American Joint Replacement Registry: Introduction and Highlights

www.aaos.org/registries/ajrr
Our Speakers Today

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  o AJRR Steering Committee Member
  o AJRR Annual Report Editor

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  o AJRR Publications Subcommittee Member
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No financial conflicts of interest relevant to this presentation

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AAOS Family of Registries

AAOS Board of Directors

Registry Oversight Committee

Collaborative Registries

- Collaborative Registry with AANS & AAOS American Spine Registry (ASR)
  - Cervical Degenerative Spine
  - Lumbar Degenerative Spine
- American Joint Replacement Registry (AJRR)
  - Hip Arthroplasty
  - Knee Arthroplasty
  - Hip Fracture*

AAOS Registries

- Musculoskeletal Tumor Registry (MsTR)
  - Orthopaedic Sarcoma
- Shoulder & Elbow Registry (SER)
  - Shoulder Arthroplasty
  - Rotator Cuff Repair
  - Elbow Arthroplasty
  - Proximal Humerus*
- Fracture & Trauma Registry (FTR)
  - Hip Fracture*
  - Ankle Fracture*
  - Distal Radius Fracture*
  - Distal Femur Fracture*
  - Proximal Humerus*

*Modules in development
Participation Across the Registries

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

Data representing over 2,600,000 procedures capturing an estimated 40% of all US TJA volume annually.
# Why Do Sites Participate?

<table>
<thead>
<tr>
<th>Facilitate site, practice-specific, payer-incentivized performance improvement programs such as Blue Distinction &amp; Centers of Excellence</th>
<th>Qualify for national distinction programs such as the Joint Commission Advanced Certification &amp; AAAHC</th>
<th>Use for reporting to quality improvement programs such as MIPS, BPCI-A, ABOS MOC &amp; ABNS CC</th>
<th>Early access to surveillance alerts for poorly performing implants</th>
<th>Improve the value of care delivered to Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compare your practice to national performance benchmarks</td>
<td>Access to on-demand practice specific quality reports and dashboards</td>
<td>Facilitate tracking and monitoring of longitudinal patient outcomes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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)
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.
About AJRR

AJRR MILESTONES

- **2010**: Pilot Sites Started
- **2011**: Funding Secured and Full Launch
- **2012**: Enrolled 100th Site
- **2013**: Began Pilot of Data Collection Expansion

**2018**
- RegistryInsights® Surgeon Dashboard Launched

**2017**
- Over 1M Procedures, RegistryInsights® Platform Launched, Re-Integration into AAOS

**2016**
- Official Registry of AAHKS, PROM Platform Launched

**2015**
- Merger of the California Joint Replacement Registry into AJRR

**2014**
- Over 150K Procedures, QCDR Designation, 1st Annual Report

**2019**
- Over 1,300 Sites Enrolled and More Than 1.2 Million Patients

**2020**
- Over 2M Procedures Reached from Over 1,400 Sites

**2021**
- Over 2.5 Million Procedures and 2.1 Million Patients Reached
AJRR Steering Committee

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  NYU Langone Health
- Jeffrey B. Stambough, MD, FAAOS
  University of Arkansas
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)

This page is a summary of the AJRR data elements and is not all inclusive.
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
  o Procedure, institution, and patient distributions
• Data Completeness
• Hip Arthroplasty
• Knee Arthroplasty
• Revision Procedures
• Implant Utilization and Survivorship
• Patient Reported Outcome Measures (PROMs)

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

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

### Table 1.1 Completeness of AJRR Data Elements, 2012-2020

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

*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.
Procedural Trends

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

- Infection & Inflammatory Reaction: 25.2%
- Mechanical Loosening: 24.1%
- Other Mechanical Complications: 20.3%
- Instability Related Codes: 13.1%
- Pain: 5.7%
- Other: 4.6%
- Wear or Osteolysis: 3.1%
- Fracture or Fracture Related Sequelae: 2.4%
- Stiffness: 0.9%
- Hematoma or Wound Complication: 0.6%
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

Age Adjusted Hazard Ratio (95% CI)
- Cementless vs. Cemented: 0.755 (0.612, 0.905) p=0.0023
- Hybrid vs. Cemented: 0.912 (0.749, 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

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

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

Age/Gender Adjusted Hazard Ratios (95% CI)
Cementless vs. Cemented: 0.627 (0.465-0.831) $p=0.0119$
Hybrid vs. Cemented: 1.237 (0.997-1.598) $p=0.1077$

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## 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

<table>
<thead>
<tr>
<th>Patient-Reported Outcome Measure (PROM)</th>
<th>PROM Component</th>
<th>Patients with Preoperative Score</th>
<th>Patients with Linked Postoperative Score</th>
<th>Response Rate, Percentage of Patients Who Completed a Preoperative and 1-Year Score</th>
<th>Patients with Meaningful Improvement*</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOOS, JR. (Hip disability and Osteoarthritis Outcome Score)</td>
<td>Score</td>
<td>32,929</td>
<td>8,241</td>
<td>25.0%</td>
<td>93.0%</td>
</tr>
<tr>
<td>PROMIS-10 (Patient-Reported Outcomes Measurement Information System 10)</td>
<td>Mental T</td>
<td>21,720</td>
<td>5,768</td>
<td>26.6%</td>
<td>39.2%</td>
</tr>
<tr>
<td></td>
<td>Physical T</td>
<td>21,720</td>
<td>5,768</td>
<td>26.6%</td>
<td>75.6%</td>
</tr>
<tr>
<td>VR-12 (The Veterans RAND 12 Item Health Survey)</td>
<td>Mental Health Component</td>
<td>13,598</td>
<td>3,737</td>
<td>27.5%</td>
<td>40.9%</td>
</tr>
<tr>
<td></td>
<td>Physical Health Component</td>
<td>13,454</td>
<td>3,743</td>
<td>27.8%</td>
<td>79.5%</td>
</tr>
<tr>
<td>KDOS, JR. (Knee disability and Osteoarthritis Outcome Score)</td>
<td>Score</td>
<td>55,016</td>
<td>14,127</td>
<td>25.7%</td>
<td>87.9%</td>
</tr>
<tr>
<td>PROMIS-10 (Patient-Reported Outcomes Measurement Information System 10)</td>
<td>Mental T</td>
<td>37,943</td>
<td>10,415</td>
<td>27.5%</td>
<td>33.8%</td>
</tr>
<tr>
<td></td>
<td>Physical T</td>
<td>37,943</td>
<td>10,415</td>
<td>27.5%</td>
<td>67.8%</td>
</tr>
<tr>
<td>VR-12 (The Veterans RAND 12 Item Health Survey)</td>
<td>Mental Health Component</td>
<td>20,416</td>
<td>5,574</td>
<td>27.3%</td>
<td>33.7%</td>
</tr>
<tr>
<td></td>
<td>Physical Health Component</td>
<td>20,213</td>
<td>5,581</td>
<td>27.6%</td>
<td>74.8%</td>
</tr>
</tbody>
</table>

*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.

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Recent Publications


• 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]


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