Published in final edited form as:
Am J Emerg Med. 2013 April ; 31(4): 651–656. doi:10.1016/j.ajem.2012.11.005.

The Impact of Race and Disease on Sickle Cell Patient Wait Times in the Emergency Department

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Abstract

STUDY OBJECTIVE—To determine whether or not patients with sickle cell disease (SCD) experience longer wait times to see a physician after arrival to an emergency department (ED) compared to patients with long bone fracture (LBF) and patients presenting with all other possible conditions (General Patient Sample), and to attempt to disentangle the effects of race and disease status on any observed differences.

METHODS—A cross-sectional, comparative analysis of year 2003 through 2008 data from the National Hospital Ambulatory Medical Care Survey, a nationally representative sample of nonfederal emergency department visits in the United States. Our primary outcome was wait time (in minutes) to see a physician after arrival to an ED. A generalized linear model was used to examine ratios of wait times comparing SCD visits to the two comparison groups.

RESULTS—SCD patients experienced wait times 25% longer than the General Patient Sample, though this difference was explained by the African-American race of the SCD patients. SCD patients waited 50% longer than did patients with LBF even after accounting for race and assigned triage priority.

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This work was presented at the 53rd Annual Meeting of the American Society of Hematology (San Diego, CA; December 2011), as well as at the 2nd National Conference on Blood Disorders in Public Health (Atlanta, GA; March 2012).

Potential Conflicts of Interest: The governmental grant support reported above for Dr. Tanabe is for a project designed to improve the quality of emergency department care for persons with sickle cell disease. Some may perceive this as a potential conflict of interest. We certify that Dr. Tanabe's study sponsors played no role in any aspect of the design of this study, the collection and analysis of data, or the interpretation of the results.

CONCLUSIONS—Patients with SCD presenting to an ED for care experience longer wait times than other groups, even after accounting for assigned triage level. The African-American race of the SCD patients, and their status as having SCD itself, both appear to contribute to longer wait times for these patients. These data confirm patient anecdotal reports and are in need of intervention.

Keywords

Sickle Cell Disease; Healthcare Disparities; Triage

INTRODUCTION

Background

The emergency department (ED) serves as a major site of healthcare for patients with sickle cell disease (SCD). It is estimated that there are over 200,000 SCD-related visits to EDs each year in the U.S., with treatment for pain being the most common reason for these visits. (1;2) Unfortunately, many persons with SCD cite dissatisfaction with the quality of care provided to them in the ED. Persons with SCD often feel as if they are subject to excessive delays in receiving care when presenting to an ED, and many feel as if SCD patients are made to wait longer for care in the ED than other groups. (3)

Empirical data exists that provides some credence to the belief that SCD patients may be subject to excessive delays in the ED, and that there are troubling disparities in the quality of care delivered to SCD patients in the ED when compared to other patient populations. Tanabe et al. found great variability in the time to initial analgesic dose experienced by SCD patients seeking care in the ED setting, with some patients waiting as long as 4 hours for the receipt of an initial dose of analgesic. (4) Lazio et al. found that when compared to patients with renal colic, SCD patients waited 30 minutes longer, on average, for the receipt of an initial analgesic dose upon arrival to an urban ED, even though the SCD patients on average had higher pain scores upon triage, and had higher priority triage ratings than did the renal colic patients. (5) Zempsky et al. found that while higher pain scores at triage among youth with long bone fracture (LBF) were associated with faster receipt of analgesia in the ED, increased pain levels did not lead to a reduction in time to analgesia among a comparison sample of youth with SCD. (6)

Importance

To this point, evidence suggesting significant disparities in the provision of ED care to patients with SCD has come from single-institution studies, thus limiting the generalizability of their findings to statements about the quality of ED care for the SCD population as a whole. Furthermore, prior studies have been unable to estimate the impact of race on their findings. African-American patients in general are known to experience longer delays than white patients when seeking care in the ED for a variety of conditions. (7–9) Because the majority of SCD patients in the U.S. are African-American, race may serve as an important confounder in studies that compare SCD to other groups with different racial demographic distributions.

As SCD has been deemed a priority health condition by the U.S. Department of Health and Human Services, efforts to improve the quality of SCD care have taken on a new significance at the federal level. (10) Because of the importance of the ED as a source of healthcare for the SCD population, an understanding of the deficits in ED care delivered to patients with SCD is vital, so that targeted interventions to improve the quality of that care can be developed.

Goals of This Investigation

We used a nationally representative database to determine whether or not SCD patients seeking care in the ED experience delays in the receipt of care compared to other patient populations while accounting for a number of potentially confounding factors. Specifically, we sought to 1) determine whether SCD patients experienced longer wait times (in minutes) to see a physician after arrival to an ED compared to patients with long bone fracture (LBF) and patients presenting with all other possible conditions (General Patient Sample); and 2) disentangle the effects of race from SCD status by repeating our analyses in an African-American only sample of patients.

METHODS

Study Design

This is a cross-sectional, comparative analysis of data from the National Hospital Ambulatory Medical Care Survey (NHAMCS). The NHAMCS is a national probability sample of ED visits made to non-federal, short-stay hospitals in the U.S. as sampled by the National Center for Healthcare Statistics, the Centers for Disease Control. Details regarding the sampling design of the NHAMCS are available on the Centers for Disease Control website: http://www.cdc.gov/nchs/ahcd/ahcd_questionnaires.htm. Due to the de-identified nature of the publicly available NHAMCS dataset, this research was exempt from review by our Institutional Review Board.

Selection of Participants

NHAMCS data for the years 2003 through 2008 were used for this study. ED visit records in the NHAMCS dataset contain up to three physician diagnosis codes in ICD-9-CM format. We defined the ED visit as SCD-related if any one of the three physician diagnoses contained an ICD-9-CM code for SCD (28241, 28242, or 28260 through 28269). We defined the ED visit as LBF-related if any one of the three physician diagnoses contained an ICD-9-CM code for LBF (8120 - 8125; 813-8139; 8230-8239; 820-8203; or 8210-8213). Patients with LBF were chosen as a comparison group in order to facilitate comparisons with prior research (6; 11), and because both SCD and LBF patients present to EDs with severe acute pain requiring rapid analgesic administration, but in conditions that are not typically immediately life-threatening. All other observations were coded as belonging to the “General Patient Sample”.

Primary Data Analyses

Our outcome of interest was waiting time, in minutes, to see a physician in the ED. Physician wait times were calculated from time seen by a physician and recorded arrival time to the ED. The predictor of interest for our study was disease category (SCD vs. LBF vs. General Patient Sample) as previously defined. We also examined the following potentially confounding patient-level and hospital-level covariates: patient age, sex, insurance type, race, assigned triage priority, recorded pain score at triage, whether or not the patient arrived by ambulance, whether or not the patient was subsequently admitted to the hospital, the region of the country in which the hospital was located, and whether or not the ED visit occurred on a weekend. Because some of the variables of interest underwent coding changes in the NHAMCS dataset over time, we first examined our variables of interest for temporal changes, and then created new, consolidated versions of any variables that did change over time before we conducted our analyses.

Stata 12.1 software was used for all statistical analyses and to account for the complex sampling design from which the data were derived. T-tests and chi-square tests were used for all bivariate analyses. The independent association of disease category with wait times

was estimated with a generalized linear model using a gamma distribution and a log link to model the outcome (wait times in minutes). This modeling approach was used in order to account for the highly skewed nature of the wait time outcome. Because of this approach, results from these models for the primary question of interest (the association of disease category with wait times) are presented as exponentiated beta coefficients (exp(βs)) and are interpreted as ratios of wait times comparing one disease group to a referent. A four-step process was used in our regression modeling approach. Model 1 examines the unadjusted effect of disease category on wait times. Model 2 adjusts for patient age, sex, insurance status, and race. Model 3 adds adjustments for assigned triage priority and pain score at triage. Model 4 (i.e., the fully adjusted model) adds adjustments for mode of arrival to the ED (ambulance vs. other), whether or not the patient was admitted to the hospital from the ED (i.e., visit disposition), the geographic region in which the hospital was located, and whether or not the ED visit occurred on a weekend.

After examining the effects of disease status upon wait times for all ED visits included in the study using the approaches described above, we then restricted our analyses to ED visits from African-American patients only in order to estimate the impact of disease status on wait times after complete removal of the effects of race. Probability weights were provided in the NHAMCS dataset to allow for the generation of national-level estimates.

RESULTS

A total of 171,789 NHAMCS records met our inclusion criteria, resulting in a weighted estimate of 553,943,439 ED visits in the U.S. over the time period of study. The total weighted number of ED visits by disease category under study was as follows: General Patient Sample (n = 546,872,276); LBF (n = 5,929,085); and SCD (n = 1,142,078). With an average age of 27.6 years (95% CI [25.8, 29.5]), the SCD patients were younger than both the General Patient Sample (mean age = 36.8, 95% CI [36.2, 37.5]) and the LBF patients (mean age = 37.2, 95% CI [35.5, 38.9]). Table 1 provides the weighted distribution (and 95% CIs) of the categorical patient and hospital characteristics by disease category. Compared to the General Patient Sample and the LBF patients, the SCD patients were slightly more likely to be male, and far more likely to be of black race.

It is notable that the SCD patients were more likely than both the General Patient Sample and the LBF patients to be represented in the higher priority triage groups. Twenty-two percent of the SCD patients (95% CI [16.8%, 28.4%]) were assigned a triage category of <15 minutes compared to 18.6% of the LBF patients (95% CI [16.1%, 21.4%]) and 16.3% of the General Patient Sample (95% CI [15%, 17.7%]). Similarly, 48.2% of the SCD patients (95%CI [38.5%, 58%]) were assigned to the 15 to 60 minute group compared to 39% of the LBF patients (95%CI [35.9%, 42.1%]) and 39.2% of the General Patient Sample (95%CI [37%, 41.5%])

SCD patients were more likely than the General Patient Sample and the LBF patients to present with severe levels of pain, defined as pain scores of 7 to 10. Severe pain at triage was recorded in 54% percent of SCD patients (95% CI [46.9%, 61%]) compared to only 32.3% of the LBF patients (95% CI [29.7%, 35%]) and 19.4% (95% CI [18.3%, 20.5%]) of the General Patient Sample.

Unadjusted Wait Times Among the Disease Category Groups

At the bivariate level, SCD patients waited longer to see physicians in the ED than did the LBF patients. The mean wait time for SCD patients was 66.8 minutes (95% CI [53.2, 80.3]) compared to 42 minutes for the LBF patients (95% CI [38.6, 45.5]). The difference in mean wait times between the two groups was 24.7 minutes (95% CI [11.3, 38.2]).

Similarly, longer ED wait times were observed for SCD patients compared to the General Patient Sample on bivariate analysis. The mean wait time for the General Patient Sample was 53.6 minutes (95% CI [50.9, 56.2]). Compared to the General Patient Sample, SCD patients waited 13.1 minutes longer, on average, to see physicians in the ED (95% CI [-0.17, 26.5]).

Independent Effects of Disease Category on Wait Times Among All Patients

Table 2 examines the independent effects of disease category on wait times. Without adjustment for patient or hospital characteristics, SCD patients waited 25% longer, on average, to see physicians in the ED compared to the General Patient Sample (exp(β) 1.25, 95% CI [1.02, 1.52]), and 59% longer to see physicians than did LBF patients (exp(β) 1.59, 95% CI [1.29, 1.95]). Adjustment for patient age, sex, race, and insurance status attenuated the differences in wait times between SCD patients and the General Patient Sample as SCD wait times went from 25% longer to 8% longer (exp(β) 1.08, 95% CI [0.88, 1.31]), with a 95% CI consistent with a finding of no difference between the two groups. While adjustment for these patient demographic factors led to some attenuation of the size of the difference in wait times between SCD patients and LBF patients, the attenuation was not complete, as SCD patients still retained wait times 32% longer, on average, than did LBF patients (exp(β) 1.32, 95% CI [1.08, 1.62]). As shown in models 3 and 4 of table 2, additional adjustment for assigned triage level, pain scores at triage, mode of arrival, ED visit disposition, hospital geographic region, and whether or not the ED visit occurred on a weekend did not lead to any further changes in effect size or directionality. That is, even with adjustment for these additional factors, wait times for SCD patients remained consistent with those of the General Patient Sample, but continued to be 33 to 38% longer, on average, than the wait times seen in patients with LBF.

Disentangling the Effects of Race: African-American only Results

We attempted to disentangle the effects of race by repeating the regression models described above among the African-American sample of ED visits. Results for these analyses are found in table 3. Wait times for SCD patients were consistent with wait times for the African-American General Sample of Patients. Adjustment for demographics, assigned triage priority, pain scores at triage, and other patient and hospital characteristics did not influence the observed effect sizes. However, mean wait times for SCD patients were about 50% longer than those found among the African-American LBF patient sample. This finding was observed even after controlling for the other patient and hospital characteristics under study, including assigned triage priority level and pain scores at triage.

DISCUSSION

We found that SCD patients experience longer wait times to see a physician upon arrival to an ED than do other patient populations, even though the SCD patients tended to present in higher levels of pain and tended to be assigned higher priority triage ratings. The African-American race of SCD patients appears to account for much of the difference in wait times between SCD patients and a General Patient Sample. However, we also found that SCD patients experience longer wait times than do patients with LBF, and this difference is not explained by the largely African-American racial makeup of the SCD population. Our results suggest, then, that both the race of SCD patients and their status as SCD patients contribute to delays in the receipt of timely care in the ED.

SCD patients in our study waited 25% longer, on average, to see a physician in the ED than did a General Patient Sample, but this difference in wait times was mitigated after accounting for the predominance of African-Americans among the SCD sample. This

finding is consistent with other research that has found that African-Americans and other minorities experience lower quality pain management or longer delays in the receipt of care than white patients for certain conditions upon presentation to an ED. Todd et al. found that black and Hispanic patients presenting to EDs with isolated long bone fractures were less likely than whites to receive any pain medication. (12; 13) In examining temporal trends in, and predictors of, ED wait times for all patients, Wilper et al. found that black patients waited about 13% longer, on average, than did white patients. (7) Johnston and Bao found that compared to white patients, African-Americans and Hispanics were more likely to wait more than an hour to see a physician in the ED for treatment of chest pain or abdominal pain, even after controlling for potentially confounding factors including assigned triage priority and pain scores at triage. (8) Karve et al. found that black stroke patients presenting to an ED had longer wait times to evaluation by an ED physician than did white stroke patients, also after accounting for potentially confounding factors such as assigned triage priority. (9)

Because the SCD population in the U.S. is predominantly African-American, factors that impact the quality of care received by the general African-American population have the potential to impact the majority of SCD patients in the U.S. Multiple pathways might explain the association of black race with longer ED wait times. Black patients may be more likely to seek ED care at urban hospitals which are often subject to overcrowding and/or lower resource availability, and therefore could contribute to longer ED wait times for those hospitals. For any particular condition, black patients may present with a different profile of symptoms than white patients, or they may describe their symptoms differently than do white patients. This different symptom presentation and/or differences in communication about their symptoms might serve to contribute to longer wait times if ED staff are not accustomed to the differences. For certain painful conditions where there may be no objective measures of pain, it is possible that the uncertainty surrounding the condition opens up opportunities for unconscious biases about black patients to subtly influence the provision of care, thus leading to longer wait times for the black patients. (14–17) It is interesting to note that while Johnston and Bao found that black patients waited longer to see a physician when presenting with chest pain or abdominal pain, two painful conditions for which there is some measure of clinical uncertainty, no racial differences were found in wait times for treatment of lacerations in extremities, conditions for which there are clear objective signs of the underlying problem and course of action. (8)

The fact that SCD patients in our study experienced similar wait times as the General Patient Sample after accounting for race is a troubling finding in its own right. The SCD patients in our sample were more likely to receive higher priority triage ratings than the patients in the General Patient Sample. This observation seems consistent with recommendations found in the Emergency Severity Index (ESI) Implementation Handbook, which suggests that the pain of patients with acute sickle cell pain crisis justifies an ESI triage rating level of 2, which is a marker of high acuity. (18) Nevertheless, the consistently higher acuity ratings assigned to SCD patients as observed in our study did not translate into shorter waiting times, on average, to see a physician in the ED than observed for patients in the General Patient Sample. In order to address and improve upon this finding, it will be important to pay particular attention to those factors that affect the processes that occur between the point of triage assignment and the point of physician evaluation.

While race seemed to explain some of the increases in wait times observed for SCD patients in the ED compared to other patients, it did not explain all of them. When removing the effects of race by conducting analyses restricted to African-American ED visits only, we still found that SCD patients waited about 50% longer to be seen by a physician in the ED compared to patients with LBF. There are no doubt a number of circumstances under which

it would be appropriate for patients with LBF to be seen by a physician in the ED ahead of some patients with SCD. However, our results persisted even after taking assigned triage priority and whether or not the patient arrived by ambulance into account. This suggests a more troubling conclusion – that SCD status itself plays a role in observed differences in wait times.

Prior research has suggested that even among African-Americans, individuals and families with SCD experience lower quality of care than do African-Americans with other conditions. Brousseau et al. found that among a sample of African-American parents whose children were hospitalized, the parents of children with SCD were more likely than parents of children with asthma and parents of children on a general pediatric service to believe that they would have been treated differently if they were of a different race, and were more likely to believe that they were not afforded adequate involvement in decision-making about their child's healthcare. (19)

Prior studies have elucidated several mechanisms that could explain the impact of SCD-status on the quality of care provided for SCD patients. In one systematic review of barriers to appropriate treatment in SCD, poor provider knowledge about SCD and SCD pain were found to play a role in the inadequate delivery of pain management to SCD patients. (20) A healthcare provider with poor knowledge about SCD may not realize that seemingly objective measures such as laboratory values and vital signs often do not correlate with the severity of vaso-occlusive pain. (21) ED staff may perceive a disconnect between a patient's reported symptoms or reported level of pain and measures of illness that are believed to be more objective. Furthermore, certain behaviors that ED staff may expect to be associated with severe acute pain such as writhing, moaning, or an inability to concentrate may not be exhibited by SCD patients who often experience daily chronic pain and may have developed unique coping mechanisms. This paradox between pain symptoms and quantifiable signs of pain can lead to misperceptions about "drug seeking" behavior and a subsequent delay in analgesia administration.

Some ED staff possess negative attitudes or biases about patients with SCD, (22; 23) and these negative attitudes may contribute to longer delays in the provision of treatment in the ED for patients with SCD. Relatedly, it is known that there is a subset of individuals in the SCD population who are frequent (or "high") utilizers of acute care services. This high-utilizing subset of the population is known to be sicker than SCD patients with lesser utilization, and it is also known to have a greater prevalence of alcohol, mood, and cocaine disorders. (24; 25) High-utilizing SCD patients who exhibit problematic behaviors in the ED may routinely be made to wait longer for care. However, an approach that is often exhibited for the high-utilizing subset of SCD patients may incorrectly be applied to all, or at least a majority, of SCD patients, thus contributing to longer observed wait times in the ED for the SCD population.

Whether due to race or disease status, longer wait times for SCD patients in the ED that are not justified on the basis of urgency of need represent troubling disparities that are in need of correction. It is possible that the way in which acute care is provided to patients with SCD is in need of drastic, system-level reform. That is, the current structures used to deliver emergent ED care to persons with SCD may not be a good fit given the complex nature of the disease. Models such as the SCD day hospital approach, which has been shown to decrease rates of hospital admission and improve SCD patient satisfaction with acute care, may be more appropriate given the nature of the disease. (26–31) Unfortunately, only a small number of institutions currently use the day hospital model. As such, a multi-faceted approach utilizing a wide variety of interventions to improve the quality of traditional ED care for SCD is still needed. One approach involves the development and dissemination of

ED specific educational models and workshops designed to improve ED provider knowledge about SCD (32). Another approach involves the use of multi-disciplinary care teams and the development of analgesic protocols utilized within a quality improvement framework. Tanabe et al. recently showed that this latter approach led to a greater reduction in pain scores from ED arrival to discharge for SCD patients seeking emergent care. (33)

Limitations

The following limitations should be considered when interpreting the results of our study. We are not able to discern from our data the specific decisional and/or structural factors within the EDs that contributed to the observed delays. The delays could have been the result of decisions by physicians, decisions by nurses, contributions from both, or other reasons entirely. This limits our ability to specify the exact mechanisms that may be in need of intervention in order to reduce any delays deemed to be unjustified.

Our outcome of interest was time to being seen by a physician in the ED, not time to receipt of an analgesic, which is not available in the NHAMCS dataset. It is possible that in some of the EDs under study, SCD patients would be able to receive an initial dose of an analgesic from a nurse or other ED provider before being seen by the physician, so longer wait times for SCD patients to be seen by a physician in these circumstances may not necessarily be indicative of a longer wait time to being treated for pain. Additionally, the NHAMCS data available for the years under study are limited in the amount of hospital characteristics information available for analysis. This limits our ability to observe the impact of structural and hospital factors on our outcome of interest. However, by restricting our analyses to the African-American only sample, we do impose some level of proxy adjustment for those unobserved hospital factors to the extent that they are also highly correlated with African-American race, such as hospital overcrowding or resource availability.

Conclusions

SCD is a priority health condition in the U.S. We found that SCD patients experience longer wait times in the ED than other patients despite a tendency for the SCD patients to have higher priority triage assignments and higher pain scores at triage. The African-American race of the SCD patients and their status as having SCD both appear to contribute to delays in the receipt of ED care. A close re-examination of the ways in which acute care is provided to SCD patients is required as part of efforts to mitigate this disparity in the provision of quality ED care.

Acknowledgments

Grant Support: Both Dr. Haywood and Dr. Lanzkron were supported by Career Development Awards from the National Heart, Lung, and Blood Institute (NHLBI) (Haywood #1K01HL108832-01; Lanzkron # 5K23HL083089-05). Dr. Beach's effort was supported by NHLBI grant #: 4R01HL088511-03. Dr. Tanabe's effort was supported by AHRQ grant #: 1R18HS019646-01A1.

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Table 1

Weighted Distribution of Categorical Patient Characteristics by Disease Category

	General Patients (n= 546,872,276)		LBF patients (n= 5,929,085)		SCD Patients (n= 1,142,078)		P-value
	Col %	**95% CI**	**Col %**	**95% CI**	**Col %**	**95% CI**	
% Male	45.7	[45.3,46.2]	50.3	[47.4,53.2]	54.7	[47.4,61.7]	0.001
Expected source of payment							<0.001
Private Insurance	34.9	[33.8,36.1]	41.4	[38.4,44.4]	12.9	[9.1,17.8]	
Medicare	16.2	[15.5,16.9]	18.9	[16.5,21.6]	16.8	[11.7,23.4]	
Medicaid	23.5	[22.3,24.8]	15.7	[13.5,18.1]	54.0	[46.4,61.4]	
Other	20.1	[19.1,21.1]	19.5	[17.2,22.0]	11.5	[7.4,17.3]	
Missing	5.3	[4.3,6.4]	4.5	[3.0,6.7]	4.9	[2.7,8.8]	
Patient Race							<0.001
White	73.3	[70.9,75.7]	83.5	[80.6,86.1]	2.8	[1.1,6.7]	
Black	23.1	[20.8,25.6]	13.0	[10.7,15.8]	95.4	[91.2,97.7]	
Other	3.6	[3.0,4.3]	3.5	[2.6,4.7]	1.8	[0.6,5.1]	
Triage Level							0.007
Unknown/no triage	13.2	[11.4,15.3]	11.5	[9.2,14.2]	8.2	[5.0,13.3]	
<15 minutes	16.3	[15.0,17.7]	18.6	[16.1,21.4]	22.1	[16.8,28.4]	
15 to 60 minutes	39.2	[37.0,41.5]	39.0	[35.9,42.1]	48.2	[38.5,58.0]	
>1hr to 24 hrs	31.3	[29.0,33.7]	31.0	[27.4,34.8]	21.5	[14.5,30.6]	
Pain at Triage							<0.001
(0 to 3) None/Mild	33.9	[32.6,35.2]	15.8	[13.8,18.0]	9.5	[6.1,14.5]	
(4 to 6) Moderate	23.7	[22.5,24.9]	34.2	[31.2,37.4]	24.3	[18.7,30.9]	
(7 to 10) Severe	19.4	[18.3,20.5]	32.3	[29.7,35.0]	54.1	[46.9,61.0]	
Missing	23.1	[21.1,25.3]	17.7	[15.0,20.7]	12.2	[8.6,16.8]	
% Arrival by Ambulance	16.0	[15.2,16.8]	25.9	[23.1,28.9]	14.3	[9.9,20.4]	<0.001
% Admitted to Hospital	13.6	[12.8,14.5]	16.5	[14.4,18.8]	35.5	[28.7,42.9]	<0.001
Geographic Region							0.001

	General Patients (n= 546,872,276)		LBF patients (n= 5,929,085)		SCD Patients (n= 1,142,078)		P-value
	Col %	95% CI	Col %	95% CI	Col %	95% CI	
Northeast	18.7	[16.8,20.7]	17.5	[15.1,20.1]	24.5	[17.3,33.6]	
Midwest	22.5	[18.6,27.0]	26.0	[21.7,30.8]	25.5	[18.1,34.8]	
South	41.2	[37.2,45.3]	35.9	[31.8,40.2]	44.1	[33.4,55.4]	
West	17.6	[14.5,21.3]	20.6	[17.1,24.7]	5.8	[2.5,13.1]	
% Weekend Visit	29.4	[29.2,29.6]	33.1	[30.2,36.1]	27.1	[21.1,34.0]	0.034

Table 2

Independent Effects of Disease Category on Wait Times - All Patients

	Model 1 (exp(βs))	**Model 2 (exp(βs))**	**Model 3 (exp(βs))**	**Model 4 (exp(βs))**
General Patient Sample	Ref.	Ref.	Ref.	Ref.
SCD	1.25 *	1.08	1.11	1.10
	[1.02,1.52]	[0.88,1.31]	[0.92,1.34]	[0.90,1.34]
LBF	Ref.	Ref.	Ref.	Ref.
SCD	1.59 *** [1.29, 1.95]	1.32 ** [1.08, 1.62]	1.38 ** [1.14, 1.67]	1.33 ** [1.09, 1.63]
N (unweighted)	215920	215920	215920	215920

Exponentiated coefficients; 95% confidence intervals in brackets

* $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$

Model 1: Unadjusted
Model 2: Adjusted for age, sex, race, and insurance status
Model 3: Model 2 + adjustments for assigned triage priority and pain score at triage
Model 4: Model 3 + adjustments for mode of arrival, visit disposition, geographic region of hospital, and weekend/weekday visit status

Table 3

Independent Effects of Disease Category on Wait Times – African-American ED Visits Only

	Model 1 (exp(βs))	Model 2 (exp(βs))	Model 3 exp(βs))	Model 4 (exp(βs))
General Patient Sample	Ref.	Ref.	Ref.	Ref.
SCD	1.08	1.11	1.15	1.14
	[0.88,1.32]	[0.91,1.37]	[0.95,1.40]	[0.93,1.39]
LBF	Ref.	Ref.	Ref.	Ref.
SCD	1.48* [1.15, 1.89]	1.51* [1.17, 1.94]	1.51* [1.18, 1.93]	1.48* [1.15, 1.90]
N (unweighted)	40672	40672	40672	40672

Exponentiated coefficients; 95% confidence intervals in brackets

* $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$

Model 1: Unadjusted
Model 2: Adjusted for age, sex, and insurance status
Model 3: Model 2 + adjustments for assigned triage priority and pain score at triage
Model 4: Model 3 + adjustments for mode of arrival, visit disposition, geographic region of hospital, and weekend/weekday visit status