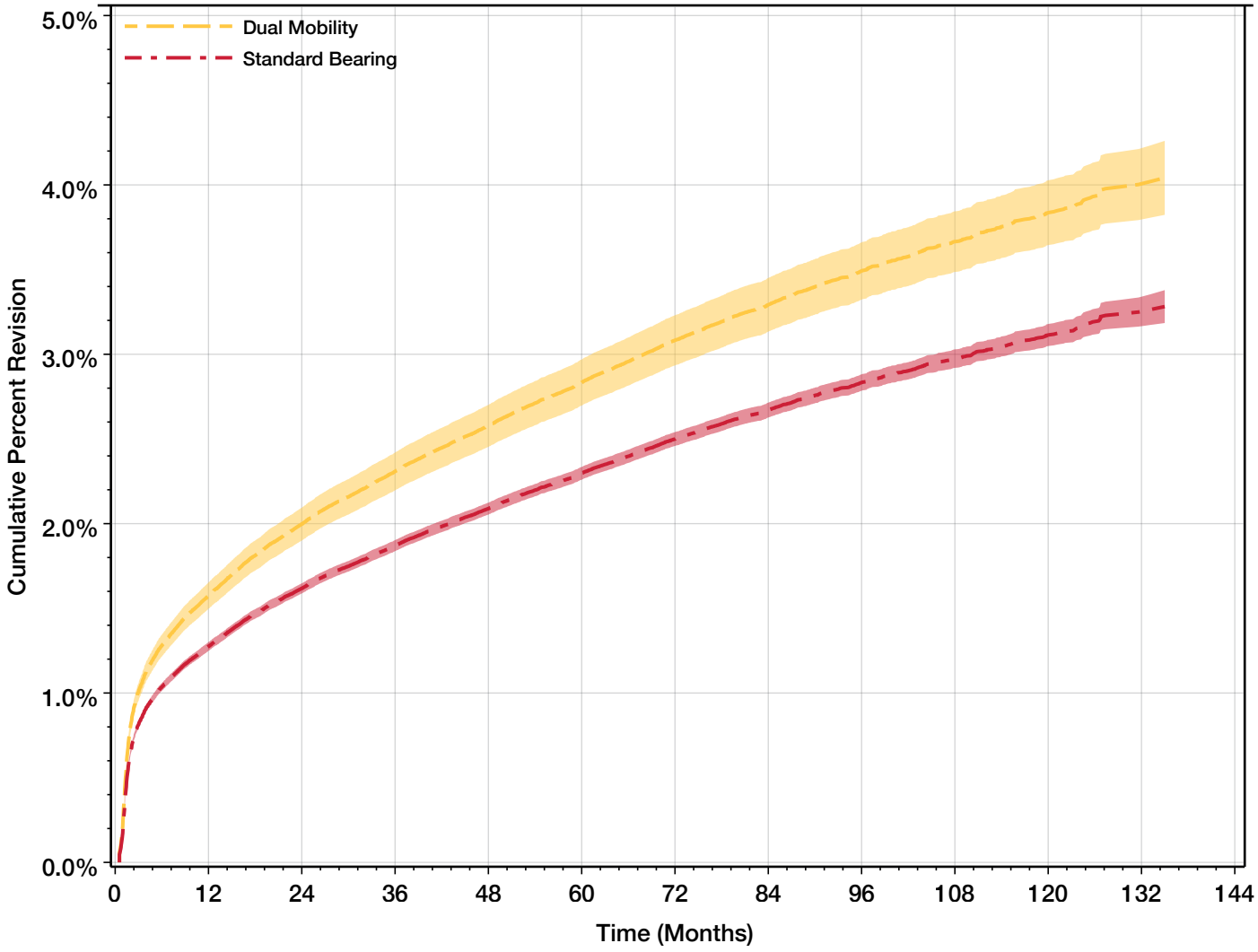


As reported to AJRR for all ages, there was increased revision when comparing dual mobility to conventional femoral head usage for elective primary total hip arthroplasty procedures after adjusting for age, sex, and CCI (HR=1.2, 95% CI, 1.2 - 1.3, p<0.0001) (Figure 2.14). Findings were similar when looking at patients ≥65 years of age as reported to either AJRR or CMS (Figure 2.15). As previously noted, this represents an association rather than a causal relationship and does not account for potential confounders, such as the patient's inherent risk of dislocation.

A higher cumulative incidence of revision surgery is associated with dual mobility bearings when compared to conventional femoral heads for elective primary total hip arthroplasty procedures, which may reflect confounding based on patient characteristics and baseline risk for dislocation.

INSIGHTS

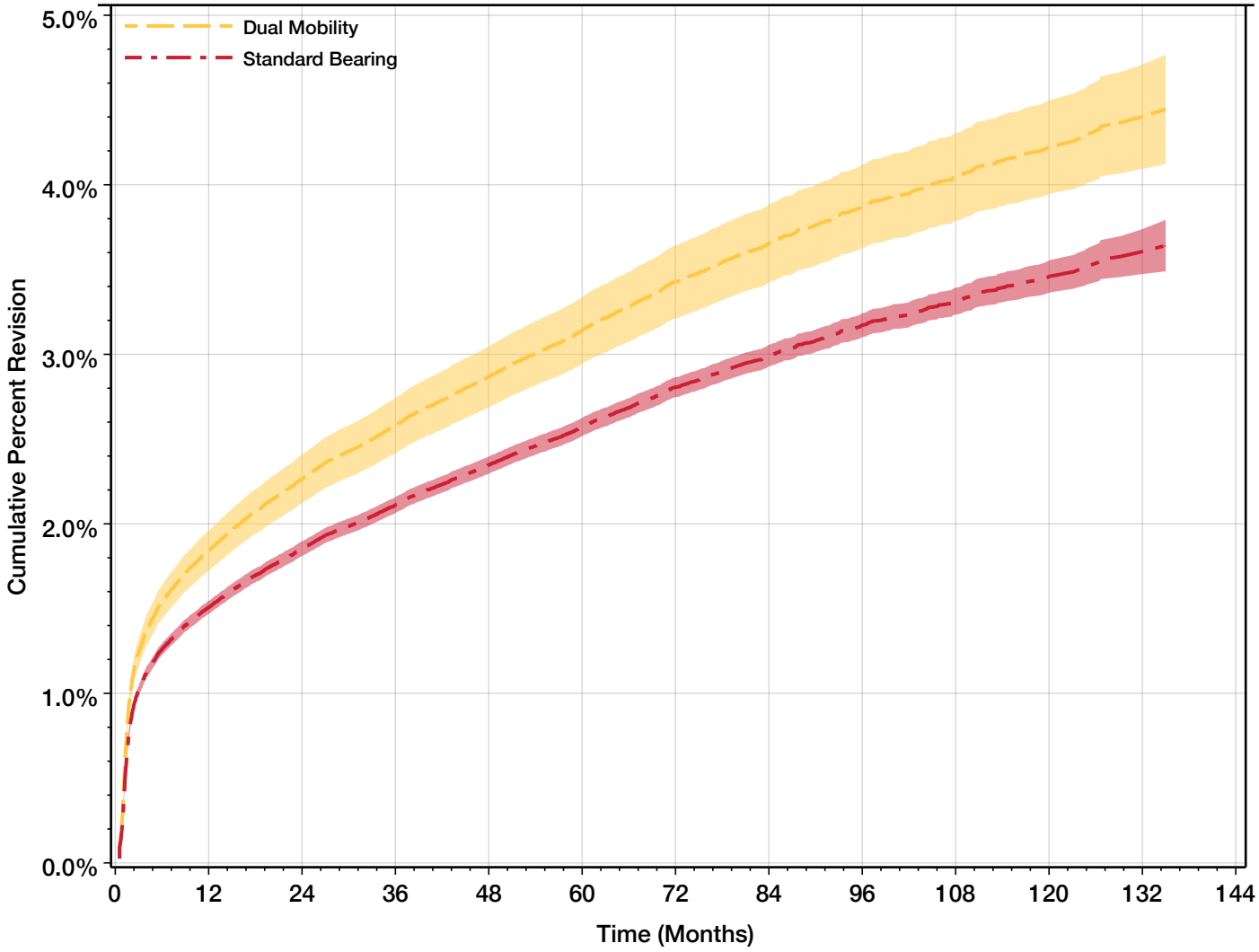
Figure 2.14 Cumulative Percent Revision for Dual Mobility Used for Elective Primary Total Hip Arthroplasty for Patients with Primary Osteoarthritis as Submitted Only to AJRR, 2012-2023



Number at Risk (Months)	0	12	24	36	48	60	72	84	96	108	120	132	144
Dual Mobility	63,477	52,869	45,078	37,712	30,475	22,674	16,097	10,612	6,177	3,332	1,461	513	4
Standard Bearing	701,515	633,836	576,775	520,217	453,478	364,858	277,489	192,310	116,984	64,853	27,944	8,191	1
Total	764,992	686,705	621,853	557,929	483,953	387,532	293,586	202,922	123,161	68,185	29,405	8,704	5

Age/Sex/CCI adjusted HR (95%CI), p-value
Dual Mobility vs. Standard Bearing:1.238(1.172,1.308), p<.0001

Figure 2.15 Cumulative Percent Revision for Dual Mobility Used for Elective Primary Total Hip Arthroplasty for Medicare Patients 65 Years of Age and Older with Primary Osteoarthritis, 2012-2023



Number at Risk (Months)	0	12	24	36	48	60	72	84	96	108	120	132	144
Dual Mobility	33,117	28,175	23,666	19,356	15,342	11,059	7,534	4,750	2,627	1,327	567	182	1
Standard Bearing	369,008	336,306	304,666	272,719	235,984	187,337	139,718	93,908	55,494	30,151	12,773	3,674	14
Total	402,125	364,481	328,332	292,075	251,326	198,396	147,252	98,658	58,121	31,478	13,340	3,856	15

Age/Sex/CCI adjusted HR (95%CI), p-value
Dual Mobility vs. Standard Bearing:1.228(1.144,1.319), p<.0001

For all elective primary total hip arthroplasty procedures, ceramic head usage has continued to increase over the years to become the most commonly used femoral head material (Figure 2.16). This increase in ceramic head use is likely explained by concerns over trunnion and taper corrosion more commonly seen with cobalt-chromium (CoCr) heads.[12] CoCr femoral heads are used more commonly in patients >70 years of age, but ceramic still predominates across age groups accounting for more than 65% of patients older than 90 (Figure 2.17). Over the last decade, ceramic on polyethylene (CoP) has consistently risen in its application while metal on polyethylene (MoP) combinations have declined. Dual-mobility systems and ceramicized metal on polyethylene (CMoP) combinations have increased in utilization in elective primary hip arthroplasty, but appear to have stabilized in recent years (Figure 2.18a).

INSIGHTS

The use ceramic heads continue to increase year after year.

Figure 2.16 Composition of Femoral Heads for All Elective Primary Total Hip Arthroplasty Procedures Excluding Dual Mobility by Year, 2012-2023 (N=882,277)

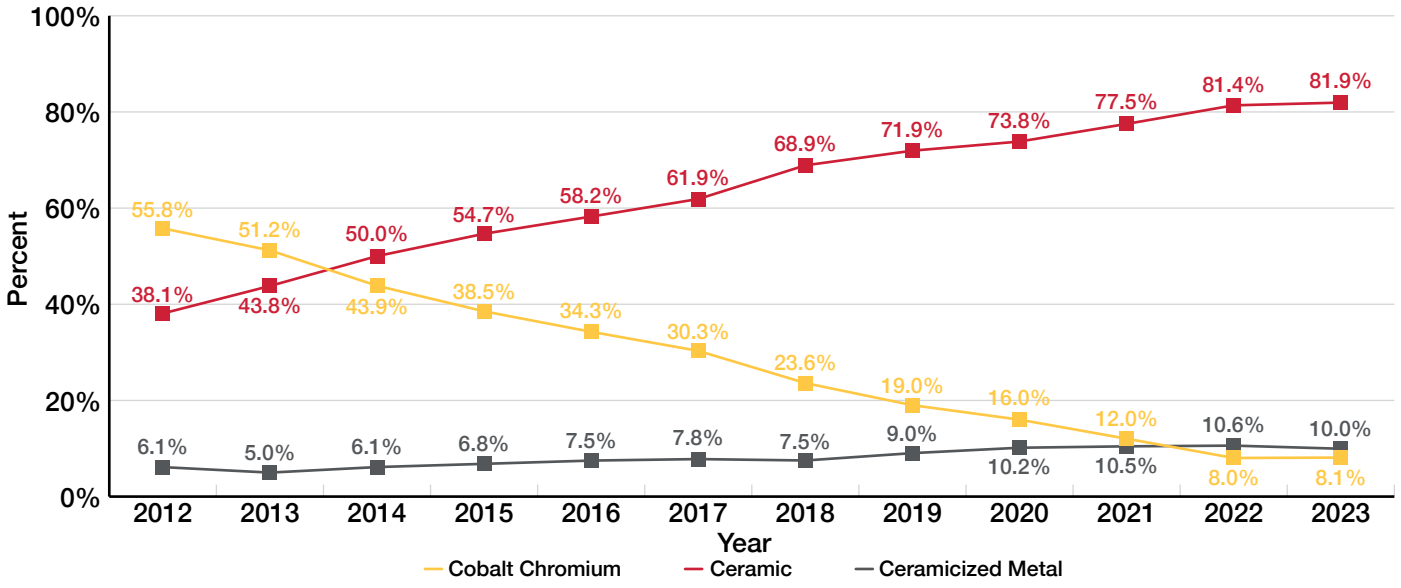


Figure 2.17 Composition of Femoral Heads for All Elective Primary Total Hip Arthroplasty Procedures Excluding Dual Mobility by Age Group,2023 (N=110,463)

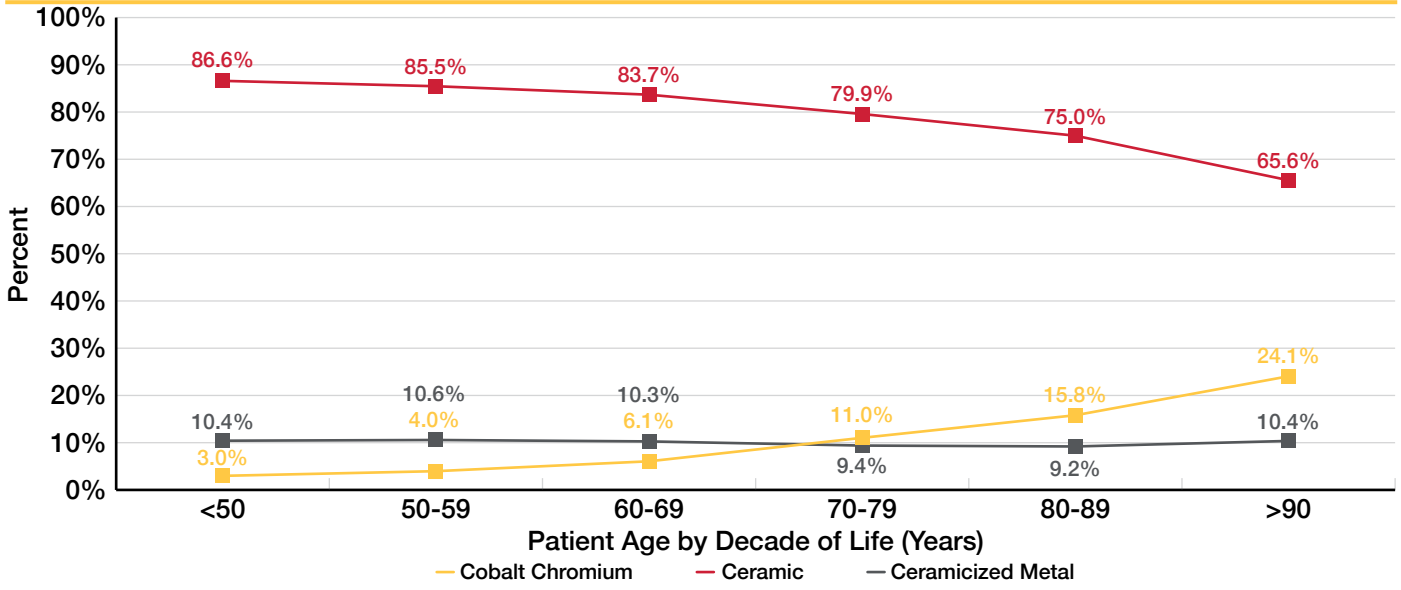
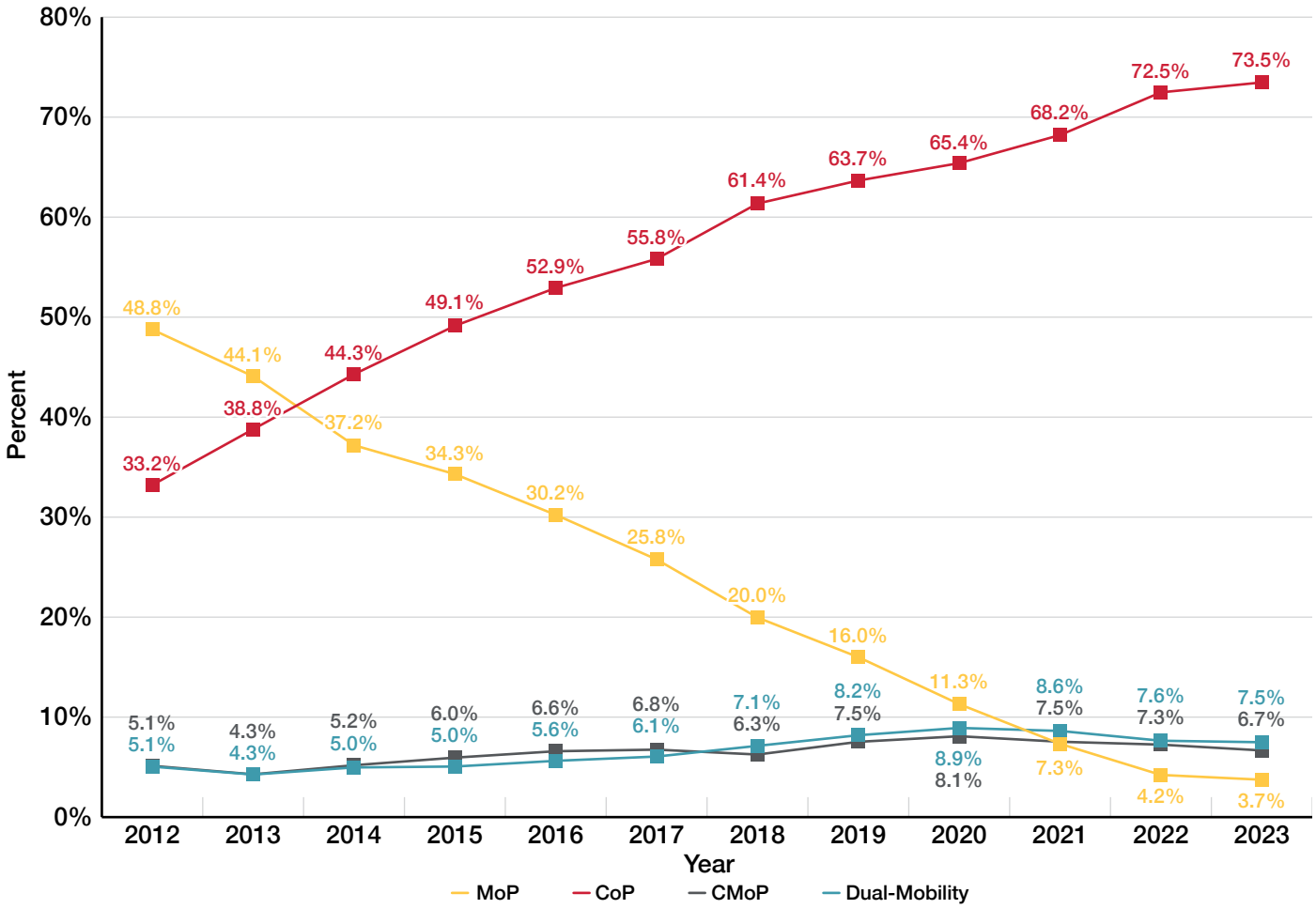


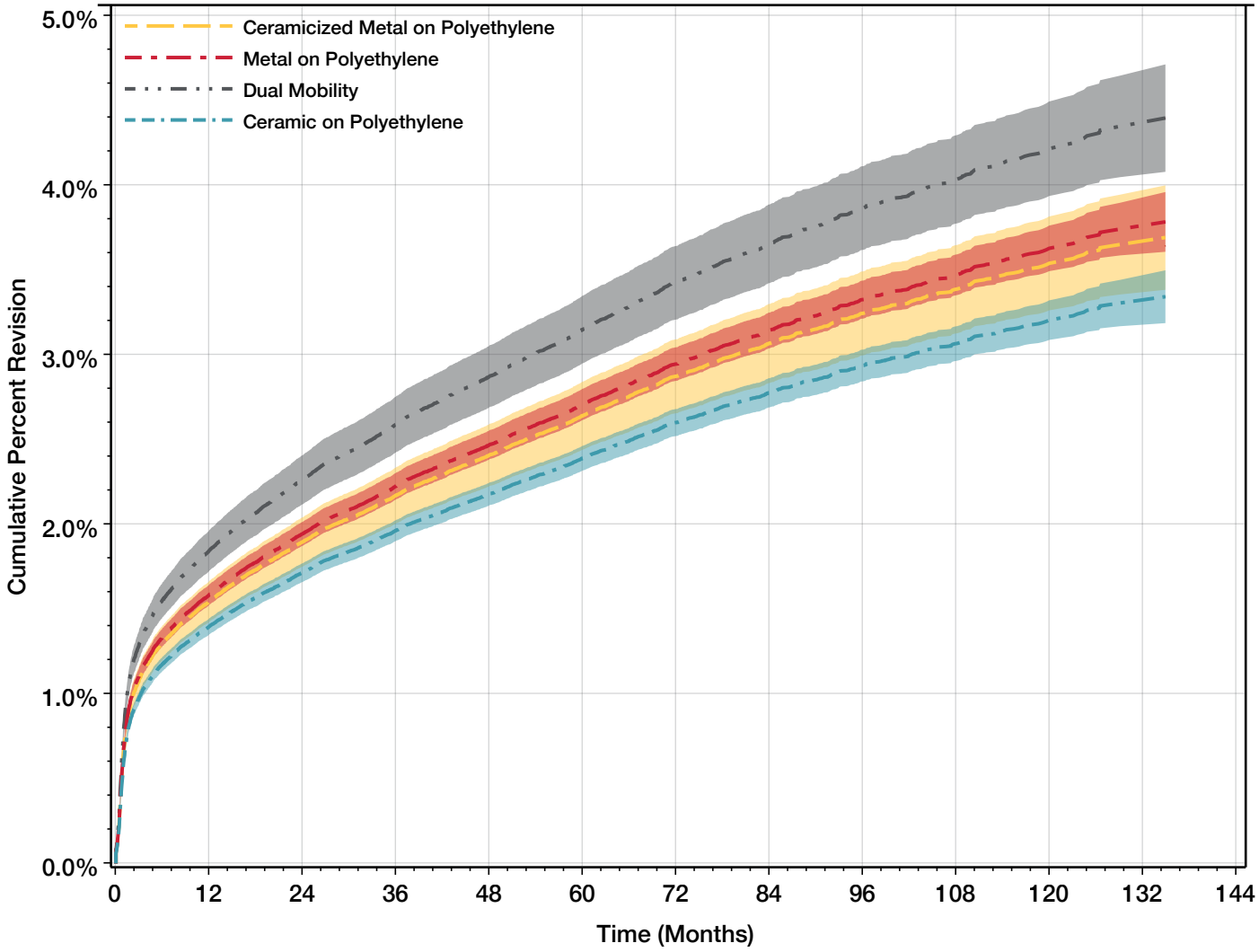
Figure 2.18a Elective Primary Total Hip Arthroplasty Bearing Surface Materials by Year, 2012-2023 (N=1,042,970)



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
Total N	14,267	29,749	53,713	71,744	98,114	110,853	113,094	112,903	94,899	98,453	117,582	127,599	1,042,970

For both cobalt chromium and ceramic heads used by surgeons in the AJRR cohort, highly cross-linked polyethylene has consistently been more commonly utilized compared to antioxidant polyethylene for all elective primary total hip arthroplasty procedures (Figures 2.19). The threshold for classification of a polyethylene liner as highly cross-linked polyethylene is a total radiation dose of 50 kGy (5 Mrad) or more. Antioxidant polyethylene is defined as a highly cross-linked polyethylene liner with an antioxidant component infused or blended in manufacturing. The use of antioxidant polyethylene has continued to derease since 2019. The use of conventional polyethylene (UHMWPE) in the AJRR primary total hip arthroplasty cohort has nearly vanished with <1.0% of annual cases, as surgeons have almost entirely moved to either highly cross-linked or antioxidant polyethylene alternatives. Highly cross-linked polyethylene showed a slightly lower cumulative percent revision rate compared to antioxidant polyethylene after adjusting for age, sex, and CCI (Figure 2.20).

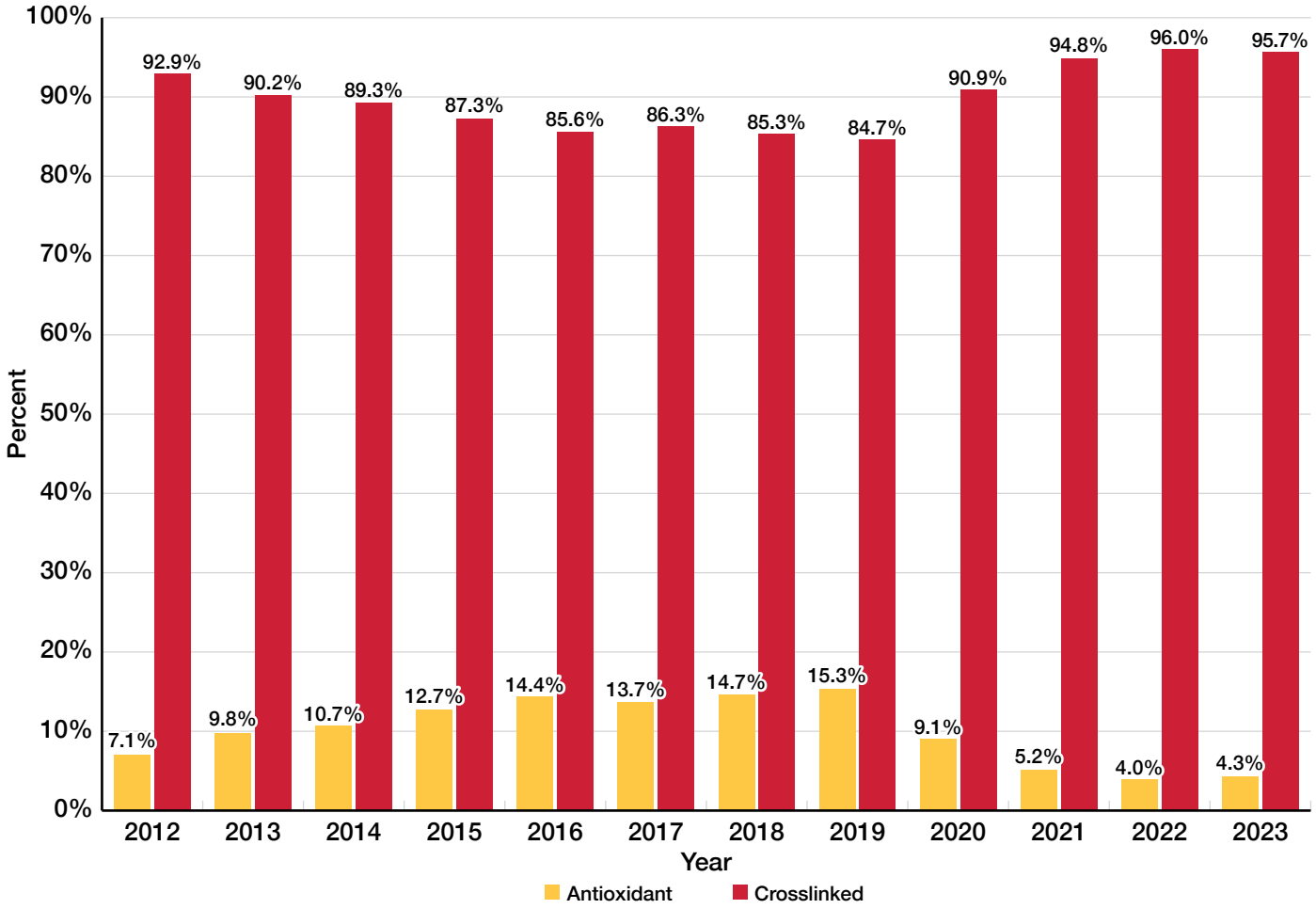
Figure 2.18b Cumulative Percent Revision for Bearing Surface Materials Used for Elective Primary Total Hip Arthroplasty for Medicare Patients 65 Years of Age and Older with Primary Osteoarthritis, 2012-2023



Number at Risk (Months)	0	12	24	36	48	60	72	84	96	108	120	132	144
Dual Mobility	191,122	171,828	153,319	134,760	112,951	84,452	58,285	36,143	19,208	9,330	3,270	776	3
Standard Bearing	28,443	24,224	19,902	16,437	13,195	9,648	6,897	4,225	2,234	1,027	348	107	1
Dual Mobility	33,117	28,175	23,666	19,356	15,342	11,059	7,534	4,750	2,627	1,327	567	182	1
Standard Bearing	121,353	115,723	110,750	104,141	95,336	82,431	67,170	48,782	31,018	17,958	8,410	2,613	11
Total	374,035	339,950	307,637	274,694	236,824	187,590	139,886	93,900	55,087	29,642	12,595	3,678	16

Age/Sex/CCI adjusted HR (95%CI), p-value
Ceramicized Metal on Polyethylene vs. Ceramic on Polyethylene:1.107(1.015,1.207), p=0.0214; Dual Mobility vs. Ceramic on Polyethylene:1.324(1.228,1.427), p<.0001; Metal on Polyethylene vs. Ceramic on Polyethylene:1.135(1.082,1.191), p<.0001

Figure 2.19 Elective Primary Total Hip Arthroplasty Liner Polyethylene Material by Year, 2012-2023 (N=795,294)

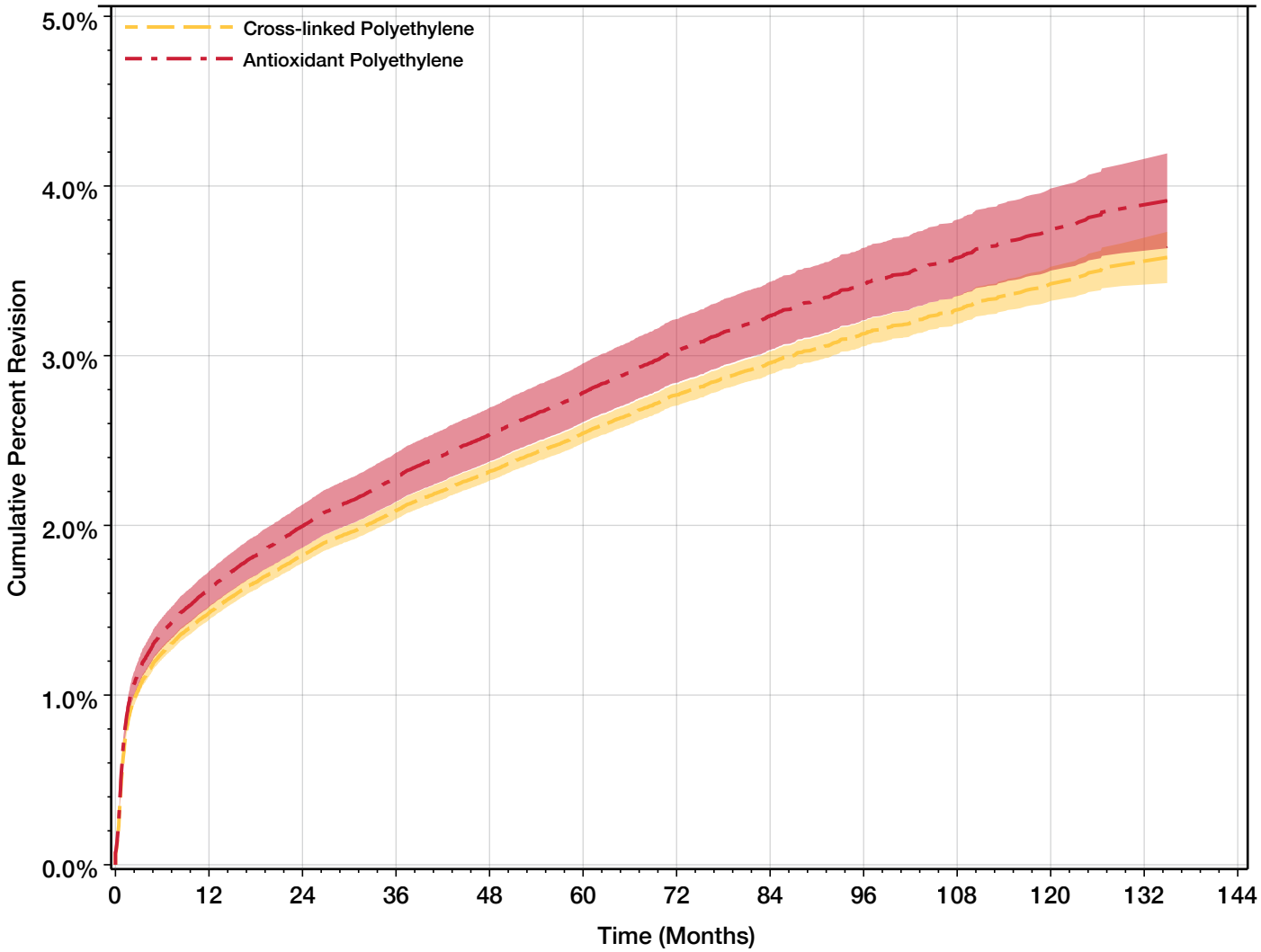


	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
Total N	12,778	27,572	50,142	68,106	92,269	101,422	101,391	99,489	72,329	57,745	55,811	56,240	795,294

INSIGHTS

Highly cross-linked and antioxidant polyethylene showed no statistical difference in cumulative percent revision after adjusting for age, sex, and CCI.

Figure 2.20 Cumulative Percent Revision for Liner Materials Used for Elective Primary Total Hip Arthroplasty for Medicare Patients 65 Years of Age and Older with Primary Osteoarthritis, 2012-2023



Number at Risk (Months)	0	12	24	36	48	60	72	84	96	108	120	132	144
Antioxidant Polyethylene	34,345	32,794	31,547	29,958	27,013	20,591	14,603	9,356	4,869	2,387	910	252	1
Cross-linked Polyethylene	330,678	300,379	271,411	241,913	207,966	165,658	124,397	83,982	49,849	27,007	11,524	3,335	14
Total	365,023	333,173	302,958	271,871	234,979	186,249	139,000	93,338	54,718	29,394	12,434	3,587	15

Age/Sex/CCI adjusted HR (95%CI), p-value
Cross-linked Polyethylene vs. Antioxidant Polyethylene:0.913(0.851,0.979), p=0.0103

INSIGHTS

In 2023, 5% of femoral stems were cemented in elective primary total hip arthroplasty, which represents the highest percentage utilization since the inception of AJRR.

Cementless femoral component fixation for elective primary total hip arthroplasty dramatically outweighs the use of cemented fixation in the AJRR population. From 2012-2023, only 3.82% of all elective primary total hip arthroplasty procedures in AJRR utilized cemented femoral component fixation. However there has been a very slight increase in cemented femoral fixation in recent years, increasing to 5.09% in 2023 (Figure 2.22).

Figure 2.21 Cemented and Cementless Femoral Stem Fixation in Elective Primary Total Hip Arthroplasty Procedures by Age Group, 2023 (N=91,872)

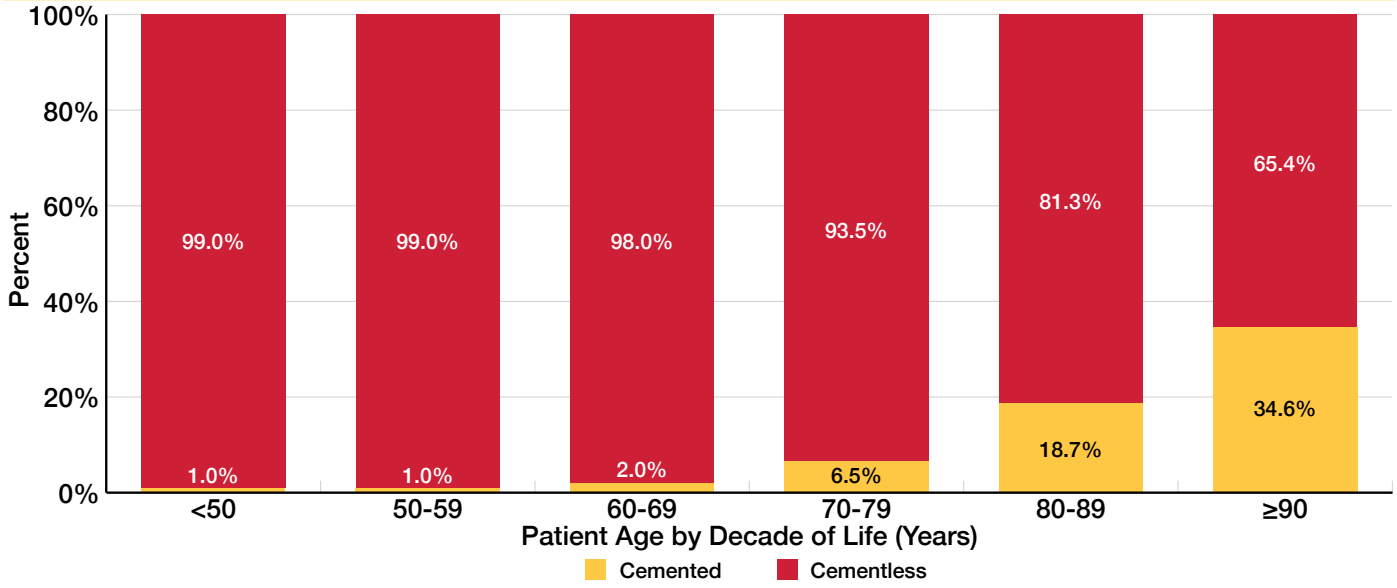
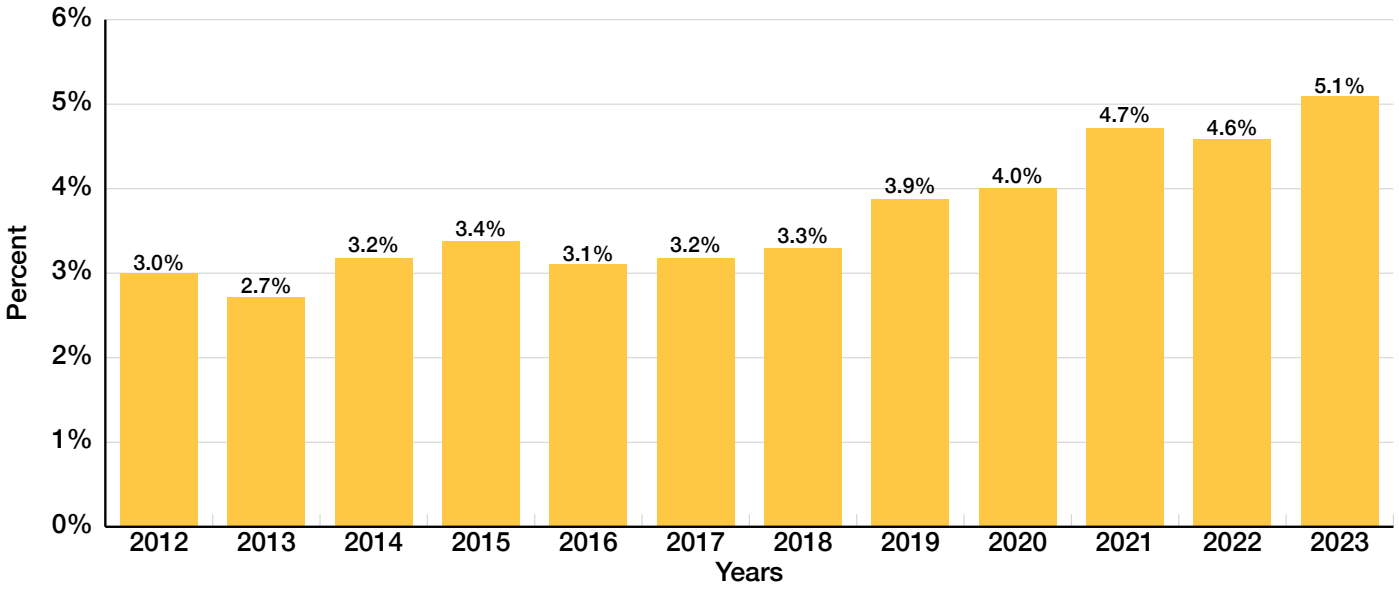


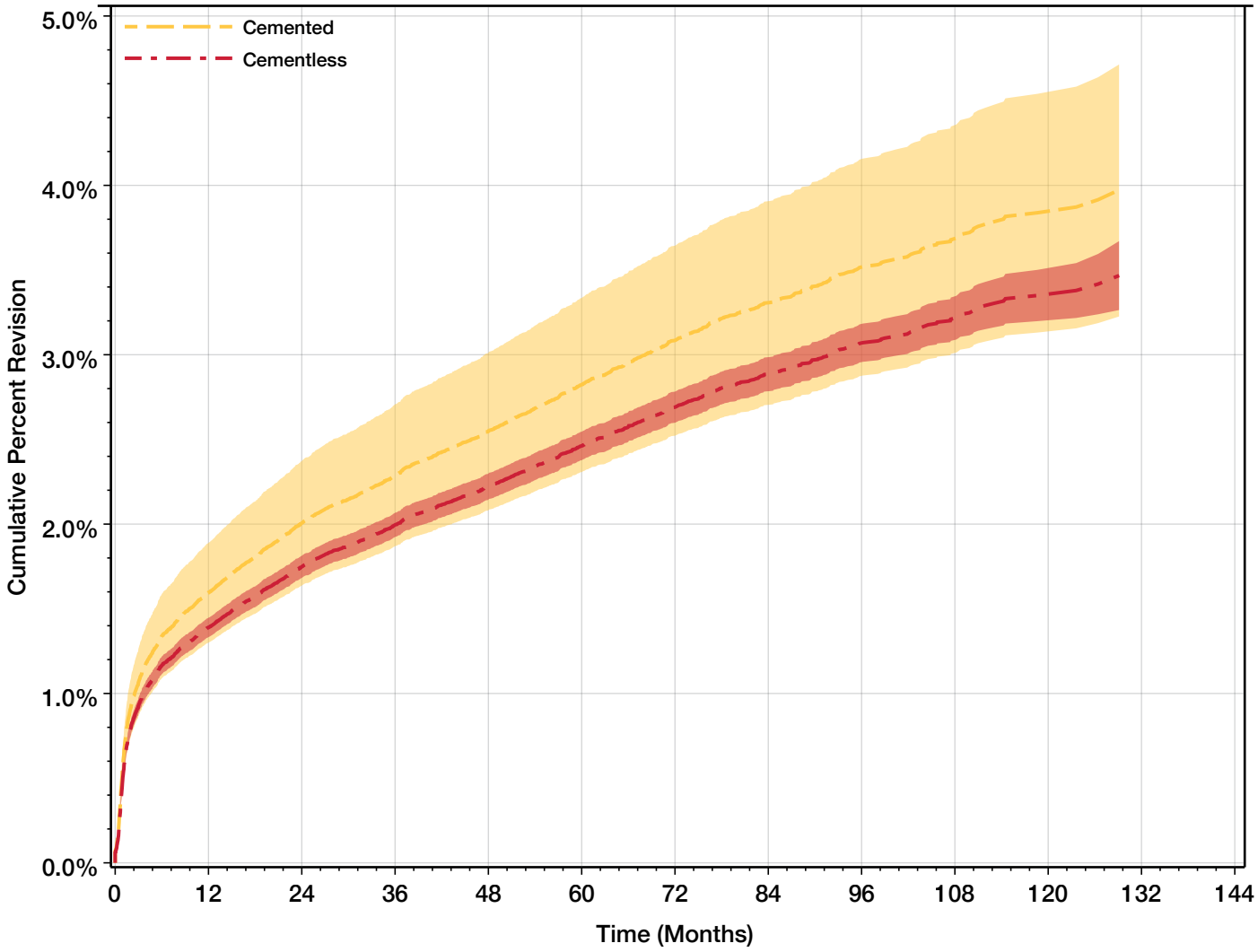
Figure 2.22 Cemented Femoral Stem Fixation in Elective Primary Total Hip Arthroplasty Procedures, 2012-2023 (N=33,747)



The use of cemented femoral component fixation in the AJRR remains lower than that seen in international registries. The 2023 Annual Report for the National Joint Registry reported much higher use of cemented femoral component fixation across all age groups (29.8%).[8] The Australian Orthopaedic Association National Joint Replacement Registry also reports a higher use of cemented fixation compared to AJRR, although the use of cementless stem fixation has been increasing from 51.3% in 2003 to 61.9% in 2022.[7] In their 2023 Annual Report, the Swedish Arthroplasty Register noted that the proportion of cemented prostheses in that year was 52%. They also commented that completely cementless fixation has been increasing from 5% in 2000 to 33% in 2022.[9]

When examining cumulative percent revision of cementless versus cemented femoral component fixation for patients ≥65 years of age as reported to either AJRR or CMS, cemented femoral components had statistically equivalent cumulative percent revision in males but significantly lower cumulative percent revision in females (Figures 2.23-2.24). It is important to note this does not account for potential confounders that were not examined.

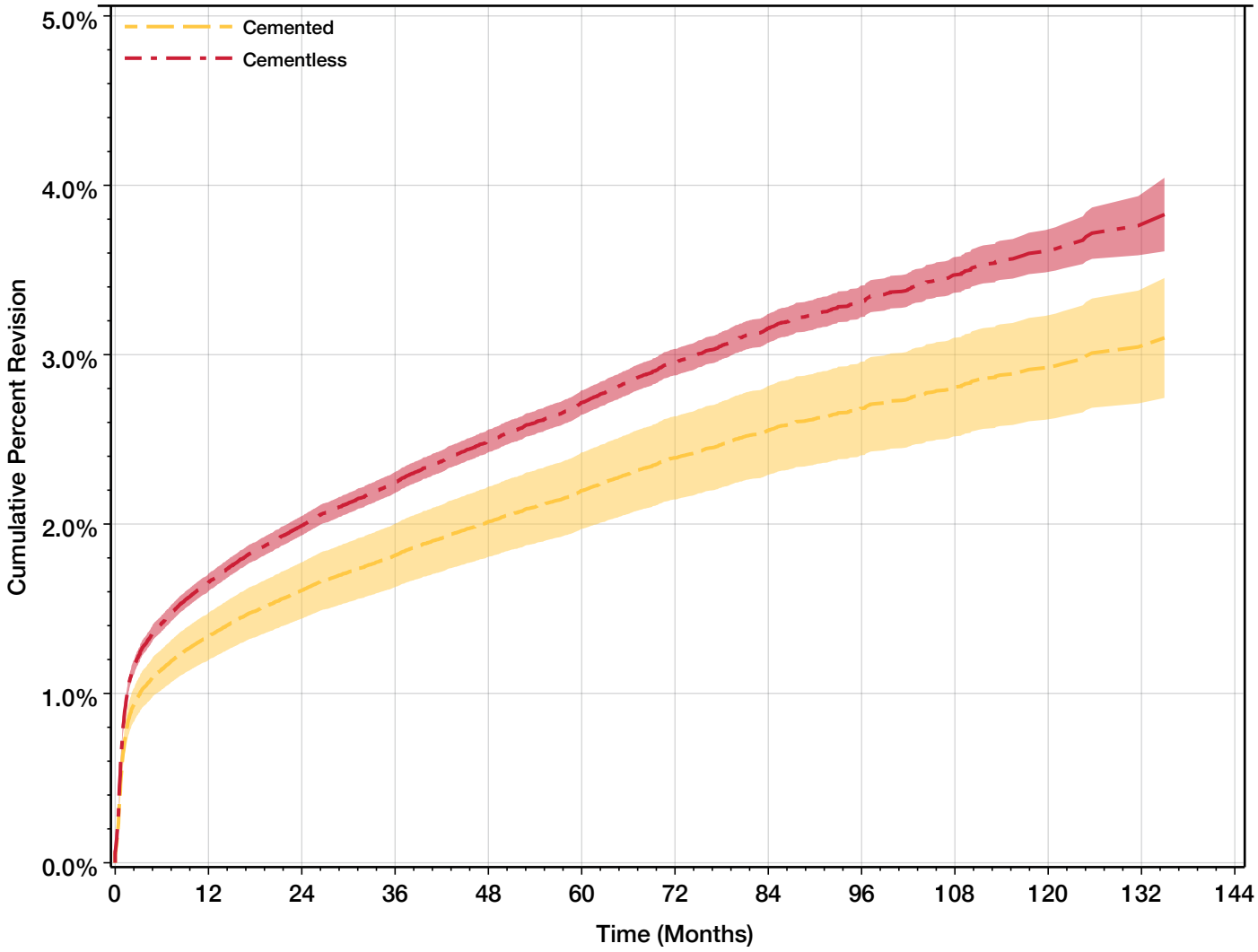
Figure 2.23 Cumulative Percent Revision for Femoral Stem Fixation Used for Elective Primary Total Hip Arthroplasty for Male Medicare Patients 65 Years of Age and Older with Primary Osteoarthritis, 2012-2023



Number at Risk (Months)	0	12	24	36	48	60	72	84	96	108	120	132	144
Cemented	4,068	3,470	2,917	2,361	1,925	1,453	1,072	722	388	178	66	23	1
Cementless	162,320	143,002	123,675	106,835	91,024	72,318	53,852	35,848	21,208	11,474	4,865	1,413	3
Total	166,388	146,472	126,592	109,196	92,949	73,771	54,924	36,570	21,596	11,652	4,931	1,436	4

Age/CCI adjusted HR (95%CI), p-value
Cemented vs. Cementless:1.149(0.946,1.396) p=0.1601

Figure 2.24 Cumulative Percent Revision for Femoral Stem Fixation Used for Elective Primary Total Hip Arthroplasty for Female Medicare Patients 65 Years of Age and Older with Primary Osteoarthritis, 2012-2023



Number at Risk (Months)	0	12	24	36	48	60	72	84	96	108	120	132	144
Cemented	18,246	15,575	12,967	10,569	8,656	6,562	4,707	3,113	1,776	861	332	120	1
Cementless	237,862	209,694	182,539	158,488	136,166	108,492	80,918	54,502	32,334	17,629	7,531	2,181	10
Total	256,108	225,269	195,506	169,057	144,822	115,054	85,625	57,615	34,110	18,490	7,863	2,301	11

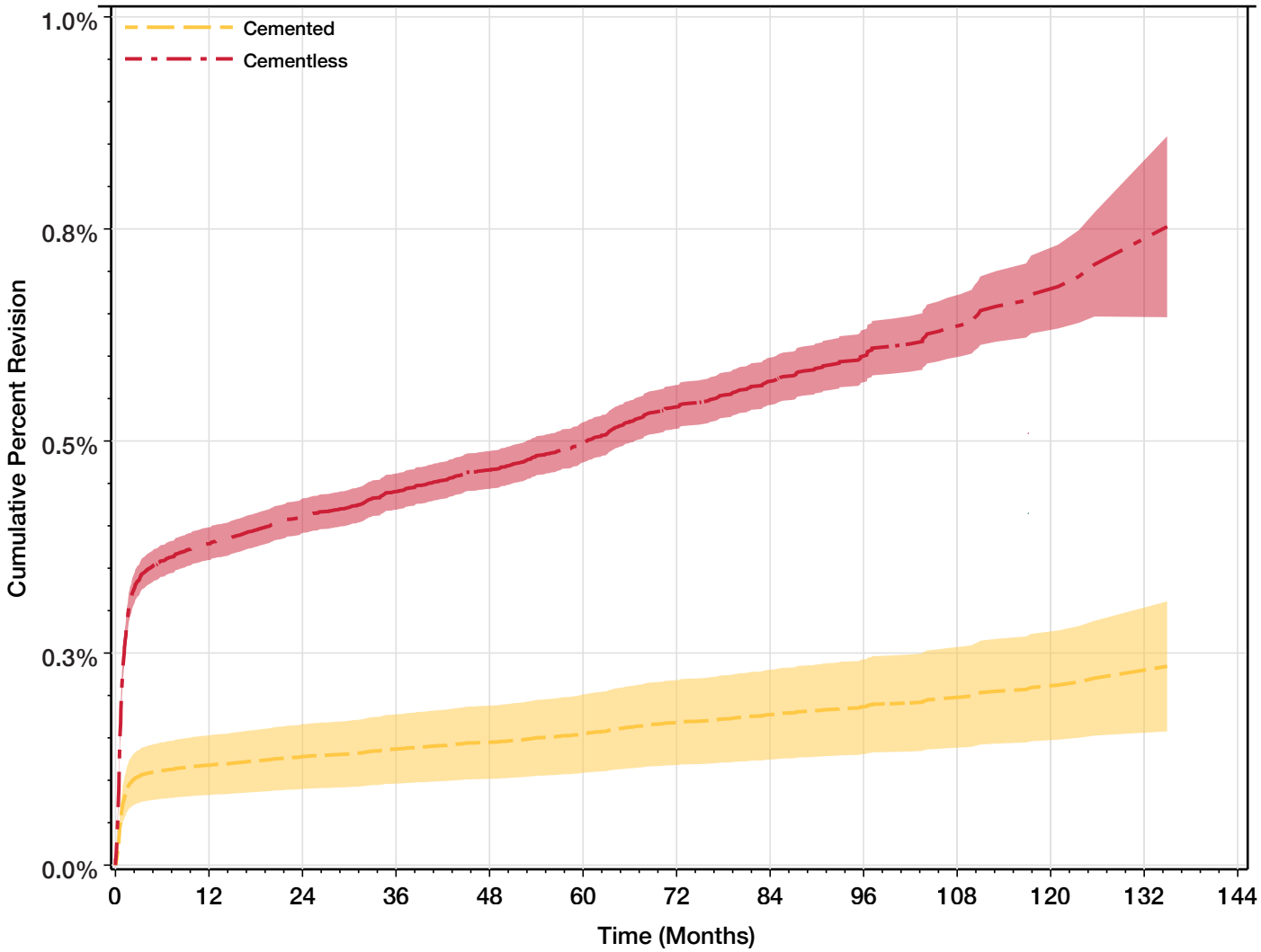
Age/CCI adjusted HR (95%CI), p-value
Cemented vs. Cementless:0.806(0.72,0.903) p=0.0002

Revision for periprosthetic fracture can be analyzed based on the fixation method of the femoral component. Figure 2.25 displays the results of a cause-specific survivorship model accounting for death and revision of non-target diagnoses as competing risks. Cemented fixation showed a statistically significant reduction in revision due to periprosthetic fracture compared to cementless fixation in elective primary THA patients ≥65 years of age (HR=0.287, 95% CI, 0.192-0.43, p<0.0001).

INSIGHTS

Adjusting for age, sex, and CCI, cemented fixation showed a statistically significant reduction in early revision due to periprosthetic fracture compared to cementless fixation in elective primary THA for patients ≥65 years of age.

Figure 2.25 Cumulative Percent Revision due to Periprosthetic Fracture by Femoral Stem Fixation Used for Elective Primary Total Hip Arthroplasty in Patients 65 Years of Age and Older Adjusted for Age and Gender, 2012-2023



Number at Risk (Months)	0	12	24	36	48	60	72	84	96	108	120	132	144
Cemented	22,314	19,045	15,884	12,930	10,580	8,015	5,779	3,834	2,164	1,038	397	141	1
Cementless	400,182	352,696	306,214	265,323	227,190	180,810	134,770	90,350	53,542	29,103	12,396	3,591	13
Total	422,496	371,741	322,098	278,253	237,770	188,825	140,549	94,184	55,706	30,141	12,793	3,732	14

Age/Sex/CCI adjusted HR (95%CI), p-value
Cemented vs. Cementless:0.31(0.223,0.431), p=<.0001

The reported utilization of both computer navigation and robotics has increased substantially over the past few years. The percentage of elective primary total hip arthroplasty cases utilizing robotic assistance is now over 6% (Figure 2.26). However, there has been a decline in computer assisted navigation in 2023.

INSIGHTS

Utilization of robotics in THA has almost tripled since 2017, however computer assisted navigation appears to be on the decline.

Figure 2.26 Rate of Technology Use for Assistance in Elective Primary Total Hip Arthroplasty, 2017-2023

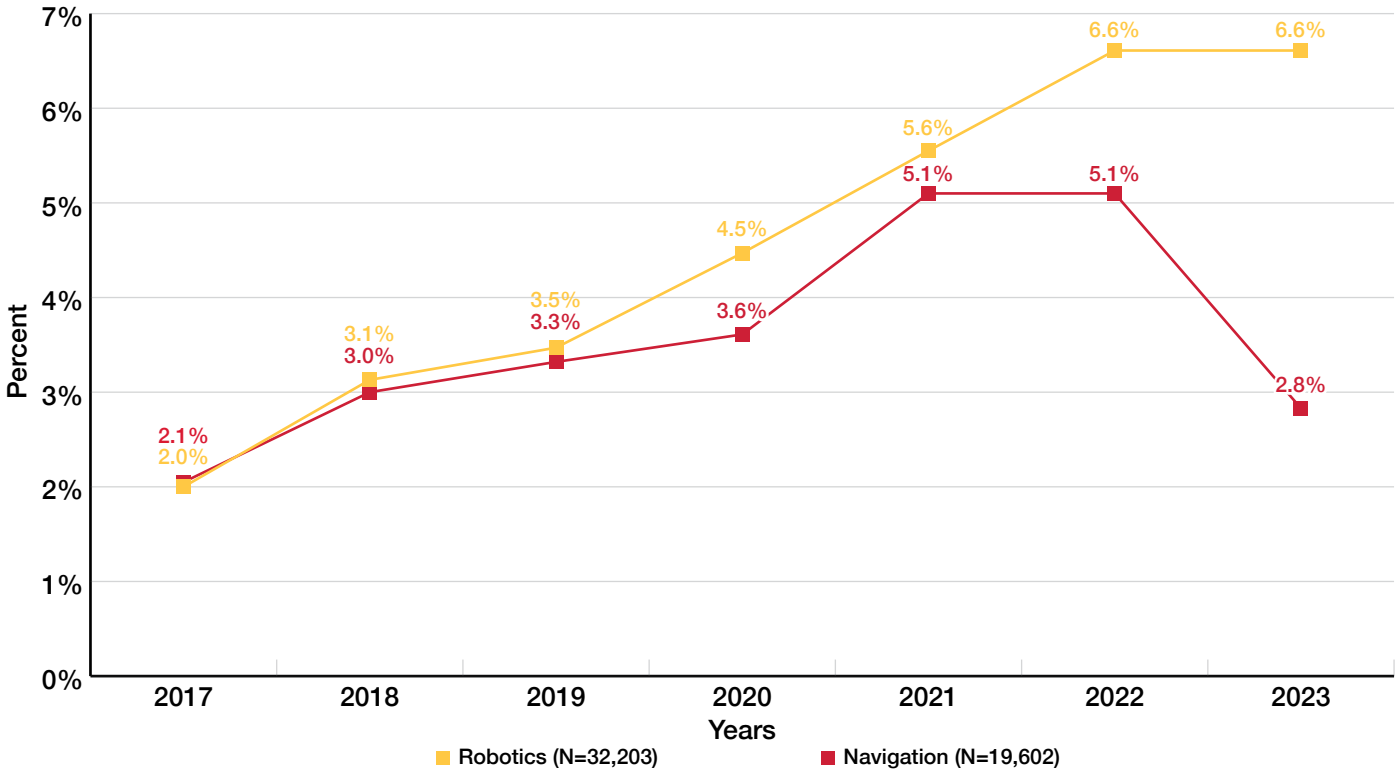
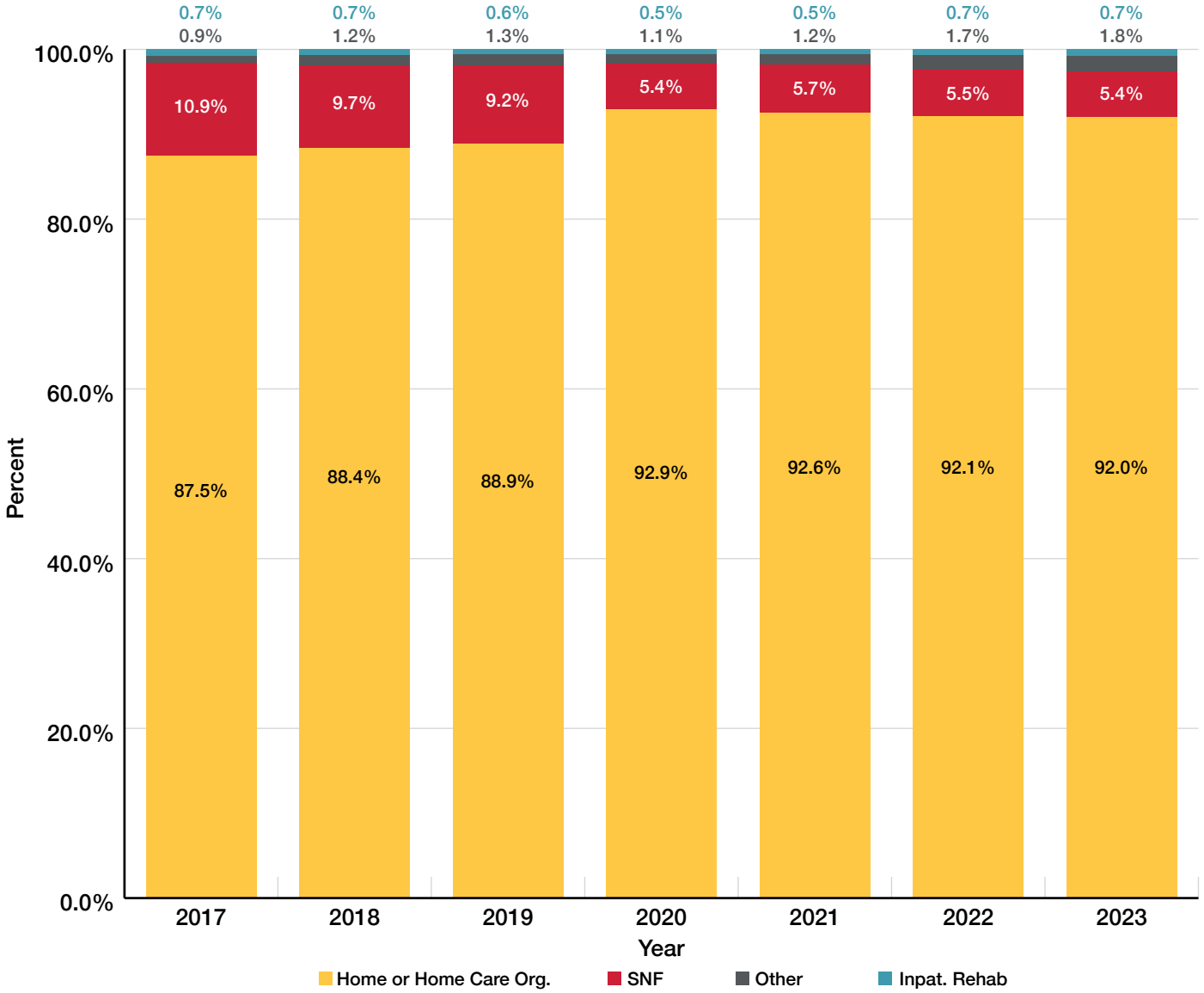


Figure 2.27 tabulates the discharge disposition reported for elective THA cases for the years 2017 through 2023, when data collection began. AJRR collects the CMS-defined Patient Discharge Status Code values. Discharge to home, represented by discharge codes 1 and 6, are reported in over 92% of cases over the last three years. Discharge to a skilled nursing facility (SNF) is reported in approximately 8% of cases and has consistently decreased over time. Other discharge codes represent only a small portion of cases.

Approximately 92% of patients are now being discharged to home following elective primary total hip arthroplasty with far fewer patients being discharged to skilled nursing facilities compared to just a few years ago.

INSIGHTS

Figure 2.27 Total Hip Arthroplasty Discharge Disposition Codes by Year, 2012-2023 (N=796,071)



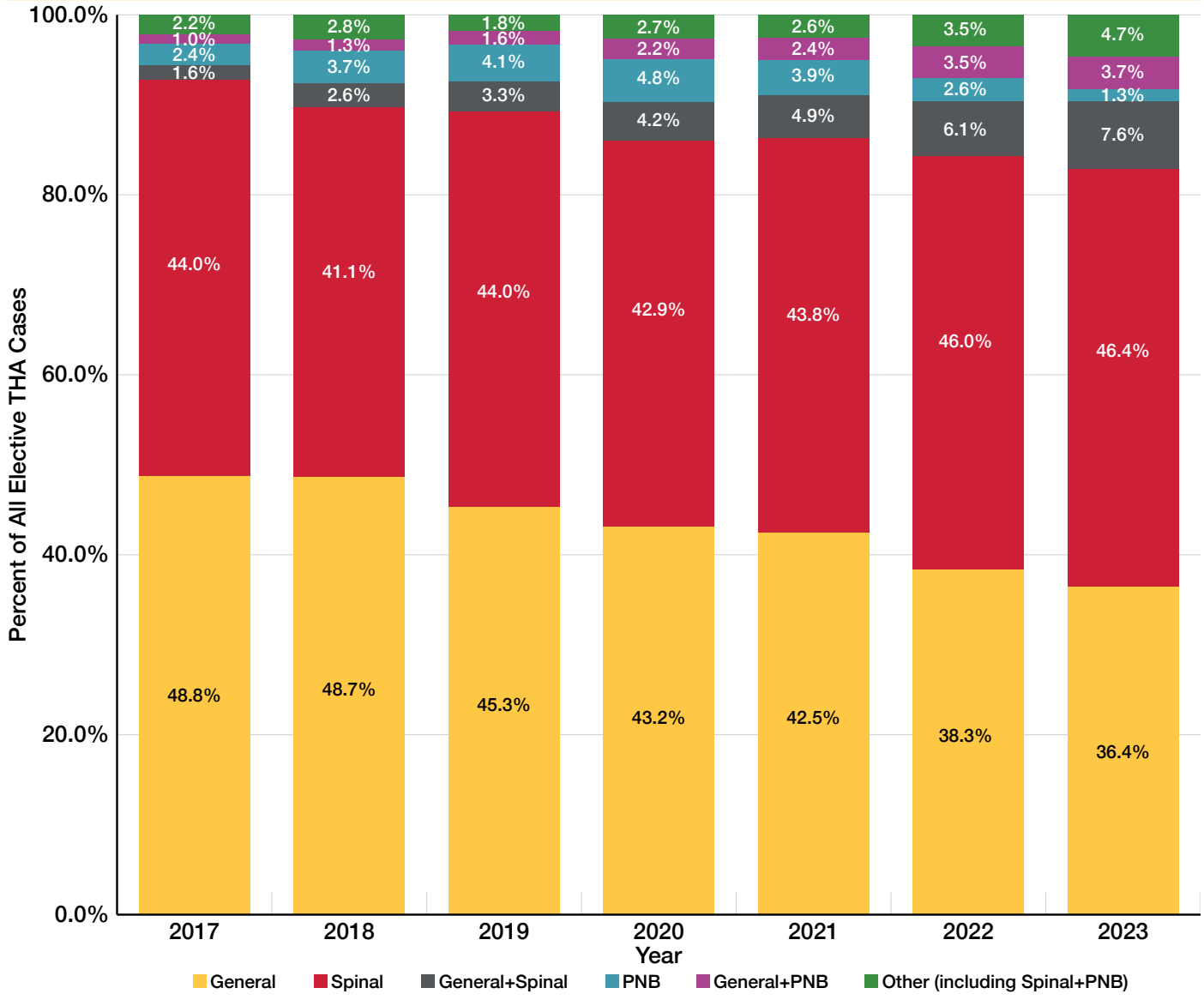
Code	Code Value
Home	Discharged to home/self-care (routine charge).
Home Care Org.	Discharged/transferred to home care of organized home health service organization.
SNF	Discharged/transferred to skilled nursing facility (SNF) with Medicare certification in anticipation of covered skilled care — (For hospitals with an approved swing bed arrangement, use Code 61 - swing bed. For reporting discharges/transfers to a non-certified SNF, the hospital must use Code 04 - ICF.)
Inpat. Rehab	Discharged/transferred to an inpatient rehabilitation facility including distinct units of a hospital (eff. 1/2002).

Figure 2.28 shows a tabulation of the two primary anesthesia techniques chosen for patients undergoing an elective primary total hip arthroplasty. Figure 2.28 shows a tabulation of anesthesia techniques chosen for patients undergoing an elective primary total hip arthroplasty such as General, Spinal, and Peripheral Nerve Block (PNB).

INSIGHTS

A decrease is the use of general anesthesia for primary total hip arthroplasty has occurred over time.

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



The AJRR can also be used to follow the utilization of individual implants over time. The following figures provide utilization data of implants used in elective primary total hip arthroplasty procedures in AJRR by year for the years 2012 through 2023. The data presented in this report is based on procedures voluntarily submitted by participating hospitals and surgeons to the American Joint Replacement Registry (AJRR). As such, the report reflects utilization trends and patterns within this specific dataset. Figure 2.29 tabulates the most implanted stem, cup, and bearing surface combinations for the most frequent stems by year. The Actis Duofix stem and Pinnacle cup with a ceramic on polyethylene (CoP) bearing surface continues to be the most frequently implanted combination with increasing utilization over time. Figure 2.30 tabulates the eight most implanted stem components used in THA by year and shows that from 2014-2021 the Accolade II stem was implanted most frequently until the Actis Duofix surpased that rate in 2022 which continues into 2023. Figure 2.31 tabulates the eight most implanted cup components in THA by year and shows that since 2012 the Pinnacle cup has been implanted most frequently with Trident II rising to a close second in recent years. Figure 2.29 reviews reported usage of femoral stem and acetabular combinations. Incomplete combinations are not considered in this figure. Reported usage of femoral stem components can be seen in Figure 2.30. Reported usage of femoral stem and acetabular components can be seen in Figures 2.30 and 2.31, respectively.

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

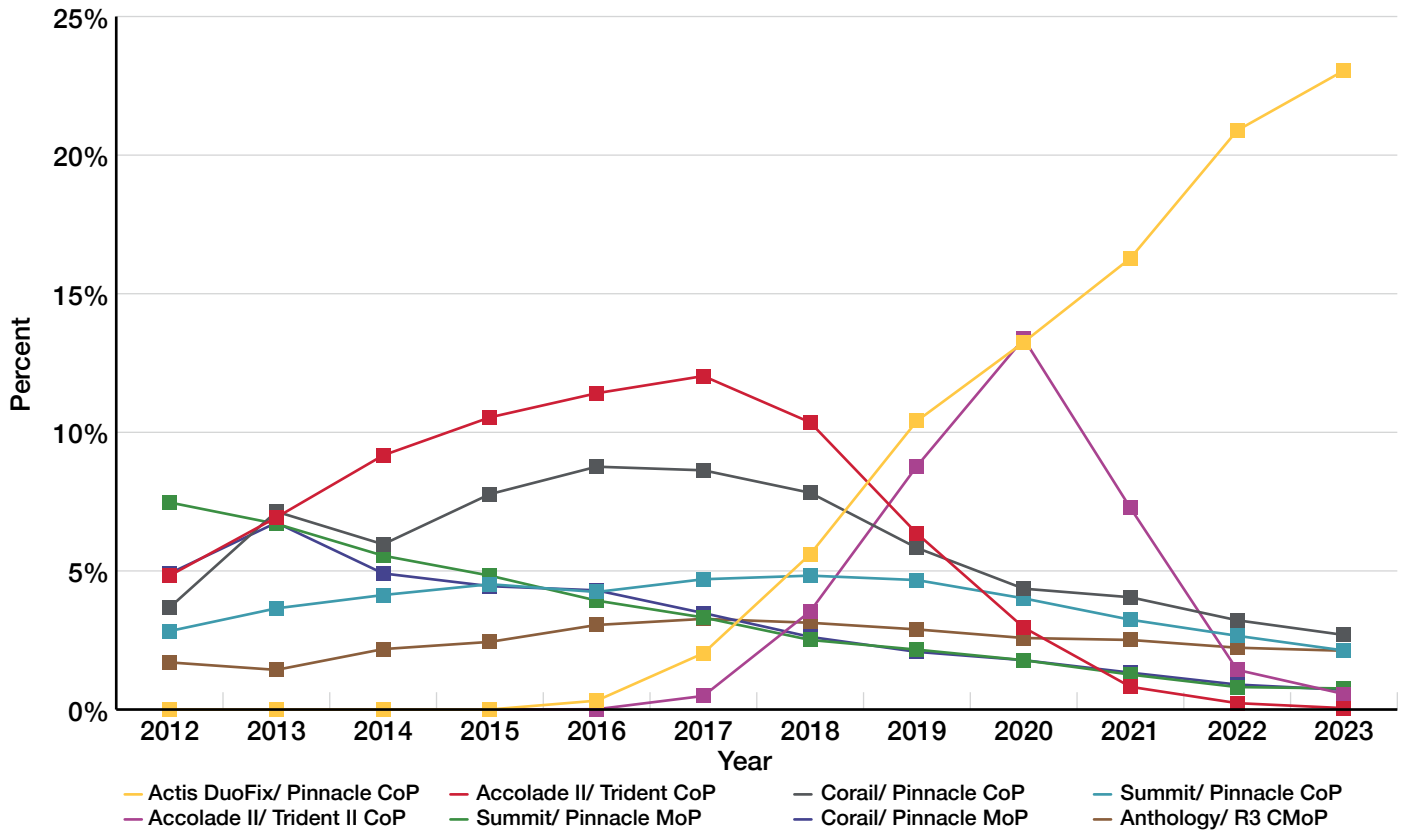


Figure 2.30 Elective Primary Total Hip Arthroplasty Femoral Stem Components by Year, 2012-2023 (N=943,690)

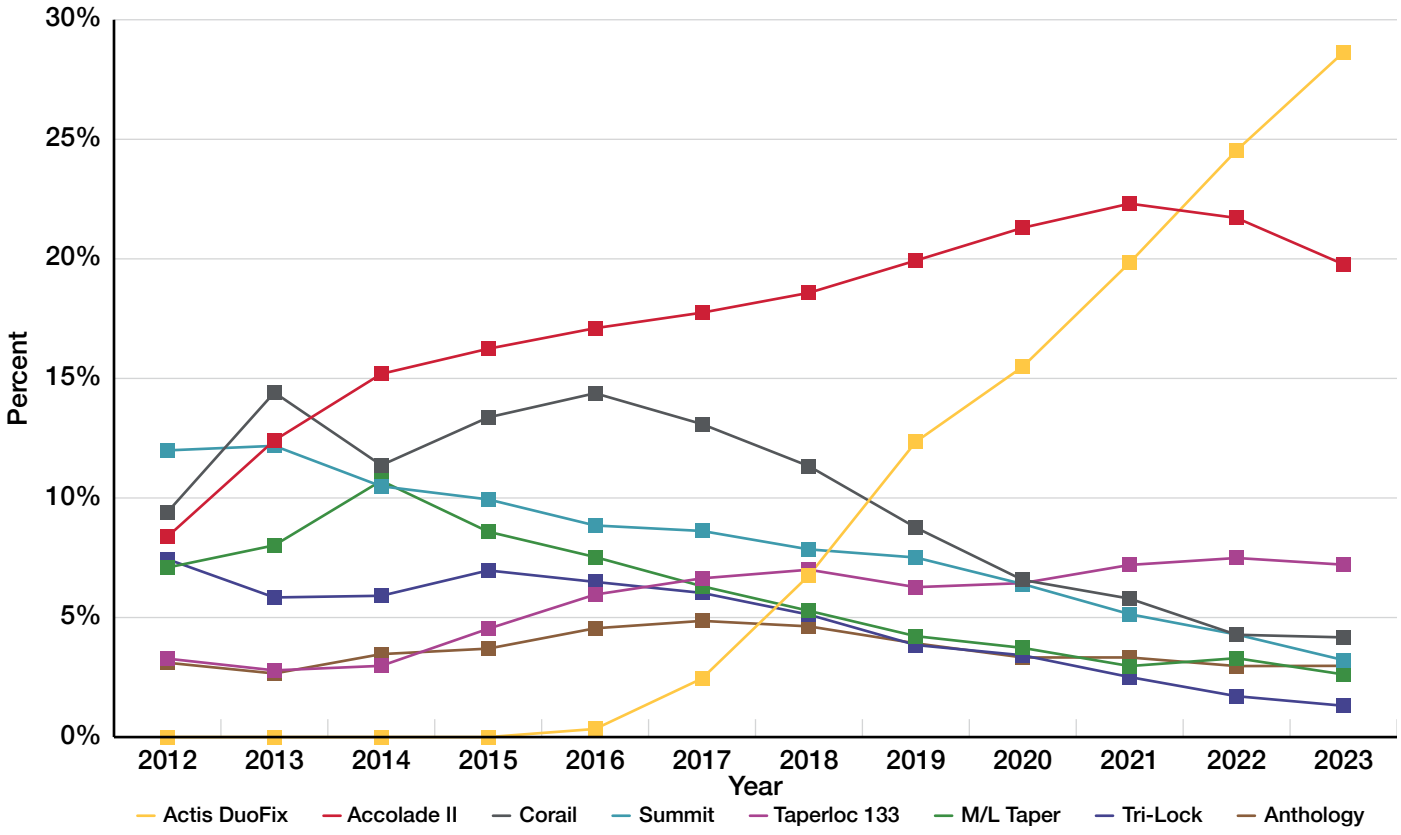
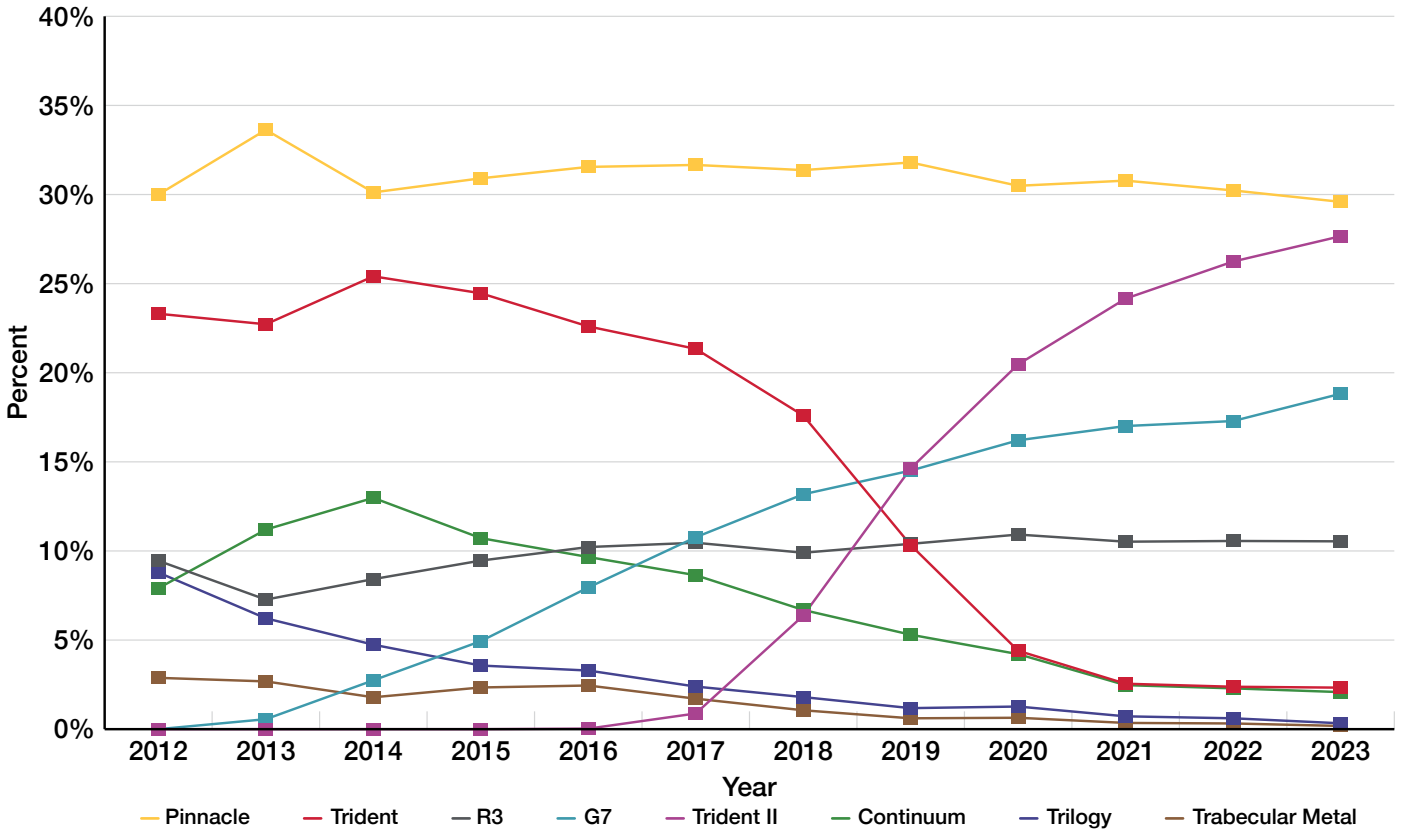


Figure 2.31 Elective Primary Total Hip Arthroplasty Acetabular Components by Year, 2012-2023 (N=990,414)



One important and powerful aspect of the AJRR is the ability to look at cumulative revision rates specific to different constructs. The majority of the variation in the hip device-specific survivorship curves appear to occur within one year of the primary procedure. Early failure is typically a result of infection, dislocation, or periprosthetic fracture, which may or may not be related to the implant itself. The table below (2.3) displays cumulative percent revision stratified by hip constructs with 95% confidence intervals. The aggregate cumulative percent revision of included devices was less than 1.5% at one year and just slightly over 3% at ten years for the cementless constructs. It is important to reiterate that this analysis does not adjust for any potential confounders of patient, procedure, surgeon, or hospital characteristics. The cumulative present revision rate of one implant may also be influenced by other components used in the construct and not reflect the inherent performance of that individual implant alone. Metal-on-metal hip constructs were excluded from all analyses. Devices presented in the analysis were required to meet the minimum case threshold of 400 total procedures.

INSIGHTS

The aggregate cumulative percent revision of included devices was less than 1.5% at one year and just slightly over 3% at ten years for cementless constructs.

Table 2.3 Unadjusted Cumulative Percent Revision of Cementless Hip Arthroplasty Construct Combinations for Primary Total Hip 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
Pinnacle/ Actis DuoFix Cementless	44,783	440	0.78 (0.7, 0.87)	1.02 (0.92, 1.12)	1.18 (1.06, 1.3)	1.19 (1.07, 1.32)	—
Pinnacle/ Corail Cementless	40,080	688	0.97 (0.88, 1.07)	1.34 (1.23, 1.45)	1.61 (1.48, 1.74)	1.83 (1.69, 1.97)	2.04 (1.87, 2.22)
Trident II-Tritanium/ Accolade II Cementless	35,316	748	1.76 (1.63, 1.9)	2.17 (2.02, 2.33)	2.36 (2.18, 2.55)	2.36 (2.18, 2.55)	—
Pinnacle/ Summit Cementless	27,659	708	1.60 (1.45, 1.75)	2.05 (1.89, 2.23)	2.39 (2.21, 2.58)	2.71 (2.51, 2.92)	3.03 (2.78, 3.3)
Trident/ Accolade II Cementless	24,698	741	1.62 (1.46, 1.78)	2.36 (2.17, 2.55)	2.82 (2.62, 3.04)	3.13 (2.91, 3.37)	3.52 (3.24, 3.82)
Pinnacle/ Tri-Lock Cementless	18,451	412	1.17 (1.02, 1.34)	1.72 (1.54, 1.92)	2.13 (1.92, 2.35)	2.34 (2.12, 2.58)	2.62 (2.34, 2.92)
G7/ Taperloc 133 Cementless	17,609	400	1.63 (1.45, 1.83)	2.07 (1.87, 2.3)	2.48 (2.24, 2.74)	2.71 (2.42, 3.01)	2.77 (2.46, 3.1)
R3/ Anthology Cementless	15,830	416	1.67 (1.47, 1.87)	2.26 (2.04, 2.51)	2.65 (2.39, 2.92)	2.89 (2.62, 3.19)	3.13 (2.8, 3.48)
Trident-Tritanium/ Accolade II Cementless	13,947	607	2.03 (1.8, 2.27)	3.08 (2.8, 3.37)	3.78 (3.47, 4.1)	4.29 (3.96, 4.64)	4.65 (4.27, 5.04)
Continuum/ M/L Taper Cementless	12,037	484	2.36 (2.1, 2.64)	3.17 (2.87, 3.5)	3.75 (3.42, 4.11)	4.13 (3.77, 4.51)	4.49 (4.09, 4.91)
R3/ PolarStem Cementless	11,973	231	1.49 (1.29, 1.72)	1.96 (1.7, 2.23)	2.18 (1.89, 2.5)	2.56 (2.17, 3)	2.56 (2.17, 3)
G7/ Taperloc 133 Microplasty Cementless	8,881	220	1.92 (1.65, 2.22)	2.26 (1.96, 2.59)	2.47 (2.15, 2.82)	2.75 (2.4, 3.15)	2.75 (2.4, 3.15)
R3/ Synergy Cementless	7,566	275	2.58 (2.24, 2.96)	3.21 (2.82, 3.63)	3.49 (3.09, 3.93)	3.90 (3.45, 4.38)	4.26 (3.67, 4.9)
Trident II-Tritanium/ Insignia Cementless	6,242	72	1.16 (0.92, 1.45)	—	—	—	—
Trident II/ Accolade II Cementless	5,222	95	1.59 (1.28, 1.96)	1.88 (1.53, 2.29)	1.92 (1.56, 2.35)	—	—
Trilogy/ M/L Taper Cementless	4,625	190	1.99 (1.62, 2.42)	2.79 (2.34, 3.29)	3.42 (2.92, 3.99)	4.18 (3.59, 4.82)	5.10 (4.36, 5.92)
Pinnacle/ S-ROM Cementless	4,250	138	1.44 (1.11, 1.83)	2.52 (2.07, 3.03)	3.17 (2.65, 3.76)	3.58 (3.01, 4.23)	3.91 (3.23, 4.69)
G7/ Echo Bi-Metric Cementless	3,825	98	1.86 (1.46, 2.32)	2.26 (1.81, 2.77)	2.67 (2.16, 3.25)	2.90 (2.36, 3.53)	2.90 (2.36, 3.53)
G7/ M/L Taper Cementless	3,550	79	1.72 (1.33, 2.19)	2.23 (1.76, 2.79)	2.45 (1.93, 3.07)	2.72 (2.1, 3.47)	—
Continuum/ Trabecular Metal Cementless	2,926	102	2.26 (1.76, 2.84)	2.94 (2.37, 3.6)	3.46 (2.83, 4.18)	3.62 (2.97, 4.36)	3.84 (3.08, 4.72)
R3/ Synergy HA Cementless	2,730	85	1.54 (1.13, 2.06)	2.12 (1.62, 2.71)	2.80 (2.21, 3.49)	3.25 (2.58, 4.02)	3.90 (3.08, 4.87)

Table 2.3 Continued on the next page

**The 95% confidence intervals are included in parenthesis.*

Table 2.3 Unadjusted Cumulative Percent Revision of Cementless Hip Arthroplasty Construct Combinations for Primary Total Hip 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
FMP/ Linear Cementless	2,483	46	1.05 (0.7, 1.51)	1.46 (1.04, 1.99)	1.55 (1.12, 2.1)	2.02 (1.48, 2.68)	2.21 (1.58, 3.01)
Trident/ Secur-Fit Max Cementless	2,312	79	1.91 (1.41, 2.53)	2.84 (2.22, 3.59)	3.18 (2.51, 3.96)	3.42 (2.72, 4.24)	3.58 (2.85, 4.44)
Trident/ Accolade TMZF Cementless	1,936	73	1.24 (0.82, 1.81)	1.55 (1.07, 2.18)	2.38 (1.77, 3.13)	3.20 (2.48, 4.06)	4.00 (3.15, 5)
Trident II-Tritanium/ Actis DuoFix Cementless	1,793	23	1.07 (0.67, 1.63)	1.48 (0.94, 2.21)	1.48 (0.94, 2.21)	—	—
G7/ Avenir-Muller Cementless	1,687	37	1.54 (1.03, 2.22)	1.93 (1.35, 2.68)	2.23 (1.59, 3.04)	2.36 (1.68, 3.23)	—
EMPOWR/ Linear Cementless	1,682	30	1.25 (0.8, 1.88)	2.01 (1.38, 2.85)	—	—	—
Trident/ Secur-Fit Cementless	1,645	63	2.13 (1.51, 2.91)	2.97 (2.22, 3.88)	3.90 (3.02, 4.95)	4.08 (3.17, 5.16)	4.08 (3.17, 5.16)
Trabecular Metal/ M/L Taper Cementless	1,592	60	2.45 (1.77, 3.3)	2.83 (2.1, 3.74)	3.10 (2.32, 4.04)	3.77 (2.9, 4.82)	3.98 (3.07, 5.07)
Trident/ Secur-Fit Plus Max Cementless	1,493	32	1.14 (0.69, 1.78)	1.55 (1.01, 2.28)	1.69 (1.12, 2.45)	2.07 (1.43, 2.91)	2.17 (1.51, 3.04)
Mallory Head/ Taperloc 133 Cementless	1,447	25	1.04 (0.61, 1.67)	1.38 (0.87, 2.09)	1.52 (0.99, 2.26)	1.70 (1.12, 2.48)	1.83 (1.21, 2.66)
Trident II-Tritanium/ Corail Cementless	1,426	12	0.70 (0.36, 1.25)	0.88 (0.48, 1.49)	0.88 (0.48, 1.49)	—	—
Trilogy/ VerSys Cementless	1,342	49	2.01 (1.36, 2.87)	2.47 (1.74, 3.41)	3.23 (2.36, 4.29)	3.53 (2.61, 4.65)	4.15 (3.08, 5.45)
Continuum/ Avenir-Muller Cementless	1,341	42	2.39 (1.67, 3.31)	3.00 (2.18, 4.01)	3.16 (2.31, 4.2)	3.16 (2.31, 4.2)	3.16 (2.31, 4.2)
FMP/ TaperFill Cementless	1,327	38	1.81 (1.19, 2.64)	2.42 (1.69, 3.36)	2.67 (1.9, 3.65)	3.12 (2.22, 4.24)	3.12 (2.22, 4.24)
Continuum/ Fitmore Cementless	1,254	55	2.55 (1.78, 3.54)	3.49 (2.57, 4.63)	3.93 (2.94, 5.13)	4.23 (3.19, 5.48)	4.75 (3.61, 6.1)
Continuum/ VerSys Cementless	1,252	43	1.44 (0.89, 2.22)	2.67 (1.88, 3.69)	3.12 (2.25, 4.22)	3.59 (2.62, 4.78)	3.75 (2.74, 4.99)
Continuum/ Taperloc 133 Cementless	1,191	36	1.85 (1.19, 2.74)	2.58 (1.78, 3.61)	3.10 (2.2, 4.24)	3.21 (2.29, 4.37)	3.21 (2.29, 4.37)
Trinity/ TriFit TS Cementless	1,119	34	2.33 (1.56, 3.34)	2.71 (1.87, 3.8)	3.11 (2.18, 4.3)	3.30 (2.31, 4.56)	3.30 (2.31, 4.56)
Continuum/ Accolade II Cementless	1,107	22	1.26 (0.73, 2.07)	1.63 (1, 2.51)	1.63 (1, 2.51)	2.11 (1.36, 3.12)	2.11 (1.36, 3.12)
Trident II-Tritanium/ Secur-Fit Cementless	1,101	32	2.27 (1.51, 3.28)	2.93 (2.03, 4.09)	3.10 (2.16, 4.31)	3.10 (2.16, 4.31)	—
Escalade Acetabular System/ Ovation Hip Stem Cementless	1,045	19	1.34 (0.77, 2.19)	1.68 (1.02, 2.62)	1.98 (1.23, 3.04)	1.98 (1.23, 3.04)	1.98 (1.23, 3.04)
G7/ Actis DuoFix Cementless	1,034	13	1.09 (0.58, 1.89)	1.52 (0.79, 2.67)	1.52 (0.79, 2.67)	1.52 (0.79, 2.67)	—
Restoration ADM/ Accolade II Cementless	959	16	1.15 (0.61, 1.99)	1.36 (0.77, 2.27)	1.64 (0.96, 2.63)	1.85 (1.09, 2.96)	1.85 (1.09, 2.96)
Trident II-Tritanium/ Secur-Fit Max Cementless	952	30	2.31 (1.49, 3.42)	3.21 (2.2, 4.53)	3.73 (2.41, 5.48)	—	—
EMPOWR/ TaperFill Cementless	943	17	1.59 (0.93, 2.56)	1.91 (1.15, 3)	—	—	—
Novation/ Alteon Cementless**	900	57	2.11 (1.32, 3.21)	2.56 (1.67, 3.75)	3.73 (2.62, 5.13)	8.35 (6.29, 10.76)	—
G7/ Corail Cementless	886	20	1.47 (0.83, 2.44)	1.95 (1.18, 3.04)	2.25 (1.4, 3.43)	2.25 (1.4, 3.43)	2.61 (1.58, 4.07)
Trident/ Citation Cementless	877	31	1.71 (1, 2.74)	2.42 (1.55, 3.62)	2.68 (1.75, 3.92)	3.07 (2.05, 4.39)	4.24 (2.87, 6.01)
Mpact/ MasterLoc Cementless	870	26	2.42 (1.54, 3.6)	2.95 (1.96, 4.25)	3.10 (2.08, 4.45)	3.10 (2.08, 4.45)	—
Trident-Tritanium/ Secur-Fit Cementless	820	44	2.07 (1.26, 3.23)	3.78 (2.63, 5.25)	4.64 (3.34, 6.23)	5.27 (3.88, 6.95)	5.61 (4.1, 7.45)
Trident-Tritanium/ Secur-Fit Max Cementless	807	32	1.49 (0.82, 2.52)	2.48 (1.57, 3.73)	3.10 (2.06, 4.47)	3.54 (2.41, 5)	4.33 (3, 6.01)

Table 2.3 Continued on the next page

*The 95% confidence intervals are included in parenthesis.

Table 2.3 Unadjusted Cumulative Percent Revision of Cementless Hip Arthroplasty Construct Combinations for Primary Total Hip Arthroplasty in Patients ≥65 Years of Age with Primary Osteoarthritis, 2012-2023* (Continued)

Group Name	N Total	N Revised	1-Yr	3-Yrs	5-Yrs	7-Yrs	10-Yrs
Pinnacle/ AML Cementless	789	25	1.27 (0.65, 2.25)	2.17 (1.31, 3.38)	2.60 (1.64, 3.91)	3.30 (2.16, 4.8)	3.53 (2.33, 5.12)
R3/ Echelon Cementless	787	28	1.40 (0.75, 2.42)	2.85 (1.84, 4.21)	3.65 (2.46, 5.19)	3.87 (2.62, 5.48)	3.87 (2.62, 5.48)
G7/ Trabecular Metal Cementless	741	23	2.43 (1.49, 3.73)	3.11 (2, 4.6)	3.34 (2.17, 4.91)	3.34 (2.17, 4.91)	—
Trident-Tritanium/ Accolade TMZF Cementless	722	32	1.66 (0.91, 2.81)	2.35 (1.43, 3.66)	3.19 (2.08, 4.66)	4.08 (2.79, 5.71)	4.85 (3.35, 6.75)
R3/ Anthology AFIT Cementless	711	8	1.13 (0.53, 2.13)	1.13 (0.53, 2.13)	1.13 (0.53, 2.13)	—	—
Continuum/ M/L Taper Kinectiv Cementless	701	34	3.00 (1.92, 4.46)	4.20 (2.88, 5.89)	4.52 (3.14, 6.26)	4.70 (3.28, 6.48)	5.33 (3.71, 7.37)
R3/ Corail Cementless	682	5	0.15 (0.01, 0.8)	0.29 (0.06, 1.01)	0.59 (0.2, 1.45)	0.74 (0.29, 1.66)	—
G7/ Fitmore Cementless	672	14	1.51 (0.78, 2.67)	1.90 (1.03, 3.21)	2.41 (1.36, 3.96)	2.41 (1.36, 3.96)	—
RingLoc+/ Taperloc 133 Cementless	666	29	2.55 (1.55, 3.97)	3.61 (2.38, 5.22)	4.22 (2.88, 5.95)	4.39 (3.01, 6.15)	4.39 (3.01, 6.15)
Trident II-Tritanium/ Secur-Fit Plus Max Cementless	645	8	1.25 (0.59, 2.36)	1.25 (0.59, 2.36)	1.25 (0.59, 2.36)	—	—
Restoration ADM/ Novation Cementless	627	12	0.64 (0.22, 1.55)	1.12 (0.5, 2.2)	1.61 (0.83, 2.86)	1.79 (0.95, 3.08)	2.13 (1.13, 3.65)
Versafitcup DM/ AMIStem-H Cementless	620	18	1.61 (0.83, 2.86)	2.10 (1.18, 3.47)	2.26 (1.3, 3.67)	2.59 (1.55, 4.08)	3.02 (1.85, 4.64)
Trabecular Metal/ Trabecular Metal Cementless	604	17	1.99 (1.09, 3.35)	2.34 (1.34, 3.8)	2.71 (1.62, 4.27)	2.97 (1.79, 4.61)	2.97 (1.79, 4.61)
Trabecular Metal/ VerSys Cementless	580	29	2.76 (1.64, 4.34)	3.45 (2.18, 5.17)	3.98 (2.6, 5.81)	4.76 (3.22, 6.74)	5.48 (3.7, 7.75)
Dynasty BioFoam/ ProFemur Gladiator Cementless	556	16	1.62 (0.8, 2.95)	1.99 (1.06, 3.44)	2.64 (1.51, 4.28)	3.15 (1.87, 4.97)	3.15 (1.87, 4.97)
Trident/ ABG II Cementless	535	18	2.62 (1.5, 4.24)	2.80 (1.64, 4.47)	3.37 (2.07, 5.15)	3.37 (2.07, 5.15)	3.37 (2.07, 5.15)
Consensus/ TaperSet Cementless	527	17	1.52 (0.72, 2.86)	2.68 (1.54, 4.34)	2.89 (1.69, 4.61)	3.37 (2.03, 5.22)	3.37 (2.03, 5.22)
Provident/ Provident Cementless	520	13	1.92 (0.99, 3.4)	2.32 (1.27, 3.9)	2.32 (1.27, 3.9)	2.64 (1.47, 4.38)	2.64 (1.47, 4.38)
Regenerex RingLoc+/ Taperloc 133 Cementless	517	18	2.32 (1.27, 3.9)	2.90 (1.7, 4.62)	3.31 (2.01, 5.13)	3.60 (2.21, 5.52)	3.60 (2.21, 5.52)
G7/ Summit Cementless	489	10	1.02 (0.39, 2.26)	1.91 (0.94, 3.48)	2.28 (1.15, 4.07)	2.28 (1.15, 4.07)	—
Restoration ADM/ Secur-Fit Plus Max Cementless	488	28	3.69 (2.27, 5.64)	5.33 (3.57, 7.57)	5.74 (3.91, 8.05)	5.74 (3.91, 8.05)	—
Continuum/ Taperloc 133 Microplasty Cementless	485	13	2.08 (1.07, 3.67)	2.33 (1.24, 4.01)	2.33 (1.24, 4.01)	2.97 (1.5, 5.26)	5.54 (1.76, 12.57)
G7/ Taperloc Complete XR Cementless	474	8	1.05 (0.4, 2.33)	1.87 (0.87, 3.54)	1.87 (0.87, 3.54)	1.87 (0.87, 3.54)	1.87 (0.87, 3.54)
PROCOTYL PRIME/ ProFemur Gladiator Cementless	443	5	1.13 (0.43, 2.5)	1.13 (0.43, 2.5)	1.13 (0.43, 2.5)	—	—
Ranawat-Burstein/ Taperloc 133 Cementless	422	11	1.42 (0.59, 2.94)	1.90 (0.9, 3.56)	2.14 (1.06, 3.88)	3.14 (1.57, 5.6)	3.14 (1.57, 5.6)
Dynasty BioFoam/ ProFemur Z Cementless	413	44	5.57 (3.64, 8.07)	7.99 (5.63, 10.87)	9.45 (6.87, 12.51)	10.80 (8.01, 14.05)	10.80 (8.01, 14.05)
Overall	**368,239**	**8,848**	**1.52 (1.48, 1.56)**	**2.05 (2, 2.09)**	**2.43 (2.38, 2.48)**	**2.77 (2.71, 2.83)**	**3.09 (3.01, 3.17)**

**The 95% confidence intervals are included in parenthesis.*

***The Novation Cup was used with two different polyethylene liners, one of which, the Connexion GXL liner, was withdrawn from the market in 2021. The revision rate may not reflect the inherent performance of the femoral component. Ongoing analysis is being performed to better understand the revision rate associated with this implant.*

Revision Hip Arthroplasty

Between 2012 and 2023, AJRR has collected data on 140,845 revision hip arthroplasty procedures.

The data submitted to AJRR contains variability in coding with respect to primary reason for revision. Reason for revision surgery was determined by the diagnosis codes submitted for each revision. AJRR accepts up to 10 diagnosis codes which can be submitted as either ICD (International Classification of Diseases)-9 or-10 codes depending on the year of the procedure. AJRR continues to refine the way that revision procedures are classified to improve the accuracy of the diagnostic categories over time.

The reasons for revision were examined and categorized as follows: infection and inflammatory reaction, mechanical complications, instability related codes, aseptic loosening, pain, fracture, wear or osteolysis, and hematoma or wound complication. All eight code fields were queried for target codes from these categories, and if none of the submitted codes matched a defined category, the reason for revision was placed in an "other" group.

Figure 2.32 displays the case distribution of all revision procedures in AJRR patients reported to either AJRR or CMS. Each reason for revision was queried independently as to allow for cases to exist in more than one category when multiple diagnoses are reported. An additional 22,138 cases are not presented as they contain erroneous or irrelevant diagnoses such as osteoarthritis, cardiac diagnoses, and comorbidities; these cases are regularly revisited for any missed classifications. The most common reason for hip revision surgery overall was infection at 21.4% (Figure 2.32). Revision surgeries can also be further examined based on their occurrence from the time of the index primary procedure. An early revision is considered one that occurred <3 months after the primary procedure. There were 14,816 early "linked" revision procedures in AJRR or CMS (Table 2.4). A "linked" revision is one in which the patient had the primary surgery in a facility that submitted data to AJRR and a revision that was also submitted to the AJRR or CMS. Although not all patients will return to the same facility for their revision procedure, a significant majority of revisions done in the early postoperative period are expected to return to the same AJRR hospital as the primary.[12] Among early revisions, 14,138 had a primary diagnosis that was relevant using the methodology above. For all early revisions, the primary reason was again infection (28.3%) followed by instability and fracture at 21.1% and 19.7%, respectively (Figure 2.33).

Infection remains the most common indication for revision hip arthroplasty, with instability and fracture being the second and third most common indications for early revision within 3 months of surgery.

INSIGHTS

Figure 2.32 Distribution of Diagnosis Associated with All Hip Revisions, 2012-2023 (N=140,845)

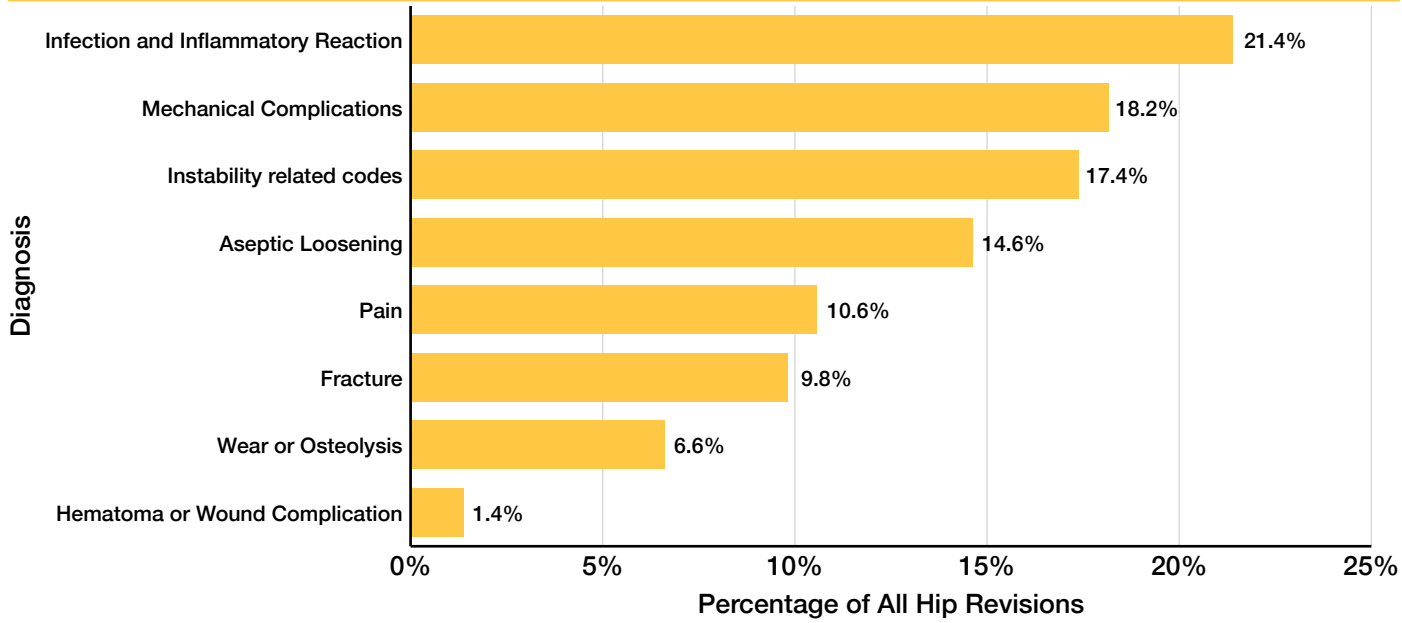
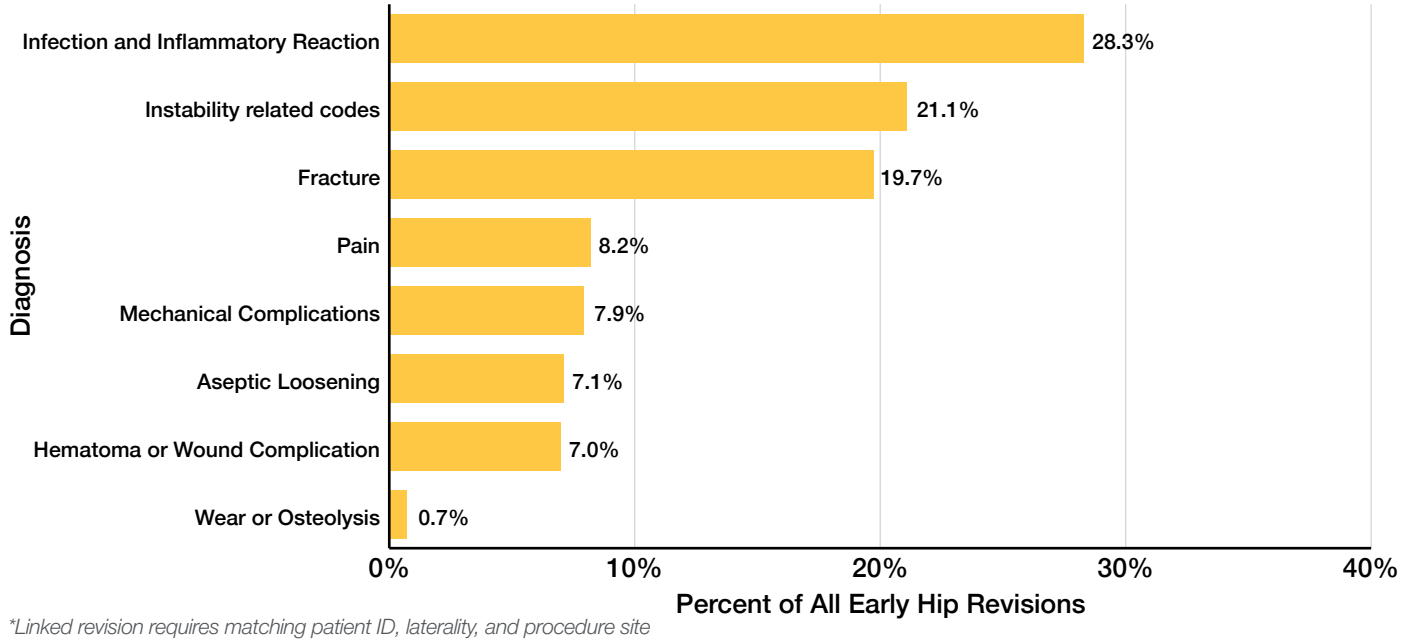


Table 2.4 Distribution of Time Interval Between Elective Primary Hip Arthroplasty Procedures and Revision for Linked Patients, 2012-2023*

Time	Frequency	Percent
< 3 Months	12,375	48.76
3 to <6 Months	2,412	9.5
6-12 Months	2,682	10.57
>1 Year	7,909	31.16

**Linked revision requires matching patient ID, laterality, and procedure site*

Figure 2.33 Distribution of Diagnosis Associated With all Early "Linked" Hip Revisions, 2012-2023 (N=14,138)*



**Linked revision requires matching patient ID, laterality, and procedure site*

The prevalence of early hip revisions between the ages of 50 and 90 appears fairly stable regardless of patient age (Figure 2.34). When reviewing the percentage of all hip arthroplasty revisions with a primary diagnosis of infection, the percentage varies from 11.8-26.3% over the years 2012-2023, and continues to increase over time (Figure 2.35). Similarly, for hip revisions due to instability/dislocation, the value appears to be increase over time (Figure 2.36). As AJRR collects historical data, these numbers could change with further data collection.

AJRR saw a statistically significant increase in dual mobility usage for revision hip arthroplasty procedures since 2012 (10%) with a slight pull-back in recent years to 17.9% of articulations classified as dual mobility in 2023 (Figure 2.37). Not surprisingly, there has been an increase in overall dual mobility usage for revisions specifically to treat dislocation/instability from 2012 to 2023 (12.9% to 34.0%), however the trend appears to be slowing (Figure 2.38). Some dual mobility constructs may erroneously be classified as smaller diameter heads if data reporting is insufficient to distinguish as dual mobility, and may explain the apparent increase in head diameters of 28 mm or less.

Figure 2.34 Early "Linked" Revisions as a Percent of Elective Primary Hip Arthroplasty Procedures by Age Group, 2012-2023 (N=14,831)

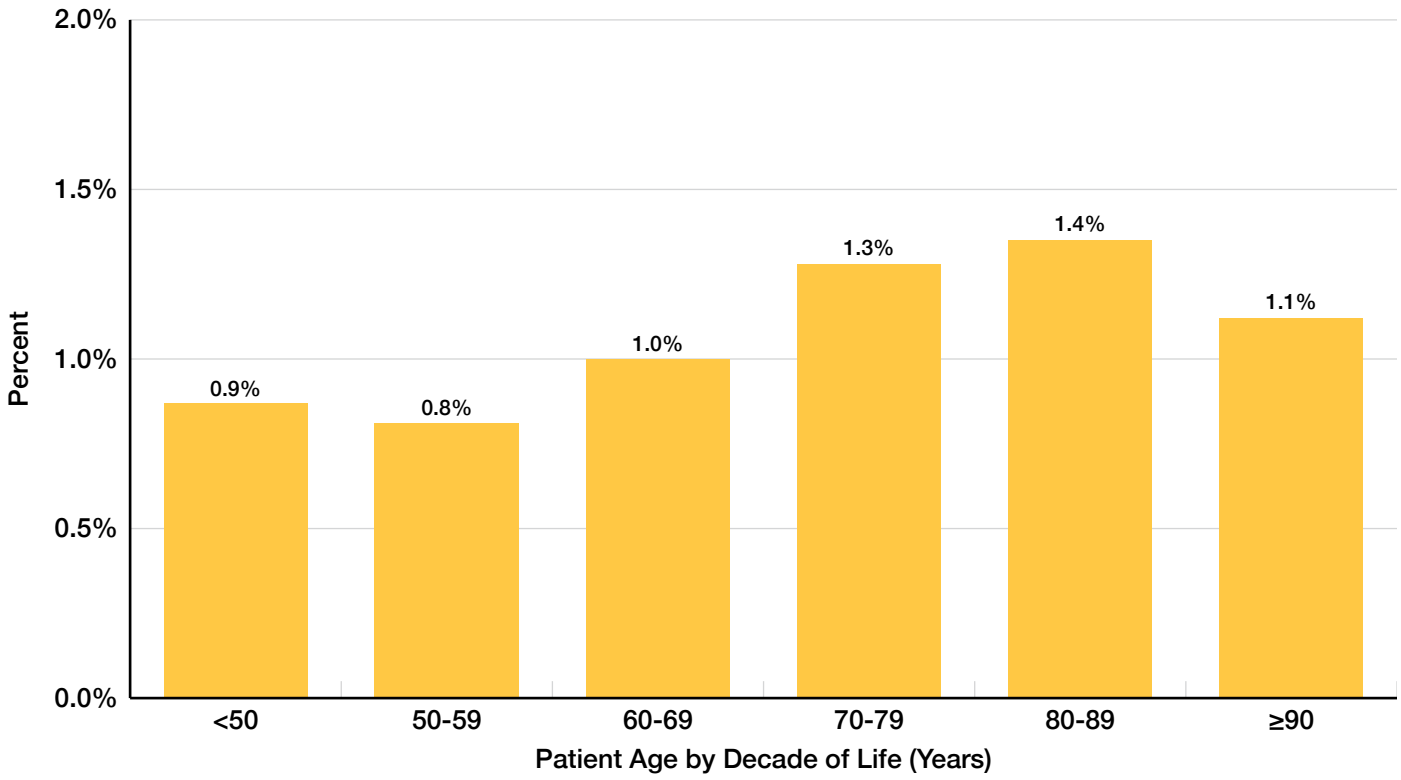


Figure 2.35 Revisions Due to Infection as a Percentage of All Hip Revisions, 2012-2023 (N=30,154)

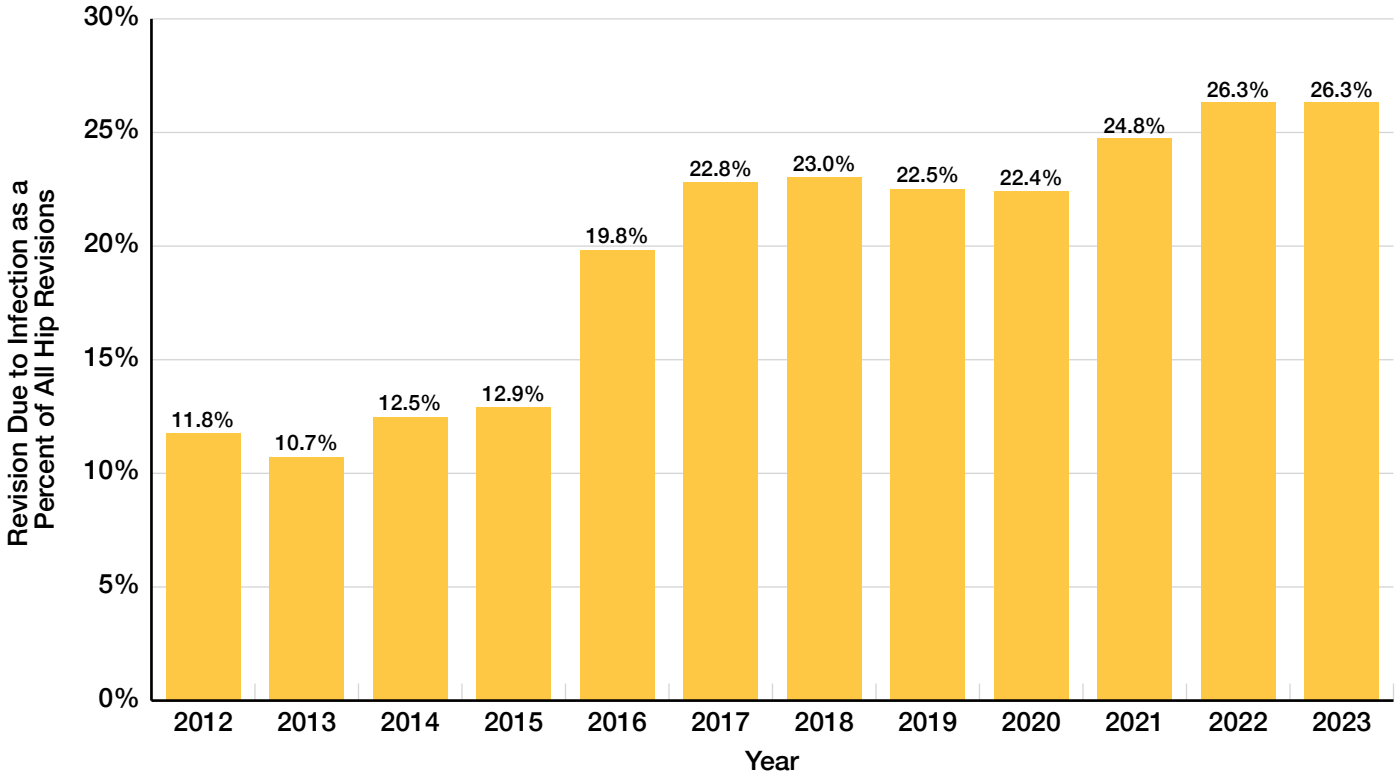


Figure 2.36 Revisions Due to Instability as a Percentage of All Hip Revisions, 2012-2023 (N=24,493)

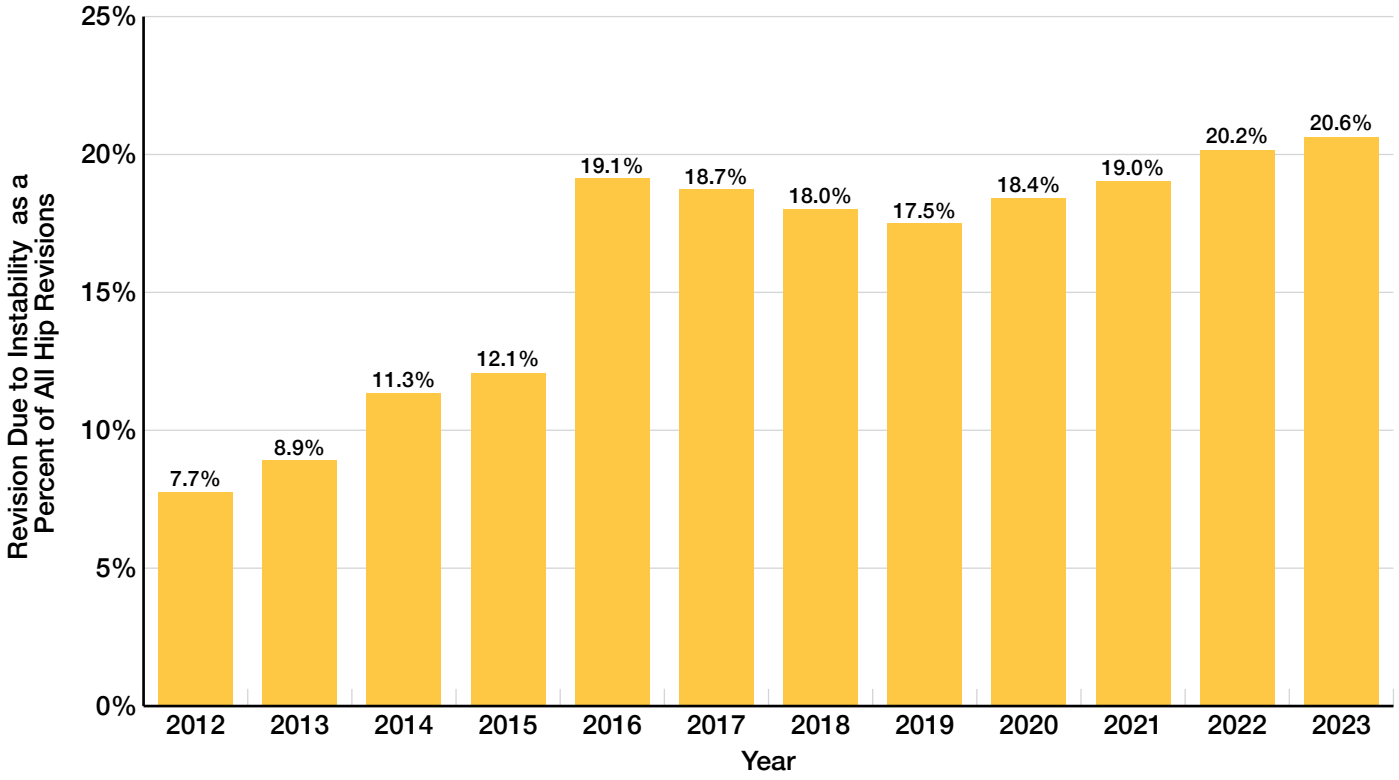


Figure 2.37 Percent Dual Mobility Usage and Femoral Neck Head Sizes Implanted for Hip Revisions, 2012-2023 (N=98,768)

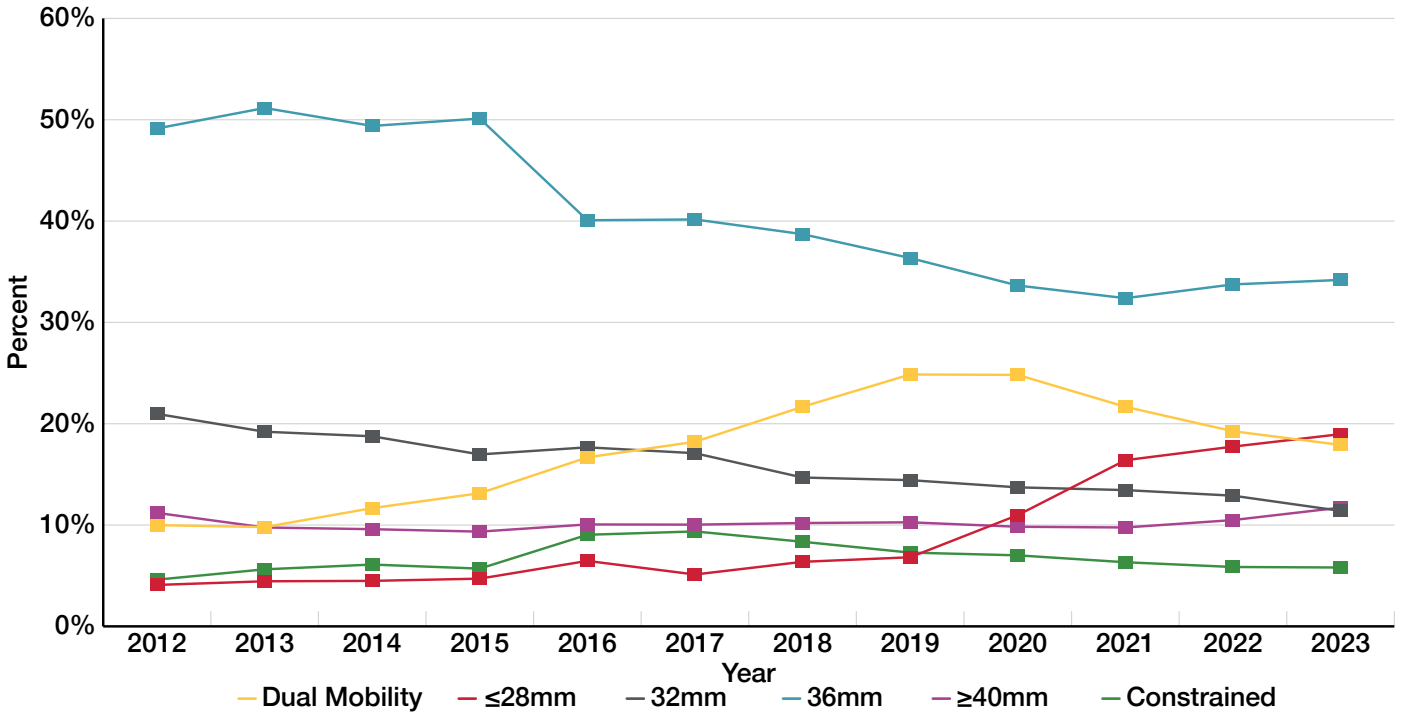
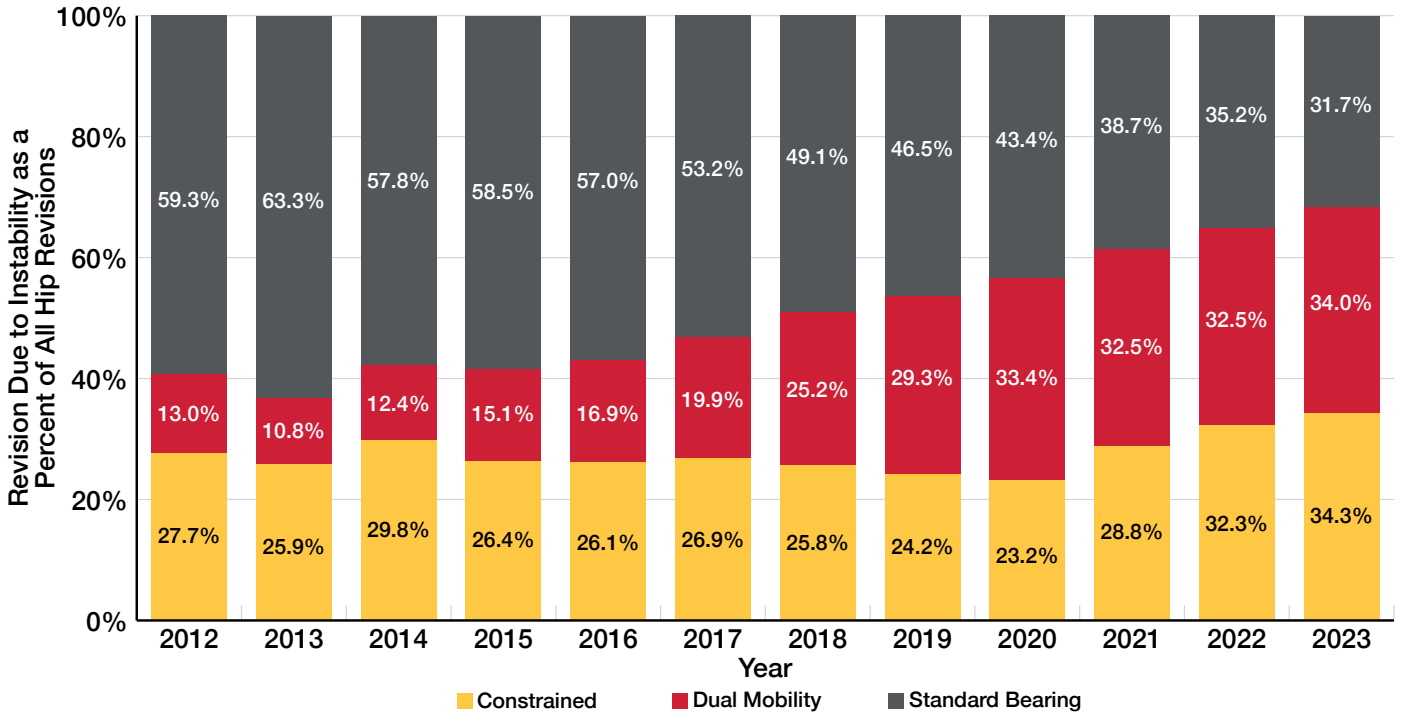


Figure 2.38 Bearing Type Usage for Hip Revisions Secondary to Dislocation/Instability, 2012-2023 (N=20,079)

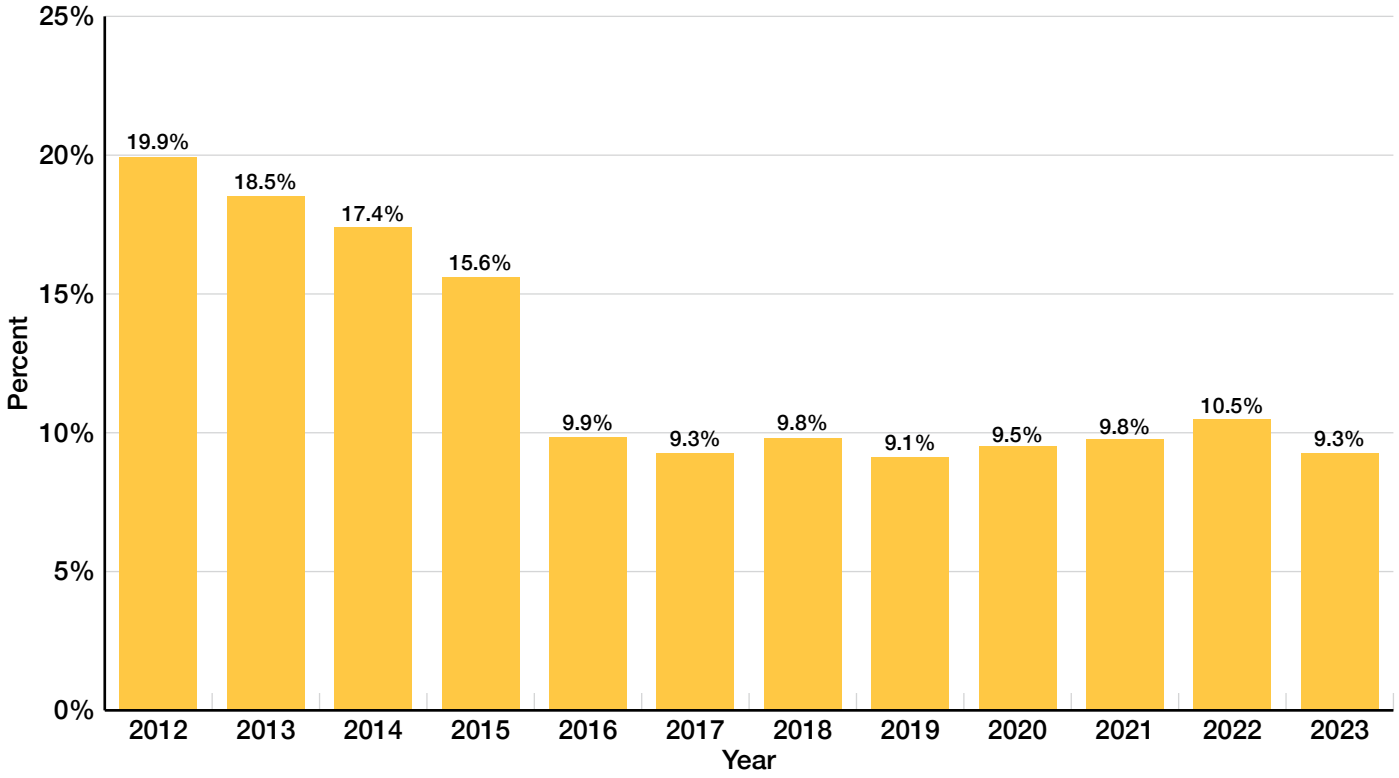


INSIGHTS

For hip revisions secondary to instability, dual mobility constructs and constrained liners are each used in one third of cases.

Revision burden is defined as the ratio of implant revisions to the total number of arthroplasties in a specific period. The revision burden in the AJRR consistently decreased for several years until it hit a plateau around 2016 (Figure 2.39). It has remained between 9-10% for the past 8 years. The improvement in the burden of revision in total hip arthroplasty seen several years ago may be secondary to reduced osteolysis and wear with highly crosslinked polyethylene. It is also possible that registry participants who submitted data early in the existence of the AJRR were more likely to do revision procedures than those who began submitting data later in time. The improvement in the burden of revision in total hip arthroplasty seen several years ago may be secondary to reduced osteolysis and wear with highly crosslinked polyethylene.

Figure 2.39 Revision Burden of Elective Primary Total Hip Arthroplasty Procedures, 2012-2023 (N=146,649)



The following two figures provide utilization data of implants used in revision hip arthroplasty procedures in AJRR. Figure 2.40 tabulates the eight most commonly used stem components used in revision THA by year. Over the 12-year period, the Restoration Modular stem has consistently been implanted most frequently.

Figure 2.41 tabulates the eight most commonly used cup components in revision THA by year and shows that over the 12-year period, the most frequently implanted cup has varied. Since 2018, the G7 component has been the most frequently implanted cup.

Figure 2.40 Revision Hip Arthroplasty Stem Components by Year, 2012-2023 (N=56,992)

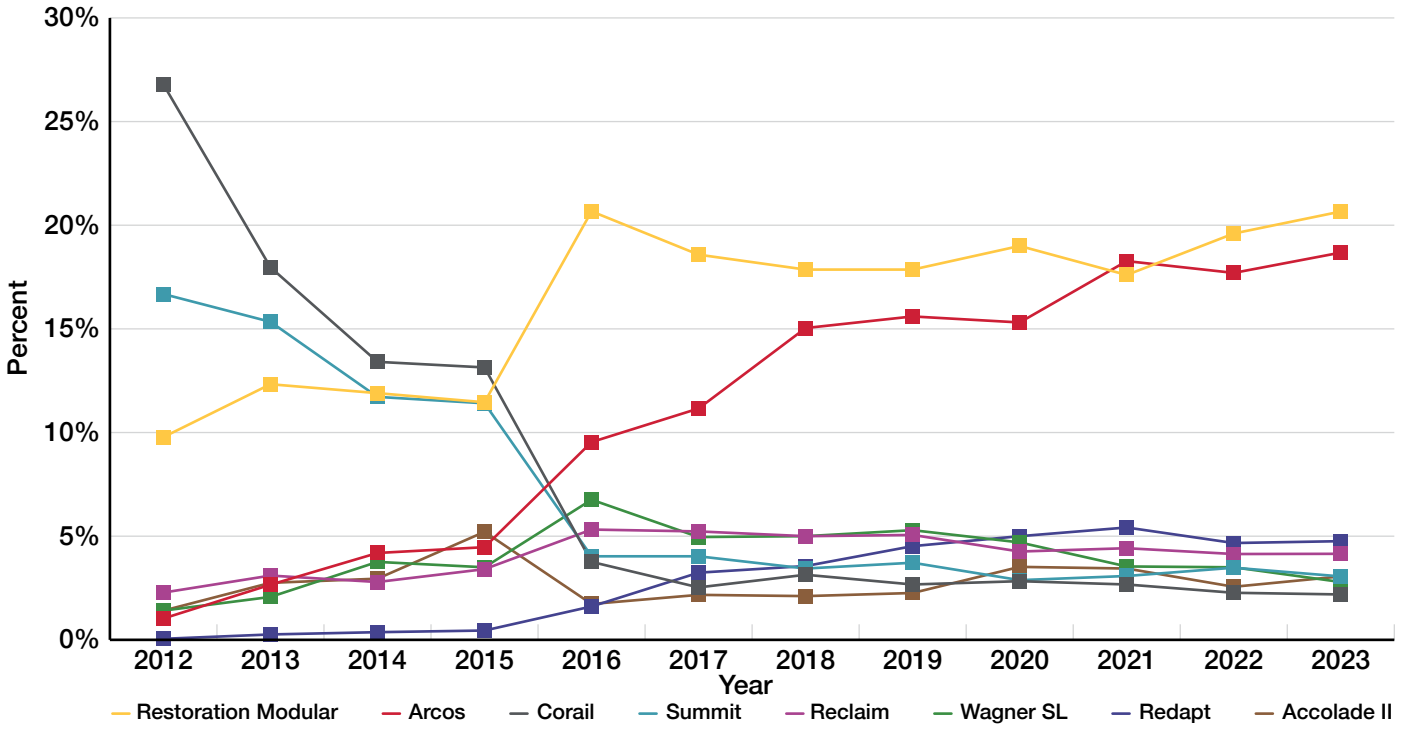


Figure 2.41 Revision Hip Arthroplasty Cup Components by Year, 2012-2023 (N=56,351)

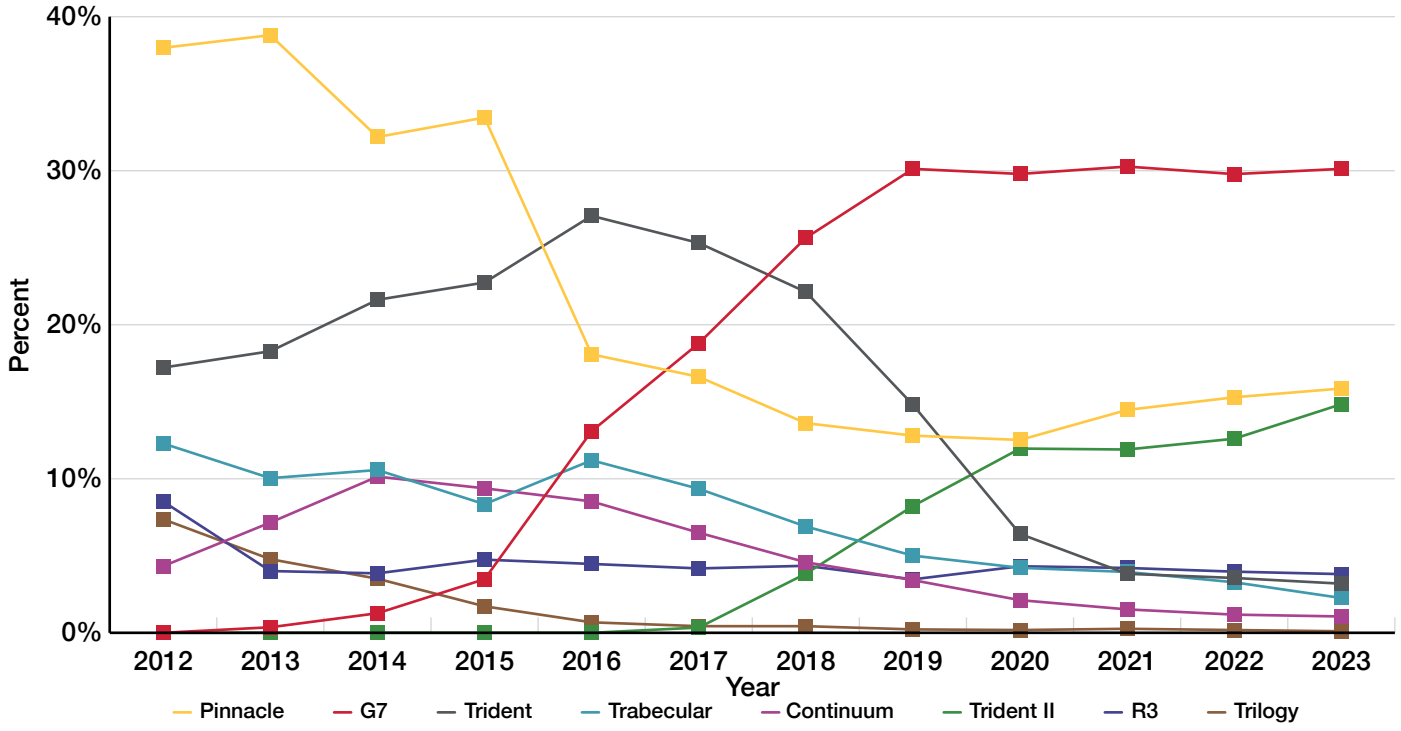


Figure 2.42 shows the liner types utilized by year for revision hip arthroplasty. Highly cross-linked polyethylene was more commonly utilized compared to antioxidant polyethylene for all revision hip arthroplasty procedures. This mirrors the observation in primary total hip arthroplasty (Figure 2.24). In contrast with elective THA, a few percent of revision hip procedures (<5%) report using conventional polyethylene.

Figure 2.42 Revision Hip Arthroplasty Liner Polyethylene Material by Year, 2012-2023 (N=78,038)

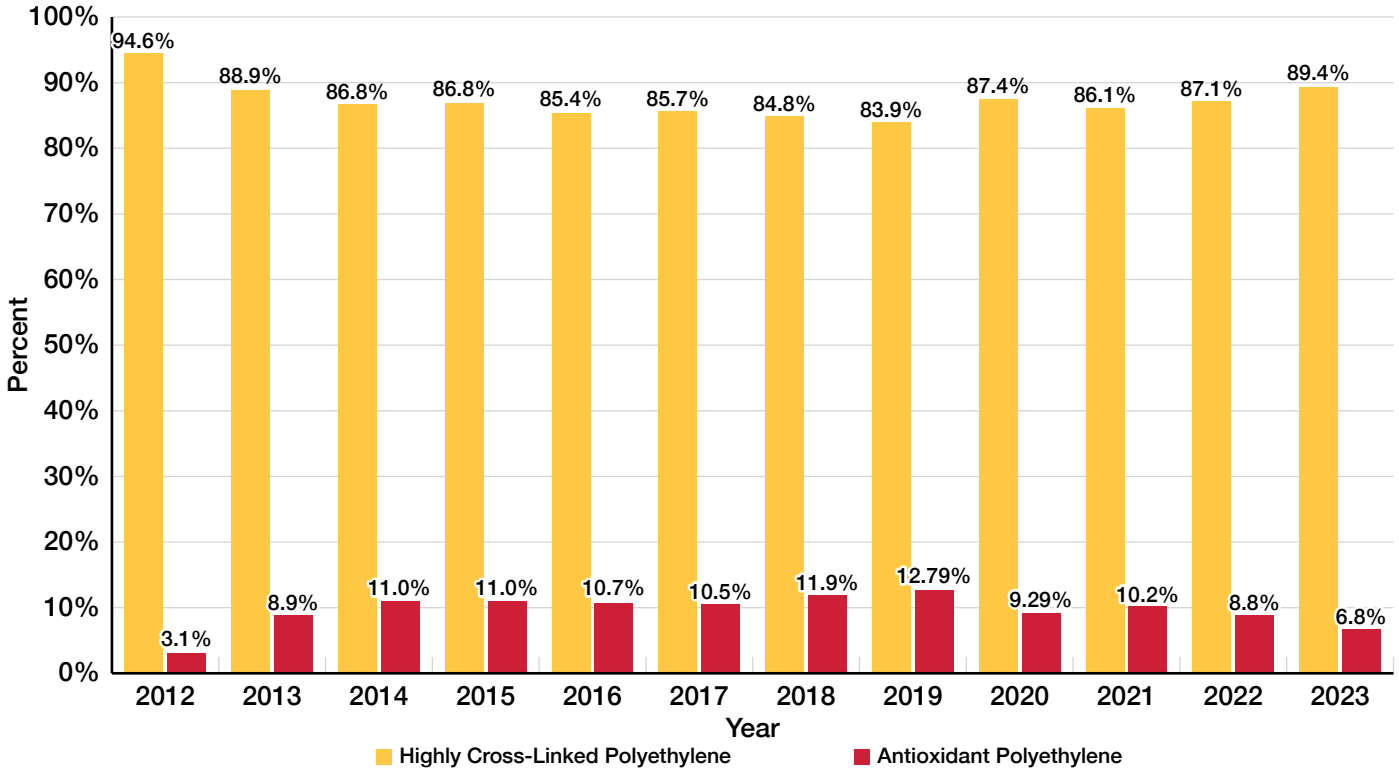
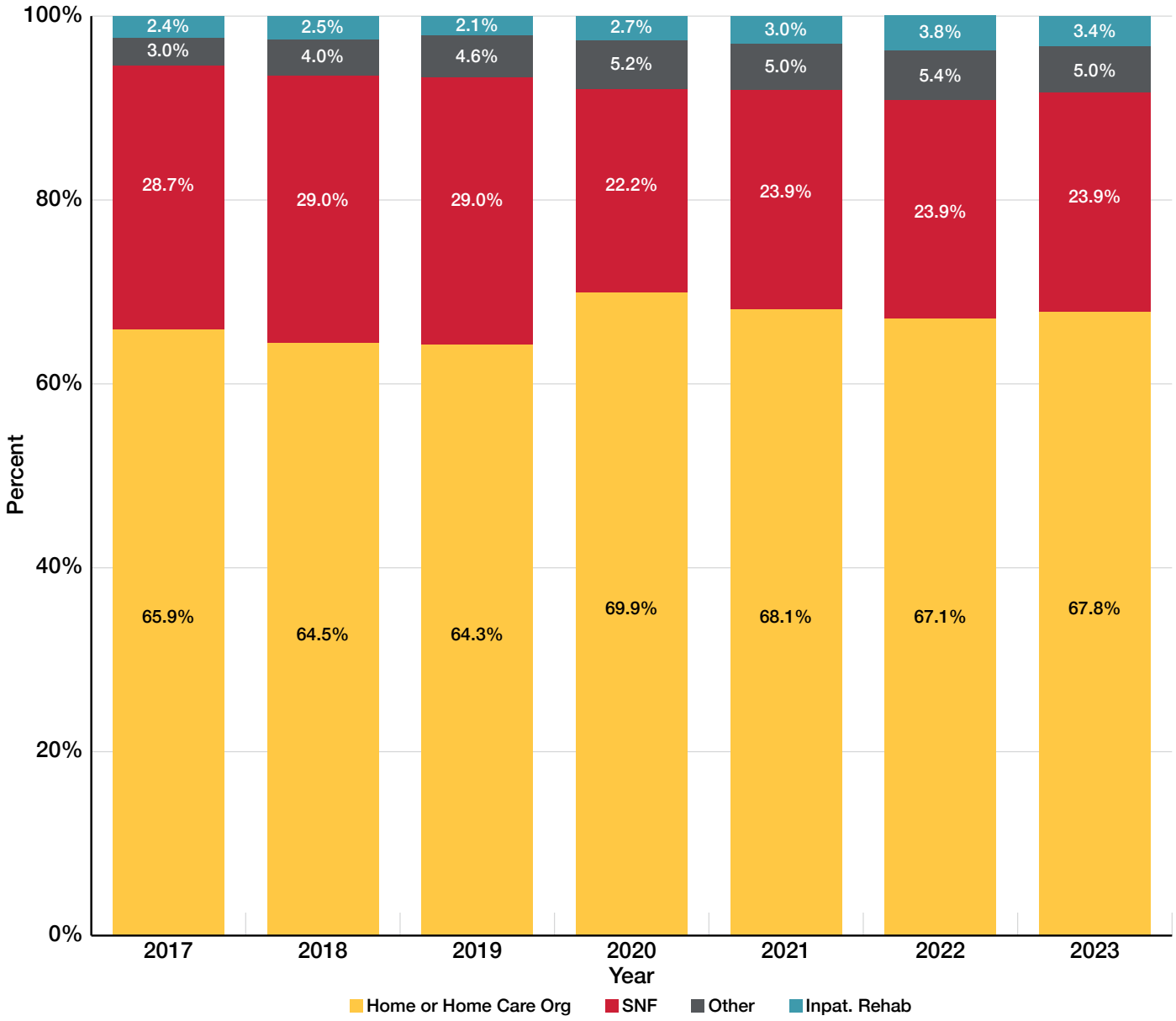


Figure 2.43 shows a tabulation of discharge disposition after revision hip arthroplasty since 2017 when these data were collected. AJRR data shows that most patients were released to home or self-care with a slight decline in those discharged to skilled nursing facilities from 2018-2023 and this has stayed consistent over time. Similar to 2022, nearly one quarter of patients were discharged to a skilled nursing facility in 2023, which is more than four times higher than the rate seen with primary total hip arthroplasty.

The percentage of patients discharged to a skilled nursing facility following revision THA declined over the last four years to less than a quarter of revision hip arthroplasty patients.

INSIGHTS

Figure 2.43 Revision Hip Arthroplasty Discharge Disposition Codes by Year, 2012-2023 (N=94,817)



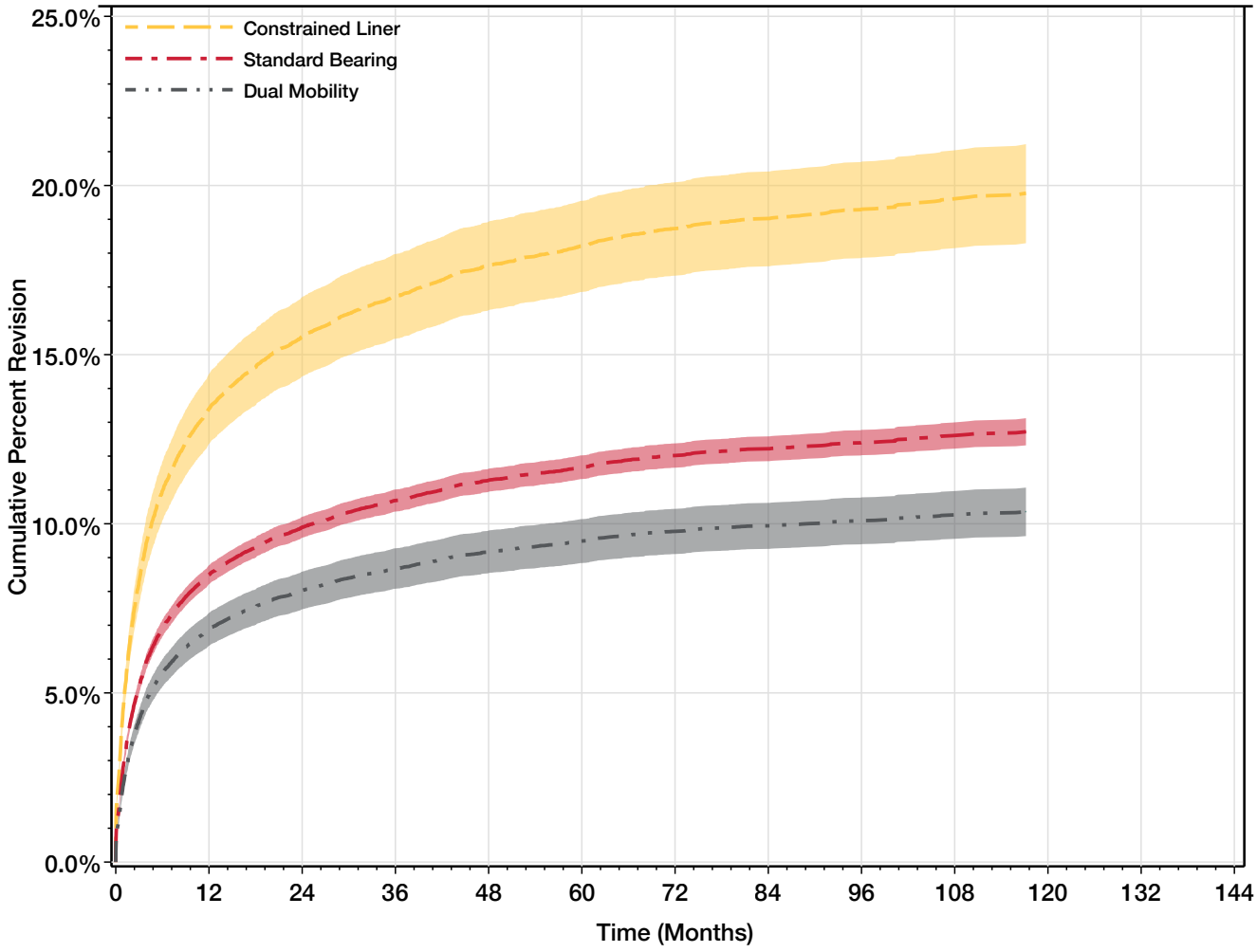
Code	Code Value
Home	Discharged to home/self-care (routine charge).
Home Care Org.	Discharged/transferred to home care of organized home health service organization.
Inpat. Care	Discharged/transferred to other short-term general hospital for inpatient care.
SNF	Discharged/transferred to skilled nursing facility (SNF) with Medicare certification in anticipation of covered skilled care--(For hospitals with an approved swing bed arrangement, use Code 61 - swing bed. For reporting discharges/transfers to a non-certified SNF, the hospital must use Code 04 - ICF.)
Inpat. Rehab	Discharged/transferred to an inpatient rehabilitation facility including distinct units of a hospital (eff. 1/2002).

Revision following revision total hip arthroplasty (re-revision) was investigated for the first time in last year's Annual Report (Figure 2.44). Dual mobility compared to constrained and standard bearings was used as the focal comparison for the first re-revision figure. After adjusting for age, sex, and CCI, dual mobility was identified to have a significantly reduced cumulative percent re-revision compared to standard and constrained lined cases in Medicare patients aged 65 and older. Similarly, standard design cases were found to have significantly reduced cumulative percent re-revision over the constrained cohort. As with all registry analyses, these findings represent an association only and do not prove a causal relationship between the bearing construct and the rate of re-revision".

INSIGHTS

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



Number at Risk (Months)	0	12	24	36	48	60	72	84	96	108	120	132	144
Constrained Liner	3,325	2,545	2,141	1,790	1,505	1,211	904	615	392	221	94	29	1
Dual Mobility	8,547	6,875	5,808	4,809	3,878	2,885	2,060	1,408	924	482	189	64	2
Standard Bearing	36,763	29,271	24,907	21,571	18,869	16,064	13,005	10,280	7,837	4,544	2,063	640	1
Total	48,635	38,691	32,856	28,170	24,252	20,160	15,969	12,303	9,153	5,247	2,346	733	4

Age/Sex/CCI adjusted HR (95%CI), p-value
Constrained Liner vs. Dual Mobility:2.026(1.815,2.261), p<.0001; Standard Bearing vs. Dual Mobility:1.246(1.151,1.35), p<.0001

Patient-Reported Outcome Measures (PROMs) - Total Hip Arthroplasty

Patient-reported outcome measures (PROMs) have received increased attention within AJRR and the wider practice of orthopaedic surgery. In the U.S., value-based payment models made capture of PROMs a prerequisite for various public and private alternative payment models. Internationally, in 2014 the International Society of Arthroplasty Registries (ISAR) Steering Committee established a working group in this area to advise on best practices.[15]

AJRR collects patient-reported outcome measures and encourages sites to submit this data at set intervals: a baseline measure obtained prior to the surgery, a measure 90-days post-discharge, and at one-year postoperatively. Patient- reported outcome measures capture information on the patient's overall health and function from the patient's perspective. The recommended intervals allow comparison over the course of a patient's care, but on a broader scope, provide a better picture of national outcomes and trends. AJRR provides national benchmarking for participating sites to review and compare this uniquely reported data.

With a growing emphasis on the value of PROMs data, the Registry in turn has expanded the ways in which sites submit this data. The Registry provides a tool for sites to collect PROMs data electronically on all eligible patients, via email or a computer or tablet device in the clinical setting. Sites also have the option to submit PROMs data through other methods, perhaps collected via a third-party vendor or a local system.

INSIGHTS

Based on the HOOS, JR. score, 92% of patients achieved a meaningful improvement after elective primary total hip arthroplasty.

Quick Facts:

- As of 2019, AJRR recommends and supports (on their PROM platform) the collection of HOOS JR., KOOS JR., PROMIS-10, and VR-12. Other PROMs are collected but not used for analyses.
- 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 2022 Annual Report.
- 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.
- 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%.

The number of institutions submitting PROMs to AJRR has increased by 27% over the past year.

INSIGHTS

PROMs Data Summary and Key Insights

1. **Overall Improvement: Across all PROMs, there is a substantial improvement in patient-reported outcomes from preoperative to 1-year postoperative, especially in physical function and hip-related outcomes.**
    - HOOS JR (Hip Disability and Osteoarthritis Outcome Score) shows a meaningful increase in scores from a preoperative mean of 47.8 to a postoperative mean of 85.6.
    - PROMIS-10 (Patient-Reported Outcomes Measurement Information System 10) and VR-12 (Veterans RAND 12-Item Health Survey) show improvements in both mental and physical health components.
2. **Meaningful Improvement:**
    - HOOS JR: 93.1% of patients with linked preoperative and postoperative scores experienced a clinically meaningful improvement.
    - PROMIS-10 Physical: 72.4% of patients reported meaningful improvement in physical health.
    - VR-12 Physical: 81.6% of patients reported meaningful improvement in physical health.
3. **Age-Stratified Results:**
    - The response rate for linked preoperative and postoperative PROMs decreases with increasing age, but meaningful improvement remains high across all age groups.
    - Patients 55-65 years of age showed the highest percentage of meaningful improvement for HOOS JR at 93.9%.
4. **Hospital Size Impact:**
    - Hospitals of all sizes (measured by bed count) report similar rates of meaningful improvement in HOOS JR scores, with response rates ranging from 92.6% to 93.3% across different bed-size groups.
    - Hospitals Between 100-399 Beds tend to have a higher percentage of patients reporting meaningful improvement in VR-12 physical health.
5. **Teaching Status Impact:**
    - Non-teaching hospitals report the highest percentage of meaningful improvement for HOOS JR (93.1%), while teaching hospitals have lower response rates but still show substantial improvement in PROMs.

Key Insights:

- High Rates of Improvement: A large percentage of patients undergoing hip arthroplasty experience significant improvement in both hip-specific and overall physical health outcomes after one year.
- Age and Bed Size: While response rates for PROMs data may vary by age and hospital bed size, the likelihood of meaningful improvement remains consistently high across groups.
- Focus on Physical Health: PROMs related to physical health, such as HOOS JR and VR-12 Physical Health Component, indicate greater improvements compared to mental health metrics, emphasizing the positive impact of knee arthroplasty on patients' physical function.

Table 2.5 Preoperative and 1-Year Postoperative PROM Mean Scores After Primary Hip Arthroplasty by PROM, 2012-2023

Patient-Reported Outcome Measure (PROM)	PROM Component	Pre or 1-year Postoperative	N	Mean	Standard Deviation
HOOS, JR. (Hip Disability and Osteoarthritis Outcome Score)	Score	Preoperative	120,252	47.8	15.8
		Postoperative	51,886	85.6	15.8
PROMIS-10 (Patient-Reported Outcomes Measurement Information System 10)	Mental T	Preoperative	92,306	47.5	10.9
		Postoperative	39,226	51.9	9.9
	Physical T	Preoperative	92,307	38.5	9
		Postoperative	39,224	49.2	10.2
VR-12 (The Veterans RAND 12 Item Health Survey)	Mental Health Component	Preoperative	23,386	51	12.5
		Postoperative	11,731	55.8	9.6
	Physical Health Component	Preoperative	23,253	30.3	9.2
		Postoperative	11,739	45.7	10.5

Table 2.6 Overall Change Between Preoperative and 1-Year Postoperative PROM Scores after Primary Hip 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
HOOS, JR. (Hip Disability and Osteoarthritis Outcome Score)	Score	120,252	32,894	27.4%	93.1%	7.9
PROMIS-10 (Patient-Reported Outcomes Measurement Information System 10)	Mental T	92,306	23,776	25.8%	29.4%	5.3
	Physical T	92,307	23,775	25.8%	72.4%	4.7
VR-12 (The Veterans RAND 12 Item Health Survey)	Mental Health Component	23,386	7,451	31.9%	38.4%	5.8
	Physical Health Component	23,253	7,456	32.1%	81.6%	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.*

Table 2.7 Age-stratified Change Between Preoperative and 1-Year Postoperative PROM Scores after Primary Hip Arthroplasty by PROM for Patients 55 Years and Over, 2012-2023

Patient-Reported Outcome Measure (PROM)	PROM Component	Age Group (Years)	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*
HOOS, JR. (Hip Disability and Osteoarthritis Outcome Score)	Score	55-64	33,076	8,801	26.6%	93.9%
		65-74	45,600	13,639	29.9%	93.6%
		75-84	22,280	6,079	27.3%	91.2%
		≥85	3,314	758	22.9%	92.2%
PROMIS-10 (Patient-Reported Outcomes Measurement Information System 10)	Mental T	55-64	24,681	6,052	24.5%	32.1%
		65-74	35,453	10,139	28.6%	29.1%
		75-84	17,457	4,564	26.1%	25.9%
		≥85	2,596	582	22.4%	23.2%
	Physical T	55-64	24,683	6,053	24.5%	75.1%
		65-74	35,453	10,139	28.6%	73.1%
		75-84	17,456	4,563	26.1%	67.0%
		≥85	2,597	582	22.4%	62.4%
VR-12	Mental Health Component	55-64	6,876	2,188	31.8%	38.1%
		65-74	8,605	2,930	34.0%	36.8%
		75-84	3,941	1,189	30.2%	42.6%
		≥85	616	139	22.6%	46.8%
	Physical Health Component	55-64	6,833	2,188	32.0%	84.5%
		65-74	8,554	2,930	34.3%	82.0%
		75-84	3,922	1,195	30.5%	75.7%
		≥85	613	138	22.5%	76.1%

**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.*

Table 2.8 Hospital Bed Size-stratified Change Between Preoperative and 1-Year Postoperative PROM Scores after Primary Hip Arthroplasty by PROM, 2012-2023

Patient-Reported Outcome Measure (PROM)	PROM Component	Bed Size Group	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*
HOOS, JR. (Hip Disability and Osteoarthritis Outcome Score)	Score	Between 1-99 Beds	21,017	6,018	28.6%	92.9%
		Between 100-399 Beds	39,183	10,900	27.8%	93.3%
		≥ 400 Beds	30,741	9,073	29.5%	92.6%
		Unknown	29,311	6,903	23.6%	93.7%
PROMIS-10 (Patient-Reported Outcomes Measurement Information System 10)	Mental T	Between 1-99 Beds	14,983	4,130	27.6%	26.9%
		Between 100-399 Beds	30,626	8,226	26.9%	29.0%
		≥ 400 Beds	24,016	6,344	26.4%	30.6%
		Unknown	22,681	5,076	22.4%	30.6%
	Physical T	Between 1-99 Beds	14,982	4,129	27.6%	72.4%
		Between 100-399 Beds	30,626	8,227	26.9%	75.0%
		≥ 400 Beds	24,016	6,343	26.4%	67.5%
		Unknown	22,683	5,076	22.4%	74.2%
VR-12	Mental Health Component	Between 1-99 Beds	3,273	702	21.4%	41.5%
		Between 100-399 Beds	5,952	1,737	29.2%	40.2%
		≥ 400 Beds	10,739	3,900	36.3%	37.8%
		Unknown	3,422	1,112	32.5%	35.8%
	Physical Health Component	Between 1-99 Beds	3,264	704	21.6%	82.0%
		Between 100-399 Beds	5,923	1,738	29.3%	83.8%
		≥ 400 Beds	10,647	3,902	36.6%	79.8%
		Unknown	3,419	1,112	32.5%	84.4%

**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.*

Table 2.9 Teaching Status-stratified Change Between Preoperative and 1-Year Postoperative PROM Scores after Primary Hip Arthroplasty by PROM, 2012-2023

Patient-Reported Outcome Measure (PROM)	PROM Component	Teaching Status Group	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*
HOOS, JR. (Hip Disability and Osteoarthritis Outcome Score)	Score	Major	15,048	3,847	25.6%	92.9%
		Minor	49,937	14,914	29.9%	92.9%
		Non-Teaching	27,263	7,747	28.4%	93.1%
		Unknown	28,004	6,386	22.8%	93.6%
PROMIS-10 (Patient-Reported Outcomes Measurement Information System 10)	Mental T	Major	11,996	1,734	14.5%	28.9%
		Minor	36,816	11,200	30.4%	29.8%
		Non-Teaching	22,125	6,283	28.4%	27.9%
		Unknown	21,369	4,559	21.3%	30.9%
	Physical T	Major	11,996	1,734	14.5%	63.7%
		Minor	36,816	11,201	30.4%	72.8%
		Non-Teaching	22,124	6,281	28.4%	73.0%
		Unknown	21,371	4,559	21.3%	74.0%
VR-12	Mental Health Component	Major	8,138	3,279	40.3%	37.0%
		Minor	8,473	2,283	26.9%	42.7%
		Non-Teaching	3,353	777	23.2%	35.5%
		Unknown	3,422	1,112	32.5%	35.8%
	Physical Health Component	Major	8,113	3,275	40.4%	80.6%
		Minor	8,392	2,292	27.3%	80.0%
		Non-Teaching	3,329	777	23.3%	86.5%
		Unknown	3,419	1,112	32.5%	84.4%

**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.*

Figure 2.45 Heat Map of Linked 1-Year Postoperative HOOS JR Submissions by State, 2012-2023*

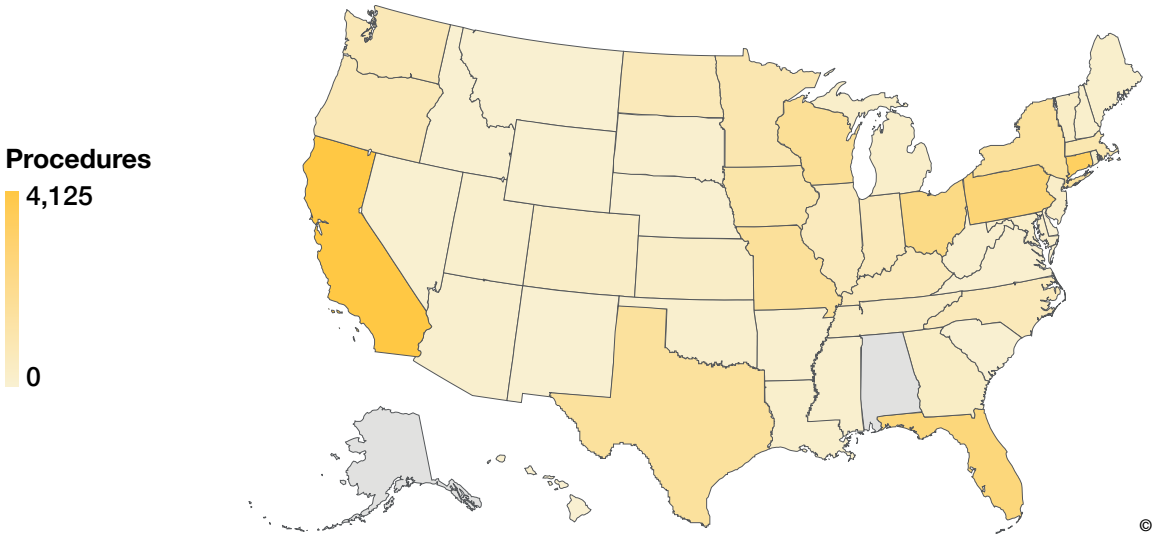


Figure 2.46 Heat Map of Linked 1-Year Postoperative PROMIS-10 Mental Component Submissions by State, 2012-2023*

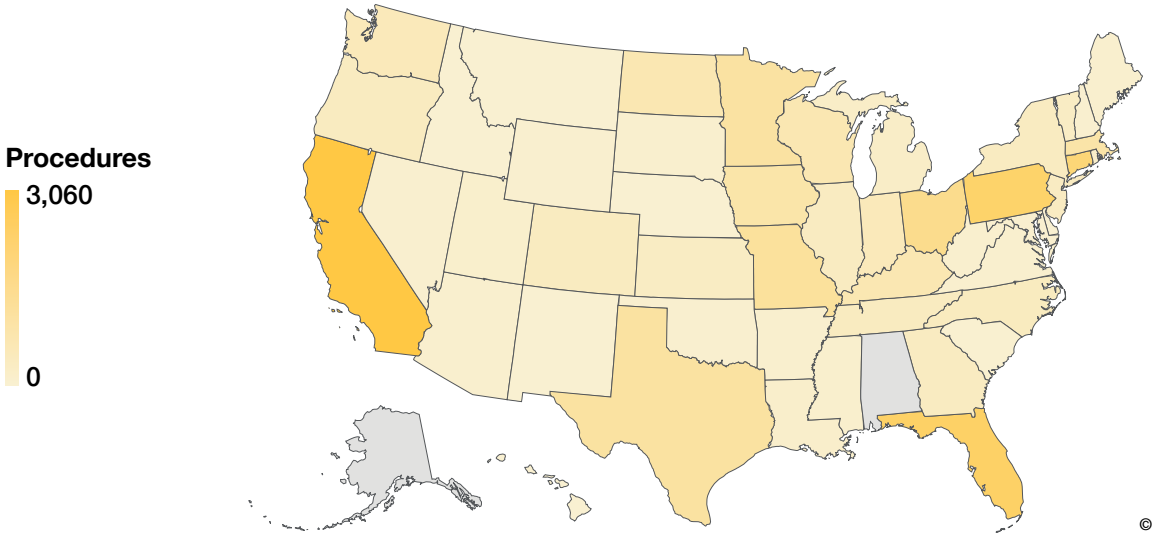
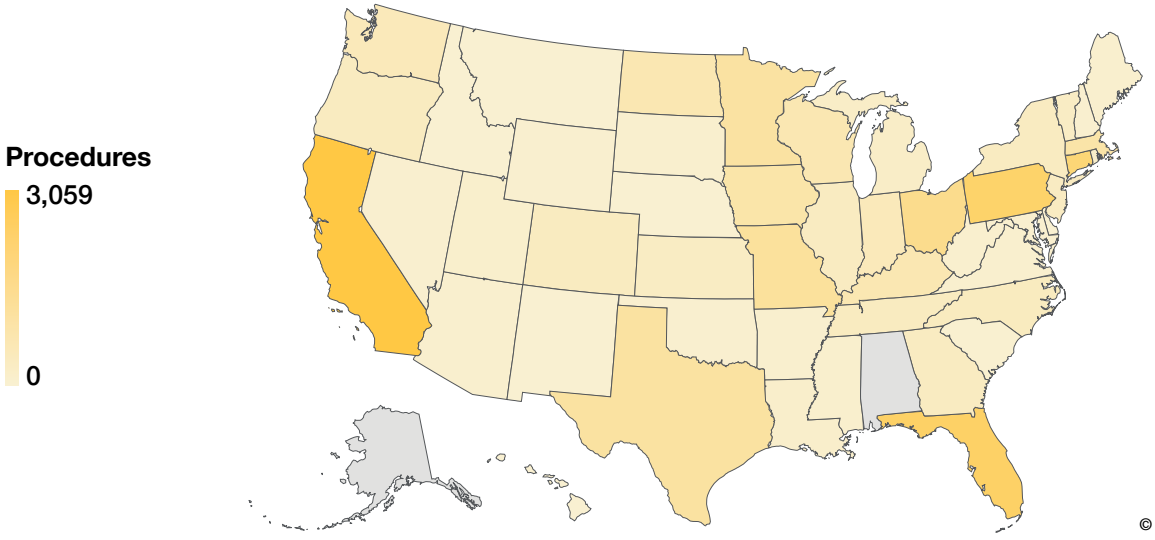
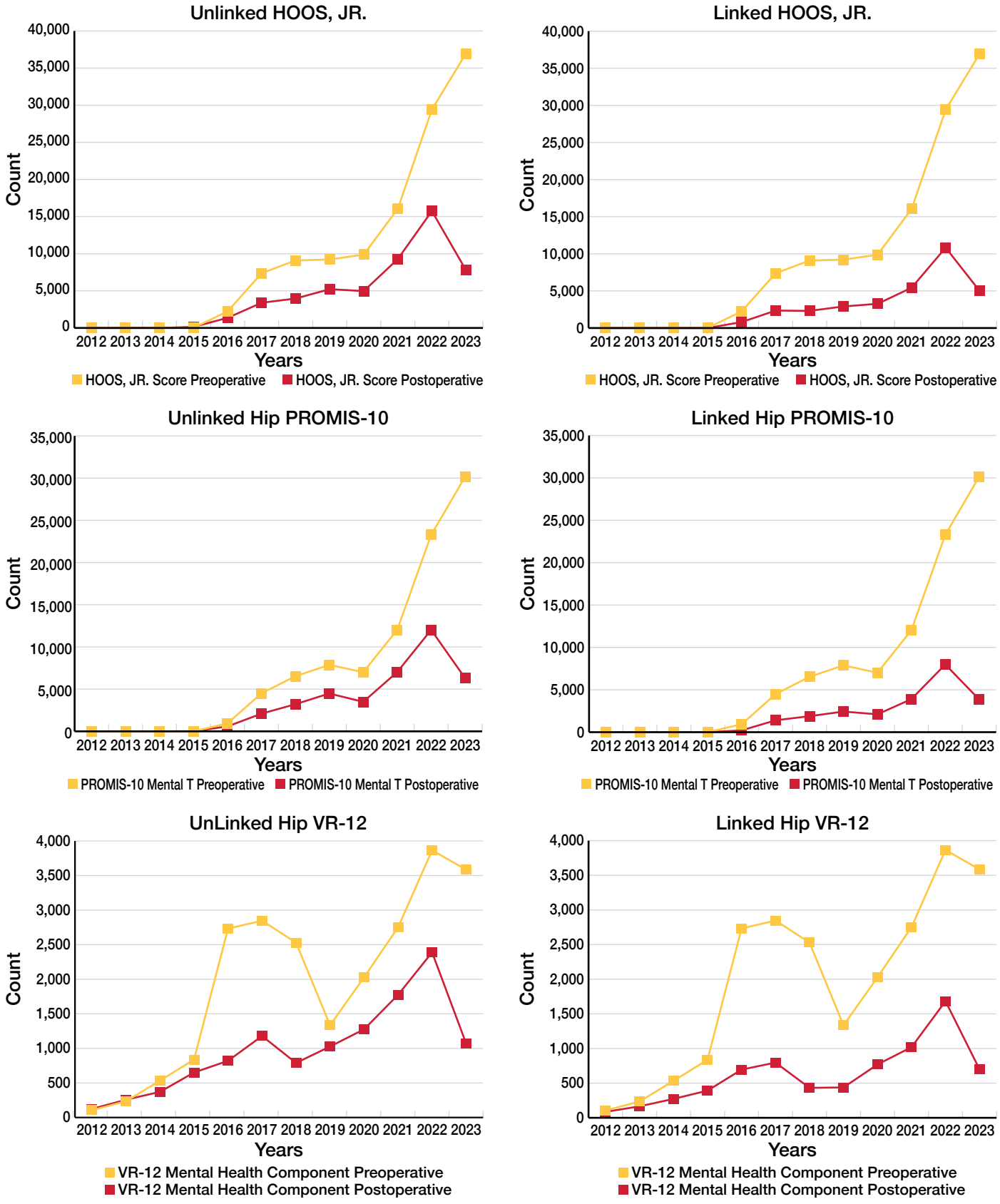


Figure 2.47 Heat Map of Linked 1-Year Postoperative PROMIS-10 Physical Component Submissions by State, 2012-2023*



** These heat maps were not adjusted for state population or number of submitting institutions.*

Figure 2.48 Submission of Preoperative and Unlinked or Linked 1-Year Postoperative Postoperative PROM Scores after Primary Hip Arthroplasty by PROM, 2012-2023*



(PROMIS-10): The Global Health values for the Physical T component are not displayed because they closely resemble those of the Mental T component.
(VR-12): The values for the Physical Health component are not displayed because they closely resemble those of the Mental T component.

**We expect the 2023 postoperative scores to be lower as not all cases would have met the 1-year follow-up time necessary to be included in this analysis.*

Knee Arthroplasty

Knee Overview

Between 2012 and 2023, AJRR has collected data on 2,181,469 knee arthroplasty procedures.

The majority of cases submitted to AJRR continues to be total knee arthroplasty (TKA) continues to account for the majority of surgeon volume. With 3,889 surgeons performing a total of 254,345 procedures, the mean number of TKA per surgeons per year was 65.4, with a median of 32. In contrast, revision knee arthroplasty involved 2,717 surgeons, averaging 9.82 procedures per surgeon, and partial knee arthroplasty involved 1,440 surgeons, averaging 7.37 procedures per surgeon per year.

The average age for patients undergoing different types of knee arthroplasty procedures remained stable in 2023 compared to past years. The mean age for partial knee arthroplasty was 64.5 years (SD = 10.8), for revision knee arthroplasty it was 66.8 years (SD = 10.4), and for total knee arthroplasty it was 67.6 years (SD = 9.3). These findings are similar to previous years, with older patients predominantly undergoing total and revision procedures, while younger patients more often receive partial knee replacements. Age distribution data for 2023 highlights that most knee arthroplasty patients are aged 65-74, followed by the 55-64 and 75-84 age groups. Patients under 55 and over 85 make up a smaller proportion of procedures.

The length of stay (LOS) for knee arthroplasty procedures has continued to decrease significantly over the years. In 2023, the mean LOS for partial knee arthroplasty was reduced to 0.5 days, down from 2.2 days in 2012. For revision knee arthroplasty, the LOS decreased from 3.6 days in 2012 to 3.3 days in 2023, while primary total knee arthroplasty saw a reduction from 2.9 days to 1.1 days over the same period. These improvements likely reflect advances in surgical techniques and recovery protocols, including enhanced recovery after surgery (ERAS) and outpatient surgery options.

Table 3.1 Average Annual Procedural Volume For Participating Surgeons, 2023

Procedure	Total Surgeons	Total Procedures	Per Surgeon Mean	Per Surgeon Median	25th Percentile	75th Percentile
Partial Knee Arthroplasty	1,440	10,609	7.37	3	1	7
Revision Knee Arthroplasty	2,717	26,683	9.82	4	2	11
Total Knee Arthroplasty	3,889	254,345	65.4	32	9	81

Table 3.2 Mean Age of Patients Undergoing Knee Arthroplasty Procedures, 2012-2023 (N=2,181,469)

Procedures	Total	Mean Age (Years)	Standard Deviation
Partial Knee Arthroplasty	92,728	64.5	10.8
Revision Knee Arthroplasty	188,894	66.8	10.4
Total Knee Arthroplasty	1,899,847	67.6	9.3

Figure 3.1 Age Distribution of Knee Arthroplasty Procedures, 2012-2023 (N=2,181,469)

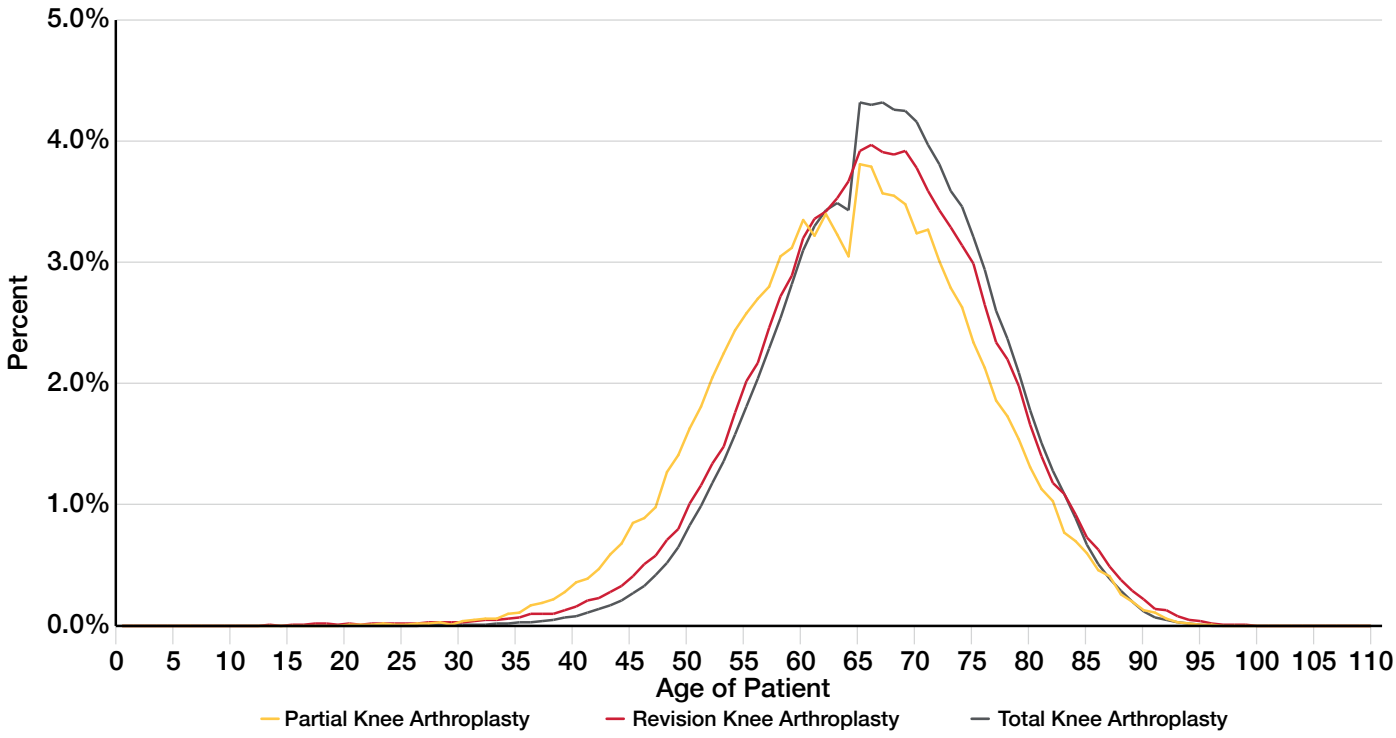
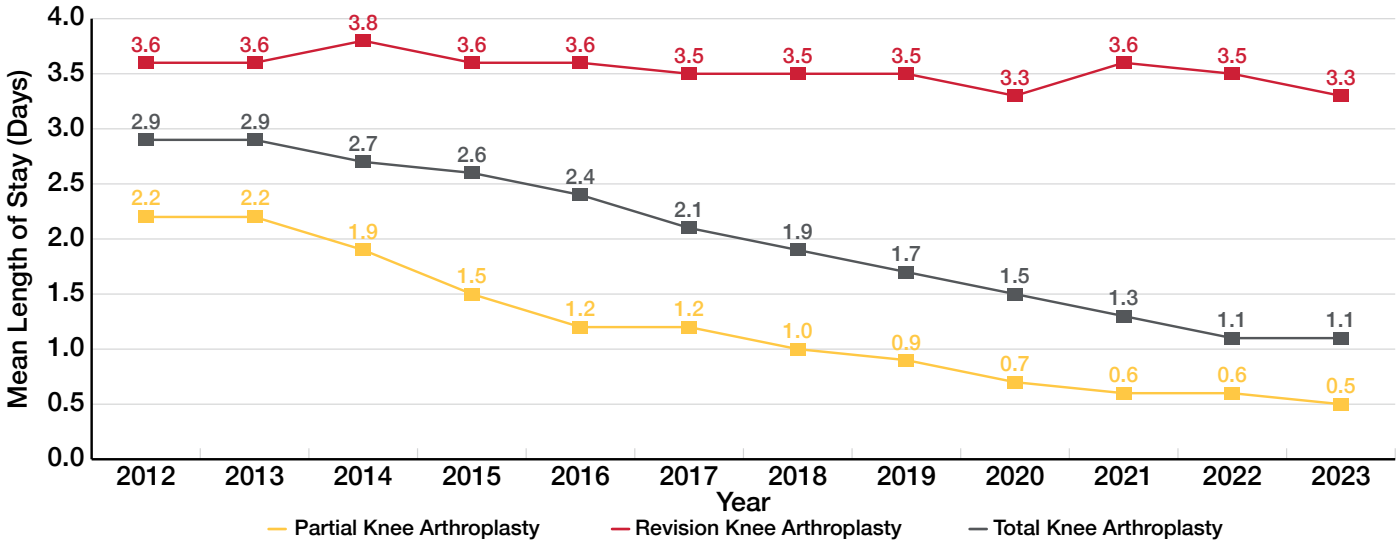


Figure 3.2 Mean Length of Stay for Knee Arthroplasty Procedures, 2012-2023 (N=1,483,055)



INSIGHTS

Mean length of stay following primary total knee arthroplasty has declined significantly from 2.9 days to 1.1 days from 2012 to 2023.

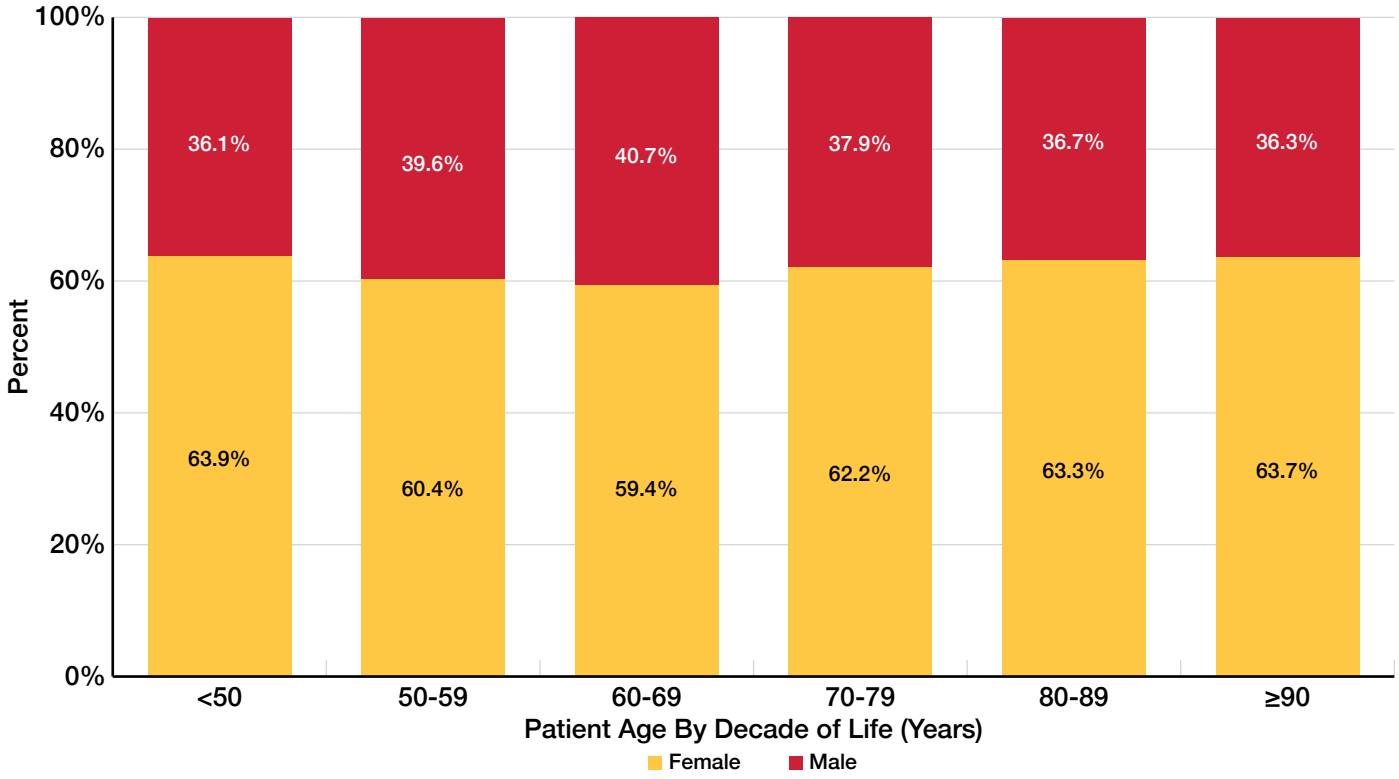
Primary Total Knee Arthroplasty

Between 2012 and 2023, AJRR has collected data on 1,899,847 primary total knee arthroplasty procedures.

The data show that females continue to outnumber males across all age groups in knee arthroplasty procedures, especially in the 65-74 and 75-84 age groups.

Figure 3.4 outlines the distribution of primary total knee arthroplasty (TKA) implant designs used from 2012 to 2023, based on 931,660 cases. Posterior Stabilized designs were the most commonly used implant type throughout the study period, although their usage has slightly declined over time. The data highlights the increasing popularity of Medial Congruent designs. While Posterior Stabilized implants remain the most commonly used, their gradual decline suggests a diversification in implant preferences.

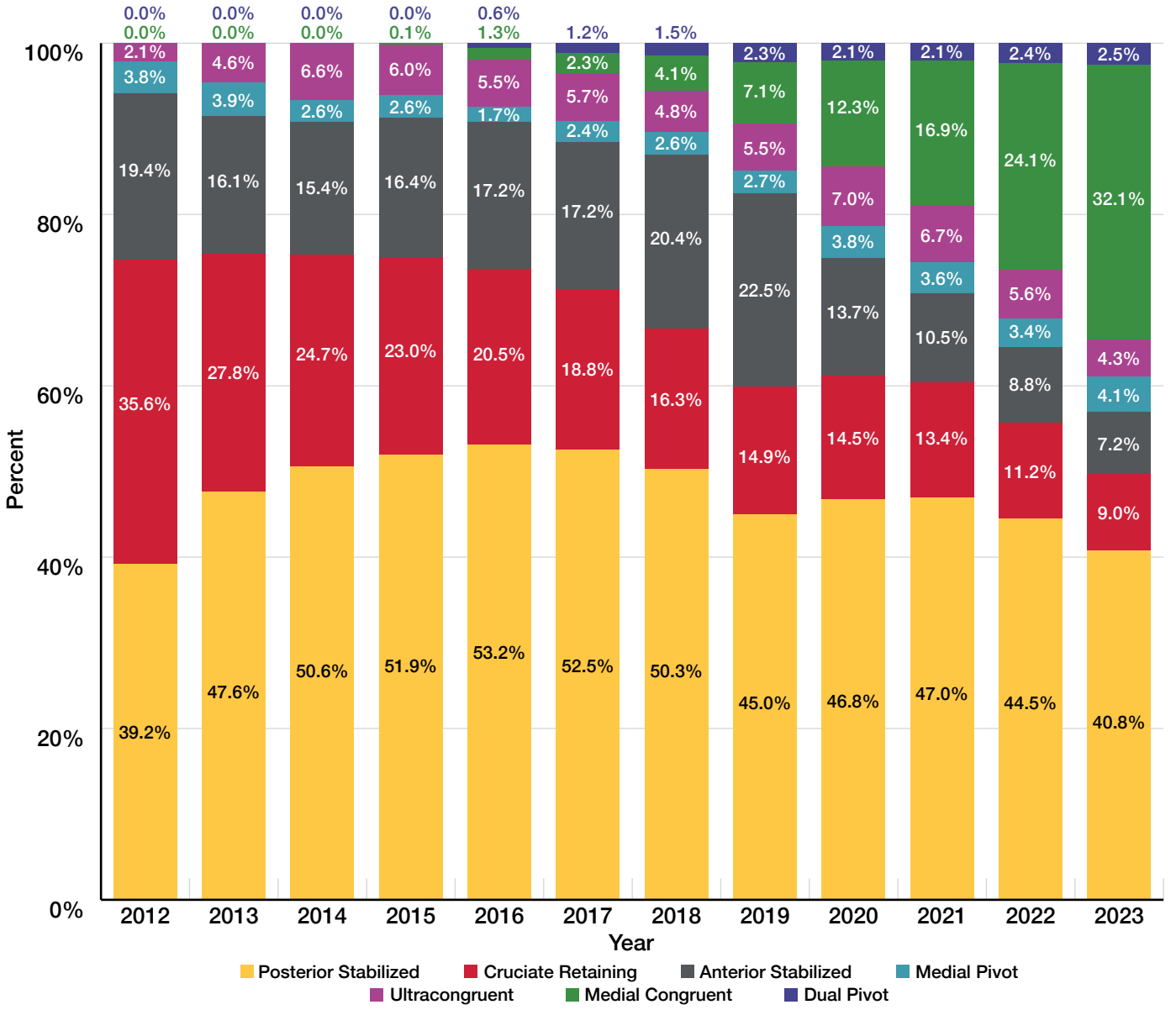
Figure 3.3 Sex Distribution of All Total Knee Arthroplasty Procedures by Age Group, 2012-2023 (N=1,892,895)



The trend towards increased use of medial congruent designs for primary total knee arthroplasty continues while use of posterior stabilized and traditional cruciate retaining designs decreases.

INSIGHTS

Figure 3.4 Distribution of Primary Total Knee Arthroplasty Implant Designs, 2012-2023 (N=1,245,884)

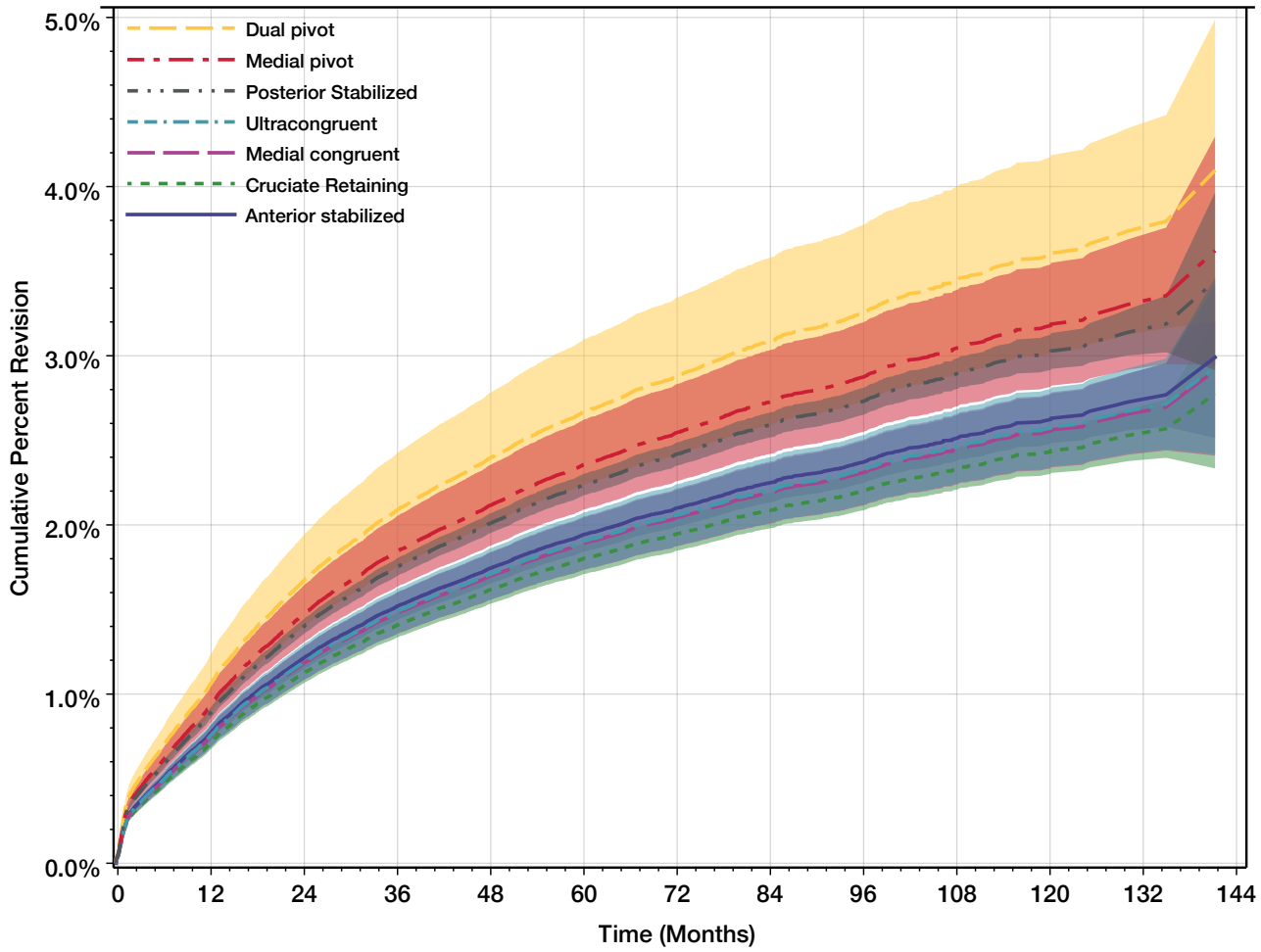


After adjusting for age, sex, and CCI in patients ≥65 years of age as reported to either AJRR or CMS, ultracongruent and cruciate retaining designs tend to have lower early revision rates but may show more variability, with some designs (e.g., Persona CR) demonstrating increased revision rates by 10 years as compared to postrior stabilized designs which tend to show higher revisions rates in the early operative period, but maintain stability over time. (Figure 3.5). This analysis does not account for numerous potential confounders and the reasons for revision may be unrelated to the implant type. See Appendix G for cumulative percent revision curve methodology.

INSIGHTS

Cruciate retaining and ultracongruent implants are associated with reduced rates of cumulative revision when compared to posterior stabilized designs in the AJRR.

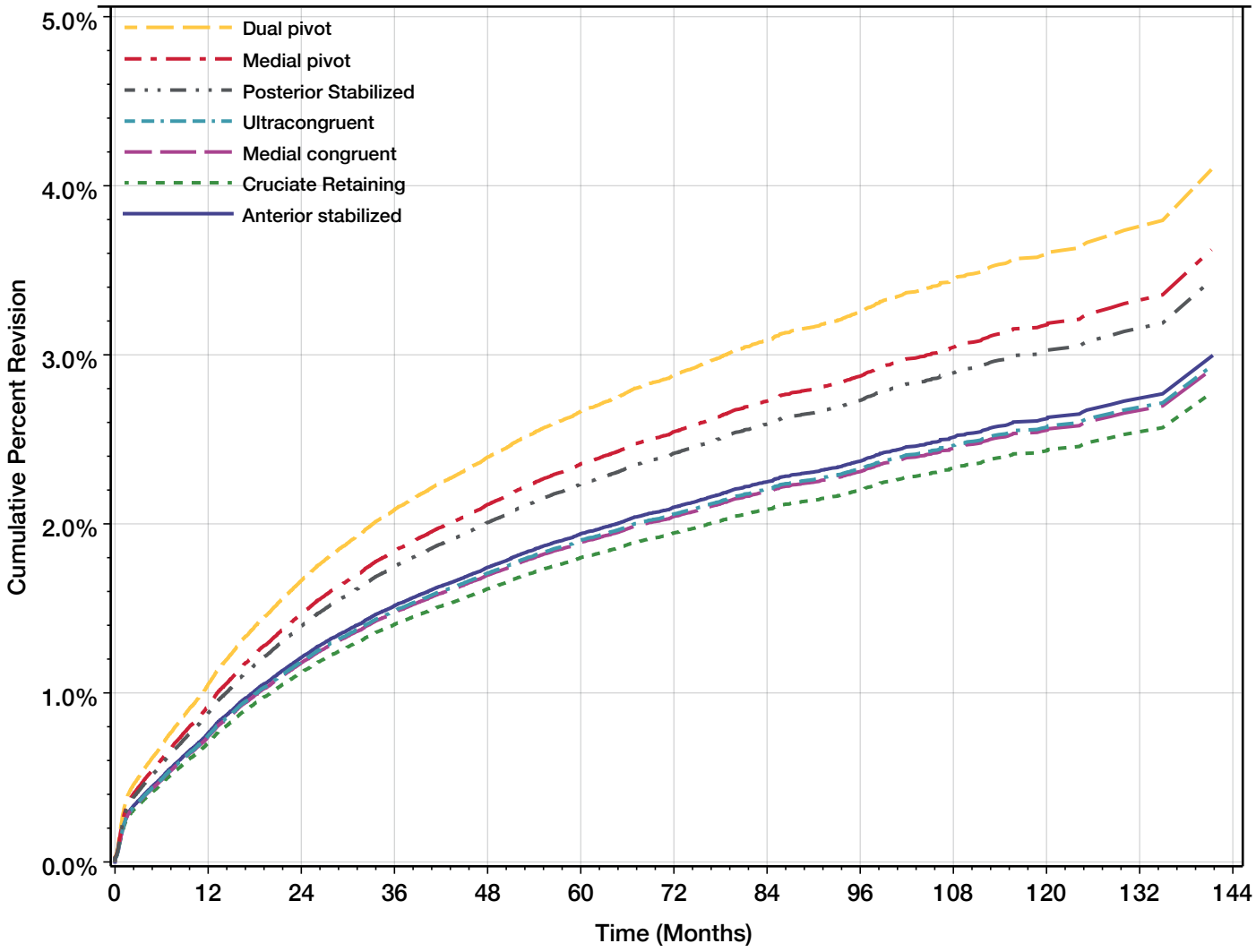
Figure 3.5a Cumulative Percent Revision for Primary Total Knee Arthroplasty Implant Designs in Medicare Patients 65 Years of Age and older with Primary Osteoarthritis With Confidence Intervals, 2012-2023



Number at Risk (Months)	0	12	24	36	48	60	72	84	96	108	120	132	144
Anterior stabilized	76,811	71,776	65,703	59,945	53,621	40,656	28,793	18,933	10,915	5,655	2,366	716	2
Cruciate Retaining	85,474	79,060	71,843	65,002	58,173	48,890	38,754	26,992	16,829	9,091	4,097	1,249	5
Dual pivot	6,956	5,443	4,014	3,132	2,511	1,586	975	285	11	2	2	2	0
Medial congruent	51,718	33,784	20,041	12,520	7,857	4,207	1,950	619	27	2	2	2	0
Medial pivot	15,595	12,873	10,653	8,886	7,294	5,671	4,171	2,835	1,935	1,093	538	162	1
Posterior Stabilized	243,823	216,607	188,952	165,916	145,382	119,224	89,429	58,345	32,288	15,594	5,839	1,304	4
Ultracongruent	29,016	25,952	22,180	18,909	15,975	12,630	9,648	6,232	3,551	1,745	458	50	1
Total	509,393	445,495	383,386	334,310	290,813	232,864	173,720	114,241	65,556	33,182	13,302	3,485	13

Age/Sex/CCI adjusted HR (95%CI), p-value
Anterior stabilized vs. Posterior Stabilized:0.785(0.698,0.883), p<.0001; Cruciate Retaining vs. Posterior Stabilized:0.805(0.755,0.858), p<.0001; Dual pivot vs. Posterior Stabilized:1.184(0.984,1.424), p=0.0730; Medial congruent vs. Posterior Stabilized:0.841(0.764,0.926), p=0.0004; Medial pivot vs. Posterior Stabilized:1.054(0.927,1.199), p=0.4226; Ultracongruent vs. Posterior Stabilized:0.881(0.828,0.938), p<.0001

Figure 3.5b Cumulative Percent Revision for Primary Total Knee Arthroplasty Implant Designs in Medicare Patients 65 Years of Age and older with Primary Osteoarthritis Without Confidence Intervals, 2012-2023



Number at Risk (Months)	0	12	24	36	48	60	72	84	96	108	120	132	144
Anterior stabilized	76,811	71,776	65,703	59,945	53,621	40,656	28,793	18,933	10,915	5,655	2,366	716	2
Cruciate Retaining	85,474	79,060	71,843	65,002	58,173	48,890	38,754	26,992	16,829	9,091	4,097	1,249	5
Dual pivot	6,956	5,443	4,014	3,132	2,511	1,586	975	285	11	2	2	2	0
Medial congruent	51,718	33,784	20,041	12,520	7,857	4,207	1,950	619	27	2	2	2	0
Medial pivot	15,595	12,873	10,653	8,886	7,294	5,671	4,171	2,835	1,935	1,093	538	162	1
Posterior Stabilized	243,823	216,607	188,952	165,916	145,382	119,224	89,429	58,345	32,288	15,594	5,839	1,304	4
Ultracongruent	29,016	25,952	22,180	18,909	15,975	12,630	9,648	6,232	3,551	1,745	458	50	1
Total	509,393	445,495	383,386	334,310	290,813	232,864	173,720	114,241	65,556	33,182	13,302	3,485	13

Age/Sex/CCI adjusted HR (95%CI), p-value
Anterior stabilized vs. Posterior Stabilized:0.785(0.698,0.883), p<.0001; Cruciate Retaining vs. Posterior Stabilized:0.805(0.755,0.858), p<.0001; Dual pivot vs. Posterior Stabilized:1.184(0.984,1.424), p=0.0730; Medial congruent vs. Posterior Stabilized:0.841(0.764,0.926), p=0.0004; Medial pivot vs. Posterior Stabilized:1.054(0.927,1.199), p=0.4226; Ultracongruent vs. Posterior Stabilized:0.881(0.828,0.938), p<.0001

Table 3.5a Hazard Ratios for Comparisons of Different Liner Designs (bold comparisons are statistically significant)

Comparison	Cox Model HR(95% CI)
Anterior stabilized vs. Cruciate Retaining	1.08(0.997,1.169), p=0.0608
Anterior stabilized vs. Dual pivot	**0.724(0.598,0.877), p=0.0010**
Anterior stabilized vs. Medial congruent	1.027(0.922,1.144), p=0.6272
Anterior stabilized vs. Medial pivot	**0.822(0.716,0.944), p=0.0054**
Anterior stabilized vs. Ultracongruent	1.02(0.912,1.141), p=0.7266
Anterior stabilized vs. Posterior Stabilized	**0.866(0.812,0.924), p=<.0001**
Cruciate Retaining vs. Dual pivot	**0.671(0.554,0.812), p=<.0001**
Cruciate Retaining vs. Medial congruent	0.951(0.855,1.059), p=0.3633
Cruciate Retaining vs. Medial pivot	**0.761(0.664,0.874), p=0.0001**
Cruciate Retaining vs. Ultracongruent	0.945(0.846,1.056), p=0.3174
Cruciate Retaining vs. Posterior Stabilized	**0.802(0.753,0.855), p=<.0001**
Dual pivot vs. Medial congruent	**1.418(1.156,1.739), p=0.0008**
Dual pivot vs. Medial pivot	1.135(0.909,1.416), p=0.2633
Dual pivot vs. Ultracongruent	**1.408(1.146,1.731), p=0.0011**
Dual pivot vs. Posterior Stabilized	1.196(0.994,1.439), p=0.0582
Medial congruent vs. Medial pivot	**0.8(0.685,0.935), p=0.0049**
Medial congruent vs. Ultracongruent	0.993(0.87,1.134), p=0.9190
Medial congruent vs. Posterior Stabilized	**0.843(0.766,0.929), p=0.0005**
Medial pivot vs. Ultracongruent	**1.241(1.06,1.453), p=0.0073**
Medial pivot vs. Posterior Stabilized	1.054(0.926,1.199), p=0.4283
Ultracongruent vs. Posterior Stabilized	**0.849(0.768,0.939), p=0.0014**

Figure 3.6 outlines the trends in the use of different types of polyethylene materials for total knee arthroplasty (TKA) inserts between 2012 and 2023. Highly cross-linked polyethylene was the most commonly used material at the beginning of the study period, accounting for 47.47% of TKA procedures in 2012. Its usage slightly declined over the years, reaching a low of 38.30% in 2015. However, there has been a gradual rebound since then, with its usage increasing to 45.91% by 2023. Antioxidant polyethylene has seen a sharp increase in adoption over the years. It started with only 10.08% usage in 2012 but quickly rose to become a significant component in TKA procedures, reaching 39.51% in 2023. Conventional polyethylene usage has declined significantly over the study period. In 2012, it accounted for 42.45% of TKA procedures, but by 2023, its usage had dropped to 14.58%.

Figure 3.6 Primary Total Knee Arthroplasty Insert Polyethylene Material by Year, 2012-2023 (N=1,463,722)

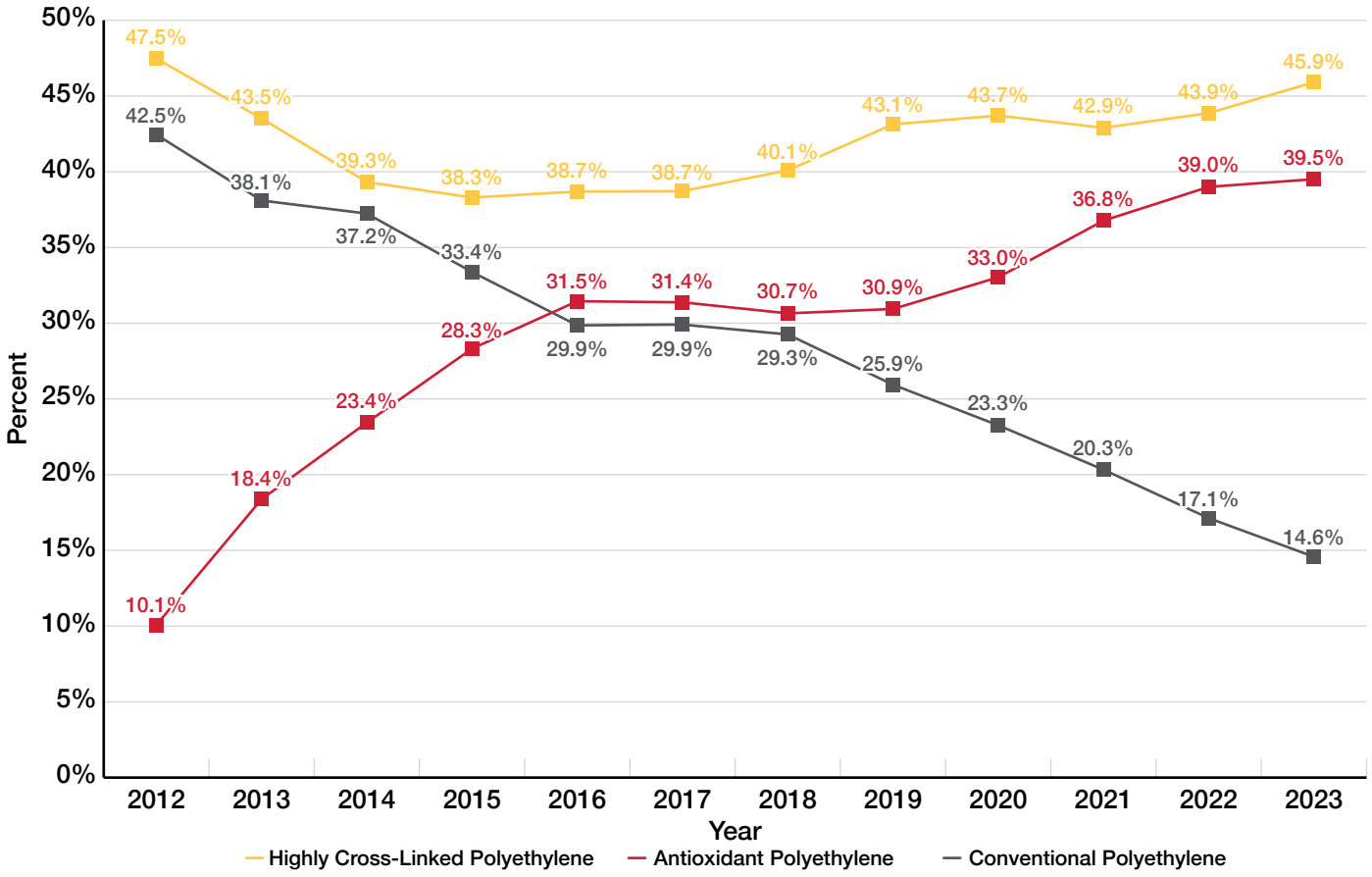
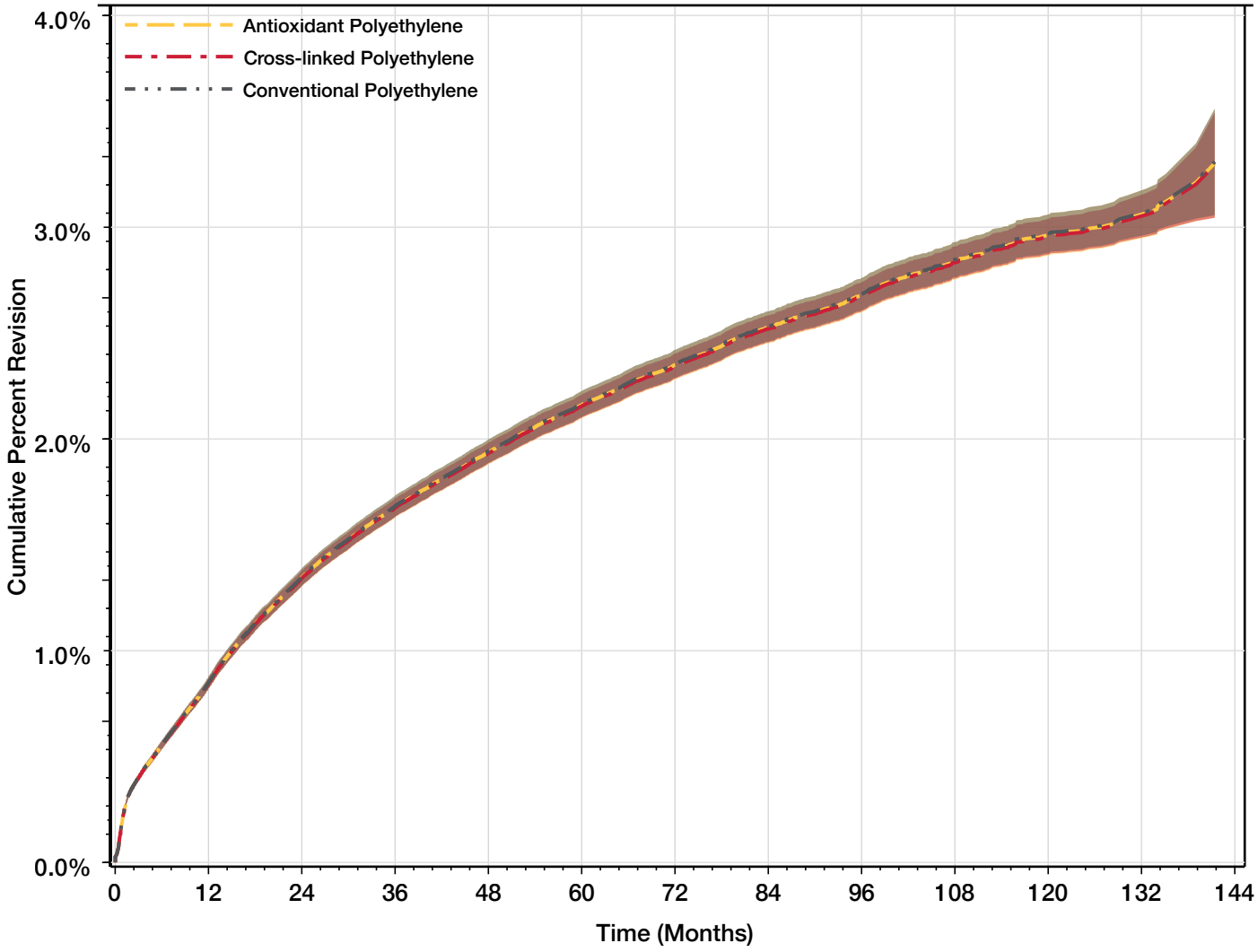


Figure 3.7 highlights data that compares the cumulative revision rates of primary total knee arthroplasty (TKA) using three different polyethylene insert materials—antioxidant polyethylene, cross-linked polyethylene, and conventional polyethylene—in Medicare patients aged 65 and older with primary osteoarthritis from 2012 to 2023. The revision rates for all three materials are similar, converging around 3% at 12 years. Statistical analysis shows no significant difference in revision risk, with hazard ratios (HR) of 0.998 for antioxidant polyethylene and 0.995 for cross-linked polyethylene compared to conventional polyethylene, both with p-values above 0.8. AJRR data thus does not suggest any short-term association between insert material and revision rates.

Figure 3.7 Cumulative Percent Revision for Primary Total Knee Arthroplasty Insert Materials in Medicare Patients 65 Years of Age and older with Primary Osteoarthritis, 2012-2023



Number at Risk (Months)	0	12	24	36	48	60	72	84	96	108	120	132	144
Antioxidant Polyethylene	245,597	206,764	169,332	142,053	120,366	95,792	70,852	44,459	23,038	10,102	3,340	473	1
Conventional Polyethylene	234,859	216,995	197,321	179,142	160,464	135,139	106,581	75,623	48,169	27,806	12,699	3,935	1
Cross-linked Polyethylene	327,476	282,119	240,049	207,649	178,292	142,953	109,444	75,185	46,356	26,072	12,462	3,712	1
Total	807,932	705,878	606,702	528,844	459,122	373,884	286,877	195,267	117,563	63,980	28,501	8,120	3

Age/Sex/CCI adjusted HR (95%CI), p-value
Antioxidant Polyethylene vs. Conventional Polyethylene:0.998(0.954,1.043), p=0.9244; Cross-linked Polyethylene vs. Conventional Polyethylene:0.995(0.955,1.037), p=0.8141

Patellar resurfacing has remained the predominant approach, though its usage has gradually declined over time. In 2012, 95.9% of TKA procedures included patellar resurfacing. However, by 2023, this percentage had decreased to 87.0%, indicating a steady reduction in the preference for resurfacing during knee replacements. Non-resurfaced patellar procedures have shown a corresponding increase over the years. In 2012, only 4.11% of procedures did not include patellar resurfacing, but this figure had risen to 13.0% by 2023. (Figure 3.8). While patellar resurfacing remains the predominant practice in the U.S., this is not necessarily the case in other international registries. In 2022, the Australian Orthopaedic Association National Joint Replacement Registry reported patellar resurfacing at the time of the primary total knee replacement had increased from a low of 41.5% in 2005 to 78.1% in 2022.[7] The Swedish Arthroplasty Register reported use of patellar resurfacing has been decreasing since the mid-1980s and in 2022 there were no reported cases of patellar resurfacing for total knee arthroplasty.[9]

Patellar resurfacing has remained the predominant approach in primary total knee arthroplasty, though performing patellar resurfacing has gradually declined over time.

INSIGHTS

Figure 3.8 Percentage of Primary Total Knee Arthroplasty with Patellar Resurfacing, 2012-2023 (N=1,339,564)

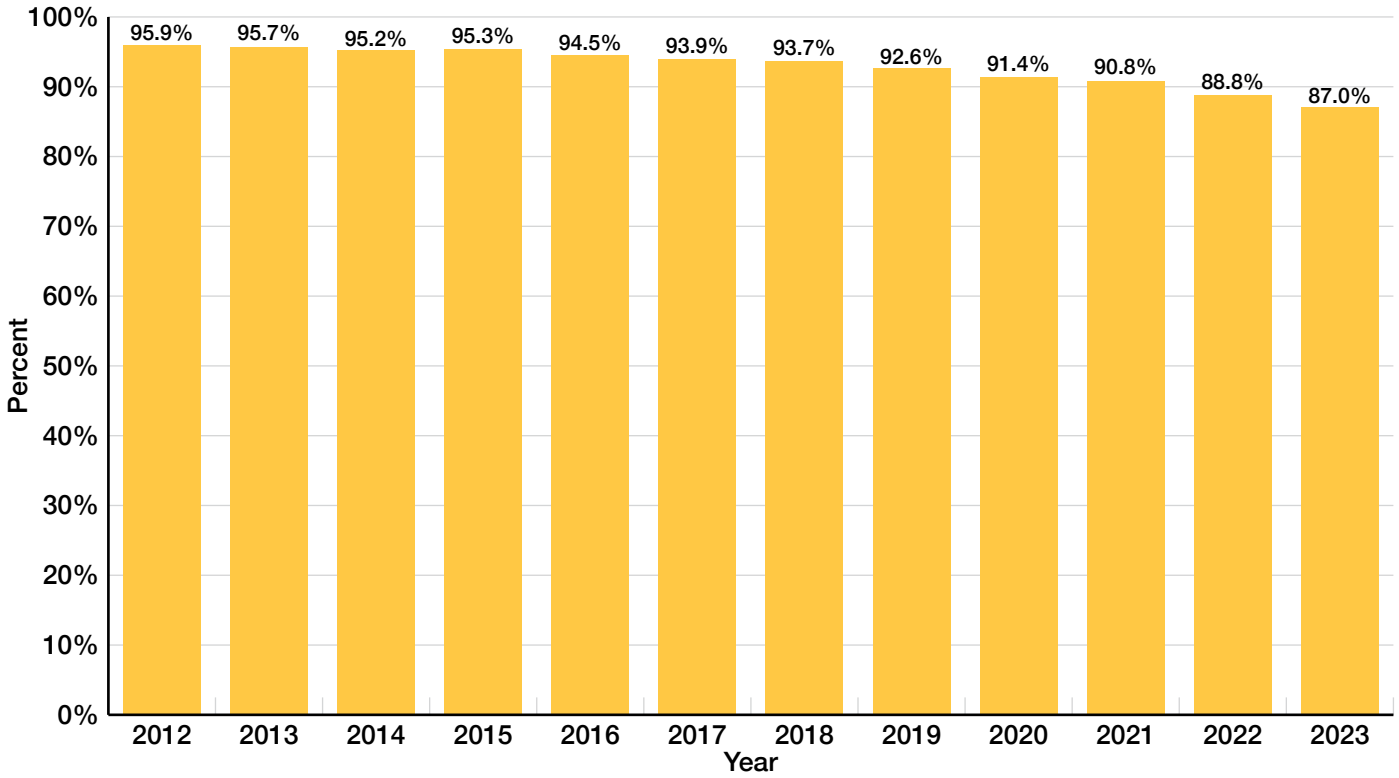
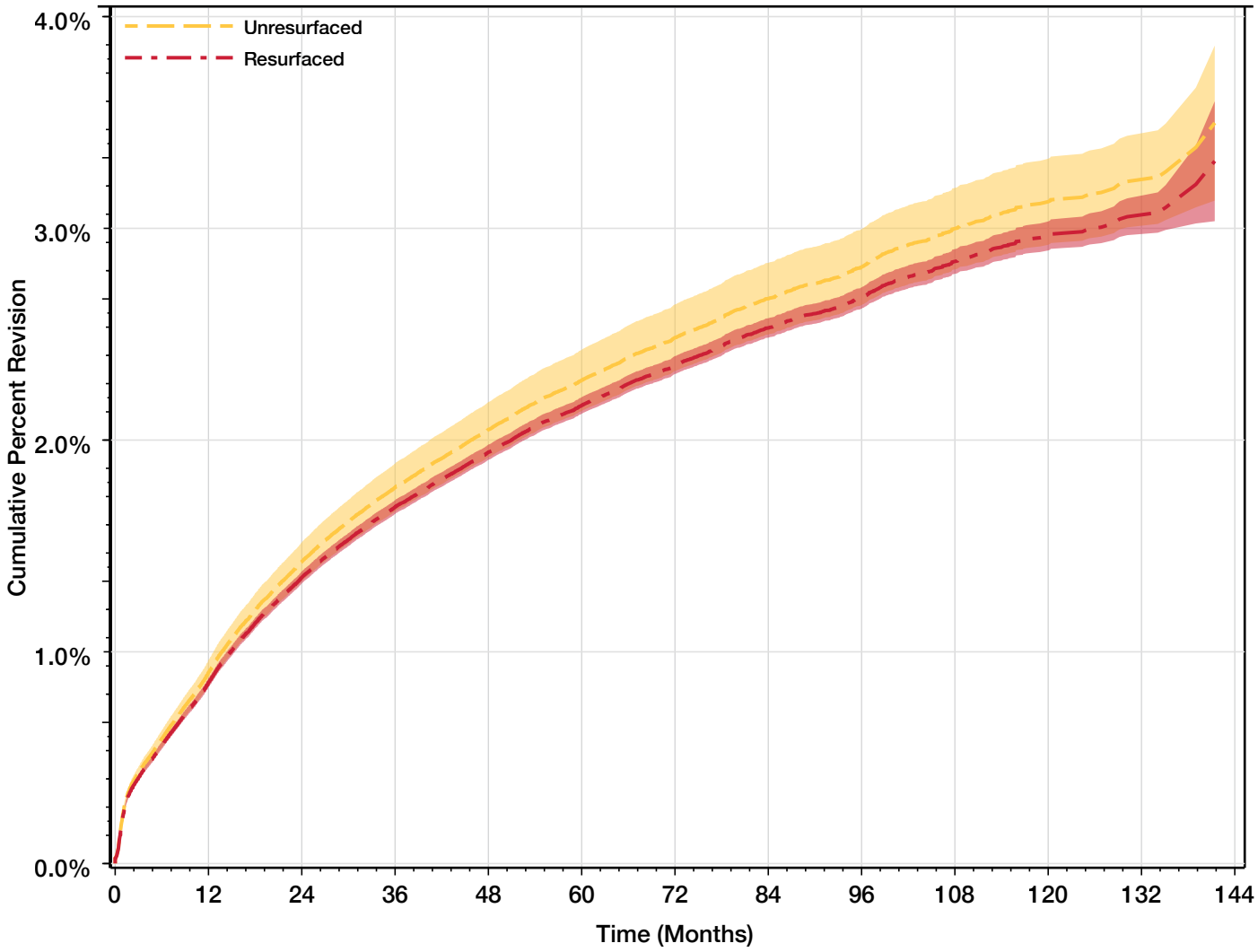


Figure 3.9 displays cumulative percent revision rates for primary total knee arthroplasty (TKA) with patellar resurfacing in Medicare patients aged 65 years and older with primary osteoarthritis, over a period from 2012 to 2023. The hazard ratio (HR) comparing the two groups is 1.056 (95% confidence interval: 0.984–1.133), with a p-value of 0.1331. These data suggest that there is no statistically significant difference between the resurfaced and unresurfaced groups in terms of revision risk. However, it should be noted that not all confounders have been considered in this analysis.

Figure 3.9 Cumulative Percent Revision for Primary Total Knee Arthroplasty Patellar-Resurfacing in Medicare Patients 65 Years of Age and older with Primary Osteoarthritis, 2012-2023



Number at Risk (Months)	0	12	24	36	48	60	72	84	96	108	120	132	144
Resurfaced	680,703	597,378	513,980	448,060	389,144	316,372	241,099	162,944	97,234	51,624	22,492	6,293	1
Unresurfaced	51,675	41,285	32,339	26,409	21,647	16,467	12,023	7,590	4,346	2,296	937	261	2
Total	732,378	638,663	546,319	474,469	410,791	332,839	253,122	170,534	101,580	53,920	23,429	6,554	3

Age/Sex/CCI adjusted HR (95%CI), p-value
Unresurfaced vs. Resurfaced:1.056(0.984,1.133), p=0.1331

INSIGHTS

Patellar resurfacing did not have a statistically different cumulative percent revision compared to those without resurfacing in patients aged 65 years and older.

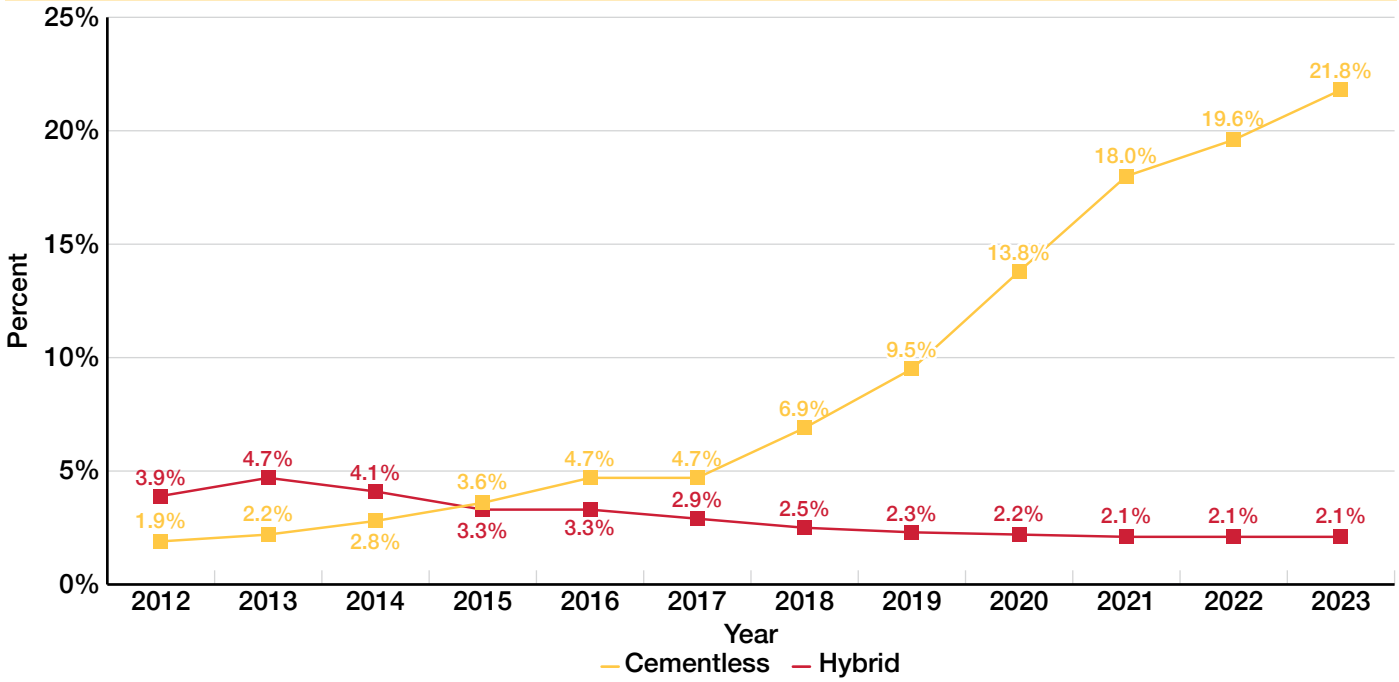
The use of cementless fixation in primary total knee arthroplasty is rapidly increasing in the AJRR and was reported for 22% of all primary total knee arthroplasties in 2023.

INSIGHTS

In the United States, the use of polymethylmethacrylate (bone cement) for the fixation of primary total knee arthroplasty components is typical. However, cementless fixation has seen a dramatic increase in usage over the years, starting at 1.9% in 2012 and steadily climbing to 21.8% in 2023 (Figure 3.10).

Similarly, the Swedish Arthroplasty Register reported in their 2023 Annual Report that cementless fixation had become slightly more common and was now used in 8.9% of the total knee arthroplasties.[9] In the 2023 National Joint Registry, more than 84% of all primary total knee arthroplasties utilized all cemented fixation and 4.1% used all cementless or hybrid fixation.[8]

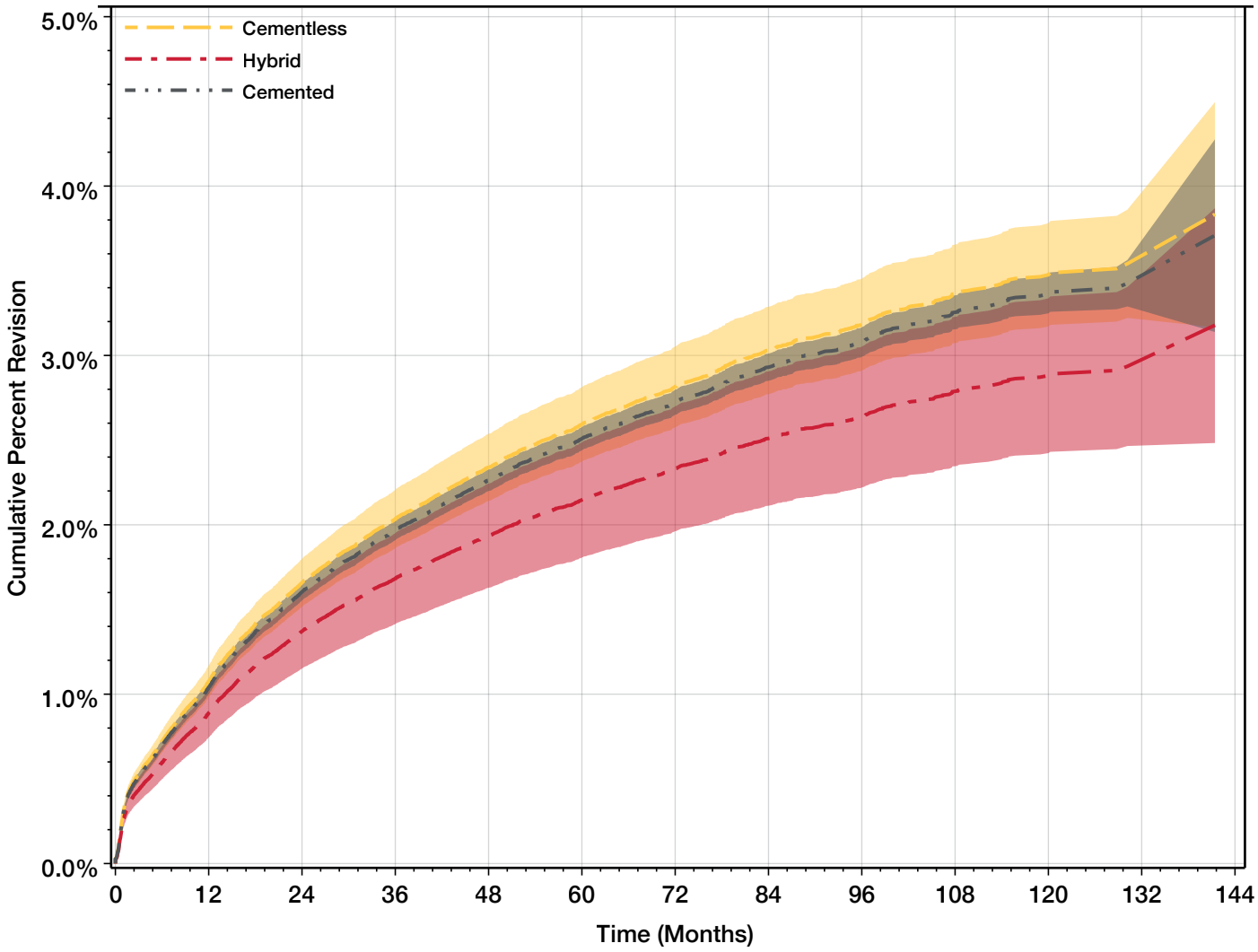
Figure 3.10 Distribution of Hybrid and Cementless Fixation Utilization for Primary Total Knee Arthroplasty, 2012-2023 (N=1,341,438)



In general, the data highlighted in the following figures (Figures 3.11-3.14) suggest that the choice of fixation method for total knee arthroplasty (TKA) is influenced by patient demographics, particularly age and gender. Cementless fixation may present a higher risk of revision in older female patients, while it does not significantly differ from cemented fixation in other groups. Cemented fixation remains a stable and reliable option across most patient groups, with no significant disadvantage in terms of revision risk. These findings do not account for numerous potential confounders. Additionally, Hybrid fixation refers to any construct where one component (femur or tibia) is cementless whereas the other component (femur or tibia) is cemented.

Figure 3.11 presents the cumulative percent revision rates for primary total knee arthroplasty (TKA) using cemented versus cementless fixation methods in male Medicare patients aged 65 years and older with primary osteoarthritis, covering the period from 2012 to 2023. The hazard ratio (HR) is 1.035 (95% CI: 0.937–1.142) with a p-value of 0.5006 which indicates no statistically significant difference in revision risk between cementless and cemented fixation. These data indicates that for male Medicare patients aged 65 and older undergoing primary TKA for osteoarthritis, there is no statistically significant difference in revision rates between cementless and cemented fixation methods.

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



Number at Risk (Months)	0	12	24	36	48	60	72	84	96	108	120	132	144
Cemented	248,678	219,557	190,409	167,392	145,441	118,799	91,096	61,400	36,711	19,661	8,641	2,414	9
Cementless	29,815	22,300	15,655	11,067	7,848	5,339	3,473	2,186	1,108	463	155	40	1
Hybrid	7,113	6,395	5,796	5,236	4,710	4,042	3,334	2,491	1,603	949	423	107	1
Total	285,606	248,252	211,860	183,695	157,999	128,180	97,903	66,077	39,422	21,073	9,219	2,561	11

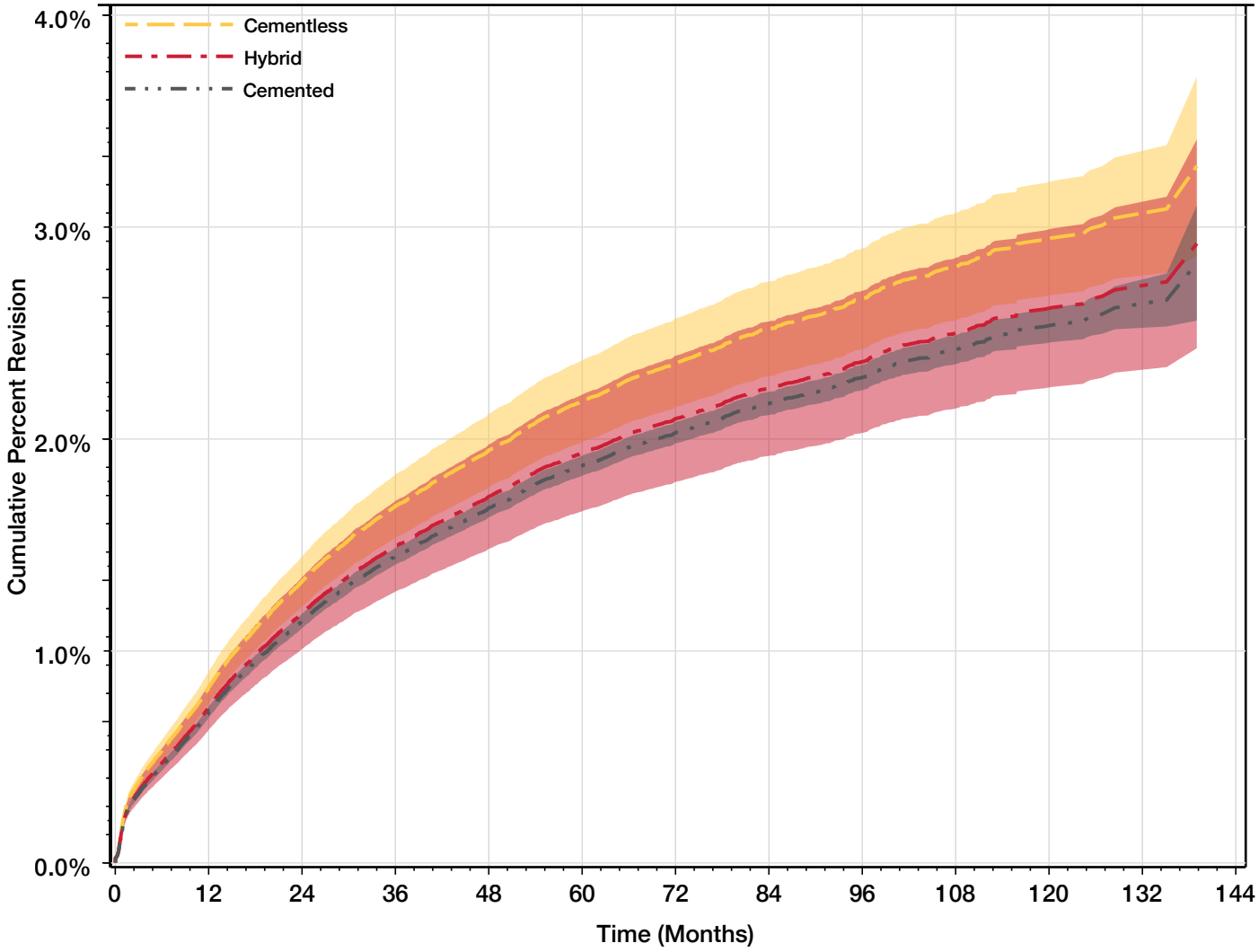
Age/CCI adjusted HR (95%CI), p-value
Cementless vs. Cemented:1.035(0.937,1.142) p=0.5006; Hybrid vs. Cemented:0.854(0.72,1.013) p=0.0693

INSIGHTS

There is no statistically significant difference in revision rates between cementless and cemented fixation methods in men, but a significantly increased rate in women age 65 and older.

Figure 3.12 presents the cumulative percent revision rates for primary total knee arthroplasty (TKA) using cemented versus cementless fixation methods in female Medicare patients aged 65 years and older with primary osteoarthritis, over the period from 2012 to 2023. For the cemented verus cemented groups, the hazard ratio (HR) is 1.165 (95% CI: 1.053–1.289) with a p-value of 0.0031. This indicates a statistically significant higher revision risk for cementless fixation compared to cemented fixation. For the hybrid versus cemented groups the HR is 1.033 (95% CI: 0.888–1.202) with a p-value of 0.6746. This suggests no statistically significant difference between hybrid and cemented fixation. For female Medicare patients aged 65 and older undergoing primary TKA, cementless fixation is associated with a statistically significant higher revision risk compared to cemented fixation. However, hybrid fixation shows no significant difference in revision risk compared to cemented fixation over the same time period.

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



Number at Risk (Months)	0	12	24	36	48	60	72	84	96	108	120	132	144
Cemented	405,488	356,668	308,891	271,138	236,741	192,820	147,587	99,749	60,385	32,730	14,225	3,925	1
Cementless	33,808	24,926	17,312	12,095	8,684	5,813	3,816	2,480	1,261	490	161	40	2
Hybrid	10,099	8,969	7,952	7,104	6,349	5,335	4,351	3,197	2,056	1,225	548	117	1
Total	449,395	390,563	334,155	290,337	251,774	203,968	155,754	105,426	63,702	34,445	14,934	4,082	4

Age/CCI adjusted HR (95%CI), p-value
Cementless vs. Cemented:1.165(1.053,1.289) p=0.0031; Hybrid vs. Cemented:1.033(0.888,1.202) p=0.6746

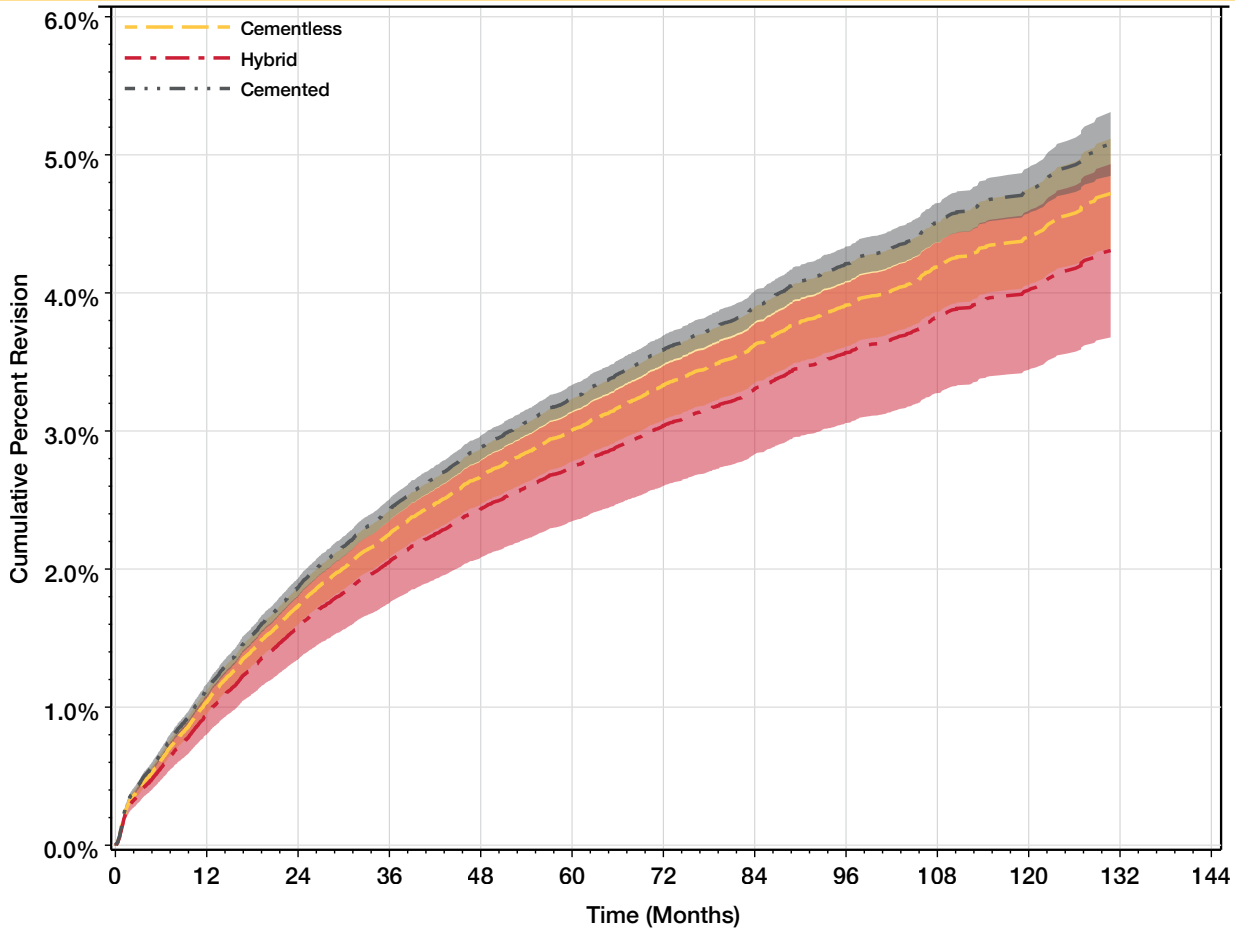
Figure 3.13 compares cumulative percent revision rates for cemented versus cementless fixation in primary total knee arthroplasty (TKA) among male patients younger than 65 years with primary osteoarthritis, from 2012 to 2023. The graph displays revision rates for three fixation types: cemented, cementless, and hybrid. Over the 12-year period, all fixation methods show a gradual increase in cumulative revision rates. Hybrid fixation exhibits the lowest cumulative revision rates, followed by cemented fixation, with cementless fixation showing the highest.

This analysis reveals that cementless fixation has a hazard ratio (HR) of 0.926 (95% CI: 0.845–1.016, p=0.1028) compared to cemented fixation, indicating no statistically significant difference in revision risk between these two groups. However, hybrid fixation demonstrates a significant reduction in revision risk compared to cemented fixation, with an HR of 0.842 (95% CI: 0.716–0.991, p=0.0391). This suggests that hybrid fixation may be associated with better outcomes in terms of lower revision rates in this population.

The number at risk, displayed in the accompanying table, shows the declining number of patients at various time points, with the majority of patients still at risk early on and fewer patients at later follow-up periods due to revisions or loss to follow-up.

Among male patients younger than 65 years undergoing primary TKA, hybrid fixation shows a statistically significant lower revision rate compared to cemented fixation, whereas cementless fixation does not demonstrate a significant difference from cemented fixation.

Figure 3.13 Cumulative Percent Revision for Cemented Versus Cementless Fixation Primary Total Knee Arthroplasty in Male Patients Less Than 65 Years of Age with Primary Osteoarthritis, 2012-2023



Number at Risk (Months)	0	12	24	36	48	60	72	84	96	108	120	132	144
Cemented	161,512	144,697	129,225	115,859	102,542	86,872	69,638	49,900	31,974	17,972	8,042	2,468	1
Cementless	32,067	24,437	18,280	13,527	10,151	7,313	5,159	3,246	1,688	900	374	107	1
Hybrid	6,698	5,992	5,394	4,938	4,497	4,002	3,271	2,429	1,596	1,015	467	138	1
Total	200,277	175,126	152,899	134,324	117,190	98,187	78,068	55,575	35,258	19,887	8,883	2,713	3

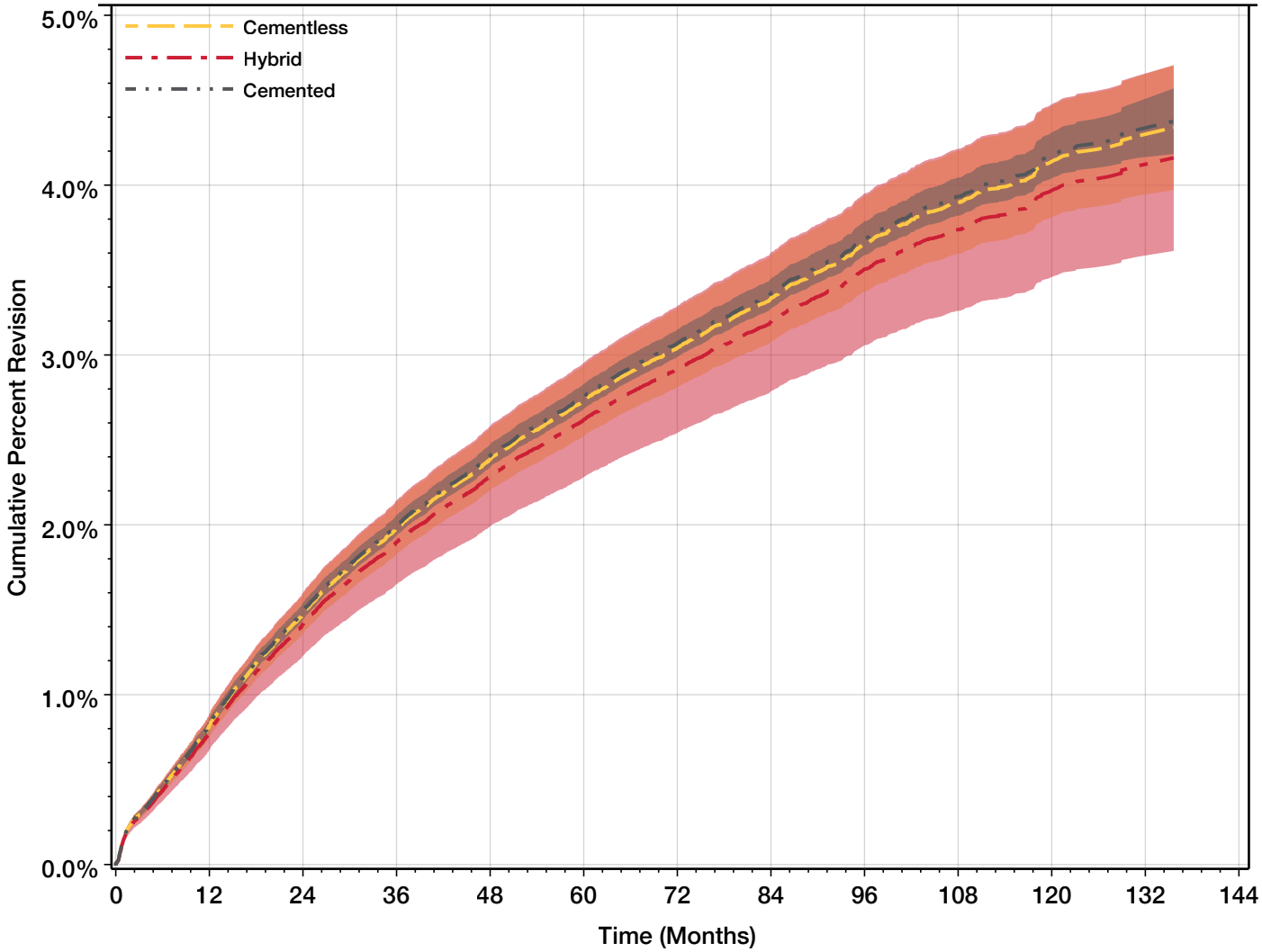
Age/CCI adjusted HR (95%CI), p-value
Cementless vs. Cemented:0.926(0.845,1.016) p=0.1028; Hybrid vs. Cemented:0.842(0.716,0.991) p=0.0391

Figure 3.14 illustrates the cumulative percent revision rates for primary total knee arthroplasty (TKA) using cemented, cementless, and hybrid fixation methods in female patients younger than 65 years with primary osteoarthritis, from 2012 to 2023. Over the 12-year period, the revision rates for all three fixation methods increase gradually, with only minimal differences in revision rates among the groups. Cementless and hybrid fixation methods show a slightly lower revision rate compared to cemented fixation, although the differences are small and not statistically significant.

The hazard ratio (HR) for cementless fixation compared to cemented fixation is 0.991 (95% CI: 0.906–1.085, p=0.8473), indicating no significant difference in revision risk between these two methods. Similarly, hybrid fixation shows an HR of 0.949 (95% CI: 0.821–1.098, p=0.4828) compared to cemented fixation, suggesting no significant reduction in revision risk with hybrid fixation either.

Among female patients younger than 65 years undergoing primary TKA, there is no statistically significant difference in revision rates between cemented, cementless, and hybrid fixation methods.

Figure 3.14 Cumulative Percent Revision for Cemented Versus Cementless Fixation Primary Total Knee Arthroplasty in Female Patients Less Than 65 Years of Age with Primary Osteoarthritis, 2012-2023



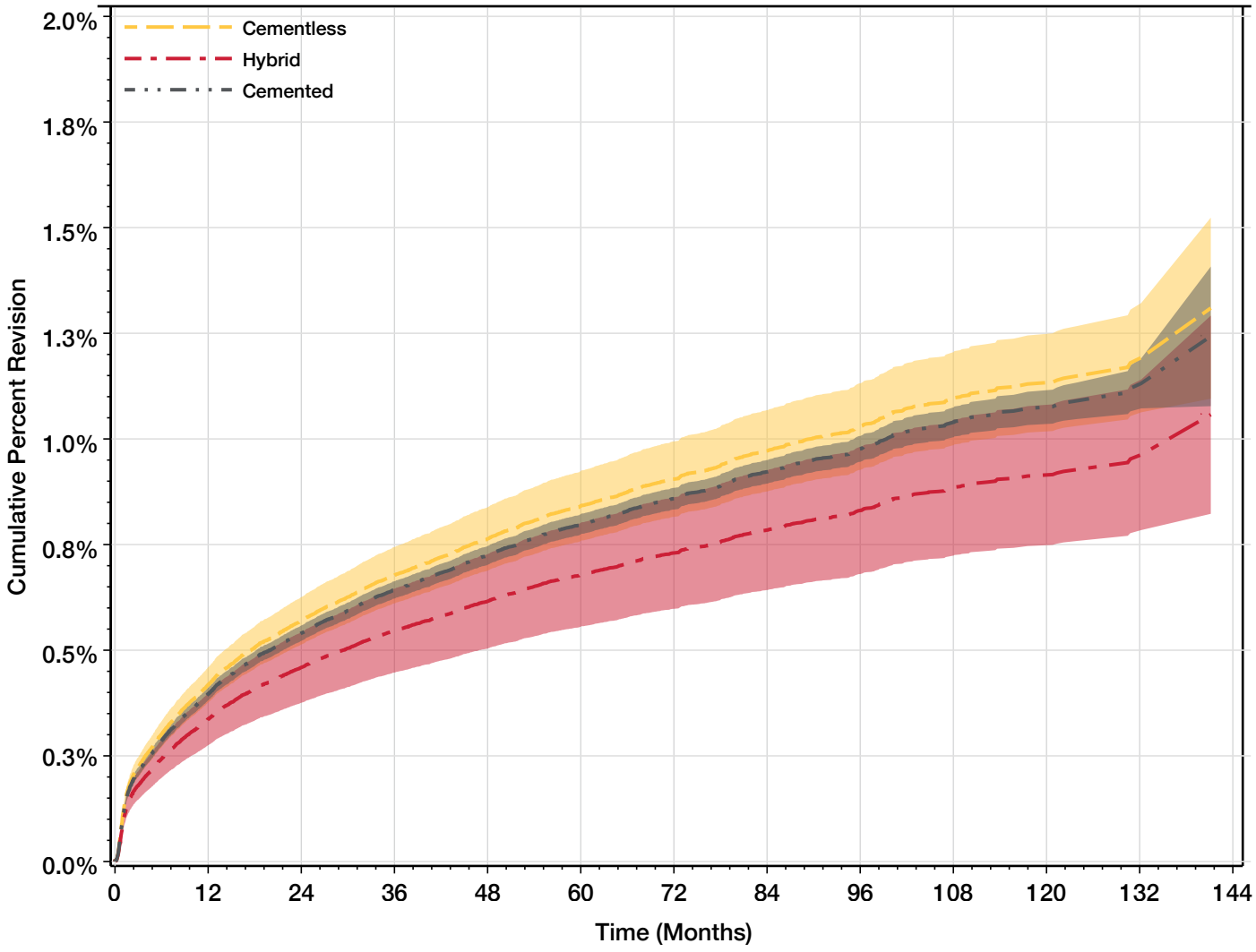
Number at Risk (Months)	0	12	24	36	48	60	72	84	96	108	120	132	144
Cemented	242,898	215,705	191,810	171,719	152,025	128,108	102,502	73,231	46,817	26,709	11,772	3,433	1
Cementless	35,701	26,779	19,808	14,557	10,874	7,706	5,353	3,476	1,805	891	355	100	2
Hybrid	8,679	7,745	6,934	6,298	5,665	4,970	4,165	3,119	2,116	1,396	666	167	1
Total	287,278	250,229	218,552	192,574	168,564	140,784	112,020	79,826	50,738	28,996	12,793	3,700	4

Age/CCI adjusted HR (95%CI), p-value
Cementless vs. Cemented:0.991(0.906,1.085) p=0.8473; Hybrid vs. Cemented:0.949(0.82,1.098) p=0.4828

Figure 3.15 presents the cumulative percent revision rates due to infection for primary total knee arthroplasty (TKA) with cemented, cementless, and hybrid fixation in Medicare patients aged 65 years and older with primary osteoarthritis, between 2012 and 2022. Over the 10-year period, the cumulative revision rates increase steadily, with cemented and cementless fixation methods showing similar rates.

The analysis shows that the hazard ratio (HR) for cementless fixation versus cemented fixation is 1.055 (95% CI: 0.942–1.181, p=0.3573), indicating no statistically significant difference in infection-related revision risk between these two fixation methods. The hybrid group shows a lower hazard ratio of 0.849 (95% CI: 0.702–1.027, p=0.0912) compared to cemented fixation, but this difference is not statistically significant at the conventional threshold (p<0.05).

Figure 3.15 Cumulative Percent Revision for Infection Based on Fixation Method for Primary Total Knee Arthroplasty in Medicare Patients 65 Years of Age and older with Primary Osteoarthritis, 2012-2023



Number at Risk (Months)	0	12	24	36	48	60	72	84	96	108	120	132	144
Cemented	654,166	576,225	499,300	438,530	382,182	311,619	238,683	161,149	97,096	52,391	22,866	6,333	1
Cementless	63,623	47,226	32,967	23,162	16,532	11,152	7,289	4,666	2,369	953	315	79	1
Hybrid	17,212	15,364	13,748	12,339	11,057	9,377	7,685	5,688	3,657	2,172	971	223	1
Total	735,001	638,815	546,015	474,031	409,771	332,148	253,657	171,503	103,122	55,516	24,152	6,635	3

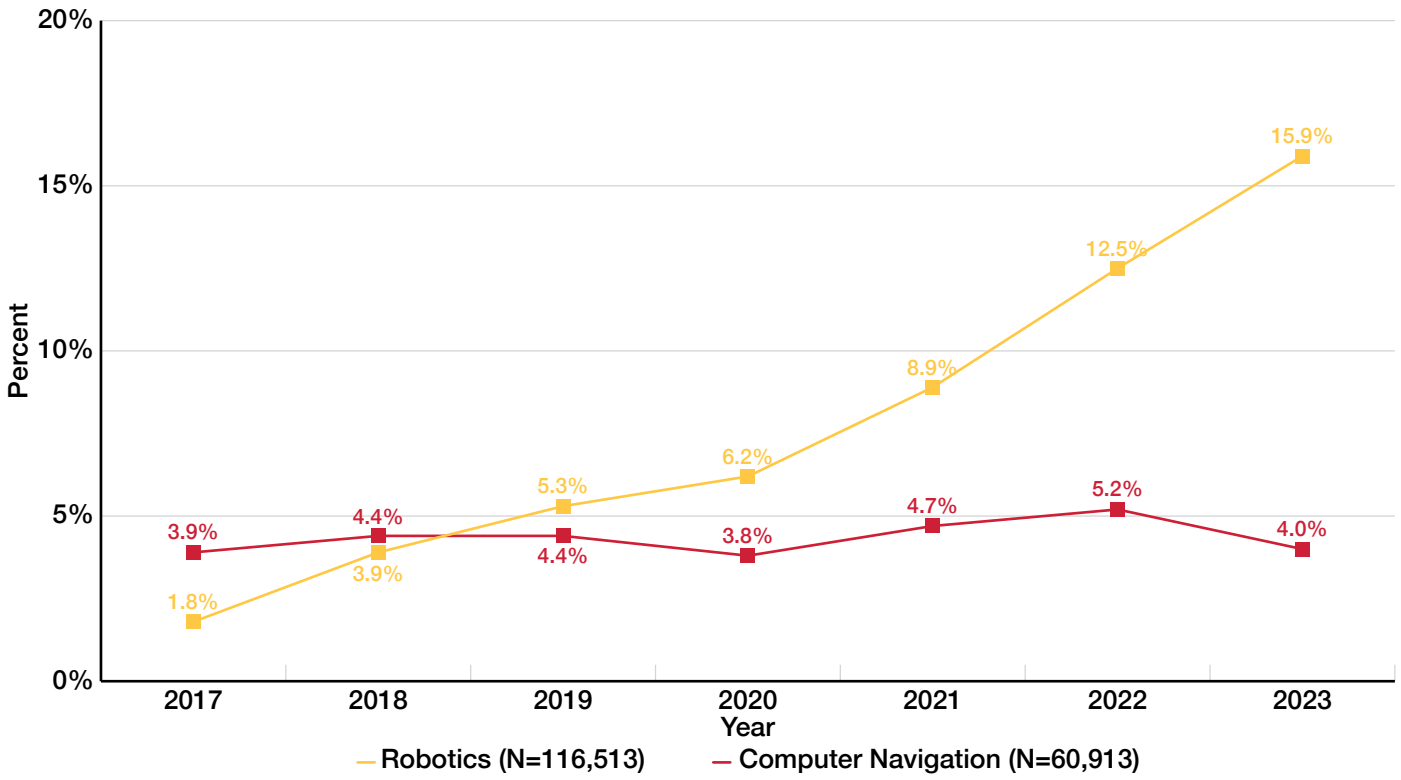
Age/CCI adjusted HR (95%CI), p-value
Cementless vs. Cemented:1.055(0.942,1.181), p=0.3573; Hybrid vs. Cemented:0.849(0.702,1.027), p=0.0912

The utilization of both computer navigation and robotics has increased substantially over the past few years. The percentage of elective primary total knee arthroplasty cases utilizing robotic assistance is now over 15.9% (Figure 3.16).

Over the past 6 years, the utilization of robotics in primary total knee arthroplasty has increased over 6-fold and is now reported in over 15.9% of procedures, whereas computer navigation use has remained relatively stable.

INSIGHTS

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

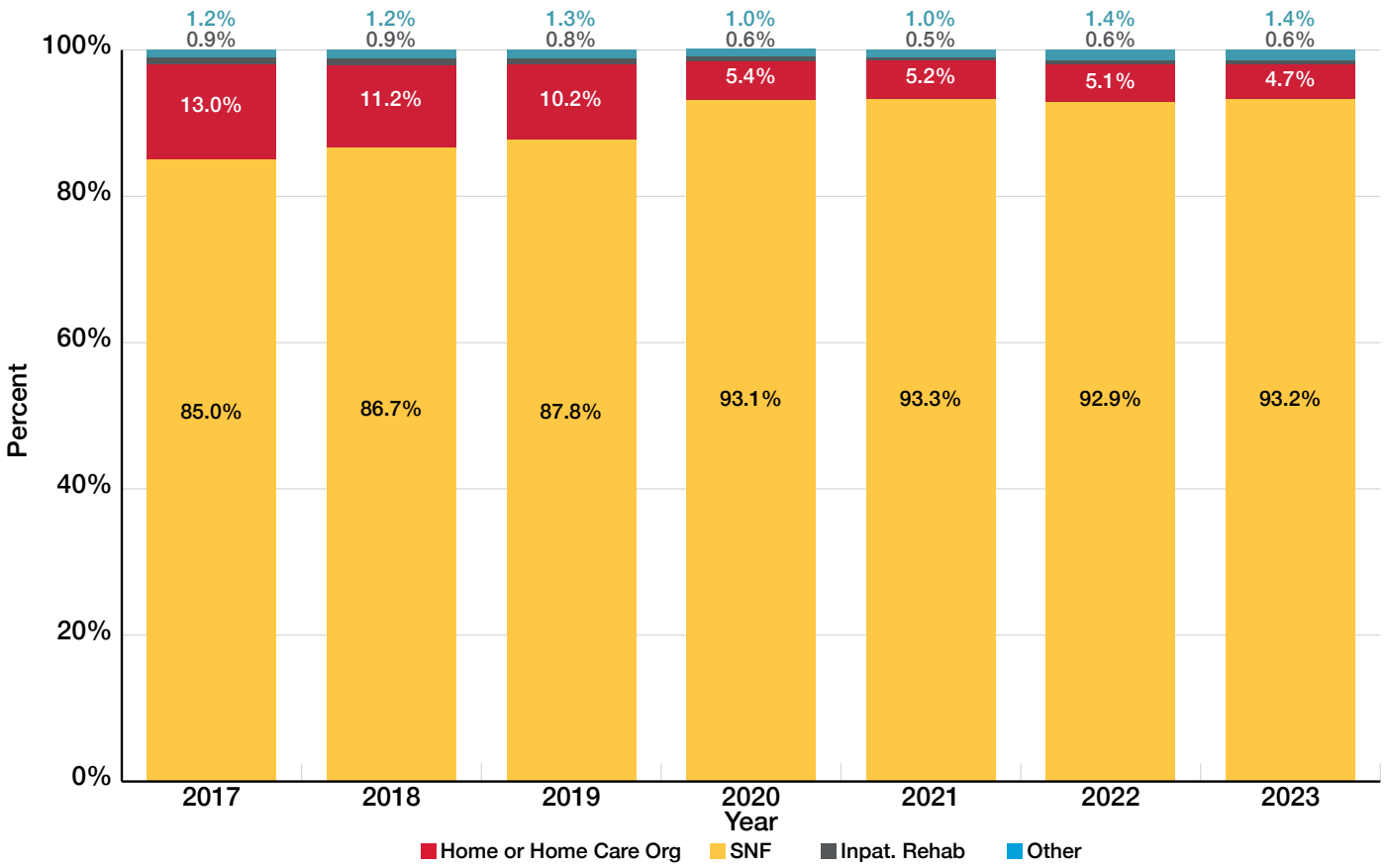


The discharge trends for TKA indicate that the vast majority of patients are now discharged home or to home care organizations (Figure 3.17). In 2023, 96.31% of TKA patients were discharged home, compared to 85.04% in 2012, suggesting improved recovery protocols and the growing prevalence of outpatient surgeries. The use of skilled nursing facilities has concurrently decreased.

INSIGHTS

The percentage of patients being discharged to skilled nursing following primary total knee arthroplasty continues to decrease and now represents less than 5% of all discharges.

Figure 3.17 Total Knee Arthroplasty Discharge Disposition Codes by Year, 2012-2023 (N=1,204,666)



Code	Code Value
Home	Discharged to home/self-care (routine charge).
Home Care Org.	Discharged/transferred to home care of organized home health service organization.
SNF	Discharged/transferred to skilled nursing facility (SNF) with Medicare certification in anticipation of covered skilled care--(For hospitals with an approved swing bed arrangement, use Code 61 - swing bed. For reporting discharges/transfers to a non-certified SNF, the hospital must use Code 04 - ICF.)
Inpat. Rehab	Discharged/transferred to an inpatient rehabilitation facility including distinct parts units of a hospital (eff. 1/2002).

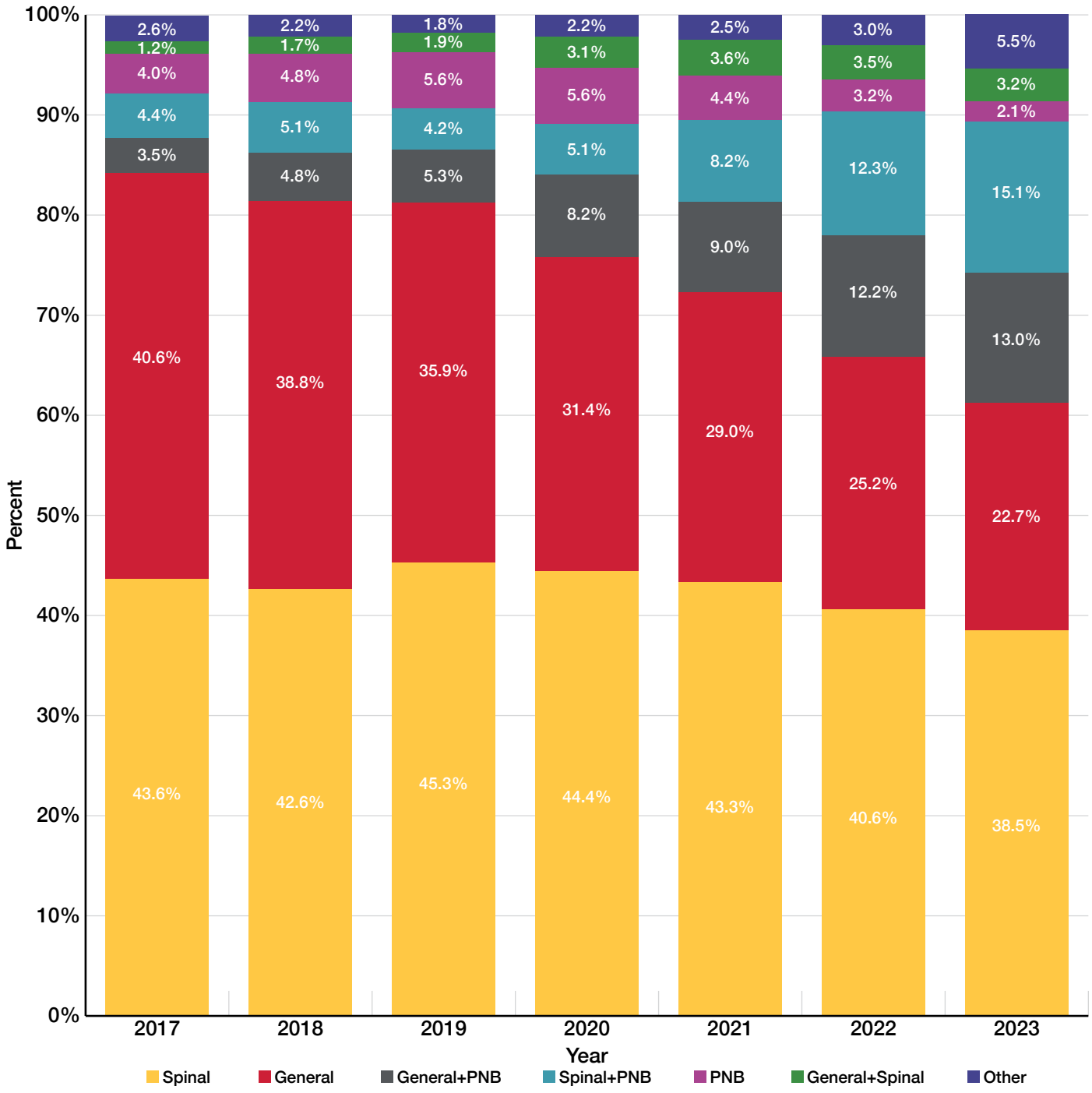
The data highlighted in Figure 3.18 highlights significant shifts in anesthesia practices for primary total knee arthroplasty (TKA) procedures from 2017 to 2023, based on a total of 814,950 cases. Over this period, the use of spinal anesthesia remained the most common choice, though its utilization has steadily declined from 43.6% in 2017 to 38.5% in 2023. This trend may indicate a growing preference for multimodal anesthesia strategies that combine spinal or general anesthesia with peripheral nerve blocks (PNB), which are increasingly favored for optimizing pain management and reducing complications.

Similarly, the use of general anesthesia has dropped significantly, from 40.6% of cases in 2017 to just 22.7% in 2023. This sharp decline aligns with growing evidence supporting the benefits of regional anesthesia, such as spinal anesthesia and PNB combinations, which are associated with better postoperative outcomes, including reduced opioid use, quicker recovery times, and fewer complications.

The use of general anesthesia combined with PNB has increased dramatically, rising from 3.5% in 2017 to 13.0% in 2023, suggesting a broader adoption of multimodal pain management techniques. Additionally, spinal anesthesia combined with PNB has also seen a substantial rise, from 4.4% in 2017 to 15.1% in 2023, underscoring the growing popularity of regional anesthesia strategies that enhance pain control and recovery.

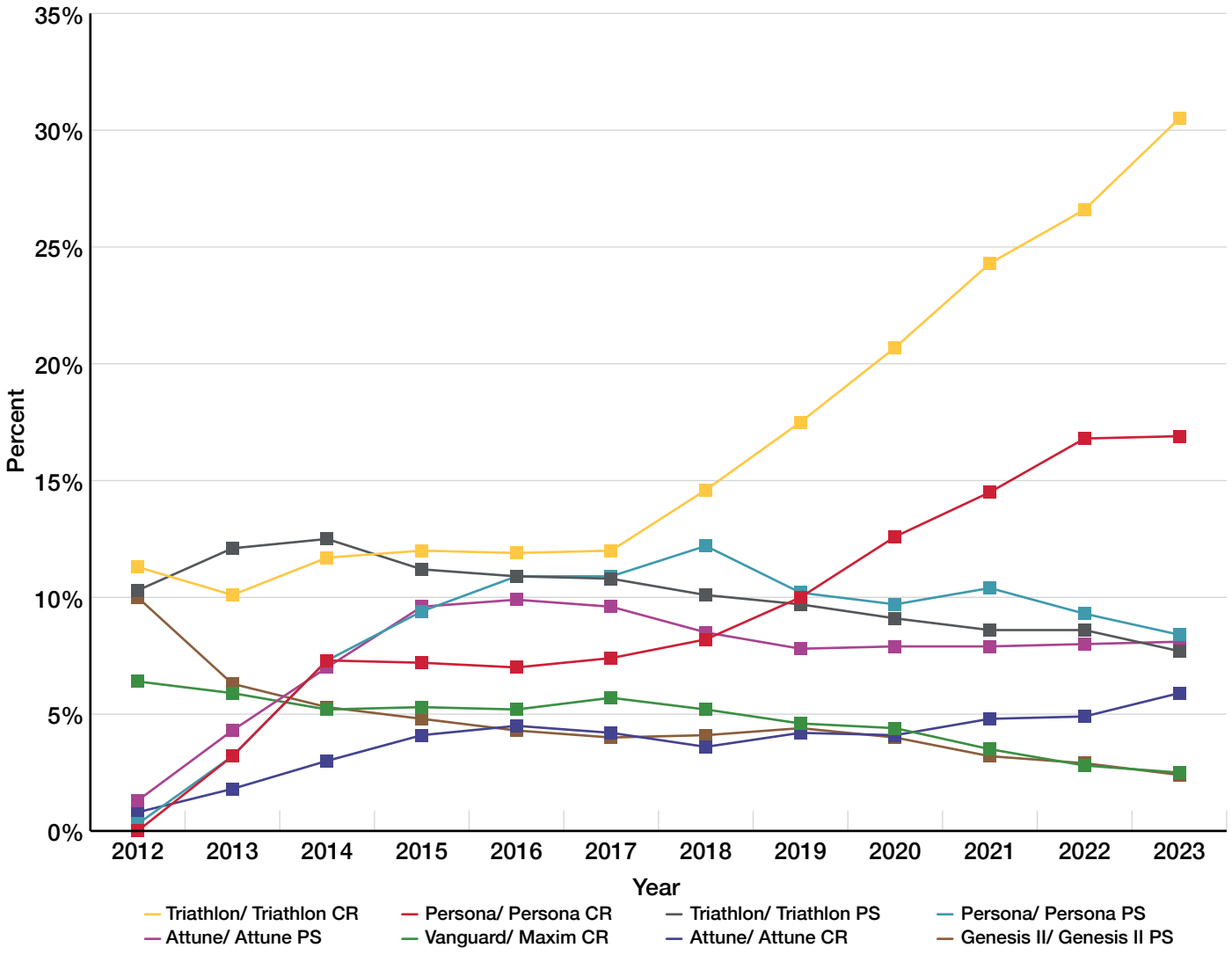
Meanwhile, the use of PNB as a standalone technique has decreased from 4.0% in 2017 to 2.1% in 2023, likely due to the increased preference for combining PNB with other anesthesia types, such as spinal or general anesthesia, rather than using it in isolation. Lastly, the category labeled other anesthesia types has more than doubled, increasing from 2.6% in 2017 to 5.5% in 2023. This rise may suggest an ongoing exploration of novel or alternative anesthesia approaches to further optimize patient outcomes in total knee arthroplasty.

Figure 3.18 Primary Total Knee Arthroplasty Anesthesia Type by Year, 2012-2023 (N=814,950)



The data shown in Figure 3.19 presents trends in the usage of different femoral and tibial component combinations in primary total knee arthroplasty (TKA) between 2012 and 2023, based on 1,442,151 cases. This data highlights shifts in surgeon preferences and implant usage over time, with some combinations becoming more dominant while others have seen declines. The Triathlon/ Triathlon CR combination has become the most commonly used implant in TKA, growing steadily from 11.3% in 2012 to 30.5% in 2023.

Figure 3.19 Primary Total Knee Arthroplasty Femoral/Tibial Component Combinations by Year, 2012-2023 (N=1,442,151)



The ability to look at revision rates for particular implants is one of the great strengths of the AJRR. The tables below (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. However, certain designs, particularly those with smaller sample sizes may show significantly higher revision rates, reaching over 10% at 10 years (Table 3.3).

Revision rates for hybrid knee arthroplasty constructs in patients aged 65 and older range from 0.89% at 1 year to 2.34% at 10 years (Table 3.4).

Revision rates for cementless knee arthroplasty constructs in patients aged 65 and older start at 1.07% at 1 year and increase to 2.40% at 10 years. Overall, the data indicate steady increases in revision rates for cementless constructs over time, with most constructs remaining below 3% by 10 years (Table 3.5).

It is important to emphasize that this analysis does not adjust for any potential confounders of patient, procedure, or hospital characteristics. The cumulative present revision rate of one implant may also be influenced by other components used in the construct and not reflect the inherent performance of that individual implant alone. Devices presented in the analysis were required to meet the minimum case threshold of 400 total procedures.

Table 3.3 Unadjusted Cumulative Percent Revision of Cemented 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 Cemented	91,324	1,453	0.77 (0.72, 0.83)	1.36 (1.28, 1.44)	1.74 (1.65, 1.84)	1.97 (1.87, 2.08)	2.27 (2.13, 2.43)
Persona/ Persona CR Cemented	79,311	1,086	0.71 (0.65, 0.77)	1.29 (1.21, 1.37)	1.60 (1.5, 1.71)	1.82 (1.7, 1.94)	2.03 (1.86, 2.21)
Persona/ Persona PS Cemented	76,580	1,548	0.83 (0.76, 0.89)	1.68 (1.58, 1.77)	2.15 (2.04, 2.26)	2.50 (2.37, 2.63)	2.61 (2.47, 2.76)
Triathlon/ Triathlon PS Cemented	66,546	1,443	0.94 (0.87, 1.02)	1.73 (1.63, 1.83)	2.16 (2.05, 2.28)	2.41 (2.28, 2.54)	2.73 (2.57, 2.9)
Attune/ Attune PS Cemented	60,626	1,302	0.83 (0.76, 0.9)	1.71 (1.6, 1.82)	2.21 (2.09, 2.34)	2.56 (2.42, 2.71)	2.89 (2.7, 3.08)
Vanguard/ Maxim CR Cemented	32,799	583	0.71 (0.62, 0.8)	1.39 (1.26, 1.52)	1.71 (1.56, 1.86)	1.95 (1.79, 2.12)	2.29 (2.08, 2.51)
Attune/ Attune CR Cemented	31,863	503	0.74 (0.65, 0.84)	1.36 (1.23, 1.5)	1.75 (1.59, 1.92)	1.99 (1.82, 2.18)	2.13 (1.93, 2.34)
Genesis II/ Genesis II PS Cemented	31,300	853	1.17 (1.06, 1.3)	2.23 (2.06, 2.4)	2.73 (2.55, 2.93)	3.12 (2.91, 3.34)	3.37 (3.13, 3.63)
Journey II/ Journey II PS Cemented	25,125	601	1.21 (1.08, 1.35)	2.25 (2.06, 2.45)	2.70 (2.49, 2.93)	2.96 (2.72, 3.22)	3.13 (2.81, 3.48)
Sigma/ PFC Sigma CR Cemented	21,409	329	0.65 (0.55, 0.77)	1.10 (0.97, 1.25)	1.39 (1.23, 1.56)	1.56 (1.39, 1.74)	1.89 (1.68, 2.12)
Sigma/ PFC Sigma PS Cemented	19,962	438	0.75 (0.63, 0.87)	1.50 (1.33, 1.67)	1.97 (1.78, 2.17)	2.29 (2.08, 2.52)	2.60 (2.35, 2.87)
Vanguard/ Maxim PS Cemented	17,233	436	0.94 (0.8, 1.09)	1.94 (1.73, 2.16)	2.50 (2.26, 2.75)	2.79 (2.53, 3.07)	3.32 (2.98, 3.69)
Legion/ Genesis II PS Cemented	16,474	346	0.84 (0.71, 0.99)	1.68 (1.49, 1.89)	2.17 (1.94, 2.42)	2.47 (2.21, 2.76)	2.85 (2.47, 3.28)
Genesis II/ Genesis II CR Cemented	15,474	292	0.77 (0.64, 0.91)	1.56 (1.37, 1.77)	1.90 (1.68, 2.14)	2.14 (1.9, 2.41)	2.28 (2.01, 2.57)
NexGen LPS-Flex/ NexGen PS Cemented	14,837	351	0.77 (0.64, 0.92)	1.49 (1.3, 1.7)	2.07 (1.85, 2.32)	2.35 (2.11, 2.61)	2.75 (2.46, 3.08)
Sigma/ MBT PS Cemented	8,397	245	0.89 (0.71, 1.11)	1.73 (1.47, 2.03)	2.44 (2.12, 2.8)	2.98 (2.61, 3.38)	3.54 (3.1, 4.02)
Legion/ Genesis II CR Cemented	7,728	143	0.87 (0.68, 1.1)	1.74 (1.45, 2.07)	2.07 (1.74, 2.43)	2.15 (1.82, 2.53)	2.15 (1.82, 2.53)
Evolution MP/ Evolution MP PS Cemented	6,900	158	0.79 (0.6, 1.03)	1.81 (1.51, 2.17)	2.38 (2.01, 2.79)	2.73 (2.31, 3.19)	2.92 (2.47, 3.43)
Natural-Knee II GS/ Natural-Knee II CR Cemented	6,744	104	0.56 (0.41, 0.77)	1.11 (0.87, 1.39)	1.51 (1.23, 1.84)	1.71 (1.4, 2.07)	1.78 (1.46, 2.16)
EMPOWR 3D/ EMPOWR CR Cemented	6,154	117	1.03 (0.8, 1.31)	1.74 (1.42, 2.11)	2.24 (1.85, 2.69)	2.40 (1.96, 2.9)	—

The 95% confidence intervals are included in parenthesis.

Table 3.3 Unadjusted Cumulative Percent Revision of Cemented Knee Arthroplasty Construct Combinations for Primary Total Knee Arthroplasty in Patients ≥65 Years of Age with Primary Osteoarthritis, 2012-2023 *(Continued)*

Group Name	N Total	N Revised	1-Yr	3-Yrs	5-Yrs	7-Yrs	10-Yrs
GMK Sphere/ GMK Primary CR Cemented	5,164	86	0.82 (0.6, 1.09)	1.63 (1.29, 2.03)	2.00 (1.59, 2.48)	2.17 (1.71, 2.72)	2.17 (1.71, 2.72)
Apex Knee/ Apex Knee CR Cemented	5,063	116	0.99 (0.75, 1.3)	2.04 (1.67, 2.48)	2.46 (2.03, 2.95)	2.64 (2.18, 3.17)	2.82 (2.26, 3.48)
NexGen CR-Flex/ NexGen CR Cemented	4,084	74	0.47 (0.29, 0.72)	1.27 (0.96, 1.65)	1.56 (1.21, 1.98)	1.78 (1.4, 2.23)	2.12 (1.63, 2.71)
Sigma/ MBT CR Cemented	3,275	86	0.82 (0.56, 1.18)	1.51 (1.14, 1.98)	2.38 (1.89, 2.96)	2.78 (2.23, 3.42)	2.94 (2.36, 3.63)
EMPOWR/ EMPOWR PS Cemented	2,559	46	0.75 (0.47, 1.15)	1.59 (1.14, 2.15)	2.09 (1.53, 2.79)	2.21 (1.61, 2.95)	—
NexGen CR-Flex/ NexGen Pegged CR Cemented	1,732	30	0.81 (0.47, 1.33)	1.41 (0.93, 2.06)	1.68 (1.15, 2.39)	1.87 (1.29, 2.64)	1.87 (1.29, 2.64)
NexGen LPS-Flex GS/ NexGen PS Cemented	1,539	39	0.91 (0.52, 1.49)	1.90 (1.29, 2.7)	2.46 (1.75, 3.38)	2.56 (1.82, 3.49)	3.04 (2.16, 4.16)
Unity Knee System/ Unity Knee System CR Cemented	1,281	17	1.04 (0.58, 1.73)	1.35 (0.8, 2.15)	1.67 (0.93, 2.77)	1.67 (0.93, 2.77)	1.67 (0.93, 2.77)
LCS Complete/ MBT CR Cemented	1,217	28	0.66 (0.31, 1.25)	1.48 (0.91, 2.29)	1.82 (1.18, 2.7)	2.26 (1.51, 3.25)	2.56 (1.73, 3.66)
Optetrak Logic**/ Optetrak Logic PS Cemented	1,192	55	1.34 (0.8, 2.13)	2.35 (1.6, 3.33)	2.78 (1.95, 3.83)	4.51 (3.41, 5.84)	5.35 (3.99, 6.97)
Apex Knee/ Apex Knee PS Cemented	1,168	8	0.34 (0.12, 0.84)	0.60 (0.25, 1.28)	0.96 (0.44, 1.88)	0.96 (0.44, 1.88)	—
NexGen/ NexGen CR Cemented	999	14	0.30 (0.09, 0.84)	0.71 (0.32, 1.4)	1.15 (0.61, 2)	1.41 (0.79, 2.34)	1.59 (0.9, 2.6)
3DKnee/ Foundation CR Cemented	706	20	1.56 (0.83, 2.69)	2.12 (1.24, 3.4)	2.56 (1.57, 3.93)	2.72 (1.69, 4.13)	2.97 (1.86, 4.48)
Unity Knee System/ Unity Knee System PS Cemented	629	6	0.32 (0.07, 1.09)	0.91 (0.34, 2.04)	1.31 (0.51, 2.87)	1.31 (0.51, 2.87)	1.31 (0.51, 2.87)
Optetrak Logic**/ Optetrak Logic CR Cemented	626	55	0.80 (0.31, 1.78)	2.40 (1.4, 3.83)	6.36 (4.61, 8.49)	9.42 (7.16, 12.04)	10.25 (7.57, 13.4)
GMK Primary/ GMK Primary PS Cemented	622	21	0.64 (0.22, 1.57)	2.28 (1.31, 3.69)	3.10 (1.93, 4.7)	3.47 (2.22, 5.16)	3.47 (2.22, 5.16)
LCS Complete/ MBT PS Cemented	622	6	0.00 (., .)	0.85 (0.33, 1.89)	1.03 (0.43, 2.15)	1.03 (0.43, 2.15)	1.03 (0.43, 2.15)
GMK Sphere/ GMK Sphere CR Cemented	584	7	0.52 (0.15, 1.43)	0.52 (0.15, 1.43)	2.20 (0.92, 4.5)	2.20 (0.92, 4.5)	2.20 (0.92, 4.5)
Natural-Knee II/ Natural-Knee II CR Cemented	518	7	0.78 (0.26, 1.89)	1.17 (0.49, 2.43)	1.17 (0.49, 2.43)	1.42 (0.63, 2.79)	1.42 (0.63, 2.79)
NexGen/ NexGen PS Cemented	440	16	1.14 (0.43, 2.51)	2.51 (1.33, 4.3)	3.00 (1.68, 4.93)	3.53 (2.06, 5.6)	4.61 (2.39, 7.93)
NexGen/ NexGen Pegged CR Cemented	423	6	0.95 (0.32, 2.28)	1.19 (0.45, 2.63)	1.46 (0.61, 3.02)	1.46 (0.61, 3.02)	1.46 (0.61, 3.02)
Overall	**671,229**	**13,074**	**0.83 (0.81, 0.85)**	**1.59 (1.55, 1.62)**	**2.02 (1.99, 2.06)**	**2.31 (2.27, 2.35)**	**2.60 (2.55, 2.66)**

**The 95% confidence intervals are included in parenthesis.*
*** The Optetrak knee was used with polyethylene components in nonconforming packaging; those polyethylene implants were subsequently removed from the market beginning in 2021*

Table 3.4 Unadjusted Cumulative Percent Revision of Hybrid 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
Sigma/ PFC Sigma CR Hybrid	2,650	38	0.49 (0.28, 0.82)	1.03 (0.7, 1.47)	1.28 (0.9, 1.77)	1.39 (0.99, 1.92)	1.66 (1.18, 2.29)
Triathlon/ Triathlon CR Hybrid	2,316	49	0.92 (0.59, 1.38)	1.69 (1.21, 2.31)	2.15 (1.58, 2.86)	2.32 (1.71, 3.08)	2.67 (1.96, 3.54)
Vanguard/ Maxim CR Hybrid	2,041	53	1.57 (1.1, 2.19)	2.15 (1.58, 2.86)	2.54 (1.9, 3.32)	2.71 (2.04, 3.52)	3.03 (2.25, 4)
Persona/ Persona CR Hybrid	1,627	31	0.57 (0.29, 1.06)	1.84 (1.19, 2.72)	2.58 (1.75, 3.67)	2.76 (1.87, 3.92)	2.99 (2.02, 4.25)
Apex Knee/ Apex Knee CR Hybrid	690	19	1.74 (0.95, 2.94)	2.63 (1.62, 4.03)	2.63 (1.62, 4.03)	2.78 (1.73, 4.22)	2.78 (1.73, 4.22)
Sigma/ MBT CR Hybrid	656	9	0.76 (0.29, 1.7)	1.10 (0.49, 2.17)	1.57 (0.77, 2.9)	1.57 (0.77, 2.9)	1.57 (0.77, 2.9)
Natural-Knee II GS/ Natural-Knee II CR Hybrid	587	9	0.51 (0.15, 1.41)	1.03 (0.43, 2.14)	1.26 (0.56, 2.48)	1.78 (0.87, 3.27)	1.78 (0.87, 3.27)
Triathlon/ Triathlon PS Hybrid	477	8	0.63 (0.18, 1.73)	1.40 (0.58, 2.91)	2.04 (0.95, 3.87)	2.04 (0.95, 3.87)	2.04 (0.95, 3.87)
Overall	**11,044**	**216**	**0.89 (0.73, 1.08)**	**1.59 (1.36, 1.84)**	**1.95 (1.69, 2.24)**	**2.11 (1.84, 2.41)**	**2.34 (2.03, 2.69)**

**The 95% confidence intervals are included in parenthesis.*

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	2,861	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.*

Partial Knee Arthroplasty

Between 2012 and 2023, AJRR has collected data on 92,728 partial knee arthroplasty procedures.

In 2023, 3.7% of all knee arthroplasties submitted to the AJRR were unicompartmental knee arthroplasties (UKA). This proportion has remained relatively stable over the years. The number of surgeons performing unicompartmental knee arthroplasty (UKA) has steadily increased from 200 in 2012 (20.81%) to 1,300 in 2023 (24.78%). Conversely, the number of surgeons performing patellofemoral arthroplasty (PFA) has decreased significantly over the same period, from 40 in 2012 (4.16%) to 57 in 2023 (1.09%), suggesting a decline in its utilization. It should be noted that this does not necessarily represent the incidence of UKA in the United States, as these percentages just reflect the cases that are submitted to the registry.

Patellofemoral knee arthroplasty (PKA) remains a rare procedure, accounting for 0.34% of all knee arthroplasties in 2023 (Figure 3.21). These low numbers are consistent with international registries, where the New Zealand Joint Registry reported from 1999-2023 a total of 152,786 primary knee arthroplasties of which only 995 (0.7%) represented patellofemoral prostheses.[17] The National Joint Registry of England and Wales and the Swedish Arthroplasty Register reported PFA in 2023 at 1.1% and 0.4% respectively.[8,9] Only 1.09% of all surgeons who submitted primary knee arthroplasty procedures to AJRR performed PFAs, and only 24.78% performed medial and/or lateral UKAs in 2023 (Table 3.6).

Figure 3.20 Medial or Lateral Unicompartmental Knee Arthroplasty as a Percentage of All Primary Knee Arthroplasty, 2012-2023 (N=1,985,172)

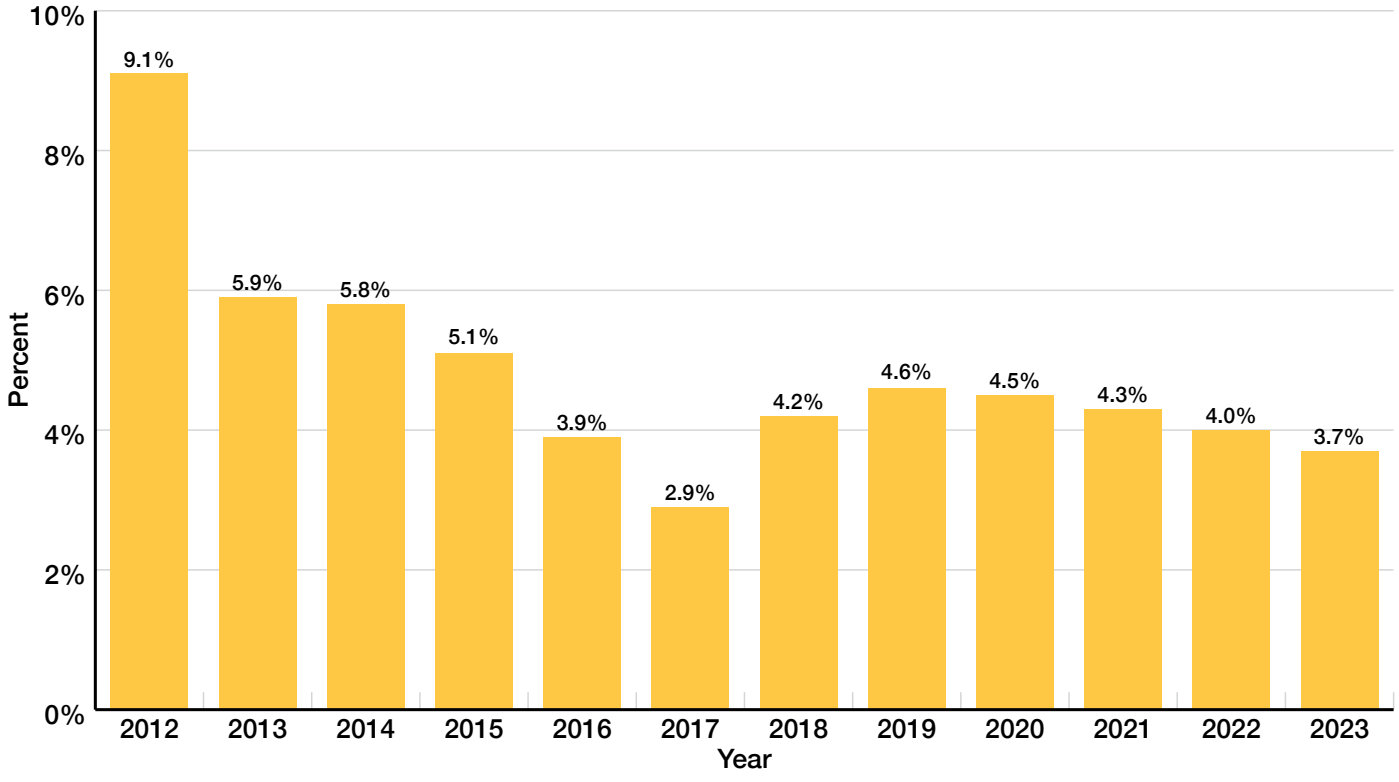


Figure 3.21 Patellofemoral Arthroplasty as a Percentage of All Primary Knee Arthroplasty, 2012-2023 (N=7,408)

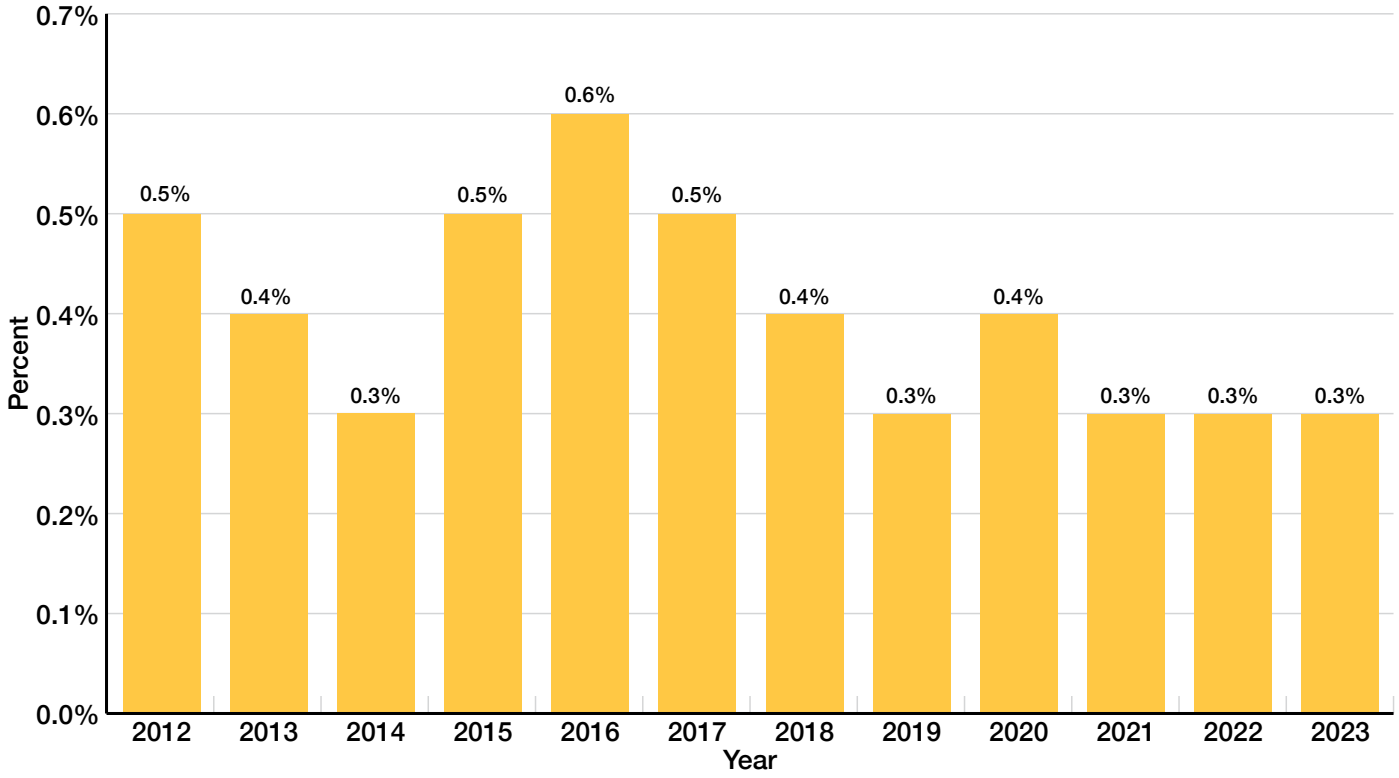


Table 3.6 Surgeons Performing Patellofemoral and Unicompartmental Knee Arthroplasty, 2012-2023

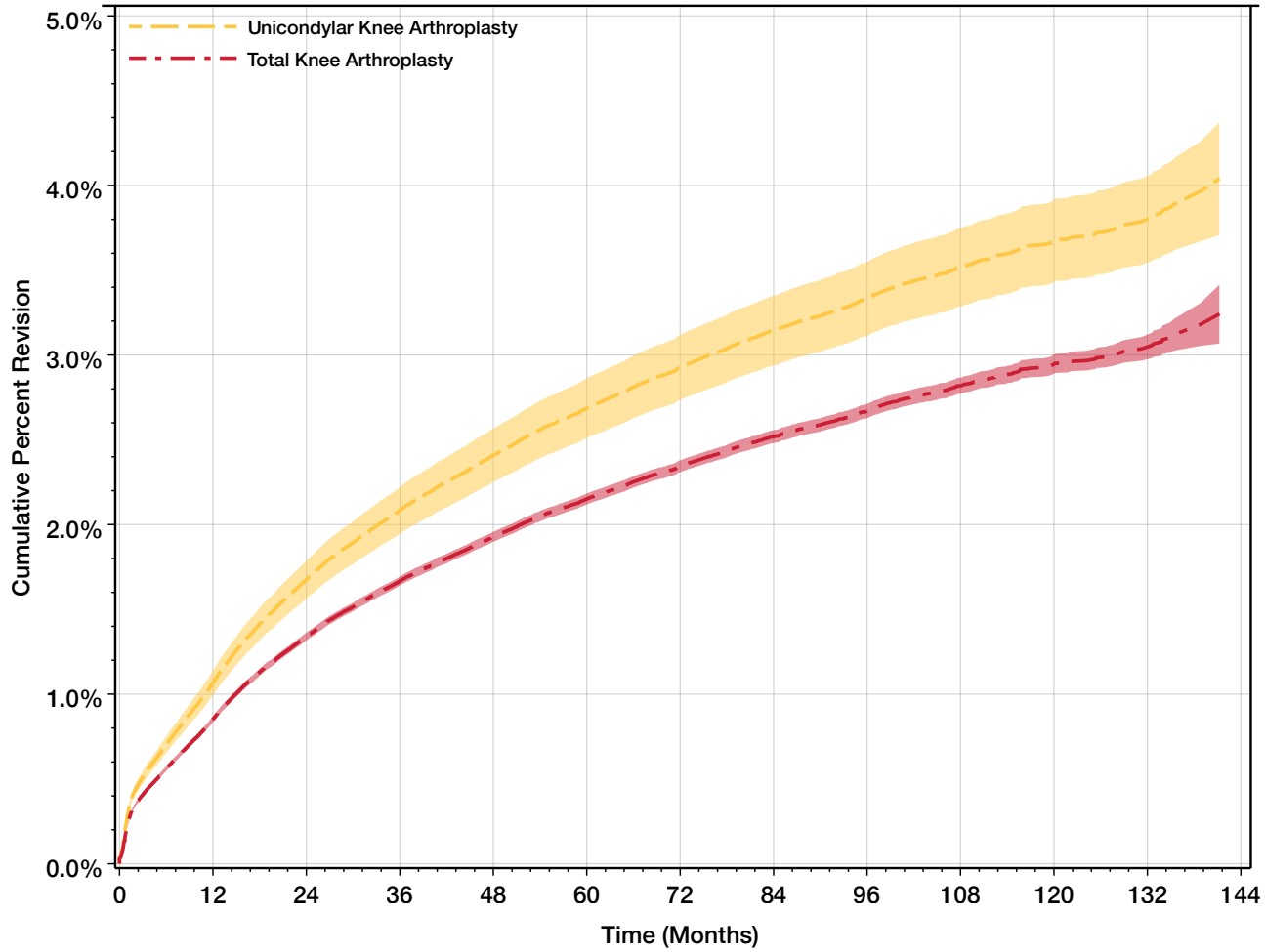
Surgeons Performing Type of Knee Arthroplasty	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2022
Surgeons Performing Unicompartmental Knee Arthroplsty	200 (20.81%)	428 (21.61%)	691 (22.75%)	923 (22.88%)	1045 (21.20%)	975 (19.68%)	1150 (23.17%)	1285 (24.05%)	1247 (23.26%)	1215 (23.41%)	1315 (24.79%)	1300 (24.78%)
Surgeons Performing Patellofemoral Arthroplasty	40 (4.16%)	82 (4.14%)	131 (4.31%)	163 (4.04%)	104 (2.11%)	90 (1.82%)	92 (1.85%)	74 (1.38%)	68 (1.27%)	58 (1.12%)	56 (1.06%)	57 (1.09%)
Total number of Surgeons submitting TKA	721 (75.03%)	1471 (74.26%)	2216 (72.94%)	2948 (73.08%)	3781 (76.69%)	3889 (78.50%)	3721 (74.97%)	3985 (74.57%)	4047 (75.48%)	3918 (75.48%)	3933 (74.15%)	3889 (74.13%)

In the AJRR or CMS database the cumulative revision rates for total knee arthroplasty (TKA) and unicompartmental knee arthroplasty (UKA) differ significantly among patients aged 65 and older. The data from 2012-2023 indicate that UKA constructs have a higher revision rate compared to TKA, and this trend is consistent across all age groups (Figure 3.22). This finding is aligned with other mature registries. In 2022, the National Joint Registry reported the chance of revision with UKA at any estimated time point being approximately doubled or more than that of TKA and overall revision with cemented UKA was more than three times higher than TKA at 10 years.[8] We recognize that overall cumulative percent revision for UKA may be lower than other registries. This may be due to lack of capture of all conversion procedures due to coding limitations, and the Registries team is working to evolve methodology and resolve this limitation.

INSIGHTS

The cumulative incidence of revision, adjusted for age, sex, and CCI, is significantly higher with unicompartmental knee arthroplasty when compared with primary total knee arthroplasty.

Figure 3.22 Cumulative Percent Revision of Total Knee Versus Unicondylar Knee Constructs for Femoral Components in Medicare Patients 65 Years of Age and older with Primary Osteoarthritis, 2012-2023

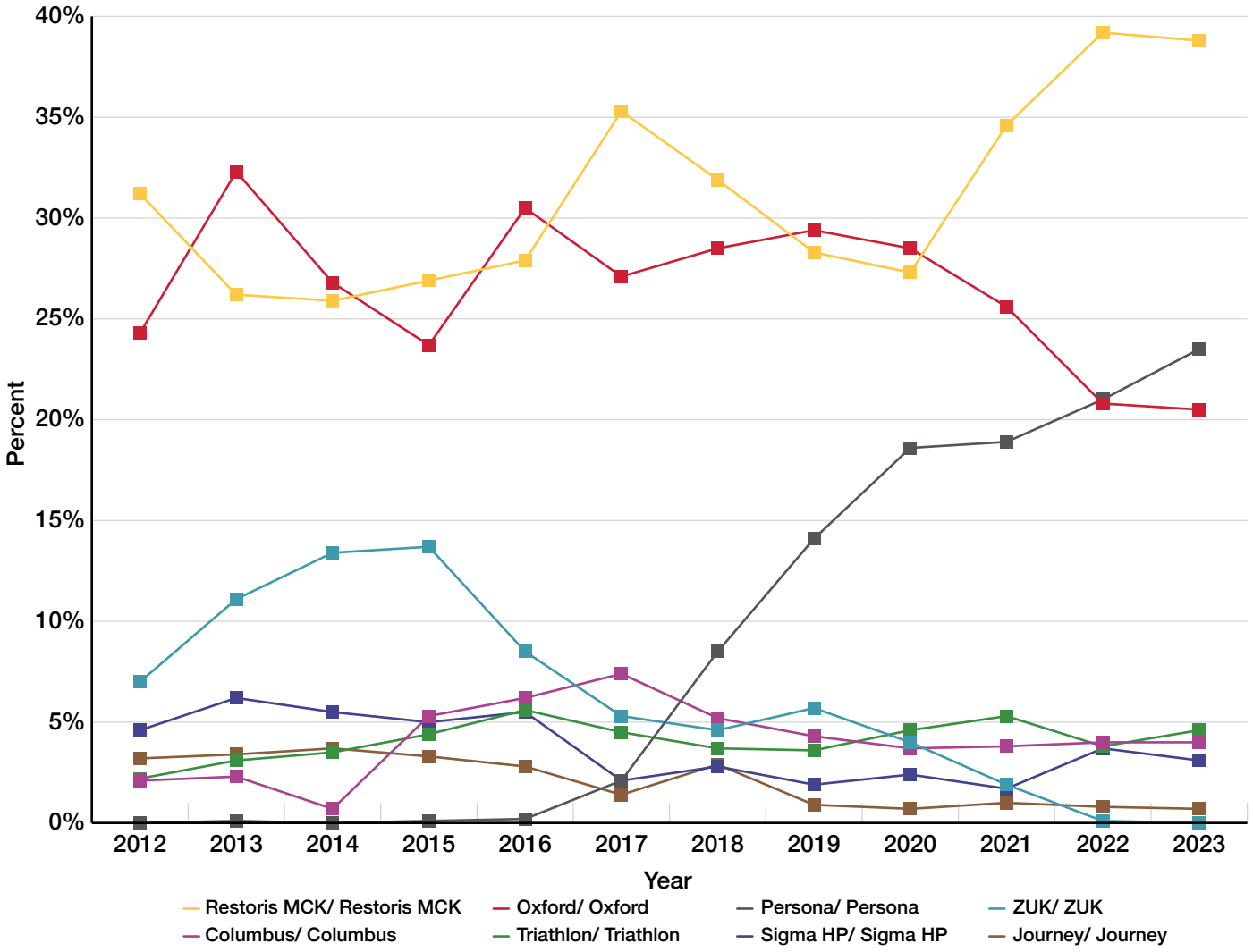


Number at Risk (Months)	0	12	24	36	48	60	72	84	96	108	120	132	144
Total Knee Arthroplasty	1,029,380	889,841	750,576	644,465	549,711	441,753	337,095	229,147	140,288	78,392	35,216	9,790	2
Unicondylar Knee Arthroplasty	37,693	33,308	28,630	24,624	20,995	16,717	12,769	10,146	7,274	4,488	2,107	814	5
Total	1,067,073	923,149	779,206	669,089	570,706	458,470	349,864	239,293	147,562	82,880	37,323	10,604	7

Age/Sex/CCI adjusted HR (95%CI), p-value
Unicondylar Knee Arthroplasty vs. Total Knee Arthroplasty:1.254(1.164,1.35), p<.0001

Figure 3.23 provides utilization data of implants used in partial knee arthroplasty procedures in AJRR. The eight most commonly used femoral and tibial combinations in UKA by year shows that the combinations most frequently implanted have also varied over time. For 2023, the Restoris MultiCompartmental Knee (MCK) was the most frequently implanted combination following a similar utilization level since 2012. Over the last four years, the Persona Knee component has seen a steep increase in utilization to become the second most common implant by 2023, followed by the Oxford Knee component.

Figure 3.23 Unicondylar Knee Arthroplasty Femoral/Tibial Component Combinations by Year, 2012-2023 (N=60,122)

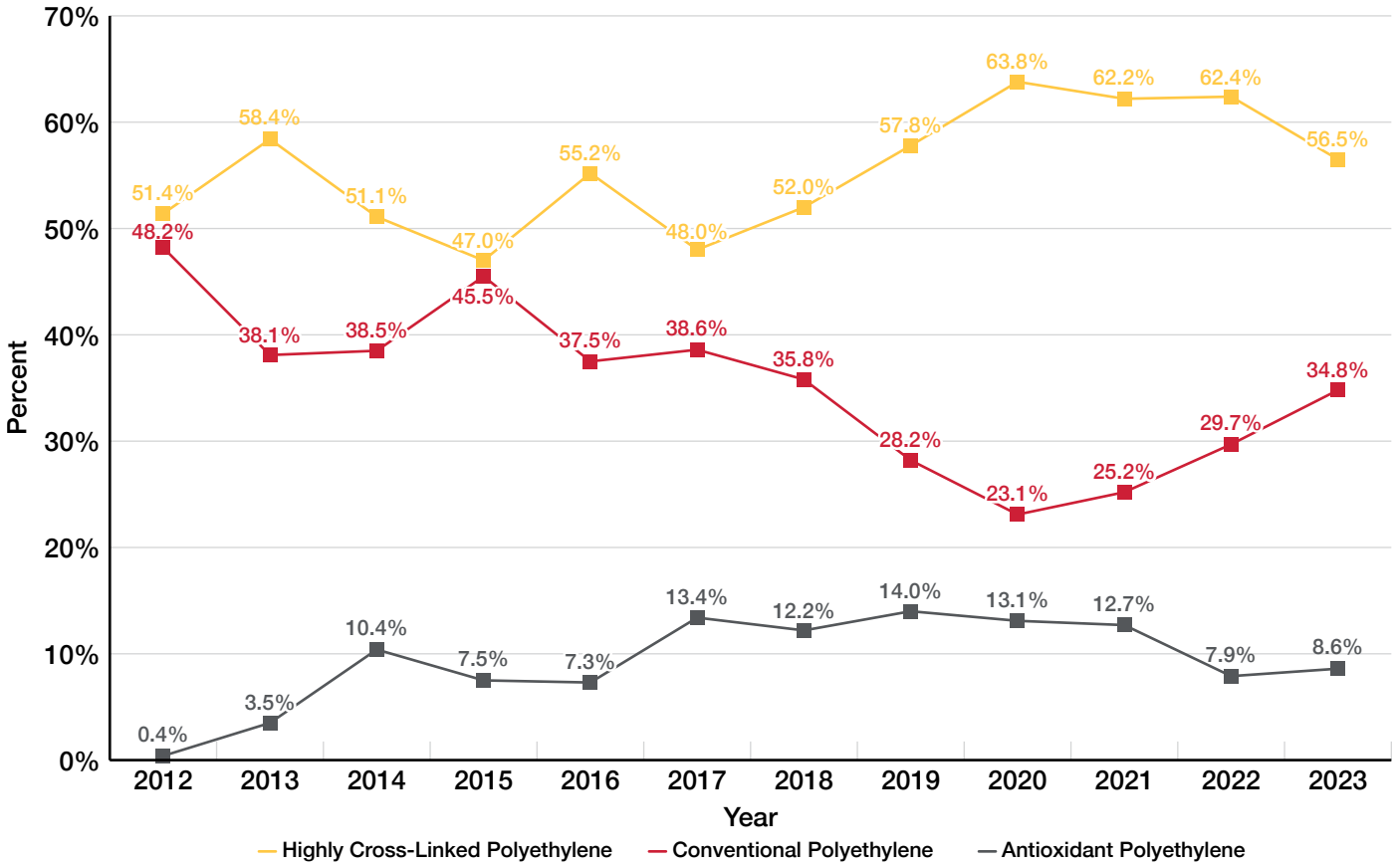


The use of conventional polyethylene inserts has substantially decreased in unicompartmental knee arthroplasty but has shown a slight increase in recent years.

INSIGHTS

The data from Figure 3.24 provides a detailed look at the trends in polyethylene usage in unicondylar knee arthroplasty (UKA) from 2012 to 2023, based on 47,685 procedures. This figure breaks down the three main types of polyethylene used: highly cross-linked polyethylene, conventional polyethylene, and antioxidant polyethylene. These results show that highly cross-linked polyethylene is the most frequently used material. The use of conventional polyethylene has substantially decreased since 2012 with a slight increase over the last two years, while the use of antioxidant polyethylene for UKA has remained relatively stable since 2014 accounting for 8.64% of cases in 2023.

Figure 3.24 Unicondylar Knee Arthroplasty Insert Polyethylene Material by Year, 2012-2023 (N=47,685)



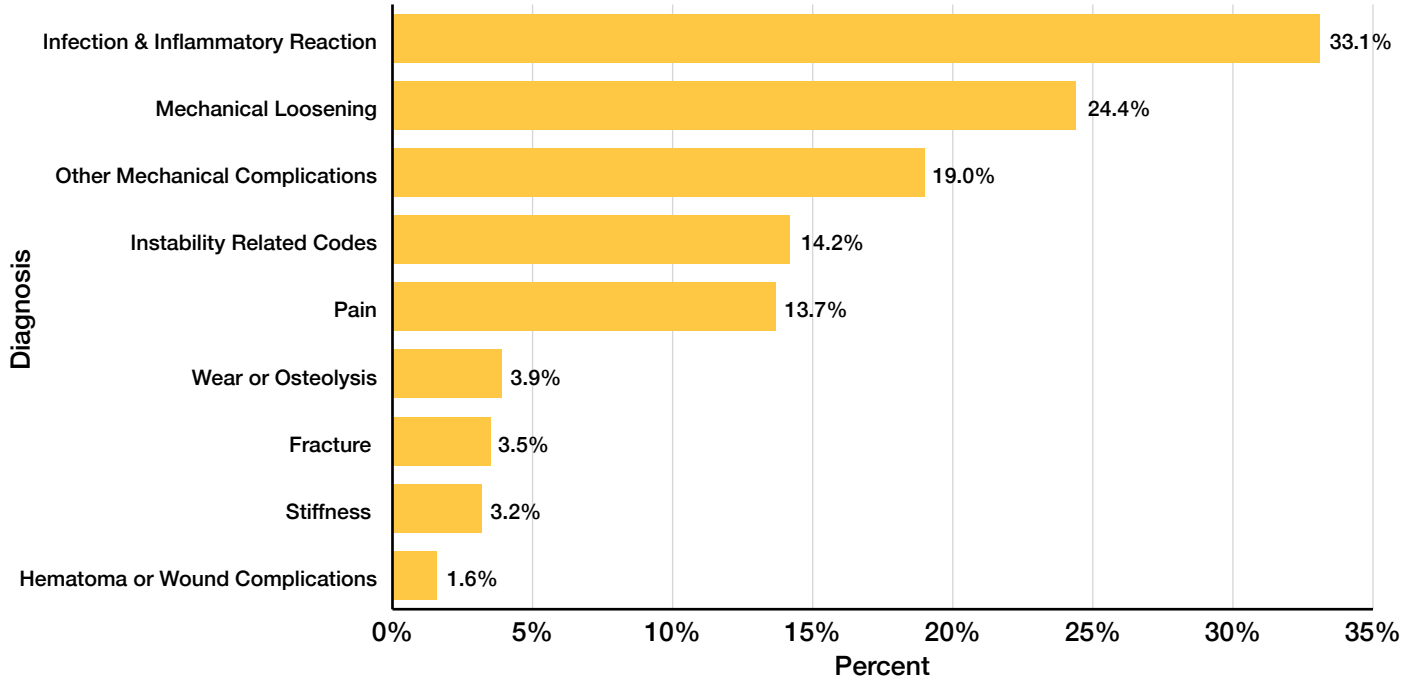
Revision Knee Arthroplasty

Between 2012 and 2023, AJRR has collected data on 188,894 revision knee arthroplasty procedures.

As discussed in the revision hip arthroplasty section, a substantial amount of work is ongoing to better identify and characterize the reasons for revision knee arthroplasty procedures. The data submitted to AJRR contains variability in coding with respect to primary reason for revision. Substantial efforts involving surgeon leadership continue to be undertaken to identify best practices for this critical coding step. The reason for revision was determined by the diagnosis codes submitted for each revision. AJRR accepts up to 10 diagnosis codes which can be submitted as either ICD (International Classification of Diseases)-9 or -10 codes depending on the year of the procedure.

The data from Figure 3.25 presents the distribution of diagnoses associated with all knee revisions performed between 2012 and 2023, based on 168,933 revision cases. The primary causes of knee revision surgery are varied, but the data show clear trends in the leading reasons for these procedures. Infection and inflammatory reactions are the leading cause of knee revisions, accounting for 33.1% of cases. This is a significant proportion of revisions, highlighting the ongoing challenge of preventing postoperative infections. Despite advances in infection control measures and perioperative care, infection remains the most common reason for revision surgery. Mechanical loosening is the second most common diagnosis, responsible for 24.4% of knee revisions.

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



The data from Table 3.8 presents the distribution of time intervals between primary total knee arthroplasty (TKA) and subsequent revision procedures for linked patients between 2012 and 2023. This breakdown offers valuable insights into the timing of revisions and the longevity of knee implants among patients requiring further surgical intervention.

INSIGHTS

Infection remains the most common reason for revision surgery following total knee arthroplasty, particularly for early revisions within three months of the index surgery.

Twenty-two percent of revisions reported to AJRR took place within 3 months of the primary TKA. As shown in Figure 3.26 a majority of these early revisions are linked to infection and inflammatory reaction (60.3%), followed by hematoma or wound complications (19.2%). Fifty-seven percent of revisions occurred more than 1 year after the initial primary TKA procedure.

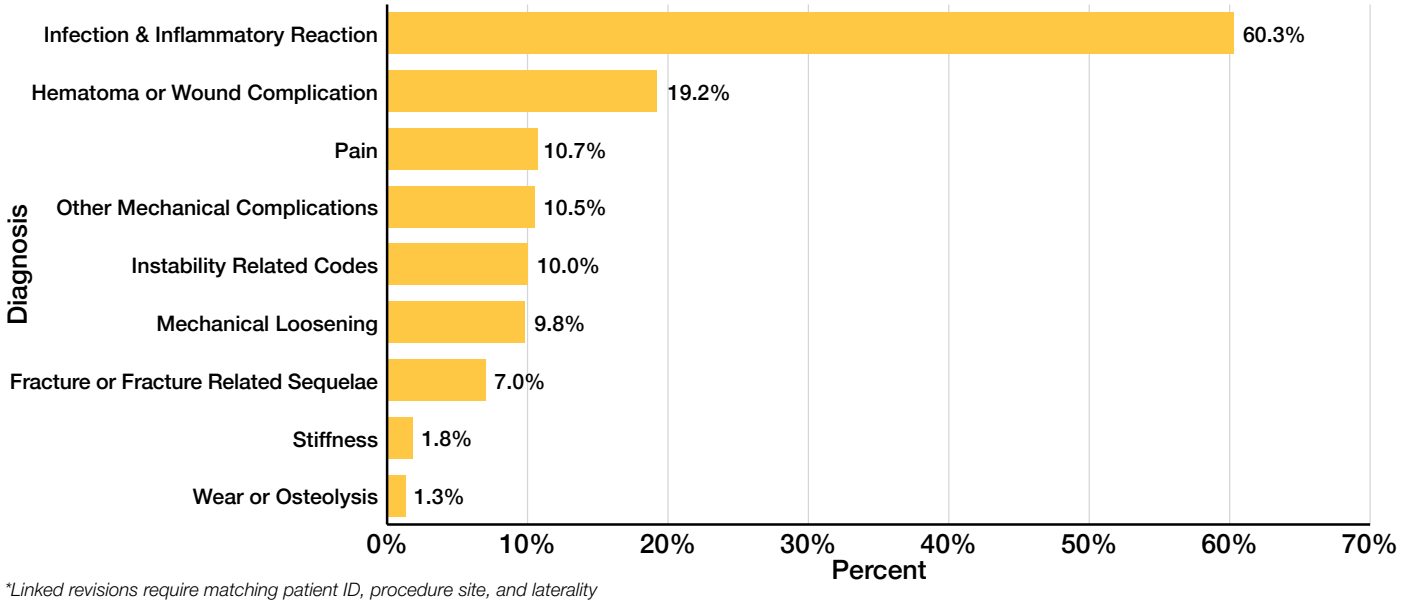
AJRR may miss revisions that are performed at a different location from the primary procedure, particularly when the institution where the revision was performed does not submit data to the registry. In a study quantifying the level of migration of primary arthroplasty patients ≥65 years of age, Etkin et al. noted only 0.62% of Medicare patients moved out of state and to a different county one year after the primary procedure.[13] Migration to a different state or county increased to >10% at 5 years and 18% at 10 years.[13]

Table 3.7 Distribution of Time Interval Between Primary Total Knee Arthroplasty and Revision Procedures for "Linked" Patients, 2012-2023*

Time	Frequency	Percent
<3 Months	7,560	22.6
3 to <6 Months	2,473	7.4
6-12 Months	4,907	14.6
>1 Year	18,589	55.4

**Linked revisions require matching patient ID, procedure site, and laterality*

Figure 3.26 Distribution of Diagnosis Associated with Early "Linked" Knee Revisions, 2012-2023 (N=7,161)*



**Linked revisions require matching patient ID, procedure site, and laterality*

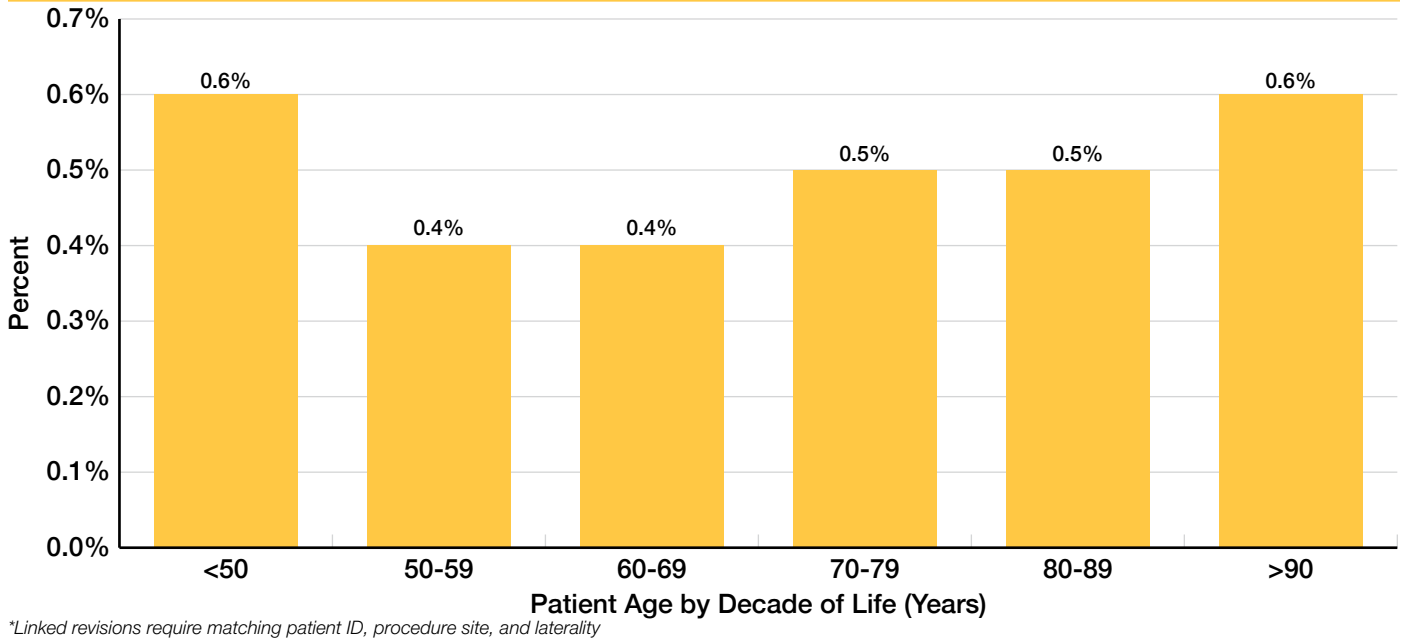
Patients >90 years of age and <50 years of age had the highest incidence of early revision following total knee arthroplasty.

INSIGHTS

As reported to AJRR, The highest percentage of early revisions was observed in patients aged over 90, where 0.61% of all primary TKA procedures required early revision. Similarly, patients younger than 50 years old also had a relatively high early revision rate, with 0.58% of primary TKAs requiring revision.

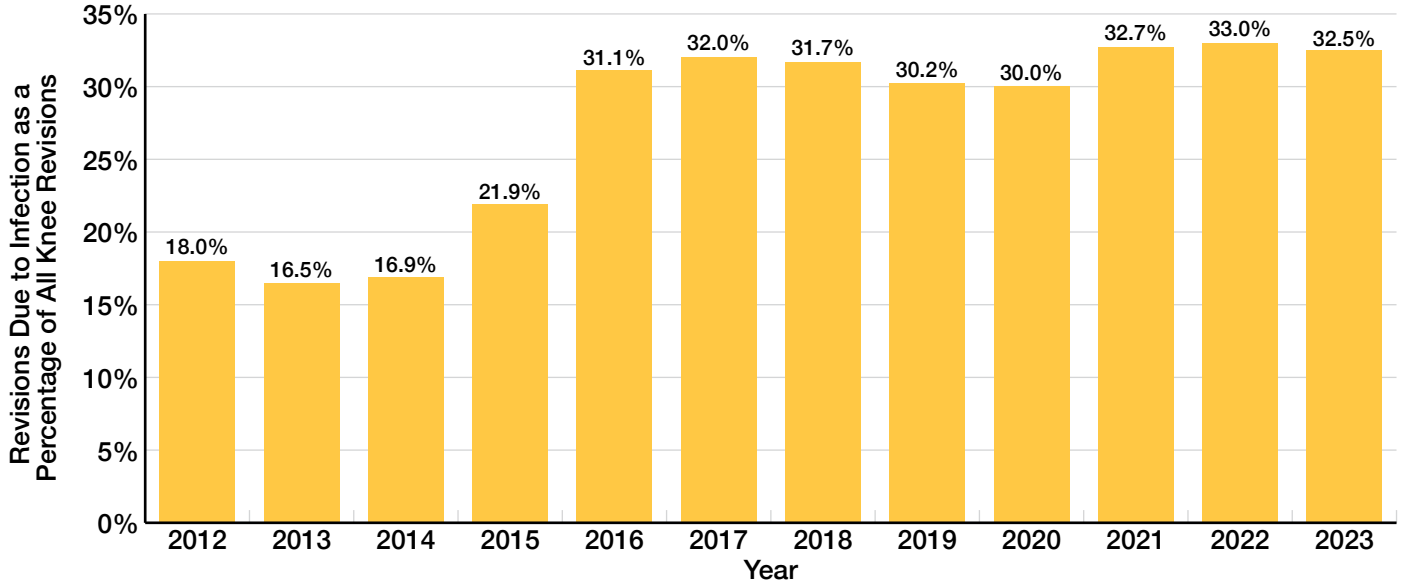
Overall, from 2015 to 2023, the percentage of revisions due to infection consistently accounted for around one-third of all knee revisions, indicating that infection has become a dominant factor driving the need for revision surgery in recent years. (Figure 3.28).

Figure 3.27 Early "Linked" Revisions as a Percent of All Primary Total Knee Arthroplasty Procedures by Age Group 2012-2023 (N=8,574)*



Linked revisions require matching patient ID, procedure site, and laterality

Figure 3.28 Percent of Revision Knee Arthroplasty Procedures Due to Infection, 2012-2023 (N=55,868)



The data from Figure 3.29 presents trends in the usage of different polyethylene materials for revision knee arthroplasty (RKA) procedures between 2012 and 2023, based on 121,878 cases. The three types of polyethylene highlighted are conventional polyethylene, highly cross-linked polyethylene, and antioxidant polyethylene. The data show a clear shift in preferences over the years, with the increasing adoption of highly crossed-linked polyethylene and antioxidant polyethylene (Figure 3.29). Non-antioxidant polyethylene inserts include both highly cross-linked polyethylene and conventional polyethylene.

Figure 3.30 provides an analysis of the femoral/tibial component combinations used in revision total knee arthroplasty (TKA) procedures between 2012 and 2023, based on 68,378 cases. The trends indicate clear shifts in the popularity of specific combinations over time, with certain combinations becoming more dominant while others have significantly decreased in usage. Triathlon TS/Triathlon remained one of the most consistently used component combinations throughout the study period, although its use has fluctuated. Starting at 15.0% in 2012, it reached 16.6% by 2023, with a dip in the mid-2010s but a steady recovery in recent years. Attune showed the most dramatic increase in usage and rose rapidly to 20.8% by 2023. Sigma TC3/MBT saw a marked decline in usage, from 17.5% in 2012 to just 1.2% in 2023.

The data from Figure 3.31 show trends in discharge disposition following revision knee arthroplasty from 2012 to 2023, based on 132,419 cases. Over this period, the proportion of patients discharged to their home steadily increased, rising from 67.0% in 2012 to 81.1% by 2023. Conversely, discharges to a skilled nursing facility decreased from 28.4% in 2012 to 13.7% in 2023, reflecting a notable shift in postoperative care preferences. The use of inpatient rehabilitation remained low and stable, fluctuating around 1.2% to 2.0% over the years. Overall, there has been a marked shift towards home discharges over time, with a corresponding decline in discharges to skilled nursing facilities.

Figure 3.29 Revision Knee Arthroplasty Insert Polyethylene Material by Year, 2012-2023 (N=121,878)

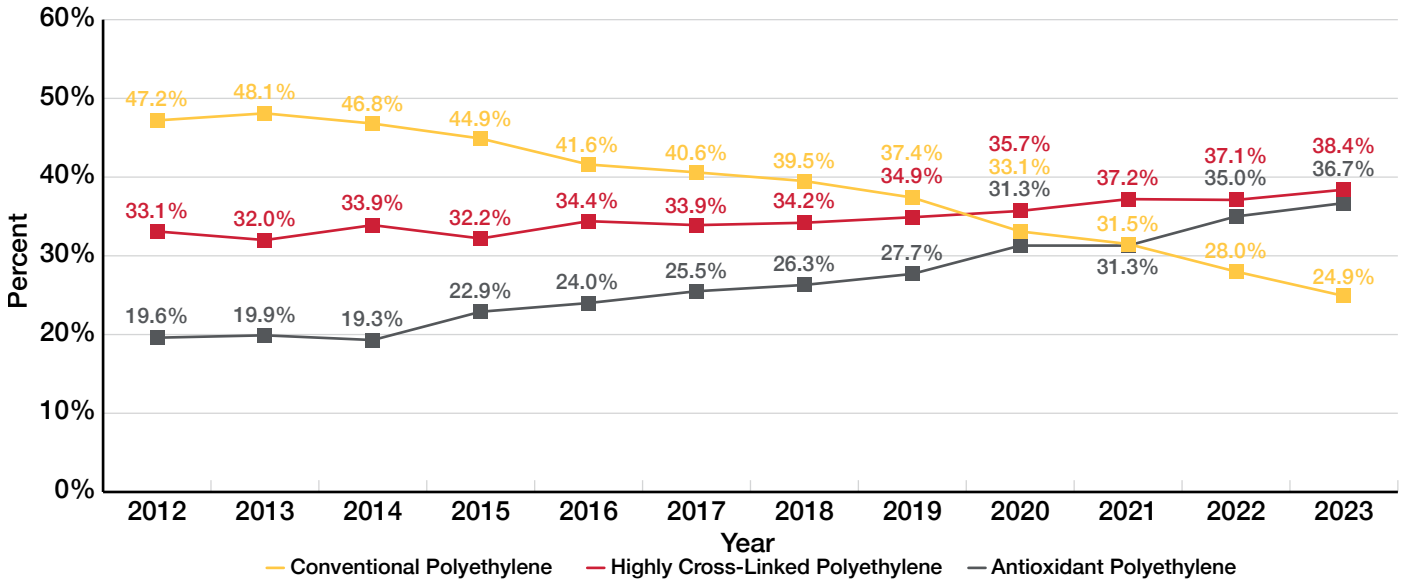


Figure 3.30 Revision Total Knee Arthroplasty Femoral/Tibial Component Combinations by Year, 2012-2023 (N=68,378)

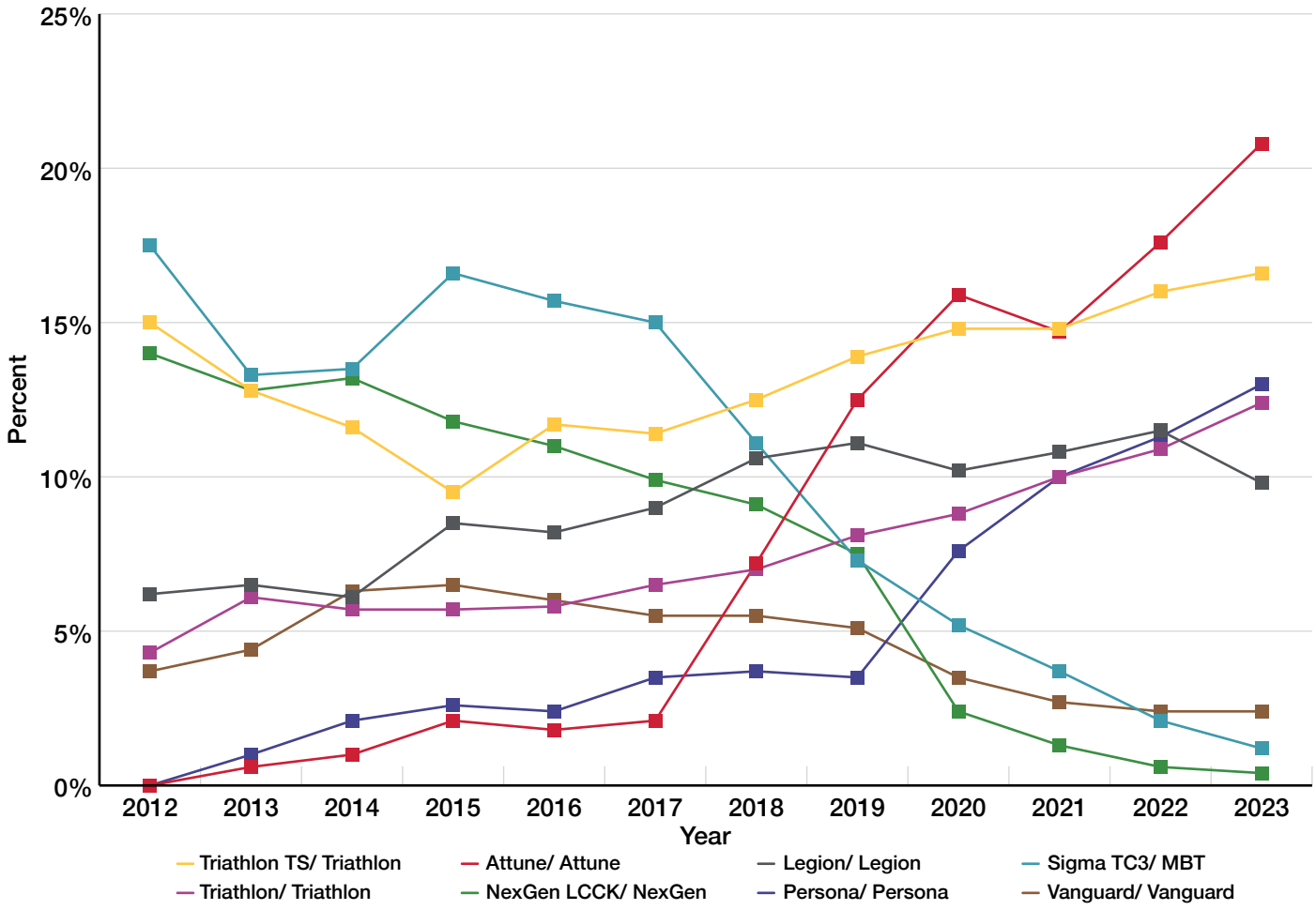
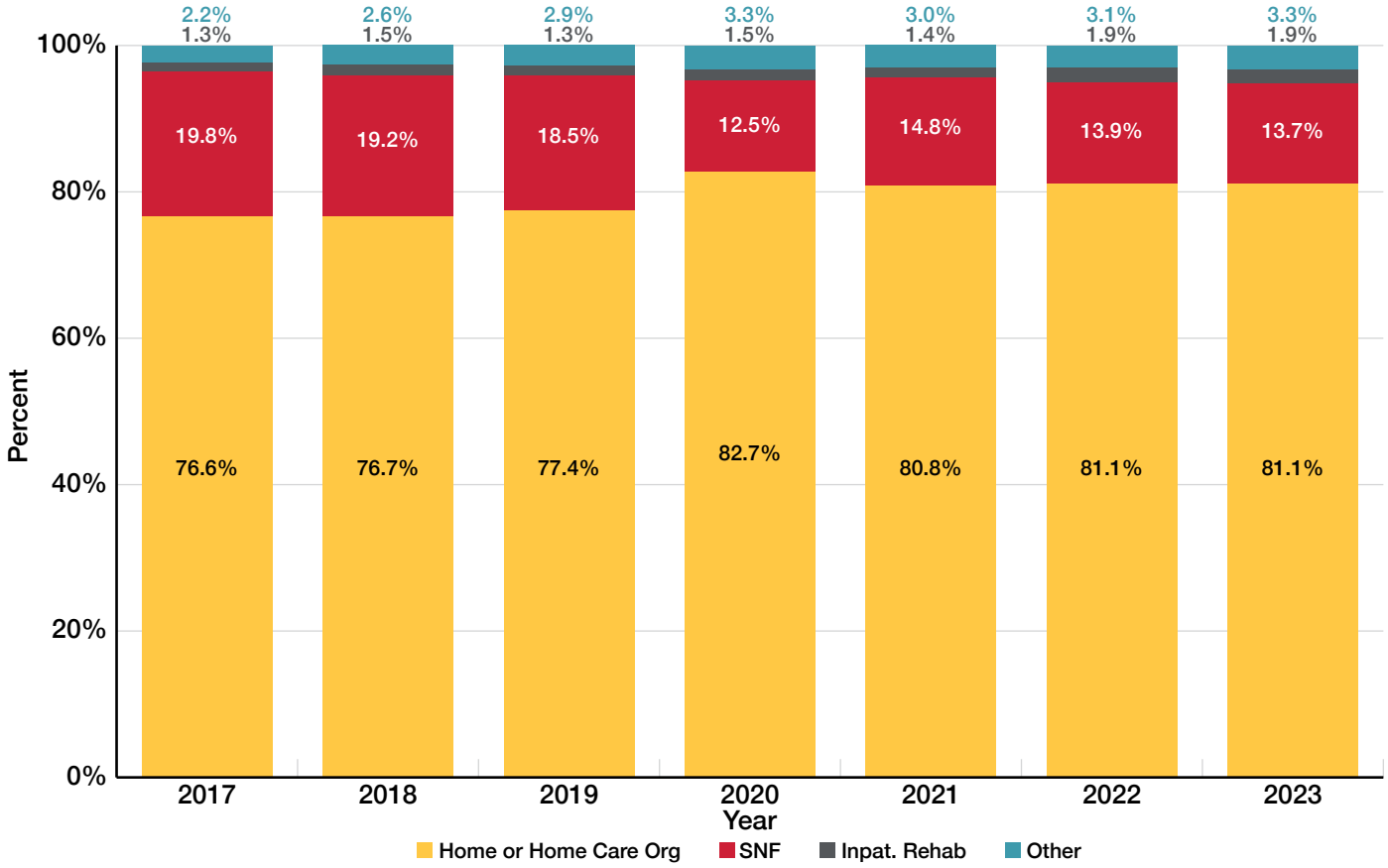


Figure 3.31 Revision Knee Arthroplasty Discharge Disposition Codes by Year, 2012-2023 (N=132,419)



Code	Code Value
Home	Discharged to home/self-care (routine charge).
Home Care Org.	Discharged/transferred to home care of organized home health service organization.
SNF	Discharged/transferred to skilled nursing facility (SNF) with Medicare certification in anticipation of covered skilled care--(For hospitals with an approved swing bed arrangement, use Code 61 - swing bed. For reporting discharges/transfers to a non-certified SNF, the hospital must use Code 04 - ICF.)
Inpat. Rehab	Discharged/transferred to an inpatient rehabilitation facility including distinct parts units of a hospital (eff. 1/2002).

TKA Re-Revision

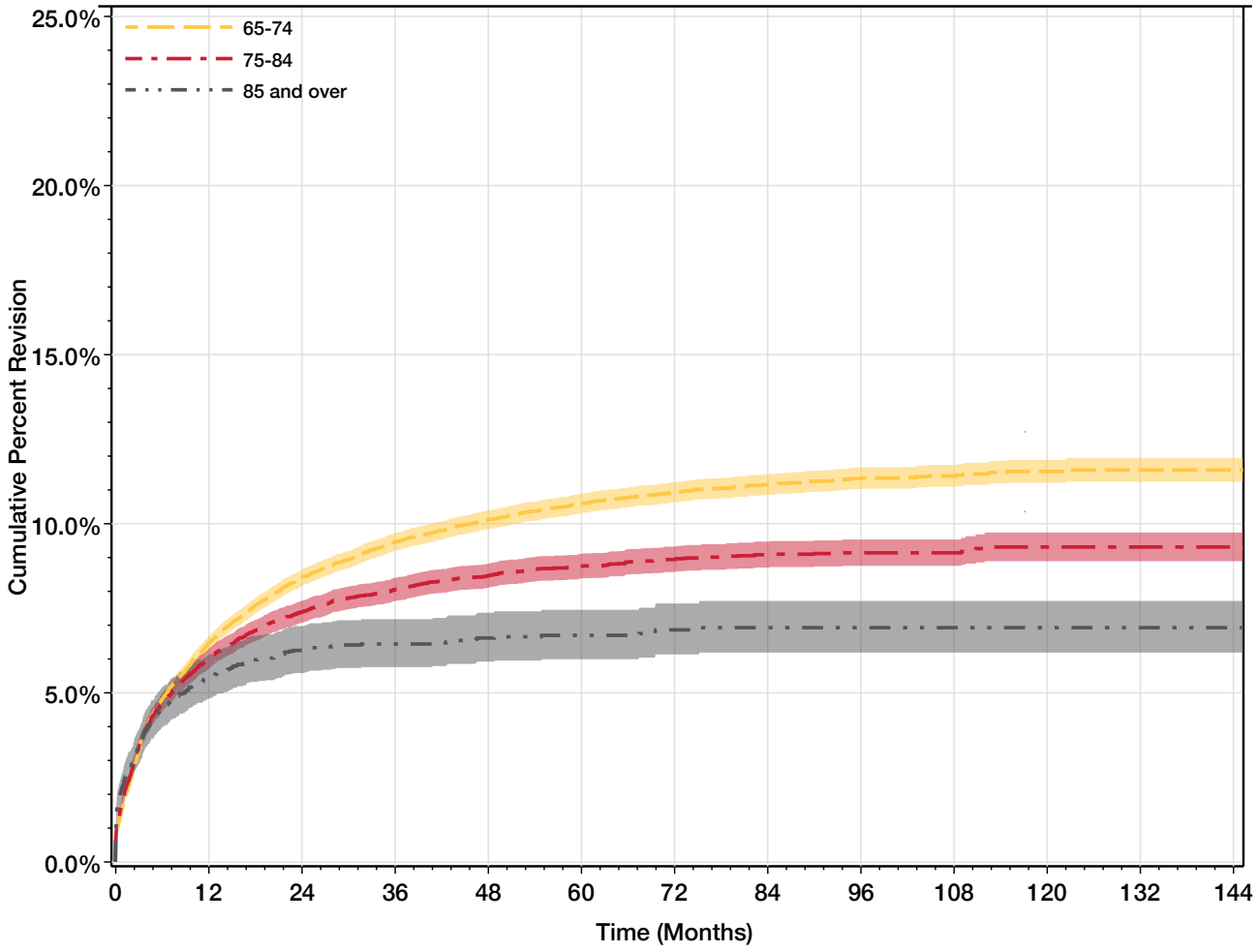
Revision following revision total knee arthroplasty (re-revision) was investigated for the first time in this year's Annual Report (Figure 3.32). Cumulative percent re-revision of three different age groups were the focal comparison for our first total knee arthroplasty re-revision figure. After adjusting for sex and CCI, patients aged 65-74 were identified to have a significantly increased cumulative percent re-revision compared to patients in older age groups.

Reasons for re-revision were also reported. As with revision following a primary procedure, infection is the most frequent reason for re-revision (Figure 3.33). Reasons for re-revision following a revision for infection, Instability, and mechanical Loosening are presented as well, however, the total number of procedures included in these figures are low which indicates trends could change over time.

INSIGHTS

The re-revision risk in older patients (85 years and older) is approximately half of that seen in younger patients (65 to 74 years).

Figure 3.32 Cumulative Percent Rerevision for a Revision Knee Arthroplasty in Medicare Patients 65 Years of Age and older, 2012-2023



Number at Risk (Months)	0	12	24	36	48	60	72	84	96	108	120	132	144
65-74	50,936	44,391	36,073	29,672	24,263	19,809	15,052	10,662	7,079	4,157	2,088	760	136
75-84	25,849	22,121	17,637	14,221	11,463	9,162	6,845	4,773	3,135	1,840	935	356	62
85 and over	4,748	3,895	3,142	2,457	1,896	1,489	1,093	739	467	282	141	43	8
Total	81,533	70,407	56,852	46,350	37,622	30,460	22,990	16,174	10,681	6,279	3,164	1,159	206

Sex/CCI adjusted HR (95% CI), p-value
75-84 vs. 65-74: 0.701 (0.664,0.741), p <.0001; 85 and over vs. 65-74: 0.484 (0.428,0.548), p<.0001

Figure 3.33 Distribution of Diagnosis Associated with All Knee Rerevisions, 2012-2023 (N=14,019)

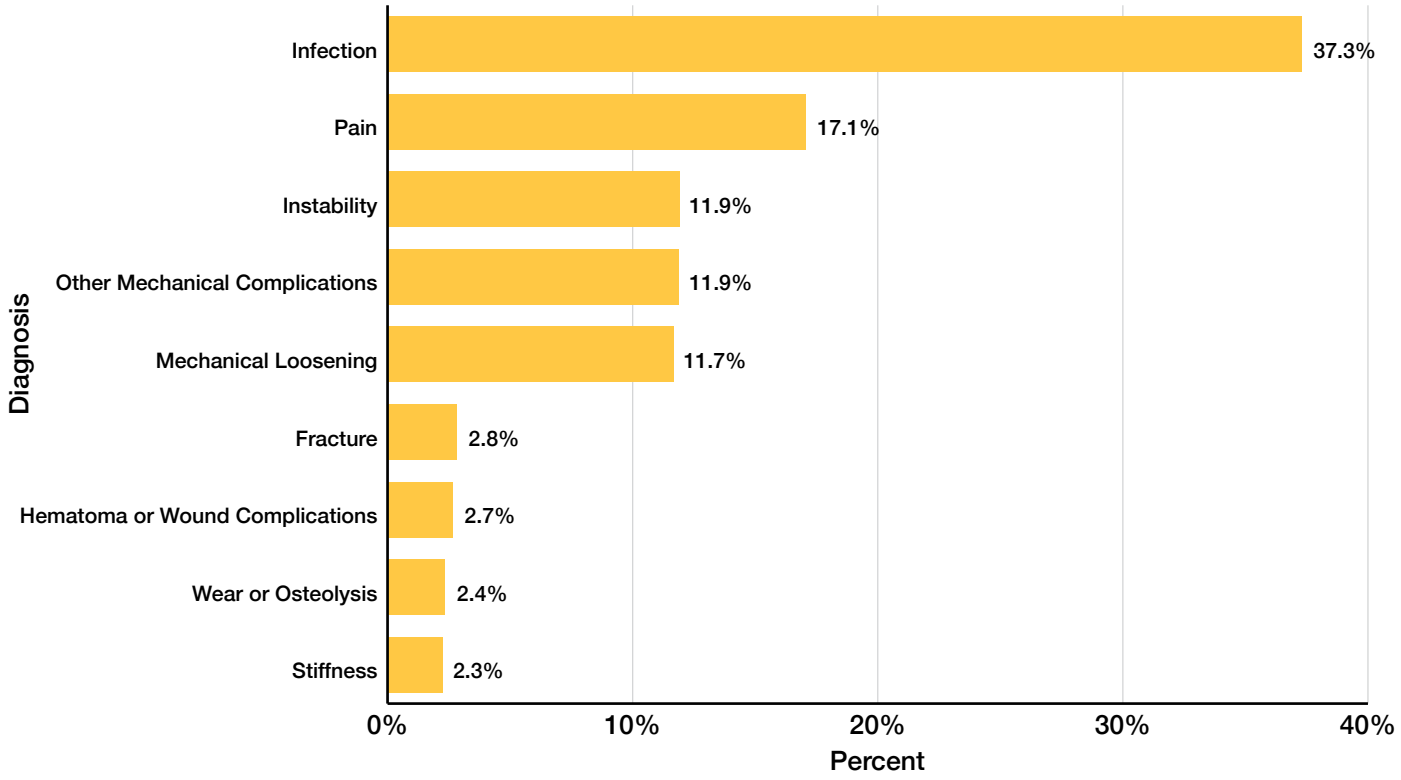


Figure 3.34 Distribution of Diagnosis Associated with Knee Rerevisions for Initial Revision due to Infection, 2012-2023 (N=612)

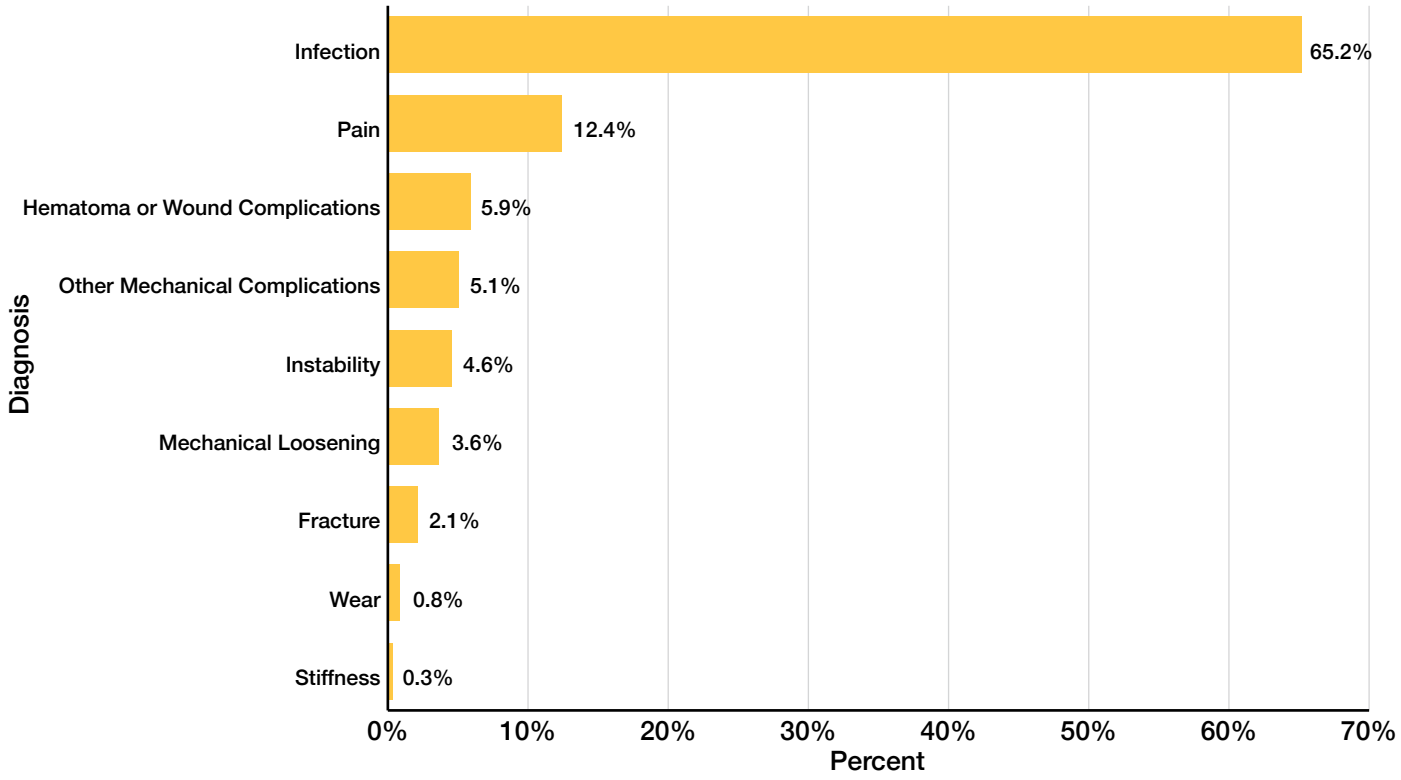


Figure 3.35 Distribution of Diagnosis Associated with Knee Rerevisions for Initial Revision due to Mechanical Loosening, 2012-2023 (N=54)

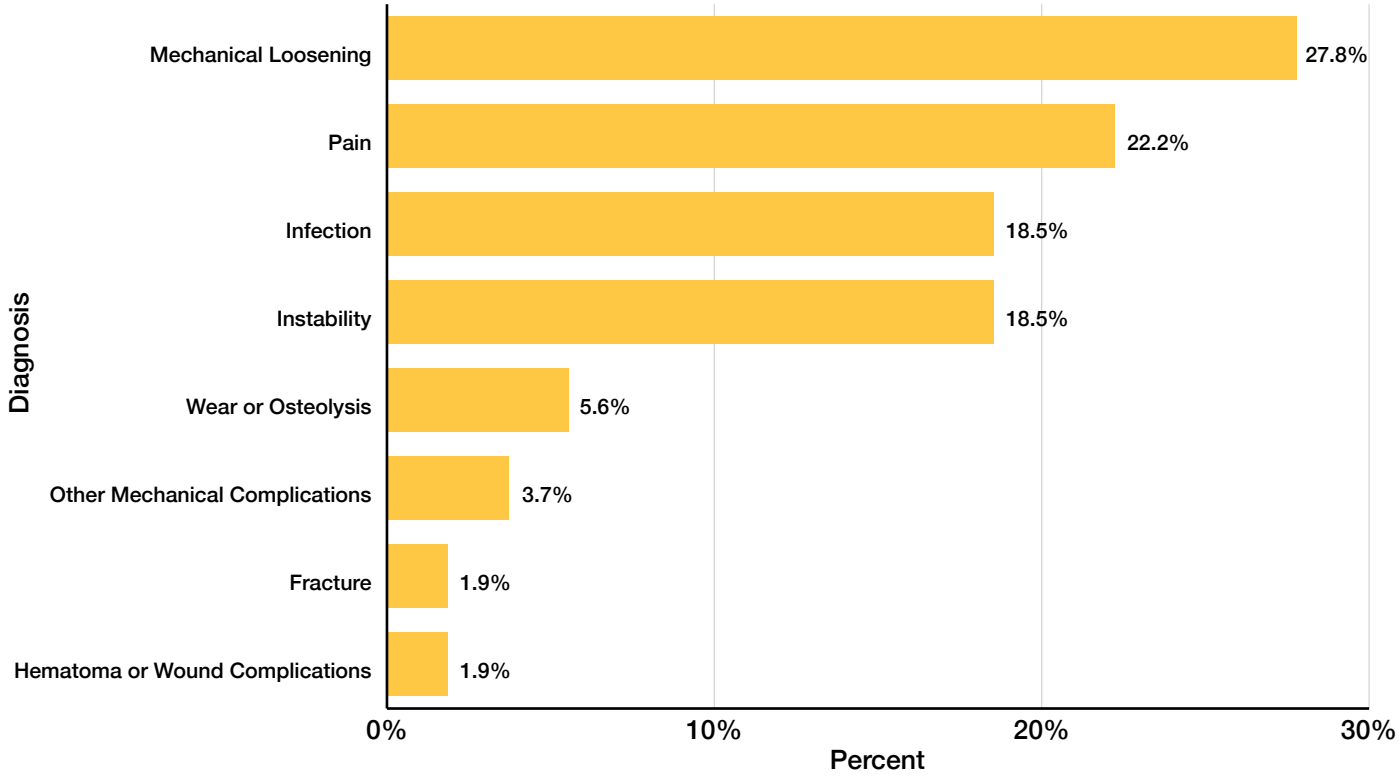
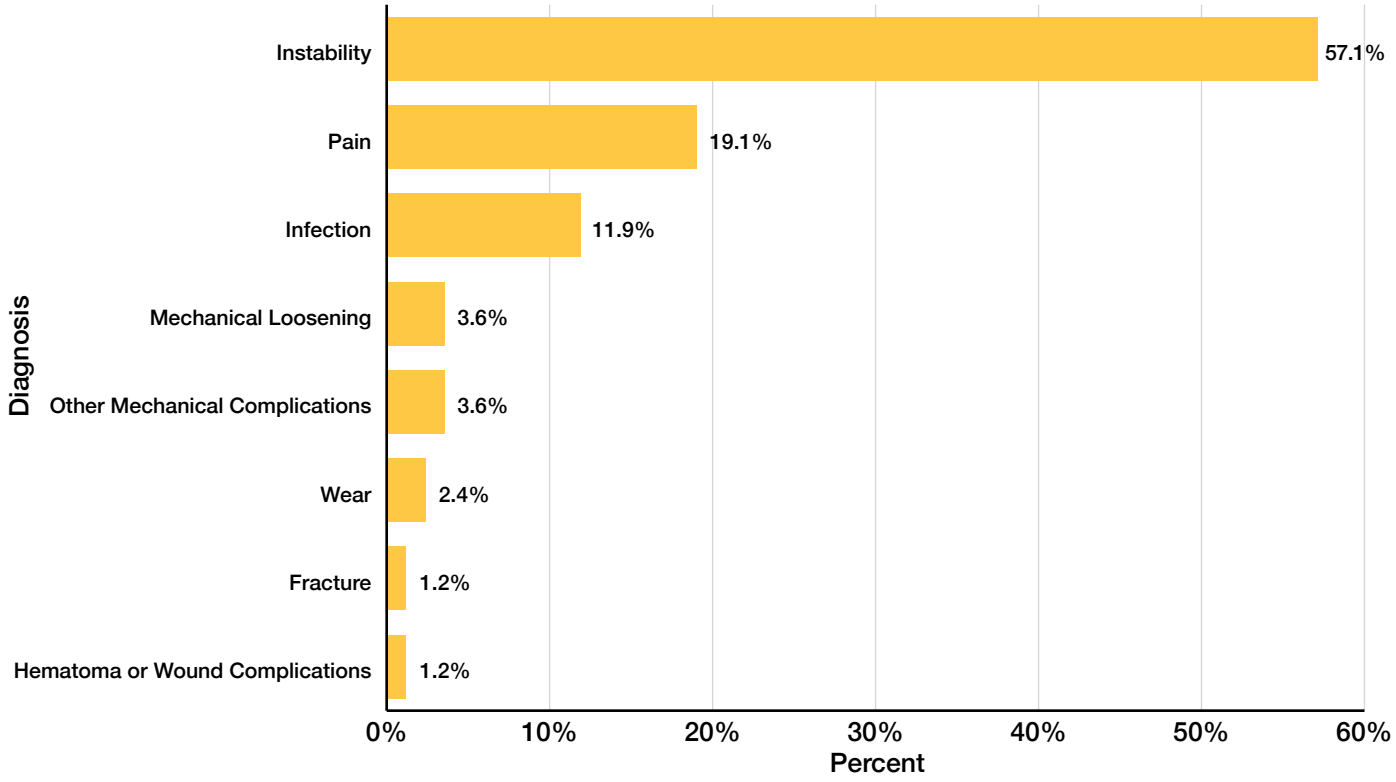


Figure 3.36 Distribution of Diagnosis Associated with Knee Rerevisions for Initial Revision due to Instability, 2012-2023 (N=84)



Patient-Reported Outcome Measures (PROMs) - Total Knee Arthroplasty

Patient-reported outcome measures (PROMs) have received increased attention within AJRR and the wider practice of orthopaedic surgery. In the U.S., value-based payment models made capture of PROMs a prerequisite for various public and private alternative payment models. Internationally, in 2014 the International Society of Arthroplasty Registries (ISAR) Steering Committee established a working group in this area to advise on best practices.[15]

AJRR collects patient-reported outcome measures and encourages sites to submit this data at set intervals: a baseline measure obtained prior to the surgery, a measure 90-days post-discharge, and at one-year postoperatively. Patient- reported outcome measures capture information on the patient's overall health and function from the patient's perspective. The recommended intervals allow comparison over the course of a patient's care, but on a broader scope, provide a better picture of national outcomes and trends. AJRR provides national benchmarking for participating sites to review and compare this uniquely reported data.

With a growing emphasis on the value of PROMs data, the Registry in turn has expanded the ways in which sites submit this data. The Registry provides a tool for sites to collect PROMs data electronically on all eligible patients, via email or a computer or tablet device in the clinical setting. Sites also have the option to submit PROMs data through other methods, perhaps collected via a third-party vendor or a local system.

Quick Facts:

- 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.
- 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%.

PROMs Data Summary and Key Insights

1. **Overall Improvement: Across all PROMs, there is a significant improvement in patient-reported outcomes from preoperative to 1-year postoperative, especially in physical function and knee-related outcomes.**
    - KOOS JR (Knee Disability and Osteoarthritis Outcome Score) shows a meaningful increase in scores from a preoperative mean of 47.5 to a postoperative mean of 76.4.
    - PROMIS-10 (Patient-Reported Outcomes Measurement Information System 10) and VR-12 (Veterans RAND 12-Item Health Survey) show notable improvements in both mental and physical health components.

2. **Meaningful Improvement:**
    - KOOS JR: 87.2% of patients with linked preoperative and postoperative scores experienced a clinically meaningful improvement.
    - PROMIS-10 Physical: 63.9% of patients reported meaningful improvement in physical health.
    - VR-12 Physical: 73.0% of patients reported meaningful improvement in physical health.

3. **Age-Stratified Results:**
    - The response rate for linked preoperative and postoperative PROMs decreases with increasing age, but meaningful improvement remains high across all age groups.
    - Patients over 85 years showed the highest percentage of meaningful improvement for KOOS JR at 89.2%.

4. **Hospital Size Impact:**
    - Hospitals of all sizes (measured by bed count) report similar rates of meaningful improvement in KOOS JR scores, with response rates ranging from 85.6% to 88.3% across different bed-size groups.
    - Larger hospitals tend to have a higher percentage of patients reporting meaningful improvement in VR-12 physical health.

5. **Teaching Status Impact:**
    - Non-teaching hospitals report the highest percentage of meaningful improvement for KOOS JR (88.5%), while teaching hospitals have lower response rates but still show substantial improvement in PROMs.

Key Insights:

- High Rates of Improvement: A large percentage of patients undergoing knee arthroplasty experience significant improvement in both knee-specific and overall physical health outcomes after one year.
- Age and Bed Size: While response rates for PROMs data may vary by age and hospital bed size, the likelihood of meaningful improvement remains consistently high across groups.
- Focus on Physical Health: PROMs related to physical health, such as KOOS JR and VR-12 Physical Health Component, indicate greater improvements compared to mental health metrics, emphasizing the positive impact of knee arthroplasty on patients' physical function.

Table 3.8 Preoperative and 1-Year Postoperative PROM Mean Scores After Primary Knee Arthroplasty by PROM, 2012-2023

Patient-Reported Outcome Measure (PROM)	PROM Component	Pre or 1-year Postoperative	N	Mean	Standard Deviation
KOOS, JR. (Knee Disability and Osteoarthritis Outcome Score)	Score	Preoperative	198,091	47.5	14.4
		Postoperative	82,173	76.4	16.1
PROMIS-10 (Patient-Reported Outcomes Measurement Information System 10)	Mental T	Preoperative	153,161	48.5	10.0
		Postoperative	63,152	51.6	9.4
	Physical T	Preoperative	153,158	39.6	8.3
		Postoperative	63,151	47.9	9.4
VR-12 (The Veterans RAND 12 Item Health Survey)	Mental Health Component	Preoperative	39,424	52.0	12.5
		Postoperative	19,275	55.6	9.9
	Physical Health Component	Preoperative	39,222	31.6	9.3
		Postoperative	19,273	43.4	10.4

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.*

Table 3.10 Age-stratified Change Between Preoperative and 1-Year Postoperative PROM Scores after Primary Knee Arthroplasty by PROM for Patients 55 Years and Over, 2012-2023

Patient-Reported Outcome Measure (PROM)	PROM Component	Age Group (Years)	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*
KOOS, JR. (Knee Disability and Osteoarthritis Outcome Score)	Score	55-64	52,828	13,336	25.2%	88.0%
		65-74	84,225	24,128	28.6%	87.0%
		75-84	41,006	10,752	26.2%	85.9%
		≥85	4,302	975	22.7%	89.2%
PROMIS-10 (Patient-Reported Outcomes Measurement Information System 10)	Mental T	55-64	39,729	9,467	23.8%	32.7%
		65-74	65,742	18,229	27.7%	31.1%
		75-84	32,346	8,209	25.4%	28.2%
		≥85	3,405	750	22.0%	28.8%
	Physical T	55-64	39,727	9,466	23.8%	66.4%
		65-74	65,743	18,233	27.7%	64.1%
		75-84	32,344	8,209	25.4%	59.8%
		≥85	3,405	750	22.0%	60.4%
VR-12	Mental Health Component	55-64	11,254	3,494	31.0%	33.3%
		65-74	16,362	5,420	33.1%	33.0%
		75-84	7,704	2,309	30.0%	32.5%
		≥85	852	222	26.1%	37.4%
	Physical Health Component	55-64	11,189	3,494	31.2%	75.0%
		65-74	16,278	5,424	33.3%	73.5%
		75-84	7,672	2,310	30.1%	69.7%
		≥85	846	222	26.2%	64.4%

**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.*

Table 3.11 Bed size-stratified Change Between Preoperative and 1-Year Postoperative PROM Scores after Primary Knee Arthroplasty by PROM, 2012-2023

Patient-Reported Outcome Measure (PROM)	PROM Component	Bed Size Group	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*
KOOS, JR. (Knee Disability and Osteoarthritis Outcome Score)	Score	Between 1-99 Beds	36,893	10,574	28.7%	87.4%
		Between 100-399 Beds	63,824	17,428	27.3%	88.3%
		≥ 400 Beds	49,045	14,025	28.6%	85.6%
		Unknown	48,329	10,807	22.4%	87.2%
PROMIS-10 (Patient-Reported Outcomes Measurement Information System 10)	Mental T	Between 1-99 Beds	27,351	7,464	27.3%	28.0%
		Between 100-399 Beds	49,273	13,291	27.0%	30.6%
		≥ 400 Beds	37,390	10,257	27.4%	31.1%
		Unknown	39,147	8,240	21.0%	34.0%
	Physical T	Between 1-99 Beds	27,351	7,465	27.3%	64.3%
		Between 100-399 Beds	49,274	13,291	27.0%	65.6%
		≥ 400 Beds	37,384	10,254	27.4%	58.4%
		Unknown	39,149	8,242	21.1%	67.5%
VR-12	Mental Health Component	Between 1-99 Beds	5,960	1,411	23.7%	36.6%
		Between 100-399 Beds	11,583	3,586	31.0%	36.8%
		≥ 400 Beds	17,270	5,998	34.7%	30.6%
		Unknown	4,611	1,455	31.6%	30.9%
	Physical Health Component	Between 1-99 Beds	5,939	1,413	23.8%	69.4%
		Between 100-399 Beds	11,508	3,587	31.2%	76.8%
		≥ 400 Beds	17,166	6,001	35.0%	70.2%
		Unknown	4,609	1,455	31.6%	78.9%

**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.*

Table 3.12 Teaching status-stratified Change Between Preoperative and 1-Year Postoperative PROM Scores after Primary Knee Arthroplasty by PROM, 2012-2023

Patient-Reported Outcome Measure (PROM)	PROM Component	Teaching Status Group	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*
KOOS, JR. (Knee Disability and Osteoarthritis Outcome Score)	Score	Major	22,578	5,632	24.9%	84.0%
		Minor	83,186	23,767	28.6%	87.3%
		Non-Teaching	46,111	13,502	29.3%	88.5%
		Unknown	46,216	9,933	21.5%	87.0%
PROMIS-10 (Patient-Reported Outcomes Measurement Information System 10)	Mental T	Major	15,634	2,588	16.6%	27.3%
		Minor	61,962	17,841	28.8%	30.5%
		Non-Teaching	38,541	11,455	29.7%	30.4%
		Unknown	37,024	7,368	19.9%	34.3%
	Physical T	Major	15,627	2,584	16.5%	53.9%
		Minor	61,964	17,843	28.8%	62.9%
		Non-Teaching	38,541	11,455	29.7%	65.4%
		Unknown	37,026	7,370	19.9%	67.3%
VR-12	Mental Health Component	Major	13,823	5,107	36.9%	30.4%
		Minor	14,826	4,184	28.2%	37.2%
		Non-Teaching	6,164	1,704	27.6%	33.2%
		Unknown	4,611	1,455	31.6%	30.9%
	Physical Health Component	Major	13,798	5,108	37.0%	70.0%
		Minor	14,707	4,189	28.5%	72.7%
		Non-Teaching	6,108	1,704	27.9%	77.8%
		Unknown	4,609	1,455	31.6%	78.9%

**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.*

Figure 3.37 Heat Map of Linked Postoperative KOOS JR Submission by State*

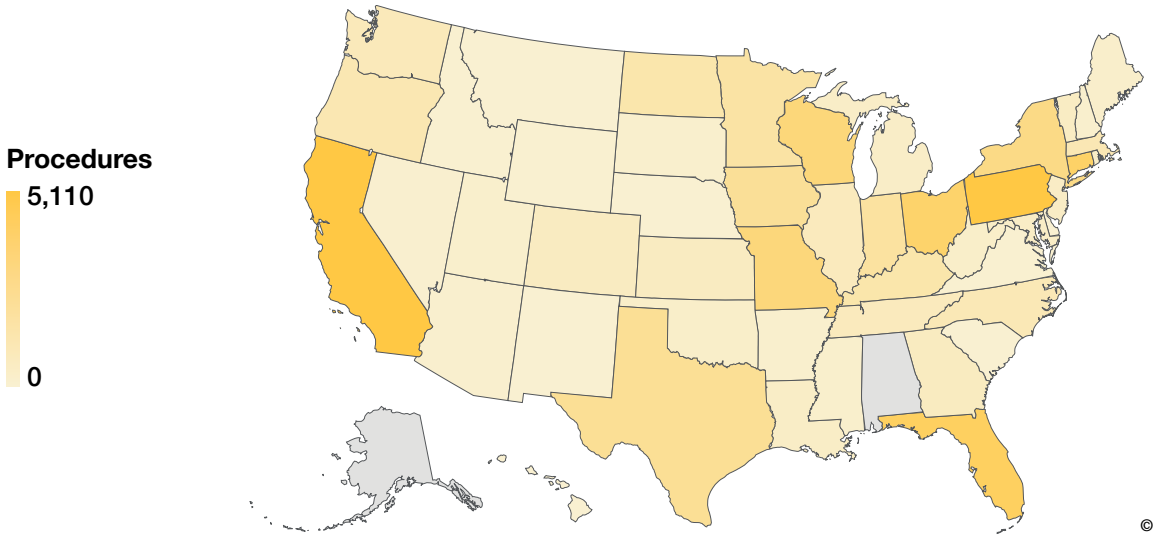


Figure 3.38 Heat Map of Linked Postoperative PROMIS-10 Mental Component Submission by State*

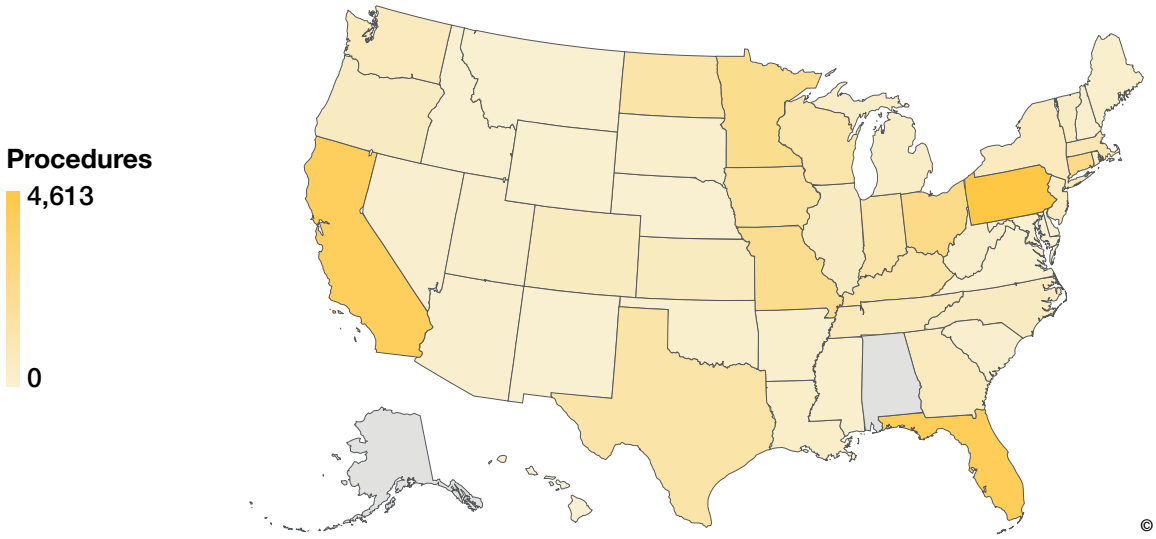
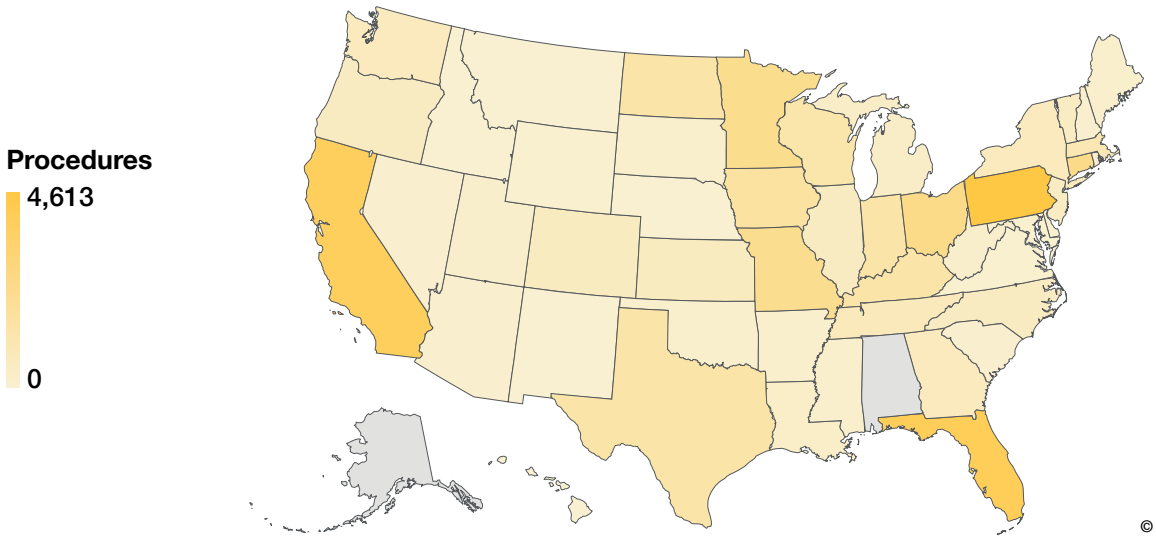
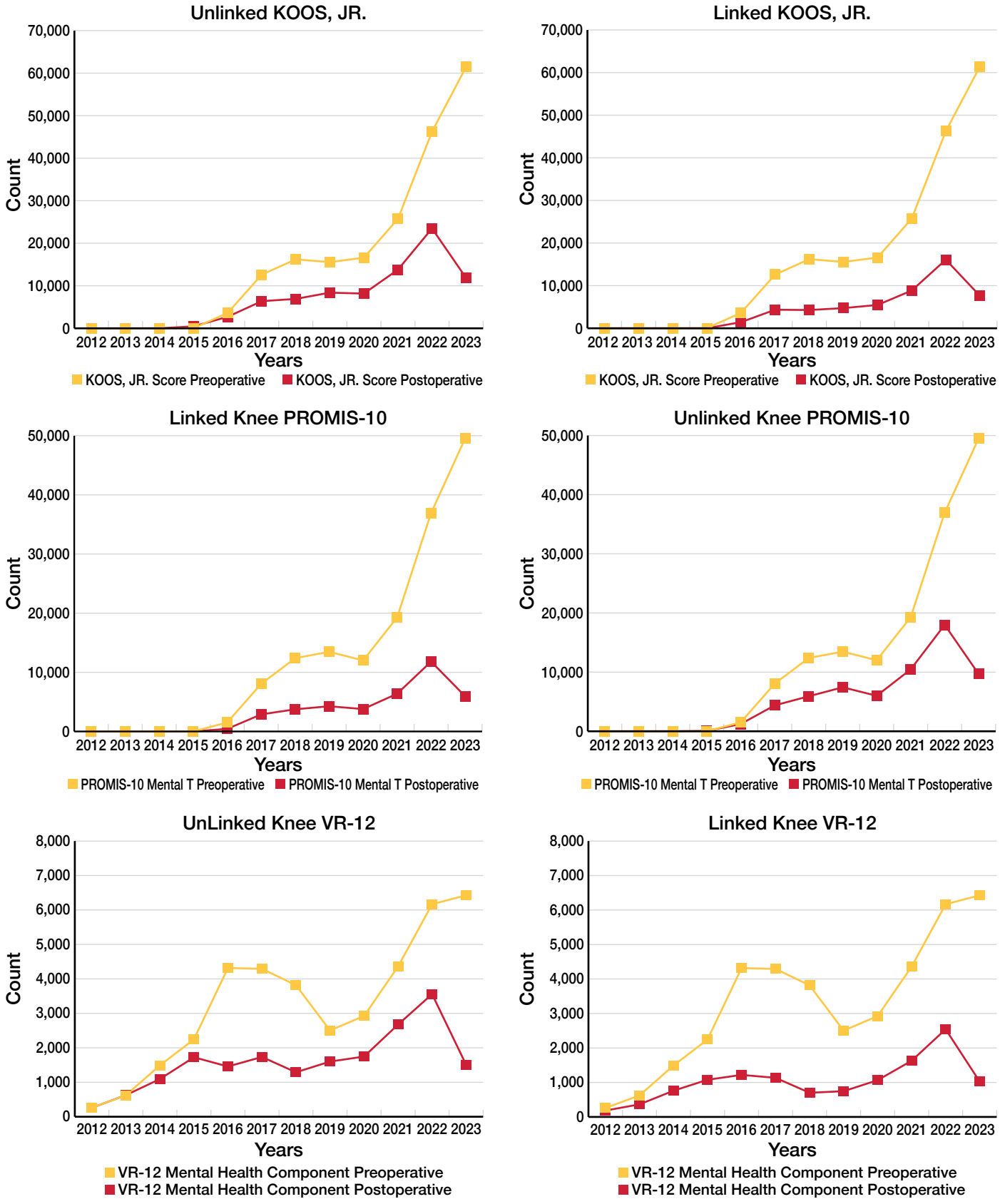


Figure 3.39 Heat Map of Linked Postoperative PROMIS-10 Physical Component Submission by State*



These heat maps were not adjusted for state population or number of submitting institutions.

Figure 3.40 Submission of Preoperative and Unlinked or Linked 1-Year Postoperative Postoperative PROM Scores after Primary Knee Arthroplasty by PROM, 2012-2023*



(PROMIS-10): The Global Health values for the Physical T component are not displayed because they closely resemble those of the Mental T component.
(VR-12): The values for the Physical Health component are not displayed because they closely resemble those of the Mental T component.

**We expect the 2023 postoperative scores to be lower as not all cases would have met the 1-year follow-up time necessary to be included in this analysis.*

Appendices and References

Appendix A

Recent AJRR 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. Investigators can submit hypotheses regarding information in AAOS registries and linked CMS clinical databases. The AJRR Research Subcommittee provides a systematic and transparent peer review process for proposal approval. Data analysis for approved clinical projects are completed by the AAOS combined analytics team. Completed RAI approved clinical projects have been submitted to a variety of orthopaedic conferences for presentation and to peer reviewed journals for publication. Please see a list of recent posters, presentations, and publications derived from AJRR data projects below. Click to learn more about the RAI application process or review all previous publications and presentations here.

1. Does Computer Navigation or Robotics Improve the Mid-Term outcomes following Primary Total Knee Arthroplasty? An Analysis from the American Joint Replacement Registry
   James I. Huddleston, MD, Scott Sporer MD, Oliva Sterling MPH, Ayushmita De PhD, James Browne MD, and Bryan Springer MD
   Abstracts Status: Podium Presentation at Knee Society 2024 & Podium Presentation at ISAR 2025

2. Survivorship of Condylar Stabilized Total Knee Arthroplasty Designs: An Analysis of the American Joint Replacement Registry (AJRR)
   Harpal S. Khanuja, MD, Vishal Hegde MD, Anirudh Buddhiraju MD, Isabella Zaniletti PhD, Ayushmita De PhD, and Ryland Kagan MD
   Abstract Status: Poster Presentation at AAHKS 2024 & Podium Presentation at ISAR 2025

3. Cementless Collared Metadiaphyseal-Filling Stems versus Cemented Fixation for Total Hip Arthroplasty
   Mackenzie Kelly, MD, Ryland Kagan MD, Adam Sassoon MD, Vishal Hegde MD, Isabella Zaniletii PhD, Ayushmita De PhD, and Harpal S. Khanuja, MD
   Abstract Status: Podium Presentation at AAHKS 2024

4. Discharge to Sub-Acute Facility after Total Joint Arthroplasty is Not Protective Against Readmissions in Patients with Lower Socioeconomic Status
   Alexandra L Hohmann, BA, Samantha S Meacock, BS, Mahveen Jahan MPH, Ayushmita De, PhD, and Yale A. Fillingham, MD
   Abstract Status: Poster Presentation at AAHKS 2024

5. Trends, Prevalence and Outcomes of Mixing Components from Different Manufacturers in Total Hip Arthroplasty: An Analysis of the AJRR
   Lucas E. Nikkel, MD, Ayushmita De, PhD, Isabella Zaniletti PhD, Gregory Kirchner MD, and Jeffrey Stambough MD
   Abstract Status: Poster Presentation at AAHKS 2024 & Podium Presentation at ISAR 2025

6. Effects of Surgeon Volume on Outcomes Following TKA in the Morbidly Obese: An Analysis from the AJRR
   Nicholas A. Bedard, MD, Christopher N. Carender, MD, Emily Jimenez, M.P.H, Ayushmita De, Ph.D, Daniel J. Berry, M.D, and Matthew P. Abdel, M.D.
   Abstract Status: Podium Presentation at AAHKS 2024 & Poster Presentation at AAOS AM 2025

7. Effects of Surgeon Volume on Outcomes Following THA in the Morbidly Obese: An Analysis from the AJRR
Nicholas A. Bedard, MD, Christopher N. Carender, MD, Emily Jimenez, M.P.H, Ayushmita De, Ph.D, Daniel J. Berry, M.D, and Matthew P. Abdel, M.D.
Abstract Status: Poster Presentation at AAOS AM 2025

8. Is American Joint Replacement Registry Data Consistent with International Survivorship in Knee Arthroplasty? A Comparative Analysis.
Bryan D. Springer MD, James I Huddleston MD, Kyle Mullen MPH, Patrick Donnelly MS, Edward Caton, and Keith Tucker MD
Abstract Status: Podium Presentation at AAOS AM & Podium Presentation at ISAR 2024
Manuscript Status: Journal of Arthroplasty, 2024, September: DOI: 10.1016/j.arth.2024.02.055

9. Is American Joint Replacement Registry Data Consistent with International Survivorship in Hip Arthroplasty? A Comparative Analysis.
Bryan D. Springer MD, James I Huddleston MD, Kyle Mullen MPH, Patrick Donnelly MS, Edward Caton, and Keith Tucker MD
Abstract Status: Podium Presentation at AAOS AM & Podium Presentation at ISAR 2024

10. Equivalent Rates of 90-day Revision for Instability Between Dual Mobility Total Hip Arthroplasty and Hemiarthroplasty for Acute Femoral Neck Fractures.
Brenden A. Shi, MD, Peter Hsiue MD, Alexander Upfill-Brown MD, Troy Sekimura MD, Kevin Y Chen MD, Edward J McPherson MD, Olivia Sterling, MPH, and Alexander Stavrakis MD,
Abstract Status: ePoster Presentation at AAOS AM 2024

11. Does Resurfacing the Patella Increase the Risk of Extensor Mechanism Injury Within the First Two Years After Total Knee Arthroplasty?
David E. DeMik, MD, PharmD, Juan David Lizcano, MD, Emily Jimenez, MPH, Jess H. Lonner, MD, and Chad A. Krueger, MD
Abstract Status: ePoster Presentation at AAOS AM 2024
Manuscript Status: Journal of Knee Surgery, 2024, September. DOI: 10.1055/a-2413-3876

12. Antibiotic Laden and Non-Antibiotic Bone Cement in Primary Total Knee Arthroplasty: Does Antibiotic Laden Bone Cement Reduce Acute Periprosthetic Joint Infection?
Blake O. Nourie, MD, Nicholas F. Cozzarelli, BS, Patrick Donnelly MPH, Chad A. Krueger, MD, and Yale A. Fillingham, MD.
Abstract Status: ePoster Presentation at AAOS AM 2024
Manuscript Status: Journal of Arthroplasty, 2024, September: DOI: 10.1016/j.arth.2024.04.068

13. Periprosthetic Fractures: A Rising Tide of Total Hip Arthroplasty failures noted in the American Joint Replacement Registry and the Preventative role of Cemented Stems
Adam A. Sassoon, MD MS, Jeremiah Taylor MD, Emily Jimenez MPH, Ryan D. Stancil MD, Daryl F Cannady MD, and Ayushmita PhD
Abstract Status: ePoster Presentation at AAOS AM 2024
Manuscript Status: Journal of Arthroplasty, 2024, September: DOI: 10.1016/j.arth.2024.06.038

14. Effects of Gender and Fixation on the Outcomes of Hemiarthroplasty for Femoral Neck Fracture: Analysis of the American Joint Replacement Registry.
Anna Cohen-Rosenblum, MD MSc, Susan Odum PhD, Ayushmita De PhD, Kara Sarrel MD, and Bryan Springer MD
Abstract Status: ePoster Presentation at AAOS AM 2024

15. Who is caring for TJA patients with PJI in the United States
Nicholas A. Bedard, MD, Khaled El-Menawi MD, Isabella Zaniletti PhD, Herve Poilvache, Ayushmita De PhD, Mathew Abdel MD
Abstract Status: Poster Presentation at ISAR 2024

16) Only 5% of Hip PJIs Are Treated by High-Volume Surgeons: Implications for PJI Centers in the US
Khaled A Elmenawi MD, Isabella Zaniletti PhD, Herve Poilvache MD, Ayushmita De PhD, Matthew Philip Abdel MD, and Nicholas Bedard MD
Abstract Status: Podium Presentation at AAOS AM 2025

17. Selective use of modern cementless total knee arthroplasty designs is not associated with increased risk of revision in patients aged 65 or greater: An analysis from the American Joint Replacement Registry
Ryland P. Kagan, MD, Christopher E. Pelt MD, Harpal S. Khanuja MD, Isabella Zaniletti PhD, Kyle Mullen MPH, Ayushmita De PhD, and Vishal Hegde MD
Abstract Status: Poster Presentation at ISAR 202
Manuscript Status: Journal of Knee Surgery, 2024, June: DOI: 10.1055/a-2332-5762

18. Extensor Mechanism Reconstruction: Is there a Role for Concomitant Revision of Components?
Denis Nam, MD, Robert Burnett, MD, Emily Jimenez, MPH, Craig Della Valle, MD, and Scott Sporer, MD
Abstract Status: ePoster Presentation at AAOS AM 2024

19. What are the incidence and outcomes of debridement, antibiotics and implant retention (DAIR) for the treatment of periprosthetic joint infections in the AJRR population
Ayushmita De PhD, Brian P. Chalmers MD, Bryan D. Springer MD, James A. Browne MD, David G. Lewallen M, and Jeffrey B. Stambough, MD
Abstract Status: Podium Presentation at ISAR 2024
Manuscript Status: Clinical Orthopaedics and Related Research, 2024, August: DOI: 10.1097/CORR.0000000000003138

20. Mobile bearing total knee arthroplasty is associated with an increased risk of mechanical loosening: A follow-up analysis of the American Joint Replacement Registry
Vishal V. Hegde, MD, Isabella Zaniletti PhD, Kyle Mullen MPH, Ayushmita De PhD, Christopher E. Pelt MD, and Ryland Kagan MD
Abstract Status: Podium Presentation at ISAR 2024 & Poster Presentation at AAHKS 2024

21. Body mass index is not associated with risk for mechanical loosening following primary total knee arthroplasty: An analysis from the American Joint Replacement Registry (AJRR)
Dencel A. García Vélez, MD, Isabella Zaniletti PhD, Kyle Mullen MPH, Ayushmita De PhD, Ryan Martin MD, Jason M. Jennings MD DPT, Ryland Kagan MD, and Vishal Hegde MD
Abstract Status: Podium Presentation at ISAR 2024

22. Health Disparities Among Elective and Nonelective Total Hip Arthroplasty
Vinod Dasa, MD, Peter Krause, MD, Ashlin Hinojosa, and Andrew Chapple, PhD
Abstract Status: Poster Presentation at AAOS 2024

23. Outcomes and survival of total knee arthroplasty comparing resurfaced and Unresurfaced Patellae
Emily S. Eiel, MD, Patrick Donnelly, MA, Antonia F. Chen, MD, MBA, Matthew Sloan, MD, MS
Abstract Status: Poster Presentation at AAOS 2024
Manuscript Status: Journal of Arthroplasty, 2023, July: DOI: 10.1016/j.arth.2023.02.060

24. Impact of Cemented Femoral Stem Implant Design on Survivorship for Total Hip Arthroplasty: An Analysis from the American Joint Replacement Registry
Ryland P. Kagan, MD, Mackenzie Kelly MD, Lucas Anderson MD, Jeremy Gililland MD, and Vishal Hegde MD
Abstract Status: Podium Presentation at ISAR 2025

25) Does the Addition of a Tibial Stem Extender in Total Knee Arthroplasty Decrease Risk of Aseptic Loosening in Patients with Obesity? An Analysis from the American Joint Replacement Registry
Alexandra L Hohmann, BA, Alexander A Linton, MD, Isabella Zaniletti, PhD, Brooke R Olin, BS, Gabriel L Furey, BS, Ayushmita De, PhD, and Yale A. Fillingham, MD
Abstract Status: Podium Presentation at AAOS AM 2025

26. Does Computer Navigation or Robotics Improve the Mid-Term outcomes following Primary Total Knee Arthroplasty? An Analysis from the American Joint Replacement Registry
Scott Sporer MD, Oliva Sterling MPH, Ayushmita De PhD, James Browne MD, Bryan Springer MD, and James I. Huddleston, MD
Abstract Status: Podium Presentation at Knee Society, Podium Presentation at ISAR 2025, & Podium Presentation at AAOS AM 2025

27. What if all Femoral Neck Fractures in the US were cemented? A population-level cost-effectiveness analysis from the American Joint Replacement Registry
Robin Blythe PhD, Ross Crawford MD, Nick Graves PhD, Kimberly R Porter PhD, Ayushmita De PhD, and Bryan D. Springer
Abstract Status: Podium Presentation at ISAR 2025 & Podium Presentation at AAOS AM 2025

28. Comparing the American Joint Replacement Registry to the Centers for Medicare and Medicaid Services database: How Specific and Sensitive is the AJRR to CMS when Evaluating New Technology Use in Total Knee Arthroplasty?
Ayushmita De, PhD, Mahveen Jahan, MPH, Patrick Donnelly, MA, Eric D. McVey, Med, Wendy M. Novicoff, PhD, and James A. Browne MD
Abstract Status: Podium Presentation at ISAR 2025 & Podium Presentation at AAOS AM 2025

29. Survivorship of Condylar Stabilized Total Knee Arthroplasty Designs: An Analysis of the American Joint Replacement Registry (AJRR)
Harpal S. Khanuja, MD, Vishal Hegde MD, Anirudh Buddhiraju MD, Isabella Zaniletti PhD, Ayushmita De PhD, and Ryland Kagan MD
Abstract Status: Podium Presentation at Knee Society 2024

Appendix B

Data Element Review

Procedural

Patient

- Name (Last, First)
- Date of Birth
- Social Security Number
- Diagnosis (ICD-9/10)
- Gender
- Ethnicity
- Height and Weight/BMI
- **Chronic Narcotics Use**
- **Medicare Beneficiary ID**

Site of Service

- Name (NPI)
- Address

Surgeon

- Name
- National Provider Identifier (NPI)

Procedure

- Type (ICD-9/10 and CPT)
- Date of surgery
- Laterality
- Implants
- Surgical Approach
- Anesthesia Technique
- Discharge Disposition
- Implants (Manufacturer, Lot #)
- Operative Duration
- Computer/Robotic Assisted Surgery
- Tourniquet Use
- Blood Transfusion
- TXA Usage
- PT Day 0
- VTE Prophylaxis
- Perioperative Antibiotics
- Multi-modal Pain Management
- **Ambulation Day of Surgery**

Post-discharge, Complications

Patient Risk Factors (ICD-9/10)*

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

**Comorbidities listed of focus, all comorbidities are accepted*

Post-discharge Complications

- Early revisions
- All-cause readmissions

Patient-Reported Outcome Measures (PROMs)

Hip dysfunction and Osteoarthritis Outcome Score for Joint Replacement (HOOS, JR.)*

Knee injury and Osteoarthritis Outcome Score for Joint Replacement (KOOS, JR.)*

Patient-Reported Outcomes Measurement Information System (PROMIS) 10-item Global Health*

The Veterans RAND 12 Item Health Survey (VR-12)*

CMS Risk Questions (Low Back Pain, Health Literacy, Total Painful Joint Count)*

Harris Hip Score

Hip disability and Osteoarthritis Outcome Score (HOOS)

Knee injury and Osteoarthritis Outcome Score (KOOS)

Medical Outcomes Study 36-Item Short Form Health Survey (SF-36)

Oxford Hip and Knee Scores

The Knee Society Knee Scoring System

Western Ontario and McMaster Universities Arthritis Index (WOMAC)

**PROMs recommended by AJRR and supported on the PROM platform*

Appendix C

AAOS Authorized Vendor Program

The AAOS Authorized Vendor Program was created to minimize the data entry burden and enhance the data submission process. The following vendors have been approved for this program.

- ✓ Algos Pathways Cedaron
- ✓ Cedaron
- ✓ Clarify Health Solutions
- ✓ CODE Technology
- ✓ Consensus Medical Systems, Inc.
- ✓ Direct Difference
- ✓ DeliverHealth
- ✓ Epic
- ✓ FORCE Therapeutics
- ✓ Health Information Alliance, Inc.
- ✓ HealthTrust Performance Group
- ✓ HOPCo
- ✓ Huma Therapeutics Limited
- ✓ Kermit
- ✓ MedTrak, Inc. (CareSense System)
- ✓ Medtronic
- ✓ MiCare Path
- ✓ Mpirik Mytonomy
- ✓ Navion HealthCare Solutions
- ✓ NeuralFrame
- ✓ OM1 Oracle Cerner
- ✓ Ortech, Inc.
- ✓ OrthoVitals OutcomeMD PatientIQ
- ✓ Pro-Mapp Health Inc.
- ✓ Q-Centrix Revo Health
- ✓ Santovia
- ✓ Surgical Information Systems
- ✓ Health Catalyst (Twistle)
- ✓ URS-Oberd, Inc.
- ✓ ValidCare VisionTree
- ✓ Vox Telehealth
- ✓ Zimmer Biomet

For updates to the list and more information on the AAOS Authorized Vendor Program, please visit here.

Appendix D

AJRR Committees

Young Physicians Committee (YPC)

Jeffrey B. Stambough, MD–Chair
University of Arkansas

Brian P. Chalmers, MD
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John Hopkins Department of Orthopaedic Surgery

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Scott M. Sporer, MD, FAAOS–Chair
Midwest Orthopaedics at Rush and Central DuPage Hospital

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Mayo University

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Mayo Clinic Florida (Jacksonville. FL)

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John W. Barrington, MD, FAAOS
Plano Orthopaedics and Sports Medicine

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University of Minnesota

William A. Jiranek, MD, FACS, FAAOS
Duke University

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Bryan D. Springer, MD, FAAOS
Mayo Clinic Florida (Jacksonville. FL)

AJRR Research Projects Subcommittee (RPS)

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University of Wisconsin

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Elizabeth Gausden, MD, MPH
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Alejandro Gonzalez Della Valle, MD, FAAOS
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David W. Hennessy, MD
University of Wisconsin

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Oregon Health and Sciences

Benjamin A. McArthur, MD, FAAOS
Texas Orthopedics

Brian T. Nickel, MD
University of Wisconsin

Jesse E. Otero, MD, PhD
OrthoCarolina

James Slover MD, MS, FAAOS
Northwell Health

Jeffrey B. Stambough, MD
University of Arkansas

Timothy Wright, PhD
Hospital for Special Surgery

Appendix E

Participating Institutions

Institutions that joined AJRR by 8/1/24 are included. Those that contributed data by 9/18/24 are highlighted.

Alabama

Cullman Regional Medical Center
Huntsville Hospital
Jack Hughston Memorial Hospital
Mobile Infirmary
South Baldwin Regional Medical Center
St. Vincent's Birmingham
USA Health University Hospital

Alaska

Alpine Surgery Center
Central Peninsula Hospital
Creekside Surgery Center
Providence Alaska Medical Center
Providence Kodiak Island Medical Center
PeaceHealth Orthopedic & Sports Medicine in Ketchikan
Alaska Regional Hospital

Arizona

Arizona Spine & Joint Hospital
Banner-University Medical Center South
Banner-University Medical Center Tucson
Carondelet St. Joseph's Hospital
Flagstaff Medical Center
Mayo Clinic in Arizona
Mountain Vista Medical Center
North Valley Surgery Center
Northwest Medical Center
OASIS Hospital*
Verde Valley Medical Center
Chandler Regional Medical Center
Gateway Surgery Center
Mercy Gilbert Medical Center
Oro Valley Hospital
Shane Martin, MD of Greater Phoenix Orthopedics
Sonoran Orthopaedic Trauma Surgeons
St. Luke's Medical Center
Tempe St. Luke's Hospital
University Orthopedic Specialists

Arkansas

Arkansas Specialty Surgery Center
Arkansas Surgical Hospital
CHI St. Vincent Hot Springs*
CHI St. Vincent Infirmary
Martin Knee & Sports Medicine Center
Mercy Hospital Fort Smith
Mercy Hospital Northwest Arkansas
Mercy Orthopedic Hospital Fort Smith
Northwest Health Physicians' Specialty Hospital*
Northwest Medical Center-Bentonville
Northwest Medical Center-Springdale
OrthoSurgeons
St. Bernards Medical Center*
University of Arkansas for Medical Sciences
Washington Regional Medical Center
White River Medical Center
National Park Medical Center

California

Adventist Health Bakersfield
Adventist Health Hanford
Adventist Health Lodi Memorial
Adventist Health St. Helena*
Alta Bates Summit Medical Center | Alta Bates Campus
Alta Bates Summit Medical Center | Summit Campus
Arroyo Grande Community Hospital
Bakersfield Memorial Hospital*
Barton Memorial Hospital
California Pacific Medical Center
Casa Colina Hospital and Centers for Healthcare*
Cedars-Sinai Medical Center
Clovis Community Medical Center
Community Hospital of the Monterey Peninsula
Community Memorial Hospital
Dameron Hospital
Doctors Medical Center of Modesto
Eisenhower Medical Center
El Camino Hospital, Los Gatos Campus
Emanuel Medical Center
Enloe Medical Center
Feather River Hospital
French Hospital Medical Center*
Fresno Surgical Hospital
Glendale Adventist Medical Center
Golden State Orthopedics & Spine
Goleta Valley Cottage Hospital*
Hoag Orthopedic Institute
Howard Memorial Hospital
Huntington Hospital*
Inland Valley Medical Center*
John Muir Health, Concord Medical Center
John Muir Health, Walnut Creek Medical Center
Keck Medicine of USC
Loma Linda University Health
Long Beach Medical Center
Los Robles Regional Medical Center
Marian Regional Medical Center
Marina del Rey Hospital
Memorial Medical Center*
Mercy General Hospital*
Mercy Hospital of Folsom
Mercy Medical Center

**Achieved The Joint Commission Advanced Certification for Total Hip and Total Knee Replacement by 8/1/24.*

Institutions that joined AJRR by 8/1/24 are included.
Those that contributed data by 9/18/24 are highlighted.

Mercy Medical Center Merced*
Mercy San Juan Medical Center
Methodist Hospital of Sacramento*
Mills-Peninsula Medical Center
Mission Hospital-Mission Viejo
Monterey Peninsula Surgery Center
NorthBay Medical Center
NorthBay VacaValley Hospital
Novato Community Hospital*
Ojai Valley Community Hospital
Orange Coast Medical Center
Palomar Medical Center Escondido
Palomar Medical Center Poway*
Petaluma Valley Hospital
PIH Health-Whittier
Pomona Valley Hospital Medical Center
Presidio Surgery Center*
Providence Holy Cross Medical Center
Providence Little Company of Mary Medical Center-San Pedro
Providence Little Company of Mary Medical Center Torrance
Providence Saint John's Health Center
Providence Saint Joseph Medical Center
Providence Santa Rosa Memorial Hospital
Providence St. Joseph Hospital Eureka
Providence St. Joseph Hospital of Orange
Providence St. Jude Medical Center*
Providence St. Mary Medical Center
Providence Tarzana Medical Center
Queen of the Valley Medical Center
Redwood Memorial Hospital
Riverside Community Hospital
Riverside University Health System*
Ronald Reagan UCLA Medical Center
Saddleback Medical Center
Saint Agnes Medical Center
Salinas Valley Memorial Healthcare System
San Antonio Regional Hospital*
Santa Barbara Cottage Hospital*
Santa Clara Valley Medical Center
Scripps Green Hospital
Sequoia Hospital
Sharp Chula Vista Medical Center
Sharp Coronado Hospital
Sharp Grossmont Hospital
Sharp Memorial Hospital
Shasta Regional Medical Center
Simi Valley Hospital
Sonoma Valley Hospital
Sonora Regional Medical Center
St. Joseph Hospital Eureka
St. Joseph's Medical Center*
St. Mary Medical Center
St. Bernardine Medical Center
Stanford Health Care
Stanford Health Care Tri-Valley*
Sutter Alhambra Surgery Center
Sutter Medical Center, Sacramento Surgery Center*
Sutter Sierra Surgery Center
Sutter Surgical Hospital North Valley
Tahoe Forest Hospital
Temecula Valley Hospital
The Bahamas Surgery Center
The Center for Orthopedic Surgery
Torrance Memorial Medical Center*
Tri-city Medical Center
UCLA Santa Monica Medical Center
UCSF Medical Center
Ukiah Valley Medical Center
Washington Hospital Healthcare System
West Coast Joint and Spine Surgery Center*
West Hills Hospital & Medical Center
White Memorial Medical Center
Alvarado Hospital Medical Center
Campus Surgery Center
Carlsbad Surgery Center
Coast Surgery Center
Corona Regional Medical Center
Desert Regional Medical Center
Dignity Health-St. Mary Medical Center
Dominican Hospital
Eden Medical Center
Fort Sutter Surgery Center
Good Samaritan Hospital
Henry Mayo Newhall Hospital
La Jolla Orthopedic Surgery Center
La Veta Surgery Center
Mammoth Hospital
Memorial Hospital Los Banos
Mercy Hospital Downtown-Bakersfield
Mercy Medical Center Redding
Mission Valley Heights Surgery Center
North Bay Regional Surgery Center
North Tahoe Orthopedics
Northridge Hospital Medical Center
Otay Lakes Surgery Center
Palmdale Regional Medical Center
Poway Surgery Center
Rancho Springs Medical Center*
Redlands Community Hospital
San Leandro Surgery Center
Santa Rosa Surgery and Endoscopy Center
St. John's Pleasant Valley Hospital
St. John's Regional Medical Center
Stockton Surgery Center
Surgery Center of Long Beach
Sutter Amador Hospital
Sutter Auburn Faith Hospital
Sutter Auburn Surgery Center
Sutter Davis Hospital Outpatient (Ambulatory) Surgery Center
Sutter Elk Grove Surgery Center
Sutter Fairfield Surgery Center
Sutter Maternity & Surgery Center
Sutter North Surgery and Endoscopy Center

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Those that contributed data by 9/18/24 are highlighted.

Sutter Roseville Medical Center Surgery Center
Sutter Solano Medical Center Surgery Center
Sutter Tracy Community Hospital
UCSF Medical Center at Mount Zion
USC Verdugo Hills Hospital

Colorado

Animas Surgical Hospital
Avista Adventist Hospital
Boulder Community Health
Castle Rock Adventist Hospital
Colorado Joint Replacement
Crown Point Surgery Center
Denver Health Medical Center
Littleton Adventist Hospital
Longmont United Hospital
Mercy Regional Medical Center
North Suburban Medical Center
OrthoColorado Hospital
Parker Adventist Hospital
Penrose Hospital
Porter Adventist Hospital
Pueblo Bone & Joint Clinic, LLC
Rose Medical Center*
Sky Ridge Medical Center*
St. Anthony Hospital
St. Anthony North Health Campus
St. Anthony Summit Medical Center
St. Francis Medical Center
St. Mary-Corwin Medical Center
St. Mary's Medical Center
St. Thomas More Hospital
Steamboat Orthopaedic & Spine Institute
Swedish Medical Center
The Medical Center of Aurora
UCHealth Broomfield Hospital
UCHealth Grandview Hospital
UCHealth Greeley Medical Center
UCHealth Highlands Ranch Hospital
UCHealth Longs Peak Hospital
UCHealth Medical Center of the Rockies
UCHealth Memorial Hospital Central
UCHealth Pikes Peak Regional Hospital
UCHealth Poudre Valley Hospital
UCHealth University of Colorado Hospital
UCHealth Yampa Valley Medical Center
Valley View Hospital
OCC Surgery Center Inverness
Panorama Orthopedics & Spine Center
Penrose-St. Francis Urgent Care
Presbyterian St. Luke's Medical Center
UCHealth Inverness Orthopedics and Spine Surgery Center

Connecticut

Backus Hospital*
Bridgeport Hospital Milford Campus-Milford
Danbury Hospital*
Glastonbury Surgery Center
Hartford Hospital*
Middlesex Hospital
MidState Medical Center*
Norwalk Hospital*
Saint Francis Hospital and Medical Center*
St. Vincent's Medical Center*
The Hospital of Central Connecticut-New Britain General Campus
Waterbury Hospital
Windham Hospital*
Yale New Haven Health Bridgeport Hospital*
Yale New Haven Health Greenwich Hospital*
Yale New Haven Health Lawrence + Memorial Hospital
Yale New Haven Health Saint Raphael Campus*
Yale New Haven Hospital York Street Campus
Johnson Memorial Hospital
New Milford Hospital
Saint Mary's Hospital
Sharon Hospital
Valley Orthopaedic Specialists, LLC
Western Connecticut Orthopedic Surgical Center

Delaware

Bayhealth Hospital, Kent Campus
Bayhealth Hospital, Sussex Campus
Christiana Hospital*
St. Francis Healthcare
TidalHealth Nanticoke
Wilmington Hospital
First State Orthopaedics
Orthopaedic Associates of Southern Delaware, P.A.
St. Francis Hospital

District of Columbia

Providence Hospital
Sibley Memorial Hospital-Johns Hopkins Medicine
George Washington University Hospital

Florida

AdventHealth Altamonte Springs
AdventHealth Carrollwood*
AdventHealth Celebration
AdventHealth North Pinellas*
AdventHealth Ocala
AdventHealth Orlando
AdventHealth Waterman
AdventHealth Wesley Chapel
AdventHealth Winter Park
AdventHealth-Zephyrhills Hospital*
Andrews Institute Ambulatory Surgery Center
Ascension St. Vincent's Medical Center Clay County Hospital
Ascension St. Vincent's Medical Center Riverside Hospital
Ascension St. Vincent's Southside Hospital

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Those that contributed data by 9/18/24 are highlighted.

Aventura Hospital and Medical Center
Baptist Hospital
Bartow Regional Medical Center
Blake Medical Center
Brandon Regional Hospital
Broward Health North*
Cape Coral Hospital
Cleveland Clinic Florida
Cleveland Clinic Florida-Weston
Cleveland Clinic Indian River Hospital
Cleveland Clinic Tradition Hospital
Coral Gables Hospital*
Doctors Hospital of Sarasota
Dr. P. Phillips Hospital*
Fawcett Memorial Hospital
Flagler Hospital
Florida Medical Center
Fort Walton Beach Medical Center
Gulf Breeze Hospital
Gulf Coast Medical Center
Gulf Coast Regional Medical Center
Health Central Hospital
Holy Cross Hospital
Indian River Medical Center
JFK Medical Center
Jupiter Medical Center
Kendall Regional Medical Center
Largo Medical Center
Lee Memorial Hospital
Martin Memorial Medical Center
Mayo Clinic in Florida*
Mease Countryside Hospital
Mease Dunedin Hospital
Medical Center of Trinity
Memorial Hospital Jacksonville*
Memorial Hospital of Tampa
Memorial Hospital West*
Morton Plant Hospital
Morton Plant North Bay Hospital
North Florida Regional Medical Center
Oak Hill Hospital
Ocala Regional Medical Center
Orlando Health Jewett Orthopedic Institute
Orlando Health Orlando Regional Medical Center
Orlando Health South Seminole Hospital
Orthopaedic Surgery Center
Orthopaedic Surgery Center of Ocala
Osceola Regional Medical Center
Palms of Pasadena Hospital
Regional Medical Center Bayonet Point
Rockledge Regional Medical Center
Sarasota Memorial
Sarasota Memorial Hospital-Venice
South Bay Hospital
South Florida Baptist Hospital
St. Anthony's Hospital
St. Joseph's Hospital-North
St. Joseph's Hospital Tampa
St. Joseph's Hospital-South
St. Lucie Medical Center
Tallahassee Memorial HealthCare*
The Orthopaedic Institute
Toman Orthopedics and Sports Medicine
UF Health Shands Hospital
University Hospital & Medical Center
University of Florida Health
University of Miami Hospital
Westside Regional Medical Center
Winter Haven Hospital
AdventHealth Palm Coast Parkway
Andrews Institute for Orthopaedics & Sports Medicine
Ascension St. Vincent's St. Johns County
Broward Health Medical Center
Cleveland Clinic Martin South Hospital
Florida Joint & Spine Institute
Lakewood Ranch Medical Center
Manatee Memorial Hospital
Medical Center Clinic
Orlando Orthopaedic Center
OrthoCare Florida
Orthopedic Center of Palm Beach County
Orthopedic Special Surgery of Palm Beaches
Parrish Medical Center
Pensacola Orthopaedics & Sports Medicine
Physicians Regional Medical Center-Collier Boulevard
Physicians Regional Medical Center-Pine Ridge
Wellington Regional Medical Center
West Florida Hospital
Weston Outpatient Surgical Center

Georgia

Atlanta Medical Center
Atlanta Medical Center South
Cartersville Medical Center
Coffee Regional Medical Center
Coliseum Medical Centers
Colquitt Regional Medical Center
Eastside Medical Center
Emory Decatur Hospital
Emory Johns Creek Hospital*
Emory Saint Joseph's Hospital
Emory University Hospital Midtown
Emory University Orthopaedics & Spine Hospital*
Houston Medical Center
Memorial University Medical Center
Navicent Health
Northwest Plaza ASC, LLC
Optim Medical Center-Tattnall
Optim Surgery Center
Perry Hospital
Piedmont Atlanta Hospital
Piedmont Augusta
Piedmont Columbus Regional Northside Campus

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Institutions that joined AJRR by 8/1/24 are included.
Those that contributed data by 9/18/24 are highlighted.

Piedmont Fayette Hospital
Piedmont Henry Hospital
Piedmont Newnan Hospital
Redmond Regional Medical Center
Southeast Georgia Health System-Brunswick Campus
Southeast Georgia Health System-Camden Campus
St. Francis Hospital*
WellStar Cobb Hospital
WellStar Douglas Hospital
WellStar Kennestone Hospital
Wellstar North Fulton Medical Center
WellStar Paulding Hospital
WellStar Spalding Medical Center
WellStar West Georgia Medical Center
Wellstar Windy Hill Hospital*
Advanced Center for Joint Surgery
AdventHealth Redmond
Augusta-Aiken Orthopedic Specialists Surgery Center
Burke Health
Coliseum Northside Hospital
Floyd Medical Center
St. Mary's Good Samaritan Hospital
St. Mary's Hospital
St. Mary's Athens Ambulatory Surgery Center
St. Mary's Sacred Heart Hospital
Summit Sports Medicine & Orthopedic Surgery

Hawaii

Adventist Health Castle
Hawaii Pacific Health
Pali Momi Medical Center
Straub Clinic and Hospital
The Queen's Medical Center*
Wilcox Memorial Hospital

Idaho

Cassia Regional Medical Center
Kootenai Outpatient Surgery
Madison Memorial Hospital
Northwest Specialty Hospital
St. Alphonsus General Surgery & Bariatric Clinic
St. Alphonsus Medical Center Nampa Campus
St. Alphonsus Regional Medical Center
St. Joseph Regional Medical Center
St. Luke's Boise Medical Center
St. Luke's Meridian Medical Center

Illinois

Adult & Pediatric Orthopedics
Advocate Lutheran General Hospital
AMITA Health Adventist Medical Center Hinsdale
AMITA Health Alexian Brothers Medical Center Elk Grove Village
AMITA Health Resurrection Medical Center Chicago
AMITA Health Saint Joseph Hospital Chicago
AMITA Health Saint Joseph Hospital Elgin
AMITA Health St. Alexius Medical Center Hoffman Estates
AMITA Health St. Mary's Hospital Kankakee
Blessing Health System
Centegra Hospital McHenry
Centegra Hospital Woodstock
DuPage Medical Group
Evanston Hospital
FHN Memorial Hospital
Genesis Medical Center, Silvis
Gibson Area Hospital
Glenbrook Hospital
Highland Park Hospital
HSHS St. Anthony's Memorial Hospital*
Memorial Medical Center-Springfield
Mount Sinai Hospital
Northwestern Medicine Central DuPage Hospital
Northwestern Medicine Delnor Hospital
Northwestern Medicine Huntley Hospital
Northwestern Medicine Kishwaukee Hospital*
Northwestern Medicine Lake Forest Hospital
Northwestern Memorial Hospital
OrthoIllinois
Orthopedic & Sports Medicine Clinic
OSF Saint Anthony Medical Center
OSF Saint Anthony's Health Center
OSF Saint Elizabeth Medical Center
OSF Saint Francis Medical Center
OSF Saint James-John W. Albrecht Medical Center
OSF St. Joseph Medical Center
OSF St. Mary Medical Center
Palos Community Hospital
Rockford Memorial Hospital
Rush University Medical Center
Sarah Bush Lincoln Health Center
Skokie Hospital
South Shore Hospital
UnityPoint Health-Methodist
UnityPoint Health-Proctor
UnityPoint Health-Trinity Rock Island
Valley Ambulatory Surgery Center
Weiss Memorial Hospital
Advocate BroMenn Medical Center
Advocate Christ Medical Center
Advocate Condell Medical Center
Advocate Eureka Hospital
Advocate Good Samaritan Hospital
Advocate Good Shepherd Hospital

**Achieved The Joint Commission Advanced Certification for Total Hip and Total Knee Replacement by 8/1/24.*

Institutions that joined AJRR by 8/1/24 are included.
Those that contributed data by 9/18/24 are highlighted.

Advocate Illinois Masonic Medical Center
Advocate Sherman Hospital
Advocate South Suburban Hospital
Advocate Trinity Hospital
AMITA Health Adventist Medical Center La Grange
Bonutti Orthopedic Clinic
Center For Minimally Invasive Surgery
Deaconess Illinois Medical Center
Decatur Orthopaedic Center
Gold Coast Surgicenter
Gottlieb Memorial Hospital
HSHS St. John's Hospital
Loyola University Medical Center
Memorial Hospital of Carbondale
Mercy Hospital & Medical Center
NorthShore Orthopaedic & Spine Institute
OSF Heart of Mary Medical Center
OSF Holy Family Medical Center
OSF Sacred Heart Medical Center
OSF Saint Luke Medical Center
OSF Saint Paul Medical Center
Raycraft & Jones Orthopaedics
Riverside Medical Center
SIH Herrin Hospital
Swedish American Hospital

Indiana

Allied Physicians Surgery Center
Columbus Regional Health Orthopedics and Sports Medicine
Elkhart General Hospital*
Franciscan Health Carmel
Franciscan Health Indianapolis
Franciscan Health Moorseville
Hancock Regional Hospital
Indiana Regional Medical Center
Indiana University Health West Hospital
IU Health Ball Memorial Hospital
IU Health Bloomington Hospital*
IU Health North Hospital
IU Health Saxony Hospital*
IU Health Saxony Surgery Center
Main Hospital*
Major Health Partners Medical Center
Memorial Hospital and HealthCare Center
OrthoIndy Northwest
Plymouth Medical Center
Porter Regional Hospital
Riverview Health Westfield Hospital
Schneck Medical Center
Sidney & Lois Eskenazi Hospital
St. Joseph Regional Medical Center
St. Mary Medical Center*
The Orthopedic Hospital
Baptist Health Floyd
Indiana Hand to Shoulder Center
Indiana University Health Methodist Hospital*
Indiana University Health White Memorial Hospital
IU Health Arnett Hospital
IU Health Bedford Hospital
IU Health Beltway Surgery Centers*
IU Health Blackford Hospital
IU Health Eagle Highlands Surgery Center*
IU Health Jay Hospital
IU Health Meridian South Surgery Center
IU Health Morgan*
IU Health Paoli Hospital
IU Health Tipton Hospital
IU Health University Hospital
Memorial Hospital of South Bend*
Munster Specialty Surgery Center
Parkview Ortho Hospital
Riley Hospital for Children at IU Health
Senate Street Surgery Center*

Iowa

Advanced Surgery Center of Central Iowa
Allen Hospital
Buena Vista Regional Medical Center
CHI Health Mercy Council Bluffs*
Finley Hospital
Genesis Medical Center, Davenport
Great River Orthopaedic Specialists
Iowa Lutheran Hospital
Iowa Methodist Medical Center
Iowa Specialty Hospital-Clarion
Lakes Regional Healthcare
Marengo Memorial Hospital
Mercy Medical Center-Cedar Rapids
Mercy Medical Center-Clinton
Mercy Medical Center-Des Moines
Mercy Medical Center-Dubuque
Mercy Medical Center-Sioux City
Mercy Medical Center-West Lakes
MercyOne North Iowa Medical Center
Methodist West Hospital
Mississippi Valley Surgery Center
Orthopaedic Outpatient Surgery Center
Spencer Hospital
St. Luke's Hospital
St. Luke's Regional Medical Center
UnityPoint Health-Trinity Bettendorf
UnityPoint Health-Trinity Muscatine
UnityPoint Health-Trinity Regional Medical Center
UnityPoint Marshalltown
University of Iowa Hospitals & Clinics
CHI Health Mercy Corning
Greater Regional Health
MercyOne Cedar Falls Medical Center
MercyOne Des Moines Medical Center
MercyOne New Hampton Medical Center

**Achieved The Joint Commission Advanced Certification for Total Hip and Total Knee Replacement by 8/1/24.*

Institutions that joined AJRR by 8/1/24 are included.
Those that contributed data by 9/18/24 are highlighted.

MercyOne Primghar Medical Center
MercyOne Waterloo Medical Center
MercyOne West Des Moines Medical Center
Steindler Orthopedic Clinic

Kansas

AdventHealth Shawnee Mission
Ascension Via Christi Hospital in Manhattan
Hays Medical Center
Hutchinson Regional Medical Center
Kansas City Orthopaedic Institute
Lawrence Memorial Hospital*
LMH Health
Menorah Medical Center
Newton Medical Center
St. Catherine Hospital
Stormont-Vail Health*
The University of Kansas Health System
Wesley Medical Center
Wesley Woodlawn Hospital & ER
AdventHealth Ottawa
Bob Wilson Memorial Hospital
Mercy Specialty Hospital-Southeast Kansas
St. Rose Ambulatory & Surgery Center

Kentucky

Hardin Memorial Hospital*
Jewish Hospital
King's Daughters Medical Center*
Mercy Health-Lourdes Hospital
Methodist Hospital
Norton Audubon Hospital
Norton Brownsboro Hospital
Norton Hospital
Norton Women's & Children's Hospital
Owensboro Health Regional Hospital
Pomeroy & Rhoads Orthopaedics, PLLC
Saint Joseph East
St. Elizabeth Hospital Edgewood
TriStar Greenview Regional Hospital
Baptist Health Corbin
Baptist Health La Grange
Baptist Health Lexington
Baptist Health Louisville
Baptist Health Paducah
Baptist Health Richmond
Bluegrass Orthopaedics
Med Center Health Orthopaedics & Sports Medicine
Saint Joseph London
South Central Kentucky Orthopedics
UofL Health-UofL Hospital

Louisiana

AVALA
Doctors Hospital at Deer Creek
East Jefferson General Hospital
Lafayette General Medical Center
Lafayette Surgical Specialty Hospital
Ochsner Baptist-A Campus of Ochsner Medical Center
Ochsner Hospital for Orthopedics & Sports Medicine
Ochsner Medical Center*
Ochsner Medical Center-Kenner
Ochsner Medical Center-West Bank Campus
Our Lady of Lourdes Regional Medical Center
Park Place Surgical Hospital
Specialists Hospital Shreveport
Thibodeaux Regional Medical Center
Tulane Lakeside Hospital
Willis-Knighton Medical Center*
Christus Ochsner St. Patrick Hospital
Lafayette Bone & Joint Clinic
Red River Surgery Center
West Bank Surgery Center

Maine

Central Maine Orthopaedics
Falmouth Orthopedic Center
Maine Medical Center*
MaineGeneral Medical Center
Northern Light Mercy Hospital*
OA Centers for Orthopaedics
St. Mary's Regional Medical Center
Northern Light Eastern Maine Medical Center

Maryland

Anne Arundel Medical Center
Atlantic General Hospital
GBMC HealthCare*
Harborside Surgery Center
Holy Cross Germantown Hospital
Holy Cross Hospital
Howard County General Hospital
Johns Hopkins Bayview Medical Center*
MedStar Union Memorial Hospital
Meritus Medical Center
Peninsula Regional Medical Center*
Saint Agnes Healthcare*
Suburban Hospital
SurgCenter of Western Maryland, LLC
Surgery Center of Easton
University of Maryland Baltimore Washington Medical Center
University of Maryland Charles Regional Medical Center
University of Maryland Harford Memorial Hospital
University of Maryland Medical Center
University of Maryland Medical Center Midtown Campus
University of Maryland Rehabilitation & Orthopaedic Institute
University of Maryland Shore Medical Center at Easton

**Achieved The Joint Commission Advanced Certification for Total Hip and Total Knee Replacement by 8/1/24.*

Institutions that joined AJRR by 8/1/24 are included.
Those that contributed data by 9/18/24 are highlighted.

University of Maryland St. Joseph Medical Center
University of Maryland Upper Chesapeake Health
Western Maryland Health System
Capitol Orthopaedics and Rehabilitation, LLC
ChristianaCare Union Hospital
Frederick Health Hospital
Greenspring Surgery Center, LLC
Sinai Hospital of Baltimore

Massachusetts

Berkshire Medical Center
Beth Israel Deaconness Hospital-Plymouth
Beth Israel Deaconness Medical Center
Beverly Hospital
Boston Medical Center
Brigham and Women's Faulkner Hospital
Brigham and Women's Hospital
Charlton Memorial Hospital*
Emerson Hospital
Good Samaritan Medical Center
Holy Family Hospital*
Lahey Hospital & Medical Center
Lowell General Hospital
Massachusetts General Hospital
New England Baptist Hospital*
Orthopedic Surgery Center of the North Shore
Quincy Medical Center
Saint Anne's Hospital*
Signature Healthcare Brockton Hospital
South Shore Hospital
Sports Medicine North Orthopedic Surgery
St. Luke's Hospital*
Anna Jaques Hospital
Boston Out-Patient Surgical Suites, LLC
Longview Orthopaedic Center, LLC
Mercy Medical Center
Mercy Medical Center of Sisters of Providence
Mount Auburn Hospital
Tobey Hospital*
Winchester Hospital

Michigan

Ascension Borgess Medical Center
Ascension Genesys Hospital
Ascension Macomb-Oakland Hospital, Madison Heights Campus
Ascension Macomb-Oakland Hospital, Warren Campus
Ascension Providence Hospital, Novi Campus
Ascension Providence Hospital, Southfield
Ascension Providence Rochester Hospital
Ascension River District Hospital
Ascension St. John Hospital
Ascension St. Mary's Hospital*
Bronson Battle Creek Hospital
Bronson LakeView Hospital
Bronson Methodist Hospital
Bronson South Haven Hospital
Henry Ford Hospital
Henry Ford Macomb Hospital
Henry Ford West Bloomfield Hospital
Henry Ford Wyandotte Hospital
Holland Hospital
Hurley Medical Center
McLaren Flint
McLaren Greater Lansing
Mercy Health Hackely
Mercy Health Muskegon
Mercy Health St. Mary's
Michigan Surgical Hospital
MidMichigan Medical Center-Midland
Munson Healthcare Cadillac Hospital
Munson Medical Center
OSF St. Francis Hospital & Medical Group
Red Cedar Surgery Center, LLC*
Sparrow Health System
Spectrum Health Hospitals Blodgett Hospital
Spectrum Health Lakeland
Spectrum Health Ludington Hospital
St. Joseph Mercy Ann Arbor*
St. Joseph Mercy Brighton Health Center
St. Joseph Mercy Chelsea
St. Joseph Mercy Oakland Hospital
St. Mary Mercy Livonia Hospital
St. Joseph Mercy Livingston Hospital
University of Michigan Health System
UP Health System-Marquette
William Beaumont Hospital
Alliance Surgery Center
Memorial Healthcare
Mercy Health Lakeshore
Mercy Health Southwest
Muskegon Surgery Center

Minnesota

Abbott Northwestern Hospital*
Alomere Health
Buffalo Hospital
Cambridge Medical Center
CHI St. Gabriel's Health
Crosstown Surgery Center
Cuyuna Regional Medical Center*
Douglas County Hospital
Eagan Surgery Center
Essentia Health-St. Joseph's Medical Center (Brainerd)*
Essentia Health-St. Mary's Medical Center
Fairview Northland Medical Center
Fairview Ridges Hospital
Fairview Southdale Hospital

**Achieved The Joint Commission Advanced Certification for Total Hip and Total Knee Replacement by 8/1/24.*

Institutions that joined AJRR by 8/1/24 are included.
Those that contributed data by 9/18/24 are highlighted.

HealthEast Clinic-Woodwinds
HealthEast St. John's Hospital
HealthEast St. Joseph's Hospital
Hennepin County Medical Center
High Pointe Surgery Center
Lakeview Hospital
Mayo Clinic Health System in Austin
Mayo Clinic Health System in Mankato
Mayo Clinic Health System in Red Wing
Mayo Clinic in Rochester
Mercy Hospital
Mercy Hospital-Unity Campus
Minnesota Valley Surgery Center, LLC
New Ulm Medical Center
North Memorial Health Hospital
Orthopaedic & Fracture Clinic
Owatonna Hospital
Park Nicollet Methodist Hospital
Regina Hospital
Regions Hospital
Ridgeview Medical Center
River's Edge Hospital and Clinic
Riverwood Healthcare Center
St. Cloud Hospital
St. Francis Regional Medical Center
St. Gabriel's Hospital
St. Luke's
Two Twelve Surgery Center
United Hospital
University of Minnesota Medical Center
Vadnais Heights Surgery Center*
WestHealth Surgery Center
Abbott Northwestern-WestHealth
Astera Health Main Campus
Sanford Bemidji Medical Center
St. Cloud Surgical Center
St. Mary's Hospital
TRIA Orthopaedic Center

Mississippi

Baptist Medical Center
Columbus Orthopaedic Outpatient Center*
Merit Health River Oaks
Mississippi Valley Surgery Center and Endoscopy Center
OrthoSouth Southaven Surgery Center
Singing River Hospital
St. Dominic Hospital
Univeristy of Mississippi Medical Center
Capital Ortho
North Mississippi Medical Center
Ocean Springs Hospital

Missouri

CoxHealth
Mercy Hospital Carthage
Mercy Hospital Jefferson
Mercy Hospital Joplin
Mercy Hospital Lebanon
Mercy Hospital Lincoln
Mercy Hospital South
Mercy Hospital Springfield*
Mercy Hospital St. Louis
Mercy Hospital Washington
Mercy Orthopedic Hospital Springfield
Meyer Orthopedic & Rehabilitation Hospital
Missouri Orthopaedic Institute
Mosaic Life Care
North Kansas City Hospital*
Pawsat, M.D. & Maeda, M.D. P.C.
Phelps County Regional Medical Center
Saint Francis Medical Center
Saint Luke's East Hospital*
Saint Luke's Surgicenter-Lee's Summit, LLC*
Signature Medical Group
Southeast Hospital
St. Joseph Outpatient Surgery Center, LLC
St. Luke's Hospital
St. Luke's Hospital-Chesterfield
The Surgical Center at Columbia Orthopaedic Group
Total Joint Center of the Northland*
Truman Medical Center-Lakewood*
Liberty Hospital Orthopaedics
Mercy Center for Performance Medicine and Specialty Care
Orthopedic Associates
SSM Health DePaul Hospital-St. Louis*
SSM Health St. Mary's Hospital-Jefferson City

Montana

Benefis Health System
Bozeman Health Deaconess Hospital
Great Falls Clinic Hospital
Providence St. Joseph Medical Center
St. Patrick Hospital
Frances Mahon Deaconess Hospital*

Nebraska

CHI Health Immanuel
CHI Health Lakeside
CHI Health Midlands
Creighton University Medical Center-Bergan Mercy
Great Plains Health
Lincoln Surgical Hospital
Midwest Surgical Hospital
Nebraska Medicine
Nebraska Orthopaedic Hospital
CHI Health Good Samaritan
CHI Health St. Elizabeth
Columbus Community Hospital
Creighton Univeristy Medical Center
MercyOne Oakland Medical Center

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Institutions that joined AJRR by 8/1/24 are included.
Those that contributed data by 9/18/24 are highlighted.

Nevada

MountainView Hospital
Northern Nevada Medical Center*
Renown Regional Medical Center
Renown South Meadows Medical Center
Southern Hills Hospital & Medical Center
Sunrise Hospital & Medical Center
Centennial Hills Hospital Medical Center
Desert Springs Hospital
Henderson Hospital
Orthopaedic Institute of Henderson
Orthopedic Specialty Hospital of Nevada
Reno Orthopedic Surgery Center
Spring Valley Hospital Medical Center
Summerlin Hospital Medical Center
University Medical Center of Southern Nevada
Valley Hospital Medical Center

New Hampshire

Atlantic Coast Surgical Suites
Concord Hospital
Dartmouth-Hitchcock Medical Center
Elliot Hospital
Lighthouse Surgical Suites, LLC*
North Atlantic Surgical Suites
Northridge Surgical Suites*
Portsmouth Regional Hospital
Southern NH Medical Center
Concord Orthopaedics
Exeter Hospital

New Jersey

Bayshore Medical Center
Chilton Medical Center
Englewood Hospital
Hackensack University Medical Center*
Holy Name Medical Center
Jersey City Medical Center
Jersey Shore University Medical Center*
JFK Medical Center
Morristown Medical Center*
Newton Medical Center
Northern Monmouth Regional Surgery Center
Ocean Medical Center
Overlook Medical Center*
Palisades Medical Center
Princeton Medical Center*
Raritan Bay Medical Center
Riverview Medical Center*
Robert Wood Johnson University Hospital New Brunswick
Robert Wood Johnson University Hospital Somerset
Southern Ocean Medical Center
St. Francis Medical Center
St. Luke's Warren Campus
St. Peter's University Hospital
The Valley Hospital
Virtua Marlton Hospital
Virtua Memorial Hospital
Virtua Voorhees Hospital
Clara Maass Medical Center
Community Medical Center
Eastern Orthopedic Associates
Hudson Crossing Surgery Center
Lourdes Medical Center of Burlington County
Monmouth Medical Center
Monmouth Medical Center Southern Campus
Newark Beth Israel Medical Center
Robert Wood Johnson University Hospital Hamilton
Robert Wood Johnson University Hospital Rahway
Saint Barnabas Medical Center
Surgical Center at Millburn, LLC
The Center for Ambulatory Surgery

New Mexico

CHRISTUS St. Vincent Regional Medical Center*
Memorial Medical Center-Las Cruces
MountainView Regional Medical Center
Presbyterian Hospital
Presbyterian Rust Medical Center
UNM Sandoval Regional Medical Center
Covenant Health Hobbs Hospital

New York

Crouse Hospital
Glen Falls Hospital
Highland Hospital*
Hospital for Special Surgery
Huntington Hospital*
Jamaica Hospital Medical Center
John T. Mather Memorial Hospital
Kenmore Mercy Hospital
Lenox Hill Hospital*
Long Island Jewish Forest Hills
Long Island Jewish Medical Center*
Long Island Jewish Valley Stream
Lourdes Hospital
Maimonides Medical Center
Mohawk Valley Health System
Montefiore Medical Center*
Mount Sinai Brooklyn
Mount Sinai Queens
Mount Sinai St. Luke's*
Mount Sinai West
Newark-Wayne Community Hospital
NewYork-Presbyterian Brooklyn Methodist Hospital
NewYork-Presbyterian Queens
NewYork-Presbyterian/Columbia University Irving Medical Center
North Shore University Hospital*
Northern Westchester Hospital*
NYC Health + Hospitals/Elmhurst*

Achieved The Joint Commission Advanced Certification for Total Hip and Total Knee Replacement by 8/1/24.

Institutions that joined AJRR by 8/1/24 are included.
Those that contributed data by 9/18/24 are highlighted.

Oswego Hospital
Peconic Bay Medical Center
Phelps Hospital
Plainview Hospital
Rochester General Hospital
Samaritan Hospital
South Shore University Hospital*
St. Charles Hospital*
St. Francis Hospital
St. Joseph's Hospital Health Center
St. Peter's Hospital
Staten Island University Hospital*
Stony Brook University Hospital
Syosset Hospital
The Hospital for Joint Diseases
The Mount Sinai Hospital*
UHS Binghamton General Hospital
UHS Wilson Medical Center
Unity Hospital
UPMC Chautauqua
Upstate University Hospital-Community Campus
Upstate University Hospital-Downtown Campus
Winthrop-University Hospital
Wyoming County Community Health System
Wyoming County Community Hospital
Albany Memorial Hospital
Alice Hyde Medical Center
Champlain Valley Physicians Hospital
Excelsior Orthopaedics
Mercy Hospital of Buffalo
Mount Sinai South Nassau*
Mount St. Mary's Hospital and Health Center
NewYork-Presbyterian Lawrence Hospital
NewYork-Presbyterian Lower Manhattan Hospital
NewYork-Presbyterian/Weill Cornell Medical Center
Northern Dutchess Hospital
Putnam Hospital
Rochester Surgery Center*
Saint Mary's Hospital
Sisters of Charity Hospital
Sisters of Charity Hospital, St. Joseph Campus
Vassar Brothers Medical Center
White Plains Hospital

North Carolina

Atrium Health Mercy, a facility of Carolinas Medical Center
Blue Ridge Surgery Center
Capital City Surgery Center
Columbus Regional Healthcare System
Cone Health Annie Penn Hospital
Cone Health Wesley Long Hospital
Davie Medical Center*
ECU Health Beaufort Hospital, a campus of ECU Health Medical Center
ECU Health Chowan Hospital
ECU Health Duplin Hospital
ECU Health Edgecombe Hospital
ECU Health North Hospital
ECU Health Roanoke-Chowan Hospital
ECU Health SurgiCenter
EmergeOrtho-Triangle Orthopedic Associates
FirstHealth Moore Regional Hospital
Greensboro Orthopaedics
High Point Medical Center
Hugh Chatham Memorial Hospital*
Lexington Medical Center
Mission Hospital
Moses H. Cone Memorial Hospital
New Hanover Regional Medical Center
North Carolina Specialty Hospital*
Northern Hospital of Surry County
Novant Health Brunswick Medical Center
Novant Health Charlotte Orthopaedic Hospital
Novant Health Clemmons Medical Center
Novant Health Forsyth Medical Center
Novant Health Huntersville Medical Center
Novant Health Kernersville Medical Center
Novant Health Matthews Medical Center
Novant Health Rowan Medical Center
Novant Health Thomasville Medical Center
Novant Health UVA Prince William Medical Center
Sentara Albemarle Medical Center
Surgical Center of Greensboro
The Outer Banks Hospital
The Surgical Center of Morehead City
UNC Health Wayne
Wake Forest Baptist Medical Center
WakeMed Cary Hospital
WakeMed North Hospital
WakeMed Raleigh Campus
AdventHealth Hendersonville
Atrium Health Lincoln
Atrium Health's Carolinas Medical Center
Carolina Sports Medicine & Orthopaedic Specialists
Cary Orthopaedics
Duke Ambulatory Surgery Center Arringdon
Viewmont Surgery Center

North Dakota

CHI St. Alexius Health Bismark*
Sanford Medical Center Fargo
Sanford Medical Center-Bismarck*

Achieved The Joint Commission Advanced Certification for Total Hip and Total Knee Replacement by 8/1/24.

Institutions that joined AJRR by 8/1/24 are included.
Those that contributed data by 9/18/24 are highlighted.

Ohio

Adena Regional Medical Center*
Bethesda Butler Hospital
Bethesda North Hospital
Blanchard Valley Health System
Cleveland Clinic Fairview Hospital
Cleveland Clinic Lakewood
Cleveland Clinic Main Campus
Crystal Clinic Orthopaedic Center
Euclid Hospital
Firelands Regional Medical Center
Fort Hamilton Hospital
Genesis Healthcare System
Good Samaritan Hospital*
Grandview Medical Center
Grant Medical Center
Greater Dayton Surgery Center
Greene Memorial Hospital
Hillcrest Hospital
Indu and Raj Soin Medical Center
Kettering Medical Center
King's Daughters Medical Center Ohio
Licking Memorial Hospital
Lutheran Hospital
Marymount Hospital
McCullough-Hyde Memorial Hospital
Medina Hospital
Mount Carmel East
Mount Carmel New Albany
Mount Carmel St. Ann's
Mount Carmel West
Northpointe Surgical Suites*
OhioHealth Mansfield Hospital*
Ohio Specialty Surgical Suites*
Ohio Valley Surgical Hospital*
Ontario Hospital
Orthopedic ONE
Selby General Hospital
South Pointe Hospital
Southview Medical Center
Southwest General Health Center
St. Vincent Medical Center (Sisters of Charity-OH)
Summa Health System-Barberton Campus
Summa Health Wadsworth-Rittman Medical Center
Sycamore Medical Center
The Christ Hospital Health Network*
The Jewish Hospital-Mercy Health
The Ohio State University Wexner Medical Center
The Surgical Hospital at Southwoods
TriHealth Evendale Hospital
Trumbull Regional Medical Center*
UH Ahuja Medical Center
UH Bedford Medical Center, a campus of Regional Hospitals
UH Cleveland Medical Center
UH Conneaut Medical Center
UH Elyria Medical Center
UH Geauga Medical Center
UH Geneba Medical Center
UH Parma Medical Center
UH Portage Medical Center
UH Richmond Medical Center, a campus of Regional Hospitals
UH St. John Medical Center
White Fence Surgical Suites
Amherst Family Health Center
Ashtabula County Medical Center
Beacon Orthopaedics & Sports Medicine Evendale
Beacon Orthopaedics & Sports Medicine Summit Woods
Beacon Orthopaedics & Sports Medicine Western Hills
Cleveland Clinic Children's Hospital for Rehabilitation
Cleveland Clinic Mercy Hospital
First Settlement Orthopaedics
Mercy Health-West Hospital
Mercy Health Anderson Hospital
Mercy Health Clermont Hospital
Mercy Health Fairfield Hospital
MetroHealth Medical Center Main Campus
Northside Regional Medical Center
UH Lake West Medical Center
UH Samaritan Medical Center
UH TriPoint Medical Center

Oklahoma

Ascension St. John Jane Phillips
Community Hospital North Campus
Community Hospital South Campus
Duncan Regional Hospital*
Mercy Hospital Ada
Mercy Hospital Ardmore
Mercy Hospital Oklahoma City
Norman Regional Hospital
Northwest Surgical Hospital
Southwestern Medical Center
St. John Broken Arrow
St. Mary's Regional Medical Center*
Stillwater Medical Center
Comanche County Memorial Hospital
Hillcrest Hospital South
Tulsa Spine & Specialty Hospital

Oregon

Adventist Health Portland
Good Samaritan Regional Medical Center
Hillsboro Medical Center
Hope Orthopedics
Legacy Emanuel Medical Center
Legacy Good Samaritan Medical Center
Legacy Meridian Park Medical Center
Legacy Mount Hood Medical Center
Legacy Silverton Medical Center
Oregon Health & Science University
PeaceHealth Orthopedics at Peace Harbor
Providence Hood River Memorial Hospital

**Achieved The Joint Commission Advanced Certification for Total Hip and Total Knee Replacement by 8/1/24.*

Institutions that joined AJRR by 8/1/24 are included.
Those that contributed data by 9/18/24 are highlighted.

Providence Medford Medical Center
Providence Milwaukie Hospital
Providence Newberg Medical Center
Providence Portland Medical Center
Providence Seaside Hospital
Providence St. Vincent Medical Center
Providence Willamette Falls Medical Center
Salem Health
Samaritan Albany General Hospital
St. Alphonsus Medical Center Baker City
St. Alphonsus Medical Center Ontario
St. Charles Health System
Tillamook Regional Medical Center
Willamette Surgery Center
Willamette Valley Medical Center*
Bend Surgery Center
CHI Mercy Health Mercy Medical Center
Oregon Orthopedic & Sports Medicine Clinic
Oregon Surgical Institute
Orthopedic + Fracture Specialists
Portland Knee Clinic
South Portland Surgical Center
Surgery Center of Southern Oregon

Pennsylvania

Abington-Lansdale Hospital, Jefferson Health
Abington Hospital-Jefferson Health
ACMH Hospital
Advanced Surgical Hospital
Barry A. Ruht MD PC
Bryn Mawr Hospital*
Butler Memorial Hospital
Conemaugh Memorial Medical Center*
Doylestown Hospital
Doylestown Surgery Center*
Excela Health Latrobe Hospital
Excela Health Westmoreland Hospital
Geisinger Community Medical Center
Geisinger Lewistown Hospital
Geisinger Medical Center
Geisinger Shamokin Area Community Hospital
Geisinger South Wilkes-Barre
Geisinger Wyoming Valley Medical Center
Heritage Valley Beaver
Heritage Valley Sewickley
Indiana Regional Medical Center
Jefferson Hospital*
Lancaster General Hospital
Lankenau Medical Center*
Mercy Fitzgerald Hospital
Monongahela Valley Hospital
Moses Taylor Hospital
Mount Nittany Medical Center
Nazareth Hospital
Orthopaedic & Spine Specialists
OSS Orthopaedic Hospital*
Paoli Hospital*
Penn Highlands Healthcare
Penn Presbyterian Medical Center
Penn State Milton S. Hershey Medical Center
Pennsylvania Hospital
Phoenixville Hospital*
Reading Hospital*
Regional Hospital of Scranton
Riddle Hospital*
Rothman Orthopaedic Institute
St. Clair Hospital*
St. Luke's Allentown Campus
St. Luke's Anderson Campus
St. Luke's Carbon Campus
St. Luke's Easton Campus
St. Luke's Upper Bucks Campus
St. Luke's University Hospital-Bethlehem Campus
St. Mary Medical Center
Thomas Jefferson University Hospital
UPMC Altoona
UPMC Carlisle
UPMC East
UPMC Hamot
UPMC Hanover
UPMC Horizon
UPMC Jameson
UPMC Magee-Womens Hospital
UPMC McKeesport
UPMC Memorial
UPMC Mercy
UPMC Northwest
UPMC Passavant-McCandless
UPMC Pinnacle
UPMC Pinnacle Community Osteopathic*
UPMC Pinnacle Harrisburg
UPMC Pinnacle Lititz
UPMC Pinnacle West Shore*
UPMC Presbyterian
UPMC Shadyside
UPMC St. Margaret
UPMC Williamsport*
ValueHealth Muve-Warminster
ValueHealth Muve-West Chester*
WellSpan Gettysburg Hospital
WellSpan Surgery & Rehabilitation Hospital
WellSpan York Hospital
Allegheny General Hospital
Chan Soon-Shion Medical Center at Windber
Geisinger Jersey Shore Hospital
Geisinger Woodbine Lane
Mercy Catholic Medical Center-Mercy Philadelphia Campus
North Pointe Surgery Center
Richards Orthopaedics Center & Sports Medicine
Rothman Orthopaedic Specialty Hospital

**Achieved The Joint Commission Advanced Certification for Total Hip and Total Knee Replacement by 8/1/24.*

Institutions that joined AJRR by 8/1/24 are included.
Those that contributed data by 9/18/24 are highlighted.

Surgery Center of Allentown
The Hospital of the University of Pennsylvania
UPMC Children's Hospital of Pittsburgh

Rhode Island

Kent Hospital*
South County Hospital*
The Miriam Hospital*
Yale New Haven Health Westerly Hospital
Newport Hospital*
Ortho Rhode Island Warwick Campus

South Carolina

Beaufort Memorial Hospital*
Bon Secours St. Francis Hospital*
Carolina Orthopedics
Carolina Pines Regional Medical Center
Chapin Surgery Center
East Cooper Medical Center
Grand Strand Medical Center
McLeod Health Cheraw
McLeod Health Clarendon
McLeod Health Dillon
McLeod Health Seacoast
McLeod Regional Medical Center
Medical University of South Carolina*
Oconee Memorial Hospital
Palmetto Health Baptist
Palmetto Health Richland
Pelham Medical Center
Prisma Health Baptist Hospital
Prisma Health Patewood Hospital*
Providence Orthopedic Hospital
Roper St. Francis Hospital
Roper St. Francis Mount Pleasant Hospital
Self Regional Healthcare
Trident Medical Center
AnMed Medical Center
Baptist Easley Hospital
Carolina Coast Surgery Center
Conway Medical Center
Novant Health Gaffney Medical Center
Prisma Health Baptist Parkridge Hospital
St. Francis Downtown

South Dakota

Avera McKennan Hospital & University Health Center
Black Hills Surgical Hospital
Sanford USD Medical Center
Dunes Surgical Hospital

Tennessee

Baptist Memorial Hospital-Collierville
Baptist Memorial Hospital-Memphis*
Bristol Regional Medical Center*
CHI Memorial Hospital Chattanooga
Erlanger Baroness Hospital
Erlanger East Hospital
Fort Loudoun Medical Center
Fort Sanders Regional Medical Center
Henry County Medical Center
Huntsville Hospital
Indian Lake Surgery Center
Indian Path Community Hospital
Johnson City Medical Center
LeConte Medical Center
Maury Regional Medical Center*
Methodist Medical Center of Oak Ridge
Morristown-Hamblen Healthcare System
OrthoSouth Germantown Surgery Center
OrthoTennessee
Parkridge East Hospital
Parkridge Medical Center
Parkwest Medical Center
Physicians Regional Medical Center
Physicians Surgery Center
Premier Orthopedic Surgery Center
Roane Medical Center
Saint Thomas Midtown Hospital
Saint Thomas River Park Hospital
Saint Thomas Rutherford Hospital
Saint Thomas West Hospital
St. Francis Hospital
Tennessee Orthopaedic Alliance
TriStar Centennial Medical Center
TriStar Hendersonville Medical Center
TriStar Horizon Medical Center
TriStar Skyline Medical Center
TriStar Southern Hills Medical Center
TriStar StoneCrest Medical Center
TriStar Summit Medical Center
Turkey Creek Medical Center
University of Tennessee Medical Center
Vanderbilt University Medical Center
Wolf River Surgery Center
CHI Memorial Hospital Hixson
Claiborne Medical Center
Cookeville Regional Medical Center*
Cumberland Medical Center
Mid-Tennessee Bone & Joint Clinic, P.C.

Texas

AdventHealth Central Texas
Ascension Seton Hays
Ascension Seton Medical Center Austin
Ascension Seton Northwest Hospital
Ascension Seton Southwest
Ascension Seton Williamson
Baptist Beaumont Hospital of Southeast Texas
Baylor Scott & White All Saints Medical Center-Fort Worth
Baylor Scott & White Medical Center-Carrollton

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Institutions that joined AJRR by 8/1/24 are included.
Those that contributed data by 9/18/24 are highlighted.

- Baylor Scott & White Medical Center-Frisco*
- Baylor Scott & White Medical Center-Garland
- Baylor Scott & White Medical Center-Grapevine
- Baylor Scott & White Medical Center-Irving
- Baylor Scott & White Medical Center-McKinney
- Baylor Scott & White Medical Center-Plano
- Baylor Scott & White Medical Center-Uptown*
- Baylor Scott & White Medical Center-Waxahachie
- Baylor Scott & White Surgical Hospital Fort Worth*
- Baylor Surgical Hospital at Las Colinas
- Baylor University Medical Center*
- CHRISTUS Good Shepherd Medical Center-Longview*
- CHRISTUS Good Shepherd Medical Center-Marshall
- CHRISTUS Mother Frances Hospital-Tyler*
- Christus Southeast Texas Hospital-St. Elizabeth
- CHRISTUS Spohn Hospital Corpus Christi-Memorial
- College Station Medical Center
- Collom & Carney Clinic Association
- Cornerstone Regional Hospital
- Corpus Christi Medical Center
- Covenant Children's Hospital
- Covenant Health Plainview*
- Covenant Medical Center
- Covenant Specialty Hospital
- Dallas Orthopedic & Shoulder Institute
- Dell Seton Medical Center at The University of Texas
- Del Sol Medical Center
- Doctors Hospital at Renaissance*
- El Paso Specialty Hospital
- Harlingen Medical Center
- HCA Houston Healthcare Clear Lake
- Hill Country Memorial Hospital
- Houston Methodist Hospital
- Houston Methodist Sugar Land Hospital
- Inov8 Surgical
- JPS Health Network
- Lake Granbury Medical Center*
- Las Palmas Medical Center
- Legent Orthopedic Hospital
- Medical City Dallas Hospital
- Medical City Denton
- Memorial Hermann Memorial City Medical Center*
- Memorial Hermann Orthopedic & Spine Hospital
- Memorial Hermann Rockets Orthopedic Hospital*
- Memorial Hermann Southwest Hospital
- Methodist Hospital
- Methodist Hospital for Surgery
- Methodist Stone Oak Hospital
- Methodist Texsan Hospital
- Metropolitan Methodist Hospital
- Midland Memorial Hospital
- Momentum Specialty Surgery Center
- Muve-Lakeway Ambulatory Surgical Center, LLC
- Nix Health
- North Central Baptist Hospital*
- North Central Surgical Center Hospital*
- Northeast Baptist Hospital*
- Northeast Methodist Hosptial
- Paris Orthopedics & Sports Medicine
- Scott & White Memorial Hospital-Temple
- Seton Highland Lakes Hospital
- South Texas Spine and Surgical Hospital*
- South Texas Surgical Hospital
- St. David's Georgetown Hospital
- St. David's Medical Center
- St. David's North Austin Medical Center
- St. David's Round Rock Medical Center
- St. David's South Austin Medical Center
- St. David's Surgical Hospital
- St. Joseph Health System
- St. Luke's Health-Lakeside Hospital*
- Texas Health Arlington Memorial Hospital*
- Texas Health Dallas
- Texas Health Harris Methodist Hospital Fort Worth*
- Texas Health Harris Methodist Hospital Southwest Fort Worth*
- Texas Health Presbyterian Hospital Denton
- Texas Health Presbyterian Hospital Flower Mound
- Texas Health Presbyterian Hospital Plano*
- Texas Health Presbyterian Hospital Rockwall
- Texas Health Surgery Center Addison
- Texas Health Surgery Center Cleburne
- Texas Health Surgery Center Heritage
- Texas Institute for Surgery
- Texas Orthopaedic Associates
- Texas Orthopedic Hospital*
- Texas Orthopedics, Sports & Rehabilitation Associates
- Texas Spine and Joint Hospital
- Texoma Medical Center*
- The Carrell Clinic
- The Medical Center of Southeast Texas
- The Physicians Centre Hospital

**Achieved The Joint Commission Advanced Certification for Total Hip and Total Knee Replacement by 8/1/24.*

Institutions that joined AJRR by 8/1/24 are included.
Those that contributed data by 9/18/24 are highlighted.

United Regional HealthCare System*
University Hospital
UT Southwestern Medical Center
W.B. Carrell Clinic
Wise Health Surgical Hospital
Advanced Surgical Care of Boerne
Advent Orthopaedics
Covenant Hospital Levelland
Cross Timbers Orthopedics
Doctors Hospital of Laredo
Edinburg Regional Medical Center
Fort Duncan Regional Medical Center
Grace Surgical Hospital
Jeff Zhao, D.O.
McAllen Medical Center
Methodist McKinney Hospital, LLC
Northwest Texas Healthcare System
Peterson Health
Seton Medical Center Harker Heights
Stefan Kreuzer
SurgCenter of Plano
Texas Health Center for Diagnostics & Surgery
Texas Health Orthopedic Surgery Center Flower Mound
Texas Orthopedics*
University of Texas Health Science Center at San Antonio

Utah

Altaview Hospital
American Fork Hospital
Bear River Valley Hospital
Cedar City Hospital
Dixie Regional Medical Center
Heber Valley Hospital
Intermountain Medical Center
Lakeview Hospital
Layton Hospital
LDS Hospital
Logan Regional Hospital
Maple Grove Hospital
McKay-Dee Hospital
McKay-Dee Surgical Center
Mountain View Hospital
North Memorial Health at Maple Grove Medical Center
North Memorial Health Hospital
Ogden Regional Medical Center*
Park City Hospital
Primary Children's Hospital
Riverton Hospital
Salt Lake Regional Medical Center
Sevier Valley Hospital
St. Mark's Hospital
Timpanogos Regional Hospital
TOSH-The Orthopedic Specialty Hospital
Univeristy of Utah Health
Utah Valley Hospital
Cedar Orthopedic Surgery Center
Orem Community Hospital

Vermont

Central Vermont Medical Center
Copley Hospital
Northeastern Vermont Regional Hospital
Rutland Regional Medical Center
The University of Vermont Medical Center
Northwestern Medical Center, Inc.
Porter Medical Center

Virginia

Carilion New River Valley Medical Center*
Carilion Roanoke Memorial Hospital*
CJW Medical Center*
Henrico Doctors' Hospital
Inova Fair Oaks Hospital
Inova Loudoun Hospital
Inova Mount Vernon Hospital
Johnston Memorial Hospital
Mary Washington Hospital
Novant Health Prince William Medical Center
Novant Health UVA Haymarket Medical Center
OrthoVirginia
Reston Hospital Center*
Riverside Doctors' Hospital Williamsburg
Riverside Regional Medical Center
Riverside Tappahannock Hospital
Riverside Walter Reed Hospital
Sentara CarePlex Hospital
Sentara Leigh Hospital
Sentara Martha Jefferson Hospital
Sentara Norfolk General Hospital
Sentara Northern Virginia Medical Center
Sentara Obici Hospital
Sentara Princess Anne Hospital
Sentara RMH Medical Center
Sentara Virginia Beach General Hospital
Sentara Williamsburg Regional Medical Center
The Surgery Center of Lynchburg
University of Virginia Health System University Hospital*
VCU Medical Center
Virginia Hospital Center
Centra Health
Inova Fairfax Hospital

Washington

Capital Medical Center
Cascade Valley Hospital
Central Washington Hospital
Everett Bone and Joint
EvergreenHealth Medical Center
Harrison Medical Center
Highline Medical Center
Kadlec Regional Medical Center
Lakewood Surgery Center
Legacy Salmon Creek Medical Center

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Those that contributed data by 9/18/24 are highlighted.

MultiCare Allenmore Hospital & Medical Center
MultiCare Auburn Medical Center
MultiCare Deaconess Hospital
MultiCare Good Samaritan Hospital*
MultiCare Tacoma General Hospital*
Multicare Valley Hospital*
Northwest Hospital & Medical Center
Overlake Medical Center
PeaceHealth Orthopedic & Sports Medicine at Medical Office Plaza
Proliance Center for Outpatient Spine and Joint Surgery of Puget Sound
Proliance Eastside Surgery Center
Proliance Highlands Surgery Center
Providence Centralia Hospital
Providence Holy Family Hospital-Spokane
Providence Mount Carmel Hospital
Providence Regional Medical Center Everett Colby Campus
Providence Sacred Heart Medical Center
Providence St. Joseph's Hospital
Providence St. Mary Medical Center*
Providence St. Peter Hospital
Samaritan Healthcare
Seattle Orthopedic Center Surgery
Seattle Surgery Center
Skagit Northwest Orthopedics
Skagit Valley Hospital
St. Anthony Hospital
St. Clare Hospital
St. Elizabeth Hospital
St. Francis Hospital
St. Joseph Medical Center
Swedish Health Ballard Campus
Swedish Health Edmonds Campus
Swedish Health First Hill Campus
Swedish Health Issaquah Campus
The Surgery Center at Rainier
The Surgery Center at TCO Kennewick
Trios Health
Valley Medical Center
Virginia Mason Medical Center
Walla Walla General Hospital
Yakima Valley Memorial Hospital
Dan Downey, MD
Edmonds Center for Outpatient Surgery
MultiCare Covington Medical Center
Olympia Surgery Center
Olympic Medical Center
PeaceHealth Orthopedics & Sports Medicine in Lynden
Providence Regional Medical Center Everett Pacific Campus
Southwest Seattle Ambulatory Surgery Center
Wenatchee Valley Hospital & Clinics

West Virginia

Cabell Huntington Hospital*
Grant Memorial Hospital
Mon Health Center for Outpatient Surgery*
Ruby Memorial Hospital
Thomas Memorial Hospital*
West Virginia University Hospital*
Princeton Community Hospital

Wisconsin

Amery Hospital & Clinic
Ascension NE Wisconsin-St. Elizabeth Campus
Ascension SE Wisconsin Hospital - Elmbrook Campus
Ascension SE Wisconsin Hospital - Franklin Campus
Ascension St. Mary's Hospital
Ascension St. Michael's Hospital
Aurora BayCare Medical Center
Aurora Lakeland Medical Center
Aurora Medical Center-Burlington
Aurora Medical Center-Grafton
Aurora Medical Center-Kenosha
Aurora Medical Center-Manitowoc County
Aurora Medical Center-Oshkosh
Aurora Medical Center-Sheboygan County
Aurora Medical Center-Summit
Aurora Medical Center-Washington County
Aurora Sinai Medical Center
Aurora St. Luke's Medical Center
Aurora St. Luke's South Shore of Aurora HealthCare Metro, Inc.
Aurora West Allis Medical Center
Beaver Dam Community Hospitals
Beloit Memorial Hospital*
Berlin Memorial Hospital
Columbus Community Hospital
Community Memorial Hospital
Fort HealthCare
Froedtert Hospital
Froedtert Community Memorial Hospital*
Gundersen Health System
Hayward Area Memorial Hospital
HSHS St. Mary's Hospital Medical Center
HSHS St. Nicholas Hospital
HSHS St. Vincent Hospital
Hudson Hospital & Clinic
Lakeview Hospital
Lakeview Medical Center
Marshfield Clinic Wasau Center
Marshfield Medical Center-Beaver Dam
Marshfield Medical Center-Eau Claire*
Marshfield Medical Center-Marshfield
Marshfield Medical Center-Minocqua
Marshfield Medical Center-Neillsville
Marshfield Medical Center-Rice Lake

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Institutions that joined AJRR by 8/1/24 are included.
Those that contributed data by 9/18/24 are highlighted.

Marshfield Medical Center-Weston
Mayo Clinic Health System-Franciscan Healthcare
Mayo Clinic Health System in Eau Claire
Memorial Medical Center
Mercyhealth Hospital & Trauma Center
Mercyhealth Hospital and Medical Center-Walworth
Midwest Orthopedic Specialty Hospital*
Monroe Clinic Hospital
OakLeaf Surgical Hospital
Oconomowoc Memorial Hospital*
Orthopedic & Sports Surgery Center
Orthopedic Hospital of Wisconsin
Osceola Medical Center
Prairie Ridge Health
ProHealth Waukesha Memorial Hospital
Ripon Medical Center
River Falls Area Hospital
Sauk Prairie Hospital
Southwest Health
SSM Health St. Clare Hospital-Janesville
St. Agnes Hospital
St. Croix Regional Medical Center
St. John's Hospital
St. Joseph's Hospital, West Bend
ThedaCare Medical Center-New London
ThedaCare Medical Center-Shawano
ThedaCare Medical Center-Waupaca
ThedaCare Regional Medical Center-Appleton
ThedaCare Regional Medical Center-Neenah
Tomah Memorial Hospital
UnityPoint Health-Meriter
University of Wisconsin Hospitals and Clinics
Vernon Memorial Healthcare
Watertown Regional Medical Center
Waupun Memorial Hospital
Westfields Hospital & Clinic
Wisconsin Specialty Surgery Center*
Ascension All Saints Hospital-Spring Street Campus
Ascension NE Wisconsin - Mercy Campus
Aspirus HealthCare
Aurora Health Center in Milwaukee
Aurora Health Center in Pleasant Prairie
Aurora Medical Center-Bay Area
Aurora Medical Center-Mount Pleasant
Bellin Health Oconto Hospital
Bellin Health Surgery & Specialty Center
Bellin Hospital
Divine Savior Healthcare
Marshfield Clinic Minocqua Center
Orthopedic & Sports Medicine Specialists of Green Bay
SSM Health St. Clare Hospital-Baraboo
SSM Health St. Mary's Hospital-Madison

Wyoming

Cheyenne Regional Medical Center
Fairview Lakes Medical Center
Mountain View Regional Hospital
Powder River Surgery Center
St. John's Medical Center
Summit Medical Center*
Wyoming Medical Center

"The sustained growth and interest in the AAOS Registry Program underscore its vital role in shaping the future of orthopaedic care. The extensive data collection, combined with the cutting-edge insights generated by our enhanced RegistryInsights® dashboards, has been nothing short of practice-changing. Year after year, the registry evolves dynamically to meet the needs of all key stakeholders—surgeons, institutions, and, most importantly, our patients—ensuring we remain at the forefront of orthopaedic innovation and patient care."

Bryan D. Springer, MD, FAAOS
Mayo Clinic Florida (Jacksonville. FL)

**Achieved The Joint Commission Advanced Certification for Total Hip and Total Knee Replacement by 8/1/24.*

Appendix F

Audit of Registry Data

The AAOS Registry Program and AJRR are committed to providing data reports that are valid and accurate. To ensure the Registry Program achieves this objective, internal quality controls are in place, in addition to an external audit of data from the previous year. This is an annual effort, and AJRR continued a contractual relationship with Advent Advisory Group© to serve as the vendor for auditing a sample of 2023 data. Advent Advisory Group is a National Committee for Quality Assurance (NCQA) licensed audit organization which provides audit, consulting, data validation, and technical assistance to health services organizations nationwide. With over 25 years of experience, Advent Advisory's staff of auditors, clinicians, analysts, statisticians, certified coders, and programmers perform validation services for a variety of health care organizations, including health plans, provider organizations, clinical registries, data aggregators, and health information exchanges. The intention of this audit was to select and review a sample of 2023 data. The Registry randomly selected 29 actively submitting AJRR sites, both hospitals and ambulatory surgical centers (ASCs), from January 1 to December 31, 2023 to participate. The participating sites included diverse representation of urban and rural locations, and both small practices and large centers. The audit process ensures data submitted to AJRR correctly represents the data in the facility medical records, and that the data reflected all hip and knee arthroplasty procedures performed at that site within the specified timeframe. The audit was completed in September 2024.

Six of the randomly selected sites for the 2024 audit were unable to participate due to personnel changes and/or data system constraints impacting their ability to complete the request by the established timeline. The sites were issued an exclusion and will be included for participation in the 2025 Audit. Per the AJRR contractual agreements, audit participation is required when selected for a given year.

The overall record agreement rate was 93.1% (Median 98%), which is consistent with prior Annual Reports. Since inception of the AJRR Annual Audit, the overall audit agreement rate has consistently exceeded 90%, above the 85% acceptable threshold, indicating high reliability of the data within the AJRR. Challenges in the completeness agreement include formatting issues with reports that participants submitted to Advent, incorrect field names, errors in patient, surgeon, and hospital fields, and mismatch of primary procedure codes with description. There were no anomalous observations to suggest any cherry picking or selection of only the best cases being submitted.

This audit reflects agreement between the information in the institution record and the information as reported to AJRR. The audit does not reflect whether data and resulting codes assigned in the hospital record were the most appropriate or accurate for the procedure performed.

Efforts to address accuracy and appropriateness of the submitted data, especially at the point of data entry, will continue in collaboration with all participating sites.

Appendix G

2024 AJRR Annual Report Cumulative Percent Revision Curve Methodology

Dataset Development

All AJRR patients undergoing a primary total joint replacement or revision surgery were identified using International Classification of Disease (ICD)-9/10 and Current Procedural Terminology (CPT) codes in both the AJRR and the Centers for Medicare & Medicaid Services (CMS) dataset. Revisions were "linked" to primary when known laterality was the same for both a primary and revision, and when revision surgery and the revision procedure postdated the primary procedure. AJRR collects a discrete laterality data element. Since ICD-9 does not identify laterality, but ICD-10 does, when laterality was in question, it was cross- referenced with AJRR data as well as the modifiers LT and RT from CPT codes as provided in AJRR and the CMS data.

For ICD-9 codes, the assumption was made that a revision code postdating a primary procedure was a "linked" revision, which was later validated in the AJRR database. ICD-10 coding allows for (but does not require) both removal and replacement codes but has the advantage of including laterality. The same postdating assumptions were made with either acceptable single codes for revision or with the dual code permutations. In short, appropriate laterality was used to identify revision and primary procedures when ICD-10 coding was used and, when ICD-9 was used, subsequent revisions were linked to previous primary procedures with laterality verified at a later step.

Patients were tracked for the data set of 2012-2023. Their follow-up was from time of procedure until December 31, 2022, and the primary time-scale was "months to revision." Patients were tracked for potential outcomes (e.g., death, dislocation, and instability) from the procedure date until December 31, 2022. Patients were right censored if they did not have the outcome of interest. Death was identified from the National Death Index (2012-2016), AJRR data (collected as an optional discrete data element, 2012-2023), or CMS data (2012-2023).

Primary procedures were counted as failed and the survivorship recorded if revision was identified or found within either the AJRR or Medicare dataset. Failure of the primary arthroplasty was the outcome, unless specified otherwise.

The CMS Research Data Assistance Center (ResDAC) data team provided AJRR with a unique identifier that matches an AJRR case record to a CMS claim file. Observations from ICD-9 codes were excluded where patients were noted to have mismatched laterality for primary and revision, or revisions without a previous record of a primary in the AJRR database. When laterality remained unknown after these methods, the primary and revision procedures were not "linked" and were subsequently removed from analyses. A merged AJRR and CMS dataset was used for all survivorship analyses unless otherwise specified.

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When citing this publication, please use:
American Joint Replacement Registry (AJRR): 2024 Annual Report. Rosemont, IL: American Academy of Orthopaedic Surgeons (AAOS), 2024

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We'd like to thank our colleagues at Mayo for our work towards the P-30 Grant. We've enjoyed collaborating on AJRR-based research analytics and are so thankful for the opportunity to learn from subject matter experts in the arthroplasty field. We continue to look forward to growing our project potential and portfolio together.

AAOS would also like to acknowledge the valuable statistical and analytical contributions from Dirk R. Larson, MS, Isabella Zaniletti, PhD, and Susan M. Odum, PhD.

Published by:

American Academy of Orthopaedic Surgeons (AAOS)
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Rosemont, IL 60018
Phone: (847) 292-0530
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At the time of publication, every effort was made to ensure the information contained in this report was accurate. The document is available for download at www.aaos.org/ajrr.

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