The Journal of Emergency Medicine, Vol. 50, No. 5, pp. 720–727, 2016
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0736-4679/$ - see front matter

http://dx.doi.org/10.1016/j.jemermed.2015.02.056

Original Contributions

RACIAL DIFFERENCES IN PEDIATRIC EMERGENCY DEPARTMENT TRIAGE SCORES

Heather G. Zook, MA,* Anupam B. Kharbanda, MD, MSC,† Andrew Flood, PHD,* Brian Harmon, BA,‡ Susan E. Puumala, PHD,§|| and Nathaniel R. Payne, MD*‡

*Department of Research and Sponsored Programs, Children's Hospitals and Clinics of Minnesota, Minneapolis, Minnesota, †Department of Emergency Medicine, Children's Hospitals and Clinics of Minnesota, Minneapolis, Minnesota, ‡Department of Quality and Safety, Children's Hospitals and Clinics of Minnesota, Minneapolis, Minnesota, §Center for Health Outcomes and Prevention Research, Sanford Research, Sioux Falls, South Dakota, and ||Department of Pediatrics, Sanford School of Medicine of the University of South Dakota, Sioux Falls, South Dakota

Reprint Address: Nathaniel R. Payne, MD, Children's Hospitals and Clinics of Minnesota, 2525 Chicago Avenue South, Minneapolis, MN 55404

☐ **Abstract—Background: Racial disparities are frequently reported in emergency department (ED) care. Objectives: To examine racial differences in triage scores of pediatric ED patients. We hypothesized that racial differences existed but could be explained after adjusting for sociodemographic and clinical factors. Methods: We examined all visits to two urban, pediatric EDs between August 2009 and March 2010. Demographic and clinical data were electronically extracted from the medical record. We used logistic regression to analyze racial differences in triage scores, controlling for possible covariates. Results: There were 54,505 ED visits during the study period, with 7216 (13.2%) resulting in hospital admission. White patients accounted for 36.4% of visits, African Americans 28.5%, Hispanics 18.0%, Asians 4.1%, and American Indians 1.8%. After adjusting for potential confounders, African American (adjusted odds ratio [aOR] 1.89, 95% confidence interval [CI] 1.69–2.12), Hispanic (aOR 1.77, 95% CI 1.55–2.02), and American Indian (aOR 2.57, 95% CI 1.80–3.66) patients received lower-acuity triage scores than Whites. In three out of four subgroup analyses based on presenting complaints (breathing difficulty, abdominal pain, fever), African Americans and Hispanics had higher odds of receiving low-acuity triage scores. No racial differences were detected for patients with presenting complaints of laceration/head injury/arm injury. However, among patients admitted to the hospital, African Americans (aOR 1.47, 95% CI 1.13–1.90) and Hispanics (aOR 1.71, CI 1.22–2.39) received lower-acuity triage scores than Whites. Conclusion: After adjusting for available sociodemographic and clinical covariates, African American, Hispanic, and American Indian patients received lower-acuity triage scores than Whites.** © 2016 Elsevier Inc.

☐ **Keywords—triage; health disparities; race; pediatrics**

INTRODUCTION

Racial disparities have been frequently reported in emergency department (ED) care (1–14). African Americans and Hispanics have been reported to experience 12–25% longer ED wait times to see a physician compared to Whites, to be about 40% less likely to receive opioid analgesia prescriptions at discharge from the ED after long bone fracture, to have 34% lower odds of receiving an opioid prescription during pain-related visits, and to have 24% lower odds of radiological testing during their ED visit (3–5,9,10). Additionally, the odds of pediatric African American patients leaving the ED prior to complete evaluation and treatment may be as much as 60% higher than the odds for White patients (6). These findings suggest a wide range of racial disparities in ED care.

RECEIVED: 1 October 2014; FINAL SUBMISSION RECEIVED: 19 January 2015;
ACCEPTED: 27 February 2015

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The size of disparity depends on the accuracy of risk adjustment. If the risk adjusters, such as triage score, are differentially assigned by race, disparities in ED care might be larger than previously estimated. The ED triage score is often used to adjust analyses of disparities (1–3,5,6,8,11). Although triage scores should estimate illness severity and anticipated resource utilization, and are assumed to be assigned without systematic bias, they do contain a measure of subjectivity. Previous studies have reported an association between minority race and lower-acuity ED triage scores for adults and in a single study of pediatric patients (12–14). However, studies of triage scores have often utilized national databases, which do not permit adjustment for sociodemographic determinants that influence ED utilization, such as income level and distance from the patient's residence to the ED (15).

Differences in triage scores might reflect patients' varying racial and cultural attitudes toward ED utilization and not represent a true disparity in care. This could give the appearance of bias, but actually reflect ED visits by minority populations secondary to poor access to primary care (16–18).

We wanted to determine if sociodemographic or clinical factors could explain racial differences in triage scores among pediatric ED patients. We hypothesized that racial differences in triage scores existed but could be accounted for by sociodemographic, clinical, or ED utilization factors. Our null hypothesis was that racial differences in triage scores did not exist.

MATERIALS AND METHODS

Study Design and Sample

To study the relationship of race and triage scores in the ED, we used a cross-sectional design encompassing all visits to either of two pediatric EDs from August 1, 2009 to March 31, 2010. The August 1, 2009 start date was chosen because a new five-level triage system, the Emergency Severity Index, version 4 (ESI), was introduced on July 1, 2009 (19–23). Both EDs serve primarily an urban, multicultural population. We excluded visits of patients who eloped, died, or had missing data (Figure 1). Due to the potential influence of factors such as lack of primary care access, poverty, and proximity to the hospital on ED utilization, we included a variable to represent distance from the patient's residence to the ED (15,24–26). Our clinical experience has been that patients who live close to the ED are more likely to visit the ED than a primary care provider for a variety of clinical complaints (25). We utilized inpatient admission as an independent marker for illness severity.

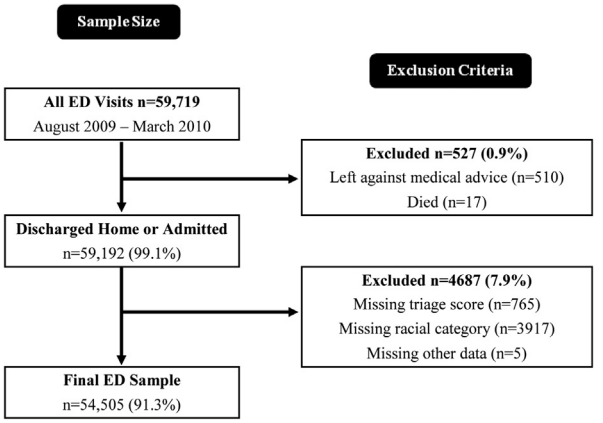

Figure 1. Flow diagram of study sample. Percentages are out of the original sample of 59,719 emergency department (ED) visits.

Subgroups were also analyzed based on the patient's presenting complaint. Subgroups included visits with presenting complaints of: 1) "breathing difficulty," "wheezing," "asthma," or "cough" (n = 8594, 15.8% of visits); 2) "abdominal pain" or "stomach pain" (n = 1868, 3.4% of visits); 3) "fever" (n = 9516, 17.5% of visits); and 4) "laceration," "head injury" (with or without loss of consciousness), or "arm injury" (n = 4170, 7.7% of visits). In addition, we separately analyzed a subgroup of patients who were later admitted to the hospital (n = 7216, 13.2% of visits). This study was approved by the hospitals' Institutional Review Board (#1003-026).

Outcome Measurements and Independent Variables

The primary outcome measure was triage level. Triage was performed by an ED nurse who documented the patient's chief complaint, obtained a short history, recorded vital signs, and performed a brief examination, as needed. The nurse then assigned a triage score ranging from level 1 (most acute) to level 5 (least acute) using the ESI system (19). We dichotomized the ESI levels into levels 1–3 vs. levels 4–5 for analysis.

All demographic, insurance, and clinical data were extracted from the electronic medical record. At registration, caregivers were asked to report their child's race, primary language, age, sex, and address. Registrars also recorded their mode of transportation to the ED, which we categorized as "private" (private vehicle, public transport, walked, or other) or "urgent" (ambulance, helicopter, plane, or police). Distance between the patient's residence and the ED was determined using ArcGIS software (Environmental Systems Research Institute, Inc., Redlands, CA) and calculated from the center of the patient's ZIP code to the ED at which

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the patient sought care. Patients were assigned the median income for the ZIP code in which they resided using Truven Health Analytics (Ann Arbor, MI) data. Median incomes were grouped into quartiles based on the median incomes of all ZIP codes in which ED patients from the seven-county Twin Cities metro area resided. Data on patients living farther from the EDs than the seven-county metro area were not included in this analysis, because those patients would likely have been referred. Insurance type was dichotomized as Medical Assistance/Self-Pay/Public insurance or Private/Other insurance.

We utilized an ED activity/overcrowding score to estimate ED busyness at the time of patient registration and to account for any impact this may have on triage scores (6). We have locally validated this score as predicting wait time to see a physician and elopement (6). The influence of ED activity/overcrowding was not linear, so we grouped scores into quartiles, with the lowest quartile (least busy ED) used as the reference (6). To address the influence of frequent ED use on triage scores, we calculated the total number of ED visits for each patient during the study period.

Statistical Analysis

We used chi-squared tests to examine univariate associations. Potential covariates were selected based on a hypothesized association with triage score and a significant association with triage score in univariate analyses ($p < 0.001$). We developed a pair-wise correlation matrix to identify variables that were correlated. Covariates with a correlation coefficient ≥ 0.7 were not included in the same model. We considered a variance inflation factor (VIF) > 2.5 as excessive (27). The overall mean VIF was ≤1.40, and the highest VIF for a specific variable was ≤2.23. Median income and public insurance logically measured the same characteristic, so we chose not to include both variables in the final model. We kept public insurance in the model because we felt it was more informative than ZIP code median income. Statistical analyses were performed using Stata version 13.1 (StataCorp, College Station, TX). The final model utilized logistic regression (routine "logit") and adjusted for race, insurance type, distance from patient residence to the ED, primary language, age, sex, ED activity/overcrowding, ED campus, previous ED visits, inpatient admission, and mode of transportation to the ED. We also adjusted the model for clustering of visits within each patient. Furthermore, we examined potential interactions of race with insurance type, primary language, and distance from the ED, and incorporated them into the final model if they were significant. We considered a p-value < 0.05 as significant.

RESULTS

Demographics

This study included 54,505 ED visits and 38,549 patients (Figure 1). Our study sample was racially diverse, with Whites constituting only 36.4% (19,845/54,505) of visits and 41.7% of patients (16,075/38,549). Demographic characteristics are shown in Table 1.

Univariate Analysis

Among all visits, African American, Hispanic, and American Indian racial categories were associated with lower-acuity triage scores than Whites (Table 1). Speaking Spanish or Somali was associated with lower-acuity scores than speaking English or Hmong. Patients ranging from 1–9 years old had a larger proportion of low-acuity scores than other age groups. As distance from the patient's residence to the ED increased, the proportion of low-acuity triage scores decreased and the proportion of White patients increased, reflecting the local demographics. We expected that increasing ED activity might be associated with lower-acuity triage scores, but the opposite was observed. Increasing ED activity/overcrowding scores were associated with higher-acuity triage scores (Table 1).

Logistic Regression Analysis of Race and Triage Level

Adjustment for potential confounders using logistic regression had little influence on the odds ratios of low-acuity triage scores (ESI levels 4–5) for African American (adjusted odds ratio [aOR] 1.89, 95% confidence interval [CI] 1.69–2.12), Hispanic (aOR 1.77, 95% CI 1.55–2.02), and American Indian (aOR 2.57, CI 1.80–3.66) patients compared to Whites. We identified significant interactions between race and insurance type, and race and distance from the ED. Triage score differences persisted between Whites and African Americans, Hispanics, and American Indians for patients with both public and private insurance; however, the differences were greater among those with private insurance (Table 2). Although racial differences were present for both distance categories, the odds of low-acuity triage scores compared to Whites were greater among African American (aOR 2.06, 95% CI 1.88–2.25) and Hispanic (aOR 2.08, 95% CI 1.85–2.34) patients living farther (>5 miles) from the ED (Table 2). On the other hand, American Indians (aOR 2.26, 95% CI 1.82–2.80) had greater odds of low-acuity triage scores than Whites among patients living closer (≤5 miles) to the ED (Table 2). Asian patients had significantly lower odds of low-acuity triage scores than Whites among patients on

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Table 1. Patient Demographics by Triage Level*

Patient Characteristics	Level 5 n = 10,894 (20.0%)	Level 4 n = 21,103 (38.7%)	Level 3 n = 15,895 (29.2%)	Levels 1–2 n = 6613 (12.1%)	Total Sample n = 54,505 (100%)
Race					
White	1650 (8.3)†	7077 (35.7)	7437 (37.5)	3681 (18.6)	19,845 (36.4)
African American	4336 (27.9)	6174 (39.7)	3720 (23.9)	1324 (8.5)	15,554 (28.5)
Hispanic	2863 (29.2)	4169 (42.6)	2195 (22.4)	568 (5.8)	9795 (18.0)
American Indian	259 (26.5)	373 (38.1)	254 (26.0)	92 (9.4)	978 (1.8)
Asian	271 (12.2)	834 (37.4)	727 (32.6)	398 (17.9)	2230 (4.1)
Other	1515 (24.8)	2476 (40.6)	1562 (25.6)	550 (9.0)	6103 (11.2)
Primary language					
English	6984 (17.3)	15,196 (37.6)	12,498 (31.0)	5697 (14.1)	40,375 (74.1)
Spanish	2265 (29.9)	3225 (42.5)	1699 (22.4)	394 (5.2)	7583 (13.9)
Somali	1304 (29.0)	1863 (41.4)	1101 (24.5)	231 (5.1)	4499 (8.3)
Hmong	86 (11.3)	282 (37.2)	248 (32.7)	143 (18.8)	759 (1.4)
Other	255 (19.8)	537 (41.7)	349 (27.1)	148 (11.5)	1289 (2.4)
Age					
<1 year	1745 (16.4)	3727 (35.1)	3541 (33.3)	1608 (15.1)	10,621 (19.5)
1–4 years	4976 (22.1)	9248 (41.1)	6154 (27.3)	2137 (9.5)	22,515 (41.3)
5–9 years	2737 (24.1)	4573 (40.3)	2860 (25.2)	1179 (10.4)	11,349 (20.8)
10–14 years	990 (15.7)	2328 (36.8)	2019 (31.9)	990 (15.7)	6327 (11.6)
15–17 years	369 (11.7)	1073 (34.1)	1129 (35.9)	575 (18.3)	3146 (5.8)
≥18 years	77 (14.1)	154 (28.2)	192 (35.1)	124 (22.7)	547 (1.0)
Sex					
Female	5369 (21.4)	9882 (39.3)	7180 (28.6)	2696 (10.7)	25,127 (46.1)
Male	5525 (18.8)	11,220 (38.2)	8715 (29.7)	3917 (13.3)	29,377 (53.9)
Insurance type					
Private	2703 (11.4)	8894 (37.4)	8285 (34.9)	3874 (16.3)	23,756 (43.6)
Public	8191 (26.6)	12,209 (39.7)	7610 (24.8)	2739 (8.9)	30,749 (56.4)
Distance from ED					
≤5 miles	7768 (26.2)	12,493 (42.1)	7034 (23.7)	2401 (8.1)	29,696 (54.5)
>5 miles	3126 (12.6)	8610 (34.7)	8861 (35.7)	4212 (17.0)	24,809 (45.5)
ED activity/overcrowding					
Lowest quartile	2774 (24.0)	4686 (40.5)	3048 (26.3)	1071 (9.3)	11,579 (21.2)
2nd quartile	2560 (21.4)	4664 (39.1)	3399 (28.5)	1315 (11.0)	11,938 (21.9)
3rd quartile	2656 (18.6)	5583 (39.1)	4237 (29.7)	1788 (12.5)	14,264 (26.2)
Highest quartile	2904 (17.4)	6170 (36.9)	5211 (31.2)	2439 (14.6)	16,724 (30.7)
ED campus					
Facility A	6195 (22.4)	11,695 (42.2)	6651 (24.0)	3151 (11.4)	27,692 (50.8)
Facility B	4699 (17.5)	9408 (35.1)	9244 (34.5)	3462 (12.9)	26,813 (49.2)
Previous ED visits					
<2 visits	7530 (18.3)	16,005 (38.9)	12,376 (30.1)	5234 (12.7)	41,145 (75.5)
2–4 visits	2785 (25.9)	4135 (38.5)	2770 (25.8)	1057 (9.8)	10,747 (19.7)
>4 visits	579 (22.2)	963 (36.9)	749 (28.7)	322 (12.3)	2613 (4.8)
Inpatient admission					
No	10,839 (22.9)	20,481 (43.3)	12,689 (26.8)	3280 (6.9)	47,289 (86.8)
Yes	55 (0.8)	622 (8.6)	3206 (44.4)	3333 (46.2)	7216 (13.2)
ED transportation					
Private	10,550 (20.8)	20,189 (39.8)	14,517 (28.7)	5418 (10.7)	50,674 (94.1)
Urgent	151 (4.8)	618 (19.6)	1247 (39.5)	1140 (36.1)	3156 (5.9)

* All univariate analyses showed significant differences ($p < 0.001$) using chi-squared tests.
† Represents total number of emergency department (ED) visits in the sample (n [%]) for the row characteristic within the column triage level.

public insurance and among those living ≤5 miles from the ED (Table 2).

Subgroup Analyses

We were unable to directly control for illness severity, so we examined four sub-populations of patients with similar presenting complaints (see Methods) to attempt to control for this variable. At visits with presenting complaints of "breathing difficulty," "abdominal pain," or "fever," triage score acuity was significantly lower in African American and Hispanic patients compared to Whites (Table 3). Among visits with presenting complaints of "laceration," "head injury" (with or without loss of consciousness), or "arm injury," there were no racial differences in triage scores (Table 3). There were too few American Indian patients to accurately study within each subgroup.

We then analyzed only patients who were admitted as inpatients. Among these patients, African Americans

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Table 2. Logistic Regression Analysis

Patient Characteristics	aOR* (95% CI)	*p*-Value
Age		
<1 year	Referent	
1–4 years	1.40 (1.32–1.48)	<0.001
5–9 years	1.61 (1.51–1.72)	<0.001
10–14 years	1.04 (0.96–1.12)	0.342
15–17 years	0.80 (0.73–0.88)	<0.001
≥18 years	0.76 (0.62–0.94)	0.010
Sex		
Female	Referent	
Male	0.85 (0.82–0.89)	<0.001
Primary language		
English	Referent	
Other	1.22 (1.14–1.30)	<0.001
ED activity/overcrowding		
Lowest quartile	Referent	
2nd quartile	0.84 (0.79–0.89)	<0.001
3rd quartile	0.79 (0.74–0.83)	<0.001
Highest quartile	0.73 (0.69–0.77)	<0.001
ED campus		
Facility A	Referent	
Facility B	0.51 (0.48–0.53)	<0.001
Previous ED visits		
<2 visits	Referent	
2–4 visits	0.94 (0.89–0.99)	0.028
>4 visits	0.74 (0.67–0.83)	<0.001
ED transportation		
Private	Referent	
Urgent	0.37 (0.34–0.41)	<0.001
Inpatient admission		
No	Referent	
Yes	0.07 (0.07–0.08)	<0.001

Interactions With Insurance Type and Distance From ED				
	aOR (95% CI)	*p*	aOR (95% CI)	*p*
Race	Public Insurance		Private Insurance	
White	Referent		Referent	
African American	1.78 (1.63–1.95)	<0.001	2.04 (1.85–2.24)	<0.001
Hispanic	1.78 (1.60–1.99)	<0.001	1.97 (1.75–2.22)	<0.001
American Indian	1.71 (1.37–2.19)	<0.001	2.21 (1.55–3.13)	<0.001
Asian	0.69 (0.59–0.82)	<0.001	1.07 (0.92–1.23)	0.378
Race	Distance ≤ 5 Miles		Distance > 5 Miles	
White	Referent		Referent	
African American	1.77 (1.62–1.92)	<0.001	2.06 (1.88–2.25)	<0.001
Hispanic	1.68 (1.52–1.87)	<0.001	2.08 (1.85–2.34)	<0.001
American Indian	2.26 (1.82–2.80)	<0.001	1.67 (1.18–2.35)	0.003
Asian	0.73 (0.63–0.85)	<0.001	1.01 (0.86–1.18)	0.916

aOR = adjusted odds ratio; CI = confidence interval; ED = emergency department.
* Adjusted odds ratio of receiving triage scores of 4–5 vs. 1–3 compared to the referent, with adjustment for confounders: race, age, sex, primary language, ED activity/overcrowding, ED campus, previous ED visits, mode of transportation, and inpatient admission. Includes interactions of race*insurance and race*distance.

(aOR 1.47, 95% CI 1.13–1.90) and Hispanics (aOR 1.71, 95% CI 1.22–2.39) had significantly higher odds of low-acuity triage scores than Whites (Table 3).

DISCUSSION

This study found racial differences in pediatric ED triage scores for African American, Hispanic, and American Indian patients compared to White patients. Adjustment for insurance type, distance from the ED, primary language, age, sex, ED activity/overcrowding, previous ED visits, inpatient admission, and other clinical factors did not eliminate these differences. Subgroup analyses confirmed the results of our primary analysis in four of the five subgroups examined, including the subgroup of patients who were admitted as inpatients.

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Table 3. Presenting Complaint and Inpatient Admission Subgroup Analyses

Subgroup	African American		Hispanic	
	aOR* (95% CI)	*p*-Value	aOR* (95% CI)	*p*-Value
Breathing difficulty†	1.76 (1.43–2.16)	<0.001	2.02 (1.53–2.66)	<0.001
Abdominal pain†	2.81 (2.03–3.89)	<0.001	1.93 (1.29–2.89)	0.002
Fever†	1.93 (1.67–2.24)	<0.001	1.90 (1.59–2.26)	<0.001
Laceration/head injury/arm injury†	1.08 (0.84–1.39)	0.536	0.95 (0.68–1.33)	0.773
Inpatient admission‡	1.47 (1.13–1.90)	0.003	1.71 (1.22–2.39)	0.002

aOR = adjusted odds ratio; CI = confidence interval; ED = emergency department.
* Adjusted odds ratio of receiving triage scores of 4–5 vs. 1–3 compared to the referent (White patients). The following potential confounders were included in the logistic regression model: race, insurance type (public vs. private), distance from patient residence to the ED, primary language (English vs. Other), age, sex, ED activity/overcrowding, ED campus, previous ED visits, mode of transportation, and inpatient admission (for all except inpatient admission subgroup). Interactions of race with insurance type, primary language, and distance from the ED were explored for the model of each subgroup and included if significant.
† This subgroup includes only patients who presented with the chief complaint as noted above in the left-most column, regardless of their final diagnosis. See Methods for more detail.
‡ This subgroup includes only patients who were admitted to the hospital, regardless of their presenting complaint or final diagnosis. We used this subgroup to explore triage assignment in a group of patients who would be sufficiently ill to warrant inpatient care.

These findings are similar to those reported in a previous pediatric study and in several adult studies of racial differences in triage scores (12–15). We were able to analyze interactions between race, insurance type, and distance from the ED that, to our knowledge, have not been reported in previous triage studies. These interactions were significant, but did not eliminate the differences in triage scores between Whites and African Americans, Hispanics, and American Indians (Tables 2 and 3).

The triage score may affect wait time to see an emergency physician, which can increase the risk of elopement and is associated with other ED outcome measures (1,3,5,6,9,11,12). Studies of racial differences in treatment or outcome measures often use triage scores to adjust for level of acuity, so any potential bias in the triage score may result in underestimated racial disparities in the pediatric ED (1–3,5,6,8,11).

Strengths

Our study was able to examine several factors that have not always been available in previous studies. Distance between patient residence and the ED, number of previous ED visits, and ED activity/overcrowding all were available to us and were associated with triage score. Controlling for these factors narrowed the differences between African American, Hispanic, and White patients' triage scores and often eliminated the differences between Asians and Whites.

Our study sample was relatively large, with a diverse racial distribution of patients, which allowed us to analyze differences among subgroups categorized by presenting complaints. We identified that African American and Hispanic patients have over 50% higher odds of low-acuity triage scores compared to Whites.

Limitations

There are several limitations to this study. Our data come from only two EDs in one metropolitan area. The sample was racially diverse, but it may not represent the racial distributions seen in other EDs nationally. There were so few American Indian patients that we could not obtain reliable estimates of triage score associations for all subgroups. We were limited in available potential covariates to those that were present and could be electronically extracted from the medical record. We did not have access to data on vital signs or past medical history, nor could we determine whether the patient was referred by a primary care practitioner, all of which may appropriately influence the triage score assignment (28).

Importantly, we were not able to directly account for the patient's illness severity. The very nature of the triage process requires subjective, contextual assessment and clinical instinct that may identify patient differences not captured in our data set or even in the medical record. Therefore, racial differences in triage scores may reflect accurate "real-time" assessment that appears biased in retrospect.

CONCLUSION

In summary, we have shown racial differences in triage score assignments that could not be explained by available sociodemographic, clinical, or ED utilization factors. Whatever their origin, these differences certainly warrant further investigation.

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Acknowledgments—The authors thank Jeffrey Barney for providing demographic and geographic information and Jill Dreyfus for assistance with statistical analysis. Research reported in this publication was supported by the National Institute on Minority Health and Health Disparities of the National Institutes of Health under Award Number U54MD008164. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

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ARTICLE SUMMARY

1. Why is this topic important?

A variety of emergency department (ED) patient care factors are influenced by the triage score, including wait time, ordering laboratory or radiology tests, and receiving pain medication. Triage scores should estimate illness severity and are assumed to be assigned without systematic bias, so any differences in triage scores while controlling for sociodemographic and clinical variables may indicate a lack of appropriate ED care.

2. What does this study attempt to show?

This study attempts to demonstrate that racial differences in pediatric ED triage scores exist and cannot be explained by available sociodemographic or clinical factors.

3. What are the key findings?

African American, Hispanic, and American Indian pediatric ED patients received lower-acuity triage scores than White patients. African Americans and Hispanics also had lower-acuity triage scores than Whites in subgroups of patients with the same presenting complaints, for all except laceration/head injury/arm injury. Racial differences in triage scores persisted for minority groups among patients who were later admitted to the hospital.

4. How is patient care impacted?

These findings will help to improve the care for all children by identifying gaps in knowledge and areas of concern in our treatment of evaluation of children in the ED setting.

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