Arthroplasty Registries: Improving Clinical and Economic Outcomes

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Abstract

With renewed focus on achieving value for patients in total hip and knee arthroplasty, payors, hospitals, and physicians strive to provide quality care while minimizing cost. Large registry datasets have gained popularity in the United States to track implant survivorship and outcomes after joint replacement. Partnerships among surgeons, insurers, and health systems have improved on earlier administrative datasets from Medicare to measure quality and outcomes. Participation in state and national registries can help surgeons and hospitals gain a financial advantage in several insurers' quality programs and alternative payment models. Although large dataset analysis has its limitations, all health care stakeholders will become increasingly dependent on arthroplasty registries to improve quality and control costs.

Keywords
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► outcomes

It has been clear for some time that registries, although imperfect, provide insights into quality and help measure and track outcomes. International total hip and knee implant registries are supported by national health care initiatives and have been used effectively to track implant survivorship, usage, and in some cases, acute complications. Between 2003 and 2010, up to 500,000 patients underwent metal-on-metal total hip arthroplasty (THA) in the United States.[1] Registry data from Australia, New Zealand, England, and Wales documented a significantly higher early revision rate with metal-on-metal implants prompting an international recall of several of these devices.[2] Recently, several registries have been started in the United States. Most U.S. registries use administrative data to create and populate data points. These data are generated well after patient care has been provided and are loosely based on billing and other such coding. Although these registries are helpful in giving insights into quality practices, they have many limitations. It is clear that moving forward, physicians, hospitals, and payors will be increasingly dependent on registries with their large datasets to monitor and improve quality as well as to control and predict costs.

History of Big Data

One of the early forays into large data was the requirement for outcomes reporting that stemmed from the Centers for Medicare and Medicaid Services (CMS). Data reporting became mandated by section 501b of the Medicare Prescription Drug Improvement and Modernization Act of 2003.[3] The Medicare Provider Utilization and Payment database was created to track inpatient results, including data on hospital-specific charges for more than 3,000 U.S. hospitals that were receiving Medicare inpatient prospective payments. Reporting hospitals were reviewed by CMS, which had the ability to rank and penalize institutions for poorer outcomes, including increased readmission rates and perioperative complications.

With political pressure to increase transparency in reporting outcomes, CMS began publishing outcome variables for hospitals across country following total knee arthroplasty (TKA) and THA, including the rate of unplanned readmissions.[4] Despite the challenges and objections of hospitals and physicians, the rates were not risk adjusted. Although the American Academy of Hip and Knee Surgeons has been working with CMS on risk adjustment,[5] CMS has administered penalties in

excess of 3% for these quality measures of the entire Medicare spend for a particular hospital. Despite best efforts, it is clear that nearly all hospitals will pay some sort of penalty. Although 3% may sound small, it may exceed the margins for many hospitals on federally insured patients. The response to these penalties can be viewed as an early push for data precursors to arthroplasty registries. To minimize financial losses, hospitals mobilized care teams, created care pathways, committees, and any number of other initiatives to improve their "quality" for the reported metrics.

The federal reporting requirements progressed to include measures for physicians, such as the Physician Quality Reporting System (PQRS), a mandatory program in 2014 that included 110 individual quality measures. The next iteration is defined in the Medicare Access and CHIP Reauthorization Act of 2015 and its Merit-Based Incentive Payment System (MIPS). MIPS is a new program that combines parts of the PQRS, the Value Modifier (or Value-Based Payment Modifier), and the Medicare Electronic Health Record incentive program into one single program on which eligible professionals will be measured. The push to alternative payment models (APMs) will give CMS new ways to pay (potential uplift incentives) and/or penalize health care providers for the care they provide Medicare beneficiaries. One should expect other insurers to follow suit.

CMS, the largest U.S. payor for arthroplasty services, controls the data collected on the Medicare beneficiaries. It is very delayed in reporting, limited in scope, contains errors, and does not focus on issues that orthopedic surgeons believe are most important to impact outcome after hip and knee arthroplasty. Non-Medicare registries have been developed to aid in quality improvement and will gain increasing importance. Other countries, such as Sweden, have already demonstrated the effect of registries on improving the quality and tracking of hip implants.[6] Large datasets from other specialties in the United States have also made improvements compared with CMS data. Nearly a decade of clinical registry data from heart failure patients was shown to be more effective than data from Medicare claims with indirect modifiers.[7]

Total Joint Arthroplasty Registries Today

There are several non-Medicare registries nationally that provide good data for analysis of hospital stays, medical comorbidities, and even some implant performance. The National Surgery Quality Improvement Program (NSQIP) database developed by the American College of Surgeons includes data abstracted from the patient's medical charts and not from patients' insurance claims. This improves the quality of the data that is obtained because the data from claims and billing tend to be limited, inconsistent, and generally subject to interpretation.[8,9] It has been noted that when comparing the NSQIP data to large administrative databases that administrative data underestimated morbidity and mortality with widely varied surgical outcomes.[10] NSQIPs data are risk adjusted and case mix adjusted and accounts for the complexity of the operations within the 30-day patients outcomes. The data can thus be extrapolated to its member and participating hospitals. The hospitals can

therefore have a reference as to how they are performing for expected outcomes and/or measures relative to the companion hospitals within the program. A limitation of NSQIP data, however, is the lack of orthopedic-specific outcomes and complications.[11]

Kaiser Permanente, a large hospital-based system in California, controls enough patients to have a registry maintained internally and began their own joint replacement registry in 2001. The proprietary system is mainly used to monitor patient care and control costs within the system for its patient members. However, they have also been able to study and publish outcome results that are helpful to providers outside their system. Papers identifying risk factors of prior bariatric surgery and chronic renal disease and outcomes after TKA have been published to provide all clinicians and hospitals a frame of reference on which to base clinical decisions.[12,13] These data, however, are only published at the discretion of the Kaiser Permanente Health System, as it is primarily used internally for promotion of quality care and cost savings for the health system. Kaiser Permanente has been able to use their joint replacement registry data to negotiate pricing with implant suppliers based on long-term performance.[14] Further economic benefits from their registry include reducing the number of patients undergoing unicompartmental knee arthroplasty, limiting younger patients undergoing TKA (higher risk for revision), and decreased use of uncemented knee implants.[15]

The Foundation and Outcomes Research for Comparative Effectiveness (FORCE) registry of total joint replacement was funded in the fall of 2010 by the Agency for Healthcare Research and Quality via a $12 million award to the University of Massachusetts, Department of Orthopedics and Physical Rehabilitation. This created a nationwide comprehensive database for total joint replacement. The mission was collection of surgical data, implant data, and, importantly, patient-reported outcomes. The hope was to develop tools with which patients' outcomes could be assessed on a nationwide basis as well as perform population-based research. The project at one point consisted of 136 surgeons and 22 states, 75% of which were community based. There were high and low volume surgeons in both urban and rural areas, teaching and nonteaching hospitals, and inclusive of private, public, and Health Maintenance Organization insurance plans. All implant manufacturers were reviewed, as were primary, revision, and unicompartmental implant types. The FORCE database is unique in providing patient-reported outcomes and risk-adjusted profiles of patients to its members.[16] This provided the registry members with the ability to compare their own outcomes to that of the associated members in realistic way. The FORCE registry has been shown to improve on CMS administrative data and increases the accuracy of risk-adjustment prediction models for 30-day readmission after THA and TKA.[17]

Several states have adopted joint replacement registries as well at various stages of implementation.[18] The Virginia Joint Registry was founded in 2005 to provide utilization data for arthroplasty procedures and long-term outcomes of these devices in the Commonwealth of Virginia. Their dataset

primarily includes implant (level I) data.[19] The California Joint Replacement Registry (CJRR) was developed as a collaboration among the California HealthCare Foundation, Pacific Business Group on Health, and California Orthopaedic Association. The initiative helped collect implant (level I), adverse event (level II), and patient-reported outcomes (level III) for 25% of all hip and knee arthroplasty procedures in the state of California.[18] In March 2015, CJRR merged with the American Joint Replacement Registry, which is now the largest joint-specific database with more than 600 hospitals enrolled nationwide.[20] Participation in state and national registries can help surgeons and hospitals gain a financial advantage in several insurers' quality programs and APMs. A summary of current joint replacement registries is listed in ►Table 1.

Michigan Arthroplasty Registry Collaborative Quality Initiative

The Michigan Arthroplasty Registry Collaborative Quality Initiative (MARCQI) is a new and somewhat unique approach to a total joint database. The organization was founded in 2012 through collaboration between Blue Cross Blue Shield of Michigan and Michigan Hospitals, and is funded as a part of the BCBSM Value Partnership Program. The voluntary state-wide total joint registry was created with the intent of collecting data on implants used in surgical procedures, inpatient hospital care data, readmission, and discharge data, as well as patient-specific data including comorbidities.

It also had the potential and goal of collecting patient-reported outcomes. As of April 2016, the collaborative included 59 hospitals and 440 surgeons who had performed more than 112,000 cases. The dataset comprised 93% of all THA and TKA performed in the state. The collaborative was founded with the purpose of creating a quality platform to improve patient care. Nurses who are funded by the collaborative specifically abstract the data and charts for all patients having undergone a hip or knee arthroplasty. These charts are specifically reviewed. Readmission data are confirmed at each of the hospitals as well as with the Michigan inpatient database that captures any readmission across the state.

The MARCQI database can and has been used for actual quality improvement and changes in care pathways; an example is one of the early projects taken on by the collaborative. Transfusion practices varied widely across the collaborative hospitals and during data review there was a large variation in transfusion rates among the MARCQI members. It was recognized that transfusion has serious hazards and presents a potential risk for patients. First, the hospitals were provided graphic data that showed their transfusion rate compared with the other hospitals in the collaborative. Next, an opportunity was provided for those hospitals with the lowest rates to share their strategies for blood conservation. Finally, an educational program was started to inform member hospitals of the safety of restrictive transfusion guidelines and the accepted guidelines for transfusion from the American Association of Blood Banks.[21] This simple education program and, perhaps more importantly,

Table 1 A summary of joint replacement registries used in the United States

Database	Summary
Medicare Provider Analysis and Review, Nationwide Inpatient Sample	Administrative data from CMS, Medicare patients only
	Large volume of patients
	Lacks orthopedic-specific outcomes and risk adjustment
National Surgery Quality Improvement Program	Developed by the American College of Surgeons
	Specifically abstracted data from each patient's chart
	30-day outcomes recorded
American Joint Replacement Registry	Large, diverse geographic area
	Tracks long-term outcomes for implants and adverse events
	Collecting patient-reported outcomes
Michigan Arthroplasty Registry Collaborative Quality Initiative	Collaboration with insurers, hospitals, physicians
	Collecting patient-reported outcomes
	Tracks readmissions across the state
Foundation and Outcomes Research for Comparative Effectiveness of total joint replacement	Improved on CMS administrative data collection
	Patient-reported outcomes and risk-adjustment profiles
	Large, diverse geographic area
Kaiser Permanente Joint Replacement Registry	Used to monitor care, control costs within single health system
	Large numbers with intermediate-term follow-up
	Helps negotiate pricing with implant companies

Abbreviation: CMS, Centers for Medicare and Medicaid Services.

the awareness of the variances by member hospitals, led to a dramatic improvement in transfusion rate, as well as "compliance" with accepted transfusion guidelines. Hospitals that were outliers wanted to learn how to improve and took cues from the higher performing member hospitals. The initial impact was a decrease in transfusion rate from approximately 15 to 5.6%, as well as a very significant decrease in transfusions for patients with hemoglobin greater than 8 mg/dL (54%).[22]

When one looks for reasons to economically support programs such as MARCQI or FORCE, quality and patient safety are clear drivers. However, the impact on cost of care resonates more strongly with the payors than even with patients. Using the transfusion project as an example, as noted, the transfusion rate was dramatically decreased. Transfusions are expensive. We projected that during an 8-month period, 756 patients were prevented from receiving an unnecessary transfusion which saved the hospitals 1,400 units of blood. Depending on the accepted cost of the transfusion, it was projected that the hospitals saved between $990,000 and $1.4 million. In addition, based on some early MARCQI data that demonstrated that transfusion in TKA was associated with a higher risk of readmission, a very costly event to any hospital or insurer, the cost savings of the transfusion project were even more dramatic. One can easily see why a major insurer such as Blue Cross Blue Shield of Michigan would support such a major endeavor as MARCQI.

The accumulation of data within the MARCQI registry has led to several other quality improvement projects at the statewide level such as reducing readmission, optimizing discharge destination, characterizing, and defining the effectiveness of the process for deep vein thrombosis prophylaxis, and the use of tranexamic acid. Interestingly, some member hospitals have used the data generated at their own institutions to examine aspects of care and quality of their own unique patient base. When doing so, the senior author's hospital found that some of the comorbidities which had been noted to significantly impact discharge disposition and readmission nationally such as body mass index were less important locally than gender and age for primary TKA/THA. This led to a local focus on patient education and preadmission preparation as a means to control both cost and quality. These data could be used in the future when projecting local costs of patient care when participating in a bundle or at risk insurance product.

In another interesting assessment of patients' outcomes locally, we were able to document that the patients' socioeconomic status had a significant impact on our patients' disposition (i.e., patients at home vs. nursing home), as well as readmission rates. Those from lower socioeconomic status had higher discharge to higher level care centers.[23] This point may resonate with insurers, and hopefully with CMS relative to the need for risk stratification as we move into increased bundling and shared risk.

Another large, state maintained, database is the Michigan Automated Prescription System (MAPS). Similar to other states, the state of Michigan maintains a program to identify and prevent drug diversion at the prescriber, pharmacy, and patient levels. It logs controlled substances that are

dispensed. The board of pharmacy administrative rule 338-3162b requires practitioners, pharmacies, and veterinarians in Michigan who dispense controlled schedule two to five substances to electronically report those prescription substances dispensed through the MAPS Web site weekly. Using a database such as this, one can observe the use of opiates by patients as well as the prescribing history associated with their care. In a recently published article, it was noted that in a group of THA and TKA patients, more than half of all the patients had more than one opiate prescriber.[24] The orthopedic surgeon represented the minority of the prescription writers, even in the postoperative period. Patients who were taking pain narcotics preoperatively stayed on narcotics significantly longer, even up to 1-year postoperatively. With the ongoing "opioid crisis," information such as this allows an assessment of patient and physician behavior, the ability to avoid complications associated with opioid use, and the ability counsel patients as well as their primary care physicians in a collaborative way to promote patient safety.

Implications of Big Data

Large dataset analysis will become increasingly important as a means to improve patient care, quality, and cost savings as we strive to manage population health. All stakeholders likely will have to participate in one form or another. It is clear from collaborative quality initiatives, such as MARCQI, that payers can benefit by linking providers to an outcomes platform. It has been well demonstrated that peer guidance, peer pressure, and competitiveness, combined with education, lead to better outcomes. Sharing data through programs such as NSQIP and FORCE have confirmed this. As a provider, it is clear that if we know our colleagues are doing something well, we will use him/her as a resource to improve our own outcomes; no one wants to be left behind or seen as at the low end of the proverbial bell curve. The importance of provider participation and collaboration with the hospital is very demonstrable. For aspects of care such as readmission, where decreasing the occurrence is of significant benefit to the hospital, physician, and patient, all parties need to be actively engaged. At our own hospital, our readmission rate was only impacted when the orthopedic and hospital leadership collaboratively engaged the emergency room and primary care groups in a focused program. The initiative led to a significant decrease in readmissions and subsequent cost savings. As a payor, these programs are favored because quality is improved and complications decreased, and the overall cost of care decreases. As we move forward in bundling projects and shared risk contracts, the ability to control negative impactors such as readmissions, or the ability to predict discharge disposition, provides a significant advantage in the marketplace relative to projecting and controlling overall costs.

Despite all of these positives, one must exercise significant caution when using large datasets. Statistics can be used very effectively but can also be very deceiving at times. Things get very complicated when large data are applied to singular questions or an individual patient. As noted by Mark Twain,

"Facts are stubborn things, but statistics are pliable." As an example, the CMS comparison of hospital sites for readmission without using a risk adjustment is deceptive and clearly very inaccurate as a comparative measure. When readmission data across the state of Michigan are reviewed and risk adjusted, it is very difficult to separate any of the hospitals or to make any quality assessment based on readmission data alone. The need for statistical relevance and quality becomes very important. Any single comorbidity when evaluated singularly may appear to impact patient outcome. However, that same data point may fall out when a multivariable analysis is applied and other comorbid conditions are considered.

Conclusion

Large data are the future. Participating in data collections, electronic medical records with high performance analytics, patient report outcomes systems, and standardized practices should allow us to better understand the effectiveness of our procedures and patient care plans. As we try to the control costs of patient care while increasing value, these strategies will be very significant in promoting patient care and quality.

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