



Original Contribution

Relationship between racial disparities in ED wait times and illness severity^{☆,☆☆}William P. Qiao, BA^{a,*}, Emilie S. Powell, MD, MS, MBA^{a,b}, Mark P. Witte, PhD^c, Martin R. Zelder, PhD^c^a Department of Emergency Medicine, Feinberg School of Medicine, Northwestern University, Chicago, IL 60611^b Institute for Healthcare Studies and Division of General Internal Medicine, Feinberg School of Medicine, Northwestern University, Chicago, IL 60611^c Department of Economics, Weinberg College of Arts and Sciences, Northwestern University, Evanston, IL 60208

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ABSTRACT

Background: Prolonged emergency department (ED) wait times could potentially lead to increased mortality. Studies have demonstrated that black patients waited significantly longer for ED care than nonblack patients. However, the disparity in wait times need not necessarily manifest across all illness severities. We hypothesize that, on average, black patients wait longer than nonblack patients and that the disparity is more pronounced as illness severity decreases.

Methods: We studied 34 143 patient visits in 353 hospital EDs in the National Hospital Ambulatory Medical Care Survey in 2008. In a 2-model approach, we regressed natural logarithmically transformed wait time on the race variable, other patient-level variables, and hospital-level variables for 5 individually stratified illness severity categories. We reported results as percent difference in wait times, with 95% confidence intervals. We used $P < .05$ for significance level.

Results: On average, black patients experienced significantly longer mean ED wait times than white patients (69.2 vs 53.3 minutes; $P < .001$). In the multivariate model, black patients did not experience significant different wait times for the 2 most urgent severity categories; black patients experienced increasingly longer waits vs nonblack patients for the 3 least urgent severity categories (14.7%, $P < .05$; 15.9%, $P < .05$; 29.9%, $P < .001$, respectively).

Conclusion: Racial disparity in ED wait times between black and nonblack patients exists, and the size of the disparity is more pronounced as illness severity decreases. We do not find a racial disparity in wait times for critically ill patients.

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1. Introduction

Emergency department (ED) crowding is a significant public health issue [1,2]. In recent years, the rate of ED utilization has increased while the number of available EDs has simultaneously decreased [3]. These 2 factors together exacerbate crowding in the ED [4]. Emergency department crowding extends the time patients have to wait to receive testing and treatment [2], potentially leading to adverse outcomes [5]. As such, ED wait time can be used as a method to measure ED crowding [6–8]. Patients with illnesses such as acute myocardial infarction, stroke, sepsis, pneumonia, and traumatic injuries benefit greatly from rapid, timely medical interventions [4], and prolonged ED wait times could potentially lead to increased mortality [9], protracted pain and suffering, and poor patient satisfaction in hospital EDs [4,10,11].

Emergency department crowding may disproportionately affect minority populations, raising questions of ED care equitability [11]. Racial

disparity in ED wait times has been studied by prior authors [1,2,4,11–13]. These studies demonstrated that black patients waited significantly longer for ED care than nonblack patients. However, to the best of our knowledge, none explicitly analyze the relationship between wait time disparities with respect to patients' illness severity upon presentation to the ED. Although studies generally show minority patients experience longer wait times, the disparity in wait times need not necessarily manifest across all illness severities. Although we should not allow for any racial disparity in ED care regardless of illness severity, detection of such disparity for critically ill patients would warrant immediate intervention.

In this study, we evaluate whether racial disparity differs by patients' illness severity as measured by ED triage level. We hypothesize that on average, black patients wait longer than nonblack patients and that the disparity is more pronounced as illness severity decreases.

2. Methods

2.1. Study design

This study is a retrospective cross-sectional study of data collected in the National Hospital Ambulatory Medical Care Survey (NHAMCS) in 2008. The NHAMCS is approved annually by the Ethics Review Board

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of National Center for Health Statistics (NCHS) with waivers of the requirements to obtain informed consent of patients and patient authorization for release of patient medical record data by health care providers [14]. The institutional review board determined that this study was exempt from informed consent.

2.2. Study setting and population

The NHAMCS is an annual, national probability sample of ambulatory visits made to nonfederal, general, and short-stay hospitals in the United States conducted by the Centers for Disease Control and Prevention, NCHS. Although the survey includes visits to selected ambulatory care departments, this analysis focuses solely on the visits to hospital EDs. The survey has been conducted annually since 1992. The multistaged sample design is composed of 3 stages for the ED component: (1) 112 geographic primary sampling units that comprise a probability subsample of primary sampling units from the 1985 to 1994 National Health Interview Surveys; (2) approximately 480 hospitals within primary sampling units; and (3) patient visits within emergency service areas. Sample hospitals are randomly assigned to 16 panels that rotate across thirteen 4-week reporting periods throughout the year. The initial sample frame of hospitals was based on the 1991 Strategic Marketing Group hospital database [14].

The NHAMCS 2008 recorded patient visits to 353 US hospital EDs and recorded a total of 34 143 patient visits. Hospital staff members were trained to complete surveys for the NHAMCS. Information for each visit was recorded on a variety of patient, visit, and hospital characteristics. The US Bureau of the Census oversees the data collection [14]. Specific methods of survey procedures were provided by the NCHS [15].

2.3. Study protocol

The data were modified before formal analysis. From the 34 143 patient visits in the NHAMCS data set, we excluded visits with missing wait times ($n = 6983$) to form a sample of 27 160 patient visits with actual wait times available for analysis. We then excluded visits with missing triage categories ($n = 3092$), unknown insurance payment information ($n = 1182$), and visits occurring in EDs that did not perform triage ($n = 409$).

We then stratified the data into 5 cohorts according to their illness severity presented to the ED. Illness severity presented to the ED was approximated by the immediacy by which a patient needed to be seen and is an “immediacy variable” in the NHAMCS. This variable is broken down into 5 triage categories in the NHAMCS: immediately, 1 to 14 minutes, 15 to 60 minutes, greater than 1 hour to 2 hours, and greater than 2 hours to 24 hours. The determination of the triage categories was assigned based on the clinical judgment of an ED health provider (ie, triage nurse) upon arrival at the ED [15]. The immediacy variable in the NHAMCS combines different triage systems used across institutions into one 5-level system. In cases where an ED used a 3- or 4-level triage system, the levels were mapped to the best corresponding category in the 5-level system in the NHAMCS during the editing process [15,16]. We used these 5 triage categories in the NHAMCS to indicate patient illness severity.

2.4. Key outcome measures

The primary outcome measure or dependent variable was wait time before being seen by a physician. *Wait time* is defined as difference between the time the patient arrives in the ED and the time the patient is examined by a physician [15]. The primary independent variable was black race (vs nonblack race).

Patient-level variables included, age (continuous variable), sex, insurance payment method (private, self-pay, other), season of visit (December–February, March–May, June–August, September–November), and day of week of visit (weekday vs weekend). Hospital-level variables included hospital ownership type (for-profit, government, nonprofit), census region of the United States (Northeast, West, South, Midwest),

metropolitan statistical area (urban vs nonurban), and teaching status (teaching vs nonteaching). Teaching hospital status was defined if a hospital had a patient seen by a resident physician [15].

2.5. Data analysis

We performed univariate analysis first to analyze whether black patients experienced longer mean and median wait times than nonblack patients. We then analyzed the disparity in wait times by stratifying the patient population by illness severity. We used a log-linear model for bivariate and multivariate regression analyses to further evaluate the differences in wait times by race. We natural-logarithmically transformed ED wait times due to the 1-side skewed distribution of wait times in our sample. Natural-logarithmically transforming the wait time variable allowed us to obtain a more normal distribution for regression analysis, potentially yielding more reliable estimations than those allowed by a skewed distribution.

We decided to use a 2-model approach to illustrate the effects of adding patient- and hospital-level variables on wait time. In model 1, we regressed natural-logarithmically transformed wait time on the race variable for each individually stratified severity categories (1–5). In model 2, we added patient- and hospital-level variables to model 1 and again regressed on each individually stratified severity categories to control for confounding. We reported results as percent difference in wait times, with 95% confidence intervals. We used $P < .05$ for significance level.

We performed statistical analyses using Stata Version 12.0 (StataCorp, College Station, TX). The survey data were analyzed using the sampled visit weight that is the product of the corresponding sampling fractions at each stage in the sample design. The sampling weights have been adjusted by NCHS for survey nonresponse within time of year, geographic region, urban/rural, and ownership designations, yielding an unbiased national estimate of ED visit occurrences, percentages, and characteristics. Because of the complex sample design, sampling errors were determined using the appropriate survey procedure following the guidance of the NHAMCS documentation, which takes into account the clustered nature of the sample [14,15].

3. Results

3.1. The patient population: black vs nonblack patients

Our sample contained 5290 black vs 17 178 nonblack patient visits (Table 1). Black patient visits encompassed 22.3% of the total visits, after accounting for survey methodology. Nationally, differences in patient and hospital characteristics existed across black vs nonblack patients (Table 1). Black patients tended to be younger on average (34.5 vs 39.5 years old; $P < .001$), more likely to be female (57.0% vs 54.0%; $P < .05$), less likely to use private insurance as source of payment (29.7% vs 38.7%; $P < .001$), less likely to visit EDs in the northeastern and western regions (13.4% vs 20.4% and 8.8% vs 23.6%; $P < .001$, respectively), more likely to visit EDs in the southern region (59.4% vs 36.5%; $P < .001$), and more likely to present with an illness with the lowest severity (category 5) (14.4% vs 7.5%; $P < .05$), when compared to nonblack patients. Mean ED wait time also differed across races. Black patients experienced average wait times of 69.2 minutes, compared to only 53.3 minutes for nonblack patients ($P < .001$). Similar pattern holds true for median ED wait times across races (43 minutes [interquartile range {IQR}, 20–88] for black patients vs 33 minutes [IQR, 15–68] for nonblack patients). No significant differences were found between races for variables such as season of the ED visit, day of visit, teaching hospital status, hospital ownership type, hospital region, and urban vs rural status.

3.2. Unadjusted analysis: mean and median wait time by race and severity

Unadjusted analyses of mean and median ED wait times (Table 2) demonstrated differences in wait times by race. Black patients

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