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RESEARCH ARTICLE

Children's Care and Coverage

Variation in Emergency Department Wait Times for Children by Race/Ethnicity and Payment Source

Christine Y. Park, Mary Alice Lee, and Andrew J. Epstein

Objective. To quantify the variation in emergency department (ED) wait times by patient race/ethnicity and payment source, and to divide the overall association into between- and within-hospital components.
Data Source. 2005 and 2006 National Hospital Ambulatory Medical Care Surveys.
Study Design. Linear regression was used to analyze the independent associations between race/ethnicity, payment source, and ED wait times in a pooled cross-sectional design. A hybrid fixed effects specification was used to measure the between- and within-hospital components.
Data Extraction Methods. Data were limited to children under 16 years presenting at EDs.
Principal Results. Unadjusted and adjusted ED wait times were significantly longer for non-Hispanic black and Hispanic children than for non-Hispanic white children. Children in EDs with higher shares of non-Hispanic black and Hispanic children waited longer. Moreover, Hispanic children waited 10.4 percent longer than non-Hispanic white children when treated at the same hospital. ED wait times for children did not vary significantly by payment source.
Conclusions. There are sizable racial/ethnic differences in children's ED wait times that can be attributed to both the racial/ethnic mix of children in EDs and to differential treatment by race/ethnicity inside the ED.

Key Words. Race/ethnicity, insurance, emergency department, wait time

Overcrowding in emergency departments (EDs) across the United States has gained attention among hospital administrators, public health officials, and policy makers. From 1994 to 2004, the number of ED visits in the United States increased 18 percent from 93 million to 110 million visits (Burt and McCaig 2006). Most EDs experience overcrowding several times a week, and nearly 40 percent of EDs experience overcrowding daily (Derlet, Richards, and Kravitz 2001). The national average of patient wait time, or the number of minutes from

when a patient presents at the ED to when the patient is seen by a physician, has increased steadily. The mean ED wait time in 2004 was 47.4 minutes, up from 38 minutes in 1997 (Nourjah 1999; McCaig and Nawar 2006).

Increasing overcrowding and strains on EDs may disproportionately affect vulnerable patient populations, including minority patients and those with less-generous or no health insurance. This study examines variations in ED wait time among children who use EDs for a different and more uniform set of clinical conditions than adults and comprise a disproportionately large share of those in poverty. Moreover, children are different from adults in that their use of medical care depends on decisions made by their parents and guardians (Forrest, Simpson, and Clancy 1997). As a result, the causes and policy implications of any variations in ED wait time among children may be different from those for adults.

While previous research has found that variations in wait time for children are associated with race/ethnicity and payment source (James, Bourgeois, and Shannon 2005a), little is known about recent associations, how much of the variation is attributable to differential treatment within EDs by race/ethnicity or payment source (i.e., within-hospital effects), and how much is attributable to differences in the racial/ethnic and/or payment source mix of EDs to which children present (i.e., between-hospital effects). Accordingly, we examined wait times for children who present to EDs during 2005–2006 in order to characterize variation in wait time by race/ethnicity and payment source between hospital arrival and being seen by a physician, and to divide the differences into between- and within-hospital factors. This information is essential for understanding possible reasons for differences in the ED quality indicator of wait time, and for formulating policies and interventions to eliminate disparities by race/ethnicity and payment source in ED care.

METHODS

Study Design and Sample

We conducted a retrospective, observational study using a sample of children under 16 years who presented in EDs in 2005 and 2006 that was drawn from

Address correspondence to Andrew J. Epstein, Ph.D., Division of Health Policy and Administration, Yale University School of Public Health, 60 College Street, New Haven, CT 06510; e-mail: andrew.epstein@yale.edu. Christine Y. Park, M.P.H., is at Avalere Health, 1350 Connecticut Avenue NW, Suite 900, Washington, DC 20036. Mary Alice Lee, Ph.D., is at theDivision of Health Policy and Administration, Yale University School of Public Health, 60 College Street, New Haven, CT 06510.

the National Hospital Ambulatory Medical Care Survey (NHAMCS). To provide stable and timely results, we combined data from the two most recent years of the NHAMCS. The NHAMCS is a national probability survey conducted by the Centers for Disease Control and Prevention's National Center for Health Statistics, and it includes data on in-person visits made in the United States to outpatient departments and EDs (McCaig and Nawar 2006). To select EDs, the NHAMCS uses a four-stage probability sample design that involves geographic primary sampling units such as counties or groups of counties. Hospital staffs are asked to complete patient record forms for a systematic sample of 100 visits that occurs during a randomly assigned 4-week reporting period. Every year, about 400 hospitals are included in the sample and about 80–150 patient encounters are recorded for each hospital.

All ED visits for children under 16 during the years 2005 and 2006 were included in the sample. Children account for nearly 25 percent of overall ED visits (Luo et al. 2003). Data from both years were combined to enhance the stability and precision of the estimates. To understand variations in wait time by race/ethnicity and payment for children, we limited the analysis to children under age 16. The most frequent causes for visits to EDs for children under 16 are ear infections, respiratory conditions, and injuries (Sarver, Cydulka, and Baker 2002). We used the appropriate survey weights to generate nationally representative results. We excluded 2,944 cases missing data on wait time. The unweighted sample size for ED visits for children under 16 in 2005 and 2006 was 12,631; after weighting, there were approximately 39.5 million ED visits for children under 16 in 2005 and 2006.

The Yale University Human Investigation Committee determined that this protocol was HIPAA compliant and exempt from review.

Data Collection and Measures

The primary outcome was length of time between ED arrival and being seen by a provider as collected by hospital staff from patient logs and medical records. Because the distribution of wait time was skewed, we log-transformed the outcome measure.

The primary independent variables were patient racial/ethnic group and payment source group, and each was coded as a set of indicator variables. The NHAMCS protocol requires hospital staff to record patient race based on self-observation or information from the medical record as white, black/African American, Asian, Native Hawaiian or other Pacific Islander, American Indian or Alaska Native, and more than one race reported. Hospital staff

record ethnicity separately from race as Hispanic or non-Hispanic. For this analysis, race/ethnicity was recoded into four groups: non-Hispanic white, non-Hispanic black, Hispanic, and other race/ethnicity. The other race/ethnicity group included children who were identified as Asian, Native Hawaiian/Other Pacific Islander, American Indian/Alaska Native, and children for whom more than one race was reported. Admissions or triage staff recorded race/ethnicity at the time of survey. The NHAMCS protocol categorizes the primary expected source of payment into the following categories: private insurance, Medicare, Medicaid/SCHIP, worker's compensation, self-pay, no charge/charity, other, missing, and unknown. Payment source was recoded for this analysis into private insurance, Medicaid/SCHIP, other/unknown (Medicare, worker's compensation, other, missing, unknown), and uninsured (self-pay, no charge/charity).

Other patient-level variables included gender, age (<3 years, 3–5 years, 6–10 years, and 11–15 years), and triage status. Triage status, or the immediacy with which the triage nurse deems the patient should be seen by a physician (immediate, 1–14 minutes, 15–60 minutes, >1–2 hours, >2–24 hours, and unknown), was included to control for differences in clinical characteristics. Hospital characteristics included geographic region (Northeast, Midwest, South, and West), location in a Metropolitan Statistical Area (MSA), hospital ownership (voluntary nonprofit, government nonfederal, proprietary), and share of NHAMCS ED visits by children under 16 (<25 percent, 25 to <75 percent, ≥ 75 percent).

Statistical Analysis

Patient and hospital characteristics were compared across the four race/ethnicity groups and five payment source groups using global χ^2 analyses for categorical variables and analyses of variance for continuous variables.

We examined overall unadjusted means for ED wait times by racial/ethnic group and payment source group. We then used multivariable linear regression models to examine the association between ED wait times and racial/ethnic group and payment source group when adjusted for patient and hospital characteristics. We estimated two models: a baseline specification and a hybrid fixed effects specification. The dependent variable in both models was log-transformed ED wait time. In the baseline specification, the independent variables included gender, age, racial/ethnic group, payment source, geographic region, hospital location in a MSA, hospital ownership, pediatric share of ED visits, and triage status. We also included indicator

variables for the day of week, time of day (daytime [6:00 A.M.–6:00 P.M.] versus nighttime), and month and year of ED visit in order to control for systematic variation in wait times that could be attributable to secular trends. As these visit-timing variables are not of direct interest, we include them in the regression models but omit them from the results and discussion.

We used a hybrid fixed effects model specification (Allison 2005) that enabled simultaneous estimation of the between- and within-hospital effects. Each race/ethnicity and payment source indicator variable was divided into two parts. The hospital-level mean (i.e., the proportion of patients in the ED of a given hospital that were of a particular racial/ethnic group or a particular payment source group) captures the between-hospital variation. The arithmetic difference between the indicator variable and its hospital-level mean captures the within-hospital variation (Neuhaus and Kalbfleisch 1998). For instance, the between-hospital variable for non-Hispanic black children was constructed as the proportion of the ED patients in each hospital who were non-Hispanic black. The within-hospital variable was constructed by subtracting from each patient's non-Hispanic black indicator variable this between-hospital variable for the patient's hospital. The between- and within-hospital variables for race/ethnicity and for payment source were substituted for the corresponding overall variables in the baseline model specification; otherwise the two specifications were identical. Calvin et al. (2006) use the same methodology to study the role of insurance in treatment patterns elsewhere.

To facilitate interpretation of the results, we report results as percent differences in ED wait times (calculated by exponentiating the regression coefficient, subtracting one, and multiplying by 100; Wooldridge 2006), rather than minutes or parts of minutes.[1] For the same reason, we also scale the effects of the between-hospital race/ethnicity and payer status variables to reflect a 10 percentage point difference in the hospital-level proportion. *SAS* version 9.1.3 software (SAS Institute, Cary, NC) was used for all analyses. All analyses accounted for the complex survey design of the NHAMCS using the appropriate sampling weights to generate nationally representative results. All statistical tests were two-sided, and we considered $p < .05$ to be significant.

RESULTS

Sample Characteristics

Data for the two 1-year NHAMCS study periods included 12,631 ED visits for children under 16, representing a national sample of 39.5 million visits for

Table 1: Patient Characteristics by Racial/Ethnic Group for Children under 16

	Total (% or Mean)	*Non-Hispanic White (% or Mean)*	*Non-Hispanic Black (% or Mean)*	*Hispanic (% or Mean)*	*Other Race (% or Mean)*	*p-Value*
Total	100.0	51.2	24.8	20.4	3.6	—
Gender						
Male	53.3	54.2	51.9	52.2	57.1	.12
Female	46.7	45.8	48.1	47.8	42.9	
Age	5.7	6.2	5.6	4.8	4.4	<.001
Payment source						
Private insurance	36.9	47.1	26.1	23.4	42.2	<.001
Medicaid/SCHIP	45.7	37.5	55.9	55.7	35.8	
Other/unknown	7.6	7.4	8.8	5.9	10.3	
Uninsured	9.8	8.0	9.1	14.9	11.7	
Geographic region						
Northeast	16.5	16.9	12.6	19.9	18.0	<.001
Midwest	22.0	26.7	22.1	12.0	11.6	
South	46.5	42.2	60.9	44.3	20.0	
West	15.0	14.2	4.4	23.8	50.4	
Metropolitan status						
MSA	85.3	79.3	90.7	93.4	87.7	.002
Non-MSA	14.7	20.7	9.3	6.6	12.3	
Hospital ownership						
Nonprofit organization	70.5	74.0	70.7	61.6	70.4	<.001
Government	15.7	15.6	16.9	13.9	18.6	
Proprietary	13.8	10.4	12.4	24.5	11.0	
Pediatric share of ED visits						
<25%	57.4	64.5	49.4	48.6	61.3	<.001
25–<75%	29.1	25.8	30.7	35.4	29.8	
≥ 75%	13.5	9.7	19.9	16.0	8.9	
Triage status						
Immediate	4.2	4.0	3.9	5.1	2.8	.003
1–14 minutes	8.4	8.3	9.3	7.5	9.9	
15–60 minutes	34.4	34.4	37.3	30.5	36.7	
>1–2 hours	24.9	24.9	25.8	23.2	26.6	
>2–24 hours	15.0	16.2	13.7	14.8	7.8	
Unknown/no triage	13.1	12.2	9.9	19.0	16.3	

Data from NHAMCS 2005–2006 weighted to be nationally representative.

children under 16 between 2005 and 2006. Nationally 51.2 percent of ED visits were for non-Hispanic white children, 24.8 percent were for non-Hispanic black children, 20.4 percent were for Hispanic children, and 3.6 percent were for the other race/ethnicity group (Table 1). Moreover, 36.9 percent of children's ED visits were for the private insurance group, 45.7 percent were for

Table 2: Patient Characteristics by Payment Source Group for Children under 16

	Total (% or Mean)	*Private (% or Mean)*	*Medicaid/ SCHIP (% or Mean)*	*Other/ Unknown Payment (% or Mean)*	*Uninsured (% or Mean)*	*p-Value*
Total	100.00	36.9	45.7	7.6	9.8	—
Gender						
Male	53.3	54.5	52.4	53.6	52.8	.45
Female	46.7	45.5	47.6	46.4	47.2	
Age	5.7	6.4	5.0	6.0	6.1	<.001
Race/ethnicity						
Non-Hispanic white	51.2	65.4	42.1	50.2	41.6	<.001
Non-Hispanic black	24.8	17.5	30.3	28.9	23.1	
Hispanic	20.4	12.9	24.8	16.0	31.0	
Other	3.6	4.1	2.8	4.9	4.3	
Geographic region						
Northeast	16.5	18.5	14.1	19.1	17.9	<.001
Midwest	22.0	23.4	21.6	28.4	13.6	
South	46.5	40.6	51.8	33.6	53.5	
West	15.0	17.6	12.4	18.8	15.0	
Metropolitan status						
MSA	85.3	86.3	83.3	89.1	88.0	.41
Non-MSA	14.7	13.7	16.7	10.9	12.0	
Hospital ownership						
Nonprofit organization	70.5	75.1	67.8	74.0	63.2	.03
Government	15.7	13.0	16.9	16.1	20.1	
Proprietary	13.8	12.0	15.3	9.9	16.6	
Pediatric share of ED visits						
<25%	57.4	60.9	53.5	58.5	61.7	.38
25–<75%	29.1	27.3	31.3	27.5	27.0	
≥ 75%	13.5	11.8	15.3	14.0	11.3	
Triage status						
Immediate	4.2	4.0	4.0	5.4	4.6	.35
1–14 minutes	8.4	8.4	8.4	10.8	6.9	
15–60 minutes	34.4	34.0	34.3	40.3	31.9	
>1–2 hours	24.9	25.4	25.4	20.3	24.1	
>2–24 hours	15.0	14.8	15.6	9.6	17.0	
Unknown/no triage	13.1	13.3	12.4	13.8	15.6	

Data from NHAMCS 2005–2006 weighted to be nationally representative.

the Medicaid/SCHIP group, 7.6 percent were for the other payment source group, and 9.8 percent were for the uninsured group (Table 2).

Patient and hospital covariates differed across racial/ethnic groups and by payment source (Tables 1 and 2). The mean age was 5.7 for all children,

and it varied by both race/ethnicity and payment source. Compared with non-Hispanic white children, non-Hispanic black and Hispanic children were more likely to have Medicaid/SCHIP insurance or to be uninsured. Non-Hispanic black and Hispanic children comprised a larger share of ED visits in the South than in other regions, at EDs located in metropolitan areas, and at EDs that primarily serve children (Table 1). Children in the Medicaid/SCHIP and uninsured groups were also responsible for a larger share of ED visits in the South, at EDs in metropolitan areas, and at pediatric EDs (Table 2).

ED Wait Times

The overall mean unadjusted ED wait time was 53.6 minutes (95 percent confidence interval [CI]: 49.8, 57.4 minutes). Unadjusted ED wait times for non-Hispanic black children and Hispanic children were significantly longer than for non-Hispanic white children (Table 3). The mean ED wait time was 46.7 minutes (95 percent CI: 43.3, 50.1) for non-Hispanic white children, 58.7 minutes (95 percent CI: 51.6, 65.8) for non-Hispanic black children, 65.3 minutes (95 percent CI: 57.8, 72.8) for Hispanic children, and 51.4 minutes (95 percent CI: 41.4, 61.4) for children in the other race/ethnicity group. Unadjusted ED wait times for children in the Medicaid/SCHIP, uninsured, and other payment groups were not significantly different from ED wait times for children in the private insurance group (Table 3). The mean ED wait time for children in the private insurance group was 52.0 minutes (95 percent CI: 48.1, 55.9), 55.7 minutes (95 percent CI: 50.9, 60.4) for children in the Medicaid/SCHIP group, 47.5 minutes (95 percent CI: 40.4, 54.7) for children in the other payment source group, and 55.1 minutes (95 percent CI: 48.7, 61.5) for children in the uninsured group.

Results from the baseline model specification predicting log-transformed ED wait time are presented in Table 4. Besides patient race/ethnicity and payment source, this model controlled for patient gender, age, payment source, triage status, geographic region, MSA, hospital ownership, pediatric share of ED visits, and day of week, time of day, year, and month of ED visit. MSA location, pediatric share of ED visits, and triage status were significant predictors of ED wait time ($p \leq .001$ for each). The R^2 for this model was 0.14.

After adjustment, racial and ethnic differences in ED wait time remained significant (Table 3). The adjusted differences by racial/ethnic group in ED wait times were 14.2 percent (95 percent CI: 3.3, 26.4 percent) longer for non-Hispanic black children and 26.1 percent (95 percent CI: 15.1, 38.3 percent) longer for Hispanic children, compared with non-Hispanic white children.

Table 3: Differences in Average Wait Times by Racial/Ethnic Group and by Payment Source Group for Children under 16

Race/Ethnicity	*Unadjusted Wait Time (Minutes)*	*Overall Adjusted Difference (%)*	*Within-Hospital Adjusted Difference (%)*	*Between-Hospital Adjusted Difference (%)*
Non-Hispanic white	46.7 [43.3, 50.1]	Referent	Referent	Referent
Non-Hispanic black	58.7* [51.6, 65.8]	14.2* [3.3, 26.4]	2.3 [−4.3, 9.5]	4.2* [1.1, 7.3]
Hispanic	65.3* [57.8, 72.8]	26.1* [15.1, 38.3]	10.4* [2.2, 19.1]	5.7* [3.1, 8.5]
Other	51.4 [41.4, 61.4]	−3.4 [−18.0, 13.9]	9.9 [−4.9, 27.0]	−5.5* [−9.4, −1.5]

Payment Source	*Unadjusted Wait Time (minutes)*	*Overall Adjusted Difference (%)*	*Within-Hospital Adjusted Difference (%)*	*Between-Hospital Adjusted Difference (%)*
Private	52.0 [48.1, 55.9]	Referent	Referent	Referent
Medicaid/SCHIP	55.7 [50.9, 60.4]	3.9 [−2.8, 11.1]	5.4 [−0.7, 11.9]	−0.5 [−2.8, 1.8]
Other/unknown	47.5 [40.4, 54.7]	−7.0 [−19.5, 7.4]	2.6 [−9.3, 16.2]	−3.2* [−6.2, −0.1]
Uninsured	55.1 [48.7, 61.5]	−0.8 [−9.9, 9.3]	0.7 [−7.5, 9.6]	−1.4 [−5.6, 2.9]

Notes. 95% confidence interval in brackets; between-hospital adjusted difference is for a 10 percentage point increase in the hospital-level share of each race/ethnicity or payment source group.

Data from NHAMCS 2005–2006 weighted to be nationally representative.

The adjusted differences are calculated from regression models that control for patient race/ethnicity, payment source, gender, age, geographic region, metropolitan status, hospital ownership, pediatric share of ED visits, triage status, day of week, time of day, and year and month of ED visit.

*$p < .05$.

Differences in ED wait times persisted within hospitals for Hispanic children but not for non-Hispanic black children (Table 3). Hispanic children had a 10.4 percent (95 percent CI: 2.2, 19.1 percent) longer wait time than non-Hispanic white children when treated at the same hospital.

Between-hospital differences by race/ethnicity were substantial (Table 3). Children presenting at EDs with higher shares of non-Hispanic black children or Hispanic children had longer wait times. In a hospital with a 10 percentage point higher share of non-Hispanic black children than the mean, children waited 4.2 percent (95 percent CI: 1.1, 7.3 percent) longer on average

Table 4: Predictors of Log-Transformed Emergency Department Wait Times for Children under 16

	Adjusted Difference (%)	*95% Confidence Interval*	*p-Value*
Race/ethnicity			
Non-Hispanic white	Referent	—	—
Non-Hispanic black	14.2	3.3, 26.4	.010
Hispanic	26.1	15.1, 38.3	<.001
Other	−3.4	−18.0, 13.9	.68
Gender			
Male	Referent	—	—
Female	−0.6	−4.9, 4.0	.80
Age			
<3	Referent	—	—
3–5	−2.5	−10.3, 5.9	.54
6–10	−10.4	−16.7, −3.5	.004
11–15	−1.7	−8.4, 5.5	.63
Payment source			
Private insurance	Referent	—	—
Medicaid/SCHIP	3.9	−2.8, 11.1	.26
Other/unknown	−7.0	−19.5, 7.4	.32
Uninsured	−0.8	−9.9, 9.3	.88
Geographic region			
Northeast	Referent	—	—
Midwest	−14.0	−27.1, 1.4	.07
South	1.6	−14.2, 20.2	.86
West	−4.3	−19.2, 13.3	.61
Metropolitan status			
Non-MSA	Referent	—	—
MSA	48.2	17.2, 87.4	.001
Hospital ownership			
Nonprofit organization	Referent	—	—
Government	−6.6	−23.4, 13.9	.50
Proprietary	−1.6	−15.4, 14.4	.83
Pediatric share of ED visits			
<25%	Referent	—	—
25–<75%	8.0	−3.8, 21.3	.20
≥ 75%	45.6	21.7, 74.2	<.001
Triage status			
Immediate	Referent	—	—
1–14 minutes	57.3	25.7, 96.7	<.001
15–60 minutes	184.8	123.9, 262.3	<.001
>1–2 hours	266.5	184.7, 371.9	<.001
>2–24 hours	286.5	195.9, 404.8	<.001
Unknown/no triage	138.3	81.5, 213.0	<.001

Notes. The regression model also controlled for day of week, time of day, year and month of ED visit.

The model R^2 was 0.14.

Data from NHAMCS 2005–2006 weighted to be nationally representative.

ED, emergency department.

holding all else equal than children in a hospital with the mean share of non-Hispanic black children. Likewise, in a hospital with a share of Hispanic children 10 percentage points higher than the mean, children in general waited 5.7 percent (95 percent CI: 3.1, 8.5 percent) longer.

The adjusted overall, within- and between-hospital payment source differences in ED wait time were small and not significant (Table 3). Though not statistically significant at conventional levels, however, children with Medicaid/SCHIP insurance waited 5.4 percent (95 percent CI: -0.7, 11.9) longer than privately insured patients at the same hospital ($p = .08$).

DISCUSSION

We found marked differences in ED wait times by race/ethnicity, with children identified as non-Hispanic black and Hispanic having an adjusted average of 14.2 percent and 26.1 percent, respectively, longer wait times than children identified as non-Hispanic white. These differences equate to wait times for non-Hispanic black and Hispanic children that are on average about 7–12 minutes longer than wait times for non-Hispanic white children.[2] These differences are consistent with findings from previous studies of children (James, Bourgeois, and Shannon 2005a) and adults (Bickell et al. 2008; Wilper et al. 2008). Such differences in ED wait times are not trivial because of the potential negative implications of long wait times. Longer wait times may lead to prolonged pain and suffering, negative health consequences, and decreased patient satisfaction (Krishel and Baraff 1993; Thompson et al. 1996; Derlet and Richards 1999; Taylor 2006). This study did not find meaningful differences in ED wait time by payment source. It is important to note that the findings from this study apply to children under 16, and the findings may not be representative of ED care for adults.

This study advances existing research by dividing the overall association of race/ethnicity and wait time into two distinct parts—differences that depend on the relative shares of minority patients treated by each hospital (i.e., between-hospital effects) and those that depend on the race/ethnicity of individual patients treated at each hospital (i.e., within-hospital effects). The findings reveal that wait times are partly determined by the hospital at which a patient is seen (between-hospital). For a pair of EDs that are alike with respect to the covariates controlled for but different in terms of the proportion of minority children they serve, our results suggest that children who present at the ED with a share of non-Hispanic black children that is 10 percentage

points higher would have about a 4.2 percent longer wait time than otherwise identical patients presenting at the other ED. A 10 percentage point difference in the share of Hispanic children served at two otherwise identical EDs translates into a 5.7 percent longer wait time. Longer average wait times in EDs seeing higher shares of minority children may be due to staffing shortages and capacity constraints, poor coordination of personnel, hospital culture, and other sociodemographic characteristics of the community (Barnato et al. 2006). In addition, it has been suggested that safety-net hospitals, many of which treat a higher percentage of minority patients, are oftentimes underfinanced and have unstable funding streams and lower resource levels (Weissman et al. 2003).

The findings also reveal that when the hospital in which care was received was held constant, so that wait times of white and minority children were compared within the same hospital, racial, and ethnic disparities in ED wait times remained sizable. In particular, Hispanic children had wait times that were about 10 percent longer on average than non-Hispanic white children when they presented to the same institution. Although the conventional thinking is that children from vulnerable populations are less likely to have a usual source of care, less likely to use primary care effectively and more likely to use the ED for nonemergent conditions, the within-hospital differences we found were independent of differences in patients' triage status, insurance status, and hospital characteristics. Longer emergency wait times for certain racial/ethnic groups that are not explained by patient or hospital characteristics raise concern. Racial/ethnic disparities within hospitals may result from unmeasured aspects of patients' clinical characteristics, language barriers, differences in patient preferences, communication patterns between clinicians and patients, or clinician/institutional bias (Hampers et al. 1999; Bradley et al. 2004). Some have speculated that racial/ethnic discrimination among health care providers is a possible cause for inequities in health care (Geiger 1996; Freeman and Payne 2000), although this is an extremely complex topic (Rathore and Krumholz 2004; Smedley, Stith, and Nelson 2007). It is important to note that this study did not distinguish among these potential explanations for within-hospital differences in ED wait times.

The findings in this study echo other research showing that racial/ethnic disparities in medical care result from both minority patients' living near providers with fewer resources and lower quality of care (e.g., Hasnain-Wynia et al. 2007) and providers' treating minority patients differently (e.g., Schulman et al. 1999). In response, the usual recommendations are to motivate and assist lower-performing providers to improve, and to encourage patients

served by lower-performing providers to seek treatment at better-performing providers instead. How to apply these to the context of children's ED wait times is not obvious. Hospitals with longer wait times frequently also have more limited resources, and sending patients needing emergency care to farther-away EDs with shorter wait times could result in longer total wait times for treatment. In addition to the usual recommendations, shortening ED wait times depends on addressing antecedent problems farther up the causal pathway, such as lack of access to appropriate primary care and other causes of ED overcrowding. The urgency of addressing these disparities is heightened in the context of the recent economic downturn. Our results suggest that if economic constraints lead to longer ED wait times, minority children may be disproportionately affected.

Several study design issues should be considered when interpreting these results. We analyzed data from a national sample of hospitals and patient encounters in the United States, and thus we were able to generate nationally representative estimates. Racial/ethnic groups are heterogeneous, however, and assignment to these groups is imperfect (Kaplan and Bennett 2003). The race/ethnicity codes captured in the NHAMCS data were recorded as observed by study personnel during patient registration; thus, these codes may not correspond to the patients' self-identified race/ethnicity (Kressin et al. 2003; Moscou et al. 2003). Given that the observed racial/ethnic identity reflects how ED personnel view patients' race/ethnicity, however, this approach is useful for understanding potential differential treatment based on perceived race/ethnicity.

Second, this study used triage status codes recorded by study personnel as patients were registered. While the results suggest that non-Hispanic black and Hispanic patients have longer wait times, even when controlling for triage status, this difference may result from the fact that triage classifications are not standard among institutions and may vary systematically by patient race/ethnicity. Studies have shown that despite training, there is substantial variability in triage practice among clinicians, even when using software programs to standardize judgment (Brillman et al. 1996; Wuerz, Fernandes, and Alarcon 1998). Subjective factors may influence whether a patient is assigned greater or lesser immediacy when compared with other patients with the same presentation. Again, to the degree that triage status assignments reflect how clinicians' views of patients' immediacy may be influenced by subjective factors, this study is useful in understanding the potential differential treatment based on perceived immediacy. We performed supplementary analyses to explore the extent to which racial/ethnic differences in ED wait times varied

systematically by triage status. Consistent with prior evidence (James, Bourgeois, and Shannon 2005b), we find that differences in unadjusted mean wait times are larger for less urgent patients on both absolute ($p < .001$) and proportionate ($p = .02$) bases (Supporting information, Table S1).

Third, the NHAMCS does not collect information on other patient socioeconomic factors that may vary by race/ethnicity and also influence wait times, such as income, education, and occupation. We did adjust for and closely analyze expected payment source, however, which is an important aspect of socioeconomic status in this context. Recent research has explored payment source, or insurance status, as a predictor of the quality of health care patients receive. The underinsured and uninsured receive fewer preventive services, are more likely to be hospitalized for acute-care conditions, and are more likely to suffer adverse outcomes (Hadley 2003; Hadley 2007). However, in this study payment source was not a significant predictor of ED wait times among children, and the between- and within-hospital contributions by payment source were also not significant.

Finally, the NHAMCS does not include extensive information about hospitals and their EDs. Our models controlled for geographic region, location in a metropolitan area, and hospital ownership. Although we also controlled for the share of NHAMCS ED visits by children under 16, we were unable to distinguish hospitals with separate pediatric EDs from those with combined adult and pediatric EDs. Omitting hospital-level controls that are correlated with both ED racial composition and wait times could lead to bias in the estimates of the overall and between-hospital associations between patient race/ethnicity and wait times. One advantage of our study design, however, is that the estimates of the within-hospital associations are immune from the bias caused by omitting hospital-level characteristics from the model specification.

CONCLUSION

Our evaluation of a national cohort of children treated at EDs in the United States found that minority patients have longer average wait times overall, even after adjustment for a range of characteristics, including payment source. Moreover, our findings suggest both that minority patients experience longer wait times than white patients when treated at the same ED, and that wait times are longer for patients treated at EDs with higher shares of minority patients. Reasons for differences in ED wait times are complex, involving differential treatment within hospitals, as well as differences in hospital selection across

racial/ethnic groups. Interventions to eliminate racial/ethnic disparities in ED wait times will require not only increased awareness of the disparities within hospitals but also systemic change that can ensure high-quality ED care to all patients.

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NOTES

1. Using the log transformation on the dependent variable in an OLS regression may yield inaccurate estimates of the effects of the independent variables on the original (unlogged) scale of the dependent variable. The appropriate approach to modeling a skewed dependent variable depends on the specifics of the data (Manning and Mullahy 2001). When the error term from the logged model is distributed normally and is homoskedastic with respect to the independent variables, however, the proportionate effect of an independent variable on the mean of the dependent variable is accurately represented by exponentiating its coefficient (Manning 1998). We confirmed that these conditions were met through visual inspection of a standardized normal probability plot and the Park test for heteroskedasticity.
2. This was calculated by multiplying the mean ED wait time for non-Hispanic white children (46.7 minutes) by the adjusted percent difference in wait time for non-Hispanic black and Hispanic children (14.2 and 26.1 percent, respectively).

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

Appendix SA1: Author Matrix.

Table S1. Average Unadjusted Wait Times by Racial/Ethnic Group and Triage Status for Children under 16.

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