The butterfly effect: How an outpatient quality improvement project affected inpatient opioid’s prescribing habits

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Abstract

Background: The aim of the study was to assess whether a quality improvement project focused on providers’ education of responsible opioid prescribing, creating order sets to facilitate pre- and post-operative adjunct use, and decreasing the number of opioids prescribed following elective outpatient surgery affected opioid prescribing habits and the use of adjunct pain medication on the inpatient Emergency General Surgery (EGS) service.

Methods: Inpatient EGS opioid prescribing habits following laparoscopic cholecystectomy, laparoscopic and open inguinal hernia repair, or open umbilical hernia repair during the pre- and post-Acute Care Surgery Division-Quality Improvement (QI) periods were recorded retrospectively. Demographics, type and dose of opioids, and non-opioid adjuncts prescribed were collected. Opioids were converted to oral morphine equivalents (OME). Pre- and post-QI data were compared. Post-QI discharge opioids prescribed were compared to reported use of opioids. Patients’ rating of pain management is reported.

Results: One hundred twenty-two and 62 patients were included during the pre- and post-QI periods, respectively. Post-QI, opioid prescribing decreased, and adjunct prescribing increased (31.1% vs. 72.6%; \( p < 0.001 \)) at discharge. Interestingly, higher 24 h pre-discharge OME was associated with a higher OME prescribed at discharge (\( B = 1.255 [0.377 – 2.134]; p = 0.005 \)). Of the 47 EGS patients who followed up in clinic post-ACS QI, 89.4% rated their pain management as excellent/good, 8.5% as fair, and 2.1% as poor.

Conclusions: Implementation of a multifaceted approach to decrease opioid prescribing in the outpatient setting organically affected opioid prescribing habits at discharge for inpatients.

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CRediT authorship contribution statement

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Declaration of Competing Interest

The authors have no conflict of interest to declare.
Keywords
Emergency general surgery; Opioid; Patient satisfaction; Pain control

1. Introduction

The opioid epidemic has been an ongoing and rapidly evolving public health crisis in the United States [1]. Several factors drove the alarming rise of opioid prescribing and consumption [2,3]. Many initiatives from various organizations have been implemented to combat this trend, resulting in decreasing opioid prescription rates [1,4–7]. Although efforts to address this problem have been made in recent years, the opioid epidemic continues to linger and opioid prescribing rates remain thrice higher than what they were in 1999 and nearly four times those observed in Europe [8].

Surgery is the 5th largest provider of opioid analgesics; 36.5% of all prescriptions written by a surgeon are for an opioid [6]. Noteworthy, surgeons are some of the most common prescribers to opioid naïve patients [9]. The number of pills and total oral morphine equivalent (OME) provided at discharge for the same procedure vary within the same department [10–13] and geographically [5,14]. Experience and degree of training also seem to play a role [12]. The consistent over-prescribing of opioids [10,13,15–17] despite patients reporting low opioid use is perhaps more significant [11,15,16,18–20].

Although large portions of opioids go unused, there is still a positive correlation between the number of opioid pills provided and those consumed [21]. The prevalence of “high opioid use” (>75 OME/day) was observed in most patients [22]. Brummett and colleagues reported a higher incidence (5.9–6.5%) of new, persistent opioid use in surgical patients (filling a prescription 90-180 days post-operatively) compared to that in a non-operative control cohort (0.4%) [9]. These results are consistent with the literature showing higher rates, although variable, of persistent opioid use in surgical patients [23,24].

Several strategies have been developed to combat these alarming trends [13,22,25]. The use of ibuprofen, acetaminophen, or a combination of both has been shown to be effective in controlling pain, decreasing opioid use; and thereby leading to fewer opioid-related adverse events [26–30]. Another approach is to educate patients and providers. Although most patients are aware that opioids are potentially addictive and harmful, it is hypothesized that these cautions are cast aside in the mind of a patient when the drug is being provided by a healthcare provider. Data show that few surgeons take the time to counsel their patients on these issues, or the alternative analgesics available [15]. When institutions implement purposeful action to educate their patients on post-operative pain control and their providers on appropriate prescription practices, opioid prescription and consumption fall substantially [20,31–37].

Our group designed a multimodal approach, incorporating several validated interventions. The healthcare team and patients were engaged in post-operative pain management education and expectations. Surgeons in the Acute Care Surgery Division, who staff the general surgery clinic, collaborated to form consensus perioperative and discharge analgesia
guidelines for the five most common elective outpatient procedures. These guidelines were made into order sets to facilitate implementation. We saw an increase in the use of pre- and post-operative adjuncts and a decrease in the number of opioids prescribed at discharge, without affecting patients' overall satisfaction regarding pain management [20].

Herein, we assessed whether the multimodal approach that reduced the number of opioids prescribed following the five most common elective outpatient procedures affected opioid prescribing habits and the use of adjunct pain medication on the inpatient EGS service. We hypothesized that our approach originally designed for outpatient surgeries would carry over to improve the prescribing habits of EGS providers in a setting where the original policies were not specifically directed.

2. Methods

2.1. Ethical statement

This retrospective study was approved by our Institutional Review Board (IRB # 201904835). A waiver of consent for all subjects was approved by the Institutional Review Board.

2.2. Outpatient service prescription guidelines

Briefly, we created pre-operative order sets for five elective procedures for ease and compliance. Those included pre-operative adjunct prescription with set doses as well as local anesthetic administered by the surgeon and/or a transversus abdominus plane (TAP) block. Gabapentin, acetaminophen, and celecoxib vs. ketorolac were on the order set, available to be checked as appropriate for each patient. The hernia order set included an automatic order for a TAP block. We also modified the post-operative order set to include a box to prescribe scheduled acetaminophen and ibuprofen for five days and pre-set opioids and number of pills. The opioids listed to choose from with a prefilled quantity of 20 pills were oxycodone 5 mg, tramadol 50 mg, and Dilaudid 2 mg [20].

2.3. Patient population

Patients admitted to the EGS service for one of the following EGS procedures: laparoscopic cholecystectomy, laparoscopic inguinal hernia repair, laparoscopic umbilical hernia repair, open umbilical hernia repair, and laparoscopic inguinal hernia repair during the previously studied time periods [June to December 2017 (pre-QI) and mid-August 2018 to February 2019 (post-QI)] were included in this study [20].

2.4. Data collection

The following information was collected: sex, age, race, type of surgery, comorbidities, including any noted history of chronic pain including fibromyalgia, use of benzodiazepines at home, hospital length of stay (LOS); name, dose, frequency of pain medications (opioids and non-opioid adjuncts) taken at home, prescribed pre-operatively (from admission to the day of surgery and on the day of surgery prior to operation), post-operatively (48 and 24 h pre discharge), and at discharged. Information regarding the frequency and type of pre-operative adjuncts used (acetaminophen, gabapentin, and NSAIDs), the frequency of

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local anesthetic and/or transversus abdominis plane (TAP) blocks, and the frequency and type of post-operative adjuncts prescribed (acetaminophen and NSAIDs) were collected. Number of phone calls regarding pain, number of refills that were provided, and the amount of opioid prescribed to those patients who called and received refills were also collected. For the post-QI group, we recorded pain management satisfaction as documented in their follow up clinic visit note, number of opioid pills used, number of days patients used their pills, and corresponding oral morphine equivalent (OME).

2.4. Statistical analysis

Pre- and post-QI data were compared using Chi-square, Mann-Whitney, and Wilcoxon tests as appropriate using SPSS 28 (Chicago, IL, USA). Additionally, post-implementation discharge opioid prescribed were compared to reported use of opioids using paired t-test. Patients’ rating of pain management is reported. Linear regression analysis was used to assess the effect of the QI implementation and being on opioids prior to surgery, and 24 h pre-discharge OME on OME prescribed at discharge. P values <0.05 were considered significant. Graphs were prepared using GraphPrism (San Diego, CA, USA).

3. Results

3.1. Patient characteristics

Patient characteristics are presented in Table 1. A total of 122 and 62 patients were seen by the EGS service during the pre- and post-QI implementation periods, respectively. No significant difference was observed in term of age, gender, comorbidities (chronic pain, fibromyalgia, anxiety, depression, other psychiatric conditions, or alcohol or drug abuse) or the type of emergency surgery they were admitted for; most patients being admitted for laparoscopic cholecystectomy. Similarly, there was no difference between the groups in term of preadmission opioid prescription.

3.2. QI implementation did not affect pain management during hospitalization

As shown in Table 1, the QI implementation did not affect in-hospital opioid and adjunct prescriptions prior to surgery. No significant difference in the number of patients who received opioid prior to surgery was noted between the groups. Similarly, no significant difference in the number of patients who received adjuncts and/or opioid on the day of surgery was observed between the groups.

3.3. QI implementation correlated with a decrease in opioid prescribing at discharge

As shown in Table 1, the ACS-QI implementation did correlate with a significant increase in adjunct prescription at discharge, with ibuprofen and acetaminophen being prescribed significantly more as a first- and/or second-line adjunct. Interestingly, the QI implementation also correlated in a significant decrease in opioid prescribing at discharge following inpatient procedures. The average OME prescribed significantly decreased (Table 1). As shown in Fig. 1, the number of combination pills prescribed significantly decreased after implementation. Prior to implementation, Lortab was the most frequently prescribed (16.4% pre vs. 0% post-implementation), while Dilaudid (21.3% pre- vs. 35.5% post-implementation) and oxycodone (10.7% pre- vs. 22.6% post-implementation)
were the most frequently prescribed opioid post-implementation. Moreover, the number of patients discharged without opioids significantly increased (15.6% pre- vs. 37.1% post-implementation).

Pre-implementation of our QI, 15.6% of our patients did not receive opioids, this increased to 37.1% post implementation (Fig. 1). Of those who received opioids pre-implementation, only 34% of patients met the discharge prescribing guidelines of discharge with 20 or less opioid pills using the order set encouraging prescription of oxycodone, Dilaudid, or tramadol and avoiding combination pills. Post-implementation, 92.1% of patients met the discharge prescribing guidelines set for our outpatient service.

As shown in Fig. 2, post-implementation, the number of pills prescribed at discharge was less variable than pre-implementation with a number of pills prescribed per patients ranging from 15 ± 6 to 21 ± 6 while, pre-implementation, the number of pills prescribed varied from 25 ± 19 to 38 ± 23.

The total quantity of opioid pills prescribed decreased significantly from 2998 prior to the QI implementation to 660 following implementation, a 78% decrease in prescribed pills (Fig. 3a). Additionally, the average number of pills prescribed per patient was significantly lower post-implementation (Fig. 3b). The lower number of pills prescribed post-implementation also reflected a significantly lower OME prescribed per patient post-implementation (Table 1 and Fig. 3c).

Forty-seven patients (76%) in the post-implementation group presented for their follow up clinic visit. Of those, 30 patients (63.8%) were discharged with an opioid prescription. Only 20 (66.6%) patients who returned to clinic reported taking an opioid post-operatively. Those 20 were prescribed 137.8 mg OME (75 – 300) at discharge which was not significantly different than the average OME prescribed post-implementation overall. They reported taking on average eight pills (1 – 30), representing 63.6 mg OME (7.5 – 240 mg) for 3.5 (1 – 10) days. As shown in Fig. 3b and c, the reported amount of opioid used was significantly lower than what the patients were prescribed at discharge. Of those 20 patients, 5 (25%) had a history of chronic pain and 3 (15%) were taking opioids prior to admission, which was not significantly different than that of the rest of the post-implementation population; 23.8% had chronic pain and 21.4% were taking opioids prior to admission. Similarly, their 24 and 48 h predischarge OME prescription were not significantly different than that of the rest of the post-implementation population (35.5 ± 23.2 vs. 30.5 ± 23.2, p = 0.432 and 34.6 ± 27.4 vs. 31.7 ± 19.5, p > 0.999). Twenty-eight patients (59.6%) reported using an adjunct post-discharge.

Controlling for patient age, gender, and opioid use in the hospital prior to surgery, linear regression analysis showed that the QI implementation was associated with a significant decrease in OME prescribed at discharge (B = −73.7 mg OME [−21.0 – −126.4]; p = 0.006). Interestingly, in this model, higher 24 h pre-discharge OME (B = 1.255 [0.377 – 2.134]; p = 0.005) and being male (B = 68.8 [17.32 – 120.36]; p = 0.009) were associated with a higher OME prescribed at discharge.
Regarding pain satisfaction, 11 patients (9%) called with concerns regarding their pain control and one (0.8%) received an opioid prescription refill prior to QI implementation. Following QI implementation, there were only three phone calls (5.6%), and no patient required an opioid prescription refill. EGS patients have their follow up visit in the same clinic as our elective patients, therefore EGS patients’ satisfaction ratings regarding their pain management post QI implementation were collected. As shown in Fig. 4, of the 47 EGS patients who followed up in our clinic, 89.4% of patients rated their pain management as excellent or good, 8.5% as fair, and 2.1% as poor.

Twenty-three patients (37.1%) did not receive an opioid at discharge. Seven of these patients were using an opioid pre-operatively and two patients called with concerns for pain but were not prescribed an opioid in response. Eighteen of these patients were prescribed an adjunct at discharge. Seventeen of these patients followed up in clinic and all described their pain control as good or excellent.

4. Discussion

Our results demonstrate that the implementation of our QI project for outpatient general surgery positively affected the prescribing habits of our EGS surgeons while on the inpatient service. Our multimodal approach in the outpatient general surgery service was significantly associated with the observed decrease in OME prescribed at discharge on the inpatient service, over the same time. Surprisingly, the decrease in mean OME at discharge for inpatients (220 mg to 137 mg) was larger than the decrease in mean OME at discharge for outpatients (179 to 127 mg) observed in the original study, suggesting that our approach could have an even greater impact for surgical management requiring a hospital stay [20]. Other improvements replicated between the two studies included an increase in non-opioid analgesic use both pre-operatively and provided at discharge, a decrease in overall opioid pills and combination pills provided, and an increase in the proportion of patients who received no discharge opioid prescription at all. Pain control was also acceptable, with 89.4% of patients rating their pain either good or excellent.

Our outpatient QI implementation did not seem to influence opioid prescribing during hospitalization, both pre- and post-operatively. This was somewhat expected given that 87.1% of the surgeries were laparoscopic cholecystectomies, a large majority of those being indicated for acute cholecystitis. In this context, an overly conservative approach to pain management could lead to needless patient suffering without providing much benefit.

Greater 24-h pre-discharge OME was associated with greater OME mg at discharge. This finding is consistent with other studies showing that opioid consumption in the post-operative period 24 h prior to discharge is the most significant covariate for prescription and consumption outside of the hospital [22,38]. Others have suggested that opioid consumption in this 24-h period could be used to tailor discharge prescriptions in a manner that would balance pain control with total OME provided [36,38]. This could potentially better identify patients that could tolerate an opioid-free recovery, while ensuring that those with greater analgesia requirements have their pain adequately managed after leaving the hospital. Further research is needed comparing a more individualized way of standardizing the
approach such as ours that utilizes pre-determined discharge order sets, to one that is more flexible and based on patient metrics.

In a national survey, only 8% of surgeons reported being informed that they were overprescribing [12]. The prescribing habits of surgeons are particularly important because 74% of patients undergoing surgery are opioid naive (defined as not having filled an opioid prescription 12 months prior to surgery), representing a significant portion of new cases of potential misuse [24]. It is a multifaceted problem that requires a multifaceted solution. Our data show that our multimodal approach, including education for patients and providers and pre-designed opioid prescription order sets, for outpatient general surgery positively affected the prescribing habits of our EGS surgeons while on the inpatient service for the duration of our study. While seeing improvement during a QI project is beneficial, providers could revert to previous habits when they no longer suspect they are being observed. Significant pressures remain to overprescribe. Surgeons cite the inconvenience of having patients return for refills and concern for their satisfaction scores as reasons they knowingly provide more opioids at discharge than what they think is appropriate [37,39]. Even if provider education can ease these fears, many are comfortable with the practice they know and have the mindset of “this is how we have always done things.” Surgical residents report attending preference (92.5%) as their main determinant when writing an opioid prescription, while potential for abuse (59.5%) is less strongly considered [34]. An approach that demonstrates it can overcome these barriers to change and lead to meaningful improvement is essential. Our study suggests that educating providers on opioid and designing tools to ease opioid prescribing are sufficient for providers to organically implement those changes in other facets of their practice.

There are several limitations to our study. The retrospective design introduced the possibility of selection bias as well as incomplete data capture from poor documentation. Pain management satisfaction surveys were not given to the pre-implementation group; thus, we were not able to determine if implementation had any adverse effect on pain management. We only looked at common, uncomplicated general surgery procedures so our findings may not be generalized to other surgeries or surgical fields. Additionally, the multilevel approach prevented us from quantifying the impact of each individual strategy. However, we compared habits on the inpatient side, while the QI was implemented to the outpatient side during the same period. Thus, patients treated as inpatients were not educated; one could speculate that the decrease in opioid prescription observed in the inpatient setting was mainly associated with providers’ education and the availability of pre-designed opioid order sets. Future studies are warranted to assess the sustainability of our approach to reducing opioid prescription, ensuring that the initial outpatient QI project had a durable impact on the prescribing habits of our institution’s attending surgeons and residents.

5. Conclusions

By educating both patients and providers, we aimed to address the opioid crisis and patient safety, while maintaining pain management satisfaction following common surgical procedures. Our multifaceted approach to reduce opioid prescribing in the outpatient setting...
was pragmatic enough for surgeons to organically implement it into their inpatient practice. Future studies aiming at assessing the sustainability of our approach are warranted.

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Fig. 1. Distribution of EGS patients prescribed combination pills and/or opioids at discharge pre- and post-ACS QI implementation.

Numbers in each bar represent the percentage of patients who were prescribed the represented opioid. * = $p < 0.05$; ** = $p < 0.01$; *** = $p < 0.001$; ns = non-significant.
Fig. 2.
Average number of opioid pills prescribed per month pre and post implementation of our prescription guidelines
Fig. 3. Change in opioid prescription.
(a) Overall number of opioid pills prescribed pre- and post-implementation and number of opioid pills used as reported by patients during their follow up visit. (b) Average number of pills prescribed pre- and post- implementation and average number of opioid pills used as reported by patients during their follow up visit. (c) Average oral morphine equivalent (OME) pre- and post-implementation and average OME used as reported by patients during their follow up visit. *** = p < 0.001.
Fig. 4.
Patient satisfaction ratings regarding pain management.
Table 1

Patient characteristics and pain management information.

| Variables                                             | Pre-ACS implementation n = 122 | Post-ACS implementation n = 62 | P-value |
|-------------------------------------------------------|---------------------------------|--------------------------------|---------|
| Age (mean ± SD)                                       | 51.2 ± 19.6                     | 47.6 ± 18.0                     | 0.218   |
| Gender, n (%)                                         | Male                            | Male                           |         |
|                                                       | 56 (45.9)                       | 35 (56.5)                      | 0.213   |
| Surgery type, n (%)                                   | Laparoscopic cholecystectomy    | Laparoscopic cholecystectomy   |         |
|                                                       | 108 (88.5)                      | 54 (87.1)                      | 0.212   |
|                                                       | Open inguinal hernia repair     | Open inguinal hernia repair    |         |
|                                                       | 9 (7.4)                         | 4 (6.5)                        |         |
|                                                       | Laparoscopic inguinal hernia    | P = 0                          |         |
|                                                       | repair                          |                                |         |
|                                                       | 2 (1.6)                         | 4 (6.5)                        |         |
| Home opioid, n (%)                                    | 23 (18.9)                       | 12 (19.4)                      | 1       |
| In-hospital opioid prior to surgery, n (%)            | 70 (57.4)                       | 37 (59.7)                      | 0.875   |
| Pre-operation opioids, n (%)                          | 47 (38.5)                       | 25 (40.3)                      | 0.873   |
| Pre-operation adjunct, n (%)                          | 33 (27.0)                       | 23 (37.1)                      | 0.178   |
| Local anesthesia prior to surgery, n (%)              | 119 (97.5)                      | 59 (95.2)                      | 0.406   |
| 48 h pre-discharge prescribed OME, mg (mean ± SD)     | 33.8 ± 29.2                     | 32.4 ± 20.7                    | 0.867   |
| 24 h pre-discharge prescribed OME, mg (mean ± SD)     | 36.6 ± 29.3                     | 32.4 ± 23.1                    | 0.435   |
| Prescribed OME, mg (mean ± SD)                        | 219.9 ± 149.4                   | 136.8 ± 49.3                   | 0.001   |
| Prescribed Adjunct at discharge, n (%)                | 38 (31.1)                       | 45 (72.6)                      | <0.001  |
| First adjunct, n (%)                                  | Acetaminophen                   |                                | <0.001  |
|                                                       | 31 (25.4)                       | 36 (58.1)                      |         |
|                                                       | Ibuprofen                       | 7 (5.7)                        | 9 (14.5) |
| Second adjunct, n (%)                                 | Acetaminophen                   |                                | 0.001   |
|                                                       | 3 (2.5)                         | 8 (12.9)                       |         |
|                                                       | Ibuprofen                       | 3 (2.5)                        | 7 (11.3) |
|                                                       | Gabapentin                      | 1 (0.8)                        | 0       |
| Phone call for pain, n (%)                            | 11 (9.0)                        | 3 (4.8)                        | 0.390   |
| Refill, n (%)                                         | 1 (0.8)                         | 0                               | 0.354   |