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## How Do Preoperative Medications Influence Outcomes After Total Joint Arthroplasty?

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## ABSTRACT

**Background:** Recent health care policy changes require hospitals and physicians to demonstrate improved quality. In 2012, a prospective database was formed with the Blue Cross and Blue Shield of Michigan to improve quality of care. The purpose of this study was to analyze patient preoperative medication as predictors of outcomes after total joint arthroplasty.

**Methods:** Data were collected on patient's preoperative medications from 2012 to 2015 using a total joint arthroplasty database. Medications were categorized as antiplatelet, antimicrobial, anticoagulant, narcotic, steroid, insulin, or oral diabetes medication. Outcomes included hospital length of stay (LOS), discharge disposition/destination, and 90-day readmission. Univariate and multivariate regression analyses were performed.

**Results:** A total of 3959 patients were studied. Eighty percent (3163 patients) were discharged home. The remainder (795) went to an extended-care facility (ECF). Patients discharged to an ECF were taking more medications (1.13 vs 0.80 in total knee arthroplasty; 1.18 vs 0.83 in total hip arthroplasty;  $P < .001$ ). Patients who were readmitted took more medications (1.0 vs 0.85;  $P < .01$ ). There were more discharges to an ECF in narcotic, steroid, and diabetes medication users. Patients taking anticoagulants, narcotics, insulin, and antiplatelets had greater readmission rates. There was a significant correlation between the number of medications and an increased LOS.

**Conclusion:** Patients taking more medications were more frequently discharged to an ECF and had increased LOS and readmission rates. Narcotics and diabetic medications had the greatest influence. Category and quantity of preoperative medications can be used as predictors of outcomes after arthroplasty surgery.

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Total joint arthroplasty (TJA) is a safe and effective treatment for patients with debilitating arthritis [1–4]. As the US population grows older, the annual demand for TJA will increase. By 2030, it is predicted that over 3.4 million total knee arthroplasties (TKAs) will be performed each year [5]. The majority of these patients are

elderly. They often have several comorbidities requiring a variety of daily medications [1]. Managing complicated medical histories in the setting of an elective procedure creates additional challenges when caring for the arthroplasty patient. Recent changes to reimbursement models have placed increased pressure on surgeons and

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hospital systems to improve quality in the delivery of health care resources [6–9]. It has become increasingly important to identify patient parameters that require a higher level of care and/or resources [10–12]. Previous studies have looked at patient demographics and comorbidities to predict patient outcomes after arthroplasty surgery [6,13–15]. Although these have proven to be useful, additional insight is needed to effectively determine predictors of patient outcomes. In 2012, a group of Michigan hospital systems as well as a major insurance company came together to form the Michigan Arthroplasty Registry Collaborative Quality Initiative (MARCQI). This initiative enabled hospitals to gather data for a quality-based total joint registry. This study utilized one of the participating hospital's data collection to evaluate preoperative medications as a predictor of patient outcomes. All data were collected prospectively by orthopedic nurses specifically trained to be data abstractors. The purpose of this study was to analyze preoperative medication quantity and category as predictors of outcomes after TJA. We hypothesized that an increased number of preoperative medications would lead to less-favorable outcomes after TJA.

## Methods

After institutional review board approval, MARCQI data specific to our hospitals (2) were retrieved. The data extracted were from all elective primary TJA patients who underwent surgery from 2012 through 2015. Patients were excluded if they had revision surgery, TJA for a fracture, or had <90-day follow-up. In addition to patient demographics, data were collected on patient's preoperative medications. Preoperative medication was defined as any medication that the patient was taking within 30 days before surgery. Medications were categorized as antiplatelet, antimicrobial, anticoagulation, narcotic, steroid, insulin, and oral diabetes medications. Dose and frequency were not recorded. Outcome measures included hospital length of stay (LOS), discharge destination (home/extended-care facility [ECF]), and 90-day readmission to our hospital system.

All patients were admitted to the hospital on the day of surgery after undergoing the primary TJA. Postoperatively, each patient underwent a standardized hospital pathway protocol for pain control, deep venous thrombosis prophylaxis, physical therapy, and discharge planning. All patients were provided preoperative information about the hospital stay and expectations for discharge. They were encouraged to attend a preoperative total joint class (attendance exceeds 95%), and were seen preoperatively for medical clearance and presurgical testing.

## Statistical Analysis

The primary variables of this study were the total number of preoperative medications and the categories of medication taken by patients. Data were interpreted using a Student 2-way *t* test for univariate analysis. Multivariate logistic regression analysis was used to identify individual medications as predictors of readmission and discharge destination. A linear regression model was used to correlate LOS and number of medications. Results were verified using SPSS statistical analysis software, version 22.0 (IBM Corporation, Armonk, NY). A *P* value of <.05 was considered statistically significant. Comparisons were made separately for TKA and THA populations.

## Results

A total of 3959 patients fit our inclusion criteria (2741 TKAs and 1218 THAs). There were 2538 female and 1421 male patients.

**Table 1**  
Demographics.

Demographics	Total Hip Arthroplasty	Total Knee Arthroplasty
Patients, n (%)	1218 (31)	2741 (69)
Age, mean (SD), y	65.57 (11.52)	66.91 (10.01)
Gender, female:male, n (%)	701 (58):517 (42)	1837 (67):904 (33)
Body mass index, mean (SD), kg/m <sup>2</sup>	30.34 (6.25)	33.22 (7.23)
Length of stay, mean (SD), d	2.35 (1.28)	2.35 (1.75)
Discharge, home:ECF, n (%)	944 (78):274 (22)	2219 (81):521 (19)
90 Day readmissions, n (%)	68 (6)	138 (5)
Total preoperative medications, mean (SD)	0.91 (0.79)	0.86 (0.78)

ECF, extended-care facility; SD, standard deviation.

The average age of our patients was 66 years, and average LOS after arthroplasty was 2.34 days. Eighty percent (3162) of patients were discharge home after surgery, whereas the remainder went to an ECF. The average number of preoperative medications per patient was 0.88 (Table 1).

Table 2 shows the number and percent of patients taking each category of medication for THA and TKA. The most common medication used were antiplatelet drugs. Forty-two percent of THA patients and 44 percent of TKA patients were on an antiplatelet drug. Twenty-four percent of all patients were taking a narcotic preoperatively. Thirty-three percent of THA patients and 37 percent of the TKA patients were not on any preoperative medications.

TKA patients discharged to an ECF were taking significantly more medications (1.13 vs 0.80; *P* < .0001). The same relationship was true of THA patients (1.18 vs 0.83; *P* < .001; Table 3). THA patients taking antiplatelet drugs, narcotics, insulin, and oral diabetes medications were all discharged to an ECF at a higher rate than those who were not taking these medications. Similarly, TKA patients taking the same medications preoperatively, in addition to anticoagulants and steroids, also showed a greater chance of discharge to an ECF (Table 4). Antimicrobial use was not significant in either patient population. THA patients taking an antiplatelet had the highest rate of readmission, whereas TKA patients taking anticoagulants, narcotics, or insulin had the greatest rates of readmission (Table 5). Linear regression showed a significant correlation between the number of preoperative medications and an increased LOS in both the THA and TKA populations (Fig. 1). When readmitted, THA patients averaged 1.15 medications, whereas those without a readmission averaged 0.95 (*P* = .01). When readmitted, TKA patients averaged 1.02 medications, whereas those without a readmission averaged 0.85 (*P* = .01).

## Discussion

TJA patients present unique challenges to the health care system. Since the care is very episodic, it has come under much scrutiny relative to cost and quality of care measures. The patients,

**Table 2**  
Medication Usage Profile Among THA and TKA Patients.

Medication Classification	THA	TKA
Anticoagulant, patients (%)	49 (4.02)	138 (5.03)
Antimicrobial, patients (%)	39 (3.20)	69 (2.52)
Antiplatelet, patients (%)	512 (42.03)	1210 (44.14)
Narcotic, patients (%)	383 (31.44)	575 (20.98)
Steroid, patients (%)	37 (3.03)	66 (2.41)
Insulin, patients (%)	20 (1.64)	72 (2.63)
Oral diabetic medication, patients (%)	71 (5.83)	226 (8.25)
No preoperative medications, patients (%)	405 (33.25)	1037 (37.83)

THA, total hip arthroplasty; TKA, total knee arthroplasty.

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