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Clinical Outcomes and Costs Within 90 Days of Primary or Revision Total Joint Arthroplasty

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ABSTRACT

Background: This study evaluated the factors and costs associated with discharge destination and readmission, within 90 days of surgery, for primary or revision total knee arthroplasty (TKA) and total hip arthroplasty (THA).

Methods: This retrospective database analysis used health care claims from the Truven MarketScan Database (2009-2013). Patients were selected if aged ≥18 years, with continuous health plan enrollment from 3-month baseline through 3-month follow-up. Logistic regression and Cox proportional hazard models were used to analyze factors associated with discharge destination and risk of readmission. Total 90-day costs were calculated for different patient pathways of care, dependent on complications, discharge destination, and readmission status.

Results: A total of 323,803 primary TKA, 25,354 revision TKA, 159,390 primary THA, and 17,934 revision THA cases met selection criteria. All-cause complications occurred in 2.5%, 37.2%, 2.6%, and 35.0% of each cohort. Complications, transfusions, and length of stay ≥3 days were associated with greater odds of discharge to home with home health services or skilled nursing facility (SNF) vs home under self-care ($P < .001$ all cohorts), whereas discharge to home with home health services or SNF was associated with greater risk of readmission ($P < .05$ for all cohorts except one). The ratio of total 90-day costs for the highest- (revision, SNF, readmission) vs lowest-cost (primary, home under self-care, no readmission) care pathways ranged from 1.8 to 2.2.

Conclusion: As Medicare payment policy for total joint arthroplasty shifts toward bundling, an awareness of factors associated with outlier costs will be requisite to remain profitable.

The incidence of total knee arthroplasty (TKA) in the United States is rising and has been projected to increase from 500,000 procedures in 2005 to 3.48 million in 2030 [1]. Not only is the demand for total joint arthroplasty (TJA) procedures rising, but a recent model using US Census, National Health Expenditures, and Nationwide Inpatient Sample data found that growth in both primary and revision TKA procedures was insensitive to the economic downturn, with growth of 6.1% and 13.5% between 2009 and 2010, respectively [2].

Against this backdrop of increasing procedural volume, Centers for Medicare and Medicaid Services has been tasked with cost containment under the Affordable Care Act. Specifically targeted is diagnosis related group (DRG) 470, the reimbursement code used to classify hip and knee arthroplasty procedures without major complications or comorbidity. As the single-most commonly billed DRG code, it totaled $6.6 billion in Medicare payments in 2013 alone and is consequently a prime target for innovative value-based payment programs [3].

One such program is the Medicare Bundled Payment for Care Improvement initiative, which revises Medicare payment policy to align hospital incentives around coordinated care from the initial hospitalization through the 90-day care period after discharge. This voluntary program combines previously separate, fee-for-service payments for all hospital and post-discharge care costs into a single, prospective payment that is managed by the hospital. Although the specifics of bundling models vary, the overall purpose is to provide strong financial incentives for caregivers and hospitals to manage episode costs [4]. More recently, the Comprehensive Care for Joint Replacement (CJR) model will require all hospitals in

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67 metropolitan statistical areas to enroll in a bundled payment program starting April 1, 2016 [5].

Hospitals enrolled in a bundled payment program simultaneously face large upside potential and significant downside risk. Hospital-specific bundled payments are calculated using the mean of three years of historical Medicare payment data to adjust for variations in casemix and cost. However, just a few high-cost outliers per year can eliminate or significantly reduce the hospital's margin on performing joint arthroplasty surgery. For example, as discussed in a recent New England Journal of Medicine opinion article, though Medicare paid an average of $26,000 per 90-day episode for DRG 470 in 2013, the top percentile (1%) of TJAs cost $75,000 per episode [6]. Because of the potential impact of this difference on annual operating margin, some hospitals rely on "stopgap" insurance to minimize downside risk; however, this additional cost layer further cuts into potential profits. Ideally, clinical strategies to optimize outcomes across all demographics groups, mitigating cost outliers and reducing variability in patient costs over the entire episode of care, are essential in this new payment environment.

Post-discharge costs, including the cost of readmissions, are one of the largest drivers of the total 90-day cost of care; one estimate found that the initial hospitalization accounted for only 55% of total episode costs [6]. Thus, optimized strategies to minimize post–acute care (PAC) costs, while not compromising patient clinical outcomes, are warranted. However, there has been little research on ideal care pathways after TJA. In an analysis of a single center's administrative claims database, authors evaluated over 1800 primary TJA procedures and found that the average 30-day post-discharge cost varied widely by surgeon, from $733 to $12,811 [7]. This suggests that there is at least some surgeon preference toward PAC setting rather than adherence to any predefined care pathways. Although the trend of discharging more patients to home with home health services (HHHS) care instead of skilled nursing facilities (SNF) has increased significantly, from 15% to 35% between 1998 and 2009 [8], there has been little research on the clinical drivers and outcomes associated with this shift.

Cost containment is critical to hospitals' long-term financial sustainability; however, it cannot come at the expense of patient outcomes. Research evaluating the safety and efficacy of different care pathways is needed to inform the development of cost-containment strategies. The present study uses nationally representative claims data from more than 500,000 patients undergoing primary or revision TKA or total hip arthroplasty (THA) procedures to evaluate costs and clinical outcomes over a 90-day care episode. Factors associated with discharge destination were evaluated, along with the destination's impact on the risk of hospital readmission.

Materials and Methods

This retrospective database analysis used health care claims data from the MarketScan Commercial Research Database (Truven Health Analytics, Ann Arbor, MI), which includes nationally representative information for >180 million unique patients covered with private insurance. Data from 2009 through 2013 were used for this analysis. The database is fully deidentified; therefore, this study did not require Institutional Review Board approval. Patients with Medicare were not excluded from this study but were required to have some form of supplemental health insurance coverage to be included in the data set.

Four mutually exclusive study cohorts were created for analysis, based on relevant International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) or Current Procedural Terminology (CPT) codes (Appendix A): primary TKA, revision TKA, primary THA, and revision THA procedures. For the primary TKA and THA cohorts, patients were selected if they had a relevant procedure code but no multiple listings (indicating bilateral or concurrent THA or TKA procedures) or revision procedures. Patients with simultaneous bilateral procedures were excluded from the present analyses because of the greater operating room and supply costs when compared to unilateral procedures. Revision TKA and revision THA cohorts were selected if an ICD-9-CM or CPT procedure code was listed for a revision procedure. For all study cohorts, patients were excluded from analysis if there was any diagnosis of fracture of the lower limb listed during baseline or the index hospitalization.

Patients were eligible if aged ≥18 years, with continuous health plan enrollment from 3 months before surgery through 3-month follow-up. Patients who did not survive the index hospitalization (and therefore had no post-discharge data) were excluded, as were patients whose 90-day follow-up costs were within the top 1% of costs. This methodology excluded patients with total 90-day costs greater than $118,400 for primary TKA, $123,133 for primary THA, $189,196 for revision TKA, and $195,429 for revision THA, which given the distribution of cost information observed were extreme outlier observations likely a result of miscoding.

The "index date" for analysis was the date of hospital admission for the procedure of interest. The baseline period was defined as the 90 days before the index date, and the follow-up period defined as the day of discharge through 90 days after discharge. The 90-day follow-up time frame was selected for this analysis because the majority of hospitals that have opted into the Medicare bundled payment program chose the 90-day time frame for the bundle, and this is also the time period for bundling in the Comprehensive Care for Joint Replacement Program program [3,5].

Patient demographic and clinical characteristics, complications during the index visit, length of stay (LOS), and costs were analyzed. Comorbidities were evaluated using diagnoses listed during baseline, the index hospitalization episode, and during any readmissions. The Charlson Comorbidity Index (CCI) score, a validated composite measure of physical health status, was calculated for each patient using diagnoses listed on a patient's record from a 1-year baseline through 90-day follow-up [9,10]. Because the data source had no information on individual patient body mass index, diagnosis of overweight or obesity was assessed using ICD-9-CM diagnosis codes (278.00-278.03, V8541, V8542, V8543, V8544, and V8545).

Diagnosis and procedure codes used in study measure creation are listed in Appendix B, similar to those used in a prior retrospective study with Premier data [11]. Complications of interest during the index hospitalization included blood transfusion (allogeneic or autologous), transfusion-related complications, hemorrhage, hematoma, seroma, postoperative infection, wound disruption, phlebitis and thrombophlebitis, pulmonary embolism, pneumonia, and any other neurologic, pulmonary, cardiac, or urinary and renal complication. Discharge destination was evaluated given the information listed in the Premier data set, including home under self-care (HUSC), HHHS, SNF, or other (including inpatient rehabilitation, short-term hospital, transferred to other facility, other).

Costs reported in the Truven data set represent the sum of all amounts paid to the provider by the insurer plus coinsurance, copayments, and deductibles paid by the patient for the same visit. We summarized total hospitalization costs during the index hospitalization, along with total follow-up costs. Follow-up costs were summed from the day of discharge through 90 days for the discharge destination plus costs incurred in the following locations: clinic, office, outpatient hospital, outpatient rehabilitation, and other outpatient. Conditional on presence of a hospital readmission during follow-up, the total hospitalization cost for the readmission