

# Optimizing opioid prescriptions after laparoscopic appendectomy and cholecystectomy

Adina E. Feinberg, MD  
 Sergio A. Acuna, MD, PhD  
 David Smith, MD  
 Brian Kashin, MD  
 Aaron Mocon, MD  
 Brian Yau, MD  
 Jenny Chiu, PharmD  
 Sanjho Srikandarajah, MD

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## Correspondence to:

A.E. Feinberg  
 Department of Surgery  
 University of Toronto  
 30 Bond Street  
 Toronto, ON M5B 1W8  
 adifeinberg@gmail.com

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**Background:** There has been an increase in opioid usage and opioid-related deaths. Opioids prescribed to surgical patients have similarly increased. The aim of this study was to assess opioid consumption in patients undergoing laparoscopic appendectomy (LA) and laparoscopic cholecystectomy (LC) and to determine whether a standardized prescription could affect opioid consumption without affecting patient satisfaction.

**Methods:** Patients undergoing LA or LC were recruited prospectively during 2 time periods (April to June 2017 and November 2017 to January 2018). In the first phase, surgeons continued their usual postoperative analgesia prescribing patterns. In the second phase, a standardized prescription was implemented. Patients were contacted by telephone and a questionnaire was completed for both phases of the study. The primary outcome was the quantity of opioids prescribed and consumed.

**Results:** In the first phase, 166 patients who underwent LC or LA were recruited. The median number of prescribed opioid tablets was 20 and the median number consumed was 2. Ninety-five percent of patients reported satisfaction with their analgesia. Based on these results, a standardized prescription for multimodal analgesia was implemented for the second phase, consisting of 10 opioid tablets. In the second phase, 129 patients who underwent LA or LC were recruited. There was a significant decrease in the median number of opioid pills filled (10) and consumed (0), with no difference in reported satisfaction with analgesia.

**Conclusion:** Patients are prescribed an excess of opioids after LA or LC. Implementation of a standardized prescription based on a quality improvement intervention was effective at decreasing the number of opioids prescribed and consumed.

**Contexte :** On a observé une augmentation de la consommation d'opioïdes, ainsi qu'une hausse des décès associés à ces substances. On a aussi constaté une augmentation semblable dans la prescription d'opioïdes aux patients ayant subi une chirurgie. La présente étude visait à évaluer la consommation d'opioïdes chez les personnes ayant subi une appendicectomie par laparoscopie (AL) ou une cholécystectomie par laparoscopie (CL), de même qu'à déterminer si une ordonnance normalisée pouvait modifier la consommation d'opioïdes sans nuire à la satisfaction des patients.

**Méthodes :** Des patients devant subir une AL ou une CL ont été recrutés de façon prospective entre avril et juin 2017 et entre novembre 2017 et janvier 2018. Durant la première phase de l'étude, les chirurgiens ont maintenu leurs habitudes de prescription d'analgésie postopératoire. Durant la deuxième phase, toutefois, ils devaient avoir recours à une ordonnance normalisée. Dans les 2 phases de l'étude, les patients ont été joints par téléphone et un questionnaire a été rempli. Le principal résultat à l'étude était la quantité d'opioïdes prescrits et consommés.

**Résultats :** Pour la première phase de l'étude, 166 patients ont été recrutés. Les nombres médians de comprimés prescrits et consommés étaient de 20 et de 2, respectivement. De tous les patients, 95 % se sont dits satisfaits de leur analgésie. Pour la deuxième phase, une ordonnance normalisée d'analgésie multimodale, qui comptait 10 comprimés, a été mise en place, et 129 patients ont été recrutés. On a alors observé une diminution significative du nombre médian de comprimés remis (10) et consommés (0), et aucune différence quant au degré de satisfaction déclaré.

**Conclusion :** Les patients se voient prescrire trop d'opioïdes après une AL ou une CL. La création d'une ordonnance normalisée dans le cadre d'une intervention d'amélioration de la qualité a réduit efficacement le nombre de comprimés d'opioïdes prescrits et consommés.

The use of opioids to manage pain has increased substantially since the 1990s, with some serious unintended consequences.<sup>1,2</sup> The increase in opioid pharmaceutical sales has been followed by a parallel increase in opioid-related deaths.<sup>3,4</sup> In Canada, Ontario is the province with the highest rate of opioid dispensing.<sup>5</sup> The number of opioids prescribed to postoperative patients has similarly increased over time.<sup>6</sup> A Canadian population-based study examining opioid-naïve elderly patients who underwent low-pain short-stay surgery found that 10% were long-term opioid users at 1 year postsurgery.<sup>7</sup> Other Canadian studies have reported long-term opioid use in 0.4%–3.0% of patients after major surgery.<sup>8,9</sup> Moreover, the risk of opioids extends beyond the individual who received the original prescription, as opioids may be misused or diverted to others.<sup>3,10</sup> The presence of opioids in a household is known to put children at risk.<sup>11</sup> According to the 2017 Centre for Addiction and Mental Health Ontario Student Drug Use and Health Survey, 11% of high school students report non-medical use of opioids; 55% of the time the opioids were obtained from home.<sup>12</sup> Younger adults are at high risk for opioid-related death, with 1 in 8 deaths among people aged 25–34 being opioid-related.<sup>13</sup> Excessive prescribing of opioid medications to postoperative patients therefore has negative effects by contributing to both long-term patient use and mishandling of unused opioids. Addressing the opioid epidemic is complex and requires multiple strategies, but an important component is more judicious prescribing by physicians.

A recent Canadian guideline on the use of opioid therapy for chronic pain emphasizes harm reduction and proposes limiting opioid prescription.<sup>14</sup> However, at the time this study was initiated, there were no clear guidelines advising on appropriate prescribing after specific surgical procedures. There are currently guidelines available from the Michigan Opioid Prescribing Engagement Network and a Canadian guideline is in production from the Best Practice in Surgery Group.<sup>15,16</sup> Several American studies have reported wide variation in opioid prescription practices and an excess of unused opioids in general surgery patients.<sup>17–19</sup> These excess, unused opioids are rarely disposed of properly.<sup>19,20</sup> We sought to characterize post-discharge opioid prescription in a cohort of patients undergoing laparoscopic appendectomy (LA) or cholecystectomy (LC) in a Canadian hospital. Our goal was to minimize excess opioid prescription. This quality improvement project sought to determine the amount of opioids used by surgical patients following discharge and then optimize opioid prescription to match this usage pattern. The primary outcome was the quantity of opioids prescribed and consumed. Secondary outcomes included the adequacy of pain control and patient education on storage and disposal methods for remaining opioid tablets.

## METHODS

In the first phase of this study, patients who were undergoing LA or LC were prospectively recruited at a university-affiliated community hospital between April 2017 and June 2017. Patient discharge prescriptions were provided by general surgery attending physicians or residents who were instructed to continue their usual, routine prescribing patterns. Patients were excluded if they were younger than 18 years of age, non-English speaking or pregnant. Patients were enrolled for the study before their operation on the day of surgery (Appendix 1, available at [cansurg.ca/001319-a1](http://cansurg.ca/001319-a1)). Informed consent was obtained and patients were contacted by telephone after discharge from hospital on postoperative day 7. Patients completed a standardized questionnaire administered by one of the investigators (Appendix 1). Patients were called up to 3 times on postoperative day 7, starting at the preferred time frame as indicated at recruitment until they were reached. If they could not be reached on day 7, they were called once on postoperative day 8. If they could not be reached on postoperative day 8, they were deemed lost to follow-up.

Following analysis of phase 1 results, a standardized postoperative discharge pain medication prescription was developed collaboratively between the Anesthesiology, Surgery and Pharmacy departments, with input from hospital patient advisers. A nominal group technique, involving structured decision-making by committee, was used across multiple meetings to arrive at a consensus-based discharge prescription.<sup>21</sup> This prescription was built into the computerized provider order entry system of the patient electronic health record. Surgeons were informed of the implementation of the new standardized prescription.

In the second phase of this study, prospective recruitment of patients undergoing LA or LC occurred between November 2017 and January 2018 and the same questionnaire was administered to assess the impact of the new standardized pain prescription. In partnership with the Pharmacy department and the Institute for Safe Medication Practices, an educational pamphlet was developed for patients and provided postoperatively upon discharge (Appendix 1). This pamphlet detailed strategies for managing pain at home, information about opioid medications and potential adverse effects, and proper opioid storage and disposal. This information was reviewed with the patients before discharge.

Ethics approval was obtained from the Research Ethics Board at North York General Hospital (NYGH REB #17–0011).

## Outcomes

The primary outcome of this study was the quantity of opioid medication prescribed and consumed postdischarge

**Table 1. Patient characteristics by surgical procedure**

Characteristic	First phase, no. (%)*		Second phase, no. (%)*	
	Laparoscopic appendectomy (n = 33)	Laparoscopic cholecystectomy (n = 94)	Laparoscopic appendectomy (n = 11)	Laparoscopic cholecystectomy (n = 98)
Age, median (IQR)	45 (33–54)	51 (38–62)	55 (39–68)	51 (43–61)
Female sex	14 (42.4)	66 (68.8)	7 (63.6)	76 (77.6)
Emergency procedure	30 (90.9)	18 (18.7)	10 (90.9)	15 (15.3)
Conversion to open	0	0	0	0
History of addiction	1 (3)	1 (1)	0	0
History of psychiatric illness	3 (9.1)	8 (8.3)	2 (18.1)	9 (9.2)
History of chronic pain	1 (3)	9 (9.4)	2 (18.1)	3 (2)
Prior long-term opioid use	1 (3)	3 (3.1)	0	1 (1)

IQR = interquartile range.  
\*Unless indicated otherwise.

**Table 2. Opioid prescription, use and disposal by procedure during phase 1**

Variable	Laparoscopic appendectomy (n = 33)	Laparoscopic cholecystectomy (n = 94)
Postoperative opioids prescribed, no. (%)	31 (93.9)	94 (100)
Number of pills prescribed, median (IQR)	20 (20–30)	20 (15–30)
Morphine equivalents prescribed, median (IQR)	150 (112.5–150)	112.5 (67.5–225)
Patients not using any opioids, no. (%)	11 (35.5)	34 (36.2)
Number of pills taken, median (IQR)	3 (0–7)	2 (0–5)
Morphine equivalents taken, median (IQR)	22.5 (0–45)	9.5 (0–31.5)
Number of pills not taken, median (IQR)	19 (13–20)	18.5 (10–26)
Morphine equivalents not taken, median (IQR)	126 (90–150)	95 (14–180)
Patients still taking opioids at postoperative day 7, no. (%)	3 (9.1)	4 (4.2)
Pain scores (out of 10) at postoperative day 7, median (IQR)	3.5 (2–5)	4 (3–5)
Satisfaction with analgesia, no. (%)	32 (96.7)	90 (95.7)
Received education on disposing of unused opioids, no. (%)	3 (9.1)	7 (7.4)
Disposed unused opioids, no. (%)	0	4 (4.2)

IQR = interquartile range.

from hospital, measured in number of pills, as well as morphine milligram equivalents (MME). For patients receiving the standardized prescription during phase 2, the number of pills/MME dispensed by the pharmacy was counted as the total number of pills prescribed, regardless of the number of partial fills used to attain that total number. Secondary outcomes included adequacy of pain management, which was measured using pain scores on a numeric rating scale (0–10) on postoperative day 7, as well as patient satisfaction with analgesia (rated as very satisfied, satisfied, somewhat satisfied, somewhat unsatisfied, unsatisfied or very unsatisfied). Other outcomes included characterizing patients' methods of disposal and storage of unused opioids, and whether a refill opioid prescription was required.

### Statistical analysis

Baseline characteristics and outcomes by surgical procedure are presented using proportions, percentages, medians and

interquartile ranges (IQR), stratified by study phase. Similarly, histograms are used to present prescribed and used MME by surgical procedure and by study phase. Univariate comparisons were done using  $\chi^2$  and the Wilcoxon Rank Sum tests. Pearson correlation was used to explore the correlation between continuous variables. Lastly, a multivariable linear regression was used to determine factors independently associated with MME used. Variables included in the model were selected a priori and checked for collinearity. All tests were 2-sided, with a  $p$  value of  $< 0.05$  considered statistically significant. Data management and analyses were performed using SAS version 9.4 (SAS Institute Inc.).

Between April and June of 2017, 118 patients underwent LA and 212 underwent LC. Of these, 166 patients (50%) met the eligibility criteria and were recruited into the study. A total of 127 patients (76%) were reached for follow-up, including 33 patients who underwent LA and 94 patients who underwent LC. The baseline characteristics of each group are displayed in Table 1. Of note, there was a higher proportion of emergency operations among patients undergoing LA (91%) compared to patients undergoing LC (19%). There was a higher proportion of female patients in the LC group (70% v. 42%). Most patients were discharged on postoperative day 0 or 1.

Most patients were discharged home with a prescription for opioids (Table 2). A total of 2622 pills were prescribed and 458 (18%) were consumed. The median number of opioid pills prescribed was 20 (IQR 15–30) in both the LA and LC groups. About 35% percent of patients in both LA and LC groups did not use any opioids. The median number of pills consumed across both groups was 2 (IQR 0–5). In both groups, 75% of patients used 7 or fewer opioid

interquartile ranges (IQR), stratified by study phase. Similarly, histograms are used to present prescribed and used MME by surgical procedure and by study phase. Univariate comparisons were done using  $\chi^2$  and the Wilcoxon Rank Sum tests. Pearson correlation was used to explore the correlation between continuous variables. Lastly, a multivariable linear regression was used to determine factors independently associated with MME used. Variables included in the model were selected a priori and checked for collinearity. All tests were 2-sided, with a  $p$  value of  $< 0.05$  considered statistically significant. Data management and analyses were performed using SAS version 9.4 (SAS Institute Inc.).

## RESULTS

### First phase

Between April and June of 2017, 118 patients underwent LA and 212 under-

pills. Fifteen (11%) patients consumed more than 10 pills. These numbers were similar when calculated using MME. Fewer than 10% of patients in both groups were still using opioids on postoperative day 7. Pain scores were less than 5 in both groups at this time, and more than 95% of patients reported being satisfied or very satisfied with their analgesia. Fewer than 10% of patients in both groups reported receiving education regarding disposal of unused opioids and fewer than 5% had disposed of the unused opioids at the time of interview.

A histogram displaying the distribution of opioids used and opioids prescribed is shown in Figure 1.

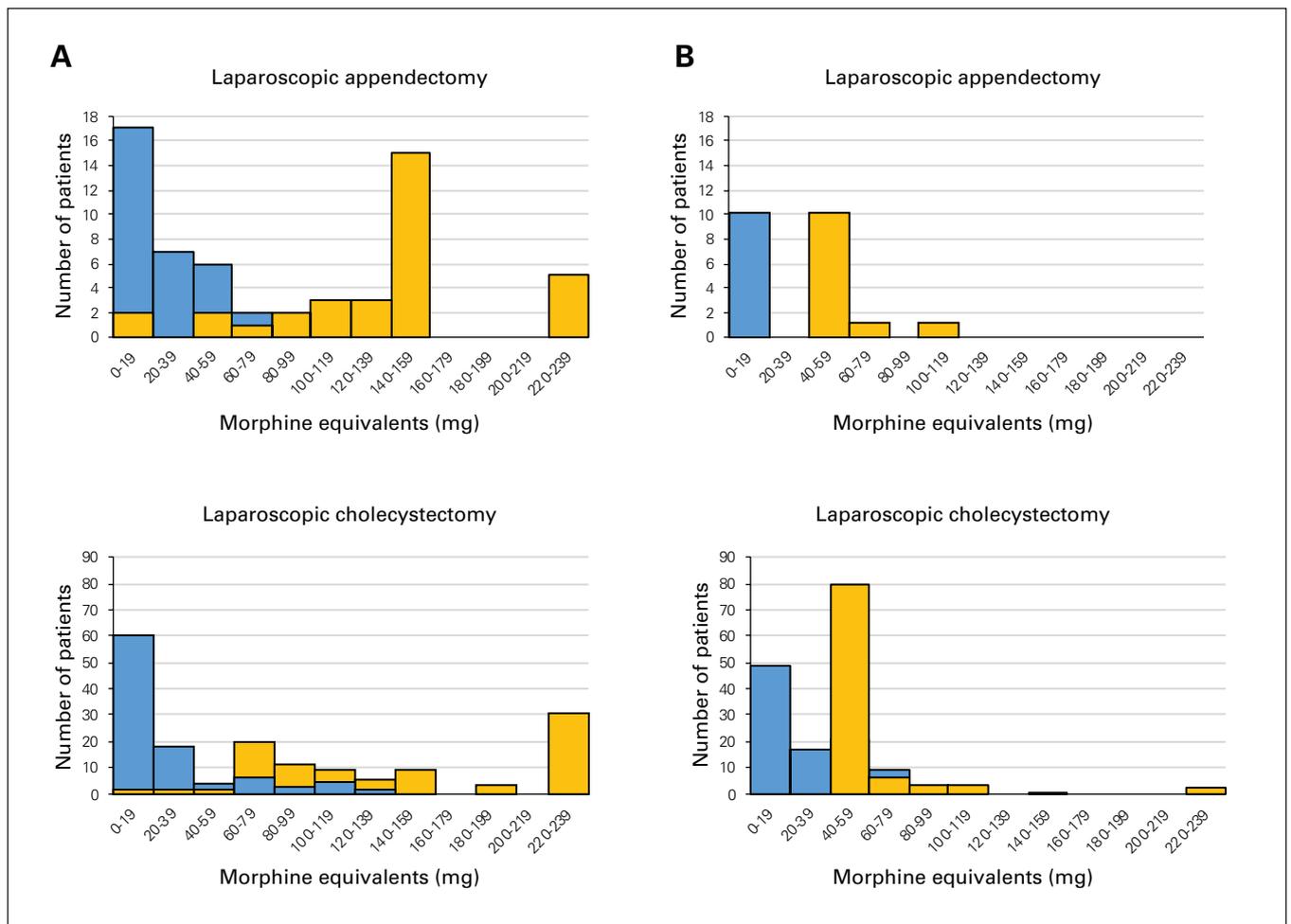
*Development of the standardized prescription*

Results of the first phase were formally presented to surgeons and surgical residents. Initially, we proposed the introduction of a standardized prescription for LAs or LCs, consisting of 10 opioid-containing pills along with multimodal analgesia, as per the amount used by the 80th percentile of phase 1 patients (Table 3). This standardized prescription was created in collaboration with the

departments of Surgery, Anesthesia and Pharmacy, with input from hospital patient advisers. During discussions, there was concern among providers that a prescription of 10 tablets would lead to decreased patient satisfaction and a need for refills, given that 15% of patients used more than 10 tablets. In Ontario, prescribers cannot provide a refill option for an opioid prescription, but they can prescribe opioids as partial fills (i.e., total quantity with number of tablets that can be dispensed over a given interval). Therefore, the final standardized prescription consisted of 10 tablets of either morphine (5 mg) or hydromorphone (1 mg) to be taken every 4 hours, as needed. The

**Table 3. Proposed standardized prescription for postoperative laparoscopic appendectomy or cholecystectomy patients based on 80th percentile of opioids consumed in phase 1**

Surgical procedure	Morphine	Codeine	Oxycodone	Hydromorphone
Laparoscopic appendectomy	45 mg	300 mg	30 mg	9 mg
Laparoscopic cholecystectomy	37.5 mg	250 mg	25 mg	7.5 mg



**Fig. 1.** Histogram of opioid prescription (yellow) and use (blue) by surgical procedure during the first (A) and second (B) phases of the study.

prescription included the option for the patients to return 3 days later for another 10 pills to be dispensed, for a total of 20 pills. An optional 3-day supply of acetaminophen and/or ibuprofen was also included in the standardized electronic prescription order set. The entire prescription was written to expire after 1 month. Once consensus was reached, this standardized prescription was created in the electronic health record to facilitate compliance and standardization of discharge postoperative pain medications for both LA and LC patients.

### Second phase

From November 2017 to January 2018, there were 95 LAs and 217 LCs performed at our hospital. Of these, 139 patients were successfully recruited using the same criteria as the first phase, with 30 lost to follow-up, resulting in a total of 109 patients (including 11 patients undergoing LA patients and 98 patients undergoing LC). The baseline characteristics of the second phase participants are displayed in Table 1. Similar to the first phase, there were a higher proportion of LA (91%) than LC patients (15%) who required emergency operations. Again, most patients were discharged on postoperative day zero or one. There was a higher proportion of female patients in the LC group (78% v. 64%).

Eighty-nine patients (82%) received the new standardized prescription. A total of 1192 pills were prescribed and 238 (20%) were consumed. The median number of pills prescribed was 10 (IQR 10–10), accounting for a median of 0 MME (IQR 0–20) consumed. Three patients returned to the pharmacy to fill the optional additional 10 pills available in their prescription. No patients required additional opioid prescriptions after discharge from hospital.

Compared with the first phase, the standardized prescription led to significantly fewer opioid pills filled (phase 1 median 20, phase 2 median 10,  $p < 0.001$ ). Interestingly, this also led to significantly fewer opioid pills consumed (phase 1 median 2, phase 2 median 0,  $p = 0.006$ ), although in both phases, this number was well below the 10 pills allowed for by our standardized prescription. There was a significantly higher percentage of patients who received education on opioid use and disposal (8% in phase 1, 44% in phase 2,  $p < 0.001$ ). However, this did not translate to increased proper disposal practices at the time of interview (4% in phase 1 v. 3% in phase 2,  $p = 0.88$ ). Despite decreased opioid prescription and use, there was no difference in pain scores or patient satisfaction with pain control (Table 4).

Using data from both phases, it was evident that the number of pills prescribed was positively associated with the number of pills consumed, ( $r = 0.2$ ,  $p = 0.007$ ) and thus the number of MME consumed ( $r = 0.29$ ,  $p < 0.001$ ). The standardized prescription was associated with a decrease in the number of pills prescribed ( $p < 0.001$ ) and

**Table 4. Comparison of opioid-related outcomes before and after implementation of standardized prescription**

Outcome	Before intervention (n = 127)	After intervention (n = 109)	p value
Number of pills filled, median (IQR)	20 (15–30)	10 (10–10)	< 0.001
Number of pills consumed, median (IQR)	2 (0–5)	0 (0–4)	0.006
Number of morphine milligram equivalents consumed, median (IQR)	15 (0–36)	0 (0–20)	0.001
Received education on opioids, no. (%)	10 (7.8)	48 (43.6)	< 0.001
Pain score (out of 10) at postoperative day 7, median (IQR)	4 (2–5)	4 (3–5)	0.97
Satisfaction score; somewhat satisfied or better, no. (%)	122 (96.1%)	105 (96.3%)	0.61

IQR = interquartile range.

MME consumed ( $p = 0.027$ ). The number of MME prescribed was not correlated with the pain score ( $r = 0.09$ ,  $p = 0.16$ ) but the number of MME consumed was correlated with the pain score ( $r = 0.29$ ,  $p < 0.01$ ).

### Factors associated with opioid consumption

A generalized linear model was used to determine factors associated with the number of MME consumed. Number of prescribed pills, age, sex, and history of addiction, psychiatric illness or chronic pain were not independently associated with consumed MME. LA was independently associated with more consumed MME compared with LC ( $p = 0.03$ ), as did patients who underwent elective surgery ( $p = 0.03$ ).

### DISCUSSION

This study indicates that at a Canadian, university-affiliated community teaching hospital, patients are using substantially fewer opioids than prescribed after LA or LC. Over a 3-month period, a total of 2672 pills were prescribed for all patients undergoing either LA or LC, and only 458 (17%) were consumed. At least one-third of patients did not use any opioid pills, stating that their pain was well-managed with non-opioid analgesics such as acetaminophen or ibuprofen. These findings are important because providers overestimate the number of opioid pills required. In a survey of surgical residents, the average prescription for LC was 166 MME, while the residents believed that their patients required only 114 MME.<sup>22</sup> In the first phase of our study, patients used a median of 10 MME, much less than both what the residents prescribed and what the residents perceived was needed. These results are also considerably lower than those of a recent American study that reported that 80% of LC patients used 15 or fewer

pills.<sup>17</sup> The results of this study were used to develop a standardized opioid prescription after LA and LC that also included non-opioid analgesics (ibuprofen and/or acetaminophen). During the second phase of the study, the median number of opioid-containing pills prescribed decreased from 20 to 10. Consumption remained at 20% of pills prescribed, but the average number of unused pills decreased from 17 to 9 per patient compared to the first phase. A greater proportion of patients received education regarding opioid use and disposal. Pain scores and patient satisfaction with pain control were unchanged between the 2 phases.

Perceived resistance to the development or use of a standardized prescription may stem from providers' perception that pain management must be individualized to a particular patient. This study included patients with pre-existing conditions that may have complicated their analgesia. However, on multivariate analysis, psychiatric conditions such as anxiety or depression, or history of chronic pain were not associated with increased opioid use, suggesting that these patients likely do not need to be prescribed increased quantities of opioids at the outset. A further barrier to limiting the amount of prescribed opioids is the belief that patients and providers will be inconvenienced by the need to organize refills. In this study, no patients required a refill for their prescription on or before postoperative day 7, and there was greater than 95% satisfaction with pain control. Furthermore, after implementation of the standardized and limited opioid prescription, patients took significantly fewer opioid pills without any change in their pain scores or satisfaction.

It has previously been shown that opioid prescription size is the strongest predictor of consumption.<sup>23</sup> Our results are very similar to those of the STOP Narcotics intervention.<sup>24</sup> In this study, an educational intervention, combined with a standardized multimodal prescription, resulted in a median prescription of 50 MME with no increase in the need for refills. In another large series of postoperative patients, the probability of requiring a refill of their opioid prescription was 9%, but this was not correlated with the amount initially prescribed.<sup>25</sup> Given the current opioid epidemic, it is not ethical to overprescribe in an attempt to obviate the need for refills.

In the first phase of this study, we identified that fewer than 10% of patients received information regarding proper disposal and storage of unused opioids, and an even smaller number had disposed of such appropriately. Using standardized patient education material, the frequency of educated patients increased to 44% but this did not translate into increased use of proper opioid storage or disposal practices. There is a lack of awareness regarding what constitutes appropriate disposal. The United States Food and Drug Administration endorses returning unused medications to authorized collection

facilities such as pharmacies; 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.<sup>26</sup> 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.<sup>26</sup> National prescription drug take-back days are held periodically in both Canada and the United States to help raise awareness and increase compliance.<sup>27,28</sup> Providing patients with information should be an essential part of safe discharge from hospital, but is not enough to effect change. Future work should consider ways to incentivize opioid returns or make it more convenient by facilitating the return of unused medication at the postoperative visit.

### Limitations

This study has several limitations. We surveyed patients to obtain data regarding the number of pills taken. This is subject to both recall bias and reporting bias, given the negative associations with opioid use. We also do not have detailed information regarding the quantity of adjuncts used, such as acetaminophen and nonsteroidal anti-inflammatory drugs, or the intraoperative use of local anesthetic. Furthermore, we did not collect individual prescriber information, including whether prescriptions were made by resident or staff physicians, and we are therefore unable to account for clustering. This would have been relevant when analyzing the amount of opioid prescribed, but is unlikely to impact the amount of opioid taken. Reported common practice is to provide patients with 30 opioid-containing pills after most surgical procedures, which is similar to our findings.<sup>17,29-31</sup> Therefore, we feel that the opioid prescribing observed in our study is representative of general practices. Finally, the number of patients with either a history of long-term opioid use or addiction history included in our study was small, compromising our ability to generalize our conclusions to this population.

### CONCLUSION

Opioids are prescribed in excessive quantities after laparoscopic appendectomy and laparoscopic cholecystectomy compared with what is clinically necessary to achieve adequate analgesia and patient satisfaction. In this single centre, more than 2000 excess opioid tablets were prescribed over the first study period that were not used by the patient. Introduction of a standardized prescription was effective in decreasing the number of opioid pills prescribed without any decrease in patient analgesia satisfaction or increased need for refills. There are still barriers to implementing safe storage and disposal of unused opioid medication, that may result in excess opioid being

diverted and contributing to the opioid crisis. Future work will be focused on the development of a clinical practice guideline for opioid prescription that encompasses a broad variety of surgical procedures, as well as working on more effective interventions to ensure proper disposal for unused opioids.

**Affiliations:** From the Department of Colorectal Surgery, Cleveland Clinic Foundation, Cleveland, Ohio, USA (Feinberg); the Department of Surgery, University of Toronto, Toronto, Ont. (Acuna); the Department of Surgery, North York General Hospital, Toronto, Ont. (Smith); the Department of Anesthesia, North York General Hospital, Toronto, Ont. (Kashin, Mocon, Yau, Srikandarajah) and the Department of Pharmacy, North York General Hospital, Toronto, Ont. (Chiu).

**Competing interests:** None declared.

**Contributors:** A. Feinberg, A. Mocon, B. Yau, J. Chiu, S. Srikandarajah contributed to the conception and design of the study. D. Smith, B. Kashin, A. Mocon, B. Yau, J. Chiu, S. Srikandarajah acquired data. A. Feinberg, A. Mocon, S. Srikandarajah contributed to analysis and interpretation. A. Feinberg, A. Mocon, S. Srikandarajah wrote the article. All authors provided a critical review of the article and gave final approval for publication.

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