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A Preliminary Study Exploring Racial Differences in Triage, Hospitalization Status, And Discharge Medication in an Emergency Department in Graniteville, SC

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A PRELIMINARY STUDY EXPLORING RACIAL DIFFERENCES IN TRIAGE, HOSPITALIZATION STATUS, AND DISCHARGE MEDICATION IN AN EMERGENCY DEPARTMENT IN GRANITEVILLE, SC

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DEDICATION

I would like to dedicate this thesis to my mother, who discussed this topic with me every morning on the phone as I walked to my office. In one of our final discussions she told me, “I can’t wait to read the final version because it looks like you are on your way to becoming a great activist.” Here is the final version. I hope you enjoy it, mom.

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ABSTRACT

Purpose

This study seeks to identify any racial differences present in assigned triage scores, hospitalization status and discharge medications in a rural hospital likely experiencing a surge after a mass casualty incident involving chlorine gas as a result of a train derailment. Differences were examined between Non-Hispanic White and African American adults who were moderately ill and who presented to the emergency department of the closest hospital to the accident site within 24 hours of the incident.

Methods

Non-Hispanic White and African American adults who presented to the emergency department of the closest hospital to the accident site and who complained of chlorine exposure symptoms were included in this descriptive epidemiological study (n=25). Data used was obtained from medical records, utilizing a standardized medical abstraction form. Toxidrome, a compilation of five symptoms specific to chlorine exposure: eye irritation or pain, ear, nose, and throat irritation or pain, cough/wheezing and/or nausea/vomiting documented in the emergency room, was used as a proxy variable for exposure to chlorine gas. Triage score is defined by classifying patients as urgent or non-urgent based on the Simple Triage Rapid Treatment (START) algorithm. Hospitalization status is defined by a coding system created by the Center for Disease

Control (CDC) and South Carolina Department of Health and Environmental Control (SC DHEC) to evaluate the severity of patients' symptoms. Patients were assigned to a hospitalization status group based on this coding system; hospitalized or not hospitalized. Both groups consisted of patients with similar severity symptoms. Discharge medications are defined by the prescribed biologic agents given to each patient upon discharge. Patients were grouped in oral medication or non-oral medication categories. Frequency distributions were calculated for all categorical variables and mean age was calculated for the only continuous variable. All categorical variables were assessed with Chi square or Fishers exact test to determine if racial differences were present in assigned triage scores, hospitalization status, and discharge medications received. Age, the only continuous variable, was assessed with a t-test.

Results

The data suggests that all victims sustained equal effects caused by exposure to chlorine gas ($p= 0.283$) and that there was no significant difference between demographic characteristics: age, sex, smoking status, and pre-existing pulmonary disease. There was no statistically significant difference between Non-Hispanic Whites and African Americans in discharge medications ($p=0.131$). The data suggests a significant difference in hospitalization status ($p=0.024$) by race, where 100% of Non-Hispanic Whites and 62.5% of African Americans were hospitalized. For patients presenting with similar injury severity, a statistically significant difference was observed between Non-Hispanic Whites and African Americans ($p=0.027$). The percentage of Non-Hispanic Whites (82.4%) was higher than that of African Americans (50.0%) who were given an urgent triage classification.

Conclusion

The present work suggests a difference in triage scores assigned and hospitalization status between Non-Hispanic White and African American adults, who sought treatment at the closest hospital to the accident site during a mass casualty incident. The differences observed may be attributed to non-clinical factors influencing triage decisions and care provided. The implications of differential care based on race are a critically important public health concern. Further research should is needed to investigate why there are racial differences in hospitalization status and triage score assignment for equally exposed patients with similar severity of injuries.

Keywords: Race, health disparities, triage, chlorine, train derailment

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CHAPTER 1

INTRODUCTION

At approximately 2:40am on January 6, 2005, a train was inadvertently switched onto an industrial spur and collided with a parked train outside of a textile mill in Graniteville, South Carolina (1;2). A train tank car was derailed and punctured, resulting in a leak of over 54,000 kg of liquid chlorine. Due to geographic positioning and calm winds that morning, the released chlorine formed into a gas and created a plume that was dispersed throughout the area. 630 people sought medical treatment due to direct chlorine exposure: 8 fatalities at the scene; 72 were hospitalized (1 died in hospital); 525 were examined as outpatients in hospital emergency departments or at a private physicians' office, and 25 were unaccounted for. Approximately 5400 people within a 1-mile radius of the accident were subject to a 1-2 week mandatory evacuation (3). Immediately following the train derailment, health care services in and surrounding Graniteville were inundated with people seeking medical attention. Despite efforts made by medical personnel, some community members repeatedly expressed concerns of differential treatment in the health care setting to employees of the South Carolina Department of Health and Environmental Control (SC DHEC) (1).

There is a copious amount of literature detailing the inequalities that exist within the health care system; however, whether racial differences are present in the health care system during a disaster situation is an understudied and critically important public health

concern. This study investigates whether racial differences in assigned triage scores, hospitalization status, and discharge medication received were present in a hospital setting immediately following a mass casualty chemical exposure resulting from a train derailment.

CHAPTER 2

LITERATURE REVIEW

CHLORINE

Chlorine is a reactive element that presents as a green-yellow gas or clear amber liquid with a characteristic pungent odor at room temperature (5;6). If released into the air, chlorine will form into a gas, which settles low to the ground due to its high density. Chlorine has an intermediate water-solubility which relates to its toxicity mechanism. Upon contact with water chlorine forms hydrochlorous (HC1O) and hydrochloric acid; the unstable HC1O decomposes, forming oxygen free radicals at the cellular level (2). As a result, exposure can cause acute damage to both the upper and lower respiratory tracts.

Rotman et al. (1983) studied clinically significant changes in pulmonary function tests (PFTs) following controlled chlorine exposure (3). Using 9 volunteers (8 with no previous respiratory disease and 1 with allergic rhinitis), data was collected on several PFTs following 4 and 8 hour exposures to 0, 0.5 and 1.0 part per million (ppm) chlorine. The study observed that exposure to chlorine at 1 ppm resulted in nose, throat, and eye irritation, and changes in pulmonary functions. Similar studies using human volunteers have demonstrated that asthmatics or people with airway hypersensitivity have increased sensitivity to the presence of chlorine (4). Animal based studies investigated the lethal

concentration necessary for chlorine gas exposure to be lethal to 50% of the population (LC_{50}) with 30 minute exposure in rodents ranged from 504 ppm in the mouse to 700 ppm in the rat (5). Death at high exposure to chlorine will result mainly from respiratory failure or cardiac arrest due to toxic pulmonary edema. The relationship between the concentration and exposure duration of chlorine is related; therefore dependent on the exposure concentration a person may develop sensory irritation, respiratory related illnesses and even death.

Exposure Standards

A growing industrial sector coupled with workplace death and injury led the federal government to create and instill regulating agencies to safeguard against exposure to toxic airborne agents in the workplace. Each regulating agency has their own threshold limit values (TLV) of what is deemed safe for each specific chemical agent. The current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) is based on an 8 hour (40 hour work week) Time Weighted Average (TWL). OSHA's PEL for chlorine is 1.0 ppm as a ceiling limit and a worker at no time shall exceed this limit (6). The National Institute of Occupational Safety and Health (NIOSH) has established a recommended exposure limit (REL) for chlorine of 0.5 ppm for up to a 10-hour workday and a 40-hour work week ,and a short-term exposure limit (STEL) of 1 ppm (7). The American Conference of Governmental Industrial Hygienists (ACGIH), a voluntary professional society, has a more conservative recommendation; a TLV of 0.5 ppm and STEL of 1.0 ppm for periods not exceeding 15 minutes and not to be repeated more than four times a day (8). The NIOSH limits are based on the risk of severe eye,

mucous membrane and skin irritation (9). The ACGIH limits are based on the risk of eye and mucous membrane irritation (9).

The United States Environmental Protection Agency (EPA) promulgates ambient airborne levels known as Acute Exposure Guideline Levels (AEGLs). Chlorine irritant properties have been studied in human volunteers and its acute inhalation toxicity has been studied in several laboratory animal species (7;13). The data from the human and laboratory animal studies was sufficient for developing AEGLs for five exposure durations (e.g. 10 and 30 minutes, and 1, 4, and 8 hours) (9). These guidelines are more applicable to our study as they were set by the EPA, which bases their limits on the general public and not occupational exposure limits. The National Research Council of the National Academies defined the AEGL classifications as: AEGL-1 - the airborne concentration of a substance, where people may experience non-disabling discomfort, irritation, or certain asymptomatic non-sensory effects; AEGL-2 the airborne concentration of a substance, where individuals may experience irreversible adverse health effects; AEGL-3 - the airborne concentration of a substance, where an individual could experience life-threatening health effects or death (9). The AEGL information pertaining to this sample was unavailable.

Transportation and Accidents involving Chlorine Gas

Chlorine is one of the most commonly manufactured and widely used chemicals in the United States (US) (10). In the US, chlorine is produced at 44 plants in 21 states and is then transported nationwide, predominately by rail (11). Unlike road transportation, the rail system is the most cost effective for carrying bulk quantities long

distances (12). For this reason, approximately 4,300 shipments of hazardous materials travel by rail each day in the US (13). The US has over 140,000 miles of freight rail and several hundred thousand workers handle over 1.2 million hazardous material movements daily (14). Unbeknownst to the public, hazardous materials travel along the railroads through areas which are densely populated by schools, parks, and homes, and consequences of a train derailment can be catastrophic. To ensure extreme caution, the US Department of Transportation (DOT) regularly updates their freight and rail regulations (15). The DOT has created regulatory requirements to reduce the risk in transporting hazardous materials by highway, rail vessel and air. The hazardous material regulation (HMR) specifies appropriate packaging and handling requirements and requires the shipper to communicate the material's hazards through the use of shipping papers, package marking and labeling, and vehicle placarding (16). Additionally, the DOT, coupled with other federal agencies including; OSHA, NIOSH, EPA and the Federal Emergency Management Agency (FEMA), have created and maintain regulations regarding training, protection, and disposal of hazardous materials (17). In the event of an accident, the Hazardous Substances Emergency Events Surveillance (HSEES) organization will collect and analyze information regarding the release of hazardous materials. The goal of the organization is to reduce morbidity and mortality from exposure to toxic materials in the public sector. Even with the advent of regulating agencies and the stringent policies, the transportation of hazardous materials has become a ubiquitous part of the industrialized world and accidents involving the release of these materials are increasingly common (18).

Despite these regulations, the risk of a hazardous material disaster travelling by rail is small; HSEES reported 49,450 events between 1999 and 2004, of those 1,165 (9%) were rail events (19). To date, the available literature detailing the exposure to a high concentration of chlorine gas resulting from a train derailment is scarce. With the exception of the train derailment in Graniteville, SC discussed in this study, there have been three notable cases of chlorine being released as a result of a train derailment: La Barre, La (1961), Macdona, Texas (2004) and Festus Missouri (2002).

On January 31, 1961, in La Barre, LA, approximately 6,000 gallons of liquid chlorine spilled from a train accident resulting in a cloud of chlorine gas covering 6 square miles (20). As a result, one human fatality, hundreds of animal fatalities, and approximately 100 persons were treated for varying degrees of exposure related problems. In Macdona, Texas, a town near San Antonio, a moving train struck a stationary train at a rail substation, causing a derailment. One tanker car was punctured, releasing approximately 90,000 pounds of chlorine. The accident resulted in 44 casualties and 3 fatalities (21). In Festus, Missouri, approximately 16,900 pounds of chlorine was released from a railroad tanker car when a flex hose ruptured during unloading at a chemical plant. This accident resulted in 67 casualties (21). There are no estimates of economic damage for these train accidents and the available information is limited to the physical health effects, both acute and long-term (21;23;24). These reported train incidents demonstrate the gravity a train derailment carrying hazardous materials may have on a community. Abiding by the stringent policies set forth by the federal agencies helps reduce the risks involved in the transportation of hazardous materials; however, accidental mishaps are always a possibility.

Given the widespread production and transportation of chlorine, coupled with the potential physiological consequences associated with high concentration of chlorine exposure, there are multiple opportunities for chlorine related disasters. This study builds upon the available literature discussing both acute and long term health consequences associated with exposure to high concentration of chlorine gas. Moreover, this study provides emergency management and medical personnel a real life scenario of potential impediments associated with a mass casualty disaster involving chlorine gas.

RACISM

A significant body of literature provides evidence of the growing health care disparities among racial and ethnic minorities in the US (22). The Department of Health and Human Services (DHHS) committed to the nation to "eliminate health disparities" (23). It outlines an agenda to define and eliminate health disparities with respect to disease patterns and prevalence, treatment outcomes by race, sex, ethnicity, socioeconomic and educational status, place of residence, and sexual orientation. Despite the efforts made by researchers, policy makers, health care professionals and health advocacy groups, health care inequality is still present.

In 2002, the Institute of Medicine (IOM) developed a report, entitled *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care* (24). This report outlined the inequalities present in the health care system. Detailing how inequalities cannot be entirely attributed to the problem of health care access, clinical performance or patient's personal characteristics, but are rooted in a complex mix of marginalization and contemporary problems of racial prejudice and systematic bias (25). Racial differences

are present throughout health care and it is important to understand how and why these differences are manifested. The following sections conceptualize the impact race has on the health care system.

Distrust between the Races

A history of racial discrimination and segregation has long permeated the cultural and medical landscape of the United States (26). Although the Civil Rights Act of 1964 (Pub.L. 88-352, 78 Stat. 241, enacted July 2, 1964), a landmark piece of legislation in the United States, outlawed major forms of discrimination (namely by race, color, and national origin), it did not prevent racism from occurring throughout several aspects of life including employment, housing, and most importantly, health and healthcare (22). For many African Americans, doubts concerning the trustworthiness of physicians and healthcare institutions are related to abuses endured from largely white health care professionals and researchers, particularly from the memory of the Tuskegee trials (25;30). This legacy of distrust, which can be the catalyst for healthcare disparities by discouraging minorities to seek the best care possible, is thus itself a by-product of racism (27).

Racism and Health Effects

Members of racial and ethnic groups, particularly African Americans living in the United States, tend to bear a disproportionate burden of death and illness compared to non-minorities (22). For example, African Americans, regardless of income, tend to suffer disproportionately from chronic diseases such as hypertension, heart disease, diabetes, asthma, or disability (28). African Americans also have shorter life spans than

Non-Hispanic Whites. According to recent data from the CDC, the life expectancy in the United States for whites is 78.2 years and 73.2 for African Americans (29). Moreover, African Americans have less access to quality care and experience a lower quality of health care and services (22;30). For example, one-third (33%) of African Americans were uninsured at some point during 2005, compared with 20 percent of working-age whites (31). Moreover, the 2002 IOM reported significant variation in the rates of routine medical procedures by race, even when insurance status, income, age, and severity of conditions are comparable (22). The committee concluded that racism may explain the variations in care received.

3 Types of Racism

Among the plethora of scientific articles describing health and health care disparities in the US, there is an extensive literature explicitly investigating the contribution of racism and how it is an important determinant of the observed health disparities (34-36). Race-associated differences in health and health care outcomes may be attributed to one of, or a combination of, three forms of racism: institutional, personally mediated, or internalized racism (32). Institutional racism is defined as differential access to the good, services, and opportunities of society by race. For example, racial/ethnic residential segregation may be considered a form of institutionalized racism (33). Personally mediated racism is defined as an individual's ideologies regarding another ethnicity about their abilities, motives, and intentions. This is the most common notion of racism; it is individually practiced and not inherent in the institutions that surround them. Internalized racism is characterized by the acceptance of negative messages by members of the stigmatized race about their own abilities and

intrinsic worth (34). This is often seen as embracing "whiteness" (e.g. using skin bleaching creams or self-devaluation by using racial slurs as nicknames) (35).

Racism in Health Care

Dykes et al. (2009) reviewed the existing literature of personally mediated racism and the impact on healthcare and found that there are many such studies already available (36). Although the ethic of physicians is to provide equal and optimal care to all of their patients, unfortunately, this may not always be the case. Prior literature observed the presence of discriminatory racial treatment among health care providers (25;34;39;40). Schulman et al. (1999) studied if race and gender were associated with differential referral rates for cardiac catheterization (37). The study surveyed 720 physicians at two national meetings. Each physician viewed a recorded interview and was given other data about a hypothetical patient. All patients had similar insurance status and presentation of disease. He/she then made recommendations about that patient's care. It was observed that African Americans were recommended for cardiac cauterization 60% as often as whites, particularly if the patient was female and of ethnicity

Racial Bias in hospitalization and treatment

The recent Institute of Medicine report, "Unequal Treatment: Confronting Racial/Ethnic Disparities in Health Care" identified over 175 studies documenting racial/ethnic disparities in the diagnosis and treatment of various conditions, even when controlled for socioeconomic status, education, and access to care. There is an abundance of literature detailing the presence of racial differences in the healthcare system; however, literature discussing racial differences in hospital admission is less copious.

Bach et al. (2004) performed a cross sectional analysis of primary care physicians who treated Medicare beneficiaries (38). This study hypothesized that racial discrepancies found in healthcare are in fact caused by a difference in physician qualifications and clinical resources. The authors found that physicians treating African American patients reported greater difficulty in obtaining access for their patients to high-quality subspecialists, high-quality diagnostic imaging, and nonemergency admission to the hospital. In addition, African American patients were more likely to be treated by physicians who have not obtained board certification in their primary specialty than white patients. These findings support the notion that minority patients have different rates of hospitalization. Moreover, the quality of care that minorities are receiving is inferior to that of their non-minority counters parts. Flaherty & Robert (1980) study supports this claim (39). The authors conducted a retrospective chart audit of male schizophrenics hospitalized in a psychiatric facility to determine if racial bias was associated with the treatment received. After controlling for severity of disease, the authors found that African American patients spent less time in the hospital, obtained a lower privilege level, and were less likely to receive recreational and occupational therapy. Seclusion and restraints were used more often in African American patients. A similar study by Schneider et al. (2002) conducted an observational study to assess if racial disparities in the quality of care for enrollees in Medicare managed care health plans was present (43). The authors found that African Americans were less likely than whites to receive breast cancer screenings, eye examinations for patients with diabetes, β-blocker use after myocardial infarction, and follow-up after hospitalization for mental illness. As such, these studies demonstrate that even after controlling for potential confounders, racial

differences in the hospitalization rates and the quality of treatment received differs by race (42;44).

Racism in Disaster

Emergency situations are stressful and quick reactions play a key role in the safety and recovery of the injured. Response should be addressed according to the severity of the injuries and not based on any other non-clinical factors. Prior, literature has confirmed that this is not the case and reveals how racial bias may play a role in an emergency situation. Saucier et al. (2005) conducted a meta-analysis assessing whether race played a role in the degree of help strangers give to each other in crisis situations (40). They found that as the severity of the emergency situation increases, the likelihood of an African American victim receiving help from strangers compared to a Caucasian victim decreased. This study demonstrates how racial bias is present during a disaster situation. Using a similar research scope, Kuntsman & Plant (2008) created a staged emergency in order to measure the speed and quantity of help offered to the two racial groups in different emergency levels (41). The evidence found that in a highly emergent situations African American victims received significantly slower help than white victims. When the emergency was not as significant, however, there was no difference in time for received help between the races. In addition, they tested the motives for white bystanders for their delayed helping of African Americans. They found that white bystanders construed the situation as less severe and themselves as less responsible to help than if the victim was white. Moreover, a Caucasian person's interpretation of the emergency mediated the relationship between victims, race, and helping speed. A similar

pattern was observed in Wegner & Crano's (1975) study in which it was found that African Americans provide more help to African American's than to white's (42).

While many studies have explored the relationship between race and health, the body of literature is lacking when a disaster component is introduced to the dynamic. The period post Hurricane Katrina launched a surge of research circumscribing the relationship between health care disparities and disaster situations. Albeit a good addition to the literature, very few studies discuss racial disparities in the context of a mass casualty disaster. This study is the first of its kind to explore whether racial differences exist in treating patients after a mass casualty exposure to chlorine gas in a hospital setting.

TRIAGE

Simple Triage and Rapid Treatment (START)

During disasters, emergency responders have an obligation to treat as many victims who have a chance of survival. The process of sorting and prioritizing victims based on their medical needs is referred to as triage. The decision criteria for triage management is based on the likelihood of medical success (43).

Pre-hospital casualty triage is the sorting and categorizing of casualties in the initial phases of the response to a mass casualty incident (MCI) by the emergency medical service (EMS) system. They determine the treatment priority of the casualties (for transport) based upon their injury severity (44). More specifically, the goal of pre-hospital triage is to designate how care resources are distributed and the necessity for

each patient, within the constraints of limited resources. Triage may also be conducted within a hospital setting. The principle of sorting and classifying persons based on the severity of their injuries is the same. The first stage on arrival at the emergency department is an assessment by a hospital triage nurse. This nurse will evaluate the patient's medical condition, as well as any changes, and will determine their priority for admission to the Emergency Room, as well as for treatment.

One of the most commonly used pre-hospital triage strategies is the Simple Triage and Rapid Treatment (START) algorithm. It was developed by the Newport Beach Fire Department and Hoag Hospital in California in 1983. The START algorithm uses the ability to obey commands, respiratory rate, and capillary refill to categorize patients. Once assessed, the patient is classified into one of the following four groups: green (walking injured); red (immediate); yellow (delayed); and black (deceased). The EMS first responders often use a triage tag, which helps organize the efficiency of victims already processed. The algorithm was developed for those eight years and older. Recognizing the physical and mental differences between children and adults, JumpSTART is a pediatric offset of the START algorithm (45).

START Process

The advantage to using the START algorithm in a mass casualty incident is that EMS first responders are able to triage large populations relatively quickly. It should take no longer than 30 seconds to triage each person. The algorithm is as follows: firstly, the EMS first responders instruct all persons able to walk to evacuate the scene to a specified safe area. This group is categorized as green and will be further assessed at a

later point if resources permit. Secondly, they proceed to triage others by determining their respirations. If a person is not breathing he or she is presumed dead or expectant and tagged black. If the victim is breathing, however, they assess the rate at which he is breathing. If the rate is greater than 30 breaths per minute, a person is tagged red and must receive immediate care. For less than 30 breaths, EMS first responders will test for adequate perfusion. A common method is capillary refill. This can be done by applying pressure to the nail bed. If the color takes longer than 2 seconds to return, the patient is showing signs of inadequate perfusion and must be tagged red. If the radial pulse is present, they proceed onto the third assessment, mental status, i.e. can the victim follow simple commands (what day is it, what is your name, etc.)? If the victim is able to follow directions he or she is tagged yellow; medical attention can be delayed for a recommended one hour. If the victim is not able to follow simple commands, then he or she is labeled with the red tag; immediate care is needed because the situation may be life threatening.

Limitations of START Triage

Although START triage may be efficacious in mass casualty disasters, it may not be an optimal choice when a chemical exposure is involved (50;51). Cone and Koenig's (2005) paper entitled "Mass casualty triage in the chemical, biological, radiological, or nuclear environment" discusses the limitations of the START algorithm (46). The authors suggest that an ideal mass casualty triage algorithm should include the following characteristics: easily memorized, rapidly applied, little inter-rate variability, applicable by rescuers with a variety of backgrounds and levels of education and experience, and lastly, reliable in determining priorities correctly (47). Albeit, the START algorithm does

contain all of the previously mentioned characteristics for an ideal mass casualty triage algorithm, it does not account for the clinical implication of a chemical exposure. Cone and Koenig suggest that before any such scheme is applied, EMS first responders must first detect the presence of the chemical agent and determine whether entry into the questionable area is safe, either with or without personal protective equipment.

Other notable limitations of the START algorithm include a potentially long latency period. Persons that have been exposed to hazardous chemicals may exhibit symptoms hours after exposure. For instance, approximately, 2-24 hours after a high concentration of chlorine exposure a person with high concentration of exposure may start to experience shortness of breath and tightness in the chest (48). A long latency period may be problematic if there is a surge of "worried well" patients that surge the emergency department at the same time. In order to ensure that triage has been assessed correctly, an additional step, which is specific for toxidrome, may be needed in the algorithm. For the purpose of this study, a toxidrome is a grouping of signs and or symptoms specific to a chlorine exposure. If a patient was observed or answered positively to having any complaints/symptoms regarding ear nose and throat pain, coughing, wheezing, nausea, and/or vomiting, he or she was categorized as experiencing signs of toxidrome. Secondly, the threat of secondary contamination (or transmissibility) to the rescuers from the chemical agent is a potential problem. It is important to determine if the area is safe for the rescuers to enter, with or without protective equipment. This is an important step in the rescue mission, as seen in the train derailment examined in this text. Although rescue personnel did assess the type of exposure that was present, many rescuers or dispatchers were not initially aware of the chlorine plume until

later on in their rescue response and, in turn, were exposed to the chlorine gas (ER Svendsen, personal communication, 2011). It is imperative to identify the type of exposure at the earliest possible time point; if the identification of the chemical is determined early on it will result in a reduction of accidental exposure and any unnecessary confusion. Thirdly, it is important to have proper organizational and logistical protocol set up in advance, which will reduce the amount of confusion regarding operation of safety equipment and/or the likelihood of a multi-agency response (49). Fourthly, during a disaster, the need for self-preservation is extremely prevalent. Victims may bypass the established zones and decontamination systems and present directly to the emergency department, thus resulting in a surge of patients in the emergency department (50). Not only does this influx of people create a chaotic and stressful environment, it can be potentially fatal for the hospital personnel. If a victim does not go through the appropriate decontamination stations, it may result in transference of the chemical exposure to others in the hospital. It is important for all victims follow procedure; however in the event of a surge of victims in the emergency room; hospital personnel should follow a predetermined protocol that facilitates the ease of triaging patients, as well as reducing secondary contamination.

Bias in Triage Decision

Triage, if performed correctly, should be free of any bias; however, prior research has demonstrated otherwise (56;57). For example, Arslanian-Engoren's (2000) study "Gender and Age Bias in Triage Decisions" used four focus groups to examine the triage decisions made by emergency department nurses for persons with symptoms suggestive of Myocardial Infarction (MI) (51). The study found that younger patients and women

were less likely to be triaged as emergent. In addition, the focus groups revealed that patient presentation, nursing knowledge and experience, practice environment, intuition, the fear of liability, and gender-specific behaviors influence triage decisions, thus demonstrating how non-clinical factors may influence triage assignment, causing patients to be assigned incorrectly. It is an unfortunate reality that non-clinical factors may influence triage decisions. Lopez et al. (2010) used a nationally representative sample from the National Hospital Ambulatory Health Care Survey of Emergency Departments (ED) for 1997-2006, studying if socio-demographic differences exist in triage assignment and whether these differences affect initial diagnostic testing in the ED for patients presenting with chest pain (59). They found that African Americans presenting with chest pain were triaged as an emergency 70% less often than Non-Hispanic Whites. Albeit, in their study insurance status played a role in triage assignment, however, they stated that non-clinical factors may have influence the triage decision making. For instance, triage nurses may be influenced by conscious or, more likely, by unconscious biases about race/ethnicity, sex and other socio-demographic characteristics for triage assignment (52). There are a number of laws and protocols that collectively instruct emergency-room physicians and other health care professional to triage the more critical injured first (53). However, infrastructure created by humans will inevitably encounter problems associated with human error. Prior research has described a wide variation of error in the triage practices of emergency medical providers (59;62-64). This study will add to the growing body of literature discussing the association of non-clinical factors and triage prioritization. To date, there is no other study examining whether racial differences are

present in the triage prioritization of patients after a mass casualty exposure to chlorine gas.

Gap in the literature

Theoretically, access to health care and the quality and treatment received is distributed equally within today's society; however, prior research has demonstrated that is not the case (45;46). There is undoubtedly a plethora of literature examining the association of racial disparities and health care, but the literature is lacking when a mass casualty component is added. The purpose of this study is to examine if racial differences are present in a mass casualty incident. More specifically the study will provide statistical evidence if racial differences are present in the hospitalization, triage categorization, and treatment received after a mass casualty incident involving exposure to a high concentration of chlorine gas

CHAPTER 3

METHODS

Research Question

This study answers the following question: was there any difference in assigned triage scores, hospitalization status and discharge medications received between Non-Hispanic Whites and African Americans adults in a rural hospital, likely experiencing a surge after a mass casualty incident involving chlorine gas as a result of a train derailment. Research hypotheses were as follows:

1. There will be a difference in triage scores between Non-Hispanics Whites and African Americans. Non-Hispanic Whites will be assigned a triage score of "urgent" more often than African Americans.
2. There will be a difference in hospitalization status between Non-Hispanic-Whites and African Americans. Non-Hispanic Whites will be hospitalized more frequently than African Americans, given both groups have similar severity of symptoms.
3. There will be a difference in discharge medications between Non-Hispanic-Whites and African Americans. Non-Hispanic Whites will be discharged more often with oral medications than African Americans.

Data Source

Personnel from the Division of Acute Disease Epidemiology and the regional and county offices of the South Carolina Department of Health and Environmental Control (SC DHEC) and the Centers for Disease Control and Prevention (CDC) collaborated to design and conduct a rapid assessment of the effects of the chlorine exposure. The data used in this study was obtained from this collaboration and was collected exclusively for public health purposes and not research (24). Therefore, the self-reported and voluntary data has a considerable amount of missing information.

A case was defined as death or illness attributed to chlorine exposure, reported within 6 weeks of the accident. A health alert was distributed through the South Carolina Health Alert Network that mandated reporting for people treated for chlorine-related symptoms in and surrounding areas of the accident site. Complete medical record abstractions were performed for patients who were hospitalized and those examined during multiple emergency department visits. Local Physicians reported information on patients who were examined in their practice to an epidemiologist at the regional health department. The collected data resides in SC DHEC and access to de-identified copies of the data was granted to the University of South Carolina (USC) investigators for this study by the SC DHEC International Review Board. Approval for this study was obtained from the institutional review board at the University of South Carolina. The study was determined to be exempt from human research subject regulations.

Sample

Inclusion Criteria:

- Those who presented to the emergency department at the closest hospital to the train derailment site. This hospital was the only hospital likely to have experienced a surge in the emergency department.
- Male and Females aged 18 years and older.
- Race/ethnicity was reported as Non-Hispanic or African American.
- Patients who presented to the hospital experiencing of symptoms of toxidrome associated with chlorine exposure.

Exclusion Criteria:

- Any person who whose race or ethnicity was reported as mixed, other or unknown.
- Any person who did not present to the closest emergency department to the accident site within 24 hours with chlorine related symptoms.

Appendix, figure 1, displays the inclusion/exclusion criteria for the sample.

Study Design

A descriptive study was used to examine racial differences in triage scores, hospitalization status, and discharge medications between Non-Hispanic White and African American adults who presented to the closest hospital of the accident site experiencing symptoms of toxidrome.

Demographic characteristics:

Demographic and health status variables were collected from medical charts. The following variables were examined:

Age: a continuous variable. Patients were asked, "What is your age?"

Sex: Patients were asked, "What is your sex?" Categories were male or female.

Race: Patients were asked "What race/ethnicity do you associate with?" The Non-Hispanic Whites group included categories 'White', 'Caucasian', and 'Non-Hispanic Whites.' The African American group included the categories 'Black' or 'African American.' We grouped the patients as "Non-Hispanic Whites" or "African American." All patients who did not fall into the Non-Hispanic Whites or African American category were excluded.

Smoking Status: Patients were asked, "Do you currently smoke any tobacco products?" Categories were yes or no.

Preexisting Pulmonary Disease: Patients were asked, "Do you have any preexisting pulmonary disease prior to the train derailment?" Categories were yes or no.

Health status:

Exposure to chlorine was assessed using a proxy variable toxidrome. By definition, a toxidrome is a grouping of signs and or symptoms specific to a certain chemical exposure. If a patient was observed or answered positively to having any complaints/symptoms regarding ear, nose, and throat pain, eye irritation or pain, coughing, wheezing, nausea, and/or vomiting, they were categorized as experiencing

signs of toxidrome. Toxidrome was used as a predictor for the severity for the appropriate triage category because it has been validated in previous studies. The following is a description of each factor used to create the toxidrome variable, how the information was collected, and how it was coded:

Eye Pain: a person who entered the emergency department complaining of eye irritation or pain. Categories were yes or no.

Ear Nose Throat Pain: a person who entered the emergency department complaining of ear, nose, and throat pain or discomfort. Categories were yes or no.

Cough : a person who entered the emergency department complaining of a cough. Categories were yes or no.

Wheeze: a person who entered the emergency department complaining of wheezing. Categories were yes or no.

Nausea/vomiting: a person who entered the emergency department with initial symptoms of nausea or vomiting. Categories were yes or no.

Outcome Variables:

Hospitalization Status: This variable was created by using a coding system created by the CDC and SC DHEC to evaluate the severity of patients' symptoms. A patient was categorized as "hospitalized" if their outcome category was deceased, in the intensive care unit (ICU) or on a ventilator, hospitalized for 3 or more days or hospitalized for 1-2 days (outcome category 1-3b). "Not hospitalized" category included patients who have visited the emergency department more than once, presented to the emergency

department with significant, moderate or with no symptoms, or they went to a physician's office (outcome category 4-8). Although one patient was dead before arrival, they were still included in the hospitalized category, as they still obtained medical attention. The way in which the values were coded may be referenced in Table 3.1.

Table 3.1 Outcome Categories

Code	Outcome Category	Hospitalization Status
1	Deceased	Dead before Arrival
2	ICU/Ventilator	Hospitalized
3a	Hospitalized for 3 or more days	Hospitalized
3b	Hospitalized for 1-2 days	Hospitalized
4	Emergency Department repeat visit	Not Hospitalized
5	Emergency Department with significant symptoms	Not Hospitalized
6	Emergency Department with moderate symptoms	Not Hospitalized
7	Emergency Department without symptoms	Not Hospitalized
8	Physician office visit	Not Hospitalized

Discharge medications: This was used as a measure for treatment received. Each individual medication category had a low frequency; therefore we grouped the medication into two categories: oral and non-oral medications. Oral medications included corticosteroids, ipratropiums and any other type of steroid administered orally. Non-oral medications included antibiotics, beta- agonist, and any other type of medication that was administered in the form of an inhaler or liquid for use in a nebulizer. All information collected was obtained from medical records. Each discharge medication was categorized as yes and no.

Triage Score: The START triage algorithm has four categories (green, yellow, black, and red); however, due to low frequency in each category, we regrouped them into two

categories: non-urgent and urgent. ‘Non-urgent’ included categories yellow and green, and ‘urgent’, included categories black and red. A prior research grant by Culley et al. took the sample of patients and assigned them to categories based on analyses of the data from previous research (54). The severity an individual’s injuries vary within the sample; therefore Culley et al., utilizing the START algorithm, assigned patients to the most appropriate category based on their injuries. Within each triage category, patients experienced similar severity of injuries. The triage score does not represent the actual priority classification used by the emergency department but instead acts as a representation of how the START triage algorithm may have classified victims of this MCI.

Statistical Analysis

All analyses were performed using SAS software 9.2 by SAS Institute Inc., Cary, NC. Descriptive statistics were computed for each measure. This included: age, sex, smoking status, race, any preexisting pulmonary disease, hospitalization status, discharge medications, and if they were categorized as experiencing symptoms of toxidrome. Demographic characteristics, experiencing symptoms of toxidrome, triage score assignment, hospitalization status and discharge medications were categorical and age was the only continuous variable.

Chi-square (χ^2) or Fishers exact (cell frequencies less than 5) tests were conducted for categorical variables and a t-test was used for continuous variables to examine the differences between Non-Hispanic Whites and African American patients. When significant differences were found, post-hoc power calculation using a non-central chi

square distribution was used to test for sufficient power. All p-values reported are for two tailed test, and a p value of <0.05 was considered statistically significant.

CHAPTER 4

RESULTS

Characteristics

The sample consisted of 25 patients with a mean (Standard Deviation (SD)) age of 42.56 (15.9) years and (84.0%) being male. Ages ranged between 20-73 years. There were twice as many Non-Hispanic Whites (17 (68.0%)) as African Americans (8 (32.0%)). A smaller proportion of patients reported having preexisting pulmonary disease (20.0% vs 80.0%) and being current smokers (36.0% vs 64.0%) than not. A disproportionate amount of patients were assigned urgent triage scores (72.0% vs 28.0%) compared to non-urgent and 88.0% of the sample was hospitalized. More patients were discharged with non-oral medications (56.0%) than oral medications (24.0%). Percentages are based on the total number of patients with available information in each group; therefore column percent does not necessarily equal 100.0%. The frequencies and column percentages for adults who sought treatment at the Emergency Department of the closest hospital to the accident site immediately following the train derailment are shown in Table 4.1.

Demographic and Health Characteristics by Race

The distribution of selected demographic and health characteristics for adults presenting to the nearest emergency department to the accident site within 24 hours of

Train Derailment by Race is shown in Table 4.2. The sample comprised 17 (68.0%) Non-Hispanic Whites and 8 (32.0%) African Americans. It was observed that African Americans had a higher mean (SD) age than Non-Hispanic Whites; 47.62 (13.9) and 40.18 (16.6), respectively. There was no significant difference in age between the two racial groups (p=0.431). In both racial groups there were disproportionately more males than females, with 14 (82.4%) Non-Hispanic White males and 3(17.6%) Non-Hispanic White females. There were 7(87%) African American males and 1 (12%) females. There was no significant difference in sex between the two racial groups (p=1.0). With the available information, 5(29.4%) Non-Hispanic Whites had preexisting pulmonary disease, compared to no African Americans 0 (0.0%) with the disease. There was no statistical significant difference between the two racial groups for preexisting pulmonary disease (p=0.278). More Non-Hispanic Whites were current smokers (41.2% vs. 25.0%) than African Americans and the difference between the two racial groups was not statically significant (p=0.661). More Non-Hispanic Whites experienced symptoms of toxidrome than African Americans (88.2 % vs 62.5%, respectively). There was no statistically significant difference between the two racial groups for experiencing symptoms of toxidrome (p=0.283).

The frequencies and percentages of assigned triage scores, hospitalization status, and discharge medications by race are presented in Table 4.3. The sample observed a statistical difference in triage score between the two racial groups (p=0.027). Compared to African Americans, more Non-Hispanic Whites were given urgent triage scores (50.0% vs 82.4%). There was a statistically significant difference in hospitalization status between the two racial groups (p=0.024). All Non-Hispanic Whites (100.0%) were

hospitalized, compared to 62.5% of African Americans. There was no significant difference in discharge medication received between the two racial groups (p =0.131). More Non-Hispanic Whites were discharged with non-oral medications when compared to African Americans (70.6% vs 25.0%, respectively). More African Americans were discharged with oral medications than Non-Hispanic Whites (37.5% vs 17.6%, respectively).

The percentage of the sample that received non-oral medications as treatment was greater in Non-Hispanic Whites than in African Americans (70.6% vs. 25.0%). Non-Hispanic Whites approximated almost half of the patients discharged with oral medications (3 (17.6%)) compared to African Americans (3 (37.5%)). There was no statistical difference in discharge medications between the two racial groups (p=0.131).

In order to test for sufficient power, we used a non-central chi-square distribution, which resulted in a power of .87 for hospitalization status and 0.97 for triage score. This demonstrates that there is an 87% likelihood that the test will correctly lead to the rejection of false null hypotheses for hospital frequency and 97% for triage, respectively. Table 4.4 displays the power calculated for the significant outcomes.

Table 4.1 Frequencies and Column percentages for adults who sought treatment at Emergency Department of the closest Hospital to the Accident Site within 24 hours of the Train Derailment

			Total	
			N	%
POPULATION INCLUDED			25	100.0%
AGE	Mean	42.56		
	Std Deviation	15.89		
	Minimum	20.00		
	Maximum	73.00		
SEX				
Female			4	16.0%
Male			21	84.0%
RACE				
African American			8	32.0%
Non-Hispanic White			17	68.0%
PREEXISITING PULMONARY DISEASE[1]				
Yes			5	20.0%
No			16	64.0%
CURRENT SMOKER				
Yes			9	36.0%
No			16	64.0%
TRIAGE GROUP[1]				
Non-Urgent			4	16.0%
Urgent			18	72.0%
HOSPITALIZATION STATUS				
Not Hospitalized			3	12.0%
Hospitalized			22	88.0%
DISCHARGED WITH MEDICATION[1]				
Non-Oral Medication[2]			14	56.0%
Oral Medication[3]			6	24.0%
EXPERIENCE SYMPTOMS OF TOXIDROME				
Yes			20	80.0%
No			5	20.0%

[1] Percentages are based on the total number of patients with available information in each group.
[2] Non-oral medications includes: antibiotics, beta-agonists and other respiratory related medications.
[3] Oral medications includes: inhaled steroids, ipratropium oral inhalations and oral steroids.

Table 4.2 Characteristics for Adults presenting to Emergency Department of the nearest Hospital to the accident site within 24 hours of Train Derailment by Race

		African American (n = 8)	Non-Hispanic White (n = 17)	P Value[2]
AGE (Years)	Mean	47.62	40.18	0.431
	Std Deviation	13.917	16.592	
	Minimum	23	20	
	Maximum	73	64	
SEX				1.000
Females	N	1	3	
	%	12.5	17.6	
Males	N	7	14	
	%	87.5	82.4	
PREXISTING PULMNOARY DISEASE[1]				0.278
Yes	N	0	5	
	%	0	29.4	
No	N	5	11	
	%	62.5	64.7	
CURRENT SMOKER[1]				0.661
Yes	N	2	7	
	%	25.0	41.2	
No	N	6	10	
	%	75.0	58.8	
EXPERIENCE SYMPTOMS OF TOXIDROME				0.283
Yes	N	5	15	
	%	62.5	88.2	
No	N	3	2	
	%	37.5	11.8	

[1] Percentages are based on the total number of patients with available information in each group.
[2] P-value was assessed with non-parametric Kruskal Wallis test for continuous variables and Pearson Chi-Square or Fisher Exact Test for categorical variables.
Statistically significant results are marked with a "*".

Table 4.3 Racial Differences in Triage Score, Hospitalization Status and Discharge Medications

		African American (n = 8)	Non-Hispanic White (n = 17)	P Value[2]
TRIAGE GROUP[1]				0.027*
Non-Urgent	N	1	3	
	%	12.5	17.6	
Urgent	N	4	14	
	%	50.0	82.4	
HOSPITALIZATION STATUS				0.024*
Not Hospitalized	N	3	0	
	%	37.5	0	
Hospitalized	N	5	17	
	%	62.5	100.0	
DISCHARGE MEDICATTIONS[1,3]				0.131
Non-Oral Medication	N	2	12	
	%	25.0	70.6	
Oral Medication	N	3	3	
	%	37.5	17.6	

[1] Percentages are based on the total number of patients with available information in each group.
[2] P-value was assessed with Pearson Chi-Square or Fisher Exact Test.
Statistically significant results are marked with a "*".

Table 4.4 Post-Hoc Power Calculation Using a Non-Central Chi Square Distribution Testing for Sufficient Power in Significant Results

Outcome Characteristic	P value[1]	Power
Triage Score	0.03*	0.87
Hospitalization Status	0.02*	0.97

[1] P-value was assessed with Pearson Chi-Square or Fisher Exact Test.
Statistically significant results are marked with a "*".

CHAPTER 5

DISCUSSION

This study sought to examine if racial differences were present in patients with injuries of similar severity in assigned triage score, hospitalization status, and discharge medications received. It is quite probable a patient, if seriously ill, would be triaged more urgently than a patient with lower priority illness. Therefore we compared patients with similar injury severities. The findings suggest that there was a statistical difference in assigned triage score and hospitalization status between Non-Hispanic whites and African Americans. We did not observe any difference in discharge medications between the groups.

This study suggests a racial difference in assigned triage scores. This is consistent with previous literature demonstrating how non-clinical factors may influence triage decision making (60;62;66). A patient's triage priority is decided by a triage nurse and, although there are a set of guidelines to prioritize a patient based on clinical symptoms, these guidelines are not always followed, nor do they encompass all situations that a triage nurse may encounter. According to Beauchamp and Childress (1994), nurses sometimes make decisions based on their personal opinions regarding whom or what should take priority (55). Lopez et al. found that persistent racial and sex differences exist in triage assignment. According to their research, minority patients were triaged less often as emergent for cardiac care as non-minorities (59). Literature demonstrates that

triage priority may be influenced by non-clinical factors which may include and are not limited to personal prejudice, intuition and prior clinical experience (60;62-64). Ultimately, non-clinical factors play a role in triage priority assignment even though this classification is supposed to be based solely on clinical symptoms.

The findings also suggest a statistical difference in hospitalization status between the two race/ethnicity groups, where Non-Hispanic Whites were hospitalized more frequently than African Americans. Shulman et al. conducted the first study to identify if treatment differed where clinical presentations were the same (56). As previously discussed in this report, physicians at the 1997 annual meeting of the American College of Physicians (ACP) and the 1996 annual meeting of the American Academy of Family Practice (AAFP) volunteered for a study which examined clinical decision making in which they were required to randomly assess cases that they believed to be real, finding a disparity in patient care based on race and sex which echoes our own findings. Likewise, a 2002 report entitled *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care* concluded that even when all aspects are controlled for racial and ethnic minorities receive lower quality healthcare (28). In this study, all patients experienced similar symptoms of toxidrome, yet Non-Hispanic whites were hospitalized more often than African Americans. Drawing from Shulman et al. research, it's possible that non-clinical decision making may have contributed to this difference. More research is necessary to determine the degree that non-clinical factors play on hospitalization status.

We found no difference between Non-Hispanic whites and African Americans discharge medications received. The available literature on pharmacotherapy and race vary amongst investigators. There is no clear understanding of whether or not race plays

a role in the pharmacotherapy received. Similar to our findings of no difference in pharmacotherapy, Tsai and Cammaro (2009) conducted a prospective multicenter cohort study involving 24 emergency departments in 15 U.S. states (57). They investigated racial and ethnic differences in emergency care for patients with acute exacerbations of chronic obstructive pulmonary disease (AECOPD). Despite pronounced racial and ethnic differences, all racial and ethnic groups received comparable quality of emergency care for AECOPD and had similar short-term outcomes. For every research article stating that there are no racial differences present in pharmacotherapy, there is an article available stating just the opposite. Hall-Lipsy et al. (2010) conducted a meta-analysis of the disparities present in the available literature (58) . They found that of the 311 investigated articles, 77% of them included significant disparity in drug treatment across race, ethnicity and sex. The most frequent disparity, found in 73% of the articles, was a difference in receipt of prescription drugs across racial groups, particularly in the type of drug prescribed, the dosage, and the administrative wait time for the drug. Although much of the available literature regarding racial disparities in pharmacotherapy deal with mental illness, HIV and cardiovascular disease management, these findings still present a disparity in prescribing patterns by physicians based on race. Kreyenbuhl et al. (2003) conducted a retrospective cohort study of 344 persons with schizophrenia recruited from outpatient psychiatric facilities in two states in the Schizophrenia Patient Outcomes Research Team study (59) . They found that African-Americans were less than half as likely to receive adjunctive psychopharmacologic treatments as Non-Hispanic Whites. The differences in whether or not a study concluded with racial differences present can be attributed to many factors, some of which include, but are not limited to: sample size,

biologic used, geographical location etc. Rerunning our analyses with a larger sample may provide results similar to researchers who discovered a racial disparity in pharmacotherapy.

Our descriptive epidemiological study has several limitations. The first limitation is the small sample size. The differences that were significant are more likely to be spurious than if our sample size was larger. Thomas et al. conducted research on the importance of statistical power and biological significance and concluded that in a small sample size biologically interesting phenomena may be overlooked because statistical tests are unlikely to yield significant statistical results (60) .When a sample size is small it is important not to overlook the lack of statistical significance; it is instead better to provide information where there is a suggestion of an effect, but missed statistical significance. There needs to be a careful balance between not dismissing outright what could be a real effect and also not making undue claims about the effect. Although statistically significant, our results must be viewed with a critical eye; for such reasons it is important to carry out a larger confirmatory study.

Second, our study is limited by the presence of potential information bias. The most challenging aspect of this study was the high volume of missing information. The information collected for this study was indented for public health purposes and not research, therefore the available information was either incomplete or nonexistent. For instance, there was no information collected regarding socioeconomic characteristics or any proxy information such as available income. The study was restricted to utilizing the available information. Typically, a researcher can increase the sample size in order to generate a more complete data set; however that is not possible with data generated from

a disaster situation. That being said, the direction and magnitude of the effect of the bias may be difficult to anticipate. In our study it is likely that the lack of available covariates would bias the results away from the null leading to an overestimation of the true relationship between racial differences and the treatment received during a disaster situation.

In addition, the information collected was abstracted from medical records and much of the missing information may be a result of poor reporting. Although, the information was abstracted from a standardized medical form, the triage nurse who initially entered the information may have left certain information blank. This could result in misclassification of any information included in this study; however, this would be non-differential and would affect all patients equally. Poor reporting may be a result of situational factors, such as a patient underreporting socially unacceptable behaviors or a triage nurse not transcribing all information. A better trained reporting staff would be needed to transcribe all information, even in the event of an emergency department surge. It is also possible to misinterpret medical records due to the poor quality of available information. Retrieving information from low-quality photocopies or ineligible handwriting may further impede quality data. Likewise, medical records are limited to occurrences in which a person presented for medical treatment. Perhaps the outcome being researched is more prevalent than what is being recorded because the documentation is being restricted to only patients who sought medical treatment. A priori understanding of the limitations associated with using these records may help researchers overcome issues such as those previously mentioned.

We did not control for any potential confounders due to insufficient data. The information collected did not have data available to determine if confounding was an issue. For instance, in similar types of studies, socioeconomic status or proxy information is analyzed to determine if these differences contributed to the real association between outcomes and racial differences often utilized in similar types of studies to determine if confounding was present was not available (71;72). The data did not include information on education, income, and insurance status, all of which are used as a proxy for socioeconomic status. Given the available data, we examined the distribution of important factors demonstrated in table 4.1 by race/ethnicity that could potentially account for some racial/ethnic differences in hospitalization status, triage score and discharge medication received.

Third, the treatment of patients in an emergency room is a complex process involving many clinical and non-clinical decisions. We were unable to control for all clinical co-morbidities that could influence the treatment received. Due to missing data, we were unable to assess the complete vital signs at presentation that could influence triage assignment. As a result, we are unable to differentiate whether the cause of differential triage scores received is errors and misclassification of patients or if there was inherent racial discrimination present.

Fourth, the results of our study have a limited generalization to racial/ethnic groups beyond African Americans and Non-Hispanic Whites. We excluded patients whose race was reported as “mixed” or other. It is possible that this subgroup may have experienced racial differences within triage, hospitalization or discharge medications;

however, because there were few members who self-identified as mixed ethnicity we were forced to exclude them in the sample.

Despite these limitations, there are several noteworthy strengths. First, our study was the first of its kind to discuss the association between racial differences and triage score, hospitalization status and discharge medications after a mass casualty incident a rural south eastern town. Second, despite a limited sample size, we were still able to achieve sufficient power, above 80%, to examine race differences in two outcomes of hospitalization status and race and triage score received. Third, we used existing medical records as a data source. Advantages of this type of data include cost, time, access, and accuracy. The cost incurred with medical records is restricted to the fee (if any) to obtain the records and the cost of reviewing the records. These costs are relatively minimal to many other data collection forms, such as the interview process. In addition, using existing medical records is very time efficient. A researcher does not have to wait for the data to be collected, a process which can take upwards of years depending on the information being collected. Furthermore, medical records allow greater access to patient population that could be otherwise hard to collect. For instance, Richardson et al. (2003) conducted a multi-city examination of the documentation practices of pediatric health care (61). Medical records were reviewed for all subjects who had sought preventive health services during a specific period. Outcome data was abstracted from the forms by trained nurses. This type of research depends allows for an efficient and inexpensive review of a large sample. Lastly, medical records provide a standard level of accuracy, in which researchers rely on to conduct their analyses.

The racial differences observed in this study regarding hospitalization status and triage scores assigned demonstrate a need for future research to further investigate why such disparities are present. The racial differences demonstrated in this research can be applied to a future disaster setting in hopes of minimizing any forms of mistreatment felt or realized in a hospital setting. Although we did not have socioeconomic information available, many of the victims were employed by the same local cotton mill. Uniformity among patients minimizes the possibility of confounding due to racial and ethnic differences in socioeconomic status. While our sample was small and missing information was prevalent, we chose variables with the most complete information. This resulted in small sample with a sufficient statistical power for significant results.

Conclusion

The present works suggests that all persons were comparably exposed to chlorine gas at the time of the accident between Non-Hispanic Whites and African Americans. Similarly, there was no difference in discharge medications by race. The data does suggest, however, that there was a statistical difference for hospitalization status and triage scores between the two racial/ethnic groups.

CHAPTER 6

DIRECTION OF FUTURE RESEARCH

The present work suggests that racial differences may occur after a disaster situation within the emergency department. Given that the results of this study are preliminary data, it is important to note that racial differences were present, albeit the sample size was small. That being said, it is important to utilize the data from this study in a larger, confirmatory study. Because this data is collected from a disaster setting, increasing a sample size to gain more insight for confirmatory results is not possible. Researchers must wait until another disaster takes place and collect similar types of information to those seen in this data set. Although it is unlikely the population, geographic location, or characteristics of the event will be the same, future studies will use the information collected to answer the same research questions. Taking our research question and applying it to a larger, more complete data set will allow researchers to report the true effect of the association between race and treatment received in an emergency department following a mass casualty. Although we reported statistically significant results in hospitalization status and triage scores received, a larger sample will confirm or deny such results. A larger sized sample will reduce the likelihood of over-estimation regarding the magnitude of the association. In addition, when examining the association of race and treatment received it is important to take into consideration potential confounders. However, when the number of observations is small adjusting for several factors can be difficult and may fail to produce sensible or reliable results.

Utilizing our research question and applying it to a larger sized sample will diminish such limitations and provide a true effect of the association between race and treatment received in an emergency department following a mass casualty incident. Both the scientific and public health community would benefit if immediately following the safety of all victims, the collection of data and standardization were worked into the regulatory protocol for disaster response. This would allow for a standardized and efficient collection of disaster data. For instance, in a chemical exposure, it would be standardized protocol to include the collection of proximity to the event and duration of exposure. This would allow for a better understanding of each person's exposure and health status. Standardization of collection methods after a mass casualty incident would provide researchers with more complete data, which will result in superior quality research.

Health care providers, like all human beings, are influenced by social cues and stereotypes. It is important to teach them to interact with patients in an objective manner, resulting in a diminished likelihood to succumb to the effects of stereotyping and social cues, which prompts a specific treatment path. Additional research into the factors that systematically influence provider decision making as it relates to the care received by patients is necessary. Once the influential factors are known, educational institutions would be better equipped to inform future health professionals with regard to conducting their patient care free from provider bias. This would allow for more optimal patient care. Particularly in our study, there may not have been a racial difference in triage categorization and hospital status.

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APPENDIX A: INCLUSION AND EXCLUSION CRITERIA

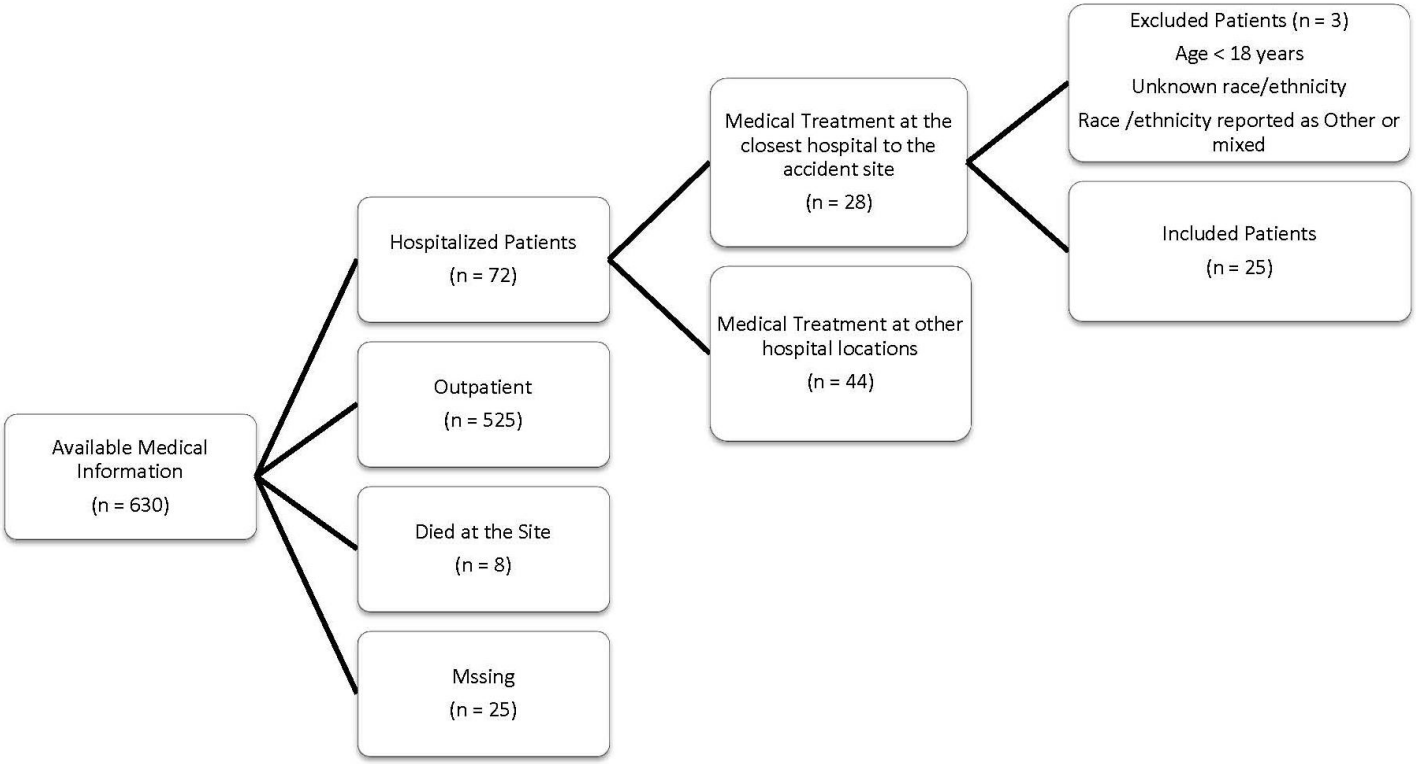

Figure A.1 Inclusion/Exclusion Criteria for Sample Population