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Systematic Review

Opioid consumption following foot and ankle surgery: a systematic review

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Abstract

Objective: Systematically review studies characterizing postoperative opioid consumption in patients submitted to foot and ankle surgery to identify trends in opioid consumption among regions of procedures (forefoot, midfoot, hindfoot/ankle) and ultimately create prescribing guidelines that treat patient's pain adequately while limiting leftover pills.

Methods: A systematic review was performed following the Meta-analysis of Observational Studies in Epidemiology (MOOSE) guidelines. Retrospective and prospective observational cohort studies that reported mean opioid consumption following foot and ankle surgery were included, as well as data from our institution that fit the review's parameters. Studies that did not report this data or reported patients receiving alternative surgical techniques were excluded. The risk of bias in non-randomized studies – of exposure (ROBINS-E) tool and the Methodological index for non-randomized studies (MINORS) criteria were used to assess bias and study quality, respectively.

Results: Three hundred ninety-five articles were identified, and six studies, including our institution's, met inclusion criteria. Reported data from 2,445 patients were synthesized to show opioid consumption overall, by region of surgery, and by invasiveness of procedure. Four of five studies found significantly higher opioid use postoperatively in patients submitted to hindfoot/ankle surgery, and two of five studies found significantly higher consumption among those submitted to bony foot and ankle surgery.

Conclusion: Prescribing physicians must approach foot and ankle patients on a case-by-case basis to ensure adequate pain management while mitigating excess opioid risk. For prescriptions of 5 mg oxycodone pills, we recommend 15-, 20-, and 25-pill prescriptions for patients submitted to forefoot, midfoot, and hindfoot/ankle surgery.

Level of Evidence I; Systematic review.

Keywords: Opioid; Epidemic; Consumption; Foot/surgery; Ankle/surgery.

Introduction

The opioid epidemic has risen to the national forefront as rates of drug overdose deaths continue to climb[1,2]. The overuse and over-prescription of narcotic medications began in the 1990s when pain was declared the "fifth vital sign" [3]. An increased emphasis on patient satisfaction scores and a perceived "under-treatment" of pain resulted in a rapid increase in the quantity of narcotics prescribed in the United States[3,4]. This increased opioid utilization was paralleled by a rise in opioid drug poisoning mortality rates, which increased by an average of 18.1% per year from 1990 to 2002[5,6]. Currently, opioid abuse continues to claim lives at an alarming rate. In 2016, opioid overdoses killed more Americans than motor vehicle collisions or gun violence[7,8].

Initial narcotic prescriptions have been shown to play a key role in the opioid epidemic, and opioid-naïve patients are at

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an increased risk of chronic opioid use following surgery[9-11]. Nearly 9% of cases of opioid dependence in previously opioid-naïve patients are attributed to legal prescriptions provided following foot and ankle surgery[12]. Orthopedic surgeons are among the highest prescribers of opioids in the United States, and much attention has been drawn recently to the need for safer postoperative narcotic prescribing practices[13-16].

Several recent studies across multiple orthopedic subspecialties have evaluated prescribing patterns and postoperative narcotic usage, including within foot and ankle surgery, with no consensus or general prescribing guidelines for providers[17-24].

The objective of this study is to perform a systematic review to examine the opioid pill consumption of patients following foot and ankle surgery and to provide more data-driven guidelines with more statistical power for physicians prescribing opioid analgesics broken down into three categories based on region of procedure (forefoot, midfoot, hindfoot/ankle). To our knowledge, this study is the first to provide generalized prescribing guidelines following foot and ankle surgery based on anatomic region.

Methods

Data sources and search

A systematic review was performed following the Meta-analysis of Observational Studies in Epidemiology (MOOSE) criteria. The following databases were searched: PubMed, EBSCOHost, and Ovid MEDLINE. The search terms "opioid" and "foot and ankle surgery" with the Boolean operator (AND) were used with each search engine, yielding results from eleven databases (Figure 1). All search results were compiled into Microsoft Excel and were independently reviewed by three reviewers.

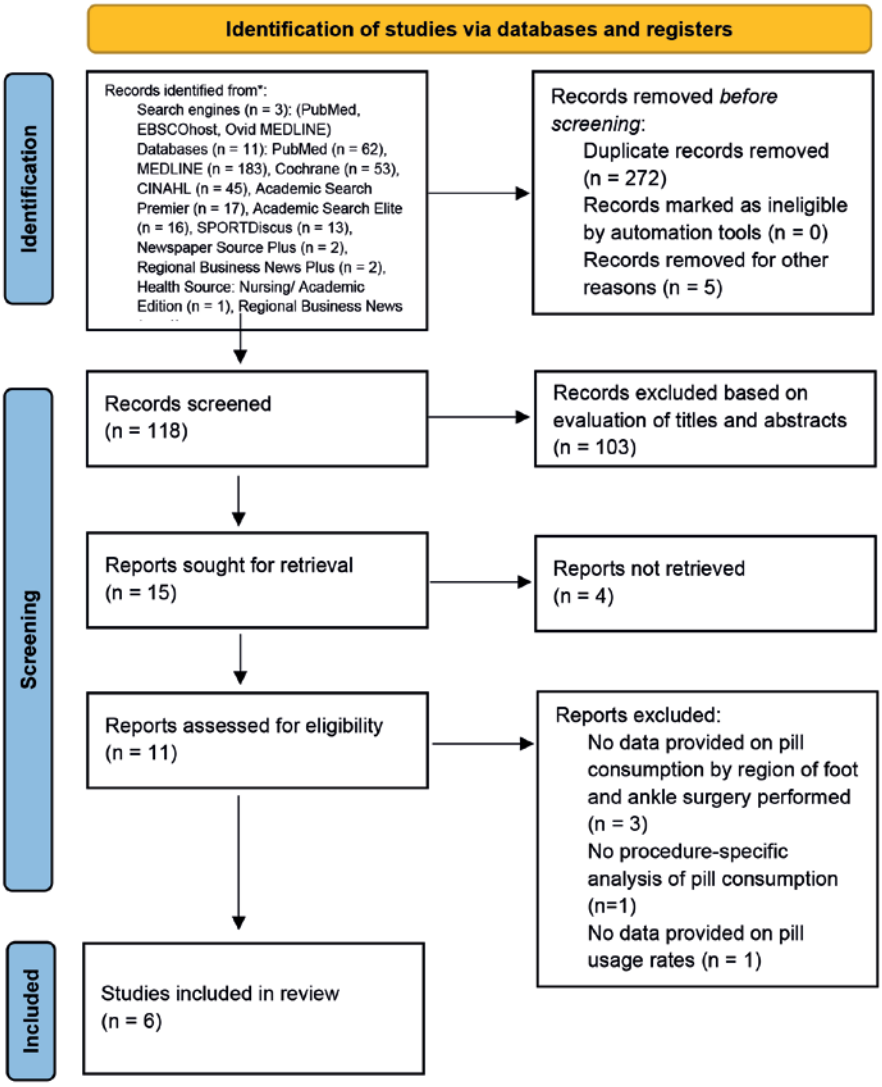

Figure 1. PRISMA flowchart showing the identification and inclusion of studies.

Inclusion criteria

Retrospective case series, retrospective cohort, and prospective observational studies that reported opioid consumption data among patients who recently were submitted to foot and ankle surgery were included. To be included, studies needed to report a breakdown of the surgical procedures that the patients were submitted to, as well as a measure of postoperative opioid consumption. Opioid prescriptions, whether already reported as such or as morphine milligram equivalent (MME), were standardized to the unit of one 5 mg oxycodone pill.

Exclusion criteria

Studies that did not report opioid consumption data after procedures from all regions of procedure (forefoot, midfoot, hindfoot/ankle), did not provide data on opioid usage, and only provided data on foot and ankle surgeries using percutaneous techniques were excluded. Also, a study comparing a higher vs. lower initial opioid prescription pill count due to its potential to affect the number of pills patients would have at their disposal postoperatively was excluded.

Unpublished study from authors' institution[25]

The study was approved by the Institutional Review Board, and then patients submitted to outpatient foot and ankle surgery were prospectively enrolled at a single academic medical center between March 2018 and April 2019 to determine how many opioid pills were consumed after surgery. A total of 78 patients were included consecutively. Eligible participants were at least 18 years of age, English-speaking, and willing to complete postoperative surveys via phone calls and follow-up visits with the authors. Exclusion criteria included narcotic use within one month before surgery (other than prescriptions provided at emergency department visits for acute fractures), past chronic narcotic use, history of chronic pain requiring pain physician management, another fracture at any site, and current pregnancy.

Once written informed consent was obtained by the authors, a preoperative survey was conducted on the day of surgery to determine the visual analog scale (VAS) pain score and level of schooling completed. The authors reviewed demographic data, including age, sex, body mass index (BMI), and payer status. Electronic medical records were used to identify the primary procedure performed, the region of procedure (forefoot, midfoot, hindfoot/ankle), and whether a regional anesthetic block was utilized. The state Prescription Monitoring Program (PMP) database was utilized to identify opioid prescriptions filled up to 12 months before surgery and up to two months following surgery. The number of pills and MMEs prescribed was calculated. Patients were categorized as opiate exposed if they filled a single narcotic prescription up to 12 months before surgery.

Following surgery, prescriptions were written by both resident and attending physicians. Surgeons were instructed to follow their standard postoperative prescribing habits, with resident prescriptions verified by the attending physician. Prescription information was collected utilizing the state PMP database for all patients by the study's authors. Follow-up surveys were conducted via phone calls on postoperative days (POD) 5 and 10 and in-person at 2 and 6-week postoperative clinic visits to document VAS pain score, number of pills consumed, number of pills remaining, satisfaction with pain control, whether additional non-narcotic pain medication was being utilized, and reasoning for discontinuing narcotic usage if applicable. Patients were instructed to bring any remaining pills to their clinic visits to be counted for accuracy by research staff and discard remaining pills when no longer requiring opioid medications for pain control. Patients were included for analysis if at least 2/4 surveys had been completed.

Narcotic consumption was defined as the number of opioid pills remaining at the last available visit. Pill utilization was calculated as the percentage of pills remaining. (For example, if 2/10 pills remained, the utilization rate was 80%). Due to small sample sizes in the midfoot and forefoot regions, proportions were compared between regions using Fisher's exact test. The Kruskal-Wallis test was used for continuous measures. A paired t-test was used to test the change in pain level from the preoperative visit to the last available visit. Linear regression modeling was used to determine if any demographic, baseline clinical characteristics, over-the-counter medication use, or previous opiate exposure was associated with total narcotic consumption.

Data extraction for systematic review

Three reviewers extracted data from the studies that met the inclusion criteria. Data collected from the studies included year, study design, location, patients enrolled, mean number of oxycodone 5 mg pill equivalents prescribed, mean number of pills consumed postoperatively, pill utilization rates, number of pills left over at the end of the study, mean or median number of pills consumed based on region of patient's surgery, and mean or median number of pills consumed based on bony vs. soft tissue procedures of the foot and ankle.

Bias and quality assessment

The included studies were assessed for bias using the Risk of Bias in Non-randomized Studies-of Exposures (ROBINS-E) tool (Figure 2)[26]. Additionally, the Methodological Index for Non-Randomized Studies (MINORS) was used to assess study quality (Table 1)[27].

Results

The search identified 395 studies. Three reviewers independently evaluated 119 non-duplicate studies. One hundred two studies were excluded based on irrelevant titles and abstracts. Seventeen full-text studies were retrieved, with five fulfilling inclusion criteria. Of the included studies, two were retrospective case series, two were prospective observational

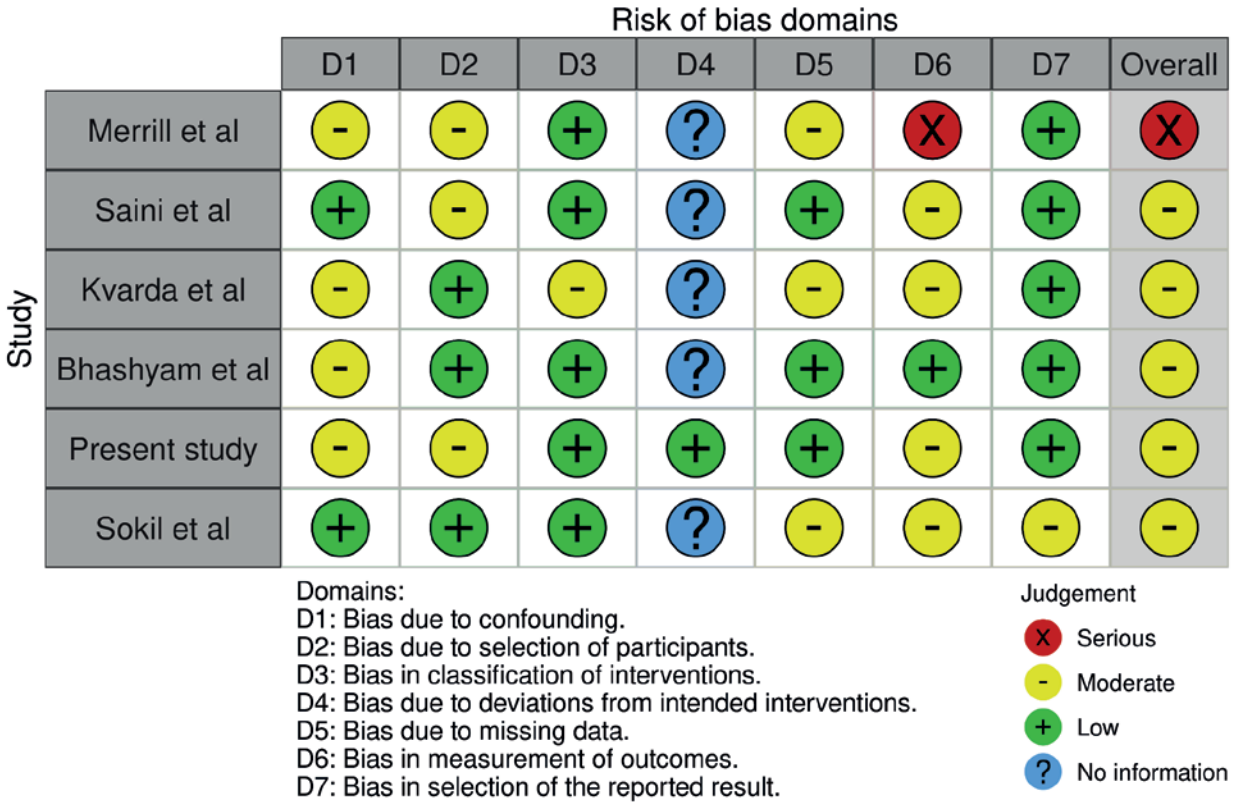

Figure 2. ROBINS-E tool results for the six included studies.

Table 1. MINORS scores for the six included studies

Study	A clearly stated aim	Inclusion of consecutive patients	Prospective collection of data	Endpoint appropriate to the aim of the study	Unbiased assessment of the study endpoint	Follow-up period appropriate to the aim of the study	Loss of follow-up less than 5%	Prospective calculation of the study size	Total MINORS score
Merrill et al.	2	1	2	2	2	2	1	2	14
Saini et al.	2	1	2	2	2	2	1	2	14
Kvarda et al.	2	2	2	2	2	2	1	2	15
Bhashyam et al.	2	2	2	2	2	2	2	2	16
Present study	2	2	2	2	2	2	2	2	16
Sokil et al.	2	1	1	1	2	2	2	2	13

cohort studies, and one was a retrospective follow-up of a prospective cohort study. Along with the five studies that met inclusion criteria, we have included an unpublished prospective observational cohort study conducted at our institution that was presented at the AOFAS Annual Meeting[25] to introduce additional data relevant to the subject at hand. Study characteristics can be found in Table 2. Contact with the authors of the included studies was attempted via email.

Primary outcomes

Opioid consumption data divided by region of foot and ankle surgery was the primary focus of this study (Table 3). Merrill et al. reported this data using the mean pills consumed but divided each region of surgery based on short-acting vs. long-acting opioids[22]. Meanwhile, Bhashyam et al. reported mean pills consumed by region of surgery but also further divided the groups by bony vs. non-bony procedures[17].

Table 2. Descriptive summary of the six included studies in the systematic review

	Year	Location and design	Age, years (mean)	Size (n)	Primary outcomes measured	Secondary outcomes measured
Merrill et al.	2018	Falls Church, VA, retrospective case series	53.1	132	Anatomic region of foot and ankle procedure and postoperative opioid pill consumption	Opioid pill consumption among bony vs. nonbony procedures of the foot and ankle, association between short-acting and long-acting opioids prescribed, and willingness to surrender leftover pills
Saini et al.	2018	Philadelphia, PA, prospective observational cohort	49	988	Opioid pill consumption patterns among patients submitted to foot and ankle surgery and the resultant over-prescription of opioids in this population	Risk factors for higher opioid consumption
Kvarda et al.	2019	Boston, MA, retrospective case series	50	244	Identify risk factors for higher opioid pill consumption in patients submitted to foot and ankle surgery and determine the rate of pill consumption	Estimate number of unused opioid pills following the conclusion of the study
Bhashyam et al.	2019	Boston, MA, prospective observational cohort	50.5	303	Opioid pill consumption based on anatomic region of surgery and between bony vs. non-bony procedures of the foot and ankle	Use findings to guide the creation of new prescribing algorithms based on the primary outcomes of the study
Present study	2019	Oklahoma City, OK, prospective observational cohort	45.2	78	Evaluate opioid pill consumption following foot and ankle surgery and identify risk factors for increased pill consumption	Estimate rate of patients with unused opioid pills at the conclusion of the study
Sokil et al.	2020	Philadelphia, PA, retrospective follow-up of prospective cohort	50.9	700	Determine the relationship between patient-reported pain tolerance and opioid pill consumption following foot and ankle surgery	Identify risk factors for higher opioid pill consumption based on demographic data and procedure characteristics

Table 3. Analysis of results of the included studies by anatomic region

	Forefoot, mean pills consumed	Midfoot, mean pills consumed	Hindfoot, mean pills consumed	Ankle, mean pills consumed	p-value
Merrill et al., short-acting opioids	18.7	24.5	21.7	b	0.356
Merrill et al., long-acting opioids	4.5	5.2	8.4^a	b	*0.0466*
Saini et al.	16*	18*	22*^a	b	*<0.001*
Kvarda et al.	-	-	-	-	-
Bhashyam et al., bony procedures	17	26.1	34.7^a	28.4	*<0.001*
Bhashyam et al., non-bony procedures	10	13.8	10.6	14.1	-
Present study	11*	17.5*	40*	b	0.0835
Sokil et al.	-	-	-	-	-

*= only median reported, a= statistically significant, b= data included in hindfoot category.

While Kvarda et al. provided useful data for this review, opioid consumption data was reported in categories made by the authors based on the invasiveness of the procedure rather than the anatomic region[21]. Sokil et al. reported the number of procedures performed per region of foot and ankle in their study; however, the mean pill consumption among each region was not reported[24]. Saini et al. reported measures of opioid consumption among regions of foot and ankle surgery using the median instead of the mean[23].

Secondary outcomes

Also of interest to this review were data on overall opioid consumption within foot and ankle surgery (Figure 3), as well as opioid consumption among bony vs. non-bony procedures of the foot and ankle (Table 4). Sokil et al. and Kvarda et al. did not report mean opioid pill consumption in bony and non-bony foot and ankle procedures, but both listed opioid pill consumption following bony procedures was significantly

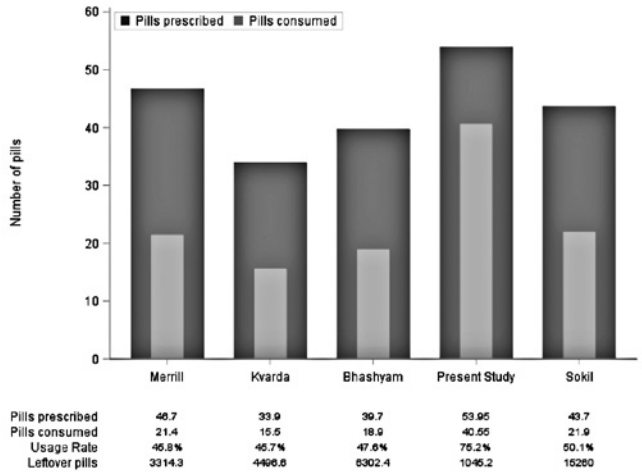

Figure 3. Pills prescribed vs. pills consumed in the included studies.

Table 4. Descriptive analysis of bony vs. non-bony procedures

	Bony procedures, mean pills consumed	Non-bony procedures, mean pills consumed	p-value
Merrill et al., short-acting opioids	21.6	19.7	0.491
Merrill et al., long-acting opioids	6.4	5	0.358
Saini et al.	20*	16*	0.069
Kvarda et al.	-	-	0.001
Bhashyam et al.	25	14	< 0.001
Present study	-	-	-
Sokil et al.	-	-	> 0.05

*= only median reported.

higher with associated p-values[21,24]. Saini et al. also used the median in reporting this measure[23]. The author's unpublished data did not investigate opioid consumption among bony vs. non-bony procedures.

Collection of opioid pill consumption data

Merrill et al. and Kvarda et al. used patient-reported counts of pill consumption[21-22]. In the unpublished study, patients were asked to complete a survey assessing the number of pills consumed and asked to bring the remaining pills to the clinic to be counted by a research team member for accuracy. Likewise, Saini et al., Bhashyam et al., and Sokil et al. reported that pill counts were verified by a member of their research team at the patient's first postoperative visits[17,23,24].

Risk factors

The included studies in this review also investigated any statistical relationship to demographic factors and factors pertaining to the patient's surgeries. In 4/6 studies, opioid consumption among patients submitted to hindfoot/ankle procedures was significantly higher compared to patients of the other two categories (Table 3)[17,22-24]. Half of the studies reported that patients submitted to bony procedures of the foot and ankle consumed a significantly higher number of opioid pills (Table 4)[17,21,23]; likewise, our unpublished data, along with two of the studies, found a statistically significant relationship between greater initial prescription amount and greater opioid consumption[21,24]. Less overall concordance among the studies was noted for statistical significance reported regarding higher opioid consumption and preoperative opioid use,[17,22] smoking status[21], younger age[17,24], traumatic surgery (versus elective)[21-22], male sex[17], higher BMI[21], and nerve block/catheter anesthesia[21,22]. Additionally, our unpublished data and Saini et al. noted that patients with higher preoperative VAS pain scores consumed more opioids[23].

Regression analyses

Out of the six studies, only Merrill et al. did not report using a regression model to investigate risk factors for increased opioid consumption but instead opted to use a t-test for continuous variable analysis and a chi-square test for frequency analysis[22]. Kvarda et al., Sokil et al., and our unpublished study all used bivariate regressions in identifying risk factors for increased opioid consumption among their patients, while Bhashyam et al. and Saini et al. utilized forward and backward, respectively, stepwise multivariable regressions to further investigate for patient-and procedure-related associations[17,21,23,24]. Lastly, Kvarda et al. also employed a multivariable regression model, which was the basis for a statistically significant difference between patient's opioid consumption following bony vs. non-bony procedures[21].

Prescription guidelines

Based on their mathematical model, Bhashyam et al. provided only opioid prescription guidelines divided into regions of surgery (forefoot, midfoot, hindfoot/ankle) and invasiveness of procedure (bony and non-bony)[17]. Kvarda et al. and Merrill et al. related that from their data, it seemed as though the prescriptions could have been cut in half and, generally, the patient's pain would have been treated adequately[21,22].

Discussion

Following foot and ankle surgery, it is generally apparent that opioid consumption increases from forefoot to midfoot to hindfoot/ankle procedures. Out of the four studies that reported opioid consumption in patients by region of surgery, three studies reported that patients submitted to hindfoot surgeries consumed significantly more opioids than patients in the other anatomic region[17,22,23]. Our study did not find a significant difference (p = 0.08) between regions of the foot, although there seemed to be an association between

the number of pills consumed and the region of foot surgery. However, the lack of statistical significance may be due to the small sample size in the midfoot and forefoot regions. The higher opioid requirements for the hindfoot/ankle region were attributed to the greater VAS pain scores reported in this group both pre-and postoperatively and to the large number of ankle fractures included in this group. This finding encourages foot and ankle surgeons to consider prescribing fewer numbers of pills to patients submitted to forefoot and midfoot surgery compared to patients submitted to hindfoot/ankle surgery.

Half of the studies included in this review reported significantly greater opioid consumption among bony vs. non-bony procedures of the foot and ankle, with Saini et al. reporting a p-value of 0.069, which was low but did not meet statistical significance[17,21,23]. In addition, opioid prescription usage rates ranged from 45.7% to 75.8%. Other studies have also demonstrated a similar correlation between opioid prescription size and overall consumption[28-30]. A likely explanation for this finding in our study and others is that patients who are prescribed more analgesic medication by a physician may assume their pain needs will be greater than those who are prescribed fewer pills.

Several studies have been recently published on opioid prescribing patterns and patient consumption following foot and ankle surgery that were excluded from this study for reasons such as randomization of initial prescription quantity and not providing opioid consumption data following procedures of the forefoot, midfoot, hindfoot/ankle. Gupta et al. prospectively evaluated opioid utilization in 84 patients and reported that a mean of 55.5 pills were prescribed, but only 22.5 pills were consumed[18]. Rogero et al. found that younger age, higher preoperative VAS pain scores, and bony procedures were associated with higher opioid utilization[30].

Similar to the results published by Saini et al. and Kvarda et al., it was found that higher preoperative VAS pain scores and initial opioid prescription size were predictive of increased narcotic consumption[21,23]. Higher patient-reported pain scores have been previously linked to pain catastrophizing and increased postoperative analgesic requirements[31-32].

Contrary to the results of several other studies in this review, our study did not find a correlation between preoperative opioid use and postoperative narcotic consumption[33-35]. The most likely explanation for this finding is that our study was underpowered to identify a significant difference. Also, an association between regional anesthesia use and narcotic consumption was not found. Christensen et al. found that regional anesthesia use reduced postoperative opioid consumption in 622 patients following ankle fracture fixation[36]. Gupta et al. also found lower pain scores and decreased narcotic usage for patients who received regional anesthesia following outpatient foot and ankle surgery[18]. Again, we may have been underpowered to find a significant effect of regional anesthesia on opioid consumption. Our findings are also attributable to the fact that regional anesthesia was used significantly more often in the hindfoot/ankle group than in the midfoot and forefoot groups. The more frequent use of regional anesthetic for procedures found to be more painful (higher VAS pain scores) and associated with greater opioid consumption introduces selection bias when analyzing the effect of regional anesthesia.

Recently, high rates of persistent narcotic use have been demonstrated in the foot and ankle literature. Utilizing a United States insurance claims database, Finney et al. identified 36,562 patients submitted to surgical treatment for hallux valgus and determined that 6.2% of patients had new persistent opioid use, defined as fulfillment of a narcotic prescription between 91 and 180 days after surgery[37]. In a similar study, Gossett et al. reported new persistent opioid use in 8.8% of patients following open treatment of ankle fractures. In their study, an initial opioid prescription of 650 mg oral morphine equivalents was the strongest modifiable risk factor predictive of persistent use[38].

Overprescribing of opioids and alarming rates of persistent narcotic use are now well established in the foot and ankle and general orthopedic literature. Recently, there has been a call for researchers to focus on potential interventions to reduce narcotic use rather than simply re-demonstrating the problem of overprescribing[39]. Patient education and preoperative counseling have been shown to reduce the duration of postoperative opioid use in orthopedic trauma patients[40]. Alter and Ilyas also found that preoperative counseling reduced opioid consumption following carpal tunnel release[41]. Non-opioid multimodal pain management is another growing area of research focus. Several countries have demonstrated success in controlling pain postoperatively and achieving greater patient satisfaction while limiting opioid administration[42-44]. Bot et al. found that patients who used more opioids while recovering from operative fracture treatment reported greater pain intensity[45]. Recently, in a randomized, double-blinded controlled trial, Weinheimer et al. showed a non-opioid regimen was non-inferior to acetaminophen and hydrocodone in providing pain relief following hand surgery[46].

Notable limitations to our review exist. Results from our study, Kvarda et al. and Merrill et al., are subject to the recall bias of patient-reported pill consumption[22-23]. Patients may have underreported pill consumption or taken additional diverted narcotic pills that were not accounted for in our data collection. Length of follow-up varied between patients in our study, and despite patients being encouraged to discard pills, it is unknown if the remaining opioid pills accounted for at the final follow-up were later consumed, saved, or discarded. Merrill et al. is the only other study in this review that reported varying follow-up times for their patients (4-10 days postoperatively), so this finding could introduce errors in the pill count data[22]. Our study's results are also limited in that our non-narcotic postoperative pain regimen was not standardized across all patients, and the effect of non-narcotic analgesia on postoperative opioid consumption in this cohort is unknown. It is worth mentioning that the primary surgeon in the unpublished study did not encourage the use

of intramuscular non-steroidal anti-inflammatories in the immediate postoperative setting, so this confounding factor is minimized in this study. However, this practice was rebutted by McDonald et al. who found that ketorolac administration in the perioperative period did not affect healing rates in foot and ankle bony procedures[47].

In addition, multimodal pain management with supplementary intravenous intraoperative COX inhibitors (ketorolac), postoperative oral postsynaptic calcium ion channel blockers (gabapentin), and/or administration of regional anesthesia as aforementioned could not be efficiently extracted from the studies included in this systematic review, adding another layer of confounding to the number of narcotics consumed. It is assumed, however, that such modalities are part of the general guidelines for multimodal operative pain management and were most likely administered in these studies, accounting for a generally reduced consumption of narcotics and influencing our recommendations of what might be viewed as a seemingly lower number of pills than expected.

Several risk factors that were investigated in these studies could not be compared to each other due to differences in reporting by the authors. For example, Merrill et al. reported data on mean postoperative VAS scores, while Saini et al. and the unpublished study collected data pertaining to both preoperative and postoperative median VAS scores[22-23]. While Merrill et al. categorized patient's opioid consumption by region of foot and ankle and by short-acting opioids versus long-acting opioids, Bhashyam et al. notes that long-acting opioids are not typically prescribed for any patients in their practice[17-22]. Missing data pertaining to this study's primary and secondary outcomes does not allow for the best possible quantification of opioid consumption in this patient population.

Additionally, a high percentage of patients in our study were uninsured and presumably of lower socioeconomic status (although we did not directly assess income level). Patients of lower socioeconomic status are less satisfied with postoperative pain control and are at greater risk of prolonged postoperative narcotic use[48]. Therefore, our results may be less generalizable to a more heterogeneous patient population. While our study was more heavily weighted toward the uninsured, Merrill et al., Kvarda et al., and Bhashyam et al. reported a patient population that was composed of mainly privately insured patients[17,21,22].

Finally, during our study period, state opioid legislation was passed regulating the quantity of pills prescribed postoperatively. A limited number of patients were enrolled after this law took effect, and we could not detect significant differences in prescription size or pill consumption before and after this date. However, we recognize that physician and patient awareness of the law may have influenced provider counseling and patient expectations for the number of pain pills that would be prescribed postoperatively.

From the data available, our prescribing recommendations are based on a stepwise increase in opioid prescription size from forefoot to midfoot to hindfoot/ankle surgery. In terms of quantity, it was decided on guidelines that would appear to mitigate excess opioids while adequately treating postoperative pain (Table 3). As the relationship between increased postoperative opioid requirement and bony involvement in foot and ankle surgeries appears to be inconsistent across the included studies (Table 4), our guidelines do not factor in this characteristic. Thus, for 5 mg oxycodone pill prescriptions, we recommend 15-, 20-, and 25-pill prescriptions for patients submitted to forefoot, midfoot, and hindfoot/ankle surgery, respectively.

Conclusion

Orthopedic surgery has a higher rate of prescribing postoperative opioids than any other specialty in medicine. Out of five available studies, four reported that patients submitted to forefoot and midfoot procedures used significantly fewer postoperative opioids than patients submitted to hindfoot/ankle procedures. When comparing bony vs. non-bony foot and ankle procedures, two studies out of the five that assessed this surgical aspect reported that patients used significantly more opioids to control postoperative pain in the bony group. While differences in data reporting among the studies prevented a formal statistical analysis of these studies, it appears that hindfoot and ankle procedures are associated with a significant risk for heightened opioid use postoperatively, while bony foot and ankle procedures may be associated with higher opioid consumption. In general, foot and ankle patients use around half of their opioid prescriptions, and thus, postoperative pain may be adequately managed with substantial decreases in prescription quantity while limiting the risk for pill diversion and new persistent opioid use. Based on all analyzed studies and reported outcomes, we put forth the following prescription guidelines for 5 mg oxycodone pills, where we recommend 15-, 20-, and 25-pill prescriptions for patients submitted to forefoot, midfoot, and hindfoot/ankle surgery.

Authors' contributions: Each author contributed individually and significantly to the development of this article: CDM *(https://orcid.org/0000-0002-4050-5447) Data collection, statistical analysis, interpreted the results of the study, bibliographic review, survey of the medical records, formatting of the article; RN, and TR *Data collection, interpreted the results of the study, bibliographic review, participated in the review process; JF *Data collection, survey of the medical records, interpreted the results of the study, bibliographic review, participated in the review process; ZB, and ST Clinical examination, data collection; AH *(https://orcid.org/0009-0008-7681-4138) Performed the surgeries, data collection. All authors read and approved the final manuscript. *ORCID (Open Researcher and Contributor ID).

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