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Disparities in Patients Presenting to the Emergency Department with Potential Acute Coronary Syndrome: It Matters if You Are Black or White

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Abstract

Objectives—To explore disparities between non-Hispanic Blacks and non-Hispanic Whites presenting to the emergency department (ED) with potential acute coronary syndrome (ACS).

Background—Individuals with fewer resources have worse health outcomes and these individuals are disproportionately those of color.

Methods—This prospective study enrolled 663 patients in four EDs. Clinical presentation, treatment, and patient-reported outcome variables were measured at baseline, 1, and 6 months.

Results—Blacks with confirmed ACS were younger; had lower income; less education; more risk factors; more symptoms, and longer prehospital delay at presentation compared to Whites. Blacks experiencing palpitations, unusual fatigue, and chest pain were more than 3 times as likely as Whites to have ACS confirmed. Blacks with ACS had more clinic visits and more symptoms 1 month following discharge.

Conclusions—Significant racial disparities remain in clinical presentation and outcomes for Blacks compared to Whites presenting to the ED with symptoms suggestive of ACS.

Keywords

Health Disparities; Race; African American; Acute Coronary Syndrome; Symptoms

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Introduction

The relationships among race, risk for cardiovascular disease, and patient outcomes has been extensively studied.[1] However, the complex relationship between race and health disparities in coronary heart disease (CHD) remains poorly understood.[2] Health disparities have been defined by Healthy People 2020 as "a particular type of health difference that is closely linked with social, economic, and/or environmental disadvantage".[3] Further, the presence of health disparities suggest that disadvantage, resulting in disease, is unjust and avoidable.[3] Describing health disparities in patients presenting to the emergency department (ED) with symptoms suggestive of acute coronary syndrome (ACS) is crucial for several reasons. First, troubling disparities in the prevalence of CHD between Black (non-Hispanic) women (7.1%) and White (non-Hispanic) women (4.6%) persist.[4] Even though Black (non-Hispanic) men have a lower prevalence of CHD (6.8%) compared to White (non-Hispanic) men (8.2%) their mortality rates are significantly higher (181.1 vs. 155.9/100,000).[4] Second, gaps in health status between higher and lower classes are increasing rather than decreasing.[1] Third, disparities between high and low income levels have widened to the greatest extent since the 1920s.[5] Fourth, inequalities in care among racial groups have been reported at varying points in the continuum of care.[6-8] Patterns of health disparities in the US have been consistent; individuals with fewer resources have worse health outcomes and individuals with fewer resources are disproportionately those of color.[1]

Racial Differences in Clinical Presentation for Possible Acute Coronary Syndrome

Heart disease is the leading cause of death for both Blacks and Whites in the US.[9] It has been well documented that Blacks have higher numbers of risk factors, such as hypertension, diabetes, and smoking, than Whites[10-12] and Blacks have among the highest incidence of hypertension (44%) in the world.[4] Hypertension may have an impact on the clinical presentation and the precision of non-invasive diagnostic studies making the diagnosis of ischemia more challenging.[13]

Eastwood et al.[6] suggest that racial differences in symptom presentation for acute coronary syndromes may be adversely affecting the time it takes to achieve diagnosis and treatment. However, there are few studies that have analyzed symptom data by racial groups.[6,14,15] According to results from the Women's Ischemic Symptoms Evaluation (WISE) study,[6] Black women with suspected ischemic heart disease were more likely to report stomach symptoms and less likely to report chest symptoms compared to White women. Similarly, Hravnak et al.[14] found that among patients with CHD, Blacks were more likely to report shortness of breath and shortness of breath was negatively correlated with revascularization procedures. McSweeney et al.[15] found that Black women reported higher frequencies for 9 of 12 acute symptoms of myocardial infarction when compared to non-Hispanic White women, including being dizzy or faint, hot/flushed, indigestion, heart racing, numbness in hands/fingers, vomiting, new vision problems, coughing, and choking sensation.

In the WISE study, the differences in symptom presentation also coincided with poorer outcomes in Black women.[6] Despite well-known reductions in morbidity and mortality when patients receive treatment within three hours of symptom onset,[13,16,17] Blacks experiencing ACS symptoms have longer pre-hospital delay times compared to Whites.[18-20]

Additional prehospital delay by Blacks may be a result of limited healthcare access, variations in symptoms, lack of understanding of the significance of symptoms,[6] or socioeconomic status (SES).[20]

Racial Differences in Assessment, Diagnosis, and Treatment

Although Blacks have a higher risk for CHD[8] and have poorer outcomes,[21] initial electrocardiograms, laboratory testing, non-invasive and invasive diagnostic evaluations are completed less often than they are for Whites. When Blacks do present with chest pain, CHD is suspected less often as a cause for the symptoms than for Whites.[13] Additionally, Blacks are less likely to receive any cardiac intervention or percutaneous coronary intervention (PCI) compared to Whites.[2,7,12] Such racial disparities in the management of patients that have been considered ideal candidates for specific therapies are more pronounced than sex disparities according to Vaccarino and colleagues who examined sex and racial differences in the management of acute myocardial infarction over an 8 year period.[11] The researchers analyzed data from 598,911 patients included in the National Registry of Myocardial Infarction between 1994 and 2002. Differences in treatment and mortality were small between White women and White men while differences in management of acute myocardial infarction were greater when patients were compared across race within each sex (Black women vs. White women and Black men vs. White men).[11] Black women had the highest risk for not receiving reperfusion therapy and the highest rates of mortality among the four groups.[11]

In a study conducted by Cohen et al.,[22] fewer Black patients received thrombolytic therapy within recommended timelines or primary PCI within 90 minutes of arrival to the hospital. In addition, smoking cessation counseling[8] and aspirin were prescribed less to Blacks than Whites on discharge.[21,22] According to Leifheit-Limson et al.,[8] younger Blacks were prescribed antihypertensive and lipid-lowering medications less often than younger Whites. An analysis of data collected in the Cooperative Cardiovascular Project, indicates disparities in the medical treatment received by Blacks may be in part due to the differences in the quality of care between hospitals.[23]

Racial Differences in Outcomes

Kataoka et al.,[21] suggested poorer clinical outcomes experienced by Blacks may in part be due to suboptimal control of CHD risk factors. Blacks have a greater risk factor burden than Whites with an increased risk for death from CHD.[2] In addition, Clark & Lingegowda[13] indicate that a delay in presentation to the ED, failure to consider and order diagnostic testing to confirm ACS on the part of clinicians, and less aggressive medical therapy and interventions contribute to poorer outcomes. Since Blacks are often socioeconomically disadvantaged, and may be less likely to afford long-term treatments, engage in physical activity, and maintain a healthy diet, health disparities may actually become more evident after the patient has been discharged from the hospital.[13] Blacks have increased mortality rates, re-hospitalization, and lower quality of life compared to Whites.[22] There is a large body of research that appears to show that Blacks with ACS are disadvantaged, however the mechanisms and circumstances under which that disadvantage is manifested remains unclear. Consequently, we hypothesized that there would be disparities in clinical

presentation (symptoms, and prehospital delay time), treatment (medications and diagnostic procedures), and patient-reported outcomes (clinic visits, calls to clinicians and 911, ED visits, and rehospitalization) between Blacks and Whites presenting to the ED with symptoms suggestive of ACS.

Methods

Each institutional review board approved a waiver of initial consent for electronic screening of patients at triage and to collect symptom data prior to enrollment. A waiver of initial consent was granted to evaluate symptoms on presentation to the ED because patients presenting with possible ACS require emergent care which precluded providing immediate informed consent.

Sample and Setting

Patients in this sample are part of the larger National Institute of Nursing Research sponsored *Think Symptoms* study. Individuals presenting to the ED with symptoms triggering a cardiac evaluation, ≥21 years old, fluent in English, and who arrived by private transportation or emergency medical services were eligible. Patients were excluded if they had an exacerbation of heart failure, were transferred from a hemodialysis facility, were referred for evaluation of a dysrhythmia, or had cognitive impairment, defined as the inability to understand and provide written informed consent. Enrollment occurred between January 2011 and September 2013 in four EDs in the Midwest, West, and Pacific Northwest regions of the US. The centers included three academic medical centers and a large, referral community medical center. The total sample size was 781 patients and included 116 Black (15.0%), 547 White (69.9%), 37 Hispanic (4.7%), 24 Asian (3.1%), 21 multi-racial (2.7%), 15 American Indian/Alaskan Native (1.9%), and 21 of other or unknown ethnicity (2.7%). Only Black and White patients (n=663) were included in the final analyses due to insufficient samples sizes for other ethnic groups.

Measures

ACS Symptom Checklist—The number of symptoms was measured with the validated 13-item ACS Symptom Checklist. The checklist was derived from the Symptoms of Acute Coronary Syndromes Index (SACSI). The SACSI, a reliable (Cronbach's α=0.81)[24] and valid (content validity indexes of 0.88 & 0.94)[25,26] instrument was tested in previous studies. Participants indicate whether the symptom is present or absent on presentation to triage. Symptoms not appearing on the checklist can be recorded in a blank space marked "other". For this study, symptoms were measured dichotomously on admission (yes/no). When the patient was stable and had been admitted to an examination room, symptoms were measured again using a 10-point scale (1-10) to gauge symptom severity. Each symptom is analyzed individually and there is no summary score.

ACS Patient Information Questionnaire—The questionnaire includes patient-reported information on demographic and clinical variables, including symptoms onset, timeline, and distress (scale of 1-10). The questionnaire was designed using the standardized reporting guidelines for studies evaluating ED patients with potential ACS.[27] The criteria were

established by the Multidisciplinary Standardized Reporting Criteria Task Force and are supported by the Society for Academic Medicine, the American College of Emergency Physicians, the American Heart Association, and the American College of Cardiology. The purpose of the questionnaire is to establish standardized reporting criteria that will facilitate study comparisons and meta-analyses.

Froelicher's Health Services Utilization Questionnaire-Revised—The tool measures clinic visits, calls to 911, subsequent visits to the ED, admissions to the hospital, myocardial infarction, stroke, and death. The instrument is a telephone survey that demonstrated initial reliability and validity in Froelicher et al.'s follow-up survey of health care utilization in women with cardiovascular disease.[28] The survey minimizes information bias by using direct telephone interview methods. A calendar was supplied to each patient to facilitate the recording of health events.

Medical Record Review Form—Further information on patient diagnosis, clinical characteristics, and treatment were collected from medical records using a medical records review form designed for the study.

Prehospital Delay—Patients were asked to respond to the question "when did the symptoms responsible for this admission start?" on the ACS Patient Questionnaire. If the patient could not recall the time that symptoms began, the data were abstracted from the medical record. Prehospital delay time was calculated as the time interval from onset of symptoms to registration in the ED. Patients were categorized into one of three groups; 1) ≤ 1 hour; 2) > 1 to ≤ 3 hours; and 3) > 3 to ≤168 hours based on recommendations by the AHA for presentation to the ED (call 911 within 5 minutes of symptom onset) and optimal treatment with PCI (< 3 hours).

Procedures

Study research staff completed the ACS Symptom Checklist shortly after the patient was evaluated in triage. Research staff were blinded to the patients' final diagnosis. Symptoms were assessed within 15 minutes of ED presentation in most cases and enrollment occurred between 7 am and 11 pm every day of the week. Research staff were not available between the hours of 11 pm and 7 am. Patients triggering a cardiac workup were approached by the research staff for enrollment after they were deemed stable by the primary nurse or physician and had been transferred to a private examination room in either the ED or hospital. The study purpose was explained, and once the patient provided written informed consent, additional clinical and individual characteristics were recorded. Initial symptom data were destroyed if the patient declined to participate. Of eligible patients, 16.7% declined to participate, citing fatigue, anxiety, or lack of interest.

Data Analysis

Data analyses were performed using SPSS, Version 19.0 (IBM Corp, Armonk, NY) and STATA (STATA Statistical Software: Release 12. StataCorp LP. College Station, TX:). Significance was set at $p<0.05$ for all statistical procedures. Frequency distributions were assessed for all variables. Bivariate analyses were conducted for differences between Blacks

and Whites on demographic and clinical characteristics, symptom characteristics, prehospital delay time, treatment, and outcomes for those confirmed with ACS and those ruled-out for ACS. Analysis of variance or t-tests were used to compare means for continuously measured variables. Chi-square tests for independence were used to test statistical differences for categorical variables.

A logistic regression model was constructed to determine if symptoms were predictive of an ACS diagnosis and an interaction term for Black race by each symptom was added. In addition, a Cox proportional hazards model was completed to determine predictors of prehospital delay. Prehospital delay times were skewed and a decision was made to exclude 46 of 598 (7.7%) cases with complete data in which the time exceeded 1 week. It was felt that patients reporting symptoms for more than one week may have experienced a prodrome or symptoms unrelated to possible ACS. Predictor variables included race, age, sex, diagnosis (ACS vs. no ACS), diabetes, mean number of symptoms, symptom distress, and symptom onset (gradual vs. abrupt). While diagnosis is generated after the patient's presentation to the ED and so cannot be used as a predictor of behavior; it may serve as a proxy measure of how the patient experiences symptoms and is therefore useful to include in analyses. Prior to analysis, tests of the proportional hazards assumption were performed by examining log-log and Kaplan-Meier plots and by performing tests of Schoenfeld residuals. Further, data were not censored (and hence no informative censoring occurred) as all patients in the study were admitted and received treatment.

Results

Sample Characteristics

Participants (n=663) included 116 non-Hispanic Black patients (17.5%) and 547 non-Hispanic White patients (82.5%). There were no differences between Blacks and Whites in the percentage of those ruled-in versus ruled-out for ACS, type of ACS (unstable angina, non-ST elevation myocardial infarction, or ST elevation myocardial infarction), or sex. More than 80% of the sample had health insurance and rates did not differ by race (Black=80.4% & White=86.6%, p=0.26).

Demographic and Clinical Characteristics by ACS Diagnosis and Race

Racial differences in demographic and clinical characteristics were found for those with a confirmed ACS diagnosis and those ruled-out for ACS (Table 1). For patients with ACS, Blacks were significantly younger than Whites (56.4 years vs. 63.2 years, $p<0.001$), were less likely to attend college (51% vs. 66.8%, p=0.034), and were more likely to have an annual income ≤ $20,000 (40.4% vs. 22.4%, p=.004). Blacks had more hypertension (88.2% vs. 66.2%, p=0.002), higher rates of diabetes (45.1% vs. 25.7%, p=.006), and had a higher mean body mass index then Whites (31.3 vs. 29.2, p=0.041). Blacks with ACS reported more current tobacco use (42% vs. 22.2%, p=0.015). For patients without ACS, Blacks were more likely to have an annual income ≤ $20,000 compared to Whites (51.8% vs. 33.0%, p=.027) and reported more hypertension than Whites (73% vs. 59.5%, p=0.044).

Symptom Characteristics by ACS Diagnosis and Race

There were significant racial differences in the type, number, and severity of symptoms as well as the overall distress experienced as a result of symptoms (Table 2). For patients with ACS, Blacks reported more symptoms and more distress from symptoms than Whites. Blacks were more likely to experience chest pressure, palpitations, and chest pain compared to Whites. Blacks with ACS also reported greater symptom severity for chest pressure, palpitations, chest discomfort, and chest pain compared to Whites. For patients without ACS, Blacks reported more symptoms and more symptom distress compared to Whites. Blacks were more likely to report chest pressure, shoulder pain, chest discomfort, and arm pain compared to Whites. Similarly, Blacks reported higher symptom severity compared to Whites for chest pressure, chest discomfort, arm pain, and chest pain. A logistic regression analysis was performed to determine if symptoms were predictive of an ACS diagnosis by race. Blacks who presented with palpitations (odds ratio [OR]=4.29), unusual fatigue (OR=3.35), and chest pain (OR=3.91) were 3 to 4 times more likely to be confirmed for ACS (Table 3). Conversely, Blacks who experienced lightheadedness (OR=0.29) were less likely than Whites to have a confirmed ACS diagnosis.

Prehospital Delay Time

Patient-reported prehospital delay times ranged from a few minutes to weeks. The distribution of times was positively skewed so median times are reported. Blacks with ACS had longer prehospital delay times (median=5.7 hours) compared to Whites with ACS (2.7 hours). The majority of patients described prehospital delay of 12 hours or less (60%), while the remaining patients reported delay times varying from more than 12 hours up to several weeks. A chi-square analysis was performed using the 3 categories of prehospital delay times (≤ 1 hour; >1 to ≤ 3 hours; and > 3 to ≤ 168 hour). A smaller percentage of Blacks with ACS arrived in the ED > 1 to ≤ 3 hours after symptom onset compared to Whites and a higher percentage arrived at the ED > 3 hours after symptom onset (p=0.048)(Table 4).

A Cox proportional hazards model regression analysis was then performed using the predictor variables of age, race, sex, diabetes, diagnosis, number of symptoms, symptom distress, and symptom onset (gradual vs. abrupt). A history of diabetes (Hazard ratio [HR]=1.23), ACS diagnosis (HR=1.31), fewer symptoms (HR=0.51), greater symptom distress (HR=1.05), and abrupt symptom onset (HR=1.41) were associated with an increased likelihood of presenting to the ED within the next hour (Table 5). Race was not significant in the model.

Treatment

The only significant racial difference in the treatment received by ACS patients was that a higher percentage of Blacks received lidocaine compared to Whites (32.6% vs. 18.8%). For patients ruled-out for ACS, Blacks received more lidocaine, nitroglycerin, morphine sulfate, and atropine and were more likely to receive a stress test. There were no racial differences in cardiac catheterization rates.

Patient Reported Outcomes

For those with ACS, Blacks continued to report a greater number of symptoms (3.3 vs. 2.1, p=.028), at 1 month follow-up, compared to Whites (Table 6). A greater number of Blacks reported experiencing symptoms of chest pressure, sweating, palpitations, chest discomfort, and chest pain compared to Whites. Additionally, Blacks reported a greater mean number of clinic visits at one month. At 6 month follow-up, Blacks continued to report more sweating, palpitations, arm pain, and chest pain than Whites. There were no other differences between Blacks and Whites, with or without ACS, on health services utilization at 6 months.

Discussion

There were numerous differences between Black and White patients (both ruled-in and ruled-out for ACS) in demographic, clinical presentation, and patient-reported outcome variables. Compared to Whites, Blacks were disadvantaged on all statistically significant demographic, clinical, and outcome indices. The most important findings were related to risk factors and clinical presentation. Blacks with ACS were significantly younger than Whites and were more likely to be socioeconomically disadvantaged. Blacks, with and without ACS, reported lower incomes and educational attainment compared to Whites. This is consistent with recent findings by Pollack et al.[29] who reported that an individual living in a high SES neighborhood (75th percentile) have, on average, a 10-year CHD risk that is 0.16 percentage points lower than a similar person residing in a low SES (25th percentile) neighborhood. However, the association was larger in Whites than minorities suggesting that minorities in high SES neighborhoods do not reap the same benefits for CHD risk reduction as Whites. In the current study, Blacks with ACS experienced more hypertension, diabetes, and tobacco use. These findings are congruent with Leifheit-Limson et al.[8] who found that Blacks had a higher prevalence of each of these risk factors compared to Whites, with Black women carrying the highest burden of all groups. Hypertension is a well-established risk factor for CHD and the prevalence of hypertension is higher in Blacks. Stamler et al.[30] proposed that higher body mass index, nutrient intake, and urinary metabolites may be partial explanations for these differences. The fact that these preventable and/or modifiable risk factor disparities persist, despite rapid advances in knowledge and treatments, suggest that greater attention must be paid to culturally-based lifestyle interventions.

Blacks, with and without ACS, reported more symptoms, higher symptom severity, and more distress from symptoms. Of note, there was an interaction effect for Black race and diagnosis. Blacks presenting with palpitations, unusual fatigue, and chest pain were significantly more likely than Whites to be confirmed for ACS. This may reflect the higher burden of comorbid conditions, mechanisms of ACS, or be related to dysrhythmia. Blacks have demonstrated lower frequencies of obstructive coronary artery disease at angiography[31] therefore transient occlusion, endothelial dysfunction, and coronary vasospasm may be common in Blacks and affect the symptom experience. Similarly, Blacks ruled-out for ACS in our study, reported higher symptom severity compared to Whites for chest pressure, chest discomfort, arm pain, and chest pain. This contrasts with prior studies that showed no racial difference in symptom occurrence or distress.[26,32]

Finally, consistent with Zerwic et al.[20], in unadjusted analyses, Blacks in our study were more likely to delay greater than the 3 hours recommended for PCI to be successful. Our findings were also similar to Deshmukh et al.[16] who examined a sample of four ethnic minority groups in New York and found that Haitians, Caribbeans, African Americans and Hispanics all delayed significantly longer than the recommended 3 hours for reperfusion therapy. However, after adjusting for multiple factors known to increase prehospital delay, including race, age, sex, diabetes, diagnosis, number of symptoms, symptom distress, and abrupt vs. gradual symptom onset, race was not a significant predictor in our study. The presence of diabetes, ACS diagnosis, and abrupt onset of symptoms were associated with shorter prehospital delay. Similarly, recent studies have reported that ACS diagnosis[33] and "fast" onset of symptoms[34] are associated with shorter delay times. Our results were inconsistent with those reported in a Scientific Statement from the American Heart Association which reported that old age, female sex, low education, low socioeconomic status, and Black race were associated with delay in seeking treatment for ACS.[18] However, the scientific statement was based on evidence compiled from multiple studies using a variety of designs.

The only significant racial difference in the treatment received by ACS patients was that a higher percentage of Blacks received lidocaine compared to Whites. No studies were found related to this finding however lidocaine, a class IB antiarrhythmic drug, has a class IIb recommendation (benefit > risk) for the treatment of sustained ventricular tachycardia in the presence of ST segment elevation myocardial infarction.[35] It is possible Black patients in our sample experienced more arrhythmia but rhythm disturbances were not measured. We did not find any racial differences in rates of revascularization in contrast to Freund et al.[2] who found lower rates of revascularization for Blacks, adjusting for demographics and comorbidities, in a secondary analysis of Medicare beneficiaries. Rathore et al.[36] found that reperfusion rates were similar for Blacks and Whites in the Northeast, Midwest, and West. The only difference in reperfusion rates occurred in the South where Blacks had lower reperfusion rates (64.5% vs. 71.7%, −7.1% racial difference, 99% confidence interval −8.7 to −5.6%) compared to Whites. Patients in our study were recruited from the Midwest, West, and Pacific Northwest regions of the U.S.

Finally, Blacks experienced poorer outcomes one month following discharge from the hospital including reports of more symptoms and more visits to the clinic but overall, there were more similarities than differences in outcomes across race. Our findings are similar to Spertus et al.[37] and Barnato et al.[23] who found racial differences in outcomes following ACS that did not persist after adjustment for site of care. Differences in site of care in this study, including academic vs. non-academic hospital, rural vs. urban setting, and geographic regions provide plausible explanations for disparities between Blacks and Whites in unadjusted analysis that disappeared in multivariable analysis. We consider the multi-site design of this study to be a strength as the heterogeneous sample allows for generalization of findings to other cohorts however a trade-off may be confounding of results because of hospital effects on patient outcomes.[23]

Implications for Future Research

Many studies have examined sex[26,38] and age[39] differences in clinical presentation for ACS but very few studies have compared the clinical presentation between Blacks and Whites.[6,14,15] In some cases, small cohorts may preclude analyses by ethnic/racial subgroups as in our study, however more research is needed to determine if there are significant racial differences in presentation, diagnosis, and treatment of ACS so that appropriate interventions can be applied to reduce health disparities.[2,22] Decades of research into risk factors and patient outcomes have led to many evidence-based guidelines for care yet disparities in risk factor prevalence between Blacks and Whites in our study are pronounced and troubling. Therefore, more study of individual biological and social factors is warranted to determine the cause for these persistent disparities. For example, hypertension has an earlier onset, is more prevalent in Blacks, and may explain up to 50% of additional mortality compared to Whites.[40] Yet despite numerous interventional studies, prevalence of hypertension has not substantially decreased in Blacks.

Strengths

The prospective study design allowed for a comprehensive picture of symptoms from presentation in the ED as they were occurring through six months following enrollment. This symptom trajectory in patients receiving a cardiac workup in the ED has not been previously reported. The ability to capture symptom data in real time eliminates bias due to recall and sensitization to symptom jargon used by clinicians. The large heterogeneous sample is also a strength of the study. Blacks comprised 17.5% of all participants, a slightly higher percentage than the US population (13.1%) according to the 2010 census.[40] The sample also included urban, suburban, and rural residents from four regions of the U.S. The use of a brief, validated symptom checklist derived from large heterogeneous samples of patients that can be used for clinical assessment as well as research is also strength of the study.

Limitations

There were limitations to the study including an insufficient number of Blacks to conduct sex-specific analyses. Patients were not enrolled between the hours of 11 pm and 7 am so it is possible that patients presenting during the night hours may vary in symptoms and other characteristics. Enrollment was based on the triage nurses' decision to begin a diagnostic work-up for ACS. Therefore, some patients with true ACS may have been missed. Caution is called for in generalizing findings outside of the ED. Individuals who sought care in the ED were a select group that made a conscious decision, alone or in consultation with others, to get care for symptoms judged to be serious. Therefore, racial differences may be ascribed to selection bias associated with decision-making rather than true pathophysiologic or psychosocial differences.

Conclusions

Significant disparities in education, income, hypertension, diabetes, body mass index, tobacco use, prehospital delay times, symptom severity, symptom management, and clinic visits for Blacks and Whites following presentation to the ED for symptoms suggestive of

ACS persist despite a decrease in mortality rates and a plethora of prior data on racial disparities. For every disparity identified in this study, Blacks were at a disadvantage. Identification of these racial disparities may open new lines of inquiry focused on design and testing of patient-centered interventions for those with a history of or at risk for ACS. Further research on differences in clinical presentation and outcomes between Blacks and Whites with ACS is warranted to reduce disparities.

Acknowledgments

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Abbreviations List

ACS	acute coronary syndrome
CHD	coronary heart disease
ED	emergency department
OR	odds ratio
PCI	percutaneous coronary intervention
SACSI	Symptoms of Acute Coronary Syndromes Index
SES	socioeconomic status
WISE	Women's Ischemic Symptoms Evaluation study

References

1. Avendano MKI. Why do American have Shorter Life Expectancy and Worse Health Than Do People in Other High-Income Countries. Annu Rev Public Health. 2014; 35:23.21–23.19.
2. Freund KM, Jacobs AK, Pechacek JA, White HF, Ash AS. Disparities by race, ethnicity, and sex in treating acute coronary syndromes. J Womens Health (Larchmt). Feb; 2012 21(2):126–132. [PubMed: 22032760]
3. Healthy People 2020. [Accessed January 4th, 2014] Foundation Health Measures: Disparities. [Website]. http://healthypeople.gov/2020/about/DisparitiesAbout.aspx
4. Go AS, Mozaffarian D, Roger VL, et al. Heart Disease and Stroke Statistics--2014 Update: A Report From the American Heart Association. Circulation. Dec 18.2013
5. Saez E. Striking It Richer: The Evolution of Top Incomes in the United States. Pathways Magazine. 2008; Vol Winter: Stanford Center for the Study of Poverty and Inequality:6–7.
6. Eastwood JA, Johnson BD, Rutledge T, et al. Anginal symptoms, coronary artery disease, and adverse outcomes in Black and White women: the NHLBI-sponsored Women's Ischemia Syndrome Evaluation (WISE) study. J Womens Health (Larchmt). Sep; 2013 22(9):724–732. [PubMed: 23992103]
7. Cram P, Bayman L, Popescu I, Vaughan-Sarrazin MS. Racial disparities in revascularization rates among patients with similar insurance coverage. J Natl Med Assoc. Nov; 2009 101(11):1132–1139. [PubMed: 19998642]
8. Leifheit-Limson EC, Spertus JA, Reid KJ, et al. Prevalence of traditional cardiac risk factors and secondary prevention among patients hospitalized for acute myocardial infarction (AMI): variation by age, sex, and race. J Womens Health (Larchmt). Aug; 2013 22(8):659–666. [PubMed: 23841468]

9. Centers for Disease Control and Prevention. [Accessed January 4th, 2014] Minority Health: Black or African American Populations. [Website]. http://www.cdc.gov/minorityhealth/populations/REMP/black.html
10. Asher CR, Topol EJ, Moliterno DJ. Insights into the pathophysiology of atherosclerosis and prognosis of black Americans with acute coronary syndromes. Am Heart J. Dec; 1999 138(6 Pt 1): 1073–1081. [PubMed: 10577437]
11. Vaccarino V, Rathore SS, Wenger NK, et al. Sex and racial differences in the management of acute myocardial infarction, 1994 through 2002. N Engl J Med. Aug 18; 2005 353(7):671–682. [PubMed: 16107620]
12. Safford MM, Brown TM, Muntner PM, et al. Association of race and sex with risk of incident acute coronary heart disease events. JAMA. Nov 7; 2012 308(17):1768–1774. [PubMed: 23117777]
13. Clark LT, Lingegowda U. Acute coronary syndromes in black Americans: is treatment different? Should it be? Curr Cardiol Rep. Jul; 2005 7(4):249–254. [PubMed: 15987621]
14. Hravnak M, Whittle J, Kelley ME, et al. Symptom expression in coronary heart disease and revascularization recommendations for Black and White patients. Am J Public Health. Sep; 2007 97(9):1701–1708. [PubMed: 17329655]
15. McSweeney JC, O'Sullivan P, Cleves MA, et al. Racial differences in women's prodromal and acute symptoms of myocardial infarction. Am J Crit Care. 2010; 19(1):63–73. [PubMed: 20045850]
16. Deshmukh M, Joseph MA, Verdecias N, Malka ES, LaRosa JH. Acute coronary syndrome: factors affecting time to arrival in a diverse urban setting. J Community Health. Dec; 2011 36(6):895–902. [PubMed: 21877106]
17. Bates ER, Jacobs AK. Time to treatment in patients with STEMI. New Engl J Med. 2013; 369(10): 889–892. [PubMed: 24004114]
18. Moser DK, Kimble LP, Alberts MJ, et al. Reducing delay in seeking treatment by patients with acute coronary syndrome and stroke: a scientific statement from the American Heart Association Council on cardiovascular nursing and stroke council.[Reprint in J Cardiovasc Nurs. 2007 Jul-Aug;22(4):326-43; PMID: 17589286]. Circulation. 2006; 114(2):168–182. [PubMed: 16801458]
19. Sheifer SE, Rathore SS, Gersh BJ, et al. Time to presentation with acute myocardial infarction in the elderly: associations with race, sex, and socioeconomic characteristics. Circulation. Oct 3; 2000 102(14):1651–1656. [PubMed: 11015343]
20. Zerwic JJ, Ryan CJ, DeVon HA, Drell MJ. Treatment seeking for acute myocardial infarction symptoms: differences in delay across sex and race. Nurs Res. 2003; 52(3):159–167. [PubMed: 12792256]
21. Kataoka Y, Hsu A, Wolski K, et al. Progression of coronary atherosclerosis in African-American patients. Cardiovasc Diagn Ther. Sep; 2013 3(3):161–169. [PubMed: 24282765]
22. Cohen MG, Fonarow GC, Peterson ED, et al. Racial and ethnic differences in the treatment of acute myocardial infarction: findings from the Get With the Guidelines-Coronary Artery Disease program. Circulation. Jun 1; 2010 121(21):2294–2301. [PubMed: 20479153]
23. Barnato AE, Lucas FL, Staiger D, Wennberg DE, Chandra A. Hospital-level racial disparities in acute myocardial infarction treatment and outcomes. Med Care. Apr; 2005 43(4):308–319. [PubMed: 15778634]
24. DeVon HA, Ryan CJ, Rankin SH, Cooper BA. Classifying subgroups of patients with symptoms of acute coronary syndromes: A cluster analysis. Res Nurs Health. Oct; 2010 33(5):386–397. [PubMed: 20672306]
25. DeVon HA, Zerwic JJ. The symptoms of unstable angina: do women and men differ? Nurs Res. Mar-Apr;2003 52(2):108–118. [PubMed: 12657986]
26. DeVon HA, Ryan CJ, Ochs AL, Shapiro M. Symptoms across the continuum of acute coronary syndromes: differences between women and men. Am J Crit Care. 2008; 17(1):14–24. quiz 25. [PubMed: 18158385]
27. Hollander JE, Blomkalns AL, Brogan GX, et al. Standardized reporting guidelines for studies evaluating risk stratification of ED patients with potential acute coronary syndromes. Acad Emerg Med. 2004; 11(12):1331–1340. [PubMed: 15576525]

28. Froelicher ES, Sohn M, Max W, Bacchetti P. Women's Initiative for Nonsmoking-VII: Evaluation of health service utilization and costs among women smokers with cardiovascular disease. J Cardiopulm Rehabil. Jul-Aug;2004 24(4):218–228. [PubMed: 15286526]
29. Pollack CE, Slaughter ME, Griffin BA, Dubowitz T, Bird CE. Neighborhood socioeconomic status and coronary heart disease risk prediction in a nationally representative sample. Public Health. Oct; 2012 126(10):827–835. [PubMed: 23083844]
30. Stamler J, Brown IJ, Yap IK, et al. Dietary and urinary metabonomic factors possibly accounting for higher blood pressure of black compared with white Americans: results of International Collaborative Study on macro-/micronutrients and blood pressure. Hypertension. Dec; 2013 62(6): 1074–1080. [PubMed: 24101663]
31. Chokshi NP, Iqbal SN, Berger RL, et al. Sex and race are associated with the absence of epicardial coronary artery obstructive disease at angiography in patients with acute coronary syndromes. Clin Cardiol. Aug; 2010 33(8):495–501. [PubMed: 20734447]
32. Klingler D, Green-Weir R, Nerenz D, et al. Perceptions of chest pain differ by race. Am Heart J. 2002; 144(1):51–59. [PubMed: 12094188]
33. DeVon HA, Hogan N, Ochs AL, Shapiro M. Time to treatment for acute coronary syndromes: the cost of indecision. J Cardiovasc Nurs. 2010; 25(2):106–114. [PubMed: 20142752]
34. O'Donnell S, McKee G, Mooney M, O'Brien F, Moser DK. Slow-onset and fast-onset symptom presentations in acute coronary syndrome (ACS): New perspectives on prehospital delay in patients with ACS. J Emerg Med. Oct 11.2013
35. Antman EM, Anbe DT, Armstrong PW, et al. ACC/AHA guidelines for the management of patients with ST-elevation myocardial infarction; A report of the American College of Cardiology/ American Heart Association Task Force on Practice Guidelines (Committee to Revise the 1999 Guidelines for the Management of patients with acute myocardial infarction). J Am Coll Cardiol. Aug 4; 2004 44(3):E1–E211. [PubMed: 15358047]
36. Rathore SS, Frederick PD, Every NR, Barron HV, Krumholz HM. Racial differences in reperfusion therapy use in patients hospitalized with myocardial infarction: a regional phenomenon. Am Heart J. Jun; 2005 149(6):1074–1081. [PubMed: 15976791]
37. Spertus JA, Jones PG, Masoudi FA, Rumsfeld JS, Krumholz HM. Factors associated with racial differences in myocardial infarction outcomes. Ann Intern Med. Mar 3; 2009 150(5):314–324. [PubMed: 19258559]
38. Khan NA, Daskalopoulou SS, Karp I, et al. Sex differences in acute coronary syndrome symptom presentation in young patients. JAMA Intern Med. Nov 11; 2013 173(20):1863–1871. [PubMed: 24043208]
39. Nguyen HL, Gore JM, Saczynski JS, et al. Age and sex differences and 20-year trends (1986 to 2005) in prehospital delay in patients hospitalized with acute myocardial infarction. Circ Cardiovasc Qual Outcomes. Nov; 2010 3(6):590–598. [PubMed: 20959564]
40. United States Census Bureau. [Accessed January 4th, 2014] USA Quick Facts. [Website]. http://quickfacts.census.gov/qfd/states/00000.html

Table 1

Demographic and Clinical Characteristics by Diagnosis and Race

	ACS			No ACS		
	Black (n=51)	**White (n=232)**	**P**	**Black (n=65)**	**White (n=315)**	**p**
Age-mean (SD)	56.4 (11.6)	63.2 (12.2)	**<.001**	57.3 (14.6)	60.2 (15.4)	.157
Females- n (%)	18 (35.3)	61 (26.3)	.194	35 (53.8)	141 (44.9)	.188
Education- n (%)			**.034**			.169
HS diploma or less	25 (49.0)	74 (33.2)		25 (39.7)	92 (30.8)	
Some college or more	26 (51.0)	149 (66.8)		38 (60.3)	207 (69.2)	
Annual Income- n (%)			**.004**			**.027**
≤20,000	19 (40.4)	44 (22.4)		29 (51.8)	92 (33.0)	
20,001-50,000	20 (42.6)	72 (36.7)		13 (23.2)	86 (30.8)	
>50,000	8 (17.0)	80 (40.8)		14 (25.0)	101 (36.2)	
Insurance- n (%)			.255			.580
Insured	41 (80.4)	188 (86.6)		56 (88.9)	258 (86.3)	
Not Insured	10 (19.6)	29 (13.4)		7 (11.1)	41 (13.7)	
Diagnosis- n (%)			.759			
Unstable Angina	13 (26.0)	46 (20.2)				
NSTEMI	30 (60.0)	115 (50.4)				
STEMI	7 (14.0)	67 (29.4)				
Hypertension- n (%)	45 (88.2)	147 (66.2)	**.002**	46 (73.0)	176 (59.5)	**.044**
Diabetes- n (%)	23 (45.1)	57 (25.7)	**.006**	20 (31.7)	75 (25.0)	.268
Hypercholesterolemia- n (%)	36 (73.5)	132 (60.3)	.084	31 (50.0)	130 (45.0)	.472
Body Mass Index- mean (SD)	31.3 (6.6)	29.2 (6.6)	**.041**	30.8 (7.9)	30.4 (7.7)	.673
Tobacco Use- n (%)			**.015**			.388
No tobacco use	18 (36.0)	109 (50.5)		40 (64.5)	166 (56.5)	
Current tobacco use	21 (42.0)	48 (22.2)		8 (12.9)	58 (19.7)	
Previous tobacco use	11 (22.0)	59 (27.3)		14 (22.6)	70 (23.8)	
Cocaine Use	7 (13.7)	18 (8.1)	.206	2 (3.2)	12 (4.0)	.750

Notes: ACS is acute coronary syndrome. SD is standard deviation. HS is high school. NSTEMI is non-ST elevation myocardial infarction. STEMI is ST elevation myocardial infarction.

Table 2

Symptom Characteristics by Diagnosis and Race

	ACS			Non-ACS		
	Black (n=51)	White (n=232)	p	Black (n=65)	White (n=315)	p
Occurrence of Symptom-n (%)*						
Chest Pressure	42 (82.4)	142 (63.7)	**.010**	45 (71.4)	173 (57.5)	**.040**
Shoulder Pain	21 (41.2)	69 (30.9)	.160	33 (52.4)	93 (30.9)	**.001**
Sweating	16 (31.4)	86 (38.6)	.338	24 (38.1)	90 (29.9)	.202
Palpitations	21 (41.2)	38 (17.1)	**.000**	20 (31.7)	84 (27.9)	.540
Chest Discomfort	41 (80.4)	155 (69.5)	.120	52 (82.5)	190 (63.1)	**.003**
Upper Back Pain	14 (27.5)	40 (17.9)	.123	19 (30.2)	94 (31.2)	.867
Shortness of Breath	28 (54.9)	105 (47.1)	.314	39 (61.9)	184 (61.1)	.909
Arm Pain	20 (39.2)	83 (37.2)	.791	31 (49.2)	83 (27.6)	**.001**
Unusual Fatigue	23 (45.1)	78 (35.0)	.177	29 (46.0)	161 (53.5)	.281
Nausea	20 (39.2)	75 (33.6)	.450	27 (42.9)	111 (36.9)	.374
Lightheadedness	19 (37.3)	83 (37.4)	.986	35 (55.6)	143 (47.5)	.245
Chest Pain	44 (86.3)	157 (70.4)	**.021**	44 (69.8)	179 (59.5)	.124
Indigestion	11 (21.6)	51 (22.9)	.841	19 (30.2)	68 (22.6)	.200
Severity of Symptom- mean (SD)**						
Chest Pressure	5.0 (3.3)	3.3 (2.7)	**.015**	5.8 (2.4)	4.7 (2.4)	**.010**
Shoulder Pain	4.3 (3.5)	4.6 (3.0)	.832	5.3 (2.0)	5.2 (2.4)	.971
Sweating	5.3 (4.0)	4.3 (3.3)	.498	4.2 (2.6)	4.6 (2.7)	.614
Palpitations	6.1 (2.0)	3.6 (2.9)	**.018**	4.8 (2.4)	5.2 (2.5)	.494
Chest Discomfort	5.6 (3.0)	3.7 (2.9)	**.011**	6.0 (2.0)	5.0 (2.5)	**.003**
Upper Back Pain	5.6 (3.2)	3.8 (2.4)	.101	5.0 (2.6)	5.5 (2.5)	.422
Shortness of Breath	5.4 (2.0)	4.9 (2.8)	.566	5.8 (2.5)	5.2 (2.7)	.206
Arm Pain	6.0 (3.2)	4.3 (2.6)	.104	5.5 (2.2)	4.4 (2.2)	**.041**
Unusual Fatigue	5.8 (2.9)	5.3 (2.5)	.506	6.4 (2.3)	6.1 (2.5)	.526
Nausea	4.7 (1.7)	4.7 (2.7)	.938	4.9 (2.5)	5.5 (2.9)	.344
Lightheadedness	4.4 (2.7)	4.3 (2.8)	.918	5.0 (2.5)	4.8 (2.7)	.647
Chest Pain	6.2 (3.1)	4.2 (3.1)	**.024**	6.1 (2.2)	5.2 (2.7)	**.032**
Indigestion	5.1 (3.2)	4.0 (2.6)	.336	5.6 (2.1)	5.1 (2.7)	.471
Symptom Distress- mean (SD)	8.1 (2.1)	7.1 (2.7)	**.005**	7.6 (2.1)	6.7 (2.5)	**.009**
Number of Symptoms- mean (SD)	6.6 (3.7)	5.5 (2.7)	**.018**	6.9 (3.3)	5.8 (3.1)	**.011**

*Notes: Denotes symptoms measured on presentation to ED triage.

**Denotes symptoms measured when patients were admitted to an examination room in the ED. SD is standard deviation.

Table 3

Prediction of ACS Diagnosis by Symptom with a Black Race by Symptom Interaction Term

Symptoms	OR (n=636)	p
Shoulder pain	1.01 (0.64, 1.57)	0.978
Sweating	**1.77 (1.16, 2.69)** **	**0.008**
Chest Pressure	1.35 (0.86, 2.11)	0.191
Palpitations	**0.55 (0.34, 0.89)** *	**0.016**
Nausea	0.93 (0.60, 1.44)	0.747
Unusual fatigue	**0.53 (0.35, 0.80)** **	**0.002**
Arm pain	**1.64 (1.06, 2.53)** *	**0.026**
Shortness of breath	0.67 (0.45, 1.00)	0.051
Upper back pain	**0.47 (0.29, 0.74)** **	**0.001**
Chest Discomfort	1.10 (0.66, 1.81)	0.720
Indigestion	1.16 (0.72, 1.85)	0.548
Chest pain	1.40 (0.88, 2.22)	0.156
Lightheadedness	0.88 (0.57, 1.36)	0.571
Symptom Interaction Term (Black Race by Symptom)		
Black Race	0.43 (0.11, 1.64)	0.219
Black × Shoulder Pain	0.47 (0.14, 1.53)	0.208
Black × Sweating	0.62 (0.21, 1.83)	0.383
Black × Chest Pressure	2.17 (0.64, 7.32)	0.211
Black × Palpitations	**4.29 (1.42, 12.97)** **	**0.010**
Black × Nausea	1.29 (0.42, 3.91)	0.655
Black × Unusual fatigue	**3.35 (1.03, 10.89)** *	**0.044**
Black × Arm pain	0.45 (0.14, 1.39)	0.164
Black × Shortness of breath	1.43 (0.52, 3.96)	0.493
Black × Upper arm Pain	1.73 (0.57, 5.24)	0.331
Black × Chest discomfort	0.42 (0.10, 1.72)	0.226
Black × Indigestion	0.56 (0.18, 1.79)	0.331
Black × Chest Pain	**3.91 (1.04, 14.60)** *	**0.043**
Black × Lightheadedness	**0.29 (0.09, 0.94)** *	**0.039**
Pseudo R^2	0.77	

Notes: ACS is acute coronary syndrome.

** $p<0.01$,

* $p<0.05$, OR = odds ratio.

Table 4

Prehospital Delay by ACS Diagnosis and Race

	ACS			Non-ACS		
	Black (n=51)	**White (n=213)**	**p**	**Black (n=65)**	**White (n=314)**	**p**
Prehospital Delay- Median Hours	5.65	2.67		5.35	6.50	
Prehospital Delay- Hour Cut-points						
≤1 hour	10 (19.6%)	43 (20.2%)	**.048**	13 (20.0%)	32 (10.2%)	.100
> 1 to ≤ 3 hours	6 (11.8%)	53 (24.9%)		10 (15.4%)	56 (17.8%)	
> 3 to ≤ 168 hours	31 (60.8%)	89 (41.8%)		30 (46.2%)	159 (50.6%)	
>1 week (not included)	1 (2.0%)	11 (5.2%)		5 (7.7%)	19 (6.1%)	
Missing Delay Time	3 (5.9%)	17 (8.0%)		7 (10.8%)	48 (15.3%)	

Note: ACS is acute coronary syndrome. ED is emergency department. Prehospital delay is defined as time of symptom onset until registration in the ED.

Table 5

Predictors of Prehospital Delay

Predictor	Hazard Ratio	95% CI		p-value
Black Race	1.07	0.85	1.32	0.590
Age	1.00	1.00	1.01	0.260
Sex	0.93	0.78	1.12	0.470
Diabetes	1.23	1.01	1.49	**0.036**
ACS Diagnosis	1.31	1.09	1.56	**0.003**
Greater number of symptoms	0.51	0.44	0.61	**0.001**
Greater symptom distress	1.05	1.01	1.08	**0.015**
Abrupt (vs. gradual) symptom onset	1.41	1.18	1.68	**0.001**

Note: CI is confidence interval. ACS is acute coronary syndrome.

Hazard ratios > 1 indicate decreased delay time. Hazard ratios < 1 indicate increased delay time.

Table 6

Clinical and Health Services Utilization Outcomes at 1 Month and 6 Months

	1 Month						6 Months					
	ACS			Non-ACS			ACS			Non-ACS		
	Black (n=39)	White (n=160)	p	Black (n=43)	White (n=211)	p	Black (n=24)	White (n=125)	p	Black (n=33)	White (n=180)	p
Number of Clinic Visits- mean (SD)	2.4 (1.7)	1.9 (1.6)	**.049**	1.1 (1.1)	2.1 (2.5)	**.000**	2.8 (2.4)	4.1 (5.7)	.251	6.3 (13.0)	5.0 (5.7)	.366
Calls to MD or NP- mean (SD)	0.8 (1.1)	0.7 (1.1)	.488	1.0 (1.3)	1.1 (2.9)	.798	0.6 (1.5)	1.2 (2.9)	.301	1.6 (2.2)	2.0 (5.5)	.672
911 Calls- mean (SD)	0.1 (0.3)	0.1 (0.3)	.404	0.1 (0.5)	0.1 (0.7)	.990	0.1 (0.6)	0.1 (0.4)	.824	0.2 (0.8)	0.2 (0.8)	.730
Visits to ED- mean (SD)	0.3 (0.5)	0.2 (0.6)	.802	0.3 (0.7)	0.2 (0.5)	.259	0.3 (0.8)	0.4 (1.0)	.712	0.4 (1.1)	1.0 (3.2)	.327
Overnight Hospital Stay- mean (SD)	0.1 (0.3)	0.1 (0.3)	.970	0.1 (0.4)	0.1 (0.4)	.946	0.1 (0.3)	0.1 (0.3)	.978	0.3 (0.5)	0.2 (0.4)	.304
Number of Symptoms- mean (SD)	3.3 (3.0)	2.1 (2.4)	**.028**	4.0 (3.5)	3.4 (3.3)	.321	3.0 (3.7)	1.5 (2.4)	.072	3.1 (3.2)	3.0 (3.4)	.881
Presence of Symptoms- n (%)												
Chest Pressure	12 (32.4)	18 (11.5)	**.002**	15 (34.9)	56 (26.5)	.266	6 (25.0)	13 (10.6)	.054	5 (15.2)	44 (24.7)	.232
Shoulder Pain	6 (16.2)	27 (17.3)	.874	17 (39.5)	59 (28.1)	.136	7 (29.2)	17 (13.8)	.063	11 (33.3)	41 (23.0)	.207
Sweating	9 (24.3)	18 (11.5)	**.042**	18 (42.9)	50 (23.7)	**.011**	6 (25.0)	12 (9.8)	**.037**	5 (15.2)	34 (19.2)	.582
Palpitations	10 (27.0)	16 (10.3)	**.007**	6 (14.0)	44 (21.1)	.288	5 (20.8)	9 (7.3)	**.039**	6 (18.2)	36 (20.2)	.787
Chest Discomfort	15 (40.5)	32 (20.4)	**.010**	19 (44.2)	66 (31.3)	.102	6 (25.0)	19 (15.4)	.255	7 (21.2)	46 (25.8)	.573
Upper Back Pain	6 (16.2)	23 (14.8)	.833	11 (25.6)	56 (26.5)	.897	4 (16.7)	9 (7.3)	.140	10 (30.3)	42 (23.6)	.412
Shortness of Breath	12 (32.4)	44 (28.2)	.610	13 (30.2)	83 (39.9)	.235	7 (29.2)	22 (17.9)	.204	11 (33.3)	56 (31.6)	.848
Arm Pain	9 (24.3)	19 (12.3)	.062	10 (23.3)	36 (17.1)	.336	5 (21.7)	10 (8.1)	**.048**	5 (15.6	36 (20.2)	.546
Unusual Fatigue	7 (18.9)	39 (25.0)	.435	18 (41.9)	61 (28.9)	.095	6 (25.0)	20 (16.3)	.305	11 (33.3)	42 (23.6)	.236
Nausea	3 (8.1)	13 (8.4)	.948	9 (21.4)	43 (20.6)	.901	4 (16.7)	9 (7.3)	.140	6 (18.2)	36 (20.2)	.787
Lightheadedness	13 (35.1)	38 (24.5)	.189	9 (20.9)	67 (31.9)	.153	5 (20.8)	22 (17.9)	.733	5 (15.2)	56 (31.6)	.055
Chest Pain	12 (32.4)	21 (13.5)	**.006**	13 (30.2)	50 (23.7)	.366	7 (29.2)	12 (9.8)	**.010**	6 (18.2)	30 (16.9)	.852
Indigestion	7 (18.9)	27 (17.4)	.830	10 (23.3)	45 (21.4)	.791	5 (20.8)	13 (10.7)	.166	12 (36.4)	52 (29.5)	.436

Notes: ACS is acute coronary syndrome. SD is standard deviation. ED is emergency department.