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Surgical Patient Compliance With Healthcare Facility–Provided In-home Opioid Disposal Products: A Systematic Review

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OBJECTIVE: The aim of this study was to review the literature regarding the use of an in-home opioid disposal product on unused opioids after surgery.
BACKGROUND: The opioid epidemic in the United States is a major cause of concern for healthcare facilities. The misuse and diversion of retained opioids after a surgical procedure continues to contribute to this problem.
METHODS: A comprehensive search of the Cumulative Index of Nursing and Allied Health Literature, OVID, and PubMed databases with keywords including *opioid*, *analgesics*, *narcotics*, *medical waste disposal*, *medical disposal*, *refuse disposal*, and *opioid disposal* resulted in 286 articles. Articles were screened based on strict inclusion and exclusion criteria.
RESULTS: Eight studies determined that an in-home opioid disposal product provided by a healthcare facility produced rates of opioid disposal between 19% and 71%.
CONCLUSIONS: The provision of an in-home opioid disposal product by a healthcare facility is likely to increase the disposal of unused opioid medications in the postoperative surgical patient population.

The opioid epidemic in the United States is a major concern for healthcare facilities involved in the perioperative care of surgical patients. Although opioids effectively manage surgical pain, the misuse of opioids, defined as taking medication for a purpose other than prescribed, can lead to opioid abuse, addiction, and life-threatening overdoses.[1] A 2017 systematic review evaluating prescription opioid use after 7 common surgeries revealed that 67% to 92% of patients had leftover opioids.[1] These medications are the primary source of misuse and diversion for nonmedical use.[2] Most individuals who have misused opioids obtained them from family members or friends who had leftover prescription opioids in medicine cabinets.[3] Excess opioids remaining after surgical procedures circulating in communities contribute to the opioid epidemic.

Deaths from drug overdoses in the United States have increased across gender, race, and age.[4] On average, 130 Americans die of opioid overdoses daily.[4] Of the 71,000 drug overdose deaths in 2019, more than 70% involved an opioid.[5] From 1999 to 2019, approximately 247,000 people died of overdoses involving prescription opioids, causing a quadrupling of overdose deaths from prescription opioids during this time period.[6]

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In response to the opioid epidemic, strategies developed to prevent opioid misuse and diversion include legislation and education of prescribers aimed toward restricting the number of opioids prescribed.[7] A 2018 systematic review evaluating postoperative opioid use revealed that surgical patients use substantially fewer opioids than prescribed and are not aware of proper disposal of these drugs.[8] Protective measures focusing on safe and timely opioid disposal to reduce leftover medications are essential. Prescribing and disposal strategies allow for the reduction in opioids that enter and are retained in communities.

Food and Drug Administration (FDA)–approved methods for opioid disposal are included in Table 1.[9] Unfortunately, FDA-recommended disposal methods capture a small portion of leftover opioid medications in communities.[3] For example, only 9% of patients with leftover opioids after surgery reported disposing of their medications as recommended by the FDA.[1] In Kentucky, an evaluation of the Kentucky All Schedule Prescription Electronic Reporting system reported opioid take-back events and permanent drug donation boxes accounted for the return of 0.3% of dispensed opioids suggesting unused opioids remain in communities for misuse and diversion.[3]

Commercially available in-home drug disposal products designed to provide a safe and convenient alternative to the suggested FDA-approved methods have emerged. Products, such as DisposeRX (SDC 1, http://links.lww.com/JONA/A848) and Deterra (SDC 2, http://links.lww.com/JONA/A849), contain compounds that, when mixed with water and pills, irreversibly bind to the opioid, deactivating the medications, thereby enabling disposal in the garbage without the possibility of retrieval.[10] Major pharmacy retailers now provide in-home opioid disposal products at reduced or no cost to patients in an effort to make an impact on the opioid epidemic.[11,12] The objective of this systematic review is to appraise the findings of current studies that address the use of in-home opioid disposal products designed to reduce opioid misuse and diversion.

Table 1. *US FDA-Recommended Disposal of Unused Medications*[9]

Safe-medication Disposal Methods
1. Biannual Drug Take-back Events
2. Drop-off Boxes: Participating Pharmacies and Local Law Enforcement
3. Flushing the medication down the toilet: Check the FDA flush list
4. Household Trash Disposal: Seal medications in a bag after mixing with an unappealing substance such as dirt, cat litter, or coffee grounds

Methods

Search Strategy

This systematic review focuses on the specific area of in-home disposal of unused opioids after surgery utilizing a healthcare facility-provided disposal product. This review addressed the following question: does the provision of a standardized, in-home opioid disposal product provided by a healthcare facility, lead to increased disposal of opioids among surgical patients who leave the hospital with a prescription for opioids.

This systematic review was guided by the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) checklist.[13] The search was limited to peer-reviewed manuscripts published in English between 2010 and 2020. The electronic databases utilized include the Cumulative Index of Nursing and Allied Health Literature, OVID, and PubMed. A description of search terms and filters applied in each electronic database search is provided in SDC 3, http://links.lww.com/JONA/A850.

Results

Study Selection and Screening Method

After the literature search, a total of 286 studies were identified. The title and abstracts of these articles were manually screened by 2 investigators utilizing predetermined inclusion and exclusion criteria (SDC 4, http://links.lww.com/JONA/A851). Eight studies were included in this systematic review, 3 randomized control trials, 3 quasi-experimental studies, and 2 quality improvement projects. A PRISMA flow diagram provides a visual representation of the systematic review screening process (SDC 5, http://links.lww.com/JONA/A852). The Johns Hopkins' Research Evidence Appraisal Tool was utilized to appraise the levels of evidence.[14] An evidence table was created to critique and summarize each article (Table 2).

Study Characteristics

The 8 studies identified for review reported on surgical patients who were prescribed opioids at discharge and were given an in-home opioid disposal product (N = 2,799) to dispose of unused opioids.[2,10,15-20] The number of patients in each study ranged from 119 to 571. In addition to the in-home disposal product, patients received written directions on product use.[2,10,15-20] Additional education was provided to patients regarding safe use, storage, and importance of opioid disposal in 6 studies.[10,15-17,19,20] Four studies reported on pediatric surgical patients,[10,15,16,19] with the remainder of the studies reporting on the adult surgical patient population.[2,17,18,20] Of the studies

Table 2. *In-home Opioid Disposal Products Evidence Table*

Authors (Year) and Level of Evidence	Study Design and Setting	Sample Size	Timing of Education	Intervention and Disposal Rates	Findings
Lawrence et al[10] (2019) Level I, quality A[a]	RCT Outpatient	n = 202	Preoperative	Standard education[b] = 56% Standard education[b] and drug disposal bag (Deterra bag) = 71%	Compared with the standard education[b] group, a higher percentage of families who received a drug disposal bag reported proper disposal (66/92 [71.7%] vs 50/89 [56. 2%]; difference in proportions, 15.5%; 95% CI, 1.7%-29.3%, *P* = .03).
Voepel-Lewis et al[15] (2020) Level I, quality A[a]	RCT Outpatient	n = 517	Preoperative	Control—no disposal or routine information = 19.2% Nudge[c]—disposal Ziploc with coffee grounds = 33% STOMP[d]—web based education and Nudge[c] = 38.5%	Prompt disposal was highest for the STOMP[d] and Nudge[c] group (38.5%), Nudge[c] alone (33.3%), or STOMP[d] alone (31%) compared with the control group (19.2%; OR, 2.64; 95% CI, 1.46-4.80).
Brummett et al[2] (2019) Level I, quality B[a]	RCT Outpatient	n = 396	Postoperative	Usual care[e] = 28% Education pamphlet = 33% Education and activated charcoal bag = 57%	The odds of opioid disposal were 3.8 (95% CI, 1.7-8.5) times higher among patients in the activated charcoal bag group compared with those in the usual care group.
Adler et al[16] (2020) Level II, quality C[a]	Quasi-experimental Outpatient	n = 331	Preoperative	Disposal education and mail-back envelope = 19.3%	Mail-back envelope given to patients (n = 331), usage (n = 64; 19.3%).
Stokes et al[17] (2020) Level II, Quality C[a]	Quasi-Experimental Inpatient	n = 571	Postoperative	Education handout and disposal kit = 54.9%	Patients who were provided with an opioid waste management disposal kit were more likely to dispose of leftover opioids (54.9% vs 34.8%, relative risk, 1.8; 95% CI, 1.3-2.5).
Ramel et al[18] (2020) Level II, Quality C[a]	Quasi-experimental Inpatient	n = 200	Postoperative	Education sheet and drug deactivation system = 27.4%	Patients reported leftover opioids (n = 106), reported disposal (n = 29; 27.4%).
Zhang et al[19] (2021) Level V, quality B[a]	Quality improvement Outpatient	n = 463	Preoperative	Educational flyer and DisposeRx = 71%	DisposeRX given to patients (n = 463), usage (n = 328; 71%).
Hite et al[20] (2020) Level V, quality B[a]	Quality improvement Inpatient	n = 119	Preoperative	Education handout and charcoal bag = 37%	70% of patients were given a charcoal bag; 37% utilized the bag for opioid disposal.

Abbreviations: CI, confidence interval; OR, odds ratio; RCT, randomized controlled trial.
[a]The Johns Hopkins Research Evidence Appraisal Tool was utilized to critically appraise the evidence; 3 grades are available for the reviewer: high, good, and low or major flaw.
[b]Standard education was provided by the care team, which included a handout describing proper opioid use, storage, and disposal, along with a video containing the same information.
[c]Nudge is a cost-efficient disposal kit (Ziploc bag with coffee grounds) with illustrated instructions on how to dispose of unused opioids.
[d]STOMP is an interactive Web-based education program in which parents make intentional analgesic use and handling decisions related to opioids.
[e]Usual care participants received no education or an in-home opioid disposal product.

reporting on pediatric patients, parents and/or adult caregivers received the educational information and were responsible for home opioid disposal.[10,15,16,19] Most of the studies focused on outpatient surgical procedures,[2,10,15,16,19] although 3 included inpatient procedures.[17,18,20] Heterogeneity existed in the type

of surgical procedures performed (SDC 6, http://links.lww.com/JONA/A853). All studies were conducted at academic medical centers within the United States.[2,10,15-20] The timing of follow-up to assess opioid disposal varied from 1 to 6 weeks.[2,10,15-20]

Findings

Opioid disposal rates varied among the 8 studies reviewed. The reported range of opioid disposal in the studies was 19% to 71%.[2,10,15-20] Of the studies reporting leftover prescription opioids, 38% to 96% of participants had pills available for disposal.[10,15-20] Across studies, 1,508 patients received an in-home opioid disposal product, and 44% utilized the product to dispose of leftover opioids.[2,10,15-20]

A variety of in-home opioid disposal products were provided to patients (SDC 7, http://links.lww.com/JONA/A854). Findings from studies that examined the use of the Deterra bag, DisposeRX, Ziploc bag with coffee grounds, and the Opioid Waste Management Disposal Kit revealed the best disposal rates, ranging from 27% to 71%.[2,10,15,17-20] Use of the mail-back envelope produced the lowest rate of opioid disposal, 19.3%.[16]

Opioid disposal rates in the studies differed based upon the type of educational approach and the timing of delivery. With detailed instruction, compliance rates for disposal products increased. Handouts and 1-on-1 communication were included in 6 studies.[10,15-17,19,20] A web-based intervention was included in 1 study,[15] with disposal rates ranging from 19% to 71%. In 2 studies, when education regarding only how to use the opioid disposal product was given, disposal rates ranged from 27% to 57%.[2,18] The timing of education regarding opioid disposal varied between the day of surgery and discharge. Preoperative education led to disposal rates that ranged from 19% to 71%,[10,15,16,19,20] with postoperative education disposal rates reported as 27% to 57%.[2,17,18] Important reasons patients did not dispose of opioids were reported as barriers to disposal in 4 studies (SDC 8, http://links.lww.com/JONA/A855).[10,15,18,20] The barrier "plans to keep for future use" was the highest one reported, with percentages ranging from 15% to 77%.[15,18,20]

Discussion

Improving disposal rates of leftover opioids after surgery seems to be an achievable goal for healthcare facilities concerned about the opioid epidemic. A high percentage of patients (38%-96%) in the studies had leftover opioids after the resolution of their surgical pain.[10,15-20] Findings from this review suggest that providing an in-home opioid disposal product and education leads patients to dispose of unused opioids. Research has reported baseline rates of opioid disposal as low as 5% to 26% when neither the provision of education nor an in-home opioid disposal product was provided.[2,21-23] Of the 8 studies reviewed, 6 reported disposal rates above the baseline (33%-71%).[2,10,15,17,19,20] Two studies revealed findings of 27% or lower.[16,18] Possible explanations for the low rate (19.3%) in 1 study include requiring participants to dispose of their unused opioids via a Drug Enforcement Agency–registered mail-back program.[16] Preoperative counseling and written instructions were provided; however, follow-up with a healthcare provider other than an email reminder 2 weeks after surgery was missing.[16] Not returning unused opioids 30 days after surgery was considered a negative return, although patients may have still needed pain relief or may have used other disposal methods.[16] In another study, the low rate of disposal (27.4%) was attributed to participants (68%) wanting to keep leftover medications for future use.[18]

A high disposal rate was reported in a study within the pediatric population.[19] The effect of written education, providing an in-home disposal product preoperatively by an anesthesiologist, and a postoperative visit with the provider 1 to 4 weeks after surgery was tested. The postoperative visit focused on topics related to pain, opioid use, and disposal. If leftover opioids had not been disposed, patients received a phone call 2 weeks later to assess disposal. Results indicated that 71% of participants in this study disposed of their opioids. Seventy-eight percent of patients reported disposal before their 1st postoperative appointment, with an additional 22% disposing before the follow-up call. This study highlights the need for a systematic process that includes providing in-home opioid disposal products and education provided by a healthcare team member preoperatively and postoperatively, along with disposal reminders.

The positive effect on disposal rates when an in-home product is provided is demonstrated in the studies utilizing the Deterra bag, DisposeRX, Ziploc bag with coffee grounds, and the Opioid Waste Management Disposal Kit, which demonstrated the highest disposal rates in the review (27%-71%).[2,10,15,17-20] Brummett et al[2] reported that compared with patients who did not receive disposal information or an in-home disposal product, the odds of opioid disposal were 3.8 (95% confidence interval, 1.7-8.5) times higher in surgical patients provided with an in-home opioid disposal product. When patients are provided an in-home disposal product, a high percentage (82%) are likely to use the product over other FDA-approved disposal methods.[17] Voepel-Lewis et al[15] discussed the provision of an in-home disposal product as a type of "nudge" strategy to increase disposal rates because it minimizes the steps involved with opioid disposal

and creates the perception that opioid disposal is expected behavior in society. Multiple studies described in-home opioid disposal products as a simple, convenient, and low-cost option to reduce leftover opioids available for misuse and diversion.[2,10,15] Finally, only 1 study reported on patient satisfaction with the in-home opioid disposal product, with survey results indicating that 95% of patients were very satisfied with the disposal process.[18]

One common limitation of providing an in-home opioid disposal product to patients prescribed opioids is cost. The cost of the commercially available products is reported in 4 studies and ranges from $1.50 to $7.00 per patient.[2,10,18,19] An alternative to commercially available products is to provide patients a cost-effective, FDA-approved disposal method made up of a Ziploc bag with coffee grounds, although this disposal method does not deactivate the opioid, leaving the potential for misuse and diversion. Lawrence et al[10] discussed that patients might not be willing to pay for in-home opioid disposal products, but to see large-scale implementation, the products would need to be provided at no cost.

Stokes et al[17] suggested that patients with leftover opioids would be willing to dispose if facilitated by providers and healthcare systems. To help facilitate and address the cost of commercially available in-home opioid disposal products, healthcare facilities could utilize savings from the 340B Drug Pricing Program. This program allows qualified hospitals serving large numbers of low-income and vulnerable patients to recognize savings through discounts on outpatient drugs from drug manufacturers.[24] The qualifying facilities can use the savings to serve more patients and offer comprehensive services by addressing unmet needs in their community. The 340B program allows hospitals to address the opioid epidemic by increasing access to naloxone, medication-assisted treatment options, and prescription drug take-back programs to include in-home opioid disposal products.[25] A 340B hospital community benefit analysis determined that in 2016, participating hospitals reinvested more than $56 billion in total benefits to their communities.[26] Utilizing savings from the 340B Drug Pricing Program to pay for the in-home opioid disposal product could provide an alternative way for healthcare facilities to improve the health of their communities and make an impact on the opioid epidemic.

Barriers to opioid disposal after surgery discovered in this review provide important information influencing the development of patient education interventions. Many participants in 3 studies wanted to keep their opioids in case they would need them in the future.[15,18,20] This finding suggests that proper long-term storage of opioids needs to be addressed in educational materials given to patients and in person-to-person presentations. Many participants in the studies reported future plans to dispose of leftover opioids.[10,18,20] The addition of postoperative follow-up phone calls or messages via email or text messaging with patients can improve opioid disposal rates by assessing the success of future disposal efforts.[19]

Recommendations for Hospital Administrators

Hospital administrators can establish effective opioid disposal programs, thereby creating a culture of safe opioid use, storage, and disposal within a healthcare facility. Educating patients regarding the safe use of opioids, appropriate long-term storage, and timely disposal throughout the perioperative period, beginning in the surgeon's office, then reinforcing the message during preadmission testing, on the day of surgery, and at discharge, can minimize potential problems. Providing a disposal product in addition to education increases the likelihood that patients will dispose of their unused drugs. One of the studies in this review noted a significantly lower rate of filled opioid prescriptions among participants who received an in-home opioid disposal product.[10] The authors suggest that this finding may indicate that providing a drug disposal product to patients emphasizes the danger of opioid use.[10] Incorporating these practice enhancements will provide needed education for patients with the in-home disposal product serving as a physical reminder to dispose of opioids once their surgical pain has resolved. As leaders in healthcare facilities, administrators must support efforts to reduce the impact of the opioid epidemic in their communities. Healthcare facility recommendations for opioid disposal should be inclusive of the following components and developed based upon the facility's resources:

1. A disposal product for patients to dispose of unused postoperative opioids such as a Deterra bag, a DisposeRX pouch, an Opioid Waste Management Disposal Kit, or a Ziploc bag with coffee grounds with every filled opioid prescription (level I, II, V; quality A, B, C)[2,10,15,17-20]
2. Written or web-based education on safe use, storage, and how to dispose of unused opioids (level I, II V; quality A, B, C)[10,15-17,19,20]
3. A 1-on-1 consultation with a healthcare provider preoperatively about what to do with unused opioids postoperatively, specifically addressing opioid disposal (level I, II, V; quality A, B, C)[10,15,16,19,20]
4. A postoperative follow-up plan, implemented by a healthcare provider at a follow-up appointment to address unused opioid disposal (level V; quality B)[19]

Recommendations for Future Research

Future research should focus on patients' plans to retain their opioids. Interviewing patients preoperatively to better understand their plans to retain opioids after surgery could decrease misuse and diversion. Given this type of information, interventions could be designed to assist patients to effectively store and/or dispose of their opioids.

Limitations of Studies Reviewed

The literature search on this topic revealed studies published between 2019 and 2021 with data collection periods between 2017 and 2019. Methodology varied among studies regarding approaches to data collection. In-person contact,[17,20] email,[15] emails and/or phone calls,[2,10] and phone calls only were used.[18] In addition to variation in data collection methods, survey completion timing may have influenced results. Timing varied between 1 and 6 weeks. Two of the studies required patients to complete the survey at the immediate postoperative follow-up visit with the surgeon.[17,20] These patients may have still required their opioids and therefore did not report disposal.

Conclusion

Findings suggest that healthcare facilities could diminish misuse of opioids by providing in-home opioid disposal products to patients undergoing surgery. Combining education and an in-home opioid disposal product perioperatively increases the likelihood of patients disposing their unused drugs and potentially reduces opioids in the community. Nurse leaders have an opportunity to collaborate with hospital-based caregivers in an effort to address the opioid problem in the United States. Evidence suggests that providing opioid disposal products and educating patients regarding their use can diminish leftover opioids. Although the best timing for education, as well as the type of information provided, remains unclear, findings from this review clearly support the use of a disposal product.

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