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Discharge Disposition After Joint Replacement and the Potential for Cost Savings: Effect of Hospital Policies and Surgeons

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ABSTRACT

Background: Up to 55% of total joint arthroplasty costs come from post–acute care, with large variability dependent on a patient's discharge location. At our institution, we identified a group of surgeons using a preoperative discharge planning protocol emphasizing the merits of home discharge. We hypothesized that using the protocol would increase patients' odds for discharge home.
Methods: Administrative data from 14,315 total hip and knee arthroplasties performed over a 3-year period were retrospectively analyzed to determine predictors of patient discharge location. Bayesian hierarchical logistic regression modeling was used to account for the complex multilevel structure within the data as we considered patient-, surgeon-, and hospital-level predictors. A simplified case-control data structure with logistic regression analysis was also used to better understand the impact of the preoperative discharge planning protocol.
Results: A variety of patient- and surgeon-level variables are predictive of patients being discharged home after total joint arthroplasty including a patient's length of stay, age, illness severity, and insurance, as well as surgeon's affiliation. In the case-control data, patients exposed to the rapid recovery protocol had 45% increased odds of being discharged home compared to patients not exposed to the protocol.
Conclusions: Although patient factors are known to play a role in predicting postdischarge destination, this analysis describes additional surgeon- and hospital-level factors that predict discharge location. Exogenous factors based on how surgeons and hospital staff practice and interact with patients may impact the postdischarge decision-making process and provide a cost savings opportunity.

Total joint arthroplasty is among the most successful interventions available in orthopedics today but is at risk of becoming a victim of its own success. Numerous studies have demonstrated the benefit that patients with end-stage osteoarthritis receive from a joint replacement [1]. But with the "baby-boomer" population aging, and wishing to remain active, the demand for such procedures can be expected to continue to increase [2]. This increasing demand will lead to increasing expenditures on these procedures, placing further stress on the Medicare budget at a time of increasing concern over rising government outlays. Among the provisions of the Affordable Care Act in 2010 aimed at controlling health care spending, the Centers for Medicare and Medicaid Services (CMS) was mandated to create the Center for Medicare and Medicaid Innovation with an expressed goal of exploring new payment models for integrating care across an episode of care. One such pilot, the bundled payments for care improvement initiative, calls for organizations to enter into payment agreements that focus on financial and performance accountability for episodes of care [3]. Although several models have been proposed within the Center for Medicare and Medicaid Innovation initiative, the most compelling definition of an episode, particularly for an arthroplasty procedure, is one in which the episode of care includes all

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preoperative, acute, and post–acute care surrounding the surgery for a defined period of time, generally 30 to 90 days.

The post–acute phase of care, the portion after hospital discharge, accounts for 36%-55% of the total costs associated with an episode of care, with rehabilitation facility choices being the overwhelming driver [4,5]. In addition, there is significant variability in resource use during this phase. Consequently, the post–acute period has been recognized as a viable target for cost savings. In particular, the location that the patient uses for rehabilitation after surgery can be a significant determinant of cost, with inpatient care costing several multiples more than outpatient rehabilitation. Understanding the factors that determine the site of post–acute care for a patient can help drive utilization to the most appropriate venue. Studies have shown that both patient and provider characteristics are predictive for discharge venue [6,7], and a nomogram has been created to determine the probability of a patient's discharge location based on typically available preoperative data [6]. To better manage these decisions, though, more information is required to determine how to best use resources and what factors are driving physician decisions in determining postoperative care venues. Specifically, the roles of the surgeon and hospital practice and culture have yet to be examined.

At our institution, we identified a group of surgeons who had been using a preoperative discharge planning protocol that emphasizes the merits of home discharge [8]. In this study, we sought to determine the impact of this protocol on the choice of venue for discharge of patients undergoing primary total hip and knee arthroplasty, controlling for other already-known factors that influence a patient's discharge disposition. We hypothesized that the use of the preoperative discharge planning protocol would increase a patient's odds for being discharged home.

Materials and Methods

Administrative data were obtained for all unilateral total hip and total knee arthroplasty discharges performed within our health system for the 3 years from 2011 to 2013. These surgical procedures were identified by diagnosis-related group codes 469 and 470. This search identified 14,488 discharges, and 173 were excluded because of these discharges being for ankle replacement surgery and extreme cost outliers (more than 2 standard deviations above/below the mean). Thus, 14,315 cases were included in the final analysis. For each patient, administrative variables were collected at the hospital, surgeon, and patient level (Table 1).

The preoperative discharge planning protocol, which we called "rapid recovery," was used by 3 of our institution's surgeons. The rapid recovery protocol directly involved the patient in making decisions about his or her own preoperative, acute, and postoperative care. This protocol included the use of a nomogram to guide postdischarge care planning by predicting which patients could safely return home for rehabilitation versus going to a rehab facility taking into account 17 factors previously shown to be predictive of discharge location (Table 2) [6]. In addition, a nurse with specialty in rehabilitation nursing contacted patients before surgery to counsel them on the expected course of their care plan. The nurse also assisted with arranging for postdischarge services such as scheduling postdischarge home visits by home health therapists. For all patients, early mobilization and pain management efforts did not differ from those of generally accepted practice.

Descriptive statistics were used to characterize the profile of total knee and hip arthroplasties performed from 2011 to 2013. Univariate associations between the variables listed in Table 1 with discharge location were assessed by chi-square analyses for categorical data and via Student's t test for normally distributed data. Bonferroni corrections were made for multiple comparisons.

Table 1
Listing of Variables Collected at the 3 Levels of Interest: Hospital, Surgeon, and Patient.

Variable Level	Variable	Variable Definition
Hospital level	Patient's operative location	Main campus Regional hospital
Surgeon level	Use of preoperative discharge planning protocol	Yes No
	Surgeon's affiliation	Academic staff surgeon Community surgeon
	Number of surgeries performed	
Patient level	Operated joint	Hip Knee
	Length of stay	
	Patient's age	
	Diagnosis-related group	469 (With major complications/comorbidity) 470 (Without major complication/comorbidity)
	Payor	Commercial insurance Government insurance Other
	Discharge location	Home Home with home care Skilled nursing facility Inpatient rehabilitation Other
	Severity of illness	Minor Moderate Major Extreme
	Risk of mortality	Minor Moderate Major Extreme

Pearson correlation coefficients were calculated to characterize the relationship between the number of surgeries a surgeon performed and the percentage of patients that surgeon discharged home. An alpha of 0.05 was used to define significance for all tests.

To reflect the complex multilevel structures within the data (having hospital-level, surgeon-level, and patient-level data), a Bayesian hierarchical logistic regression model was fit with discharge location being the dependent variable [9]. Patient-level independent variables included a patient's length of stay, age, diagnosis-related group code, surgery type (total knee or total hip), severity of illness, risk of mortality, and payor. Surgeon-level variables included surgeon's affiliation, rapid recovery protocol use, and the number of surgeries (transformed onto the $\log_2$ scale) performed by the patient's surgeon during the 3 years of interest. The only hospital-level independent variable included was surgery location. It was assumed that surgeon effects were independent of hospital effects. The resulting marginal posterior distributions of parameters were described using medians and 95% highest posterior density intervals (95% HDIs).

In an effort to simplify the multilevel data structure to a single level, a limited data set that did not vary at the surgeon or hospital level was created using a case-control design. All the patients comprising the case and control cohorts received care at our main

Table 2
Predictive Variables Used in the Nomogram Calculation [6].

- Procedure
- Hypertension
- Preoperative ambulatory status
- Home location
- Diabetes
- Age
- Pulmonary
- Number of entry steps
- Heart disease
- Gender
- Infection
- Bedroom location
- Arthritis
- BMI
- Projected weight bearing
- Bathroom location
- Caregiver assistance

BMI, body mass index.