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Original Research

Reducing Opioid Prescriptions Lowers Consumption Without Detriment to Patient-Reported Pain Interference Scores After Total Hip and Knee Arthroplasties

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ABSTRACT

Background: Opioid addiction is endemic in the United States. We developed a standardized opioid-prescribing schedule (SOPS) after total hip arthroplasty (THA) and total knee arthroplasty (TKA) and evaluated opioid usage alongside Patient-Reported Outcomes Measurement Information System (PROMIS) pain interference scores. We hypothesized that opioid usage would be less than prescribed and reducing prescription would decrease consumption without negatively impacting the PROMIS scores.
Methods: A prospective observational study was performed on all patients undergoing primary THA and TKA from April 7, 2018, to August 10, 2019. Opioid consumption and pain interference were determined 2 weeks after discharge via telephone and email surveys. SOPSs were implemented during the study. Outcomes were compared in patients before and after the SOPS.
Results: A total of 715 patients met inclusion criteria; 201 patients completed surveys. Before the SOPS, the mean opioid prescription was 81.2 ± 15.3 tablets for THA and 82.9 ± 10.6 for TKA. The mean usage was 35.1 ± 29.4 tablets and 35.4 ± 33.4, respectively. After the SOPS, the mean usage decreased to 19.4 ± 16.8 ($P = .04$) and 31.6 ± 20.9 ($P = .52$), respectively. After implementation of a second SOPS for THA, the mean number of tablets consumed was 21.5 ± 18.6 ($P = .05$ compared with pre-SOPS). The PROMIS 6B responses in patients who underwent THA demonstrated no significant changes. PROMIS 6B responses for TKA showed an increase in interference with recreational activities ($P = .04$) and tasks away from home ($P = .04$), but otherwise had no significant impact on reported scores.
Conclusions: Implementation of the SOPS reduced postoperative opioid prescription and consumption without significantly impacting the reported pain interference, supporting the need to decrease opioid prescription after THA and TKA.

Introduction

Opioid-prescribing patterns have garnered national attention after the increased rates of opioid use and opioid-related deaths, with the United States consuming an estimated 80% of the global opioid supply [1]. Although total hip arthroplasty (THA) and total knee arthroplasty (TKA) are widely successful in reducing pain and enhancing function, orthopaedic surgeons may be overprescribing postoperative opioids [2]. A notable risk factor for increased postoperative opioid use is preoperative opioid use, with an estimated 44% of patients who underwent THA and 31% of those who underwent TKA receiving opioid prescriptions within 3 months before their procedure [3,4]. However, opioid-naïve patients can also develop chronic opioid dependence postoperatively, with orthopaedic surgeons' prescriptions, contributing to an estimated 8.8% of these cases [5]. Despite this, postoperative analgesia is paramount for success as studies have demonstrated that patients who had moderate or severe pain postoperatively were more likely to develop persistent stiffness and report worse outcomes [6].

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Since the American Pain Society declared pain as the 'fifth vital sign' in 1995, there has been increased pressure on the providers of postoperative patients, resulting in increased prescribing patterns [7]. However, a delicate balance exists between analgesia and overmedication. Most patients undergoing arthroplasty are older than 65 years, and opioids are known to cause lethargy, delirium, and even postoperative falls [5]. Side effects such as nausea or fatigue could prompt patients to decline physical therapy sessions which are crucial to earlier discharge and long-term outcomes [8]. To combat the overuse of opioids, a multimodal pain regimen has been shown to reduce complications of isolated opioid use postoperatively and improve outcomes and has become the gold standard for pain management postoperatively for total joint arthroplasty [9].

Prior studies have evaluated postoperative opioid-prescribing protocols and demonstrated that a reduction in the number of opioids prescribed, as a result of an institutional or a legislative policy, resulted in fewer opioids consumed [2,10,11]. However, it was unknown how institution- and state-wide mandates to lower opioid prescription would impact patient-reported outcome measurements.

The purpose of this study was to prospectively evaluate a standardized opioid-prescribing schedule (SOPS) in THA and TKA. We hypothesized that reducing opioids prescribed through an SOPS would result in decreased opioid consumption without negatively impacting Patient-Reported Outcomes Measurement Information System (PROMIS) pain interference scores postoperatively.

Material and methods

Institutional review board approval was obtained before initiation of this study. We performed a prospective survey study of consecutive patients presenting for THA and TKA at our high-volume academic medical center with 2 senior surgeons. Consecutive patients undergoing primary THA and TKA (identified by Current Procedural Terminology [CPT] codes 27130 and 27447, respectively) were included, enrolled, and consented in the study when they received the 2-week postoperative telephone or electronic survey. All patients without osteoarthritis (eg, hip fractures or impending pathological fracture) were excluded from the study. Patients with a prior history of drug abuse or dependence were excluded. All patients were offered a preoperative total joint arthroplasty educational program that involved a facility tour and teaching on their expected postoperative course including therapy. Opioid counseling did not differ before or after SOPS optimization, and the study was not discussed during the educational program. All patients underwent spinal anesthesia with no change in the intraoperative or immediate postoperative anesthesia protocol during the study period. Both surgeons followed the same SOPS.

The PROMIS score is a validated algorithm developed by the National Institutes of Health to improve patient-reported outcomes measurements in pain by tracking and assessing patient outcomes and is becoming increasingly popular with the shift to outcome-based reimbursement. Specific to this study, the PROMIS 6B short form is a validated measure of pain interference in daily activities that assesses pain interference in 6 aspects of livelihood: enjoyment of life, ability to concentrate, performance in day-to-day activities, enjoyment of recreational activities, participating in tasks away from home such as running errands, and socializing with others [12]. The PROMIS 6B short form has been used in previous orthopaedic studies [13,14]. The PROMIS 6B short form is graded from 1 (not at all) to 5 (very much).

From April 7, 2018, until October 1, 2018, opioid consumption and PROMIS 6B scores were assessed using the pre-SOPS opioid-prescribing patterns after primary THA and TKA. One surgeon used a periarticular injection with liposomal bupivacaine. All patients received a similar multimodal pain control program postoperatively. Patients were encouraged to use nonopioid adjunct medications before taking oxycodone that was available at a dosage of 5-mg tablets every 4 hours as needed for severe pain if nonopioid medications were ineffective. Nonopioid adjunct medications prescribed included acetaminophen 1000 mg scheduled every 8 hours and the use of cryotherapy. One surgeon also prescribed meloxicam 7.5 mg taken once daily. Intravenous morphine was also available for pain uncontrolled by oral medications. The multimodal nonnarcotic portion of the pain protocol did not differ before and after the SOPS. Each patient's chart was retrospectively reviewed, and the medical reconciliation at the time of discharge was analyzed. The number of oxycodone 5-mg tablets prescribed was recorded and stored in a secure database.

A SOPS was created by using approximately one standard deviation higher than the total number of tablets consumed as reported on postoperative surveys obtained from April 7, 2018, through October 1, 2018, a process similar to methods used previously at our institution for nonorthopaedic surgical procedures. Before initiation of the SOPS, the average number of oxycodone 5-mg tablets prescribed was 81.2 ± 15.3 and the average usage was 35.1 ± 29.4 for THA. The average number of oxycodone 5-mg tablets prescribed was 82.9 ± 10.6, and the average usage was 35.4 ± 33.4 for TKA. Using the average number of oxycodone consumed for each procedure plus one standard deviation, an SOPS of 60 tablets was adopted for both THA and TKA.

The SOPS was initiated on October 1, 2018, and continued until March 1, 2019. A new SOPS was initiated on March 1, 2019, for THA only because of the lower consumption comparatively to TKA and continued until August 10, 2019. Patients received either telephone or electronic surveys at 2 weeks after discharge that assessed opioid consumption and the PROMIS 6B pain interference short form. Surveys transitioned from telephone surveys to electronic surveys via email on October 29, 2018. If the patient was unable to be successfully reached via telephone, the callers would attempt contacting the patient an additional 2 more times (a total of 3 times). For the electronic survey, emails were sent initially 2 weeks after discharge, and if the survey was not completed, the patient would receive an automated second and third email stating that the survey has not been completed. Patients would not receive more than 3 emails. Results were stored within a secure database. Continuous outcomes were analyzed with 2-sample t-tests for TKA and with ANOVAs and Bonferroni post hoc tests for THA with significance set at $P < .05$. TKA PROMIS questions were examined using the Mann-Whitney U tests. THA PROMIS questions were analyzed using the Kruskal-Wallis tests with pairwise comparison by Dwass-Steel-Critchlow-Fligner methods. All statistical analyses were performed using SAS, version 9.4 (SAS Institute Inc., Cary, NC).

Results

A total of 715 patients met inclusion criteria, including 282 patients after primary THA (using CPT code 27130) and 433 patients after TKA (using CPT code 27447) (Fig. 1). During the study, there was 90% adherence to the SOPS protocol for THA and 94.4% adherence to SOPS for TKA, combining for 92.6% adherence rate to the SOPS protocol. A total of 323 patients received telephone surveys with a total of 111 (34.4%) patients completing the survey. A total of 392 patients received electronic surveys via email with a total of 192 (49%) patients completing the survey.

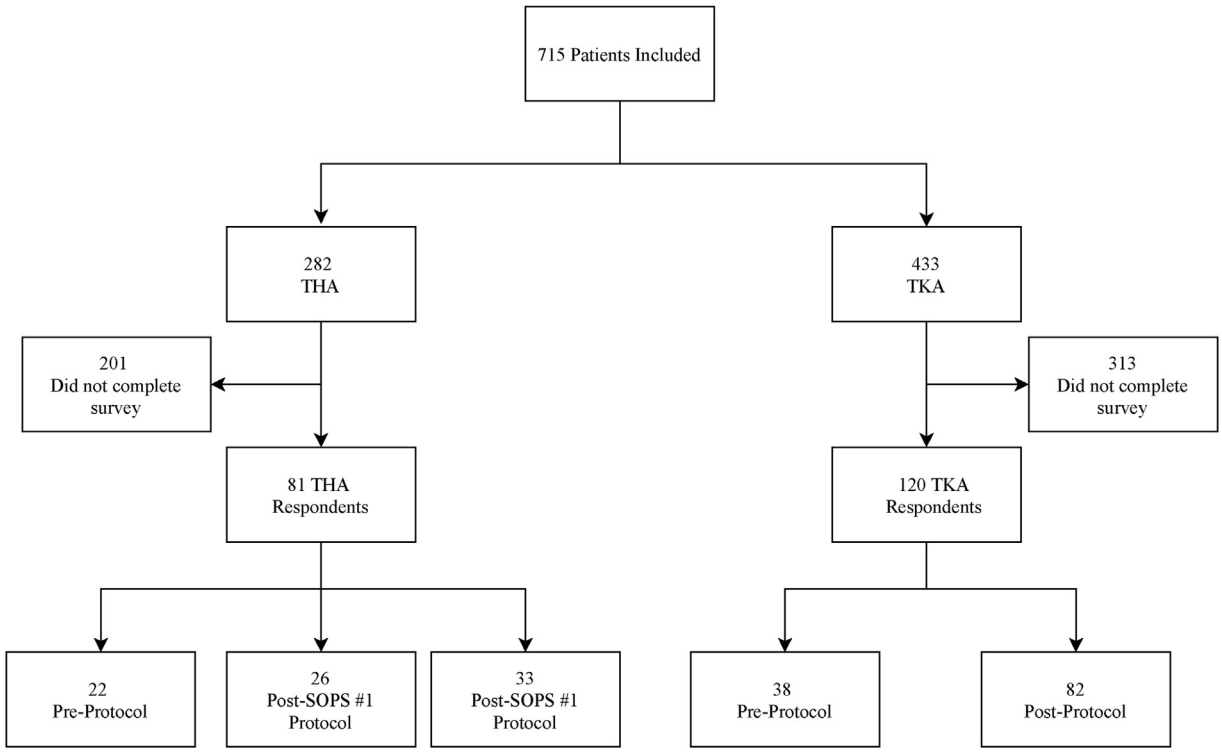

Figure 1. Consolidated Standards of Reporting Trials (CONSORT) diagram. The CONSORT diagram showing those patients who were included in, enrolled in, and completed the surveys for each procedure.

Total hip arthroplasty

Of the 282 patients who underwent THA during our study period, 81 (31.2%) completed the surveys: 22 pre-SOPS and 26 during the first SOPS and 33 during the second SOPS. The average age of participants was 62.1 ± 8.8 years pre-SOPS and 62.2 ± 10.1 years post-SOPS of 60 tablets and 61.5 ± 11.8 year post-SOPS of 30 tablets ($P = .95$). There was a statistically significant decrease in the number of prescribed doses of oxycodone from the pre-SOPS to post-SOPS of 60 tablets ($P < .0001$) and from the post-SOPS of 60 tablets to post-SOPS of 30 tablets ($P < .0001$). After the initiation of the SOPS of 60 tablets, average opioid usage significantly dropped from 35.1 ± 29.4 to 19.4 ± 16.8 tablets ($P = .04$) (Fig. 2). After the initiation of the SOPS of 30 tablets, average opioid slightly increased to 21.5 ± 18.6, but the increase was not significant relative to the SOPS of 60 tablets ($P = .71$). PROMIS 6B scores did not demonstrate any significant change between the pre-SOPS and post-SOPS (Table 1). The length of stay during the study period for THA was 2.5 ± 1.1 days pre-SOPS, 2.5 ± 0.7 days post-SOPS for 60 tablets, and 2.7 ± 1.0 days post-SOPS for 30 tablets. This was not significantly different among the 3 groups ($P = .76$).

Total knee arthroplasty

Of the 433 patients who underwent TKA during our study period, 120 (27.7%) completed surveys: 38 pre-SOPS and 82 post-SOPS. The average age of participants was 64.9 ± 8.0 years pre-SOPS and 66.4 ± 9.4 years post-SOPS ($P = .42$). There was a statistically significant decrease in the number of prescribed doses of oxycodone from 82.9 ± 10.6 pre-SOPS to 60.8 ± 13.8 post-SOPS ($P < .0001$). After the initiation of the SOPS, average opioid usage dropped from 35.4 ± 33.4 pre-SOPS to 31.6 ± 20.9 tablets post-SOPS ($P = .52$) (Fig. 2). PROMIS 6B scores had no significant difference between the pre-SOPS and post-SOPS aside from pain interfering with recreational activities and tasks away from home, which were both statistically significant increases in reported scores ($P = .04$) (Table 2). Length of stay during the study period for TKA was 2.2 ± 0.8 days pre-SOPS and 2.5 ± 0.8 days post-SOPS. This did represent a statistically significant difference ($P = .03$).

Discussion

The results of this study demonstrate that implementation of an SOPS reduced opioid prescription and consumption without a clinically significant detriment to patient-perceived pain interference scores after THA and TKA. Previous studies have defined that the minimally important difference for the PROMIS pain interference scale is 2 points [15]. For THA, none of the 6 questions within the PROMIS reached statistical differences between the pre-SOPS and post-SOPS. However, for TKA, 2 questions did reach a statistical difference between the pre-SOPS and post-SOPS: pain interference with recreational activities and pain interference with performing tasks away from home (eg, running errands and getting groceries). However, neither of these 2 reached the previously defined minimally important difference. The PROMIS 6B short form was distributed to patients 2 weeks postoperatively, a time when the majority of patients are still in physical therapy and would likely find these tasks and activities challenging.

It is interesting to note the somewhat surprising results that the usage between patients who underwent THA and TKA was approximately the same and that the variation in usage was substantial and virtually the same for patients who underwent THA and TKA. We attribute the wide variation in usage to the small subset of each patient who underwent THA and TKA and reported minimal to no opioid consumption postoperatively. Although the number of consumed doses was only statistically significant

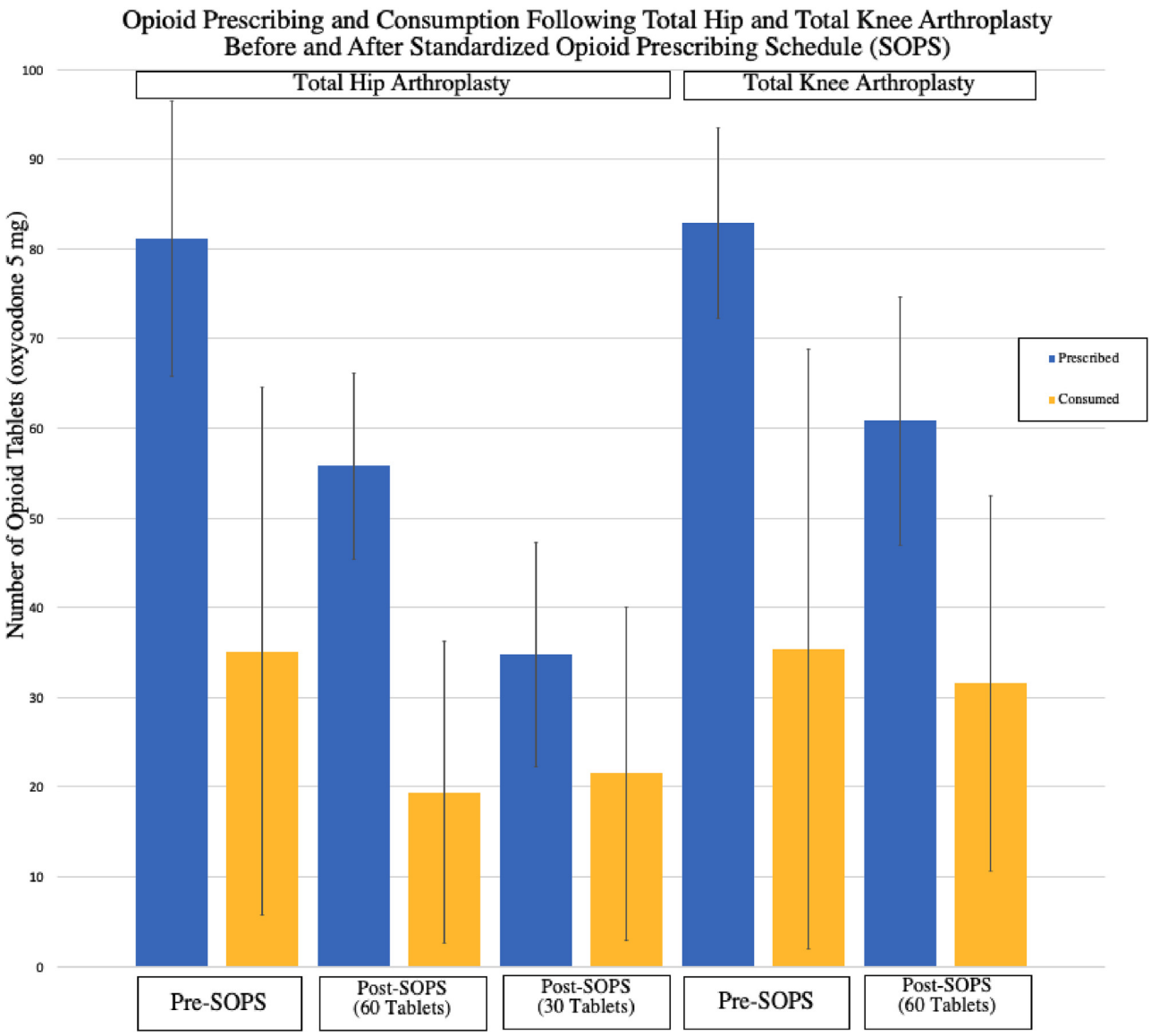

Figure 2. Opioid prescription and consumption after total hip and total knee arthroplasties before and after the standardized opioid-prescribing schedule. This graph shows the number of oxycodone tablets prescribed and consumed postoperatively as reported by patients 2 wk after discharge along with error bars representing 1 standard deviation from the mean.

between the pre-SOPS and post-SOPS 60-tablet groups for THA, a large decrease of overall consumption of postoperative opioids was evident.

The importance of appropriate prescribing habits and disposal is highlighted by the review of prescribing patterns by Sabatino et al [2], which found that although 61% of cases had unused opioid

Table 1
PROMIS 6B scores after THA.

PROMIS 6B	Pre-SOPS	Post-SOPS (60 tablets)	Post-SOPS (30 tablets)	*P*-value
How much did pain interfere with your enjoyment of life?	2.55 ± 1.68	2.77 ± 1.18	2.88 ± 1.08	.35
How much did pain interfere with your ability to concentrate?	2.23 ± 1.51	2.20 ± 1.08	2.13 ± 1.16	.89
How much did pain interfere with your day-to-day activities?	3.14 ± 1.46	2.85 ± 1.01	2.85 ± 1.37	.68
How much did your pain interfere with recreational activities?	3.41 ± 1.65	3.12 ± 1.34	3.52 ± 1.35	.52
How much did pain interfere with doing your tasks away from home (eg, getting groceries, running errands)?	3.55 ± 1.68	2.96 ± 1.37	3.42 ± 1.35	.26
How often did pain keep you from socializing with others?	2.14 ± 1.32	2.31 ± 1.23	2.22 ± 1.16	.81

Using analysis of variance with 95% confidence interval for difference; $\alpha < 0.05$.
PROMIS 6B graded on a scale from 1 (not at all) to 5 (very much).

Table 2
PROMIS 6B scores after TKA.

PROMIS 6B	Pre-SOPS	Post-SOPS	*P*-value
How much did pain interfere with your enjoyment of life?	3.16 ± 1.33	3.56 ± 1.08	.13
How much did pain interfere with your ability to concentrate?	2.5 ± 1.29	2.94 ± 1.24	.086
How much did pain interfere with your day-to-day activities?	3.24 ± 1.20	3.41 ± 1.15	.40
How much did your pain interfere with recreational activities?	3.46 ± 1.37	3.99 ± 1.20	.04[a]
How much did pain interfere with doing your tasks away from home (eg, getting groceries, running errands)?	3.43 ± 1.50	4.02 ± 1.19	.04[a]
How often did pain keep you from socializing with others?	2.71 ± 1.43	3.04 ± 1.12	.14

Using 2-sample t-test with 95% confidence interval for difference; $\alpha < 0.05$.
PROMIS 6B graded on a scale from 1 (not at all) to 5 (very much).
[a] Represents statistical significance.

medications, only 41% of patients appropriately disposed of unused opioid pills after nonuse. Prior studies have also demonstrated success in reducing opioid consumption by limiting prescription. In a 304-patient randomized controlled trial by Hannon et al [10], prescribing fewer opioid pills at discharge after total joint arthroplasty led to a significant reduction in unused opioid pills and decreased overall opioid consumption without an increase in pain scores or a difference in patient-reported outcomes. After Vermont's implementation of legislation limiting the amount of postoperative opioids that could be prescribed at the time of hospital discharge, the observational study by MacLean et al [11] was associated with decreased opioid prescription. The results of the present study further solidify these conclusions and substantiate that a reduction in opioid prescription decreases consumption without negatively impacting pain interference perception.

There are several limitations inherent to this prospective observational study. First, we relied on self-reported opioid consumption and did not analyze scheduled substance-prescribing databases. Because our Accountable Care Organization operates under a policy in which the orthopaedic surgeon is solely responsible for opioid prescription in the first 6 weeks postoperatively, it is unlikely the patients were obtaining additional prescriptions. In addition, our survey response rate was low with only 31.2% of patients who underwent THA and 27.7% of patients who underwent TKA completing postoperative surveys. Although it is possible that these nonresponders showed dissatisfaction with reduced opioid prescription, it is also conceivable that this population was simply uninterested in or unable to complete the survey. Of note, the mode of survey changed from telephone survey to electronic survey during the study. This change was made because of resource and time constraints of those making the phone calls and may have contributed to the observed change in the response rate. In regard to the characteristics of the participants, there was no significant difference in the age between the groups. However, further patient baseline characteristics could have been beneficial to compare between the groups to ensure no other variable confounded narcotic consumption. Another limitation is the slight difference in multimodal pain control, with one surgeon using a periarticular injection. Analysis of opioid consumption by the surgeon could provide insight into ways to further reduce consumption, but owing to the confidential methodology used for survey administration, this information was not available. The multimodal protocol could also be expanded with other modalities. The length of stay during the study did have a statistically significant increase in TKA but not in THA. Despite this statistical significance for TKA, we do not believe the half-day increase in the length of stay was clinically meaningful. Finally, despite short-term follow-up, the 2-week survey was intentionally chosen to capture narcotic usage in the acute postoperative period. Although patients may be experiencing postsurgical limitations in their activities, the results of the present study demonstrate that similar early results in patient satisfaction and pain interference can be attained with reduced opioid prescription postoperatively. Ultimately, we demonstrated that fewer opioids prescribed led to fewer consumption in the immediate postoperative period, with most patients not consuming the amount prescribed.

Conclusions

The results of the present study substantiate that a reduction in opioid prescription reduces postoperative opioid consumption without detriment to patient-reported pain interference scores after THA and TKA. The authors will continue to reassess our SOPS for our specific population and currently prescribe 30 tablets of oxycodone 5 mg for THA and 60 tablets for TKA. By adopting an SOPS, other institutions may be able to reduce opioid prescription without negatively impacting patient-reported outcomes. The authors recommend that other institutions adopt a similar methodology to reduce opioid prescription, consumption, and surplus knowing that doing so will not negatively impact patient-perceived pain after THA and TKA.

Conflict of Interests

D.J.D. Gaizo is a member of the speakers' bureau for Pacira Pharmaceuticals, is a paid consultant for DePuy Synthes, OrthAlign, Pacira Pharmaceuticals, and SPR Therapeutics, receives research support from Biom'Up, Conformis, DePuy, Pacira, Reflexion Health, Stryker, and Zimmer Biomet, and is a member of the editorial or governing board of the *Journal of Arthroplasty*; all other authors declare no potential conflicts of interest.

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