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Original Research Article

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Reducing postoperative opioid pill prescribing via a quality improvement approach

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Abstract

Background: The opioid epidemic has been fueled by prescribing unnecessary quantities of opioid pills for postoperative use. While evidence mounts that postoperative opioids can be reduced or eliminated, implementing such changes within various institutions can be met with many barriers to adoption.

Objective: To address excess opioid prescribing within our institutions, we applied a plan-do-study-act (PDSA)-like quality improvement strategy to assess local opioid prescribing and use, modify our institutional protocols, and assess the impacts of the change. The opioid epidemic has been fueled by prescribing unnecessary quantities of opioid pills for postoperative use. While evidence mounts that postoperative opioids can be reduced or eliminated, implementing such changes within various institutions can be met with many barriers to adoption. We describe our approach, findings, and lessons learned from our quality improvement approach.

Methods: We prospectively recorded home pain pill usage after robotic-assisted laparoscopic prostatectomy (RALP) and robotic-assisted partial nephrectomy (RAPN) at two academic institutions from July 2016 to July 2019. Patients prospectively recorded their home pain pill use on a take-home log. Other factors, including numeric pain rating scale on the day of discharge, were extracted from patient records. We analyzed our data and modified opioid prescription protocols to meet the reported use data of 80% of patients. We continued collecting data after the protocol change. We also used our prospectively collected data to assess the accuracy of a retrospective phone survey designed to measure postdischarge opioid use. Our primary outcomes were the proportion of patients taking zero opioid pills postdischarge, median pills taken after discharge and the number of excess pills prescribed but not taken. We compared these outcomes before and after protocol change.

Results: A total of 266 patients (193 RALP, 73 RAPN) were included. Reducing the standard number of prescribed pills did not increase the percentage of patients taking zero pills postdischarge in either group (RALP: 47% vs. 41%; RAPN 48% vs. 34%). The patients in either group reporting postoperative Day 1 pain score of 0 or 1 were much more likely to use zero postdischarge opioid

pills. Our reduction in prescribing protocol resulted in an estimated reduction in excess pills from 1555 excess pills in the prior protocol to just 155 excess pills in the new protocol.
Conclusion: Our PDSA-like approach led to an acceptable protocol revision resulting in significant reductions in excess pills released into the community. Reducing the quantity of opioids prescribed postoperatively does not increase the percentage of patients taking zero pills postdischarge. To eliminate opioid use may require no-opioid pathways. Our approach can be used in implementing zero opioid discharge plans and can be applied to opioid reduction interventions at other institutions where barriers to reduced prescribing exist.

Key words: quality improvement, PDSA, opioids, minimally invasive surgery, pain control, health services research

Introduction

The harms of opioids prescribed in the postoperative setting have been well described, including persistent long-term opioid use in 1–6% of opioid naïve patients who are prescribed opioids after surgery [1]. Minimizing opioid prescribing carries dual objectives of decreasing opioid adverse events for patients and limiting excess pills that could harm others.

Some groups have accordingly recommended limiting prescription quantities to a standard 0 to 10 pills after radical prostatectomy [2–6]. In general, these recommendations are based on expert consensus or retrospective phone surveys of patients to assess the number of pills taken after discharge, although there are some prospective evaluations, all of which suggest modified prescription protocols are effective [7].

However, implementing new recommendations into practice can be met with many barriers. We found initial hesitancy to modifying perioperative protocols at our institutions. Others used behavioral interventions to successfully reduce opioid prescribing [8]. These interventions may not be acceptable in all local contexts, however. Achieving buy-in to encourage sustained adoption of lower or no postoperative pill prescribing requires tailored interventions considering the local context. For these reasons, we approached reducing opioid prescribing through a continuous quality improvement (CQI) approach.

Our CQI approach adds to the existing literature in a number of ways. First, we outline a plan-do-study-act (PDSA)-like approach that could be used to address opioid prescribing or other problems facing barriers to implementation by surgeons. We outline lessons learned and suggest improvements for initiating and sustaining CQI within urologic surgical practices, report associations with postdischarge opioid use and support findings of other opioid studies by comparing phone-based pill use recall surveys with prospectively collected pill use data. These findings can be applied to other groups facing barriers to reduction in opioid prescribing or other problems amenable to CQI.

Methods

We implemented a PDSA-like process to decrease opioid prescribing at two institutions. We first collected data on opioid prescribing and patient use during the postdischarge period through prospectively recorded take-home questionnaires. We presented these data to surgeons at our institutions and agreed on a modified prescribing protocol. We continued collecting data after the protocol change and assessed predictors of low or no opioid use through retrospective chart review. Finally, we compared opioid use reporting on our prospective take-home questionnaire to retrospectively reported opioid use reported through a telephone survey.

Opioid use data collection

We prospectively recorded home pain pill usage, including opioids, acetaminophen and ibuprofen, following robotic-assisted laparoscopic prostatectomy (RALP) and robotic-assisted partial nephrectomy (RAPN) by fellowship trained urologic surgeons at two academic institutions between July 2016 and July 2019. Institutional Review Board approval was obtained from each institution.

Initial pain management protocol

Our initial pain management protocol included intermittent morphine or a morphine patient-controlled anesthesia system from the day of surgery continuing until postoperative day (POD) 1. At our institutions, most RALP patients are discharged POD1, and most RAPN patients are discharged POD2. Most RALP patients were given intravenous (IV) ketorolac starting 1 hour postoperatively, and RAPN patients were given IV ketorolac starting the morning of POD1 if creatinine clearance was appropriate. At time of discharge, patients were given a prescription for 5 mg instant-release oxycodone pills ranging from 20 to 35 pills according to surgeon, institution and/or resident protocols and norms. At our institutions, discharge prescriptions are written by residents, physician assistants or nurse practitioners. Discharge plans are discussed with patients by these providers and the attending surgeon prior to discharge, but there was no standard script for discharge counseling regarding opioid use. Patients are encouraged to take oral acetaminophen for pain, and only to take opioids if their pain remains uncontrolled.

Data collection

Patients prospectively completed a pain pill log documenting the daily quantity of pills of each analgesic type taken after discharge. At the first postoperative visit, clinic staff collected the log and counted remaining opioid pills to verify reported opioid use. While excess opioids could not be collected in clinic, patients were advised of safe methods of opioid disposal. Only patients who returned the pain log were included in this study. We encouraged data collection by continued email and face-to-face reminders with residents and staff to distribute and collect the pain logs. Additionally, we printed pain logs on bright orange paper.

We then extracted data on in-hospital pain medication use, POD1 pain score and patient comorbidities from electronic medical records. We retrospectively identified the total number of patients undergoing RALP and RAPN at our institutions over the study period.

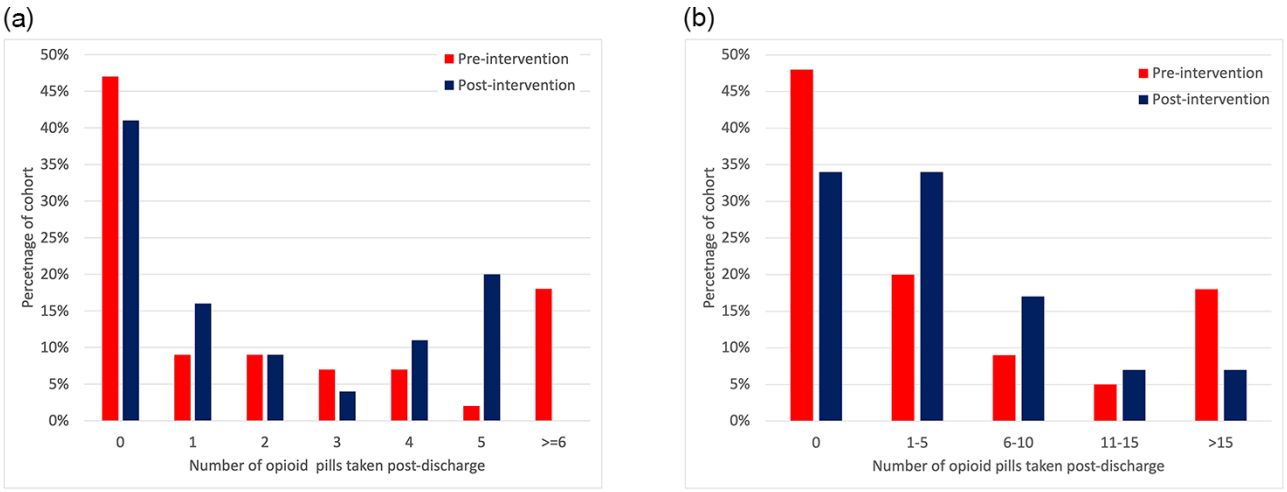

Figure 1 (a) Postdischarge pills taken in prostatectomy cohort. (b) Postdischarge pills taken in partial nephrectomy cohort.

Numerical rating scale (NRS) scores, a validated pain scale, were extracted from medical records corresponding to pain score assessment by nursing staff on a scale from 0 (no pain) to 10 (worst pain) [9]. Preoperative NRS was defined as the pain score recorded in the preoperative area before surgery. Postoperative NRS was defined as pain score closest to 7 am on POD1. Perioperative opioid use was converted to morphine equivalents for comparison. We also collected data on history of conditions *a priori* related to pain or opioid use, dichotomously classifying any documented history of the following conditions: alcohol abuse, anxiety, opioid use at time of surgery, chronic pain, depression and diabetes. We calculated Charlson Comorbidity Index based on factors extracted from patient charts, as described for comorbidity estimates in oncology patients [10, 11]. We included continuous variables that *a priori* may impact pain, such as body mass index (BMI), kidney tumor size, age and severity of prostate cancer (measured by Gleason score).

Establishing new opioid prescription protocol

After collecting data for 2 years, we performed *a priori* analyses prior to instituting new opioid prescription guidelines in July 2018 (Supplementary Data). We assessed the number of postdischarge opioid pills needed to meet the use of 80% of patients, based on our first cohort of 137 RALP and 44 RAPN patients. We implemented reduced standard prescription of 5 oxycodone pills for RALP and 15 pills for RAPN patients at time of discharge.

Postimplementation study

Following this change in prescribing habits, we compared pills taken in the preprotocol and postprotocol cohorts using the chi-squared test.

Identifying associations with low/no postdischarge opioid use

We used multivariable logistic regression to identify associations with taking zero opioid pills postdischarge. Covariates for the prostatectomy model included age, diabetes, Charlson comorbidity score, BMI, history of depression, history of anxiety, history of chronic pain, pre- and postoperative pain scores and POD1 opioid use. The partial nephrectomy model included age, sex, diabetes, Charlson comorbidity score, BMI, tumor size, pre- and postoperative pain scores and POD1 opioid use.

Phone survey

Prior studies of opioid use have relied on patient recall to quantify pill use, but it is unclear how accurate these reports are. To compare prospective to retrospective collection of pill use reporting, we leveraged a larger institutional effort to assess opioid use in which patients were contacted by phone 4 weeks postoperatively to retrospectively report their opioid use. We identified RALP patients who both returned a pain pill log and answered the telephone survey and compared their prospective and retrospective pill counts.

Results

A total of 193 RALP and 73 RAPN patients completed their postdischarge pain logs (Figure 1). During the study period, a total of 774 RALP and 318 RAPN were performed by participating surgeons, corresponding to a roughly 25% rate of questionnaire distribution and return.

Robot-assisted radical prostatectomy

Of 193 prostatectomy patients, 137 (71%) were in the preintervention group and received 20 to 35 oxycodone pills. In the post intervention group, 56 patients (29%) received standardized 5 pill prescriptions.

In the pre-intervention group, 64/137 (47%) of prostatectomy patients took zero opioid pills post-discharge, and 90/137 (66%) of prostatectomy patients took 2 or fewer pills (Table 1). We found 5 pills would meet the usage of 111/137 (81%) of this cohort and *a priori* changed our prescribing protocol.

Of patients subsequently prescribed 5 pills (i.e. the postintervention cohort), 23/56 (41%) took zero opioid pills postdischarge, and 37/56 (66%) took 2 or fewer pills. Only one pill refill from either group was required, in a patient prescribed five pills.

The reduced prescribing protocol resulted in 280 total oxycodone pills prescribed to 56 patients. Of these, 125 pills were taken, resulting in an excess cumulative pill count of 155 pills. If these patients had instead been prescribed 30 pills per the prior protocol, 1680 pills would have been prescribed, resulting in an excess of 1555 pills (**Supplementary Figure S1**). In contrast, before the prescription count reduction, 3690 pills were prescribed and only 439 were taken, resulting in an excess cumulative pill count of 3251 pills.

Table 1 Cohort characteristics

Prostatectomy cohort		
	Preintervention cohort (prescribed > 5 pills)	Postintervention cohort (prescribed 5 pills)
Number of patients (*n*)	137	56
Age (mean (SD))	63.43 (6.49)	62.88 (6.78)
BMI (mean (SD))	27.99 (4.90)	28.57 (3.35)
Charlson Comorbidity Index[a] (*n*, %)		
2	3 (2.9)	0 (0.0)
3	30 (29.4)	17 (30.4)
4	37 (36.3)	23 (41.1)
5 or greater	32 (31.4)	16 (28.6)
Gleason score[b] (*n*, %)		
6	10 (7.8)	2 (4.0)
7	106 (82.8)	42 (84.0)
8 or greater	12 (9.4)	6 (12.0)
Alcohol abuse (*n*, %)	5 (3.6)	0 (0.0)
Depression (*n*, %)	9 (6.6)	4 (7.1)
Anxiety (*n*, %)	18 (13.1)	3 (5.4)
Chronic pain (*n*, %)	10 (7.3)	10 (17.9)
Current opioid use[c] (*n*, %)	2 (1.5)	0 (0.0)
Diabetes (*n*, %)	18 (13.1)	0
Partial nephrectomy cohort		
	Preintervention cohort (prescribed > 15 pills)	Postintervention cohort (prescribed ≤ 15 pills)
Number of patients (*n*)	44	29
Age (mean (SD))	57.45 (13.8)	58.00 (11.4)
Male (*n*, %)	29 (65.9)	17 (58.6)
Charlson score (*n*, %)		
0	4 (11.1)	5 (17.2)
1	9 (25.0)	7 (24.1)
2	8 (22.2)	5 (17.2)
3	9 (25.0)	5 (17.2)
4 or greater	6 (16.7)	7 (24.1)
BMI (mean (SD))	30.40 (5.94)	30.58 (7.26)
Tumor size (mean (SD))	3.35 (1.31)	3.57 (1.67)
Alcohol abuse (*n*, %)	3 (6.8)	0 (0.0)
Depression (*n*, %)	6 (13.6)	6 (20.7)
Anxiety (*n*, %)	12 (27.3)	7 (24.1)
Chronic pain (*n*, %)	6 (13.6)	5 (17.2)
Diabetes (*n*, %)	7 (15.9)	6 (20.7)

Comorbid conditions are defined as any history of the conditions recorded in the patient chart; numbers reported here reflect the number of patients with a documented history of the condition in the electronic medical record.

[a]Charlson Comorbidity Index was calculated from comorbidities reported in the electronic medical record (higher values represent higher comorbid burden).

[b]Gleason score reflects the aggressiveness of prostate cancer, with higher values more aggressive prostate cancer.

[c]Current opioid use was defined as active opioid use at the time of surgery.

Robot-assisted partial nephrectomy

Of 73 partial nephrectomy patients, 44 patients (60%) were given prescriptions for 20 to 30 oxycodone pills, and 29 patients (40%) were given 15 or fewer postdischarge pills. Of patients prescribed 20 to 30 pills (i.e. the preintervention cohort), 21/44 (48%) took zero opioid pills postdischarge, and 34/44 (77%) took 10 or fewer pills. We implemented prescriptions of 15 or fewer pills postdischarge, which would address ∼80% of pill requirements (36/44; 82%).

Of patients prescribed 20–30 pills (i.e., the pre-intervention cohort), 21/44 (48%) took zero opioid pills post-discharge, and 34/44 (77%) took 10 or fewer pills (Figure 1).

Table 2 Multivariable logistic regression identifying associations with zero postdischarge pill use

Variable	OR	95% CI	*P* value
Prostatectomy cohort			
Age	1.0	0.92–1.10	0.93
Diabetes	1.22	0.30–5.02	0.78
Charlson score	0.91	0.52–1.60	0.73
BMI	0.98	0.87–1.08	0.65
Depression	1.21	0.16–8.62	0.85
Anxiety	0.32	0.07–1.21	0.11
Chronic pain	1.39	0.37–5.36	0.62
Preoperative pain score	0.75	0.52–0.99	0.07
POD1 morphine equivalents used	0.92	0.88–0.96	<0.01
Postoperative Day 1 NRS pain score	0.76	0.58–0.98	0.04
Partial nephrectomy cohort			
Age	0.95	0.86–1.03	0.24
Male sex	0.68	0.13–3.28	0.63
Diabetes	0.97	0.12–7.23	0.97
Charlson score	1.20	0.75–1.94	0.44
BMI	0.86	0.73–0.99	0.04
Tumor size	1.55	0.85–3.12s	0.18
Preoperative NRS pain score	0.87	0.52–1.36	0.54
Postoperative Day 1 morphine equivalents	0.92	0.85–0.96	<0.01
Postoperative Day 1 pain score	0.61	0.38–0.89	0.02

Associations with zero opioid pill use

On multivariable logistic regression for associations with zero pills used postdischarge in prostatectomy patients, only higher POD1 morphine equivalents (odds ratio (OR): 0.92, 95% confidence interval (CI): 0.88–0.96, $P < 0.01$) and higher POD1 pain score (OR: 0.76, 95% CI: 0.58–0.98, $P = 0.04$) were associated with lower likelihood of taking zero pills (Table 2). We found similar results in the partial nephrectomy group, except higher BMI (OR: 0.86, 95% CI: 0.73–0.99, $P = 0.04$) was also associated with lower likelihood of taking zero pills.

Postoperative pain scores

Patients with minimal POD1 pain (POD1 NRS 0–1) took a median of zero pills after discharge. In the prostatectomy group, pill requirements were minimally increased at higher POD1 pain scores with median pill counts of two to three pills after discharge (Supplementary Material).

Of partial nephrectomy patients with minimal POD1 pain (pain score 0–1), 21/22 (95%) took 5 or fewer pills after discharge, and 17/22 (77%) took no pills after discharge. In contrast, of patients with higher POD1 scores, 29/51 (57%) of patients took 5 or fewer pills postdischarge (Supplementary Material).

Telephone survey validation

Of 266 total patients, 29 (11%) were also contacted by phone as part of a separate quality improvement initiative to retrospectively report postdischarge opioid use. Of these, 20/29 (69%) exactly matched on pill count, and 27/29 (93%) were within 2 pills of each report.

Discussion

Statement of principal findings

Opioid overuse is an epidemic that should be faced head on by urologists, yet barriers to low or no pill prescribing persist. While others have demonstrated low or no opioid prescribing is optimal, implementing these suggestions requires tailoring strategies to different institutions. By using a CQI approach, we achieved an acceptable intervention that was rapidly adopted by our two institutions. As a result, we substantially reduced excess pill prescribing by an order of magnitude.

Although low postoperative opioid requirements are not a novel finding, our study did find that higher POD1 pain score was correlated with higher postdischarge opioid use, particularly for patients undergoing partial nephrectomy. Whether this reflects patients with higher pain control needs, or a behavioral response to higher pain in the postoperative period, requires further study.

Additionally, our intervention decreased excess pills prescribed, but did not decrease the pills taken on average by patients. This suggests that addressing anchoring bias, as suggested by Davies et al., may not be a means to encourage more patients to take no opioids [12]. This suggests that a goal of zero opioids postoperatively is not facilitated by lower prescribing; only prescribing zero pills could effect this change successfully.

Interpretation within the context of the wider literature

Some have championed this zero opioid discharge protocol for prostatectomy [11]. Attempts to aggressively manage perioperative pain through non-opioid pathways coupled with meaningful perioperative counseling may facilitate the no-opioid pathway and is supported by our finding of fewer pills taken by patients with minimal postoperative pain. Ideally, such approaches could be immediately implemented and opioid prescribing could be eliminated entirely. However, this approach may not be acceptable to some surgeons. This was particularly applicable when our project began in 2017, although evidence continues to mount for opioid-free surgery. We sought to decrease the number of excess pills prescribed instead of eliminating entirely as a starting point to increase the acceptability and adoption of surgeons at our institutions. Our aim was to minimize harmful effects of excess pills on the community, i.e. risk mitigation instead of risk elimination. Our approach can be seen as a trialable initial step for providers who are concerned about providing adequate pain control to patients. Additionally, providing provider- and institution-specific data to support reduced pain pill needs was instrumental in achieving buy-in at our institutions. Specifically, we found it easier to significantly reduce surgeon barriers to lower pill prescribing and reach consensus on a reduced pill prescription quantity by presenting surgeons with their own institutional data on pill use, similar to a limited audit and feedback approach.

Additionally, our prospective questionnaire correlated well with retrospective reports of opioid use. Although this reflects only a small portion of our total population and may be biased due to selection, our results suggest that other studies relying on retrospective reporting of opioid use are reasonably accurate, i.e. there may be minimal recall bias in retrospective reports of opioid use.

Implications for policy, practice and research

In developing this intervention, we employed multiple useful strategies of note. First, we leveraged existing relationships to manage our intervention. By modifying existing written protocols and continuous communication between prescribers, we essentially performed daily informal audit and feedback on both pill prescribing and pain pill log distribution and collection. We looked to maximize our adoption of the pain pill logs by making the sheets a standard part of the discharge paperwork packet, included language referencing the pain log in our discharge instructions, and printed all pain logs on bright orange sheets. These measures served as reminders to both providers and patients to distribute, fill out and collect the forms, and made an easy reminder question of 'remember the orange sheets'. We did not directly test the effectiveness of each of these interventions on survey distribution or response rates, but anecdotally this strategy worked well. We also had the advantage of relatively few prescribers, with a hierarchical structure wherein discharge protocols are given the greatest priority when considering discharge pill quantity. Furthermore, we leveraged our resident rotation schedule, as the same residents rotate through two institutions, and changed resident prescribing patterns at both institutions through resident prescribing habits. We also involved residents as project champions to gain investment in the project and enhance dissemination of the pain pill logs and implementation of the modified protocol. This allowed for rapid change of prescribing protocol with minimal additional administrative effort.

Moving forward, we will incorporate lessons learned from these initial project phases into continued quality improvement efforts. One strategy is to trial prescribing zero opioids postdischarge, as other institutions have successfully implemented. Given our prior collected data, we can apply a historical audit to provide feedback to our providers that in most cases opioids are unnecessary. This strategy has an additional aspect of trialability that was not feasible when our project began as we are now able to electronically prescribe opioids to patients who have intractable pain post discharge. We believe this will make a zero opioid intervention more acceptable to our providers. Furthermore, while pushes for early discharge and resulting pain control factors have uncertain effects on patient satisfaction, other institutions have reported no impact on satisfaction from decreasing or eliminating postdischarge opioids [8, 12]. In future iterations of data collection, we will also collect patient satisfaction data to provide feedback to our prescribers.

We also looked for associations with higher postdischarge opioid use and found that only POD1 morphine requirements and POD1 pain score were associated with more opioid use in RALP patients. Opioid requirements in the hospital and POD1 pain score are likely related and have a direct correlation to subsequent pill requirements at home. We will continue to look to minimize pain while in the hospital, as the experience of more initial pain may lead to greater pill use after discharge. Additionally, we may tailor our prescribing based on POD1 pain scores within the partial nephrectomy cohort, where pill use was more widely. Specifically, patients with minimal pain after partial nephrectomy (POD1 NRS pain score 0–1) rarely took opioid pills and can likely be discharge with no opioids, whereas those with higher POD1 pain scores required up to 20 pills.

Strengths and limitations

Our study has some limitations. Patients who returned pill logs could behave differently from patients who did not return pill logs, making our cohort subject to selection bias. We captured an estimated 25% of potentially eligible patients, due to both failure to distribute questionnaire logs and/or failure to return the log to clinic visits. In the future, we will record log distribution as well as receipt. We extracted our pre- and postoperative pain scores from the medical record and did not assess these directly in a standardized fashion; future efforts could benefit from standardized assessments. There was minor institutional variation in preprotocolized opioid prescribing quantity resulting in slightly different preintervention pill quantities (ranging from 20–35 pills prescribed). After the intervention, there was standardized prescribing as described. However, we did consistently counsel patients, record pill use and implement a protocol change in a systematic fashion at multiple institutions, a significant strength of our study.

Conclusion

To help address the opioid epidemic, we implemented a quality improvement approach to opioid prescription reduction at our institution. We successfully limited excess opioid pills released to the community and supported the validity of telephone survey pill count recall. Future quality improvement approaches at our institution will focus on POD1 pain score for targeted interventions. Our PDSA-like approach allowed us to engage stakeholders in an acceptable intervention to decrease excess prescribing and can be a model for other institutions with resistance to decreasing opioid prescribing.

Supplementary material

Supplementary material is available at *International Journal for Quality in Health Care* online.

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