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# Racial And Ethnic Variations in Waiting Times for Emergency Department Visits Related to Nontraumatic Dental Conditions in The United States

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## ABSTRACT

### Background

Researchers have documented an association between waiting times in emergency departments (EDs) and quality of care for medical conditions, but little is known about trends and factors associated with waiting times for ED visits related to nontraumatic dental conditions (NTDCs). The authors examined trends in waiting time and associated factors for NTDC-related ED visits in the United States.

### Methods

The authors analyzed data from the National Hospital Ambulatory Medical Care survey for 1997 to 2007, excluding 2001 and 2002 owing to lack of information about waiting times. The authors used a survey-weighted linear regression of log-transformed waiting-time model to determine the waiting time for NTDC-related visits.

### Results

The geometric mean (standard error) waiting times for NTDC- and non-NTDC-related visits were 29 (1.0) and 25 (0.6) minutes, respectively ( $P < .01$ ). The geometric mean waiting time for NTDC-related visits increased by 6 percent annually and from 20 minutes in 1997 to 37 minutes in 2007. Compared with whites, Hispanics and African Americans had significantly longer waiting times for NTDC-related visits (adjusted fold-difference [R] = 1.2, 95 percent confidence interval [CI] = 1.13–1.31) and [R] = 1.3, [CI] = 1.29–1.38). Age, payer type, reason for visit and triage category were significant predictors of waiting time (R = 2.3 and 2.4 for NTDC-related visits in the triage categories of more than one to two hours and more than two to 24 hours, respectively).

### Conclusion

Nationally, waiting times in EDs for NTDC-related visits increased over time. Compared with whites, Hispanics and blacks waited longer to receive care for NTDCs in EDs.

### Practical Implications

Prolonged waiting times associated with NTDC-related ED visits reinforce the need for dental professionals to continue to advise patients regarding the need to implement oral health preventive strategies and to avoid the use of the ED for preventable common dental conditions.

### Keywords

Emergency health services, dental service utilization, dental care

### ABBREVIATION KEY

ED Emergency department

NHAMCS National Hospital Ambulatory Medical Care Survey

NTDC Nontraumatic dental condition

Investigators have described the association between emergency department (ED) waiting times and various medical conditions,<sup>1, 2, 3</sup> but no published studies have provided specific national trend information about waiting times as they relate to visits for dental conditions, specifically nontraumatic dental conditions (NTDCs), to EDs in the United States. Nationally, between 1997 and 2007, NTDC-related visits to EDs increased at an

average annual rate of 4 percent and by 54 percent overall.<sup>4</sup> This increase is of concern to health care advocates, given that most NTDCs are best managed by dental care providers and are preventable with early intervention, sustainable home care and the availability of appropriate access to dental care. In addition, the unavailability of information about waiting time for NTDC-related visits in EDs impedes the understanding of its implications for the health care system, for the cost of care and for dental practice.

Furthermore, assessment of waiting times for NTDCs is important for a number of other reasons. First, it serves to highlight any disparate experiences in waiting times of racial and ethnic minorities in hospital EDs for NTDCs, if such disparate experiences exist. Second, prolonged waiting times for patients in EDs are suboptimal, and their identification even in NTDC-related visits could serve as a window into other types of emergency care disparities. Given that studies already have documented that racial and ethnic minorities are more likely to use EDs for NTDC-related visits,<sup>4, 5</sup> one wonders whether these groups, among others, also might experience disparities in waiting times in EDs.

In 2009, a Government Accountability Office<sup>6</sup> report about crowding in hospital EDs indicated that overall waiting times for some medical conditions in EDs had increased and, in fact, had exceeded the recommended time frames on the basis of ED triage category. However, this report did not include information about waiting times for NTDC-related visits to EDs. In addition, prolonged waiting times have been suggested as an indication of overcrowding in EDs, and ED overcrowding is an emerging threat to patient safety and public health.<sup>6</sup> According to an Institute of Medicine<sup>7</sup> report on hospital-based emergency care, there is a growing concern about the timeliness of care in EDs, because patients could be experiencing protracted pain and suffering as a result of delays in diagnosis and treatment caused by prolonged waiting times. From a public health perspective, documenting and understanding waiting times related to NTDC-related visits in EDs is important for policy and program development as well as for setting priorities and goals for performance improvement.

Our study findings are critical to policymakers, health care providers, researchers and health advocates because they will improve the understanding of how NTDCs are managed in EDs with regard to quality of care. Herring and colleagues<sup>8</sup> reported that prolonged waiting times in EDs have an adverse effect on quality of care and patient outcomes. The National Quality Forum<sup>9</sup> has reiterated the importance of providing quality care to patients in EDs within a reasonable time irrespective of the conditions for which they are seeking care. Despite the importance of providing care to ED patients in a timely manner, there is a dearth of studies that address the issue of waiting times for NTDC-related visits in EDs.

In our study, we used 1997–2007 data from a nationally representative sample (excluding 2001 and 2002 owing to lack of information about waiting times), the National Hospital Ambulatory Medical Care Survey<sup>10</sup> (NHAMCS), to examine changes in waiting times, and we identified factors associated with waiting times for NTDC-related visits to EDs. In addition, we examined whether there were variations in waiting times according to a patient's race or ethnicity. In particular, we examined whether racial and ethnic minorities with NTDCs were more likely to wait longer than white patients for care in EDs in the United States. This question is particularly important given the abundance of literature documenting the existence of racial and ethnic disparities in access to dental care and the dental disease burden. We hypothesized that waiting times for NTDC-related visits would increase over time given the nature of dental conditions, and that increased waiting times would be associated with racial and ethnic minority groups owing to their increased use of EDs.

## METHODS

### Study design, settings and selection of participants

We conducted a retrospective secondary data analysis of the NHAMCS for 1997 through 2007, excluding 2001 and 2002 owing to lack of waiting-time information for those years. This database was tailored toward understanding the use of ambulatory care in hospital EDs and outpatient departments. The data are based on a national sample of visits to the EDs and outpatient departments of noninstitutional general and short-stay hospitals within the 50 states and the District of Columbia.<sup>10</sup> The NHAMCS involved the use of a four-stage probability sampling design with samples of primary sampling units, hospitals within primary sampling units, clinics and emergency services areas within hospitals and patient visits within clinics and emergency services areas. Included in the NHAMCS data were sections pertinent to socioeconomic status, race/ethnicity, financing of care, information regarding reasons for visits, diagnosis and treatment, as well as the times and dates when the sampled patients sought care in the emergency facilities. The institutional review board of Marquette University, Milwaukee, approved the study as exempt.

### Dependent and independent variables

The outcome measure we chose for this study was waiting time. We operationalized our outcome variable by using an approach similar to that of Horwitz and Bradley.<sup>11</sup> They defined waiting time as the amount of time a patient waits before being seen by an ED physician for diagnosis and treatment. In this study, we evaluated waiting time as a continuous variable, which we log transformed for analysis to reduce skewness (according to the method used by Sonnenfeld and colleagues<sup>12</sup>). The reader can interpret the resulting analyses as examining fold changes in waiting time.

The main subgroup of interest in our study was patients with NTDCs. This included all patients who had an NTDC in the primary diagnosis field as used in our previous study of NTDC-related visits<sup>4, 5</sup> and in other published studies in which investigators analyzed dental visits to EDs and physicians' offices.<sup>4, 5</sup> Specifically, we considered NTDCs to be conditions assigned the following codes from the International Classification of Diseases, Ninth Revision, Clinical Modification<sup>13</sup>: 521.0–521.9 (diseases of dental hard tissues of teeth), 522.0–522.9 (diseases of pulp and periapical tissues), 523.0–523.9 (gingival and periodontal diseases), 525.3 (retained dental root) and 525.9 (unspecified disorder of the teeth and supporting structures).<sup>4, 5</sup>

For context, we also report some results for other ED visits, which we term "non-NTDC" visits. These include traumatic dental conditions and all nondental primary diagnoses. Other independent variables included in our analysis were age, sex, race or ethnicity (non-Hispanic white, African American, Hispanic, other), payer type (self-pay, Medicare, Medicaid, private insurance, other, unknown), patient-stated reason for visit (dental versus nondental) and triage categorization. ED health care providers performed triage categorization on the basis of their assessment of a patient's condition when the patient arrived at the ED for care. Triage category is recorded as a recommendation for the patient to be seen in less than 15 minutes, 15 minutes to one hour, more than one hour to two hours or more than two hours.

### Statistical analysis

We used descriptive statistics and a multivariate linear model to assess the effect of the predictors on waiting time. We treated waiting time as a continuous variable for the analysis, but we also reported descriptive statistics for a categorized version with cutoffs at 15 minutes, one hour and two hours to match the triage categorization. We categorized age into six groups, with cutoffs chosen to approximate the lower and upper 10th and 25th percentiles and the median for the entire population. On the basis of findings from the descriptive statistics, we treated calendar year as a linear continuous predictor in the multivariate analyses. We did not include in the analyses observations with a missing outcome variable, and we coded independent

variables to include a separate category for missing values. We also examined potential interactions between race or ethnicity and triage categorization and the other covariates.

We performed all statistical analyses by using software (SAS, Version 9.2, SAS Institute, Cary, N.C.), with the primary model fitted by using Proc Surveyreg. We adjusted all analyses for the survey design. We weighted sample estimates to provide national estimates and adjusted standard errors to reflect the complex sampling scheme of NHAMCS. We used an a level of .05 throughout to denote statistical significance.

## RESULTS

The database contained 2,773 NTDC-related and 202,992 non-NTDC-related visits for the period studied. Waiting time and triage category information were missing for 26 percent and 19 percent of visits, respectively. Among observations with available waiting-time data, the geometric means (standard errors [SEs]) for NTDC- and non-NTDC-related visits were 29 (1.0) and 25 (0.6) minutes, respectively.

Table 1 represents descriptive statistics comparing NTDC- and non-NTDC-related waiting times and triage categories. The most common triage category for both NTDC- and non-NTDC-related visits was 15 to 60 minutes (32 percent and 43 percent, respectively). The proportion of patients who waited for 15 to 60 minutes was 49 percent for those making NTDC-related visits and 44 percent for those making non-NTDC-related visits. The lowest percentages were recorded for more than two hours of waiting time and triage category for non-NTDC-related visits (9 percent, 13 percent) and for waiting times for NTDC-related visits (8 percent). Few NTDC-related visits were triaged for less than 15 minutes (10 percent). The Figure 1 shows that the geometric mean waiting time for NTDC-related visits increased on average by 6 percent annually, from 20 minutes in 1997 to 37 minutes in 2007.

Table 1. Distribution of nontraumatic dental condition (NTDC)-related and non-NTDC-related emergency department visits, according to triage and waiting time category, among patients with nonmissing values.

PREDICTOR	PERCENTAGE (SE*) OF PATIENTS, ACCORDING TO CONDITION		P value
	NTDC	Non-NTDC	
Triage Category (Urgency)			≤.01
≤ 15 minutes (emergent)	9.5 (0.9)	20.5 (0.7)	
15-60 minutes (urgent)	32.3 (1.7)	42.7 (0.8)	
≥ 1-2 hours (semiurgent)	30.1 (1.6)	23.4 (0.8)	
≥ 2 hours (nonurgent)	28.1 (1.6)	13.4 (0.6)	
Waiting Time			≤.01
≤ 15 minutes	25.1 (1.4)	31.4 (0.9)	
15-60 minutes	48.6 (1.3)	43.9 (0.5)	
≥ 1-2 hours	17.8 (1.0)	15.4 (0.4)	
≥ 2-24 hours	8.4 (0.8)	9.3 (0.4)	

\*SE: Standard error of the mean.

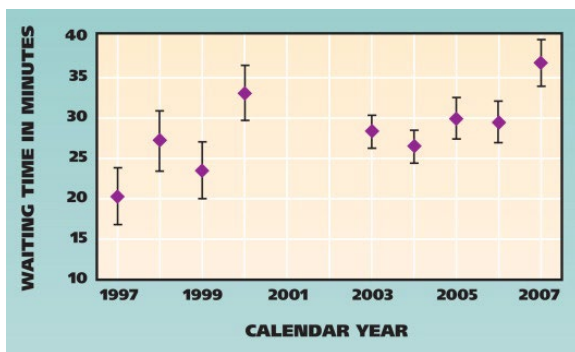


Figure 1. Relationship between calendar year and emergency department waiting time, shown as a geometric mean with standard error bars (data not available for 2001 and 2002). Source: U.S. Centers for Disease Control and Prevention.<sup>10</sup>

Table 2 shows the geometric mean of waiting times for NTDC-related visits according to study population characteristics. In this analysis, triage category, payer type, race or ethnicity and age group were the only significant predictors of waiting times for NTDC-related visits. Among specific racial or ethnic groups in our study, non-Hispanic whites had the shortest geometric mean waiting time (27 minutes), whereas blacks (35 minutes) and Hispanics (32 minutes) had higher geometric mean waiting times. The age group with the highest geometric mean waiting time was those 73 years or older (33 minutes). Compared with other payer types, Medicaid enrollees and self-pay patients had significantly higher geometric mean waiting times of 31 minutes and 28 minutes, respectively. As expected, those in the triage categories of more than one to two hours and more than two hours had significantly longer geometric mean waiting times for NTDC-related visits—35 minutes and 36 minutes, respectively—compared with those categorized into shorter triage periods.

Table 2. Waiting time for nontraumatic dental condition– related emergency department visits, according to patients’ characteristics.

PREDICTOR	FREQUENCY(N = 2,773)	GEOMETRIC MEAN (SE*) WAITING TIME, IN MINUTES	P value
<b>Payer Type</b>			
Self-pay	882	28.2 (1.7)	
Medicaid	801	30.8 (3.6)	
Private insurance	667	25.4 (5.2)	≤.01
Medicare	144	27.6 (1.6)	
Other	100	30.4 (1.9)	
Unknown	179	28.6 (2.9)	
<b>Sex</b>			
Female	1,463	28.7 (1.3)	.55
Male	1,310	29.0 (1.5)	
<b>Triage Category (Urgency)</b>			
≤ 15 minutes	226	14.9 (1.9)	
15-60 minutes	845	26.8 (1.4)	≤ .01
≥ 1-2 hours	706	35.0 (2.2)	
≥ 2-24 hours	643	36.4 (2.0)	
Unknown or no triage	353	23.7 (2.5)	
<b>Age Group (in Years)</b>			
0-4	142	26.9 (4.1)	
5-18	255	28.8 (2.2)	
19-33	1,322	28.9 (1.4)	≤ .01



34-52	853	29.3 (1.7)	
53-72	157	27.0 (3.6)	
73 or older	44	32.6 (6.6)	
<b>Race/Ethnicity</b>			
Hispanic	285	32.1 (3.5)	
African American	683	35.3 (2.3)	< .01
Non-Hispanic white	1,710	26.5 (1.1)	
Other	95	26.1 (3.7)	
<b>Patient-Stated Reason for visit</b>			
Dental reason	1,717	29.0 (1.2)	.56
Nondental reason	1,056	28.7 (1.7)	

\*SE: Standard error of the geometric mean.

Table 3 (page 833) shows the results of the multivariate linear regression model. We ran two separate analyses: one that did not include triage category and one in which we adjusted for triage category. The results of the two models were similar, with the exception of the effect of sex, for which the difference was statistically significant in the first model, and that of patient-stated reason for dental visit, for which the difference was significant in the second model. However, the estimated effect sizes were similar for those two variables as well. Compared with non-Hispanic whites and averaged across all ages, blacks had 1.3-fold longer waiting times with or without the triage category included in the model. Also, Hispanics had significantly longer waiting times ( $P < .01$ ) for NTDC-related visits (data not shown). Patients in the triage categories of 15 to 60 minutes, more than one to two hours and more than two hours had geometric mean waiting times 2.0 to 2.4 times longer than those of patients in the triage category of less than 15 minutes. Compared with private-insurance enrollees, self-pay patients had significantly longer waiting times for NTDC-related visits without the inclusion of triage category. Among non-Hispanic whites, very young children (younger than 4 years) had 23 to 25 percent shorter waiting times, whereas those older than 5 years and older than 73 years had waiting times 11 to 22 percent longer than those of young adults (aged 19 to 33 years) for NTDC-related visits in EDs. The patient-stated reason for the ED visit had a significantly detectable effect on waiting times for NTDC-related visits in EDs when we adjusted for triage category.

Table 3. Multiplicative effects of independent variables on waiting times for nontraumatic dental condition-related emergency department visits: results of survey-adjusted regression models with and without adjustment for triage category (urgency).\*

COMPARISON	WITHOUT TRIAGE	P Value	WITH TRIAGE	P Value
	Ratio (95% CI) <sup>†</sup>		Ratio (95% CI)	
<b>Payer Type</b>		≤.01		≤.01
Private insurance	1.00		1.00	
Medicaid	0.98 (0.94-1.01)		0.96 (0.92-1.00)	
Medicare	1.08 (0.99-1.19)		1.07 (0.98-1.16)	
Self-pay	1.06 (1.01-1.10)		1.03 (0.99-1.08)	
Unknown	1.01 (0.95-1.08)		1.06 (1.00-1.13)	
Other	0.86 (0.79-0.94)		0.94 (0.86-1.02)	
<b>Sex</b>				
Male	1.00	.04	1.00	.27
Female	0.97 (0.94-1.00)		0.98 (0.96-1.01)	
<b>Triage Category</b>				

≤15 minutes	Not included	Not applicable	1.00	
15-60 minutes			1.82 (1.70-1.94)	
≥ 1-2 hours			2.32 (2.16-2.49)	≤.01
≥ 2-24 hours			2.39 (2.22-2.57)	
Unknown or no triage			1.60 (1.48-1.73)	
<b>Patient-Stated Reason for visit</b>				
Dental versus nondental reason	0.98 (0.95-1.01)	.24	0.95 (0.92-0.98)	.01
<b>Year</b>	1.03 (1.02-1.03)	≤.0001	1.02 (1.02-1.03)	≤.01
<b>Age Group Within Non-Hispanic White (in Years)</b>				
0-4	0.75 (0.72-0.78)		0.77 (0.74-0.80)	
5-18	1.10 (1.04-1.16)		1.12 (1.07-1.17)	
19-33	1.00	≤.0001	1.00	≤.01
34-52	1.11 (1.06-1.16)		1.09 (1.04-1.14)	
53-72	1.12 (1.02-1.22)		1.11 (1.03-1.21)	
73 or older	1.22 (1.02-1.45)		1.43 (1.23-1.67)	
<b>Race/Ethnicity, According to Age Group (in years)</b>				
<b>Hispanic versus non-Hispanic white</b>				
0-4	1.30 (1.23-1.37)		1.18 (1.10-1.26)	
5-18	1.20 (1.01-1.42)		1.16 (1.00-1.35)	
19-33	1.74 (1.55-1.94)		1.75 (1.57-1.94)	
34-52	0.99 (0.85-1.15)		1.03 (0.88-1.20)	
53-72	0.45 (0.31-0.67)		0.46 (0.33-0.65)	
73 or older	0.14 (0.12-0.17)		0.09 (0.08-0.11)	
<b>African American versus non-Hispanic white</b>				
0-4	2.41 (2.15-2.69)		2.30 (2.16-2.46)	
5-18	1.17 (1.06-1.29)	≤.01	1.16 (1.06-1.27)	≤.01
19-33	1.51 (1.43-1.59)		1.44 (1.37-1.53)	
34-52	1.13 (1.05-1.20)		1.14 (1.08-1.21)	
53-72	1.05 (0.91-1.22)		1.05 (0.92-1.20)	
73 or older	1.26 (1.07-1.49)		1.25 (1.07-1.45)	
<b>Other versus non-Hispanic white</b>				
0-4	2.98 (2.28-3.89)		2.60 (2.07-3.27)	
5-18	0.66 (0.61-0.70)		0.60 (0.54-0.68)	
19-33	0.74 (0.68-0.79)		0.76 (0.71-0.82)	
34-52	1.07 (1.00-1.16)		1.15 (1.10-1.21)	
53-72	1.61 (1.40-1.85)		1.66 (1.47-1.88)	
73 or older	1.90 (1.30-2.78)		1.71 (1.38-2.13)	

\*Effects with 95 percent confidence intervals that do not include the no-change value of 1.0 are statistically significant at the 5 percent level.

†CI: Confidence interval.

In the analysis of interactions between the variables, we found multiple statistically significant interactions. However, most of them explained a much smaller proportion of the total variance than did the main effects, and the examination of the estimates showed the effects to be quantitative (that is, changing the exact numeric value) rather than qualitative (that is, changing the presence or direction of the effect). The only qualitative

interaction was that between race or ethnicity and age, and so we have presented these results. Compared with non-Hispanic whites, blacks consistently had statistically significantly prolonged waiting times in most age groups. This was most pronounced among the younger age group (0–4 years) in the analyses including and not including triage category. On the other hand, the results for Hispanics were slightly more variable and more difficult to interpret. Prolonged waiting times were evident among patients in the younger age groups (0–33 years) and shorter waiting times in those 53 years or older. Overall, Hispanic patients had prolonged waiting times across most covariates, with self-pay Hispanic patients experiencing the largest disparity (data not shown).

## DISCUSSION

This study is national in scope and provides estimates of trends in waiting times in EDs as related to visits for NTDCs. Although NTDCs are not life-threatening and rarely lead to death, they have the potential to cause morbidity and to affect people's oral health–related quality of life. We found that the annual geometric mean waiting times for NTDC-related visits in EDs increased by 6 percent between 1997 and 2007, from 20 minutes in 1997 to 37 minutes in 2007. Wilper and colleagues<sup>14</sup> reported an average increase in waiting times of 4.1 percent each year for all conditions examined in U.S. EDs and an increase in waiting time of 11 percent each year for patients with acute myocardial infarction. Other research has documented an overall increase in waiting times in EDs for nonurgent, semiurgent and emergent medical conditions.<sup>6, 12, 14, 15, 16</sup> However, to the best of our knowledge, this is the first national study to involve the use of a nationally representative sample for a specific examination of waiting times for NTDC-related visits.

### ED overcrowding

Despite the controversy surrounding the definition of ED overcrowding among researchers and policymakers, Derlet and Richards<sup>17</sup> indicated that overall increases in ED patient volume are a potential cause of ED overcrowding, and some effects of this overcrowding include longer waiting times and dissatisfaction among patients. The prolonged waiting times identified in this study, as well as in a recent publication by Okunseri and colleagues,<sup>4</sup> which showed an increase in NTDC-related visits over time, might be a contributing factor to ED overcrowding in the United States. In addition, our study shows that the geometric mean (SE) waiting times for NTDC- and non-NTDC-related visits were 29 (1.0) and 25 (0.6) minutes, respectively ( $P < .0001$ ). Another interesting finding was that approximately 10 percent of patients with NTDCs and 21 percent of patients without NTDCs were in the triage category of less than 15 minutes. Because triage category speaks to the urgency of a condition, this brings into question the appropriateness of evaluating dental conditions in EDs in cases in which no life-threatening conditions are involved.

### Predictors of waiting times

Several factors were significant predictors of waiting time in NTDC-related visits to EDs in the multivariate analysis (with and without the inclusion of triage category in the model). We found significant racial and ethnic disparities in waiting times for NTDC-related visits to EDs. Compared with non-Hispanic whites, blacks waited 1.2 to 2.4 times longer for NTDC-related visits; among Hispanics, only those aged 0 to 33 years experienced prolonged waiting times for NTDC-related visits.

By improving hospital efficiency and patient flow, emergency departments could eliminate bottlenecks in their triage systems and reduce overcrowding and waiting times, thereby enhancing patient care while potentially reducing costs.

This finding is consistent with those of studies in which investigators have examined children's and adults' waiting times in EDs. For example, Wu and colleagues<sup>18</sup> indicated that racial and ethnic minorities with acute pancreatitis, acute appendicitis or upper gastrointestinal hemorrhage had prolonged waiting times in EDs. Park and colleagues<sup>19</sup> investigated variations in ED waiting times for children and reported that blacks and Hispanics

had longer waiting times than those of whites when treated at the same hospital. Wilper and colleagues<sup>14</sup> reported that racial and ethnic minorities had higher median waiting times and that whites had a median waiting time of 24 minutes versus a median waiting time of 31 minutes for blacks and of 33 minutes for Hispanics. Notably, in our study the prolonged waiting times for blacks and Hispanics remained even in most of our subgroup analyses. However, we were not able to adjust for characteristics of individual facilities, so it is possible that longer waiting times for racial and ethnic minorities are due to generally prolonged waiting times in the facilities they are more likely to visit. Our findings add to the growing list of racial and ethnic disparities in the quality of care received by patients in EDs, specifically by those seeking care for NTDCs.

Investigators in many studies have attempted to postulate possible reasons for prolonged waiting times associated with racial and ethnic disparities in EDs, but not all are applicable to NTDC-related visits. Barnato and colleagues<sup>20</sup> suggested staffing shortages and capacity constraints, poor coordination of personnel, hospital culture and other sociodemographic characteristics of the community as potential sources of racial and ethnic disparities in EDs. Park et al. found that even when hospital type is held constant, allowing for comparison of waiting times of white and minority children in the same hospital, disparities in racial and ethnic minority waiting times remained, with Hispanic children having waiting times a mean of 10 percent longer than those of white children. Furthermore, James and colleagues<sup>21</sup> suggested that the longer waiting times observed for racial and ethnic minorities could be associated with the fact that people in these groups are more likely to use EDs for nonurgent problems.

### Triage category

Triage category decisions are influenced by subjective factors such as providers' beliefs and completeness of information provided by patients. These factors have the potential to lead to variations in how ED visits are recorded on the basis of triage category, even for similar conditions.<sup>21</sup> In this study, triage category was a strong predictor of actual waiting time, with 2.3-fold and 2.4-fold longer waiting times for those in the triaged categories of more than one to two hours and more than two to 24 hours, respectively. Our findings for non-NTDC-related visits are consistent with those reported by the Government Accountability Office<sup>6</sup> for the year 2006 regarding waiting times that exceeded the recommended ED triage time frame. In addition, the proportion of NTDC-related visits scheduled in the "emergent" triage category (< 15 minutes) and for which the waiting time was less than 15 minutes were 10 percent and 25 percent, respectively. Although the reason for this finding is beyond the scope of our study, possible reasons could include the physician's bias in evaluating chief complaints (as described by Dutch and colleagues<sup>22</sup>), inefficiency of the ED triage process (as described by Asplin and colleagues<sup>23</sup>) and ED physicians' lack of comfort in managing NTDCs.

### Intervention strategies

Recent economic downturns could exacerbate the situation in EDs and lead to longer waiting times for NTDC-related visits for racial and ethnic minorities in the United States. Thus, there is a need to seek urgent and appropriate intervention strategies to eliminate or reduce the racial and ethnic disparities identified in our study. Possible intervention strategies include improved access to dental care, improved training of ED physicians in the management of dental conditions in EDs, provision of urgent care clinics for dental care as an alternative to EDs and provision of electronic medical records and case managers. In addition, by improving hospital efficiency and patient flow, EDs could eliminate bottlenecks in their triage systems and reduce overcrowding and waiting times, thereby enhancing patient care while potentially reducing costs.

### Study limitations

One should interpret our study findings with the following limitations in mind. Information about waiting time was not available for a substantial portion of patients, a lack that could have affected the results. We acknowledge the possible influence of subjective factors on how triage categorization and codes for different

hospitals were documented and the unavailability of data that would have allowed us to examine the function of resources to meet health care needs. Nonetheless, our findings are important for understanding potential differences in service provision on the basis of subjective evaluations.<sup>19</sup> There was also a lack of data for potential covariates such as education, income and occupation that may vary according to race or ethnicity. Nonetheless, we considered payer type as a proxy measure of the socioeconomic context.<sup>19</sup> We recognize that information about race and ethnicity was collected on the basis of the perception of hospital personnel, rather than on patients' self-reports. Finally, we were unable to adjust for the frequency of ED visits for NTDCs and how much these facilities served as a resource for traumatic dental condition–related visits, although we know that all these factors could affect triage categorization and waiting times.

## CONCLUSIONS

Our findings in this study demonstrate that nationally, waiting times in EDs for NTDC-related visits have increased substantially over time. Hispanics and blacks are more likely than whites to wait longer for care in EDs for NTDC-related visits. ED waiting-time information is an important measure for understanding timeliness, efficiency and patient-centeredness of emergency care.<sup>24</sup> Prolonged waiting times and triage categorization for NTDCs also indicate a lingering problem regarding access to dental care in the United States. Finally, this study will increase the awareness of ED care providers regarding waiting times associated with NTDCs, with the goal of contributing to the development of guidelines for improved management of these conditions.

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