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Racial disparities in analgesic use amongst patients presenting to the emergency department for kidney stones in the United States

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ABSTRACT

Introduction: We sought quantify racial disparities in use of analgesia amongst patients seen in Emergency Departments for renal colic.
Methods: We identified all individuals presenting to the Emergency Department with urolithiasis from 2003 to 2015 in the nationally representative Premier Hospital Database. We included patients discharged in ≤1 day and excluded those with chronic pain or renal insufficiency. We assessed the relationship between race/ethnicity and opioid dosage in morphine milligram equivalents (MME), and ketorolac, through multivariable regression models adjusting for patient and hospital characteristics.
Results: The cohort was 266,210 patients, comprised of White (84%), Black (6%) and Hispanic (10%) individuals. Median opioid dosage was 20 MME and 55.5% received ketorolac. Our adjusted model showed Whites had highest median MME (20 mg) with Blacks (−3.3 mg [95% CI: −4.6 mg to −2.1 mg]) and Hispanics (−6.0 mg [95% CI: −6.9 mg to −5.1 mg]) receiving less. Blacks were less likely to receive ketorolac (OR: 0.72, 95% CI: 0.62–0.84) while there was no difference between Whites and Hispanics.
Conclusions: Black and Hispanic patients in American Emergency Departments with acute renal colic receive less opioid medication than White patients; Black patients are also less likely to receive ketorolac.

1. Introduction

Despite improvements in medical technology and care delivery, disparities exist in health care access and quality in the United States [1]. Minority race and/or ethnicity, in particular, has been implicated in poorer health outcomes even when controlling for socioeconomic and geographic factors. There is now growing data to suggest these disparities extend to treatment of acute pain.

In the ED, patients' race and ethnicity have been shown to effect physicians' decisions to administer opioid medications, with minorities receiving lower dosages of opioids for a variety of painful conditions [2-7]. Furthermore, the literature suggests that minorities are less likely to receive opioid analgesia than non-opioid analgesia, such as non-steroidal anti-inflammatories (NSAIDs), in this context. Minority patients are also more likely to receive no pain medications than White patients.

There is currently a paucity of literature evaluating racial and ethnic disparities amongst patients presenting to the Emergency Department (ED) with obstructing kidney stones. In this report we utilized a large nationally representative database to trial the hypothesis that minority patients receive less opioid and non-opioid analgesia when presenting to the ED with renal colic, just as others have concluded in populations presenting with other painful conditions.

2. Methods

2.1. Data source

Data were abstracted from Premier Hospital Database (Premier Inc., Charlotte, NC, USA), an all-payer hospital discharge database. All data are de-identified, and we received institutional review board exemption. Premier captures 45 million inpatient discharges and >310 million hospital visits annually from approximately 700 private and academic hospitals, accounting for 20% total discharges in the United States.

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2.2. Study cohort and covariates

Utilizing International Classification of Diseases, ninth revision (ICD-9), codes, we identified all patients ≥18 years old presenting to the ED with a primary diagnosis of urolithiasis (ICD9 592.0, 592.1, 592.9, 274.11) in the 13-year period from January 1, 2003 – December 31, 2015. Patient characteristics included age, gender, insurance status (Medicare, Medicaid, private, other/unknown) and substance abuse history. Race and/or ethnicity was categorized as White, Black or Hispanic. Patients with unknown race/ethnicity were excluded given potential heterogeneity. Hospital characteristics included teaching status, hospital bed size, location (urban or rural) and geographical region (Northeast, Midwest, West or South).

To focus on non-toxic patients, we incorporated the following exclusion criteria: hospital stay greater than one day, administration of intravenous antibiotics, admission to the ICU, operative management, and inpatient mortality. Additionally, we also excluded patients with diagnosis of chronic pain syndrome and renal insufficiency.

2.3. Outcomes

The primary outcome of interest was quantity of analgesia, specifically opioid and intravenous non-opioid (i.e., ketorolac) pain medication. The quantity of analgesic medications was calculated from billing data for each patient. All opioid medications were converted to morphine milligram equivalents (MME) as has been previously described [8]. Given the standard dosing for ketorolac, this outcome was quantified by the percentage of patients receiving ketorolac and dosing information was not included.

2.4. Statistical analyses

The study cohort was divided into race/ethnicity categories and clinicodemographic characteristics were evaluated with descriptive statistics. Categorical variables were assessed with chi-square tests. We utilized multivariable median regression and logistic regression to evaluate race/ethnicity as a predictor for the outcomes of interest. We employed survey weighting and hospital clustering to achieve a nationally representative estimation. All analyses had 80% power to detect 20% difference and were two-tailed with a p-value <0.05 statistically significant. The statistical analyses were performed with Stata 14 (College Station, TX: StataCorp LP).

3. Results

3.1. Demographics

The sociodemographic characteristics of the cohort are summarized in Table 1. The cohort consisted of 266,210 patients. Amongst these patients, 223,963 (84%) were White, 15,841 (6%) were Black and 26,412 (10%) were Hispanic. The majority were <70 years old, with only 14% aged 70 and older. White patients were more likely to be 70 years and older (14%) compared to Black (7.4%) and Hispanic (7.1%) patients (p ≤0.001). There were also differences in the percentage of patients with substance abuse history between White (8.8%), Black (10.1%) and Hispanic (6.4%) patients (p ≤0.001). The majority of patients (74%) were male. There were no differences amongst racial groups in the teaching hospital status (Yes 14.6%, 18.1%, 13.0%, p = 0.468) and hospital size (p = 0.106).

White patients were more likely to be seen in rural hospitals (8.6%) compared to Black and Hispanic patients (4.1% and 2.5%, p ≤ 0.001). There were notable regional differences: 68.1% of Black and 60.9% of Hispanic patients were from the Southern region, compared to 45.2% of White Patients. White patients were more likely than Black and Hispanic patients to be from the Midwest (26.7% vs 16.5% vs 10.2%, p < 0.001) and Northeast (9.9% vs 6.6%, 4.4%, p < 0.001). A larger percentage of Hispanic patients (24.3%) were from the Western region than the other two groups (18.9% White, 8.9% Black p < 0.001).

Table 1
Demographic characteristics.

	White	Black	Hispanic	p-value
	n = 223,963	n = 15,841	n = 26,412	
Age				<0.001
<50	43.4	53.1	58.9	
50–69	42.7	39.5	34	
≥70	14	7.4	7.1	
Gender				0.014
Male	74.6	70.8	73.7	
Female	25.4	29.2	26.3	
Substance abuse				<0.001
No	91.2	89.1	93.6	
Yes	8.8	10.9	6.4	
Payor				<0.001
Medicare	22.9	17.3	14.8	
Medicaid	5.4	9.9	10.9	
Managed Care	46.3	37.4	40.3	
Commercial	8.6	7	3.2	
Other	16.8	28.6	30.9	
Hospital location				<0.001
Rural	7.4	4.1	2.5	
Urban	92.6	95.9	97.4	
Teaching hospital				0.468
No	85.4	81.9	87	
Yes	14.6	18.1	13	
Hospital size				0.106
<200 beds	30.9	21.8	27.3	
200–299 beds	20.9	18.9	18.6	
300–399 beds	20.3	24.9	12.8	
400–499 beds	9.1	10.1	9.2	
500+ beds	18.8	24.3	32.1	
Region				
Midwest	26.7	16.5	10.2	<0.001
Northeast	9	6.6	4.4	
South	45.4	68.1	60.9	
West	18.9	8.9	24.3	

3.2. Opioid administration

The overall median opioid dosage per patient encounter was 20 mg MME. Utilizing weighted median regression and controlling for patient and hospital characteristics, White patients received 3.3 mg (95% CI 2.1–4.6 mg) more MME than Black patients and 6.0 mg (95% CI 5.1–6.9 mg) more than Hispanic patients. White patients were 30% more likely than Black patients and 40% more likely than Hispanic patients to be in the top 75th percentile of morphine dosage (Table 2).

Older patients received less MME than younger patients: the amount of MME received decreased in all groups older than 54. Patients 55–64 years of age received 3.2 MME (95% CI 2.3–4.2) less than those <45. Patients older than 74 years of age received 11.5 MME (95% CI 9.7–13.3 mg) less than those <45 years.

Patients with substance abuse disorder received 13.9 mg more MME (95% CI 11.4–16.4) than the median. These patients also had a 2.3 (95% CI 1.8–2.8) adjusted odds of being in the highest 75% of MME.

Finally, there were geographic differences in dosage of morphine administered. Patients in the Midwest received lowest dosage at 15.2 MME (95% CI 14.5–15.9). Patients in the Northeast received 3.4 MME more (95% CI 2–4.8), South 3.6 MME more (95% CI 2.8–4.3) and West 10.3 MME more (95% CI 9.2–11.5) than their Midwest counterparts. Within each region, Black and Hispanic patients received lower MME compared to White patients.

3.3. Differences in ketorolac administration

Patients receiving ketorolac also received larger amounts of opioid: 3.7 MME (95% CI 3–4.4 mg) more than the median. Those who were

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Table 2
Adjusted difference in median opioids received (morphine milligram equivalents [MME]) and 95% Confidence Interval.

	Model adjusting for patient characteristics[a]	Model adjusting for hospital characteristics[b]	Model adjusting for patient and hospital characteristics[c]
White	Reference	Reference	Reference
Black	−3 (−3.9 to − 2.1)*	−3 (−3.8 to − 2.2)*	−3.3 (−4.6 to − 2.1)*
Hispanic	−3 (−4 to − 2)*	−5 (−6.3 to − 3.7)*	−6 (−6.9 to − 5.1)*

* $p < 0.0001$.
[a] Adjusting for patient characteristics in Table 1 and ketorolac use.
[b] Adjusting for hospital characteristics in Table 1 and ketorolac use.
[c] Adjusting for all characteristics in Table 1 and ketorolac use.

given ketorolac had a 1.2-fold (1.05–1.3) adjusted odds of being in the top 75% of MME administered.

Our analysis revealed that Blacks were less likely to receive ketorolac (OR: 0.72, 95% CI: 0.62 to 0.84). There was no difference between Whites and Hispanics (Table 3). More White patients received both opioids and ketorolac (41.21%) as compared to Black (33.72%, $p = 0.0005$) and Hispanic (39.8%, $p = 0.0005$) patients. In the study cohort, 19.49% of Hispanic patients received ketorolac alone; this was a significantly higher percentage than White (14.22%, $p = 0.0005$) and Black (15.52%, $p = 0.0005$) patients. Black patients (18.03%) were more likely to receive neither opioids nor ketorolac compared to White patients (16.22%, $p = 0.0005$) and Hispanic patients (14.92%, $p = 0.0005$).

4. Discussion

We found that Black and Hispanic patients seen in the ED in the United States with acute renal colic receive less opioid pain medication than White patients. White patients in our study received a median 20 MME with Black patients receiving 3 MME less and Hispanic patients receiving 5.4 MME less. Black and Hispanic patients were also less likely to be in the top 75% of MME dosage and more likely to be in the bottom 25%.

To our knowledge, this study represents the largest evaluation of disparities in analgesia amongst patients presenting to the ED with kidney stones. Given the large size of the Premier Hospital Database, we achieved a nationally representative analysis evaluating different racial/ethnic groups as well as geographic regions and hospital types. Additionally, due to the available granular prescribing data, we were also able to determine the specific dosage – in MME – of opioid pain medication administered. Whereas previous studies compared whether or not patients received opioids, we were able to specifically delineate and compare dosage of these medications.

The findings of this study echo reports which have described disparities in opioid administration amongst patients presenting to the ED with a variety of conditions. In particular, minority patients with orthopedic injuries, abdominal and back pain and appendicitis have been shown to receive less opioid and non- opioid pain medication in the ED [6,9,10]. Our data also complements the 2008 paper by Pletcher et al. which suggested patients presenting to the ED with pain – including those with nephrolithiasis – were less likely to be prescribed opioids if they were non-White [3]. In their heterogenous group of patients with all indications, they found that 31% of White patients were prescribed a opioid, compared to 23% of Black and 24% of Hispanic patients [3]. The distinction between this current report and that by Pletcher is that our data describes opioid dosage administered.

Geographic differences existed in our cohort, with patients in the Midwest receiving the lowest dosage of opioids and patients in the Western United States receiving the most. This geographic variation supports prior literature documenting the large amount of county, state and regional variability in opioid prescribing in the United States [11,12]. Despite these geographic variations, racial/ethnic disparities in opioid administration were consistently present with White patients receiving more than Blacks and Hispanics (Fig. 1). Further research is warranted to better understand this interplay.

Along with differences in opioid administration between racial/ethnic groups, we also documented important racial/ethnic disparities in administration of ketorolac both in combination with opioids and alone. Black patients in our study were less likely to receive ketorolac, while Hispanics received the same amount as Whites. White patients were most likely to receive both opioids and ketorolac than either of the minority groups. This finding expands upon the prior study by Pletcher et al. which found that Black and Hispanic patients were more likely than White patients to be prescribed non- opioid analgesia alone, but less likely to receive combined non-opioid and opioid analgesia [3]. The use of NSAIDs, such as ketorolac, is particularly pertinent, as there is a robust body of literature suggesting that NSAIDs are as, if not more, effective than opioids in managing acute renal colic discomfort [13,14]. One 2004 systematic review of 20 trials found both NSAIDs and opioids were effective in renal colic pain, but patients treated with NSAIDs had a more significant pain reduction [8]. A randomized, controlled, double-blinded trial published in Lancet in 2016 similarly demonstrated that intramuscular diclofenac was more effective than morphine at achieving a 50% reduction in pain in patients presenting with acute renal colic [14]. The lower rate of combined ketorolac/opioid administration amongst Black and Hispanic patients raises concern that these patients may not have equivalent analgesia to White patients.

The etiology of the disparities observed in our study is likely multifactorial. Racial and ethnic differences in our cohort persisted even when controlling for regional and urban/rural variations, insurance type, hospital size, teaching hospital status, age and history of substance abuse. This suggests that the lower opioid dosage administered to minority groups cannot be explained by geographic or practice setting differences. Instead, unrecognized provider racial/ethnic bias may contribute to the observed difference between analgesia given to Black/Hispanic patients and White patients. This report should therefore induce a continued evaluation of the etiology of such biases on an individual practitioner and public health scale.

Table 3
Percentage of patients receiving either opioids, or ketorolac, or both.

	All	White	Black	Hispanic	p-Value
Neither opioids nor ketorolac	16.20%	16.22%	18.03%	14.92%	0.0005
Opioids only	28.36%	28.36%	32.73%	25.78%	
Ketorolac only	14.82%	14.22%	15.52%	19.49%	
Both opioids and ketorolac	40.62%	41.21%	33.72%	39.80%	

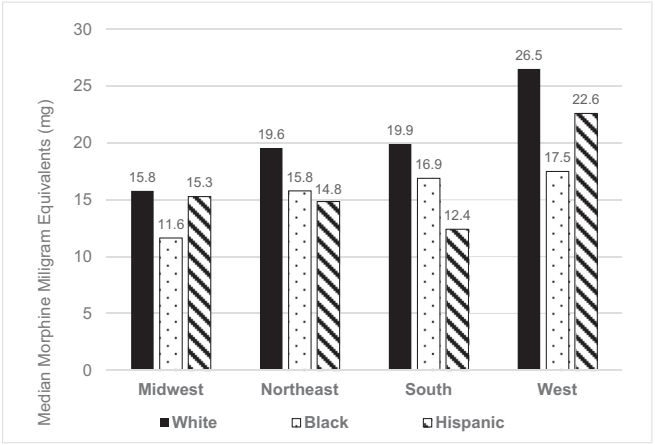

Fig. 1. Racial and regional differences in median MME administered. Patients in the Midwest received the lowest MME and West the highest. In all regions, Black and Hispanic patients received lower MME compared to White patients.

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The current study is not without limitations. A shortcoming of our analysis, as with others utilizing administrative data, is that there is a risk for misclassification bias as our study utilizes a secondary analysis of administrative data which may include coding errors. Our study also does not address opioid prescribing, instead focusing on opioid administration. It is possible that disparities described in opioid administration in the ED may not be reflected in prescriptions. As the database does not include prescription information, we utilized diagnosis codes for substance use disorder and chronic pain syndrome to identify individuals who may have been on chronic opioids. Furthermore, we did not investigate the use of oral or other intravenous NSAIDs such as diclofenac and ibuprofen, as these agents were not available in intravenous formulations in 2003. Another limit of our study is that Premier Hospital Database does not include data about other racial minorities, in particular Asians. In total, 18.7% of our population had their race listed as "other" and these patients were excluded from our analysis. It is possible that members of our minority populations were coded into this category and erroneously excluded from our study.

5. Conclusion

This study suggestions that Black and Hispanic patients seen in the ED in the United States with acute renal colic receive significantly less opioid pain medication than White patients. Black patients are also less likely to receive ketorolac, whereas Hispanic patients receive the same dosage of ketorolac as White patients. Additional research is warranted to determine the cause of this racial disparity in analgesic use, as well as to explore opportunities to reduce this difference.

Key

ED	emergency department
ICD-9	International Classification of Diseases, ninth revision
NSAIDS	non-steroidal anti-inflammatories
MME	morphine milligram equivalents

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None.

Presentations

This abstract was presented as a moderated poster at the AUA Conference in San Francisco, CA in May of 2018.

Declaration of competing interest

None.

References

[1] Centers for Disease Control and Prevention. CDC health disparities and inequalities report: United States. http://www.cdc.gov/mmwr/pdf/other/su6001.pdf; 2011.
[2] Singhal Astha, Tien Yu-Yu, Hsia Renee Y. Racial-ethnic disparities in opioid prescriptions at emergency department visits for conditions commonly associated with prescription drug abuse. PLoS One 2016;11(8):e0159224.
[3] 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;299:70–8 [pmid:18167408].
[4] Tamayo-Sarver JH, Hinze SW, Cydulka RK, Baker DW. Racial and ethnic disparities in emergency department analgesic prescription. Am J Public Health 2003;93:2067–73 [14652336].
[5] Shah AA, Zogg CK, Zafar SN, Schneider EB, Cooper L, Chapital AB, et al. Analgesic access for acute abdominal pain in the emergency department among racial/ethnic minority patients: a nationwide examination. Med Care 2015;53(12):1000–9 [pmid:26569642].
[6] Todd KH, Samaroo N, Hoffman JR. Ethnicity as a risk factor for inadequate emergency department analgesia. JAMA 1993;269:1537–9.
[7] Todd KH, Deaton C, D'Adamo AP, Goe L. Ethnicity and analgesic practice. Ann Emerg Med 2000;35:11–6.
[8] Nielsen Suzanne, et al. Comparing opioids: a guide to estimating oral morphine equivalents (OME) in research. Sydney, Australia: National Drug and Alcohol Research Centre; 2014.
[9] Goyal MK, et al. Racial disparities in pain management of children with appendicitis in emergency departments. JAMA Pediatr 2015;169(11):996–1002.
[10] Mills AM, et al. Racial disparity in analgesic treatment for ED patients with abdominal or back pain. Am J Emerg Med 2011;29(7):752–6.
[11] McDonald DC, Carlson K, Izrael D. Geographic variation in opioid prescribing in the US. J Pain 2012;13(10):988–96.
[12] Paulozzi LJ, Mack KA, Hockenberry JM. Variation among states in prescribing of opioid pain relievers and benzodiazepines—United States, 2012. J Safety Res 2014;51:125–9.
[13] Holdgate Anna, Pollock Tamara. Systematic review of the relative efficacy of non-steroidal anti-inflammatory drugs and opioids in the treatment of acute renal colic. Bmj 2004;328(7453):1401.
[14] Pathan SA, et al. Delivering safe and effective analgesia for management of renal colic in the emergency department: a double-blind, multigroup, randomised controlled trial. Lancet 2016;387(10032):1999–2007.

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