



# The Impact of Neighborhood Socioeconomic Status and Race on the Prescribing of Opioids in Emergency Departments Throughout the United States

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**BACKGROUND:** Racial and ethnic disparities in opioid prescribing in the emergency department (ED) are well described, yet the influence of socioeconomic status (SES) remains unclear.

**OBJECTIVES:** (1) To examine the effect of neighborhood SES on the prescribing of opioids for moderate to severe pain; and (2) to determine if racial disparities in opioid prescribing persist after accounting for SES.

**DESIGN:** We used cross-sectional data from the National Hospital Ambulatory Medical Care Survey between 2006 and 2009 to examine the prescribing of opioids to patients presenting with moderate to severe pain (184 million visits). We used logistic regression to examine the association between the prescribing of opioids, SES, and race. Models were adjusted for age, sex, pain-level, injury-status, frequency of emergency visits, hospital type, and region.

**MAIN MEASURES:** Our primary outcome measure was whether an opioid was prescribed during a visit for moderate to severe pain. SES was determined based on income, percent poverty, and educational level within a patient's zip code.

**RESULTS:** Opioids were prescribed more frequently at visits from patients of the highest SES quartile compared to patients in the lowest quartile, including percent poverty (49.0 % vs. 39.4 %,  $P < 0.001$ ), household income (47.3 % vs. 40.7 %,  $P < 0.001$ ), and educational level (46.3 % vs. 42.5 %,  $P = 0.01$ ). Black patients were prescribed opioids less frequently than white patients across all measures of SES. In adjusted models, black patients (AOR 0.73; 95 % CI 0.66–0.81) and patients from poorer areas (AOR 0.76; 95 % CI 0.68–0.86) were less likely to receive opioids after accounting for pain-level, age, injury-status, and other covariates.

**CONCLUSIONS:** Patients presenting to emergency departments from lower SES regions were less likely to receive opioids for equivalent levels of pain than those from more affluent areas. Black and Hispanic patients were also less likely to receive opioids for equivalent levels of pain than whites, independent of SES.

**KEY WORDS:** disparities; pain control; controlled medication; opioid.

## Abbreviations

NAMCS	National Ambulatory Medical Care Survey
NHAMCS	National Hospital Ambulatory Medical Care Survey
NCHS	National Center for Health Statistics
CDC	Center for Disease Control and Prevention
NDC	National Drug Code
ED	Emergency Department

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## INTRODUCTION

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO), the Federation of State Medical Boards, and many state medical boards have stressed the importance of adequate pain control, yet the undertreatment of pain in the emergency room setting remains a significant concern.<sup>1</sup> Several studies have consistently documented disparities in opioid prescribing in the emergency department (ED) based on race and ethnicity.<sup>2–7</sup> For instance, one study demonstrated that Hispanic patients were twice as likely as non-Hispanic white patients to receive no analgesia for isolated bone fractures in EDs.<sup>5</sup> Further, a recent study demonstrated that the prescribing gap in opioid prescribing by race and ethnicity did not diminish between 1993 and 2005.<sup>2</sup>

Although racial and ethnic disparities in opioid prescribing in the emergency departments remains steady, the broader influence of socioeconomic status (SES) on the treatment of patients' pain is unknown. Additionally, it is unknown whether differences in SES may explain some of the racial and ethnic disparities previously observed in opioid prescribing in the emergency setting. Understanding the factors that influence the decision to prescribe opioids in

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the emergency setting is critical to the development of equitable treatment policies.

To better understand the factors associated with opioid prescribing for pain-related emergency department visits, we aim to (1) examine the effect of neighborhood socioeconomic status (income, percent poverty, and educational level) on the prescribing of opioids; and (2) to determine if racial and ethnic disparities in opioid prescribing persist after accounting for SES. We hypothesized that patients presenting to emergency departments with moderate to severe pain who reside in lower socioeconomic areas would be less likely to receive an opioid prescription. We also hypothesized that accounting for SES would attenuate, but not extinguish, the previously defined racial disparities in opioid prescribing for patients who present to the ED in pain.

## METHODS

### Data Source

We used cross-sectional data from the National Hospital Ambulatory Care Survey (NHAMCS) to examine the prescribing of opioids to adults aged 18 years and older presenting to the ED with a complaint of moderate to severe pain from 2006 to 2009. NHAMCS is a national survey designed to collect data on the utilization and provision of emergency care throughout the United States.<sup>8</sup> NHAMCS is conducted yearly by the National Center for Health Statistics (NCHS), with the U.S. Bureau of the Census acting as the field agents for data collection. The survey uses a multistage probability design to select a stratified systematic sample of visits to EDs throughout the United States. The data are then weighted to produce national estimates of utilization of emergency medical care services in the United States.<sup>8</sup> A comprehensive description of all methods used for sampling, data collection, and weighting are available online at <http://www.cdc.gov/nchs/ahcd.htm>. Prior to 2006, SES variables were not routinely available through the NHAMCS.

### Inclusion Criteria

We included visits from patients age 18 years or older presenting with moderate to severe pain to EDs. We did not include patient visits where patients reported no pain or only mild pain, since we would not expect an opioid to be prescribed in these circumstances.

### Main Outcome Measure

Our primary outcome measure was whether an opioid was prescribed (yes/no) during a visit to the ED for moderate to severe pain. We defined an opioid based on classification

codes provided NHAMCS and the Lexicon Plus<sup>®</sup>, a proprietary database of Cerner Multum, Inc. The Lexicon Plus is a comprehensive database of all prescription drug products available in the U.S. drug market. Additional information on the Multum Lexicon Drug Database is available at: <http://www.multum.com/Lexicon.htm>. We included all scheduled II-V opioids. We did not include non-controlled, centrally-acting synthetic analgesics in our analyses.

### Independent Variables of Interest—Socioeconomic Status, Race, and Ethnicity

We used three measures of neighborhood-level SES, including (1) poverty level, (2) income status, and (3) educational level. The NCHS collects data on SES based on census data geocoded to the five-digit zip code provided by patients at registration. Therefore, poverty indicates the percent of poverty within the patient's zip code, income describes the median household income within the patient's zip code, and education indicates the percent of adults with a Bachelor's degree or higher in the patient's zip code. We evaluated levels of SES based on the quartiles provided by the NCHS.

We categorized race as white, black, or other. Due to sample size constraints, we collapsed Asian, Native Hawaiian/Other Pacific Islander, and American Indian/Alaska Native into "other race". Ethnicity was recorded separately as Hispanic or non-Hispanic.

### Other Key Covariates

Pain was recorded based on patients' self-reported severity of pain. Between 2006 and 2008, NHAMCS recorded patient reported pain with a 4-point scale (None, Mild, Moderate, Severe). Beginning in 2009, NHAMCS began recording pain along a 10-point scale based on patient report. To produce a common measure of pain across the years studied, we used the Clinical Practice Guidelines published by the Agency for Healthcare Research and Quality to categorize pain listed on a 10-point scale to none (0), mild (1–3), moderate (4–6), or severe (7–10). We only included ED visits for moderate to severe pain in our analyses.

Other key covariates included age, sex, whether the visit was related to an injury or trauma, the frequency of prior visits to the ED, region of the country (Northeast, South, Midwest, West), type of hospital (nonprofit, government, proprietary), and metropolitan status (large, medium, small, or non-metro).

### Data Completeness

Field representatives from the U.S. Bureau of the Census performed checks for data completeness and, when necessary,

missing data were imputed by the NCHS for race and ethnicity. A comprehensive description of methods used to ensure data completeness and imputation of missing data is available at [http://www.cdc.gov/nchs/ahcd/ahcd\\_data\\_collection.htm#nhamcs\\_collection](http://www.cdc.gov/nchs/ahcd/ahcd_data_collection.htm#nhamcs_collection) and through the NHAMCS documentation.<sup>8</sup> Socioeconomic status (either poverty, income, or education) was missing for approximately 5.7 % of visits. Visits without SES were not included in our analysis.

## Data Analysis

All Statistical tests were performed using SAS version 9.1 and SAS callable SUDAAN functions to appropriately weight visits and account for the complex sampling design. We used commonly accepted standards from the NCHS to determine the reliability of the estimates derived in this study.

We examined the bivariate associations between our primary independent variables of interest (SES, race, and ethnicity) and our outcome measure (prescribing of an opioid—yes/no). We used  $\chi^2$  test statistics to compare all proportions and also list unadjusted odds ratios with 95 % confidence intervals.

We subsequently developed logistic regression models to examine the independent effects of socioeconomic status, race, and ethnicity on the prescribing of opioids in emergency departments (opioid prescribed—yes/no). Based on prior literature, we included patient race, ethnicity, gender, patient age, pain severity, region of country, hospital location (urban/Metropolitan Statistical Areas (MSA)), hospital ownership, and whether the visit was related to an injury or trauma in our models.<sup>2,4</sup> To control for whether a patient was a frequent visitor to the ED, we also included the frequency of prior visits to the ED within the past year and whether the patient had been seen in the ED within the past 72 hours. All covariates were included based clinical significance and statistical significance in bivariate analyses. To avoid collinearity, we developed separate models for each measure of socioeconomic status (poverty, income, and education). Each separate regression model included only one measure of SES, but included race, ethnicity, and all covariates.

The NCHS has established strict release standards for data based on the relative standard error of the point estimate and the absolute number of visits to ensure reliability of national estimates.<sup>8</sup> All values reported meet the established release criteria for national estimates.

## Institutional Board Review

This study was approved by the University of Rochester Research Subjects Review Board and the protocols used by NHAMCS were approved by the NCHS Institutional Review Board.

## RESULTS

Between 2006 and 2009, a total of 1,408 emergency departments participated in NHAMCS (90 % participation rate). There were 50,264 visits in which opioids were prescribed for moderate or severe pain. Table 1 lists the weighted characteristics of these patient visits.

### Socioeconomic Status

Opioids were prescribed less frequently to patients in lower socioeconomic groups, including patients residing in poorer areas and those in neighborhoods with lower levels of education (Fig. 1a, b, and c). In adjusted models, SES was an independent predictor of opioids being prescribed for moderate to severe pain. Table 2 describes the percent of patients receiving opioids in the ED and provides three regression models, each with a different marker of socioeconomic status—poverty, income, and education. Compared to patients in low poverty areas (< 5 % poverty), those residing in high poverty areas (> 20 % poverty) were less likely to receive opioids for moderate to severe pain (39.4 % vs. 49.0 %; AOR 0.76, CI 0.68–0.84). Similar associations with opioid prescribing were found based on level of income and educational status (Table 2).

### Race and Ethnicity

Opioids were prescribed less frequently to black patients for moderate to severe pain compared to white patients at all levels of SES (Fig. 1). Adjusting for SES did not attenuate the influence of race on the prescribing of opioids for patients in the emergency department with moderate to severe pain (Table 2). For moderate to severe pain, white patients presenting to the ED more frequently received opioids compared to black patients (46.4 % vs. 38.7 %;  $P < 0.001$ ). In adjusted models, black patients were less frequently prescribed opioids compared to white patients while accounting for percent poverty (AOR=0.81, 0.68–0.97), median household income (AOR=0.80, 0.66–0.96), and education level (AOR=0.79, 0.66–0.95) (Table 2).

Similarly, opioids were prescribed less frequently to Hispanic patients for moderate to severe pain compared to non-Hispanic patients (40.4 % vs. 44.9 %;  $P < 0.001$ ). In adjusted models, Hispanic patients were less frequently prescribed opioids compared to non-Hispanic patients while accounting for percent poverty (AOR=0.83, 0.75–0.91), median household income (AOR=0.83, 0.74–0.88), and education level (AOR=0.80, 0.73–0.88) (Table 2).

### Trend Over Study Period

We did not find a trend between 2006 and 2009 in the frequency of prescriptions written for opioids for white

**Table 1. Visit Characteristics in the NHAMCS Between 2006 and 2009**

Characteristic	Weighted percent*
Age (years)	
18–39	49.7 %
40–64	38.1 %
> 65	12.2 %
Sex	
Female	59.1 %
Poverty	
< 5.00 %	13.7 %
5.00–9.99 %	26.9 %
10.00–19.99 %	37.3 %
> 20.00 %	22.1 %
Education - bachelors or higher	
> 31.69 %	33.6 %
16.67–31.68 %	25.9 %
12.84–19.66 %	22.3 %
< 12.84 %	18.2 %
Severity of pain	
Moderate	44.4 %
Severe	55.6 %
Type of Hospital	
Nonprofit	75.3 %
Government (non-Fed)	13.9 %
Proprietary	10.8 %
Race	
White	72.6 %
Black	24.3 %
Other	3.1 %
Ethnicity	
Hispanic	11.3 %
Non-Hispanic	88.7 %
Income	
\$52,388 or More	33.0 %
\$40,627–\$52,387	26.1 %
\$32,794–\$40,626	22.4 %
\$32,793 or less	18.5 %
Region	
Northeast	17.7 %
South	22.9 %
Midwest	42.3 %
West	17.1 %
Urban/Rural	
Large Metro	46.0 %
Medium/Small Metro	35.2 %
Non-Metro	18.8 %
Insurance	
Private	34.9 %
Public	35.6 %
Uninsured	20.3 %
Unknown/Other	9.2 %

\*Total unweighted sample size was 50,236 patient visits; total weighted sample size was 183,784,463 visits

patients ( $\beta=0.01$ ;  $P=0.69$ ), black patients ( $\beta=0.03$ ;  $P=0.32$ ), or patients of other racial groups ( $\beta=-0.03$ ;  $P=0.63$ ).

## DISCUSSION

This study found that patients presenting to emergency departments for moderate to severe pain from lower socioeconomic neighborhoods were less likely to receive an opioid for equivalent levels of pain compared to patients presenting to the ED from more affluent neighborhoods. We also found that racial and ethnic disparities in opioid prescribing persist in emergency departments in the United

States and were not attenuated by the influence of socioeconomic status.

This is the first study, to our knowledge, to identify differences in prescribing of opioids for pain based on SES. We found that visits from patients from lower SES neighborhoods were less likely to receive an opioid for equivalent levels of reported pain than patients from more affluent neighborhoods. This relationship was consistent across all aspects of SES studied, independent of race and ethnicity. Disparities based on the percent of poverty in the patient's neighborhood revealed the most striking differences, with an approximate 10 % absolute difference in prescribing rates between those in the highest versus lower quartiles. Several smaller studies have observed variations in preventive screening, timing of diagnosis, and overall survival,<sup>9–15</sup> but none have examined the relationship of opioid prescribing, SES, and race.

Consistent with prior studies,<sup>2,4</sup> we found that black patients were prescribed opioids less frequently than white patients for moderate to severe pain in the emergency setting. This relationship remained consistent across each aspect of neighborhood-level SES, while accounting for other factors including pain level, type of visit, age, gender, frequency of prior ED visits, and hospital location. Similarly, Hispanic patients were less likely to receive an opioid than non-Hispanic patients for equivalent levels of pain after accounting for SES.

The combination of black race or Hispanic ethnicity and residing in poorer SES neighborhoods creates a negative synergistic effect on opioid prescribing for pain. For instance, black patients from lower SES neighborhoods were approximately 6 % less likely to receive opioids for pain compared to white patients residing in similar neighborhoods, nearly 6 % less likely than black patients in more affluent neighborhoods, and nearly 14 % less likely than white patients residing in more affluent neighborhoods. The factors mediating this finding are likely numerous and difficult to reconcile, but this is clearly a psychosocial dilemma that needs to be further addressed.

The influence of physician–patient racial and ethnic concordance on patient care has been consistently documented for decades,<sup>16–20</sup> and may partially explain some of the disparities found. Previous studies have demonstrated that despite their best efforts, physicians sometimes struggle to perform as unbiased operators, often allowing their own cultural and social constructs to partially dictate their approach to patient care, including their medication prescribing.<sup>21,22</sup> The fact that the majority of physicians currently employed in the United States are white, and likely members of the highest socioeconomic quartile, may in part reflect why this group was the most likely to receive prescriptions for opioids.<sup>23</sup>

We also found that prescribing patterns varied according to geographic region, consistent with the previous litera-

**Table 2. Characteristics of Patients Receiving Opioids for Moderate to Severe Pain Visit to the Emergency Department Between 2006 and 2009**

Variable	% Visits opioid Rx	Odds ratio (95 % CI)	AOR poverty* (95 % CI)	AOR income* (95 % CI)	AOR education* (95 % CI)
<b>Race</b>					
White	46.4 <sup>†</sup>	1.0	1.0	1.0	1.0
Black	38.7 <sup>†</sup>	0.73 (0.66–0.81)	0.73 (0.67–0.80)	0.71 (0.65–0.78)	0.69 (0.63–0.76)
Other	42.2 <sup>†</sup>	0.84 (0.72–0.99)	0.81 (0.68–0.97)	0.80 (0.66–0.96)	0.79 (0.66–0.95)
<b>Ethnicity</b>					
Non-Hispanic	44.9 <sup>†</sup>	1.0	1.0	1.0	1.0
Hispanic	40.4 <sup>†</sup>	0.83 (0.75–0.92)	0.83 (0.75–0.91)	0.81 (0.74–0.88)	0.80 (0.73–0.88)
<b>Poverty</b> <sup>§</sup>					
< 5.00 %	49.0 <sup>†</sup>	1.0	1.0	–	–
5.00–9.99 %	47.7 <sup>†</sup>	0.95 (0.87–1.0)	0.93 (0.86–1.0)	–	–
10.00–19.99 %	43.3 <sup>†</sup>	0.79 (0.71–0.88)	0.82 (0.75–0.90)	–	–
> 20.00 %	39.4 <sup>†</sup>	0.68 (0.60–0.76)	0.76 (0.68–0.84)	–	–
<b>Income</b> <sup>  </sup>					
> \$52,388	47.3 <sup>†</sup>	1.0	–	1.0	–
\$40,627–\$52,387	47.4 <sup>†</sup>	1.00 (0.91–1.10)	–	0.97 (0.89–1.07)	–
\$32,794–\$40,626	44.5 <sup>†</sup>	0.89 (0.80–1.00)	–	0.89 (0.81–0.99)	–
\$32,793 or less	40.7	0.76 (0.68–0.86)	–	0.83 (0.75–0.91)	–
<b>Education</b> <sup>¶</sup>					
> 31.69 %	46.3 <sup>‡</sup>	1.0	–	–	1.0
16.67–31.68 %	45.8 <sup>‡</sup>	0.98 (0.90–1.07)	–	–	0.97 (0.89–1.06)
12.84–19.66 %	44.3 <sup>‡</sup>	0.92 (0.84–1.02)	–	–	0.92 (0.84–1.01)
< 12.84 %	42.5 <sup>‡</sup>	0.86 (0.76–0.96)	–	–	0.90 (0.82–0.98)
<b>Age</b>					
18–39 years	43.5 <sup>†</sup>	1.0	1.0	1.0	1.0
40–64 years	47.3 <sup>†</sup>	1.17 (1.11–1.24)	1.17 (1.10–1.23)	1.17 (1.1–1.23)	1.17 (1.1–1.23)
> 65 years	38.9 <sup>†</sup>	0.83 (0.75–0.91)	0.84 (0.76–0.92)	0.84 (0.76–0.92)	0.84(0.76–0.92)
<b>Sex</b>					
Female	43.9 <sup>‡</sup>	1.0	1.0	1.0	1.0
Male	45.1 <sup>‡</sup>	1.05 (1.00–1.10)	1.03 (0.98–1.08)	1.02 (0.98–1.07)	1.03(0.98–1.08)
<b>Pain</b>					
Moderate	34.1 <sup>†</sup>	1.0	1.0	1.0	1.0
Severe	52.6 <sup>†</sup>	2.15 (2.03–2.27)	2.15 (2.04–2.27)	2.15 (2.04–2.27)	2.15 (2.04–2.27)
<b>Injury</b>					
Non-injury Related	42.0 <sup>†</sup>	1.0	1.0	1.0	1.0
Injury related	48.7 <sup>†</sup>	1.31 (1.25–1.38)	1.34 (1.27–1.41)	1.34 (1.27–1.42)	1.34 (1.27–1.42)

AOR Adjusted Odds Ratio, CI Confidence interval, Rx prescription

\*Logistic regression model was adjusted for all covariates listed in the table, as well as type of hospital (nonprofit, government, proprietary;  $p=0.04$ ), metropolitan status (large, medium, small, or non-metro;  $p<0.001$ ), whether the patient had been seen in the past 72 h ( $p=0.01$ ), the number of ED visits within the last year ( $p<0.001$ ), and region of the country ( $p<0.001$ )

<sup>†</sup>  $p<0.001$  using  $\chi^2$  test statistics

<sup>‡</sup>  $p<0.05$  using  $\chi^2$  test statistics

<sup>§</sup> Poverty indicates the percent of poverty within the patient's zip code

<sup>||</sup> Income indicates the median household income in the patient's zip code

<sup>¶</sup> Education indicates the percent of adults with Bachelor's degrees or higher in patient's zip code

ture.<sup>2,4</sup> Opioids were prescribed more frequently at ED visits in the South and West regions as compared to the Northeast. According to the most recent US Census data, however, Southern and Midwest states had lower per capita incomes as compared to states in the Northeast.<sup>23</sup> Despite these regional variations, we did not find that regional differences attenuated the influence of SES or race on the prescribing of opioids for moderate to severe pain in the ED.

This study has several limitations. Most notably, SES was defined based on the patient's five-digit zip code. NHAMCS uses the patient's self-reported zip code to stratify patient visits into specific quartiles for poverty, income, and education level. Unfortunately, we are not able to capture patient-level SES parameters beyond neighborhood-level quartiles. Second, our sample size did not allow us to examine racial differences for Asian or other races. Third, information on the quantity and strength of opioids prescribed was not available. Last, we were

not able to account for clinician factors, such as race or ethnicity, or institutional level factors. Differences in prescribing patterns in EDs based on provider and hospital type have been previously described.<sup>24</sup> To adjust for the potential differences between institutions, we were able to adjust for hospital type, but were unable to account for individual prescriber trends and predilections. We were also unable to assess whether emergency prescribers employed testing methods, such as urine and serum toxicology, or other techniques, such as prescription monitoring websites, to help determine risk for abuse and aid in their decisions on whether or not to prescribe opioids.

Despite these limitations, it is clear that disparities in the prescribing of opioids in emergency departments exist, not only by race and neighborhood-level socioeconomic status, but along regional levels as well. It is imperative that national guidelines and safety standards be instituted in an effort to

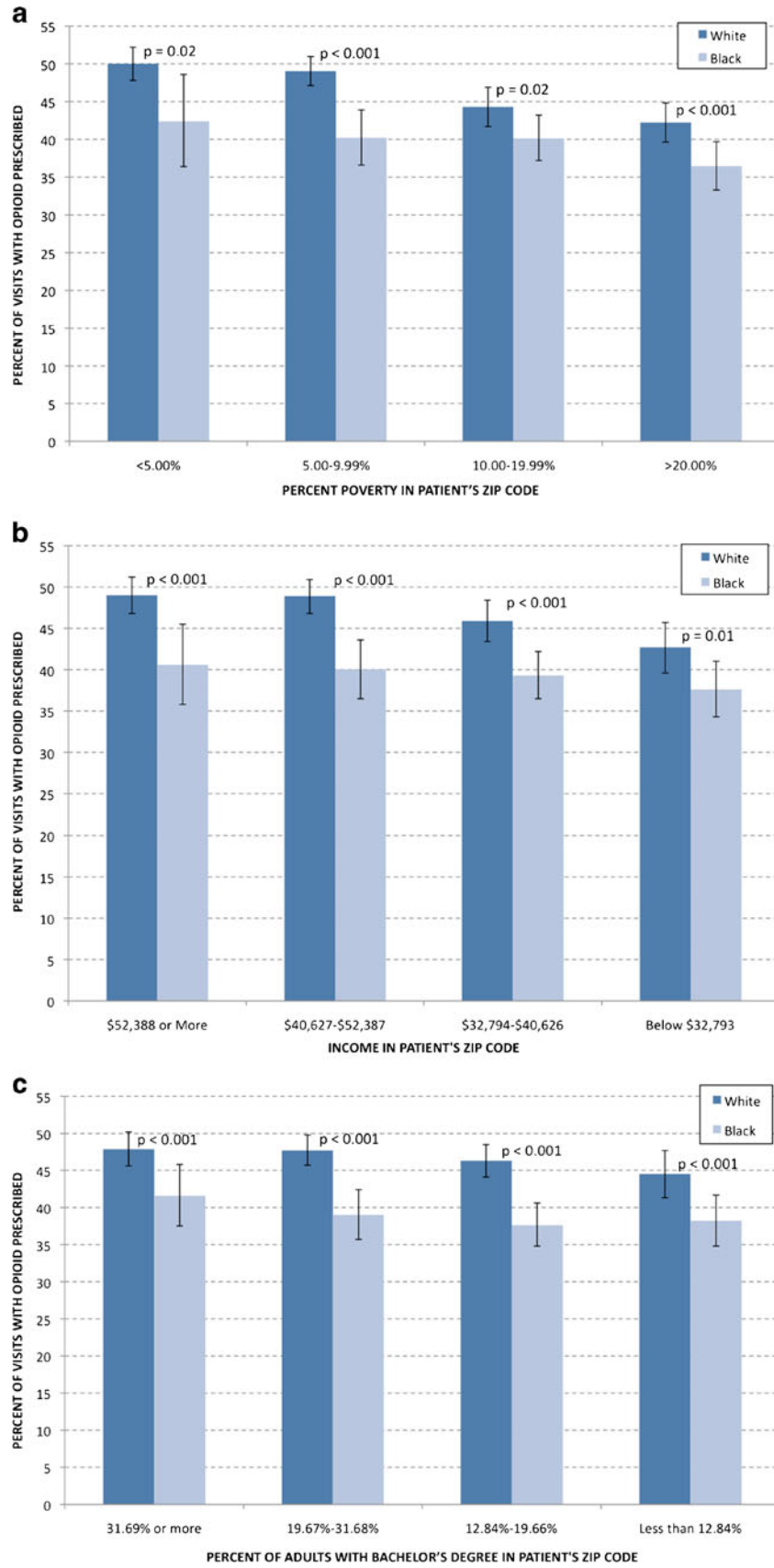


Figure 1. a Percentage of visits with opioid prescriptions by poverty level in patient's zip code between 2006 and 2009. b Percentage of visits with opioid prescriptions by income level in patient's zip code between 2006 and 2009. c Percentage of visits with opioid prescriptions by education level in patient's zip code between 2006 and 2009.

provide consistent and unbiased treatment for pain in all settings. Policies such as uniform teaching to medical students and residents, specific guidelines and continuing education for current practicing providers, as well as accessible prescription monitoring programs, should be considered.<sup>25,26</sup>

## CONCLUSION

Patients presenting to United States emergency departments for moderate to severe pain from lower socioeconomic neighborhoods were less likely to receive opioids for equivalent levels of pain compared to those from more affluent neighborhoods. Furthermore, black patients and Hispanic patients were less likely to receive opioids for equivalent levels of pain while accounting for socioeconomic status. The reasons for these disparities are complex, likely multifactorial, and warrant further investigation.

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