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Disparities in Emergency Department Quality of Care among Patients with and without Coronary Heart Disease Diagnoses

A dissertation submitted in partial satisfaction of the requirements for the degree

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by

Jitka Sammartinova

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ABSTRACT OF THE DISSERTATION

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Professor Deborah C. Glik, Chair

This study investigated predictors of emergency department quality of care using the indicator of wait time to see a health care provider. Prior evidence shows that quality of care may vary by patient characteristics, with poorer outcomes among women and minority populations. Given as well the burden of acute coronary syndrome and the need to treat it quickly, the aim of this work was to study whether the amount of time patients waited in the emergency department varied by patient characteristics, with specific attention to patient gender and presenting with symptoms of coronary heart disease. Primary research hypotheses tested whether women and patients with minority population status had longer wait times compared to men and non-minority patients, while controlling for the contextual factors related to the patient visit. Study research questions were addressed using a large-scale population-based survey, the Emergency Department dataset of the National Hospital Ambulatory Medical Care Survey collected in 2008. Predictors of emergency department wait time were selected based on prior research. Development of the conceptual model that guided the study analysis applied the theoretical perspective of social stratification with focus on health disparities.

Study findings revealed that the length of time patients must wait to see a physician in a hospital emergency department can be predicted from a cluster of factors descriptive of the patient visit. In general, patient wait time is associated with the situational nature of the visit, structural characteristics of the hospital, as well as the characteristics of the patients themselves. Patients who wait a longer time are more likely to be women, African American, and poor. Among patients with coronary heart disease diagnoses at the time of visit to the emergency department, the amount of time people wait is associated with situational characteristics of the patient visit, and structural characteristics of the hospital, but patient sociodemographic characteristics are not significant predictors.

Among patients in general longer emergency department wait time for women patients, African American patients and the poor could indicate systematic biases and lower quality of care. However, when considering the specific context of seeking care among patients with coronary heart disease diagnoses, no significant gender differentials in wait time were found.

The dissertation of Jitka Sammartinova is approved.

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To my family with love

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CHAPTER 1. RESEARCH PURPOSE

1.1 Introduction

In the United States (U.S.) differential outcomes in health and health care that are based on patient sociodemographic status have been documented for the past two centuries.[1] The U.S. Department of Health and Human Services (USDHHS) defines health disparities as unequal burden in disease morbidity and mortality experienced by population minority groups as opposed to dominant groups.[1,2] Causes of health disparities are believed to be tied to environmental factors, education level and health behaviors, and as such, they relate to the access to, and utilization of, adequate health care.[1,2] Health disparities are most commonly reported in contemporary chronic health conditions, namely heart disease, cancer and diabetes.[1] Compared to Whites, patients with racial and ethnic minority status are more likely to experience poorer health, and more chronic diseases, functional limitations, and mortality.[1-6] Differences in health outcomes by gender have been observed as well. Women compared to men are likely to have more non-fatal chronic conditions and functional impairment.[1,7-13] Patient socioeconomic characteristics are tied to health outcomes, in that the socially disadvantaged have historically suffered greater burden compared to the wealthiest and most educated. [14] Even those with intermediate income and education achievement have worse health compared to the upper socioeconomic class.[14] Women and African Americans, for example, have had unequal access to social resources, such as education, employment and wealth as a result of social stratification.[9,15] However, generally, it is the socially disadvantaged and minority populations who have experienced a greater burden of social inequality in regards to health.[15] Together with the economic burden, minority populations experience a poorer health and quality of life. [6,9-14,16]

Disparities in health care, on the other hand, are defined as the differences in the quality of care that are not related to access to care.[17] Consequently, causal factors of health care disparities are not patient clinical needs or appropriateness of treatment, but rather they relate to the role of patient sociodemographic characteristics, patient-physician relationships and bias in the provision of care.[1,17] The quality of care Americans receive has been shown to vary by patient gender, race and ethnicity.[18] Being a woman or a member of a racial or ethnic minority has been linked to lower quality of care.[18]

Disparities in health and health care have been most commonly studied and observed in heart disease.[1] Cardiovascular disease is the main cause of death among women and men in the developed world.[19-25] While more men than women are diagnosed with cardiovascular disease overall, a greater percentage of women than men die of cardiovascular disease every year. [19,25-27] Racial and ethnic differences in the prevalence of heart disease exist, with African Americans and Hispanics suffering greater burden compared to Whites, and minority women suffering a greater burden compared to White women.[26,27] Despite these findings, fewer women than men have been included in cardiovascular research,[25,28] fewer women who experience coronary artery symptoms tend to be properly diagnosed with coronary heart disease, [25,28,31,32] physicians appear to be less certain of a coronary heart disease diagnosis in women,[29,30,32] fewer women with coronary symptoms, compared to men, are referred for cardiac diagnostic testing [25,28,32] even though women are more likely to present with chest pain in general, [33,34] and women are less likely to have coronary artery procedures and are more likely to die in the hospital.[35]

Women themselves have also undervalued their susceptibility to heart disease. [36-38] Even though heart disease is the leading cause of death in developed world populations overall, women underestimate their risk of coronary heart disease and heart attack, and perceive they are more likely to die from cancer.[36-38] Yet, ten times more women die from a cardiovascular disease-related condition compared to breast cancer every year.[19] Women's lack of accurate knowledge about their susceptibility to heart disease and the seriousness of dying from it are linked to delays in seeking treatment for acute coronary symptoms.[22] Although the perception of heart disease as the main cause of death in women nearly doubled between 1997 and 2006, since then this perception has remained relatively stable at approximately 50 percent of women perceiving heart disease is the main cause of death.[36-38]

Heart attack symptom recognition among women has not changed significantly over the past decade.[36-38] Approximately half of women reported they would call 9-1-1 if they perceived acute coronary symptoms.[36-38] During an acute coronary event, indecision and reluctance play a major role in postponing the seeking of medical help.[36-38] There are conflicting findings about the role of patient gender in delaying seeking treatment for acute coronary symptoms. Some researchers found no differences in delay times between women and men,[39-42] while others found evidence that women wait longer than men.[43-45]

Reasons for the delay in seeking help are complex, and include underestimating the severity of symptoms, not recognizing the symptoms as cardiac in origin, and disbelief that one may be having a heart attack.[46] Women may be more likely to delay seeking help for the reason of being concerned about troubling others when they have symptoms.[46] Age tends to have a strong effect on delay time, in that increasing age is associated with greater delay, but only in women.[46,47] Careful consideration of acute coronary symptoms together with the awareness of heart attack risks can be lifesaving.[46] Interestingly, even women currently diagnosed with a coronary heart disease report that the disease is not a major concern for them when they are symptom free or do not feel ill, and rather than prioritizing disease management, they focus on getting back to their normal lives.[48]

The scientific community has recognized that heart attack symptoms in women have been misunderstood, both on the part of women and the general public, and the health care providers. Recent studies examined whether possible physiological parameters might help explain gender differences in symptom presentation. Findings suggest that women may have heart disease and/or acute myocardial infarction with less extensive coronary artery obstruction, or have a more subtle obstruction in the smaller coronary vessels, which may explain their experiencing less chest pain than men during an acute coronary event.[25,49] This evidence suggests that women may experience coronary heart disease (CHD) differently compared to men, as opposed to having "atypical" acute coronary symptoms that are sometimes inaccurately referred to in the heart disease symptoms literature when describing the symptoms of women.[50] Consequently, more appropriate diagnostic procedures that can detect subtle or diffused coronary obstruction may be necessary to appropriately diagnose the disease in women.[49]

Recent research suggests that gender bias in coronary heart disease diagnosis may operate in complex ways, where the effect of gender on heart disease recognition and treatment may be mediated by other factors, such as the symptoms reported at the time of seeking help.[31] Further, while symptomatology plays a role in the diagnosis for both men and women, differences in ischemic test results may vary by gender even if men and women have a similar degree of severity of coronary artery obstruction.[51,52] Thus the context under which acute coronary symptoms are reported must also be considered.[25,31,49] To reduce heart disease burden among women, global heart health promotion programs and public health interventions aim to raise awareness about heart disease as the main cause of death among women.[53-56] There are also attempts to shift women's perceptions and recognition of acute coronary symptoms, and stress the importance of seeking treatment at the first onset of symptoms.[53,54] At present, most coronary heart health interventions tend to focus on primary and secondary prevention rather than point of care diagnostics and treatment.[1,7] Although it may be perceived as easier to attempt to modify individual risk behaviors when assuming that individuals are responsible for their own health, (as we routinely practice in western societies), it may not be enough to change outcomes.[1] Specifically, the social and medical contexts of care may also require change, as prior research has shown that fewer women than men are properly diagnosed with CHD,[25,28,31,32] physicians are less certain of coronary symptoms in women,[29,30,32] and fewer women are referred for cardiac testing even though they present with similar symptoms as men.[25,28,32-34]

Altogether, prior findings suggest that medical management of acute coronary symptoms in women seems sub-optimal, and hence, not only behavioral, but also institutional and procedural changes are needed. This study will examine quality of care among patients with and without coronary heart disease to evaluate whether disparities in the quality of emergency care exist.

1.2 Study purpose

The focus of this research is studying the quality of health care women receive. The overall purpose of this study is twofold: to examine quality of care in terms of gender disparities, as well as other sociodemographic disparities, in the context of emergency care among patients in general, and then among those diagnosed with coronary heart disease, and to provide potential explanations for the processes by which the inequalities operate. The main objective is to increase the understanding of the predictors of emergency care in women, as well as among minority populations and those who are from lower income areas, with special attention to women with minority status. If biases in quality of care are discovered, these data can be used to contribute to translational research for reducing the discrepant outcomes in care. In addition, the findings will enhance the current knowledge pertaining to the situational and environmental factors associated with the quality of emergency care in the U.S. The primary focus of this research is studying the quality of health care women receive because the historically available literature shows that there is far less empirical research into coronary heart disease care and health care overall in women compared to men, and that a need exists to develop a more accurate understanding and reliable predictive tools into the processes that surround treatment-seeking behavior, diagnosis and treatment of heart disease in women.[25,28,32-34]

1.3 Study approach

When studying health disparities and health care disparities by patient gender, different types of research and data can be considered. One can look at descriptive epidemiological data to assess the burden of the disease, or use inferential epidemiological statistics to look for meaningful differences in the burden. We can use social science research to consider patient risk perception, awareness, knowledge and health behaviors. We can also use health care utilization data to assess the quality of care patients receive.

Instead of comparing the descriptive and inferential epidemiological literature reflecting the burden of heart disease, this study focused on one telling aspect of coronary heart disease care, which is the quality of care. Thus, I used a health services utilization approach to investigate gender, racial and ethnic disparities in the care for patients with and without coronary heart disease diagnoses. Specifically, studying the quality of emergency care patients receive in the U.S. was possible because of the availability of a dataset from a health care utilization study, the National Hospital Ambulatory Medical Care Survey (NHAMCS).[57] This is a national health care survey that has collected health care utilization data that reflect the context of seeking emergency care.[57] These data contain information on the characteristics of the patients who were seeking emergency care, the situational characteristics of patient visits to emergency departments, such as how did patients pay for the care they received, as well as information descriptive of the hospitals where patients sought care.[57] With the help of these data, I was able to study whether the quality of emergency care varies between women and men, and among those with and without minority status. Using these analyses to suggest overall trends, I was then able to analyze a subset of patients with coronary heart disease. Thus, my research aims reflect a quality of care approach to the study of this issue.

The 2008 Emergency Department (ED) dataset of the NHAMCS is a publically available large-scale population-based survey based on a national probability sample survey of nonfederal, general and short-stay hospitals conducted by the Division of Health Care Statistics, National Center for Health Statistics, Centers for Disease Control and Prevention.[57] The dataset, on which I conducted a secondary data analysis, is descriptive of patient visits to the ED, and it includes information on hospital, patient, and visit characteristics.[57] (Detailed description continues in the dataset description section of the methodology chapter).

I used the information on patient, visit, and hospital characteristics to evaluate the quality of care patients receive when they seek emergency care. Specifically, as one measure of quality of care, I considered the amount of time patients have to wait to be seen by an emergency department physician. From the information that was available in the dataset, I selected factors that, based on prior literature, play an important role in the context of emergency care utilization. I was primarily interested in studying whether emergency department wait time varies by patient gender and other sociodemographic characteristics of the patient, and further, what other contextual factors help decrease or increase the wait. The study of potential predictors of emergency department wait time was guided primarily by the theoretical framework of social stratification with focus on health disparities, together with the related literature base, which suggests that women and minority populations may be more likely to experience less than optimal quality of care. Consequently, in assessing the amount of time people waited to receive emergency care, I included the information on patient gender, patient minority status and poverty level as predictors.

While I focused on studying differences in emergency department wait time by patient characteristics, I also evaluated some major situational factors that occur at the time of visit, and, based on prior literature, seem to contribute to either a decrease or an increase in emergency department wait time, such as the expected form of payment for emergency services. Further, I evaluated some major larger structural factors that are related to wait time, such as the ownership type of hospital where patients seek care.

Study results are pertinent to translational research within hospital emergency care, in that the findings have the potential to contribute to the design of practice-oriented interventions that could help improve disparities in emergency department care through education, retraining, changes in standard operational procedures, policy and structural changes, and guidance for future research.

The specific research aims of this dissertation are presented next, and they are followed by a discussion of the scientific approach that was executed within the systematic study.

1.4 Research aims

1. To assess the contribution of patient gender to one aspect of the quality of emergency care: the amount of time a patient must wait to be seen by an emergency physician, while also considering other contextual factors that may help decrease or increase emergency department wait time.
2. To examine whether the way patients' need for care is categorized at emergency department triage mediates the relationship between patient gender and wait time.
3. To examine whether poverty level mediates the relationship between patient gender and wait time.
4. Among patients diagnosed with coronary heart disease at the time of visit to the hospital emergency department, to assess the contribution of patient gender to emergency department wait time, while controlling for other contextual factors of the patient visit.
5. Among patients diagnosed with acute myocardial infarction at the time of visit to the hospital emergency department, to assess the contribution of patient gender to emergency department wait time, while adjusting for other important contextual factors of the patient visit.

1.5 Study structure

This dissertation is organized in the following way: Chapter 2 discusses the background and significance of the research. It includes relevant findings from the health services literature about the patient experience in the emergency department setting reflecting prior research on disparities in emergency care. It also includes a literature review of descriptive epidemiology as well as inferential epidemiology on coronary heart disease. In addition, I discuss findings from social science research descriptive of patient knowledge, perceptions and behaviors that are connected to seeking care for coronary heart disease, while focusing on the experience of women.

Chapter 3 introduces the theoretical framework that was applied in the development of the conceptual model in this study. The theoretical perspective that guided this work consists primarily of the theory of social stratification with focus on health disparities. Aside for reviewing the theory, I also present empirical findings of health disparities that are based on this theoretical perspective.

Chapter 4 begins with a discussion of the conceptual framework for this research. The conceptual model was developed based on extensive review of prior literature and theoretical background. The discussion of the conceptual framework is navigated by application of theory to this research. I also briefly address the relevance of the applicability of individual level health behavior models as they apply to the person level factors associated with seeking emergency care, such as perception of symptoms.

Subsequently follows a discussion of the study design, which consists of a detailed description of the National Hospital Ambulatory Medical Care Survey (NHAMCS) dataset, the operalization of key variables used in the research, statement of research questions and hypotheses, and a discussion of statistical methodologies that were used to test the research questions, together with a summary of the strengths and weaknesses of the study design. The overall strengths and weaknesses of the study are presented in the Discussion section.

The study results are presented in Chapter 5. The descriptive findings portray the distribution and characteristics of the studied factors. The inferential results document what elements and conditions seem to predict emergency department wait time pertaining to the patient, visit, and hospital characteristics. The results offer explanations for the pathways that take place in the emergency care context and that influence the amount of time patients wait to see an emergency department physician.

Chapter 6 consists of a discussion of the findings, including integration of the results with prior literature, presenting implications for practice, and offering directions for future research.

Study results, presented in Chapter 5, and the synthesis of key findings and how they fit in with prior literature, as described in Chapter 6, demonstrate the importance of this research, while advancing the current understanding of the factors that help predict emergency department wait time not only among patients with coronary heart disease, but also among patients in general. The findings have the potential to facilitate future intervention efforts to ameliorate disparities in the quality of emergency care, and to support evidence-based policy, structural, and procedural changes toward less discrepant emergency care in the practical setting.

CHAPTER 2. BACKGROUND AND SIGNIFICANCE

The literature reviewed in this chapter consists of health services findings descriptive of the patient experience in the hospital emergency department settings, socio-epidemiological data reflective of the heart disease burden among patients in the United States (U.S.), social science research that depicts patient and professional perceptions and behaviors connected to seeking care for heart disease symptoms, and intervention research that looks at what has been done historically in an attempt to improve the quality of care among patients with acute coronary symptoms. While I am conducting health care utilization research, I am drawing on the other types of data to describe and explain the framework of this study.

The available health services studies that were reviewed describe the variation in the quality of emergency department care by patient demographic and socioeconomic characteristics. The epidemiological findings document gender, racial, and ethnic differentials in heart disease prevalence and mortality. To provide an adequate background for the social context within which emergency treatment seeking occurs, I discuss main social science findings about relevant gender differences in heart disease risk perception and symptom recognition, treatment seeking behaviors, and professional response to coronary heart disease symptoms in women. To assess what has been done in the past to eliminate some of the documented disparities in the quality of emergency care, I review major interventions that were implemented, mainly by large Government or academic institutions, with the objective to improve emergency coronary heart health in women.

2.1 Emergency department wait time

While people seek health care in many contexts, urgent or emergent conditions often result in patients seeking care in hospital emergency departments. For patients presenting to emergency departments, providing timely care is a key quality goal in the Institute of Medicine (IOM)'s report named Crossing the Quality Chasm, which evaluated quality of care objectives for emergency healthcare.[58] According to the key quality goal, emergency department wait time is a central indicator of providing timely care.[58] However, several studies that examined the trends in emergency department quality of care indicators suggest that the average patient wait time to see an emergency physician has increased in the past decade.[59-61] Specifically, a recent national survey of emergency department visits found that between 1997 and 2004, emergency care wait time increased by 4.1 percent per year for all patients, and by 11.2 percent per year for patients diagnosed with acute myocardial infarction (AMI).[60] Further, women, African American and Hispanic patients, and those who sought care in emergency departments located in urban areas waited longer to see an emergency physician compared to other patients.[60] Moreover, it has been documented that between 1994 and 2004, visits to the emergency department increased by approximately 18 to 26 percent.[60] At the same time, according to one study, the number of emergency departments decreased by 9 to 12 percent.[61,62] Another study, using absolute numbers found that between 1996 and 2006, emergency departments decreased from 4,019 to 3,833.[63] Investigating possible reasons for the increase in emergency department visits, one study found that rise in visits can be predicted from decreased access to routine care or regular preventative care among the general population, together with accommodating care for the elderly, and less than adequate management of chronic conditions.[64] Increased number of emergency visits and decreased number of emergency departments may lead to longer wait time to see an emergency physician, and these are risk factors for poorer health outcomes for certain emergency conditions including acute episodes of coronary heart disease.

There is also some evidence, however, that the nature of emergency department visits has changed, in that some of the burden of increased emergency department visits consists of visits of patients who require less emergent care, or are dealing with chronic issues.[63] Need for less emergent care could suggest that patients without primary source of healthcare insurance might use the emergency department for primary care purposes because emergency departments cannot deny urgent care. However, studies that investigated this speculation have not found significant supporting evidence.[64,65] For example, a recent national study of emergency department visits suggests that overall, non-urgent care needs of patients who lack primary source of health insurance constitutes only a minor factor in increased emergency visits, proposing that only one percent of emergency department visits seem to be visits of patients seeking non-urgent care.[65] Another recent study of emergency department visits that investigated visits of uninsured patients reported findings in a similar direction, proposing that what contributes more heavily to increased emergency department visits appears to be decreased access to regular preventative or routine care for all patients in general, decrease in continuous and integrated primary care, and the aging of the population, as opposed to utilizing the emergency department for primary care purposes.[64] Aside for the uninsured, insured people with diagnosed or undiagnosed chronic conditions also use the emergency department for acute issues.[66] People with chronic conditions are heavy users of emergency services.[64,66] For insured patients, needs for emergency care may arise from mismanagement of chronic conditions and from care that lacks continuity.[64,66] To achieve adequate management of chronic conditions, primary care has to be routine, comprehensive, and integrated with patients' other health needs.[66] Current models of emergency medicine focus on disease-oriented episodes, which generally do not accommodate the complex needs for care of patients suffering from diagnosed or undiagnosed chronic conditions.[66]

With regard to emergency department wait time and patient race, one study about social inequalities in emergency care examined racial disparities based on data from the National Hospital Ambulatory Medical Care Survey (NHAMCS) between 2003 and 2005.[67] Significant disparities based on race were found, in that minority patients had longer average wait times compared to other patients.[67] The study documented that not only hospitals with a higher proportion of African American patients had longer wait times, but also that African American patients had longer average wait times compared to non-African American patients within the same hospital.[67]

Analyses of the pathways that elaborate on basic bivariate statistical relationships in emergency care are rare in the literature. Although there is evidence suggesting that patient sociodemographic factors are associated with differences in emergency department wait times, effects of alternative variables that could explain the disparities often are not tested empirically. Thus, the current study enriches the contemporary knowledge of emergency care beyond the basic descriptive relationships through controlling for variables that are theoretically and/or conceptually relevant within the context of the emergency department, through controlling for the variables that may confound, mediate or moderate the bivariate associations, and thus increasing the understanding of patient care within the hospital emergency department setting.

2.2 Immediacy of care

In general, hospital emergency departments triage their patients into levels of urgency of care to facilitate effective provision of emergency care, where patients with the most urgent conditions can be seen with a priority, and scarce emergency department resources are used in the most efficient way possible.[68] Worldwide, there are multiple systems of triage into urgency of care.[68] The U.S. currently follows the Emergency Severity Index (ESI).[68] The ESI is a triage tool developed for emergency department care that provides the information for a triage algorithm based on clinically relevant stratification of patients into five urgency of care categories ranging from most urgent to least urgent, as: immediate, emergent, urgent, semi-urgent, or non-urgent.[68]

Historically, the U.S. did not always utilize standardized triage tools. The ESI triage scale was developed by U.S. emergency department physicians Richard Wuerz and David Eitel in the late 1990s, who believed in the importance of prioritization based on the urgency of treatment of patients' conditions, which is based on how long a patient can safely wait to be seen by the emergency department physician.[68] The first version of the ESI was piloted in Boston in 1998 at two hospitals, and the measure was evaluated to be both valid and reliable.[68,69] The pilot study's inter-rater reliability indicated 77 percent exact agreements and 22 percent within one triage level. In several subsequent assessments of the triage tool, the weighted kappa reliability statistic ranged 0.68-0.90.[68,69] The ESI was first implemented in 1999, and it was subsequently adopted in hospitals at the national level in the following years.[68,69]

The ESI is an operational model designed to meet the need for emergency services of all patients, and it is believed to facilitate efficient emergency care services.[68] However, there is evidence of continuing challenges pertaining to the decision-making rules guiding the assessment of urgency.[70] Most commonly raised issues with the urgency of care scales have to do with the evaluation of the validity and reliability of the tools in different setting, specifically, assessing the degree to which the triage system predicts true urgency of care.[70] Nonetheless, the ESI is currently the best available tool to assess patient urgency of care within the U.S.

2.3 Hospital structural characteristics and emergency department wait time

Prior literature on emergency department overcrowding has yielded relatively consistent conclusions about the associations of hospital crowding with hospital structural characteristics, such as population size served and hospital ownership, which help shed light on some of the disparities in emergency department wait time.[71-75] Although the causes of overcrowding appear multi-factorial and complex, consistent associations of hospital structural characteristics with overcrowding have been identified.[71-75] Most commonly reported, the causes of overcrowding are associated with a hospital's location in large metropolitan area, and voluntary hospital ownership.[71-75] Specifically, it has been documented that overall, emergency departments that serve populations of less than 250,000 have had less severe crowding compared to hospital emergency departments in larger metropolitan areas.[71-75] Further, it has been found that private hospital ownership status is associated with less overcrowding overall, compared to voluntary, or academic type of hospital ownership.[71] Both findings are descriptive of a nation-wide problem. Further factors associated with overcrowding include accommodating the needs of an aging population that requires more complex care and integrated routine care, and the need for technological advances in emergency care procedures.[71]

These contributing factors fall beyond the control of most emergency departments, and public policy interventions are needed on a national basis to ameliorate the problem. In addition, some acute issues that are related to diagnosed or undiagnosed chronic conditions could be controlled in routine, comprehensive, and integrated primary care[76] (e.g., diabetic shock, medication side effects and overdose).

Emergency department overcrowding has been described as a relatively recent issue, beginning in the mid 1990s, but one that deserves careful attention in order to keep the quality of emergency care high.[71-75] The documented findings descriptive of more severe crowding in larger metropolitan statistical areas (MSA), and less crowding in privately owned hospitals, guided the conceptually based selection of these two hospital structural characteristics for an inclusion in the conceptual model in regard to predicting emergency department wait time in this study.[71-75] Although studying hospital emergency department crowding would be preferable, direct data on hospital crowding are unavailable in the dataset used for the analyses in this study, and the metropolitan statistical area (MSA) status categorization will be used instead to differentiate whether patients sought care in urban or rural areas.

2.4 Expected source of payment

Similarly to the consistent findings pertaining to longer average wait time in hospital emergency departments in large metropolitan areas, studies that examined expected source of payment for emergency services suggest that patients with no primary source of healthcare may experience longer average wait times in the hospital emergency room.[77-80] For example, a study of emergency department length of stay published in 2012 in *JAMA,* the Journal of American Medical Association*,* found that safety-net need patients (patients with no primary source of health insurance) were less likely placed into the emergent and urgent immediacy of care categories, reflecting longer average time spent in the emergency room, mediated by the assignment into lower urgency of care category.[77] The study documented that expected source of payment for emergency services that indicated absence of private insurance coverage, specifically, no charge to the patient, affected the average time patients waited in the emergency department, where wait time was predicted through an assignment into a less urgent category of immediacy.[77]

A study by Lopez et al. (2010) found that low-income patients in Australia who presented with chest pain in the emergency room were less likely to be seen immediately as a result of their expected source of payment status, where more affluent patients had better outcomes.[78] Their study documented that patients with greater financial resources, not necessarily the ones in the most urgent group, waited less time compared to those less affluent.[78]

With respect to expected method of payment for services provided to patients in hospital emergency departments, a study by Huynth et al. (2006) that investigated whether the quality of health care in the U.S. varies by socioeconomic status found that low-income patients were more likely to go without needed care.[79] This outcome was directly related to the patients' inability to pay for services.[79]

In a study by Doyle (2005) that investigated differences in patient mortality associated with expected method of payment for hospital emergency care found that patients who were in automobile accidents and were uninsured received fewer hospital emergency services compared to those who were insured, and the uninsured patients were also more likely to die at the hospital.[80]

In summary, whether a patient does or does not have primary source of health insurance may have an impact on the quality of emergency care they receive. Given the specific findings suggesting that visits of uninsured patients or visits with no cost to the patient for emergency services related to longer average wait time in the emergency department, at times through an assignment into a lower triage category of urgency of care, the primary source of payment for the emergency services was considered in this study as one of the possible factors that has to do with evaluating hospital emergency department wait time, together with other patient, visit, and hospital characteristics. In particular, based on prior research, the current study attempted to evaluate wait time in patients who did not have primary source of health insurance, or who incurred no direct cost to the patient in the emergency department, comparing wait time to patients with private health insurance coverage.

2.5 Poverty and health

Prior research has found consistent association between poverty and adverse health outcomes, in that the poor and social minorities are more likely to experience worse health.[6,913,16,26,27] People who are poor, or near poor, experience a greater burden of all circulatory diseases compared to people who are not poor.[26,27] For example, a study of older women from 2008 found that poor women and African American women had more functional disability compared to women who were not poor and compared to White women.[6] Further, poverty status was a strong independent predictor of less function among White women.[6] The study's longitudinal findings reporting on more functional deficits in women who were poor and minority women in older age documented more adverse health also at the study conception, suggesting a life long effect of poverty and minority status on health.[6] In the U.S., African Americans experience significantly more poverty compared to Whites, and African American women have higher poverty rates compared to African American men.[9]

It has also been know that due to structural inequality, women have had less access to societal resources that are linked to optimal maintenance of good health. [9] The currently accepted observation in studying maintenance of good health by gender is that women live longer than men, but have more illnesses.[9-13]

A review of health on women living in poverty has documented direct negative effects of poverty and social inequalities on women's health and wellbeing.[16] Poor women seem to be systematically deprived of societal resources and opportunities,[16] such as employment that provides the benefits of regular preventative health care and screening. In the U.S., living in poverty is often perceived as a consequence of bad decision-making, such as exercising bad habits and inadequate self-control.[16] Therefore, in addition to living without sufficient material means, poor women often face societal stigmatization and alienation.[16]

When considering the causes of poor health and functional limitations, the *biomedical* perspective views genetic and biological factors as primary determinants, while the *social-determinants of health* perspective views the role of social, economical and political factors as contributors to ill health, and it explains the effects of such structural factors on the onset of most chronic diseases.[16] According to this perspective, the structural inequality and limited access to societal resources explains why those who live in poverty have more chronic illnesses compared to other people.[9-13,16]

The next section addresses prior research on disparities in health and health care as is relevant to the main cause of morbidity and mortality in the developed world, heart disease. As previously stated, because women tend to have disproportionate burden, special focus is put on the experience of women.

2.6 Heart disease prevalence and mortality

As noted above, patients with diagnosed and undiagnosed chronic conditions often use emergency departments when experiencing acute episodes linked to chronic disease.[76] Heart disease patients often fall into this category.[76] Coronary chest pain is the most commonly presented symptom of acute coronary heart disease.[81-84] To manage acute coronary chest pain most effectively, such patients must be triaged for immediate care.[85,86]

The National Institutes of Health define cardiovascular diseases (CVD) as a range of diseases affecting the heart muscle and blood vessels.[87] Coronary heart disease (CHD) is defined as narrowing of the blood vessels that supply the heart muscle with blood and oxygen necessary for its function.[87] The narrowing is caused by hardening of the coronary vessels by plaque buildup (of fatty material and other substances) in the walls of the vessels, which decreases blood flow to the heart, and may lead to an acute coronary event.[87] An acute coronary event is defined as oxygen restriction in myocardial infarction or unstable angina.[88] A myocardial infarction, or heart attack, happens when the coronary vessels that supply oxygen to the heart become blocked, the heart does not receive the oxygen it needs, and the heart muscle becomes permanently damaged or it dies.[88] Angina is chest pain experienced during oxygen restriction to the heart.[89] Stable angina is chest pain resulting from poor blood flow in the heart muscle during physical exertion when the heart works harder than usual.[89] This type of pain goes away at physical rest. That is, stable angina follows a pattern. Unstable angina, on the other hand, occurs because of narrowed or blocked heart vessels by plaque buildup.[89] The pain tends to last longer than 15 minutes, and it becomes progressively worse.[89] Unstable angina is a warning sign of a heart attack.[90] Both men and women experience symptoms during an acute coronary event.[22,44,91,92] However, acute symptoms in women and men may differ. [22,44,91,92]

Until the early 1990s, studies that investigated acute coronary symptoms and coronary heart disease (CHD) focused largely on men, partially because the descriptive statistics for the incidence and prevalence of cardiovascular diseases documented that men were at higher risk for the disease compared to women.[25,28] Moreover, because men were studied more, it has been perceived that, heart disease was mainly a disease of men.[93]

In the United States (U.S.), more men than women have been diagnosed with a cardiovascular disease, but overall, more women die of a cardiovascular cause every year.[19-27] The final age-adjusted vital statistics by the Centers for Disease Control and Prevention reported that in 2010, 12.7 percent men were diagnosed with a cardiovascular disease (CVD) compared to 10.6 percent women.[26] In 2009, 13.2 percent men were diagnosed with a CVD compared to 10.2 percent women.[27] These statistics document that overall, men are diagnosed with a CVD at a greater rate compared to women. However, the final National Vital Statistics Report on causes of mortality shows that in 2009, overall, women died from CVD at a rate of 255.8 per 100,000 population, compared to 252.7 per 100,000 in men.[19]

Considering only coronary heart disease (CHD), in 2009, 8.4 percent American men received the CHD diagnosis, compared to 4.6 percent American women, which might suggest that men are approximately twice as likely to be diagnosed with CHD compared to women. [27] National death rates for 2009 do not show, however, such large differences: men died from CHD at a rate of 138.7 per 100,000 compared to 113.3 in women.[19] In 2009, heart attack mortality rate in women was 36.5 per 100,000 population compared to 45.4 per 100,000 in men, certainly not a mortality rate that correspond to the staggering gender differences that are evident in CHD diagnosis rates.

Although in the last decade cardiovascular disease mortality trends have shown an overall steady decrease in both men and women, since 1985 women have had greater overall CVD mortality rates compared to men.[94] Compared to the steady increase in CHD mortality after WWII until about 1965, the National Center for Health Statistics and the American Heart Association document that in men, CHD mortality has been steadily decreasing during the past four decades. This has not been the case in women.[20,21,95,96] Specifically, between 1999 and 2006, coronary mortality in women aged 35-44 years increased by 1%.[20,94]

2.7 Diagnostic disparities in heart disease burden

Gender, racial and ethnic disparities in heart disease diagnosis exist.[26,27] Gender differences in heart disease diagnosis are more pronounced among Whites compared to African Americans or Hispanics.[26,27] For example, in 2009, 14.4 percent White men received a diagnosis of CVD compared to 10.7 percent White women, but overall, White women died of CVD at a greater rate than White men (274.1 versus 266.6 per 100,000 population).[27] For CHD, in 2009, 8.9 percent of White men received the diagnosis compared to 4.4 percent of White women.[27] This suggests that White men are twice as likely to be diagnosed with a CHD compared to White women. However, women's CHD mortality rate is closer to that in men compared to the large gender differentials in the disease prevalence (139 vs. 113 per 100,000 population), in that the mortality rate does not reflect the fact that the overall diagnostic rates for CHD are twice as high for men[19,26,27]

The prevalence statistics for African American and Hispanic patients do not exhibit the same magnitude of gender differentials of heart disease diagnosis as in White patients, in that the within race and ethnicity gender differential diagnostic rates appear smaller compared to those of Whites.[26,27] Although, as it is characteristic of the White population, overall, African American and Hispanic women are still diagnosed less and die from CVD at a greater rate compared to men.[19,26,27] Among African Americans, CVD is diagnosed in 11.7 percent men and 10.9 percent women, and CHD is diagnosed in 7.4 percent men and 6.2 percent women. Among Hispanics, CVD is diagnosed in 8.7 percent men compared to 8.4 women, and CHD is diagnosed in 6.4 men compared to 5.2 women. Of all women, African American women carry the greatest burden of coronary heart disease, with the prevalence of 6.2 percent, followed by Hispanic women at 5.2 percent and White women at 4.4 percent.

Considering the empirical evidence from social science and health services research (described later in this chapter), suggesting that women (1) may delay seeking treatment for acute coronary symptoms more than men, (2) may be underdiagnosed for coronary heart disease (CHD), and (3) appear more likely to be undertreated for acute coronary symptoms, it is possible that the discrepancy in coronary heart disease CHD prevalence versus mortality rate may result from unrecognized, undiagnosed or undertreated CHD and/or heart attack.

Some support for this suggestion may be deduced from the findings of the 2007 National Hospital Ambulatory Medical Care Survey and the 2007 National Hospital Discharge Survey, the main sources of national data on hospital visits and discharges.[97,98] The ambulatory survey shows that in people under 65 years of age, chest pain, the hallmark symptom of heart attack, was the principal reason for emergency department visit in 3 percent women's and 2.8 percent men's visits.[97] In people over 65 years of age, chest pain was the major reason for a visit among 5.1 percent women and 3.3 percent men.[97] The hospital discharge survey shows that among discharges of in-patients from short-stay hospitals, men were discharged at a higher rate for all primary diagnoses within the coronary health category, except for hypertension.[98] For acute heart attack, men were discharged at a rate of 23 per 10,000 population compared to 15.4 per 10,000 in women.[98] For CHD diagnosis, men were discharged at a rate of 144 per 10,000 compared to 121 per 10,000 in women.[98] Among men cardiovascular procedures were performed at the rate of 268 per 10,000 population vs. 195 per 10,000 in women.[98] Approximately four million cardiovascular procedures were performed on men compared to three million procedures on women. Similarly, cardiac catherization rates were higher in men during the 1997-2007 period.[98]

These statistical indicators suggest several possible explanations. For people under 65 years of age, as more men happen to be diagnosed with CHD even though similar rates of women and men presented with the principal symptom of acute coronary event, suggests that more women with chest pain may be possibly undiagnosed, or underdiagnosed, for CHD. The conceptual foundation for this potential explanation is that the presentation of acute coronary symptoms indicates the presence of underlying CHD. If the rate of chest pain in patients' hospital visits is similar in women and men, possibly indicating similar rates of underlying disease, but fewer women are diagnosed with it, it follows that women may be underdiagnosed for CHD. Further, considering that the national survey documented that women and men presented with chest pain at similar rates, but a greater percentage of men as coronary patients happened to be discharged from in-patient care could suggest that a greater percentage of women compared to men were not discharged from in-patient hospital care because they were either never admitted with a CHD diagnosis, or they did not survive the acute coronary condition that brought them into the emergency room in the first place. As documented by the National Center for Health Statistics and the American Heart Association, unlike in the population of men who experience a steady decrease in coronary mortality, the disease is a persistent problem in American women.[20,21,94-96]

Recent cardiovascular health literature suggests that the following factors may play a role in gender outcome differences pertaining to acute coronary event treatment seeking behavior, CHD diagnosis, and treatment: women may be less likely to recognize their acute coronary symptoms as cardiac in origin, and as a consequence, they may have more delay in seeking help; medical personnel may be less likely to diagnose women who present coronary symptoms with a CHD and have less certainty with a CHD diagnosis in women; and women may be referred for follow up cardiac testing at a lower rate compared to men. A synthesis of these factors that contribute to the outcome differences is discussed next.

2.8 Treatment seeking for acute coronary events

The recognition of less than optimal care for CHD in women began approximately two decades ago when findings of the U.S. Framingham Heart Study from the late 1980s documented that in women, 35 percent acute coronary events were not recognized, compared to 28 percent in men.[99,100] Further, the Framingham study showed that 40 percent of women compared to 13 percent of men suffered another heart attack in the next year.[99,100] Moreover, the multi-institutional U.S. Coronary Artery Surgery Study that evaluated coronary artery bypass post-operative mortality between 1975-80 found that post bypass mortality rates in women were 4.5 percent compared to 1.9 percent in men.[101]

In 1993 an article published in *Circulation*, the Journal of the American Heart Association, served as an imperative scientific statement bringing attention to the lack of study of CHD in women, the urgent need for CHD prevention in women, and for further research into women's acute coronary symptoms, point of care diagnosis, and treatment.[102] This article motivated research interest into the study of heart attack symptoms in women, comparing and contrasting them with those of men, and it urged active investigation into more effective point of care diagnostics, especially in women.[102] Since that time, research in this area has gained a momentum that has yet to diminish.

Review of methodologically sound empirical studies that investigated acute coronary symptoms in women has suggested that during a heart attack, overall, the majority of men tend to report symptoms of chest pain.[22,44,103-107] Women do report symptoms of chest pain as well, but they also tend to describe chest pain as chest discomfort, tightness or squeeziness.[22,44,103-107] Women, compared to men, more often cite acute coronary symptoms of sudden unexpected fatigue, indigestion-related symptoms of nausea and/or vomiting, shortness of breath, pain in other areas in the upper body, and other non-specific physiological symptoms that can be attributed to other health-related conditions aside for a heart attack.[22,44,103-107] Non-specific acute coronary symptoms play a major role in heart attack recognition and subsequent help seeking.[104-107] Most people are unaware that women and men might have different acute coronary symptoms.[37,38] It is also difficult to interpret non-specific physiological symptoms (e.g., sudden fatigue) without symptoms of chest pain as signs of heart attack.[38,108,109] Considering that women are more likely to experience non-specific symptoms, they may be consequently less likely to recognize their acute coronary symptoms as cardiac in origin, which may lead to delay in seeking medical help.[38,108,109] A review of research on pre-hospital delay from the time period 1960 - 2008 suggests that women may be more likely to postpone seeking treatment compared to men.[110] Although findings descriptive of specific delay time by patient gender are limited, the Worcester Heart Attack Study showed that in 2005, overall, the mean and median delay times for all patients were 4.6 and 2 hours, very similar to delay in 1995 and 1986.[111] Fewer than half of all patients sought help within two hours of symptoms onset, and an additional third did so between 2-6 hours. [111]

In parallel with the U.S., heart disease research in Europe documents a shorter delay among patients who recognized their coronary symptoms as cardiac in origin, of whom, fewer were women.[112-114] Predictors of seeking timely help were: having an emergency action plan, age below 65 years, and living with, or contacting, someone else at the onset of symptoms.[113,114]

Some evidence suggests that one third of women and one quarter of men self-medicate to reduce acute coronary pain, and 84 percent of patients consult a layperson prior to calling professional help.[115]

Indecision and reluctance play a major role in postponing seeking help.[116,117] Every half hour delay in seeking heart attack treatment is associated with additional 7.5 percent probability of one-year mortality.[116] To avoid permanent heart damage, it is crucial to seek help within one hour of onset of first symptoms.[116,117] Careful consideration of acute coronary symptoms together with the awareness of heart attack risks can be lifesaving.[117]

Given that coronary chest pain has been consistently described in the literature as the dominant symptom of underlying coronary heart disease,[22,44,103-107] as well as a reason people seek emergency care, this study involved an investigation of whether within a sub-population of patients with coronary heart disease diagnoses, symptoms of coronary chest pain reported at time of arrival to the emergency department moderate the relationship between patient gender and wait time.

2.9 Patient perceptions and coronary heart disease outcomes

Heart disease perception surveys conducted in 1997, 2000, 2003, and 2006 document that women's perception of heart disease as the main cause of death near about doubled from 30 percent in 1997 to 57 percent in 2006, and since then it remained relatively stable at 54 percent of women recognizing heart disease as the main cause of death in 2009.[36-38] Half of women reported they would call 9-1-1 if they felt heart attack symptoms, and a quarter reported they would take an aspirin.[36] Heart attack symptom recognition has not changed significantly over the previous decade: over half of women recognize pain in the chest, neck, shoulder and arm, 29 percent women recognize shortness of breath, 17 percent recognize chest tightness, 15 percent recognize nausea, and 7 percent women recognize fatigue, as symptoms of heart attack.[36] Even though heart disease is the leading cause of death, overall, women tend to underestimate their risk of coronary heart disease and heart attack, and tend to perceive that they are more likely to die from cancer as opposed to heart disease. [36-38]

The documented perceptions of heart disease risk among women show that women underestimate their actual risk for heart disease and heart attack, and do not recognize heart disease as the leading cause of death among women.[36-38] The National Vital Statistics Report from 2009 shows that fewer than 41 thousand deaths in women were due to breast cancer compared to 398 thousand deaths in women were due to cardiovascular disease.[19] Almost ten times more women die from a cardiovascular disease-related condition compared to breast cancer.[19] Of all cardiovascular deaths, in 2009 more than 176 thousand women died of coronary heart disease and over 56 thousand women died of a heart attack.[19] The lack of accurate knowledge about the susceptibility to heart disease and the seriousness of dying from it has been linked to postponing seeking treatment for acute coronary symptoms.[118]

2.10 Physicians' behaviors in coronary heart disease diagnosis

Recent cardiovascular research suggests that women are less likely properly diagnosed with coronary heart disease (CHD), and that fewer women compared to men may be referred for cardiac diagnostic testing and treatment, again putting patients at risk of seeking emergency care for acute episodes with symptoms that may be poorly understood.[31,119] A recent meta-analysis of 11 randomized trials of acute coronary symptoms revealed that gender-based disparities in 30-day mortality among heart attack patients was significantly explained by the clinical differences at the time of seeking treatment for acute coronary symptoms and the seriousness of disease detected in angiographic testing.[119] These findings imply that once patients are appropriately tested, diagnosed, and treated, their clinical test results and diagnoses may be more predictive of short-term mortality rather than patient gender, and minimal differences should be seen in coronary outcomes from that point on.[119] It follows that women could experience adverse cardiac outcomes because of less than optimal testing, diagnosis, and treatment. Congruent with this implication, the goal of recent research on physicians' behaviors in coronary heart disease diagnosis has been to identify gender bias that may contribute to women being underdiagnosed for coronary heart disease and underreferred for cardiac testing.[119] The context within which acute coronary symptoms are reported is important as symptomatology plays a role in diagnosis for both men and women, and differences in ischemic test results may vary by gender even if both men and women have similar degree of severity of a heart condition.[31,118]

In studying context of diagnoses, recent methodologically sound research by Chiaramonte found that when acute coronary symptoms were presented together with anxiety symptoms or stress, internists gave less coronary heart disease (CHD) diagnoses and cardiologist referrals to women but not men.[31] Symptoms of stress in men were considered a risk factor for CHD.[31] What confounded this outcome, however, is that women tend to present more anxiety symptoms than men during medical visits in general.[31] Therefore, reporting symptoms of anxiety or stress might mediate receiving fewer CHD diagnoses compared to men, even if both report the same physiological symptoms.[31] Another finding by Chiaramonte suggested that when CHD symptoms were presented together with stress, family physicians were more likely to give women a psychogenic diagnosis, such as panic attack or anxiety, whereas men were more likely to receive the organic diagnosis of CHD.[31] This finding further supports the evidence that fewer women may be appropriately diagnosed with CHD even when they present with the same acute coronary symptoms as men. Yet another finding of the study suggested that when presenting coronary symptoms that lack chest pain, family physicians were likely to give psychogenic diagnoses to both women and men. That is, no gender bias was found in diagnosing patients who present with symptoms other than chest pain. However, considering the evidence that women are more likely to present non-specific acute coronary symptoms, such as sudden fatigue or indigestion,[22,44,103-107] these results support the findings that fewer women may be properly diagnosed with a CHD.

In summary, this evidence suggests possible indirect paths of CHD underdiagnosis in women. Specifically, women are more likely to present with non-specific acute coronary symptoms, and women are more likely to report symptoms of anxiety or stress together with acute coronary symptoms, both of which are linked to CHD underdiagnosis.

Methodologically strong studies by Luftey et al. on the certainty of CHD diagnosis found that physicians were less certain of CHD diagnosis in women compared to men.[29,30] Higher diagnostic certainty (observed in male patients) was significantly associated with subsequent therapeutic actions, and lower certainty of CHD diagnosis in women predicted lower likelihood of receiving appropriate treatment, providing supporting evidence for CHD underdiagnosis in women.[29,30]

A relevant study by Kusnoor et al. found that electrocardiographs were less frequently used to investigate the severity of acute symptoms in women, women were less likely admitted to a coronary care unit for cardiac testing (in-patient and out-patient), and received less revascularization.[120]

Additionally, an analysis of the Minnesota Heart Study that tested gender bias in treatment of patients with acute myocardial infarction found that women were less likely to have coronary angiography to investigate the severity of symptoms.[121]

Some studies that examined acute coronary symptoms by patient gender tend to conceptualize of women's symptoms as "atypical." Assuming that symptoms of women are "atypical" from a norm, (i.e. the symptoms men present), rather than describing women's symptoms as simply different from those of men is unwarranted and suggests the need for rethinking the framework of diagnosing women from a perspective that does not take an exclusionary point of view.

Overall, the findings from research on physicians' behaviors in the context of seeking care for acute coronary symptoms suggest that receiving appropriate testing, diagnosis, and treatment seems more predictive of short-term coronary heart health outcomes rather than patient gender alone. The available research on providers' behaviors suggests bias in the quality of care.

2.11 Interventions

Primary objectives of global CHD public health interventions are to raise the awareness of heart disease both in regard to its prevention as well as educating the public that heart disease remains the main cause of death, increasing heart attack symptom recognition, and emphasizing the importance of seeking treatment at the onset of first symptoms.[53,54,56] In the U.S., the American Heart Association (AHA), the National Heart, Lung and Blood Institute (NHLBI), and the National Institutes of Health have been instrumental in developing interventions to increase women's knowledge about heart attack risk.[53,54,56]

Historically, interventions toward acute coronary symptoms recognition and timely treatment seeking have been implemented mainly through the means of educational campaigns.[53] The NHLBI and the National Institutes of Health have worked together toward the creation of *The Heart Truth* national awareness campaign that launched in 2002.[53] This major educational campaign focuses on increasing the awareness of heart disease mainly through techniques of social marketing.[53] Aside for communication strategies with the objective to disseminate key messages about primary and secondary prevention of heart disease, the campaign's social marketing techniques are used for tertiary prevention and seeking timely care for heart attack.[53] This campaign serves as the main U.S. national heart health awareness movement toward improved heart health for all women.[53] Many people are familiar with *The Heart Truth* movement through the campaign's iconic symbol, an image of a red dress with carved out image in the shape of a heart in the chest area.[53] This symbol has the primary purpose to urgently warn women that heart disease is the main cause of death.[53] *The Heart Truth* campaign's social marketing techniques include conducting extensive formative research with diverse population segments of women, empowering women to reduce their risk of dying of the disease, utilizing celebrities of all ages and ethnic background who report on their personal experiences and struggles with heart disease, utilizing key messages to promote heart-healthy behaviors, applying cultural awareness in the design of key marketing messages, using popular media outputs to deliver the campaign messages, as well as message dissemination through multiple, culturally relevant outlets.[53]

The Heart Truth campaign's intervention efforts are directed at the national level as well as the community level. The campaign offers a multitude of educational resources that are intended to increase women's awareness of heart disease in the form of print and on-line informational materials, the above-mentioned symbol of the campaign that serves as a cue to action, as well as heart disease awareness-increasing national and community-level educational events.[53]

One of *The Heart Truth* campaign's main national educational events is the *National Wear Red Day.* This event is observed every year on the last Friday of February.[53] This event unites people throughout the nation through wearing the color red as a symbol of heart disease awareness, and its primary intent is one of a wake up call to all women about their risk for the disease.[53]

As for intervention efforts at the local level, *The Heart Truth Road Show* is a community level fair-like event that delivers education about heart disease awareness to communities and cities throughout the U.S.[53] With the use of partnership building strategies, this event benefits from an extensive collaboration with local community-based organizations, which enables the campaign to reach out to diverse sociodemographic groups of women who might otherwise not be reachable by the nation-wide interventions.[53]

Another heart disease awareness effort, *The Heart Truth Community Action Grant Program*, where the NHLBI collaborates with the Foundation for the National Institutes of Health, organizes a competitive funding program to facilitate heart disease awareness programs and events at the community level.[53] The objective of these efforts is to partner with local community organizations and organize local, culturally relevant events with the intent to reach out to various segments of women and motivate them toward heart healthy lifestyle behaviors through education, testimonials, and cues to action.

Thanks to this multipronged campaign, *The Red Dress* image that symbolizes the awareness of heart disease as the main killer of women is now one of the most recognizable symbols in the nation.[53]

In addition to *The Heart Truth* campaign, the main national movement to raise heart disease awareness, other efforts by national organizations have been taking place. Since the mid 1990s, when medical researchers recognized the burden of less than optimal acute coronary care among women,[36,102,118] the American Heart Association (AHA), the National Heart, Lung, and Blood Institute (NHLBI), the Institute of Medicine, and the World Heart Federation created numerous websites with educational information to increase heart attack awareness for the public and health professionals.[54,56] Educational information that is available on-line can be located just by typing simple words, such as “heart attack get help” into any on-line search engine. [54,56] Available on-line resources include fact sheets that can be used by the public and by health professionals when providing the information on heart disease awareness to their patients.[54,56] Information for health professionals includes data on results from clinical trials, information on funding and research, and on professional medical networks with heart disease awareness as special interest.[54,56]

For example, at the present, the AHA’s official website HeartHealthyWomen.org offers easy-to-understand guidelines on how to recognize heart attack symptoms, behavioral cues for seeing timely treatment, and guidance on how to overcome barriers to seeking help.[54] The current AHA behavioral recommendations posit, even when unsure, to execute the 9-1-1 call immediately upon experiencing first symptoms, using sixth grade grammar in easy-to-remember phrases, such as: “Don’t delay-call 9-1-1 right away,” and “Be a survivor, not a delayer.” [54] Strong emphasis is placed on increasing women’s self-efficacy in preventing and treating CHD by recommending regular health check-ups and discussing health concerns and medical history with a primary care provider.[102]

Recent additions to the guidelines address scientific findings pertaining to popular self-help strategies, such as that there is insufficient scientific evidence to suggest that antioxidant supplements help treat CHD, and that aspirin therapy might not be as beneficial to ease symptoms in women as it does in men.[36] Importantly, AHA researchers have published scientific effectiveness-based guidelines on the prevention of CHD in women for the public and health professionals that are periodically updated to reflect the most current research findings.[122]

Possibly, it could be due to these countless nation-wide and local intervention efforts that women's awareness of heart disease as the main cause of death has increased, but based on the available literature it cannot be concluded that the interventions caused changes in people's perceptions.

2.12 Protocol for the assessment of patients with acute coronary symptoms in emergency department

To illustrate how emergency department staff approaches the care for patients with acute coronary symptoms, I now discuss the current U.S. protocol set by the American College of Cardiology and the American Heart Association that recommend a set of guidelines for the triage and care of patients who seek treatment in the emergency department with possible acute coronary syndrome (myocardial infarction or unstable angina).

Acute chest pain is the most commonly presented symptom of acute myocardial infarction.[81-84] When patients present with symptoms of chest pain, the goal of the emergency department's evaluation is to recognize what causes it and to start appropriate treatment as soon as possible. [82-85] The initial assessment of the patient condition must be fast, and it has to be based on sound methodological research.[81-84,123]

To distinguish what causes patient's symptoms of chest pain, emergency department staff follows protocol set by the American College of Cardiology (ACC) and the American Heart Association (AHA). [85,86] Their guidelines recommend an algorithm for the management of patients with suspected acute coronary occlusion (Appendix A). This protocol offers a straightforward approach to risk assessment and guides emergency department personnel toward immediate management of the condition based on the assessed risk. [85,86] Emergency clinicians must rapidly dissociate whether the patient condition might be life threatening. [85,86] Patients with chest pain that suggests acute coronary syndrome (myocardial infarction or unstable angina) must be triaged for immediate care. [85,86] The primary evaluation focuses on distinguishing whether the chest pain is caused by an acute coronary syndrome (myocardial infarction or unstable angina), or non-ischemic condition (no obstruction in the coronary artery).[81-85] What makes the work of emergency department physicians' difficult in assessing the etiology of patient's chest pain is that some patients with underlying myocardial infarction might not have symptoms suggestive of acute occlusion of coronary artery or might not show signs of abnormalities at the time of initial examination.[85]

Whether patient heart incurs a reversible or permanent injury depends on the amount of time the heart muscle is deprived of oxygen and nutrients and on the degree of coronary artery occlusion.[81-85] Unlike reversible myocardial obstruction in unstable angina, myocardial infarction leads to injury of the heart muscle due to oxygen restriction. [81-85]

The ACC and the AHA's guidelines for immediate assessment of patients with suspected acute coronary occlusion are as follows: First part of the rapid evaluation of the patient consists of assessing patient's airway, breathing and circulation, and obtaining a brief medical history of the patient, including the information on patient's current and past cardiac symptoms, specific characteristics of the chest pain, any previous history of coronary heart disease, and any current medication that could interfere with treating the patient's current condition.[83-85] Physical examination follows.[83-85] If it is determined that patient chest pain is cardiac in origin, the ACC and the AHA guidelines recommend that the electrical activity of patient heart should be evaluated through electrocardiography (ECG). [81-85] The initial ECG evaluation of patient heart serves as a base for early diagnosis and it is the foundation for subsequent testing and care.[85]

Determining which patients should be evaluated using the ECG (or EKG) may be difficult in patients with myocardial infarction without chest pain symptoms.[82-86] Beginning in the late 1990s, since it has been recognized that women may present with different acute coronary symptoms compared to men, in particular, presenting symptoms that may or may not include chest pain, the ACC and AHA guidelines have recommended that special attention be given to the assessment of acute coronary syndrome in women.[124] Specifically, caution should be taken when women present with symptoms of sudden unexpected tiredness, weakness, nausea and vomiting, or shortness of breath.[124]

A prospective observational study that used the National Registry of Myocardial Infarction found that one third of patients diagnosed with myocardial infarction (MI) did not report chest pain symptoms at the time of seeking treatment, and these patients were more likely to be women (49% vs. 38%).[125] The patients who did not present with chest pain delayed seeking care of acute coronary symptoms more than others (7.9 vs. 5.3 hours, on average), and they also received less MI diagnosis (22.2% vs. 50.3%) and were given less treatment for their acute coronary symptoms (25.2% vs. 74.0%).[125] Importantly, patients without chest pain were more likely to die in the hospital 23.3% vs. 9.3% among patients who did report chest pain at presentation to the hospital, incurring over twice the adjusted odds ratio for mortality.[125]

Similarly, in 2004, The Global Registry of Acute Coronary Events reported a finding showing that patients without chest pain symptoms incur higher mortality compared to those with chest pain.[126] For example, patients who presented with nausea and vomiting had odds of dying of 1.6 compared to those who presented with chest pain; and patients diagnosed with unstable angina who did not present with chest pain had odds of dying of 2.2 compared to those with chest pain.[126]

The emergency department protocol states that patients with suspected MI should be evaluated with the ECG.[85] The ECG portrays the heart's electrical activity, and it shows whether the patient's heart's rhythm is regular or if abnormalities are present. [85] With the ECG monitoring of the patient heart, clinicians focus on the assessment of the S-T wave segment of the heart's electrical activity.[85] Significant elevation of the S-T wave segment is a sign of complete occlusion of the coronary artery, where part of the heart muscle is completely deprived of needed oxygen and nutrients and it may sustain injury, requiring immediate treatment. [85] No S-T wave segment elevation but high levels of cardiac markers (e.g., Troponin, discussed next) indicate injury to the heart in locations that are supplied with blood by a coronary artery that is partially occluded. [85] No S-T wave segment elevation and no elevation of cardiac markers of heart injury but presence of persistent coronary chest pain indicate unstable angina.[85] The ECG can also show signs of an injury to the heart muscle from a previous heart attack.[85]

As documented by current research on the management of acute coronary syndrome, the first ECG reading is not always diagnostic of the S-T wave segment elevation.[85] Therefore, the recommended protocol suggests that the reading be repeated at 5 and 10-minute intervals if there is strong suspicion for acute coronary syndrome.[85] Among patients with suspected acute coronary syndrome, resuscitation equipment should be brought to patient's bedside.[85]

To assess possible injury to the heart, the ACC and the AHA recommend that status of cardiac biomarkers (preferably Troponin) be obtained. [82-86,123] Obtaining levels of cardiac markers is critical for establishing the diagnosis of myocardial infarction (both with and without S-T elevation), because their levels lead to conclusions about whether the heart muscle sustained an injury, and their readings should be obtained in all patients with suspected acute coronary occlusion. [85,86] Troponin, indicating injury to the heart, can be detected in approximately 6 hours post myocardial infarction, with peak at about 12 hours, and importantly, its levels stay high for one week to 10 days, allowing the detection of heart injury among patients who delay seeking care.[86] Troponin levels are the preferred assessment of establishing the AMI diagnosis. [82-86,123]

Initial medial history of the patient, physical exam, electrocardiograph (ECG) reading and tests of cardiac biomarkers are used to evaluate the etiology of patient chest pain together with the symptoms patient reports. [82-86,123]

Overall, the goal for the initial evaluation of the patient, including the instituting of ECG, monitoring and management of acute symptoms, is 10 minutes from the time the patient first presented with acute chest pain symptoms.[85] However, recent data show that the institution of ECG is often delayed, with significantly more delay in women.[127]

Although the ACC and the AHA's protocol constitutes the primary guidelines to care for patients with suspected acute coronary syndrome (myocardial infarction or unstable angina), they recommend that all hospitals institute their own specific chest pain protocols for how to triage and manage patients with symptoms of acute coronary chest pain within their facility.[85] The ACC and the AHA further recommend that hospitals engage a multidisciplinary team of health professionals in the process of managing patients with suspected acute coronary syndrome.[85]

Often, diagnosis about whether or not a patient with symptoms of chest pain has an acute coronary obstruction is inconclusive, and further assessment, including continuous monitoring and/or admission to a hospital, has to be done.[128,129] Among patients with suspected acute coronary syndrome who have been stabilized and/or admitted to a hospital on an in-patient basis, it might take days to establish whether the patient did or did not have a heart attack, because the patient may still be undergoing diagnostic testing, and the test result might not be available for several days.[128] For example, a physician may order radionuclide imaging to observe images of the heart through a gamma rays camera that scans a small amount of radioactive materials injected in the patient's body. [128] Similarly, a physician may order that the patient's heart be evaluated by echocardiogram that uses sound waves to examine the structure of the patient's heart and to assess whether the heart functions normally or if abnormalities are present. [128,129] Doppler ultrasound testing could be ordered to assess the blood flow in the heart. [128,129]

Those with stable angina, and those with no observation and negative tests of coronary obstruction are discharged and advised to follow up with their regular health care provider.[130,131] On average, 2-4% patients with coronary occlusion are mistakenly not diagnosed with acute coronary syndrome and thus are not treated for myocardial infarction or unstable angina.[130] Those patients are more likely to die as a result.[130-132] In the U.S., patients who happen to be mistakenly discharged from the emergency department because no coronary occlusion was identified are more likely to be women, non-Whites, and those who presented with symptoms of shortness of breath rather than symptoms of chest pain as dominant reason for seeking care. [130,131]

In the time you read the last two sentences, someone in the U.S. suffered an acute coronary event. While you read this paragraph, someone in the U.S. will die of it. As reported by the American Heart Association in their 2010 update on heart disease statistics, every 25 seconds one person in the U.S. suffers from an acute coronary event, and one person dies from it approximately every minute.[133] Each year, almost 70 percent of all coronary heart disease deaths in the U.S. happen out of hospital. [134] These deaths are generally diagnosed as sudden deaths as a consequence of cardiac arrest. [134] Emergency medical personnel attempts resuscitation in about 60 percent of those who experience out-of-hospital cardiac arrest, with the remaining 40 percent of cases pronounced deceased upon arrival of the emergency medical services team.[134] Only about a quarter of those who suffered a cardiac arrest out of hospital have a detectable heart rhythm. [134] Of those, the average survival rate to discharge from care is only 7.9 percent. [134] Those with a shockable heart rhythm are most likely to survive without neurological impairment.[134]

A significant difficulty in achieving timely treatment of patients with suspected acute coronary event persists.[134-136] The AHA's primary focus is on reducing the total amount of time from the onset of first symptoms to successful treatment of the coronary occlusion.[134] Although there are studies that assessed pre-hospital delay and delay upon presenting at emergency department, what is often lacking in the current literature is controlling for the contextual factors that take place during the patient visit to the hospital. Such factors are controlled for in the current study, and they include the elements that have to do with the situational factors of the patient visit and the structural factors of the hospitals where the patient visit take place.

In summarizing Chapter 2, the major findings from the reviewed literature pertaining to the factors that play a role in predicting lower quality of care in the emergency department setting, i.e. longer wait times to see an emergency department physician, are patient minority population characteristics, namely African American and Hispanic race/ethnicity, and female gender of the patient. Shorter wait times have been observed in ambulance mode of arrival to the emergency room, primary health care insurance coverage, visit to a privately owned hospital, and visit to hospital in non-urban areas. Adding to prior research, this study controls for the effects of other contextually related factors, while predicting the amount of time one has to wait to be treated in the emergency department, such as testing whether the assignment into urgency of care category plays a role in predicting wait time from patient gender.

In addition to the descriptive and inferential epidemiological literature and the health care utilization research, this study is built on the theoretical framework of social stratification with the health disparities perspective and the relevant prior literature that demonstrates the usefulness of this theory. The theoretical framework is discussed next. First I describe the theoretical perspective that will be applied in the construction of the conceptual model. Subsequently I illustrate the relevance of this theoretical application through a review of prior research that documents disparities in the quality of emergency care. This perspective focuses on gender, racial, and ethnic health outcome differentials. I apply the health disparities perspective to discuss health care disparities in the emergency department setting.

CHAPTER 3. THEORETICAL FRAMEWORK

3.1 Theoretical framework

This section describes the theory used in the development of the conceptual framework for this study. In this research I utilized the social stratification theoretical framework with the health disparities perspective that focus on gender, race and ethnic differentials to investigate inequalities in emergency department wait time among patients in general, in a population of patients with coronary heart disease diagnoses, and in a sub-population of patients diagnosed with the acute myocardial infarction (AMI) in the hospital emergency department. The social stratification framework guides the investigation of whether one aspect of the quality of emergency care, the emergency department wait time, varies by patient, visit, and hospital characteristics. I apply the theory in examining whether socially disadvantaged populations, namely women, African American, and Hispanic patients, experience health disparities in the form of longer emergency department wait times that are not explained by other situational and/or structural factors related to seeking emergency care. I also briefly address the limitations of the data used in the analyses, in that they are not conducive to the application of individual level health behavior models that are otherwise particularly useful in their application to patients' risk perception, symptom recognition, and seeking care.

3.2 Social stratification

Social stratification refers to a hierarchical arrangement of social classes that is based on shared socio-economic conditions.[137] This ranking of people or groups of people within a society leads to unequal access to societal resources, such as education, employment and wealth, and it directly, as well as indirectly, produces societal inequality, including health disparities.[15]

Furthermore, social stratification implies some form of justification for the hierarchical classification of people and for a differing level of access to resources.[15] The legitimization for the hierarchical arrangement of people and unequal access to resources perpetuates social stratification in modern societies, because, according to the theoretical perspective, without the beliefs of its legitimization, social stratification would not remain stable over time. [15]

The theory of social stratification, as we think of it today, originated from sociological research of the 19th-century theorists Karl Marx, Emil Durkheim, and Max Weber, all of whom conducted systematic theoretical analyses of the effects of social class.[15] Marx argued that class divisions are based primarily on ownership of property, because in market economies the primary social separation took place between owners of industrial capital and the working class. Consequently, to reduce social stratification and the inequalities associated with unequal access to resources, he argued for the elimination of private property.[15] Weber, Marx' successor, held a more complex view of social stratification. He recognized the multiple dimensions that play a role in social stratifications. In addition to economical ownership, he theorized that a social division is also based on occupational skills, status, and organizational power, or *class, status and power*.[15] Weber's expanded perspective of social stratification became the most accepted view of sociologists in the past century. Theoretical insights of both Marx and Weber influence current thinking of social inequalities as social scientists strive for a more sophisticated and realistic conceptualization of social stratification, one that would facilitate its effective application in practical settings toward decreasing health inequity.

Although different social stratification theorists vary in the explication of the dimensions of power within a modern society, a general agreement holds that there are four basic principles of social stratification: (1) Social ranking is a societal characteristic, not just a result of individual differences; (2) Social hierarchy position persists over generations; (3) Social stratification is based on beliefs about the legitimization of hierarchical ranking and access to resources; and (4) The social ranking is universal, with variation.[15] Social stratification progressively leads to unequal access to societal resources; in particular, education, employment and wealth, and ultimately, it produces societal inequality.[15] Aside for economic inequality, socially constructed categories of gender, race and ethnicity are associated with unequal access to resources associated with the promotion of health and health care, and consequently, lead to health disparities.[15,138] According to the theory, socioeconomic health disparities are best understood as being interwoven into the salient processes of social stratification that perpetuates the adverse effects on health.

Minority populations within societies have long experienced a greater burden of social inequality. From a historical perspective, women and African Americans, for example, have had unequal access to social resources, such as education, employment and wealth, which produce economic inequality.[15,138] Together with the economic burden, economically disadvantaged populations further experience a poorer quality of health compared to the dominant group.[26,27,138]

The following are findings about health outcomes that document disparities in health as based on patient social stratification. Pertaining to patient racial and ethnic characteristics, African Americans and American Indians have the highest rates of hypertension and stroke.[26,27] American Indians have the highest rates of circulatory diseases overall.[26,27] Of all people, African American women have the highest rates of hypertension and stroke, and the highest rates of coronary heart disease among all women.[26,27] Similarly, people who are poor, or near poor, experience a greater burden of all circulatory diseases compared to people who are not poor.[26,27] Likewise, education and income level highly correlate with the prevalence of all circulatory diseases, in that less education and lower income consistently predict a greater burden.[7,8] Structurally, poverty, unequal access to education, and lower income, are more prevalent in minority populations, whose economic disadvantage leads to impairment in health as well.[15,138] Already in childhood, disadvantaged social background of minority populations, due to inadequate access to social resources, predicts poor health.[138] In turn, poor health in childhood has a significant, direct, and a large adverse effect on educational achievement and income in adulthood.[138] Poor health in childhood is further indirectly associated with lower employment achievement and less wealth accumulation in adulthood through lower educational attainment and adult health status, perpetuating the adverse circle of events leading to sub-optimal health, and demonstrating that social stratification into a minority population category continually causes health selection associated with less desirable outcomes.[138] In addition, the social construct of gender has been discussed as a contributing mechanism to the extent and experience of poverty.[139] Also, gender differences in deprivation of social resources, where women have fewer opportunities, have been linked to greater societal constrains and poverty. [140]

In line with the social disparities perspective, the current study addresses whether poorer quality of care seem associated with female gender of the patient, and patient minority population characteristics, such as non-White race. Prior studies of emergency department visits suggested the presence of gender, racial and ethnic disparities with regard to the amount of time patients waited in the emergency room, but there is a paucity of research into more specific explications for the pathways of the disparities, due to limited empirical research into alternative explanations. Aside for patient sociodemographic characteristics that are often utilized in descriptive assessments of the bivariate relationships depicting receiving care, this study examined the situational characteristics of the patient visit, and the hospital structural characteristics, that help explain the pathways for some of the disparities. Guided by the health disparities perspective, the conceptual framework of this study predicts that people with historical social disadvantages, including the perpetual circle of limited access to resources, will have longer emergency department wait time compared to population groups that have historically not experienced such disadvantages. Specifically, I am applying the theory to evaluate whether the quality of care varies by patient gender and race, in testing whether socially disadvantaged social groups, namely women, African Americans, and Hispanic patients tend to wait a longer time to see an emergency physician compared to other patients, as the social construction perspective would predict.

Furthermore, I assess whether, as predicted by the health disparities perspective, women, African American, and Hispanic patients are consistently assigned into a lower urgency of care category compared to other patients. The effects of the alternative predictor variables on wait time, which consist of the structural and situational factors associated with the visit and hospital characteristics, were tested together with the patient sociodemographic characteristics to determine how much variation in hospital emergency department wait time do the patient characteristics predictors explain.

Considering the cardiovascular perception findings described earlier in Chapter 2, suggesting that perceived susceptibility of having heart disease or heart attack and perceived severity of the risk are linked to women's treatment-seeking behaviors for acute coronary event symptoms, the Health Belief Model that utilizes perceptions of personal risk of a health condition, the severity of the risk, and perceived barriers to action in a systematic way to understand health behavior at the individual level is applicable in explaining the processes associated with treatment-seeking behavior for acute coronary event symptoms.[141,142] Although the Health Belief Model offers an appropriate and meaningful theoretical perspective that can be applied to, and tested within, the treatment-seeking paradigm to predict favorable health behaviors and help in the design of interventions to improve women's health, the data that were used to test the research questions within this study do not contain variables descriptive of patients' perceptions of their health and/or health behavior, which would be needed to apply the Health Belief Model perspective within the framework of this study. Similarly, a theoretical application of the Extended Parallel Process Model to perceptions of symptoms and treatment-seeking behaviors in women would be particularly appropriate and meaningful. However, the nature of the variables included in the dataset limits what research questions may be asked. Given the unavailability of characteristics descriptive of patient perceptions with regard to symptoms recognition, current and past health status, and/or seeking emergency care services, it was not possible to apply the individual level health behavioral models in this study.

The National Hospital Ambulatory Medical Care Survey (NHAMCS) dataset includes the information on patient, visit, and hospital characteristics that, based on prior research and theoretical background, I conceptualized into a complex but meaningful model of predicting hospital emergency department wait time. The conceptual model that is presented in Figure 1 will be tested among the general population of patients who visited a hospital emergency department, among patients with coronary heart disease diagnoses, and among patients with the myocardial infarction diagnosis. The discussion of the conceptual framework follows next.

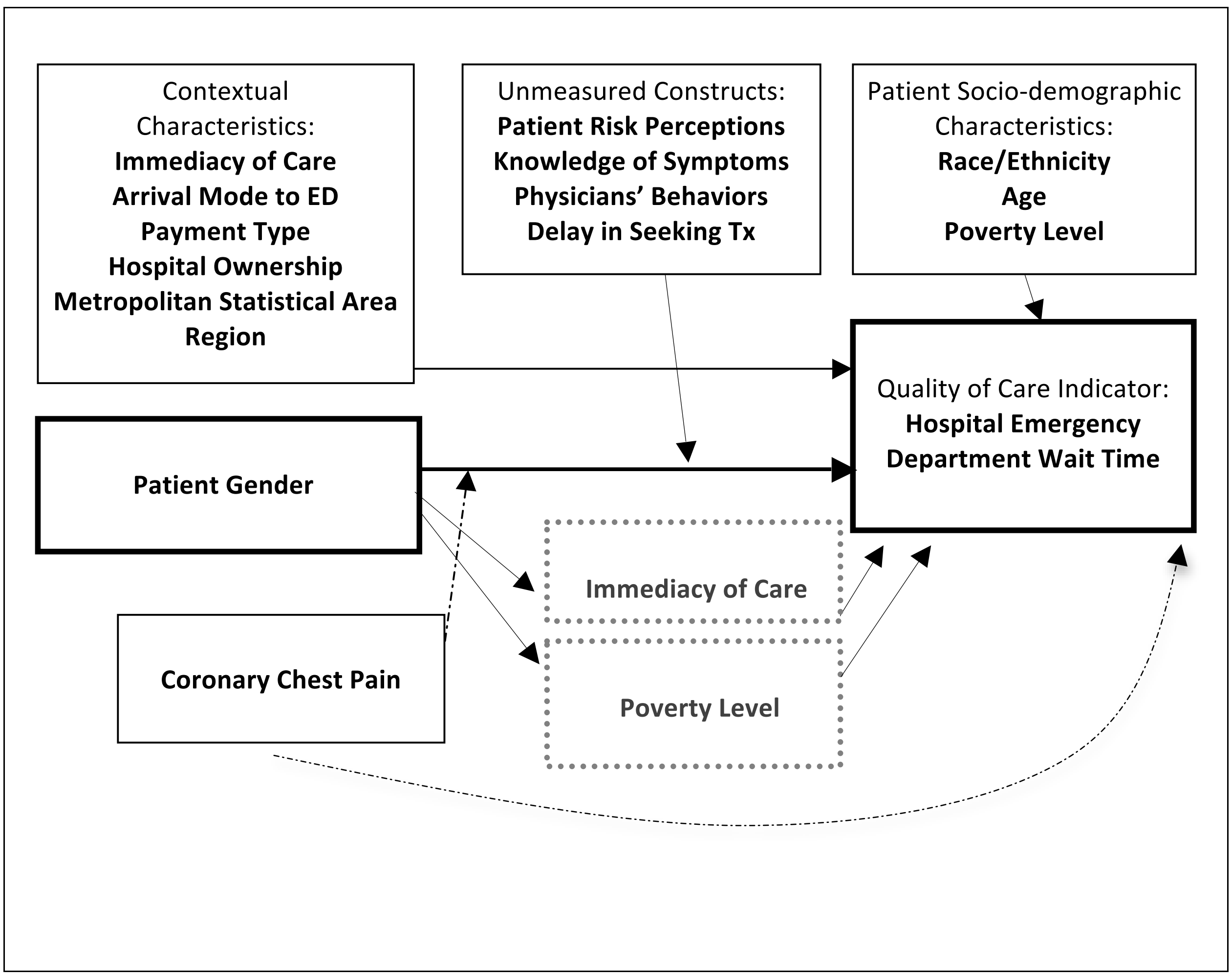
CHAPTER 4. RESEARCH DESIGN AND METHODOLOGY

4.1 Conceptual framework

Figure 1 portrays the overall conceptual framework of this study. The conceptual model was constructed based on prior findings documenting that poorer quality of care (i.e. longer emergency department wait time) has been observed in populations of women and people with minority sociodemographic status, namely African American and Hispanic patients, and that shorter waits were found in people who arrived to the emergency department by ambulance, patients who had primary source of health insurance, and in patient visits to emergency departments in non-urban areas. An important factor that was considered during the development of the framework was patient's urgency of care assigned at the time of visit at triage. This factor is related to wait time, in that the higher the urgency, the shorter the anticipated wait, and vice versa.[68] Theory was applied in that it guided the selection of the variables from the dataset for inclusion in the model, as well as in the application of the variables' conceptual roles within the predictive framework. The assembly of factors into relationship paths predicting emergency department wait time in the statements of research hypotheses was systematically guided by prior findings from the literature on social stratification where health disparities were often associated with minority population status. Additional conceptual pathways, i.e. possible moderating and mediating effects, were considered to reflect prior findings suggesting that minority women may experience longer wait times, and that urgency of care assigned at triage may play a role in the amount of wait time as well.

The focal relationship under investigation within the conceptual framework constitutes: patient gender, the focal independent variable, and emergency department wait time in minutes, the focal dependent variable. Emergency department wait time constitutes the quality of care indicator in this study. Based on prior research and the social stratification theory, relevant patient socio-demographic characteristics to consider in predicting wait time besides patient gender are patient's racial and ethnic characteristics, patient age, and poverty level.

Figure 1. Conceptual model predicting emergency department wait time among patients in general, and among patients diagnosed with coronary heart disease in the hospital emergency department.



Notes: Straight lines = Context in population of patients in general and patients diagnosed with coronary heart disease. Dashed lines = Additional context in the population of patients diagnosed with coronary heart disease.

Alternative independent variables that are conceptually associated with emergency department wait time in this framework constitute factors descriptive of the urgent care context within which patients sought care. The contextual factors consist of patient visit situational factors, and hospital structural factors. The visit situational factors are: immediacy of care, mode of arrival to the emergency department, and patient's anticipated method of payment for emergency services. The hospital structural factors are: type of hospital ownership, metropolitan statistical area (MSA) status, and geographical region of the emergency department where the patient visit took place.

According to prior research, of the patient sociodemographic characteristics, longer emergency department wait time was observed in minority populations. Regarding patient visit characteristics, longer wait times were found associated with lower urgency of care, non-ambulance arrival to the hospital emergency department, and non-private health care insurance coverage. Regarding hospital structural characteristics, longer waits were observed in hospitals with voluntary ownership, and in emergency departments located in crowded urban areas.

The conceptual model as presented in Figure 1 was tested in three population groups of patients: (1) general population of patients who visited hospital emergency departments in the U.S. in 2008, (2) a population of patients who received coronary heart disease diagnoses at the time of visit to the emergency department, and (3) a sub-population of patients who received the acute myocardial infarction diagnosis at the time of visit to the emergency department. When testing the model in the population of patients with coronary heart disease diagnoses, as well as in the smaller population of patients diagnosed with acute myocardial infarction, based on prior findings suggesting that coronary chest pain is the dominant symptom of underlying coronary heart disease, symptoms of chest pain were conceptualized of as another factor in predicting emergency department wait time.[81-84]

Prior to the explanation of the specific statistical function of each of the factors and relationship paths in the model, I first supply the reader with the information on the data that were used to study the quality of care that patients receive in the emergency department context to allow for better understanding of the application of the data to this investigation. The statistical functions of the factors in the model, the associated relationship paths of the conceptual framework, and the specifics of the measurement considerations will be explained in detail following the description of the dataset that was used to test the research questions of the study.

4.2 Study design

To investigate possible disparities in hospital emergency department wait time among patients in general and among patients diagnosed with coronary heart disease in the hospital emergency department, I conducted a secondary data analysis utilizing a publically available large-scale population-based survey dataset (described in detail below). This section contains the information on the dataset characteristics, the complex sampling design, the data collection procedures, the operationalization of the key variables used in the analyses, the research questions and hypotheses, and the statistical methodologies that were utilized to test the hypotheses. Further, I address some relevant contemporary questions surrounding the choices of applicable statistical methodologies. Finally, I discuss the strengths and weaknesses of the study design as it pertains to the analyses.

The NHAMCS dataset was selected for this work for a number of reasons. First, the dataset contains variables that were suitable to test the research questions of interest.

Specifically, these data allow for analyses of the quality of care for patients with coronary heart disease diagnoses and among patients in general in the context of the emergency department visit, while controlling for other important contextual (situational and structural) factors that are theoretically associated with the emergency visit. Second, the NHAMCS dataset has methodological strengths: the NHAMCS study uses a probability sample survey design that allows for a generalization of findings to the U.S. population, (given appropriate methodological approach), and, the large sample size of this study allows for sophisticated statistical analyses that are needed to test the study hypotheses. Third, the NHAMCS dataset is publicly available, allowing for a relatively inexpensive approach to analyzing the quality of emergency care at the national level.

As previously discussed, the variables included in the analyses were selected based on prior research in the context of hospital emergency department care. The inferential statistical analyses were developed and guided primarily by the theoretical framework of social stratification with focus on health disparities. The focal relationship under investigation in the dissertation analyses consists of testing the effect of patient gender on hospital emergency department wait time, while controlling for alternative independent variables and control variables that are theoretically associated with emergency department wait time. Within the focal relationship I investigated the effects of patient sociodemographic characteristics (patient age, race/ ethnicity and poverty level) that may theoretically confound the focal relationship, while controlling for the effects of the alternative independent variables: method of arrival to the emergency room, urgency level category, expected method of payment for the emergency services, hospital ownership type, hospital metropolitan statistical area status, and region, all of which are theorized to relate to emergency department wait time.

Study results are pertinent to translational research within hospital emergency care, in that the findings have the potential to contribute to the design of practice-oriented interventions that can improve gender and racial disparities in emergency department care through education, retraining, policy and procedural changes, and guidance for future research.

4.2.1 The National Hospital Ambulatory Medical Care Survey (NHAMCS) 2008 Dataset description

Ambulatory medical care is the predominant method of providing healthcare services in the United States (U.S.).[143] To meet the need for objective, reliable information about the provision and use of ambulatory medical care services in the U.S., the Centers for Disease Control and Prevention (CDC)'s National Center for Health Statistics implemented the National Ambulatory Medical Care Survey in 1973.[57] Data have been collected on a sample of ambulatory patient visits to non-federal employed office-based physicians who are primarily engaged in direct patient care. Data were collected annually from 1973 to 1981, in 1985, and annually since 1989.[57]

Ambulatory care in the U.S. occurs also in settings beyond the office-based physician environment, such as in hospitals, but hospital ambulatory patients may differ from office patients in their demographic characteristics and medical issues.[144] Therefore, in 1992 the CDC and the National Center for Health Statistics implemented the National Hospital Ambulatory Medical Care Survey (NHAMCS) to expand the scope of the data collected in the National Ambulatory Medical Care Survey by initiating the collection of data on ambulatory services provided by hospital emergency departments and outpatient departments.[57] Hospital-based ambulatory surgery centers were included in 2009, and freestanding ambulatory surgery centers were added in 2010.[57] The NHAMCS is conducted by the Ambulatory and Hospital Care

Statistics Branch of the National Center for Health Statistics, CDC. The resulting national estimates describe the use of hospital ambulatory medical care services in the United States. The National Ambulatory Medical Care Survey and the National Hospital Ambulatory Medical Care Survey are important tools for tracking ambulatory healthcare use in the U.S.[57]

The dissertation analyses used the Emergency Department (ED) dataset of the National Hospital Ambulatory Medical Care Survey (NHAMCS) collected in 2008 (n=34,134 patient visit records).

4.2.2 Sample design

The 2008 NHAMCS survey consists of two components: a national probability sample of patient visits to (1) emergency departments, and (2) outpatient departments, of a national sample of hospitals. The hospitals were: non-institutional general and short-stay hospitals, not including Federal, military, and Veterans Administration hospitals, located in the 50 States and the District of Columbia. The data were collected from patient visit records (detailed description is in the Data collection procedure section). The 2008 survey remained unchanged from the previous year. Data were collected from 431 emergency departments that provided 34,134 patient record forms, and from 209 outpatient departments that provided 33,908 patient record forms.

The NHAMCS used a four-stage cluster sample with stratification probability design with samples of primary sampling units (PSUs); hospitals within PSUs; clinics within hospitals; and patient visits within clinics. Each sampling stage is described below.

4.2.2.1 Primary sampling units (PSUs)

A PSU consisted of a county, a group of counties, county equivalents (parishes and independent cities), towns, townships, minor civil divisions, or a metropolitan statistical area (MSA). MSAs were defined by the U.S. Office of Management and Budget on the basis of the

1980 Census. The first-stage sample consisted of 112 PSUs that comprised a probability subsample of the PSUs used in the 1985-94 National Health Interview Survey (NHIS). The NHAMCS PSU sample included with certainty the 26 NHIS PSUs with the largest populations. In addition, the NHAMCS sample included one-half of the next 26 largest PSUs, and one PSU from each of the 73 PSU strata formed from the remaining PSUs for the NHIS sample.
The NHIS PSU sample was selected from approximately 1,900 geographically defined PSUs that covered the 50 States and the District of Columbia. The 1,900 PSUs were stratified by socioeconomic and demographic variables and then selected with a probability proportional to their size. Stratification was done within four geographical regions by MSA or non-MSA status.

4.2.2.2 Hospitals

The sampling frame for the 2008 NHAMCS was constructed from products of Verispan L.L.C., specifically, "Healthcare Market Index, Updated July 15, 2006" and "Hospital Market Profiling Solution, Second Quarter, 2006," formerly known as the Strategic Marketing Group (SMG) Hospital Database, which is a database of U.S. hospitals that is utilized for purposes of national level research. The original NMAMCS sample frame was compiled as follows.
Hospitals with an average length of stay for all patients of less than 30 days (short-stay) or hospitals whose specialty was general (medical or surgical) or children's general were eligible for participation in the NHAMCS. Excluded were hospitals with less than six beds staffed for patient use. In 1991, with the initiation of the NHAMCS, the SMG Hospital Database contained 6,249 hospitals that met these eligibility criteria. Of the eligible hospitals, 5,582 (89 percent) had emergency departments (EDs) and 5,654 (90 percent) had outpatient departments (OPDs).

Hospitals were defined to have an ED if the hospital file indicated the presence of such a unit or if the file indicated a non-zero number of visits to such a unit. A similar rule was used to define the presence of an OPD. Hospitals were classified into four groups: those with only an ED; those with an ED and an OPD; those with only an OPD; and those with neither an ED nor an OPD. Hospitals in the last class were considered as a separate stratum and a small sample (50 hospitals) was selected from this stratum to allow for estimation to the total universe of eligible hospitals and the opening and closing of EDs and OPDs in the sample hospitals. Hospitals were sampled without replacement so that each hospital would be chosen only once.

The 2008 NHAMCS was conducted between December 31, 2007 and December 28, 2008, and it consisted of a sample of 475 hospitals. Of the sampled hospitals, 79 were found ineligible due to closing or other reasons. Of the 396 hospitals that were eligible for the survey, 357 participated, for an unweighted hospital sampling response rate of 90.2 percent (89.8 percent weighted).

4.2.2.3 Emergency service areas

Of the 475 hospitals selected for the 2008 NHAMCS, 379 had eligible emergency departments (EDs). Of these, 353 participated, yielding an unweighted ED response rate of 93.1 percent. A sample of 463 emergency services areas (ESAs) was selected from the EDs. Of these, 431 responded fully or adequately by providing forms for at least half of their expected visits based on the total number or visits during the reporting period, and three responded minimally (i.e. they provided fewer than half of their expected forms).

In all, 34,134 Patient Record Forms (PRFs) were collected. The resulting unweighted emergency service area sample response rate was 93.1 percent, and the overall unweighted two-stage sampling response rate was 86.7 percent. Response rates have been adjusted to exclude minimal participants.

4.2.2.4 Patient visits

The basic sampling unit in the NHAMCS was the hospital ambulatory patient visit or encounter. Only visits made in the United States were included in the 2008 NHAMCS. Patient visits were systematically selected over a randomly assigned 4-week reporting period.

A visit was defined as a direct, personal exchange between a patient and a physician, or a staff member acting under a physician's direction, for the purpose of seeking care and rendering health services. Visits for administrative purposes, such as payment of a bill, and visits in which no medical care was provided, such as visits to deliver a specimen, were not included in the data set. The target number of Patient Record Forms (PRFs) to be completed in emergency departments in each hospital was 100. In clinics with higher visit volumes, visits were sampled by a systematic procedure, which selected every *nth* visit after a random start. Visit sampling rates were determined from the expected number of patients to be seen during the reporting period and the desired number of completed PRFs. During the 2008 NHAMCS, PRFs were completed for 34,134 emergency department visits.

4.2.3 Data collection procedures

The U.S. Bureau of the Census was the agent for the 2008 NHAMCS survey and was responsible for the data collection process, training the Census Regional Office staff, and writing the field manual. Regional Office staff members were responsible for training the NHAMCS field representatives and monitoring the data collection. The training of field representatives comprised a four-hour long self-study and two-day classroom training. Field representatives inducted the hospitals and trained hospital staff on patient visit sampling and completion of the Patient Record Forms, the survey instrument, which was provided in two versions: one for emergency departments, and one for outpatient departments.

The Patient Record Forms were completed as a systematic random sample of patient visits during a randomly assigned four-week reporting period. The NHAMCS Patient Record Forms were patterned after those developed for the National Ambulatory Medical Care Survey (NAMCS), and they can be completed in six minutes. The NAMCS and the NHAMCS outpatient department Patient Record Forms are nearly identical, while the emergency department Patient Record Form was designed specifically for the emergency care setting. In 2008, 62.1 percent of ED records and 60.6 percent of OPD records required Census abstraction.

The hospital staff, trained by the field representatives, used the Patient Record Form (PRF) to enter data on patients' demographic characteristics, arrival method, urgency of care, expected source of payment, patients' complaints, diagnoses, diagnostic/screening services, procedures, medication therapy, disposition, types of providers seen, causes of injury, and certain characteristics of the facility, such as geographic region and metropolitan status. As a quality control measure, field representatives visited the sampled hospitals areas each week during the four-week data collection period and maintained telephone contact with the data-collection hospital staff.

Patient Visit Weight

Because the NHAMCS is a sample survey, the application of a patient visit weight (PATWT variable) to the dataset was a necessary component to produce national estimates of emergency department visits, as well as to accurately assess the sampling error of statistics based on the survey data. The patient visit weight is an inflation factor used to obtain national visit estimates. The statistics descriptive of the NHAMCS sample reflect only a sample of patient visits to hospital emergency departments in 2008, not a complete count of all visits that occurred in the United States in that year. Each record on the ED file represents one visit in the sample of

34,134 visits. In order to obtain national estimates from the NHAMCS sample, each record is assigned a patient visit weight inflation factor. Aggregating the patient visit weights on the 34,134 ED patient records collected in 2008 yields a total of 123,761,419 estimated visits made by all patients to hospital emergency departments in the United States in 2008.

The statistical programming application of the patient weight design variable for the population parameter estimations is discussed in the Statistical methodologies section.

4.2.4 Operalization of key variables

This section introduces the variables that were used to test the research questions of this study. All the variables used in this investigation originated in the 2008 Emergency Department dataset of the National Hospital Ambulatory Medical Care Survey (NHAMCS) and were pertinently recoded to enable appropriate statistical analyses designed to test the research questions (described below). All research questions within this study pertain to testing outcomes in the adult population. Therefore, only data descriptive of the experience of persons of 18 years of age and older were included in the analyses. The variable summary is presented in Table 1 that follows the description of the operalization of the variables.

4.2.4.1 Focal dependent variable

The focal dependent variable within the tested conceptual model is hospital emergency department wait time, reflecting the net amount of time in minutes that patients waited in the hospital emergency department to see an emergency physician during their visit (from now on referred to as: wait time). Wait time constitutes the quality of care indicator in this study. This variable was calculated as the difference in minutes between the time a patient arrived to the emergency department (ED) and the time the patient was seen by an emergency department physician. Wait time in minutes was recorded during the NHAMCS study by the hospital staff on the Patient Record Form, the survey instrument of the study (Appendix B). Wait time was recorded as a continuous scale variable, and it contains whole numbers only. From the original WAITTIME variable in the NHAMCS dataset, I generated the WAITT variable that consists of wait time information characteristic of adult patient visits only. The range for wait time within the adult population was 0 – 1,407 minutes, with a weighted average wait time of 57.25 minutes, a standard error of 2.19, and a 95% confidence interval [52.93; 61.56 minutes]. Of the total of 34,134 Patient Record Forms collected in the 2008 Emergency Department NHAMCS study, 26,696 records corresponded to adult patient visits. Of those, 21,273 forms included the information on wait time. Approximately 20% of the Patient Record Forms (5,423 / 26,696) were missing the information on wait time. However, patients with missing wait time did not differ significantly from patients with non-missing wait time in patient sociodemographic characteristics (details in Results/ Descriptive statistics).

4.2.4.2 Independent variables

The independent variables that were tested within this conceptual framework were selected based on prior research, theory, and data availability. The conceptual design of the variables into a predictive model was supported by the theoretical framework of social stratification that helps explain possible pathways for disparities in emergency department wait time by belonging to a social or demographic minority group.

The independent variables that were manipulated in the testing of the conceptual model include two types of factors: patient sociodemographic characteristics, and patient visit contextual characteristics. Patient sociodemographic characteristics comprise patient gender, race and ethnicity, age, and poverty level. Patient visit contextual characteristics are further sub-divided into visit characteristics (or situational factors), and hospital structural characteristics (or environmental factors). Visit characteristics comprise mode of arrival to the emergency department (ED), urgency level, and expected source of payment for the emergency services, as to depict the situational context within which the patient visit occurred. The hospital structural characteristics consist of the type of hospital ownership, the hospital metropolitan statistical area status, and the geographic region to which the hospital belongs, as to depict the structural characteristics of the hospitals within which the patient visit took place.

4.2.4.3 Focal independent variable

Chapters 2 and 3 reviewed and applied prior research and theory pertaining to women's health and health disparities proposing that for multi-factorial and complex reasons, women may receive a lower quality of care compared to men, including emergency care. Following on the discussion of gender disparities in the quality of care, the focal investigational variable that was tested within the predictive model of this study was patient gender. The original NHAMCS patient gender variable (SEX) was coded as 1=Female and 2=Male. For analytical purposes, I recoded that variable into a new patient gender variable named (WOMEN), where 1=Women and 0=Men, to facilitate relevant statistical analyses and the interpretation of results. As previously stated, in the process of recoding this variable, I excluded ED visits of pediatric patients.

Aside for its conceptual and analytical role as the focal independent variable in testing its effect on wait time directly (while controlling for the contextual factors), the patient gender variable was further utilized in testing path 'a' in two mediation analyses in an attempt to investigate possible mediation effect of the focal relationship by the two following variables: (1) immediacy of care, and (2) poverty level (details in the Statistical methodologies section).

Of the total of 26,696 adult patient visits within the NHAMCS dataset, 14,825 (56.34 percent weighted) were visits of women, and 11,871 (43.66 percent weighted) were visits of men.

4.2.4.4 Patient sociodemographic variables

Aside for patient gender, the other patient sociodemographic variables that played a role in testing of the predictive relationships were patient race and ethnicity, age, and poverty level. These variables had the primary conceptual and statistical role of control variables, in that when testing the effect of patient gender on wait time, I controlled for the effects of the patient sociodemographic variables (together with the visit contextual factors). The patient race variable had an additional role of a moderator variable in the testing of moderation (conditionality) within the focal relationship. The poverty level variable was further employed in the testing of its possible mediation effect on the focal relationship.

Patient racial/ethnic characteristics

The original race and ethnicity RACEETH variable in the NHAMCS dataset included the information on both, patient race and ethnicity characteristics in the following categories: White only, Black only, Hispanic, Asian, Native Hawaiian, Other Pacific Islander, American Indian/Alaska Native, and Multiple races. From that variable, I generated the RACE variable that consisted of adult patient visits in the following categories: 1=Non-Hispanic White, 2=Non-Hispanic Black, 3=Hispanic, and 4=Other. The other original race and ethnicity populations were represented in very small numbers, at approximately under one percent of the distribution in each group, and as such, did not allow for a sufficient statistical power to observe statistically significant differences. In fact, preliminary analyses that included all available racial and ethnic categories within the original RACEETH variable in the adult population yielded very non-significant statistical results pertaining to the differences in mean wait time. As a result of the very small percentages of the other racial categories in the original race variable, those population categories were not included in the final RACE variable that was used in the analyses but were combined into a joint ‘Other’ patient race category. The NHAMCS study collected sufficient information characteristic of visits of African American and Hispanic patients, which were the two demographic groups within the race and ethnicity category whose emergency department visit experience was investigated, comparing and contrasting it to the experience of White patients.

The reason for including both racial and ethnic characteristics in one variable was based on the evidence that compared to the variable that combined patient race and ethnicity, the original NHAMCS race-only variable included patient visits of Hispanic patients in the White race category. This categorization would not allow for accurate conclusions regarding race and ethnicity associations with wait time. Furthermore, it would be impossible to use the White patient race category as a reference group, (which currently appears to be the golden standard for comparison purposes), because this group includes also visits of Hispanic patients.

Of the total of 26,696 adult patient records, approximately 60 percent corresponded to visits of White patients, one fifth were African American patients, one tenth were Hispanic patients, and fewer than four percent were patients of all other race categories, including multiple races.

Patient age

The values of the original AGE variable in the NHAMCS dataset range from 0 to 100, where the value 0 includes patients under the age of one year, and the value 100 includes patients 100 years of age and older. From the original AGE variable I generated a new patient age variable named ADULTS that includes only observations on the visits of patients aged 18 years or over (n=26,696). In this study, the patient age variable was conceptually treated and statistically analyzed as a continuous variable in all analyses, predicting the change of one minute of wait time associated with a one year change in patient age. Of the total of 26,696 adult patient records, the weighted average patient age was 46.08 years, with a standard error of 0.30, and a 95% confidence interval [45.48; 46.67 years].

Poverty level

This variable is operationalized as the percentage of population poverty within patient's zip code. The data were recorded on ordinal scale, where 1=Quartile 1 (Less than 5.00 percent), 2= Quartile 2 (5.00-9.99 percent), 3=Quartile 3 (10.00-19.99 percent), and 4=Quartile 4 (20.00 percent of more). From the original PCTPOVR variable in the NHAMCS dataset, I generated the PERCPOV variable that contains information on adult patients only. Of the total of 25,053 adult Patient Record Forms that recorded data on poverty level, approximately 16 percent were in Quartile 1, the lowest level of poverty; 28 percent fell in Quartile 2; two thirds fell in Quartile 3; and one fifth were in Quartile 4, the highest level of poverty.

4.2.4.5 Alternative independent variables

The variables that have the primary conceptual role of alternative independent variables within the framework of this study consist of patient visit contextual characteristics, which are divided into patient visit characteristics (or situational factors), and hospital structural characteristics (or environmental factors). Visit characteristics comprise arrival mode, urgency level, and payment type, depicting the visit situational context. The hospital characteristics comprise type of hospital ownership, hospital metropolitan statistical area status, and geographic region, depicting the hospital structural characteristics within which the patient visit took place.

Situational Factors:

Immediacy of care

The immediacy of care variable is operationalized as the level of urgency of care with which a patient should see an emergency physician. The urgency level is based on efficient provision of emergency care as well as on how long a patient can safely wait to receive emergency treatment for his or her condition. Triage clinicians assigned immediacy at the time of patient arrival to the emergency department (ED) based on the standard Emergency Severity Index scale (described in detail in Chapter 2). In the NHAMCS, the information on immediacy was recorded on the Patient Record Form by the hospital staff at the time of data collection. The immediacy variable is coded on an ordinal scale and it has five ordered categories of urgency corresponding to the Emergency Severity Index as: 1=Immediate, 2=Emergent (<14 min), 3=Urgent (15-60 min), 4=Semi-urgent (1-2hrs), and 5=Non-urgent (2-24hrs).

From the original NHAMCS immediacy variable I generated the IMM variable that is descriptive of the adult patient experience. In this study, the statistical role of the urgency of care variable was a control variable when testing the effect of the focal relationship. Specifically, I investigated whether after controlling for assignment into urgency of care, differentials in emergency wait time exist. Aside for its primary conceptual role of an alternative independent variable, the immediacy variable also behaves as a mediator variable in a mediation analysis of the focal relationship, while controlling for the other situational and structural factors in the model. Specifically, in the mediation analysis, the IMM variable has a temporary role of a dependent variable in the path ‘a’ of the mediation analysis, where I test whether immediacy assignment varies by patient gender (details in the Statistical methodologies section). If, when controlling for urgency of care, the focal relationship becomes statistically non-significant, urgency of care will be seen to mediate the relationship. If, after controlling for urgency of care, the strength of the focal relationship decreases but the focal relationship is still statistically significant, we will see evidence for partial mediation by the urgency variable.

Of the 22,444 adult patient records that reported immediacy, approximately five percent of visits were categorized for immediate care, 15 percent were triaged for emergent care, slightly less than one half were triaged into the urgent category, less than one forth were triaged as semi-urgent, and less than ten percent were triaged as non-urgent.

Although conceptually, assignment into a category of urgency corresponds to how long patients wait to be seen by an emergency physician,[84] immediacy and emergency department wait time do not represent the same concept, and accordingly, the two constructs are measured in different ways. Despite the theoretical association, the two NHAMCS variables are correlated at r = -0.1924 (Table 3).

Arrival Mode

The arrival mode variable depicts the transportation method that patients utilized to arrive to the hospital emergency department to seek care. The original NHAMCS variable, ARRIVE contains the arrival mode information in the following categories: Ambulance, Non-ambulance public service, Personal transportation, Unknown, and Blank. From the original variable, I generated the ARRIVAL variable that contains the information on adult patients and is coded categorically as: 1=Ambulance arrival, 2=Public service, and 3=Personal transportation. For the purposes of this analysis, the Unknown and Blank categories were declared missing, as they did not contribute meaningful information to testing of the research questions. Of the 25,017 adult patient visit records that contained arrival mode information, three quarters were arrivals by the means of personal transportation, one fifth were arrivals by ambulance, and about two percent were non-ambulance public service arrivals. Approximately five percent of patient visits had unknown arrival mode.

Pay Type

The pay type variable is operationalized as the expected method of payment for patient's emergency department visit. The information about payment type was recorded on the Patient Record Form by the hospital staff. The original NHAMCS PAYTYPE variable was coded into the following categories: 1=Private insurance, 2=Medicare, 3=Medicaid, 4=Worker's compensation, 5=Self-pay, 6=No charge, or 7=Other. I recoded that variable into a pay type variable PAY that includes adults only. Within this variable, the primary investigational interest was the contrast of outcome between patients with private insurance coverage and patients with Medicaid, together with other pay type categories within this variable. The Medicaid categorization reflects patient sociodemographic stratification into a disadvantaged population group that may theoretically be associated with more adverse outcomes in the quality of care, such as longer wait time in the hospital emergency department. The anticipated type of pay among adult patients was distributed in the following way: slightly more than one third were visits covered by private insurance, one quarter of visits was covered by Medicare, about 16 percent visits were covered by Medicaid, approximately 17 percent of visits were Self-paid, one and a half percent were each: Worker's compensation and No charge. Approximately four percent of the patient visits had other method of payment.

Environmental Factors:

Owner

The OWNER variable is operationalized as the type of hospital ownership where emergency care was sought during the patient visit. Hospital ownership is designated according to the primary owner of the hospital based on the Verispan Hospital Data Base that was used for the sampling design (details in the Study design/ Sample design section). This variable is categorical and it was coded into the following hospital ownership type categories: 1=Voluntary non-profit, 2=Government non-federal, or 3=Proprietary hospital ownership. Voluntary non-profit categorization reflected hospitals that were church-based, nonprofit corporations, or other nonprofit ownership. Government non-federal categorization reflected hospitals that were operated by State, county, city, city-county, or hospital district or authority. Proprietary categorization reflected hospitals that were individually or privately owned or were partnerships or corporations for profit.

From the original NHAMCS variable I generated the OWNER variable that contains information on adults only. Of the total of 26,696 adult patient visits, three quarters reflected Voluntary non-profit hospital ownership, and approximately 12 percent each were: Government non-federal, and Proprietary hospital ownership.

MSA

The hospital metropolitan statistical area status variable MSA reflects whether or not the patient visit took place in a hospital that is located in a metropolitan statistical area, based on the actual location in conjunction with the definition of the Bureau of the Census and the U.S. Office of Management and Budget. The MSA definition involves two specifications: (1) a city or cities of specified populations that make up the central city and identify the county in which it is located as the central county; and (2) economic and social relationships with contiguous counties that are metropolitan in character so that the periphery of the specific metropolitan area may be determined. Some MSAs cross state lines. In New England, MSAs consist of cities and towns as opposed to counties. Non-MSA are areas other than metropolitan, and include micropolitan statistical areas. The NHAMCS variable is categorized as: 1=MSA, and 0=non-MSA. From the original variable I generated the MSA variable that contains information on adults only. Of the total of 26,696 adult patient visits, 84% reflected visits to MSA hospitals and 16% to non-MSA hospitals.

Region

The REGION variable reflects the geographic region, within which the patient visit took place. Based on the actual location, hospitals were classified into one of four geographic regions of the United States (U.S.), corresponding to the classification used by the U.S. Bureau of the Census: 1=Northeast, 2=Midwest, 3=South, 4=West. From the original NHAMCS variable I generated the REGION variable that includes data on adults only, and I reverse-coded the four regions to allow the Western region be the reference group for comparison purposes as: 1=West, 2=South, 3=Midwest, and 4=Northeast. Of the total of 26,696 adult patient visits, approximately 20 percent (weighted) reflected each of the three regions: West, Midwest, and Northeast, and 38 percent (weighted) reflected patient visits in the South.

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*Note:
Northeast geographic region contains: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.

Midwest geographic region contains: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

South geographic region contains: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.

West geographic region contains: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

Chest pain

The CHESTPAIN variable was computed from the Patient Record Form Item 4.a that collected the information on patient's principal complaint(s), symptom(s) or other reason(s) for the emergency department visit. This original item consisted of three parts: (1) the most important complaint, symptom, reason for visit; and parts (2) and (3) that collected data on other complaint, symptom, or reason for visit. Parallel to these three items that asked about patients' reasons for visit, the NHAMCS contains three items for the responses to reasons 1, 2, and 3: coded in variables RFV13D (Most important reason for visit), RFV23D (Other reason for visit), and RFV33D (Other reason for visit). Chest pain as reason for visit was coded as reason number 1050. Chest pain classification comprised the following patient reasons, symptoms, or complaints: chest pain, chest discomfort, soreness, pressure, tightness, or heaviness (included chest pressure), burning sensation in the chest (includes angina pain, heart distress, and pain over heart). This categorization of chest pain complaints at the time of emergency department visit has been previously used in Wilper et al. (2004) to study symptoms of chest pain and emergency department wait time using prior versions of the NHAMCS dataset.[60]

From the original NHAMCS responses to reasons 1, 2, and 3 that were coded in variables RFV13D, RFV23D, and RFV33D, I computed the index CHESTPAIN variable as a dichotomous variable indicating whether or not adult patients reported such symptoms. The CHESTPAIN variable is coded 1=Chest pain, 0=No chest pain. Of the 26,696 adult patient record forms, 1,627 (6.53 percent weighted) recorded chest pain as a reason, symptom or complaint for visit. Summary of key variables that are used in testing of the research questions in this study is provided in Table 1.

Table 1. Summary of key variables operationalized

Variable Name	**Variable Label**
OUTCOME VARIABLE	
WAIT TIME *(Focal outcome variable)*	Wait time to see an emergency department physician (in minutes). Calculated from the Emergency Department Patient Record Form Q1.d. (arrival time - time seen by physician). Values range 0-1,407 minutes.
INDEPENDENT VARIABLES	
Patient sociodemographic characteristics	
WOMEN *(Focal independent variable)*	Patient gender 1=Female 0=Male
RACE	Patient Race/Ethnicity 1 = Non-Hispanic White 2 = Non-Hispanic Black 3 = Hispanic 4 = Other
ADULTS	Patient age in years at the time of visit. Values range 18 – 100, where 100 = 100 and over
PERCPOV	Population percent poverty in participant's zip code. 1= < 5% 2= 5-9.99% 3= 10-19.99% 4= > 20%
Alternative independent variables - Contextual factors	
Patient visit characteristics (Situational factors)	
IMMEDIACY *(This variable behaves as an independent variable in relation to wait time, but as an outcome variable in testing path 'a' of a mediation analysis within focal relationship)*	Immediacy with which patient should be seen in the ED. 1 = Immediate 2 = Emergent (1-14 minutes) 3 = Urgent (15-60 minutes) 4 = Semi-urgent (>1 hour – 2 hours) 5 = Non-urgent (>2 hours – 24 hours)
ARRIVE	Mode of arrival to the emergency room. 1=Ambulance 2=Public service 3=Walk-in (private transportation)
PAYTYPE	Primary expected source of payment for the emergency visit 1 = Private insurance 2 = Medicare 3 = Medicaid/SCHIP 4 = Worker's Compensation 5 = Self-pay 6 = No charge/charity 7 = Other
	Table 1. Continues

Table 1. Continued

Hospital structural characteristics (Environmental factors)	
OWNER	Hospital ownership 1 = Voluntary non-profit 2 = Government, non-Federal 3 = Proprietary
MSA	Metropolitan/Non-Metropolitan Status 1 = MSA (Metropolitan Statistical Area) 0 = Non-MSA (includes micropolitan statistical areas)
REGION	United States' geographical region where patient visit took place 1=West 2=South 3=Midwest 4=Northeast
CHD & AMI Domain Sub-population Analyses	
CHD	This information was used to sub-set the NHAMCS dataset for a part of the analysis by a population of patients who received the coronary heart disease (CHD) diagnoses in the ED at time of visit. (Based on ICD-9-CM diagnosis = codes 410 – 414 = diagnoses of coronary heart disease (CHD) in the NHAMCS data) 1=Yes 0=No Computed from the original NHAMCS items DIAG13D – DIAG33D.
AMI	This information was used to sub-set the NHAMCS dataset for a part of the analysis by a population of patients who received the Acute Myocardial Infarction (AMI) diagnosis in the ED at time of visit. (Based on ICD-9-CM diagnosis = code 410 in the NHAMCS data) 1=Yes 0=No Computed from the original NHAMCS items DIAG13D – DIAG33D.
Additional Independent Variable tested in the CHD & AMI Domain Sub-populations	
CHESTPAIN	Coronary chest pain reported as a reason for ED visit 1=Yes 0=No Computed from the original NHAMCS items RFV13D – RFV33D (Reasons For Visit 1 – 3 #1050).

Table 1. Continues

Table 1. Continued

Population estimation variables	*Design variables used to survey set the dataset for estimates of population parameters.*
CPSUM	Clustered PSU marker
CSTRATM	Clustered PSU stratum marker
PATWT	Patient visit weight

As portrayed in the conceptual framework for this study presented in Figure 1, within the focal relationship, patient gender is conceptualized as having an effect on hospital emergency department wait time, in that I tested whether overall, women seem to experience longer average wait time to see a hospital emergency department physician compared to men, after having adjusted for the patient sociodemographic characteristics, patient visit situational factors and the hospital structural factors.[60] The conceptual model will be tested in the general population of patients who visited the hospital emergency department, in a population of patients with coronary heart disease diagnoses at the time of visit to the emergency department, and in a sub-population of patients with the acute myocardial infarction diagnosis at the time of visit to the emergency department.

As noted, studying gender disparities in the quality of coronary care is both empirically grounded and historically relevant, as differentials in the quality of heart health care for women have been discussed for the past two decades, together with intervention attempts that have intended to eliminate those disparities. However, a particularly important issue is to examine whether such inequities persist. The research hypotheses are presented next and they attempt to address these issues.

4.2.5 Research questions and hypotheses

Research question (1): Does hospital emergency department wait time reflect gender, racial and/or ethnic disparities? If so, what factors are at play? What factors confound, or moderate the effect of patient gender on hospital emergency department wait time?

(1.1)

Ho: Patient sociodemographic characteristics do not predict emergency department wait time.

Ha: Female gender of patient, and African American and Hispanic ethnicity predict longer emergency department wait time after controlling for patient visit contextual factors.

(1.2)

Ho: Situational and environmental contextual characteristics of the emergency department visit are not associated with emergency department wait time.

Ha: Non-private insurance coverage, non-private hospital ownership, and hospital location in a Metropolitan Statistical Area predict longer emergency department wait time.

(1.3)

Ho: The association between patient gender and emergency department wait time is not moderated by patient race.

Ha: Patient race moderates the effect of patient gender on wait time, in that African American women experience significantly longer wait time, compared to White women.

Research question (2): Does the immediacy of care assigned at the time of emergency department triage mediate the focal relationship between patient gender and emergency department wait time? Is the association between patient gender and wait time partially or fully explained by urgency of care?

(2.1)

Ho: Immediacy of care does not mediate the relationship between patient gender and emergency department wait time, while controlling for the effect of visit contextual factors.

Ha: Immediacy explains some of the effect of gender and wait time, while controlling for the effect of visit contextual factors.

Research question (3): Does poverty level mediate the focal relationship between patient gender and emergency department wait time? Is the association between patient gender and wait time partially or fully explained by poverty?

(3.1)

Ho: Poverty level does not mediate the relationship between patient gender and emergency department wait time, while controlling for the effect of visit contextual factors.

Ha: Poverty level explains some of the relationship between gender and wait time, while controlling for the effect of visit contextual factors.

Research question (4): In a subset of the NHAMCS survey patient population with coronary heart disease (CHD) diagnoses in the emergency department, what patient and contextual factors predict hospital emergency department wait time?

(4.1)

Ho: In patients with the CHD diagnoses in the emergency department, patient sociodemographic characteristics do not predict emergency department wait time, while controlling for the effect of visit contextual factors.

Ha: In patients with the CHD diagnosis in the emergency department, female gender, African American and Hispanic ethnicity predict longer emergency department wait time, and this relationship prevails after controlling for the visit contextual factors.

Research question (5): In a subset of the NHAMCS survey patient population with acute myocardial infarction (AMI) diagnoses in the emergency department, what patient and contextual factors predict hospital emergency department wait time?

(5.1)

Ho: In patients with the AMI diagnosis in the emergency department, patient sociodemographic characteristics do not predict emergency department wait time, while controlling for the effect of visit contextual factors.

Ha: In patients with the AMI diagnosis in the emergency department, female gender, African American and Hispanic ethnicity predict longer emergency department wait time, and this relationship prevails after controlling for the visit contextual factors.

(5.2)

Ho: Coronary chest pain as a reason for visit does not have a conditional effect on the focal relationship between patient gender and emergency department wait time.

Ha: Coronary chest pain as a reason for visit in women is associated with longer emergency department wait time compared to wait in men with chest pain as a reason for visit.

The following paragraphs describe the specific methodological function of each variable that has been operationalized and included in the study hypotheses, including the relationship paths that now have a specific conceptual meaning for testing of the research questions.

In testing the significance of the focal relationship, I controlled for the effects of the theoretically relevant factors that play a role in the emergency department care setting, namely patient sociodemographic variables, and patient visit contextual characteristics. Aside for patient gender, the patient sociodemographic variables that were tested in the model constitute: patient race, ethnicity, age, and poverty level. The contextual factors under investigation consist of patient visit situational characteristics and hospital structural characteristics. The patient visit situational characteristics are: method of arrival to the emergency department (from now on referred to as: arrival mode), urgency of care determined at triage, and expected method of payment for the emergency department services (from now on referred to as: payment type). The hospital structural characteristics are: type of hospital ownership, metropolitan statistical area status of the hospital emergency department (from now on referred to as MSA), and the geographical region of the hospital that the patients visited (from now on referred to as: region). The alternative independent variables are conceptually relevant within the study of emergency department wait time, in that prior research suggests that longer average wait time seems associated with visits characterized by non-ambulance arrival, no charge to the patient, non-privately owned hospitals, and large metropolitan statistical areas.[68]

With regard to the patient sociodemographic variables that take on primarily the conceptual role of control variables within the model, I tested the significance of gender by race interaction in an attempt to evaluate whether average wait time in women and men varies by patient race. This effort was motivated by prior descriptive findings proposing that African American patients have longer average emergency department wait times compared to White patients.[60]

For the purposes of the interaction analyses, I treated the patient race variable as an intervening variable. Specifically, the statistical conceptualization of patient race was a moderator variable, testing its effect on the focal relationship.

Another variable that has primarily the conceptual role of a control variable within the framework is the categorization of patients who arrive to the emergency room into one of five urgency of care categories based on the immediacy with which the patient should be seen, as determined at triage (from now on referred to as: immediacy). Although immediacy and emergency department wait time do not represent the same concept, and accordingly, the two constructs are measured in different ways, conceptually, assignment into a category of urgency corresponds to how long patients wait to be seen by an emergency physician.[68] Assignment into a more urgent category of immediacy should lead to shorter emergency department wait time, and vice versa.[68] Consequently, the inclusion of the immediacy variable as a control variable in the investigation of associations within this predictive model is critical.

Aside for taking on the analytical role of a control variable during the majority of the analyses, in investigating possible mediation in Research Question (2) the immediacy variable is tested as a mediator of the focal relationship. Its role as a mediator, however, is purely statistical. Conceptually, the immediacy variable still is an alternative independent variable that is included in the model along with the other theoretically-relevant independent variables when assessing the effect of patient gender on wait time. This mediation analysis is portrayed within the conceptual model in Figure 1.

Motivated by prior research and the social disparities theoretical perspective, an additional mediation analysis of the focal relationship involved the poverty level variable (from now on referred to as: poverty). Investigating whether poverty may explain the effect of patient gender on wait time, controlling for the other theoretically relevant independent variables, the poverty variable took on the role of a mediator variable. This mediation analysis is portrayed in the conceptual model in Figure 1.

Building on prior research that suggests gender disparities in the quality of coronary care, within this conceptual framework coronary chest pain is conceptualized to have a modifying effect on the focal relationship in the AMI sub-population, (while controlling for the other conceptually-associated variables in the model), in testing whether coronary chest pain reported at the time of visit to the emergency department interacts with patient gender and modifies its effect on wait time, as to assess whether the effect of gender on wait time is conditional upon coronary chest pain symptoms reported upon arrival to the emergency room. This moderation analysis is visually portrayed in Figure 1 by an arrow that points from the coronary chest pain variable toward the focal relationship.

4.2.6 Statistical methodologies

This section details the descriptive statistical analyses, data manipulation steps, as well as the inferential statistical techniques that were conducted to test the five main research questions and related hypotheses of this study. The methodologies that were applied to test the research hypotheses are grounded in current and recommended statistical processes based on the analytical goal and the nature of the variables tested in the study.

4.2.6.1 Descriptive statistical analyses

To obtain sample characteristics of the adult patient visits to the hospital emergency departments from the 2008 NHAMCS dataset, I conducted descriptive univariate and bivariate analyses of the variables used in the study (Table 2). To capture descriptive characteristics of the variables, I obtained their measures of central tendency. For the two continuous variables in the study, (1) hospital emergency department wait time, and (2) patient age, I computed the mean, median, mode, range, inter-quartile range, standard deviation, standard error, and the 95% confidence interval for the mean, and I obtained plots of residuals of the observations' distribution. For the categorical and ordinal variables in the study: (1) patient gender, (2) patient race/ethnicity, (3) immediacy, (4) arrival mode, (5) pay type, (6) hospital ownership, (7) MSA, (8) geographical region, (9) chest pain, and (10) poverty level, I computed the frequencies, percentages, cumulative percentages, and standard errors. For all variables that were tested in the model, I obtained graphical portrayals of the variables' distribution, such as histograms, and residual plots to check the univariate assumptions of normality and homoscedascity of residual values.

In the computation of descriptive statistics, I utilized the survey design weight variables that were necessary for the estimation of the population parameters based on the observations in the sample: CPSUM (the clustered PSU marker), CSTRATM (the cluster PSU stratum marker), and PATWT (the patient visit weight), to obtain weighted descriptive statistics of all variables. Subsequent data management procedures consisted of four major steps:

(Step 1) I recoded all variables used in this study to exclude observations that reflected hospital emergency department visits of pediatric patients. This step was executed by computing new variables (all of which were introduced in the Operation of key variables section) through using the original AGE variable, in that only observations that were equal to, or were greater than, the value 18 were included in the new variables and used in the study analyses.

(Step 2) I recoded the following variables to modify its categories based on the conceptual framework, theory, and data availability: The original RACE variable from the Emergency Department NHAMCS dataset was recoded from 1=White only, 2=Black only, 3=Hispanic, 4=Asian, 5=Native Hawaiian or Other Pacific Islander, 6=American Indian/Alaska Native, and 7=Multiple races into the following new categories: 1=Non-Hispanic White, 2=Non-Hispanic Black, 3=Hispanic, and 4=Other due to the lack of sufficient data in the other categories (as described in the Operalization of key variables section). Next I modified the categories of the ARRIVAL variable in that the original categories that contained the information on arrival mode coded as: -8=Unknown and -9=Blank were declared missing for analytical purposes because these categories did not provide sufficient meaningful information for the testing of the study hypotheses. Next I modified the categories of the PAY variable in that the original categories that contained the information on pay type coded as: -9=Blank and -8=Unknown were declared missing for analytical purposes because they did not provide enough information relevant to the research hypotheses. This variable already contains an ‘Other’ pay type category, (the 7th pay type category of this variable) that already provided the information useful for hypotheses testing.

(Step 3) I recoded the following variables to specify reference group categories of the variables based on the study research questions and the comparisons I intended to make. The original NHAMCS patient gender variable was recoded from 1=Men and 2=Women into the new WOMEN variable where 1=Women and 0=Men to facilitate statistical testing and the interpretation of results.

Additional variables were reverse-coded to change the variables' reference categories to allow for comparisons based on the research questions of the study. This step was conducted because the original variable categorization did not always yield statistical results with reference groups that were useful for the target mean comparisons of this study. For example, utilizing the original categorization within the immediacy variable, the non-urgent category was treated (by the SAS 9.3 statistical software) as the reference group for comparisons within the immediacy variable, (which was not useful with regard to the research questions). Rather, the target comparison category of the immediacy variable was the immediate group, to which I intended to compare the average wait time in other categories of the immediacy variable. To modify variables' reference categories, the following variables were reverse coded: immediacy IMM (to specify the 'immediate' category as the reference group), ARRIVAL (to specify 'ambulance arrival' as the reference), RACE (to specify 'White race' as the reference category), PAY (to specify 'private insurance' as the reference category), OWNER (to specify 'voluntary ownership' as the reference category), and REGION (to specify 'West' as the reference category).

(Step 4) Computation of a new variable from multiple NHAMCS original variables. To generate the variable descriptive of patient chest pain reason(s), symptom(s) or complaint(s) for visit CHESTPAIN, I utilized the original NHAMCS variables RFV13D, RFV23D, and RFV33D that contained the information on patient reason(s), symptom(s) or complaint(s) for visit. Chest pain symptoms were coded as the value 1050. From the three variables that collected the information on patient reasons for visit, I generated the new CHESTPAIN variable through the computation of responses to these questions, where observations among adult patients that were coded 1050 yielded the category 1=Chest pain, and all other 0=No chest pain.

Following any manipulation of variables, I obtained univariate descriptive statistics of the newly created variables and I compared the cell counts and totals against the original variables to assure accuracy of computation.

After all studied variables were modified in the specified ways in the data steps procedures, I obtained characteristics of the bivariate relationships between the variables. I generated inter-variable correlations to check for variable multicollinearity. Collinearity could pose issues in the estimation of regression coefficients. If two or more variables that are strongly correlated are tested in a regression model together, the estimates of the population parameters for the model cannot be accurately computed. The model estimates of the coefficients become unstable and the standard errors for the coefficients can get inflated. To avoid unstable coefficients resulting from collinear variables, I attempted not to include collinear variables in the multiple regression model together.

4.2.6.2 Inferential statistical analyses

4.2.6.2.1 Predicting emergency department wait time among patients in general: Research question (1)

The purpose of the inferential statistical analyses was to test the five main research questions of this study. The types of statistical analyses that were used to test the hypotheses were determined primarily based on the analytical goal of the study, the nature of the dependent variables and the number and type of the predictor variables that were tested together.

The focal outcome variable in this study is the continuous variable hospital emergency department wait time. All five research questions involve this variable. The key predictor variables are (1) categorical variables (gender, race/ethnicity, arrival mode, pay type, ownership, MSA, region, chest pain), (2) ordinal variables (immediacy, and poverty level), and (3) the continuous variable: patient age. Given the continuous nature of the dependent variable, ultimately, as described below, survey regression statistical analysis techniques were employed to predict hospital emergency department wait time.

Arriving at the decisions pertaining to which statistical methodologies to use to test the study hypotheses entailed a complex process, and it included preliminary inferential analyses employing the dependent variable wait time and the model predictors. The selected methodological procedures are fundamentally grounded in current literature on applied statistical methodologies relevant to analyzing complex survey data.[145,146] The methodology selection emerged as follows: Predicting wait time, in statistical terms, constitutes predicting time to event (event = seeing an ED provider). The raw wait time data point distribution approximates a survival distribution. Therefore, the statistical survival analysis method, or predicting time to event, could be an appropriate statistical procedure to predict emergency department wait time.

However, conducting survival analysis with complex survey design data is problematic. In particular, testing for mediation poses problems in both, the estimation of population parameters, and in the interpretation of the mediation results. Further, the interpretation of hazard ratios from the survival analyses is not particularly straightforward when intending to compare and contrast minutes of wait time, in that the hazard ratio results are estimates of the hazard of seeing a provider, and the directionality of the association is inverse of that depicting the length of time a patient waited to see an emergency physician. I briefly illustrate: I estimated the statistical model as time to event analysis of wait time. The resulting hazard ratios were smaller for predictors associated with longer emergency department wait time, because they predict hazard of being seen in the emergency department. The ratios were greater for predictors with a shorter wait time. For example, the preliminary inferential survival regression results estimated the hazard ratio for African American patients to see a provider at .78 that of White patients, suggesting that African American patients have smaller odds of being seen by the emergency provider compared to Whites. Similarly, the hazard ratio for Hispanics versus Whites was .90, estimating a longer average wait among Hispanic patients. That way, I could interpret the differences in the odds of being seen by an emergency department physician. Although the interpretation of hazard ratios is interesting, it is more logical and compelling to obtain estimates of wait time that can be interpreted, and compared, in minutes of time. Discussing wait time in minutes not only is more practical and applicable to real world scenarios, it also facilitates comparing and contrasting the findings with prior research.

Given the arduous testing of mediation in survival analysis together with the less-than-straightforward interpretation of the odds of seeing a provider, I next explored the application of the general linear models (glm) statistical procedures to predict wait time. The glm technique uses log-transformed values of the continuous dependent variable to estimate the regression coefficients. Given the large size of the dataset that was used to test the research questions of this study, not surprisingly, the glm methodology yielded results that were very similar in the level of statistical significance to the results generated from the survival analysis. The significant difficulty in interpreting the estimates from the glm technique, however, is that the coefficients are log-transformed values of the wait time dependent variable. Therefore, to compare and contrast average wait time in the emergency department, and to make conclusions about the effects of the predictors in the model, one must transform the coefficients back to the linear scale, if the intent is to interpret the findings in minutes of time.

Previous research that examined emergency department wait time that used prior versions of the NHAMCS data was generally conducted utilizing survey multiple linear regression analytical methods, given the dependent variable was a continuous scale variable. The survey regression approach is an appropriate method of analyzing data obtained from complex survey samples, such as study designs that use stratification, clustering and sampling probability weights.[146] (Analyzing complex data using techniques that were developed for simple random sample design is likely to yield biased parameter estimates and underestimated standard errors of the parameters. In other words, treating complex survey data as simple random sample data might lead to inflated results from tests of statistical significance. Consequently, one might find statistically significant differences in places where they do not exist).[145]

To compare findings generated from different statistical methodologies, all of which were theoretically appropriate approaches to predict wait time, I used the survey multiple linear regression analysis to predict wait time in this study and compared the findings to the results from the glm estimation method and the survival analysis estimation method. Not surprisingly, the statistical significance findings were very similar. In fact, the survey regression analyses yielded results that were almost identical in level of statistical significance to the results from the glm statistical procedure and the survival Cox regression.

To summarize the selection process of possible analytical options, of the available methodologies, I opted for the most direct method of analysis and interpretation of the results through using primarily survey multiple linear regression analytical techniques to predict wait time in this study. The primary advantage of this methodology is that its resultant regression coefficients are straightforward to interpret: Comparing average wait time in minutes, as opposed to log-transformed values of the wait time variable (utilized in the glm), because no log transformation is necessary to interpret the linear regression coefficients. Comparing average wait time in minutes is also more direct as opposed to interpreting hazard ratios of seeing a provider. Further, with a large sample, such as the NHAMCS dataset, multiple linear regression can find significant differences in wait time, if in fact, the differences exist, and the statistical differences are at similar levels of significance compared to the glm technique.

One of the disadvantages of analyzing a dataset as large as the NHAMCS is that one might find statistically significant findings as a result of large number of observations. Importantly, the purpose of this work was not only the evaluation of findings based on statistical significance. Instead, what is of great interest here is examining the clinical significance of the statistically significant findings. For example, a one-minute difference (statistically significant) in wait time among groups of people in the non-urgency group is not as meaningful as a ten-minute difference (statistically significant) among groups of people in the urgent category.

To observe bivariate associations of the conceptually related predictor variables with the emergency department wait time dependent variable, I employed simple survey linear regression analyses that revealed which of the independent variables were statistically significantly associated with wait time. The predictor variables that were statistically significantly associated with the dependent variable wait time in the bivariate linear regression analyses were consecutively included in multivariate testing of the mean differences in emergency department wait time, using the survey multiple linear regression analyses.

In estimating emergency department wait time, I tested for differences in average wait time by patient, visit and hospital characteristics, with the primary objective to evaluate statistically significant differences in the mean time patients waited to see an emergency physician. For the purpose of all analyses in this study, I have adopted the alpha level of p-value = 0.05 to make conclusions about statistically significant findings. However, as relevant, I also discuss findings that occur near this level of arbitrarily set statistical significance. As needed, subsequent t-tests were used to test for statistically significant differences in average wait time between levels of categorical variables, if statistical significance was suggested in the primary regression tests of model effects.

Given the complex survey design of the NHAMCS data, the statistical analytical actions were conducted using the *svy*: survey command in the *stata* statistical language, and the *survey reg* command in the SAS statistical language.

The following STATA survey code was used to set the NHAMCS dataset as a survey dataset in the STATA environment to obtain accurate population estimates based on the survey design variables:

```
svyset CPSUM [pweight=PATWT], strata(CSTRATM)
```

The following SAS survey code was used to set the NHAMCS dataset as a survey dataset in the SAS environment to obtain accurate population estimates based on the survey design variables:

```
PROC SURVEYREG DATA;
CLUSTER CPSUM;
STRATA CSTRATM;
WEIGHT PATWT;
```

4.2.6.2.2 Mediation analyses: Research questions (2) and (3)

Aside for regressing the continuous variable emergency department wait time on the predictor variables in the model, research questions (2) and (3) involved testing of possible mediation effects within the focal relationship of patient gender and wait time. In mediation analysis we test the effect of an intervening variable on the relationship between an independent variable and a dependent variable. Specifically, we test whether this third variable explains partially or fully the relationship between the independent variable and the dependent variable.[145]

In the mediation analyses of this study (Research questions 2 and 3), the predictors with the statistical role of a mediator variable were: the Immediacy variable (Figure 2), and the Poverty level variable (Figure 3). I tested whether the effect of each of these two variables explains some of the effect of the focal relationship between patient gender and emergency department wait time. The main assumption in mediation testing is that the focal relationship is statistically significant, so there is an effect to mediate.[145] Preliminary inferential analyses showed that this is the case, in that patient gender appears to be statistically significantly associated with emergency department wait time (Chapter 5). Aside for the focal independent variable having a statistically significant effect on the focal dependent variable, a mediation of the focal relationship can take place only if the independent variable is statistically significantly associated with the intervening variable (the tested mediator), and the intervening variable is statistically significantly associated with the outcome variable.[145]

Mediation analysis of the focal relationship constitutes computing the following regression coefficients: coefficient *a* that reflects the effect of the independent variable on the tested mediator; coefficient *c'* that reflects the net effect of the independent variable on the dependent variable while controlling for the effect of the mediator variable, which gives coefficient *b*; and coefficient *c*, which reflects the total effect of the independent variable on the dependent variable within the focal relationship.[145]

Coefficients in testing mediation by <u>Immediacy</u> – Research question (2)

As portrayed in Figure 2, path *a* of this mediation analysis reflects the effect of patient gender on immediacy. Path *b* reflects the effect of immediacy on wait time. Path *c* reflects the total effect of gender on wait time, while controlling for the contextual factors in the model. Coefficient *c'* is the effect of gender net of the effect of immediacy, which is the direct effect of the gender variable on the wait time variable. The indirect mediated effect may be calculated using one of two possible ways: either as a product of the two regression coefficients *(a)(b),* or as the difference between the total effect of gender on wait time and the direct effect of gender on wait time: as $c - c'$. The indirect effect: $(a)\,(b) = c - c'$.

The indirect mediated effect is the expected change in the focal dependent variable wait time (in minutes) that could be operating through the intervening variable immediacy (if found statistically significant). The indirect effect shows how much the estimated effect of gender on wait time changes when immediacy is added to the model.

Coefficients in testing mediation by <u>Poverty level</u> - Research Question (3)

As portrayed in Figure 3, coefficient *a* of this mediation analysis reflects the effect of patient gender on the poverty level variable. Coefficient *b* reflects the effect of poverty level on wait time. Coefficient *c* is the total effect of gender on wait time, while controlling for the contextual factors in the model. Coefficient *c'* is the effect of gender net of the effect of poverty level, which is the direct effect of the gender variable on the wait time variable.

Coefficient a Computation

As portrayed in Figures 2 and 3, path *a* of the mediation analyses involved testing the effect of an independent variable on an intervening variable. In mediation testing, this intervening variable behaved as a dependent variable. Both of the tested mediator variables, immediacy, and poverty level, are ordinal scale variables. Immediacy has five categories, ordered from most urgent to least urgent need for emergency care. Poverty level has four categories, ordered from lowest level of poverty to highest level of poverty (Table 1). Therefore, in testing the effect of the independent variable (patient gender) on the immediacy variable (in Research Question 2), and in testing the effect of the independent variable on the poverty level variable (in Research Question 3), when obtaining the corresponding coefficient *a*, the appropriate statistical methodology is the survey ordinal logistic regression analysis, because this methodology accommodates an ordinal-level dependent variable in estimating the predictive model coefficients. Together with the ordinal logistic regression coefficients, I obtained the group contrast statistics for the patient gender variable and intergroup differences among categories of the other predictor variables.

Coefficient b Computation

Path *b* of the mediation analyses involves testing the effect of an intervening variable (the tested mediator) on the focal dependent variable, wait time. Calculations of coefficient *b* in this study involved computing the effect of each of the tested mediator variables on the dependent variable wait time. In this step the tested moderator behaved as an independent variable. Testing the association between the immediacy variable and the wait time variable (in Research Question 2), as well as testing the association between the poverty level variable and the wait time variable (in Research Question 3), were conducted using survey linear regression analytical techniques, as described above in the Inferential statistical analyses section, because the dependent variable wait time is a continuous scale variable.

Coefficient c' Computation

Path *c'* of the mediation analyses involves testing the effect of the patient gender variable net of the effect of the immediacy variable. This is the direct effect of the patient gender variable on the wait time variable. Calculation of coefficient *c'* involves testing the effect of the patient gender variable, while controlling for the tested mediator, the immediacy variable (in Research Question 2), and the poverty level variable (in Research Question 3). Considering the theoretically grounded construction of the conceptual model, I further controlled for the effects of the other predictor variables in the model. As described above, testing the associations of the patient gender variable and the immediacy variable on the wait time variable (in Research Question 2), as well as testing the association of the patient gender variable and the poverty level variable on the wait time variable (in Research Question 3) was executed through employing survey linear regression analytical techniques.

Coefficient c Computation

Path *c* of the two mediation analyses reflects the total effect of the focal independent variable patient gender on the focal dependent variable wait time, while controlling for the other variables in the theoretically-grounded conceptual model. The tested mediator is not included as one of the predictors in this step because the objective of this particular computation step is to obtain the total effect of the patient gender variable on wait time. As described previously, testing of the associations between the independent variable patient gender and the dependent variable wait time was executed using survey linear regression analytical techniques.

Figure 2. Testing mediation of the focal relationship by Immediacy

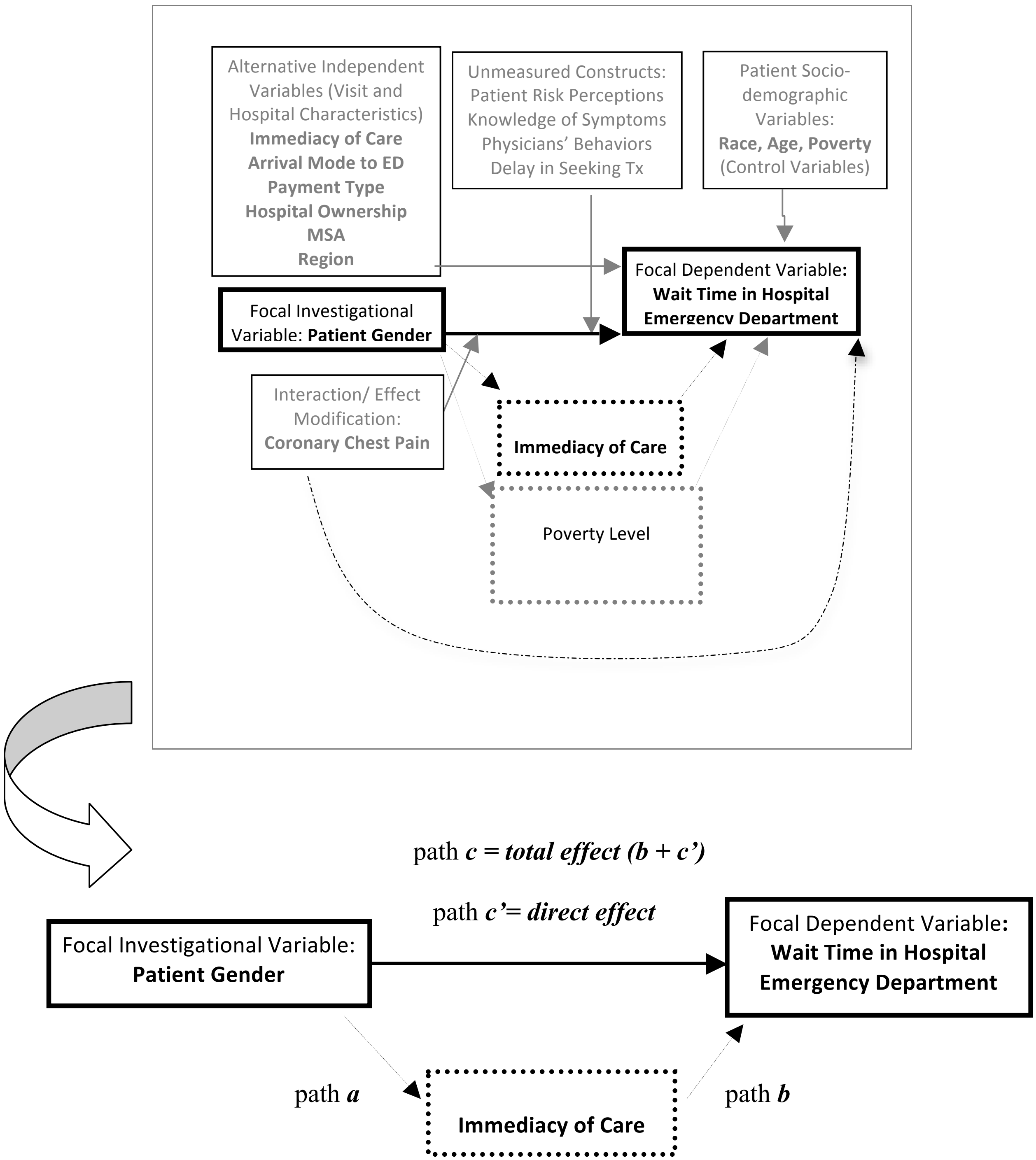
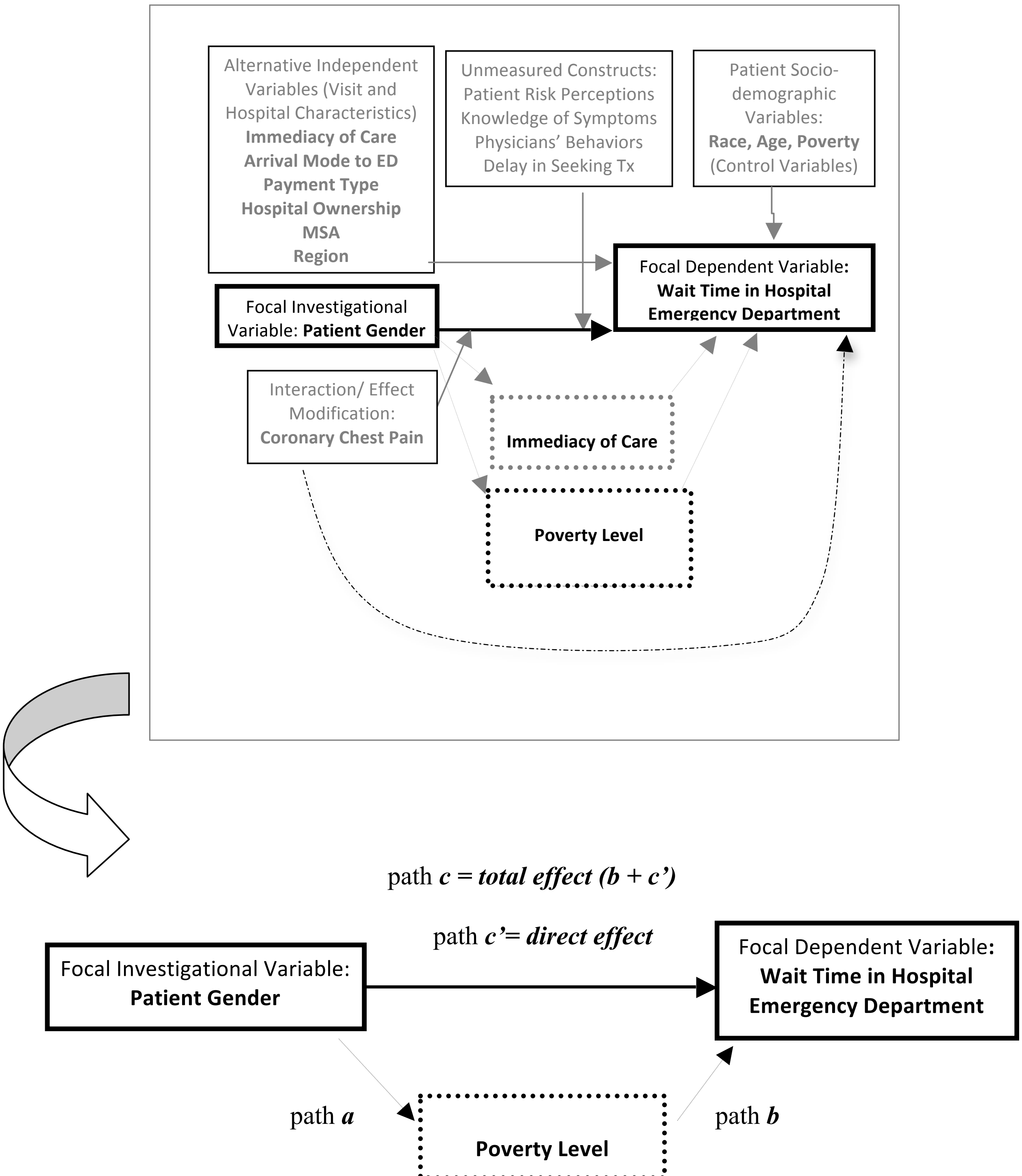


Figure 3. Testing mediation of the focal relationship by Poverty level



4.2.6.2.3 Predicting wait time among patients with CHD diagnoses: Research question (4)

This section explains the methodological procedures that were employed in testing the conceptual predictive framework of this study in a population of patients who received coronary heart disease (CHD) diagnoses at the time of visit to the hospital emergency department.

The NHAMCS dataset uses the international classification of diseases (ICD-9) medical codes to classify the types of diagnoses patients receive in the emergency department (ED). The NHAMCS used this coding to collect the information on patient diagnoses. I used the NHAMCS classification of diagnostic outcomes to identify patients with the CHD diagnoses.

The original NHAMCS variables that contained the information on patient diagnoses in the emergency department were: DIAG1, DIAG2, and DIAG3, reflecting that a patient could have received up to three possible diagnoses at the time of their hospital emergency department visit. Within these three variables, the NHAMCS categorization for CHD diagnoses corresponded to ICD-9 codes 410-414. Based on this coding diagnostic system, I sub-set the adult NHAMCS population by observations that reflected the coronary heart disease (CHD) diagnoses in the emergency department, through assigning the value 1 to all observations that reflected the codes 410 through 414 diagnoses, which comprise the diagnoses of CHD, and the value 0 to observations that did not reflect the CHD diagnosis. Of all adult patients' visits, 346 Patient Record Forms reported CHD diagnoses in the ED. A value of this size was expected, because not all people who suffer from CHD receive the diagnosis at the time of the emergency department visit. Most patients ever diagnosed with coronary heart disease receive the diagnosis during an ambulatory visit, typically in primary care.[147]

After sub-setting the NHAMCS dataset by a domain indicative of observations with the CHD diagnoses in the emergency department, the subsequent analytical procedures that tested the conceptual model presented in Figure 1 were conducted by employing the survey multiple regression analytical methodology techniques, as described above.

4.2.6.2.4 Predicting wait time among patients diagnosed with AMI: Research question (5)

This section explains the methodological procedures that were used to test the conceptual predictive framework of this study within a sub-population of patients who received the acute myocardial infarction (AMI) diagnosis in a hospital emergency department at the time of visit. The AMI population is a sub-population of patients diagnosed with coronary heart disease (CHD) and it is addressed separately because prior research suggests possible health disparities in this population based on belonging to a population minority group.

The NHAMCS dataset uses the international classification of diseases (ICD-9) medical codes to classify the types of diagnoses patients receive in the emergency department (ED). The NHAMCS used this coding to collect the information on patient diagnoses. I used the NHAMCS classification of diagnostic outcomes to identify patients with the AMI diagnosis.

The original NHAMCS variables that contained the information on patient diagnoses in the emergency department were: DIAG1, DIAG2, and DIAG3, reflecting that a patient could have received up to three possible diagnoses at the time of their hospital emergency department visit. Within these three variables, the NHAMCS categorization for AMI diagnosis corresponded to code 410. Based on this coding diagnostic system, I sub-set the adult NHAMCS population by observations that reflected the acute myocardial infarction (AMI) diagnosis in the emergency department, through assigning the value 1 to all observations that reflected the code 410 AMI diagnosis, and the value 0 to observations that did not reflect the AMI diagnosis. Of all adult patients' visits, 123 Patient Record Forms reported AMI diagnosis in the ED. A value of this size was expected, due to the nature of the diagnosis. For example, each year, almost 70 percent of all myocardial infarction deaths in the United States happen out of hospital.[133] These deaths are generally diagnosed as sudden deaths as a consequence of cardiac arrest.[133] Emergency medical personnel attempts resuscitation in about 60 percent of those out-of-hospital cardiac arrest cases, with the remaining 40 percent of patients being pronounced dead upon arrival of the emergency medical services team. [133] Of all people who die from acute myocardial infarction, approximately half die within one hour of onset of symptoms prior to ever reaching a hospital.[148] For those reasons, the size of the AMI population within the NHAMCS dataset is not representative of national AMI prevalence.

Further, this analysis is important enough based on prior research that has suggested possible health disparities, (in particular, with chest pain as a reason for visit) that it justifies an investigation of this topic.

Moreover, although statistical significant differences might be arduous to find, the primary intent was to explore the clinically significant differences in mean wait time that is, comparing the minutes of time people waited to be seen. Given the size of this subpopulation, the findings will likely show only the most important differences in wait time.

After sub-setting the data by AMI diagnosis in the emergency department, the remainder of the analytical procedures were conducted by employing the survey multiple linear regression analytical methodology approach, as described above.

4.2.6.3 Why not Hierarchical Linear Modeling?

It appears to be a common knowledge among statisticians that hierarchical linear modeling with complex design survey data is not yet well developed.[146] Performing multi-level modeling with survey data is substantially more complex compared to analyzing data that were sampled at a single stage. Specifically, the added analytical difficulty lies in accurately incorporating weighted sampling that occurs at multiple stages of the survey design, and consequently, applying appropriate multiple sampling probability weights. To conduct a valid hierarchical linear analysis using complex data samples, the quantitative researcher must know the probability of subject selection at each level of analysis.[146] The statistical probabilities of selection at each stage of sampling that are needed for this type of analysis are not the strata and cluster selection probabilities that are commonly provided in survey datasets. To conduct an externally valid multi-level analysis using the NHAMCS data, one must have the statistical probabilities of subject selection at the lower level sampling (patient visit) and the probability of selection at each higher level of sampling, (an emergency service area, and such). The 2008 NHAMCS dataset does not contain such sampling weights. The dataset includes a variable called the Emergency department weight that was first added to the 2005 public use files. According to the dataset documentation, this probability weight may allow for calculations of department-level estimates. However, an investigation of this variable's values revealed that over 99% observations (patient visits) within the dataset had the value 0 for this variable rendering it not useful to weigh the observations for the purposes of a hierarchical linear analysis.

Presently, active investigation into multi-level analysis of complex survey data is still taking place. [146] For example, even the latest SAS 9.3 statistical software package does not yet contain operational commands to allow for analysis of complex survey data using hierarchical linear modeling. The Stata statistical package currently has the capability of analyzing two-level hierarchical models with complex survey data, provided the sampling probabilities at each level of analysis are available. Hopefully, recent exploration of this important topic eventually leads to the availability of multi-level sampling probabilities in complex survey datasets, and statistical software programmers develop procedures (and operational commands) that allow for multi-stage hierarchical linear modeling with complex survey samples.

4.2.7 Strengths and limitations of the study design

A limitation of the NHAMCS data that are descriptive of patient visits to the United States emergency departments (ED) is that these data were extracted from charts by each individual participating hospital, and thus, it is possible that the data do not accurately reflect the actual visit characteristics. Further, as addressed before, approximately 20 percent of the Patient Record Forms were missing the information on wait time, and consequently, those patient visit observations were excluded from analyses. However, data that were excluded for missing wait time did not differ significantly from data that included wait time, pertaining to patient characteristics.

Further limitation is that the dataset does not contain information on hospital emergency room crowding (or overcrowding), which likely varied among the participating hospitals. This important emergency room characteristic is likely associated with emergency department wait time. However, due to the lack of direct data on emergency department overcrowding, it was not possible to examine its effect.

Further, pertaining to immediacy assignment, we do not know who assigned the immediacy of care at the time of triage. Specifically, we do not have the information on the characteristics of the triage person who determined how long people can wait to receive care, including their level of training, educational level, and experience, which could play a confounding role on the outcome as well.

An important strength of the study design is that it uses recent national data that were collected using a complex four-stage sampling design, which allows for generalizations to hospital emergency department patient visits in the U.S. population. Additionally, a sample of this size allows for observations of statistical significant differences if in fact, such differences exist.

Most importantly, the analyses conducted within this study have the potential to increase the knowledge of current disparities in the quality of emergency care. Specifically, the findings will elaborate on the pathways that may explicate the commonly reported bivariate relationships descriptive of patient characteristics and emergency care wait time, through the purposeful examination of the underlying pathways that could help explain the bivariate associations between patient gender or race, and wait time. This research offers a much-needed theory-based investigation of factors that may confound or mediate the basic bivariate relationship. Studies guided by theory are needed for effective and efficient translation of elaborate research efforts oriented toward decreasing the disparities in quality of care.

Lastly, compared to previous analyses of the NHAMCS data, assessing the emergency care situation in the time period of 2008 allows for a description of the healthcare situation during the national economic recession that started in 2008, offering findings pertinent to the recession climate on the quality of healthcare.

CHAPTER 5. RESULTS

5.1 Predicting emergency department wait time among patients in general

This section presents the characteristics of the patient visit data that were utilized in the inferential analyses, as well as the findings from the investigation of whether hospital emergency department wait time reflects gender, racial and/or ethnic disparities, while controlling for the patient visit contextual factors. The results of this study document what factors help predict disparities in emergency department wait time, and address whether there is supportive evidence to suggest that the effect of patient gender on wait time appears moderated by patient race (Research question 1), whether the focal relationship seems mediated by immediacy of care assigned at triage upon patient arrival to the emergency department (Research question 2), and/or whether the focal relationship seems mediated by poverty level (Research question 3). Further, the results describe what factors seem to predict hospital emergency department wait time in a population of patients with coronary heart disease diagnoses at time of visit to the emergency department (Research question 4), and in a sub-population of patients diagnosed with the acute myocardial infarction in the emergency department (Research question 5).

5.1.1 Descriptive findings

Table 2 presents the characteristics of the 2008 NHAMCS sample of adult patient visits to U.S. hospital emergency departments (ED). Of the total of 34,134 observations, 7,438 patient reports corresponded to visits of pediatric patients, and those were excluded from the analyses because the objective of this investigation was to examine emergency department wait time differences in adult patients only. Adult patient visits comprised 26,696 observations. Of those, 14,825 were visits of women, and 11,871 were visits of men. Slightly less than two thirds were visits of non-Hispanic White patients, approximately one fifth were visits of non-Hispanic

African American patients, and approximately 11% were visits of Hispanic patients. Fewer than 4% of the sample characterized patients of the following racial/ ethnic categories: American Indian/ Alaska Native, Asian, and Native Hawaiian/ Other Pacific Islander, all of whom were grouped together and analytically treated as the Other category, primarily due to the fact that the small sizes of the individual ethnic categories did not provide sufficient statistical power to test for statistically significant differences in wait time within the preliminary analyses. Overall, the gender, racial and ethnic distribution of the NHAMCS sample approximates the 2008 U.S. population.

Approximately 20 percent of the NHAMCS Emergency Department (ED) adult patient record forms were missing information on wait time (5,423 adult patient records that were missing data on wait time / 26,696 total adult patient visits). As a consequence of this finding, and to investigate whether patients with reported wait time differed significantly from those without reported wait time with regard to patient sociodemographic characteristics, (the main independent variables of interest in this dissertation), I performed survey logistic regression analyses to predict the odds of wait time missingness by patient race and gender. If, for example, emergency department records of male patients differed statistically significantly in the likelihood of including data on wait time compared to women patients, the inferential analytical results could be deemed biased predictors of wait time. The odds ratio results from the survey logistic regression analyses revealed that patient gender and race did not predict wait time missingness at p-value = 0.4855, and 0.8929, respectively. Therefore, the regression results could be considered unbiased estimates of gender, and racial differences in average wait time, in that missing wait time data did not cause biased estimates of the regression coefficients. Immediacy of care was found to predict wait time missingness, in that higher order of urgency predicted more wait time missingness. An association of this direction is understandable, as it is reasonable that patients with very high need for care could be taken to the emergency physician directly without having to wait.

Descriptive statistical analyses of the adult patient data revealed that most of the variables that were, based on theory and prior research, conceptualized of as predictors of emergency department wait time in this study were approximately normally distributed and did not significantly violate assumptions of equality of variance. The descriptive analyses revealed that the dependent variable wait time appeared skewed to the right, depicting primarily patients in the non-urgent category of the immediacy variable, who waited up to 24 hours to be seen by an emergency physician. Such distribution could effect tests of statistical significance. As previously explained, as a correction for the skewness of the dependent variable wait time, in the preliminary analyses I regressed a log-transformed wait time variable on the predictor variables in the model and compared the results to the regression of the original linear scale wait time variable on the predictors, and the two outcomes were very similar, with a markedly more straightforward interpretation in the linear scale scenario.

Due to the large sample size used in the inferential analyses in studying the population of patients in general, the effects of the predictor variables on the wait time variable were statistically significant, if in fact, significant effects existed. Importantly, aside for findings of statistical significance, a substantial interest of this work was to investigate any meaningful clinically significant differences in average wait time that were statistically significant, in both, the general patient population and among patients diagnosed with coronary heart disease. The observed clinical differences are useful to make conclusions about the quality of care in the practical setting and to compare the findings with prior research on emergency care.

Table 2. Characteristics of the 2008 NHAMCS sample of patient visits to U.S. emergency departments, adults only (n=26,696)

Key Variables		ED Visit Frequency	% / Mean	Weighted % / Mean	Std. Error
Wait time		21,273	57.47	57.25	2.19
Immediacy of care		22,444			
	Immediate	1,204	5.36	4.95	0.46
	Emergent (1-14min)	3,376	15.04	15.19	1.08
	Urgent (15-60min)	10,743	47.87	46.88	1.49
	Semi-urgent (1-2hrs)	5,074	22.61	23.73	1.26
	Non-urgent (2-24hrs)	2,047	9.12	9.25	1.13
Gender		26,696			
	Women	14,825	55.53	56.34	0.50
	Men	11,871	44.47	43.66	0.50
Race/Ethnicity		26,696			
	Non-Hispanic White	16,339	61.20	63.71	1.60
	Non-Hispanic Black	5,966	22.35	21.26	1.56
	Hispanic	2,974	11.14	11.23	0.99
	Other	1,417	5.31	3.81	0.49
Age		26,696	45.91	46.08	0.30
Percent poverty		25,053			
	< 5	3,696	14.75	15.61	1.25
	5 - 9.99	6,699	26.74	28.21	1.57
	10 - 19.99	8,865	35.38	35.77	1.88
	> 20	5,793	23.12	20.41	1.73
Arrival mode		25,017			
	Ambulance	5,152	20.59	19.82	0.69
	Public service (Non-ambulance)	691	2.76	1.86	0.26
	Personal transportation	19,174	76.64	78.32	0.73

(Table 2. Continues)

Table 2. Continued.

		ED Visit Frequency	% / Mean	Weighted % / Mean	Std. Error
Payment type		25,072			
	Private insurance	8,448	33.69	35.35	0.99
	Medicare	6,096	24.31	25.01	0.70
	Medicaid	4,701	18.75	15.74	0.72
	Worker's compensation	373	1.49	1.50	0.13
	Self-pay	4,270	17.03	17.09	0.68
	No charge	342	1.36	1.40	0.46
	Other	844	3.37	3.90	0.76
Hospital ownership		26,696			
	Voluntary non-profit	19,468	72.92	76.82	3.26
	Government non-federal	4,525	16.95	11.63	1.80
	Proprietary	2,703	10.13	11.55	2.79
Metropolitan statistical area (MSA) status		26,696			
	MSA	23,133	86.65	83.58	4.16
	Non-MSA	3,563	13.35	16.42	4.16
Region		26,696			
	Northeast	6,642	24.88	19.82	1.68
	Midwest	5,404	20.24	21.81	2.01
	South	9,737	36.47	38.16	2.52
	West	4,913	18.40	20.21	2.46
Chest pain as reason for visit		26,696			
	Chest pain	1,627	6.09	6.53	0.23
	No chest pain	25,069	93.91	93.47	0.23

Note: NHAMCS = National Hospital Ambulatory Medical Care Survey. SE = Standard error. Of the total of 34,134 observations in the 2008 NHAMCS Emergency Department dataset, 7,438 observations corresponded to visits of pediatric patients and those were excluded from the analyses.

Table 3. Correlations of key variables employed in predicting hospital emergency department wait time among patients in general, among patients with CHD diagnoses, and among patients diagnosed with AMI

	Wait time	Immediacy	Age	Gender	Race	Arrival	Pay	Hosp Owner	MSA	Region	Poverty
Wait time	1.00	-0.19***	-0.06***	-0.03***	-0.06***	-0.08***	-0.06***	0.02**	0.11***	-0.04 ***	0.08***
Immediacy	-0.19***	1.00	0.16***	0.01	-0.01	0.27***	0.06 ***	0.00	0.02**	-0.03***	-0.03***
Age	-0.06***	0.16***	1.00	0.01*	0.12***	0.25***	0.23***	0.06***	-0.05***	-0.0	-0.09***
Gender	-0.03***	0.01	0.01*	1.00	0.02**	0.03***	-0.05***	0.01	-0.01*	-0.01	-0.01*
Race	-0.06***	-0.01	0.12***	0.02**	1.00	-0.02*	0.10***	0.13***	-0.18***	-0.07***	-0.22***
Arrival	-0.08***	0.27***	0.25***	0.03***	-0.02**	1.00	0.01	-0.00	0.05***	-0.08***	0.04***
Pay	-0.06***	0.06***	0.23***	-0.05***	0.10***	0.01	1.00	0.07***	-0.03***	-0.05***	-0.17***
Hosp Owner	0.02**	0.00	0.06***	0.01	0.13***	-0.00	0.07***	1.00	-0.10***	-0.29***	-0.09***
MSA	0.11***	0.02*	-0.05***	-0.01*	-0.18***	0.05***	-0.03***	-0.10***	1.00	0.12***	-0.03***
Region	-0.04***	-0.03***	-0.0	-0.01	-0.07***	-0.08***	-0.05***	-0.29***	0.12***	1.00	0.02**
% Poverty	0.08***	-0.03***	-0.09***	-0.01*	-0.22***	0.04***	-0.17***	-0.09***	-0.03***	0.02***	1.00
Chest pain	-0.03	0.16***	0.07***	0.02*	0.01	0.04***	0.05***	0.02*	-0.0	0.02**	-0.01

Note: ***=p<.0001; **=p<.01; *=p<.05

Prior to building the predictive model that addressed emergency department wait time among patients in general in Research question 1, I obtained inter-variable correlations for all key variables that were employed in the inferential analyses to assess collinearity among the variables (Table 3), with the intention not to employ variables that were strongly correlated with each other in the regression analyses together. As Table 3 shows, the constellation of the variables that were included in the model does not pose issues of multicollinearity, with the exception of the age variable, that is moderately correlated with the arrival mode variable at $r=0.25$, and with the pay type variable at $r=0.23$. As I later describe, removing the age variable from the predictive model in the inferential analyses did not result in important changes in the regression coefficients, nor in the amount of variance explained, and the variable was kept in the model because it is conceptually important based on prior research.

Of special consideration are the two variables: wait time and immediacy. The detailed results from the inferential analyses are discussed in the subsequent section, but it is worth noting at this point, that although conceptually, the two variables have a strong theoretical association, in that patients who are assigned into a higher order of urgency should wait a shorter time to be seen by an emergency physician compared to patients assigned into lower urgency level categories, statistically, the two variables in this model were moderately correlated at $r = -0.19$, suggesting that higher order of urgency is associated with shorter emergency department wait time. This moderate correlation would be expected and in fact suggests that the data set is valid.

5.1.2 Inferential findings: Patients in general

Employing simple survey linear regression analyses in the sample of patients in general, bivariate associations of the conceptually- related predictor variables with the emergency department wait time dependent variable revealed that the following variables were statistically significantly associated with wait time at a p-value of at least <= 0.05: patient age, gender, race and ethnicity, poverty level, immediacy, arrival method, payment type, hospital ownership, and metropolitan area status (MSA) (Table 4). The geographical region variable approached statistical significance at p-value = 0.073, and was included in the subsequent regression model building process. The named variables were included in consecutive testing of differences in average emergency department wait time in the survey multiple linear regression analyses.

Table 4. Bivariate associations of independent variables with wait time (n=26,696) from the 2008 ED NHAMCS

Independent variables	Number of Observations	P-value
Immediacy	18,613	<.0001
Age	21,273	<.0001
Patient gender	21,273	<.0001
Patient race	21,273	<.0001
Poverty level	20,075	0.0026
Arrival mode	20,067	<.0001
Payment type	20,092	<.0001
Hospital ownership	21,273	<.0001
MSA	21,273	<.0001
Region	21,273	0.073

Note: ED = Emergency Department.
NHAMCS = National Hospital Ambulatory Medical Care Survey.

The multiple regression results indicated that of the predictor variables consecutively included in the model, the following independent variables were statistically significantly associated with emergency department wait time at least at the p-value of <= 0.05: immediacy, patient gender, patient race, poverty level, arrival method, payment type, hospital ownership, metropolitan statistical area (MSA) status, and geographical region (Table 5a). The pay type variable approached statistical significance at p-value = 0.0572, and the patient age variable was not found statistically significant at p-value = 0.1169 (Table 5a). I commence the interpretation of the survey multiple regression results with a description of the relationships between the dependent variable wait time and each of the predictor variables in the model.

Immediacy

I address the results pertaining to the immediacy variable first based on the evidence that theoretically and conceptually, this variable is the strongest correlate with emergency department wait time, as it directly predicts the amount of time people waited in the emergency department. As discussed in the literature review section, the Emergency Severity Index (ESI) immediacy scale (that was used to collect data on immediacy in this study) was developed to prioritize emergency care based on treatment urgency of patients' conditions, depending on how long a patient can safely wait to be seen. [68] The higher the urgency of care assignment a patient receives, the shorter the predicted average time the patient waits in the emergency department; and the lower the urgency, the longer the average wait time, based on clinically relevant stratification of patients into five groups ranging from most urgent to least urgent, as: immediate, emergent, urgent, semi-urgent, or non-urgent (Table 5b).[68]

The immediate category of the immediacy variable served as the reference group to evaluate changes in average wait time between the immediate category (highest order) of the immediacy variable and each of the four lower order sequential categories of the immediacy variable (emergent, urgent, semi-urgent, and non-urgent). As expected, compared to the immediate category of the immediacy variable, each successive category of the immediacy variable was associated with statistically significantly longer average wait time in the hospital emergency department (Table 5b). Controlling for patient characteristics (gender, race, age, and poverty level), the patient visit situational characteristics (arrival mode, and payment method), and hospital structural characteristics (hospital ownership, metropolitan status, and geographic region), patients assigned into the emergent category waited, on average, 18.5 minutes longer compared to patients in the immediate category (p-value = < 0.0001, 95% CI: 13.21; 23.93). Patients assigned to the urgent category waited, on average, 31.41 minutes longer compared to patients in the immediate category (p-value = < 0.0001, 95% CI: 26.39; 36.42). Patients assigned to the semi-urgent category waited, on average, 40.07 minutes longer compared to patients who were seen immediately (p-value = < 0.0001, 95% CI: 33.46; 46.68), and patients in the non-urgent category waited, on average, 56.66 more minutes compared to patients who were seen immediately (p-value = < 0.0001, 95% CI: 41.85; 71.46) (Table 5b).

Table 5a. Test of model effects predicting hospital emergency department wait time among patients in general, 2008 NHAMCS (n=16,002).

Wait time (in minutes)	Test of Model Effects	
Independent Variables	F Value	P>|t|
Model	18.27	<.0001
Immediacy	52.12	<.0001
Age	2.50	0.1160
Gender	12.57	0.0005
Race	3.63	0.0142
Poverty	3.38	0.0197
Arrival Method	22.39	<.0001
Pay Type	2.09	0.0572
Owner	8.08	0.0004
MSA	24.96	<.0001
Region	3.66	0.0137
Intercept	85.85	<.0001

Note: Note: NHAMCS = National Hospital Ambulatory Medical Care Survey.
Number of strata = 8; Number of clusters = 172; Design df = 164;
R-squared = 0.086; Estimation population size = 58,355,256.

Table 5b. Differences in mean hospital emergency department wait time among patients in general, 2008 NHAMCS (n=16,002).

Wait time (min.)	Estimate	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Immediacy						
Immediate						
Emergent	18.57	2.72	6.84	<.0001	13.21	23.93
Urgent	31.41	2.54	12.37	<.0001	26.39	36.42
Semi-Urgent	40.07	3.35	11.97	<.0001	33.46	46.68
Non-Urgent	56.66	7.50	7.56	<.0001	41.85	71.46
Age	-.06	0.04	-1.58	0.1160	-.14	0.02
Women vs. Men	5.15	1.45	3.55	0.0005	2.28	8.02
Race						
White						
Black	10.04	3.27	3.07	0.0025	3.58	16.49
Hispanic	4.64	3.95	1.18	0.2413	-3.15	12.44
Other	-0.84	4.53	-0.18	0.8537	-9.79	8.12
Poverty						
> 20%						
10-19.99%	-7.34	3.22	-2.28	0.0238	-13.69	-0.99
5-9.99%	-5.35	3.82	-1.40	0.1634	-12.90	2.19
< 5 %	-10.39	3.77	-2.75	0.0066	-17.84	-2.93
Arrival						
Ambulance						
Public Service	22.73	9.39	2.42	0.0165	4.20	41.27
Walk-in	15.17	2.34	6.47	<0.0001	10.54	19.80
Payment						
Private Insurance						
Medicare	4.15	2.22	1.87	0.0638	-0.24	8.54
Medicaid	0.71	2.34	0.30	0.7610	-3.90	5.33
Worker's Com	-5.23	4.78	-1.09	0.2761	-14.67	4.22
Self Pay	2.70	2.36	1.14	0.2542	-1.96	7.37
No Charge	10.34	6.47	1.60	0.1118	-2.43	23.10
Other	9.99	5.23	1.91	0.0579	-0.34	20.32

(Table 5b. Continues)

Table 5b. Continued.

Wait time (min.)	Estimate	Std. Err.	t	P>|t|	[95% Conf. Interval]	
Hospital Ownership						
Voluntary						
Government	0.98	5.45	0.18	0.8585	-9.82	11.78
Proprietary	-19.75	5.15	-3.84	0.0002	-29.92	-9.58
MSA						
MSA vs. not	23.76	4.76	5.00	<0.0001	14.37	33.15
Region						
West						
South	14.81	4.78	3.10	0.0023	5.37	24.25
Midwest	9.52	5.85	1.63	0.1057	-2.04	21.08
Northeast	13.09	4.85	2.70	0.0077	3.51	22.67
constant |	-13.04	8.27	-1.58	0.1169	-29.38	3.30

Note: Number of strata = 8; Number of clusters = 172; Design df = 164; Prob > F < 0.0001; Population R-squared = 0.086; Estimation population size = 58,355,256.

Table 5c. Average hospital emergency department wait time among patients in general, 2008 NHAMCS (n=16,002).

Predictor Variables	Average wait time estimate (in minutes)
Immediacy	
Immediate	16.50
Emergent	35.00
Urgent	48.21
Semi-Urgent	56.79
Non-Urgent	72.49
Gender	
Men	42.88
Women	48.72
Race	
White	41.05
Black	52.73
Hispanic	47.51
Other	41.90
Poverty	
< 5%	39.91
5-9.99%	44.94
10-19.99%	42.97
> 20%	50.33
Arrival	
Ambulance	32.45
Public Service	56.95
Walk-in	47.99
Payment	
Private Ins	42.09
Medicare	46.79
Medicaid	43.85
Worker's Comp	36.11
Self Pay	45.41
No Charge	53.34
Other	53.00

(Table 5c. Continues)

Table 5c. Continued.

Predictor Variables	Average wait time estimate (in minutes)
Hospital Ownership	
Voluntary	51.72
Government	53.86
Proprietary	31.81
MSA	
MSA	57.02
Non-MSA	34.57
Region	
West	37.16
South	51.31
Midwest	45.66
Northeast	49.05

Note: Number of strata = 8; Number of clusters = 172; Design df = 164; Prob > F < 0.0001; R-squared = 0.086; Estimation population size = 58,355,256.

Next I present the results from the multiple linear regression analysis that describe the regression of wait on patient sociodemographic factors (the main predictors of interest in this investigation), having adjusted for the contextual factors in the model. That is, the regression coefficients for the sociodemographic predictors document whether or not sufficient evidence exists to suggest the presence of gender and racial/ethnic disparities in hospital emergency department wait time in patients in general.

Patient gender

The outcome of the multiple linear regression analysis suggested that among patients in general, the patient gender variable was statistically significantly associated with the hospital emergency department wait time variable having adjusted for patient sociodemographic factors (age, race, and poverty level) and patient visit contextual factors (immediacy, arrival mode, payment type, hospital ownership, metropolitan status, and geographical region), in that women waited, on average, 5.15 minutes longer than men to see an emergency department physician (p-value = 0.0005; SE: 1.45; 95% CI: 2.28; 8.02) (Table 5b).

Patient race

Patient race, another predictor variable of interest, was statistically significantly associated with emergency department wait time as well (p-value = 0.0142). White race was used as the reference category for the mean wait time comparison analyses to assess any significant differences in wait time between White and non-White patients and to allow for analogous comparisons regarding prior research on wait time. Controlling for the patient characteristics and the patient visit contextual factors, the mean wait time group comparisons revealed that compared to White patients, African American patients waited, on average, 10.04 minutes longer (p-value = 0.0025; SE: 3.27; 95% CI: 3.58; 16.49). The group mean differences in wait time between White patients and Hispanic patients, and between White patients and patients of other race/ethnicity were not statistically significant (p-value = 0.2413, and 0.8537, respectively).

5.1.3 Testing moderation of the focal relationship by patient race/ethnicity

The results from testing Research Question 1.3, of whether the effect of patient gender on wait time seems moderated by patient race, while controlling for patient factors and the contextual factors in the model, revealed that the interaction term constructed from the patient gender and race was not statistically significantly associated with wait time (p-value = 0.9528) (Table 6a). Although on average, White women waited a shorter time than Black men, the results documented that overall, within each racial group women waited a longer average time compared to men (Table 6b, Figure 4). White men waited, on average, 38.43 minutes compared to White women who waited, on average, 43.67 minutes. Black men waited, on average, 50.13 minutes compared to Black women who waited, on average, 55.33 minutes. Hispanic men waited, on average, 42.82 minutes, compared to Hispanic women who waited, on average, 52.20 minutes (Table 6b, Figure 4). The largest absolute difference in average wait time was observed between White men and Black women, in that controlling for patient and contextual factors in the model, Black women waited, on average, 16.7 minutes longer than White men.

The finding that the interaction term constructed from patient gender and race is not statistically significant suggests that, holding all other variables in the model constant, patient race does not moderate the effect of patient gender on wait time. Alternatively, we can say that the effect of patient gender on wait time is not conditional upon patient race. Specifically, although White women had shorter average wait time compared to Black men, the results document that overall, among patients in general, women had significantly longer wait times in the emergency department compared to men. Table 6a presents the model effects in predicting hospital emergency department wait time among patients in general, with the inclusion of the interaction term constructed from the patient gender and race variables. Table 6b portrays the average emergency department wait time by patient gender and race, having adjusted for patient age, poverty, and the contextual variables in the model.

Table 6a. Test of model effects predicting hospital emergency department wait time among patients in general, 2008 NHAMCS, including Gender*Race interaction term (n=16,002).

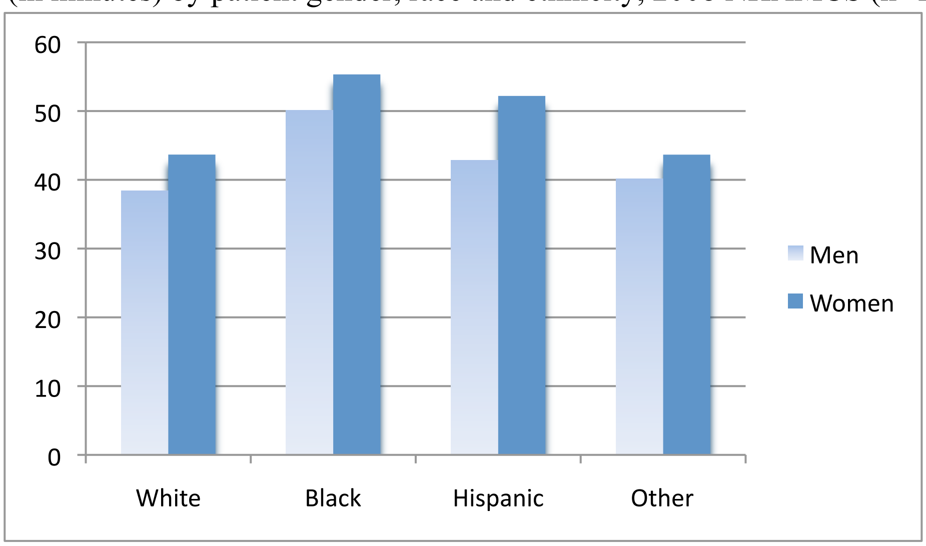
Wait time (in minutes)	Test of Model Effects	
Independent Variables	F Value	P>|t|
Model	17.53	<.0001
Immediacy	52.04	<.0001
Age	2.52	0.1146
Gender	6.11	0.0145
Race	3.44	0.0182
Gender*Race	0.11	0.9528
Poverty	3.41	0.0190
Arrival Method	22.36	<.0001
Pay Type	2.13	0.0529
Owner	8.09	0.0004
MSA	24.94	<.0001
Region	3.65	0.0139
Intercept	87.50	<.0001

Note: Number of strata = 8; Number of clusters = 172;
Design df = 164; Prob > F < 0.0001; Population R-squared = 0.086;
Estimation population size = 58,355,256.

Table 6b. Emergency department wait time differences among patients in general by patient gender and race, 2008 NHAMCS (n=16,002).

Patient race /ethnicity	Average emergency department wait time (minutes) Patient gender Men	Women	Mean difference (W-M)
White	38.43	43.67	5.24
Black	50.13	55.33	5.20
Hispanic	42.82	52.20	9.38
Other	40.15	43.66	3.51

Figure 4. Emergency department wait time differences among patients in general (in minutes) by patient gender, race and ethnicity, 2008 NHAMCS (n=16,002).



Patient age

Although in the bivariate linear regression analysis the patient age variable was significantly associated with wait time (p < 0.0001), having adjusted for the patient characteristics and the contextual factors in the multiple regression analysis, the effect of patient age on wait time was no longer statistically significant (p-value = 0.1160). The associated estimated regression coefficient decreased from -0.23 minutes of wait time per additional year of age in the bivariate regression analysis (that showed significant effect of age on wait time) to -0.06 minutes of wait in the multiple regression analysis.

Poverty level

Population poverty level was significantly associated with emergency department wait time (p-value =0.0197). Poverty level below 20 percent (the highest poverty level) served as the reference category for average wait time comparisons with lower poverty levels. Controlling for the patient sociodemographic factors and the contextual factors in the model, compared to the highest poverty level (>20 percent), patients with 10-19.99 percent poverty level in their zip code waited, on average, 7.34 minutes less (p-value = 0.0238, SE: 3.22; 95% CI: -13.69; -0.99), and patients with less than 5 percent poverty level in their zip code waited, on average, 10.34 minutes less (p-value = 0.0066; SE: 3.77; (95% CI: 3.51; 22.67). The difference in mean wait time between patients with more than 20 percent poverty in their zip code and patients with 5-9.99 percent poverty in their zip code was not found statistically significant at p-value = 0.1634 (Table 5b).

Arrival method

Patient method of arrival to the emergency department was statistically significantly associated with wait time (p-value < 0.0001). Ambulance arrival served as the reference category in the mean wait time group comparisons to allow for parallel comparison with prior research, and because this method of arrival appears to be associated with the shortest wait time, to which I intended to compare average wait time of patients who used public service and who walked into the emergency department. Holding the patient and contextual factors constant, in comparison to ambulance arrival, arrival by public service was associated with 22.73 minutes longer wait time (p-value = 0.0165; SE: 9.39; 95% CI: 4.20; 41.27), and walk-in method of arrival was associated with 15.17 minutes longer wait time (p-value < 0.0001; SE: 6.47; 95% CI: 10.54; 19.80).

Pay type

Although in the bivariate linear regression analysis, payment method for emergency department services was significantly associated with emergency department wait time (p-value = 0.0001), after controlling for the patient sociodemographic factors and the patient visit factors, the Pay type variable approached statistical significance at p-value =0.0572. Although in this work I set the alpha level for making conclusions about statistical significance to p-value < 0.05, I will interpret this finding as it may help guide future inferential analyses of these data. Patients with private insurance coverage were used as the reference group to evaluate differences in wait time compared to patients with payment methods other than private insurance. The only interesting finding pertaining to the Pay type variable was the comparison between patients with private insurance coverage and patients with Medicare coverage. Had I extended the statistical significance for the purposes of this analysis to p-value < 0.10, the parameter estimate for the Pay type predictor variable would suggest that, controlling for the patient sociodemographic and contextual factors, patients with Medicare coverage waited, on average, 4.15 minutes longer than patients with private insurance (p-value=0.0638). This finding corresponds to prior research suggesting a positive correlation between age and wait, in that older patients may wait longer. Compared to patients with private insurance, average wait time did not statistically significantly differ for patients with Medicaid coverage (p-value = 0.7610), patients with workers' compensation coverage (p-value = 0.2761), patients who self-paid for the emergency services, (p-value = 0.242), or those with no charge to the patient (p-value = 0.1118) (Table 5b).

Hospital ownership

Hospital ownership was significantly associated with patient wait time at p-value < 0.0004. Voluntary non-profit ownership served as the reference category, and the mean wait time for this category was compared to average wait time in hospitals with private ownership, and in Government hospitals. Controlling for patient sociodemographic factors and the contextual factors, compared to voluntary non-profit ownership, patients who visited a privately owned emergency department, waited, on average, 19.75 minutes less (p-value = 0.0002; SE: 5.15; 95% CI: -29.92; -9.58). Average wait time in a Government owned hospital did not statistically significantly differ from wait time in voluntary non-profit hospital (p-value = 0.8585) (Table 5b).

Metropolitan statistical area

Patient visit to a hospital emergency department located within a metropolitan statistical area was significantly associated with wait time as well. Compared to a hospital emergency department in a metropolitan area, patients who visited an emergency department in a non-metropolitan area waited, on average, 23.76 minutes less (p-value < 0.0001; SE: 4.76; 95% CI: -14.37; 33.15) (Table 5b).

Region

Geographic region was statistically significantly associated with emergency department wait time at p-value < 0.0137. The Western region of the United States served as the reference category for average wait time comparisons with the South, Northeast and Midwest regions as it had on average the lowest wait times. Compared to the West, patients who visited an emergency department in the South waited, on average, 14.81 minutes longer (p-value = 0.0023; SE: 4.78; 95% CI: 5.37; 24.25), and patients who visited a hospital emergency department in the Northeast waited, on average, 13.09 minutes longer (p-value = 0.0077; SE: 4.85; (95% CI: 3.51; 22.67). The difference in mean wait time between patient visits in the West and the Midwest geographic regions was not statistically significant at p-value = 0.1057 (Table 5b).

5.2 Mediation analysis: Testing focal relationship by Immediacy (Research question 2)

In this mediation analysis I tested whether the effect of patient gender on hospital emergency department wait time could be partially or fully explained by the immediacy assignment at the time of patient arrival to the emergency department, while controlling for patient sociodemographic characteristics (gender, race/ ethnicity, age, and poverty level), patient visit situational factors (arrival method and payment type), and hospital structural factors (hospital ownership type, metropolitan are status, and geographical region). The objective of this analysis was to determine whether after controlling for the effect of the contextual factors, the differences in average emergency department wait time between women and men could be explained by differences in urgency assignment at triage.

In testing the three relationship paths of mediation (described in detail in the Methodology section), path (a) tested the association between the focal independent variable, patient gender and the tested mediator variable, immediacy; path (b) tested the association between the immediacy variable and the focal dependent variable, wait time, while controlling for the contextual factors, path (c’) tested the direct effect of the focal independent variable, patient gender, on the focal dependent variable, wait time, while controlling for the contextual factors in the model, including immediacy, and path (c) tested the total effect of the focal independent variable, patient gender, on the focal dependent variable, wait time, while controlling for the contextual factors, but not including the tested mediator variable, immediacy.

Table 7. Test of mediation of the focal relationship by Immediacy, 2008 NHAMCS, (n=16,002)

Mediation Test Path	Factors Involved	Pr > F
Path c	Gender->Wait time In context (no Immediacy)	0.0005
Path c'	Gender -> Wait time In context + Immediacy	0.0035
Path b	Immediacy -> Wait time In context	< 0.0001
Path a	Gender->Immediacy	0.0875*

*Wald test, Pr > ChiSq

The findings show that while paths (c), (c'), and (b) suggested the following significant associations: total effect (path c) p-value < 0.0005, direct effect of the patient gender variable on the wait time variable (path c') p-value = 0.0035, and the effect of the immediacy variable on the wait time variable (path b) p-value < 0.0001, the effect of the patient gender variable on the immediacy variable (path a) was not found statistically significant at p-value = 0.0875. This finding suggests that immediacy assignment at the time of patient arrival to the hospital emergency department does not seem to vary by patient gender (the non-significant path (a) of the mediation test), suggesting that urgency level assignment did not differ statistically significantly between women and men. These results indicate that immediacy assignment does not appear to explain the effect of patient gender on wait time, while controlling for the other variables in the model. Specifically, immediacy does not seem to explain why women, on average, tend to have longer hospital emergency department wait times compared to men.

5.3 Mediation analysis: Testing focal relationship by Poverty level (Research question 3)

In this mediation analysis I tested whether the effect of the focal independent variable, patient gender, on the focal dependent variable, wait time, could be partially or fully explained by the poverty variable, while controlling for patient characteristics (gender, race/ ethnicity, and age), situational factors (arrival method and payment type), and hospital structural factors (hospital ownership, metropolitan status, and geographical region). The objective of this analysis was to determine whether the differences in average patient wait time between women and men could be explained by different poverty levels (Figure 3).

In analyzing the three relationship paths of the mediation analysis, path (a) tested the association between the focal independent variable, patient gender, and the tested mediator variable, poverty level. Path (b) tested the association between the poverty level variable and the focal dependent variable, wait time, while controlling for the other patient and contextual factors in the model. Path (c’) tested the direct effect of the patient gender variable on the wait time variable, while controlling for the other variables in the model, including the tested mediator variable, poverty level. Path (c) tested the total effect of the patient gender variable on the wait time variable, while controlling for the other variables in the model, but not poverty level (Figure 3).

The findings from this mediation analysis show that while paths (c), (c'), and (b) suggested the following statistically significant associations: total effect (path c) p-value < 0.0005, direct effect of the gender variable on the wait time variable (path c') p-value = 0.0145, and the effect of the poverty level variable on the wait time variable (path b) p-value = 0.0190, the effect of the gender variable on the poverty variable (path a) was not found statistically significant at p-value = 0.2159 (Table 8).

Table 8. Test of mediation of the focal relationship by Poverty level, 2008 NHAMCS, (n=16,002)

Mediation Test Path	Factors Involved	Pr > F
Path c	Gender->Wait time in context (no Poverty)	0.0005
Path c'	Gender -> Wait time In context + Poverty	0.0145
Path b	Poverty -> Wait time In context	0.019
Path a	Gender -> Poverty	0.2159*

*Wald test, Pr > ChiSq

This finding suggests that, controlling for the other variables in the model, the poverty level variable does not seem to vary statistically significantly by patient gender (the non-significant path (a) of this mediation analysis). The results indicate that the poverty level variable does not explain the effect of the focal independent variable, patient gender, on the focal dependent variable, emergency department wait time. Specifically, poverty level does not seem to explain why women patients, on average, tend to have longer emergency department wait times compared to male patients.

5.4 Predictors of emergency department wait time among patients with coronary heart disease diagnoses (Research question 4)

This section presents findings from the analyses that tested what factors predict average hospital emergency department wait time in a population of patients who received coronary heart disease (CHD) diagnoses at the time of visit to the emergency department. As in the study of patients in general, this analysis tested the conceptual framework presented in Figure 1. That is, the effects that were investigated were patient characteristics, and visit contextual characteristics (visit situational factors, and hospital structural factors). Together with the general context for the hospital emergency department visits, this analysis included additional context specific to patients diagnosed with coronary heart disease (CHD): CHD diagnosis is commonly accompanied by symptoms of coronary chest pain (described in detail in the background literature section). Coronary chest pain is the most commonly presented symptom of acute coronary heart disease.[87-90] Therefore, in predicting emergency department wait time in the population of patients with CHD diagnoses, the statistical analyses that aimed to assess differences in mean wait time also included a variable reflecting whether patients reported chest pain symptoms as reason for visit, as one of the covariates, together with the other conceptually related predictor variables that were employed in predicting emergency department wait time among patients in general. The chest pain variable was an index of chest pain symptoms.

To predict average hospital emergency department wait time in patients diagnosed with

CHD, I created a CHD diagnoses domain, where I sub-set the adult patient population in the emergency department (ED) NHAMCS dataset based on information about whether or not a patient received a CHD diagnosis at the time of their visit. In the NHAMCS, coronary heart disease diagnoses were recorded using the ICD-9 codes 410 through 414. These five coronary heart disease diagnosis codes were used to create a domain indicating observations with recorded CHD diagnoses. Of the adult patient visits that included data on wait time, 346 Patient Record Forms indicated a patient visit with a CHD diagnosis at the time of visit to the hospital emergency department. A population of this size was expected, considering that not all patients with CHD receive the diagnosis at the time of visit to a hospital emergency department. Most patients ever diagnosed with coronary heart disease receive the diagnosis during an ambulatory visit, typically in primary care.[147]

Table 9 presents the distribution of observations among categories of independent variables in the population of patients who received the CHD diagnosis at the time of visit to the hospital emergency department. Prior to being employed in the testing of bivariate relationships with the wait time dependent variable, the immediacy variable was recoded in that the two lowest immediacy levels were combined: the lowest urgency level that contained only seven observations was combined with the second lowest immediacy category that had 16 observations, into a combined category of n=23, indicating low urgency of care.

The independent variables presented in Table 9 were subsequently tested in bivariate regression analyses to assess their individual effects on wait time in patients who received the CHD diagnosis in the hospital emergency department. Table 10 shows the results from bivariate regression analyses of wait time on the 11 independent variables in testing the outcome among the CHD population.

Table 9. Distribution of the population of patients diagnosed with CHD in the hospital emergency department, 2008 NHAMCS, adults only (n=346)

		Visit Frequency	Weighted %
Immediacy		298	
	Immediate	54	18.12
	Emergent	105	35.23
	Urgent	116	38.93
	Semi-urgent	16*	5.37
	Non-urgent	7*	2.35
Chest pain		346	
	Chest pain	187	54.05
	No chest pain	159	45.95
Gender		346	
	Women	149	43.06
	Men	197	56.94
Race/Ethnicity		346	
	White	241	69.65
	Black	60	17.34
	Hispanic	25	7.23
	Other	20	5.78
Arrival mode		325	
	Ambulance	140	43.08
	Non-ambulance	185	56.92
Payment type		336	
	Private insurance	112	33.33
	Medicare	174	51.79
	Medicaid	31	9.23
	Other	19	5.76
Ownership		346	
	Voluntary	283	81.79
	Government	42	12.14
	Proprietary	21	6.07

(Table 9. Continues)

Table 9. Continued.

		Visit Frequency	Weighted %
Metropolitan Statistical Area (MSA) status		346	
	MSA	282	81.5
	Non-MSA	64	18.5
Region		346	
	Northeast	70	20.23
	Midwest	107	30.92
	South	104	30.06
	West	65	18.79
Poverty		327	
	< 5%	62	18.96
	5-9.99%	90	27.52
	10-19.99%	120	36.7
	> 20%	55	16.82

Note: NHAMCS = National Hospital Ambulatory Medical Care Survey.
* These two categories were combined for a combined n=23.

Table 10. Bivariate associations of independent variables with wait time in patients diagnosed with CHD in the hospital emergency department, 2008 NHAMCS, (n=295)

Independent variables	Number of Observations	P-value	R-square
Immediacy	261	0.0001	0.072
Chest pain	295	0.0436	0.019
Patient gender	295	0.4200	0.003
Patient race	295	0.6744	0.011
Patient age	295	0.6050	0.001
Poverty level	281	0.6854	0.013
Arrival mode	278	0.0005	0.028
Payment type	287	<.0001	0.017
Hospital ownership	295	0.0055	0.009
MSA	295	0.0069	0.017
Region	295	0.9152	0.003

The results from the bivariate simple linear regression analyses that tested each of the investigated predictor variables with the dependent variable wait time suggested that among patients diagnosed with coronary heart disease at the time of visit to the emergency department, the following independent variables were statistically significantly associated with the dependent variable wait time at least at p-value < 0.05: immediacy of care, chest pain symptoms as reason for visit, arrival mode, payment type, hospital ownership, and metropolitan statistical area (Table 10). The patient sociodemographic variables: patient gender, racial and ethnic characteristics, age, and poverty level, together with geographical region, were not found statistically significantly associated with wait time in the bivariate statistical analyses at p-value = 0.4200, 0.6744, 0.6050, 0.6854, and 0.9152, respectively.

In conducting the bivariate analyses of each independent variable with wait time, the number of observations included in the analyses decreased, primarily because approximately 15 percent of the observations were missing data on wait time. Of the 346 observations that recorded a CHD diagnosis, 295 observations included data on wait time. As a remedy to the problem of missing wait time data, as in the diagnostic procedure that was executed in the analysis of wait time among patients in general, I tested whether wait time missingness varied significantly among the independent variables presented in Table 10. That is, I tested whether CHD patients with missing wait time varied in some aspects from patients with non-missing wait time. To determine whether any of the independent variables predict wait time missingness, I conducted survey logistic regression analysis predicting the odds of wait time missingness. Of the independent variables presented in Table 10, immediacy was the only variable that predicted wait time missingness, in that the higher the urgency of care category within the immediacy variable, the more likely the information on wait time was missing. This finding seems feasible because it is reasonable that in very urgent cases where patients who need immediate care are taken to the emergency physician directly rather than being placed in the waiting area. Although higher order of immediacy predicts wait time missingness, this variable was not a major factor investigated in this analysis. Rather, it is an important conceptually related covariate. Aside for the immediacy variable, the other patient or contextual factors in the model did not predict wait time missingness. That is, in the population of patients with CHD diagnoses, patient visits with missing wait time data did not vary significantly in the other patient and contextual aspects from the patient visits that included data on wait time.

Aside for missing information on wait time, some observations were lost because of missing data on the predictor variables. To correct for this occurrence, one can impute those missing data from the data that were observed. However, there is a significant difficulty in imputing missing observations in a survey dataset due to its complex sampling design, and some statisticians even consider this process controversial.[146] Further, the CHD population has a relatively small number of observations that could be used for data imputation. The approach I adopted was the following: having tested for whether the independent variables varied significantly on wait time missingness and having found that only the immediacy variable predicted missing wait time, and considering the difficulty (and controversy) in imputing survey data observations, I determined that I would impute missing data for the predictor variables in the case of observing borderline finding of differences in average wait time in the results from the multiple regression analysis. In the absence of borderline results from the model's main effects, I will make conclusions based on the observed results, and I will interpret the findings with a statement describing the presence of missing data, as this appears to be the approach that is commonly adopted by statisticians in general.[146]

Subsequently, the conceptually related independent variables presented in Table 10 were used in the multiple linear regression analyses during the model building process of predicting emergency department wait time among patients who received coronary heart disease diagnoses at the time of visit to the emergency department.

Table 11a. Model effects predicting hospital emergency department wait time among patients diagnosed with CHD at time of visit to hospital emergency department, 2008 NHAMCS, (n=243).

	Test of model effects	
Wait time	F Value	P>|t|
Immediacy	4.70	0.0013
Arrival	7.75	0.0006
Pay Type	2.38	0.0412
Owner	4.37	0.0142
MSA	6.41	0.0123
Constant	9.88	0.0020
Population R-square		0.187

Within the CHD population of patients, the independent variables that were not significantly associated with the dependent variable wait time in the bivariate analyses were also not found to be significant predictors of wait time in the multiple regression analyses. Further, the independent variable chest pain that was statistically significantly associated with wait time in the bivariate analysis was not significantly associated with wait time in the multiple regression, and, it was found to be correlated with the immediacy variable at r=0.16, indicating that some of the variability in wait time that is explained by chest pain is also explained by the assignment to immediacy of care. Immediacy was a stronger predictor of wait time in the bivariate analysis (p=0.0001) versus chest pain (p=0.0346), and immediacy, unlike chest pain, remained a significant predictor of wait time in the multiple regression analysis (p=0.013). Consequently, immediacy of care was kept in the final model, while the chest pain variable was removed, as it was collinear with immediacy and no longer a significant predictor of wait time when tested together with immediacy. Table 11a presents the final model predicting emergency department wait time in patients diagnosed with CHD at the time of visit to the emergency department, while testing the conceptual framework of the study, and it contains only the independent variables that were found to be statistically significant predictors of wait time at p<0.05. Table 11b portrays the differences in average wait time in patients diagnosed with CHD at the time of visit to the emergency department.

Table 11b. Differences in mean hospital emergency department wait time among patients diagnosed with CHD at time of visit to the emergency department, 2008 NHAMCS, (n=243).

Wait time (min.)	Estimate	Std. Err.	t	P>|t|
Immediacy				
Immediate				
Emergent	10.11	7.17	1.41	0.1606
Urgent	33.87	9.98	3.39	0.0009
Low Urgency	46.22	14.06	3.29	0.0012
Ambulance arrival				
Non Ambulance	31.95	8.67	3.91	0.0001
Payment				
Private Ins				
Medicare	25.31	9.64	2.63	0.0095
Medicaid	32.26	22.87	1.72	0.0479
Other	73.19	44.72	1.64	0.1036
Hospital Ownership				
Voluntary				
Government	-33.86	11.46	-2.95	0.0036
Proprietary	-6.73	21.08	-0.32	0.7497
MSA				
MSA vs. not	18.48	7.30	2.53	0.0123
Constant	-26.26	12.10	-2.17	0.0315

Note:
Population estimation size 294,428;
Population R-squared = 0.187.

As portrayed in Table 11b, compared to high urgency of care, lower urgency of care levels were associated with longer hospital emergency department wait time among patients with CHD diagnoses. Holding all factors in the model constant, compared to patients in the immediate category of the immediacy variable, patients assigned to the urgent group waited, on average, 34 minutes longer (p=0.0009), and patients in the least urgent immediacy waited, on average, 46 minutes longer (p=0.0012). No significant difference in average wait time was observed between patients in the immediate category and patients in the emergent category of the immediacy variable (p=0.1606).

Holding all factors in the model constant, compared to ambulance method of arrival to the emergency room, patients who walked in waited, on average, 32 minutes longer (p=0.0001).

Holding all other factors in the model constant, compared to patients with private insurance coverage, patients with Medicare coverage waited, on average, 25 minutes longer (p=0.0095), and patients with Medicaid coverage waited, on average, 32 minutes longer (p=0.0479).

Holding other factors in the model constant, no significant difference in average wait time was observed between voluntary and private hospital ownership (p=0.7497), but compared to patient visit to a voluntary hospital, patients who visited a Government hospital waited, on average, 34 minutes less (p=0.0036).

All else equal, compared to hospitals with metropolitan statistical area status, patients who made a visit to an emergency department in a non-metropolitan area waited, on average, 18 minutes less (p=0.0123).

5.5 Predictors of emergency department wait time in patients with the acute myocardial infarction diagnosis (Research question 5)

This section presents findings from analyses that tested what factors predict average hospital emergency department wait time in a sub-population of patients diagnosed with acute myocardial infarction (AMI) at the time of visit to the emergency department, while testing the conceptual framework of the study, and investigating the effects of patient sociodemographic characteristics and contextual characteristics (visit situational factors, and hospital structural factors).

AMI diagnosis is commonly accompanied by symptoms of chest pain (described in detail in the background literature section). Coronary chest pain is the most commonly presented symptom of acute myocardial infarction.[81-84] Therefore, together with the other theoretically related predictor variables that were employed in predicting emergency department wait time in patients in general, the AMI sub-population analyses also included the variable reflecting whether or not patients presented chest pain symptoms as a reason for visit. The chest pain variable has a statistical function of one of the covariates in predicting emergency department wait time, as in the study of wait time in the population of patients with coronary heart disease diagnoses in the emergency department.

For the analyses in this section, I used a sub-set of the adult patient population in the emergency department (ED) NHAMCS dataset based on information about whether or not a patient received the AMI diagnosis in the emergency department at the time of their visit. Of all adult patient visits that included data on wait time, 123 Patient Record Forms indicated an AMI diagnosis. A sub-population of this size was expected, considering the nature of the diagnosis. For example, each year, almost 70 percent of all myocardial infarction deaths in the United

States happen out of hospital.[133] These deaths are generally diagnosed as sudden deaths as a consequence of cardiac arrest. [133] Of all people who die from acute myocardial infarction, approximately half die within one hour of onset of symptoms prior to ever reaching a hospital.[148]

Table 12 presents the distribution of observations among the categories of independent variables in the sub-population of patients with the AMI diagnosis in the emergency department. As the Table shows, within the immediacy variable, only one patient with the AMI diagnosis was triaged into the least urgent category of the immediacy variable (understandably so, as these are patients who are eventually diagnosed with AMI). Prior to executing inferential analyses, this category was combined with the second lowest immediacy category that had six observations into a category indicative of low urgency of care. As a result, rather than five categories of urgency of care, in this analysis the immediacy variable had four categories, where the two least urgent categories were combined.

Within the categories of the arrival mode variable, the descriptive statistics showed that only one patient with the AMI diagnosis used the non-ambulance public service mode of transportation. Prior to inferential analyses, I recoded the categories of the arrival mode variable, where originally (1) ambulance arrival, (2) public service, and (3) personal transportation/walk-in arrival, into new categories where the non-ambulance public service category was combined with the other non-ambulance mode of arrival: personal transportation category for a combined n=71. As a result, rather than three arrival categories, this analysis used two categories of the arrival mode, one indicating ambulance arrival to the emergency department and the other indicating non-ambulance arrival, where the non-ambulance arrival category now contained both, patients who walked-in to the emergency department, and the one patient who used public service method of transportation.

Table 12. Distribution of the NHAMCS sub-sample of patients diagnosed with AMI, adults only (n=123)

Key Variables		ED Visit Frequency	Percentage Distribution
Immediacy of care		123	
	Immediate	23	21.10
	Emergent (1-14min)	41	37.61
	Urgent (15-60min)	38	34.86
	Semi-urgent (1-2hrs)	6	5.50
	Non-urgent (2-24hrs)	1	0.92
Gender		123	
	Women	50	40.65
	Men	73	59.35
Race/Ethnicity		123	
	Non-Hispanic White	91	73.98
	Non-Hispanic Black	19	15.45
	Hispanic	4	3.25
	Other	9	7.32
Percent poverty		117	
	< 5	23	19.66
	5 - 9.99	39	33.33
	10 - 19.99	40	34.19
	> 20	15	12.82
Arrival mode		114	
	Ambulance	43	37.72
	Public service (Non-ambulance)	1	0.88
	Personal transportation	70	61.40
Payment type		119	
	Private insurance	45	37.82
	Medicare	56	47.06
	Medicaid	14	11.76
	Worker's compensation	1	0.84
	Self-pay	3	2.52
	No charge	0	0.00
	Other	0	0.00

(Table 12. Continues)

Table 12. Continued.

Key Variables		ED Visit Frequency	Percentage Distribution
Hospital ownership		123	
	Voluntary non-profit	105	85.37
	Government non-federal	11	8.94
	Proprietary	7	5.69
Metropolitan statistical area (MSA) status		123	
	MSA	102	82.93
	Non-MSA	21	17.07
Region		123	
	Northeast	19	15.45
	Midwest	42	34.15
	South	41	33.33
	West	21	17.07
Chest pain as reason for visit		123	
	Chest pain	73	59.35
	No chest pain	50	40.65

Note: NHAMCS = National Hospital Ambulatory Medical Care Survey. SE = Standard error. Of the total of 34,134 observations in the 2008 NHAMCS Emergency Department dataset, 7,438 observations corresponded to visits of pediatric patients and those were excluded in the analyses.

The pay type variable consisted of seven pay type categories, which did not work well in building a predictive model in this smaller sub-population. Within this variable, due to very low or missing counts in the pay type categories descriptive of other than the private, Medicare or Medicaid coverage, the other forms of payment were combined into one category indicative of other form of payment. Consequently, the pay type variable resulted in four categories: private insurance, Medicare, Medicaid coverage, and other.

All the conceptually related independent variables from Table 12 were included in subsequent bivariate regression analyses with the emergency department wait time variable to assess the variables' individual effects on the outcome variable. Table 13 shows the results of the bivariate analyses. The bivariate regression results suggested that the following independent variables were significantly associated with the dependent variable wait time at least at p-value < 0.05: immediacy, chest pain as a reason for visit, patient race, arrival mode, payment type, hospital ownership, metropolitan statistical area (Table 13). The variables patient age, gender, race, poverty level, and geographical region were not found statistically significantly associated with wait time in the bivariate statistical analyses at p-value = 0.8623, 0.6831, 0.1932, 0.6238, and 0.6434, respectively.

Table 13. Bivariate associations of independent variables with wait time in AMI sub-population (n=107)

Independent variables	Number of Observations	P-value
Immediacy	98	0.0004
Age	107	0.8623
Patient gender	107	0.6831
Patient race	107	0.1932
Poverty level	101	0.6238
Arrival mode	99	<.0001
Payment type	103	<.0001
Hospital ownership	107	0.0079
MSA	107	0.0205
Region	107	0.6434
Chest pain	107	0.0460

Approximately 13 percent of the observations within the AMI sub-population were missing data on wait time. Therefore, as in the previous two analyses of predicting wait time among patients in general and among patients with CHD, I employed survey logistic regression techniques to test whether patient visits with missing data on wait time differ significantly in certain aspects from patient visits with non-missing data on wait time. The findings from the logistic regression showed that the only variable that significantly predicted wait time missingness in this sub-population was patient age. This variable predicted wait time missingness in that increasing patient age predicted more wait time missingness. As presented in the bivariate analyses in Table 13, as well as subsequently in the multiple regression main effects in Table 15a, the patient age variable was not found to be a statistically significant predictor of emergency department wait time in the AMI patient sub-population. Although its predictability of wait time missingness is concerning, the conceptual function of the patient age variable is one of a control variable rather than a focal variable, and the discussion of the results will include this shortcoming.

Further, aside for missing data on wait time, some independent variables were missing observations. As in the CHD analysis, based on the currently recommended approach to imputing survey data, I determined that I would impute missing observations on independent variables if I encounter borderline findings in the main multiple regression analysis, as imputing missing data in a survey dataset may be considered methodologically suspect, due to the complex sampling design.[146]

Next, all of the conceptually related independent variables presented in Table 13 were used in the subsequent multiple linear regression analyses during the model building process of predicting emergency department wait time in the AMI sub-population.

Testing the AMI sub-population model effects in the survey multiple regression analysis consisted of a complex process, mainly because of relatively large numbers of independent variables that were included in the testing of the model and the relatively small sub-sample of patients with the AMI diagnosis in the emergency department. Further, some categories of the independent variables that were tested in the model had small number of, or no observations, as described above. For example, within the immediacy variable, there was only one observation in the non-urgent category, only one observation in the public service arrival category of the arrival mode variable, and no observations in the no-charge category and in the other type of payment category within the pay type variable.

The preliminary results from the multiple linear regression analysis that employed the variables' recodes as described above yielded significant main effects (Table 14a), but examination of the estimated regression coefficients suggested that several independent variables might be collinear, in that categories within independent variables could be collinear with other categories of other independent variables.

Table 14a. Preliminary model effects predicting hospital emergency department wait time in AMI patients, 2008 NHAMCS, (n=84).

	Test of model effects	
Wait time	F Value	P>|t|
Immediacy	2.85	0.0393
Age	1.01	0.3167
Gender	3.38	0.0678
Race	1.52	0.2110
Poverty	3.57	0.0154
Arrival	5.21	0.0237
Pay Type	4.98	0.0025
Owner	3.79	0.0245
MSA	7.06	0.0087
Region	3.30	0.0218
Chest pain	6.89	0.0095
R-square		.4334
Population estimation size		299,101

Table 14b. Preliminary differences in mean hospital emergency department wait time in patients diagnosed with AMI at time of visit to the emergency department, 2008 NHAMCS, (n=84).

Wait time (min.)		Estimate	Std. Err	t	P>|t|
Immediacy					
	Immediate				
	Emergent	31.08	16.66	1.87	0.0638
	Urgent	68.40	23.92	2.86	0.0048
	Low urgency	26.59	65.03	0.41	0.6832
Age		1.24	1.23	1.00	0.3167
Women vs. Men		-44.36	24.13	-1.84	0.0678
Race					
	White				
	Black	-7.25	24.69	-0.29	0.7696
	Hispanic	100.29	55.31	1.81	0.0716
	Other	-37.07	30.89	-1.20	0.2319
Poverty					
	> 20%				
	10 - 19.99%	-7.32	16.86	-0.43	0.6650
	5 - 9.99%	-10.78	29.55	-0.36	0.7156
	< 5%	-63.87	23.39	-2.73	0.0070
Arrival mode					
	Ambulance				
	Non-ambulance	65.57	28.73	2.28	0.0237
Owner					
	Voluntary				
	Government	-50.52	23.17	-2.18	0.0307
	Private	37.78	33.17	1.14	0.2564
Pay type					
	Private insurance				
	Medicare	39.02	14.37	2.27	0.0073
	Medicaid	141.00	48.46	2.91	0.0041
	Other	112.83	58.06	1.94	0.0537

(Table 14b. Continues)

Table 14b. Continued.

Wait time (min.)		Estimate	Std. Err	t	P>|t|
MSA vs. not		36.51	13.74	2.66	0.0087
Region	South				
	West	-20.46	32.56	-0.63	0.5307
	Midwest	39.54	18.13	2.18	0.0306
	Northeast	19.74	26.14	0.75	0.4514
Chest pain					
	No chest pain	35.17	13.39	2.63	0.0095
Constant		-143.55	107.57	-1.33	0.0580

Note: NHAMCS = National Hospital Ambulatory Medical Care Survey. SE = Standard error.
Population R-squared = 0.4334.

To investigate which categories of independent variables may be collinear, I performed a sub-analysis of the predictive effects among the categories of the independent variables. This exploration was an arduous process, but it was a necessary step because of the unavailability of alternative and more efficient techniques that incorporate both, survey data weights and domain analysis. Such analysis is a standard statistical procedure used to explore variable collinearity.[146] The investigation of collinearity among categories of the independent variables in the model is explained below:

Using each predictor variable in the model that had more than two categories, I created separate independent variables for each category of the predictor variable. For example, of the immediacy category that now had four categories (immediate, emergent, urgent, and low-urgency), I created four separate independent variables, one for each category of the variable. Having generated one independent variable for each category of the independent variables, I then predicted each category of the independent variables from the other categories of the independent variables in the model to explore which variables could be associated.

This sub-analysis suggested that the independent variables that were affected by multicollinearity issues were the patient race/ethnicity variable and the pay type variable. This was indicated by inflated coefficients in the Hispanic patient ethnicity category of the patient race variable, and the ‘other’ and Medicaid categories of the pay type variable. To correct for this problem, I reexamined the distribution of the observations within each predictor variable, replicated the multiple regression analyses with and without each predictor, and I modified the variables as follows: I recoded the pay type variable in that based on the original seven categories, I declared missing the two categories of the variable that had no observations in the AMI sub-population: no charge/charity, and the original ‘other’ type of payment category. Then I combined the workers’ compensation, and the self-pay categories into a new category indicative of ‘other’ type of payment. Declaring the no charge/charity and the former ‘other’ pay type categories missing helps with the collinearity issue in this analysis and it does not cause problems with testing of the research questions. The four categories that were left in the pay type variable were (1) the category reflecting patients with private insurance coverage, which served as the reference group for comparison purposes, (2) patients with Medicare insurance coverage, (3) patients with Medicaid coverage, and (4) patients with other type of payment that now consisted of patients who used worker’s compensation coverage and self-pay type of payment for the emergency department services.

Within the patient race category, only four observations indicated visits of patients of Hispanic origin. To alleviate its collinearity with the pay type variable, this variable was recoded in that the four observations were combined with the observations indicative of ‘other’ race of the patients. The resulting three categories of the patient race variable consisted of: (1) White, (2) African American, and (3) Other, and this third category now included also visits of patients of Hispanic ethnicity.

Following each variable recode, I replicated the survey multiple linear regression analysis predicting emergency department wait time in the AMI patient sub-population and assessed changes in the regression coefficients of the pay type variable and the patient race/ethnicity variable.

Reduction of collinearity was indicated by a decrease in the coefficients for these two variables in the test of model effects from the multiple linear regression analyses. Although the above described variable manipulation processes did not cause important changes in the statistical significance findings, it eliminated regression coefficients that were inflated as a result of collinearity between the pay type variable and the patient race/ethnicity variable, to the extend possible.

Using the corrected variable categories, the test of model effects shows that among patients who received the AMI diagnosis at the time of visit to the emergency department, the following independent variables were statistically significantly associated with emergency department wait time: immediacy, chest pain symptoms, arrival method, pay type, hospital ownership, MSA, and poverty level (Table 15a). Variables that were not found to be statistically significant predictors of emergency department wait time among patients with the AMI diagnosis in the emergency department were: patient age, gender, race, and geographical region (Table 15a).

Table 15a. Model effects predicting hospital emergency department wait time in AMI patients, 2008 NHAMCS, (n=84).

	Test of model effects	
Wait time	F Value	P>|t|
Immediacy	1.91	0.0322
Age	0.40	0.5303
Gender	2.79	0.0969
Race	0.29	0.7505
Poverty	3.58	0.0152
Arrival	5.07	0.0257
Pay Type	4.68	0.0036
Owner	4.55	0.0119
MSA	7.08	0.0086
Region	1.31	0.2746
Chest pain	7.57	0.0066
R-square		0.4334

Table 15b. Differences in mean hospital emergency department wait time among patients diagnosed with AMI at time of visit to the emergency department, 2008 NHAMCS, (n=84).

Wait time (min.)		Estimate	Std. Err	t	P>|t|
Immediacy					
	Immediate				
	Emergent	11.59	15.42	0.75	0.4532
	Urgent	46.99	21.75	2.16	0.0322
	Low urgency	14.69	65.15	0.23	0.8218
Chest pain					
	No chest pain	35.22	13.39	2.75	0.0066
Age		0.63	1.00	0.63	0.5303
Women vs. Men		-34.01	20.37	-1.67	0.0969
Race					
	White				
	Black	-19.48	25.71	-0.76	0.4497
	Other	-2.04	24.07	-0.08	0.9325
Poverty					
	> 20%				
	10 - 19.99%	-7.34	17.26	-0.43	0.6710
	5 - 9.99%	-5.81	29.59	-0.22	0.8274
	< 5%	-63.54	23.08	-2.75	0.0066
Arrival mode					
	Ambulance				
	Non-ambulance	64.86	28.80	2.25	0.0257
Pay type					
	Private insurance				
	Medicare	46.01	14.38	3.41	0.0008
	Medicaid	133.75	49.07	2.73	0.0071
	Other	72.52	42.47	1.71	0.0896

(Table 15b. Continues)

Table 15b. Continued.

Wait time (min.)		Estimate	Std. Err	t	P>|t|
Owner					
	Voluntary				
	Government	-53.21	24.38	-2.18	0.0305
	Private	38.20	31.35	1.22	0.2249
MSA vs. not		39.61	14.89	2.66	0.0086
Region	West				
	South	6.82	27.74	0.25	0.8060
	Midwest	40.11	29.37	1.37	0.1739
	Northeast	29.11	25.91	1.12	0.2630
Constant		-125.25	100.02	-1.25	0.2123

Note: NHAMCS = National Hospital Ambulatory Medical Care Survey. SE = Standard error.
Population R-squared = 0.4148.

The findings suggested the following associations and directionality in patients who received the AMI diagnosis at the time of visit to the emergency department: Within the immediacy variable, shorter emergency department wait time was statistically significantly associated with higher order of urgency, where controlling for the other variables in the model, compared to the immediate category of the immediacy variable, patients who were assigned to the urgent category waited, on average, 47 minutes longer to be seen (p-value = 0.0322). Differences in average wait time between other categories of the immediacy variable were not found statistically significant (Table 15b).

Controlling for the other factors in the model, patients who presented symptoms of coronary chest pain as a reason for visit, waited, on average, 35 minutes less compared to patients who did not present such symptoms (p-value = 0.0066).

Controlling for the other factors in the model, compared to patients living in the highest level of poverty (> 20 percent), patients who lived in the lowest level of poverty (< 5 percent) waited, on average, one hour less (p-value = 0.0066). All else equal, patients who did not arrive to the hospital emergency department by ambulance waited, on average, 65 minutes longer compared to patients who arrived by ambulance (p-value 0.0257). Controlling for the other factors in the model, compared to patients with private health insurance coverage, patients with Medicare coverage waited on average 46 minutes longer (p-value = 0.0008), and patients on Medicaid waited, on average, 134 minutes longer (p-value = 0.0071). No significant difference in average wait time was observed between patients with private insurance and patients with other forms of payment (p=0.0896).

Controlling for the other independent variables in the model, patients who visited a Government hospital waited on average 53 minutes less compared to patients who visited a voluntary hospital (p-value = 0.0305). Holding the other predictors in the model constant, patients who visited an emergency department in a metropolitan statistical area, waited, on average, 40 minutes longer compared to patients who visited an emergency department in a rural area (p-value = 0.0086).

As in the bivariate analyses that tested the effect of each independent variable on the dependent variable wait time, the multiple linear regression analysis showed that patient gender was not a statistically significant predictor of hospital emergency department wait time in the AMI sub-population (p-value = 0.0969). With more observations available for the analysis, it is feasible that with increased statistical power, a statistically significant effect could be observed. The interesting finding pertaining to the relationship between emergency department wait time and the patient gender variable, however, is that the findings suggested an association but not in the direction hypothesized. Had the p-value for this analysis been extended to $p<0.10$, the estimated regression coefficient for patient gender would suggest that among AMI patients, holding the other factors in the model constant, women waited, on average, 34 minutes less compared to men (p-value 0.0969). Together with the findings pertaining to the patient gender variable that were not significant at p-value <0.05, patient race/ethnicity, age, and geographical region were also not found statistically significantly associated with emergency department wait time, at p-value = 0.7505, 0.5303 and 0.2746, respectively. This predictive model was found to explain 41 percent of the variance in emergency department wait time in the AMI sub-population. The R-square statistic in survey regression is known to be a population R-square, or weighted R-square, as it controls for the design weight variables in the model and is used in place of an adjusted R-square to make conclusions about the proportion of variance explained with survey design data.[146]

In an attempt to evaluate whether patient gender could have an effect on wait time through the means of patient race, where patient gender and wait time could be associated but only conditionally based on patient race, I constructed an interaction term (patient gender by patient race) and entered it into the model depicted in tables 15a and 15b and retested the model effects. The test of the model effects showed that the interaction term (patient gender by patient race) term was not found statistically significant predictor of hospital emergency department wait time (p-value = 0.4930), and was therefore not included in the final model of predicting wait time in the sub-population of patients who received the AMI diagnosis at the time of visit to the emergency department.

Importantly, the suggested associations (and directionalities) from the AMI analysis have also been observed in the findings descriptive of the experience of patients in general (e.g., immediacy, arrival mode, pay type, hospital ownership, and poverty level). However, the suggested association between wait time and patient gender needs further research attention before attempting to generalize the findings to a larger population.

The relatively small sample size of observations characteristic of patients with the AMI diagnosis in the emergency department might play a role in possibly insufficient statistical power to detect statistically significant differences in average wait time by patient gender and race (compared to the findings of the experience of patients in general), if in fact, the differences exist.

Aside for the non-significant findings relevant to the relationships between wait time and patient sociodemographic characteristics, the results suggest important associations of hospital emergency department wait time and patient visit contextual factors (patient visit situational factors and hospital structural factors).

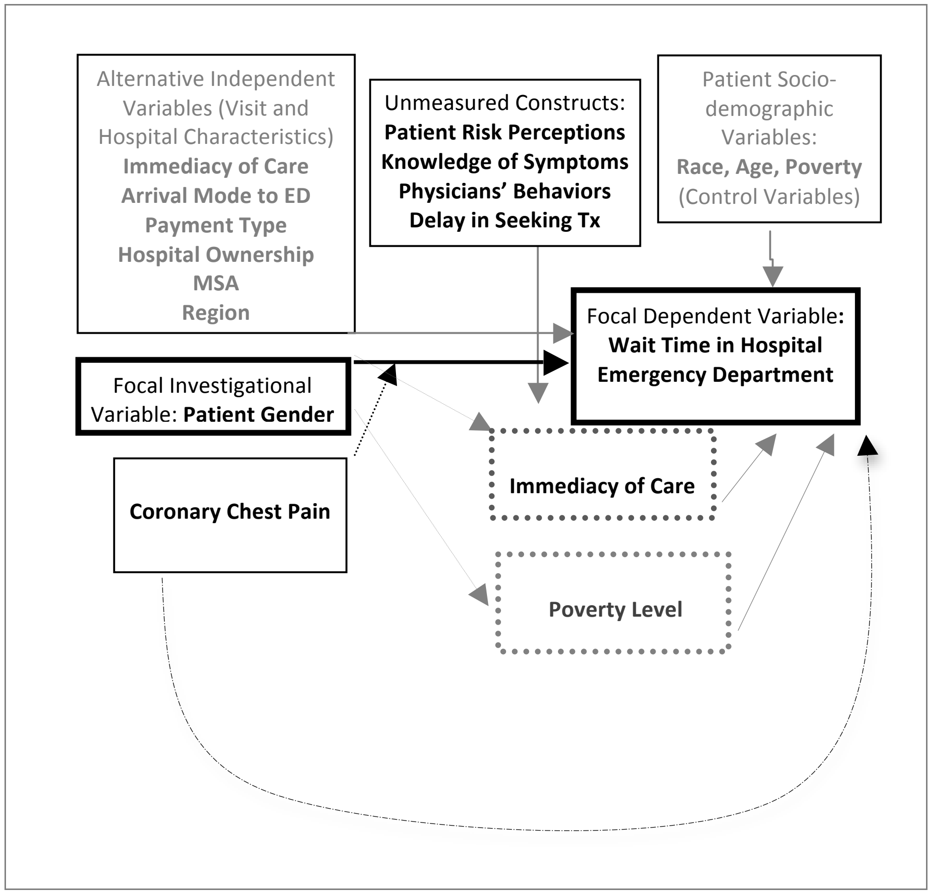
5.5.1 Testing moderation of the focal relationship by symptoms of chest pain

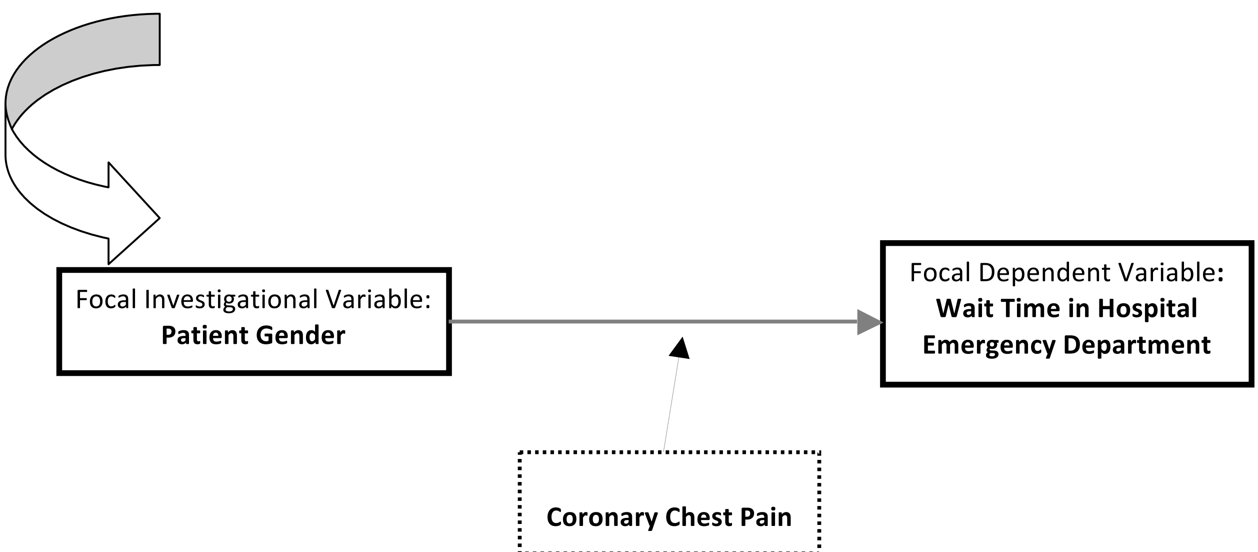
In an attempt to evaluate whether patient gender and hospital emergency department wait time could be associated only conditionally based upon symptoms of chest pain that patients report at the time of seeking care in the hospital emergency department, I constructed an interaction term from the patient gender variable and the symptoms of chest pain variable and entered it into the predictive model to test for possible interaction (Figure 5). The results of the test showed that the interaction term was not found statistically significant (p-value = 0.8861), indicating that there is not significant difference in emergency department wait time between women and men who report symptoms of chest pain at triage (Table 16). Consequently, the interaction term was not included in the final model predicting hospital emergency department wait time in patients diagnosed with AMI at the time of visit to the emergency department.

Table 16. Model effects predicting hospital emergency department wait time in AMI patients, 2008 NHAMCS, including the Gender*Chest pain interaction term (n=84).

	Test of model effects	
Wait time	F Value	P>|t|
Immediacy	3.04	0.0305
Age	1.48	0.2256
Gender	3.44	0.0655
Race	1.50	0.1915
Arrival	3.89	0.0225
Pay Type	3.90	0.0047
Owner	4.57	0.0117
MSA	6.62	0.0110
Region	3.36	0.0202
Poverty	3.62	0.0144
Chest pain	5.05	0.0260
Gender*Chest pain	0.02	0.8861
R square		0.465

Figure 5. Testing moderation of the focal relationship by Chest pain in AMI patients





CHAPTER 6. DISCUSSION

6.1 Key findings

This study proposes that health disparities in contemporary society manifest not only in differences in disease prevalence and incidence rates, but also through societal responses to urgent health care needs. Taking an important chronic condition - coronary heart disease - this study explored how individual, situational and structural characteristics converge to exacerbate ongoing differences in quality of care experienced by patients in emergency health care settings. Using hospital emergency department wait time as the major outcome of interest, it was found that, wait time can be predicted from a cluster of factors that are characteristic of the patient emergency department visit experience.

Among patients in general, shorter emergency department wait time is associated with higher order of urgency of care, being male, White, wealthier, taking an ambulance to the emergency department, visiting a privately owned hospital, visiting an emergency department in a non-metropolitan statistical area, and visiting a department in the Western geographical region of the United States.

Longer wait time is associated with low urgency of care, African American race, female gender of patient, living in high poverty, walking-into the emergency department or using public service to seek care, visiting a voluntary hospital, visiting emergency departments in metropolitan areas, and visiting departments in the South and Northeast of the United States.

The association between patient gender and wait time is not conditional upon patient race and ethnicity, meaning that women waited on average five minutes longer compared to men to see an emergency department physician, and this association did not vary by patient race and/or ethnicity. Patient age was not found to be a significant predictor of wait time, nor did method of payment make a difference.

Although theoretically supported, neither the urgency of care, nor poverty level, mediated a significant amount of the relationship between patient gender and emergency department wait time. Rather, even after controlling for immediacy and poverty level in two separate analyses, and holding the other contextual factors in the model constant, the significant differences in average wait time that were predicted by patient gender persisted. Immediacy assignment did not vary by patient gender, and neither did poverty level.

In the population of patients with coronary heart disease (CHD) diagnoses at the time of visit to the hospital emergency department, shorter wait time was predicted from high urgency of care, ambulance arrival to the emergency department, private health insurance coverage, visiting a Government hospital, and visiting an emergency department in non-metropolitan area. Longer wait time was associated with low care urgency, non-ambulance arrival to the emergency department, Medicare and Medicaid health coverage, seeking care in a voluntary hospital, and visiting an emergency department in a metropolitan statistical area. Patient sociodemographic characteristics: age, gender, race/ethnicity and poverty were not significant predictors of emergency department wait time. Therefore, hypotheses that tested whether women who are diagnosed with CHD in the hospital emergency department wait longer than men are not supported.

For acute myocardial infarction (AMI) patients a shorter wait time was associated with higher order urgency of care, reporting symptoms of chest pain, ambulance arrival to the emergency department, private insurance coverage, low poverty level, Government hospital ownership, and non-metropolitan statistical area. Longer wait time was predicted from low urgency of care, not reporting symptoms of chest pain upon arrival, non-ambulance arrival, Medicare and Medicaid insurance coverage, high poverty level, visiting a voluntary hospital, and visiting an emergency department located in metropolitan areas. As in the CHD population, patient gender, race, age, and geographical region of the emergency department were not significant predictors of emergency department wait time, thus, hypotheses that tested whether women who are diagnosed with acute myocardial infarction in the emergency department wait longer than men are not supported. For patients with CHD diagnoses, and patients with the AMI diagnosis, aside for the overall consistent findings described above, both sub-analyses revealed that shorter wait was observed in Government owned hospitals compared to voluntary hospitals.

In all three main analyses, consistent findings were the following: shorter wait was predicted from higher order of immediacy, ambulance arrival to the emergency department, and visiting a department in non-metropolitan areas. In practical context, people who waited a long time were those who did not use ambulance services, who went to a hospital located in a metropolitan area, and who were categorized with a low urgency of care.

Regarding a consistent non-significant finding, having adjusted for the other important conceptually related factors in the model, none of the three analyses found patient age to be a significant predictor of emergency department wait time.

Based on these findings, the main contribution of this study is that when evaluating the quality of care in heart disease-specific context, wait time was not predicted from patient gender, or racial and/or ethnic characteristics, or patient age. Therefore, it is crucial to consider disease-specific contexts when evaluating quality of care. Neither of the two sub-sample analyses found patient gender and race/ethnicity to be significant predictor of wait time. Although this finding did not support the study hypotheses that tested for gender differentials in wait time in these particular sub-populations, this result is a favorable one, because it suggests an absence of differential treatment based on patient gender in the hospital emergency department.

Aside for the consistent predictors of wait time that were observed in both, the CHD and the AMI domain, the study of the AMI sub-population identified two additional predictors of wait time that were not observed in the CHD group: reporting chest pain symptoms as reason for visit, and poverty level. Chest pain symptoms predicted shorter wait, and high poverty level predicted longer wait. The association of high poverty and longer wait was also observed in the population of patients in general, but not in patients with CHD.

Keeping in mind the ultimate objective of this research, which was to increase the understanding of the predictors of hospital emergency wait time and to examine the effects of patient gender, as well as other patient sociodemographic characteristics, while controlling for the important contextual factors of the emergency department visit, a set of important factors that predict hospital emergency department wait time was identified.

The findings revealed similarities as well as differences in contrast with previous research. The following paragraphs address the integration of the study findings in the existing literature, including how this research moves the emergency department care field forward. Larger contextual factors that play a role in emergency department wait time are addressed first. Overall, the discussed conditions that take place within the structural context of the emergency department care demonstrate persistent historic effects on the quality of emergency care (specified below). Subsequently follows a discussion of the effects of patient sociodemographic characteristics. Some of the trends in wait time disparities are consistent with prior literature, while other important patterns appear to have changed, and those deserve further attention in future research.

6.1.1 Effects of the patient visit context

In regard to the hospital structural context of the emergency department patient visit, and congruent with the outcomes of wait time analyses from 1997 – 2004, this study found longer wait times in large metropolitan settings.[60] In 2008, 84 percent (weighted) of all emergency departments (similar to percentages in previous years) served patients in urban areas. Although due to limited data availability, this study did not evaluate the effect of hospital emergency department crowding directly, this outcome served as a proxy for crowdedness, (a concept that still needs a more concrete definition within the emergency department care research) to conclude that among patients in general, among patients with coronary heart disease diagnoses (CHD), and among patients diagnosed with acute myocardial infarction (AMI), those who visited urban emergency departments were likely to wait longer.

In addition to the metropolitan statistical area status, the study findings revealed that among patients in general, compared to the Western geographical region of the U.S, those who sought care in the Northeast waited longer, but unlike the literature that described the situation in the past decade, we also observed significantly longer waits in the South. Average wait in the South was 15 minutes longer compared to the West, and this effect was a region unique effect holding urban area constant (and controlling for all other contextual factors in the model).

The other structural contextual factor that played a role in predicting wait was hospital ownership status. Among patients in general, those who visited a privately owned emergency department waited less compared to those who visited a voluntary hospital. Among patients with AMI, and among patient with CHD diagnoses, those who visited a Government hospital waited less compared to those who visited a private hospital (no differences were observed between wait time in private and voluntary hospital in AMI and CHD patients). Both findings describe persistent contextual effects that were previously demonstrated.[60] As expected, arrival by ambulance predicted overall shorter wait compared to patients who walked-in to the emergency departments and those who used public service, in all patients.

The factors that influence wait time through the structural context of the emergency department (ED) patient visit often do not fall under direct control of the hospitals or emergency departments where patients seek care. Rather, higher order structural, societal, and public policy changes, as well as localized procedural changes are needed to reduce the disparities in wait.

Although intervention efforts at the nation-wide structural level of seeking emergency care are arduous to pass and implement, reversing the overall general trend of longer waits in urban emergency departments (EDs), EDs with voluntary ownership, and EDs in the South and Northeast, could be accomplished through expanding the areas that provide emergency treatment, hiring additional emergency department physicians and support staff, periodical retraining and reeducation of ED personnel to increase overall service efficacy of the emergency departments and to streamline the provision of care, and importantly, by applying evidence based findings from the disparities in care literature to everyday practice. Similarly, rural EDs may need additional emergency service areas to accommodate the needs of patients with conditions that require urgent care, such as those with AMI. Additional service areas can be established as both, a physical location, or a versatile mobile team of health professionals who respond to emergency situations.

In addition to expanding emergency service areas, hiring additional staff, and continuous retraining of existing staff, medical schools could restructure their student acceptance policies to recruit a greater number of individuals who wish to pursue this route of practice. Aside for educating all medical professionals who come in contact with patients needing emergency services about the complex disparities in care, quality of urgent care may need increased attention in medical school curriculum as well.

Another area of focusing intervention efforts includes better management of the needs of the aging population that requires more complex care. In particular, patients with chronic conditions are known for their heavy use of acute hospital services when their illness is not controlled in routine primary care.[150] Therefore, there seems to be a need for improvements in primary care so that chronic illness is integrated with routine care for chronically ill patients.

Further, technological advances in emergency care procedures can streamline the provision of needed care and lead to greater efficiency, which would benefit both, the patient, and the emergency department.

Although the patient medical insurance factor approached statistical significance, the effect of anticipated source of payment of emergency services was not found statistically significant at $p<0.05$ in the general patient population. This non-significant finding is consistent with prior literature suggesting that although the inability to pay for care may be associated with poorer quality of care overall, in the general patient population emergency department wait time does not appear to differ by type of insurance coverage. That is, patients with no private insurance coverage do not seem to experience longer average wait times compared to those with private insurance. In patients with AMI and CHD diagnoses, however, longer average waits in patients with Medicare and Medicaid coverage compared to patients with private insurance coverage were observed. This finding is an important suggestion of a trend characteristic of better care among wealthier patients who have private insurance, compared to patients without private insurance coverage. This suggestion can motivate future research endeavors, especially in times of increased political interest into alternative public options of health insurance coverage in the U.S. Public health insurance coverage happens to be the golden standard of coverage in all developed European countries, and those countries do not exhibit increased emergency department visits, decreased number of emergency departments, excess hospital crowding, nor a progressive trend of increased emergency department wait times.

6.1.2 Patient sociodemographic effects

In the population of patients in general, overall, even after controlling for the contextual factors of the emergency department patient visit, longer average waits in women were observed. Although at the nation-wide level we have been striving for increased equality in the quality of care, this differential persists.[60] It is important to articulate that this gender-specific difference in wait was not explained by poverty level nor the urgency of treatment assignment, and this differential persists even after controlling for metropolitan statistical area status. Although urgency was not found to vary by patient gender, longer waits of women could still be an indirect result of differential evaluation of patient need at time of triage by hospital staff, where assignment into urgency of treatment categories could be indirectly based on different administration of screening tests and/or pre-evaluation by hospital staff upon patient arrival. This possible explanation is congruent with historically different treatment of women and men, where traditionally, the health of men was given a higher priority. However, the unavailability of data on the characteristics of hospital staff and their perceptions about the risk for the disease by gender does not allow for testing of such hypotheses.

Considering patient race, among patients in general, compared to White patients longer average waits in African American patients were observed. Similar to the gender differential finding, this sociodemographic disparity has persisted over time.[60,64] In this study, African American race was the strongest patient characteristic that predicted longer wait. Conceptually, some previously described disparities in the quality of care may be explained by different poverty level experience and living in crowded urban areas. A major contribution of this study is that even after controlling for poverty level and metropolitan statistical area status, overall, African American patients still wait on average ten minutes longer to see an emergency physician compared to White patients. Unlike in prior research,[60] this study did not find longer average wait times among patients of Hispanic ethnicity, nor in patients of other races, compared to White patients.

Aside for disparities in actual emergency care, longer waits of African American patients could be a result of differential administration of pre-screening tests and pre-evaluation by hospital staff at time of triage. This possible explanation is theoretically congruent with historically different treatment of African Americans versus Whites that persists, although in a more covert form.[15, 138]

There is no valid reason for why women or African American patients should wait a longer time to receive emergency treatment. After controlling for urgency of care, poverty level, arrival method, type of health insurance coverage, hospital crowdedness, and geographical region, these two demographic groups may still experience a poorer quality of care. Although the effects of patient gender and race are additive and not multiplicative, in that the effect of patient gender is not conditional on patient race (Figure 4), Black women wait, on average, 17 minutes longer compared to White men (Table 6b).

Oftentimes, conceptually, poverty tends to mediate bivariate relationships of patient demographic variables with an outcome, where after estimating the mediated effect of poverty, the bivariate effects disappear. A contribution of this work then is to suggest that even after controlling for poverty level, among patients in general, the significant effects of patient race and gender have persisted. Additionally, in patients diagnosed with AMI in the emergency department, poverty level explained a greater amount of variance in wait time compared to chest pain symptoms that were presented at the time of seeking care. Upon including poverty level in the predictive model among AMI patients, the percentage of variance explained increased by ten percent, compared to chest pain symptoms that explained additional two percent of the variance in wait time in the predictive model.

Compared to the above-mentioned higher order public policy changes that are essential to ameliorate structural disparities in wait time, especially in crowded urban areas, the effects of patient sociodemographic predictors seem more proximal, and as such, they may potentially offer opportunities for more direct mediation efforts. For example, if it is the case that triage staff happens to evaluate the urgency of patient condition in a biased manner, such as placing the need for pre-evaluation of White patients above the needs of other groups, direct intervention efforts can be attempted on location. It is crucial, however, that continuous surveillance efforts take place at the emergency department level, because interventions without evidence-based evaluation are inadequate.

Just as it is relevant at the structural level, medical schools could modify their student acceptance policies to recruit a greater number of interested students who wish to dedicate their work to alleviating differential outcomes in the quality of emergency care. Educating all medical professionals who come in contact with patients needing emergency services about the complex disparities in the quality of care is crucial, if we intend to intervene at the patient visit level.

Considering intervention efforts, most CHD intervention efforts focus on primary and secondary prevention rather than on seeking care when suspecting a heart attack. It may be easier to attempt to modify individual risk behaviors, however scientific studies show that this type of effort may not be enough to change health outcomes. If fewer women are properly diagnosed with CHD, physicians are less certain of symptoms in women, and fewer women are referred for cardiac testing even though they present with the same physiological symptoms as men do, higher order changes are needed. To reduce disparities in coronary outcomes, interventions toward improvements in women's heart disease care need to include educating health professionals about the disparities in cardiac care, and rethinking the framework within which women receive treatment without an exclusionary perspective, which is clearly lacking in the current literature.

The main finding of this study revealed that when considering the specific context of seeking care for acute coronary heart disease, patient personal characteristics were not significant predictors of emergency department wait time. Although this finding did not support the study hypotheses that tested for gender differentials in quality of care operationalized as wait time, this is a favorable outcome in that this finding suggests an absence of gender disparity in one aspect of the quality of emergency care.

6.2 Strengths and limitations

The study findings contribute to the body of research on health disparities based on a conceptually meaningful predictive model estimating how patient sociodemographic characteristics, as well as patient visit situational factors and emergency department structural factors impact the quality of emergency care. Compared to prior research that often reports bivariate relationships between the predictive factors involved, this study comprised intensive investigation that applied social stratification theory to conceptualize the multi-factorial relationships that are at play at the time of seeking emergency care into a coherent predictive model. This study offers a sophisticated analysis that not only provided the description of the recent situation, but tested for the effects of possible moderating and mediating variables, which, based on the conceptual framework, were hypothesized to influence the effect of patient gender on emergency department wait time.

The research questions were tested using a large-scale population-based dataset. Importantly, this study controlled for the effect of patient poverty level when estimating emergency department wait time.

Multiple statistical techniques and software packages were used to examine statistically significant differences in mean emergency department wait time. The use of survey weight design variables allows for generalization of findings to the larger U.S. population.

This study also has several limitations, most of which are related to data availability. To examine differences in average emergency department wait time, I utilized the wait time variable that was available within the National Hospital Ambulatory Medical Care Survey (NHAMCS) Emergency Department dataset as the dependent variable in the predictive model. Due to incomplete records by hospital staff on the Patient Record Forms, the instrument of the study, information on wait time was missing for 20 percent of the observations in the study of patients in general, for 15 percent of observations in the CHD population, and for 13 percent of observations in the AMI sub-population. Although this occurrence could lead to biased findings, the tests of predicting wait time missingness did not showed significant issues in varying wait time missing data for the patient characteristics tested in the model. Among patients in general and in the CHD analysis, wait time missingness was predicted from immediacy, in that higher urgency predicted more wait time missingness, which seems feasible as patients with immediate needs may be taken directly to the physician without waiting and recording wait time. In the AMI sub-population missing wait time was predicted from patient age, where older age predicted more wait time data missingness. However, although the missing data are of concern, patient age was not found to be a significant predictor of wait time in neither of the three analyses.

Data descriptive of hospital overcrowding were not available, thus exploration of the hypothesized association of hospital overcrowding with emergency department wait time was not possible. However, I utilized the metropolitan statistical area (MSA) status variable to conclude that emergency department wait time was longer in hospital emergency departments located in large urban areas (which are associated with emergency department crowding).

In testing of the associations of hospital emergency department wait time within the population of patients who received coronary heart disease (CHD) diagnoses and in the sub-population of patients diagnosed with acute myocardial infarction (AMI), one might perceive that the CHD and AMI domains contained a relatively small number of observations descriptive of patients who received the diagnoses. However, the named diagnoses in the emergency department should not be confused with overall prevalence rates of CHD and AMI. Most patients ever diagnosed with coronary heart disease receive the diagnosis during an ambulatory visit, typically in primary care setting.[147] As for myocardial infarction, almost 70 percent of all myocardial infarction deaths in the United States happen out of hospital.[133] Of all out-of-hospital cardiac arrest cases, 40 percent of patients are pronounced dead upon arrival of the emergency medical services team.[133] Of all acute myocardial infarction deaths, approximately half die prior to ever reaching a hospital.[148]

The findings based on studying disparities in care in the CHD population as well as the AMI sub-population comprise an important starting point for future investigation of disparities in emergency department wait time. In the CHD population, the predictive model explained approximately 19 percent of the variance in hospital emergency department wait time, and in the

AMI sub-population, the predictive model explained over 40 percent of the variance in wait time.

Of significant importance could be the investigation of associations between the personal characteristics of the hospital triage staff who collected the original data descriptive of the patient experience in the emergency department and wait times. For example, it could be interesting to explore whether any of the characteristics of the triage staff, such as personal, educational, or situational characteristics (e.g., previous negative experience with a patient) may predict administration of pre-assessment procedures, which may lead to differential assignment into urgency of care category. However, such data were unavailable.

In the general patient population, the theoretically grounded predictors of emergency department wait time explained almost nine percent of the variance in wait time. A percentage of this size is commonly observed in studies that employed large national datasets because large data contain much individual variability that cannot be explained by a limited availability of variables used for building a predictive model.[146] These same theoretically developed predictor variables explained 41 percent of the variability in wait time in patients with the AMI diagnosis with a considerably smaller population of patients. The unexplained variance in the general patient population seems to relate to a larger degree to the greater context depicting the structure of provision of emergency care in the U.S. In particular, decrease in the number of emergency departments, increase in emergency visits, associated hospital crowding, inadequate medical and support staff, staff layoffs and furloughs in recent years, as well as chronic illness that is not adequately managed in primary care may all contribute to longer wait times.

Overall, considering its analytical strengths, the data that were utilized for this study were of similar or better quality compared to previous research that studied emergency department care.

It is critical to note that as substantial as these population level predictors are all together, they do not portray the whole picture of seeking emergency care. A substantive part of treatment seeking comprises patients' health beliefs and perceptions, knowledge, and health behaviors. Specifically, patient knowledge and perceptions of one's own current and past health status, as well as patient understanding of the symptoms one perceives, and their risk of a health condition matters when evaluating one's health (Chapter 2). In assessing one's health behavior, patient perceptions of own behavioral changes one believes they are able to make toward increased health are of significant importance. Such person level factors are well explained by the individual level health behavior models, such as the Health Belief Model, and are even more detailed in the Extended Parallel Process Model. Due to the unavailability of data on patient level factors, such as patient health beliefs, perceptions and health behaviors, I was unable to examine the contributions of such individual level factors as patient perceptions, knowledge, and previous and current health behaviors as opposed to the larger contextual effects on emergency department wait time. However, consideration of the patient level health belief and health behavior factors is a necessary step toward a more comprehensive understanding of seeking emergency care in the U.S.

6.3 Directions for future research

This work is one of a few studies that investigated predictors of emergency department wait time as a quality of care indicator. The study findings revealed important relationships that seem to occur in the hospital emergency care setting. Although significant predictive associations were observed, this area needs further research. Specifically, unlike the relatively robust findings pertaining to the mode of arrival to the emergency room, hospital ownership status, or hospital metropolitan statistical area status, more examination is needed in the area of patient sociodemographic characteristics, some of which were found to be strong predictors of wait time in this study, even after controlling for other important contextual factors. Specifically, further research is needed to replicate this study with a newer version of the dataset with the inclusion of patient gender and race/ethnicity as predictors of wait time, while controlling for other theoretically related factors that occur in the emergency department setting.

This study documented disparities in hospital emergency department wait time in the adult patient population. Of considerable importance could be the investigation of whether similar predictive patterns may exist within the pediatric population as well. Limited evidence suggests that among patients in general, children with minority population characteristics may also experience longer wait times to see an emergency department physician.[149] Recent versions of the Emergency Department dataset of the National Hospital Ambulatory Medical Care Survey provide an opportunity to study outcome variations in the point-of-care setting also in pediatric patients.

To achieve a more complete understanding of the emergency care patient experience, it is imperative that we connect the patient level factors that precede the treatment seeking behaviors with the point of care experience. We can do so if we bridge patients' beliefs about their own health with their treatment seeking behaviors. For example, similarly to studying eating behavior, where we may be interested in the factors that may motivate increased or decreased food consumption, and connect those findings to the availability of healthy food stores in the areas where people live, the quality-of-care research too can benefit from a deeper understanding of beliefs that can lead one person to seek emergency care and not the other. I am unfamiliar with any current data that include both, patient health behavior beliefs, and hospital emergency department care. However, those are the kind of data we would need to bridge the health belief-based experience with the treatment seeking experience. The effort to include health belief-based data in large national population based surveys would be arduous, but we can attempt to collect such data in smaller exploratory studies to begin with. For example, during the data collection period, we could take a subsample of patients from the NHAMCS dataset and conduct individual interviews to collect relevant data on patients' heart disease risk perception and health behaviors. To move forward in studying the emergency department patient experience, we need to study the patient beliefs that preceded treatment-seeking behaviors, as those have the potential to aid in designing intervention efforts toward increased quality of care.

6.4 Implications for practice

6.4.1 General implications

Without considering disease-specific context, the study findings showed that emergency department wait time appears to vary by patient characteristics, patient visit situational characteristics, and hospital structural characteristics, even after accounting for the level of urgency of care assigned at the time of patient arrival. Translating the findings to practice requires a multipronged approach because disparities in the quality of care were observed at several levels of the patient emergency treatment seeking experience. Moreover, although strong predictive factors of longer emergency department wait were identified, an amelioration of the pertinent disparities is likely to take place over time, and it will demand persistent effort, political power, as well as continuous surveillance of any changes.

On average, longest wait time occurs in crowded hospitals with voluntary ownership. This outcome clearly demonstrates a need for change of the structural differentials in the quality of care. It has been documented that between 1994 and 2004, visits to the emergency department increased by approximately 18 to 26 percent, while the number of emergency departments decreased by 9 to 12 percent.[61,62] Between 1996 and 2006, the number of emergency departments has decreased from 4,019 to 3,833.[63] The connection between the increase in emergency department visits and the decrease in emergency departments (that have to accommodate the increased visits) has been established, and it does appear to contribute to longer wait time to see an emergency physician. [61-63] Study findings propose that recruiting and training additional emergency department physicians, together with additional support staff is critical, but without a structural expansion of areas that provide emergency treatment, we might not see significant changes in the increasing trend of wait time to be seen by an emergency physician.

From a historical perspective, larger structural public policy changes could take extensive time to be implemented. In lieu, medium level policy changes at the hospital level have the potential to be effective in attempting to decrease differentials in the quality of care locally. In parallel to the very recent trend of hospitals at the national level that make a vigorous commitment to end smoking behavior in their immediate geographical neighborhood areas, hospitals can also commit as an entity to provide the highest attainable quality of service, while striving to eliminate all possible disparities in the provision of care.

Many hospitals have already committed to providing the highest standards of care. Committing to eliminating disparities in emergency care provision, however, elevates such commitment in that the hospital emergency department wait time would be continuously evaluated as a separate outcome objective. Such findings could be made public through the publishing of the intermediate outcomes in a local newspaper, or otherwise disseminated to the population served by the hospital. With such a commitment, continuous evaluation of services that are provided to the public would manifest what areas of care might need further improvement, which in turn, would guide any intervention efforts toward greater equality of care. In such way, hospitals as entities can commit to solving pertinent quality of care issues at the local level without relying on the anticipated higher order policy changes.

Based on the findings of main effects on emergency department wait time by patient gender and race, one of the first steps in ameliorating disparities in emergency wait time at the local level has to be educating health professionals who come in contact with patients needing emergency care about the evidence-based multi-factorial relationships that underlie the differentials in the quality of emergency care. Not only should the evidence-based findings be applied to train new employees as part of the general training at time of hire, annual retraining is critical to incorporate updated findings from the hospital's continuous surveillance of the quality of care efforts. As previously noted, medical school curriculums to which emergency department physicians were exposed to during their training plays a particularly important role. As hospitals increase their focus on reaching out to new hires that have incorporated the understanding of, and value, of providing the highest attainable quality of care, medical schools have the opportunity to rethink and restructure their student acceptance policies to recruit a greater number of individuals who wish to pursue emergency medicine and want to dedicate their work to decreasing disparities in care that are based on patient sociodemographic characteristics.

Aside for the professional training of emergency department physicians, urgent need exists to educate all healthcare professionals who come in contact with patients needing emergency services about the current quality of care findings, as based on empirical research, not on anecdotal evidence. Such educational processes can be interwoven into emergency departments' standard operational procedures that serve for annual retraining of all staff.

6.4.2 Implications for quality of care among heart disease patients

A major finding that was observed in the population of patients with coronary heart disease diagnoses revealed that patient gender and race/ethnicity were not found significant predictors of wait time. Although these findings did not support the study hypotheses pertaining to assessing gender differentials in the quality of coronary care, these results suggest absence of longer wait times among women patients, which is a positive finding. The absence of gender effect on wait time in this population could suggest that heart disease awareness interventions, such as the large national social marketing campaigns: *The Heart Truth* by the National Heart, Lung and Blood Institute (NHLBI) together with the National Institutes of Health, and the *Go Red For Women* campaign by the American Heart Association that have taken place in the past decade may have had an effect on women's heart disease awareness and risk perception of women and possibly even influenced the approach emergency staff have toward treating women with heart disease symptoms as well. The issue of unequal care for women with heart disease was first confronted in the 1990s, and it is possible that the persistent national heart disease awareness social marketing messages have had an effect on women's better understanding of the associated risks. However, based on the current literature, it cannot be concluded that heart health promoting interventions caused the change in women's awareness.

A valuable secondary finding that arose from testing the model in patients with coronary heart disease documented that most people with acute coronary syndrome do not benefit from the advanced medical technology that is currently available to treat acute myocardial infarction because only relatively small percentages of people with those diagnoses sought treatment in the emergency department. This study documented that only a small portion of people with acute heart disease were seeking treatment in the emergency department. As the heart disease literature documents, the majority of people who suffer from this acute condition do not survive. This finding could also suggest a greater generic problem indicating that many people do not seek emergency treatment for acute conditions in general, or do not do so fast enough.

More research into quality of emergency care is needed to make sound conclusions about the experience of patients who visit emergency departments in the U. S. Limited evidence, however, should not hinder organized efforts directed toward reducing disparities in emergency department wait time, in particular, efforts that target improving wait time in urban hospitals, in the population of African American patients, and in patients living in high poverty.

CHAPTER 7. CONCLUSION

The purpose of this research was to investigate predictors of emergency department wait time in the United States, and to examine the pathways for possible differences in average wait time when seeking emergency care. I tested the effects of patient characteristics and contextual factors among patients in general, among patients with coronary heart disease diagnoses in the emergency department, and among patients diagnosed with acute myocardial infarction at the time of visit to the emergency department. Overall, the findings of this research documented that predicting emergency department wait time is complex, and associations between wait time and patient characteristics, together with patient visit factors, must be considered within the context in which the emergency visit occurred. In particular, among patients in general, average wait time appears to vary by patient gender and race, in that women and African American patients experience longer average wait times compared to men and White patients. These findings were consistent across the inferential analyses that tested the experiences of patients in general. The associated average wait time differences were statistically significant, relatively robust, and practically meaningful, in that women waited, on average, five minutes longer compared to men, and African American patients waited, on average, ten minutes longer compared to White patients.

However, the major finding of this study is that when considering specific contexts within the emergency department patient visit experience, in this case a population of patients with coronary heart disease diagnoses, the results differed. The main overall finding of this study revealed that patient gender, race and ethnicity were not significant predictors of hospital emergency department wait time in the population of patients who received coronary heart disease diagnoses in the emergency department, nor in the sub-population of patients with the acute myocardial infarction diagnosis at the time of visit to the emergency department. No evidence was found to suggest that women who report chest pain symptoms as a reason for visit have longer average wait times compared to men who report the same symptoms.

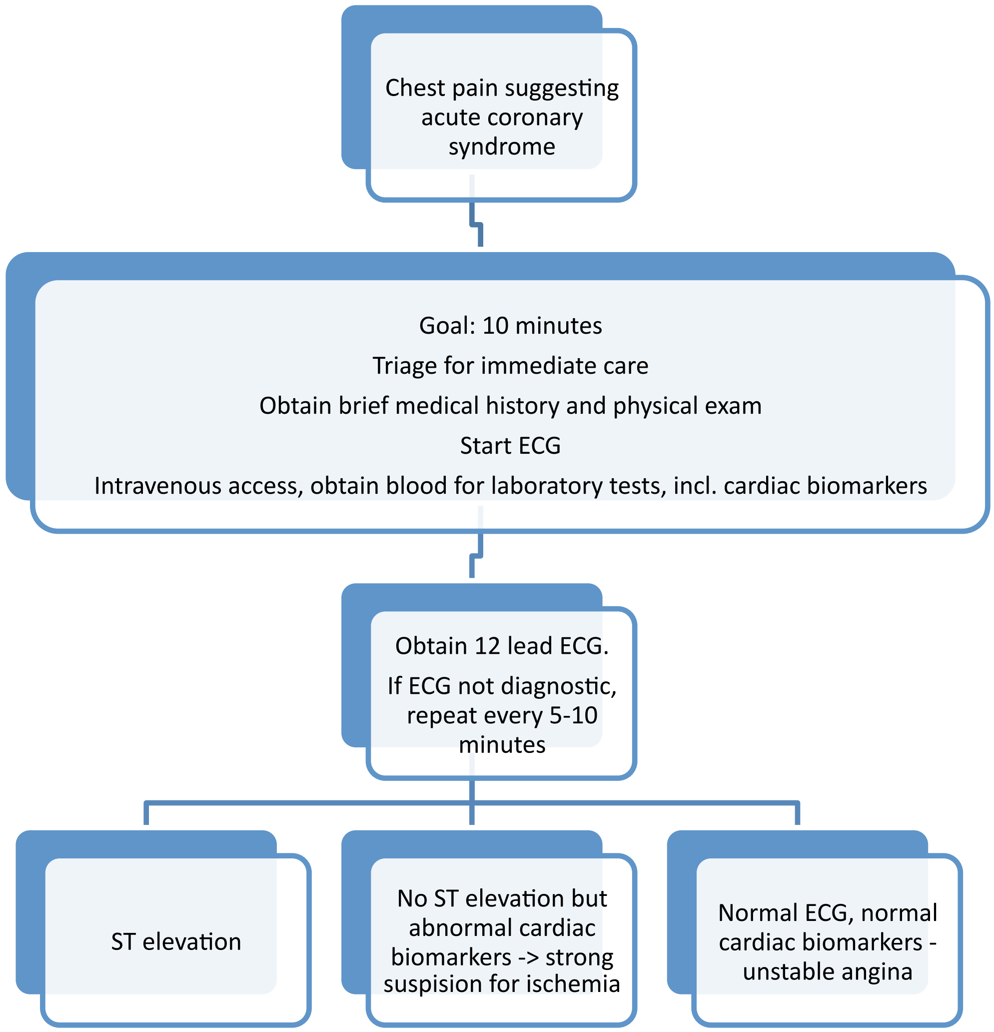
It is of compelling importance to conclude that among patients with the acute myocardial infarction diagnosis in the emergency department, poverty level explained more variance in emergency department wait time compared to symptoms of chest pain reported at time of visit. While chest pain symptoms added approximately two additional percent of explained variance in wait, poverty level explained ten additional percent in wait time variance.

This outcome is a suggestion of an absence of gender differentials in one aspect of the quality of emergency department care, the amount of time patients have to wait to be seen by the emergency physician. This study did not test why this is the case, I can only speculate on possible reasons leading to this observation. Given the intense nation-wide efforts toward raising heart disease awareness through large national campaigns such as *The Heart Truth* and *Go Red For Women*, it is possible that a large part of the U.S. population has been exposed at some point to these intervention efforts. It is feasible that many people, especially those who pay more attention to their health, retained some of the disseminated information about the risk for heart disease in populations of women. If this is the case, it would follow that continuous effort toward heart disease awareness at the national as well as the community level play an important role toward educating women about their risks of heart disease and that persistent effort to disseminate key awareness messages is critical. Aside for raising heart disease awareness in women, it is possible that emergency department staff too have benefited from increased availability of educational information on heart disease manifestation in women through the nation-wide efforts. However, based on current literature, it cannot be concluded that the named interventions caused the change in heart disease awareness.

Although the general findings that demonstrated persistent gender and racial disparities in wait time among patients in general are urgently relevant in the design of intervention efforts towards reducing persistent disparities in the quality of emergency care, it is critical to interpret the findings within the context in which the patient visit took place. However, limited findings should not hinder intervention efforts aimed toward the highest attainable quality of emergency care.

Finally, although providing timely care is a key quality goal outcome in emergency care,[58] and in turn, it is considered a central indicator of providing timely care,[58] emergency department wait time reflects the quality of a process, not the quality of ultimate health outcomes. Future studies should assess how good of a predictor of health outcomes wait time is among different health conditions, and investigate whether other indicators of quality of care could do a better job predicting the quality of actual health outcomes rather than the quality of a process.

APPENDIX A. Algorithm for triage of patients presenting coronary chest pain in the emergency department



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APPENDIX B: Patient Record Form used in the 2008 Emergency Department National Hospital Ambulatory Medical Care Survey (NHAMCS)

(The Patient Record Form starts on next page)

Form Approved OMB No. 0920-0278 Exp. Date 8/31/09 CDC 64.136

NHAMCS-100(ED)

U.S. DEPARTMENT OF COMMERCE
Economics and Statistics Administration
U.S. CENSUS BUREAU
ACTING AS DATA COLLECTION AGENT FOR THE
U.S. Department of Health and Human Services
Centers for Disease Control and Prevention
National Center for Health Statistics

PATIENT RECORD NO.:

PATIENT'S NAME:

NATIONAL HOSPITAL AMBULATORY MEDICAL CARE SURVEY
2008 EMERGENCY DEPARTMENT PATIENT RECORD

Provider: Detach and keep)

Please keep (X) marks inside of boxes ➔ ☒ Correct ☒ Incorrect

1. PATIENT INFORMATION

a. Date of visit Month Day Year 2 0 0

b. ZIP Code

c. Date of birth Month Day Year

d. Time of day
(1) Arrival ☐ AM ☐ PM ☐ Military
(2) Time seen by physician ☐ AM ☐ PM ☐ Military
☐ Not seen by physician
(3) ED discharge ☐ AM ☐ PM ☐ Military
Mark (X) if ED discharge is more than 24 hours from arrival. ☐

e. Patient residence
1 ☐ Private residence
2 ☐ Nursing home
3 ☐ Other institution
4 ☐ Other residence
5 ☐ Homeless
6 ☐ Unknown

f. Sex
1 ☐ Female
2 ☐ Male

g. Ethnicity
1 ☐ Hispanic or Latino
2 ☐ Not Hispanic or Latino

h. Race – Mark (X) one or more.
1 ☐ White
2 ☐ Black/ African American
3 ☐ Asian
4 ☐ Native Hawaiian Other Pacific Islander
5 ☐ American Indian/ Alaska Native

i. Mode of arrival – Mark (X) one.
1 ☐ Ambulance
2 ☐ Public service (non-ambulance)
3 ☐ Personal transportation
4 ☐ Unknown

j. Expected source(s) of payment for this visit – Mark (X) all that apply.
☐ Private insurance
☐ Medicare
☐ Medicaid/SCHIP
☐ Worker's compensation
☐ Self-pay
☐ No charge/Charity
☐ Other
☐ Unknown

2. TRIAGE

a. Initial vital signs
(1) Temperature ☐ °C ☐ °F
(2) Heart Rate per minute
(3) Respiratory rate per minute
(4) Blood pressure Systolic Diastolic
(5) Pulse oximetry %
(6) Oriented X 3 ☐ Yes ☐ No ☐ Unknown

b. Immediacy with which patient should be seen
1 ☐ Immediate
2 ☐ 1-14 minutes
3 ☐ 15-60 minutes
4 ☐ >1 hour-2 hours
5 ☐ >2 hours-24 hours
☐ No triage
☐ Unknown

c. Presenting level of pain
1 ☐ None
2 ☐ Mild
3 ☐ Moderate
4 ☐ Severe
5 ☐ Unknown

3. PREVIOUS CARE

a. Has patient been –	Yes	No	Unknown
(1) seen in this ED within the last 72 hours? . .	1 ☐	2 ☐	3 ☐
(2) discharged from any hospital within the last 7 days?	1 ☐	2 ☐	3 ☐
b. How many times has patient been seen in this ED within the last 12 months?	☐		3 ☐

4. REASON FOR VISIT

a. Patient's complaint(s), symptom(s), or other reason(s) for this visit. *Use patient's own words.*
(1) Most important:
(2) Other:
(3) Other:

b. Episode of care
1 ☐ Initial visit for problem
2 ☐ Follow-up visit for problem
3 ☐ Unknown

5. INJURY/POISONING/ADVERSE EFFECT

a. Is this visit related to an injury, poisoning, or adverse effect of medical treatment?
1 ☐ Yes
2 ☐ No – SKIP to item 6.

b. Is this injury/ poisoning intentional?
1 ☐ Yes, self inflicted
2 ☐ Yes, assault
3 ☐ No, unintentional
4 ☐ Unknown

c. Cause of injury, poisoning, or adverse effect – Describe the place and events that preceded the injury, poisoning, or adverse effect (e.g., allergy to penicillin, bee sting, pedestrian hit by car driven by drunk driver, spouse beaten with fists by spouse, heroin overdose, infected shunt, etc.).

6. PROVIDER'S DIAGNOSIS FOR THIS VISIT

As specifically as possible, list diagnoses related to this visit, incl. chronic conditions
(1) Primary diagnosis:
(2) Other:
(3) Other

7. DIAGNOSTIC/SCREENING SERVICES

1 ☐ NONE Mark (x) all ordered or provided

Blood tests:
2 ☐ CBC
3 ☐ BUN/Creatinine
4 ☐ Cardiac enzymes
5 ☐ Electrolytes
6 ☐ Glucose
7 ☐ Liver function tests
8 ☐ Arterial blood gases
9 ☐ Prothrombin time/INR
10 ☐ Blood culture
11 ☐ BAC (blood alcohol)
12 ☐ Toxicology screen
13 ☐ Other blood test

Other tests:
14 ☐ Cardiac monitor
15 ☐ EKG/ECG2
16 ☐ Pregnancy test
17 ☐ Rapid flu/Influenza test
18 ☐ Urinalysis (UA)
19 ☐ Wound culture
20 ☐ Other test/service

Imaging:
21 ☐ X-ray
22 ☐ CT scan
☐ Head
☐ Other than head
23 ☐ MRI
☐ Head
☐ Other than head
24 ☐ Ultrasound
25 ☐ Other imaging

8. PROCEDURES

Mark(x) all provided at visit. Exclude medications
1 ☐ NONE
2 ☐ IV fluids
3 ☐ Cast
4 ☐ Splint or wrap20
5 ☐ Laceration repair
6 ☐ Incision & drainage (I&D)
7 ☐ Wound debridement
8 ☐ Foreign body removal
9 ☐ Nebulizer therapy
10 ☐ Bladder catheter
11 ☐ NG tube/gastric suction
12 ☐ CPR
13 ☐ Endotracheal intubation
14 ☐ Other

9. MEDICATIONS & IMMUNIZATIONS

List up to 8 rugs given at this visit or prescribed at ED discharge. Include Rx and OTC drugs, immunizations, and anesthetics.

☐ NONE

	Given in ED	Rx at
	1 ☐	2 ☐
	1 ☐	2 ☐
	1 ☐	2 ☐
	1 ☐	2 ☐
	1 ☐	2 ☐
	1 ☐	2 ☐
	1 ☐	2 ☐
	1 ☐	2 ☐

10 PROVIDERS

Mark (X) all providers seen at this visit.
1 ☐ ED attending physician
2 ☐ ED resident/Intern
3 ☐ On call attending physician/Fellow/Resident
4 ☐ RN/LPN
5 ☐ Nurse practitioner
6 ☐ Physician assistant
7 ☐ EMT
8 ☐ Other

11. VISIT DISPOSITION

Mark (X) all that apply.
1 ☐ No follow-up planned
2 ☐ Return if needed, PRN/appointment
3 ☐ Return/Refer to physician/clinic for FU
4 ☐ Refer to social services
5 ☐ Left before medical screening exam
6 ☐ Left after medical screening exam
7 ☐ Left AMA
8 ☐ DOA
9 ☐ Died in ED
10 ☐ Transfer to different hospital – Specify reason
11 ☐ Admit to observation unit
12 ☐ Admit to hospital – Please continue with Item 12 - HOSPITAL ADMISSION on the reverse side.
13 ☐ Other

12. HOSPITAL ADMISSION

Complete if the patient was admitted to the hospital at this visit. – Mark (X) "Data not available" in each item, if efforts have been exhausted to collect the data.

a. Admitted to:
- ☐ 1 Critical care unit
- ☐ 2 Stepdown or telemetry unit
- ☐ 3 Operating room
- ☐ 4 Cardiac catheterization lab
- ☐ 5 Mental health or detox unit
- ☐ 6 Other bed/unit
- ☐ 7 Data not available

b. Hospital admission date

Month / Day / Year 2 0 0 _

☐

c. Hospital admission time

☐ AM
☐ PM
☐ Military

☐

d. Hospital discharge date

Month / Day / Year 2 0 0 _

☐

e. Principal hospital discharge diagnosis

1 Data not available

☐

f. Hospital discharge status/disposition

- 1 ☐ Alive → 1 ☐ Home/Residence; 2 ☐ Transferred; 3 ☐ Other; 4 ☐ Data not available
- 2 ☐ Dead
- 3 ☐ Unknown
- 4 ☐ Data not available

If this information is not available at time of abstraction, then complete the Hospital Admission Log.

NHAMCS-100(ED) (10-2-2007)

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