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Evaluating for Racial Differences in Pain Management of Long-Bone Fractures in a Pediatric Rural Population

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Objectives: The aim of this study was to determine if a racial disparity exists in the administration of an analgesic, time to receiving analgesic, and type of analgesic administered to children with long-bone fractures. Prior studies have reported the existence of racial disparity but were mostly in adult and urban populations.

Methods: This is a retrospective chart review of 727 pediatric patients (aged 2–17 years) with *International Classification of Diseases, Ninth Revision* (or 10th revision) codes for long-one fractures in an emergency department that cares for a suburban and rural population between January 2013 and January 2016. Logistic regression was used to estimate the odds ratio of receiving no analgesic versus receiving an analgesic and receiving a nonopioid versus opioid drug. Linear regression analysis was performed to study the relationship between race and time to receive the analgesic, after adjusting for sex, age, insurance type, and mechanism of injury.

Results: Of the 727 children, 27% of them did not receive analgesics regardless of race. 27% (164/605) of white children, 25% (8/31) of African American children, and 24% (12/49) of Hispanic children did not receive analgesics. African Americans are 12% more likely (odds ratio [OR], 1.12; 95% confidence interval [CI], 0.48–2.61) to receive an analgesic compared with whites, and Hispanics are 22% more likely (OR, 1.22; 95% CI, 0.60–2.45) to receive an analgesic than whites. African Americans are 26% less likely (OR, 0.74; 95% CI, 0.31–1.75) to receive an opioid versus a nonopioid compared with whites, and Hispanics are 92% more likely (OR, 1.92; 95% CI, 0.91–4.17). Mean wait time across all races was 69 minutes, with no statistical difference between groups.

Conclusions: This study showed no statistical significance in the receipt or type of analgesic or wait time for pediatric long-bone fractures between race in a major academic level 1 trauma children's hospital, despite previous literature citing otherwise. This study augments to the few studies conducted in a rural setting. It is also one of the few studies that analyzed pain management in a large pediatric population as well as used waiting time to receive analgesic as an outcome measure. Overall, we found a mean wait time of 69 minutes for analgesic administration regardless of race, suggesting the need for more prompt pain management across all races for the management of long-bone fracture in the pediatric population.

Key Words: long bone, pain, racial

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Racial disparities in the health care setting have been well described in previous studies.[1–3] The 2002 Institute of Medicine report entitled, "Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care," provided overwhelming evidence of racial disparities in both adults and children.[4] These disparities were found in a wide range of health care settings, including in the emergency department (ED), despite adjusting for factors such as insurance status, age, income, and severity of illness.

In the ED, racial disparity in pain management specifically in long-bone fractures has been one of the most frequently cited areas of racial disparity since the 1990s.[5,6] A 1993 study found that non-Hispanic whites were twice as likely to receive pain management drugs for long bone fractures.[5] In 2000, another study in Atlanta, Ga, found that African American patients with long-bone fractures were less likely to receive analgesia than white patients.[6]

On the other hand, several recent studies did not show evidence of racial disparity. A retrospective chart review of 2461 patients in an urban medical center found no race-based disparity in the pain management of long-bone fractures, back pain, or migraine.[7] A 2007 study in the Bronx, NY, found no racial disparity in long-bone fracture treatment. However, their sample population predominantly consisted of Hispanics (52%) and African Americans (30%), with whites consisting only 18% of the sample size.[8] It is possible that the minority-dominated sample size demographics precluded any findings between racial groups. Few studies on this topic have been conducted in rural studies and include a larger sample of white patients. In addition, few studies have analyzed disparity using wait time for analgesic receipt as an outcome measure.

METHODS

Study Design and Setting

This study is a retrospective chart review of 727 pediatric patients. *International Classification of Diseases, Ninth Revision* or *International Classification of Diseases, 10th Revision* codes for fractures of the tibia, humerus, fibula, radius, ulna, and femur were used to identify medical records of these patients aged 2 to 17 years. The study was conducted at a trauma level I major academic hospital with approximately 20,000 pediatric ED visits a year. The hospital serves suburban and rural counties in central Pennsylvania with a large white population. The study was approved by the academic hospital's institutional review board.

Inclusion and Exclusion Criteria of Patients

Patient charts were selected by the following criteria: (1) aged 2 to 17 years, (2) had *International Classification of Diseases, Ninth Revision* or *International Classification of Diseases, 10th Revision* codes for long-bone fractures, and (3) were treated in the ED between January 1, 2013, and April 30, 2016. Patients were excluded if patients (1) presented with multiorgan trauma or more than 3 fractures, (2) were noted as being intoxicated or abused drugs, or (3) were given pain drugs in prehospital.

Measurements

Data were abstracted from a quality assurance measure that is reported to the Centers for Medicare & Medicaid Services. Electronic medical records were used to assess the accuracy of the data reported to the Centers for Medicare & Medicaid Services for the pediatric population with long-bone fractures. Demographic data were collected, including sex, age, insurance type, and mechanism of injury. Data on race were collected through self-reported data in

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TABLE 1. Comparison of Sample Characteristics Between 4 Racial Groups

Variable	Whites	African Americans	Hispanics	Other	*P*
n (%)	605 (83)	31 (4.3)	49 (6.7)	42 (5.8)	
Age, mean ± SD, y	8.7 ± 3.8	8.0 ± 4.1	8.4 ± 3.9	7.6 ± 3.9	0.22
Sex, n (%)					0.28
Male	331 (55)	19 (61)	29 (59)	29 (69)	
Female	274 (45)	12 (39)	20 (41)	13 (31)	
Insurance, n (%)					0.08
Insured	524 (87)	27 (87)	46 (94)	41 (98)	
Self-pay	79 (13)	4 (13)	3 (6)	1 (2.4)	
Mechanism of injury, n (%)					0.33
Fall	432 (71)	25 (81)	39 (80)	31 (74)	
Sports	109 (18)	2 (7)	3 (6)	6 (14)	
Motorized	20 (3)	0	1 (2)	0	
Other	44 (7)	4 (13)	6 (12)	5 (12)	

ED registration. If any patient identified as any part Hispanic, the patient's race was input into the data as Hispanic. If a patient was not mixed Hispanic, any patient who identified as any part African American was assigned the race African American in the data. If the patient did not identify as Hispanic, white, or African American, then the patient's race was assigned as other. Also recorded were data on the type of analgesic that the patient was first given, time of drug administration, time the drug was ordered, and patient arrival time to the ED. A comparison of time the drug ordered to the time a drug was administered was conducted to examine steps of pain administration that could result in racial differences in pain management. Although many patients were given multiple pain drugs, the type of analgesic entered in the data was the earliest analgesic drug given upon arrival to the ED. Morphine, fentanyl, nonsteroidal anti-inflammatory drug, and acetaminophen were cited as the drugs given for pain management.

Data Analysis

Summary statistics were provided for quantitative and qualitative variables with their differences between 4 racial groups tested by Fisher exact test or analysis of variance as appropriate. Logistic regression was used to estimate the odds ratio of receiving pain medication between racial groups that controls for confounding variables. Linear regression analysis was performed to study the dependence of time to receive the drug on race. The confounding variables adjusted for are sex, age, insurance type, and mechanism of injury in the logistic regression and χ^2 test. A significance criterion of 0.05 was used for all the statistical tests. All results were analyzed using R version 3.3 software (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Of the 727 children who met the inclusion criteria, 605 (83%) were white, 31 (4.3%) were African American, 42 (6.7%) were Hispanic, and 42 (5.8%) were other races, such as Asian or Native American. No statistically significant difference was found between the racial groups in terms of age, gender, insurance type, or mechanism of injury type (Table 1). The mean age for pediatric long-bone fractures in this study was approximately 8 years. Older children were more likely to receive no analgesic medication versus receiving analgesic medication and more likely to receive nonopioids versus opioids ($P < 0.001$) than younger children. They were also more likely to have a shorter wait time after a drug is ordered ($P < 0.001$).

A χ^2 analysis showed no statistically significant difference between racial groups on receipt of no analgesic, nonopioid analgesic, or opioid analgesic (Table 2). Overall, opioids were more frequently prescribed as the first analgesic than nonopioids upon ED arrival. The proportion of children who received opioid analgesic among those who presented long-bone fractures is 41% for white children, 35% for African American children, and 53% for Hispanic children. In total, across all racial groups, 27% received no analgesic at all (Table 3).

A logistic regression adjusted for covariates was run to examine the odds ratio of receiving no analgesic versus analgesic, as well as the odds ratio of receiving nonopioid versus opioid drug using the white racial group as the reference group. Compared with whites, the odds ratio of receiving analgesics versus no analgesic was 1.12 (95% confidence interval [CI], 0.48–2.61) for African Americans and 1.22 (95% CI, 0.60–2.45) for Hispanics. The odds ratio of receiving an opioid drug over a nonopioid was 0.74 (95% CI, 0.31–1.75) for African Americans and 1.92 (95% CI, 0.91–4.16) for Hispanics, compared with whites. There was no statistically significant difference regarding the receipt of any analgesic or the type of analgesic.

Table 4 analyzes the time for a patient to receive a drug once the patient enters the ED and after the drug has been ordered in the electronic medical system, respectively. The average wait time to

TABLE 2. Receipt of Analgesics by Race/Ethnicity

	White (n = 605)	African American (n = 31)	Hispanic (n = 49)	Other (n = 42)
No analgesic	164 (27%)	8 (25%)	12 (24%)	14 (33%)
Received nonopioid	194 (32%)	12 (39%)	11 (22%)	9 (21%)
Received opioid	246 (41%)	11 (35%)	26 (53%)	19 (45%)

$\chi^2_6 = 6.02$, $P = 0.42$.

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TABLE 3. Odds Ratio of Receiving Any Analgesic and Receiving Nonopioid Versus Opioid Analgesic by Race and Ethnicity*

	White (n = 605)	African American (n = 31), Odds Ratio (95% CI)	Hispanic (n = 49), Odds Ratio (95% CI)	Other (n = 42), Odds Ratio (95% CI)
Received analgesic vs no analgesic	1.00	1.12 (0.48–2.61)	1.22 (0.60–2.45)	0.74 (0.37–1.48)
Received opioid vs received nonopioid	1.00	0.74 (0.31–1.75)	1.92 (0.91–4.16)	1.61 (0.69–3.70)

*Controlled for age, sex, insurance type, and mechanism of injury.

receive analgesic across all 3 racial groups was 69 minutes (P = 0.65). The average wait time is 69 minutes for whites, 72 minutes for African Americans, 59 minutes for Hispanic patients, and 71 minutes for patients in the other group. After an analgesic has been ordered in the electronic medical record, the wait time are 15, 15, 14, and 18 minutes for the 4 racial groups, respectively (P = 0.39).

Limitations

This study has several limiting factors. Although this study has a meaningful number of African American (n = 31) and Hispanics (n = 49) children, the patient population is dominated by white patients. According to the 2017 US census data, 76.6% of Americans identified as white alone, with 18% identifying as Hispanic and 13% as African American.[9] Although this study has more similar distributions of race to US census data than many of the more urban studies conducted, accumulation of more minority patients will strengthen the generalizability of the study. However, this study provides valuable information in a more rural setting, which is limited in literature on this topic.

Another limitation is that pain scores were not collected in this study, so the results cannot be adjusted for refusal of medication or severity of fractures. It is possible that some patients refused medication because of lack of pain or were unable to self-advocate because of language barrier or other cultural factors. However, previous studies found no racial differences in pain scores.[10] Data on route of analgesic administration were not collected. It would be interesting to see how the route of administration of initial analgesics affected wait times in this study.

DISCUSSION

In this retrospective study of 727 pediatric patients, no statistically significant differences were found that would indicate racial disparity regarding use of analgesic, type of analgesic, and time to administer analgesic in pediatric patients with long-bone fractures in the ED between 2013 and mid-2016. According to the results, older children were more likely to receive no analgesic or a nonopioid than they were to receive an opioid and were also more likely to receive their drug quicker after the drug was ordered. It is possible that older patients are more able to verbalize lack of pain or are more likely to refuse medication. It is also plausible that health care workers are more likely to aggressively treat pain in younger patients.

The results showed that patients classified as other had a statistically significantly longer wait time for an ordered drug to be administered, compared with the white reference group. Patients in this group included Asian, Native American, and Native Hawaiian patients. Because the time variables had a wide standard deviation and the sample size included only 42 patients, it is likely that this finding does not suggest racial differences between the other group and the white group.

This study adds to conflicting previous literature on this topic, where research done in rural communities and white-dominant populations has been scarce. A study performed in 1990–1991 showed that Hispanics were twice as likely to receive no pain drugs, and another study showed black patients less likely to receive pain drugs in 1997.[6] Since then, most of the studies have found no evidence of racial disparity. A 1997 study, consisting of 63 children in Phoenix, Ariz, found equal pain treatment across racial groups.[11] Lack of evidence of racial disparity is also consistent with results from several other studies conducted in more diverse and urban settings.[7,12] In a Bronx, NY, study, 65% (53/81) of whites, 59% (79/133) of blacks, and 66% (156/235) of Hispanics were found to receive opioids with no statistical significance in results. Compared with this study, where 30%, 39%, 22% of whites, African Americans, and Hispanics, respectively, received nonopioids, nonopioids were found to be used less frequently used in the Bronx, NY, study, with only 9%, 10%, and 11% of whites, African Americans, and Hispanics.[8]

Although recent literature suggests lack of disparity in the treatment of long-bone fractures, a nationally representative study evaluating ED treatment pain management of children with appendicitis found that black children had one-fifth the odds of receiving opioid analgesic compared with white children, despite adjusting for pain score.[10] Although both groups were equally likely to receive any analgesia, black children were much less likely to receive opioid and nonopioids. Another study in 2003 examining ED treatment of patients for migraine, back pain, and long-bone fractures found racial differences in the treatment of back pain and migraine but not for long-bone fractures, even after adjusting for pain score.[13]

Our data demonstrate that there are no present racial disparities in the pain management for long-bone fractures in pediatric patients. However, wait times for pain management can be

TABLE 4. Comparison of Time to Receive Pain Drug and Time Between Drug Ordered and Drug Administered Between Racial Groups*

	White (n = 605)	African American (n = 31)	Hispanic (n = 49)	Other (n = 42)	Global P Between 4 Racial Groups
Time to receive pain drug from arrival to the ED (SD)	68.78 (42.10)	71.65 (34.95)	59.36 (35.03)	70.82 (40.0)	0.65
Time between drug ordered to drug administered (SD)	15.40 (9.81)	15.18 (12.32)	13.64 (10.52)	17.82 (10.33)	0.39

*Controlled for age, sex, insurance type, and mechanism of injury.

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improved across all races. The average wait time to receive pain medication is 69 minutes, and the average wait time after the drug is ordered in the computer system is 15 minutes. We can improve times by reminding providers the existence of intranasal forms of opioids and promoting clinical pathways to expedite care.

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