Racial and Ethnic Disparities in Opioid Prescribing for Long Bone Fractures at Discharge From the Emergency Department: A Cross-sectional Analysis of 22 Centers From a Health Care Delivery System in Northern California

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Study objective: We examine racial and ethnic differences in opioid prescribing and dosing for long bone fractures at emergency department (ED) discharge.

Methods: We conducted an electronic health records–based cross-sectional study of adults with long bone fractures who presented to the ED across 22 sites from a health care delivery system (2016 to 2017). We examined differences in opioid prescribing at ED discharge and, among patients with a prescription, differences in opioid dosing (measured as morphine milligram equivalents) by race/ethnicity, using regression modeling with statistical adjustment for patient, fracture, and prescriber characteristics.

Results: A total of 11,576 patients with long bone fractures were included in the study; 64.4% were non-Hispanic white; 16.4%, 7.3%, 5.8%, and 5.1%, respectively, were Hispanic, Asian, black, and of other or unknown race; and 65.6% received an opioid at discharge. After adjusting for other factors, rates of opioid prescribing were not different by race/ethnicity; however, among patients with an opioid prescription, total morphine milligram equivalent units prescribed were 4.3%, 6.0%, and 8.1% less for Hispanics, blacks, and Asians relative to non-Hispanic whites.

Conclusion: Racial and ethnic minority groups with long bone fractures receive similar frequencies of opioid prescriptions at discharge, with a small potency difference. How this affects pain relief and why it happens is unclear. [Ann Emerg Med. 2019;74:622-631.]

Please see page 623 for the Editor's Capsule Summary of this article.

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INTRODUCTION

Background

In the United States, opioids are often prescribed to treat acute, severe pain associated with bone fractures.[1,2] Opioid use has increased during the past 2 decades in the United States, leading to a serious national epidemic of addiction and overdose-related deaths that have, in part, been driven by overprescribing of drugs intended for short-term use.[3]

As a result of this epidemic, opioid-seeking behavior has become more common. The emergency department (ED) is one setting in which patients may exhibit such behavior.[4,5] Although patients with definitively painful conditions, such as long bone fractures, are unlikely to have ulterior motives for opioid use, ED clinicians nevertheless may decide not to prescribe an opioid. There are various legitimate clinical reasons for not doing so, such as contraindications or drug sensitivity; however, given the recent attention to the national opioid crisis, clinicians may have concerns about potential drug diversion, misuse, or abuse, influenced by implicit biases about race and ethnicity. Such practices may result in the undertreatment of pain for certain populations.

Importance

Evidence for racial and ethnic disparities in the treatment of pain for long bone fractures in the ED is

Editor's Capsule Summary

What is already known on this topic

Pain treatment in the emergency department (ED) can vary according to many factors aside from the underlying trigger, and nonmedical patient features can influence care.

What question this study addressed

For patients with one injury type, does race or ethnicity link with any opioid prescribing differences?

What this study adds to our knowledge

Of 11,576 patients with a long bone fracture treated in 22 California EDs, 65.6% received an opioid prescription at discharge, with little difference in proportion among race/ethnicity. Non-Hispanic white patients received slightly higher potency aggregate prescriptions.

How this is relevant to clinical practice

In this hospital system, there is little difference among patient race/ethnicity in opioid prescribing after acute long bone fracture treated in the ED.

mixed. At least 2 retrospective cohort studies found lower rates of opioid administration for isolated long bone fractures among Hispanics[6] and blacks[7] relative to non-Hispanic whites. Other studies, however, have shown no such disparities.[8-11] These were small studies conducted at single ED sites, and were mostly from academic medical centers during the 1990s. Historical and sociocultural factors within a given city or region may explain whether disparities in opioid treatment were observed for specific racial and ethnic groups.

Nationally representative studies examining disparities in opioid treatment for long bone fractures have also shown mixed results.[12-14] In a retrospective analysis of National Hospital Ambulatory Medical Care Survey data between 1993 and 2005, Pletcher et al[13] described lower rates of opioid treatment in the ED for blacks, Hispanics, and Asians compared with non-Hispanic whites for various types of pain, including long bone fractures. Specifically, among 4,348 patients presenting to the ED with a long bone fracture, blacks (45%) and Asians (43%), but not necessarily Hispanics (51%), were less likely to receive an opioid compared with non-Hispanic whites (52%). A more recent analysis of National Hospital Ambulatory Medical Care Survey data (2007 to 2011), which specifically examined opioid treatment at discharge, found no statistically significant differences in opioid prescribing among 594 ED visits for long bone fractures in blacks (odds ratio 1.00; 95% confidence interval [CI] 0.53 to 1.89), with a trend toward greater odds in Hispanics (odds ratio 1.87; 95% CI 0.98 to 3.56) relative to non-Hispanic whites; Asian patients were not evaluated in the study.[14] The noncontemporaneous observation periods may explain discrepancies between observed findings in these studies. However, discrepancies may be present because the former study was unable to distinguish between opioids administered in the ED versus those prescribed at discharge, given the manner in which National Hospital Ambulatory Medical Care Survey data were collected before 2005. The distinction between administration versus outpatient prescribing is important because the latter introduces more uncertainty about whether or how the drug is used.

Currently, there is a paucity of studies explicitly examining disparities in opioid prescribing for long bone fractures at ED discharge. Moreover, we are unaware of studies that have examined potential disparities in the dosing of prescribed opioids.

Goals of This Investigation

In this study, we sought to examine treatment patterns in opioid prescribing and dosing for long bone fractures at ED discharge by race/ethnicity across 22 sites from a health care delivery system, using electronic health records data. Such an investigation can lead to a better understanding of potential disparities in care that need to be addressed to mitigate the under- or overtreatment of pain in specific populations.

MATERIALS AND METHODS

Study Design

This was an electronic health records–based cross-sectional study of adults presenting to the ED with a long bone fracture in 2016 and 2017.

Setting

This study was conducted at Sutter Health, a large, private, and not-for-profit community-based health care delivery system in Northern California. Sutter Health provides comprehensive medical care within 20 urban and rural counties, and across 130 ambulatory clinics and 24 acute-care hospitals, including 22 ED sites. All Sutter Health clinics and hospitals are linked by a single electronic health records system (Epic, Verona, WI). Annually, Sutter Health has approximately 11 million ambulatory visits, 870,000 ED visits, and 200,000 hospital discharges. The catchment area of Sutter Health is diverse, with greater than 50% of the

population belonging to a racial and ethnic minority group: 43% non-Hispanic white, 26% Hispanic of any race, 21% Asian, 6% black, and 4% other or mixed race.

Data were derived from the electronic health records of Sutter Health. Clinical information from the electronic health records is stored in a relational database, with patients indexed by a unique, random study identification number. A statistical analyst on the study team extracted data from standardized fields in the electronic health records database after institutional review board review and approval of the study protocol.

Selection of Participants

In the electronic health records, we identified patients aged 18 years or older with a discharge diagnosis of a long bone fracture from 22 EDs across Sutter Health in 2016 and 2017. We required that patients have an ED visit meeting the following eligibility criteria during the study period: a long bone fracture on a single limb, discharged to home after the visit, no evidence of pregnancy, and no ED visit for any type of bone fracture in the previous 3 months. We defined the visit meeting these criteria as the patient's index visit and included this visit in the analysis. Each patient contributed one visit to the analysis. See Table E1 (available online at http://www.annemergmed.com) for *International Classification of Diseases, 10th Revision* (*ICD-10*) diagnosis codes for long bone fractures.

Data Collection and Processing

Among eligible study patients, we extracted information from structured fields in the electronic health records on patients' dates of birth, sex, and race/ethnicity. Patients self-reported this information at clinical encounters. We operationalized race/ethnicity as Hispanic (regardless of race), non-Hispanic white, black, Asian, and other/unknown race. The other/unknown race category included patients who reported their race as "other," mixed race, Native American/Alaska Native, and Pacific Islander/Native Hawaiian, as well as those for whom race was missing. We classified patients as existing ambulatory or primary-care patients at Sutter Health or those new to the system (ie, index ED visit was the first documented encounter at Sutter), and whether they had evidence of an opioid prescription before the index visit. We characterized the index visit according to the Emergency Severity Index (1 [most severe] to 5 [least severe]),[15] as recorded by the triage nurse; whether the patient arrived in the ED alone or by ambulance or other medical transport; insurance type used at the visit; and whether analgesia (opioid or nonopioid) was administered during the visit. We calculated a Charlson comorbidity index score for each patient as a measure of overall disease burden, based on comorbidities documented as *ICD-10* codes at the visit.[16-18] Potential contraindications to opioid analgesia were also identified; namely, pulmonary or respiratory diseases (acute respiratory distress syndrome, chronic bronchitis, chronic obstructive pulmonary disease, emphysema, and severe persistent asthma) or concurrent use of benzodiazepines. We collected information on the provider who treated the patient in the ED, including sex and the type of provider (physician [MD or DO degree] or advanced-care provider [physician's assistant or nurse practitioner]). We categorized each of the 22 sites by the total number of ED discharges in 2016 and 2017, using data from California's Office of Statewide Health Planning and Development (https://oshpd.ca.gov/). We also categorized sites by the underlying population density according to data from the US Census Bureau.

Outcome Measures

The primary outcome was a prescription (ie, electronic medication order) for an opioid analgesic at discharge, documented in the electronic health records. We used Generic Product Identifier codes to classify nonopioid and opioid-based analgesic products. The secondary outcome was total morphine milligram equivalent (MME) units prescribed at discharge for oral opioid medications. Given that clinicians often prescribe opioids with instructions to "take as needed," we quantified the potency of the prescribed medication in total MME units rather than daily ones. We calculated total MMEs as the product of the quantity of pills, milligram strength, and the MME conversion factor for the prescribed opioid. MME conversion factors for oral products, which are used to standardize potency across different opioids, were obtained from the Centers for Disease Control and Prevention (Table E2, available online at http://www.annemergmed.com).[19]

Primary Data Analysis

We conducted data analyses with the R statistical software package (version 3.5.1; R Foundation; Vienna, Austria; https://www.r-project.org/), unless otherwise noted. We summarized continuous variables as means (SDs) and categoric variables as percentages. For all statistical models, we considered 95% CIs that did not overlap with the null or reference groups as statistically significant.

We used a modified Poisson regression model to examine differences in opioid prescribing at discharge (dependent variable: yes/no) by race/ethnicity (main independent variable: non-Hispanic white [reference]

versus Asian, black, Hispanic, and other/unknown) before and after statistical adjustment for covariates shown in Table 1. This model allows a computationally simplified method of calculating risk ratios with binary data compared with traditional logistic regression.[20] Unadjusted and adjusted risk ratios (hereafter termed prevalence ratios) and 95% CIs were calculated.

Among patients with an oral opioid analgesic at discharge, we used linear regression models to examine differences in total MME units prescribed (dependent variable) by racial and ethnic groups (main independent variable), before and after statistical adjustment for covariates as described above. Given the non-normal distribution of MME units (data not shown), we log-transformed this variable to meet statistical assumptions for linear regression. Subsequently, linear model coefficients were back-transformed to represent proportional mean differences in MME units.[21] Point estimates were calculated with 95% CIs.

We examined potential variation in opioid prescribing across ED sites by calculating intraclass correlation coefficients after random-effects logistic regression. In the absence of significant between-site heterogeneity, we included ED site as a fixed-effect covariate in statistical models to adjust for potential differences in prescribing by geographic region.

We conducted several exploratory analyses, using Stata MP (version 15.0; StataCorp, College Station, TX). We explored variation in overall opioid prescribing by ED site by the total number of discharges per site and the underlying population density, using weighted linear regression. We specified weights as the sample size of each ED site, and generated coefficients of determination (R^2) and linear equations from each model. We also explored variation in relative rates of opioid prescribing at discharge by race/ethnicity for each ED site. Unadjusted prevalence ratios were calculated with 95% CI as described elsewhere.[22]

RESULTS

Characteristics of Study Subjects

A total of 11,576 patients with an ED visit for a long bone fracture met study eligibility criteria between 2016 and 2017. Mean age was 56.7 years and 63.7% of patients were women (Table 1). The majority of patients were non-Hispanic white (65.4%); 16.4% were Hispanic, 7.3% were black, 5.8% were Asian, and 5.1% were of other/unknown race. The most common long bone fracture was an isolated radius fracture (27.6%), followed by isolated humerus (21.8%) and fibula (17.7%) fractures. Approximately 15% of patients had multiple fractures on a single limb, representing either multibone fractures (ie, radius-ulna or fibula-tibia) or multiple fractures to a single bone. Twenty-eight percent of patients arrived at the ED by ambulance or other medical transport.

Patients had visits at 22 ED sites with 472 unique clinicians. The majority of patients had an ED visit with a physician (99.2%) rather than an advanced-care provider (Table 1). The majority of ED visits (69%) were to sites within small to large urban communities (≥3,000 persons per square mile). Across 21 of the 22 ED sites, the rate of opioid prescribing ranged from 54.2% to 73.4%; the smallest site, with 35 long bone fracture visits, had an opioid prescribing rate of 34.4%. The rate of opioid prescribing by site increased with the total number of discharges per site, but not the underlying population density of the ED catchment area (Figure E1, available online at http://www.annemergmed.com). Between-site variation as a proportion of total variation in discharge opioid prescribing was minimal (intraclass correlation coefficient=1.13%). Therefore, statistical models included fixed rather than random effects for ED site.

During the ED visit, 7,051 patients (60.9%) received opioid analgesia. Approximately half of all opioids were administered orally (49%) and half parenterally (51%). The most frequently administered medications were oral hydrocodone (36.9%), parenteral hydromorphone (17.9%), or parenteral morphine (14.8%) (Table E3, available online at http://www.annemergmed.com). Some 14.6% of patients were administered multiple opioid analgesics during the ED visit. The rate of opioid administration was largely similar for non-Hispanic whites (61.3%), blacks (62.1%), Hispanics (64.2%), and those of other/unknown race (58.8%); however, comparatively, Asians were less frequently administered an opioid in the ED (48.0%).

On discharge from the ED, 7,595 patients (65.6%) received a prescription for an opioid, of which nearly all (7,594 [99.9%]) were for oral opioid products; 1 patient was prescribed a fentanyl patch (Table 2). Less than one tenth of patients (n=1,013 [8.8%]) received a prescription for a nonopioid analgesic. Nonopioid analgesics prescribed at discharge were most commonly ibuprofen (82%) or naproxen (15%) (Table E4, available online at http://www.annemergmed.com). One quarter of all patients (n=2,968 [25.6%]) received no prescription for an analgesic (Table 2).

Main Results

Non-Hispanic whites (64.4%), blacks (66.0%), Asians (64.6%), and those of other/unknown race (65.2%) were

Table 1. Baseline characteristics (N=11,576).

Demographics	Values
Mean age (SD), y	56.7 (20.2)
Age distribution, No. (%), y	
18–39	2,730 (23.6)
40–55	2,369 (20.5)
56–64	2,115 (18.3)
≥65	4,362 (37.7)
Women, No. (%)	7,371 (63.7)
Race/ethnicity, No. (%)	
Non-Hispanic white	7,576 (65.4)
Non-Hispanic Asian	675 (5.8)
Non-Hispanic black	844 (7.3)
Hispanic, any race	1,894 (16.4)
Non-Hispanic other/unknown race	587 (5.1)
Established outpatient, No. (%)	7,736 (66.8)
Insurance type, No. (%)	
Commercial	5,003 (43.2)
Medicare	2,077 (17.9)
Medicaid	3,550 (30.7)
Self-pay	477 (4.1)
Other	469 (4.0)
Clinical and medication-related characteristics	
Charlson comorbidity index, No. (%)	
0	10,024 (86.6)
1–2	1,207 (10.4)
3–4	246 (2.1)
5–6	47 (0.4)
≥7	52 (0.4)
Pulmonary/respiratory disease, No. (%)	464 (4.0)
Opioid before admission, No. (%)	1,043 (9.0)
Benzodiazepine before admission, No. (%)	150 (1.3)
Long bone fracture characteristics	
Long bone fracture type, No. (%)	
Femur	729 (6.3)
Fibula	2,049 (17.7)
Humerus	2,521 (21.8)
Radius	3,200 (27.6)
Tibia	837 (7.2)
Ulna	676 (5.8)
Fibula-tibia	419 (3.6)
Radius-ulna	1,145 (9.9)
Multiple fractures, No. (%)	1,820 (15.7)
ED visit characteristics	
Ambulance/medical transport arrival, No. (%)	3,265 (28.4)
Emergency Severity Index, No. (%)	
1 (most severe)	47 (0.4)
2	446 (3.9)
3	4,707 (40.7)
4	6,255 (54.3)
5 (least severe)	55 (0.5)
Missing	66 (0.5)
Analgesia administered in ED, No. (%)	
None	3,623 (31.3)
Opioid	7,051 (60.9)
Nonopioid	902 (7.8)
Benzodiazepine in the ED, No. (%)	293 (2.5)
ED visits in 3 mo before, No. (%)	
0	10,149 (87.7)
1–2	1,264 (10.9)
≥3	163 (1.4)
Clinician characteristics (patient visit level)	
Clinician type, No. (%)	
Physician (MD/DO)	11,489 (99.2)
Midlevel (NP/PA)	87 (0.8)
Clinician sex, No. (%)	
Women	2,867 (24.8)
Men	7,958 (68.7)
Missing	751 (6.5)
Site characteristics (patient visit level)	
Population density per square mile, No. (%)	
100–999 (small rural)	2,188 (18.9)
1,000–2,999 (large rural)	1,401 (12.1)
3,000–9,999 (small urban)	6,129 (53.0)
≥10,000 (large urban)	1,858 (16.0)

NP, Nurse practitioner; *PA*, physician's assistant.

similarly likely to receive an opioid prescription at discharge; however, Hispanic patients were most likely to receive an opioid (70.6%), corresponding to a 10% greater unadjusted likelihood compared with non-Hispanic whites (prevalence ratio 1.10; 95% CI 1.06 to 1.13) (Table 2). This relationship was mitigated after adjusting for other factors (adjusted prevalence ratio 1:03; 95% CI 1.00 to 1.06). Point estimates for all covariates from the multiple regression model are provided in Table E5, available online at http://www.annemergmed.com.

Among patients with an oral prescription at ED discharge, non-Hispanic whites received opioid doses that were on average more potent than those for other racial or ethnic groups (Table 3). After adjusting for other factors, mean total MME units were significantly lower, by 4.3% (95% CI –7.1% to –1.3%) for Hispanics, 6.0% (95% CI

Table 2. Analgesic prescriptions at discharge by race/ethnicity.

	Non-Hispanic White, N = 7,576	Non-Hispanic Black, N = 844	Non-Hispanic Asian, N = 675	Hispanic of Any Race, N = 1,894	Other/Unknown Race, N = 587
Analgesic at discharge, No. (%)*					
Opioid (with or without nonopioid)	4,881 (64.4)	557 (66.0)	436 (64.6)	1,338 (70.6)	383 (65.2)
Nonopioid (only)	336 (4.4)	57 (6.8)	38 (5.6)	134 (7.1)	44 (7.5)
None	2,359 (31.1)	230 (27.3)	201 (29.8)	422 (22.3)	160 (27.3)
Prevalence ratios for opioid Rx (95% CI)					
Unadjusted	1 [Reference]	1.02 (0.97–1.08)	1.00 (0.95–1.06)	1.10 (1.06–1.13)†	1.01 (0.95–1.08)
Adjusted‡	1 [Reference]	1.02 (0.98–1.08)	1.03 (0.98–1.09)	1.03 (1.00–1.06)	0.98 (0.92–1.03)
	N = 4,881	**N = 557**	**N = 436**	**N = 1,338**	**N = 383**
Opioid Rx generic name, No. (%)*					
Codeine	143 (2.9)	28 (5.0)	15 (3.4)	80 (6.0)	14 (3.7)
Fentanyl	1 (<0.1)	0	0	0	0
Hydrocodone	3,617 (77.2)	430 (81.2)	354 (75.9)	1,015 (79.6)	305 (77.2)
Hydromorphone	59 (1.2)	1 (0.2)	3 (0.7)	12 (0.9)	2 (0.5)
Meperidine	1 (<0.1)	0	0	0	0
Methadone	1 (<0.1)	0	0	0	0
Morphine	17 (0.4)	2 (0.4)	2 (0.5)	2 (0.2)	1 (0.3)
Oxycodone	708 (14.5)	61 (11.0)	36 (8.3)	139 (10.4)	42 (11.0)
Tapentadol	1 (<0.1)	0	0	0	0
Tramadol	234 (4.8)	30 (5.4)	20 (4.6)	74 (5.5)	18 (4.7)
Multiple Rx at discharge	99 (2.0)	5 (0.9)	6 (1.4)	16 (1.2)	1 (0.3)

Rx, Prescription.
*Statistical test not performed.
†Statistically significant according to nonoverlapping 95% CI with the null.
‡Statistical adjustment for covariates in Table 1.

–10.0% to –1.8) for blacks, 8.1% (95% CI –12.3% to –3.6%) for Asians, and 8.1% (95% CI –12.3% to –2.0%) for those of other/unknown race compared with non-Hispanic whites. Fewer MME units prescribed to racial or ethnic minority groups relative to non-Hispanic whites corresponded to less frequent prescriptions for

Table 3. Oral opioid analgesic prescription potency at discharge from the ED by race/ethnicity.

	Non-Hispanic White, N = 4,881	Non-Hispanic Black, N = 557	Non-Hispanic Asian, N = 436	Hispanic of Any Race, N = 1,337	Other/Unknown Race, N = 383
Mean total MME units (SD)*	132.2 (100.4)	118.6 (69.2)	109.4 (54.4)	122.6 (76.8)	116.6 (62.3)
Proportional mean difference in total MME units (95% CI)					
Unadjusted estimate	1 [Reference]	−7.8 (−11.8 to −3.7)†	−12.1 (−16.3 to −7.7)†	−5.2 (−8.0 to −2.2)†	−8.7 (−13.3 to −3.8)†
Adjusted estimate	1 [Reference]	−6.0 (−10.0 to −1.8)†	−8.1 (−12.3 to −3.6)†	−4.3 (−7.1 to −1.3)†	−7.8 (−12.3 to −3.0)†
Relative morphine potency, No. (%)‡					
Less potent than morphine	448 (8.7)	61 (10.6)	41 (9.1)	178 (12.7)	33 (8.4)
Morphine equivalent	3,859 (74.7)	451 (78.2)	366 (81.2)	1,060 (75.5)	312 (79.6)
More potent than morphine	862 (16.7)	65 (11.3)	44 (9.8)	166 (11.8)	47 (12.0)
Mean pill quantity, count (95% CI)	19.6 (19.4 to 19.8)	18.6 (18.1 to 19.1)†	18.9 (18.4 to 19.4)	19.1 (18.8 to 19.4)	19.2 (18.6 to 19.8)

*Statistical test not performed.
†Statistically significant according to a nonoverlapping 95% CI with the null or the reference category of non-Hispanic whites.
‡Statistically significant according to a χ^2 test of independence (*P* value not shown).

opioids of higher potency than morphine and more frequent prescriptions for opioids of lower potency than morphine and, among blacks, fewer pills prescribed.

By ED site, crude opioid prescribing prevalence ratios for Hispanics versus non-Hispanic whites were nominally greater than 1 across most sites, albeit with varying magnitude and precision (Table E6 and Figure E2, available online at http://www.annemergmed.com). Crude opioid prescribing prevalence ratios for blacks, Asians, and those of other/unknown race versus non-Hispanic whites were more variable, with point estimates both greater than and less than 1. The majority of prevalence ratios within sites did not reach statistical significance. The magnitude and direction of prevalence ratios were unrelated to the total number of discharges at each site (Figure E2, available online at http://www.annemergmed.com) and the underlying population density (data not shown).

LIMITATIONS

This study has several important limitations. Our cross-sectional analysis does not allow causal inferences. ED clinicians consider various factors when deciding on appropriate treatment for pain, and we recognize that electronic health records databases do not capture all nuances of patient care, particularly those that are subjective. For example, patient preferences and self-reported pain may play a role in opioid prescribing and dosing, driven by pain tolerance and perceptions about and experiences with opioids.

Pain level is likely the most important unmeasured confounder in this study. If minority groups reported lower levels of pain relative to non-Hispanic whites, this could explain observed differences in MME units prescribed.

The purpose of electronic health records data is the delivery of medical care and billing, not research. Although we expect that data are accurate, given their intended purpose, we cannot rule out errors in clinical data entry. However, we do not expect these errors to be different across patients of different racial or ethnic backgrounds.

Because pain is a subjective phenomenon, we cannot know whether differences in total MME units prescribed are clinically important. Small differences in MME units prescribed may be important for some individuals in terms of pain management. Conversely, large differences in MME units prescribed may not be as important for other individuals, especially if their pain tolerance is high. Moreover, we cannot rule out the possibility that mean differences in MME units are influenced by a limited number of prescribers.

Last, the majority of prescribing providers in our study were physicians rather than advanced-care providers. Thus, prescribing practices in our study may reflect those primarily of physicians in Northern California and in community-based ED settings. We cannot know whether results are generalizable to other prescribers, other geographic regions, or academic or for-profit health systems. Our findings warrant confirmation in other large databases.

DISCUSSION

In this study of the treatment of long bone fractures at discharge from the ED within a large community-based health care delivery system, racial and ethnic minority groups had a similar propensity for receiving an opioid prescription at discharge relative to non-Hispanic whites; however, among those with an opioid, minority groups received less potent prescriptions, ranging on average from 4.3% to 8.1% fewer MME units. Lower opioid doses correlated with prescriptions for opioid products less potent than morphine. To our knowledge, this is the largest study to date examining opioid prescribing practices for long bone fractures in the ED, with more than 11,000 patient visits across 22 clinical sites.

The undertreatment of pain has been well described in the ED setting.[23] Disparities in opioid treatment have also been described, albeit with mixed results. Most studies have shown that racial and ethnic minority groups are less likely to receive opioid analgesia in the ED for nondefinitively painful conditions, such as toothaches, migraines, and abdominal pain.[12-14] However, the evidence for disparities in opioid prescribing for definitively painful conditions, such as kidney stones and bone fractures, has been less clear.

Within individual ED sites, exploratory analyses showed that Hispanics consistently had nominally higher rates of receiving an opioid prescription than non-Hispanic whites; however, the relationship was less consistent for blacks and Asians, who each showed both higher and lower rates compared with non-Hispanic whites. Most associations were not statistically significant. Differences in overall and racial and ethnic group sample sizes at each ED site, as well as the fact that these are unadjusted estimates, complicate the interpretation of findings. There did not appear to be an association between the direction and magnitude of prevalence ratios according to the total number of discharges at each site or the underlying population density of the ED catchment area. In future studies, we plan to examine site-specific differences in opioid

prescribing in more detail; specifically, to uncover contextual factors that may explain disparities.

Most racial and ethnic groups had a similar propensity for receiving opioid analgesia during the ED visit, with the exception of Asians. Less than half of all Asian patients received an opioid analgesic during their visit (48.0%). Although this may be interpreted as a disparity in treatment, studies have shown greater sensitivity to opioids[24] and differences in opioid metabolism[25-27] in Asians compared with whites, although cultural differences in the acceptance of opioids cannot be ruled out.[28] Asians had a higher rate of receiving an opioid for the outpatient setting (64.6%) than in the ED. It is possible that some Asian patients were willing to accept an opioid prescription for outpatient use, with no intention of filling the prescription postdischarge. More research is needed in this area.

To our knowledge, this is the first study to examine prescribed opioid dosing at ED discharge across different racial and ethnic groups. As an illustration, compared with a non-Hispanic white patient with a hydrocodone prescription for a total of 132 MME units, minority groups received hydrocodone prescriptions that were on average 4% to 8% less potent, corresponding to 5 to 11 fewer pills, respectively.

Although the average number of pills prescribed was largely similar across racial and ethnic groups in our study, blacks received on average one less pill per opioid prescription than non-Hispanic whites (18.6 versus 19.6), a small yet statistically significant difference. That said, lower opioid dosing among minority groups is primarily likely due to the prescribing of less potent opioid products. For example, at discharge approximately 15% of non-Hispanic white patients received a prescription for oxycodone, which is 50% more potent than morphine or hydrocodone, compared with only 8% to 11% of patients from a racial or ethnic minority group. Overall, nearly 17% of non-Hispanic whites received prescriptions for opioid products more potent than morphine compared with 10% to 12% of racial or ethnic minority groups.

Although it is tempting to speculate that observed differences in opioid dosing represent the undertreatment of pain in minority groups, an alternative interpretation of these data is that non-Hispanic whites are overtreated. It is well known that the opioid crisis has disproportionately affected white communities,[29] and it has been speculated that implicit racial and ethnic biases may have insulated minority groups from the brunt of this epidemic.[30] As health care systems across the United States seek to identify strategies to curb inappropriate opioid prescribing, the ED is one setting to consider. Opioid prescribing practices for bone fractures in the ED may require standardization based on local and federal regulations and evidence-based prescribing guidelines. Prescribing defaults in the electronic health record for the type of opioid, strength, and quantity of pills may help to mitigate both overprescribing and potential disparities in care.

Since October 2, 2018, prescribers in California have been required by law to consult the state's prescription drug monitoring program (Controlled Substance Utilization, Review and Evaluation System) when writing opioid prescriptions.[31] Although the program was available before this date, and its use was encouraged during the study period (2016 to 2017) by both the Medical Board of California and the health care organization, we cannot know whether prescribers actually consulted it and whether that had an influence on prescribing behavior. Evidence for the influence of prescription drug monitoring programs on opioid prescribing and overdose deaths is mixed.[32-35] Future studies are needed to understand how the programs may influence potential disparities in opioid prescribing and dosing, especially in the ED.

The overall rate of opioid prescribing at discharge ranged from 34.3% to 73.4% and increased according to the total number of ED discharges, which correlates with the overall size of the ED. Thus, in larger EDs with more long bone fracture visits, physicians may be more comfortable with opioid prescribing. Approximately 25% of patients with long bone fractures in our study did not receive an analgesic at discharge and 30% did not receive an opioid, which is consistent with data from previously published studies of isolated long bone fractures.[6-14] Physicians may not have prescribed an opioid because the fracture was not very painful (eg, hairline fracture). Alternatively, an opioid administered during the ED visit may not have been well tolerated, or the patient may have refused a prescription at discharge. It is also possible that opioids were contraindicated, such as in some older adults, those with pulmonary or respiratory disease, or those concurrently receiving a benzodiazepine. We cannot rule out the possibility that an opioid was not prescribed because the patient had a prescription at home. Nine percent of patients had an opioid prescription documented in the electronic health records in the 3 months before their ED visit (Table 1); however, other patients may have reported having a recent opioid prescription from a clinician outside of the health care system, and therefore it was not documented in the electronic health records. We noted a very low rate of nonopioid analgesic prescribing ($\approx$5%), possibly because patients preferred over-the-counter nonopioid

analgesics because of costs or the inconvenience of filling a prescription at the pharmacy when the medication was readily available at home.

In summary, in this community-based health care delivery system across 22 ED sites in Northern California, racial and ethnic minority groups with long bone fractures have a similar propensity of receiving an opioid at discharge from the ED compared with non-Hispanic whites; however, on average, they receive opioid prescriptions that are less potent.

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