Opioid Use After Discharge in Postoperative Patients

A Systematic Review

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Background: Over the past 2 decades, there has been an increase in opioid use and subsequently, opioid deaths. The amount of opioid prescribed to surgical patients has also increased. The aim of this systematic review was to determine postdischarge opioid consumption in surgical patients compared with the amount of opioid prescribed. Secondary outcomes included adequacy of pain control and disposal methods for unused opioids.

Objective: The objective of this study is to characterize postdischarge opioid consumption and prescription patterns in surgical patients.

Methods: A systematic search in MEDLINE and EMBASE identified 11 patient survey studies reporting on postdischarge opioid use in 3525 surgical patients.

Results: The studies reported on a variety of surgical operations, including abdominal surgery, orthopedic procedures, tooth extraction, and dermatologic procedures. The majority of patients consumed 15 pills or less postdischarge. The proportion of used opioids ranged from 5.6% to 59.1%, with an outlier of 90.1% in pediatric spinal fusion patients. Measured pain scores of those taking opioids ranged between 2 and 5 out of 10 and the majority of patients were satisfied with their pain control. Seventy percent of patients kept the excess opioids. Where planned disposal methods were reported, between 4% and 59% of patients planned proper disposal.

Conclusion: This study suggests that surgical patients are using substantially less opioid than prescribed. There is a lack of awareness regarding proper disposal of leftover medication, leaving excess opioid that may be used inappropriately by the patient or others. Education for providers and clinical practice guidelines that provide guidance on prescription of outpatient of opioids are required.

Keywords: opioid use, postdischarge, surgical patients, systematic review

(*Ann Surg* 2017;xx:xxx–xxx)

In his 1995 presidential address to the American Pain Society, Dr. James Campbell introduced the notion of ''pain as the fifth vital sign.''[1] This marked a paradigm shift where the focus of medical care was broadened to prioritize pain control.[2] Although there have been great advances in pain management, the increasing use of opioid medication has had serious unintended consequences.[3,4] From the late 1990s to the late 2000s, there was a fourfold increase in the number of opioid overdose deaths in the United States, which paralleled a fourfold increase in sales of opioids.[5] Opioid misuse accounts for more overdose deaths than heroine and cocaine combined.[5] Moreover, unused opioids are often diverted for nonmedical use.[5,6] This has led to strong calls for action to address the opioid crisis from the American and Canadian governments.[7,8]

The amount of opioids prescribed to postoperative patients has similarly increased over time.[9] A Canadian population-based study examining opioid-naive elderly patients undergoing low-pain short-stay surgery found that 10% were long-term opioid users at 1 year.[10] Other Canadian studies have reported long-term opioid use in 0.4% to 3% of patients after major surgery.[11,12] Excess prescription of opioid medications to postoperative patients has negative effects by both contributing to long-term use and creating unused opioids for diversion. There remains significant variation in the quantity of opioid prescribed across providers.[13,14] The American College of Physicians has called for efforts to standardize opioid prescriptions.[15] Although a clinical practice guideline is needed to inform on true opioid requirements of surgical patients, we undertook this study to assess the current status of opioid prescription to surgical patients' postdischarge.

Thus, the objective of this systematic review is to characterize postdischarge opioid consumption and prescription patterns in surgical patients. Our primary goal is to determine the amount of opioid intake by surgical patients following discharge and compare this to the amount prescribed. Secondary outcomes include the adequacy of pain control and disposal methods for leftover opioids.

METHODS

We performed and report this review in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.[16]

We performed a systematic literature search in MEDLINE and EMBASE from inception to December 17, 2016, without language restriction, for any human clinical study quantifying use of opioids for postoperative patients after hospital discharge. We used MeSH descriptors that included ''pain, postoperative,'' and ''narcotics,'' ''analgesics, opioid,'' or ''opioid-related disorders'' combined with ''practice patterns, physicians,'' ''drug prescriptions,'' ''drug utilization,'' or ''drug utilization review.'' We also searched the references of relevant articles and Google Scholar to identify further studies. Two authors (A.E.F. and T.R.C.) independently screened the abstracts of the search results and independently assessed the remaining full-text articles for eligibility. Any discrepancies were resolved via discussion and consensus.

We included studies of any design that reported on the quantity of opioid medication taken by postoperative patients after hospital discharge. We excluded studies that reported only on inpatient opioid use.

Outcomes

Our primary outcome was the quantity of opioid medication used postdischarge. When the mean number of pills prescribed and

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The authors report no conflicts of interest.

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ISSN: 0003-4932/16/XXXX-0001
DOI: 10.1097/SLA.0000000000002591

taken were available, we calculated the percentage of used pills. Secondary outcomes included pain scores postdischarge, whether instructions were given for disposal of leftover opioid, and method of disposal used by patients.

Data Synthesis

Descriptive synthesis was used to summarize study characteristics and outcomes. Descriptive statistics are presented as mean and standard deviation where possible. All eligible studies were patient surveys with heterogeneous patient populations due to varying surgical procedures studied and variability in reporting on opioid medication use. Therefore, meta-analysis was not appropriate.

RESULTS

Systematic Search

The database search identified 2602 articles. After excluding duplicates, 2424 titles remained (Fig. 1). An additional 5 titles were added from gray literature and citation tracking, yielding a total of 2429 citations. After title and abstract review, 31 publications were selected for full text review. Twenty articles were further excluded (2 were abstracts and 18 did not report on the quantity of opioid used posthospital discharge). Eleven articles met the inclusion criteria for this systematic review.

Study Characteristics

There were 11 studies that included 3562 patients who received outpatient opioid prescriptions after elective surgery (Table 1).[17–27] All studies were from institutions in the United States (n = 10) and Canada (n = 1). All studies prospectively identified patients for participation and used surveys or logbooks to track opioid use. The overall weighted response rate was 77%. Individual response rates ranged from 29% to 96%. The number of patients in each study ranged from 50 to 1416 (median = 223). Eight studies reported on adult surgical patients, while 3 studies reported on pediatric surgical patients. Most studies included only outpatient surgical procedures, but 4 studies also included some inpatient procedures as well.[21,22,24,27] There was significant heterogeneity on the types of surgical interventions that were studied. Three studies included patients having orthopedic procedures, which included upper extremity hard and soft tissues procedures and spinal fusion for scoliosis,[18,26,27] 2 studies included patients having pediatric surgical procedures,[20,21] 1 study included patients having tooth extraction,[23] 2 study included patients having dermatologic procedures,[19] 1 study included patients having C-section or thoracic procedures,[22] 2 studies included patients having urologic or urogynecologic procedures,[17,24] and 1 study included patients having common outpatient general surgical procedures such as laparoscopic cholecystectomy, mastectomy, and inguinal hernia repair.[25] Four studies excluded patients with a prior history of chronic opioid use.[18,21,23,25] All study inclusion periods spanned approximately 1 year or less with data collected between 2009 and 2015.

Pain Scores

Three studies reported on patient satisfaction with pain control (Table 1).[17,18,24] Overall, between 86% and 100% of patients were satisfied with their pain control. Six studies reported on postoperative pain scores.[17–19,23,24,27] There was heterogeneity in the types of surgical procedures and the point in time when the pain scores were measured, ranging from postoperative day 1, the day of discharge, or at the time of the interview. However, the reported pain scores ranged from 2 to 5 out of 10.

Outpatient Use of Prescription Opioids

All 11 studies reported on the outpatient use of prescription opioids (Table 2). The majority of studies report the number of opioid

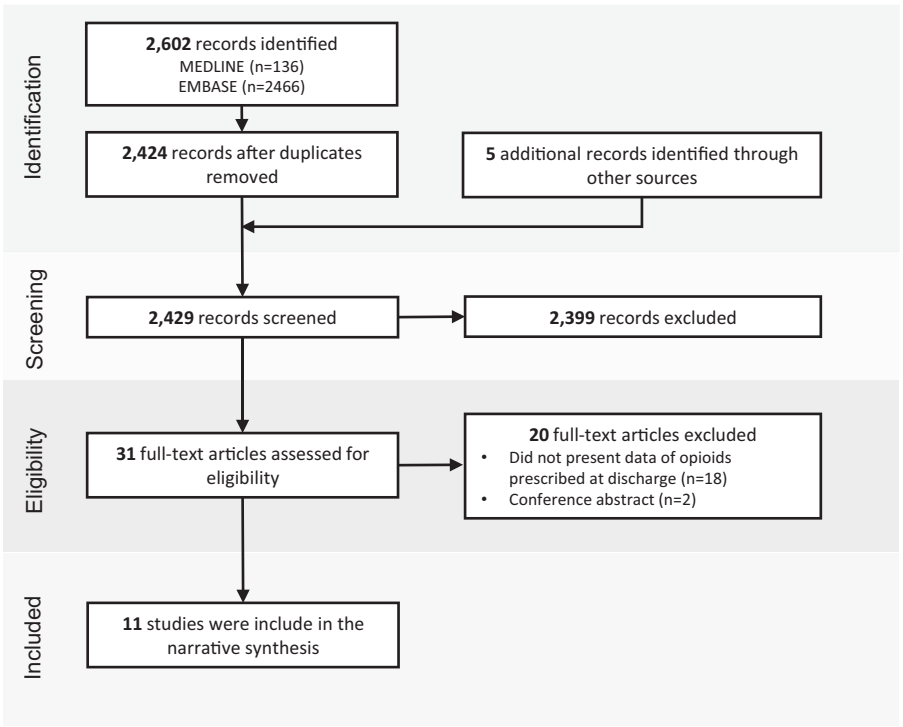

FIGURE 1. Article selection.

TABLE 1. Study Characteristics

Reference	Year	Location	Setting	Population	Procedures/Discipline	N	Study Period	Study Method	Response Rate	Pain Measures
Orthopedic and neurosurgical procedures										
Rodgers et al[18]	2012	USA	Private hospital	Adults	Orthopedics | Elective outpatient upper extremity surgery	287	February 2010–November 2010	Telephone survey	87%	N = 250 Satisfaction with pain control: 92% adequate Scores at interview (POD 7–14) (mean) 1.9/10 for soft tissue 2.4/10 for hard tissue
Kim et al[26]	2016	USA	Academic hospital	Adults	Orthopedics | Hand, wrist, elbow, forearm, or shoulder surgery	1416	April 2014–October 2014	Interview at first postoperative visit	96%	Not measured
Grant et al[27]	2016	USA	Academic hospital	Children	Spinal fusion for scoliosis	72	February 2014–May 2015	Electronic survey	85%	N = 61 Score on day of discharge (mean, SD) 4.2/10, 1.9
Thoracic and abdominal procedures										
Bartels et al[22]	2016	USA	Academic hospital	Adults	C-section	63	November 2014–November 2015	Electronic survey	26%	Not measured
					Thoracic surgery				31%	Not measured
Bates et al[17]	2011	USA	Academic hospitals, multicenter	Adults	Urologic procedures	275	March 2009–June 2009	Telephone survey or mail-out survey	47%	N = 237 Satisfaction with pain control:* 64% very satisfied 22% somewhat satisfied 6% neutral 5% somewhat dissatisfied 3% very dissatisfied
Abou-Karam et al[21]	2015	Canada	Academic hospital	Children	Pediatric day surgery and pediatric general surgery patients	243	January 2014–May 2014	Logbook and telephone survey	90%	Not measured
Swenson et al[24]	2016	USA	Academic hospital	Adults	Minimally invasive urogynecologic surgery for pelvic organ prolapse	50	May 2014–October 2014	Telephone survey	NR	N = 38 (patients who used ≤30 pills) Satisfaction with pain control: 0% poor 21.1% adequate 78.9% good Score on day of discharge (median, IQR) 2/10, 0–4
									NR	N = 12 (patients who used >30 pills) Satisfaction with pain control: 0% poor pain control 41.7% adequate 58.3% good Score on day of discharge (median, IQR) 3/10, 0–5
Hill et al[25]	2016	USA	Academic hospital	Adults	Common outpatient general surgery procedures	642	January 2015–December 2015	Telephone survey	38%	Not measured

TABLE 1. (*Continued*)

Reference	Year	Location	Setting	Population	Procedures/Discipline	N	Study Period	Study Method	Response Rate	Pain Measures
Miscellaneous minor procedures										
Voepel-Lewis et al[20]	2015	USA	Academic hospital	Children	Pediatric day surgery	223	March 2013–August 2013	Logbook	NR	Not measured
Maughan et al[23]	2016	USA	Academic hospital	Adults	Elective surgical extraction of impacted teeth	79	March 2015–September 2015	Text messaging surveys and telephone survey	90%	N = 67 (patients without dry socked) Pain score on POD1 (median, IQR) 5/10, 3–6
Harris et al[19]	2013	USA	Academic hospital	Adults	Dermatology	212	May 2011–June 2011	Telephone survey	87%	N = 212 Score at unspecified time (mean, SD) 3.5/10, 2.7

containing pills without detailing the specific medications. Two studies report their results using morphine milligram equivalents (MMEs).[22,23] One study standardized the number of pills so that 1 pill was equivalent to 5 mg of oxycodone.[25] For abdominal procedures, the majority of patients took less than 15 opioid pills.[17,24,25] For orthopedic procedures, the mean number of pills taken ranged from 9 to 22, with more opioid used in procedures that involved bone versus soft tissue.[18,26] Dermatologic and breast lumpectomy patients used very little opioid with most patients taking less than 5 pills.[19,25] Pediatric patients who underwent spinal fusion used much more opioid with a mean of 55 pills, albeit with a large standard deviation of 37 pills.[27]

The proportion of used opioids ranged from 10.9% to 58.1%, with an outlier of 90.1% in pediatric spinal fusion patients. Patients undergoing head and neck, minor abdominal, laparoscopic, or pediatric procedures reported smaller proportions of used opioids. Although patients undergoing urologic or orthopedic procedures reported using a larger proportion of their prescribed opioids, they still used less than half of the prescribed pills.

Grant et al[27] reported on pediatric patients who underwent posterior spinal fusion for scoliosis with higher opioid use of 90.1% of pills prescribed. Within their study, there was significant variation in use among the participants and this may be explained by the inclusion of patients with prior opioid use.

Disposal of Unused Opioids

Six studies reported on planned or actual methods of disposal for leftover opioids (Table 3).[17,19,21,23,25–27] The outcomes differed whether patients were polled on methods of disposal or on the future planned method of disposal. Where actual disposal methods were reported, at least 70% of patients kept excess opioids.[17,22,25] Where planned disposal methods were reported, between 4% and 59% of patients planned proper disposal.[19,21,23,27] Maughan et al[23] randomized patients to receiving either a controlled substance information sheet alone or an information sheet along with information on a pharmacy-based drug disposal program. They found that additional information on a pharmacy-based drug disposal program resulted in a 20% increase in planned proper disposal.

DISCUSSION

This systematic review identified 11 studies, including 3562 patients, describing outpatient opioid prescription and intake after elective surgery. The majority of patients consumed 15 opioid pills or less following discharge and the proportion of opioids prescribed and taken ranged from 11% to 90.1%. Few patients reported employing proper disposal methods for leftover opioids. Therefore, excessive opioid prescription to surgical patients might contribute to opioid misuse, opioid diversion, and further related consequences.

This systematic review provides data from a variety of different surgical procedures, which can be used to construct specific guidelines for a range of surgical procedures. Existing guidelines for management of postoperative pain are overly broad and do not advise on a suggested quantity of opioid medication.[28] Reported current common practice is to provide patients with thirty opioid containing pills.[18,20,23,25] This generous practice is likely motivated by the desire to avoid patients requiring refills. In light of the current opioid crises, it is necessary to reform this behavior. Moreover, appropriate prescription for patients avoids exposure to excess side effects of medication and increased cost of treatment. Stanek et al[29] employed an educational tool for hand surgeons that resulted in a 15% to 48% decrease in opioid prescription size without an increase in refills. In their study, a multimodal pain management plan was devised with faculty consensus. This plan was disseminated to the faculty,

TABLE 2. Opioid Prescription and Opioid Use

Reference	Year	Specific Procedure	N	Mean Opioid Prescription (Number of Pills)	Mean Opioid Use (Number of Pills	% Taken
Orthopedic and neurosurgical procedures						
Rodgers et al[18]	2012	Hard tissue: ORIF, arthroplasty, rotator cuff repair	58	30	14 (SD 11)	46.7
		Soft tissue: carpal tunnel, ganglion excision, trigger finger release, cubital tunnel release, arthroscopy	191	30	9 (SD 9)	30.0
Kim et al[26]	2016	Hand	586	Overall:	7.7	27.0
		Wrist	651	24	7.5	27.0
		Elbow or forearm	141	20*	11.1	35.0
		Upper arm or shoulder	23		22.0	56.6
Grant et al[27]	2016	Posterior spinal fusion for scoliosis	61	61 (SD 14)	55 (SD 37)	90.1%
Thoracic and abdominal procedures						
Bartels et al[22]	2016	Post C-section	30	268 (53 SD) MME	53% took none or very few	—
		Post thoracic surgery	33	795 (710 SD) MME	45% took none or very few	—
Bates et al[17]	2011	Major open urologic	213	28.6	16.214*	56.6
		Major laparoscopic urologic		23.2	13.312*	57.3
		Minor open urologic		22.2	10.38*	46.4
		Endoscopic urologic		21.7	12.610 *	58.1
Abou-Karam et al[21]	2015	Pediatric day surgery and general surgery patients	104 prescribed regular basis	Not reported	56% took regularly as prescribed	—
			77 prescribed as needed	18*	1*	—
Swenson et al[24]	2016	Minimally invasive urogynecologic surgery: vaginal hysterectomy, robotic-assisted laparoscopic supracervical hysterectomy, colpoclesis, sacrocolpopexy, sacrocervicopexy, Michigan 4-wall sacrospinous ligament suspension, uterosacral ligament suspension	50	40* (IQR 35–60)	13* (IQR 1–30)	—
Hill et al[25]	2016	Partial mastectomy	20	19.8 (SD 10.2)20*	5 (INTS80%)	15.0
		Partial mastectomy with SLNB	21	23.7 (SD 11.3)20*	10 (INTS80%)	25.0
		Laparoscopic cholecystectomy	48	35.2 (SD 16.9)30*	15 (INTS80%)	33.0
		Laparoscopic inguinal hernia repair	20	33.8 (SD 9)30*	15 (INTS80%)	15.0
		Open inguinal hernia repair	18	33.2 (SD 15.7)30*	15 (INTS80%)	31.0
Miscellaneous minor procedures						
Voepel-Lewis et al[20]	2015	Tonsillectomy	223	52.2	8.4	16.1
		Musculoskeletal		33.6	4.0	11.9
		Minor abdominal, genitourinary tract, or peripheral procedures		31.3	3.4	10.9
Maughan et al[23]	2016	Elective extraction of impacted teeth	72 total	140* MME	40* MME	—
			67 without dry socket	28 (SD 6)	13 (SD 10)	46.4
			5 with dry socket	36 (SD 11)	18 (SD 9)	50.0
Harris et al[19]	2013	Dermatologic surgery	72	8.9 (SD 2.7)	3.7 (SD 3.7)	41.5

INTS80% indicates ideal number of pills to satisfy approximately 80% of patients; IQR, interquartile range; MME, morphine milligram equivalents; N, number; SD, standard deviation.

*Median.

residents, and nursing staff. A laminated card was distributed as a memory aid. Our goal is to institute a wider intervention that would produce similar results in all surgical fields. In addition to educating prescribers and providing guidance specific to the patient's surgical procedure, efforts are required to administer less opioid in hospital. By using multimodal pain medications, there will be less opioid required at the time of discharge. An alternative strategy to limit the amount of opioids prescribed at discharge could be via legislation. The Massachusetts STEP Act aims to do this by mandating that in most cases, opioid prescriptions must be limited to a 7-day supply.[30] Patients are encouraged to fill less than the prescribed amount, a pain management agreement is required for any prescription for long-acting opioids, and prescribers are required to review the patient's condition and risk history.

In addition to identifying that most patients are prescribed too much opioid, leading to possible harm to patients, this review is timely because of the concern around the increasing frequency of deaths attributed to opioid overdose. Furthermore, excess opioids are often diverted for use by others. This review identified that knowledge and compliance with proper disposal for leftover opioids is an area that

TABLE 3. Instructions and Disposal Methods for Unused Opioids

Reference	Year	Instructions for Unused Opioids	Disposal Methods for Unused Opioids
Bates et al[17]	2011	N = 231 92.2% no instruction 7.8% given instruction	N = 164 90.8% kept excess 6.1% threw in trash 2.4% flushed in toilet 0.6% returned to pharmacy
Rodgers et al[18]	2012	No information	No information
Harris et al[19]	2013	No information	N = 49 *Planned 53% keep 29% unsure 14% improper disposal 4% proper disposal
Voepel-Lewis et al[20]	2015	No information	No information
Abou-Karam et al[21]	2015	No information	N = 172 *Planned 55% return to pharmacy 27% throw in trash 9% keep 9% unsure
Bartels et al[22]	2016	No information	N = 30 (C-section) 77% unlocked storage for leftover
		No information	N = 33 (thoracic surgery) 73% unlocked storage for leftover
Maughan et al[23]	2016	N = 27 Received controlled substance info sheet	30% disposed or intended to dispose
		N = 31 Received controlled substance info sheet and information on pharmacy-based drug disposal program	52% disposed or intended to dispose
Swenson et al[24]	2016	No information	No information
Hill et al[25]	2016	No information	N = 127 74% kept or did not recall disposal method 14% threw in trash 9% proper disposal 3% mixed with coffee grounds or kitty litter threw in trash
Kim et al[26]	2016	N = 1415 5.3% given instruction	No information
Grant et al[27]	2016		N = 61 *Planned 59% proper disposal 8% improper disposal 33% keep

*Means 'planned' disposal method.

should be targeted for inclusion in an educational intervention. Most often patients keep unused medications at home, without the realization that this is a common source of opioid misuse in adolescents.[31] There is a lack of awareness regarding what constitutes appropriate disposal. The US Food and Drug Administration (FDA) endorses returning unused medications to authorized collection facilities such as pharmacies, or where collection facilities are not available, medication can be mixed with dirt or kitty litter, sealed in a plastic bag and disposed with the trash.[32] Opioids are considered to be particularly harmful if accidentally ingested, so flushing them down the toilet is recommended if proper disposal methods are not readily available.[32] National prescription drug take-back days are held periodically in both Canada and the United States to help raise awareness and increase compliance.[33,34] Providing patients with information about the harm of keeping leftover opioids at home and instructions regarding proper disposal should be an essential part of safe discharge from hospital. Maughan et al[23] demonstrated that a similar intervention increased proper disposal by about 50%. Establishment of pharmacy "buy back" programs incentivize return of unused opioids and are likely cost-effective given the society cost of the opioid crises.

This work has several limitations. Surveys are the most feasible method for tracking the amount of pain medication taken postdischarge, but this study design is subject to recall bias. In addition, patients may have underestimated the amount of pain medication that was taken, given the negative perceptions of opioid use. On the contrary, a generous prescription may have encouraged patients to consume more medication than they needed. It is conceivable that if more conservative opioid prescriptions were given, patients may have adequately controlled pain with multimodal additions of nonopioid medications such as acetaminophen or nonsteroidal anti-inflammatory drugs. The included studies did not measure the prescription of these adjuncts, which would contribute to opioid sparing. Several of the studies do report that a majority of the patients used either acetaminophen or Non steroidal anti inflammatory drugs in combination with the prescribed opioids.[17–19,21,23,24] Second, only 2 studies presented their results in MMEs, and in 1 study, pills were standardized so that 1 pill was 5 mg oxycodone, which would enable conversion to MME. However, in the remaining studies, results were shown using the number of pills. Patients were prescribed a variety of opioid medication so

conversion of the results to MME was not possible. Third, the majority of these studies reported on outpatient surgical procedures, but some also included inpatient procedures. It is difficult to draw conclusions from the prescriptions given to inpatients on discharge, without information relating to their postoperative course and length of stay. A further limitation is that these results cannot be generalized to all surgical patients. Four of the studies focused on opioid-naive patients, and the remaining studies did not account for pre-existing opioid use or the presence of conditions that are risk factors for increased opioid use. Patients with preexisting chronic opioid use may experience postoperative pain differently and require individualized treatment. Ideally, these patients should be followed by a specialized pain clinic. As well, establishment of a transitional pain service could identify patients who are high risk for chronic postsurgical pain and create a tailored approach to optimize their care.[35,36]

In conclusion, this systematic review provides evidence that surgical patients are using substantially less opioid than prescribed. There appears to be a lack of awareness regarding proper disposal of leftover medication, leaving excess opioid that may contribute to the opioid crisis. Strategies are needed to educate prescribers and create clinical practice guidelines that will help standardize outpatient prescriptions. This should include addressing patient expectations surrounding pain management combined with information regarding the risks of opioid use and instructions for disposal.

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