Examining Racial, Ethnic, and Gender Disparities in the Treatment of Pain and Injury Emergencies

Laurel A. Wimbish, MA; Janelle R. Simpson, MA; Lauren R. Gilbert, PhD; Andria Blackwood, PhD; Emily A. Grant, PhD

Abstract

Background
Racial, ethnic, and gender disparities in effective pain management have been well-documented across healthcare settings. However, discrepancies in the treatment of patients in prehospital pain management settings have not been well researched. The objective of this study was to determine whether Wyoming emergency medical service (EMS) providers’ use of opioids to treat prehospital pain or injury varies by patient race/ethnicity or gender.

Methods
This cross-sectional study of EMS records examined 27,448 patient care reports (PCRs) generated during emergency medical responses to pain/injury emergencies in the state of Wyoming between January 2016 and March 2019. We included PCRs in the sample when 1) the primary impression was pain or injury, 2) the type of service was a 911 response, 3) the patient received treatment from and was transported by the EMS unit completing the PCR, and 4) the responding unit included one or more providers authorized to administer opioids.

Results
The analysis identified a disparity in opioid administration by EMS providers during emergency transport (N = 27,448). Logistic regression reveals that EMS providers administered opioids to American Indian/Alaska Native patients (AI/AN) \( n = 1610; 5.9\%; P < .001; \text{OR} = 0.44 \) and those of Hispanic ethnicity \( n = 1351; 4.9\%; P = .001; \text{OR} = 0.74 \) at statistically significant lower rates \( n = 14,769; 53.8\%; P = .004; \text{OR} = 0.90 \) than they administer opioids to White patients. The analysis found EMS providers administer opioids to females at significantly lower rates \( P = .004 \) compared to males.

Conclusion
Wyoming EMS providers administer opioids to White and male patients more often than non-White and female patients. Our results do not show a significant difference in the administration of opioids between White and Black patients. However, the data indicate a statistically significant difference between Hispanic, AI/AN, and White patients as well as between male and female patients.

Keywords
healthcare disparities; pain management; emergency medical services (EMS); opioids; opioid analgesics; prehospital pain management

Introduction
Pain is undertreated across medical settings and patient populations.\(^1,2\) Studies confirm racial, ethnic, and gender disparities in pain management across healthcare settings,\(^1\) including hospital emergency rooms, chronic pain treatment centers, and Veteran’s Administration hospitals.\(^1,4\) Poor pain management has substantial consequences for patients, including reduced quality of life, impaired sleep, impaired physical function, and the economic burden of seeking remedies for pain relief.\(^5\) Pain relief
in prehospital settings should be a priority in prehospital care. Policymakers and the medical community have increasingly scrutinized the use of opioids to treat pain amid the ongoing opioid epidemic. The objective of this study was to determine whether emergency medical service (EMS) providers’ use of opioids to treat prehospital pain or injury varies by patient race/ethnicity or gender. We hypothesized that EMS providers administer opioids to White and male patients more often than non-White and female patients.

Methods

Study Oversight and Data Collection
The University of Wyoming Institutional Review Board reviewed and approved this study (Protocol #20190701LW02457). To test our hypothesis, we conducted a cross-sectional study of EMS records generated during emergency medical responses to pain/injury emergencies in the state of Wyoming between January 2016 and March 2019. In 2016, the Wyoming Office of Emergency Medical Services (OEMS) transitioned from the NEMSIS 2.2 data dictionary to NEMSIS 3.4. OEMS provided researchers with data from the Wyoming Ambulance Trip Reporting System (WATRS), an electronic patient care reporting system (ePCR) that stores patient care reports (PCRs). These reports, submitted by EMS providers, include demographic data on the patient (eg, race/ethnicity, gender, vital signs), the EMS response (eg, time of dispatch and arrival, location of pain or injury on the body, and type of service call), and treatment provided (eg, medication administered).

Study Design andParticipant Inclusion Criteria
We analyzed PCRs submitted by EMS providers between January 2016 and March 2019 to determine the association between patient race/ethnicity and gender and EMS providers’ use of opioids to treat pain in prehospital emergencies. We limited our study to incidents where the EMS provider’s primary impression was pain or injury. A primary impression is the EMS provider’s characterization of the most significant condition or problem leading to patient treatment. We included PCRs in the sample when 1) the primary impression was pain or injury, 2) the type of service was a 911 response, 3) the patient received treatment from and was transported by the EMS unit completing the PCR, and 4) the responding unit included one or more providers authorized to administer opioids.

Variables

Outcome (Dependent) Variable
EMS providers administered 4 different opioids to patients in the sample (fentanyl, morphine, hydrocodone, and tramadol). The outcome variable was opioid administration where 1 = opioids administered and 0 = no opioids administered.

Independent Variables
We collapsed the independent variable race/ethnicity into 5 categories: Black, Hispanic, American Indian/Alaska Native (AI/AN), White, and Other. We combined Asian, Native Hawaiian, Other Pacific Islander, More Than One Race, and Other Race into a single category, Other Race, due to the small sample size. EMS providers reported gender using 3 categories: male, female, and unknown.

Control Variables
To isolate the effect of race/ethnicity and gender on the likelihood of opioid administration (dependent variable), the analysis included 5 control variables in our regression model: 1) age of the patient (collapsed into 6 categories: under 5, 5 to 17, 18 to 24, 25 to 44, 45 to 64, and 65+ years old), 2) the amount of time the EMS provider spent with the patient (the number of minutes from the time the provider first arrived at the patient’s side to the time the patient arrived at the healthcare facility), 3) the location of the pain or injury on the body (chronic pain, extremities, head/neck, spine/back, torso, or unspecified), 4) whether the EMS provider was likely able to observe the pain and injury (observable, not observable, unlikely, or unknown) as categorized by OEMS, and 5) the patient’s self-reported pain score. EMS providers recorded the patient’s self-reported pain severity using a Numerical Rating Scale (NRS) that measures pain on a scale from 0 to 10, (0 = no pain and 10 = severe pain). We categorized NRS pain scores into 5 categories (no score; no pain, 0; mild, 1-3; moderate, 4-6; and severe, 7-10).

The data included 42 unique primary impressions (30 for injury and 12 for pain). The major-
Table 1: Demographics and PCR Characteristics

|                        | n      | %     |
|------------------------|--------|-------|
| **Opioids**            |        |       |
| No                     | 21889  | 79.7  |
| Yes                    | 5559   | 20.3  |
| **Age**                |        |       |
| Under 5                | 151    | 0.6   |
| 5 to 17                | 1473   | 5.4   |
| 18 to 24               | 2071   | 7.5   |
| 25 to 44               | 5856   | 21.3  |
| 45 to 64               | 7386   | 26.9  |
| 65+                    | 10511  | 38.3  |
| **Gender**             |        |       |
| Male                   | 12660  | 46.1  |
| Female                 | 14769  | 53.8  |
| Unknown                | 19     | 0.1   |
| **Race/Ethnicity**     |        |       |
| Black                  | 459    | 1.7   |
| Hispanic               | 1351   | 4.9   |
| AI/AN                  | 1610   | 5.9   |
| Other                  | 2606   | 9.5   |
| White                  | 21422  | 78.0  |
| **Primary impression** |        |       |
| Pain                   | 15568  | 56.7  |
| Injury                 | 11880  | 43.3  |
| **Location of body pain or injury** |    |       |
| Chronic                | 705    | 2.6   |
| Extremities            | 5068   | 18.5  |
| Head/Neck              | 5508   | 20.1  |
| Spine/Back             | 361    | 1.3   |
| Torso                  | 8868   | 32.3  |
| Unspecified            | 6938   | 25.3  |
| **Observability of pain or injury** |    |       |
| Not observable         | 17990  | 65.5  |
| Observable             | 3052   | 11.1  |
| Unknown                | 6239   | 22.7  |
| Unlikely               | 167    | 0.6   |
| **Pain score**         |        |       |
| No score               | 11960  | 43.6  |
| No pain (0)            | 855    | 3.1   |
| Mild (1-3)             | 1643   | 6.0   |
| Moderate (4-6)         | 3263   | 11.9  |
| Severe (7-10)          | 9727   | 35.4  |

We identified the specific location of the injury or pain on the patient’s body (e.g., injury-elbow, pain-eye). We used the ICD-10-CM Injury Diagnosis Matrix to assign each primary impression to a general body location. The matrix organizes injury diagnosis to groupings on body regions. For example, the matrix locates “injury-elbow” on the extremities and locates “pain-eye” on the head/neck. The resulting variable included 4 body locations (extremities, head/neck, spine/back, and torso). We categorized chronic pain (a primary impression included in the sample) as “chronic.” We categorized unspecified pain as “unspecified.”

Each of the 42 primary impressions was categorized by OEMS into four categories: 1) observable, 2) not observable, 3) may or may not be observable, and 4) not observable, but may have an associated observable injury.
**Statistical Analysis**
We began our analysis by calculating descriptive statistics including frequencies, percent-ages, and cross-tabulations. We conducted a binary logistic regression analysis to evaluate the relationship between race/ethnicity and gender and the EMS providers’ use of opioids to treat pain during pain and injury emer-gencies. We controlled for patient age, the number of minutes the EMS provider spent with the patient, the location of the pain or injury on the body, the observability of the pain or injury, and the reported pain score to isolate the effects of race, ethnicity, and gender.\(^7\,9^\) We assessed for multicollinearity using tolerance and Variance Inflation Factors (VIF) and detected none. We completed the analysis using Microsoft Access, SPSS Version 25, and STATA 16.

**Results**
**Sample Population**
Our sample included 27,448 PCRs that met the study inclusion criteria and had complete demographic information. The sample included 21,422 White (78%) patients and 14,769 females (54%). Almost two-thirds, 65% (n = 17,897 pa-tients), were age 45 or older. The mean age was 54.6 (SD±23.6). Nearly one-third, 32% (n = 8868), of PCRs were for pain or injury to the torso (eg, abdomen, genitals, or non-cardiac chest). The majority, 66% (n = 17,990 pa-tients), did not display observable pain or injury (eg, pain-eye, pain-tooth, or injury-upper back). Table 1 presents demographics and other PCR characteristics.

**Opioid Administration and Race/Ethnicity and Gender**
EMS providers did not use opioids to treat the majority (80%; n = 21,889) of patients in the sample. Of the 21,422 White patients treated with opioids, 22% (n = 4610) received opioids compared to only 192 (12%) of AI/AN patients and 16% (n = 211) of Hispanic patients (Table 2). The logistic regression model reveals that EMS providers administer opioids to AI/AN (\(P = .001\); OR = 0.44) and those of Hispanic ethnicity (\(P = .001\); OR = 0.74) at statistically significant lower rates than they administer opioids to White patients (Table 3). We found no signifi-cant differences in the rate of opioid administration to Black or Other Race patients com-pared to White patients. The analysis found EMS providers administer opioids to females at significantly lower rates (\(P = .004; \text{OR} = 0.90\)) compared to males (Table 3). We found no signifi-cant difference in the rate of opioid adminis-tration to patients of unknown gender.

**Discussion**
This study supports, in part, our hypothesis that EMS providers administer opioids to White and male patients more often than to non-White and female patients. Some of our results are consistent with previous research showing the disparate administration of opioids during pain and injury emergencies based on race/ethnicity and gender. For example, a review of 2012-2014 National Emergency Medical Services Information System (NEMSIS) data found that pre-hospital providers are less likely to treat Black patients who experience burns, penetrating injuries, or fractures with pain medication than White patients.\(^10^\) Another study found providers less likely to use pain medication when treating Black and Hispanic patients experiencing blunt trauma compared to White patients.\(^11^\) Additionally, analysis of Oregon NEMSIS data found that Black, Asian, Other Race, and unknown race patients treated for traumatic injury or complaining of pain are less likely to receive pain medication than White patients.\(^7^\) While our results do not show a significant difference in the administration of opioids between White and Black patients, as might be expected given the findings of prior studies, the small sample size of Black patients may have contributed to this result. The data indicate a statistically significant difference between Hispanic, AI/AN, and White patients. This difference reinforces the importance of disaggregating data on racial and ethnic groups to illuminate disparities in treatment.

A 2020 study found women regularly receive inadequate treatment for pain despite reporting more pain than their male counterparts.\(^12^\) Another study using EMS data examined the impact of several factors, including gender, ethnicity, age, and income on prehospital admini-stration of opioids for isolated extremity injuries. The study found statistically significant differences in the proportion of men receiving opioids compared to women.\(^13^\)
Table 2: Patient Demographics and PCR Characteristics and Opioid Administration

|                        | Opioids not given | Opioids given |
|------------------------|-------------------|---------------|
|                        | n   | %    | n   | %    |
| **Age**                |     |      |     |      |
| Under 5                | 143 | 94.7 | 8   | 5.3  |
| 5 to 17                | 1141| 77.5 | 332 | 22.5 |
| 18 to 24               | 1648| 79.6 | 423 | 20.4 |
| 25 to 44               | 4642| 79.3 | 1214| 20.7 |
| 45 to 64               | 5856| 79.3 | 1530| 20.7 |
| 65+                    | 8459| 80.5 | 2052| 19.5 |
| **Gender**             |     |      |     |      |
| Male                   | 10 086| 79.7 | 2574| 20.3 |
| Female                 | 11 786| 79.8 | 2983| 20.2 |
| Unknown                | 17   | 89.5 | 2   | 10.5 |
| **Race/Ethnicity**     |     |      |     |      |
| Black                  | 380  | 82.8 | 79  | 17.2 |
| Hispanic               | 1140 | 84.4 | 211 | 15.6 |
| AI/AN                  | 1418 | 88.1 | 192 | 11.9 |
| Other                  | 2139 | 82.1 | 467 | 17.9 |
| White                  | 16 812| 78.5 | 4610| 21.5 |
| **Primary impression** |     |      |     |      |
| Pain                   | 12 914| 78.8 | 2654| 21.2 |
| Injury                 | 8975 | 73.6 | 2905| 26.4 |
| **Location of body pain or injury** |     |      |     |      |
| Chronic                | 624  | 88.5 | 81  | 11.5 |
| Extremities            | 3177 | 62.7 | 1891| 37.3 |
| Head/Neck              | 5147 | 93.4 | 361 | 6.6  |
| Spine/Back             | 230  | 63.7 | 131 | 36.3 |
| Torso                  | 7178 | 80.9 | 1690| 19.1 |
| Unspecified            | 5533 | 79.7 | 1405| 20.3 |
| **Observability of pain or injury** |     |      |     |      |
| Not observable         | 14 661| 81.5 | 3329| 18.5 |
| Observable             | 2354 | 77.1 | 698 | 22.9 |
| Unknown                | 2139 | 82.1 | 467 | 17.9 |
| Unlikely               | 11 138| 93.1 | 822 | 6.9  |
| **Pain score**         |     |      |     |      |
| No score               | 844  | 98.7 | 11  | 1.3  |
| No pain (0)            | 1591 | 96.8 | 52  | 3.2  |
| Mild (1-3)             | 2789 | 85.5 | 474 | 14.5 |
| Moderate (4-6)         | 5527 | 56.8 | 4200| 43.2 |
| Severe (7-10)          | 12 914| 78.8 | 2654| 21.2 |
| **Total**              | 21 889| 79.7 | 5559| 20.3 |

Explanations for these disparities are complex, with patient, healthcare provider, and healthcare system factors all playing a role. Some researchers have linked the dismissal and undertreatment of pain in women to the gender stereotypes held by their healthcare providers. EMS providers may hold similar beliefs and misconceptions that negatively impact the care they provide to different demographics. Modifying the attitudes of EMS providers may offer opportunities for increasing the use of prehospital analgesia for these disparately affected groups. EMS providers practice within the broader context of the ongoing opioid crisis and may be influenced by “opioid pharmacovigilance” or the increased surveillance of opioid prescriptions.
among clinicians treating chronic non-cancer pain.16 Previous research has demonstrated that clinicians’ concerns around possible litigation and disciplinary action may cause providers to alter opioid prescribing and dispensing practices in ways that harm patients with pain management needs, especially for racial and ethnic minority populations.17 EMS providers may experience similar concerns and subsequently, reduce their administration of opioids to their patients. If so, such hesitation in administering opioids could result in the unintended consequence of leaving pain untreated across all groups and further exacerbate the racial, ethnic, and gender disparities previously noted.

These findings indicate the need for increased EMS provider awareness of disparities in pain management practices associated with patient race/ethnicity and gender.23,27 In addition,
training and educational interventions directed toward healthcare providers, including implicit bias training, have shown to be effective in reducing implicit bias among other health professionals and trainees.\textsuperscript{28,29} EMS administrators and policymakers should develop and deliver implicit bias training tailored specifically to EMS providers to reduce implicit biases and promote equitable care for all patients.

**Strengths**
This study contributes to the larger discussion of prehospital pain management by EMS providers. The majority of the findings confirm previous findings regarding disparities between different gender and racial/ethnic groups within the U.S. context, specifically noting the significant differences in opioid administration for Hispanic and AI/AN patients. This nuance of disparities beyond the White/non-White binary contributes to the complexity of how race/ethnicity and gender affect health outcomes. This study specifically examined the use of opioids in prehospital pain management, which is vital as the country continues to address the opioid epidemic and the acceptability of opioid use for acute pain management. EMS providers may be aware of the heightened concerns with using opioids as pain management tools and may be cautious to avoid contributing to the opioid crisis.

**Limitations**
This study used data reported by individuals, meaning the data likely suffered from human error and inconsistencies in provider-to-provider use and application of data codes. Additionally, EMS providers did not always report insurance status or the payment method (a proxy for socioeconomic status [SES]), thereby precluding the inclusion of SES as a control variable. Previous studies have identified a relationship between SES and the administration of opioids, using insurance status and payment method as a proxy measure.\textsuperscript{3,9} Most records in our sample were missing these data; 23,331 (85\%) records did not include insurance status, and 18,939 (69\%) did not include the payment method.

Finally, we were unable to explore the impact of other covariates that may influence the administration of opioids, including, for example, patient comorbidities, the race and ethnicity of the EMS provider, and the nature of prior interactions between the patient and the EMS provider.

**Conclusion**
EMS providers are more likely to treat White and male patients with opioids during pain and injury emergencies than to use these medications to treat Hispanic, AI/AN, and female patients. More research is needed to explore the cause of the disparities observed and to identify and implement strategies to improve current practice to ensure EMS providers provide the same level of care to all patients.

**Conflicts of Interest**
The authors declare they have no conflicts of interest.

**Author Affiliations**
1. Wyoming Survey & Analysis Center, University of Wyoming, Laramie, WY
2. Health Systems and Population Health Sciences, University of Houston, Houston, TX

**References**
1. Parker M, Rodgers A. Management of pain in pre-hospital settings. Emerg Nurse. 2015;23(3):16-23. doi:10.7748/en.23.3.16.e1445
2. Sullivan LW, Eagel BA. Leveling the playing field: recognizing and rectifying disparities in management of pain. Pain Med. 2005;6(1):5-10. doi:10.1111/j.1526-4637.2005.005016.x
3. 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. doi:10.1016/j.jpain.2009.10.002
4. Burgio KL, Williams BR, Dionne-Odom JN, et al. Racial differences in processes of care at end of life in VA medical centers: planned secondary analysis of data from the BEACON trial. J Palliat Med. 2016;19(2):157-163. doi:10.1089/jpm.2015.0311
5. Sinatra R. Causes and consequences of inadequate management of acute pain. Pain Med. 2010;11(12):1859-1871. doi:10.1111/j.1526-4637.2010.00983.x
6. Fingerhut LA, Warner M. The ICD-10 injury mortality diagnosis matrix [published correction appears in Inj Prev. 2006 Apr;12(2):135]. Inj Prev. 2006;12(1):24-29. doi:10.1136/ip.2005.009076
7. Kennel J. IHI ID 08 Emergency medical services treatment disparities by patient race. BMJ Open Qual. 2018;7(suppl 1). doi: 10.1136/ihisciabs.8
8. Lee HH, Lewis CW, McKinney CM. Disparities in emergency department pain treatment for toothache. JDR Clin Trans Res. 2016;1(3):226-233. doi:10.1177/2380084416655745
9. Shah AA, Zogg CK, Zafar SN, 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):1000-1009. doi:10.1097/MLR.0000000000000444
10. Hewes HA, Dai M, Mann NC, Baca T, Taillac P. Prehospital pain management: disparity by age and race. Prehosp Emerg Care. 2018;22(2):189-197. doi.org/10.1080/10903127.2017.1367444
11. Young MF, Hern G, Alter HJ, Barger J, Vahidnia F. Racial differences in receiving morphine among prehospital patients with blunt trauma. J Emerg Med. 2013;45(1):46-52. doi.org/10.1016/j.jemermed.2012.07.088
12. Lloyd EP, Paganini GA, ten Brinke L. Gender stereotypes explain disparities in pain care and inform equitable policies. Policy Insights Behav Brain Sci. 2020;7(2):198-204. doi:10.1177/2372732220942894
13. Michael GE, Sporer KA, Youngblood GM. Women are less likely than men to receive prehospital analgesia for isolated extremity injuries. Am J Emerg Med. 2007;25(8):901-906. doi:10.1016/j.ajem.2007.02.001
14. Green CR, Anderson KO, Baker TA, et al. The unequal burden of pain: confronting racial and ethnic disparities in pain [published correction appears in Pain Med. 2005 Jan-Feb;6(1):99. Kaloukalani, Donna A [corrected to Kalauokalani, Donna A]]. Pain Med. 2003;4(3):277-294. doi:10.1046/j.1526-4637.2003.03034.x
15. Walsh B, Cone DC, Meyer EM, Larkin GL. Paramedic attitudes regarding prehospital analgesia. Prehosp Emerg Care. 2013;17(1):78-87. doi:10.3109/10903127.2012.717167
16. Knight KR, Kushel M, Chang JS, et al. Opioid pharmacovigilance: A clinical-social history of the changes in opioid prescribing for patients with co-occurring chronic non-cancer pain and substance use. Soc Sci Med. 2017;186:87-95. doi.org/10.1016/j.socscimed.2017.05.043
17. Samuel CA, Corbie-Smith G, Cykert S. Racial/ethnic disparities in pain burden and pain management in the context of opioid overdose risk. Current Epidemiology Reports. 2019;6(2):275-289. doi.org/10.1007/s40471-019-00202-8