

CME

American Society for Enhanced Recovery and Perioperative Quality Initiative-4 Joint Consensus Statement on Persistent Postoperative Opioid Use: Definition, Incidence, Risk Factors, and Health Care System Initiatives

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Persistent postoperative opioid use is thought to contribute to the ongoing opioid epidemic in the United States. However, efforts to study and address the issue have been stymied by the lack of a standard definition, which has also hampered efforts to measure the incidence of and risk factors for persistent postoperative opioid use. The objective of this systematic review is to (1) determine a clinically relevant definition of persistent postoperative opioid use, and (2) characterize its incidence and risk factors for several common surgeries. Our approach leveraged a group of international experts from the Perioperative Quality Initiative-4, a consensus-building conference that included representation from anesthesiology, surgery, and nursing. A search of the medical literature yielded 46 articles addressing persistent postoperative opioid use in adults after arthroplasty, abdominopelvic surgery, spine surgery, thoracic surgery, mastectomy, and thoracic surgery. In opioid-naïve patients, the overall incidence ranged from 2% to 6% based on moderate-level evidence. However, patients who use opioids preoperatively had an incidence of >30%. Preoperative opioid use, depression, factors associated with the diagnosis of substance use disorder, preoperative pain, and tobacco use were reported risk factors. In addition, while anxiety, sex, and psychotropic prescription are associated with persistent postoperative opioid use, these reports are based on lower level evidence. While few articles addressed the health policy or prescriber characteristics that influence persistent postoperative opioid use, efforts to modify prescriber behaviors and health system characteristics are likely to have success in reducing persistent postoperative opioid use. (Anesth Analg 2019;129:543–52)

In light of the opioid epidemic in the United States, anesthesiologists are uniquely positioned to play a role in reducing opioid use for surgical patients, for whom opioids continue to be first-line analgesic agents and nonopioid medications are inconsistently prescribed.^{1,2} Crucially, several studies suggest that surgery is associated with an increased risk of long-term opioid use, a phenomenon known as persistent postoperative opioid use.^{3,4} As such, efforts to reduce

the risk of persistent postoperative opioid use can have a direct effect on opioid use at the population level. In addition, decreasing the risk of persistent postoperative opioid use could also have indirect benefits in reducing population-level opioid use by reducing the incidence of diversion, particularly in light of studies suggesting a substantial amount of opioid overprescription and large amounts of unused pills among patients undergoing surgery.^{5–7}

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Table 1. Example Reported Definitions/Measures of Persistent Postoperative Opioid Use

≥1 opioid prescriptions within 1–90 d after surgery along with ≥1 prescriptions for opioids within 91–180 d after surgery ⁸
Having filled ≥10 prescriptions or >120 d supply within a 1-y period ⁹
Opioid prescription fulfillment between 90 and 180 d among those patients who filled opioid prescriptions perioperatively ³
Filling an opioid prescription within the perioperative period and continued to refill between postoperative days 90 and 120 ¹⁰
Trajectory analysis of opioid filling for 12 consecutive 30-d periods postoperatively ¹¹
Patients who filled an opioid prescription attributed to surgery and then filled ≥1 additional opioid prescription between 90 and 180 d after surgery ¹²
Time until opioid cessation ^{13,14}
Long-term opioid use was defined as an additional claim for any opioid within 60 d of the 1-y anniversary date (eg, 305–425 d after the index date) ¹⁵
Number of patient using opioids 2 and 5 y postoperatively ¹⁶

Efforts to address persistent postoperative opioid use have faced several limitations. First, the term remains poorly defined in the literature (Table 1). Additionally, it is likely driven by a wide variety of causal factors, including patient characteristics (eg, comorbidities), nature of the patient's surgery, and health system characteristics (eg, clinical pathways and health legislation).¹⁷ Indeed, 1 stated benefit of initiatives such as the perioperative surgical home and enhanced recovery after surgery programs is the possibility that they may reduce the risk of persistent postoperative opioid use. As a result of these limitations, to date, there have been few systematic attempts to characterize the incidence of persistent postoperative opioid use and the associated patient, surgery, and health care system characteristics that may serve as risk factors. As part of the fourth American Society for Enhanced Recovery Perioperative and Quality Initiative-4 working group, we used a systematic literature review and modified Delphi Grading of Recommendations Assessment, Development and Evaluation consensus process to address the following questions:

- What is the definition and incidence of persistent postoperative opioid use?
- What are patient and surgery characteristics associated with persistent postoperative opioid use?
- What health system characteristics are associated with persistent postoperative opioid use?

METHODS

Expert Group and Process

The Perioperative Quality Initiative-4 conference was convened with the goal of advancing the understanding of opioid use throughout all perioperative phases. This article is the result of a modified Delphi analysis performed by the Perioperative Quality Initiative-4 working subgroup, whereby evidence pertaining to perioperative opioid use was reviewed. The Delphi method is detailed in the first article in this series.¹⁸ Twenty-four experts in anesthesiology, nursing, surgery, pharmacy, and pain medicine met on January 4–6, 2018 in Nashville, TN. Each workshop participant was chosen based on a record of significant clinical and/or research experience in perioperative pain medicine. We systematically reviewed the literature

pertaining to the definition/incidence of and risk factors for persistent postoperative opioid use within specific surgical subtypes. In the interest of feasibility, the workgroup focused on 5 commonly performed surgery subtypes affecting major body regions and tissue types, including joint arthroplasty, mastectomy, spine surgery, thoracic surgery, and abdominopelvic surgery. Based on the literature review described next, the working group arrived at a consensus regarding the (1) definition and incidence of persistent postoperative opioid use, (2) patient and surgeries associated with persistent postoperative opioid use, and (3) health care system characteristics associated with persistent postoperative opioid use. These results were presented to the Perioperative Quality Initiative-4 collaborative, and the following conclusions and recommendations reflect the consensus of the collaborative.

Literature Review

Data Sources and Search. We complied with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines conducting a systematic search of available literature pertaining to the incidence of and risk factors for persistent postoperative opioid use. We searched MEDLINE, Embase, and Scopus within the past 10 years (January 1, 2007 to February 2, 2018) restricting articles to the English language (Supplemental Digital Content, PPOU Database Search, <http://links.lww.com/AA/C663>). Due to the recent expansion of enhanced recovery after surgery programs, comprehensive acute pain management programs, and recent attention to opioid over prescription, the working group chose a 10-year search strategy. As seen here, only 1 of 46 articles that met inclusion criteria was published before 2010. We constructed a search strategy using terms focusing on adults undergoing arthroplasty, mastectomy, spine surgery, thoracic surgery, and abdominopelvic surgery (population), postoperative opioids (exposure), and the incidence of or risk factors for persistent postoperative opioid use (outcome). Because evidence for contributory health care system characteristics to persistent postoperative opioid use is emerging, we decided to narratively review this topic and offer recommendations for research and policy considerations.

Inclusion Criteria and Outcome Definition. We included studies of adults within the United States and Canada undergoing total knee/hip arthroplasty, mastectomy, thoracic surgery, abdominopelvic surgery, and spine surgery. The United States and Canada were chosen due to similar opioid-prescribing practices and being characterized by the highest opioid consumption in the world.^{19,20} We required that the patient's opioid use or exposure be measured during the postdischarge period and include the incidence of and/or risk factors for opioid use or prescription filling after 90 days postoperatively. There was no time limit on follow-up for this initial search.

From our Perioperative Quality Initiative-4 working group, 1 reviewer (M.L.K.) assessed 2540 abstracts, and 2478 were excluded for not meeting content inclusion criteria. Sixty-two titles underwent full-text review by 2 reviewers (M.L.K. and G.M.O.), after which 46 studies met inclusion criteria. The primary set of outcomes included the incidence of persistent postoperative opioid use (as defined by the given study) in opioid-naïve and opioid-exposed patients and patient/surgical characteristics associated with the

development of persistent postoperative opioid use across all patients. These outcomes were obtained for each of the aforementioned surgical subtypes.

Quality Assessment. Two reviewers (M.L.K. and G.M.O.) independently assessed the quality of studies. The Grading of Recommendations Assessment, Development and Evaluation assessment for prognostic studies set forth by Iorio et al²¹ and Huguet et al²² was used to evaluate study limitations, indirectness of evidence, imprecision, and publication bias.^{21,22} Limitations were primarily assessed as risk of bias, with particular attention paid to appropriate study sample and adjustment for confounding prognostic factors. Indirectness of evidence was rated on whether study data corresponded to the population of interest and at the same time using appropriate measures. Imprecision was evaluated based on variables such as appropriate sample size and observation of CIs for outcomes. Studies were also evaluated based on the presence of univariate/multivariate analysis. After Grading of Recommendations Assessment, Development and Evaluation

evaluation of individual articles, patient characteristics associated with persistent postoperative opioid use were reviewed to generate a list of the most common factors for each surgical subtype. Based on the aggregate quality of evidence, each patient characteristic was also evaluated and assigned a Grading of Recommendations Assessment, Development and Evaluation score. In the case of disagreement, a third reviewer (R.W.H.) functioned as a tie-breaker.

Data Extraction and Synthesis. One of the reviewers (M.L.K.) extracted pertinent study characteristics using an agreed-on extraction template. Data included study design, setting, patient population, number of patients, incidence of persistent postoperative opioid use in opioid-naïve and tolerant patients per the study author's definition, and risk factors.

RESULTS

After full-text review, 46 studies met inclusion criteria across prespecified surgical subtypes (Figure 1²³; Supplemental Digital Content, Table 1, <http://links.lww.com/AA/C663>).

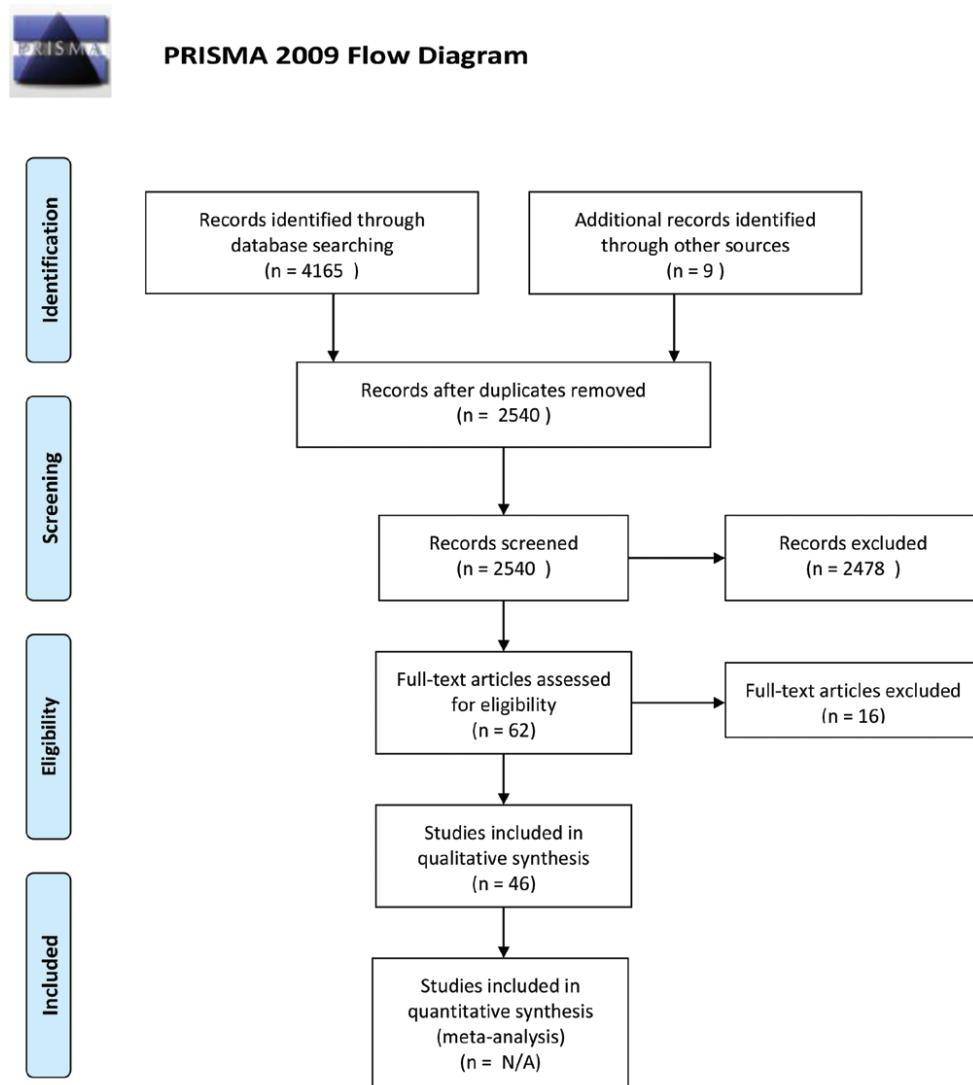


Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) flowchart. Figure reused with the permission of the Perioperative Quality Initiative (POQI). For permission requests, contact info@poqi.org.

The majority of studies were retrospective, with data originating from institutional records or external databases (ie, insurance claims, state prescription monitoring, etc). Studies addressed patient/surgical characteristics associated with persistent postoperative opioid use, the incidence of persistent postoperative opioid use, or both. Of note, certain retrospective cohort studies included numerous surgical subtypes and patient/surgical characteristics associated with persistent postoperative opioid use, and such studies were analyzed in aggregate.^{8,9,12} In these scenarios, manuscripts underwent Grading of Recommendations Assessment, Development and Evaluation assessment for each respective surgical subtype, but the lack of surgery-specific analysis within such mixed surgical studies was taken into account when assessing the quality of evidence. No studies received an assessment of "high quality" in part due to variability in persistent postoperative opioid use definition, sample size, and lack of representation of the entire surgery-specific population.

Definition of Persistent Postoperative Opioid Use

There was no consistent definition of persistent postoperative opioid use across the studies due to variations in how opioid use was measured (eg, prescriptions written, prescriptions filled, or opioid usage per patient report), the starting and ending points during which opioid use was measured (eg, 90 days postoperatively until 1 postoperative year), and the level of opioid use required to meet the threshold for persistent postoperative opioid use. Despite this variation, a notable proportion of articles focused on the time period from 90 postoperative days to 1 postoperative year.^{3,8–12,15,24–45}

Incidence of Persistent Postoperative Opioid Use

Due to the variability in time frame used to describe persistent postoperative opioid use and the trends noted earlier, the consensus group chose to initially focus on studies that characterized the incidence of persistent postoperative opioid use from 90 days until 1 year postoperatively as patients using opioids longer than 1 year postoperatively may have had other confounding painful conditions not linked to the surgical insult for which they were using opioids.

Differences were noted among each surgical subtype, and a wide range of reported incidence rates were likely due to variability among studies, including sample size, definition of persistent postoperative opioid use, and total number of institutions represented in any given study. Unlike other patient characteristics (ie, depression, anxiety, etc), preoperative opioid users were often treated as a separate patient category where incidence rates were measured. Thus, our working group found it important to report the differing incidence rates between these 2 groups (Table 2). Even when considering the heterogeneity of sample sizes and definitions of persistent postoperative opioid use, the incidence of persistent postoperative opioid use was >10 times greater in preoperative opioid users when compared to opioid-naïve patients for arthroplasty and abdominopelvic patients and was rated as high-quality evidence. In patients undergoing

Table 2. Reported Incidences of Persistent Postoperative Opioid Use Across Surgical Subgroups

Surgery	Overall Sample	Opioid-Naïve Sample	Preoperative Opioid Sample
Arthroplasty	5.5%–32%	0.6%–8%	14%–68%
	5.5%–32%	0.6%–4%	35%–68%
Abdominopelvic	0.36%–77%	0.09%–12%	8.1%–77%
	0.36%–14%	0.119%–6%	59%–77%
Spine	18%–85%	0.02%–26%	59%
	18%–59%	26%	59%
Mastectomy	Not applicable	10%–11%	Not applicable
	Not applicable	10%–11%	Not applicable
Thoracic	22%	<2%–14%	Not applicable
	Not applicable	14%	Not applicable

spine surgery, preoperative opioid users were more than twice as likely to develop persistent postoperative opioid use when compared to opioid-naïve patients (59% vs 26% incidence of persistent postoperative opioid use) in 1 moderate quality study.²⁴ While only a few studies assessed persistent postoperative opioid use in thoracic surgery (4 studies) and mastectomy (3 studies), those studies that were considered moderate quality reported the incidence of persistent postoperative opioid use to be >10% in opioid-naïve patients in both surgical subclasses. No studies in thoracic surgery or mastectomy evaluated preoperative opioid users.

Patient and Surgical Characteristics Associated With Persistent Postoperative Opioid Use

The majority of studies measuring patient characteristics drew data from large insurance claim databases where comorbid conditions were gathered via International Classification of Diseases coding. Prescription fills were determined either through claims data, state prescription monitoring databases, or institutional prescription records. Studies that were prospective observational or institutional chart review in design measured patient characteristics such as anxiety or depressive symptoms through validated research tools (ie, Hospital Anxiety and Depression Scale, Zung Depression Scale).^{24,34} In these studies, opioid prescription/use was measured by patient report. Only 4 studies described surgery-specific variables such as the Knee Society Score for total knee arthroplasty or the presence of adjuvant chemotherapy/radiation in oncologic samples.^{10,12,34,41} Summative patient characteristics associated with persistent postoperative opioid use in all of the combined surgical groups are presented in Table 3.

Arthroplasty. Seventeen studies assessed patient characteristics associated with persistent postoperative opioid use in patients undergoing total knee arthroplasty or total hip arthroplasty (Supplemental Digital Content, Tables 2–3, <http://links.lww.com/AA/C663>).^{9,13,31–41,46–49} While heterogeneously defined, all studies that measured preoperative opioid use indicated a significant relationship with persistent postoperative opioid use. Moderate quality evidence was given to depression, substance use, preoperative painful conditions, and smoking.

Table 3. Risk Factors for Persistent Postoperative Opioid Use in Combined Surgical Groups

Risk Variable	Study Limitations	Indirectness	Imprecision	Inconsistency	Level of Evidence
Preoperative opioid use	2	2	1	1	++++
Depression	2	2	1	1	++++
Substance abuse	2	3	1	1	+++
Preoperative pain condition	2	3	2	1	+++
Smoking	2	2	2	2	+++
Anxiety	2	2	2	3	++
Sex	2	2	2	3	++
Psychotropic drug use (antidepressant, benzodiazepine)	2	3	2	1	++

Limitations: #1, no serious limitation; #2, serious limitation; #3, very serious limitation. Quality of evidence: +, very low quality; ++, low quality; +++, moderate quality; +++, high quality.

Five studies measured associated factors for persistent postoperative opioid use in both total hip arthroplasty and total knee arthroplasty.^{9,32,34,37,40} Three of these 5 studies identified total knee arthroplasty as a risk factor for persistent postoperative opioid use when compared to total hip arthroplasty.^{34,37,40} Additionally, Sun et al⁹ conducted a residual confounding analysis supporting the notion that total hip arthroplasty and total knee arthroplasty were risk factors for persistent postoperative opioid use when compared to a nonsurgical cohort.

Abdominopelvic. Sixteen studies assessed patient characteristics associated with persistent postoperative opioid use; however, significant heterogeneity was observed regarding the types of reported surgeries (Supplemental Digital Content, Tables 4–5, <http://links.lww.com/AA/C663>).^{3,8,9,11,12,15,26–30,42,45,50–52} Moderate-level evidence was observed for depression, substance use, preoperative painful conditions, tobacco use, and use of psychotropic prescription drugs. While some studies measured both minimally invasive and open surgical techniques, no formal comparative analyses were performed to determine an association between surgery type and persistent postoperative opioid use.

Spine. Five of 13 studies reported on associated patient characteristics, and a significant degree of diversity in surgery types was observed (Supplemental Digital Content, Tables 6–7, <http://links.lww.com/AA/C663>).^{24,25,43,44,53–61} Lumbar arthrodesis was the most commonly reported surgical intervention. Preoperative opioid use and depression were assigned high-quality level of evidence for their influence on persistent postoperative opioid use. Larger than other surgical types, the baseline presence of preoperative opioid use was noted to be >50%.^{24,58} Relative to other spine surgical subclasses, 2 studies observed lumbar fusion as having a higher association with persistent postoperative opioid use, while the 3 remaining studies identified revision and/or more invasive surgeries as risks.^{24,25,55,56,58}

Thoracic Surgery. All 4 studies that involved thoracic surgery were conducted on mixed surgical groups (Supplemental Digital Content, Tables 8–9, <http://links.lww.com/AA/C663>).^{8,12,30,62} Two of the 4 studies analyzed the same sample from a large Canadian database but utilized 2 different measures of postoperative opioid use.^{8,30} Given these limitations, preoperative opioid use was given a low-quality level of evidence. Very low-quality evidence

was observed for depression, substance use, age, and use of prescription psychotropic drugs. Clarke et al⁸ reported a significantly higher risk of persistent postoperative opioid use in open thoracic surgeries versus minimally invasive approaches.

Mastectomy. Three studies evaluated risk factors in patients undergoing mastectomy (Supplemental Digital Content, Tables 10–11, <http://links.lww.com/AA/C663>).^{10,12,13} Only 1 study focused solely on opioid-naïve patients undergoing mastectomy with immediate reconstruction instead of a mixed surgical cohort.¹⁰ Given this finding, a low-quality level of evidence was observed for preoperative opioid use, anxiety, and depression. No studies conducted a comparative analysis of differing surgical types (ie, radical mastectomy versus simple mastectomy, etc).

DISCUSSION

Defining Persistent Postoperative Opioid Use

There are 3 elements in defining persistent postoperative opioid use: how to measure opioid use, timeframe to measure opioid use, and magnitude of opioid use required to trigger a diagnosis of persistent postoperative opioid use. With regard to the former, the working group noted that direct measurements of opioid consumption are labor intensive and expensive for researchers to measure and are also not readily available for most clinicians. By contrast, prescription data are easier for researchers and clinicians to obtain, and the use of prescription data as a proxy for actual drug consumption is a commonly used practice.⁶³ Therefore, the working group decided that any definition of persistent postoperative opioid use should be based on prescription data.

In terms of the timeframe to measure persistent postoperative opioid use, because some opioid use immediately after surgery is expected, the working group decided that the timeframe should start at a point when acute surgical pain should have resolved and end at a point that (1) provides enough time to evaluate an individual's opioid use over the long term, and (2) is practical for research purposes because patients can be lost to follow-up over longer periods of time. Overall, the working group decided that persistent postoperative opioid use should be measured during opioid use between postoperative days 90 and 365 for 2 reasons. First, this was a common period described for the assessment of persistent postoperative opioid use

Table 4. Perioperative Quality Initiative-4 Consensus Statement Regarding Persistent Postoperative Opioid Use

- #1 We recommend persistent postoperative opioid use in the opioid-naïve patient (no history of opioid use in the 90 d before surgery)⁵⁸ be defined as having used opioids for 60 d during postoperative days 90–365
- #2 For patients who use opioids before surgery,⁵⁸ we recommend persistent postoperative opioid use be defined as any increase in opioid use during postoperative days 90–365, relative to opioid use in the 90 d before surgery
- #3 We suggest providers use known risk factors to identify high-risk patients for persistent postoperative opioid use
- #4 Because persistent postoperative opioid use occurs in the setting of a patient's interaction with numerous health care providers and institutions, addressing system-based characteristics may be more determinative of persistent postoperative opioid use than clinical decision making. We strongly recommend the evaluation of public health initiatives, policies, and legislation at the local, state, and federal levels aimed at safe opioid prescribing with subsequent recommendation for further improvements that target all health care system components

for several of the studies we examined.^{3,9} Second, this timeframe corresponds to a period where acute surgical pain should have resolved.^{64–66}

Defining the level of opioid use during the timeframe required to trigger the diagnosis of persistent postoperative opioid use was also considered. Any choice of threshold incorporates a tradeoff between sensitivity and specificity: lower thresholds make a diagnosis more likely but also run the risk of including postsurgical patients who are incidentally using opioids for nonsurgical reasons. For example, in a large retrospective analysis of health care claims, Sun et al⁹ reported persistent postoperative opioid use rates <2% across numerous surgical groups using a threshold of having filled ≥10 prescriptions or >120 days' supply within 90 days to 1 year postoperatively. Conversely, Brummett et al³ reported rates of persistent postoperative opioid use of 5.9%–6.5% using a less restrictive definition of opioid prescription fulfillment between 90 and 180 days postoperatively. In addition, any threshold should be based on the level of opioid use before surgery because patients who use opioids preoperatively may be expected to have higher postoperative use than opioid-naïve patients. Based on the studies we reviewed, the working group suggested that in the case of opioid-naïve patients, persistent postoperative opioid use should be defined as having filled opioid prescriptions for at least a 60 days supply during postoperative days 90–365 (Table 4). For patients who used opioids before surgery, we suggest that persistent postoperative opioid use be defined as any increase in opioid use relative to baseline (Table 4).

Incidence of Risk Factors for Persistent Postoperative Opioid Use

Across surgeries in moderate quality studies, the incidence of persistent postoperative opioid use ranges from 0.6% to 26% for opioid-naïve patients and from 35% to 77% for patients with previous opioid exposure. These ranges take into account variations in the definition and measurement of persistent postoperative opioid use across the studies

in our review. The following patient characteristics were consistently identified as risk factors for persistent postoperative opioid use: preoperative opioid use, depression, substance use, tobacco use, sex, psychotropic drug prescription, and anxiety (Table 3). Indeed 1 strength of these associations is that they were robust across a wide array of definitions for each characteristic (eg, preoperative opioid use was not defined consistently across studies). However, few studies assessed the relative importance of these risk factors. In addition, no studies assessed whether modification of these risk factors was associated with a reduced risk of persistent postoperative opioid use, which is a promising area for further research.

We were unable to identify any specific surgeries that were identified with an increased risk of persistent postoperative opioid use. A few studies suggest that total knee arthroplasty, open thoracic, and lumbar fusion may be linked to higher rates of persistent postoperative opioid use within their own subclasses (ie, orthopedics, thoracic surgery, etc), but large-scale studies where important biopsychosocial variables are controlled for between surgical groups have not occurred.^{8,9} Of note, 1 study suggested that the incidence of persistent postoperative opioid use was fairly consistent across major and minor surgeries, suggesting that surgery characteristics may play a small role in determining the risk of persistent postoperative opioid use.³

Systems and Prescribing Characteristics Associated With Persistent Postoperative Opioid Use

Finally, we found only 1 study that examined the association between persistent postoperative opioid use and prescriber or health care system characteristics.⁶⁷ In this large database of commercially insured patients, the duration of the initial opioid prescription, not the total dosage of opioids prescribed, was associated with factors indicative of persistent postoperative opioid use, including opioid dependence, misuse, or overdose after surgery. This finding was stable across 7 different surgical types.

This paucity of studies is concerning because persistent postoperative opioid use likely represents the end result of numerous interactions between a patient and his or her health care team, such as the surgeon, anesthesiologist, and primary care provider. Moreover, there recently have been many efforts aimed at modifying prescriber behaviors and modifying health care systems, with the goal of reducing persistent postoperative opioid use, such as surgeon education,^{6,68} quality improvement initiatives,^{6,69–72} legislative initiatives to reduce opioid prescribing,^{73–76} and initiatives to limit coverage for opioids.⁷⁵ However, whether these efforts have succeeded in reducing persistent postoperative opioid use remains unknown. Overall, characterizing the prescriber and health care system characteristics remains an important area for further study.

Study Limitations

We recognize numerous limitations regarding the incidence of and risk factors for persistent postoperative

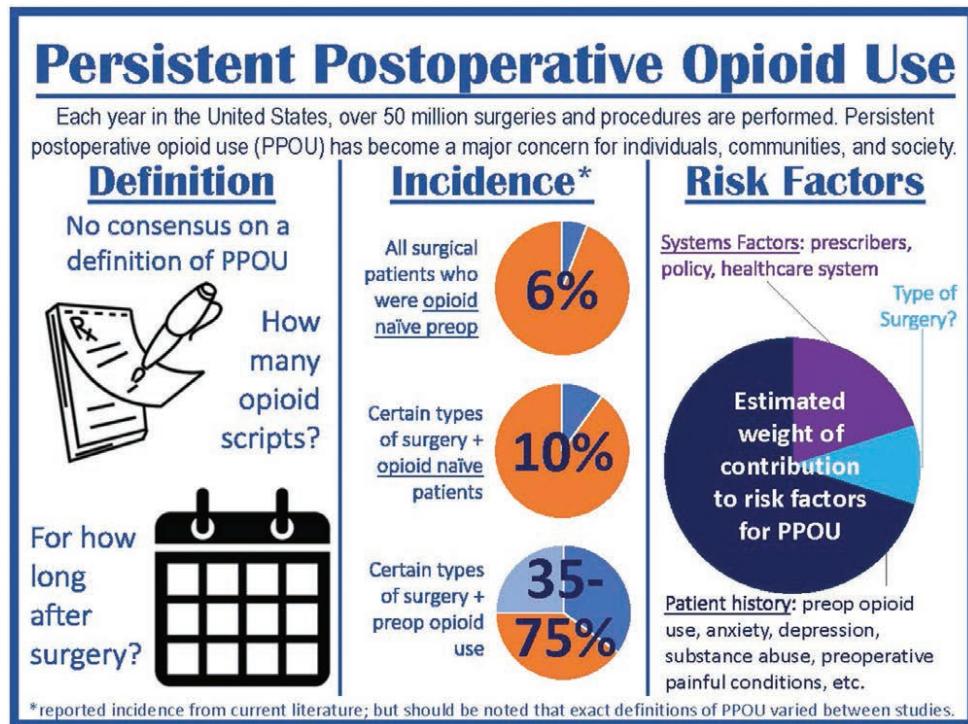


Figure 2. Summary of variables impacting the definition and incidence of persistent postoperative opioid use. Figure reused with the permission of the Perioperative Quality Initiative (POQI). For permission requests, contact info@poqi.org.

opioid use. One limit relates to the heterogeneous definition of persistent postoperative opioid use in studies, leading to variability in reported rates of persistent postoperative opioid use. Additionally, risk factors for persistent postoperative opioid use were often measured via different systems, whether by International Classification of Diseases diagnostic codes (depression, substance abuse, etc) or symptoms related to a particular condition (ie, anxiety symptoms as measured by the hospital depression and anxiety scale). Future studies that utilize consistent definitions of persistent postoperative opioid use and standardized outcomes that consider condition duration and severity will likely further specify persistent postoperative opioid use rates and risk factors. Our review is also limited by differing measures of opioid use or prescription. These measures were heterogeneously reported and represent different facets of persistent postoperative opioid use. Studies where opioid use was reported often described a link to the surgical insult, whereas opioid prescription filling cannot always be clearly linked to surgery. Future studies that focus on contributions of patient use versus opioid availability (ie, prescription) will provide additional clarity and possible strategies to curb persistent postoperative opioid use. Finally, we recognize that our focus on US and Canadian health care systems introduces bias because other international sites were not included. While this decision was made based on similar opioid-prescribing practices, future studies that stratify persistent postoperative opioid use by country, region, and health care models are needed.

CONCLUSIONS

In summary, our working group arrived at the following conclusions:

- For opioid-naïve patients, persistent postoperative opioid use should be defined as having filled a 60 days' supply of opioid during postoperative days 90–365. For patients who used opioids before surgery, persistent postoperative opioid use should be defined as any increase in opioid use above baseline during this time period.
- The incidence of persistent postoperative opioid use ranges from 0.6% to 26% for opioid-naïve patients and from 35% to 77% for patients with previous opioid exposure.
- Patient characteristics associated with an increased risk of persistent postoperative opioid use included preoperative opioid use, depression, substance use disorder, preoperative pain conditions, and smoking. Whether specific surgeries are associated with an increased risk of persistent postoperative opioid use remains unclear, and is the extent to which the risk of persistent postoperative opioid use has been affected by health care system characteristics and health policy.

As a result of its analysis, the working group provides several recommendations (Table 4; Figure 2) to the anesthesiology and medical communities. Each of these recommendations is rooted in the results of the literature review described earlier. By implementing these recommendations, the working group believes that physicians and other health care providers will be better positioned to find ways

of reducing the risk of persistent postoperative opioid use among patients undergoing surgery. ■

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