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Hospital Readmission and Costs of Total Knee Replacement Surgery in 2009 and 2014: Potential Implications for Healthcare Managers

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Abstract

The purpose of this article is to describe changes in hospital readmissions and costs for U.S. hospital patients who underwent Total Knee Replacement (TKR) in 2009 and 2014. Data comes from the Healthcare Cost and Utilization Project net-Nationwide Readmissions Database. Compared to 2009, overall 30-day rates of readmissions after TKR decreased by 15% in 2014. Rates varied by demographics: readmission rates were lower for younger patients, males, Medicare recipients, and those with higher incomes. Overall, costs rose 20% across TKR groups. This report is among the first to describe changes in hospital readmissions and costs for TKR patients in a national sample of U.S. acute care hospitals. Findings offer hospital managers a mechanism to benchmark their facilities' performances.

Keywords

Hospital readmissions; National Health Policy; Total Knee Replacement; Quality Improvement; Health Services Research; Agency for Healthcare Research and Quality

Total Knee Replacement (TKR) is one of the most commonly performed surgical procedures in U.S. hospitals. The operation reduces pain and improves mobility for patients who suffer from inflammatory and degenerative arthritis. In the past two decades, Medicare-covered TKR procedures nearly tripled, from 93,230 in 1991 to 243,802 in 2010¹. The number of TKR surgeries is expected to exceed 1.3 million by 2030². Costs for such procedures are expected to increase exponentially.

In April 2016, the Centers for Medicare & Medicaid Services (CMS) proposed the Comprehensive Care for Joint Replacement (CJR) model to address increasing healthcare

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Conflicts of Interest

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costs by incentivizing hospitals, physicians, and post-acute care providers to work together to reduce costs and rates of readmission over a care episode. A care episode encompasses all Part A and Part B services for the TKR and care received for 90 days following discharge. Under the CJR, nearly 800 hospitals in 67 metropolitan areas were required to participate in the four-year program ending on Dec. 31, 2020³. In August 2017, CMS proposed reducing mandatory participation from 67 to 34 geographic areas, allowing the remaining 33 areas to participate on a voluntary basis. In addition, CMS proposed making participation in the CJR model voluntary for all low volume and rural hospitals in all the CJR geographic areas. Given the increasing number of TKR procedures performed each year, accurate projections of hospital costs and readmission rates might help healthcare managers improve health system quality and patient care.

Past studies examining TKR readmission trends have focused solely on Medicare fee-for-service beneficiaries^{1,4}. Purvis et al.⁵ examined patients enrolled in a single private health plan (Medicare Advantage), since the implementation of the Hospital Readmission Reduction Program. In this study, hospital readmission among TKR patients declined much faster among those 65 to 84 years of age compared to adults ages 50 to 64 (38% vs. 12%, respectively). While this study has many strengths including a large sample size (N=142,022) and patients under 65 years of age, there are two limitations. First, study findings may not be generalizable because the data included patients enrolled in a single private health plan. Second, no payment data or costs were reported.

Building on past work, this brief report aims to: (1) describe changes in costs and readmission rates for TKR patients treated in US hospitals in 2009 and 2014; and (2) examine costs and hospital readmission rates stratified by demographic and socioeconomic subgroups. This report is among the first to describe changes in hospital readmission and costs for TKR patients in 2009 and 2014 in a national sample of US acute care hospitals. In addition, this report has offers managers a mechanism to benchmark their hospital's performance and underscores the importance identifying potentially high risk and high cost groups when contemplating the adoption of alternative payment models.

METHODS

This study used a retrospective cross-sectional design. The sample is drawn from a nationwide database including patients readmitted to U.S. acute-care hospitals with a primary procedure of TKR replacement in 2009 and 2014. TKR, a high-volume condition, was identified using the Clinical Classification Software (CCS). CCS categorizes specific procedures into a manageable number of clinically meaningful categories.

Data Source

The Agency for Healthcare Research and Quality developed the Healthcare Utilization Project (HCUP), which includes a group of nationwide databases designed to provide health information and statistics on utilization, cost, and quality of health services⁶. HCUP.net, an online query system based on data from the HCUP, was used to access health statistics and information on hospital utilization and readmission rates from the Nationwide Readmissions Database (NRD)⁷. The NRD is the largest all-payer hospital readmissions database in the

United States. Its discharge-level data is drawn from the HCUP State Inpatient Databases (SID), a nationally representative sample of approximately 20% of U.S. community hospitals⁸. Discharge data are weighted to produce national estimates. These discharge weights are stratified by census region, urban-rural location, hospital teaching status, bed size, and facility control/ownership. To date, 21 geographically dispersed states are included in the NRD dataset, which account for 49.3 percent of the total U.S. population and 49.1 percent of all U.S. hospitalizations.

Variables

We examined demographic characteristics such as age, gender, and payor (Medicare, Medicaid, private insurance, or uninsured), socioeconomic characteristics including estimated median household income of residents in the patient's ZIP Code) and location of the patient's residence (metropolitan or non-metropolitan). The outcomes of interest were defined as (1) readmission, a hospital stay within 30 days following an original admission and discharge for a TKR, and (2) hospital costs for readmissions. HCUP.net uses cost-to-charge ratios based on hospital accounting reports from CMS. Hospital charges represent the amount the hospital billed for services rendered during the entire hospital stay and do not include professional (physician) fees.

Data Analysis

Descriptive statistics were used to describe trends based on 30-day hospital readmissions, causes of 30-day hospital readmissions, and costs related to 30-day hospital readmissions. Cost data were analyzed by adjusting the 2009 mean cost per stay for inflation using the Consumer Price Index (CPI) for 2014⁹. A CPI adjustment of 8.6% was applied to 2009 cost per stay. The percent change between the adjusted and unadjusted cost per stay from 2009 through 2014 was also calculated.

RESULTS

Approximately 30,000 TKR patients were readmitted within 30 days of hospital discharge. Overall, the readmission rate for TKR decreased slightly from 5.0% in 2009 to 4.2% in 2014, a reduction of 16%. The decrease in readmission rate was greatest among the 65-years-and-older group that saw an 18% decrease—from 5.6% in 2009 to 4.6% in 2014. The readmission rate for females saw the largest decline—from 4.6% in 2009 to 3.8% in 2014, a 17% reduction over the four-year period.

The Medicaid population had the lowest 30-day readmission rates decreasing from 7.1% in 2009 to 5.7% in 2014, a decrease of 20% over the study period. The 30-day readmission rates for Medicare and private payors decreased 16% and 17% respectively. Patients in metropolitan areas experienced the largest decline in 30-day readmissions with a decrease from 5.1% in 2009 to 4.2% in 2014, for an 18% reduction. The rate of 30-day readmissions also declined from the 1st income quartile through the 4th income quartile.

Costs per stay increased from \$9,929 to \$11,904 over the four-year period, up a total of 20%. The mean costs per initial stay for patients undergoing TKR was highest in those ages 45–64 years, insured by Medicaid and/or living in the non-metropolitan regions.

Contributing to costs, the length of stays for patients ages 45–64 years increased 4% from 2009 to 2014. Descriptive statistics on readmissions and costs for all TKR patients are shown in Table 1.

The Medicaid payor group represented a 30% decrease when compared to Medicare and Private payors. Stays decreased the greatest in the 1st quartile income group and increased the greatest among the 4th income quartile group. There was a 10% decrease in stays in the non-metropolitan group. Those TKR patients insured by Medicaid accounted for the greatest increase in LOS (30%).

DISCUSSION

These findings suggest the 30-day readmission rates among TKR decreased slightly from 2009 to 2014. However, a readmission rate varied by demographic and socioeconomic groups, and this finding warrants further analysis. The largest reductions in 30-day readmission rates for TKR patients by age groups were for those 65 years and older, female, insured by Medicaid, in the 3rd income quartile, and residing in metropolitan areas. The mean cost differences observed among TKR procedures also varied by demographic and socioeconomic group.

This report shows small, but consistent increases in costs per hospital stay across all TKR groups from 2009 through 2014. Differences could be attributed to changes in reimbursement, increases in implant costs, and/or hospital profitability (profit margin). Past research confirms that implant costs associated with TKR procedures account for a large share of total costs and reimbursements to hospitals⁹, but cost differences are also driven by hospital profitability goals. In general, hospital profitability for commercial plans remains high while Medicare, and especially Medicaid, is substantially lower¹⁰. Nonetheless, hospitals have begun to increase their Medicaid hospital stays, which was reflected in our brief report. While seemingly unconventional, Stensland et al.¹¹ suggest Medicaid patients have been profitable for some hospitals in certain states, particularly those participating in the federal disproportionate share program. In 2014, CMS paid a total of \$18 billion (\$8 billion in state funds and \$10 billion in federal funds) in DSH payments to hospitals serving a disproportionately high percentage of low-income and uninsured patients. These same hospitals could face significant cuts resulting from the Affordable Care Act's Medicaid expansion and should be monitored further¹².

The overall decline in 30-day readmission rates was 16%, and TKR patients insured by Medicaid accounted for the greatest reduction in 30-day readmission rates as compared to patients insured by other means (Medicare vs. private). However, reports in the literature suggest readmission rates are higher for this population¹³. Risk factors for readmission among the Medicaid population include financial stress, high rates of mental health and substance abuse disorders, medication noncompliance, and housing instability¹⁴. In addition, we found higher rates of readmission for TKR among patients living in lower-income communities compared to higher-income communities, which was consistent with past research¹⁶. Witt et al.¹⁷ found that patients from low-income communities are 12% more likely to have post-surgical complications compared to those from higher-income

communities. Further, when such complications arose, little to no access to home health and/or rehabilitation facilities increased their risk for re-hospitalization. In 2014, the AHRQ produced a hospital guide to reduce readmissions among the adult Medicaid population. Given that much of the variation in readmission rates is explained by primary care access and the quality of nursing homes in the community¹⁸, additional research is needed to better understand best practices, effective hospital-community partnerships, and other community-level variables associated with reducing readmissions among low-income TKR populations.

Implications for Healthcare Management

Findings from this report have several implications for health care management. First, managers can use the nationally representative data of TKR patients in this report to benchmark their own hospitals' performance. Reducing readmissions will gain greater importance as healthcare delivery organizations increasingly assume greater risk for managing the health of their populations, especially in light of the potential for reduced financial reimbursement under the development of alternative payment models and quality measures. Second, health care managers can assess whether they had similar decreases in readmissions as was observed nationally; if not, they can assess the potential role for the characteristics found in this report to be associated with increased readmission risk. For example, managers consider opportunities to tailor clinical services for successful transitions home following TKR for younger patients. For men, managers might consider what kind of informal help they have in the home and if a lack of informal help explains why men had higher readmissions. Lastly, for those patients with Medicaid coverage or from lower-income communities, are there barriers to appropriate follow-up care such as less access (e.g., rural areas, primary care deserts)? Focusing on these areas of interest may help healthcare managers minimize their hospitals' financial risk.

Several limitations were noted in this brief report. No multivariate analyses were conducted to estimate associations between variables or to control for confounders because HCUP.net provides aggregated data that does not allow linkage to other datasets. As such, we did not assess several patients (due to race, comorbidities)¹⁹, health systems (teaching status, surgical volume), or community-level factors (access to and quality of post-acute care)^{16,20–21} known to be associated with readmission. The HCUP.net contains data on total charges for each hospital discharge in the NRD. Finally, differences across time points were not tested for statistical significance; only clinical significance was interpreted.

This brief report refined the estimated risk for readmission and trends in healthcare costs for TKR patients. Healthcare managers may use this information from a nationally representative sample of 30-day hospital readmission rates as a benchmark by which to measure their own facilities. This comparison may inform quality improvement efforts and lead to reduced costs and better patient outcomes.

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Table 1.

Number of stays, costs, and percent readmitted for TKR patients, 2009 and 2014

Characteristics	Number of stays			Mean costs per initial stay			30-day % readmitted		
	2009	2014	% change	2009	2014	% change	2009 (%)	2014 (%)	% change
Overall	29,780	29,757	−0.1	\$9,929	\$11,904	20	5.0	4.2	−16
Age									
18–44	834	745	−11	\$10,967	\$12,656	15	5.5	5.0	(−9)
45–64	9,840	10,194	4.0	\$9,504	\$11,978	26	4.1	3.5	(−15)
65+	19,003	18,656	−2	\$10,110	\$11,828	17	5.6	4.6	(−18)
Sex									
Male	12,432	13,100	5	\$10,040	\$12,167	21	5.6	4.8	−14
Female	17,348	16,656	−4	\$9,850	\$11,699	19	4.6	3.8	−17
Payor									
Medicare	20,486	20,273	1	\$9,942	\$11,854	19	5.7	4.8	−16
Medicaid	1,266	1,655	30	\$9,467	\$12,835	36	7.1	5.7	−20
Private Insurance	7,014	6,661	−5	\$9,546	\$11,709	23	3.5	2.9	−17
Income									
1 st quartile	7,782	6,538	−16	\$9,414	\$10,837	15	5.4	4.6	−15
2 nd quartile	8,179	8,283	1	\$9,865	\$11,811	20	5.0	4.3	−14
3 rd quartile	7,378	7,468	1	\$9,807	\$12,285	25	4.9	4.0	−18
4 th quartile	5,947	7,041	18	\$10,795	\$12,475	16	4.6	4.0	−13
Residence									
Metropolitan	23,428	24,043	3	\$10,075	\$11,844	18	5.1	4.2	−18
Non-metropolitan	6,353	5,714	−10	\$9,406	\$12,153	29	4.7	4.0	−15

Notes: To calculate percentage change: First, determine the difference by subtracting 2009 data from 2014 data. Then, divide the difference by the 2009 data and multiply by 100. Negative numbers reflect reduced stays or costs.

Data not presented for patients ages 0 to 17 years.