HealthEast Joint Replacement Registry: 20 Year Report

Foreword

HealthEast Care System began the first community-based joint replacement registry (HJRR) in the U.S. in 1991, with a database that allowed tracking of implant use and failure rates among the 90 orthopaedic surgeons performing arthroplasty surgery in the greater metropolitan area of St. Paul, MN. Initially conceived as part of a process to better manage costs and determine which implants were most cost-efficient, it became apparent that the registry would allow insight into the same process that had proven its value in the Scandinavian joint registries. With the knowledge that a majority of total joint arthroplasties in the U.S. are performed by relatively low-volume community surgeons, the HJRR remains uniquely positioned to reflect contemporary U.S. surgical practices.

The purpose of the HJRR is to maintain and improve the care of individuals undergoing joint replacement surgery by providing timely information to their surgeons and the broader orthopaedic community. With the primary outcome measure of time to revision surgery, combined with analysis of confounding factors and mortality monitoring, the HJRR can provide some realistic measure of the success of a given arthroplasty procedure in our community. In addition, the registry can evaluate the relative effectiveness of different prosthetic designs, identify patient variables that may impact implant survival, and provide the tracking mechanism necessary in the event of implant recalls.

Over the 20 years of its existence, the HJRR has refined its data-gathering, data verification, and data analysis and utilizes a process design that requires no direct surgeon involvement with data input. Volunteer surgeons review each revision chart and operative note to carefully delineate the reason for revision. The HJRR capture process has been validated and more than 94% of the revision surgery is performed within the HJRR. The database is used to generate information of practical use to the surgeon, and has been demonstrated to influence surgeon behavior. Among other examples, HJRR reports on the failure rates associated with unicompartmental knee arthroplasty, hybrid and cementless total knee arthroplasty, and metal-on-metal total hip designs have led to significant declines in their respective use over the periods documented. Similarly, the HJRR allowed for rapid notification of surgeons and expedited patient care during the three significant hip implant recalls of the last decade.

As it moves into the third decade, the HJRR is proud of its influential role in the development of the national American Joint Replacement Registry (AJRR) as one of the earliest participants and pilot hospitals. It will remain an important contributor to the larger national effort, particularly for certain data subsets that may be outside of the scope of the much larger AJRR. The HJRR core workgroup has published widely on its findings in the last two decades, and looks forward to the future as a compelling example of how worthwhile information and advancements in orthopaedic science can be made in the community setting.

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A Historical Look at Joint Registries

1969
Mayo Clinic physician Mark B. Coventry, MD, establishes the first total joint registry

1975
The Swedish Knee Arthroplasty Registry is established

1979
Research begins for the Swedish National Hip Registry.

1987
The Norwegian Arthroplasty Register begins collecting hip replacement data.

1991
The HealthEast Joint Replacement Registry (HJRR) is established.

1998
The Australian National Joint Replacement Registry receives funding, and New Zealand’s National Joint Registry begins a pilot study in Christchurch.

2001
Kaiser Permanente forms the National Total Joint Replacement Registry for its member providers, and the Canadian Institute for Health Information establishes the Canadian Joint Replacement Registry.

2005
The statewide Virginia Joint Registry launches.

2010
The Food and Drug Administration launches the International Consortium of Orthopaedic Registries, including HJRR and other registries from around the globe.

2011
The American Academy of Orthopaedic Surgeons began collecting data in the American Joint Replacement Registry, with HJRR as a participant.
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Kaiser Permanente forms the National Total Joint Replacement Registry for its member providers, and the Canadian Institute for Health Information establishes the Canadian Joint Replacement Registry.

2002
The National Joint Registry of England and Wales is founded.

2004
International Society of Arthroplasty Registries is established.

2005
The statewide Virginia Joint Registry launches.

2009
The Food and Drug Administration launches the International Consortium of Orthopaedic Registries, including HJRR and other registries from around the globe.

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The American Academy of Orthopaedic Surgeons began collecting data in the American Joint Replacement Registry, with HJRR as a participant.
Figure 1: Registry Volumes for Hip Arthroplasty

Figure 2: Registry Volumes for Total Hip Arthroplasty by Construct
Patient Demographics

- As of December 31, 2010 there were 6,164 primary total hip arthroplasties (THA), 2,873 hip hemiarthroplasties, and 489 revision hip arthroplasties captured in the registry.
- Females accounted for 63% of primary cases and 62% of revision cases.
- 22% of primary cases and 27% of revision cases were patients < 60 years old.
- Osteoarthritis was the most common diagnosis among primary THA (90%)
- Aseptic loosening (26%) and dislocation (28%) were the most common reasons for THA revision procedures.
Implant Design

- 2% of primary THA cases were cemented, 37% were hybrid, and 61% were uncemented.
- 28mm was the most common femoral head size for primary THA (51%) and revision THA (52%).
- Metal femoral heads were used the most often for primary THA cases (85%).
There was no difference in the survival of THA by sex with males having a survival probability of 88% and females having a survival probability of 87%.

*Note: The shaded areas on the implant survival curves represent the 95% confidence intervals on this and all subsequent survival curves.
Figure 8: THA Survival by Age
There was a significant difference in the survival of THA by age. Patients < 55 had a lower survival probability (77%) than patients ≥ 55 (90%).

Figure 9: THA Survival by Head Size
There was no difference in the survival of THA by head size with ≤ 28 mm head sizes having a survival probability of 88% and ≥ 32 mm head sizes having a survival probability of 94%.
**Figure 10: THA Survival by Fixation Technique**

There is no difference in the survival of THA by fixation technique with cemented THAs having a survival probability of 91%, hybrid THAs having a survival probability of 89% and uncemented THAs having a survival probability of 85%.

![Graph showing survival probabilities by fixation technique](image)

Log Rank p-value = 0.98

**Figure 11: THA Survival by Design Type**

There is no difference in the survival of THA by design type with ceramic on ceramic THAs having a survival probability of 96%, ceramic on poly THAs having a survival probability of 97%, hybrid metal on poly THAs having a survival probability of 89%, ingrowth metal of poly THAs having a survival probability of 87%, and metal on metal THAs having a survival probability of 95%.

![Graph showing survival probabilities by design type](image)

Log Rank p-value = 0.34
Figure 12: Registry Volumes for Knee Arthroplasty

Figure 13: Registry Volumes for Total Knee Arthroplasty by Construct
Patient Demographics

- As of December 31, 2010 there were 12,537 primary total knee arthroplasty procedures, 1,104 unicompartmental knee arthroplasty procedures, and 544 revision procedures captured in the registry.
- Females accounted for 63% of primary knee procedures and 54% of revision procedures.
- Patients < 60 account for 25% of the primary and 24% of the revision knee procedures.
- Osteoarthritis was the most common diagnosis (98%) for primary TKA procedures.
- Aseptic loosening (24%) and wear/osteolysis (19%) are the most common reasons for TKA revision procedures.
Implant Design

- 90% of all primary procedures were cemented, 1% were uncemented, and 9% were hybrid.
- A fixed bearing surface (90%) was used more often than a mobile bearing surface (10%).
There was a significant difference in the survival of TKA by sex. Male patients had a lower survival probability (90%) than female patients (94%).
Figure 19: TKA Survival by Age
There was a significant difference in the survival of TKA by age. Patients < 55 had a lower survival probability (85%) than patients ≥ 55 (93%).

![Graph showing survival probability by age](image)

Log Rank p-value < 0.0001

Figure 20: TKA Survival by Design Type
There was a significant difference in the survival of TKA by design type. Cemented knee with all-poly tibia had the highest survival probability (99%) followed by cemented knees with metal-backed tibia (94%), hybrid knees (88%) and ingrowth knees (84%).

![Graph showing survival probability by design type](image)

Log Rank p-value < 0.0001
Figure 21: UKA Survival
The survival probability for unicompartmental knee arthroplasty was 81%.

![Graph showing UKA survival probability over time with survival time on the x-axis and survival probability on the y-axis.]

Log Rank p-value = 0.75

Figure 22: TKA Survival by Bearing Surface
There was no difference in the survival of TKA by bearing surface with fixed bearing TKAs having a survival probability of 93% and mobile bearing TKAs having a survival probability of 97%.

![Graph showing TKA survival probability by bearing surface with survival time on the x-axis and survival probability on the y-axis. Two lines represent mobile and fixed bearing TKAs, with a log rank p-value of 0.75.]

Log Rank p-value = 0.75
Figure 23: TKA Survival by Cruciate Status

There was no difference in the survival of TKA by cruciate status with posterior stabilized TKAs having a survival probability of 96% and cruciate retaining TKAs having a survival probability of 94%.
**Most Recent**


Routine patellar resurfacing performed at the time of knee arthroplasty is controversial, with some evidence of utility in both TKA (tricompartmental) and bicompartamental knee arthroplasty. However, whether one approach results in better implant survival remains unclear. We asked whether (1) routine patellar resurfacing in TKAs resulted in lower cumulative revision rates compared to bicompartamental knee arthroplasties, (2) patella-friendly implants resulted in lower cumulative revision rates than earlier designs, and (3) bicompartamental knee arthroplasties revised to TKAs had higher cumulative revision rates than primary TKAs. We compared registry data for 9530 cemented, all-polyethylene patella TKAs and 627 bicompartamental knee arthroplasties without patellar resurfacing. TKAs had a lower cumulative revision rate for patella-only revision than bicompartamental knee arthroplasties (0.8% versus 4.8%). Adjusting for age, bicompartamental knee arthroplasties were 6.9 times more likely to undergo patellar revision than TKAs. Bicompartamental knee arthroplasties had higher revision rates than TKAs. Femoral component design did not influence the cumulative revision rate. Secondary patella resurfacing in a bicompartamental knee arthroplasty carried an increased revision risk compared to resurfacing at the time of index TKA. To reduce the probability of reoperation for patellofemoral problems, our data suggest the patella should be resurfaced at the time of index surgery.

**Registry Methodology**


This article provides an excellent overview of registry history, development accomplishments and goals. The authors review the structure of the registry and the process for entering data. Comparisons with other well known registries, such as Mayo Clinic and the Swedish Knee Arthroplasty Register are discussed and limitations are reviewed.

**Cost Analysis**


Numerous joint implant options of varying cost are available to the surgeon, but it is unclear whether more costly implants add value in terms of function or longevity. We evaluated registry survival of higher-cost “premium” knee and hip components compared to lower-priced standard components. We compared 3462 standard TKAs to 2806 premium TKAs and 868 standard THAs to 1311 premium THAs using standard statistical methods. The cost of the premium implants was on average approximately $1000 higher than the standard implants. There was no difference in the cumulative revision rate at 7-8 years between premium and standard TKAs or THAs. In this time frame, premium implants did not demonstrate better survival than standard implants. Revision indications for TKA did not differ, and infection and instability remained contributors. Longer follow-up is necessary to demonstrate whether premium implants add value in younger patient groups.


In this study, analysis of an all-polyethylene tibial component in total knee replacements revealed a survival rate of 99.5%. We estimate a cost savings for this group (compared with the group that had a metal-backed tibial component) at about $724 per patient (in 2004 dollars). If all patients over the age of seventy-five with a total knee replacement in our registry had received an all-polyethylene tibial component, the estimated cost savings for twelve years would have been just over $900,000.
Publications:


Conference Proceedings:


24. Gioe, T. J., Daly, P., Killeen, K., Huang, Z., & Mele, S. *Early Acetabular Component Failures in a Community-Based Total Hip Implant Registry*. In American Association of Hip and Knee Surgeons 1999 Annual Meeting, Dallas, TX: 1999 (Scientific Exhibit)


