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Racial differences in treatment among patients with acute headache evaluated in the emergency department and discharged home

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ABSTRACT

Background: Prior research has demonstrated the widespread presence of racial disparities in emergency department (ED) care and analgesia. We hypothesized that racial disparities continue to exist in ED analgesic prescribing patterns, time to analgesia, and time to provider in the treatment of headache.
Methods: We performed a retrospective cohort study of patients presenting to a large tertiary academic ED with chief complaint of headache. A structured medical record review was conducted to abstract relevant variables of interest. Patient race was categorized as white or Black, Indigenous, or person of color (BIPOC). Descriptive statistics were used to characterize the cohort and stratified analyses were conducted based on patient race and our key outcome measures of analgesic prescribing patterns, time to analgesia, and time to provider in the treatment of headache.
Results: White patients were more likely to be assigned an Emergency Severity Index score 2 or 3 and their BIPOC counterparts were more likely to be assigned an ESI score 3 or 4 ($p = 0.02$). There was no significant difference by race in time to analgesia ($p = 0.318$), time to provider ($p = 0.358$), or time to first medication treatment ($p = 0.357$). However, there were clear differences in prescribing patterns. BIPOC patients were significantly more likely to be treated with acetaminophen ($p = 0.042$) or ibuprofen ($p = 0.015$) despite reporting higher pain levels during triage ($p < 0.001$). White patients were significantly more likely to receive a head CT scan ($p < 0.001$) or neurology consult ($p = 0.003$) than their BIPOC counterparts.
Conclusion: Racial disparities persist in assessment and type of analgesia for patients being treated for headache in a large academic emergency department.

1. Introduction

Headache is one of the most common presenting complaints and accounts for 2.8% of all emergency department (ED) visits [1]. Moreover, headache is a chief complaint that can often be successfully treated with pharmacotherapy in the ED [2]. First-line treatments for headache in the ED include non-steroidal anti-inflammatory drugs (NSAIDs), antiemetics, and triptans, depending on the headache type [3]. Opioids are not recommended, particularly for those experiencing migraine headaches [4] although they remain one of the most prescribed pharmacological treatments for headaches in the ED [3,5]. However, research suggests that there are significant disparities in how pain is treated in the ED among patients who identify as a Black, Indigenous or persons of color (BIPOC) compared to white patients [6].

Over the past several years, previous studies have demonstrated widespread racial disparities in ED care and analgesia [1,5-12]. A recent review of racial differences in the ED found that, in general, BIPOC patients were significantly less likely to receive analgesia for any chief complaint and minority patients were more likely to leave without being seen [13]. Prior studies have examined racial disparities in care for postoperative pain and long-bone fractures. These studies show BIPOC patients have longer wait times both to see a provider [14] and to analgesia administration [11,14], as well as inadequate analgesia

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administration [8,9,12,14-18]. Other studies have shown that lower rates of opioid prescriptions are given to Black and Hispanic patients, as well as less frequent reassessments of pain [15,17,18]. In a 2015 study, Black patients presenting to the ED with low back pain were significantly less likely to receive opioid medication compared to white patients with similar chief complaints [19]. Headache is a somewhat more subjective complaint than previously studied sources of pain and is likely at higher risk of bias in treatment decisions. A recent study by Wang and colleagues (2021) [5] found that non-Hispanic white patients had a 67% increase in odds of receiving IV opioids in the ED for treatment for migraine compared to Black patients. However, there are no recent studies that investigate racial disparities in treatment for all types of headache (i.e., not only migraines) in the ED.

We aimed to assess for possible racial disparities in ED care in a sample of patients who presented to the ED with a chief complaint of headache and were discharged home. We hypothesized that there would be racial differences related to time to see a provider, time to receiving analgesia, analgesia prescribing practices, and additional evaluations such as CT scan and neurology consultation.

2. Methods

2.1. Study design

We conducted a retrospective cohort study of 500 randomly selected patients presenting to a large academic emergency department in upstate New York with chief complaint of headache between January 1, 2017, and January 1, 2018. Institutional Review Board approval was granted with a waiver of informed consent.

2.2. Population and participants

The sample patient population of interest in this study included adult patients age 18 years and older who presented to the ED for a chief complaint of headache and did not require hospital admission. Patients were excluded if they left before seeing a provider (i.e., no clinical exam), but were included if they left after seeing a provider but before their treatment was complete. Patients were excluded from the study if aged under 18, if there was history of trauma, diagnosis of intracranial hemorrhage, prior diagnosis of intracranial mass or space-occupying lesion, clinical concern for meningitis or encephalitis, patients who left before physician evaluation, and patients who were ultimately admitted to the hospital.

A total of 1723 subjects were identified using a specific list of ICD-10 codes for headache. Random selection of charts was completed via Microsoft Excel. All 1723 potential charts were entered and a random number generator was used to select the first 500 charts for inclusion. Those 500 charts were reviewed by a team of physicians to confirm the primary diagnosis of headache through medical record abstraction. The sample size was determined based on a power calculation to detect statistically significant differences in analgesia type among BIPOC versus white patients with an additional 10% oversampling to account for missing data and potential exlcusions. Data related to race, demographic, and basic clinical characteristics were exported directly from the electronic medical record. Additionally, the medical record for each randomly selected subject was manually reviewed by one of three emergency physician medical abstractors to obtain additional data that could not be directed exported. Physician abstractors were trained through joint in-person review of 10 subjects, using the same template and following a detailed protocol. The protocol included a data abstraction guide designed to standardize the data collection process across reviewers. Any ambiguities that occurred during abstraction were reviewed with other members of the team until consensus could be achieved.

2.3. Outcome measures

Variables of interest included demographic data including race, age, gender; time of significant events during ED course (time of triage, time of first provider assignment, time of first analgesia order, time of first analgesia administration, total treatment time); pain scale at time of triage and at discharge; Emergency Severity Index (ESI); type of analgesia ordered in ED (route of analgesia and class of medication); and whether patient received advanced workup such as computed tomography (CT) scan, lumbar puncture, or neurology consult. Variables were collected from the electronic medical record. Note that demographic data such as race was included based on patients' self-reported race as recorded by ED registration records. Key variables were operationalized by creating groups of data. Specifically, data was organized by race to create groups "White" and "BIPOC" (Black, Indigenous, People of Color). Visual analog pain scale ranged from 0 to 10 and was classified as mild (0–3), moderate (4–6), and severe (7–10). This classification was determined based on the skewness of the distribution on pain scores in our sample and based on clinical experience in our ED. A sensitivity analysis was also conducted in which the threshold values for these categories were modified using tertiles to explore potential differences based on variable definition.

2.4. Data analysis

Descriptive statistics were used to describe the demographic, health, and visit characteristics of the patients. Bivariate analyses were conducted to compare these characteristics across white and BIPOC groups. Chi-square tests were used to compare binary and categorical variables, and *t*-tests were used to compare means of continuous variables. Unadjusted and adjusted logistic regression was used to determine the odds of receiving an over-the-counter medication by race category and controlling for ESI and pain score. All analyses were conducted using SAS 9.4 (Carey, NC).

3. Results

Complete data on race and all outcome variables were obtained on 482 subjects. Of these, 265 (55.0%) were white and 217 (45.0%) were classified as BIPOC. Characteristics of the white and BIPOC groups are presented in Table 1. In both groups, the majority of patients were female and between 18 and 35 years of age. White patients were more likely to have been coded as ESI of 2 or 3 compared to BIPOC patient (88.7% vs 81.1%, $p = 0.02$). However, BIPOC patients were significantly more likely to report higher pain scores, with 82.9% reporting a pain level of 7 or higher compared to 64.2% of white patients ($p < 0.001$). White patients were also more likely to have received a CT scan (52.5%) compared to BIPOC patients (32.7%, $p < 0.001$) and were more likely to have a neurology consult (13.6%) compared to BIPOC patients (5.5%, $p = 0.003$). In bivariate analyses, BIPOC patients were more likely to have received ibuprofen (9.7%) or acetaminophen (25.4%) compared to white patients (ibuprofen: 4.2%, $p = 0.015$; acetaminophen: 17.7%, $p = 0.042$).

With regard to opiates, only 11 patients in the total sample received oral doses of an opiate, but the majority of these patients were white (73%). While the difference between the number of white and BIPOC patients who received opiates did not reach statistical significance ($p = 0.231$) due to small sample size, this finding is still noteworthy. Similarly, 27 patients received IV opiates, but two-thirds of these patients were white. White patients were also more likely to receive another medication in addition to ibuprofen or acetaminophen; of the 56 white patients who received either ibuprofen or acetaminophen, 77% received another medication. For the 69 BIPOC patients who received ibuprofen or acetaminophen, 61% received another medication ($p = 0.058$). This comparison was not significant at the 0.05 level but is still notable. In an unadjusted logistic regression analysis, BIPOC patients

Table 1
Characteristics of Sample and Treatment Patterns

Characteristic		White ($N = 265$) N (%)	BIPOC ($N = 217$) N (%)	*p*-value
Age	18–35	128 (48.3)	118 (54.4)	0.407
	36–65	115 (43.4)	84 (38.7)	
	65+	22 (8.3)	15 (6.9)	
Gender	Female	172 (64.9)	149 (68.7)	0.384
	Male	93(35.1)	68 (31.3)	
Bed Location	Hallway	55 (21.1)	56 (26.0)	0.202
	Room	206 (78.9)	159 (74.0)	
Acuity	2 or 3	235 (88.7)	176 (81.1)	0.020
	4 or 5	30 (11.3)	41 (18.9)	
Pain Level	0–3	31 (12.6)	17 (8.3)	<0.001
	4–6	57 (23.2)	18 (8.8)	
	7–10	158 (64.2)	170 (82.9)	
Medication Received*	Benadryl	103 (38.87)	100 (46.1)	0.110
	Compazine	121 (45.7)	99 (45.6)	0.993
	Decadron	12 (4.5)	5 (2.3)	0.188
	Ibuprofen	11 (4.2)	21 (9.7)	0.015
	IV Opiate	18 (6.8)	9 (4.2)	0.209
	Oral Opiate	8 (3.0)	3 (1.4)	0.231
	Phenergan	13 (4.9)	13 (6.0)	0.600
	Reglan	57 (21.5)	45 (20.7)	0.836
	Toradol	125 (47.2)	97 (44.7)	0.588
	Acetaminophen	47 (17.7)	55 (25.4)	0.042
	Zofran	35 (13.2)	18 (8.3)	0.086
	Other	35 (13.2)	18 (8.3)	0.086
	No Medication	31 (11.7)	19 (8.8)	0.292
Received Another Medication in Addition to OTC	Yes	43 (76.8)	42 (60.9)	0.058
CT Scan Ordered	Yes	139 (52.5)	71 (32.7)	<0.001
Lumbar Puncture	Yes	9 (3.4)	3 (1.4)	0.158
Neurology Consult	Yes	36 (13.6)	12 (5.5)	0.003
		M(SD)	**M(SD)**	
Time to First Analgesia (min)		121.3 (132.7)	108.6 (122.2)	0.318
Time to Bed Assignment (min)		105.0 (116.2)	114.0 (122.2)	0.420
Time to Provider (min)		127.3 (124.7)	138.4 (131.0)	0.358
Time to First Treatment (min)		173.9 (131.9)	162.5 (116.8)	0.357

had 1.74 times the odds of receiving an over-the-counter medication (OTC; i.e., ibuprofen or acetaminophen) compared to white patients (95% CI: 1.15, 2.62). Table 2 shows the adjusted analysis. After controlling for ESI and pain score, BIPOC patients had 1.64 times the odds of receiving an OTC medication compared to white patients (95% CI: 1.06, 2.55). As anticipated pain score was highly skewed in our sample and 30% of our sample had a pain score of 10. In our sensitivity analysis in which pain score was redefined using tertiles: 0–6, 7–8, and 9–10, the results of our multivariable model did not change. The effect estimates for race did not appreciably change and both pain score and acuity remained non-significant in our model. There were no differences in time to treatment.

Table 2
Unadjusted and Adjusted Logistic Regression Assessing Association between Race and Receiving an Over-the-counter Medication for Headache Management

	Model 1 (Unadjusted)		Model 2 (Adjusted)	
	OR	95% CI	AOR	95% CI
Race				
White	1.0 (Reference)	–	1.0 (Reference)	–
BIPOC	1.74	(1.15, 2.62)	1.64	(1.06, 2.55)
Acuity				
2 or 3	–	–	1.0 (Reference)	–
4 or 5	–	–	1.13	(0.61, 2.09)
Pain Level				
0–3	–	–	1.0 (Reference)	–
4–6	–	–	1.68	(0.69, 4.11)
7–10	–	–	1.45	(0.67, 3.13)

OR: Odds ratio, AOR: Adjusted odds ratio, CI: Confidence interval.

4. Discussion

The purpose of this study was to assess for possible racial disparities in ED headache care related to time to see a provider, time to receiving analgesia, and analgesia prescribing practices. We were particularly interested in assessing whether previously demonstrated racial disparities in analgesia prescribing practices and time to care have changed since studies done in previous decades, given the attention on both racial disparities and the opioid epidemic in recent years. Our results did not demonstrate any statistically significant difference by race in time to analgesia, time to bed assignment, or time to provider. These results were surprising, particularly given prior research that had demonstrated disparities in wait times and time to analgesia. A recent review [13] identified several studies that noted significantly longer wait times for pain conditions in the ED for Black patients compared to White, but the most recent of these studies was published in 2013 [20]. It is possible that changes in behavior occurred due to dissemination of previous research and there is less disparity in wait times in the ED [20]. Further research is indicated to better clarify these findings.

However, our study did demonstrate significant racial disparities in triage assessment and type of treatment received. Specifically, BIPOC patients were significantly more likely to receive an ESI score of 4–5, while white patients were statistically more likely to receive an ESI score of 2–3. This is consistent with previous literature that notes BIPOC patients are more likely to receive less acute triage scores compared to white patients with similar conditions. This might reflect conscious or unconscious bias in the triage process, and further research

about the etiology of this difference is warranted. It is well-known that the ESI is susceptible to bias, and is also impacted by other factors, such as ED volume and interruptions in care delivery [21–23]. We suggest that intentional training about bias in healthcare for triage staff may be important and could positively impact the care that BIPOC patients receive in the ED.

Our study also shows that racial disparities exist in the type of analgesia prescribed for patients treated in the ED for a headache. Specifically, our data show that BIPOC patients are more likely to be treated with oral ibuprofen and acetaminophen despite reporting higher pain levels during triage. Though our results were not statistically significant due to small sample size, we did find that more white patients were prescribed oral and IV opioids compared to BIPOC patients. This is consistent with a recent study that found that non-Hispanic white patients were more likely to receive IV opioids than Black or Hispanic patients for migraine treatment in the ED, despite the fact that opioids are not a recommended treatment for migraine [5]. As recently as 2016, medical professionals report still believing in biological differences in the way white and Black patients feel pain [24]. Among these beliefs are that Black patients have less sensitive nerve endings and thicker skin than white patients [24]. Although these beliefs are false, they may contribute either explicitly or implicitly to treatment decisions. Further research is needed on the role of implicit and explicit provider bias in treatment of headache in the ED.

Finally, our data shows that white patients presenting to the ED with complaint of headache are more likely to receive a CT or neurology consult. This is consistent with previous research documenting that Black patients were significantly less likely to receive a CT than white counterparts [25]. It is well-known in medicine that "more treatment doesn't necessarily indicate better treatment". While these two variables are not markers of "better" care, these variables may reasonably serve as surrogate markers for a physician's level of concern, and our data would then imply that white patients received a higher level of concern and thus a higher level of workup. This may also be another result of inaccurate beliefs about biological differences between races.

4.1. Limitations

There are a number of important limitations to consider. First, data were collected from a single academic hospital Emergency Department with a large catchment area in upstate New York. Findings may not be generalizable to other patient populations or regions of the county. While our region does have significant racial diversity, the data was not powered for analysis of individual racial categories and we were unable to assess for differences between each racial subgroup. Our categories of "white" and "BIPOC" may not fully reflect disparities that may exist in ED care. Future studies looking at a larger data set may provide more detail. Further, we relied on self-reported race classification as reported by patients during their ED registration and documented in the medical record. Classification of race is complex and it is very likely that some patients' race was not accurately captured. In particular, patients who identify as mixed-race were likely not captured accurately due to the method of data collection and capabilities of the electronic medical record system. Additionally, our study was unable to directly compare the characteristics of individual providers and the extent to which provider-level factors, such as experience, race, age, etc., may play a role in the acute management of headache. This is an area in which future research is warranted.

5. Conclusions

Racial disparities were observed in triage assessment, type of analgesia received, frequency of head CT and frequency of neurology consult for patients being treated for headache in a large academic ED.

Article summary

- **Why is this topic important?** Understanding the impact of racial disparities in emergency medicine is critical in providing high-quality care to all patient populations.
- **What does this study attempt to show?** This study demonstrates that racial disparities exist in the treatment of non-traumatic headaches in an academic emergency department.
- **What are the key findings?**
- During triage assessment, BIPOC patients were more likely to be assigned lower Emergency Severity Index (ESI) scores than their white counterparts.
- BIPOC patients with headaches were more likely to be treated with oral ibuprofen and acetaminophen than white patients with headaches, despite reporting higher pain scores during initial assessments.
- White patients with headaches were more likely to receive a CT head or a neurology consult than non-white patients with headaches.
- There was no significant difference by race in time to analgesia, time to provider, or bed assignment.
- **How is patient care impacted?** Despite extensive publicity and research over the past decade about racial disparities in healthcare, these racial disparities persist in triage assessment and treatment decisions. Having a better understanding of how racial disparities manifest in the emergency department can directly improve patient care.

CRediT authorship contribution statement

Rachel Nelson: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing. **Julie Kittel:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Iman Mahoui:** Writing – original draft, Writing – review & editing, Conceptualization, Methodology. **David Thornberry:** Writing – review & editing, Methodology, Data curation, Conceptualization. **Andrew Dunkman:** Conceptualization, Data curation, Writing – review & editing. **Malik Sams:** Writing – review & editing, Investigation, Conceptualization. **David Adler:** Conceptualization, Investigation, Methodology, Project administration, Supervision, Writing – review & editing. **Courtney Marie Cora Jones:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Formal analysis, Data curation, Conceptualization.

Declaration of Competing Interest

The authors have no conflicts of interest to disclose.

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