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Patient Ethnicity Affects Triage Assessments and Patient Prioritization in U.S. Department of Veterans Affairs Emergency Departments

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Abstract: Ethnic minority patients receive lower priority triage assignments in Veteran's Affairs (VA) emergency departments (EDs) compared to White patients, but it is currently unknown whether this disparity arises from generalized biases across the triage assessment process or from differences in how objective and/or subjective institution-level or person-level information is incorporated into the triage assessment process, thus contributing to disparate treatment.

The VA database of electronic medical records of patients who presented to the VA ED from 2008 to 2012 was used to measure patient ethnicity, self-reported pain intensity (PI) levels, heart rate (HR), respiratory rate (RR), and nurse-provided triage assignment, the Emergency Severity Index (ESI) score. Multilevel, random effects linear modeling was used to control for demographic and clinical characteristics of patients as well as age, gender, and experience of triage nurses.

A total of 359,642 patient/provider encounters between 129,991 VA patients and 774 nurses were included in the study. Patients were 61% non-Hispanic White [NHW], 28% African-American, 7% Hispanic, 2% Asian-American, <1% American Indian/Alaska Native, and 1% mixed ethnicity. After controlling for demographic characteristics of nurses and patients, African-American, Hispanic, and mixed-ethnicity patients reported higher average PI scores but lower HRs and RRs than NHW patients. NHW patients received higher priority ESI ratings with lower PI when compared against African-American patients. NHW patients with low to moderate HRs also received higher priority ESI scoring than African-American, Hispanic, Asian-American, and Mixed-ethnicity patients; however, when HR was high NHWs received lower priority ESI ratings than each of the minority groups (except for African-Americans).

This study provides evidence for systemic differences in how patients' vital signs are applied for determining ESI scores for different ethnic groups. Additional prospective research will be needed to determine how this specific person-level mechanism affects healthcare quality and outcomes.

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Abbreviations: ED = emergency department, ESI = Emergency Severity Index, HR = heart rate, NHW = non-Hispanic White, PI = pain intensity, RR = respiratory rate, VA = Veteran's Affairs, VHA = Veteran's Health Administration.

INTRODUCTION

Emergency Severity Index (ESI) scores are widely used to prioritize the urgency of patient treatment in the emergency department (ED) and are reliable predictors of hospital admission and expected resource needs of patients.[1,2] Numerous healthcare systems including the Veteran's Health Administration (VHA) have adopted the ESI methodology to triage patients who present for ED care. ESI scores are widely presumed to accurately reflect patient symptom severity and are intended to incorporate objective features of patient condition to prioritize patient care. When assigning an ESI score, vital signs including heart rate (HR) and respiratory rate (RR) are taken into consideration. Although not part of the ESI, patient pain level reporting is mandated as the additional vital sign[1] and is left to the discretion of the triage nurse to determine its influence on emergency severity scoring.[2–4] ESI scoring is more subjective than presumed,[2,3] and studies show that African-Americans and Hispanic ED patients are assigned less urgent/prioritized ESI scores and tend to wait significantly longer, are less likely to receive opioids, and are less likely to be prescribed analgesics on discharge than non-Hispanic White (NHW) patients presenting similar conditions.[5–12]

It is currently unknown why these disparities exist and how they are influenced by institution-level and person-level mechanisms, including patient and provider factors. For instance, differences in ESI scoring by ethnicity may reflect baseline differences in patients' physical conditions at the time of intake and/or reflect provider biases, irrespective of patients' presenting conditions. If ED nurses integrate subjective and objective patient information, such as patient's pain level reporting and vital sign measurements, into ESI assignments differently depending on salient patient characteristics such as ethnicity or cultural differences in the expression of distress, it could potentially affect clinical judgments of severity. Previous studies have not been able to reliably quantify how patient ethnicity influences clinical reasoning of ESI assignments at the time of triage. In this study, we retrospectively examined both patient-driven and provider-driven factors to measure

whether patient-presented vital signs and nurse-assigned ESI scoring differed according to patients' ethnicity, after controlling for demographic and clinical characteristics of patients and characteristics of triage nurses. By simultaneously measuring the influence of both patient and provider characteristics in ESI scoring, it is possible to identify how providers incorporate objective (e.g., vital signs) and subjective (e.g., pain reports) patient information into treatment decision-making at the time of triage.

METHODS

Study Population

This study used the VHA Corporate Data Warehouse (CDW) for patient encounters dating from January 1st, 2008 to December 31st, 2012. The VHA CDW houses regional and national data downloaded from electronic health records from 6 million Veterans nationwide.[13] Approval of the study was granted by the Institutional Review Board at the University of New Mexico and the Research and Development Board of the New Mexico Veterans Affairs (VA) Health Care System (HRRC 12-544). As described in the Supplemental materials, http://links.lww.com/MD/A870, only EDs with identifiable pain scores and ESI ratings were used. Patients were included in the study if they were treated within the 5-year period and their medical records indicated that they had been treated for a pain-related visit associated with a musculoskeletal or an inflammatory condition, and measured at intake by a person with a nursing degree (e.g., RN, NP, and LVN/LPN). Patients that received an ESI score of 1 were not included in the analyses, because patients who receive this score are usually at risk of dying, unconscious, and in need of resuscitation, and hence under conditions when there is limited discretion in the ability to deviate from the most severe ESI score (<1% of the patients were given this assignment).

The *VA* Informatics and Computing Infrastructure sourced and merged the data tables with patients' triage records and the records of the attending nurses for the patients at each visit, as described elsewhere;[12] for detailed information on the procedures used to manage the data, see the Supplemental materials, http://links.lww.com/MD/A870. Patients' race and ethnicity were coded from 6 patient-provided responses from their chart records: NHW, Hispanic, African-American, Asian-American, American Indian/Alaskan Native, or mixed/more than 1 race. In total, the sample consisted of 129,991 patients (92% males) with complete (patient and triage nurse) data for inclusion in the study. Patient age ranged from 18 to 103 years ($M_{age} = 59.5$ years, $SD_{age} = 15.10$). Each patient was seen between 1 and 157 times on separate visits by one of 774 nurses ranging in age from 21 to 75 years ($M_{age} = 47.5$, $SD_{age} = 11.0$; 82% females) across a total number of 359,642 visits /triage assignments (28% of patients had between 1 and 3 total visits during the 5 year-period analyzed).

Study Design

The clinical variables included patients' pain intensity (PI) rating, HR, RR, and ESI score. Patients' age, gender, and total number of unique ICD9 codes for a diagnosis of an alcohol or substance-related problem behavior were included as covariates. Patients with extreme outlying measurements of HR and RR (<1% of patients) were not included in the analyses (see Supplemental materials, http://links.lww.com/MD/A870). Patients' race and ethnicity were coded as dummy variables

(with NHW as the reference category). Male was the reference category for patient gender. Information on nurses included the amount of time they had been employed by the VA, age, and gender (reference group = male). Visits with any missing information were excluded from analyses.

Our goal was to examine differences in measurements of PI scores, and HR, and RR across ethnicities and determine whether ethnicity influenced how nurses assign an ESI triage score. We used cross-classified, random-effects (nested) models,[14] because both patients and nurses could contribute multiple patient scores on different occasions and thus cause the nonindependence of observations and errors. Each clinical variable is nested under a unique patient and nurse, enabling patient scores to vary across nurses, who may differ in how they affect patient-presenting and in their approach to ESI assignments regardless of the unique patient they are assessing, as well as across the patients, who may differ in communication and symptom presenting styles. We estimated random-effects models for all visits with complete patient and nurse data. In the models, the dependent variable was the PI, HR, RR, or ESI score for a given visit, and the predictors included the dummy codes for the patient's ethnicity. For the equations predicting ESI assignments, we also included interaction terms between the ethnicity dummy codes and pain scores (1st ESI model); HR (2nd ESI model); and RR (3rd ESI model). In each model, we included as covariates patient characteristics expected to influence PI/HR/RR/ESI scores (e.g., gender, age, and substance-related diagnoses) and nurse characteristics that should not (age, gender, and years of experience). The analyses were conducted in R v3.1.0[15] using the package lme4 v1.1-6[16] and restricted maximum-likelihood estimation. An online tool was used to ascertain 2-way interactions in random-effects models to examine potential follow-up effects.[17] To estimate the proportion of variances in PI/HR/RR measurements that are due to differences across patients, and to differences across nurses, we estimated null models with no predictors other than an intercept, which was allowed to vary across both patients and nurses.

RESULTS

The ethnic makeup of the patient population sampled was: NHW (61% of total patient/provider interactions), Hispanic (7%), African-American (28%), Asian-American (2%), American Indian/Alaskan Native (1%), or mixed ethnicity (1%). Continuous predictors were centered at the mean across visits (nurse age = 47.5 years, nurse experience = 14.0 years, RR = 18.3 breaths/min, HR = 81.4 beats/min, patient age = 59.5 years), except for problem behaviors (sum of alcohol/substance disorders), which was centered at the modal value of 0.

In total, 23% of the variation in PI scores was due to differences across patients, whereas 4% of the variation was due to differences across nurses. For HR measurements, 42% of the variation was due to differences across patients, whereas 8% of the variation was due to differences across nurses. In contrast, for RR measurements, less than 1% of the variation was due to differences across patients, whereas 29% of the variation was due to differences across nurses.

After controlling for patient characteristics (gender, age, pain scores, HR and RR, and number of ICD9 codes for substance/behavioral problems) and nurse characteristics (gender, age, and years of experience), there were significant differences in PI scores, HR, and RR between certain ethnic

groups and NHWs at each visit. Specifically, African-American, Hispanic, and mixed-ethnicity patients reported higher levels of pain and had slower HR and RR than NHWs on average by visit (see Table 1). Asian-American patients also had slower RR than NHW patients, on average.

Table 1 shows how all of the additional patient predictor variables examined in this study (gender, age, HR and RR, pain score, and behavioral problems) were associated with patient's PI/HR/RR measurements at each visit. Female patients and patients with a greater number of documented behavioral problems had higher pain scores, slower HRs, and faster RRs at each visit, on average, controlling for the other patient and nurse characteristics. Older patients had lower pain scores, slower HRs, and faster RRs at each visit, on average. Patients with faster HR and RR tended to have higher pain scores, on average, and patients with faster HRs also tended to have faster RRs.

Several of the nurse characteristics were also independently associated with PI/HR/RR measurements at each visit. Patients interacting with a female nurse reported higher PI levels than patients interacting with a male nurse. In addition, holding constant the age of the nurse, patients had faster HRs, slower RRs, and reported higher pain to the nurses with fewer years of experience, whereas controlling for the nurses' number of years of experience showed that patients had faster HRs, slower RRs, and reported higher pain to the older nurses, on average.

In the next set of analyses, we estimated models in which we predicted ESI score from patient and nurse characteristics by including interaction terms between the ethnicity dummy codes and: pain score (1st ESI model), HR (2nd ESI model), and RR (3rd ESI model). Including interaction terms in the models allow us to determine whether the relationship between PI/HR/RR measurements and subsequent ESI score differs across ethnic groups. Results from the 3 separate models are shown on the right side of Table 2 under ESI (estimated).

Estimates of the proportion of variance in ESI scores that is due to differences across patients and nurses showed that a larger proportion of the variation in ESI scores was due to differences across nurses (21%) than across patients (13%). Thus, the ESI score depended more on which nurse was responsible for the rating than on which patient was being examined by the nurse.

As shown in Table 2 under ''Pain Score,'' the effect of PI measurements on ESI scores differed between African-American patients and NHW patients after controlling for the remaining patient and nurse characteristics. In particular, as shown in Figure 1, pain score had a stronger relationship with ESI among African-American patients (slope $= -0.008$ [SE $= 0.0005$], Wald $z = -14.33$, $P < 0.001$) than NHW patients (slope $= -0.002$ [SE $= 0.0004$], Wald $z = -4.57$, $P < 0.001$). In both groups, ESI score was lower (more severe) for higher PI. However, at lower levels of PI, a larger disparity in ESI scores was apparent between NHW and African-American patients; NHW patients received more urgent treatment compared to African-Americans when patients reported lower levels of pain. Still, regardless of PI levels, NHW patients were given lower ESI scores than African-American patients (when pain is 0: difference $= .10$ [SE $= 0.005$], Wald $z = 22.55$, $P < 0.001$; when pain is 10: difference $= 0.05$ [SE $= 0.005$], Wald $z = 9.37$, $P < 0.001$). That is, even when PI reports were at maximum, differences in ESI scores between NHW and African-American patients remained after controlling for patient and nurse covariates.

In Table 2, column ''Heart Rate'' shows that the effect of HR on ESI scores differed between African-American patients and NHW patients, Asian-American patients and NHW patients, Hispanic patients and NHW patients, and between mixed-ethnicity patients and NHW patients. Simple-slope analyses revealed that regardless of the ethnic group, nurses attributed lower (more urgent) ESI scores to patients with faster HRs (all Ps < 0.001). However, in all of these cases the associations between HR and ESI scores were stronger among the minority group than among NHWs. Figure 2 shows the relationship between HR and ESI score for African-American and NHW patients. As shown in Figure 2, for a given HR and for

TABLE 1. Predicting PI Score, HR, and RRs From Patient and Nurse Characteristics

Predictor Level	Predictor	PI (Estimated)	HR (Estimated)	RR (Estimated)
–	(Intercept)	4.022***	80.845***	18.280***
Patient	African-American	0.375***	−1.124***	−0.102***
	Asian-American	0.005	−0.488	−0.126***
	AIAN	0.216	0.422	−0.093
	Hispanic	0.183***	−1.278***	−0.056***
	Mixed	0.206**	−0.782*	−0.081*
	Patient gender	0.399***	1.972***	−0.127***
	Patient age	−0.037***	−0.117***	0.012***
	Heart rate	0.007***	–	0.024***
	Respiratory rate	0.011***	1.285***	–
	Behavioral Problems†	0.097***	0.946***	−0.010***
	Pain score	–	0.118***	0.003**
Nurse	Nurse gender	0.174*	0.222	0.031
	Nurse age	0.028***	0.072***	−0.048***
	Nurse experience	−0.025***	−0.086***	0.005

Hypothesis tests are Wald z tests obtained by dividing the parameter estimates by their standard errors. *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$. HR = heart rate, PI = pain intensity, RR = respiratory rate.
†Sum of separate substance or alcohol abuse diagnoses.

TABLE 2. Predicting ESI Assignment From Patient and Nurse Characteristics

Predictor Level	Predictor	ESI (Estimated)		
		Pain Score	HR	RR
–	(Intercept)	3.369***	3.369***	3.369***
Patient	African-American	0.078***	0.077***	0.077***
	African-American*pain	−0.006***	–	–
	African-American*HR	–	−0.001**	–
	African-American*RR	–	–	0.001
	Asian-American	0.034**	0.033**	0.031**
	Asian-American*pain	−0.001	–	–
	Asian-American*HR	–	−0.002*	–
	Asian-American*RR	–	–	−0.010*
	AIAN	0.023	0.025	0.020
	AIAN*pain	0.0002	–	–
	AIAN*HR	–	−0.001	–
	AIAN*RR	–	–	−0.014
	Hispanic	0.008	0.009	0.009
	Hispanic*pain	0.001	–	–
	Hispanic*HR	–	−0.001**	–
	Hispanic*RR	–	–	0.001
	Mixed	0.034**	0.034**	0.034**
	Mixed*Pain	−0.004	–	–
	Mixed*HR	–	−0.002**	–
	Mixed*RR	–	–	−0.002
	Patient gender	−0.024***	−0.024***	−0.024***
	Patient age	−0.005***	−0.005***	−0.005***
	HR	−0.005***	−0.005***	−0.005***
	RR	−0.040***	−0.040***	−0.040***
	Behavioral problems[†]	−0.011***	−0.011***	−0.011***
	Pain	−0.002***	−0.004***	−0.004***
Nurse	Nurse gender	−0.023	−0.024	−0.023
	Nurse age	0.002	0.002	0.002
	Nurse experience	0.001	0.001	0.001

Hypothesis tests are Wald z tests obtained by dividing the parameter estimates by their standard errors. *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$. ESI = Emergency Severity Index, HR = heart rate, RR = respiratory rate.
[†]Sum of separate substance or alcohol abuse diagnoses.

a given value on the covariates, NHW patients were given higher priority ESI scores over African-American patients, with the exception that when HR was high, the difference between NHW and African-American patients was not significant (when HR is minimal at 30: difference = 0.10 [SE = 0.009], Wald z = 11.33, $P < 0.001$; when HR is average at 81: difference = 0.08 [SE = 0.003], Wald z = 23.00, $P < 0.001$; when HR is maximal at 199: difference = 0.02 [SE = 0.020], Wald z = 0.75, n.s.).

In contrast to the comparison with African-Americans, at very fast HRs, Hispanics, Asian-Americans, and mixed-ethnicity patients were given more urgent ESI scores than NHWs. At low HRs, all 4 ethnic groups received significantly higher (less urgent) ESI scores than NHWs. Figure 3 shows the corresponding figure for Hispanic patients. Hispanic patients were given less urgent ESI scores than NHW patients when HR was minimal at 30 ($P < 0.001$); Hispanic patients were also given less urgent ESI scores when HR was average at 81, but this difference was not significant ($P = 0.135$). However, for very high HRs, Hispanic patients were given more urgent ESI scores than NHW patients (when HR is maximal at 199:

difference = −0.10 [SE = 0.037], Wald z = −2.81, $P = 0.005$). For Asian-American and mixed-ethnicity patients, the pattern is the same as the pattern for Hispanic patients shown in Figure 3, except that the disadvantage of Asian-American and mixed-ethnicity patients relative to NHW patients at an average HR reached statistical significance (both $Ps < 0.005$).

The effect of RR on ESI scores was more similar across ethnic groups than was the case for the effect of HR (Table 2, column ''Respiratory Rate''). The only exception is for Asian-American patients: both Asian-American and NHW patients were given more urgent ESI scores when presenting with faster RRs, but this association was again stronger among Asian-American patients (slope = −0.051 [SE = 0.005], Wald z = −11.02, $P < 0.001$) than NHW patients (slope = −0.040 [SE = 0.001], Wald z = −54.67, $P < 0.001$). As was the case for HR, after controlling for the covariate variables, Asian-American patients were given less urgent ESI scores than NHW patients when RR was minimal (e.g., estimated at 0) and average (at 18; both $Ps < 0.01$), but Asian-American patients were given more urgent ESI scores than NHW patients when RR was maximal (at 50; $P = 0.043$).
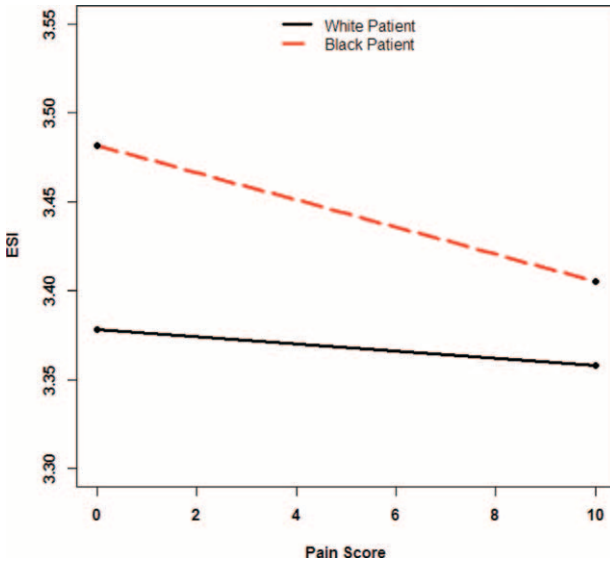
FIGURE 1. ESI for NHW and African-American patients as a function of pain score. ESI = Emergency Severity Index, NHW = non-Hispanic White.

FIGURE 3. ESI for NHW and Hispanic patients as a function of heart rate. ESI = Emergency Severity Index, NHW = non-Hispanic White.

DISCUSSION

Our study examining 2 types of person-level factors (patient-driven and provider-driven), and hence mechanisms that could potentially contribute to health disparities in patient care using over 350,000 patient-provider encounters showed higher PI, HR, and RR levels during ED triage for African-American, Hispanic, and mixed racial/ethnic patients as compared to NHW patients. Overall, individual differences between patients (patient-driven mechanisms) accounted for a greater amount of variance than differences between nurses (provider-driven mechanisms) for patient-reported pain levels and HRs, while nurses accounted for more variance than patients for RRs.
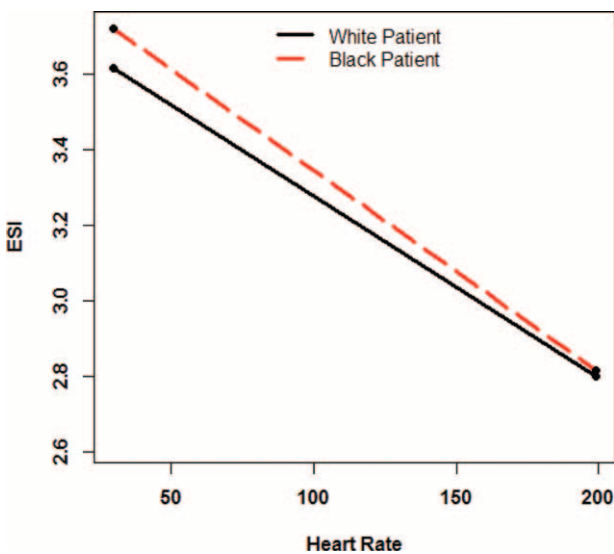

FIGURE 2. ESI for NHW and African-American patients as a function of heart rate. ESI = Emergency Severity Index, NHW = non-Hispanic White.
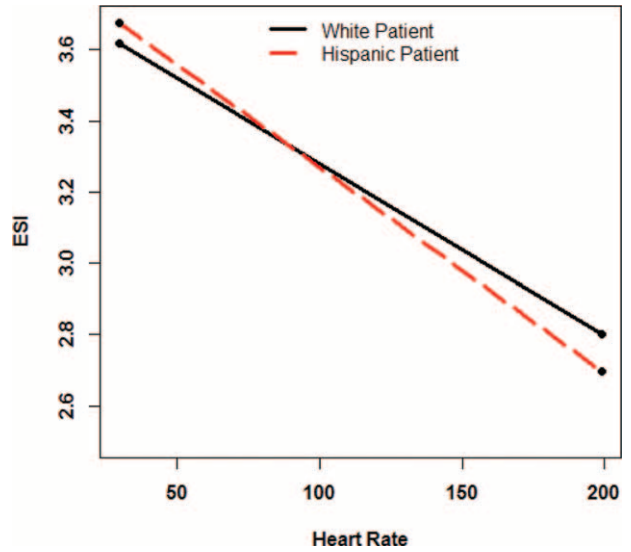
Likewise, the ESI score depended more on which nurse was responsible for the rating than on which patient was being examined by the nurse (21% vs 13%). Examination of the influence of patient's ethnicity and PI/HR/RR measurements on nurse-assigned ESI urgency/priority scoring showed that NHW patients received more urgent ESI scores than African-American patients at all levels of PI and HR, especially when both PI and HR were relatively low. These findings suggest that when PI and HR are less extreme and there is more clinical ambiguity, patient's race/ethnicity gets incorporated into ESI scoring by triage nurses. Moreover, while several of the other ethnic minority patient groups also received less urgent ESI ratings than NHW patients when the patients presented with relatively low HR measurements, these ethnic groups (excluding African-Americans) actually received more urgent ESI scores when presenting high (more severe) HR measurements. Similarly, Asian-American patients received more urgent ESI scores than NHW patients when presenting high RR measurements, suggesting that the influence of patient characteristics and presenting conditions on the ESI assignments they receive at triage are complex.

As expected and consistent with previous findings[18–21] patients' vital signs (HR and RR) independently predicted higher patient-reported PI levels, as did patients' gender, age, and problem behaviors (alcohol/substance-related disorders). Although patient characteristics accounted for a much higher proportion of variance in PI scores, several nurse characteristics were independent predictors of the higher PI scores, including female gender, older age, and fewer years of experience. These findings are consistent with experimental research and smaller case studies showing that people tend to report higher PI levels following brief interactions with, and in the presence of female rather than male laboratory personnel.[22–25]

Our results suggest that the NHW patients may have received prioritized treatment (more urgent ESI scores) compared to African-American patients when lower levels of pain were reported and presumably with less overall patient complaints and greater clinical ambiguity. It is currently

unknown how the ethnic identity of health providers may influence PI reporting in emergency care settings. However, in our own laboratory (JMV), we have observed a pattern whereby participants tend to report higher PI following interactions with an NHW experimenter as compared to a Hispanic experimenter,[26] providing support for the hypothesis that patient pain reporting may also be influenced by a multitude of demographic (e.g., gender) and cultural characteristics of triage examiners.

Differential ED care based on characteristics that are irrespective of patients' physical presenting symptoms, including gender, age,[27] and ethnicity can have cost and equity implications for our healthcare system in general, and particularly for veterans receiving emergency care. If ethnic disparities in ESI assessments contribute to disparities in patient outcomes, this could lead to increased costs through under-provision of care to some patients, leading to costly complications and follow-up visits, and/or over-provision of care to other patients, based solely on their ethnicity. Other studies show that some ethnic groups report feelings of distrust as a result of perceived discrimination by healthcare staff.[28,29] We do not know whether African-American patients or any of the other ethnic groups suffered more or received lower quality ED care than NHW patients, as has been demonstrated in other studies,[30–36] and additional prospective research is needed to determine how ESI assignments affect healthcare quality and outcomes. At the very least, and consistent with prior research[9] we suspect that higher pain scores did reflect patient's motivation to seek immediate attention and less urgent ESI scores on average did result in longer wait times in the ED, which has been linked to poorer outcomes in a variety of diseases, such as myocardial infarction,[37] stroke,[38] and sepsis.[39]

A major limitation of our study was that many significant personal attributes of the nurses (e.g., nurses' ethnicities/races) and characteristics of ED settings (e.g., local population density[40]) that may influence patient behaviors and provider treatment decisions in ED settings were unavailable in the dataset. The predominance of male and older patients in this VA sample and the common trend for VA staff to be Veterans themselves may have also limited the generalizability of the findings. A potential benefit of using the current dataset, however, is that the VA healthcare system provides a rich national database of ED records using relatively uniform and standardized protocols, likely reducing the potential impact of procedural variability on patient/provider measurements found in other health care systems. The fact that patients in the VA system have equivalent access to VA primary care clinics also reduces the likelihood that the current findings were due to differences in ED utilization for different acuity conditions. Rather, the current findings suggest that the conventional protocol of using ESI scores to prioritize ED patients is not always employed equally across patient groups, and there is a current need to reevaluate the policy and practice of equalizing ED triage assessments for all groups of VA patients.

ACKNOWLEDGMENTS

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