ing dual antiplatelet therapy) had had AT medication temporarily stopped in preparation for surgery and were therefore excluded from the study. The remaining 93 patients continued their normal AT regimen through surgery. There were 69 patients taking aspirin, 7 taking warfarin, 9 taking clopidogrel, 1 taking dabigatran, 3 taking warfarin plus aspirin, and 4 taking dual antiplatelet therapy. Patients treated with AT agents were older than the control group (mean, 66.1 years vs 56.9 years; $P < .001$). They were also more likely to be male (96.8% vs 84.4%; $P = .002$), diabetic (55.9% vs 22.9%; $P < .001$), and nonsmokers (82.8% vs 71.7%; $P = .04$). Average preoperative median nerve motor latencies at the wrist did not differ significantly between the AT user and non-AT user groups (6.9 milliseconds vs 6.7 milliseconds; $P = .44$), nor did the rate of intraoperative tourniquet use (32% vs 56% for AT user and nonuser groups, respectively; $P = .22$).

Estimated blood loss was higher in the no-tourniquet group for both AT users (4.33 mL vs 3.22 mL; $P = .02$) and non-AT users (4.21 mL vs 3.13 mL; $P = .006$). Mean operating time was shorter in the no-tourniquet group for both those treated with AT agents (20.1 minutes vs 25.7 minutes; $P = .001$) and those not treated with AT agents (22.40 minutes vs 24.52 minutes; $P = .13$). There was no statistical difference in EBL (3.94 mL vs 3.89 mL; $P = .87$) or operative time (22.0 minutes vs 23.0 minutes; $P = .38$) in AT and non-AT patient groups overall.

Rates of postoperative complications were similar between the AT group and the non-AT group (5.4% vs 4.9%; $P > .99$). No hematomas or neurological complications were reported, and no patients required reoperation during the study period. Overall, 91.8% of patients reported improvement of symptoms postoperatively, with a mean follow-up time of 3.3 months (**Table**).

Discussion | Oral AT agents are commonly prescribed for patients with atrial fibrillation, mechanical heart valves, vascular disease, or previous thromboembolism. Interruption of these agents may increase morbidity risk[5,6] and often necessitates multiple preoperative office visits, which are inconvenient for patients and result in an increased burden on the health care system. Despite this, temporary cessation of AT medications in the perioperative period remains common practice in elective hand surgery.[2] There are few reports on the effects of AT on elective hand surgery,[3-5] and to our knowledge, this study is the first to provide evidence that AT medications may be safely continued in wide-awake CTR with or without a tourniquet. Complications were few, and there were no major differences in outcomes between groups.

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Reduction in Opioid Prescribing Through Evidence-Based Prescribing Guidelines

Most opioid drugs prescribed by surgeons to treat acute pain following surgery remain unused,[1] which results in excess medication in the community available for diversion.[2] Diversion of leftover opioid medication is a major component of the current opioid epidemic.[3] Identifying strategies to curb overprescribing could mitigate this risk. We evaluated the effect of evidence-based postoperative prescribing guidelines in an effort to reduce this excess.

Methods | This protocol was deemed exempt from review by the University of Michigan institutional review board. No informed consent procedures were deemed necessary.

We identified patients who underwent elective laparoscopic cholecystectomy from January 2015 through June 2016. The amount of opioids prescribed at discharge was represented in milligrams of oral morphine equivalents (OME). Patients were queried within 12 months of operation about the number of opioid pills they had used, their use of nonopioid analgesics (specifically over-the-counter acetaminophen and ibuprofen), and their pain level during the first week after surgery. Patients were asked to measure their pain on a scale of 0 to 10, with 0 being no pain and 10 being the worst pain imaginable. Results of this telephone survey were used to develop postoperative prescribing guidelines, which were imple-

Table. Preintervention and Postintervention Comparison

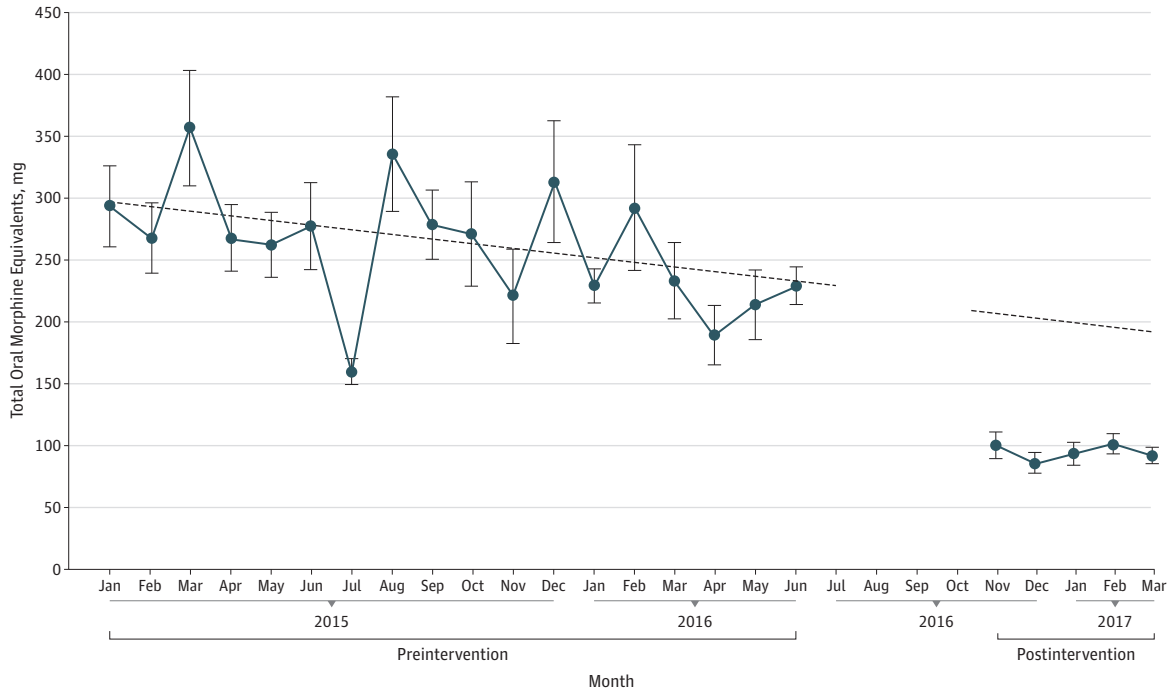
Patient Characteristics and Prescribed Pain Medication	Preintervention (n = 170)	Postintervention (n = 200)	*P* Value
Age, mean (SD), y	46 (14)	48 (16)	.20
Female, No. (%)	132 (77.6)	149 (74.5)	.50
Patients receiving opioid prescription, No. (%)	170 (100)	185 (92.5)	< .001
Prescription size, median (IQR), mg OME	250 (200-300)	75 (75-112.5)	< .001
No. of pills, median (IQR)	40 (30-60)	15 (10-20)	< .001
Requests for refills, No. (%)	7 (4.1)	5 (2.5)	.40
Acetaminophen/ibuprofen prescribed, No. (%)	36 (21.2)	97 (48.5)	< .001
Survey completion, No. (%)	100 (58.8%)	86 (43.0%)	.002
Amount of opioid used,[a] median (IQR), mg OME	30 (6-60)	20 (0-45)	.04
Patients using acetaminophen/ibuprofen,[a] No. (%)	61 (61)	59 (69)	.60
Patient-reported pain score,[a,b] median (IQR)	5.0 (3.5-6.5)	5.0 (3.1-6.5)	.80

Abbreviations: IQR, interquartile range; OME, oral morphine equivalent.

[a] Final 3 rows include only those individuals who completed surveys (n = 100 and n = 86 for preintervention and postintervention groups, respectively).

[b] Pain was reported on a 0 to 10 scale, with 0 indicating no pain and 10 indicating the worst pain imaginable.

Figure. Reduction in Postoperative Opioid Prescribing After Implementation of Prescribing Guidelines



Following the implementation of evidence-based prescribing guidelines, opioid prescriptions were significantly reduced from an equivalent of approximately 45 pills of hydrocodone, 5 mg, to approximately 15 pills (*P* < .001). The dashed line represents the expected decline in prescribing prior to the study intervention.

mented at our institution in November 2016. No explicit changes in preoperative analgesia prescription practices were made in the guideline, nor were changes made in analgesia use during operations.

After guideline implementation, subsequent patients receiving laparoscopic cholecystectomy operations from November 2016 through March 2017 were administered the same survey questions. An interrupted time series analysis was conducted to evaluate the effect of these guidelines over existing trends in opioid and nonopioid prescribing.[4] Preintervention and postintervention outcomes were compared using the Mann-Whitney *U* test and χ^2 test as appropriate. *P* values were 2-tailed, and significance was set at $P \leq .05$.

Results | All patients in the preintervention group (n = 170) received a prescription for opioids prior to the intervention; 7 of these individuals (4.1%) requested an opioid prescription refill. The median (interquartile range [IQR]) amount prescribed was 250 (200-300) mg. Of this cohort, 100 patients

(58.8%) completed the survey, and they reported a median (IQR) opioid use of 30 (6-60) mg. In addition, 61 patients (61.0%) reported using acetaminophen or ibuprofen in addition to opioids. The median (IQR) pain score was 5.0 (3.5-6.5) on a scale of 0 to 10.

These data were used to develop post-laparoscopic cholecystectomy guidelines that recommended prescribing 15 tablets of hydrocodone/acetaminophen, 5/325 mg (OME, 75 mg) or 15 tablets of oxycodone, 5 mg (OME, 112.5 mg), plus acetaminophen or ibuprofen as needed. Videos and oral presentations were used to communicate these guidelines to all surgical faculty, residents, and staff.

Five months after guideline implementation, an additional 200 patients had undergone laparoscopic cholecystectomy (**Table**). The median amount of opioid prescribed was reduced from 250 mg to 75 mg (postintervention IQR, 75-112.5 mg) ($P < .001$). Despite this change, only 5 of 200 patients (2.5%) requested refills, compared with 7 of 170 patients (4.1%) prior to these guidelines ($P = .40$). Prescriptions for either acetaminophen or ibuprofen increased; 36 of 170 preintervention patients (21%) and 98 of 200 postintervention patients (49%) received these ($P < .001$). However, in a survey of 86 patients, 59 (69.0%) reported use of these medications; this was not a significant change from the preintervention use (61.0%; $P = .60$). Median (IQR) postoperative opioid use was significantly reduced from 30 mg to 20 mg after the intervention (postintervention IQR, 0-45 mg) ($P = .04$) without a change in pain score (median, 5.0; IQR, 3.1-6.5) ($P = .80$).

Interrupted time-series analysis revealed that, despite a preexisting decline in mean (SD) prescription size of 4 (2) mg/mo, there was a significant reduction of 119 (25) mg/mo ($P < .001$) after guideline implementation (**Figure**).

Discussion | Following laparoscopic cholecystectomy, the median prescription size was 250 mg (OME), while median patient use was only 30 mg. This is equivalent to receiving 50 tablets of hydrocodone/acetaminophen, 5/325 mg, and using only 6 tablets. Evidence-based prescribing guidelines reduced prescription size by 63% without increasing the need for medication refills, thereby eliminating the excessive prescription of roughly 7000 pills. Patients also reported using fewer opioids after guideline implementation. This might be explained in part by the anchoring and adjustment heuristic,[5] where the initial prescription size serves as the mental reference point for assessments of change. A recent study of cesarean delivery patients showed a significant correlation between larger prescription size and self-reported use.[6]

Limitations | Limitations of this study include the nonrandomized study design and the single-institution implementation. These results should also be interpreted within the context of this procedure, although the framework of this study could be applied to a variety of surgical procedures.

Conclusions | Initial work within the state of Michigan intimates a similar mismatch between prescribing and medication use. This work will be used as a template for statewide practice transformation, which may serve as a platform for other states.

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Correction: This article was corrected on February 20, 2019, to add a conflict of interest disclosure that was missing at the time of publication. The disclosure specifies that Dr Howard reports receiving funding from the Blue Cross Blue Shield of Michigan Foundation.

Author Contributions: Drs Howard and Englesbe had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.
Study concept and design: All authors.
Acquisition, analysis, or interpretation of data: Howard, Waljee, Englesbe, Brummett.
Drafting of the manuscript: Howard, Waljee, Brummett.
Critical revision of the manuscript for important intellectual content: Howard, Waljee, Englesbe, Lee.
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The Veterans Affairs Medical Center's Contribution to Plastic Surgery Education

Veterans Affairs (VA) medical centers have played a major role in graduate medical education since the 1940s.[1] Currently, the VA health system operates 168 medical centers across the United