Racial and Ethnic Disparities in Discharge Opioid Prescribing from a Hospital Medicine Service

Aksharananda Rambachan, MD, MPH[1]*, Margaret C Fang, MD, MPH[1], Priya Prasad, PhD, MPH[1], Nicholas Iverson, MD[2]

[1]Division of Hospital Medicine; University of California, San Francisco, San Francisco, California; [2]Division of Hospital Medicine, Priscilla Chan and Mark Zuckerberg San Francisco General Hospital and Trauma Center; San Francisco, California.

BACKGROUND: Differential opioid prescribing patterns have been reported in non-White patient populations. However, these disparities have not been well described among hospitalized medical inpatients.

OBJECTIVE: To describe differences in opioid prescribing patterns among inpatients discharged from the general medicine service based on race/ethnicity.

DESIGN, SETTING, AND PARTICIPANTS: For this retrospective study, we performed a multivariable logistic regression for patient race/ethnicity and whether patients received an opioid prescription at discharge and a negative binomial regression for days of opioids prescribed at discharge. The study included all 10,953 inpatients discharged from the general medicine service from June 2012 to November 2018 at University of California San Francisco Medical Center who received opioids during the last 24 hours of their hospitalization.

MAIN OUTCOMES AND MEASURES: We examined two primary outcomes: whether a patient received an opioid

prescription at discharge, and, for patients prescribed opioids, the number of days dispensed.

RESULTS: Compared with White patients, Black patients were less likely to receive an opioid prescription at discharge (predicted population rate of 47.6% vs 50.7%; average marginal effect [AME], −3.1%; 95% CI, −5.5% to −0.8%). Asian patients were more likely to receive an opioid prescription on discharge (predicted population rate, 55.6% vs 50.7%; AME, +4.9; 95% CI, 1.5%-8.3%). We also found that Black patients received a shorter duration of opioid days compared with White patients (predicted days of opioids on discharge, 15.7 days vs 17.8 days; AME, −2.1 days; 95% CI, −3.3 to −0.9).

CONCLUSION: Black patients were less likely to receive opioids and received shorter courses at discharge compared with White patients, adjusting for covariates. Asian patients were the most likely to receive an opioid prescription. *Journal of Hospital Medicine* 2021;16:XXX-XXX. © 2021 Society of Hospital Medicine

Within the nationwide effort to combat the opioid epidemic and reduce opioid prescribing, researchers have described different prescribing patterns for non-White racial and ethnic groups, including Black and LatinX populations. This remains a largely unexplored area within hospital medicine. Earlier studies of racial disparities demonstrate how some patients are assessed less often for pain and prescribed fewer opioids from the emergency department, surgical settings, and outpatient primary care practices. Researchers also have documented racial and ethnic disparities in analgesia for cancer pain and chronic non-cancer pain.[1-11] Studies have demonstrated that White patients are more likely to receive opioid prescriptions compared with Black patients. Even with similar documented pain scores, there is evidence that Black patients receive fewer analgesics com-

pared with White patients. For example, a recent study found that Black and Hispanic patients presenting to the emergency room for renal colic received less opioid medication compared with White patients.[3] A study across 22 sites in Northern California found that racial minorities with long-bone fractures received fewer opioids at discharge than White patients.[1]

It is unknown whether differential prescribing patterns by race exist among patients hospitalized on general medicine services. The objective of our study was to assess whether race and ethnicity were associated with the likelihood of opioids being prescribed and the duration of opioids prescribed when these patients are discharged from the hospital. Quantifying and seeking to understand these differences are the first steps toward ensuring racial and ethnic health equity in patient care.

METHODS

Study Population and Data Sources

We identified all adults (age ≥18 years) discharged from the acute care inpatient general medicine services between June 1, 2012, and November 30, 2018, at the University of California, San Francisco (UCSF) Helen Diller Medical Center at Parnassus Heights, a 785-bed urban academic teaching hospital. All data were obtained from the hospital's Epic-based electronic

*Corresponding Author: Aksharananda Rambachan, MD, MPH;
Email: aksharananda.rambachan@ucsf.edu.

medical record (Epic Systems Corporation). Data elements were extracted from Clarity, the relationship database that stores Epic inpatient data. Patients discharged from the inpatient cardiology or bone marrow transplant services were not included. We excluded patients who did not receive opioids in the last 24 hours of their hospitalization. Patients with cancer-related pain diagnoses or sickle cell disease pain crises and patients who were discharged to hospice or followed by palliative care were excluded from the study based on *International Classification of Diseases, Tenth Revision* (ICD-10) codes (available on request) or service codes, when available, or admitting provider electronic health record documentation (Appendix Figure 1). Palliative care and hospice patients have significantly different pain needs, with management often directed by specialists. Patients with sickle cell disease are disproportionately Black and have distinct opioid prescribing patterns.[12,13] We also excluded discharge opioid prescriptions that were a resumption of the patient's opioid prescription before admission based on medication documentation. Only new prescriptions signed by the discharging hospitalist, including different doses and formulations, were included in this study.

We performed a subgroup analysis of patients who were not prescribed opioids before their admission based on medication reconciliation but were started on opioids while hospitalized.

Primary Outcomes

We examined two primary outcomes: whether a patient received an opioid prescription at discharge, and, for patients prescribed opioids, the number of days prescribed. Days of opioids at discharge were calculated as total morphine milligram equivalents (MMEs) prescribed divided by MMEs administered during the final 24 hours of hospitalization. This metric was used as a patient-specific approach to calculating how long an opioid prescription will last after discharge, standardized according to the actual opioid requirements from hospitalization.[14] If a patient was discharged with prescriptions for several opioids, the longest single prescription duration was used.

Primary Predictors

The primary predictor was the patient's primary self-reported race/ethnicity, categorized as White, Black, LatinX, Asian, Native Hawaiian or other Pacific Islander, American Indian or Alaska Native, and other/unknown. Other/unknown included patients who were listed as other, declined, or who were otherwise unspecified. Self-reported race/ethnicity is obtained through reporting to the registrar. These race/ethnicity groupings were done in concordance with US Census Bureau definitions. Researchers classified patients as LatinX if they had Hispanic documented as their ethnicity, no matter their racial identification. These categorizations were chosen to be consistent with the existing literature, recognizing the role of a combined race/ethnicity definition for Hispanic or LatinX populations.[15] These definitions of race/ethnicity are self-reported and reflect socially—not genetically defined—groupings.[16] This variable serves as a surrogate for the structural factors that contribute to racism, the determining factor for racially disparate outcomes.[17]

Covariate Data Collection

Additional data were obtained regarding patient demographics, hospitalization factors, and medical diagnoses. Demographic factors included age, sex, and limited English proficiency (LEP) status. LEP was defined as having a primary language other than English and requiring an interpreter. Hospitalization factors included length of stay, whether they required intensive care unit (ICU) management, average daily MMEs administered during their entire hospitalization, MMEs administered during the final 24 hours of their hospitalization, whether the patient was on a teaching service or direct-care hospitalist service, their disposition on discharge, and year. Medical diagnosis variables included the adjusted Elixhauser Comorbidity Index based on ICD-10 codes; whether the patient was taking opioids at admission; and specific diagnoses of cancer, posttraumatic stress disorder (PTSD), and mood, anxiety, or psychotic disorder based on ICD-10 documentation.[18]

Statistical Analysis

All statistical analyses were performed using Stata software version 16 (StataCorp LP). Baseline demographic variables, hospitalization factors, and medical diagnosis variables were stratified by race/ethnicity. Within group comparisons were performed using chi-square or analysis of variance (ANOVA) testing. For regression analyses, we fit two models. First, we fit a multivariable logistic regression model on all patients who received opioids during the last 24 hours of their hospitalization to examine the association between patient race/ethnicity and whether a patient received opioids at discharge, adjusting for additional patient, hospitalization, and medical covariates. Then we fit a negative binomial regression model on patients who were prescribed opioids at discharge to examine the association between patient race/ethnicity and the amount of opioids prescribed at discharge, adjusting for covariates. We used a negative binomial model because of the overdispersed distribution of discharge opioid prescriptions and only examined patients with an opioid prescription at discharge. We included the listed variables in our model because they were all found a priori to be associated with discharge opioid prescriptions.[19] Instead of using days of opioids based on the last 24 hours, we performed a secondary analysis using the actual days of opioids supplied as the outcome. For example, a prescription of 12 tablets with every 6 hours dosing would be 3 days' duration.

For both models, subgroup analyses were performed using the adjusted models restricted to patients newly prescribed opioids during their hospitalization and who were not previously taking opioids based on admission medication reconciliation. After testing for effect modification, this subgroup analysis was performed to reduce selection bias associated with earlier opioid use.

For all models, we reported predicted population opioid prescribing rates from the average marginal effects (AME).[20]

Marginal effects were used because ours was a population level study and the outcome of interest was relatively common, limiting the effective interpretation of odds ratios.[21] Marginal effects allow us to observe the instantaneous effect a given independent variable has on a dependent variable, while holding all other variables constant. It is implemented using the margins command in Stata. Marginal effects enable us to present our results as differences in probabilities, which is a more accurate way to describe the differences found among patient groups. Further, marginal effects are less sensitive to changes in model specifications.[22]

The UCSF Institutional Review Board for Human Subjects Research approved this study with a waiver of informed consent.

RESULTS
Unadjusted Results
We identified 10,953 patients who received opioids during the last 24 hours of hospitalization (see Appendix Figure 1 for study consort diagram). The patient population was 52.2% White, 18.4% Black, 11.5% Latinx, 10.1% Asian, 6.2% other/unknown, 0.9% Native Hawaiian/Other Pacific Islander, and 0.8% American Indian/Alaska Native (Table 1, Appendix Table 1). Black patients had fewer cancer diagnoses and the highest rate of prescribed opioids on admission. Asian patients were older and more likely to be female, and had higher rates of cancer, the highest median comorbidity index, and the smallest median daily MME during both the last 24 hours and total duration of hospitalization. Representative of general medicine patients, the most common principal discharge diagnoses in our dataset were pneumonia, cellulitis, altered mental status, sepsis, and abdominal pain.

Overall, 5541 (50.6%) patients who received opioids in the last 24 hours of their hospitalization received an opioid prescription at discharge. There were significant differences among racial/ethnic groups receiving an opioid prescription at discharge. Black patients were less likely to be discharged with an opioid compared with White patients (47.7% vs 50.3%; *P* < .001) (Table 2). The median discharge prescription duration for all patients was 9.3 days (interquartile range [IQR], 3.8-20.0). Black patients received the fewest median days of opioids at 7.5 days (IQR, 3.2-16.7) compared with White patients at 8.8 days (IQR, 3.7-20.0; *P* < .001) (Table 2).

Adjusted Regression Results
Demographic, clinical, and diagnosis specific factors were significantly associated with opioid prescriptions, including previous opioid use, sex, and a concurrent cancer diagnosis. There were fewer opioid prescriptions over time (Figure).

Following multivariable logistic regression for the association between race/ethnicity and opioid on discharge and controlling for covariates, we found that Black patients were less likely to receive an opioid prescription on discharge compared with White patients (predicted population rate, 47.6% vs 50.7%; AME −3.1%; 95% CI, −5.5% to −0.8%). Asian patients were more likely to receive a prescription on discharge compared with White patients (predicted population rate, 55.6% vs 50.7%; AME +4.9; 95% CI, 1.5%-8.3%).

Following multivariable negative binomial regression for the association between race/ethnicity and the number of opioid days on discharge, we found that Black patients received a shorter duration of opioid days compared with White patients (predicted days of opioids on discharge, 15.7 days vs 17.8 days; AME −2.1 days; 95% CI, −3.3 to −0.87) (Table 3). There were no significant differences among patients and the other racial/ethnic groups.

Our secondary analysis from the negative binomial regression with the days of opioids supplied metric yielded similar results to our primary analysis showing that Black patients received statically significantly fewer days of opioid therapy compared with White patients (Appendix Table 2).

Subgroup Regression Results
After testing for effect modification, which was negative, we examined the relationships for patients started on opioids during their hospitalization (Appendix Table 3 and Appendix Table 4). There were 5101 patients with newly prescribed opioids during their hospitalization. Adjusting for covariates, we found that Black patients were less likely to receive opioids at discharge compared with White patients (predicted population rate, 34.9% vs 40.4%; AME −5.5%; 95% CI, −9.2% to −1.9%). American Indian or Alaska Native patients were more likely to receive opioids on discharge (predicted population rate, 58.3% vs 40.4%; AME +17.9%; 95% CI, 1.0%-34.8%). We also found that Asian patients received more days of opioids on discharge (predicted days of opioid on discharge, 16.7 vs 13.7 days; AME +3.0 days; 95% CI, 0.6-5.3 days) (Appendix Table 4, Appendix Figure 2).

DISCUSSION
We found that Black patients discharged from the general medicine service were less likely to receive opioids and received shorter courses on discharge compared with White patients, adjusting for demographic, hospitalization, and medical diagnosis variables. Asian patients were more likely to receive an opioid prescription at discharge—a finding not reported in the literature on opioid prescribing disparities in most other practice settings.[1]

Previous studies have shown racial disparities in pain management in emergency and surgical settings, but these relationships have not been characterized in an inpatient medicine population. Medicine patients comprise the majority of admitted patients in the United States and reflect a wide diversity of medical conditions, many requiring opioids for pain management. Determining the etiology of these differential prescribing patterns was not within the scope of our study, but earlier studies demonstrate a number of reasons why these patterns exist across racial and ethnic groups in other practice settings.[23,24] These reports give us insight into potential mechanisms for our study population.

Differences in pain management likely represent the multiple structural mechanisms by which racism operates.[17] Drawing from the existing literature and the socioecological model, we hypothesize the ways that individual, interpersonal relationships, organizations, communities, and public policy impact opioid prescribing.[25,26] Using this model and considering the

TABLE 1. Baseline Characteristics of Patients Receiving Opioids by Race/Ethnicity (N = 10,953)

Covariate[a]	White (n = 5720)	Black (n = 2011)	Latinx (n = 1264)	Asian (n = 1101)	Other/unknown[b] (n = 857)
Demographic variables					
Age, mean (SD), y	54.0 (17.0)	51.8 (15.5)	47.4 (17.6)	61.3 (19.9)	52.5 (18.4)
Limited English proficiency	111 (1.9)	8 (0.4)	259 (20.5)	502 (45.6)	100 (11.7)
Male sex	2919 (51.0)	952 (47.3)	606 (47.9)	480 (43.6)	432 (50.4)
Discharging service					
Teaching service	4536 (79.3)	1579 (78.5)	1017 (80.5)	894 (81.2)	666 (77.7)
Hospitalist service	1184 (20.7)	432 (21.5)	247 (19.5)	207 (18.8)	191 (22.3)
Other covariates					
Cancer diagnosis	1026 (17.9)	201 (10.0)	217 (17.2)	314 (28.5)	160 (18.7)
ICU stay	914 (16.0)	281 (14.0)	175 (13.8)	128 (11.6)	135 (15.8)
Opioids at admission	3145 (55.0)	1183 (58.8)	658 (52.1)	456 (41.4)	410 (47.8)
Mood disorder	1372 (24.0)	395 (19.6)	227 (18.0)	112 (10.2)	137 (16.0)
Anxiety disorder	928 (16.2)	178 (8.9)	164 (13.0)	63 (5.7)	103 (12.0)
Posttraumatic stress disorder	159 (2.8)	47 (2.3)	19 (1.5)	9 (0.8)	28 (3.3)
Non-mood psychotic disorder	213 (3.7)	100 (5.0)	30 (2.4)	17 (1.5)	29 (3.4)
Comorbidity index, median (IQR)	7 (0-16)	8 (0-16)	7 (0-16)	10 (0-21)	7 (0-16)
Length of stay, median (IQR), d	4 (2.2-7.1)	3.9 (2.1-7.1)	4 (2.1-7.4)	3.5 (1.9-6.1)	3.8 (2.0-6.8)
MMEs per 24 hours, median (IQR)	62.2 (24.6-170.4)	60 (23.5-151.7)	51.7 (20.5-133.8)	24.5 (10.9-57.5)	46.8 (19.8-132.8)
Last 24 hours MMEs, median (IQR)	60 (22.5-160)	52 (20-150)	45 (15-120)	22.5 (10-52.5)	40.0 (15.0-114.0)

Results are presented as No. (%) unless otherwise noted.

[a] All differences between groups were significant except for discharging service.

[b] Other/unknown includes American Indian or Alaska Native and Native Hawaiian or Other Pacific Islander due to space limitations. Our analysis treated these patient groups independently and not included in "Other." Appendix Table 1 has a complete listing with all racial/ethnic groups reported independently.

Abbreviations: ICU, intensive care unit; IQR, interquartile range; MME, morphine milligram equivalents.

framework of Critical Race Theory (CRT), we can work towards understanding how race and ethnicity stand in as surrogates for racism and how this manifests in different outcomes and identify areas for intervention. CRT draws attention to race consciousness, contemporary orientation, centering in the margins, and praxis. In the context of this analysis, we recognize race consciousness and the interactions among factors such as race/ethnicity, language, and diagnoses such as PTSD.[27] This approach is necessary because racism is a multilevel construct influenced by macrolevel factors.[28]

Individually and interpersonally, there is clinician-driven bias in pain assessment, which is activated under times of stress and diagnostic uncertainty and is amplified by a lack of clear guidelines for pain management prescriptions.[23,29-32] Institutional and organizational culture contribute to disparities through ingrained culture, practice patterns, and resource allocation.[29,33] Last, public policy and the larger sociopolitical environment worsen disparities through nondiverse workforces, state and federal guidelines, criminal justice policy, supply chain regulation, and access to care.

As individual clinicians, departments, and health systems leaders, we must identify areas for intervention. At the individual and interpersonal levels, there is evidence that taking implicit association tests could help clinicians become more aware of their negative associations, and empathy-inducing, perspective-taking interventions can reduce pain treatment bias.[31,34] At the institutional level, we must report data on disparities, create guidelines for pain management, and reevaluate the educational curriculum and culture to assess how certain biases could be propagated. The lack of straightforward guidelines leads to unclear indications for opioid prescriptions, exacerbating provider-level differences in prescribing. At the policy level, legislation that promotes workplace diversity, increases training for and access to pain specialists, and incentivizes data collection and reporting could help reduce disparities.[35] Equitable access to prescriptions and care is essential. Pharmacies often understock opioids in minority neighborhoods, meaning that even if a patient is prescribed an opioid on discharge, he or she might have difficulty filling the prescription.[36]

One could question whether fewer opioid prescriptions for Black patients protects against the harms of opioid overprescribing, and therefore is not reflective of harmful inequity.[37] Ongoing national programs aim to reduce the harmful effects of opioids, which is reflected in the reduction in opioid prescribing over time in our institution. Our point is that differences in prescribing could reflect practices that do result in

TABLE 2. Overall Unadjusted Results for Percentage of Patients Prescribed Opioids on Discharge and Median Opioid Prescription at Discharge (n = 5541)

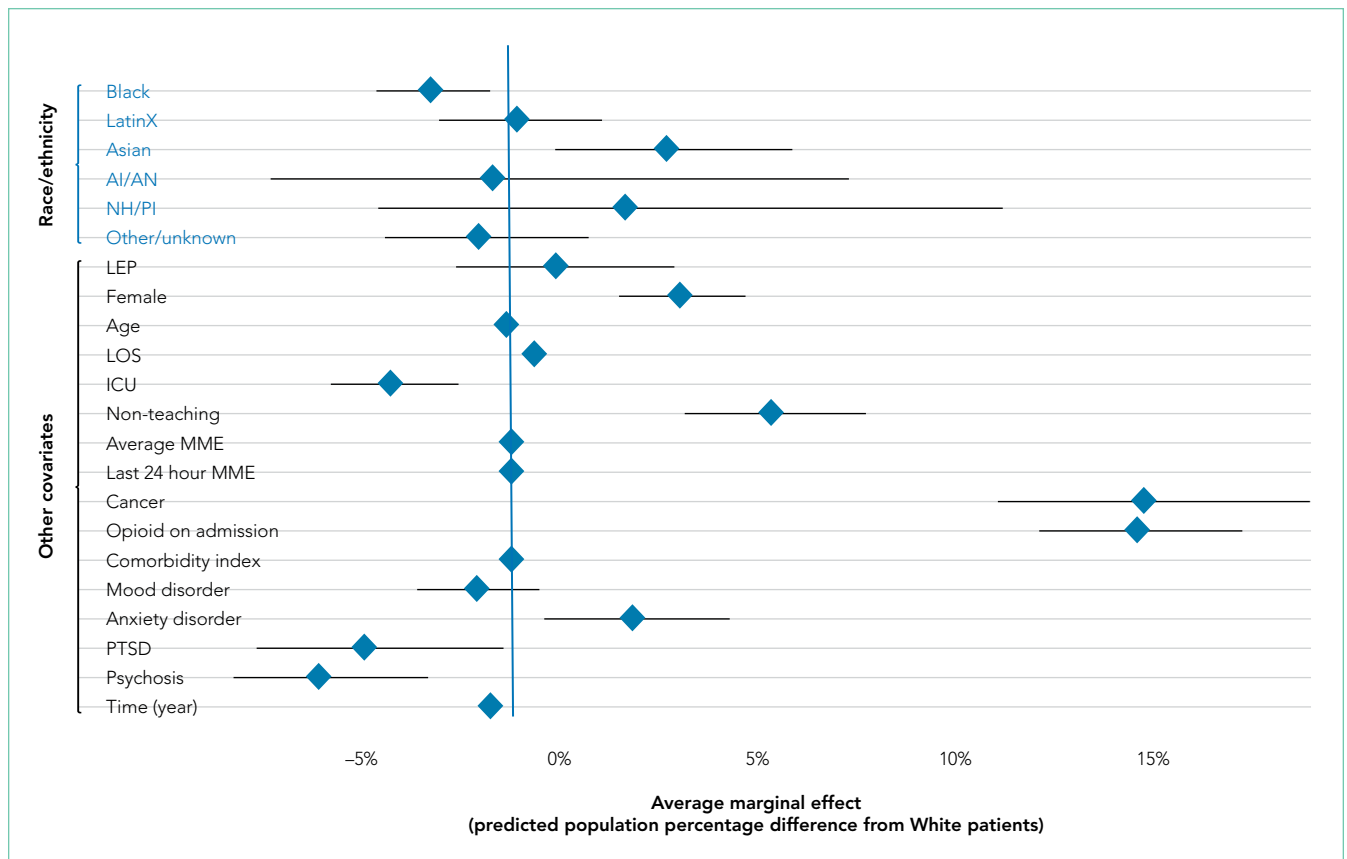| Race/ethnicity	Patients discharged on opioids, %	Days of opioids on discharge, median (IQR)
White	50.3	8.8 (3.7-20.0)
Black	47.7	7.5 (3.2-16.7)
LatinX	53.1	8.7 (3.4-20.0)
Asian	55.8	13.7 (6.2-29.4)
American Indian/Alaska Native	53.0	8.2 (5.0-17.1)
Native Hawaiian/Other Pacific Islander	52.0	12.5 (5.3-30.0)
Other/unknown	47.9	9.7 (4.0-20.5)
P value	<.001	<.001

FIG. Adjusted Regression Results. This graph shows the average marginal effects for the likelihood of receiving opioids on discharge for all patients who received opioids during the last 24 hours of their hospitalization (N = 10,953).

Abbreviations: AI/AN, American Indian/Alaska Native; ICU, intensive care unit; LEP, limited English proficiency; MME, morphine milligram equivalents; NA/PI, Native American/Other Pacific Islander; PTSD, posttraumatic stress disorder.

patient harm, such as less adequately controlled pain among Black patients.[1,3] Undertreated pain has negative health and social consequences and further contributes to substance-use stigma within minority communities.[38] Moreover, Black people who describe more discrimination in medical settings were more likely to report subsequent opioid misuse.[39]

Although the above mechanisms might partially explain our findings among Black patients, the higher rate of prescribing for Asian patients is more challenging to explain. Our models adjusted for clinical factors. Notably, our Asian patients had

TABLE 3. Multivariable Logistic Regression Between Race/Ethnicity and Opioid Prescription on Discharge (n = 10,953) and Multivariable Negative Binomial Regression between Race/Ethnicity and Days of Opioids Prescribed on Discharge (n = 5541)

Race/ethnicity	Predicted percentage of patients discharged on opioids (95% CI), %	P value	Predicted days of opioids on discharge (95% CI)	P value
White	50.7 (49.5-52.0)	Reference	17.8 (17.0-18.5)	Reference
Black	47.6 (45.5-49.6)	.010	15.7 (14.6-16.8)	.001
LatinX	50.8 (48.2-53.4)	.935	17.3 (15.9-18.7)	.540
Asian	55.6 (52.6-58.6)	.004	18.6 (17.0-20.3)	.351
American Indian/Alaska Native	50.0 (39.7-60.3)	.893	17.1 (11.8-22.3)	.801
Native Hawaiian/other Pacific Islander	54.4 (45.4-63.4)	.426	19.5 (14.1-24.9)	.514
Other/unknown	49.5 (45.8-53.1)	.537	17.4 (15.4-19.3)	.699

Variables included were age; limited English proficiency status; sex; opioid on admission; length of stay; intensive care unit transfer; discharging service; average morphine milligram equivalents (MME) per day; MMEs in last 24 hours; adjusted Elixhauser Comorbidity Index; posttraumatic stress disorder, mood, anxiety, psychosis, or cancer diagnosis; time; and discharge disposition.

the highest baseline comorbidity index, oldest mean age, and highest cancer rates, and it is possible that we were unable to fully account for illness severity or related pain needs (Table 1). It also is possible—although speculative—that factors such as language, provider concordance, and the type of disease process all contribute.[40] Some researchers have proposed a "stereotype content model" that seeks to establish a pathway among social structure (status of a patient) to clinician stereotypes (is this patient warm and/or competent) to emotional prejudices (envy, pride) and ultimately to discrimination (active/passive, help/harm).[23]

Our study has limitations. Our model was limited by the available data collected on our patients. Covariates including primary care follow-up, pain scores, and overdose history were not available. Furthermore, our categorization of race/ethnicity was based on self-reported data. We had 676 patients with race/ethnicity specified as other/unknown. We recognize the heterogeneity within these racial/ethnic categorizations. For example, within the LatinX or Asian communities, there are large differences based on region, country, ethnic, or cultural groups. Our study only included patients presenting to a hospital in San Francisco, which is different from the racial/ethnic makeup of other cities across the nation. Our electronic health record capture of history of opioid use disorder and mood disorders is contingent on individual clinician documentation. We did not account for provider-level differences, which is an important part of variation in prescribing differences. We also did not examine differences at the diagnosis-specific level. Finally, we could not determine the indication or appropriateness of opioid prescriptions.

Future studies will be necessary to characterize this relationship at a diagnosis-specific level and to describe causal pathways. Within our own institution, these findings present an op-

portunity for positive change. We hope to continue to explore the etiology of these disparities and identify areas where differences could impact patient outcomes, such as pain control. It is essential to develop appropriate recommendations for inpatient and discharge opioid prescribing to help minimize disparities and to mitigate potential harms of overprescribing. All health systems should continue to collect data on their own disparities in opioid prescribing and educate clinicians on promoting more equitable practices.

References

1. Romanelli RJ, Shen Z, Szwerinski N, Scott A, Lockhart S, Pressman AR. 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. *Ann Emerg Med.* 2019;74(5):622-631. https://doi.org/10.1016/j.annemergmed.2019.05.018
2. Tamayo-Sarver JH, Hinze SW, Cydulka RK, Baker DW. Racial and ethnic disparities in emergency department analgesic prescription. *Am J Public Health.* 2003;93(12):2067-2073. https://doi.org/10.2105/ajph.93.12.2067
3. Berger AJ, Wang Y, Rowe C, Chung B, Chang S, Haleblian G. Racial disparities in analgesic use amongst patients presenting to the emergency department for kidney stones in the United States. *Am J Emerg Med.* 2021;39:71-74. https://doi.org/10.1016/j.ajem.2020.01.017
4. Dickason RM, Chauhan V, Mor A, et al. Racial differences in opiate administration for pain relief at an academic emergency department. *West J Emerg*

Med. 2015;16(3):372-380. https://doi.org/10.5811/westjem.2015.3.23893

5. Singhal A, Tien Y-Y, Hsia RY. Racial-ethnic disparities in opioid prescriptions at emergency department visits for conditions commonly associated with prescription drug abuse. *PloS One.* 2016;11(8):e0159224. https://doi.org/10.1371/journal.pone.0159224

6. Green CR, Anderson KO, Baker TA, et al. The unequal burden of pain: confronting racial and ethnic disparities in pain. *Pain Med Malden Mass.* 2003;4(3):277-294. https://doi.org/10.1046/j.1526-4637.2003.03034.x

7. Hoffman KM, Trawalter S, Axt JR, Oliver MN. Racial bias in pain assessment and treatment recommendations, and false beliefs about biological differences between blacks and whites. *Proc Natl Acad Sci U S A.* 2016;113(16):4296-4301. https://doi.org/10.1073/pnas.1516047113

8. Anderson KO, Green CR, Payne R. Racial and ethnic disparities in pain: causes and consequences of unequal care. *J Pain.* 2009;10(12):1187-1204. https://doi.org/10.1016/j.jpain.2009.10.002

9. Cintron A, Morrison RS. Pain and ethnicity in the United States: a systematic review. *J Palliat Med.* 2006;9(6):1454-1473. https://doi.org/10.1089/jpm.2006.9.1454

10. Pletcher MJ, Kertesz SG, Kohn MA, Gonzales R. Trends in opioid prescribing by race/ethnicity for patients seeking care in US emergency departments. *JAMA.* 2008;299(1):70-78. https://doi.org/10.1001/jama.2007.64

11. Campbell CM, Edwards RR. Ethnic differences in pain and pain management. *Pain Manag.* 2012;2(3):219-230. https://doi.org/10.2217/pmt.12.7

12. Yawn BP, Buchanan GR, Afenyi-Annan AN, et al. Management of sickle cell disease: summary of the 2014 evidence-based report by expert panel members. *JAMA.* 2014;312(10):1033-1048. https://doi.org/10.1001/jama.2014.10517

13. Brown W. Opioid use in dying patients in hospice and hospital, with and without specialist palliative care team involvement. *Eur J Cancer Care (Engl).* 2008;17(1):65-71. https://doi.org/10.1111/j.1365-2354.2007.00810.x

14. Iverson N, Lau CY, Abe-Jones Y, et al. Evaluating a novel metric for personalized opioid prescribing after hospitalization: a retrospective cohort study. *PloS One.* 2020;15(12):e0244735. https://doi.org/10.1371/journal.pone.0244735

15. Howell J, Emerson MO. So what " should " we use? Evaluating the impact of five racial measures on markers of social inequality. *Sociol Race Ethn (Thousand Oaks).* 2017;3(1):14-30. https://doi.org/10.1177/2332649216648465

16. Kaplan JB, Bennett T. Use of race and ethnicity in biomedical publication. *JAMA.* 2003;289(20):2709-2716. https://doi.org/10.1001/jama.289.20.2709

17. Boyd RW, Lindo EG, Weeks LD, McLemore MR. On racism: a new standard for publishing on racial health inequities. *Health Affairs.* Published July 2, 2020. Accessed August 20, 2021. https://www.healthaffairs.org/do/10.1377/hblog20200630.939347/full

18. van Walraven C, Austin PC, Jennings A, Quan H, Forster AJ. A modification of the Elixhauser comorbidity measures into a point system for hospital death using administrative data. *Med Care.* 2009;47(6):626-633. https://doi.org/10.1097/MLR.0b013e31819432e5

19. Sun GW, Shook TL, Kay GL. Inappropriate use of bivariable analysis to screen risk factors for use in multivariable analysis. *J Clin Epidemiol.* 1996;49(8):907-916. https://doi.org/10.1016/0895-4356(96)00025-x

20. Norton EC, Dowd BE, Maciejewski ML. Marginal effects-quantifying the effect of changes in risk factors in logistic regression models. *JAMA.* 2019;321(13):1304-1305. https://doi.org/10.1001/jama.2019.1954

21. Zhang J, Yu KF. What's the relative risk? A method of correcting the odds ratio in cohort studies of common outcomes. *JAMA.* 1998;280(19):1690-1691. https://doi.org/10.1001/jama.280.19.1690

22. Norton EC, Dowd BE. Log odds and the interpretation of logit models. *Health Serv Res.* 2018;53(2):859-878. https://doi.org/10.1111/1475-6773.12712

23. Dovidio JF, Fiske ST. Under the radar: how unexamined biases in decision-making processes in clinical interactions can contribute to health care disparities. *Am J Public Health.* 2012;102(5):945-952. https://doi.org/10.2105/AJPH.2011.300601

24. van Ryn M. Research on the provider contribution to race/ethnicity disparities in medical care. *Med Care.* 2002;40(1 Suppl):I140-151. https://doi.org/10.1097/00005650-200201001-00015

25. Krieger N. Theories for social epidemiology in the 21st century: an ecosocial perspective. *Int J Epidemiol.* 2001;30(4):668-677. https://doi.org/10.1093/ije/30.4.668

26. Golden SD, Earp JAL. Social ecological approaches to individuals and their contexts: twenty years of health education & behavior health promotion interventions. *Health Educ Behav Off Publ Soc Public Health Educ.* 2012;39(3):364-372. https://doi.org/10.1177/1090198111418634

27. Ford CL, Airhihenbuwa CO. Critical race theory, race equity, and public health: toward antiracism praxis. *Am J Public Health.* 2010;100 Suppl 1(Suppl 1):S30-5. https://doi.org/10.2105/AJPH.2009.171058

28. Ford CL, Daniel M, Earp JAL, Kaufman JS, Golin CE, Miller WC. Perceived everyday racism, residential segregation, and HIV testing among patients at a sexually transmitted disease clinic. *Am J Public Health.* 2009;99 Suppl 1:S137-143. https://doi.org/10.2105/AJPH.2007.120865

29. Hall WJ, Chapman MV, Lee KM, et al. Implicit racial/ethnic bias among health care professionals and its influence on health care outcomes: a systematic review. *Am J Public Health.* 2015;105(12):e60-76. https://doi.org/10.2105/AJPH.2015.302903

30. Staton LJ, Panda M, Chen I, et al. When race matters: disagreement in pain perception between patients and their physicians in primary care. *J Natl Med Assoc.* 2007;99(5):532-538.

31. Drwecki BB, Moore CF, Ward SE, Prkachin KM. Reducing racial disparities in pain treatment: the role of empathy and perspective-taking. *Pain.* 2011;152(5):1001-1006. https://doi.org/10.1016/j.pain.2010.12.005

32. Mende-Siedlecki P, Qu-Lee J, Backer R, Van Bavel JJ. Perceptual contributions to racial bias in pain recognition. *J Exp Psychol Gen.* 2019;148(5):863-889. https://doi.org/10.1037/xge0000600

33. King G. Institutional racism and the medical/health complex: a conceptual analysis. *Ethn Dis.* 1996;6(1-2):30-46.

34. Maina IW, Belton TD, Ginzberg S, Singh A, Johnson TJ. A decade of studying implicit racial/ethnic bias in healthcare providers using the implicit association test. *Soc Sci Med.* 2018;199:219-229. https://doi.org/10.1016/j.socscimed.2017.05.009

35. Meghani SH, Byun E, Gallagher RM. Time to take stock: a meta-analysis and systematic review of analgesic treatment disparities for pain in the United States. *Pain Med.* 2012;13(2):150-174. https://doi.org/10.1111/j.1526-4637.2011.01310.x

36. Morrison RS, Wallenstein S, Natale DK, Senzel RS, Huang LL. "We don't carry that"—failure of pharmacies in predominantly nonwhite neighborhoods to stock opioid analgesics. *N Engl J Med.* 2000;342(14):1023-1026. https://doi.org/10.1056/NEJM200004063421406

37. Frakt A, Monkovic T. A 'rare case where racial biases' protected African-Americans. *The New York Times.* November 25, 2019. Updated December 2, 2019. Accessed July 5, 2021. https://www.nytimes.com/2019/11/25/upshot/opioid-epidemic-blacks.html

38. Khatri U, Shoshana Aronowitz S, South E. The opioid crisis shows why racism in health care is always harmful, never 'protective'. *The Philadelphia Inquirer.* Updated December 26, 2019. Accessed July 5, 2021. https://www.inquirer.com/health/expert-opinions/opioid-crisis-racism-healthcare-buprenorphine-20191223.html

39. Swift SL, Glymour MM, Elfassy T, et al. Racial discrimination in medical care settings and opioid pain reliever misuse in a U.S. cohort: 1992 to 2015. *PloS One.* 2019;14(12):e0226490. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0226490

40. Hsieh AY, Tripp DA, Ji L-J. The influence of ethnic concordance and discordance on verbal reports and nonverbal behaviours of pain. *Pain.* 2011;152(9):2016-2022. https://doi.org/10.1016/j.pain.2011.04.023