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Original Research

Preoperative Patient Education as a Tool for Reducing Postoperative Opioid Use Following Primary Total Hip Arthroplasty: One Institution's Experience

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ABSTRACT

Background: Minimizing postoperative opioids remaining after total hip arthroplasty (THA) is important for patient outcomes and community safety. The purpose of this study was to investigate whether completion of one preoperative patient education class prior to THA was associated with reduced opioid consumption at 2 weeks postoperatively. Secondary goals included evaluating whether satisfaction scores and postoperative healthcare utilization were impacted by class attendance, and whether demographic characteristics varied between groups that may highlight care disparities for our practice to address.

Methods: Patients undergoing primary THA between January 2022 and December 2024 at a single large academic institution were retrospectively evaluated for inclusion, identifying 372 patients who completed the education class and 30 patients who did not. All patients received a multimodal perioperative pain management protocol standardized at our institution.

Results: The number of morphine milligram equivalents (MMEs) consumed in the 2 weeks following THA was significantly lower among the class completion group (84.60 vs 127.30 MMEs; $P = .04$). On multivariable analysis, patients who attended the preoperative education class consumed 41.57 fewer MMEs compared to those who do not attend (95% confidence interval: −75.87 to −7.27; $P = .018$). No differences in complications, 2-week refill requests, emergency department visits, or readmission were noted. Functional outcome and satisfaction scores were high among both groups.

Conclusions: THA patients who completed an education class preoperatively consumed significantly fewer prescribed opioids as measured at the 2-week mark following surgery compared to those who did receive education. Our results support the role of patient education in reducing opioid use following arthroplasty.

Introduction

Orthopaedic surgeons prescribe between 7.7% and 8.8% of all opioid prescriptions in the United States [1]. While these medications provide benefit to patients by reducing pain and thereby increasing their ability to participate in postoperative physical therapy, they also carry multiple established short-term risks, including respiratory depression and sedation, postoperative urinary retention, increased rates of infection, and poor mobilization leading to increased incidence of deep venous thrombosis and pulmonary embolism [2-4]. In the longer term, these narcotic medications pose a risk for diversion and addiction [5-7]. Combined with the shift to outpatient surgery limiting medical supervision for the use of these high-risk medications, there has been a concerted effort within the field of orthopaedics and the

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subspecialty of arthroplasty to reduce opioid prescribing after surgical procedures [8-10].

Following the removal of total hip arthroplasty (THA) and total knee arthroplasty (TKA) from the Medicare inpatient-only list, as well as the impact of the COVID-19 pandemic, the subspecialty of arthroplasty has successfully shifted to outpatient surgical care, with approximately 54.5% of THA surgeries and 62.4% of TKA surgeries now performed on a same-day basis [11]. Concerns about overprescribing opioids among patients undergoing total joint arthroplasty (TJA) are particularly relevant, as the shift to outpatient surgery necessitates that most of the postoperative recovery occurs in the outpatient setting without oversight of opioid consumption [12]. The positive impact of preoperative patient education on patient outcomes following TJA is well-established [13,14], yet the impact of education on postoperative opioid use specifically is an area of ongoing study [12,15,16]. Patient education classes are considered an important component of enhanced recovery after surgery (ERAS) pathways following TJA, with the implementation of ERAS protocols heralding substantial reductions in opioid prescribing postoperatively, with studies reporting reductions of close to 50% in morphine milligram equivalents (MMEs) prescribed at discharge for arthroplasty patients [17,18].

Patient education has already been demonstrated to impact TJA postoperative opioid consumption, yet analysis has been largely limited to very short-term time points and concentrated within TKA patients. A randomized controlled trial of 93 TKA patients demonstrated that patients receiving preoperative video-based opioid counseling consumed fewer MMEs during the first 3 postoperative days (78.8 vs 106.1 MMEs; $P = .020$) and the first week (129.9 vs 180.7 MMEs; $P = .028$) [12]. Similarly, a study providing TKA patients with an analgesic information card found a significant reduction in opioid consumption during the first 2 postoperative days following implementation of the card system (median MMEs: 38 vs 71; $P = .001$) [15]. Given current findings are limited to the days immediately following surgery, the primary purpose of this study was to identify whether completion of a single preoperative education class addressing postoperative pain control and expectations following surgery resulted in reduced postoperative opioid consumption following elective primary THA when evaluated at the 2-week mark following the procedure.

Secondary goals were to evaluate whether completion of a preoperative education class was associated with less postoperative healthcare utilization (emergency department [ED] visits and hospital readmission) and whether functional, pain, and satisfaction scores following these procedures were impacted. We hypothesized that patients who completed the education class would utilize fewer postoperative opioids without increased postoperative healthcare utilization or inferior patient-reported outcome measures. Additionally, we sought to evaluate this information as part of a quality improvement (QI) initiative to determine if demographic characteristics varied between education groups that may highlight disparities in access to preoperative education.

Material and methods

Study design

All patients undergoing elective primary THA procedures performed at our institution between January 1, 2022, and December 31, 2024, were retrospectively evaluated for study eligibility based on the inclusion and exclusion criteria outlined in Table 1. The idea for this study originated as a QI initiative to evaluate patient attendance of preoperative patient education classes to determine if there were barriers to address to improve accessibility. Upon further development, this project grew in scope to investigate the potential of an association between preoperative patient education attendance and postoperative opioid use. Institutional review board was sought, and this study was deemed exempt. All patients received THA by one of 4 fellowship-trained arthroplasty surgeons using the anterior-based muscle-sparing (ABMS) (also known as the modified Watson-Jones or Rottinger approach) [19,20] or direct anterior approach. All patients received a similar multimodal perioperative pain management protocol aligned with practice protocol; patients were excluded if a regional anesthesia block not yet adopted as part of the current protocol was utilized (fascia iliaca compartment block, n = 1; pericapsular nerve group block, n = 74) (Supplemental Table 1) as well as if they had any opioid use within the 30 days prior to surgery (Table 1). The outcomes of interest were evaluated based on preoperative education class completion. All patients were offered the preoperative education class with the expectation established that they would attend before proceeding with THA surgery.

Preoperative patient education class

Patient education classes were available in one of 3 formats based on patient preference. The in-person class was conducted at the practice office and the electronic class was conducted on Zoom (Zoom Communications, San Jose, California). Both classes covered the same material via slide deck, were conducted in English, and lasted 60 minutes in duration. Prerecorded videos made using the same slide deck utilized in the in-person and Zoom (Zoom Communications, San Jose, California) classes were published on YouTube (Google, San Bruno, California) and available for patients who required instruction in a language other than English. YouTube was utilized for the platform's ability to provide closed captioning and autotranslation for over 100 languages (Google, San Bruno, California). Patients without home access to internet and/or otherwise

Table 1
Study inclusion and exclusion criteria.

Inclusion	Exclusion
Undergoing eligible surgical procedure between 2022 and 2024 • Primary THA	• Age at the time of surgery less than 18 years • Arthroplasty for fracture and/or infection • Conversion arthroplasty • Preoperative opioid use (OUD, chronic pain) within 30 days of surgery • Cases with multiple scripts for opioids • Liver and/or renal insufficiency • Regional anesthesia block nonstandard to practice's current multimodal perioperative pain management protocol • Cases without 2-week postoperative pill count data • Cases without refill requests that reported higher pill count at 2-week postoperative visit than was prescribed at the preoperative visit

OUD, opioid use disorder.

unable to attend an in-person or Zoom (Zoom Communications, San Jose, California) class were scheduled for additional office time to watch the prerecorded videos in a clinic exam room prior to their history and physical (H&P) appointment. Class completion status was queried at the H&P appointment for all patients. Classes were led by a designated Orthopaedic Nurses Certification Board-certified nurse (Orthopaedic Nurses Certification Board, Chicago, IL). Class materials were based on education materials curated by this nurse with the oversight and input of practice surgeons based on American Association of Hip and Knee Surgeons best practice guidelines. Each patient pursing elective THA was expected to attend a single class within 6 months of their procedure. For most patients, class completion was targeted after a surgery date had been scheduled but before the H&P office visit appointment had occurred, most often 4-6 weeks prior to the operation. The class reviewed desired preparation for surgery, day-of-surgery instructions and an overview of the day, postoperative pain control, postoperative risk prevention, expectations for the days following surgery, return precautions, contact information, and a period for questions and answers. While preoperative patient education classes have been a standard part of our preoperative workflow for patients undergoing elective THA for multiple years, the specific emphasis placed on opioid use and postoperative pain expectations, as well implementation of electronic tracking of class attendance, was instituted in January 2022 in response to the shift toward outpatient THA following the COVID-19 pandemic. Patient participation was tracked via creation of an EPIC (EPIC Systems, Verona, Wisconsin) nursing note after completion of the class, and an EPIC SmartPhrase (EPIC Systems, Verona, Wisconsin) was created to efficiently pull this information into subsequent surgeon notes.

Data collection

Demographic data were obtained from the institutional electronic medical record (EMR), including sex (male or female, as recorded in the EMR), age, body mass index (BMI), race, ethnicity, American Society of Anesthesiologists score, Charlson Comorbidity Index [21], insurance category (Medicare, Medicaid, Department of Veterans' Affairs, private, uninsured, or workers' compensation), preoperative diagnosis, regional anesthesia block type, surgical approach (ABMS or direct anterior), location of surgery (outpatient surgical center, hospital outpatient, or hospital inpatient), and same-day discharge status (yes/no). The status of an online MyChart patient portal account (activated, inactivated, pending activation, patient declined) (EPIC Systems, Verona, Wisconsin) was recorded. Postoperative data collected included the occurrence of any postoperative complication, ED visit within 30 days, and readmission within 90 days. Opioid utilization data included predischarge visual analog scale (VAS) pain score, intraoperative MME, postanesthesia care unit (PACU) MME, total MME prescribed on discharge, MME consumed in the 2 weeks postoperatively (calculated based off of remaining pill count and any refill requests, collected at the 2-week postoperative office visit), proportion of the postoperative opioid prescription consumed at 2 weeks postoperatively, and postoperative opioid refill requests (binary yes/no) within 2 weeks of the index procedure, all collected from an in-house database. Patient reported outcome measures (PROMs) were recorded preoperatively and at 6 weeks and 1 year postoperatively. These included VAS and the Hip Disability and Osteoarthritis Outcome Score Joint Replacement score collected from an in-house database. Satisfaction scores evaluating functional improvement, procedure meeting expectations, pain relief, and surgeon were collected for the postoperative time points.

Data analysis

To assess the relationship between completion of the preoperative education class and outcomes of interest, all demographic and outcome variables were analyzed with respect to this variable. Class completion was defined as attendance of one preoperative education class offered through any of the 3 modalities (in-person, via Zoom, and via recording) within 6 months of their THA procedure. Noncompletion was defined as lack of attendance of any preoperative education class within the 6 months prior to performed THA procedure. Predischarge total MME (MME prescribed during surgery, in the PACU, and/or predischarge) was not included; only medication prescribed by the orthopaedic surgeon at the time of discharge was included in the final analysis.

For continuous variables with a normal distribution, an independent Student's *t*-test was conducted to compare means between cohorts. For results that did not follow a normal distribution, nonparametric analysis was conducted using a Mann-Whitney U test. Assessment of categorical variables was done through a chi-square test or Fisher exact test when criteria for application of the former were not met. A P value of <0.05 was considered statistically significant. Because multiple secondary outcomes were analyzed independently (including 2-week opioid refills, postoperative complications, 30-day ED visits, and 90-day readmission), P values associated with these secondary outcomes were adjusted using the Benjamini-Hochberg procedure to control the false discovery rate. Adjusted P values < 0.05 were considered statistically significant following this correction. A power analysis was conducted to evaluate the adequacy of the sample size for detecting differences in MME consumption between education groups. The analysis was based on a two-sided confidence interval of 95%. The power of the study was calculated using a *t*-test power calculation and resulted in a power estimate of 77.04%, indicating that the sample size is acceptably high-powered to accurately detect true differences in MME consumption.

Univariate regression models were created to analyze the relationship between patient- and hospital-reported outcomes and all covariates. Multivariable logistic regression models were then created using a combination of purposeful selection ($P < .2$) and clinical expertise with respect to individual outcome. Any patients with missing data were excluded from the regression analysis. All analysis was performed using R version 4.2.1 (R Foundation for Statistical Computing, Vienna, Austria).

Results

Patient demographics

A total of 402 THA patients were included in this study. Patients were most often excluded due to failure to capture or properly record 2-week postoperative opioid pill count (Fig. 1). This constituted a substantial number of the eligible patient population (85.8% of otherwise eligible patients; Supplemental Table 2). In the education class completion group, there were 372 patients, and in the noncompletion group, there were 30 patients. A total of 92.5% of included patients completed the preoperative patient education class. There were no significant differences in mean age, sex, BMI, and Charlson Comorbidity Index among class completion and noncompletion groups. Medicare insurance was the predominant healthcare coverage type, followed by Medicaid. The predominant self-reported racial and ethnic identity of the patient population was White race and non-Hispanic ethnicity. Arthritis was the predominant preoperative diagnosis in both groups. No regional anesthesia block was performed for any included patients.

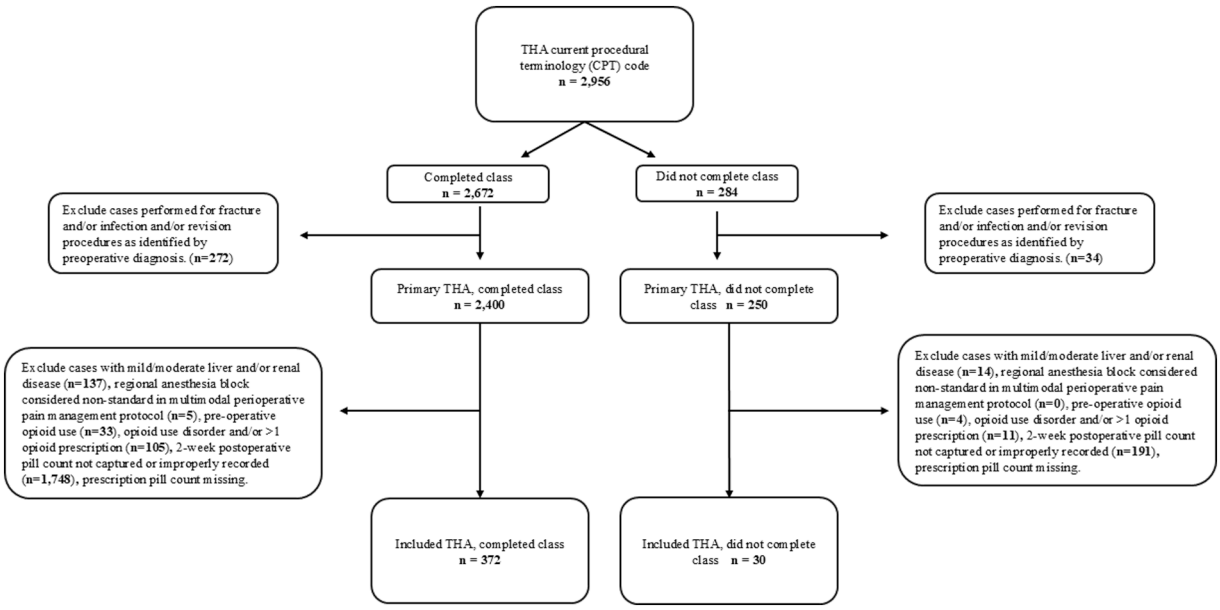

Figure 1. Cohort selection based on inclusion and exclusion criteria.

Notably, MyChart patient portal activation (EPIC Systems, Verona, Wisconsin) was significantly higher among THA patients who completed the preoperative education class compared to those who did not complete the class (96.0% vs 76.7%; $P < .001$). Distribution of surgical approach utilized did not vary significantly between class completion and noncompletion groups, and the ABMS approach was the predominant approach among both groups. The majority of patients received surgery at an outpatient surgical center (82.8% of patients in the class completion group and 76.6% of patients in the class noncompletion group; $P = .58$) and approximately have of all included patients had a same-day discharge (56.2% among the class completion group and 46.7% among the class noncompletion group; $P = .34$). Table 2 summarizes the demographic and perioperative characteristics of the study cohorts. Supplemental Table 2 compares demographic variables between all patients included in this study and those patients excluded (including exclusion due to incomplete pill counts at 2-week postoperative appointment); age, sex, race, BMI, insurance type, surgical approach, and location of surgery did not vary significantly between the included and excluded THA patient populations. A greater proportion of included patients underwent same-day discharge (55.5%) when compared to excluded patients (44.4%) ($P < .001$). The potential exists that ethnicity varied slightly, with the included patient population more often reporting "declined, unknown" when asked to self-report ethnicity. Supplemental Table 3 addresses differences in demographics based on patient class completion method—in-person, over Zoom (Zoom Communications, San Jose, California), or via YouTube (Google, San Bruno, California). Few differences existed based on class type—in-person class participants had the lowest percentage of MyChart patient portal activation (85%) when compared to YouTube (Google, San Bruno, California) (93%) and Zoom (Zoom Communications, San Jose, California) (97%; $P = .014$). A greater percentage of Zoom (Zoom Communications, San Jose, California) class participants (85%) received surgery at an outpatient surgical center than YouTube (Google, San Bruno, California) (71%) and in-person class participants (85%; $P = .03$), and the Zoom (Zoom Communications, San Jose, California) class participants correspondingly had a greater percentage of same-day discharges (59%) than YouTube (Google, San Bruno, California) (55%) and in-person class participants (22%; $P < .01$). Age, BMI, and insurance status did not vary significantly between class instruction type.

Outcomes and opioid use

Postoperative events were rare within study participants; there were no statistically significant differences in incidence of any complication, ED visit within 30 days, or readmission within 90 days between groups. Opioid refill requests recorded at the 2-week postoperative office visit did not differ based on class completion status. Patients completing the preoperative patient education class who underwent THA consumed fewer opioids in the 2-week postoperative period. This was a mean consumption of 84.60 (0-420) vs 127.30 (0-585) MME ($P = .04$). There was not a statistically significant difference in discharge opioid prescribing, with a mean MME of 224.91 (45-420) prescribed for the class completion group and 250.83 (150-675) for the noncompletion group ($P = .35$). There were no differences in intraoperative MME between groups. The class completion group received a greater amount of MME in the PACU (38.31 [0-98]) when compared to the noncompletion group (28.61 [0-134]) ($P = .011$). The proportion of the postoperative opioid prescription used at 2 weeks postoperatively approached significance, with the class completion group consuming 37.15% (0-100%) of their script compared to 47.25% (0-100%) in the noncompletion group ($P = .07$). Table 3 summarizes postoperative outcomes and opioid use characteristics of the study cohort. Multivariable analysis showed that THA patients who attended the preoperative education class consumed 41.57 fewer MMEs on average compared to those who do not attend (95% confidence interval: −75.87 to −7.27; $P = .018$). Table 4 summarizes results of this analysis. Supplemental Table 4 addresses differences in MME use based on patient class completion method—in-person, over Zoom (Zoom Communications, San Jose, California), or via YouTube (Google, San Bruno, California); the only significant difference ($P = .027$) observed was in proportion of postoperative prescription consumed at 2 weeks postoperatively, of which in-person class participants used 54% (0.0-100%), YouTube (Google, San Bruno, California) class participants used 45% (0.0-100%), and Zoom (Zoom Communications, San Jose, California) class participants used 35% (0.0-100%).

Table 2
Demographic information stratified by completion status of preoperative patient education class prior to total hip arthroplasty.

Characteristic	Class completion (n = 372)	Class noncompletion (n = 30)	*P* value
Mean age in y (range)	67.35 (34-89)	65.63 (38-84)	.45
Female sex, n (%)	197 (53.0%)	16 (53.3%)	1.00
Race, n (%)			1.00
American Indian and Alaska Native	1 (0.3%)	0 (0.0%)	
Asian	1 (0.3%)	0 (0.0%)	
Black or African American	0 (0.0%)	0 (0.0%)	
Multiracial	3 (0.8%)	0 (0.0%)	
White or Caucasian	362 (97.3%)	30 (100.0%)	
Native Hawaiian or other Pacific Islander	0 (0.0%)	0 (0.0%)	
Declined, other, unknown	5 (1.3%)	0 (0.0%)	
Ethnicity, n (%)			.30
Hispanic	3 (0.8%)	1 (3.3%)	
Non-Hispanic	357 (96.0%)	29 (96.7%)	
Declined, unknown	12 (3.2%)	0 (0.0%)	
Mean BMI (range)	28.39 (18.4-41.9)	30.09 (20.5-41.9)	.11
BMI category, n (%)			.86
Healthy weight	89 (23.9%)	6 (20%)	
Underweight	2 (0.5%)	0 (0.0%)	
Overweight	151 (40.6%)	12 (40%)	
Obese	130 (34.9%)	12 (40%)	
Mean ASA (range)	2.85 (0-10)	2.50 (0-5)	.26
Mean CCI (range)	2.15 (1−3)	2.33 (2−4)	.08
Insurance type, n (%)			.23
Medicare	209 (56.2%)	16 (53.3%)	
Medicaid	7 (1.9%)	1 (3.3%)	
Department of Veteran Affairs	1 (0.3%)	1 (3.3%)	
Private	152 (40.9%)	12 (40.0%)	
Uninsured	0 (0.0%)	0 (0.0%)	
Workers' compensation	3 (0.8%)	0 (0.0%)	
MyChart, n (%)			**<.001**
Activated	357 (96.0%)	23 (76.7%)	
Inactivated	2 (0.5%)	0 (0.0%)	
Pending activation	11 (3.0%)	7 (23.3%)	
Patient declined	2 (0.5%)	0 (0.0%)	
Preoperative diagnosis, n (%)			1.00
Arthritis	370 (99.5%)	30 (100.0%)	
Osteonecrosis	2 (0.5%)	0 (0.0%)	
Anesthesia block type, n (%)			1.00
No block	372 (100%)	30 (100%)	
THA approach, n (%)			.72
Direct anterior	30 (8.1%)	1 (3.3%)	
Anterior-based muscle-sparing	342 (91.9%)	29 (96.7%)	
Operative location, n (%)			.58
Outpatient surgical center	308 (82.8%)	23 (76.7%)	
Outpatient hospital	51 (13.7%)	6 (20%)	
Inpatient hospital	13 (3.5%)	1 (3.3%)	
Same-day discharge, n (%)	209 (56.2%)	14 (46.7%)	.34

ASA, American Society of Anesthesiologists; CCI, Charlson Comorbidity Index.
For all analyses, significant values in bold and defined as $P < .05$.

Table 3
Postoperative variables stratified by completion status of preoperative patient education class prior to total hip arthroplasty.

Characteristic	Class completion (n = 372)	Class noncompletion (n = 30)	*P* value
Mean intraoperative MME (range)	44.74 (4-100)	48.12 (25-95)	.4
Mean PACU MME (range)	38.31 (0-98)	28.61 (0-134)	**.011**
Mean predischarge VAS (range)	3.12 (0-8)	2.70 (0-7)	.27
Mean MME prescribed at discharge (range)	224.91 (45-420)	250.83 (150-675)	.35
Mean postdischarge MME consumed at 2 wks postoperatively (range)	84.60 (0-420)	127.30 (0-585)	**.04**
Proportion of postoperative prescription used at 2 wks postoperatively	37.15% (0-100%)	47.25% (0-100%)	.07
2-wk refill requests, n (%)	26 (6.9%)	1 (3.3%)	1.00
Any complication, n (%)	2 (0.5%)	0 (0.0%)	1.00
ED visit within 30 d, n (%)	6 (1.6%)	0 (0.0%)	1.00
Readmission within 90 d, n (%)	1 (1.9%)	0 (0.0%)	1.00

VAS, visual analog scale.
For all analyses, significant values in bold and defined as $P < .05$.

Table 4
Results of multivariate analysis for predicting total MME consumed in the 2 weeks following total hip arthroplasty procedure.

Characteristic	β coefficient[a]	95% Confidence interval	*P* value
Attended preoperative education class	−41.57	−75.87 to −7.27	**.018**

[a]For all analyses, significant values in bold and defined as $P < .05$.
[a] Multivariable analysis controlling for age, sex, and Charlson Comorbidity Index.

PROMs revealed successful return to function, alleviation of pain, and high satisfaction at the 6-week and 1-year time points among both education class completion and noncompletion groups; most scores did not vary significantly based on class completion status, yet preoperative pain (VAS) was higher among the class noncompletion group (7.50 [5−10] vs 5.64 [1−10]; $P = .009$). Table 5 summarizes PROMs of the study cohort.

Discussion

Preoperative patient education has been solidified as a core component of ERAS pathways [17,18], and an emerging body of evidence suggests the specific role of preoperative education in minimizing postoperative opioid consumption following TKA in the days immediately following surgery [12,15]. We found that primary THA patients who attended a preoperative patient education class consumed 41.57 fewer MMEs at 2 weeks postoperatively when compared to those patients who do not attend. The findings of no significant differences in complications, 30-day ED visits, 90-day readmissions, nor refill requests between education groups further emphasize that decreased postoperative opioid consumption can be prioritized without increasing healthcare usage nor practice workflow burden. Demographic characteristics among preoperative patient class completion and noncompletion groups revealed higher MyChart (EPIC Systems, Verona, Wisconsin) patient portal activation among the class completion group, which highlights the potential impact of technological literacy and internet access—factors that can be associated with socioeconomic status—on access to arthroplasty care. The possibility exists for a self-selection bias—that patients who completed the education course preoperatively have a high health literacy or higher concern about opioid addiction and thus were less likely to utilize opioids postoperatively regardless of their class attendance. The surprising finding that patients in the class completion group consumed a greater amount of MME in the PACU setting may contradict the hypothesis that it is opioid fear driving less use. Additionally, further study on the impact of MyChart utilization on outcomes following TJA (EPIC Systems, Verona, Wisconsin) is needed. Plate et al. reported that MyChart (EPIC Systems, Verona, Wisconsin) utilization did not significantly decrease 90-day ED visits or readmissions following TJA, but identified patients engaging with MyChart (EPIC Systems, Verona, Wisconsin) as more likely to be young, healthy, and have private insurance [22]. Similarly, Holte et al. found that while online patient portal access was associated with younger age and higher household income, it was not associated significant improvement in physical function nor joint-specific function following THA [23]. Findings that specific demographic factors varied based on class completion method further highlight the intersecting roles of technological literacy—including MyChart (EPIC Systems, Verona, Wisconsin) utilization—and access to care. In-person class participants had the lowest percentage of MyChart patient portal activation, less often received surgery at an outpatient surgical center, and had the lowest percentage of same-day discharges when compared to Zoom (Zoom Communications, San Jose, California) and YouTube (Google, San Bruno, California) class participants. Similarly, in-person class participants used a greater proportion of postoperative prescription used at 2 weeks postoperatively (54%) when compared to other groups, suggesting that additional factors—beyond simply MyChart (EPIC Systems, Verona, Wisconsin) activation or class completion status—are at play and worthy of further investigation.

Table 5
Patient-reported outcome measures stratified by completion status of preoperative patient education class prior to total hip arthroplasty.

Characteristic	n	Class completion[a]	Class noncompletion[a]	*P* value
Preoperative				
VAS	306	5.64 (1−10)	7.50 (5−10)	**.009**
HOOS JR	289	12.05 (1−24)	13.58 (8−21)	.30
6-wk postoperative				
VAS	200	2.35 (0-10)	1.82 (0-6)	.27
HOOS JR	197	4.89 (0-18)	3.18 (0-6)	.13
Satisfaction-pain relief	195	8.65 (0-10)	9.36 (8−10)	.36
Satisfaction-functional improvement	195	8.33 (0-10)	9.01 (8−10)	.28
Satisfaction-procedure expectations	194	8.55 (0-10)	9.18 (7−10)	.46
Satisfaction-surgeon	194	9.77 (0-10)	9.90 (9,10)	.91
1-y postoperative				
VAS	89	2.06 (0-8)	2.63 (0-7)	.73
HOOS JR	85	1.58 (0-9)	2.13 (0-13)	.72
Satisfaction-pain relief	88	9.39 (0-10)	9.75 (9,10)	.60
Satisfaction-functional improvement	88	9.24 (0-10)	9.88 (9,10)	.09
Satisfaction-procedure expectations	88	9.36 (1−10)	10.00 (10−10)	**.03**
Satisfaction-surgeon	88	9.70 (0-10)	10.00 (10−10)	.43

VAS, visual analog scale; HOOS JR, Hip Disability and Osteoarthritis Outcome Score, Joint Replacement.
For all analyses, significant values in bold and defined as $P < .05$.
[a] Mean (range).

For our practice, these findings indicate an area for QI, with additional resources needed for assisting patients in signing up for MyChart (EPIC Systems, Verona, Wisconsin) and contacting patients without MyChart (EPIC Systems, Verona, Wisconsin) established. Regardless of class completion status, patients reported high scores on all PROM metrics postoperatively. All together, these results support ongoing findings that reductions in postoperative opioid use are not associated with diminished patient-reported outcomes or additional healthcare utilization.

Across both education groups, a notably high proportion of the discharge opioid prescription remained at 2 weeks postoperatively, with the class completion group consuming 37.15% (0-100%) of their script and the noncompletion group consuming 47.25% (0-100%). Our study aligns with the findings of a recent systematic review and meta-analysis by Dawson et al, which reported THA patients consumed an average of 29.8 pills out of 64.0 prescribed, and left approximately 53.4% of the postoperative opioid medication unused [24]. Given that primary THA is one of the most common elective surgeries performed, with an estimated annual procedure volume ranging from 572,000 to 633,000 by 2030 [25-27], opioids remaining following THA likely account for a significant number of pills. Reducing postoperative THA opioid usage and prescribing offers a clear area for further study and intervention within the field of arthroplasty, of which preoperative patient education can play a role [28-30].

Potential limitations

To the best of our knowledge, the present study is the first to address the impact of preoperative patient education on 2-week postoperative opioid consumption in a cohort of primary THA patients. Several limitations are notable. This study was retrospective in nature, limiting causative analysis. Patients undergoing revision and conversion arthroplasty, as well as surgeries performed for fracture and/or infection, were excluded, as were patients with a history of opioid use. The inclusion of these patient populations would have made the sample more reflective of the broader population seeking arthroplasty care, and potentially impacted the findings observed. It is reassuring that the power analysis indicated that the study had reasonably sufficient power (77.04%) to detect a significant difference in MME consumption between the education class completion and noncompletion groups undergoing THA, yet a significant limitation remains that a substantial portion of eligible patients were excluded by study design due to failure to adequately collect opioid pill count at the 2-week postoperative office visit (Fig. 1). While we anticipate this was due to random workflow factors, there exists the possibility that the patients with 2-week postoperative opioid pill count recorded were somehow distinct from those who did not have this variable recorded and that our sample is otherwise nonrepresentative. The finding that age, sex, self-reported race, BMI, and insurance type did not vary significantly between the included and excluded THA patient populations is reassuring that this is not the case, yet the finding that a lower percentage of excluded patients discharged on the same day of surgery when compared to included patients indicates there may be additional variables unaccounted for. Rationale for this finding is supported by demographic differences in patients receiving education through different modalities—in-person, Zoom (Zoom Communications, San Jose, California), and YouTube (Google, San Bruno, California) class participants showed significant differences in same-day discharge, outpatient surgical center surgery location, and MyChart (EPIC Systems, Verona, Wisconsin) activation. Standardizing the method of education would allow for less confounding, though potentially limit the accessibility of education to patients. Expanding the scope of this study to include patients receiving care for the listed conditions and improving the logistics of postoperative pill data collection on a practice-level scale offer areas for further study.

Additional limitations to this study include the racial and ethnic homogeneity of the study population. The racial and ethnic makeup of this cohort is proportionately reflective of the state in which this research took place [31], which is predominantly White race and non-Hispanic ethnicity. Disparities in postoperative opioid prescribing following TJA by patient race, ethnicity, and English language proficiency have been reported [32-34], and known inequity exists in pain management and opioid prescribing patterns based on patient racial identity [35]; our study was underpowered to detect any such differences and therefore cannot adequately address these disparities. Classification of sex was limited to the male/female categories available in the EMR; gender was not addressed. Our practice is proud to prioritize patient attendance of preoperative education classes prior to THA, but, as such, the class noncompletion group was small and study arms uneven. Complications were infrequent, making it challenging to identify and statistically account for differences observed between groups. This research domain can benefit from future prospective studies and analyses of larger sample sizes powered to detect additional important differences.

Conclusions

This study shows that following primary THA patients consumed significantly fewer opioids postoperatively as evaluated at the 2-week period if they completed a preoperative patient education class that addressed expectations for postoperative pain. Our findings support the role for patient education in mitigating postoperative opioid use following THA.

Conflicts of interest

B.J. McGrory receives royalties from Innomed, Inc. and Smith & Nephew, Inc.; is on the speakers bureau/paid presentations for Smith & Nephew; receives institutional research support from Smith & Nephew, Inc. and Zimmer Biomet, Inc.; receives royalties, financial, or material support from Springer, Inc.; and is an emeritus at *Arthroplasty Today* (AAHKS). R.J. Mountjoy is on the speakers bureau/paid presentations for Pacira BioSciences; and is a paid consultant for Pacira BioSciences. A.J. Rana receives royalties from, is on the speakers bureau/paid presentations for, and is a paid consultant for Smith & Nephew; receives research support from Zimmer; and is a board member/committee appointments for a society for Eastern Orthopedics Association and AAHKS; all other authors declare no potential conflicts of interest.

For full disclosure statements refer to https://doi.org/10.1016/j.artd.2025.101870.

CRediT authorship contribution statement

Catherine M. Call: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Project administration, Methodology, Investigation, Formal analysis. **Zoë A. Walsh:** Writing – review & editing, Writing – original draft, Visualization, Software, Methodology, Investigation, Formal analysis, Data curation. **Diane Jeselskis:** Writing – review & editing, Writing – original draft, Supervision, Data curation, Conceptualization. **Ryan J. Mountjoy:** Writing – review & editing, Writing – original draft, Validation, Project administration, Methodology, Investigation, Data curation, Conceptualization. **Brian J. McGrory:** Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Methodology, Investigation, Data curation.

Adam J. Rana: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Conceptualization.

References

[1] Trasolini NA, McKnight BM, Dorr LD. The opioid crisis and the orthopedic surgeon. J Arthroplasty 2018;33:3379–3382.e1.
[2] Chung BC, Bouz GJ, Mayfield CK, Nakata H, Christ AB, Oakes DA, et al. Dose-dependent early postoperative opioid use is associated with periprosthetic joint infection and other complications in primary TJA. J Bone Joint Surg Am 2021;103:1531–42.
[3] Hannon CP, Fillingham YA, Nam D, Courtney PM, Curtin BM, Vigdorchik J, et al. The efficacy and safety of opioids in total joint arthroplasty: systematic review and direct meta-analysis. J Arthroplasty 2020;35:2759–2771.e13.
[4] Hollman F, Wolterbeek N, Veen R. Risk factors for postoperative urinary retention in men undergoing total hip arthroplasty. Orthopedics 2015;38: e507–11.
[5] Howard R, Fry B, Gunaseelan V, Lee J, Waljee J, Brummett C, et al. Association of opioid prescribing with opioid consumption after surgery in Michigan. JAMA Surg 2019;154:e184234.
[6] Bateman BT, Cole NM, Maeda A, Burns SM, Houle TT, Huybrechts KF, et al. Patterns of opioid prescription and use after cesarean delivery. Obstet Gynecol 2017;130:29–35.
[7] Osmundson SS, Raymond BL, Kook BT, Lam L, Thompson EB, Schornack LA, et al. Individualized compared with standard post-discharge oxycodone prescribing after cesarean birth: a randomized controlled trial. Obstet Gynecol 2018;132:624.
[8] Hannon CP, Hamilton WG, Della Valle CJ, Fillingham YA. Multimodal analgesia and small opioid prescriptions are the new standard in total joint arthroplasty: a survey of the American association of hip and knee surgeons membership. J Arthroplasty 2018;40:566–572.e4.
[9] Bronstone AB, Leonardi C, Kubilay T, Plessl DS, Morreale PJ, Tortorich GM, et al. Dramatic reduction in opioid prescribing for common outpatient orthopaedic lower extremity surgical procedures at a Louisiana university-based safety-net hospital after enactment of opioid-limiting state legislation. J Am Acad Orthop Surg 2022;30:e405–14.
[10] Hannon CP, Fillingham YA, Nam D, Courtney PM, Curtin BM, Vigdorchik JM, et al. Opioids in total joint arthroplasty: the clinical practice guidelines of the American association of hip and knee surgeons, American society of regional anesthesia and pain medicine, American academy of orthopaedic surgeons, hip society, and knee society. J Arthroplasty 2020;35:2709–14.
[11] Richardson MK, Wier J, Liu KC, Mayfield CK, Vega AN, Lieberman JR, et al. Same-day total joint arthroplasty in the United States from 2016 to 2020: the impact of the medicare inpatient only list and the COVID-19 pandemic. J Arthroplasty 2024;39:858–863.e2.
[12] Maheu AR, Hohmann AL, Cozzarelli NF, Khan IA, Hozack WJ, Ilyas AM, et al. The efficacy of preoperative video-based opioid counseling on postoperative opioid consumption after total knee arthroplasty: a prospective randomized controlled trial. J Arthroplasty 2024;39:S143–7.
[13] Moyer R, Ikert K, Long K, Marsh J. The value of preoperative exercise and education for patients undergoing total hip and knee arthroplasty: a systematic review and meta-analysis. JBJS Rev 2017;5:e2.
[14] Kearney M, Jennrich MK, Lyons S, Robinson R, Berger B. Effects of preoperative education on patient outcomes after joint replacement surgery. Orthop Nurs 2011;30:391–6.
[15] Yajnik M, Hill JN, Hunter OO, Howard SK, Kim TE, Harrison TK, et al. Patient education and engagement in postoperative pain management decreases opioid use following knee replacement surgery. Patient Educ Couns 2019;102:383–7.
[16] Rucinski K, Cook JL. Effects of preoperative opioid education on postoperative opioid use and pain management in orthopaedics: a systematic review. J Orthop 2020;20:154–9.
[17] Layson JT, Markel DC, Hughes RE, Chubb HD, Frisch NB, John N. Insall award: MARCQI's Pain-Control Optimization Pathway (POP): impact of registry data and education on opioid utilization. J Arthroplasty 2022;37:S19–26.
[18] Pirzada WU, Shamith S, Le T, Thomas TL, Ramtin S, Ilyas AM. Application and analysis of the enhanced recovery after surgery opioid prescription protocol in arthroscopy and arthroplasty patients. J Am Acad Orthop Surg 2025;33: e583–92.
[19] Civinini R, Cozzi Lepri A, Carulli C, Matassi F, Villano M, Innocenti M. The anterior-based muscle-sparing approach to the hip: the "other" anterior approach to the hip. Int Orthop 2019;43:47–53.
[20] Bertin KC, Röttinger H. Anterolateral mini-incision hip replacement surgery: a modified Watson-Jones approach. Clin Orthop Relat Res (1976-2007) 2004;429:248–55.
[21] Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. J Chronic Dis 1987;40:373–83.
[22] Plate JF, Ryan SP, Bergen MA, Hong CS, Attarian DE, Seyler TM. Utilization of an electronic patient portal following total joint arthroplasty does not decrease readmissions. J Arthroplasty 2019 Feb;34:211–4.
[23] Holte AJ, Molloy IB, Werth PM, Jevsevar DS. Do patient engagement platforms in total joint arthroplasty improve patient-reported outcomes? J Arthroplasty 2021;36:3850–8.
[24] Dawson Z, Stanton SS, Roy S, Farjo R, Aslesen HA, Hallstrom BR, et al. Opioid consumption after discharge from total knee and hip arthroplasty: a systematic review and meta-analysis. J Arthroplasty 2024;39:2130–2136.e7.
[25] Kurtz S, Ong K, Lau E, Mowat F, Halpern M. Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. JBJS 2007;89:780–5.
[26] Sloan M, Premkumar A, Sheth NP. Projected volume of primary total joint arthroplasty in the US, 2014 to 2030. JBJS 2018;100:1455–60.
[27] Kurtz S, Mowat F, Ong K, Chan N, Lau E, Halpern M. Prevalence of primary and revision total hip and knee arthroplasty in the United States from 1990 through 2002. JBJS 2005;87:1487–97.
[28] Howard R, Waljee J, Brummett C, Englesbe M, Lee J. Reduction in opioid prescribing through evidence-based prescribing guidelines. JAMA Surg 2018;153:285–7.
[29] Brown CS, Vu JV, Howard RA, Gunaseelan V, Brummett CM, Waljee J, et al. Assessment of a quality improvement intervention to decrease opioid prescribing in a regional health system. BMJ Qual Saf 2021;30: 251–9.
[30] Roberts KC, Moser SE, Collins AC, McCardel BR, Schultz KA, Schaffer NE, et al. Prescribing and consumption of opioids after primary, unilateral total hip and knee arthroplasty in opioid-naive patients. J Arthroplasty 2020;35: 960–965.e1.
[31] USCBRfCRPpfM. American Community Survey 1-year and 5-year estimates. https://censusreporter.org/profiles/04000US23-maine/. [Accessed 12 March 2025].
[32] Udoji MA, Thompson O, Cui X, Glas KE, Woodbury A. Retrospective study of disparities in regional anesthesia and discharge opioid prescriptions at a veterans affairs medical center. F1000Res 2023;12:1451.
[33] Joo H, Nguyen K, Kolodzie K, Chen LL, Kim MO, Manuel S. Differences in acute postoperative opioid use by English proficiency, race, and ethnicity after total knee and hip arthroplasty. Anesth Analg 2025;140:155–64.
[34] Thirukumaran CP, Fiscella KA, Rosenthal MB, Doshi JA, Schloemann DT, Ricciardi BF. Association of race and ethnicity with opioid prescribing for medicare beneficiaries following total joint replacements. J Am Geriatr Soc 2024;72:102–12.
[35] Morden NE, Chyn D, Wood A, Meara E. Racial inequality in prescription opioid receipt - role of individual health systems. N Engl J Med 2021;385: 342–51.

Supplemental Table 1
Multimodal analgesic protocol based on procedure: total hip arthroplasty or total knee arthroplasty.

Timing	Components of multimodal perioperative pain management protocol
Night before procedure	• Pregabalin − 75 mg, PO
Morning of procedure	• Acetaminophen − 1000 mg, PO
Preoperative holding bay	• OxyContin − 10 mg, PO
Intraoperative management	• Dexamethasone − 10 mg • Limited opioid use • Periarticular injection of 30 mL 0.25% bupivacaine
Postoperative	• Acetaminophen − 1000 mg, PO, every 8 h • Celecoxib − 200 mg, every 12 h for 14 days • Pregabalin − 50 mg (if > 70 years old) or 75 mg (if < 70 years old) every 12 h for 3 days • Oxycodone − 5 mg tablets, PO, 1-2 tablets PRN for breakthrough pain up to every 4 h, max 6 tablets per day
Postoperative standard opioid script	• Oxycodone− 5 mg, 24 pills

PO, per os; PRN, pro re nata.

Supplemental Table 2
Comparison of demographics of included patients to patients excluded.

Characteristic	Excluded from study (n = 2248)	Included in study (n = 402)	*P* value
Completed preoperative education class, n (%)	2028 (90%)	372 (93%)	.14
Mean age in y (range)	67.03 (16-98)	67.22 (34-90)	>.9
Female sex, n (%)	1263 (56%)	213 (53%)	.25
Race, n (%)			.23
American Indian and Alaska Native	4 (0.2%)	1 (0.2%)	
Asian	4 (0.2%)	1 (0.2%)	
Black or African American	13 (0.6%)	0 (0.0%)	
Multiracial	7 (0.3%)	3 (0.7%)	
Native Hawaiian or other Pacific Islander	0 (0.0%)	0 (0.0%)	
White or Caucasian	2192 (98%)	392 (98%)	
Declined, other, unknown	28 (1.2%)	5 (1.2%)	
Ethnicity, n (%)			**.03**
Hispanic	12 (0.5)	4 (1.0%)	
Non-Hispanic	2195 (98.2%)	386 (96.0%)	
Declined, unknown	41 (1.8%)	12 (3.0%)	
Mean BMI (range)	28.64 (15.8-45.8)	28.52 (18.4-41.9)	.75
BMI category, n (%)			.18
Healthy weight	583 (25.9%)	95 (23.7%)	
Underweight	24 (1.1%)	3 (0.7%)	
Overweight	788 (35.0%)	162 (40.4%)	
Obese	853 (38.0%)	142 (35.4%)	
Mean ASA (range)	2.21 (1.00 - 4.00)	2.16 (1.00 - 4.00)	.09
Mean CCI (range)	2.96 (0.00 - 15.00)	2.83 (0.00 - 10.00)	.29
Insurance type, n (%)			.09
Medicare	1324 (59%)	225 (56%)	
Medicaid, n(%)	65 (2.9%)	8 (2.0%)	
Department of Veteran Affairs	30 (1.3%)	2 (0.5%)	
Private	824 (37%)	164 (41%)	
Uninsured	0 (0.0%)	0 (0.0%)	
Workers' compensation	5 (0.2%)	3 (0.7%)	
MyChart set up, n (%)			.16
Activated	2059 (91.6%)	380 (94.5%)	
Inactivated	36 (1.6%)	2 (0.5%)	
Pending activation	141 (6.3%)	18 (4.5%)	
Patient declined	12 (0.5%)	2 (0.5%)	
Preoperative diagnosis, n (%)			.79
Arthritis	2229 (99%)	400 (100%)	
Osteonecrosis	19 (0.8%)	2 (0.5%)	
Anesthesia block type, n (%)			**<.001**
No block	2173 (97%)	402 (100%)	
Fascia iliaca compartment block	1 (<0.1%)	0 (0%)	
Pericapsular nerve group (PENG)	74 (3.3%)	0 (0%)	
THA approach, n (%)			.84
Direct anterior	168 (7.5%)	31 (7.7%)	
Anterior-based muscle-sparing	2080 (92.5%)	371 (92.3%)	
Operative location, n (%)			.77
Outpatient surgical center	1813 (80.6%)	331 (82.3%)	
Outpatient hospital	350 (15.7%)	57 (14.2%)	
Inpatient hospital	85 (3.8%)	14 (3.5%)	
Same-day discharge, n (%)	998 (44.4%)	223 (55.5%)	**<.001**

ASA, American Society of Anesthesiologists; CCI, Charlson Comorbidity Index.
For all analyses, significant values in bold and defined as $P < .05$.

Supplemental Table 3
Demographic information stratified by patient class instruction type: in-person, over Zoom (Zoom Communications, San Jose, California), or via YouTube (Google, San Bruno, California).

Characteristic	Overall N = 372	In Person N = 27	YouTube N = 42	Zoom N = 303	*P* value
Mean age in y (range)	67.35 (34.00-90.00)	68.19 (39.00-89.00)	66.29 (34.00-82.00)	67.42 (40.00-90.00)	.7
Female sex, n (%)	197 (53%)	15 (56%)	26 (62%)	156 (51%)	.4
Race, n (%)					.4
American Indian and Alaska Native	1 (0.3%)	0 (0%)	1 (2.4%)	0 (0%)	
Asian	1 (0.3%)	0 (0%)	0 (0%)	1 (0.3%)	
Black or African American	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Multiracial	3 (0.8%)	0 (0%)	0 (0%)	3 (1.0%)	
White or Caucasian	362 (97%)	27 (100%)	40 (95%)	295 (97%)	
Native Hawaiian or other Pacific Islander	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Declined, other, unknown	5 (1.3%)	0 (0%)	1 (2.4%)	4 (1.3%)	
Ethnicity, n (%)					.8
Hispanic	3 (0.8%)	0 (0%)	0 (0%)	3 (1.0%)	
Non-Hispanic	357 (96%)	27 (100%)	40 (95%)	290 (96%)	
Declined, unknown	12 (3.2%)	0 (0%)	2 (4.8%)	10 (3.3%)	
Mean BMI (range)	28.38 (18.00-42.00)	29.04 (20.00-42.00)	28.64 (19.00-42.00)	28.28 (18.00-42.00)	>.9
BMI category, n (%)					.8
Healthy weight	89 (24%)	8 (30%)	10 (24%)	71 (23%)	
Underweight	2 (0.5%)	0 (0%)	0 (0%)	2 (0.7%)	
Overweight	151 (41%)	8 (30%)	16 (38%)	127 (42%)	
Obese	130 (35%)	11 (41%)	16 (38%)	103 (34%)	
Mean ASA (range)	2.15 (1.00-3.00)	2.26 (1.00-3.00)	2.36 (1.00-3.00)	2.11 (1.00-3.00)	**.001**
Mean CCI (range)	2.85 (0.00-10.00)	3.19 (0.00-6.00)	2.90 (0.00-8.00)	2.82 (0.00-10.00)	.4
Insurance type, n (%)					.08
Medicare	209 (56%)	17 (63%)	25 (60%)	167 (55%)	
Medicaid	7 (1.9%)	1 (3.7%)	2 (4.8%)	4 (1.3%)	
Department of Veteran Affairs	1 (0.3%)	0 (0.0%)	1 (2.4%)	0 (0.0%)	
Private	152 (41%)	9 (33%)	13 (31%)	130 (43%)	
Uninsured	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Workers' compensation	3 (0.8%)	0 (0%)	1 (2.4%)	2 (0.7%)	
MyChart, n (%)					**.014**
Activated	357 (96%)	23 (85%)	39 (93%)	295 (97%)	
Inactivated	2 (0.5%)	0 (0.0%)	1 (2.4%)	1 (0.3%)	
Pending activation	11 (3.0%)	3 (11%)	2 (4.8%)	6 (2.0%)	
Patient declined	2 (0.5%)	1 (3.7%)	0 (0.0%)	1 (0.3%)	
Preoperative diagnosis, n (%)					>.9
Arthritis	370 (99%)	27 (100%)	42 (100%)	301 (99%)	
Osteonecrosis	2 (0.5%)	0 (0.0%)	0 (0.0%)	2 (0.7%)	
Anesthesia block type, n (%)					1.00
No block	372 (100%)	27 (100%)	42 (100%)	303 (100%)	
THA approach, n (%)					**.04**
Direct anterior	30 (8.1%)	0 (0.0%)	7 (17%)	23 (8%)	
Anterior-based muscle-sparing	342 (92%)	27 (100%)	35 (83%)	280 (92%)	
Operative location, n (%)					**.03**
Outpatient surgical center	308 (83%)	21 (78%)	30 (71%)	257 (85%)	
Outpatient hospital	51 (14%)	4 (15%)	12 (29%)	35 (12%)	
Inpatient hospital	13 (3.5%)	2 (7.4%)	0 (0.0%)	11 (3.6%)	
Same-day discharge, n (%)	209 (56%)	6 (22%)	23 (55%)	180 (59%)	**<.001**

ASA, American Society of Anesthesiologists; CCI, Charlson Comorbidity Index.
For all analyses, significant values in bold and defined as $P < .05$.

Supplemental Table 4
Postoperative variables stratified by patient class instruction type: in-person, over Zoom (Zoom Communications, San Jose, California), or via YouTube (Google, San Bruno, California).

Characteristic	Overall N = 372	In Person N = 27	YouTube N = 42	Zoom N = 303	*P* value
Mean intraoperative MME (range)	44.74 (4.00-100.00)	46.67 (10.00-100.00)	42.72 (4.00-80.00)	44.83 (10.00-100.00)	.8
Mean PACU MME (range)	28.61 (0.00-134.00)	33.17 (0.00-95.00)	27.63 (0.00-134.00)	28.32 (0.00-118.50)	.4
Mean predischarge VAS (range)	3.12 (0.00-8.00)	3.56 (0.00-7.00)	3.58 (0.00-8.00)	3.02 (0.00-8.00)	.07
Mean MME prescribed at discharge (range)	224.91 (45.00-420.00)	209.78 (120.00-336.00)	219.56 (120.00-420.00)	227.00 (45.00-420.00)	.3
Mean postdischarge MME consumed at 2 wks postoperatively (range)	84.60 (0.00-420.00)	121.85 (0.00-336.00)	102.51 (0.00-420.00)	78.80 (0.00-345.00)	.07
Mean proportion of postoperative prescription used at 2 wks postoperatively, (range)	37% (0.0-100)	54% (0.0-100%)	45% (0.0-100%)	35% (0.0-100%)	**.027**
2-wk refill requests, n (%)	26 (7.0%)	0 (0%)	4 (9.5%)	22 (7.3%)	.3
Any complication, n (%)	2 (0.5%)	0 (0%)	1 (2.4%)	1 (0.3%)	.3
ED visit within 30 d, n (%)	6 (1.6%)	0 (0%)	0 (0%)	6 (2.0%)	>.9
Readmission within 90 d, n (%)	7 (1.9%)	1 (3.7%)	1 (2.4%)	5 (1.7%)	.4

VAS, visual analog scale.
For all analyses, significant values in bold and defined as $P < .05$.