

American Joint Replacement Registry: Introduction and Highlights

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Our Speakers Today

- **James A. Browne, MD, FAAOS**
 - AJRR Publications Subcommittee Chair
 - AJRR Steering Committee Member
 - AJRR Annual Report Editor
- **Antonia F. Chen, MD, MBA, FAAOS**
 - AJRR Steering Committee Member
 - AJRR Research Projects Subcommittee Member
 - AJRR Publications Subcommittee Member

Disclosures: James A. Browne, MD, FAAOS

No financial conflicts of interest relevant to this presentation

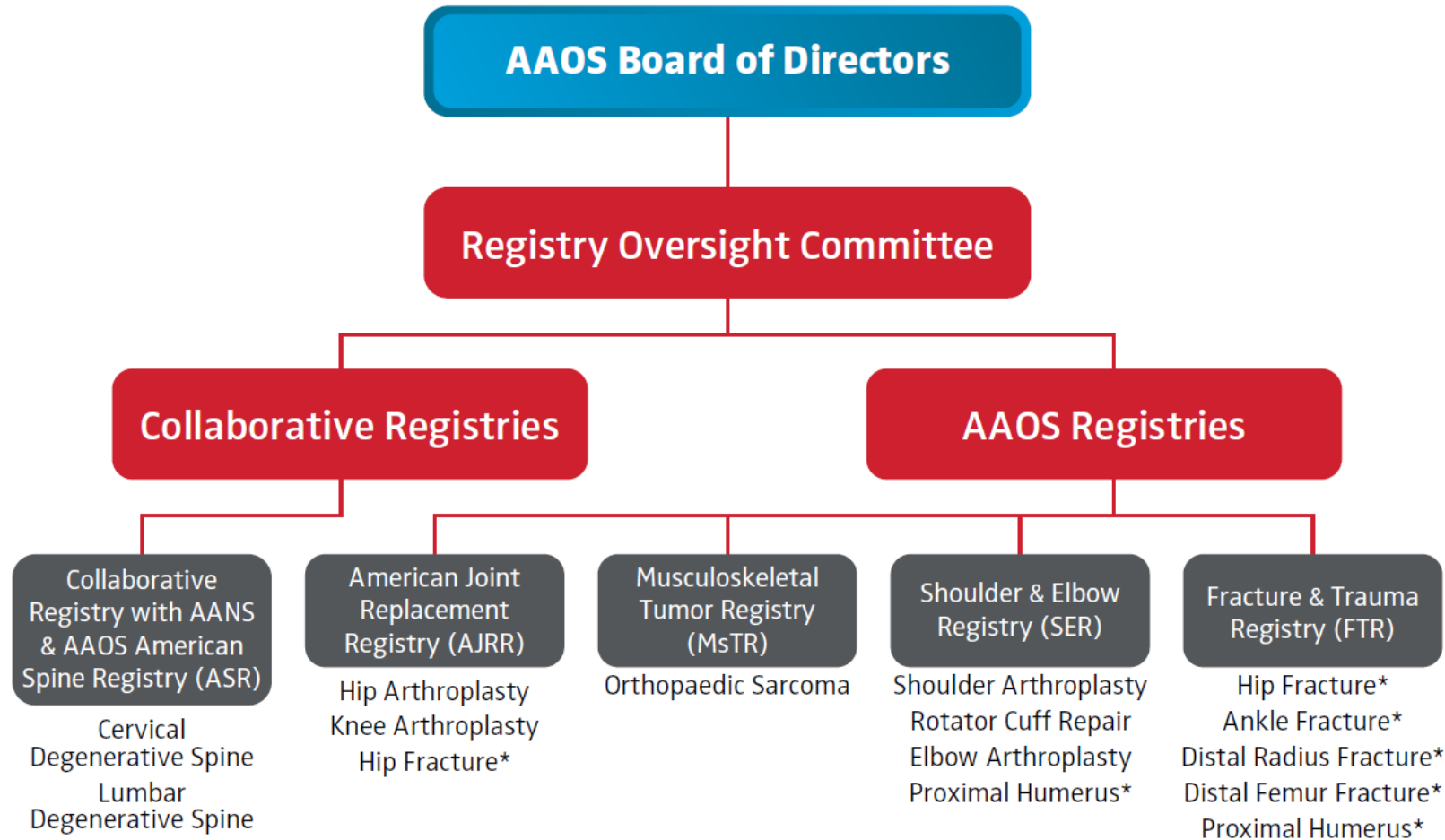
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- Journal of Arthroplasty: Editorial or governing board; Publishing royalties, financial or material support
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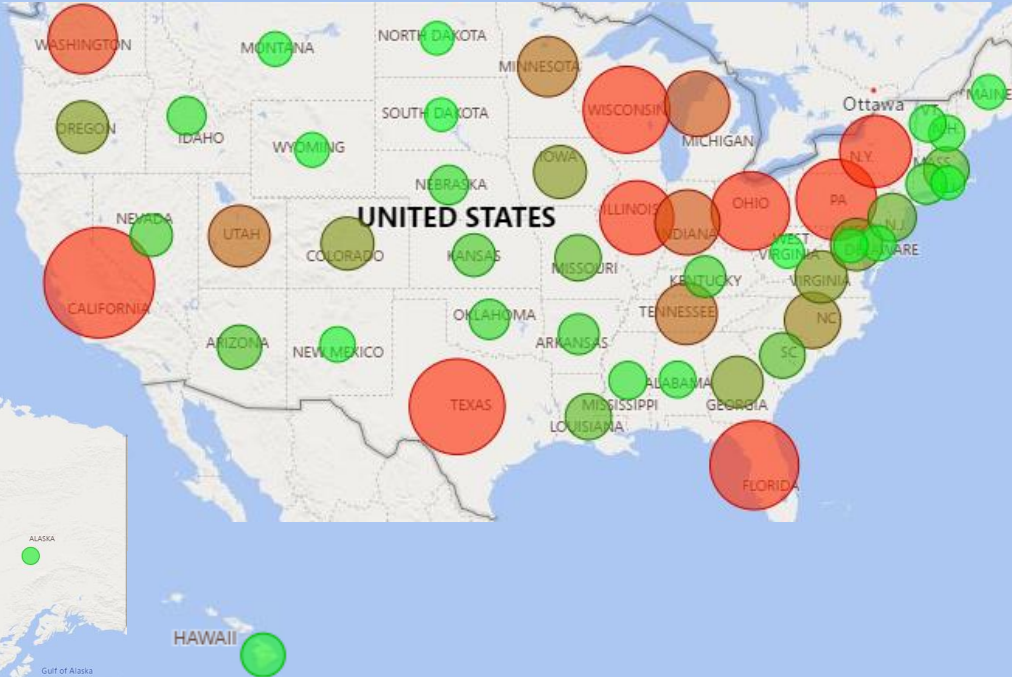
AAOS Family of Registries



**Modules in development*

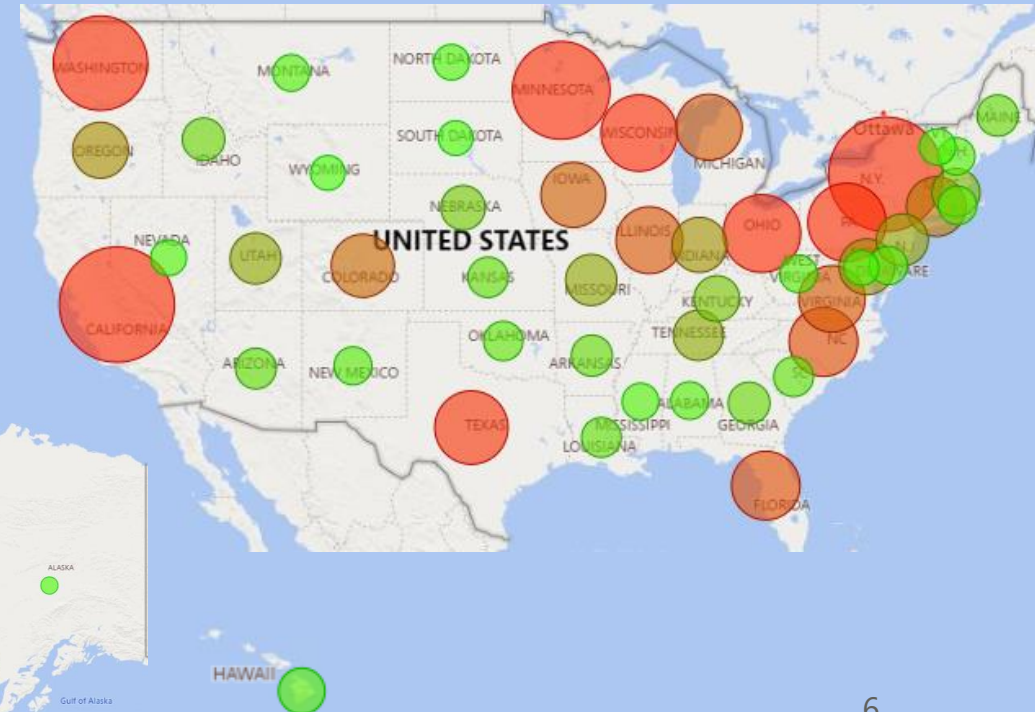
Participation Across the Registries

Sites by State



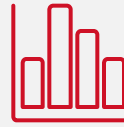
Over 1,600 participating sites contracted and 13,500 registered surgeons across all 50 states.

Procedures by State



Data representing over 2,600,000 procedures capturing an estimated 40% of all US TJA volume annually.

Why Do Sites Participate?



Compare your practice to **national performance benchmarks**



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



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



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



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



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



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

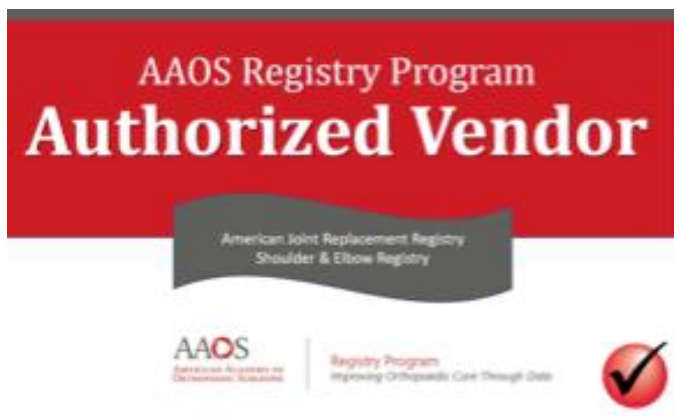


Improve the **value of care** delivered to Patients

Data Reuse Opportunities

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

- AAOS RegistryInsights® Platform Standard Reports and personalized dashboards
- AAOS RegistryInsights National Benchmarks
- Accreditation Association for Ambulatory Health Care (AAAHC) Advanced Orthopaedic Certification
- Aetna Institutes of Quality (IOQ) Orthopaedic Surgery
- American Board of Neurological Surgery (ABNS) Continuous Certification (CC)
- American Board of Orthopaedic Surgeons (ABOS) Maintenance of Certification (MOC) Program
- BlueCross BlueShield Blue Distinction Specialty Care
- Blue Shield of California waiver of prior authorization
- Bree Collaborative
- CMS Merit-based Incentive Payment System (MIPS) Promoting Interoperability (PI) and Quality Payment Program (QPP)
- Centers for Medicare & Medicaid Services (CMS) Bundled Payments for Care Improvement Advanced (BPCI-A)
- CMS Comprehensive Care for Joint Replacement (CJR) Model
- Cigna Surgical Treatment Support Program
- DNV GL Orthopaedic Center of Excellence
- The Alliance QualityPath
- The Joint Commission Advanced for Total Hip & Knee Replacement Certification
- The Joint Commission Advanced Certification in Spine Surgery (ACSS)



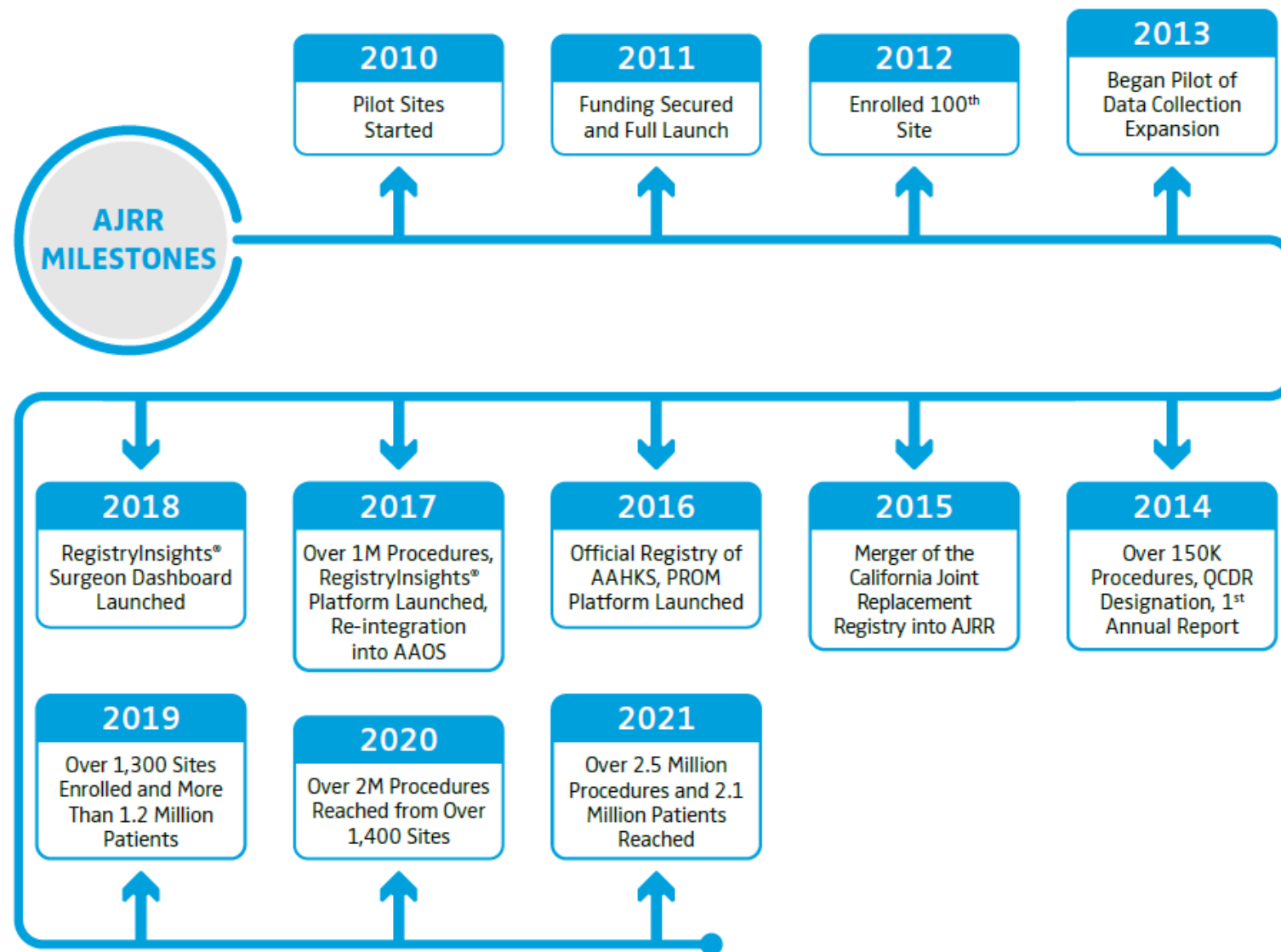
Decrease Data Collection Burden

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

American Joint Replacement Registry



About AJRR



AJRR Steering Committee

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University of Arkansas

AJRR Data Element Overview

Two Modules: Hip Arthroplasty & Knee Arthroplasty

Procedure

Patient

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

Site of Service

- Name and Address (TIN, NPI)

Surgeon

- Name (NPI)
- Trainee

Procedure

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

Comorbidities and Complications

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

Patient-reported Outcomes

Recommended:

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

Also Accepted:

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

Integration of Medicare Data

- Access to **Medicare claims** linked by full identifiers for longitudinal tracking
- Follow outcomes of AJRR patients occurring at non-AJRR participating institutions
- 2012-2020 Medicare data for all patients represented in Registry
 - Inpatient claims (148 data elements)
 - Outpatient claims (122 data elements)
 - National Death Index

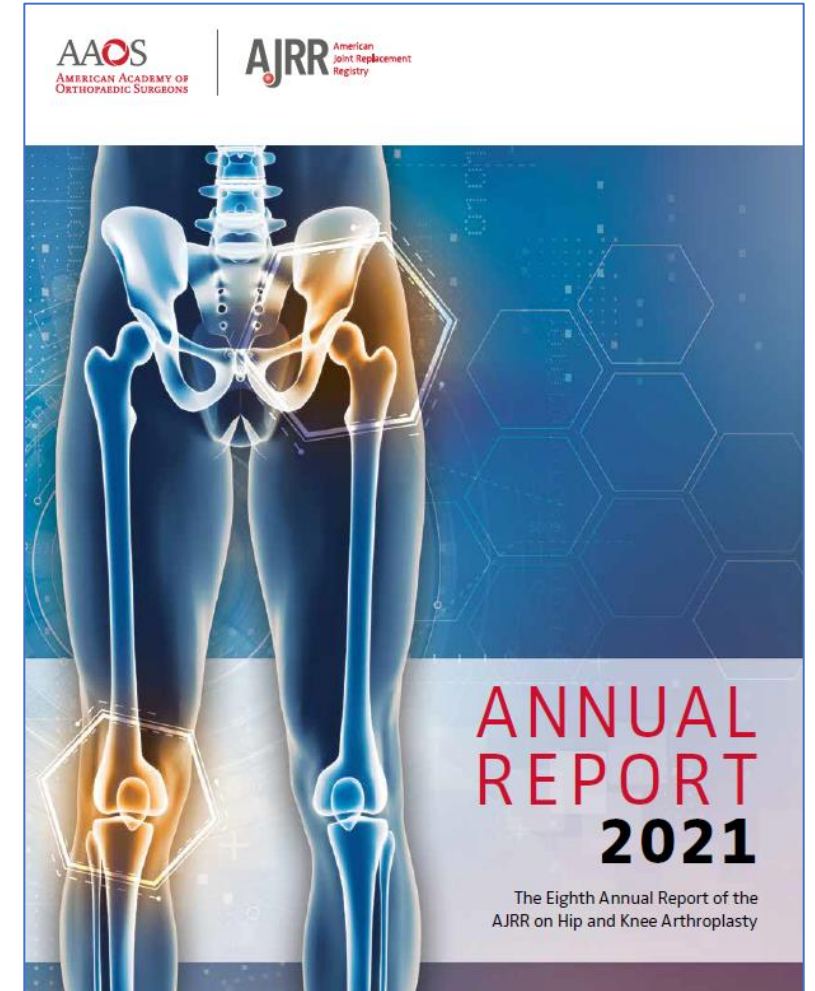


2020 AJRR Annual Report

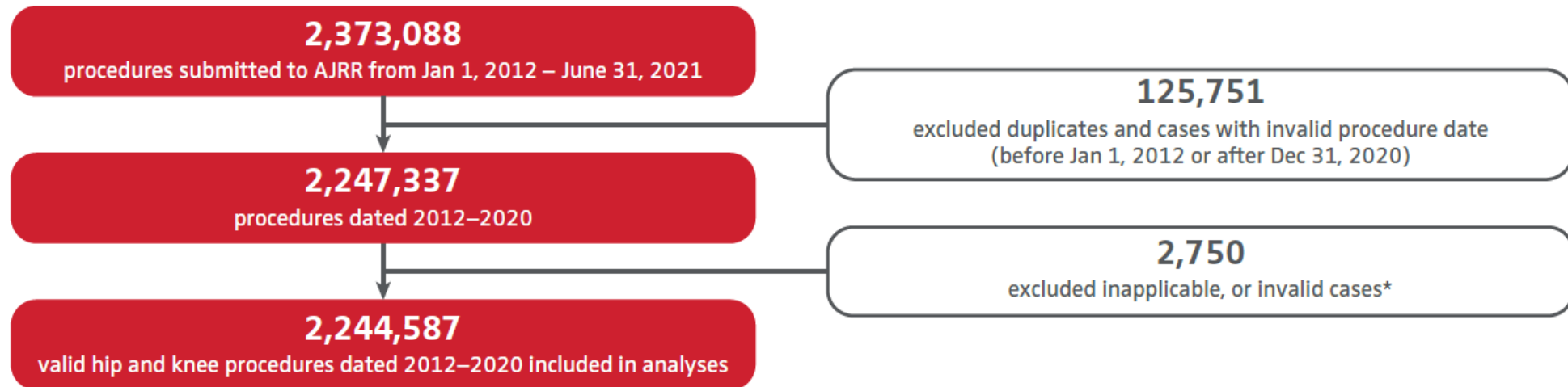
- Summary Statistics
 - Procedure, institution, and patient distributions
- Data Completeness
- Hip Arthroplasty
- Knee Arthroplasty
- Revision Procedures
- Implant Utilization and Survivorship
- Patient Reported Outcome Measures (PROMs)

Download the 2020 Annual Report and

2019 Annual Report Supplement: www.aaos.org/registries/publications



AJRR Annual Report Overview



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

AJRR Data Completeness

Table 1.1 Completeness of AJRR Data Elements, 2012-2020

Specifications Period	Element	% Reported	% NR	% Invalid	1-Year % Reported (% Change)
AJRR Data 2012 - 2021Q2 (N=2,323,697) (1-Year N=407,722)					
All Versions	Surgeon Information	99.87	0	0.13	99.92 (+0.05)
	Principal Procedure Code	99.78	0	0.22	100 (+0.22)
	Principal Diagnosis Code	93.38	0	6.62	99.41 (+6.03)
	First Implant Catalog # Listed	95.3	0	4.7	86.8 (-8.5)
	First Implant Lot # Listed	93.15	0	6.85	87.12 (-6.03)
	Incision Start Time (Procedure Start Time)	68.33	30.24	1.43	88.41 (+20.08)
	Skin Closure Time (Procedure End Time)	68.25	30.39	1.36	89.32 (+21.07)
	Ethnicity	82.08	17.12	0.8	88.32 (+6.24)
	Race	84.33	14.83	0.84	90.62 (+6.29)
	Date of Birth	100	0	0	100 (+0)
	Gender	99.6	0.4	0	98.08 (-1.52)
	City	92.7	7.3	0	98.68 (+5.98)
	State	94.5	5.5	0	99.97 (+5.47)
Zip Code	94.38	0	5.62	99.94 (+5.56)	

AJRR Data Completeness

Table 1.1 Completeness of AJRR Data Elements, 2012-2020

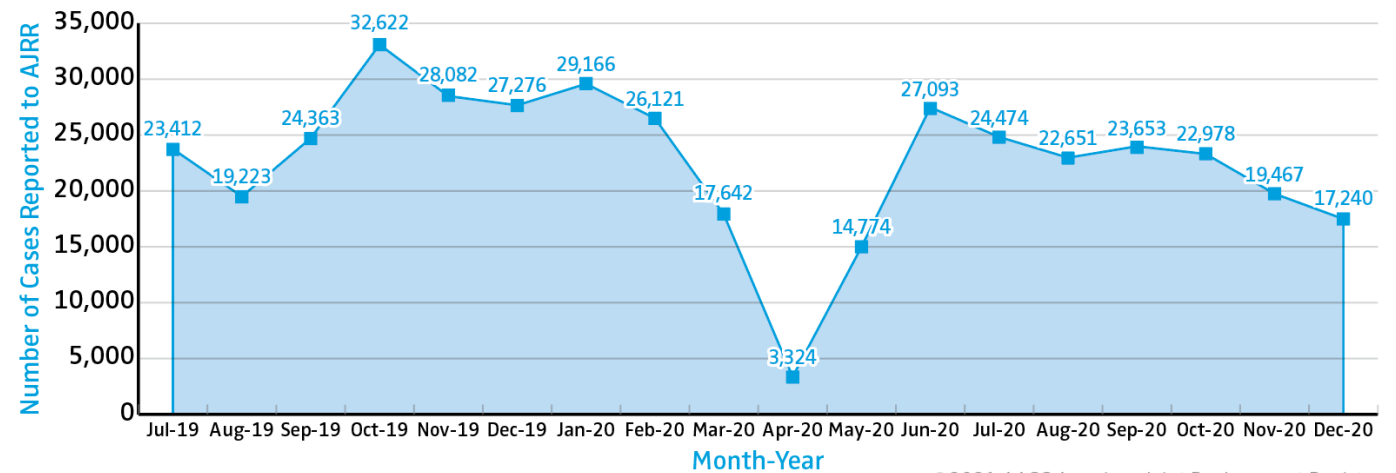
Specifications Period	Element	% Reported	% NR	% Invalid	1-Year % Reported (% Change)
AJRR Data 2012 - 2021Q2 Using Updated Specifications (N=1,149,951) (1-Year N=407,722)					
Late 2017-2021 Versions	Comorbidity - at least one code reported	73.56	25.24	1.2	68.01 (-5.55)
	Body Mass Index (BMI)	86.98	12.66	0.36	87.46 (+0.48)
	Discharge Disposition Code	92.6	6.18	1.23	91.46 (-1.14)
	Admission Date	98.03	1.97	0	96.54 (-1.49)
	Discharge Date	98.05	1.95	0	96.56 (-1.49)
	Length Of Stay	98.01	1.99	0	96.52 (-1.49)
	Surgical Approach (Hip/Knee)	14.21	79.8	5.99	17.43 (+3.22)
	Computer Navigation	34.24	64.86	0.9	24.4 (-9.84)
	Robotic Assisted	40.1	59.76	0.14	34.33 (-5.77)
	Anesthesia Type	65.17	27.47	7.36	67.95 (+2.78)
	Periarticular Injection	18.81	80.82	0.37	21.59 (+2.78)
	ASA Classification	23.62	75.88	0.5	26.2 (+2.58)
AJRR Data 2012 - 2021Q2 Using 2020 or Newer Specifications (N=122,691) (1-Year N=110,058)					
2020 - 2021 Versions	Tourniquet Use (N=68,968)*	37.15	62.82	0.03	33.67 (-3.48)
	Trainee	7.01	92.82	0.17	7.5 (+0.49)
	Payer Status	36.95	62.68	0.38	33.88 (-3.07)

*Knee procedures only

COVID-19 Procedural Impact Summary

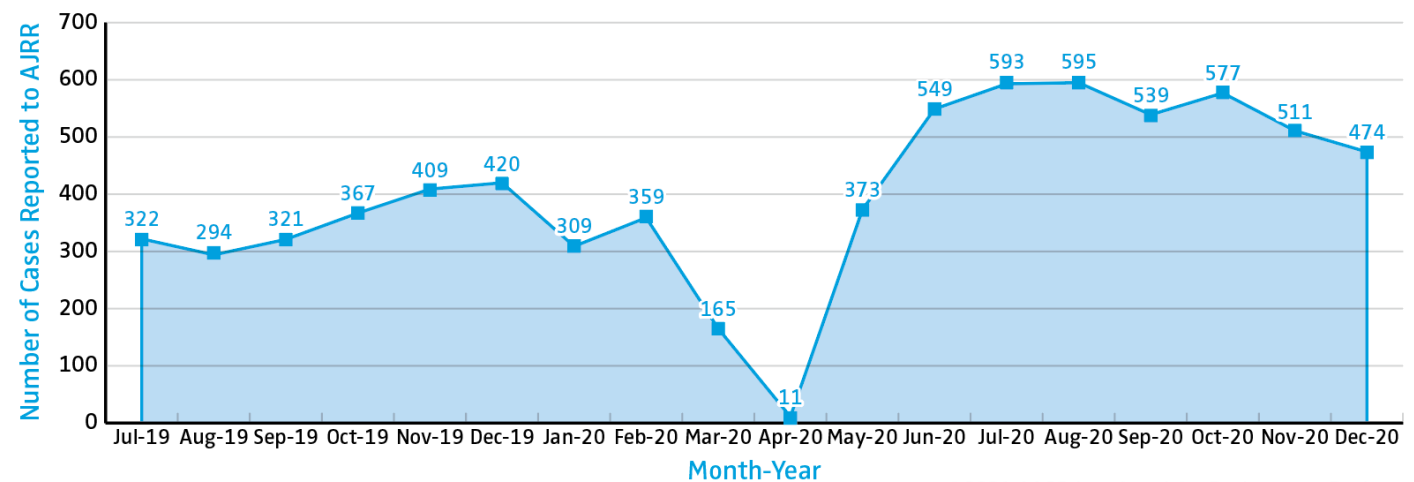
- Procedural case volume for hospitals and ASCs during the height of the COVID-19 pandemic
- Despite the pandemic, overall cumulative procedural volume reported to AJRR increased 18.3% compared to the 2020 report.

Figure 1.1 Hospital Case Volume by Month, Jul 2019-Dec 2020



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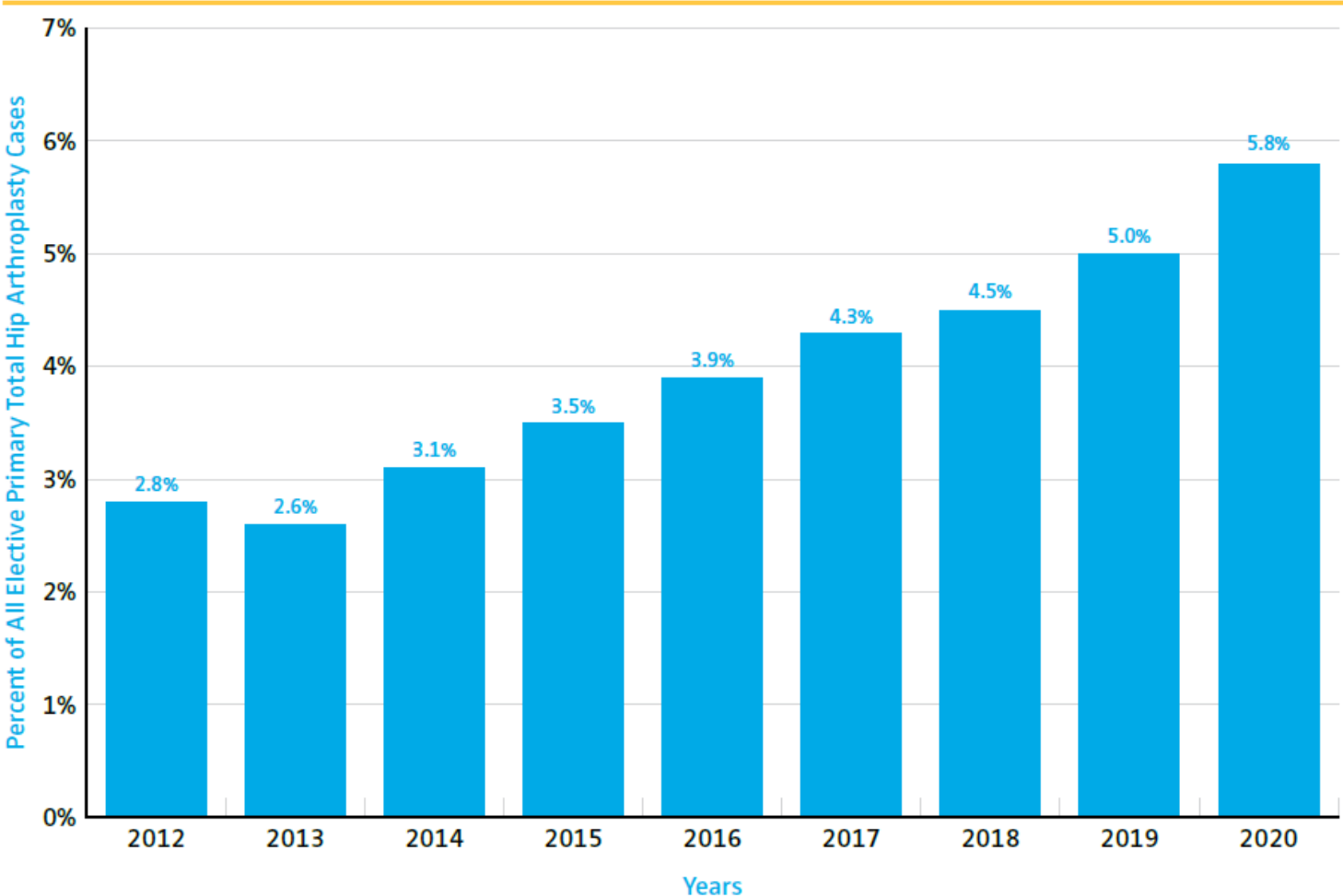
Figure 1.2 Ambulatory Surgical Center Case Volume by Month, Jul 2019-Dec 2020



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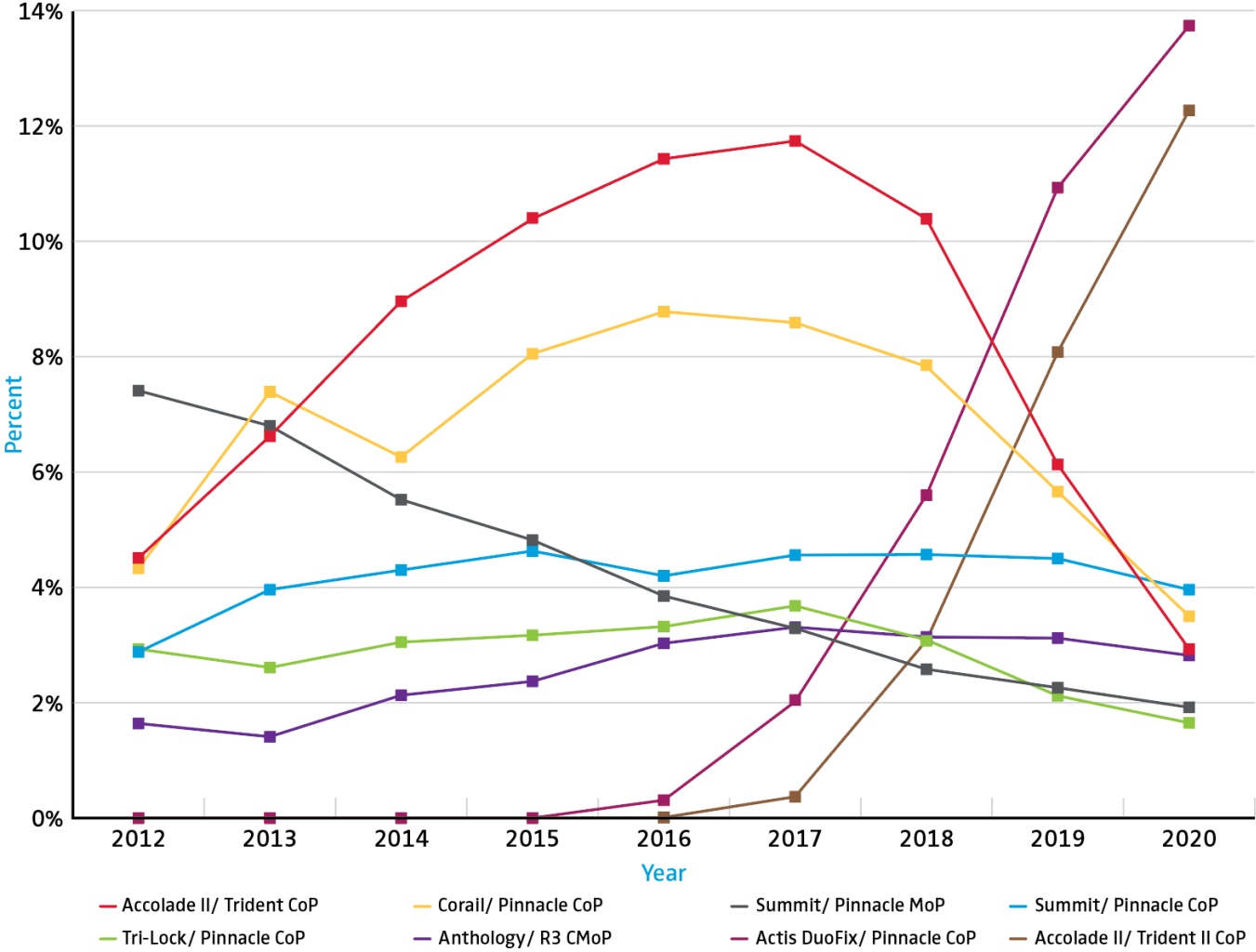
Procedural Trends

Figure 2.25 Cemented Femoral Stem Fixation in Elective Primary THA Procedures, 2012-2020 (N=597,511)



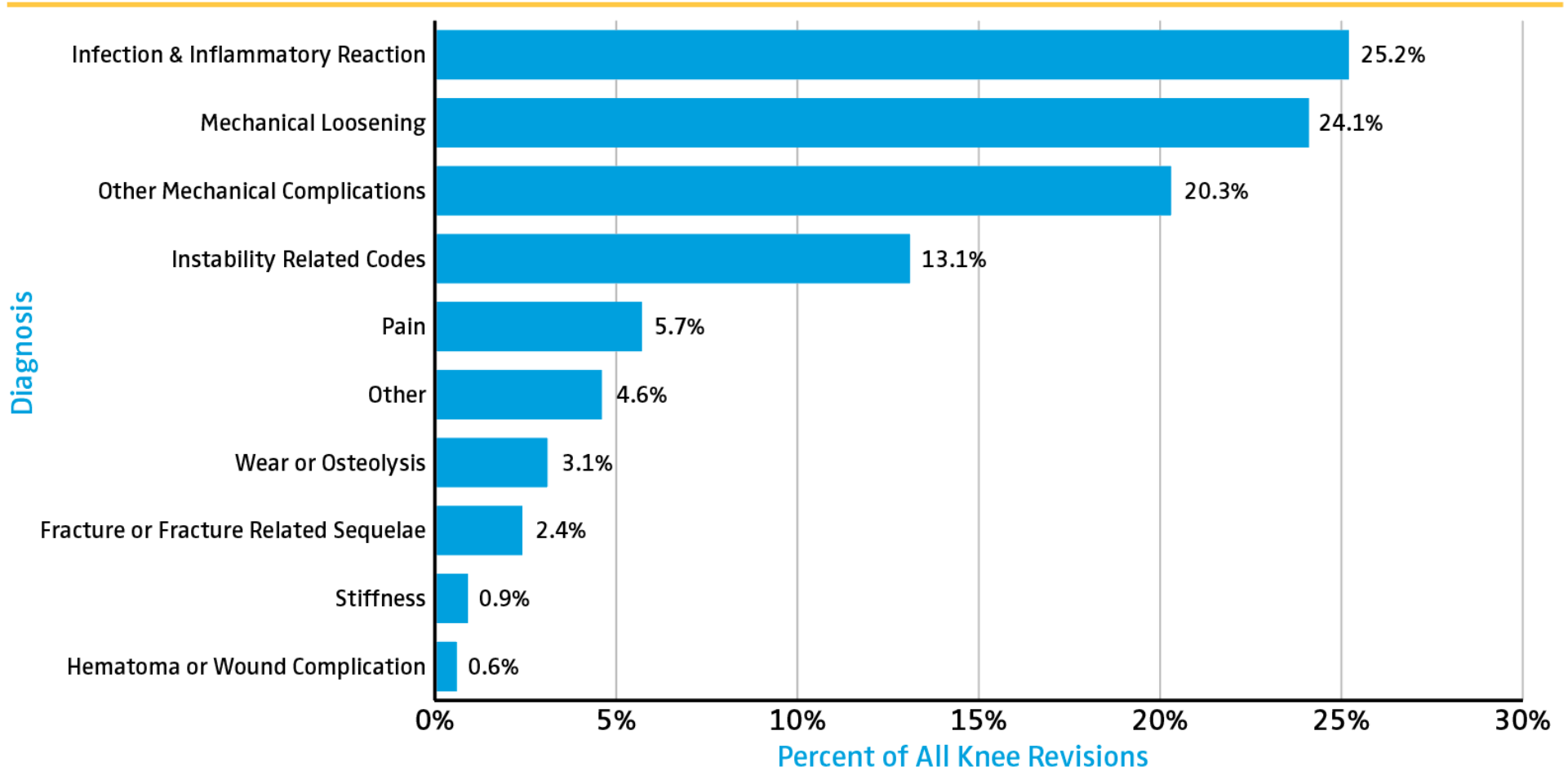
Implant Utilization

Figure 2.33 Elective Primary Total Hip Arthroplasty Stem/Shell Component Combinations by Year, 2012-2020 (N=594,575)



Revision Procedures

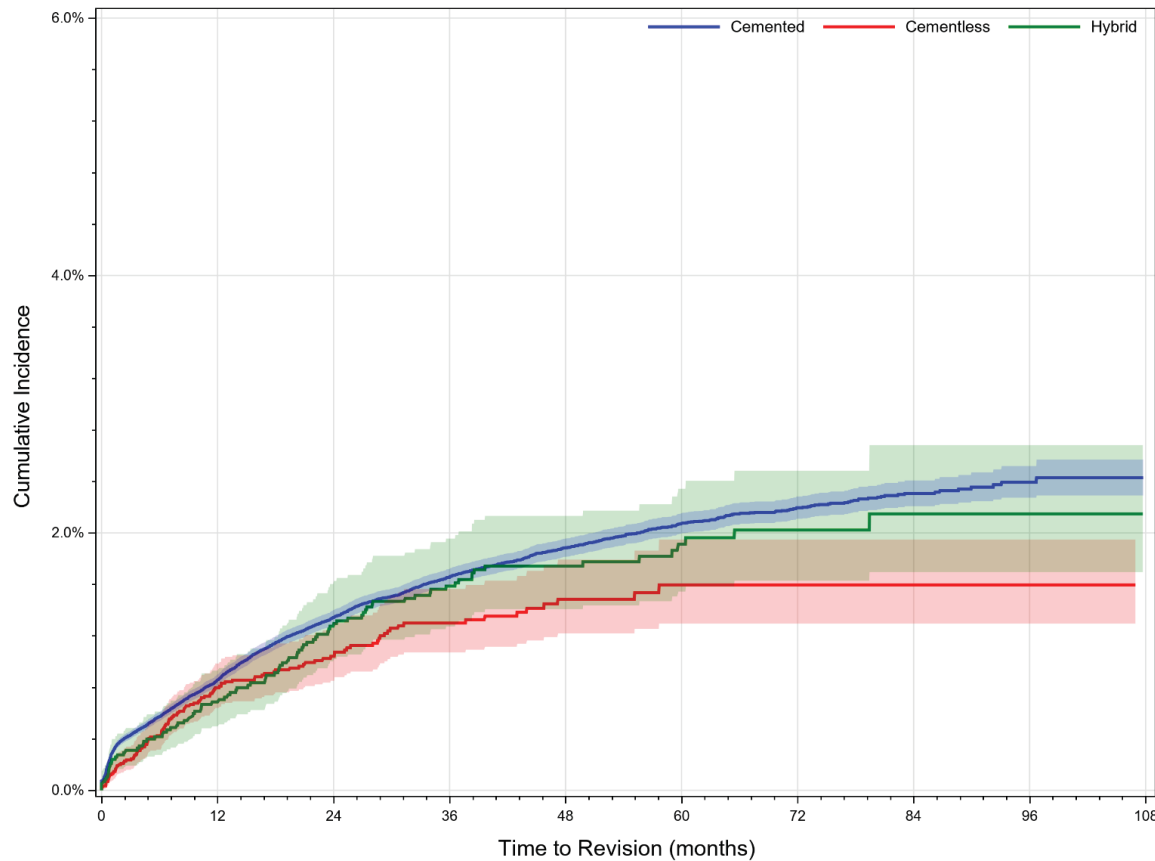
Figure 3.28 Distribution of Diagnosis Associated with All Knee Revisions, 2012-2020 (N=77,520)



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Cumulative Percent Revision

Figure 3.12: Cumulative Percent Revision for Cemented Versus Cementless Fixation for a Primary Total Knee Arthroplasty for Male Patients ≥65 Years of Age Diagnosed with Primary Osteoarthritis, 2012-2020



Number at Risk (Months)	0-12	13-24	25-36	37-48	49-60	61-72	73-84	85-96	97-108	Total
Cemented	19,936	25,732	28,529	32,376	27,735	19,904	13,511	7,713	2,921	178,357
Cementless	3,118	2,579	1,986	1,384	1,253	769	372	144	49	11,654
Hybrid	455	712	767	962	984	761	670	376	127	5,814
Total	23,509	29,023	31,282	34,722	29,972	21,434	14,553	8,233	3,097	195,825

Age Adjusted Hazard Ratio (95% CI)
 Cementless vs. Cemented: 0.755 (0.631, 0.905) $p=0.0023$
 Hybrid vs. Cemented: 0.912 (0.745, 1.118) $p=0.3764$

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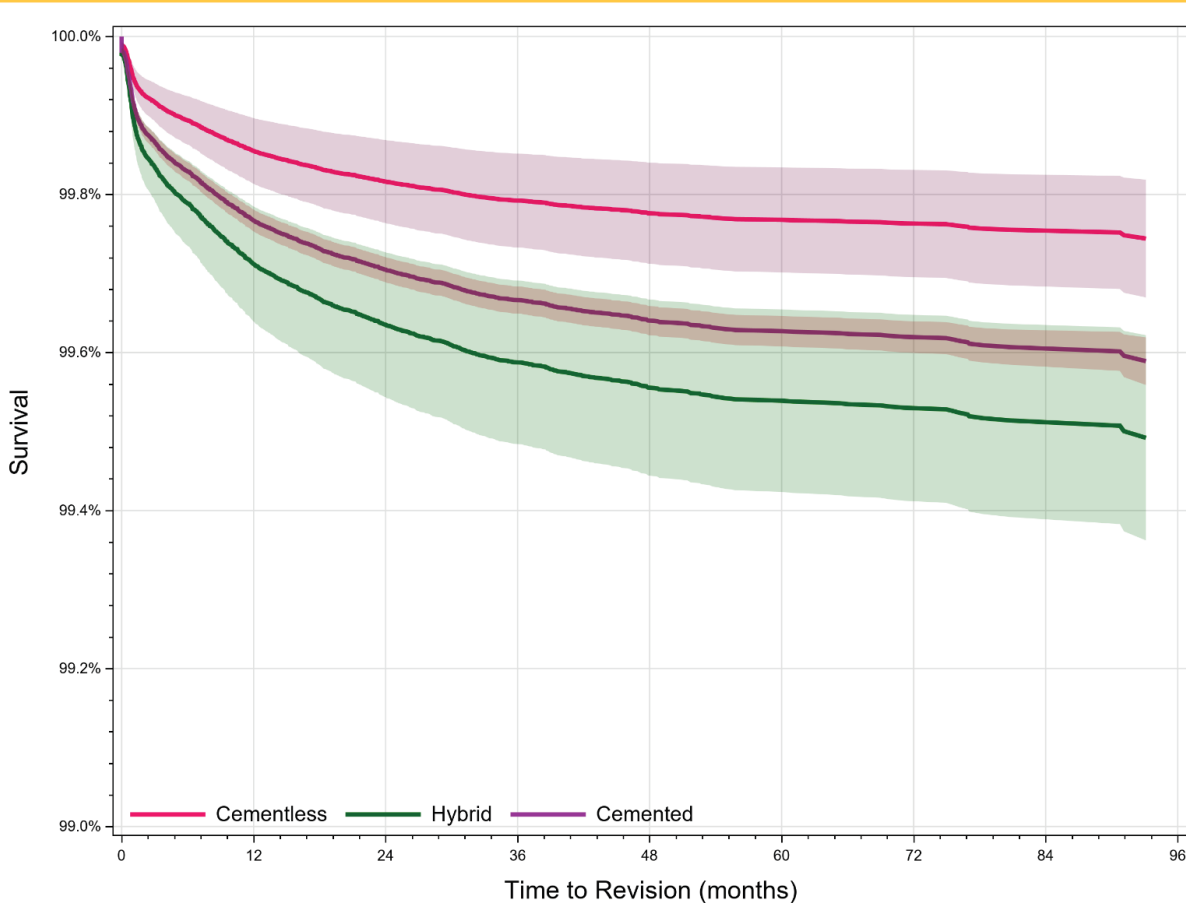
Device-Specific Cumulative Revision

Table 2.5 Cumulative Percent Revision of Cementless Acetabular Components in Hip Arthroplasty Constructs, 2012-2019

Acetabular Shell	N Total	N Revised	1 Yr	3 Yrs	5 Yrs	7 Yrs
Pinnacle	84,033	1,044	0.95 (0.89, 1.02)	1.30 (1.22, 1.39)	1.55 (1.45, 1.66)	1.72 (1.56, 1.90)
Trident	51,036	1,062	1.48 (1.37, 1.58)	2.09 (1.96, 2.23)	2.45 (2.30, 2.62)	2.88 (2.60, 3.17)
R3	24,887	464	1.54 (1.39, 1.70)	2.00 (1.82, 2.19)	2.20 (1.99, 2.43)	2.41 (2.10, 2.75)
G7	23,353	335	1.31 (1.17, 1.47)	1.63 (1.46, 1.82)	1.76 (1.54, 2.00)	—
Continuum	21,696	502	1.78 (1.61, 1.97)	2.33 (2.13, 2.55)	2.65 (2.41, 2.90)	2.87 (2.57, 3.19)
Trident II	8,998	101	1.29 (1.05, 1.57)	1.36 (1.10, 1.67)	—	—
Trilogy	7,379	174	1.49 (1.23, 1.79)	2.05 (1.74, 2.41)	2.69 (2.29, 3.14)	3.17 (2.61, 3.82)
Trabecular Metal	4,456	106	1.82 (1.45, 2.24)	2.19 (1.78, 2.66)	2.74 (2.22, 3.36)	3.36 (2.44, 4.52)
FMP	2,937	31	0.91 (0.61, 1.31)	1.14 (0.78, 1.63)	1.45 (0.85, 2.34)	—
Restoration ADM	2,702	48	1.35 (0.96, 1.84)	1.80 (1.34, 2.38)	1.96 (1.45, 2.58)	1.96 (1.45, 2.58)
Mallory Head	1,873	21	0.75 (0.43, 1.24)	1.14 (0.72, 1.74)	1.26 (0.79, 1.90)	1.26 (0.79, 1.90)
RingLoc+	1,617	35	1.49 (0.99, 2.18)	1.95 (1.35, 2.72)	2.17 (1.53, 2.99)	2.51 (1.66, 3.62)
Novation	1,538	27	1.46 (0.95, 2.17)	2.16 (1.39, 3.21)	2.16 (1.39, 3.21)	2.16 (1.39, 3.21)
Dynasty BioFoam	1,434	40	1.98 (1.35, 2.81)	2.69 (1.92, 3.67)	3.11 (2.23, 4.23)	3.52 (2.40, 4.95)
Regenerex RingLoc+	1,251	29	1.62 (1.02, 2.45)	2.16 (1.43, 3.13)	2.90 (1.92, 4.20)	2.90 (1.92, 4.20)
Escalade Acetabular System	1,149	8	0.53 (0.22, 1.10)	0.62 (0.28, 1.24)	0.80 (0.37, 1.55)	—
Trinity	1,010	17	1.44 (0.83, 2.36)	1.94 (1.16, 3.07)	1.94 (1.16, 3.07)	1.94 (1.16, 3.07)
Versafitcup DM	964	19	1.56 (0.91, 2.50)	1.89 (1.16, 2.91)	2.08 (1.28, 3.18)	2.08 (1.28, 3.18)
Interface Acetabular System	826	17	1.34 (0.71, 2.32)	1.91 (1.12, 3.06)	2.57 (1.47, 4.17)	—
Ranawat-Burnstein	841	20	2.03 (1.23, 3.16)	2.35 (1.46, 3.59)	2.70 (1.65, 4.16)	2.70 (1.65, 4.16)

Diagnosis-Specific Survivorship

Figure 3.16 Percent Survival for Revision due to Infection for Elective Primary Total Knee Arthroplasty ≥65 Years of Age Adjusted for Age and Gender, 2012-2020



Age/Gender Adjusted Hazard Ratio (95% CI)
Cementless vs. Cemented: 0.622 (0.465-0.831) $p=0.0013$
Hybrid vs. Cemented: 1.237 (0.957-1.598) $p=0.1037$

Patient Reported Outcome Measures

Table 2.5/3.8: Change Between Preoperative and 1-Year Postoperative PROM Scores After Elective Primary Hip Arthroplasty and Knee Arthroplasty, 2012-2020

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*
HOOS, JR. (Hip disability and Osteoarthritis Outcome Score)	Score	32,929	8,241	25.0%	93.0%
PROMIS-10 (Patient-Reported Outcomes Measurement Information System 10)	Mental T	21,720	5,768	26.6%	39.2%
	Physical T	21,720	5,768	26.6%	75.6%
VR-12 (The Veterans RAND 12 Item Health Survey)	Mental Health Component	13,598	3,737	27.5%	40.9%
	Physical Health Component	13,454	3,743	27.8%	79.5%
KOOS, JR. (Knee disability and Osteoarthritis Outcome Score)	Score	55,016	14,127	25.7%	87.9%
PROMIS-10 (Patient-Reported Outcomes Measurement Information System 10)	Mental T	37,943	10,415	27.5%	33.8%
	Physical T	37,943	10,415	27.5%	67.8%
VR-12 (The Veterans RAND 12 Item Health Survey)	Mental Health Component	20,416	5,574	27.3%	33.7%
	Physical Health Component	20,213	5,581	27.6%	74.8%

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

Recent Publications

- Illgen RL, Lewallen DG, Yep PJ, Mullen KJ, Bozic KJ. Migration Patterns for Revision Total Hip Arthroplasty in the United States as Reported in the American Joint Replacement Registry. Journal of Arthroplasty. 2021; 36(4):1401-1406. <http://dx.doi.org/10.1016/j.arth.2020.10.030>
- Huddleston JI, De A, Jaffri H, Barrington JW, Duwelius PJ, and Springer BD. Cementless Fixation is Associated with Increased Risk of Early and All-Time Revision after Hemiarthroplasty But Not After THA for Femoral Neck Fracture: Results from the American Joint Replacement Registry. Clinical Orthopaedics and Related Research. 2021; 479(10): 2194-2202. <http://dx.doi.org/10.1097/CORR.0000000000001932>
- Porter KR, Illgen RL, Springer BD, Bozic KJ, Sporer SM, Huddleston JI, Lewallen DG, Browne JA. Is American Joint Replacement Registry Data Representative of National Data? A Comparative Analysis. Journal of American Academy of Orthopedic Surgeons. 2021; <http://dx.doi.org/10.5435/JAAOS-D-21-00530>
- Chen AF, Barrington JW, Duwelius PJ, Browne JA, Sporer SM, Gioe TJ, Porter KR, Hsiue PP, Stavrakis AI. Trends of Femoral Neck Fracture Treatment using Total Hip Arthroplasty: Reported from the American Joint Replacement Registry. Journal of American Academy of Orthopedic Surgeons. 2021; <http://dx.doi.org/10.5435/JAAOS-D-21-00132>
- Lawson KA, Chen AF, Springer BD, Illgen RL, Lewallen DG, Huddleston JI, Amanatullah DF. Migration Patterns for revision Total Knee Arthroplasty in the United States as Reported in the American Joint Replacement Registry. Journal of Arthroplasty. 2021; 36(10): 3538-3542. <http://dx.doi.org/10.1016/j.arth.2021.06.005>

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