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ORIGINAL ARTICLE

Post-Discharge Opioid Prescribing Patterns and Risk Factors in Patients Undergoing Elective Colon and Rectal Surgery Without Complications

Jeffrey S. Scow[1] · Nicholas M. Tomhave[2] · Jenna K. Lovely[3] · Grant M. Spears[4] · Marianne Huebner[5] · David W. Larson[1]

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Abstract

Background Few studies have examined opioid usage in the post-discharge period. The primary aim of this study was to evaluate the need for post-discharge opioids in a unique set of patients: those undergoing colorectal operations and experiencing no surgical complications. The secondary aim was to examine the accuracy of the Opioid Risk Tool (ORT) to predict the need for additional opioid prescriptions. Our hypotheses were that few patients would require post-discharge opioids and that the ORT would predict patients requiring post-discharge opioids.

Methods All patients undergoing elective colorectal surgery between January 2012 and December 2014 that did not experience NSQIP complications within 30 days or receive an opioid prescription in the 2 weeks prior to operation were reviewed. ORT score was calculated for all patients. Patients requiring post-discharge opioids within 1 year were compared to those not receiving additional opioids after discharge.

Results There were 367 patients that met inclusion criteria and 56 (15%) received post-discharge opioids. Opioid use in the year prior to surgery was the only significant risk factor to receive post-discharge opioids. Opioids were prescribed for three distinct reasons by three groups of prescribers. The ORT did not accurately predict need for post-discharge opioids.

Conclusions Even among patients without complications, 15% received post-discharge opioid prescriptions. Previous opioid use within the year prior to surgery was a major risk factor for additional prescriptions. The timing and prescriber's specialty are impacted by the indication for post-discharge opioids. The ORT did not predict which patients would receive post-discharge opioids.

Keywords NSQIP · Opioid Risk Tool · Colorectal surgery

Abbreviations

CUC	Chronic ulcerative colitis
ERP	Enhanced recovery pathway
HALS	Hand-assisted laparoscopic surgery
IPAA TPC	Ileal pouch-anal anastomosis total proctocolectomy
IQR	Interquartile range
MMEs	Morphine milligram equivalents
NSQIP	American College of Surgeons National Surgical Quality Improvement Program
ORT	Opioid Risk Tool
RX	Prescription

✉ David W. Larson
larson.david2@mayo.edu

[1] Colon and Rectal Surgery, Mayo Clinic, 200 First Street SW, Rochester, MN 55905, USA

[2] St. Olaf College, Northfield, MN, USA

[3] Mayo Clinic Pharmacy, Rochester, MN, USA

[4] Department of Health Sciences Research, Mayo Clinic, Rochester, MN, USA

[5] Department of Statistics and Probability, Michigan State University, East Lansing, MI, USA

Introduction

Opioid abuse is an official public health emergency.[1] In 2015, opioids contributed to over 33,000 overdose deaths: an astounding 16% increase in age-adjusted opioid-related deaths from 2014.[2] Multiple studies have demonstrated that patients undergoing surgical procedures are at risk for long-term opioid use.[3–7] Post-operative prescribing practices are far from optimized or evidence based.[6,8,9] Post-operative opioid overprescribing is common and has been associated with

misuse and overuse.[6,10–13] Unfortunately, there are few studies to inform opioid prescribers of the ideal dosage or duration of opioid usage in the post-operative and post-discharge period.

Known risk factors for prolonged post-operative pain and prolonged post-operative opioid use include depression, anxiety, younger age, preoperative pain, operation type, incision size, and preoperative opioid use.[14,15] Knowledge of risk factors for opioid misuse has led to the development of screening tools to aid in opioid risk management.[16–22] A commonly used risk stratification instrument validated for chronic use is the Opioid Risk Tool (ORT).[21] The ORT stratifies patients as being at low, moderate, or high risk to misuse opioids based on ten risk factors in the following domains: patient and family histories of substance abuse, age, preadolescent sexual abuse, gender, and mental disorders.[21] The ORT has been used and validated in outpatient pain and primary care settings, but to our knowledge, it has not been used or validated in patients undergoing inpatient operative procedures.

As few studies have examined opioid prescribing patterns at discharge, the primary aim of this study is to describe and evaluate opioid prescribing patterns for patients in a high volume colon and rectal surgical practice, experiencing *no* American College of Surgeons National Surgical Quality Improvement Program (NSQIP) defined complications.[6,12] The use of post-discharge opioids in patients without complications undergoing major abdominal surgery is novel and has not been studied. Our purpose in selecting patients without complications was to study patients that would not be expected to require opioids after discharge. There is minimal research guiding surgeons on duration of opioid use after surgery. The secondary aim is to examine the ability of the ORT to predict the need for additional opioid prescriptions in surgical patients. Our hypotheses were that few patients in this group would require post-discharge opioids and that the ORT would accurately predict which patients would require post-discharge opioids. Excluding patients with complications would potentially allow for more accurate identification of risk factors for use of post-discharge opioids as surgical complications can frequently result in pain and subsequent use of post-discharge opioids.

Methods

This retrospective study was approved by the Mayo Clinic Institutional Review Board and took place at a high volume, referral center in the Midwestern United States. In our colon and rectal surgery practice, patient care has been standardized across all surgeons in the division since 2011 through a default enhanced recovery protocol which has previously been described. Briefly, it consists of five elements: 1—non-opioid preoperative, preemptive oral analgesics; 2—preoperative intrathecal analgesia; 3—general diet immediately after surgery; 4—post-operative acetaminophen and NSAIDs for baseline analgesia and opioids reserved for breakthrough pain; and 5—discontinuing IV fluids the morning after surgery to maintain euvolemia.[23–25] Initial inclusion criteria included all patients 18 years or older undergoing elective, inpatient operations by one of the colorectal surgeons in the practice from January 2012 through December 2014. For the years of this study, there were nine to 11 active surgeons.

Our a priori hypothesis was that patients without NSQIP defined 30-day post-operative complications would be unlikely to require post-discharge opioids; therefore, we restricted our study to such patients. Furthermore, we restricted our study to patients not using opioids in the 14 days prior to the procedure. NSQIP 30-day complications are well defined, validated, and used in many institutions. Abstractors collect perioperative data including post-operative complications on randomly selected patients through the first 30 post-operative days per the NSQIP standard abstraction methodology.[26] Complications include surgical site infection, pneumonia, reintubation, bleeding, thrombosis, embolism, renal insufficiency, urinary tract infections, and reoperation. Patients who underwent emergency operations, required operation by a colorectal surgeon in our division within 1 year of the index procedure, died within the year following surgery, or declined to participate in retrospective research studies were excluded.

Patient demographics, reoperation, readmission, and primary surgical endpoints were determined through administrative data, national quality data, and the electronic medical record. Administrative data, including opioid medications prescribed by Mayo providers, were evaluated for each patient up to 1 year before and after the index operation. Post-discharge opioid prescriptions were defined as any opioid prescriptions provided after the initial dismissal opioid prescription in the year after the index operation. Dismissal prescriptions were defined as those written between admission and within 1 day of discharge. Medications defined by the American Hospital Formulary Service (AHFS) as “opioid” or “opioid containing” were included in the query. The opioid content of each prescription was converted into oral morphine milligram equivalents (MMEs) to allow for comparisons of different medications and dosages (i.e., 30 oxycodone 5-mg tablets equals 225 MMEs).[27,28] Diagnosis was manually abstracted and classified as cancer, Crohn’s/chronic ulcerative colitis (CUC), diverticulitis, neoplasia, or “other.” Self-reported personal and family health history was abstracted to calculate the ORT score for each patient.

The primary endpoints of this study were to (1) characterize this patient population, (2) define the risk factors associated with post-discharge opioid prescriptions, and (3) determine the accuracy of the ORT to predict post-discharge opioid prescriptions.

Table 1 Patient characteristics vs. receipt of post-discharge opioids

NSQIP patients with no post-op complications and no reoperations (within 30 days or 1 year) and no preop RX (within 14 days)

	Prescribed additional opioids after discharge			
	No ($N = 311$)	Yes ($N = 56$)	Total ($N = 367$)	p value
Age at surgery				0.6674[1]
Median	58.0	58.5	58.0	
IQR	46.0, 69.0	48.5, 70.0	46.0, 69.0	
Gender				0.2580[2]
Female	169 (54%)	35 (63%)	204 (56%)	
Male	142 (46%)	21 (38%)	163 (44%)	
Had opioid RX in year prior to surgery				0.0063[2]
No	204 (66%)	26 (46%)	230 (63%)	
Yes	107 (34%)	30 (54%)	137 (37%)	
Surgery mode				0.1863[2]
Lap/robotic	83 (27%)	12 (21%)	95 (26%)	
HALS	50 (16%)	5 (9%)	55 (15%)	
Open	178 (57%)	39 (70%)	217 (59%)	
Diagnosis				0.6277[2]
Cancer	90 (29%)	18 (32%)	108 (29%)	
Crohn's/CUC	46 (15%)	5 (9%)	51 (14%)	
Diverticulitis	52 (17%)	7 (13%)	59 (16%)	
Neoplasia	23 (7%)	4 (7%)	27 (7%)	
Other	100 (32%)	22 (39%)	122 (33%)	
Procedure				0.0519[3]
Complex pelvic operation	7 (2%)	1 (2%)	8 (2%)	
IPAA TPC	5 (2%)	1 (2%)	6 (2%)	
Ileostomy/colostomy	16 (5%)	4 (7%)	20 (5%)	
Other	9 (3%)	6 (11%)	15 (4%)	
Rectal resection	81 (26%)	19 (34%)	100 (27%)	
SB resection	9 (3%)	3 (5%)	12 (3%)	
Segmental colectomy	166 (53%)	21 (38%)	187 (51%)	
Subtotal colectomy	18 (6%)	1 (2%)	19 (5%)	
Surgical length (min)				0.9734[1]
Median	137.5	137.0	137.0	
IQR	92.0, 197.0	90.0, 189.0	92.0, 197.0	
Estimated blood loss (ml)				0.9162[1]
Median	100.0	100.0	100.0	
IQR	45.0, 187.5	50.0, 200.0	50.0, 200.0	
Length of hospital stay (days)				0.1478[1]
Median	3.0	3.0	3.0	
IQR	2.0, 4.0	2.5, 4.0	2.0, 4.0	
Prescribed opioids initial at discharge				0.8414[2]
No	63 (20%)	12 (21%)	75 (20%)	
Yes	248 (80%)	44 (79%)	292 (80%)	
MMEs prescribed at discharge				0.8325[1]
Median	187.5	225.0	200.0	
IQR	75.0, 450.0	75.0, 450.0	75.0, 450.0	

Table 1 (continued)

NSQIP patients with no post-op complications and no reoperations (within 30 days or 1 year) and no preop RX (within 14 days)				
	Prescribed additional opioids after discharge			
	No ($N = 311$)	Yes ($N = 56$)	Total ($N = 367$)	p value
Sum of MMEs prescribed within 1 year post-op				< 0.0001[1]
Median	187.5	615.0	225.0	
IQR	75.0, 450.0	325.0, 1200.0	75.0, 600.0	
ORT risk				0.4947[3]
Missing	1	0	1	
Low	289 (93%)	50 (89%)	339 (93%)	
Moderate	16 (5%)	5 (9%)	21 (6%)	
High	5 (2%)	1 (2%)	6 (2%)	

[1] Kruskal-Wallis

[2] Chi-square

[3] Fisher's exact

Statistical Analysis

Patient characteristics were summarized using frequency (percent) for categorical variables and median (interquartile range [IQR]) for continuous variables. Comparisons between patients who did or did not receive opioid prescriptions after discharge and between ORT risk groups were evaluated using chi-square, Fisher's exact, and Kruskal-Wallis tests, as appropriate. Multivariable logistic analysis using the variables age, gender, opioid prescription in the preceding year, mode of surgery, and procedure was performed. A p value of 0.05 was considered statistically significant. Statistical analysis was performed using SAS, version 9.4.

Results

Overall, 367 patients met criteria for inclusion in this study. Median age was 58 years, the study population was predominantly female (56%), and 63% had not received opioids in the year prior to surgery. Open operations (59%) were more common than hand-assisted (15%) or laparoscopic/robotic (26%) procedures. Patients underwent operation for a diagnosis of "other" (33%) followed by cancer (29%), diverticulitis (16%), Crohn's/CUC (14%), and neoplasia (7%). Three quarters of patients underwent segmental colectomy (51%) or rectal resection (27%). Median blood loss was estimated at 100 ml (IQR 50–200 ml). Median lengths of surgery and hospital stay were 137 min (IQR 92–197 min) and 3 days (IQR 2–4 days) respectively. Most patients (80%) were prescribed opioids (median 200 MMEs, IQR 75–450 MMEs) at discharge. Median MME prescribed at 1 year for the entire study population was 225 MMEs (IQR 75–600 MMEs). Most patients were calculated by the ORT to be low risk for opioid abuse (93%) (Table 1).

In the year following the index operation, 56 patients (15%) received post-discharge opioids. There was no difference in age, gender, mode of surgery, diagnosis, procedure, length of surgery, blood loss, hospital length of stay, opioids at discharge, or ORT risk categories among patients that did and did not receive post-discharge opioids (Table 1). Patients who were prescribed post-discharge opioids were more likely to have had an opioid prescription filled in the year prior to surgery ($p = 0.0063$). These results were consistent when multivariable analysis was performed. The only factor that predicted use of post-discharge opioids was use of opioids in the year prior to surgery ($p = 0.014$). Age, gender, mode of surgery, and procedure were not significantly associated with post-discharge opioid use (Table 2).

Approximately 20% of patients in each group received no prescription for an opioid at discharge. In the year following discharge, patients who received post-discharge opioids were prescribed three times more MME than those who received no post-discharge opioid prescription (Table 1; 187 (IQR75–450) vs. 615 (IQR 325–1200) MMEs; $p < 0.001$).

Of the patients that received post-discharge opioid prescriptions within the year after their index operation, 17 (30%) received post-discharge opioids for pain related to the index operation, 25 (45%) received opioids for an unrelated procedure, and 14 (25%) for preexisting medical conditions ($p = 0.0016$). The duration of time between discharge and first post-discharge opioid prescription was significantly different between the three groups: median 43 days (IQR 14–80) for perioperative pain, 226 days (IQR 82–303) for unrelated

Table 2 Multivariable logistic model for post-discharge opioids after uncomplicated colon and rectal surgery

Parameter	OR (95% CI)	*p* value
Male gender (vs. female)	0.78 (0.43, 1.41)	0.405
Age (per 10-year increase)	1.08 (0.91, 1.28)	0.379
Had opioid RX in year prior to surgery (vs. no)	2.21 (1.18, 4.15)	0.014
Open surgery (vs. lap/robotic/HALS)	1.51 (0.77, 2.96)	0.233
Pelvic operation (vs. non-pelvic)	1.74 (0.92, 3.28)	0.088

surgical procedures, and 93 days (IQR 33–173) for individuals with preexisting medical conditions ($p = 0.008$). There was considerable variability in the specialty of the prescribing provider based on the reason for the post-discharge opioid prescription. Surgeons tended to prescribe for surgical issues and medical providers prescribed for preexisting medical conditions.

When patients were grouped based on the their ORT risk score, there was no difference in age, gender, prior opioid prescriptions, mode of surgery, diagnosis, procedure, length of surgery, blood loss, length of hospital stay, or prescription of opioids at discharge between low-, moderate-, or high-risk groups. Furthermore, average numeric ORT scores did not differentiate between patients that did and did not receive post-discharge opioids, nor did categorical ORT scores. The sum of MME prescribed at discharge varied significantly by ORT risk category (low = 200 MMEs (IQR 75–450 MMEs), moderate = 150 MMEs (0–450 MMEs), and high = 1035 MMEs (300–1200 MMEs); $p = 0.0122$; Table 3). Additionally, patients calculated by the ORT to be high risk had greater median MME at 1 year compared to other risk categories (low = 225 MMEs (IQR 75–600 MMEs), moderate = 150 MMEs (0–630 MMEs), and high = 1035 MMEs (300–1530 MMEs); $p = 0.0300$; Table 3).

Discussion

This study identified a unique population of patients that we presumed would be unlikely to receive post-discharge opioids based on pre-, peri-, and post-operative factors. In spite of these restrictive selection criteria, 15% of patients in this study received a prescription for post-discharge opioids in the year after the index operation of which 4% received opioids for pain related to the index operation. Extended post-discharge use of opioids has been reported in 3–15% of patients undergoing an operation.[3,4,29] However, no other study that we know of has purposely selected for low-risk patients, undergoing major abdominal surgery, as was done in this study.

Our results fall within the range of previously reported results for opioid use after surgery. Alam et al. reported that 7.7% of patients continued to use opioids after outpatient surgery, a year after the index operation.[7] In a pilot study to elucidate risk factors for opioid use beyond 150 days, it was reported that 6% of patients continued to use opioids.[3] When 39,140 patients undergoing major surgery in Canada were studied, 3% continued to receive opioids more than 90 days after operation.[4] Recently, Jiang et al. reported an overall prevalence of 9.2% for chronic opioid usage in surgical patients and 14.4% in those undergoing gastrointestinal surgery at a large academic center in the USA.[29]

Notably, few objective factors that we examined could accurately predict the use of post-discharge opioids. Age, gender, surgical factors, diagnosis, hospital stay, prescription of opioids at discharge, the MME of opioid initially prescribed at discharge, and ORT risk category were not found to correlate with the need for post-discharge opioids in both univariate and multivariate models. The only factor that appeared predictive of post-discharge opioids in both univariate and multivariate models was a history of a preoperative opioid usage in the year prior to surgery. Notably, this risk factor has been identified by others.[3,14,15]

It is notable that 20% of patients did not receive an opioid at discharge. Furthermore, the overall median amount of opioid prescribed at discharge (200 MMEs) was low: equivalent to 27 tablets of oxycodone 5 mg. These observations are likely a consequence of our enhanced recovery protocol. Additionally, they validate our selection criteria as we expected these patients to require few opioids. Notably, these numbers are much less than those of a recent report from our institution which reported that 94% of patients undergoing elective procedures went home with a median of 375 MMEs.[6]

In this study of patients with no NSQIP complications undergoing colon or rectal surgery, the ORT was not capable of predicting a patient's need for post-discharge opioids. Notably, the original ORT study was developed and validated in an outpatient pain clinic and the ORT's accuracy may vary based on a population's characteristics. Other studies have suggested that the ORT may not be as effective in pain practices as initially reported. A range of sensitivities have been published: 0.18 to 0.83.[20,30,31] It should also be noted that the ORT was designed to predict "aberrant opioid use behaviors" in an attempt to minimize the risks of opioid abuse.[21] We acknowledge that our use and goal for the ORT, prediction of patients requiring post-discharge opioids, significantly differs from its original aim, and we do not know if abuse of opioids played a role in those that obtained post-discharge opioids. Patients in each ORT risk group (low, moderate, or high) had roughly the same incidence (14–21%) of post-discharge opioids ($p = 0.4947$). Additionally, the most common reason patients received post-discharge opioids in our study was for an unrelated procedure. The ORT would not

Table 3 Patient characteristics vs. ORT category

NSQIP patients with no post-op complications and no reoperations (within 30 days or 1 year) and no preop RX (within 14 days)

	ORT risk score			*p* value
	Low (*N* = 339)	Moderate (*N* = 21)	High (*N* = 6)	
Age at surgery				0.3176[1]
Median	58.0	58.0	47.5	
IQR	47.0, 69.0	46.0, 67.0	29.0, 61.0	
Gender				0.3766[2]
Female	191 (57%)	10 (48%)	2 (33%)	
Male	148 (44%)	11 (52%)	4 (67%)	
Had opioid RX in year prior to surgery				0.0826[2]
No	215 (63%)	13 (62%)	1 (17%)	
Yes	124 (37%)	8 (38%)	5 (83%)	
Surgery mode				0.4442[2]
Lap/robotic	91 (27%)	4 (19%)	0 (0.0%)	
HALS	51 (15%)	3 (14%)	0 (0.0%)	
Open	197 (58%)	14 (67%)	6 (100.0%)	
Diagnosis				0.0838[2]
Cancer	102 (30%)	6 (29%)	0 (0%)	
Crohn's/CUC	47 (14%)	1 (5%)	3 (50%)	
Diverticulitis	55 (16%)	4 (19%)	0 (0%)	
Neoplasia	22 (7%)	4 (19%)	0 (0%)	
Other	113 (33%)	6 (29%)	3 (50%)	
Procedure				0.9638[2]
Complex pelvic operation	8 (2%)	0 (0%)	0 (0%)	
IPAA TPC	6 (2%)	0 (0%)	0 (0%)	
Ileostomy/colostomy	20 (6%)	0 (0%)	0 (0%)	
Other	14 (4%)	1 (5%)	0 (0%)	
Rectal resection	92 (27%)	5 (24%)	3 (50%)	
SB resection	12 (4%)	0 (0%)	0 (0%)	
Segmental colectomy	170 (50%)	13 (62%)	3 (50%)	
Subtotal colectomy	17 (5%)	2 (10%)	0 (0%)	
Surgical length (min)				0.8283[1]
Median	139.0	117.0	161.0	
IQR	92.0, 197.0	94.0, 184.0	101.0, 199.0	
Estimated blood loss (ml)				0.7596[1]
Median	100.0	100.0	50.0	
IQR	50.0, 200.0	37.5, 125.0	30.0, 100.0	
Length of hospital stay				0.0736[1]
Median	3.0	3.0	5.0	
IQR	2.0, 4.0	2.0, 4.0	4.0, 7.0	
Prescribed opioids initial at discharge				0.1971[2]
No	67 (20%)	7 (33%)	0 (0%)	
Yes	272 (80%)	14 (67%)	6 (100%)	
Sum of MMEs prescribed initially at discharge				0.0122[1]
Median	200.0	150.0	1035.0	
IQR	75.0, 450.0	0.0, 450.0	300.0, 1200.0	

Table 3 (continued)

NSQIP patients with no post-op complications and no reoperations (within 30 days or 1 year) and no preop RX (within 14 days)				
	ORT risk score			*p* value
	Low (*N* = 339)	Moderate (*N* = 21)	High (*N* = 6)	
Sum of all MMEs prescribed within 1 year post-op				0.0300[1]
Median	225.0	150.0	1035.0	
IQR	75.0, 600.0	0.0, 630.0	300.0, 1530.0	

[1] Kruskal-Wallis

[2] Fisher's exact

reasonably be expected to predict this. Based on these results, the ORT in our patient population does not appear to be suitable as a screening tool to predict the need for post-discharge opioids. One potential utility that deserves further research includes the finding that the ORT appears effective at predicting patients that would be prescribed greater amounts of MME at discharge and possibly in the year following their procedure. Overall, the ORT appears to be of limited use in surgery but it may provide a simple, yet crude, mechanism for risk profiling that can be utilized either pre- or post-operatively to identify patients with risk factors for opioid abuse.

This study has several limitations which should be noted. As with all retrospective studies, it is subject to a degree of selection bias. We minimized this by using the institution's NSQIP data. Furthermore, the primary assumption of this study, that patients without NSQIP complications including reoperations would be unlikely to require post-discharge opioids, is at risk of oversimplifying this complex issue. But this study demonstrates that even in this setting, a substantial and surprisingly high percentage of patients will receive opioids after discharge from the hospital. This knowledge demonstrates the need for additional research to combat the current opioid epidemic. Another limitation is that the administrative data used to evaluate opioid prescriptions (discharge and post-discharge) only includes information from the Mayo Clinic system. Most patients though tend to have high follow-up rates within this system for care and prescriptions. Based on a geographic analysis, 67% and 80% of patients lived within 300 mile and 500 mile radius respectively. However, many patients continue to receive care at satellite locations within our Mayo Clinic Health System. Additionally, if patients received prescriptions outside of our system, it would lead to an underestimation of the number of patients receiving post-discharge opioids. Notably, instead of 15%, the number could actually be greater.

Numerous opioid screening tools exist and could potentially have been more discriminatory. The ORT was chosen for evaluation in this study for several reasons: The CDC opioid toolkit uses ORT and our institution has added it to the EMR. Therefore, it was desirable to evaluate the ORT and examine whether it might be of use in our practices beyond chronic pain clinic settings and possibly other surgical practices. There is also a potential for psychological and previous abuse or misuse to be underreported by both patients and physicians in the medical record, and we did not prospectively survey our patients. Additionally, some patients may not be fully aware of their family's history of substance abuse and may not be able to provide accurate information which is needed to correctly calculate an ORT score.

Conclusions

New knowledge is required to effectively limit opioid risk for patients. Even among surgical patients without post-operative complications, roughly 15% of patients received post-discharge opioids. Opioid use within the year prior to surgery was a major risk factor for additional prescriptions. The timing of post-discharge opioids and prescribing provider's specialty are based on the justification for the post-discharge opioids. The ORT was not predictive in identifying patients at risk for post-discharge opioids in this population of surgical patients.

Author Contributions Conception and design of the study: Tomhave, Lovely, Huebner, Larson.

Acquisition of data: Tomhave, Lovely, Larson.

Analysis and interpretation of data: All authors.

Drafting of manuscript: Scow, Tomhave, Lovely, Larson.

Critical revision for important intellectual content: Scow, Lovely, Huebner, Larson.

Final approval: All authors.

Compliance with Ethical Standards

This retrospective study was approved by the Mayo Clinic Institutional Review Board and took place at a high volume, referral center in the Midwestern United States.

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