ORIGINAL SCIENTIFIC ARTICLE

# Spillover Effect of Evidence-Based Postoperative Opioid Prescribing

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**BACKGROUND:** Opioid prescribing after operations is often excessive, resulting in leftover pills in the community available for diversion. Procedure-specific postoperative prescribing guidelines can reduce excessive prescribing, however, it is unclear whether such guidelines are associated with reductions in opioid prescribing for other procedures.

**STUDY DESIGN:** A retrospective chart review was conducted for patients undergoing laparoscopic appendectomy, laparoscopic inguinal hernia repair, laparoscopic sleeve gastrectomy, and thyroidectomy/parathyroidectomy between January 1, 2016 and August 31, 2017. Postoperative opioid prescription size (in oral morphine equivalents [OME]) was compared before and after November 1, 2016, when prescribing guidelines were introduced for laparoscopic cholecystectomy. An interrupted time series analysis was conducted to evaluate changes in opioid prescribing after this intervention.

**RESULTS:** A total of 1,158 patients were included in the cohort (558 pre-intervention, 600 post-intervention). Opioid prescription size was significantly reduced for laparoscopic sleeve gastrectomy (447.6 ± 74.3 OME vs 291.9 ± 104.3 OME; $p < 0.001$), laparoscopic appendectomy (173.7 ± 101.6 OME vs 85.8 ± 52.7 OME; $p < 0.001$), laparoscopic inguinal hernia repair (185.0 ± 101.8 OME vs 107.9 ± 57.9 OME; $p < 0.001$), and thyroidectomy/parathyroidectomy (81.5 ± 52.8 OME vs 42.6 ± 22.5 OME; $p < 0.001$). Interrupted time series analysis revealed that this reduction was attributable to intervention for laparoscopic sleeve gastrectomy (-24.5 ± 5.3 OME; $p = 0.001$), laparoscopic appendectomy (-50.2 ± 28.7 OME; $p = 0.04$), and thyroidectomy/parathyroidectomy (-28.8 ± 9.4 OME; $p = 0.001$). For laparoscopic inguinal hernia repair, the immediate decrease in prescription size was not statistically significant (-38.8 ± 33.1 OME; $p = 0.24$). There was a significant increase in requests for refills after laparoscopic appendectomy (0.8% vs 6.6%; $p = 0.01$) but not for other procedures.

**CONCLUSIONS:** After implementing evidence-based opioid prescribing recommendations for a single surgical procedure, opioid prescribing decreased for 4 other surgical procedures. Requests for refills did not increase substantially. This spillover effect demonstrates the potential impact of raising awareness about safe and appropriate opioid prescribing after operations. (J Am Coll Surg 2018;■:1−8.


Opioid prescribing for acute pain is a common surgical practice. However, variable and excessive prescribing of opioids after operations is a significant contributor to the current opioid crisis in the US. Recent studies have demonstrated that opioid prescribing after operations often results in patients having leftover medication.[1-5] Up to 92% of patients report having unused opioids after general surgical procedures, and these excess prescription opioids pose significant risk.[6] For example, the majority of Americans who misuse prescription opioids get the medication from friends or relatives who have leftover medication.[7] Given these consequences, surgeons need evidence-based prescribing recommendations to optimize postoperative pain control and minimize the risks of opioids.

**CME questions for this article available at http://jacscme.facs.org**

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A number of investigators have examined approaches to develop best practice recommendations. Hill and colleagues[8] evaluated patient-reported opioid consumption after 5 common surgical procedures and made prescribing recommendations designed to satisfy 80% of patients' opioid requirements. They observed a 53% reduction in opioid prescription size, with only 1 new patient requiring a refill. At our institution, we successfully implemented opioid prescribing recommendations based on patient-reported opioid consumption for laparoscopic cholecystectomy and observed a 63% reduction in opioid prescription size.[9] This represents thousands of excess pills kept out of the community for a single procedure at 1 institution. Although these recommendations were effective for reducing opioid prescribing for laparoscopic cholecystectomy, it is unclear whether or not implementing these recommendations for laparoscopic cholecystectomy had any effect on opioid prescribing for other procedures at our institution. Targeted interventions in other areas of healthcare have been shown to influence provider practice beyond the specific issue they address.[10] Insofar as prescribing recommendations raise awareness about appropriate opioid prescribing in general, that effect can spill over into other operations and specialties.

Within this context, we sought to evaluate whether implementation of opioid prescribing recommendations for laparoscopic cholecystectomy was associated with changes in opioid prescribing for other common procedures. We hypothesized that implementation of evidence-based recommendations for laparoscopic cholecystectomy would be associated with reductions in opioid prescribing for other surgical procedures.

## METHODS

### Study cohort, data source, and study outcomes

This study was approved by the University of Michigan IRB. The need for informed consent was waived for this retrospective analysis of de-identified data. We previously described the development and implementation of evidence-based postoperative opioid prescribing recommendations for laparoscopic cholecystectomy at our institution.[9] In brief, the recommendations were for 15 tablets of hydrocodone/acetaminophen 5/325 mg or 15 tablets of oxycodone 5 mg. The recommendations also encouraged the use of multimodal analgesia by prescribing acetaminophen or ibuprofen in addition to opioids. The current study analyzes changes in postoperative opioid prescribing for 4 different procedures during the same time period. These procedures were laparoscopic appendectomy, laparoscopic inguinal hernia repair, laparoscopic sleeve gastrectomy, and thyroidectomy (including hemi- and total thyroidectomy) and/or parathyroidectomy. These procedures were chosen to provide broad representation across common general surgical procedures for which opioids are commonly overprescribed.[1] A non-laparoscopic procedure was chosen to evaluate the effect on a markedly different procedure during the same time period. We identified patients who underwent these procedures from January 1, 2016 to August 31, 2017. Patients were excluded from analysis if they experienced a postoperative complication before discharge (such as need for reoperation, need for interventional radiologic procedures, or surgical wound complication), or presented to an emergency department within 30 days after operation. All patient and opioid prescription data were obtained by chart review of the electronic medical record.

Primary outcomes for this study were opioid prescription size at the time of discharge, prescription of acetaminophen or ibuprofen at the time of discharge, and patient requests for refills during the 30 days after operation. The amount of opioids prescribed at discharge was converted to milligrams of oral morphine equivalents (OME) to adjust for varying potencies between medications.[11] For ease of reference, we also calculated the equivalent dose in number of pills of hydrocodone/acetaminophen 5/325 mg ("pills").

### Statistical analysis

Patients were divided into 4 groups based on procedure type: laparoscopic appendectomy, laparoscopic inguinal hernia repair, laparoscopic sleeve gastrectomy, and thyroidectomy/parathyroidectomy. For each group, we calculated the mean opioid prescription size (OME) each month. We then used interrupted time series analysis[12] to compare opioid prescribing before and after implementation of prescribing recommendations for laparoscopic cholecystectomy in November 2016. This is a regression model that tests for the effect of a time-based intervention and controls for any pre-existing trends before intervention.[13,14] These guidelines were shared with all surgical faculty, staff, and residents via in-person and video presentations at the beginning of November 2016. The 2 preceding months (September to October 2016) were excluded from analysis, as in our previous study.[9] This period was during development and logistical implementation of prescribing recommendations and did not reflect either pre-intervention or post-intervention states. This resulted in comparison of 8 pre-intervention months (January to August 2016) and 10 post-intervention months (November 2016 to August 2017).

In addition to the interrupted time series analysis, outcomes were compared for each procedure before and