

# Patterns in Opioid Prescription for Patients Operatively Treated for Ankle Fractures Following Implementation of 2017 Ohio Opioid Prescriber Law

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## Abstract

**Background:** The purpose of this study was to report patterns of opioid prescription for patients treated operatively for ankle fractures after implementation of the 2017 Ohio Opioid Prescriber Law in comparison to the previous year.

**Methods:** A total of 144 patients operatively treated for isolated ankle fractures during two 6-month periods, January 2017 to July 2017 (pre-law) and January 2018 to July 2018 (post-law), were retrospectively identified. Preoperative and postoperative patient narcotic use was reviewed using a legal prescriber database. Total number of prescriptions, quantity of pills, and morphine milligram equivalents (MMEs) per patient prescribed during the 90-day postoperative period were compared between those treated before and those treated after implementation of the Ohio prescriber law.

**Results:** The average number of opioid prescriptions prescribed per patient in the 90-day postoperative period was 2.3 in the pre-law group and 2.1 in the post-law group ( $P = .625$ ). The average MMEs prescribed per patient dropped from 942.4 MME pre-law to 700.5 MME post-law ( $P = .295$ ). Differences in the average number of pills per prescription pre- and post-law (49.7 vs 36.2) and average MME per prescription (382.1 mg vs 275.2 mg) were statistically significant ( $P < .001$  and  $P = .016$ , respectively).

**Conclusion:** Following the implementation of the 2017 Ohio Opioid Prescriber Law, there was a downward trend in the number of pills per prescription and MMEs per prescription in patients operatively treated for isolated ankle fractures. The presence of a downward trend in the quantity of opioids prescribed in this patient cohort suggests the effectiveness of the state law.

**Level of Evidence:** Level III, comparative study.

**Keywords:** opioid, prescriptions, ankle fracture

## Introduction

In the mid-1990s, concern for untreated pain prompted greater use of narcotic pain medications, changing prescribing practices considerably.<sup>2</sup> Today opioids are among the most heavily prescribed pharmaceuticals, and they are highly addictive.<sup>6</sup> The United States is now facing the impact of widespread narcotic use. Total costs for opioid-related health care and substance abuse treatment accounted for \$28 billion in 2013, creating a tremendous economic burden.<sup>3</sup> Narcotic use has become a major societal issue, accounting for 68% of all drug overdose deaths in 2017.<sup>1</sup> Ohio was among the states with the highest rates of death (46.3 per 100 000 persons).<sup>18</sup>

Physicians must be cognizant of the addictive nature of opioids and the ramifications of their misuse. Orthopedic

surgeons are the fourth leading prescribers of opioids secondary only to primary care physicians, internists, and dentists.<sup>21</sup> Orthopedic surgeons manage conditions that involve both acute and chronic pain that are often managed with opioids. Previous studies have shown that the orthopedic trauma population in particular may be more susceptible to prolonged opioid use and substance abuse.<sup>7,12</sup>

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Various states have initiated prescription drug monitoring programs in an effort to combat narcotic misuse.<sup>9</sup> In 2017, Ohio implemented the Opioid Prescriber Law (Appendix 1, see supplemental material). This law limits the initial prescription duration to 7 days for an acute pain episode. Additionally, the total morphine milligram equivalent (MME) cannot exceed an average of 30 MME a day. The purpose of this study was to report patterns of opioid prescription for patients treated operatively for ankle fractures after implementation of the 2017 Ohio Prescriber Law in comparison to the previous year. We hypothesized that there would be a decrease in the number of opioid prescriptions and total MME post-implementation of the Ohio Prescriber Law.

## Methods

Institutional review board approval was obtained prior to the start of this study. A retrospective chart review was performed to identify patients who underwent operative treatment of an ankle fracture during two 6-month periods at a single academic institution. The time periods reviewed were January 2017 to July 2017, which included patients treated before implementation of the Ohio Opioid Prescriber Law, and January 2018 to July 2018, which included patients treated after implementation of the law. Patients were identified using CPT codes 27766, 27769, 27784, 27792, 27814, 27822, 27823, and 27829 (Appendix 2, see supplemental material). A total of 280 patients were identified and screened for inclusion. The operations were performed by a total of 15 different orthopedic surgeons. Patients were included in the analysis if they underwent operative treatment for an acute isolated ankle fracture. Patients with multiple injuries or chronic ankle injuries were excluded.

A chart review of the electronic medical record was performed to collect information regarding patient demographics, injury data, treatment details, postoperative emergency department (ED) visits, postoperative hospital readmissions, follow-up examinations, reoperations, and complications. Patient comorbidities were evaluated using the Charlson Comorbidity Index (CCI), which is a validated health measure based on a patient's medical history. The reviews of postoperative ED visits, hospital readmissions, follow-up examinations, reoperations, and complications were limited to the 90-day postoperative period.

A total of 144 patients met inclusion criteria for the study. The average age was 46.8 years. Fifty (35%) of patients were male and 94 (65%) were female. Forty-four percent of injuries (n=63) were bimalleolar fractures, 34% (n=49) were either isolated lateral or medial malleolar fractures, and 22% (n=32) were trimalleolar fractures. Thirteen percent of fractures were open. Seventy-three patients (51%) were operatively treated between January 2017 and July 2017. Seventy-one patients (49%) were treated between January 2018 and July 2018. Differences in age, sex, BMI, Charlson Comorbidity Index, smoking

**Table 1.** Patient Demographics.

Variable	Pre-Law (2017)	Post-Law (2018)	P Value
Sex, male/female, n	(25/48)	(25/46)	.99
Age, y	45.9	47.7	.59
CCI	1.21	1.23	.94
BMI	30.6	31.5	.5
Smoking status, yes/no, n	23/49	18/53	.46
Preoperative narcotic use category, n			.42
Acute	34	37	
Exposed	19	11	
Intermediate sustained	1	1	
Chronic sustained	4	6	

Abbreviations: BMI, body mass index; CCI, Charlson Comorbidity Index.

status, type of injury, and preoperative narcotic use were not statistically significant between groups (Table 1).

Preoperative and postoperative patient narcotic use was reviewed using a legal state prescriber database, the Ohio Automated Rx Reporting System (OARRS). The OARRS is a prescription monitoring program controlled by the Ohio State Board of Pharmacy. The system tracks dispensing of controlled prescription medications by Ohio-licensed pharmacies. The information is stored in a secure database accessible to Ohio prescribers. The database also includes prescription information from neighboring states. The prescription search was limited to prescriptions prescribed within 1 year prior to surgery and 6 months postoperatively. Non-narcotic analgesic medications, which included nonsteroidal anti-inflammatory drugs (NSAIDs), acetaminophen, gabapentin, and muscle relaxers, were reviewed using the electronic medical record (Appendix 3, see supplemental material). Prescriptions issued between 2 weeks preoperatively and 90 days postoperatively were included in the main analysis for both narcotic and non-narcotic medications.

Length of preoperative opioid use was categorized using a classification similar to one defined in a previous study assessing opioid consumption in orthopedic spine patients.<sup>17</sup> Preoperative use was classified as acute exposure (first opioid prescription issued within 30 days of surgery), nonsustained or intermediate sustained exposure (opioid prescription issued within 1 year of surgery without continuous use or continuous use for less than 6 months), or chronic sustained use (continuous use for greater than 6 months). Extended postoperative narcotic use was defined as narcotic use beyond the 90-day postoperative period. Narcotic use beyond 6 months of surgery was not evaluated. The amount of narcotic issued in the prescription was described using MMEs. For reference, hydrocodone has an MME conversion factor of 1, so that a 30-pill prescription of 5-mg hydrocodone tablets is equal to 150 MMEs. Oxycodone has an MME conversion factor of 1.5, so that a 30-pill prescription of 5-mg oxycodone is equal to 225 MMEs.

**Table 2.** Narcotic and Postoperative Data.

Variable	Pre-Law (2017)	Post-Law (2018)	P Value
Postoperative narcotic prescriptions per patient	2.3	2.1	.63
Number of pills per patient	112	85.8	.22
MME per patient	942.4	700.5	.3
Number of pills per prescription	49.7	36.2	<.001*
MME per prescription	382.1	275.2	.016*
Postoperative narcotic prescriptions after 90 d	0.72	0.78	.86
Number of postoperative prescriptions for non-narcotic pain meds <sup>a</sup>	0.89	1.4	.015*
Length of hospital stay, d	3.2	3.1	.81
Number of postoperative ED visits <sup>b</sup>	0.37	0.21	.19
Number of postoperative hospital readmissions <sup>b</sup>	0.15	0.07	.21

Abbreviations: ED, emergency department; MME, morphine milligram equivalent.

<sup>a</sup>Including NSAIDs, acetaminophen, gabapentin, and muscle relaxers (within 90-day postoperative period).

<sup>b</sup>Within 90-day postoperative period.

\*Statistically significant value.

### Statistical Analysis

Statistical analysis was conducted using *t* tests and 1-way analysis of variance to compare continuous variables between patients treated before implementation of the Ohio Opioid Prescriber Law and those treated after implementation. Total number of prescriptions, quantity of pills, and MMEs per patient prescribed during the 90-day postoperative period were compared. Average number of pills per prescription and average MME per prescription were also compared. Categorical variables, such as patient demographics, were compared using chi-square tests.  $P < .05$  was considered significant. All statistics were performed using R version 3.4.0 (R Foundation for Statistical Computing, Vienna, Austria)<sup>13</sup> with R studio version 1.0.153 (R Studio Inc, Boston, MA).<sup>16</sup>

### Results

The average number of opioid prescriptions prescribed per patient in the 90-day postoperative period was 2.3 in the pre-law group and 2.1 in the post-law group ( $P = .63$ ; Table 2). The average MME prescribed per patient dropped from 942.4 mg pre-law to 700.5 mg post-law ( $P = .3$ ). Differences in the average number of pills per prescription pre- and post-law (49.7 vs 36.2) and average MME per prescription (382.1 mg vs 275.2 mg) were statistically significant ( $P < .001$  and  $P = .02$ , respectively). The most commonly prescribed narcotics were oxycodone/acetaminophen 5/325 mg and hydrocodone/acetaminophen 5/325 mg in both the pre-law and post-law groups. The total MME of opioids prescribed was not statistically different based on age, sex, BMI, type of insurance, smoking status, or type of injury

( $P > .05$ ). The average number of non-narcotic analgesic prescriptions, which included NSAIDs, acetaminophen, gabapentin, and muscle relaxers, significantly increased from 2017 to 2018 ( $P = .02$ ). Differences in postoperative narcotic use exceeding the 90-day postoperative period was not statistically significant between groups ( $P > .05$ ). The average number of postoperative follow-up visits, ED visits, and hospital readmissions during the 90-day postoperative period were not statistically different between groups ( $P > .05$ ). There were no statistically significant differences in the number of reoperations or postoperative complications between groups ( $P > .05$ ).

### Discussion

The current study demonstrated a change in opioid prescription patterns following the Ohio Opioid Prescriber Law of 2017. In patients who underwent operative treatment of an isolated ankle fracture, the average MME per prescription significantly decreased from 382 MME in 2017 to 275 MME in 2018. This change was not accompanied by any significant difference in the number of postoperative ED visits, hospital readmissions, reoperations, or complications. This change was, however, accompanied by a significant increase in non-narcotic analgesic prescriptions. As the United States struggles with rising rates of opioid dependence, it is exceedingly important for orthopedic surgeons to assess their postoperative prescription patterns. Additionally, it is important to assess the effect of narcotic-related legislation and policy changes on orthopedic practices.

In addition to Ohio, several other states have enacted laws to regulate narcotic use. In an evaluation of Medicaid drug utilization between 2011 and 2014, Wen et al<sup>22</sup> found that states that had implemented prescription drug monitoring mandates during that time period saw a 10% reduction in opioid prescriptions. Studies evaluating narcotic regulation in orthopedic practices have largely focused on single-institution policies. Stepan et al reported a significant decrease in the number of total morphine equivalents prescribed postoperatively following a mandatory education program for all prescribers in their academic orthopedic hospital.<sup>20</sup> Holte et al retrospectively evaluated patient opioid consumption before and after implementation of a strict postoperative narcotic protocol in a total joint arthroplasty practice.<sup>8</sup> The authors found that patients treated prior to the restrictive opioid policy required more prescription refills and called into the office more frequently. Clinical outcomes were not significantly different between groups. These results are similar to those of current study, in which postoperative ED visits, hospital readmissions, reoperations and complications did not differ following the Ohio law implementation. These findings suggest that policies restricting opioid consumption can be implemented without adversely affecting patient outcomes. However, the exact amount of narcotic pain medication necessary to provide adequate pain relief in postoperative orthopedic patients is unclear.

Several studies have investigated opioid consumption after elective orthopedic surgery. These studies have shown that a majority of patients do not require the entirety of their postoperative narcotic prescriptions.<sup>10,15,24</sup> Fewer studies have focused on opioid consumption in the orthopedic trauma population. Ankle fracture patients are frequently treated as outpatients, necessitating early postoperative pain management plans. The pain produced by these injuries requires adequate analgesia, but, unfortunately, this population may be at increased risk of developing opioid dependence. Many of the demographic characteristics that have been identified as risk factors for musculoskeletal trauma overlap with risk factors for substance abuse and addiction.<sup>7</sup> Gossett et al<sup>5</sup> found that 8.4% of opioid-naïve patients operatively treated for ankle fractures continued opioid use beyond 90 days after surgery. This behavior was significantly increased in patients who had been prescribed a dose that was in the top 25th percentile of total morphine equivalents. This finding suggests that in ankle fracture patients, overprescription of opioids can lead to extended use, even in opioid-naïve patients. Therefore, orthopedic surgeons must be especially cognizant of opioid consumption in this patient population.

The current study found a statistically significant increase in the average number of non-narcotic analgesic prescriptions following the Ohio law implementation, perhaps secondary to an effort to decrease opioid prescription. The use of multimodal analgesia, which utilizes non-opioid pain modalities such as NSAIDs, cyclooxygenase inhibitors, gabapentin, and methocarbamol, has been proposed to help decrease opioid consumption and avoid related adverse effects.<sup>23</sup> In a prospective study comparing multimodal analgesia to postoperative patient-controlled analgesia following upper extremity surgery, Lee et al<sup>11</sup> found no difference in pain scores between treatment groups. However, the patient-controlled analgesia group had significantly more opioid-related adverse effects, such as nausea and vomiting, and had lower satisfaction scores. Notably, complications related to the medications used in the multimodal group, such as headaches or dizziness, were not reported by any patients. Physicians should continue to pursue methods of pain control that limit adverse effects while maintaining patient satisfaction. Of note, gabapentin is a restricted and monitored medication in several states because of its sedative and opioid-potentiating properties. However, the drug does not have the same addictive potential as opioids. In the current study, no adverse effects related to gabapentin use were recorded.

Another interesting finding of this study was that the postoperative narcotic use at 6 months was not significantly different between the pre-law and post-law groups. However, persistent pain at 1 year postoperatively is common in patients treated for ankle fractures.<sup>4,14</sup> Therefore, an investigation into the persistent use of narcotic medications at extended time intervals, such as 1 year and beyond, would be a useful direction for future study.

This study is not without limitations. A major limitation was its retrospective design, which is subject to documentation inaccuracies. Another limitation was that no patient-reported outcome measures were collected to determine how satisfied patients were with their pain control. This information would have been useful in evaluating whether patient satisfaction was affected by the change in opioid prescription patterns. This information would have also been useful in potentially determining appropriate dosing of narcotic medication for pain control. Future studies are necessary to determine the most appropriate dose of postoperative narcotics following ankle surgery. Additionally, as prescription information was collected using a prescriber database, actual opioid consumption by each patient was not documented. Therefore, although the current study demonstrated that patients were prescribed fewer narcotics, the study was unable to determine whether patients consumed fewer narcotics. Another important limitation is that the current study represents only 1 hospital in Ohio and, therefore, does not reflect widespread adoption of the 2017 prescriber policy. Other practitioners in Ohio may not have changed their narcotic-prescribing patterns in the same manner.

## Conclusion

Following the implementation of the 2017 Ohio Opioid Prescriber Law, there was a downward trend in the number of pills per prescription and MMEs per prescription in patients operatively treated for isolated ankle fractures. This change was accompanied by an increase in prescription of non-narcotic analgesics without a change in the number of postoperative clinic or ED visits. The presence of a downward trend in the quantity of opioids prescribed in this patient cohort suggests the effectiveness of the state prescriber law. This result is promising in the setting of the current opioid epidemic in the United States.

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## Appendix

### Appendix I. Ohio Administrative Code 4731-11-13: Prescribing of Opiate Analgesics for Acute Pain.<sup>19</sup>

- A) For the treatment of acute pain, the physician shall comply with the following:
  1. Extended-release or long-acting opioid analgesics shall not be prescribed for treatment of acute pain;
  2. Before prescribing an opioid analgesic, the physician shall first consider non-opioid treatment options. If opioid analgesic medications are required as
    3. In all circumstances where opioid analgesics are prescribed for acute pain:
      - a) Except as provided in paragraph (B) of this rule, the duration of the first opioid analgesic

determined by a history and physical examination, the physician shall prescribe for the minimum quantity and potency needed to treat the expected duration of pain, with a presumption that a three-day supply or less is frequently sufficient and that limiting the duration of opioid use to the necessary period will decrease the likelihood of subsequent chronic use or dependence;

- prescription for the treatment of an episode of acute pain shall be:
- i) For adults, not more than a seven-day supply with no refills;
  - ii) For minors, not more than a five-day supply with no refills. A physician shall comply with section 3719.061 of the Revised Code, including but not limited to obtaining from the parent, guardian, or another adult who is authorized to consent to the minor's medical treatment written consent prior to prescribing an opioid analgesic to a minor;
  - iii) The seven-day limit for adults and five-day limit for minors may be exceeded for pain that is expected to persist for longer than seven days based on the pathology causing the pain. In this circumstance, the reason that the limits are being exceeded and the reason that a non-opioid medication was not appropriate to treat the patient's conditions shall be documented in the patient's medical record. The number of days of the prescription shall not exceed the amount required to treat the expected duration of the pain as noted in paragraph (A) (2) of this rule; and
  - iv) If a patient is allergic to or otherwise unable to tolerate the initially prescribed opioid medication, a prescription for a different, appropriate opioid may be issued at any time during the initial seven- or five-day dosing period and shall be subject to all other provisions of this rule. The allergy and/or intolerance shall be documented in the patient's medical record. The patient or the minor patient's parent, guardian, or another adult who is authorized to consent to the minor's medical treatment must be provided education of the safe disposal of the unused medication.
- b) The patient, or a minor's parent or guardian, shall be advised of the benefits and risks of the opioid analgesic, including the potential for addiction, and the advice shall be documented in the patient's medical record; and
  - c) The total morphine equivalent dose (MED) of a prescription for opioid analgesics for treatment of acute pain shall not exceed an average of thirty MED per day, except when all of the following apply:
    - i) The patient suffers from medical conditions, surgical outcomes or injuries of such severity that pain cannot be managed within the thirty MED average limit as determined by the treating physician based upon prevailing standards of medical care, such as:
      - a) Traumatic crushing of tissue;
      - b) Amputation;
      - c) Major orthopedic surgery;
      - d) Severe burns
    - ii) The physician determines that exceeding the thirty MED average limit is necessary based on the physician's clinical judgment and the patient's needs.
    - iii) The physician shall document in the patient's medical record the reason for exceeding the thirty MED average and the reason it is the lowest dose consistent with the patient's medical condition.
    - iv) Only the prescribing physician for the conditions in paragraph (A)(3) (c)(i) of this rule may exceed the thirty MED average. The prescribing physician shall be held singularly accountable for prescriptions that exceed the thirty MED average.
    - v) In circumstances when the thirty MED average is exceeded, the dose shall not exceed the dose required to treat the severity of the pain as noted in paragraph (A) (2) of this rule.
  - d) Prescriptions that exceed the five- or seven-day supply or thirty MED average daily dose are subject to additional review by the state medical board. The dosage, days supplied, and condition for which the opioid analgesic is prescribed will be considered as part of this additional review.
- B) The requirements of paragraph (A) of this rule apply to treatment of acute pain and do not apply when an opioid analgesic is prescribed:
    - 1) To an individual who is a hospice patient or in a hospice care program;
    - 2) To an individual receiving palliative care;
    - 3) To an individual who has been diagnosed with a terminal condition; or
    - 4) To an individual who has cancer or another condition associated with the individual's cancer or history of cancer.
  - C) This rule does not apply to prescriptions for opioid analgesics for the treatment of opioid addiction utilizing a schedule III, IV or V controlled substance narcotic that is approved by the federal drug administration for opioid detoxification or maintenance treatment.
  - D) This rule does not apply to inpatient prescriptions as defined in Chapter 4729. of the Revised Code.

## Appendix 2. CPT Codes and Descriptions

CPT Code	Description	Diagnosis
27766	Open treatment of medial malleolus fracture	Medial malleolus fracture
27769	Open treatment of posterior malleolus fracture	Posterior malleolus fracture
27784	Open treatment of proximal fibula or shaft fracture	Proximal fibula or shaft fracture
27792	Open treatment of distal fibula fracture	Lateral malleolus fracture
27814	Open treatment of bimalleolar fracture	Lateral and medial malleoli fractures/Lateral and posterior malleoli fractures/Medial and posterior malleoli fractures
27822	Open treatment of trimalleolar fracture without fixation of posterior lip	Lateral, medial, and posterior malleoli fractures
27823	Open treatment of trimalleolar fracture with fixation of posterior lip	Lateral, medial, and posterior malleoli fractures
27829	Open treatment of distal tibiofibular joint disruption	Syndesmosis disruption

## Appendix 3. Non-narcotic Analgesics

Drug Class	Name
Nonsteroidal anti-inflammatories	Ibuprofen, aspirin, naproxen, ketorolac, meloxicam, celecoxib
Muscle relaxants	Cyclobenzaprine, diazepam
Anticonvulsants	Gabapentin
Other analgesics	Acetaminophen, butalbital-acetaminophen-caffeine