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Hospital opioid use predicts the need for discharge opioid prescriptions following laparoscopic bariatric surgery

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Abstract

Background Overprescribing of opioids after surgery increases new persistent opioid use and diversion contributing to the opioid epidemic. There is a paucity of evidence regarding discharge opioid prescribing after bariatric surgery.

Methods We conducted a retrospective, cohort study analyzing post-operative opioid use at a single institution in patients who underwent laparoscopic sleeve gastrectomy (LSG) and laparoscopic Roux-en-Y gastric bypass (LGB) from July 2019 thru February 2020. Multimodal analgesia was used including 5 mg oxycodone pills as needed during hospitalization with five prescribed on discharge if requested after discussion. Opioid use was determined from medical record review and post-operative data collected from patients at a 2-week follow-up visit. The Michigan Automated Prescription System (MAPS) was used as an adjunct to evaluate perioperative opioid prescriptions.

Results The cohort of 84 patients included those having LSG (72) and LGB (12). Fifty-five patients (65%) received a prescription for opioids on discharge and 91% filled their prescription. Only 44% (22/50) of those filling their opioid prescription took any opioids with 24% (65/275) of the total pills prescribed actually consumed. Opioid use on the surgical ward had the strongest correlation with discharge opioid use ($\rho = 0.65$, CI 0.494, 0.770). The number of opioid pills taken on the surgical ward was positively associated with the number of pills taken after discharge. Those who took none, 1 to 3, or 4 or more opioid pills consumed 0.14 ± 0.48 , 0.95 ± 1.71 , and 3.14 ± 1.86 pills after discharge ($p < 0.001$). No patients required an additional opioid prescription within 90 days of surgery with MAPS confirmation.

Conclusion Postoperative in-hospital opioid use following laparoscopic bariatric surgery predicts opioid use after discharge. This knowledge can guide patient-specific discharge opioid prescribing with the potential to mitigate diversion and reduce chronic opioid use.

Keywords Bariatric · Opioid prescribing · Opioid reduction · Laparoscopic Roux-en-Y gastric bypass · Laparoscopic sleeve gastrectomy

Opioid abuse in the United States has devastated our country and prompted the President to declare the opioid crisis

a public health emergency in 2017. From 1999 to 2017, the rate of drug overdose deaths from opioids increased from 1.0 to 4.4 in 100,000 [1]. In 2017 alone, 17,029 people died of drug overdose from prescription opioid medications [2]. Over half of the respondents in a National Survey of Drug Use and Health admitted to receiving opioid pain pills from a friend or relative for free [3] This isn't surprising as most patients report having unused opioids in their possession 30 days after surgery with over three-quarters of patients admitting to storing them in unlocked locations [4–6].

Because of this, decreasing overprescribing of opioids to surgical patients on discharge has become a subject matter of interest in recent literature [7]. A study published by Howard et al. in 2020 investigated pathways to create opioid prescribing guidelines and determined that utilizing

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patient-reported outcomes allowed physicians to reduce excessive opioid prescribing without affecting the perceived patient experience post-operatively [8]. Multiple other studies have demonstrated the large number of pills patients have remaining after recovering from surgery, and some have even gone on to recommend specific prescribing guidelines based on opioids taken in the hospital [4–6, 9–14].

Bariatric surgery patients are a unique population found to be at higher risk of developing new persistent opioid use when compared to non-surgical controls [15]. This was reported in 6.3% of patients, and is associated with significantly worse patient outcomes including decreased weight loss, decreased patient satisfaction and less improvement in body image and depression [15, 16]. There is a paucity of literature specifically relating to opioid prescribing on discharge after bariatric surgery. Therefore, we analyzed the records of 87 patients who underwent laparoscopic sleeve gastrectomy (LSG) or laparoscopic Roux-en-Y gastric bypass (LGB) to determine if there was a relationship between postoperative in-hospital opioid use and discharge opioid use. We sought to utilize this information to establish guidelines to facilitate discharge prescribing of patient-specific quantities of opioids following laparoscopic bariatric surgery.

Methods

We performed a retrospective, cohort study at a single institution. Institutional review board approval was obtained prior to collecting any patient data. We completed a chart review of patients between 18 and 70 years old who underwent LSG or LGB from July 2019 thru February 2020. Exclusion criteria included patients who underwent bariatric revision surgery, those with a history of chronic opioid use defined as >90 days of near daily use of prescription medication classified as an opioid within 1 year prior to surgery, any patient who had an intra-operative or post-operative complication, or those who did not attend their first post-operative follow-up appointment 2 weeks after surgery.

All patients included in the chart review had their surgeries performed by the same surgeon and were enrolled in an Enhanced Recovery After Surgery (ERAS) program which included perioperative multimodal analgesia and intraoperative bilateral transversus abdominis plane blocks. The ERAS protocol was standard throughout the entire study period and did not differ between LSG or LGB cases. Opioid pain medication in the post-operative period was administered on an “as needed” basis at the discretion of the nurses taking care of the patients and based on the “Numerical Pain Rating Scale”. Opioids were given only if their pain rating was seven or higher after other non-opioid analgesics were given. Hydromorphone was administered in the

post-anesthesia care unit (PACU) and morphine and oxycodone were administered on the surgical ward as needed. In addition to opioid pain medication, patients who underwent LSG as well as LGB were given scheduled acetaminophen and celecoxib and had methocarbamol available as needed. Upon discharge, five celecoxib pills (200 mg) were prescribed for all patients with the order written as 200 mg daily as needed for pain. Twenty-four acetaminophen pills were prescribed to all patients with dosing of 1000 mg every 6 h as needed for pain. The decision whether to write a prescription for oxycodone came from a discussion held with the patient. As part of this discussion, the surgeon reviewed the patient’s hospital use of opioids, explained the role of NSAIDs and acetaminophen, and discussed the negative side effects of opioids. Five oxycodone pills (5 mg) were given if requested, and patients were instructed to take one pill every 6 h as needed.

The patient charts were reviewed for age, gender, race, medical comorbidities, body mass index (BMI), type of surgery, length of stay, and operative time. They were also reviewed for the quantity of opioids taken during their hospital admission and prescribed on discharge. Per the surgeon’s standard post-operative protocol, all patients are asked to report the number of acetaminophen, celecoxib, and oxycodone pills that had been consumed since discharge at the first 2-week follow-up appointment by our registered dietician. Under the guidance of our dietician, the numbers of each of these pills consumed were recorded and then reviewed for purposes of this study. Opioid use was converted to morphine milligram equivalents (MME) for comparisons where appropriate. The Michigan Automated Prescription System (MAPS) was used to verify all perioperative opioid prescriptions.

Statistical analysis

Continuous variables were described with means and standard deviations. Nominal variables were described with counts and percentages. All correlations were computed using the nonparametric Spearman correlation. The outpatient opioid use followed a Poisson distribution. To analyze this a negative binomial model was used. Univariate models evaluated each variable individually and a multivariate model was fit on multiple variables in the same model. Diabetes was evaluated with a two-way analysis of variance for repeated measures. Student’s *t* test or Chi-squared tests were used for two group comparisons. Throughout this study, a *p* value < 0.05 (two-tail) was considered statistically significant. Following initial data entry using Microsoft Excel, Minitab version 19 Statistical Software (State College, PA) was used for performing the analyses.

Results

Our initial criteria for review included 87 patients, however 3 patients were excluded from the study due to preoperative opioid use. Seventy patients (90%) were female. The mean age was 44 and mean BMI was 47. Seventy-two patients underwent LSG (86%) while 12 underwent LGB (14%). Mean length of stay (LOS) was 1 day. Fifty-five patients (65%) received a prescription for five oxycodone 5 mg pills on discharge and 91% filled their prescription. Only 44% (22/50) of those filling their opioid prescription took any opioids. A total of 275 pills were prescribed (55 × 5) and only 24% (65) of these pills were actually consumed after discharge in the 2-week postoperative period. Characteristics of the entire cohort are demonstrated in Table 1.

There was no correlation between the amount of opioids consumed after discharge with age, weight, BMI, operative time, or length of stay. In addition, there was no association with discharge opioid consumption and gender, hypertension, hyperlipidemia, obstructive sleep apnea, arthritis, or degenerative disc disease. However, the preoperative

diagnosis of diabetes mellitus was associated with decreased discharge opioid consumption ($p=0.042$) (Fig. 1).

There was no correlation between the amount of opioids taken in the post-anesthesia care unit (PACU) and the amount of opioids taken on discharge. However, there was a moderately strong correlation with opioid use on the surgical ward and opioid use on discharge ($\rho=0.65$, CI 0.494, 0.770) (Fig. 2). Furthermore, there was a significant positive association with the number of oxycodone pills taken on the surgical ward in the hospital with the amount taken after discharge (Table 2).

All patients were prescribed both acetaminophen and celecoxib on discharge. There was no relationship between opioid use on discharge and consumption of acetaminophen ($\rho=0.18$) or celecoxib ($\rho=0.30$). Regarding prescribing practices, patients who consumed greater amounts of opioids in the hospital were more likely to be discharged with an opioid prescription ($p=0.001$). No patients required a refill or a new prescription for opioids within 90 days of surgery. This was confirmed using MAPS. It is also important to note that no phone calls were made to the surgeon's office requesting an opioid prescription.

Table 1 Characteristics of entire cohort

Variable	
Age, mean (SD)	44.5 (11.3)
Gender, <i>n</i> (%)	
Male	8 (9.5)
Female	76 (90.5)
LOS, mean (SD)	1 (0.41)
BMI, mean (SD)	46.6 (6.5)
Race, <i>n</i> (%)	
White	59 (70.2)
Black	24 (28.6)
Asian	1 (1.2)
Comorbidities, <i>n</i> (%)	
DM II	27 (32.1)
HTN	41 (48.8)
HLD	38 (45.2)
OSA	36 (42.9)
DDD	7 (8.3)
Arthritis	27 (32.1)
OR time, min (SD)	81 (31.9)
Surgery type, <i>n</i> (%)	
LSG	72 (85.7)
LGB	12 (14.3)
Opioid prescriptions written, <i>n</i> (%)	55 (65.5)
Opioid prescriptions filled, <i>n</i> (%)	50 (90.9)
Pts who consumed opioids on DC upon receiving script, <i>n</i> (%)	22/50 (44)
Pills consumed compared to prescribed, <i>n</i> (%)	65/275 (23.6)

Discussion

Our study demonstrates that for patients undergoing laparoscopic bariatric surgery the best predictor of post-operative opioid use after discharge is hospital opioid use on the surgical ward. We also found diabetes mellitus protective against opioid use, with diabetic patients using less opioids on discharge. In our study, 275 pills were prescribed on discharge and only 24% (65) of these pills were actually consumed. Those who consumed greater than or equal to 4 pills on the ward were much more likely to consume opioids on discharge (Fig. 3).

We demonstrated in our study gross over prescribing with a large number of pills available for diversion. Despite the relatively small number of opioids consumed after discharge, no patients contacted our office for additional pain medications. Based on our data, we have developed discharge prescribing guidelines for our laparoscopic bariatric surgery patients. We prescribe 0 pills if the patient used no opioids on the surgical ward, 1 pill if they used 1–3 pills on the surgical ward, or 3 pills if they used 4 or more pills on the surgical ward. By utilizing these guidelines, we anticipate a reduction in unused opioids available for diversion and a lower rate of new persistent opioid use.

Hospital opioid use as a predictor of discharge opioid use is supported in a study including several different operations both open and laparoscopic by Hill et al. that demonstrated the best predictor of opioid use at home was the amount of opioids used the day prior to discharge [10] In their findings;

Opioids Consumed in Diabetics vs. Non-Diabetics

p=0.042

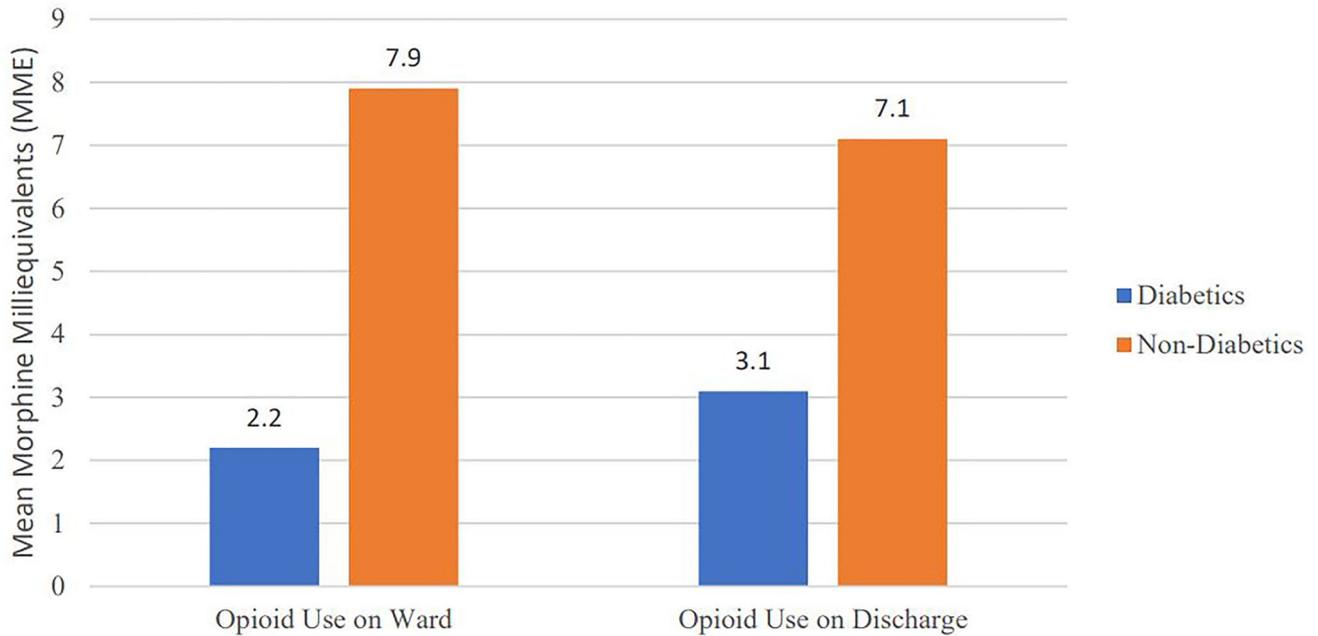


Fig. 1 Average MME used on the ward and on discharge in the diabetic patient population compared to the non-diabetic

Percentage of Patients Using Opioids After Discharge Compared to Ward Use

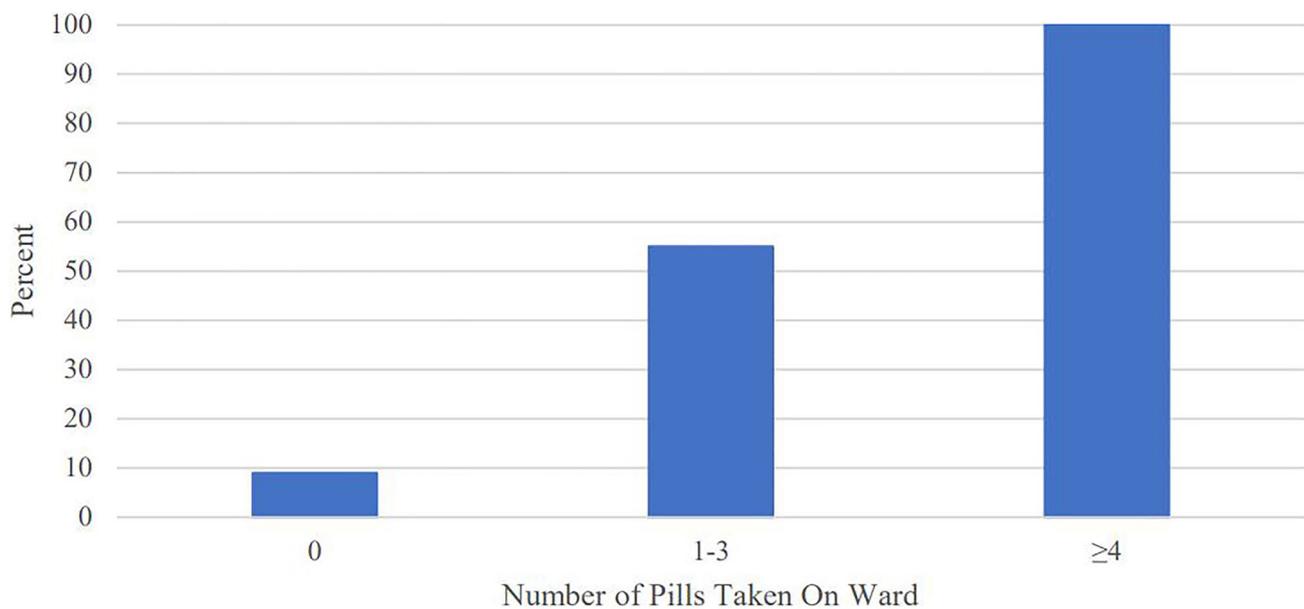
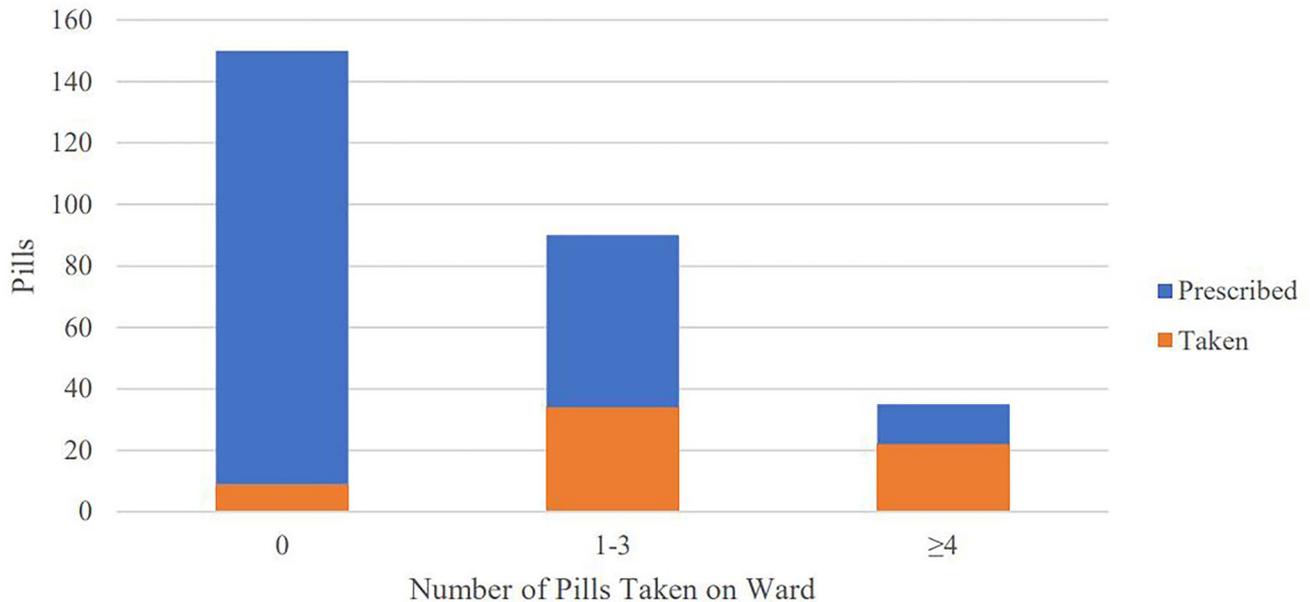


Fig. 2 Percentage of patients using opioids on discharge after consuming 0, 1–3, or ≥4 pills on the ward

Table 2 Univariate and multivariate analysis of variables associated with outpatient opioid use

Variable	<i>n</i>	Pills taken after discharge, median (IQR)	Pills taken after discharge, mean (SD)	Univariate <i>p</i> value	Multivariate <i>p</i> value
Age, years				0.798	0.912
≤44	43	0 (0.1)	0.72 (1.47)		
>44	41	0 (0.1)	0.83 (1.64)		
Sex				0.882	0.465
Male	8	0 (0.1)	0.88 (1.81)		
Female	76	0 (0.1)	0.76 (1.53)		
Type of surgery				0.911	0.566
LSG	72	0 (0.1)	0.76 (1.54)		
LGB	12	0 (0.1)	0.83 (1.64)		
LOS, days				0.351	0.509
1	70	0 (0.0)	0.67 (1.44)		
≥2	14	0 (0.2)	1.28 (1.88)		
# Pills taken on ward				0.001	0.001
0	37	0 (0.0)	0.14 (0.48)		
1–3	40	0 (0.1)	0.95 (1.71)		
≥4	7	4 (2.5)	3.14 (1.86)		

Discharge Opioid Pills Prescribed vs. Taken Relative to Opioid Use on Ward

**Fig. 3** Number of pills prescribed versus number of pills consumed on discharge when patients took 0, 1–3, or ≥4 pills on the ward

however, they concluded that patients being discharged prior to post-operative day (POD) 2 should receive 15 pills (5 mg oxycodone) regardless of hospital use. Those being discharged on or after POD 2 would receive a number of pills based on their opioid consumption on the ward. Most of our patients were discharged home on POD 1 (83%). If

each of these patients was generically given 15 pills, this would result in 1,050 pills being prescribed. As a group, our patients discharged on POD 1 only used 47 pills.

Pill surplus has been noted in other research studies on opioid use. A meta-analysis of 6 prospective studies evaluating the oversupply of opioids after a wide variety

of surgical procedures including orthopedic, urologic, thoracic, and general surgery showed 67–92% of patients reported having unused opioids with 73–77% of patients storing them in unlocked locations [4]. A cohort study done analyzing over 2300 patients in Michigan undergoing general and gynecologic surgical procedures in 2017 showed the mean number of hydrocodone-acetaminophen pills prescribed on discharge was 30 with the mean number of actual pills consumed on discharge being 9 [17]. In their study, they found that patients consumed more pills after discharge if they were prescribed more pills. They also found that obese patients used higher amounts of opioids.

While our study showed no correlation between BMI and opioid use, we did find that patients with type II diabetes mellitus used significantly less opioids in the hospital as well as after discharge. Several forms of diabetic neuropathy exist, but distal symmetric polyneuropathy is the most common form [18]. It can present itself as loss of nerve function or gain of nerve function resulting in pain [19]. The nerve damage begins peripherally in the small-diameter sensory nerve fibers that perceive thermal and electrical energy as well as pain [19]. It is not only the peripheral nerves that are affected by diabetes. A small, prospective study performed in Denmark demonstrated decreased sensitivity to mechanical, electrical, and heat stimulation of the foregut leading to what they referred to as a “high overall gut pain threshold” [20]. Additional research into patterns of opioid use of diabetic patients after abdominal surgery could guide clinicians in their future prescribing practices as these patients may require less opioid medication.

The Michigan Opioid Prescribing Engagement Network (Michigan OPEN) makes procedure specific opioid prescribing recommendations based on published studies and/or expert opinion. With regards to sleeve gastrectomy, their recommendations are based only on expert opinion and data from the Michigan Pain Control Optimization Pathway (POP). The POP is used to guide opioid use in opioid naïve patients undergoing uncomplicated elective surgery with no contraindications to acetaminophen or ibuprofen [14]. Their current recommendations are 0–10 oxycodone pills (5 mg) on discharge after sleeve gastrectomy. They do not have recommendations for gastric bypass. Following these guidelines, our LSG patients would have been potentially discharged with 720 pills; however, they only used 32 pills or 4% of the POP recommended maximum prescription. Clearly our study demonstrates that following the POP guidelines for sleeve gastrectomy in our patients would lead to excessive over prescribing. The high number of recommended pills by Michigan OPEN could be attributed to their guidelines being based on expert opinion which highlights the need for additional investigations regarding discharge opioid

prescribing following laparoscopic bariatric surgery. Currently their website states that prospective data collection is ongoing for future revisions.

It is important to note that using our prescribing guidelines developed from this study, our entire cohort of patients would have had an opportunity to consume 41 pills on discharge. The patients used a total of 65 pills. On further analysis, 17 patients (20.2%) used more opioids than our prescribing algorithm would have suggested. 12 patients (14.2%) used less pills than would have been prescribed. Under prescribing of opioids could potentially increase office calls for refills or increase emergency room visits due to inadequate pain control and over prescribing can lead to pill diversion or an increased amount of opioids consumed as previously described [17].

Limitations to this study include its relatively small sample size and retrospective analysis with potential for bias. An additional limitation would include potential recall bias from patients regarding the number of pills taken. They were asked about the exact numbers of three different medications consumed, and it is possible they may not have reported the correct number of each pill. In future studies analyzing post-operative opioid use, it may be helpful to have patients bring in pill bottles to help confirm amounts taken.

The number of opioids prescribed and consumed on discharge may appear low to some; however, all procedures were performed by a single bariatric surgeon who utilizes a strict ERAS protocol with a multi-modal pain control pathway for all patients. ERAS protocols using multi-modal pain pathways have been shown to decrease opioid use in both the inpatient setting and on discharge. Our results may not be generalizable to all bariatric surgery populations due to differences in surgical technique and analgesic management including multi-modal pain control and ERAS protocols. Future studies analyzing patient behavior when prescribed a limited number of opioids based on post-operative in-hospital opioid use need to be performed to validate our new prescribing guidelines.

Conclusion

Opioid use on the surgical ward predicts opioid use on discharge following laparoscopic bariatric surgery. This information can be used as a guide for discharge opioid prescribing to potentially mitigate new persistent opioid use as well as pill diversion.

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Declarations

Disclosures Dr. Sarah Diaz, Dr. Arthur Carlin, and Alissa Dandalides have no conflicts of interest or financial ties to disclose.

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