Increasing Use of Total Knee Replacement and Revision Surgery

James Slover, MD, MS
Joseph D. Zuckerman, MD

In this issue of JAMA, Cram and colleagues report detailed analysis of primary and revision total knee replacement (TKR) performed on more than 3.2 million Medicare beneficiaries from 1991 to 2010. This analysis confirms and quantifies several important findings. First, the use of primary and revision TKRs in Medicare beneficiaries has increased both in absolute volume from 93,230 procedures in 1991 to 226,177 procedures in 2010 and in per capita usage. Second, the pattern of care has changed substantially. Between 1991 and 2010, length of hospital stay for primary TKR decreased from 7.9 to 3.5 days and revision TKR from 8.9 to 5.0 days. However, 30-day all-cause readmission rates after primary TKR increased from 4.2% in the years 1991-1994 to 5.0% in the years 2007-2010 and after revision TKR increased from 6.1% in the years 1991-1994 to 8.9% in the years 2007-2010. A clear change in the pattern of discharge status also occurred with a shift initially to a more institutionalized setting, and recently to a discharge to home with home care services (ie, discharges to patients’ homes decreased from 67.5% in the years 1991-1994 to 39.9% in the years 1999-2001 then increased to 56.2% in years 2007-2010). In addition to the increase in readmissions, the data demonstrated an important increase in infection rates for revision cases, increasing from 1.4% in the years 1991-1994 to 3.0% in the years 2007-2010.

The first question to consider is what is driving the increased utilization. While there are different contributing factors, more importantly this report may be describing only the surface of what is expected to be a profound increase in knee arthroplasty over the next 30 years. By 2030, the demand for TKR in the United States is projected to be as high as 3.48 million procedures annually. Cram et al address only Medicare beneficiaries, but the number of younger individuals (and those without Medicare) undergoing knee replacement is also expected to continue to increase. This is particularly true considering the development of newer arthroplasty procedures used to treat degenerative arthritis in younger patients, such as bicompartamental and unicompartmental knee replacements, which have been shown in select studies to be the most rapidly increasing arthroplasty treatment in this younger population.

These projections will make TKR a key driver of health care cost, which makes this procedure worthy of careful consideration. This is particularly challenging given the magnitude of the predicted increase and because, as the authors discuss, many studies have demonstrated that TKR is a cost-effective procedure that may improve patients’ activity and health-related quality of life. Although health benefits are difficult to quantify, this expenditure could potentially decrease the allocation of health care resources used by patients having knee replacement over the remainder of their lifetime. Consequently, the ideal number of knee replacements that should be performed per capita is unknown.

Although the study by Cram et al suggests that recent stabilization in rates of TKR procedures appears to have occurred, the authors suggest several explanations for the per capita increase, including expansion of indications and the increased prevalence of obesity, which combined with the increase in the number of patients eligible for Medicare has led to the significant increases in utilization reported. Another factor is the increased demand for an active lifestyle in this age group. Furthermore, increased efforts are needed to identify and address predisposing modifiable factors, such as obesity that lead to the need for knee replacement, and to advance efforts at early intervention strategies to treat mild arthritis and to prevent progression of the disease obviating the need for eventual arthroplasty.

The cost of TKR over the next 20 years will be driven by the absolute number of primary procedures performed, the increasing number of more costly revision procedures, and

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the total cost of care associated with these procedures, which includes not just the cost of the inpatient stay but the cost of every aspect of care, including before surgery, during the hospitalization, and after surgery until patients fully recover. In the past, these areas were often considered separately and efforts to contain costs focused on each aspect individually. The initiation of the prospective payment system in 1984 clearly led to reduced length of stay and initially shifted postoperative care to an institutionalized setting (skilled nursing facilities, acute inpatient rehabilitation programs). Although this may have had an initial positive influence on the cost of hospital care, the increasing volume of procedures performed now requires further measures to control costs.

The Episodes of Care projects contained in the Patient Protection and Affordable Care Act of 2010 may be an important step in controlling costs. This initiative will compel joint replacement centers to assume responsibility for the cost of an entire episode of care beginning before surgery, continuing through the hospital stay, and concluding with the postoperative recovery period through a bundled payment plan. Institutions participating in these programs will be responsible for reducing the total cost of care for a 30-, 60-, or 90-day period based on previous Medicare cost data. This payment structure could encourage the development of coordinated systems of care that maximize efficiency, communication, and quality outcomes while minimizing the cost of the entire episode of care.

Despite the need to consider the costs across the entire episode of care, efforts to focus on cost reduction during the hospitalization will remain paramount. The cost of this aspect of care is driven primarily by cost of joint implants, length of stay, and operating room time. Implant costs are of a particular concern because the health system cannot sustain the annual increase in cost of implants particularly when there is little if any evidence to show increased effectiveness. Recognizing the implication of joint implant costs, hospitals and health care systems have increased efforts to control the cost of implants through improved negotiating strategies and the use of demand matching by which newer technologies are reserved for patients thought to benefit the most from the proposed advantages of more expensive implants. The profitability of knee replacement implant sales has led to the development of numerous joint-implant systems and iterations from a multitude of vendors. Presently, however, no one specific implant design has demonstrated superior performance.

A challenge for evaluating knee implants has been the inability to compare the performance of myriad available joint implants with each other, given that 90% of implants last more than 10 years. The American Joint Replacement Registry (AJRR) has emerged as an effort across the profession to address this issue. National orthopedic joint registries in smaller countries have demonstrated the ability to identify problematic and poorly performing implants, thereby decreasing patient complications and costs by ensuring that these implants are removed from the market as soon as performance inferiority is evident. Furthermore, as the data collection process is expanded to include patient operating room data, other factors can be identified that lead to improved quality and decreased cost. The AJRR has moved from a pilot phase to active recruitment, with the goal of enlisting all hospitals and centers performing joint replacement procedures.

The study by Cram et al also demonstrated a stable but significant risk of complications and increased readmission for primary TKR, as well as an increase in infection and readmission rates for more complicated revision procedures. The authors suggest the increase in infections associated with revision procedures may be related to the decreased length of stay and earlier transition from the acute hospital setting. Although these may be contributing factors, other potential contributors include the physiologic frailties associated with obesity and diabetes, as well as an increase in other comorbidities that coincide with the age of patients undergoing repeat procedures. Consequently, it will become increasingly important to establish strategies that address these conditions and to use risk assessment tools that help identify patients at risk before surgery so that appropriate preoperative interventions and supportive measures can be implemented.

Readmissions were noted to occur more frequently in older patients, black patients, and patients with a higher number of comorbid conditions. This finding highlights the need for the development of centers capable of delivering highly coordinated care throughout the entire episode of treatment. Currently, a significant percentage of TKRs are performed by low-volume surgeons, who perform less than 12 cases per year. In the study by Cram et al, greater volume of primary TKA was associated with lower readmission rates, which is consistent with other studies showing improved outcomes and decreased complication rates in high-volume centers. Therefore, careful consideration should be given to whether the majority of these cases should be shifted toward high-volume centers, which often have the infrastructure and the experience needed to develop the highly coordinated care pathways necessary to optimize the quality outcomes and efficiency of the episode of care for complex patients. This approach should be considered regardless of whether a bundled payment system is ultimately implemented to maximize outcomes of knee arthroplasty.

The report by Cram et al characterizes some important epidemiologic aspects of primary and revision knee replacement that have occurred over the past 20 years, including the evolution of increased volume and changes in care patterns, complication, and readmission rates. In an effort to control costs and improve quality of care, the findings provide important information concerning patient demographics associated with primary and revision TKRs and compli-
cations. In the currently challenging and dynamic health care environment, critical evaluation and systematic data collection about total knee replacements will be needed to optimize outcomes and ensure access to these life-improving procedures.

Conflict of Interest Disclosures: All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Dr Zuckerman reported earning royalties for designing a shoulder arthroplasty system. Dr Slover reported no financial conflict.

REFERENCES