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RACIAL DISPARITY IN EMERGENCY DEPARTMENT TRIAGE

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☐ **Abstract—Background: Previous reports of lower triage acuity scores and longer Emergency Department (ED) wait times for African Americans compared to Caucasians had insufficient information to determine if this was due to bias or appropriately based on medical history and clinical presentation. Objective: (1) Determine if African Americans are assigned lower triage acuity scores (TAS) after adjusting for a number of demographic and clinical variables likely to affect triage scores. (2) Determine if lower TAS translate into clinically significant longer wait times to assignment to a treatment area. Methods: This was a retrospective matched cohort design analysis of de-identified data extracted from the ED electronic medical record system, which included demographic and clinical information, as well as TAS, and ED process times. Triage scores were assigned using a 5-point scale (ESI), with 1 being most urgent and 5 being least urgent. Mean TAS and wait times to a treatment area for specific chief complaints were compared by race; after adjusting for age, gender, insurance status, time of day, day of week, presence of co-morbidities, and abnormal vital signs using a 1:1 matched case analysis. Results: The overall mean TAS for African Americans was 2.97 vs. 2.81 for Caucasians (difference of 0.18; *p* < 0.001), translating to a lower acuity rating. African Americans had a significantly longer wait time to a treatment area compared to case-matched Caucasians (10.9 min; *p* < 0.001), with much larger differences in wait times noted within certain specific chief complaint categories. Conclusion: Our current study supports the hypothesis that racial bias may influence the triage process.**

☐ **Keywords—racial disparity; ED triage**

INTRODUCTION

Background

As emergency department (ED) resources continue to be stressed, triage becomes the most important factor in determining how quickly patients are seen by an emergency provider (1–6). Recently, several highly publicized articles have featured poor outcomes in patients who have deteriorated while waiting to be seen in EDs across the United States (7–9). There has been increased scrutiny of the triage process as demand for limited resources increases and as disparity in medical care has become better recognized (10–14). A number of triage systems have been developed for the purpose of more accurately recognizing the need for timely intervention and quantifying potential resource utilization (15–19). These formal triage systems attempt to use objective data to assess patient acuity.

The overall effectiveness of any triage system to accurately assign acuity scores is dependent on triage personnel using the system as it is designed. All triage systems with which we are familiar allow for significant subjectivity in triage assessment. For example, the 5-point scoring system that we currently use allows upgrading of scores (based on "high-risk situation" or "severe pain") in order to slot "sicker" patients ahead of others for a limited number of treatment areas. This seems reasonable and even necessary, but may allow unrecognized influences and bias into the triage decision-making process.

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We and others have previously reported that racial bias may exist in triage scoring; with lower acuity scores and longer wait times for African-Americans than for Caucasians, when adjusting for a number of clinical and demographic factors (20,21). However, we are unaware of any published studies on potential racial bias in triage that have adjusted for the clinical variables of triage vital signs and medical co-morbidities, both of which may serve as important predictor variables in determining triage acuity.

Study Objectives

We sought to determine if racial disparities exist in the triage process at a high-volume (87,000+), American College of Surgeons–verified Level 1, urban emergency department. More specifically, we explored whether the assigned triage acuity score (TAS) might be influenced by race, after adjusting for age, gender, chief complaint, insurance status, day and time of presentation, presence of co-morbidities or abnormal vital signs, and disposition. In order to determine if any existing disparity in the TAS was clinically relevant, "wait time" (defined as time from triage assessment to ED treatment area assignment) was evaluated as a secondary outcome.

MATERIALS AND METHODS

Study Design and Setting

The study was a matched cohort design analysis of patients presenting to the ED of a large, urban-based academic teaching hospital between September 2007 through August 2008. The ED has an annual census of 87,000+ visits, serves a patient population from all socioeconomic backgrounds, and serves as the primary teaching facility for an emergency medicine residency program.

Since the primary outcome variable is the TAS as assigned by a triage nurse, it is important to briefly describe our triage structure and process. During the study period, triage was performed by trained registered nurses using the Emergency Severity Index (ESI©), a five-tiered triage acuity system that has been shown to accurately predict the need for resource utilization (19,22). The number of triage nurses in the department at any time ranged from two (12 AM–7AM) to five (12 PM–12 AM); covering 24 h a day, 7 days a week, equating to about 20 FTEs. However, we use a rotation system for assigning the triage role, so there were dozens of nurses that performed this role during the study period, some more often than others. We did not collect identifying information on the triage nurses; however, the gender and racial mix of our nurses is 85% female and 90% Caucasian. Patient demographic data was collected at the time of service by registration staff and confirmed when identification or insurance cards were scanned and available in our electronic medical record. Due to the retrospective nature of the study, no one performing triage during the study period was aware of the project.

Participants

A list of inclusion criteria and a number of specific demographic and clinical variables likely to affect TAS were identified a priori. To obtain homogeneity amongst our sample population, we chose to only include patients seen in our ED during the review period with one of the following eight common chief complaints: chest pain, abdominal pain, weak and dizzy, syncope, shortness of breath, altered mental status, back pain, and headache. Patients with an ESI score of I (active resuscitation) were excluded since these patients bypass triage and go directly to a treatment area. We also excluded any patients with a wait time of "0" min. Patients whose race was not listed or was listed as "other" and any patients with missing demographic or clinical data (as listed in "Methods of Measurement" section) were also excluded from analysis. Demographic and clinical variables in our model included age, gender, chief complaint, insurance status, time of day, day of week, presence of co-morbidities, abnormal vital signs, and disposition.

Methods of Measurement

Age was incorporated as a continuous independent variable, gender was dichotomized as male or female, and race was categorized as Caucasian, African American, and "Other." African-American and Caucasian cohorts were matched 1:1 for each of the eight chief complaints noted above. Insurance status was defined as "insured" or "self-pay," as our previous research has shown no significant differences in triage scores or wait times between various types of insurance (20). Cohorts were matched exactly for the day of the week, and they were matched within 4-h time blocks (beginning at 6 AM) for time of day, to adjust for personnel issues, staffing, and ED volume. Co-morbidity and vital-sign data were obtained from the electronic medical record and handled as described under data collection. Although ultimately unknown to triage staff, we included patient disposition to serve as a surrogate marker of severity of illness. We limited disposition categories to "discharged," "expired/ICU admission," or "admitted/not ICU." Since elopements, leaving against medical advice, and transferring out of the department were felt to be poor discriminators of severity of illness, patients with these dispositions were excluded. The outcome variable of wait time was defined as the time (in minutes) from triage assessment to ED treatment area assignment.

Table 1. Vital Sign Threshold Values Used to Calculate the Modified Early Warning Score

Score	3	2	1	0	1	2	3
Respiratory rate (min^{-1})		≤8		9–14	15–20	21–29	>29
Heart rate (min^{-1})		≤40	41–50	51–100	101–110	111–129	>129
Systolic BP (mm Hg)	≤70	71–80	81–100	101–199		≥200	
Temperature (°C)		≤35	35.1–36	36.1–38	38.1–38.5	≥38.6	

BP = blood pressure.

Data Collection and Processing

Prior to onset of data collection, Internal Review Board approval was obtained. De-identified data were electronically extracted from the ED electronic medical record (EMR) system (HMED; Allscripts, Chicago, IL) for all patient charts during the study period. Age, race, gender, chief complaint, insurance status, date and time of service, TAS, ED process times (time to triage, time to a treatment room, time to discharge), and disposition (admission, discharge) were automatically captured by the EMR system. Abnormal vital-sign data was captured using an algorithm to identify predetermined thresholds for each vital sign. These predetermined thresholds were based on the values reported and used in the Modified Early Warning System (MEWS; Table 1) (23). Co-morbidities were identified using a keyword search algorithm and scanning the EMR triage note (which includes a history of the present illness, and a past medical history). The keyword search included the terms “diabetes,” “hypertension,” “high blood pressure,” “heart disease,” “myocardial infarction,” “coronary artery disease,” “congestive heart failure,” “CHF,” “cardiomyopathy,” “COPD,” “emphysema,” “asthma,” “chronic lung disease,” “stroke,” “CVA,” and “cancer.” If no co-morbidity was documented at the triage level, even if it was noted in the physician note, it was considered not to have been a part of the triage decision-making process, and the patient would be categorized as having no co-morbidities. We matched subjects for the presence of co-morbidities by placing them into one of three groups: 0, 1, or more than 1 co-morbidity. We chose this method of accounting for co-morbidity rather than using a composite like the Charlson’s co-morbidity index score because we believe it more closely reflects the way our triage nurses use this information in triage decision making.

Initial (triage) vital signs were collected and classified using the total MEWS score, which has been shown to reliably predict need for intensive medical services (23–25). MEWS does include a measure of level of consciousness in its score, but we assumed that all patients presenting to a triage nurse were “alert” since patients at our institution with a significantly altered level of consciousness would bypass triage and present directly to an examination room.

Triage acuity was assigned using the ESI version 4, a five-level triage instrument that ranges from Level 1 (most urgent) through Level 5 (least urgent). The ESI is widely used and has been studied extensively for reliability and validity (16–19). Although previous studies have focused on the reliability of version 3, our institution had already implemented version 4 at the time of the data collection. The key difference between ESI version 3 and ESI version 4 is the expansion of ESI Level 1 criteria and refinement of the pediatric fever criteria (26). Neither of these changes pertains to the population studied. ESI uses an algorithm to assign TAS based on chief complaint, as well as demographic and clinical variables such as age, co-morbidities, and unstable vital signs; however, it gives triage personnel latitude to move a score up or down based on clinical judgment (26).

Primary Data Analysis

Prior to analysis, we chose our inclusion criteria, which consisted of eight chief complaints common in adult emergency departments, and which have reasonable likelihood to be associated with a serious condition. We also selected several demographic and clinical variables that were thought to potentially affect TAS. We then analyzed mean ESI using a 1:1 matched-paired analysis in order to adjust for these other variables. To do so, we used the gmatch function—a computerized matching of cases to controls using the greedy matching algorithm developed by Erik Bergstralh & Jon Kosanke (2003) at the Mayo Clinic (27). The cases were matched exactly with respect to chief complaint, abnormal vital signs (as defined in Table 1), number of co-morbidities, gender, disposition, insurance status, and day of the week. Cases were matched within 10 years of age, and within 4 h of time of ED visit. Vital signs were assigned an overall composite MEWS score of Low (MEWS = 0–3) or High (MEWS > 3) (Table 1). Co-morbidity data was stratified into the presence of 0, 1, or more than 1 co-morbidity. Due to the smaller total number of Caucasians, we defined Caucasians as the “cases” with African-Americans as the “matched controls.”

Following the matched-pairs *t* test, the data was inputted into the Wilcoxon signed-rank test. After comparing mean TAS, we then compared mean wait times for the matched pairs. However, we also compared mean wait times between the matched cohorts at each composite MEWS score (0–6) to ascertain if there were significant wait-time differences between African Americans and Caucasians with identical MEWS scores (rather than just with "high" or "low" scores), and if the differences varied with MEWS score. We intentionally excluded triage scores as a predictor variable for wait time, as our hypothesis was that they would directly correlate and affect wait times. Finally, we looked at differences in triage scores and mean wait times for each distinct chief complaint. The statistical software used was SAS /STAT software, version 9.1.3 of the SAS System for Windows; SAS Institute Inc., Cary, NC, USA.

RESULTS

From our initial sample of 87,685 patient-visits, we excluded those that did not have one of the eight predefined chief complaints, were missing data, had a race of "other," or a wait time of 0 min, leaving 19,726 visits for analysis (Figure 1).

Our starting sample for the matched-pairs analysis included 6,456 Caucasians and 13,270 African Americans.

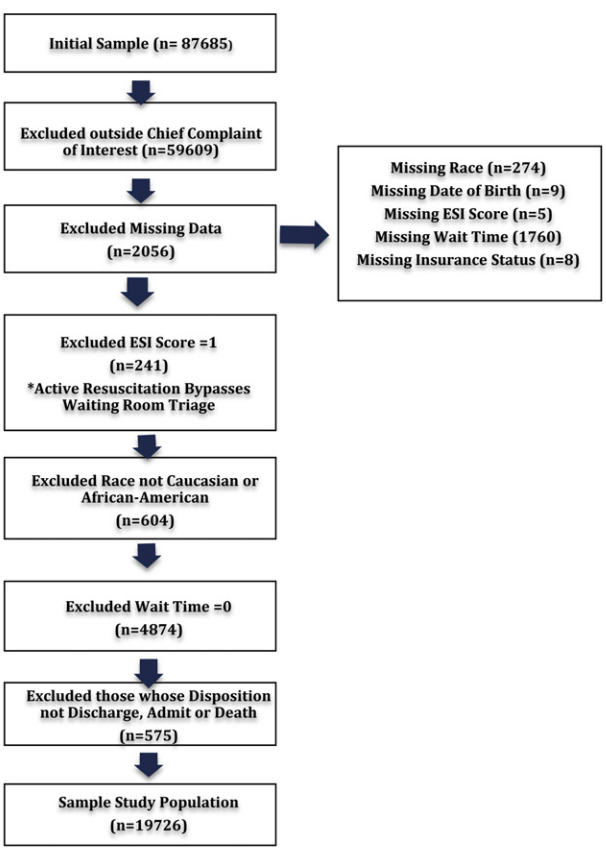

Figure 1. Flow diagram demonstrating how the initial sample of subjects was pared down to the final study population.

Table 2. A 4×4 Table Comparing the Distribution of Triage Acuity Scores between African-Americans and Case-Matched Caucasians

Comparison of Assigned Triage Scoress					
	Triage Acuity African-American				
Triage Acuity Caucasian	2	3	4	5	Total
2	269	615	81	7	972
3	316	1551	595	26	2488
4	13	222	449	22	706
5	0	15	22	7	44
Total	598	2403	1147	62	4210

Note there are not triage acuities of "1" because this was an exclusion.

Of the 6,456 Caucasians, a well-matched African American could be found for only 4,210. Based on these 4,210 matched visits, the overall mean TAS for African Americans was 2.97 vs. 2.81 for whites (difference of 0.18; $p < 0.001$). African Americans were twice as likely to be triaged to a lower acuity (n = 1,346) than to a higher acuity (n = 588) vs. matched-paired Caucasians. For the remainder of visits (n = 2,276), matched African Americans and Caucasians were assigned identical triage scores.

There was a significant occurrence of African Americans being triaged at 2–3 levels below a similar matched-paired Caucasian (Table 2). For example, there were 81 episodes in which a Caucasian presented and was triaged to a "high-risk" acuity (acuity = 2) for which the corresponding matched African American was assigned an acuity level of 4, whereas the opposite occurrence (a 2-point lower score for Caucasians versus matched African Americans) was seen only 13 times.

Significant differences in triage scores were noted in all chief complaints except syncope ($p = 0.08$) and altered mental status ($p = 0.62$). This is illustrated in Table 3. Overall, African Americans had a longer mean wait time of 10.9 min ($p < 0.001$) compared to matched Caucasians. Significant differences in wait times were noted in the chief complaint categories of chest pain, weak and dizzy, shortness of breath, and headache (Table 4). Wait times were longer for African Americans than for whites regardless of the number of co-morbidities, being highest (17 min) for 1 co-morbidity, and lowest (6 min) for 0 co-morbidities (Table 5). Higher MEWS scores were significantly associated with shorter wait times regardless of race. Mean MEWS scores were 1.39 for Caucasians vs. 1.35 for African-Americans ($p = 0.008$). The overall distribution of MEWS scores shows a slightly higher frequency of a score of zero among African Americans (140 vs. 114), and a slightly lower frequency of a score of 3 (343 vs. 410), when compared to Caucasians (Table 6). Frequencies for MEWS scores of 1 or 2

Table 3. Difference in Triage Acuity Scores (TAS) between Caucasians and African-Americans by Chief Complaint

Chief Complaint	n	Label	Mean TAS	Difference of Means	*p*-Value
Chest pain	916	Caucasian	2.7	−0.2	<0.001
		African-American	2.9		
Abdominal pain	1347	Caucasian	3.0	−0.2	<0.001
		African-American	3.2		
Weak and dizzy	441	Caucasian	2.8	−0.2	<0.001
		African-American	3.0		
Syncope	53	Caucasian	2.7	−0.2	0.08
		African-American	2.9		
Shortness of breath	500	Caucasian	2.7	−0.1	<0.01
		African-American	2.8		
Altered mental status	35	Caucasian	2.4	−0.0	0.62
		African-American	2.4		
Back pain	537	Caucasian	3.7	−0.1	<0.001
		African-American	3.8		
Headache	381	Caucasian	3.1	−0.3	<0.001
		African-American	3.4		

did not differ much between cohorts (<2%). Finally, African Americans had a slightly lower frequency of scores of 4, but higher frequencies of scores of 5 or 6, although the absolute numbers of these highest scores were quite small. It is important to note that when we matched subjects for identical MEWS scores, mean wait times were longer for African Americans regardless of the MEWS score (Table 7). The number of matched subjects at each score other than a score of 1 or 2 was small, and so in spite of large differences at MEWS scores of 3 and 5, these did not reach statistical significance.

DISCUSSION

Accurate and reliable triage, particularly in a busy ED setting, presents a dubious challenge. Despite efforts to move to objective criteria, there remains a significant subjective component to triage. The important role of gestalt in medical decision- making is recognized by almost any practicing clinician.

However, subjective assessment may open the door for bias and undue influence from other causes. A recent published study suggested that increasing ED volumes and limited resources may be a source of unrecognized pressure to down-triage patients, particularly when the ED is overcrowded (28). Our current study supports the hypothesis that other factors, notably race, may affect the triage process. Even after controlling for numerous confounding variables, we were unable to account for the difference seen in mean triage acuity scores between African Americans and Caucasians for eight common and potentially serious chief complaints.

Does this small but statistically significant difference in mean TAS translate into any clinically meaningful difference in medical care? The mean increase in wait times for African Americans for all chief complaints was

Table 4. Difference in Wait Times between Caucasians and African-Americans by Chief Complaint*

Chief Complaint	n	Race	Mean	Difference in Mean (95% CI)	*p* Value
Chest pain	916	Caucasian	74.6	−21.0 (−29.8 to −12.3)	<0.001
		African-American	95.6		
Abdominal pain	1347	Caucasian	101.7	−3.9 (−11.6 to 3.8)	0.32
		African-American	105.6		
Weak and dizzy	441	Caucasian	83.7	−13.3 (−26.2 to −0.5)	0.04
		African-American	97.0		
Syncope	53	Caucasian	100.5	−12.1 (−55.8 to 31.7)	0.58
		African-American	112.5		
Shortness of breath	500	Caucasian	74.9	−23.4 (−35.8 to −11.0)	<0.001
		African-American	98.3		
Altered mental status	35	Caucasian	71.5	19.2 (−18.3 to 56.7)	0.30
		African-American	52.3		
Back pain	537	Caucasian	93.1	3.2 (−6.6 to 13.1)	0.52
		African-American	89.9		
Headache	381	Caucasian	87.4	−14.3 (−27.1 to −1.4)	0.029
		African-American	101.7		

CI = confidence interval.
* Negative number implies Caucasians had a shorter wait.

Table 5. Difference in Mean Wait Times (in Minutes) between Caucasians and African-Americans, Adjusting for Number of Comorbidities

Number of Comorbidities	Number of Observations	Δ Mean Wait Times	*p* Value
0	2165	−6.12	0.03
1	829	−16.88	<0.01
2 or more	1216	−15.09	<0.01

approximately 11 min longer than for matched Caucasians. It is difficult to say how clinically meaningful this is. However, for two specific and potentially serious chief complaints, chest pain and shortness of breath, the difference in wait times was 21 min for the former and 23 min for the latter; both of which are in a range that could be clinically significant. Interestingly, the wait time for the chief complaint of "altered mental status" was shorter for African Americans than Caucasians, but this did not reach statistical significance (Table 4).

Limitations

This study was performed at a single institution. Results may vary based on ED volume, acuity, crowding, and overall personnel. Further, although dozens of nurses performed triage during this study period, we did not include the identity of the triage nurse, therefore we do not know the exact racial/gender mix of the triage nurses involved. It is also possible that the overall effects could have been due to a small number of individuals who may have been assigned more often to the triage role.

In an attempt to maintain homogeneity in the setting of unlimited data points, our initial investigation only looked at eight common chief complaints. Although we are aware that this excludes a large portion of our initial study population, we wanted an emphasis on clinical significance apart from statistical significance. We feel that the chief complaints selected represent a broad cohort of patients who present to the ED, and capture most serious conditions. Future studies might consider a focus on disparities within other chief complaints.

Table 6. Frequency Table of MEWS Scores in Caucasians Compared to MEWS Scores in African-Americans

MEWS Scores (Caucasians)	MEWS Scores (African-Americans) 0	1	2	3	4	5	6	Total
0	4	84	18	8	0	0	0	114
1	96	2085	490	228	0	0	0	2899
2	27	493	136	70	0	0	0	726
3	13	287	73	37	0	0	0	410
4	0	0	0	0	28	12	3	43
5	0	0	0	0	9	4	2	15
6	0	0	0	0	2	1	0	3
Total	140	2949	717	343	39	17	5	4210

MEWS = modified early warning score.

Table 7. Difference in Mean Wait Times (in Minutes) between Caucasians and African-Americans with Identically Matched MEWS Score

MEWS Score	Number of Observations	Δ Mean Wait Times	*p* Value
0	4	−27.50	0.65
1	2085	−8.36	<0.01
2	136	−23.32	0.03
3	37	−17.41	0.46
4	28	−11.71	0.48
5	4	−36.50	0.42

MEWS = modified early warning score.
Difference in wait time is the wait time for Caucasians minus the wait times for MEWS-matched African-Americans. A negative number implies a longer wait for African-Americans.

There are a number of other factors that may appropriately influence triage decisions such as the "look" of the patient, different descriptors for the complaint (e.g., sharp chest pain versus heavy or crushing), or even the patient's behavior at the triage desk. These factors are currently difficult for our information system to capture electronically and would require a direct observation and a manual chart review. Also, although we included a large number of co-morbidities, we did not include other serious co-morbidities (the most common in our population, after those we did include, being renal disease), which could have played a role in triage decision making. However, at our institution the majority of ED patients with concurrent renal insufficiency are African American, so would be unlikely to mitigate our findings. Further work to refine a methodology that could better evaluate the complex process of triage might allow a more robust determination of the effects of various demographic and clinical variables on the overall triage process.

CONCLUSIONS

After adjusting for a number of demographic and clinical variables, this study demonstrated an association between African-American race and higher TAS (i.e., lower assigned acuity), and longer wait times from triage assessment to assignment to a treatment area. There is increasing recognition of racial bias in other aspects of medical management, including the ED setting, which adds external validity to these findings (29).

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ARTICLE SUMMARY

1. Why is the article important?

It increases the awareness of the potential for racial disparity in ED triage.

2. What does the study attempt to show?

The study attempts to determine if there is racial disparity in assigning triage acuity scores.

3. What are the key findings?

Overall, triage acuity was lower for African Americans compared to Caucasians after adjusting for a number of variables that might impact severity of illness on presentation. These lower scores were in some cases associated with clinically meaningful increases in wait times to treatment.

4. How is care impacted?

By increasing our awareness of the potential for bias in assigning triage acuity scores, we can mitigate against this possibility by carefully monitoring data at our own individual institutions and continually attempt to improve our triage process.