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A Pathway for Developing Postoperative Opioid Prescribing Best Practices

Ryan Howard, MD^{*,§}, Joceline Vu, MD^{*,§}, Jay Lee, MD^{*,§}, Chad Brummett, MD^{†,§}, Michael Englesbe, MD^{*,‡,§}, Jennifer Waljee, MD, MPH^{*,§}

^{*}Department of Surgery, University of Michigan, Ann Arbor, MI

[†]Department of Anesthesiology, University of Michigan, Ann Arbor, MI;

[‡]Michigan Surgical Quality Collaborative, Ann Arbor, MI;

[§]Michigan Opioid Prescribing Engagement Network, Ann Arbor, MI.

Abstract

Objective: Opioid prescriptions after surgery are effective for pain management but have been a significant contributor to the current opioid epidemic. Our objective is to review pragmatic approaches to develop and implement evidence-based guidelines based on a learning health system model.

Summary Background Data: During the last 2 years there has been a preponderance of data demonstrating that opioids are overprescribed after surgery. This contributes to a number of adverse outcomes, including diversion of leftover pills in the community and rising rates of opioid use disorder.

Methods: We conducted a MEDLINE/PubMed review of published examples and reviewed our institutional experience in developing and implementing evidence-based postoperative prescribing recommendations.

Results: Thirty studies have described collecting data regarding opioid prescribing and patient-reported use in a cohort of 13,591 patients. Three studies describe successful implementation of opioid prescribing recommendations based on patient-reported opioid use. These settings utilized learning health system principles to establish a cycle of quality improvement based on data generated from routine practice. Key components of this pathway were collecting patient-reported outcomes, identifying key stakeholders, and continual assessment. These pathways were rapidly adopted and resulted in a 37% to 63% reduction in prescribing without increasing requests for refills or patient-reported pain scores.

Conclusion: A pathway for creating evidence-based opioid-prescribing recommendations can be utilized in diverse practice environments and can lead to significantly decreased opioid prescribing without adversely affecting patient outcomes.

filip@med.umich.edu.

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Keywords

learning health system; opioid prescribing; opioids; postoperative opioid prescribing; quality improvement

Opioid prescribing following surgical care has been a major factor driving the opioid epidemic in the United States.¹ Excessive opioid prescribing has commonly occurred across surgical procedures and specialties, in part because of a lack of evidence about patients' opioid requirements following surgery.²⁻⁶ Unfortunately, unused pills following procedural care are a major source of nonmedical opioid use, and the most common initial opioid exposure for individuals with opioid use disorder owing to heroin.⁷⁻¹¹ Moreover, high levels of opioid prescribing in the immediate postoperative period are associated with prolonged opioid use among previously opioid-naïve patients.¹²⁻¹⁵ Although recent legislative measures now require providers to use prescription drug monitoring programs (PDMPs) and restrict prescribing for acute pain, these have been met with mixed success.¹⁶⁻¹⁹ Furthermore, these measures are neither patient-focused nor physician-driven, and fail to engage these primary stakeholders in the current opioid crisis.

A number of institutions have had success reducing excessive opioid prescribing utilizing a quality improvement framework.²⁰⁻²³ This framework is based on the principles of a learning health system, in which improvements in care are achieved by integrating data and experience generated by routine practice.²⁴ In this model, a continuous cycle is developed in which data are analyzed to identify opportunities for quality improvement, measures are implemented based on this analysis, and then iterative change takes place based on reanalysis of new information (Fig. 1). A well-known example of this is the development of a National Trauma Care System with the goal of zero preventable deaths for patients who have sustained traumatic injury.²⁵ It is estimated that this effort has the potential to save 100,000 lives in a 5-year period.²⁶ Another successful example includes the Surgical Care and Outcomes Assessment Program, wherein electronic medical records are used to feedback outcomes and performance to surgeons in the state of Washington. This has resulted in decreased variability in care delivery, which in turn has decreased complications and improved cost savings.²⁷

For opioid prescribing, similar projects have leveraged patient feedback on key outcomes, such as pain, satisfaction, and opioid consumption to create tailored guidelines for postoperative opioid prescribing.²⁸ Encouragingly, this work has led to significant and sustained improvements in postoperative prescribing without negatively impacting patient satisfaction or pain.^{20,29,30} Randomized controlled trials (RCTs) could help augment these studies and establish a causal connection between prescribing recommendations based on patient outcomes, changes in prescribing practice, and stability in patient satisfaction. However, RCTs are costly, logistically challenging to execute, and often do not represent real-world practice given the constraints of creating study cohorts and comparison groups.³¹ In addition, it is imperative to ensure pain is effectively treated after surgery, and testing interventions that threaten adequate postoperative pain control can be ethically challenging.³²

In the absence of high-level evidence, pragmatic quality improvement studies based on the principles of a learning health system may represent the best opportunity to garner robust, patient-centered evidence to efficiently change practice. We review a pathway that is meant to engage surgeons and patients in generating data to support changes in prescribing practice that are unique to the settings in which they are implemented. By utilizing analysis and feedback from providers and patients, practice change is more likely to be sustainable and reflect the values of patients and providers.^{33,34} The result is rapid improvement in quality of surgical care that integrates patient-reported outcomes to create practical opioid prescribing guidelines following surgery.

METHODS

We conducted a search of the PubMed/MEDLINE database to identify studies for inclusion. Primary inclusion criteria were original research studies that evaluated the amount of opioids prescribed and the amount of opioids consumed by patients after. The primary outcomes of interest were prescription size and opioid consumption by patients. The search query used was “(opioid[TIAB] OR opiate[TIAB]) AND (postoperative[TIAB] OR postsurgical[TIAB] OR surgery[TIAB] OR procedure[TIAB] OR procedures[TIAB]) AND (prescription OR prescribing) AND (use OR utilization OR consumption)” This was limited to English-language articles analyzing adult populations (18 years) published before March 2019. Of the 305 query results, 30 met inclusion criteria.^{2,3,7,23,30,4,35–40,41–58}

RESULTS

Procedure and Patient Selection

The success of quality improvement projects depends in large part on their ability not to overextend stakeholders or be too methodologically complex.⁵⁹ Therefore, the majority of literature has focused on developing guidelines for patients undergoing common surgical procedures in which a straightforward postoperative course is expected (eg, laparoscopic cholecystectomy, inguinal hernia repair).^{20,21} Studies addressing postoperative opioid prescribing have focused on a narrow range of procedures, such as common outpatient general surgical procedures, outpatient orthopedic surgery, minimally invasive gynecologic and urologic surgery, dental procedures, and dermatologic procedures (Table 1).^{2,7,20,30,35–40,60}

In these examples, the focus on elective procedures and a relatively healthy, opioid-naïve patient population may have contributed to their success. Piloting practice change in a single or small group of related procedures may facilitate identifying and engaging the primary stakeholders (residents, faculty, nurses, midlevel providers) whose participation will be critical to success. After the success of initial pilot efforts, it may be possible to expand prescribing guidelines to more complex procedures or patient populations (such as those with preoperative opioid use or postoperative complications).

Baseline Data Collection

Collecting data regarding existing postoperative prescribing practices provide a baseline description of institutional trends against which changes can be compared. This process uses

medical record review to capture basic patient demographics, surgical procedures, and postoperative prescriptions, and is performed retrospectively in a defined period of time (6–12 months) to illustrate variability and preexisting trends. Most studies describe using chart review to collect data regarding the type and size of opioid prescription that patients receive.^{2–4,7,23,36–38,42–48,52,53,58} If this is not feasible, these data can also be collected directly from patients, for example, by asking them to read the label on the prescription bottle they received at discharge.³⁰ PDMP registries could also be queried, which are now used in every state. This review can also be used to identify which providers are writing opioid prescriptions after surgery, which is important to know during implementation and engagement of stakeholders and may vary across environments.

Baseline data collection should also involve meeting with stakeholders involved in the patient's care pathway. Qualitative data can be generated to understand the knowledge and motivations that drive current prescribing practices, such as environmental and social factors.⁶¹ For example, are surgeons prescribing a given amount because of strongly held beliefs, or would they be amenable to change? Interviews with nursing and other clinical staff, who may do the bulk of patient education about pain management, are also instrumental to garner perspectives and engagement.

Pain- and opioid-related postoperative outcomes

Patient-reported outcomes regarding opioid consumption, postoperative pain, refill requests, and patient satisfaction after surgery are the cornerstone of creating patient-centered guidelines for opioid prescribing. Depending on the resources and workflow of a given institution, studies that have implemented this pathway have described data collection via phone survey, electronic survey, postal mail survey, or even in person at a follow-up clinic visit (Table 1). At minimum, the following information is universally collected: type of medication taken after surgery, number of pills taken, number of days medication was taken after surgery, need for refills, pain after surgery, and satisfaction with surgery (Table 2). Patient-reported opioid use should be converted into milligrams of oral morphine equivalents (OMEs) to adjust for differing potency between medications.⁶² As with other retrospective studies, data collected are subject to recall bias. Previous work has described a typical survey interval of 1 month after surgery; however, earlier survey time may help reduce recall bias, and a majority of patients report cessation of opioid use within a few days after surgery.⁶³ Some studies describe surveying patients as early as 2 days after discharge.⁵⁸ Periodic reminders and even providing patients with a medication log may increase the accuracy of reporting. Additionally, prompting patients with objective data collected from their chart can also effectively reduce recall bias (eg, “I see you were prescribed 10 pills, how many did you take?”).⁶⁴

In addition to collecting data strictly related to postoperative opioid use and pain scores, patient survey can be a valuable tool to assess other important health behaviors related to opioids. Many patients report having and using leftover opioids from other procedures, so although they may not use opioid prescribed after a current surgery, they may take opioids from a previous surgery. For example, 1 in 4 adults aged 50 to 80 report filling an opioid prescription in the last 2 years, and 86% saved leftover pills for later use.⁶⁵ Patient survey

also allows for assessment of what patients were told by their provider regarding opioids and how patients store or plan to dispose of opioids, which has been found to be an area for significant improvement.⁴⁰

There may be a necessary tradeoff between the amount of information collected from patients and available resources to conduct surveys. As data collection, especially involving patient surveys, can be time- and resource-intensive, utilization of administrative data abstractors, research residents, and even medical students has been described to conduct this work effectively. In limited practice settings, data collection can be integrated into the postoperative visit, and limited to a few key pieces of information. Another strategy is to utilize a PDMP maintained by the state as a source of already collected data. Although some states only allow abstraction of deidentified data for research purposes, many states allow full access to PDMP registries as part of research and quality improvement initiatives. Lastly, in small or individual practices that lack resources, existing data sources for patient-reported outcomes such as the Consumer Assessment of Healthcare Providers and Systems (CAHPS) that have resulted from the Medicare Access and CHIP Reauthorization Act (MACRA) can be utilized to capture these patient data. This type of quality improvement initiative falls within the American Board of Surgery's requirement that practicing surgeons continue to stay involved in practice improvement activities.

Generation of Prescribing Recommendations

After data collection regarding institutional prescribing practices and patient-reported opioid use after surgery, prescribing recommendations can be generated. For a single procedure, there will be a range of opioid use with significant outliers. A majority of studies collect patient-reported outcomes from at least 100 patients. With a skew toward low opioid usage in most patients, a survey of 100 patients would achieve roughly a 10% margin of error with a 95% confidence level. Given the homogenous trends so far observed in postoperative opioid use across a number of study populations, even smaller sample sizes may still obtain a sufficient 80% power.^{20,21} The amount of medication that would cover the opioid needs of 80% of patients undergoing the chosen surgical procedures has been previously used as a benchmark.²¹ Other strategies have included defining evidence-based prescribing recommendations based on low, standard, and high opioid users, as well as using a process such as the Delphi method to develop expert consensus.^{43,66} Simply choosing the mean or median opioid use for a given procedure runs the risk of undertreating 50% of patients, particularly given the potential variation around point estimates.

Once the amount of medication is agreed upon, this should be translated into a number of pills depending on the type of medication, as potencies differ between medications. For example, 5/325 mg of hydrocodone/acetaminophen is equivalent to 5mg of oral morphine, whereas 5mg of oxycodone is equivalent to 7.5mg of oral morphine. Therefore, if the agreed-upon prescribing recommendation for the chosen procedure is 75mg OME, the equivalent prescription size would be 15 tablets of hydrocodone/acetaminophen 5/325mg or 10 tablets of oxycodone 5mg. This must also be balanced against ease of implementation. Recommending a single number of pills regardless of medication type—despite the relative difference in potency—may increase compliance by providers. Furthermore, opioid

formulations that contain acetaminophen make it more difficult for patients to dose around-the-clock acetaminophen, so recommendations that favor non-acetaminophen-containing medications such as oxycodone may be preferable.

Developing prescribing guidelines should also be used as an opportunity to recommend a multimodal analgesic strategy after surgery, which is universally recommended.⁶⁷ This evidence-based practice has been shown to decrease pain scores, improve patient satisfaction, and even improve outcomes after surgery compared to using opioids alone. Most medical record systems—electronic or otherwise—allow providers to add these over-the-counter medications to the patient’s postoperative medication list as a reminder to take these at scheduled times throughout the day.

Stakeholder Engagement

For many health systems, implementing evidence-based opioid prescribing practices will represent a significant change from the norm. Successful implementation of postoperative prescribing recommendations relies on familiarizing providers with this new practice. Critically, this effort must be aimed at all providers who will take part in the care of a patient undergoing the targeted procedure, from the first clinic visit to the final follow-up. Failure to focus on stakeholder engagement at all levels can lead to an experience whereby conflicting information is provided by surgeons, trainees, and other clinical staff members. For example, informing only prescribing providers of new changes could lead to significant confusion, inappropriate patient counseling, and even the belief that the prescription was entered in error if the postoperative nursing staff are not made aware that a new prescription size will be used which will likely be significantly smaller than those they have seen in the past.

Methods for disseminating this information can include departmental meetings, educational videos, email, website creation, and printed reference materials. In academic practice settings, regular meeting such as grand rounds or weekly educational conferences provide an appropriate forum to reach a large audience. Providing material online also offers a quick way for providers to reference new procedures. Educational brochures targeted at providers can also be developed and shared across institutions.⁶⁸ There are also a number of process change strategies that can be used to maximize stakeholder involvement. Lean quality improvement methods, which are used at many health systems, suggest creating a value-stream map to identify stakeholders, or creating a stakeholder map to measure the reaction, needs, and effect on those involved in implementing a new care pathway.

Patient Education

Efforts by pharmaceutical companies and various professional societies in the 1990s have led to many patients holding the belief that surgery can be pain-free. Even today, older adults report that they are infrequently counseled on safe opioid use.⁶⁹

There are several principles which should be communicated to patients, which we outline in Table 3. These principles can be communicated during pre- and postoperative clinic visits, throughout a patient’s hospital stay, and using engaging printed material.⁷⁰ Patient education should focus on 3 critical elements: expectations for pain, risks and alternatives of opioid analgesics, and safe storage and disposal of opioids.

By informing patients that some pain is normal after surgery, and that the goal is adequate function as opposed to being pain free, patients are less likely to take as much medication or call for a refill.⁷¹ Setting expectations and norms can also be augmented by the data previously collected as part of the protocol. For example, if patient-reported outcomes reveal that most patients take X number of pills after a given procedure, providers can have a powerful impact on patient expectations by sharing, “We’ve found that most patients use X pills after this procedure.” Presenting information that helps set expectations has been shown to serve as an anchor for a patient’s own postoperative experience.⁷² To that end, patients can also be briefly introduced to the larger context of the intervention, that is, the ongoing changes and legislation surrounding postoperative opioids in the context of the opioid epidemic. Patients should also be counseled on the use of nonopioid, multimodal analgesia after surgery, including acetaminophen and nonsteroidal anti-inflammatory drugs (NSAIDs). This should be emphasized as the primary method of pain control, with opioids being reserved for breakthrough pain.

Lastly, pre- and postoperative patient counseling provides a good opportunity to discuss appropriate use of opioids (ie, not taking them for unrelated conditions), risks of opioids, and how to safely dispose of opioids. This final piece of information may be particularly helpful, as most patients report not knowing how or where to dispose of leftover pills.^{1,35,36}

Continual Assessment

A cycle of data analysis and practice change is central to a learning health system, and has been shown to lead to sustainable, patient-focused quality improvement.²⁴ Prospective chart review of prescribing patterns should be conducted to assess the impact of opioid prescribing recommendations. This will demonstrate whether the new recommendations are being utilized and help identify areas for improvement. For example, chart review may identify that a given provider or hospital unit has not implemented new prescribing practices, giving project leaders an opportunity to identify barriers. This continual assessment is an important tenet of improving care delivery within a learning health system. The goal should be a cycle of continuous feedback that drives improvement on a regular basis.⁷³

Continual data collection also helps ensure that new practices are beneficial to patients. It is necessary to continually assess the impact of prescribing changes on the patient experience. A survey instrument similar to the one used to collect preintervention data can be used to assess medication use, pain scores, and patient satisfaction after implementation of prescribing changes. This serves 2 major roles. First, it will allow providers to make sure that new prescribing practices have not resulted in decreased patient satisfaction, increased pain scores, or increased calls for medication refills. Second, it allows providers to adjust and improve postoperative prescribing practices based on evolving data. Smaller opioid prescriptions have been shown to be linked to decreased opioid consumption after surgery.^{3,30} Therefore, reducing opioid prescription size may lead to reduced opioid use by patients, allowing investigators to further tailor new prescribing recommendations based on this dynamic patient feedback. Again, in practice settings where continual assessment is not feasible, the aforementioned data sources such as CAHPS could be utilized to capture these patient data.

The above 7 elements of this protocol are outlined in Table 4.

EXAMPLES OF PATHWAY IMPLEMENTATION

As outlined in Table 1, this common pathway to collect data regarding opioid-prescribing practices and patient use has been described in several studies. The majority of studies collected data regarding opioid prescribing through medical record review, then collected patient-reported outcomes through a survey instrument. Three studies have specifically described the creation of opioid prescribing guidelines utilizing this pathway.^{20–22}

Hill et al chose 5 common surgical procedures to target for intervention: partial mastectomy, partial mastectomy with sentinel lymphnodebiopsy, laparoscopiccholecystectomy, laparoscopicinguinal hernia repair, and open inguinal hernia repair.²¹ Using electronic medical record review, data were collected regarding prescription size and medicals refills for these procedures. Phone surveys were used to collect patient-reported opioid use. Investigators demonstrated universal overprescribing of opioids for all procedures. Prescribing recommendations were then developed based on the 80th percentile of patient-reported opioid use. The prescribing recommendations, in an equivalent dose of oxycodone 5mg, were: 5 pills for partial mastectomy, 10 pills for partial mastectomy with sentinel lymph node biopsy, and 15 pills for laparoscopic cholecystectomy, laparoscopic inguinal hernia repair, and open inguinal hernia repair.

These data regarding overprescribing and the guidelines were then shared at surgical grand rounds, departmental meetings, a resident forum, and by email. Prescribers were also instructed to encourage patients to use acetaminophen and NSAIDs as the primary form of pain control. Following implementation of these recommendations, prescription size decreased by 43% to 74% for these 5 procedures.²¹ Only 1 patient required a medication refill.

At our own institution, we implemented this pathway initially for elective laparoscopic cholecystectomy, a very common surgical procedure.²⁰ Retrospective chart review identified postoperative prescribing patterns and phone surveys established postoperative use data. Opioid use at the 80th percentile was 75 OMEs. This is equivalent to 15 tablets of hydrocodone/acetaminophen 5/325mg or 10 tablets of oxycodone 5mg. For ease of implementation, we recommended 15 tablets of either medication. These data and recommendations were presented to faculty, residents, and staff at grand rounds, departmental meetings, email, and through an easily accessible website.⁷⁴ Our standard preoperative patient education materials were also changed to encourage nonopioid analgesic use and address the risks of opioids. After publicizing these recommendations, we immediately began conducting prospective chart review and patient surveys to track prescription sizes and assess the impact of these guidelines. Postoperative prescribing fell by 63% without any change in requests for refills or patient-reported pain score.²⁰

Lee et al²² described application of this pathway in five common surgical oncology procedures. Here, the investigators utilized the previously published recommendations from Hill et al, which eliminated the time-consuming process of surveying patients regarding

postoperative opioid use. The recommendations, in tablets of oxycodone 5mg, were 20 tablets for melanoma wide local excision with or without sentinel lymph node biopsy (SLNB), 20 tablets for simple mastectomy with or without SLNB, 10 tablets for SLNB, 10 tablets for lumpectomy with SLNB, and 5 tablets for breast biopsy or lumpectomy without SLNB. Prescriber education was accomplished through a written protocol and mandatory educational conferences, and patients received standardized instructions regarding pain control. Again, continuous data collection after implementing the recommendations demonstrated reductions of 37% to 42% in prescription size without an increase in requests for refills.

IMPLICATIONS AND ADAPTABILITY

A pathway that utilizes patient-reported outcomes and physician-led practice change can result in significantly decreased postoperative opioid prescriptions without increasing pain or need for refills after surgery. In the studies references above, new prescribing practices were rapidly adopted by surgeons following brief educational interventions. This represents a powerful strategy by which to quickly and effectively mitigate excess opioid exposure among patients and communities without decreasing patient satisfaction. Although the studies identified in this review may not provide the quality of evidence available from a randomized controlled trial, they produce real results to address an urgent clinical problem.

An important element of this pathway is that it allows for development of improved prescribing in any practice setting. By collecting patient data and developing practice change based on those results, these changes can be implemented to serve the unique population in a given institution or community. Different patient populations may have different analgesic requirements following surgery and collecting patient-reported opioid use enables new prescribing practices to match this. Interestingly, however, the similarity in prescribing recommendations and outcomes at both of these institutions may suggest similar, procedure-specific pain needs. This would further lend to the generalizability of this type of prescribing recommendation.

This pathway can also be implemented at any scale of surgical practice and for a variety of surgical procedures. A small, individual practice that may not have the resources to conduct phone surveys could collect data regarding opioid consumption at in person followup visits, then adjust prescribing accordingly. Individual practices that may lack additional resources could further utilize prescribing data generated from a similar population, region, or practice, and again tailor the results to match their practice. In Michigan, for example, many community hospitals now use prescribing guidelines developed through data collection from large health systems around the state. This pathway can also be significantly upscaled to enable substantial practice change on a large scale. Again, in Michigan, patient-reported opioid consumption is now collected across the entire state through a large surgical collaborative.³ Prescribing recommendations are then developed based on more robust data and disseminated not just to one health system, but to a collaborative of >70 hospitals across the state. This has resulted in patient-focused prescribing recommendations being developed for roughly 25 common operations.⁷⁵

This effort fulfills the definition of quality improvement in a learning health system, wherein data generated through routine practice are used to develop new knowledge that can then be integrated into practice.⁷³ As a result, the measures put into place improve care quality and patient safety while being tailored to a specific patient population. Continual assessment ensures that these measures benefit patients. For example, it would be a great disservice to patients if implementing a protocol designed to improve surgical quality and safety negatively affected patients' pain and satisfaction after surgery. What's more, by driving practice change with institutional data and stakeholder feedback, these changes reflect the goals and motivations of all the providers involved, rather than being mandated by a small group. This framework has been shown to lead to quality improvement that is both sustainable and grounded in a sense of purpose among those involved.⁷⁶ This is an inherently collaborative approach which relies on inclusion of providers at every level of care delivery, again increasing ownership of practice change among providers. Quality improvement initiatives that fail to effectively involve all levels of care—and not just leadership—have been shown to have only limited impact in clinical operations.

Although this pathway represents an important and practical step in combating the ongoing opioid epidemic, it is not without limitations. First, the prescribing recommendations developed through this pathway are based on patient-reported opioid use only. They do not account for other patient-specific factors such as presence of comorbidities, chronic pain conditions, preoperative opioid use, or complications. These factors should also be taken into consideration when providing a postoperative prescription to a patient to achieve maximal pain control. It is possible that future prescribing recommendations could be developed using a combination of these factors in a predictive model to allow for prescriptions that are tailored to individual patients. Additionally, to date this pathway has only been implemented at a limited number of institutions and may not have the same success at other health systems. However, by following a learning health system model, this pathway is designed to be adjustable depending on each institution's unique resources and needs. Lastly, appropriate prescribing is only one part of a larger effort to address the opioid epidemic. In addition to this effort, other work continues to be critical, such as public awareness campaigns, opioid take-back drives, and access to addiction treatment.

CONCLUSION

A pathway that utilizes patient-reported outcomes enables physicians to dramatically reduce excessive opioid prescribing without negatively impacting patients' experience after surgery. Importantly, this approach is generalizable to various settings, practical to implement, and leads to practice change that is patient-focused. Our own experience upscaling this pathway to a population level has already shown promising results. We encourage providers to utilize these principles and make them their own.

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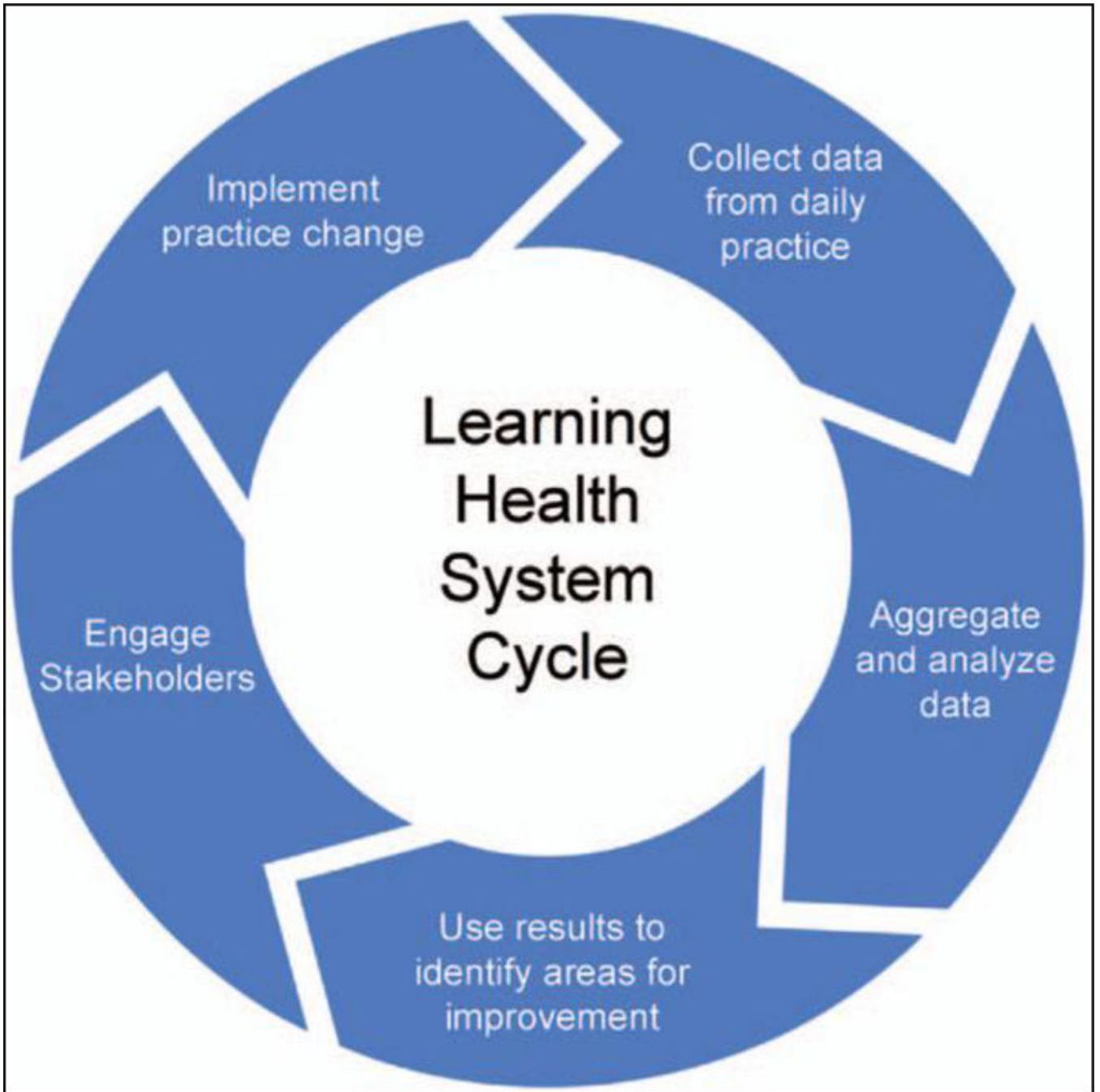


FIGURE 1. Cycle of continuous quality improvement in a learning health system.

TABLE 1.
Review of Studies Describing Data Collection Methods Regarding Opioid Prescription and Use.

Study	Opioid Prescription Data Collection Method	Opioid Use Data Collection Method	Procedures	N
Bates et al., 2011 ³⁵	Phone and mail-out survey	Phone and mail-out survey	Urologic surgery	275
Rodgers et al., 2012 ⁷	Medical record review	Phone survey	Upper extremity surgery	287
Harris et al., 2013 ³⁶	Medical record review	Phone survey	Dermatologic surgery	212
Swenson et al., 2016 ³⁷	Medical record review	Phone survey	Minimally invasive urogynecologic surgery	50
Maughan et al., 2016 ³⁸	Medical record review	Text message survey	Impacted tooth extraction	49
Kim et al., 2016 ³⁹	In-person survey	In-person survey	Upper extremity surgery	1416
Bartels et al., 2016 ⁴⁰	Electronic or mail-out survey	Electronic or mail-out survey	Cesarean delivery, thoracic surgery	63
As-Sanie et al., 2017 ⁴	Medical record review	Phone survey	Hysterectomy	102
Osmundson et al., 2017 ⁴¹	Not collected	Email or phone survey	Cesarean delivery	246
Hill et al., 2017 ²	Medical record review	Phone survey	Elective surgical procedures	642
Howard et al., 2017 ⁴²	Medical record review	Phone survey	Laparoscopic cholecystectomy	370
Bateman et al., 2017 ¹⁵	Phone survey	Phone survey	Cesarean delivery	720
Thiels et al., 2018 ⁴³	Medical record review	Phone survey	Elective surgical procedures	2486
Swarup et al., 2018 ⁴⁴	Medical record review	Mail-out survey	Outpatient anorectal surgery	42
Howard et al., 2018 ³	Medical record review	Phone survey	Common surgical and gynecologic procedures	2392
Wojahn et al., 2018 ⁴⁵	Medical record review	Written questionnaire	Knee arthroscopy	221
Saini et al., 2018 ²³	Medical record review	In-person survey	Orthopedic foot and ankle procedures	988
Hart et al., 2018 ⁴⁶	Medical record review	Phone survey	Breast surgery	95
Sabatino et al., 2018 ⁴⁷	Medical record review	Phone survey	Elective orthopedic procedures	1159
Cunningham et al., 2018 ⁴⁸	Medical record review	In-person survey	Hip arthroscopy	80
Griffith et al., 2018 ⁴⁹	Phone survey	Phone survey	Gynecologic procedures	56
Peters et al., 2018 ⁵⁰	Phone survey	Phone survey	Carpal tunnel release	49
Hota et al., 2018 ⁵¹	Written questionnaire	Written questionnaire	Gynecologic procedures	75
Bartels et al., 2019 ⁵³	Medical record review	Online, phone, or mail-out survey	Gastrointestinal procedures	233
Friedman et al., 2019 ⁵⁴	In person	In person	Bariatric surgery	115
Rose et al., 2019 ⁵⁵	Written questionnaire	Written questionnaire	Outpatient plastic surgery	170
Locketz et al., 2019 ⁵⁶	Not collected	Written questionnaire	Sinus and nasal surgery	219

Study	Opioid Prescription Data Collection Method	Opioid Use Data Collection Method	Procedures	N
Hozack et al, 2019 ⁵⁷	Not collected	In-person survey	Cubital tunnel decompression surgery	100
Bicket et al, 2019 ⁵⁸	Medical record review	Phone survey	Joint and spine surgery	140
Fujjii et al, 2019 ⁵²	Medical record review	Phone survey	Common surgical procedures	539

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TABLE 2.

Opioid- and pain-related outcomes survey.

-
- 1 Did you fill the opioid prescription that was given to you after surgery?
 - 2 How many pills did you use?
 - 3 For how many days did you take pills?
 - 4 Are you still taking the medication?
 - 5 How many leftover pills you have?
 - 6 If you still have leftover pills, where do you store it?
 - 7 If you disposed of the leftover pills, how did you dispose of them?
 - 8 Did you need to refill the prescription you were given after surgery?
 - 9 Did you take any pain medications other than what your doctor gave you after surgery? This includes over the counter medications such as Motrin (generic name: ibuprofen) and Tylenol (generic name: acetaminophen).
 - 10 Do you feel like you had enough pain medication?
 - 11 On a scale of 0 to 10 (0 being no pain, 10 being the worst pain imaginable), what was your average overall pain score in the week following your surgery?
-

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TABLE 3.

Patient Counseling Principles.

Principle	Example
Set expectations	“Having some pain after surgery is normal. You will be sore for a few days, but this will gradually improve.”
Set norms	“We’ve found that most patients who undergo this procedure usually only need about 5 pills to control their pain.”
Non-opioids	“You’ll get the best pain control by taking over-the-counter pain medication such as acetaminophen and ibuprofen around the clock. You should take the stronger, prescription medication only for breakthrough pain.”
Appropriate use	“This prescription is only for pain related to your surgery. You should not use these pills to treat other pain like a headache or backache.”
Adverse effects	“It’s important to know that opioids can be addictive and harmful if used inappropriately, therefore we recommend taking only the minimum necessary amount.”
Safe disposal	“Most patients have leftover pills after surgery. These can be dangerous to others, like children, if left around the house. We recommend safely disposing of the pills when you no longer need them using the following resources: https://takebackday.dea.gov/ ”

TABLE 4.

Framework for an Evidence-based Postoperative Opioid-prescribing Pathway.

Pathway Element	Description/Examples
Choose procedure or patient cohort to pilot initiative	Elective, low variability, uncomplicated patients
Collect data on prescribing practices	Retrospective chart review, Prescription Drug Monitoring Programs
Collect data on patient-reported opioid use	Prospective patient surveys (medication use, pain scores, satisfaction)
Generate evidence-based prescribing recommendations	Using patient-reported medication use, identify potential prescribing cut-points (such as by percentile treated)
Stakeholder education	Engaging all providers involved in patient care (pre-op, peri-op, post-op residents, faculty, nurses, PAs, NPs)
Patient and caregiver education	Counseling patients and caregivers regarding safe postoperative opioid use, pain control, disposal
Continual assessment and update of recommendations	Prospective chart review to analyze impact of recommendations, patient surveys to analyze medication use and pain scores

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