

Success of Hospital Intervention and State Legislation on Decreasing and Standardizing Postoperative Opioid Prescribing Practices

Monica Zipple, MD, Amy Braddock, MD, FACS

- BACKGROUND:** We sought to evaluate change in postoperative prescription practices in an independent community-based hospital after hospital interventions and a state legislation change.
- STUDY DESIGN:** This is a retrospective review of opioid-naïve adult subjects who underwent 5 common general surgical procedures between 2015 and 2017, including cholecystectomy, appendectomy, minimally invasive inguinal hernia repair, open inguinal hernia repair, and breast lumpectomy. Educational interventions were introduced, new statewide legislation was passed, and 129 subsequent cases were reviewed.
- RESULTS:** Mean \pm SD oral morphine equivalent (OME) prescribed for all procedures on retrospective review was 218.8 ± 113.7 ($n = 722$), cholecystectomy 235.3 ± 133.8 ($n = 248$), appendectomy 220.2 ± 103.2 ($n = 175$), open inguinal hernia repair 214.4 ± 97.2 ($n = 119$), minimally invasive inguinal hernia repair 187.7 ± 87.8 ($n = 117$), and lumpectomy 212.5 ± 114.5 ($n = 63$). There was significant variation in OME prescribed by procedure and by surgeon ($p = 0.006$ and $p = 0.008$, respectively). Review of post-intervention cases showed a significant reduction in the OME prescribed each year (mean OME 197.6 in 2015 to 2017 vs 72.3 in 2018; $p < 0.005$), and a 60% to 70% reduction in mean OME per procedure. Post-intervention data also revealed resolution of previously seen variation in prescription practices, and a significant increase in the percentage of patients prescribed multimodal pain therapy (23.5% in 2015 to 2017 to 31.5% in 2018; $p < 0.05$).
- CONCLUSIONS:** We achieved a 60% to 70% decrease in postoperative opioid prescription at our community hospital for 5 common surgical procedures, and resolution of variation in opioid prescription practices after a hospital-wide intervention and statewide legislation. (*J Am Coll Surg* 2019; 229:158–163. Published by Elsevier Inc. on behalf of the American College of Surgeons.)

The opioid epidemic has been well-documented and publicized in the US during the past decade. Studies of postoperative patients suggest that excess prescriptions are common in surgical populations and that opioids

can have negative consequences that surpass the immediate perioperative period.¹⁻⁴ It has been suggested that only 30% of prescribed opioids are actually taken by postoperative patients.

In an effort to standardize postoperative prescribing, the Michigan Opioid Prescribing Engagement Network (MI-OPEN) coordinated with the Michigan Surgical Quality Collaborative to establish prescribing recommendations in opioid-naïve patients with a recommended or “ideal” number of tablets to prescribe for common general surgery operations. The recommended number was defined as the number of tablets that would satisfy 80% of patients’ postoperative opioid usage.^{1,5,6} Similar prescription recommendations are starting to become available in other states as well.⁷ To address the severity of the epidemic, several states have also introduced legislation that limits opioid prescribing in opioid-naïve patients.⁸

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From the Department of Surgery, Saint Joseph Mercy Oakland, Pontiac, MI.

Correspondence address: Monica Zipple, MD, Department of Surgery, Saint Joseph Mercy Oakland, 44405 Woodward Avenue, Pontiac, MI 48321. email: Monica.Zipple@stjoeshealth.org

Abbreviations and Acronyms

MI-	= Michigan Opioid Prescribing Engagement
OPEN	Network
MIS	= minimally invasive
OME	= oral morphine equivalent
SJMO	= Saint Joseph Mercy Oakland

The majority of published literature concerning postoperative opioid prescribing currently comes from academic centers, where patient populations and prescribing habits might be different from those found at independent community-based hospitals (defined as a nonfederal, short-term general or other special hospital without a university affiliation). We examined postoperative opioid prescription practices for the most common general surgery procedures in our independent community-based hospital before and after the implementation of a hospital educational intervention and new state legislation.

METHODS

We performed a retrospective study of opioid prescribing habits before and after the adoption of new state legislation and a hospital intervention. Saint Joseph Mercy Oakland (SJMO) hospital is a 443-bed independent community-based hospital located in Pontiac, Michigan where surgeons perform more than 11,000 operations annually. The general surgery residency program at SJMO includes a complement of 14 residents, as well as rotating residents from the transitional year residency program. The SJMO IRB reviewed the protocol for this research study and approved it.

Patients were included in the study if they underwent 1 of the 5 most common outpatient procedures performed at SJMO, including cholecystectomy, appendectomy, open inguinal hernia repair, minimally invasive inguinal hernia repair, and breast lumpectomy (with and without SLNB). Patients undergoing cholecystectomy or appendectomy were included in the study if they were performed via a minimally invasive (MIS) approach (laparoscopic or robotic). Minimally invasive inguinal hernia repair also included both laparoscopic and robotic procedures, as well as unilateral or bilateral hernia repairs. Similarly, open inguinal hernia repair included both unilateral and bilateral repairs. Subjects were identified using CPT codes. Exclusion criteria included patients potentially using opioids (any prescription or documented opioid use in the last 90 days) or a history of opioid abuse. Intraoperative or postoperative complications (including conversion to open operation) were excluded, as these

subjects can experience more pain and have different pain management requirements. Pregnant patients were also excluded from the study. Finally, subjects were excluded if postoperative prescription information was not available within electronic medical records.

In preparation for new state legislation, an educational campaign was performed. This included collective review of past prescription practices and prescribing recommendations for respective procedures from MI-OPEN. For the 5 procedures involved in this study, the MI-OPEN recommendations are 15 tablets of 5 mg hydrocodone, or 75 oral morphine equivalent (OME). These recommended doses were posted throughout the perioperative areas of the hospital and were available for resident and attending staff as pocket cards during the course of several months leading up to the implementation of new state legislation. In addition, a hospital pharmacist gave a resident lecture focusing on the opioid epidemic and evidence-based recommendations for multimodal therapy to decrease postoperative opioid prescriptions.

State legislation change became effective in July 2018 (after hospital intervention) and included a limit on the number of opioids that can be prescribed in an opioid-naïve patient for an acute problem to a 1-week supply (equates to forty-two 5-mg hydrocodone tablets, or 210 OME). Legislation also involved other measures that served to increase provider awareness of opioid prescribing, including a patient consent form and mandatory provider review of a patient's earlier opioid prescriptions using the state Prescribing Drug Monitoring System.

As part of the hospital-wide intervention, chart abstraction was performed, including eligible cases performed in the pre-intervention period (January 1, 2015 to December 31, 2017) and during the period of time immediately after the educational campaign and policy change (July 1, 2018 to October 31, 2018). Data were extracted from electronic medical records on password-protected SJMO computers by designated data abstractors, including the authors and medical students. All data abstractors underwent formal training in human subject research, as well as focused training regarding abstraction of data pertinent to this study. Data elements collected included age, race, sex, comorbidities, operation performed, and outcomes. The primary end point of interest was average postoperative opioid prescription. These prescriptions were calculated and reported in OME of opioids prescribed for ease of reporting and comparison. The secondary outcomes measures examined were associations between patient factors and opioid prescriptions, analysis of variation in postoperative opioid prescribing, prescribing of non-opioid (multimodal) pain medication regimens, and return to the emergency

Table 1. Pre-Intervention Subject Demographics (n = 5,722)

Variable	Data
Age, y, median (range)	57 (18–94)
Male sex, n (%)	372 (51.5)
Race, n (%)	
White	566 (78.8)
African American	91 (12.6)
Hispanic	26 (3.6)
Asian	4 (0.6)
Other/unknown	32 (4.4)
Comorbidity, n (%)	
Obesity	194 (26.9)
Mood disorder	119 (16.5)
Current tobacco use	127 (17.6)
Current alcohol use	42 (5.8)
Current substance abuse	21 (2.9)
Operation performed, n (%)	
Cholecystectomy	248 (34)
Appendectomy	175 (24)
Open inguinal hernia repair	119 (17)
Minimally invasive inguinal hernia repair	117 (16)
Lumpectomy	63 (9)

department or readmission to the hospital for uncontrolled pain within 30 days.

Analyses were conducted using SPSS, version 22 software (SPSS Inc). Associations between categorical variables were made with chi-square. Differences between groups on continuous variables were examined using the

Student's *t*-test. A *p* value <0.05 was considered statistically significant. Analysis of variance was performed to evaluate variation in the prescription practices by surgeon and by type of operation. For each *t*-test, the Levene's test for equality of variance indicated a normal distribution. Pearson's correlation was used for age and length of stay.

RESULTS

There were 722 subjects in the 3-year pre-intervention group. The mean age overall was 57.1 years (range 18 to 94 years), and 51.5% (n = 372) were male. Racial breakdown as follows: 78.8% (n = 566) were white, 12.6% (n = 91) were African American, 3.6% (n = 26) were Hispanic, 0.6% (n = 4) were Asian, and 4.4% (n = 32) were other or unknown. Of the 722 subjects, 34% performed were cholecystectomy (n = 248), 24% were appendectomy (n = 175), 17% were open inguinal hernia repair (n = 119), 16% were MIS inguinal hernia repair (n = 117), and 9% were lumpectomy (n = 63). Descriptive statistics are presented in Table 1. There were 12 surgeons involved in the pre-intervention cases, including a mix of hospital-employed and private practice.

The overall mean \pm SD of OME prescribed during the pre-intervention period for all procedures was 218.8 \pm 113.7 (n = 722). Means \pm SDs OME by operation during the time period are as follows: cholecystectomy 235.3 \pm 133.8, appendectomy 220.2 \pm 103.2, open inguinal hernia repair 214.4 \pm 97.2, MIS inguinal hernia repair 187.7 \pm 87.8, and lumpectomy 212.5 \pm 114.5.

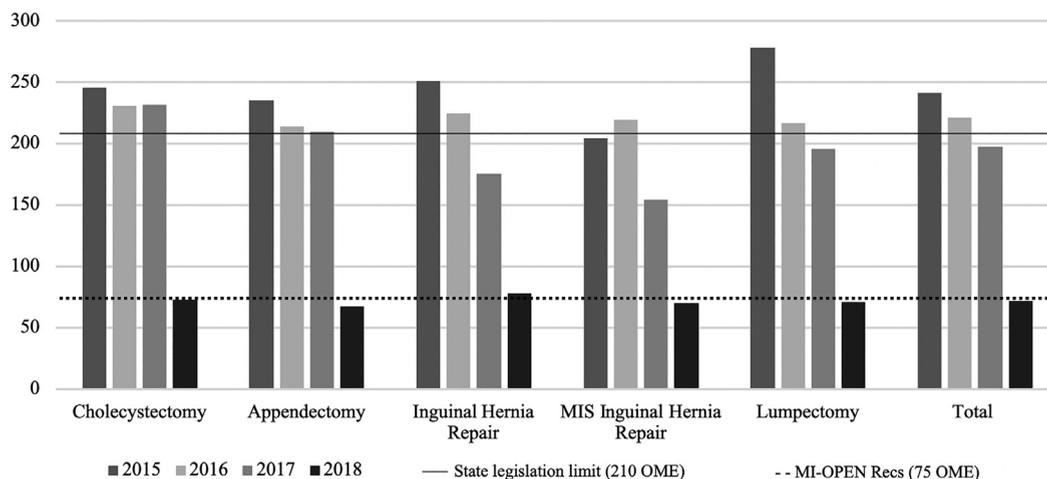


Figure 1. Comparison of average oral morphine equivalent (OME) prescription by operation and year. The dashed line represents the state legislation limit of opioid prescription, 210 OME. Solid line represents the Michigan Opioid Prescribing Engagement Network (MI-OPEN) recommendations for opioid prescription, 75 OME. For reference, 5-mg hydrocodone tablet = 5 OME. Each individual procedure, and the total for all procedures, demonstrates a 60% to 70% decrease in mean OME prescribed. MIS, minimally invasive surgery.

Table 2. Association of Subject Factors With and Without Opioid Prescription

Variable	Pre-intervention	Post-intervention
Age		
Pearson <i>r</i> value	0.11	0.02
p Value	0.16	0.80
Sex, mean ± SD		
Male	225.6 ± 94.3	72.8 ± 23.1
Female	214.0 ± 112.8	71.5 ± 20.9
p Value	0.46	0.75
Race, mean ± SD		
White	215.4 ± 110.2	71.9 ± 22.1
Other	231.7 ± 125.4	71.7 ± 20.4
p Value	0.11	0.95
Obesity, mean ± SD		
With	227.8 ± 125.7	71.7 ± 11.6
Without	215.4 ± 108.9	72.0 ± 25.5
p Value	0.20	0.91
Mood disorder, mean ± SD		
With	253.1 ± 159.6	69.2 ± 22.1
Without	214.2 ± 88.6	72.4 ± 21.5
p Value	0.23	0.56
Substance abuse, mean ± SD		
With	232.5 ± 159.5	41.7 ± 38.2
Without	219.9 ± 102.2	72.6 ± 20.7
p Value	0.81	0.01*
Current tobacco use, mean ± SD		
With	221.2 ± 110.3	70.0 ± 18.3
Without	220.0 ± 101.8	72.3 ± 22.2
p Value	0.95	0.64
Length of stay		
Pearson <i>r</i> value	0.01	-0.04
p Value	0.71	0.65

Subgroup analysis was performed evaluating subject factors and average oral morphine equivalent prescribed.

*Statistically significant.

Demonstration of breakdown by each year within the pre-intervention review is demonstrated in [Figure 1](#).

Evaluation of several patient factors to determine any association with OME prescribed was performed using Student's *t*-tests and results are shown in [Table 2](#). For each *t*-test, the Levene's test for equality of variance indicated a normal distribution. Pearson's correlation was used for age and length of stay. There was no association between sex, age, mood disorder, history of substance abuse, or tobacco use with increased OME ($p > 0.05$). Analysis of variance was then performed to evaluate variation in prescribing and demonstrated significant variation between OME prescribed by operation ($p = 0.006$). Analysis of variance was also performed for each

individual procedure and these did not reach statistical significance. During testing of variation in OME prescribed by type of operation, controlling for surgeon was not performed. Finally, ANOVA was performed evaluating OME by surgeon and was found to be statistically significant ($p = 0.008$), also shown in [Table 3](#).

We reviewed 129 subjects in the post-intervention group and demonstrate statistically significant decrease in mean OME prescribed by year (241.6 in 2015, 220.9 in 2016, 197.6 in 2017, and 71.9 in 2018; $p < 0.005$). When comparing pre-intervention data with post-intervention data, there was a 60% to 70% reduction in the average OME prescribed for each operation (shown in [Figure 1](#)). Mean ± SD OME for each operation was as follows: cholecystectomy 72.4 ± 25.3 ($n = 77$), lumpectomy 70.8 ± 12.9 ($n = 18$), open inguinal hernia repair 78.0 ± 13.4 ($n = 10$), MIS inguinal hernia repair 70.0 ± 19.7 ($n = 9$), and appendectomy 67.3 ± 12.0 ($n = 13$). A statistically significant increase in the percent of subjects discharged with non-opioid pain medications (described as multimodal therapy) by year was seen (7% in 2015, 17.3% in 2016, 23.5% in 2017, and 31.5% in 2018; $p < 0.05$). There was no variation between surgeon ($p = 0.99$) and operation ($p = 0.82$) in the 2018 cohort (see [Table 3](#)). Finally, there were no unplanned admissions to the hospital or returns to the emergency department for uncontrolled pain among our study population during the study period.

DISCUSSION

This study shows prescription of large quantities of OME after common general surgery procedures before intervention. In total, there were 163,941 total OME (or the equivalent of 32,788 five-milligram hydrocodone tablets) prescribed during the 3-year pre-intervention period. Assuming that postoperative patients used only 30% of those prescriptions, then 22,952 tablets were left in excess. In contrast, if MI-OPEN recommendations had been followed in years before intervention, the maximum amount prescribed would have been 54,150 OME (or 10,830 tablets) and there would have been 109,791 fewer OMEs (21,958 fewer tablets) available in our population.

Pre-intervention review also shows significant variation in opioid prescription by surgeon and by operation performed. There is some recent literature that supports these findings by demonstrating wide variation in opioid prescription by different providers, and even by individual providers, after common and elective surgical procedures.^{1,2,9} This variation in prescription suggests that a more standardized approach to postoperative pain control can be beneficial in guiding management. One potential confounding factor is that surgical residents wrote

Table 3. Analysis of Variation in Opioid Prescribing

Variable	Pre-intervention	Post-intervention
Variation by procedure		
p Value	0.006*	0.82
Cholecystectomy, mean \pm SD	235.3 \pm 133.8	78.1 \pm 25.3
Lumpectomy, mean \pm SD	212.5 \pm 114.7	70.8 \pm 12.8
Open inguinal hernia, mean \pm SD	214.4 \pm 97.2	78.0 \pm 13.4
Minimally invasive inguinal hernia, mean \pm SD	187.7 \pm 87.8	70.0 \pm 19.7
Appendectomy, mean \pm SD	220.2 \pm 113.7	67.3 \pm 12.0
Variation by surgeon		
p Value	0.008*	0.99
Surgeon number, mean \pm SD		
1	231.5 \pm 129.4	73.1 \pm 6.93
2	228.2 \pm 125.6	73.1 \pm 5.30
3	224.1 \pm 123.4	70.3 \pm 10.1
4	200.8 \pm 85.0	71.7 \pm 29.0
5	215.0 \pm 113.5	72.5 \pm 16.6
6	227.3 \pm 127.4	68.0 \pm 15.1
7	223.8 \pm 143.5	78.0 \pm 6.71
8	243.2 \pm 133.4	75.0 \pm 25.0
9	282.5 \pm 158.2	NA

NA, not applicable; 1 surgeon did not perform operations in the post-intervention cohort, unrelated to the study.

*Statistically significant.

>95% of the postoperative prescriptions within this study. The resolution in the variation seen in the post-intervention group is related to change in prescribing habits of the surgical residency (and might not represent the attending surgeons).

We found that a targeted, aggressive approach, including an educational intervention, is successful in decreasing opioid prescription and resolution of variation in prescribing. In addition, this intervention was successful in a statistically significant increase in the prescription of multimodal pain management methods. There are some limited studies in the literature that support similar findings. Hill and colleagues¹⁰ demonstrated that an educational intervention in an outpatient surgery population was successful in decreasing postoperative opioid prescription by 53%, without any change in opioid refill prescriptions. The opioid prescription limitations set by legislation implemented in our state during the study are significantly higher than the proposed prescription recommendations by MI-OPEN, and so likely had less of an effect in the results of the study. However, the other measures included in this legislation certainly served to increase provider awareness of opioid prescribing and has contributed to the overall culture change in our hospital.

One major concern in reducing postoperative opioids is the risk of uncontrolled pain and increased emergency department visits for opioid prescriptions. Fortunately, there were no unplanned admissions or emergency department visits for inadequate pain control in the 129 subjects after intervention. However, we did not evaluate incidence of opioid prescription refills or patient satisfaction in postoperative pain control. Additional research in this population is necessary in these efforts to standardize pain control in opioid-naïve postoperative patients.

There are several additional potential weaknesses to this study, including the limitations of a single-institution study, small sample size, retrospective nature, and generalizability. Unique characteristics of the patient population, institutional standards about opioid prescription, and provider differences in decision making and prescribing might not make these single-institution findings generalizable to other organizations. Retrospective review might be subject to convenience sampling, confounding, missing data in retrospective chart review, and difficulty assessing causal and temporal relationships. Generalizability is limited by the individuality of state legislation on opioid control, and several of the other restrictions mentioned. In addition, we did not evaluate patient satisfaction scores or otherwise assess patient perception of postoperative pain control after intervention.

Nonetheless, the data gathered from this busy independent community-based hospital help confirm that an aggressive approach to decreasing opioid overprescription and variation in prescribing can be successful. Additional research is needed to define ideal postoperative pain control regimens.

CONCLUSIONS

We have shown that a targeted approach including a hospital intervention is successful in a significant decrease in postoperative opioid prescription and resolution of variation in prescription practices. Longer-term data are needed to support a sustained decrease in opioid prescription. Additional research is needed across different surgical populations and procedures to establish a standardized approach to postoperative pain management.

Author Contributions

Study conception and design: Zipple, Braddock

Acquisition of data: Zipple

Analysis and interpretation of data: Zipple, Braddock

Drafting of manuscript: Zipple, Braddock

Critical revision: Zipple, Braddock

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Surgeons Take Action to Reduce Opioid Diversion via the Implementation of Guideline-Based Opioid Prescribing



Gabriella Tortorello, BA,
Rachel R Kelz, MD, MSCE, MBA, FACS
Philadelphia, PA

Diversion of prescribed but unused opioids is a significant factor contributing to our current opioid epidemic.¹ Surgeons commonly prescribe opioid medications after operations, and evidence suggests that only approximately 28% of prescribed pills are actually used for postoperative analgesia. As such, surgeons have begun to examine prescribing practices and to develop strategies to reduce the excess of opioids that can lead to abuse and diversion.

A new study out of St Joseph Mercy-Oakland Hospital showcases a successful strategy to reduce the quantity of opioids prescribed postoperatively within a community-based, private hospital in Michigan.² Initiated, in part, by impending state legislation regulating opioid prescriptions, a 2-pronged intervention was deployed. First, the Michigan Opioid Prescribing Engagement Network guidelines were posted throughout perioperative areas and were made available for physicians as pocket guides. Then, a lecture for surgical trainees about appropriate opioid prescribing practices and multimodal analgesia was developed and delivered to the staff. This straightforward approach resulted in a 60% to 70% reduction in the number of postoperative opioid tablets prescribed, and it decreased the variability in prescribing practices across surgeons within the hospital. This study is particularly noteworthy because most of the literature surrounding postoperative opioid reduction has taken place in university-affiliated hospitals, and here we see a comparably successful intervention within an independent community-based private hospital.